

Abstracts of papers to be presented at the 1969 meeting of the Northwest Scientific Association

(Following are abstracts of papers received by presstime to be presented at the 42nd Annual Meeting of the Northwest Scientific Association to be held at Cheney, Washington, on March 21 and 22.)

Woodland Soil-Site Correlation in Northern Idaho

Steve R. Base

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Woodland soil-site data from 144 temporary plots in northern Idaho were selected from over 200 plots collected by the Soil Conservation Service. Stepwise multiple regression analyses were made to predict site index of ponderosa pine, lodgepole pine, western white pine and western larch by using 10 soil and site variables including the lower three categories of the new soil classification system. R^2 values of 0.45, 0.41, 0.64 and 0.26 were obtained for the regression equations selected. Simple correlations among the various combinations of soil and site variables and site indexes of the four tree species resulted in many significant r values.

The Kink in the Curve, How It Got There, and a Faint-Hearted Suggestion for Its Raison d'Être

R. W. Behan

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In the graphics of economic analysis, a

normal supply curve slopes upward, smoothly, to the right. It indicates that a producer will offer more and more output as the price offered for it rises. In public forestry enterprises, however, a sharp kink in the curve appears at the quantity known as "allowable cut," and no more timber will be offered for sale regardless of price offered. As the operational quantification of the sustained yield policy, the allowable cut

thus imposes a limit on a segment of the market economy.

The paper hypothesizes that the imposition is "political," i.e., an expression of public will working through the channels of American democracy. The origin of the sustained yield policy is traced and its assumptions examined as to (1) the economy in which it operates, (2) the biological system of which it is a function, and (3) the political and cultural system it is designed to serve. Finally, the hypothesis is rejected: sustained yield is seen as wholly inconsistent with modern economic institutions and biological perceptions. And its administration is seen as inconsistent with American cultural and political traditions: it is seen as an arbitrary application of the dogma of forestry professionalism.

Adaptations of Fairy Shrimp to Saline Astatic Waters

Edmund S. Broch

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The fairy shrimp *Branchinecta campestris* was found in association with *Artemia salina* (L.) in four saline astatic lakes in Okanogan County, Washington and in British Columbia. In all four lakes sulphate was the predominant ion making up in milliequivalence 48% of the total ions. The predominant cations sodium and magnesium occurred in varying proportions. The osmotic concentrations of 286 mOsm/l and less *B. campestris* regulate hypototically. However, from 451 to 660 mOsm/l *B. campestris* is poikilo-osmotic and not a hypo-osmotic regulator like *A. salina*. Therefore, its ability to live in saline astatic waters can be partly attributed to tolerance of a high hemolymph concentration.

Coexistence between *A. salina* and *B. campestris* is brief. *B. campestris* is restricted to the early phase of the saline astatic lake, characterized by low but increasing salinity and temperature, whereas *A. salina* appears a month later and is restricted to the high salinity-temperature phase of the lake. Factors responsible for temporal separation of these two species appear to be differences in osmoregulation and in factors regulating development and hatching.

Some Quantitative Aspects of the Grass-Oak Woodland in Sequoia National Park, California

William H. Brooks

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The grass-oak woodland vegetation type is represented nowhere in the national park system except in the Sierra Nevada foothills of central California and Pinnacles National Monument in the inner Coast Range of California. Both areas represent excellent field study potential as a result of their protected status and the availability of past management records. The present study attempts to define some quantitative distributional aspects of the persistent perennial vegetation found in the *Quercus douglