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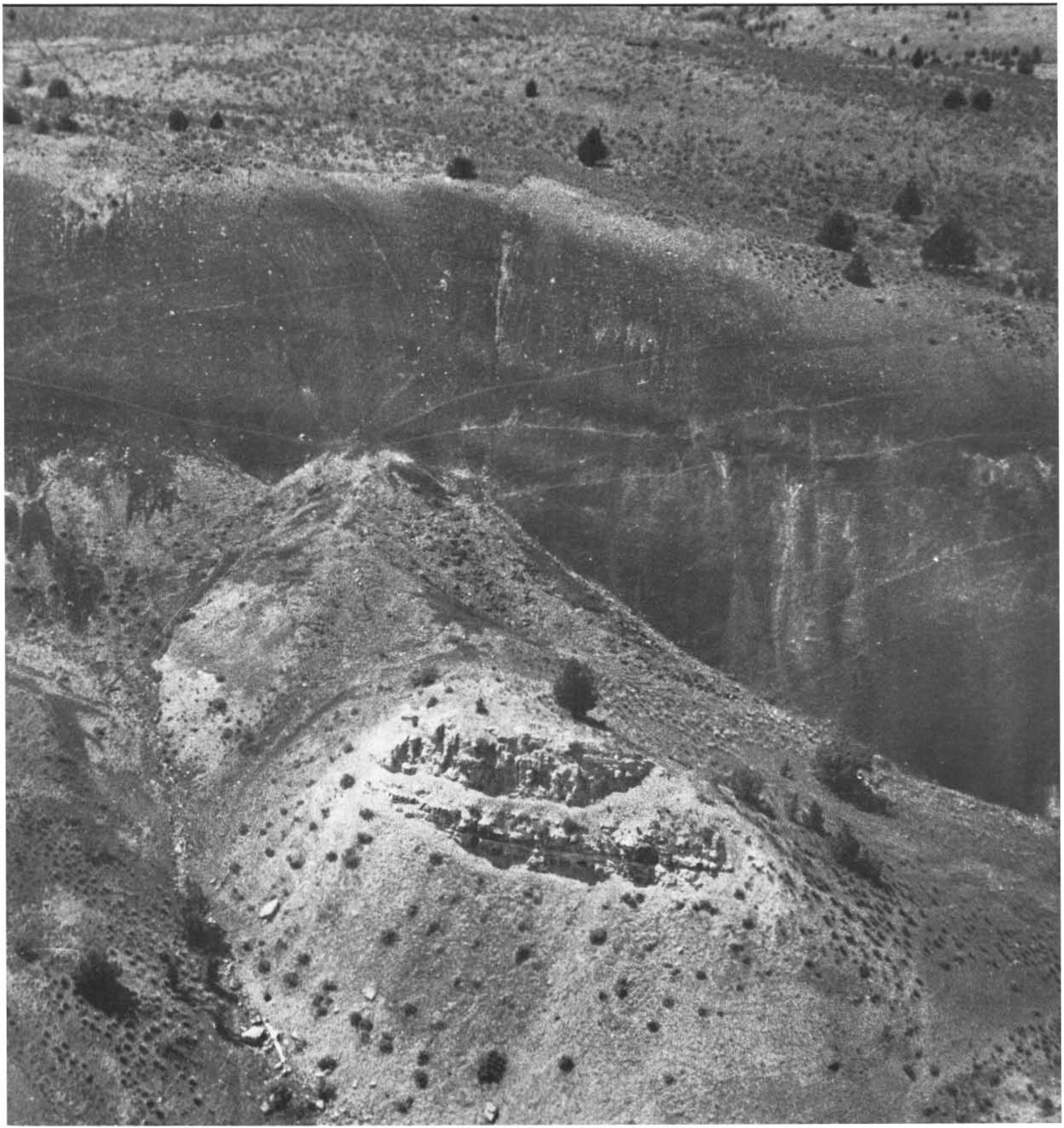

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COVER PHOTO

Oblique aerial view of the Clarno Nut Beds (rocky, light-colored outcrops), middle Eocene stream deposits, overlain by late Eocene and early Oligocene fossil soils of Red Hill (dark slopes), near Clarno, north-central Oregon. Fossil plants and soils from here indicate that vegetation during the Eocene and Oligocene was very different from the scattered sage and juniper of today. See article beginning on next page.

Willamette Valley rock resources, volcanic hazards, and north-central/northeastern Oregon geology subjects of new reports

The Oregon Department of Geology and Mineral Industries (DOGAMI) announces the release of three new open-file reports. Open-File Report 0-81-7, *Rock Material Resources of Marion, Polk, Yamhill, and Linn Counties, Oregon*, by Jerry J. Gray and Allan H. Throop, DOGAMI, identifies 1,168 rock material sites with past or present production of sand and gravel, stone, clay, and cinder in the four-county area located in the mid-Willamette Valley. The report summarizes the results of a cooperative study by DOGAMI, the Pacific Northwest Regional Commission, and the Oregon Land Conservation and Development Commission. Included in the 47-page report are tables containing such data as location, status, and size of sites; nature of the resource; mining systems; uses of the product; and reclamation possibilities for the mined-out areas. On three accompanying maps (scale 1:125,000), the sites are located and keyed to the tables of the text. The report is intended to serve as a data base that can be used by planners, politicians, and private citizens in planning and making public decisions concerning land use and in locating resources for road and construction projects. The authors emphasize that the mineral potential of an area should be an integral part of land use considerations. Cost of 0-81-7 is $7.

Open-File Report 0-81-9, *Seismic and Volcanic Hazard Evaluation of the Mount St. Helens Area, Washington, Relative to the Trojan Nuclear Site, Oregon*, by John D. Beaulieu and Norman V. Peterson, DOGAMI, systematically evaluates the relevance of seismic activity and volcanic activity at Mount St. Helens for the nuclear power plant site at Rainier in Columbia County, Oregon. The volcanic hazards investigated include lateral blast, mudflow, ashfall, floods, and pyroclastic flows. The study was funded by the Oregon Department of Energy (ODOE), and this open-file report, which summarizes the results of the study, will be added to the body of technical material maintained by ODOE for guiding the safe operation of the Trojan plant. Purchase price of 0-81-9 is $5.

Open-File Report 0-81-10, *Post-Columbia River Basalt Group Stratigraphy and Map Compilation of the Columbia Plateau, Oregon*, by S.M. Farooqui, R.C. Bunker, R.E. Thoms, and D.C. Clayton of Shannon and Wilson, Inc., Portland, and J.L. Bela, DOGAMI, covers an area of more than 200,000 sq mi in north-central and northeastern Oregon. The report consists of a 79-page text and six blackline maps (scale 1:250,000) covering parts of The Dalles, Pendleton, Grangeville, Baker, Canyon City, and Bend 1° by 2° quadrangles. The maps were compiled from 308 7.5-minute quadrangles which had been mapped by a combination of field reconnaissance and office compilation techniques over a period of two years. Cost of 0-81-10 is $10.

All of these open-file reports are available for inspection or purchase at the Portland office of the Oregon Department of Geology and Mineral Industries, 1005 State Office Building, Portland, OR 97201. Copies of these reports may also be purchased by mail. Orders under $20 require prepayment. □

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Preliminary observations on fossil soils in the Clarno Formation (Eocene to early Oligocene) near Clarno, Oregon

by Greg Retallack, Department of Geology, University of Oregon, Eugene, Oregon 97403

INTRODUCTION

One would expect fossil soils to be common in sedimentary rocks laid down on dry land. However, since geologists seldom have training in soil science, they often fail to recognize such soils. This is unfortunate because fossil soils can tell us much about the past. They are evidence for the nature of extinct vegetation, depth of ancient water tables and nature of the ground water, rates of subsidence and sedimentation, and ancient topography and climate.

In the summer of 1979, during a brief visit sponsored by the Oregon Museum of Science and Industry (OMSI) Paleontology Research Program, I discovered several fossil soils in the Clarno Formation near Camp Hancock in north-central Oregon (Figure 1). Fossil soils occur in the Clarno Nut Beds, which contain fossil plants and mammals of middle Eocene age; in the overlying red beds of Red Hill; and under a volcanic mudflow which overwhelmed an upright petrified tree (the "Hancock Tree") in Hancock Canyon. The red beds and mudflow are probably, in part, early Oligocene in age, like the rocks of the nearby fossil mammal quarry. The age and relationships of these localities are discussed by Hanson (1973) and Manchester (1979, 1981). All localities are protected from unauthorized collecting by OMSI and the John Day Fossil Beds National Monument.

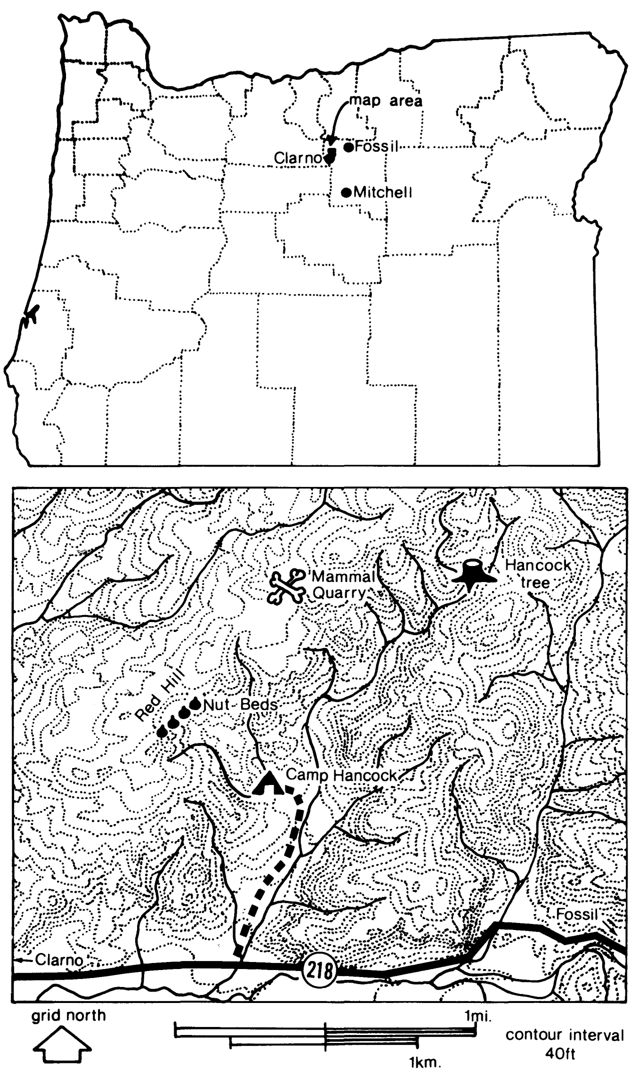

Figure 1. Locality map: Camp Hancock and Clarno fossil soil localities discussed in text.

Thick reddish fossil soils have also been reported by Oles and Enlows (1971) on erosional unconformities below and within the Clarno Formation near Mitchell (Figure 1). Such fossil soils that formed during very long periods of erosion are difficult to interpret, as they may have been initiated under different vegetation and climate than they supported just before burial, and they may also contain relict and residual features of older soils. Only the fossil soils of ancient sedimentary environments near Camp Hancock are considered further here.

AN INTRODUCTION TO MODERN AND FOSSIL SOILS

In terrestrial sedimentary environments such as river valleys, sediment may be moved around by running water, wind, or gravity slides. For most of the time, however, this sediment lies relatively undisturbed. Plants and animals colonize this material after floods. Very soon their activity modifies the sediment at the surface to such an extent that we call this material a soil. It may be penetrated by roots and churned by burrows and may contain decaying leaves and other organic matter. At an early stage of its formation, a new soil may still have some structures formed during the original flooding, such as bedding and ripple marks. Soils with a lot of sedimentary relicts and little change, apart from the addition of organic matter, are called alluvial soils or entisols. With additional time and growth of vegetation, rainfall leachates and other chemicals from plants and soil organisms may leach the upper part of the soil to form an eluvial or A horizon. Eventually, as more material is leached out, the A horizon becomes more enriched with resistant minerals, such as quartz. Not all the material is completely lost from the soil; it may accumulate to form an illuvial or B horizon.

The chemicals involved in these processes may differ in different kinds of soils. In podzolic soils, the A horizon tends to be quartz-rich, sandy, and light colored. It is leached of clay, humus, iron, and aluminum. These accumulate in the B horizon, which thus tends to be more massive, clayey, dark, and red.

Soils do not persist indefinitely. Eventually they are either covered by sediment or eroded away. In subsiding river valleys, of the sort in which many thick sequences of terrestrial sedimentary rocks accumulate, soils are periodically covered by flood sediment. If the flood is especially powerful and up to 1 m (3 ft) of alluvium is deposited over the soil, smashing down vegetation and driving off the animals, then a new soil will

Figure 2. Clarno Nut Beds, light-colored near-stream deposits, and overlying clayey fossil soils of Red Hill. OMSI Paleontology Research team (arrow, lower left) is excavating at base of large down-slumped block of Nut Beds. Colorful variegated badlands like Red Hill commonly contain numerous fossil soils.

begin to form at a higher level.

If this later soil never develops deeply enough to obscure the underlying soil, then geologists will have no trouble distinguishing the older fossil soil from the younger one. However, such simple sequences are seldom found. If only a few inches of sediment are deposited in a flooded forest, for example, trees will continue to grow and incorporate the new sediment into the existing soil. In this way, a sequence that is comprised mainly of A horizons may accumulate, a situation here called an accreting soil. Another complication is that the B horizon of a later soil may form in the A horizon of an earlier one. In this case, the younger B horizon may have a variety of older soil features (pedorelicts) inherited from the older A horizon. Such situations can be very difficult for geologists to interpret.

Another difficulty with studying older fossil soils is that they change during many years of burial and compaction. Such post-depositional changes that are not severe enough to be regarded as metamorphism are commonly called diagenesis. For example, soils may have considerable accumulations (up to 3.6 percent) of plant silica bodies (phytoliths) in the A horizon. During diagenesis, this silica can be dissolved and reprecipitated to form a hard flinty cement (Retallack, 1977). As another example, well-drained soils may have oxides of ferric iron in the form of gels or minerals such as limonite and goethite, which form a light-brown or yellow stain. During diagenesis, these iron oxides may change to the brick-red mineral hematite, giving the fossil soil a much redder color (Walker, 1974).

FOSSIL SOILS OF THE CLARNO FORMATION

There are at least three kinds of fossil soil in the Clarno Formation at Camp Hancock. As in the modern world, each of these probably formed under different vegetation and in different parts of the landscape. Although they are not necessarily all of exactly the same age, they give an idea of the mosaic of terrestrial environments during the Eocene and early Oligocene in the area which is now Camp Hancock.

Alluvial fossil soils of the Nut Beds

The Nut Beds consist of conglomerates and sandstones, both probably deposited by streams (Figure 2). The sandstone beds are usually less than 0.3 m (1 ft) thick and alternate with silty layers. Many of these sandstones are riddled with fossil horsetail plants (*Equisetum*) in life position (Figure 3). Some of the disturbed upper portions of the sandstones may be small rills or weathered hoof prints of Eocene ungulate mammals. These sediments are very similar to those found in modern streamside levees. The sandstones were probably weakly differentiated alluvial soils covered in thickets of *Equisetum*.

Figure 3. Equisetum *in position of growth in lower Nut Beds. Arrow points to branching axis. Stems are approximately a third of an inch in diameter. (Photo courtesy of S.R. Manchester)*

Horsetails are well known for their abundant phytoliths. Living mature plants average 10 percent silica by dry weight. This is why they make such excellent pot cleaners and once were called scouring rushes. Although silica-charged waters from nearby volcanic hot springs may have been important in the silicification of the Nut Beds, substantial contributions of silica from these accumulator plants are also likely.

Bottomland forested soils of Red Hill

The origin of red beds, variegated beds, and badlands has long been somewhat of a mystery. Undoubtedly they originated in several different ways, but many are turning out to be accumulations of fossil soils. My own excavations of the slumped and weathered exposures of Red Hill, just above the Nut Beds, revealed a number of fossil soils. Some of these were difficult to interpret and were evidently accreting soils. In these, each additional increment of flood sediment appeared to have been incorporated into pre-existing soil without destroying the vegetation, so that successive soil horizons were overlapping.

Some of the fossil soils in Red Hill, however, were well preserved (Figure 4). These appear to have been well-differentiated soils with gray A horizons and reddish-brown B horizons. Large drab tubules, the reduced clay around individual large roots, extend down from the A into the B horizon. These ancient soils were evidently vegetated by large trees, probably a kind of rain forest similar to that which provided much of the plant debris to the Nut Beds. Many of the plant remains in the Nut Beds have living relatives in subtropical broadleaf forests. The diversity of the plant remains and the numerous vines indicate that it was a rain forest or jungle (Manchester, 1981), at least along the streams in which the plants are preserved. Carbonaceous and gray layers, patches of purple-colored claystone, and the pattern of mottling of the well-differentiated, reddish clayey fossil soils are indications of moist, partly waterlogged conditions. The former water table was probably within 1 m (3 ft) of the surface. Thus, these fossil soils were valley bottom soils. This fact and plant remains preserved in the Nut Beds indicate that Eocene valley bottoms near Camp Hancock were vegetated by rain forest.

Each fossil soil in Red Hill represents a depositional hiatus of at least several hundred, perhaps several million, years. There are many superimposed paleosols in Red Hill. Thus, it is likely that the unconformity thought to separate older and younger parts of the Clarno Formation is split into a number of minor unconformities in Red Hill.

Upland forested soils of Hancock Canyon

One of the silicified stumps and logs in the volcanic mudflow in Hancock Canyon is still standing upright (Figure 5), rooted in a fossil soil that is not as well differentiated as the soils on Red Hill. Although better differentiated than the horsetail-bearing fossil soils of the Nut Beds, the Hancock Canyon soil is still best regarded as an alluvial soil. It has a silicified, leached, root-penetrated A horizon and also a well-preserved leaf litter. Only the flatter leaves of the lower leaf litter have been preserved in place. The curled loose leaves have been swept up into the overriding mudflow and form fossiliferous lenses as much as a foot above the base of the flow. Beyond a very indistinct clay-rich layer, the fossil soil does not have a well-differentiated B horizon. There is also much relict bedding in the fossil soil. These features are probably due to a relatively short time of formation, probably little longer than it took to grow the preserved crop of tree trunks. They could also have developed because the area was more elevated and seldom had a waterlogged layer near the surface, in which case chemicals and clay leached out of the A horizon would wash right out of the profile rather than accumulate there. The volcanic mudflow presumably slid down the flanks of a nearby volcano and is additional evidence that these soils formed in higher parts of the landscape. Interestingly, the fossil flora associated with these fossil soils is quite different from that at the Nut Beds. There are fewer species of wood and leaves, mainly forms similar to katsura (*Cercidiphyllum*) and sycamore (*Platanus*; Manchester, personal communication, 1980). Modern relatives of these plants are trees of cool temperate climates. Perhaps this less diverse, cold-adapted flora forested hills adjacent to the humid rain-forested bottomlands near Camp Hancock during the Eocene and early Oligocene.

Eocene fossil soils similar to those in Hancock Canyon are also found in northeastern Yellowstone National Park, where there are many horizons of silicified stumps in a great pile of volcanic mudflows, erupted rocks, and stream and lake deposits (Dorf, 1964; Fritz, 1980). On Specimen Ridge, some of these fossil soils have well-differentiated silicified A horizons as well as massive, clay-rich B horizons (Retallack, 1981). None have reddish B horizons of bottomland fossil soils, like those of Red Hill. The Yellowstone fossil soils were largely forested by conifers of cool, temperate climatic affinities, such as pine (*Pinus*) and redwood (*Sequoia*). As in this region today, it is likely that conifers grew at higher elevations than angiosperms.

Figure 4. Well-differentiated fossil soil in the middle of east slope of Red Hill, with light-gray A horizon over reddish B horizon. Hammer gives scale.

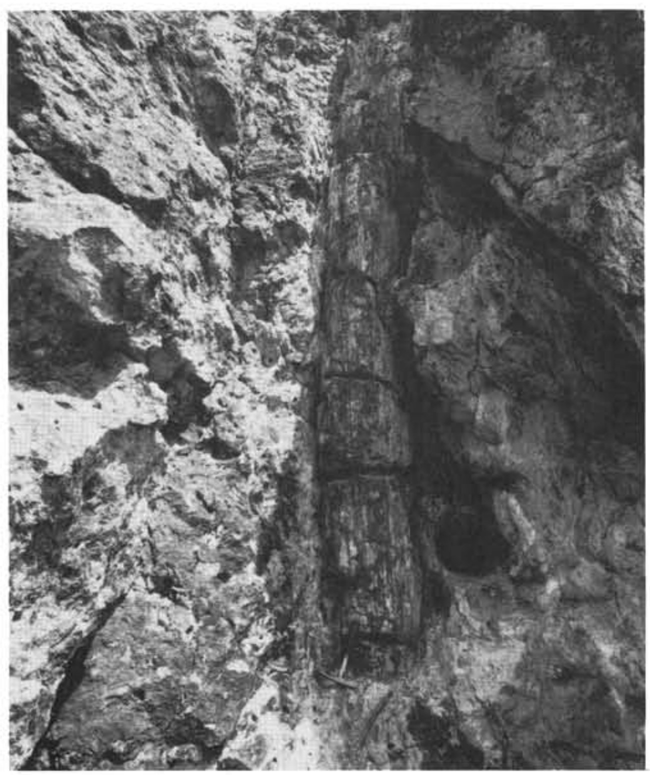

*Figure 5. "Hancock Tree," most similar to modern katsura (*Cercidiphyllum*; S.R. Manchester, personal communication, 1980), preserved in position of growth by a thick volcanic mudflow. Hammer gives scale.*

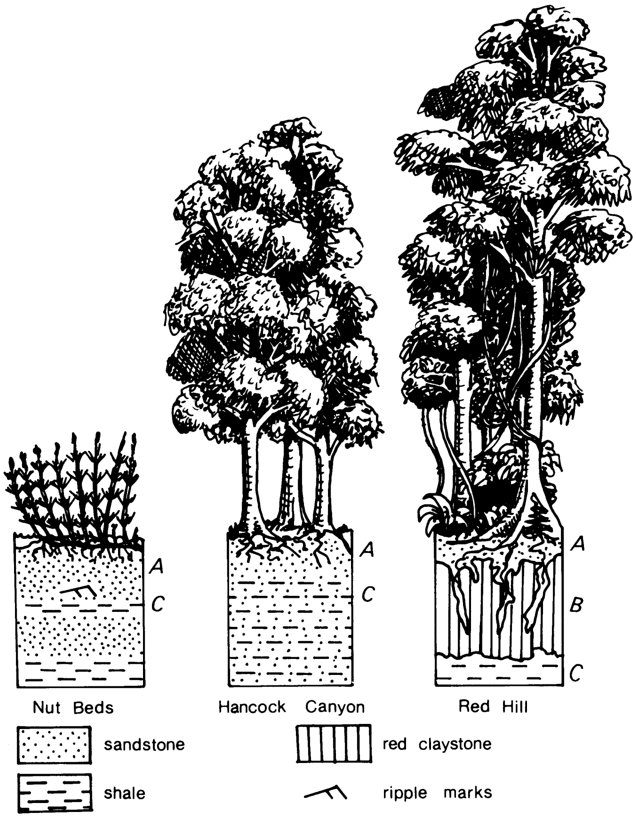

Figure 6. Soil horizons and reconstructed vegetation of some fossil soils of the Clarno Formation (schematic).

CONCLUSION

Fossil soils near Camp Hancock are important evidence of Eocene and early Oligocene vegetation and landscapes. They are reconstructed in Figure 6. Even in areas where the geology is well known, fossil studies can add much to our understanding of ancient terrestrial ecosystems. Although abundant in nonmarine rocks of all ages, pre-Quaternary fossil soils remain comparatively little studied. We need to know more about them.

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Annual award for exemplary mined land reclamation to be given

Realizing that it is as desirable to recognize outstanding performance as it is to punish offenders, the Governing Board of the Oregon Department of Geology and Mineral Industries at its April 9, 1981, meeting approved a proposal to recognize and honor an outstanding example of mined land reclamation each year. One Oregon site demonstrating either voluntary or mandatory reclamation of mined land will be selected each year. The first award will be announced in June 1982.

These awards are intended to reward outstanding achievement by operators and to further the goal of reclamation by awarding trophies and providing appropriate publicity.

Some of the criteria that will be considered include the following: The future value of the site; the imagination, innovativeness, and effectiveness involved in the completed planned reclamation; safety characteristics; aesthetics; and the appropriateness to local environment.

Nominations for consideration will be welcomed from any source. Most nominations are expected to come from personnel who frequently observe sites, such as the Mined Land Reclamation (MLR) staff of the Oregon Department of Geology and Mineral Industries; their counterparts in the Bureau of Land Management, the U.S. Forest Service, and other departments of the State; county personnel; environmental groups; and industry. Nominations will be screened by the MLR professionals, and the final selection will be by a committee which will include a member from an environmental organization, a member from industry, and the supervisor of the Mined Land Reclamation Program.

A permanent trophy listing the names of the winners will be displayed in the office of the State Geologist. An individual plaque will also be given permanently to each annual winner. An illustrated article of recognition will be published in *Oregon Geology*, and news of the award will be given to the appropriate trade journals. Whenever possible, a field day or tour of the site will be arranged with the winner's approval and will be open to the public.

The annual announcement and award are anticipated to be made on the nearest practical date to the 15th of June each year.

—Paul F. Lawson, Supervisor
Mined Land Reclamation Program

State legislation affecting mineral industry summarized

The 61st Oregon Legislative Assembly completed its biennial session on August 2, 1981. Several bills of particular interest to the mineral industry in Oregon were passed, including various changes in the regulation of surface mining, oil and gas drilling, and geothermal energy drilling and production.

SURFACE MINING

HB 2160—The Oregon surface mined land reclamation law (Oregon Revised Statutes 517) underwent significant change. The maximum amount of bonding for certain new large-scale "nonaggregate" mines including coal, uranium, and metal mines was increased from $500 per acre to $10,000 per acre. The actual amount of reclamation bonds for these operations will continue to be based on the estimated cost of reclamation consistent with the approved reclamation plan for each mine.

The ceiling for penalties and liens was also increased to $10,000 per acre to be consistent with the higher bonding limits.

The increased bonding, penalty, and lien limits do not apply to sand and gravel pits, rock quarries, or underground mines. Small placer gold mines moving less than 5,000 cubic yards per year are exempted from the higher bonding level.

This legislation also revises the definition of surface mining in Oregon by increasing the minimum amount of material extracted from 2,500 to 5,000 cubic yards in a 12-month period. Thus surface mines in general may not be required to comply with various provisions of the reclamation law if they remove no more than 5,000 cubic yards in any 12-month period.

HB 2220—The operating permit fee required of surface mine operators was increased to $390 per year for a new site and $290 for annual renewal of an existing site.

OIL AND GAS DRILLING

HB 2146—House Bill 2146 provides several administrative changes to the Oregon oil and gas conservation law (ORS 522) and streamlines the existing law with respect to drilling of wells. The bill provides for issuance of drilling permits without formal hearing for wells located outside of established spacing unit areas if topographic or geologic conditions justify such approval.

This legislation also requires the reclamation of drill sites and filling of sumps for other subsequent beneficial uses such as grazing or timber management.

The new law allows the State Geologist to extend the two-year confidentiality period for information from oil and gas wells.

GEOTHERMAL ENERGY

SB 116—Senate Bill 116 provides a comprehensive procedure for unitization of ownership interests in geothermal energy reservoirs. A two-stage approach involves voluntary agreement by the private parties initially or later compulsory unitization by the Governing Board of the Department of Geology and Mineral Industries in cases where the voluntary agreement is not possible. A suitable majority of both royalty and operating interests must approve any unitization plan, and it would take into consideration pre-existing plant dedicated area agreements.

SB 117—Senate Bill 117 clarifies the respective responsibilities of the Department of Geology and Mineral Industries and Department of Water Resources in the regulation of geothermal energy production. A coordination mechanism is provided to deal with possible conflicts between geothermal energy and ground-water development. Fluid production less than 250°F from wells will be regulated by the Department of Water Resources, and hotter fluids will be treated as a geothermal resource.

HB 2147—A simplified regulatory procedure for geothermal well drilling is provided by House Bill 2147, which revises ORS 522. A requirement in the existing law to obtain a production bond after drilling a successful well has been deleted. A time limit of 180 days to begin well drilling after receiving a permit has been added, with provision for extension up to a total of 360 days. The hearing requirements for certain actions of the Governing Board have been streamlined.

CONCLUSION

The new legislation described above clarifies the state's regulatory process and should encourage responsible development and production of the important mineral and energy commodities. □

Northwest Mining Association offers drilling course

Explorationists and operators can gain a practical knowledge of drilling in the classroom at the Northwest Mining Association short course to be held November 30-December 2, 1981, at the Davenport Hotel in Spokane, Washington.

"In the past, the art of drilling could only be learned on the job," said Short Course Director William J. Whinnen. The course, Drilling and Management of Drilling Projects, is geared toward the geologist or engineer in charge of a field or mine project. It will cover techniques, systems, equipment, and costs. "The NWMA drilling course differs from other courses for drillers in that it includes a comprehensive study of the management of drilling projects," Whinnen said.

Working papers will be available to class participants. A formal volume based on the course will be published next year and mailed to those who attend the drilling course.

The short course will precede the Northwest Mining Association 87th annual convention which is scheduled for December 3-5 in Spokane. Registration information for the drilling course and/or convention is available from the Northwest Mining Association, 633 Peyton Bldg., Spokane, WA 99201; phone (509) 624-1158. □

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On the marketing of earth science information: A review of USGS Circular 813

Earth scientists may not have had to face such moral dilemmas as the possible misuse of knowledge about the atom or about genetic engineering, but for most geologists, the day of searching for knowledge just for its own sake without attention to its practical application is long past. In fact, increasing energy, environmental, and land use pressures today require more and more attention to such applications of the earth scientist's knowledge. What is most pressing now is the subsequent problem: the task of transferring earth science information to those in our society who need it—citizens, business, industry, and local governments involved in decisions about land and resource problems.

This is the context for a recent U.S. Geological Survey publication (Circular 813, 1979) by Thomas F. Bates, entitled *Transferring Earth Science Information to Decisionmakers*. In it, Bates describes and analyzes the experiences of the USGS in its attempts to bridge the gap between the "producers" of the earth science information, the scientists, and the "users" of that information, the citizens and their administrative, planning, and regulating decisionmakers. A representative sample of projects from five major programs administered by the USGS Land Information and Analysis Office (LIA) is discussed on the basis of evaluation reports and many interviews with people personally involved in earth science information exchange.

Even a brief glance at the two groups of producers and consumers shows that the main burden of getting information across lies on the shoulders of the earth scientists. They are a fairly well defined and consistent group facing, on the other side of the "interface," a wide spectrum of users, a "user community" that also changes continuously, e.g., in citizen participation and interest, in elected officials and staff members. And, according to Bates' assessment of the present situation, "the earth science community as a whole has yet to realize that it has primary responsibility for ensuring adequate and proper use of earth science information by the public and its representatives" (p. 2). Geologists, too, have to "sell their stuff"—which may not always be as easy as in the recent wave of public interest in volcanology and Mount St. Helens—and they have to see that it gets to the right people.

Bates' paper addresses the following questions:

- Who are the new users of earth science information, and what characteristics and interests place them in a position to relate more closely to the earth science community?
- What are the needs of these users for earth science information?
- What specific forces generate pressure for increased application of earth science information to land use planning problems?
- What are some of the difficulties faced by the earth science producer and the user communities in working together on these needs and problems?
- What are some of the more successful methods, as demonstrated on USGS projects, of transferring earth science information to nontechnical users?

Some of the points to keep in mind, if not direct answers to specific problems, that have emerged from the USGS experience include:

- The need for the earth scientist to adjust the language and format of the information to the users' degree of familiarity with the issue.
- The advisability of an alliance with an intermediary type of organization, where effective identification and involvement of key representatives from user communities is difficult.
- The fact that "product demand must often be created by a variety of educational efforts," not only to show that information is available but also that it will indeed be helpful.

One of the five major programs was the three-year Pacific Northwest Land Resource Inventory Demonstration (PNLRID) project. Its purpose was to determine the technical and economic feasibility of using Landsat data as an aid in the solution of regional land resource problems in Idaho, Oregon, and Washington. The program received effective intermediary support from a task force of the Pacific Northwest Regional Commission. Throughout the 3-year project, Federal agency personnel at the EROS Data Center and NASA's Ames Research Center worked with some 125 representatives of the State and local government user agencies to familiarize them with the possibilities of using remote sensing in land resource management areas, such as forestry, natural resources, agriculture, water resources, fish and wildlife, and urban change.

In conclusion, Bates calls for a mobilization of the entire earth science community, to achieve what LIA has attempted to do with its projects:

- Create nationwide awareness of earth science information needs and uses.
- Provide specialized, technical information in a form and language understandable to the intelligent citizen.
- Engage in the educational, advisory, and review services necessary to assist the public and its representatives in making effective use of that information.

The methods and approaches will differ, Bates concludes, but "all will require establishing intimate working relations by every possible means of communication and interaction between the two 'communities' involved—the earth scientists and the land resource planners and decisionmakers throughout the Nation."

Circular 813 can be obtained at no charge from a number of U.S. Geological Survey offices; the nearest of them is the USGS Public Inquiries Office, U.S. Courthouse, Room 678, West 920 Riverside Avenue, Spokane, Washington 99201, phone (509) 456-2524.

—Klaus Neuendorf, Editor/Librarian
Oregon Department of Geology and
Mineral Industries

November AIME meeting to be held in Corvallis

The Oregon section of the American Institute of Mining, Metallurgical, and Petroleum Engineers will meet Friday, November 20, in Corvallis. Neal Wagner will be the speaker for the evening; his topic will be "Hewlett-Packard, Corvallis—Products, Technology, and Analytical Applications." The exact location of the meeting has not yet been selected, but AIME members should receive notices of the meeting in the mail. Social hour is at 6 p.m., dinner at 7 p.m., and talk at 8 p.m. For reservations or more information, contact Mike York, Accident and Failure Investigations, Inc., 2107 NW Fillmore, Corvallis, OR 97330; phone (503) 757-0349. The public is invited. □

OIL AND GAS NEWS

Willamette Valley:

Exploration in the Willamette Valley continues to result in dry holes during recent months. American Quasar, however, was encouraged enough by shows of gas to run a production string and do some testing on a recent well near Jefferson. The well, Wolverton 13-31, in sec. 13, T. 10 S., R. 3 W., Marion County, was finally abandoned on October 7, at a total depth of 4,555 ft.

Using the same Paul Graham rig that drilled the Wolverton well, American Quasar moved back onto Hickey 9-12, the company's producing gas well in Linn County. On line since May of this year, the well has been disappointing, so additional perforating was done during this workover job. Results were poor, however, and the well was abandoned on October 15.

Clatsop County:

Drilling continues on Oregon Natural Gas Development Company's Johnson 33-33, southeast of Astoria. Barring trouble with the hole, the proposed total depth of 10,000 ft should be reached during November. There have been signs of H_2S in the hole but no reported shows of oil or gas.

Mist Gas Field:

A redrill of Reichhold Energy's Longview Fibre 12-33 has resulted in one of the Mist Gas Field's best producers. We reported last month that the straight hole was dry; since then, however, a redrill to a depth of 2,475 ft has resulted in a tested potential of nearly 5 million cu ft per day of gas. The well, located in sec. 33, T. 7 N., R. 5 W., followed a dry hole in the same quarter section. Production will be from a new pool in the upper Clark and Wilson sand, the same productive sand as elsewhere in the field. Construction of a gathering line has begun, and an offset well, Longview Fibre 41-32, was spudded on October 9 in the adjacent sec. 32.

Applications for leasing State lands:

The Division of State Lands will hold another lease sale after the first of the year, as soon as applications for 100,000 acres have been received. So far, the Salem office has received applications for over 85,000 acres. Counties receiving the most interest include Malheur (55,000 acres), Harney (10,000 acres), Lake (10,000 acres), Marion and Clackamas (4,000 acres), and Clatsop (2,500 acres). Terms of State leases are $1 per acre per year and a ⅛ royalty on leases with a 10-year term.

BLM oil and gas lease application fee increase:

The fee for filing an oil and gas lease application with the Bureau of Land Management (BLM) increased from $10 to $25 beginning October 1, 1981. Roger Dierking of BLM's records and data management branch said that the fee is charged when the BLM receives offers for land that has previously not been leased or for lands where leases have expired or have been canceled. BLM is the agency responsible for oil and gas leasing on federal lands.

Applications submitted on or after October 1 that are not accompanied by the $25 filing fee will not be accepted by BLM. The fees are used to defray the government's cost of processing the applications, Dierking said. The increase was directed by the Omnibus Budget Reconciliation Act of 1981.

Under the federal government's oil and gas leasing program, the government issues a lease to the first offerer on a noncompetitive basis for those lands that are not known to be an area of productive oil and gas deposits. When more than one person files for lands that have previously been leased, a drawing is held to determine the lessee.

The fee has not changed since 1949. BLM estimates that the increase in filing fees will bring in about $80 million annually, nationwide.

In Oregon, there are 1,198 oil and gas leases in effect on federal land, covering 2.1 million acres. In Washington, 126 leases have been issued for 148,517 acres. In addition, applications are pending for several million acres more. □

Test of Oregon's hottest geothermal well confirms a substantial resource

The U.S. Geological Survey's geothermal test hole in Newberry Crater, Deschutes County, Oregon, has been tested and abandoned. The hole, reported in the September 1981 *Oregon Geology,* was cored to a depth of 3,057 ft. A temperature of 509°F was encountered at 3,051 ft. Substantial gas and steam encountered in the last 6 ft of the well halted the drilling.

A 20-hour flow test found 12,000 gallons per day of fluid condensed from their separator and 1,000,000 cu ft per day of gas phase, including steam and other volatiles. The temperature of the fluid in the separator was 295°F. Initial calculated bottom-hole pressure was 900 psi. These temperatures and flow rates may be adequate for electrical generation, subject to further testing.

When testing was completed, the drill rods were stuck in the hole, and the hole was plugged with cement. No plans for further drilling in the area have been announced. □

Bear attack victim honored as outstanding handicapped federal employee

Cynthia Dusel-Bacon, 35, of Menlo Park, California, a geologist with the U.S. Geological Survey (USGS) and victim of a bear attack, was honored as one of the ten outstanding handicapped federal employees of the year at ceremonies on October 8, 1981, in Washington, D.C. The ceremonies were part of the celebration of the International Year of Disabled Persons and National Employ the Handicapped Week.

While on a routine geologic field assignment in a remote area of east-central Alaska in 1977, Cynthia Dusel-Bacon was attacked by a small black bear. Although badly injured during the hour-long attack, she never lost consciousness and was able to eventually reach her walkie-talkie and call for help. Her left arm was so badly damaged that it was immediately amputated above the elbow. Despite attempts to save her right arm, it was amputated at the shoulder about 10 days later.

She waged a long hard battle to find alternative ways to duplicate functions that had been lost with her arms. Today she is back at work in Menlo Park, Calif., as a project chief in the Branch of Alaskan Geology, working on topical studies of metamorphic rocks in east central Alaska, in addition to compiling a map providing information about metamorphic rocks in all of Alaska. She has just recently completed her second field trip to Alaska since the ill-fated attack.

Besides her work for USGS, she is active in speaking to civic groups about her rehabilitation and views as a disabled person and in making herself available to help other amputees. She remains physically active by swimming, hiking, birdwatching, riding a tandem bicycle with her husband Charlie, a fellow USGS geologist, and, in general, being self-sufficient. □

ABSTRACT

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.

SEDIMENTATION, STRATIGRAPHY, AND FACIES VARIATION OF THE LOWER TO MIDDLE MIOCENE ASTORIA FORMATION IN OREGON, by David Michael Cooper (Ph.D., Oregon State University, 1981)

The lower to middle Miocene Astoria Formation consists of four distinct lithologic members which crop out in three separate embayments along the Oregon coast. These units are the Newport sandstone and Big Creek sandstone, new members which are herein described and informally named, and the Angora Peak sandstone and Silver Point mudstone members.

The Angora Peak member is composed of up to 1,000 ft of fine- to coarse-grained, micaceous, feldspathic, and volcanic sandstone. Sedimentological and faunal evidence suggest that the bulk of this sandstone was deposited in a high energy, wave-dominated shallow marine environment. Conglomerate channels, coal beds, finely laminated carbonaceous siltstone, and a complex intertonguing of the marine/nonmarine parts of the member indicate a fluvial-deltaic origin. This delta consisted of shifting distributary channels and interdistributary deposits fronted by an extensive system of beaches and bars similar to modern high-energy wave-dominated deltas. A fence diagram of the facies suggests that a prograding delta extended from the Angora Peak-Hug Point area southward to Cape Meares during early Astoria time, followed by continued subsidence and concurrent marine transgression. At Astoria, most of the formation is composed of deep-marine mudstone, indicating that a deep-marine basin existed there throughout most of Astoria time.

Overlying gradationally and intertonguing with the Angora Peak member is the 700-ft-thick Silver Point member. This member consists of well-laminated to structureless, micaceous and carbonaceous silty mudstone with numerous well-bedded graded turbidite sandstones in the lower part of the member. The member was deposited in low energy, open to semi-restricted marine conditions of neritic to upper bathyal depths, possibly in a prodeltaic environment. Evidence in the unit for minor local littoral conditions also exists. Oversteepening of the prograding deltaic wedge resulted in slumping of the delta front sands to form turbidity flows which transported the coarse clastics into the deeper water prodelta environment.

The Newport sandstone member is composed of 1,000 ft of moderately to well-sorted, medium- to fine-grained sandstone. These sheet sands were deposited probably as subtidal bar and continental shelf sands distributed by longshore currents on the southern flanks of the Angora Peak delta. This member fines upward, becoming well laminated and resembling the Silver Point mudstones, to which it is tentatively correlated.

East of Astoria, the 1,400-ft-thick Big Creek sandstone member is the lateral equivalent of the Angora Peak and Silver Point members. The Big Creek sandstones coarsen, then fine upward, indicating an influx of coarser sands, probably by a northward shift in the discharge from the Angora Peak delta. Deposition was in intertidal to middle neritic marine conditions on the continental shelf. The upper part of the Big Creek sandstone intertongues to the west with upper bathyal marine mudstones. These sandstone tongues formed as a result of gravity-induced fluidized sediment flows transporting shallow-marine sands into the deeper marine environment.

All of the members are lithologically similar, although the strata in the Newport embayment may have been, in part, semi-isolated from those to the north. Sediment sources were dominantly calc-alkaline and arkosic rocks, probably andesites, dacites, and pyroclastics of the ancestral Cascades, from local Coast Range Eocene basaltic highs as well as from minor recycling of sedimentary units. Petrography and chemistry indicate that some of the Astoria sediments were derived from eastern Oregon and Washington, Idaho, Montana, and British Columbia via an ancestral Columbia River drainage system. Paleocurrent dispersal patterns support this hypothesis.

Micro-textures of sand grains viewed with the scanning electron microscope indicate deposition in high-energy fluvial-marine conditions, adding further evidence of the depositional environment interpreted from other data.

Facies patterns indicate that petroleum potential is greatest in the Angora Peak delta sheet and inner shelf sandstones in the near-offshore continental shelf between Cannon Beach and Cape Kiwanda. □

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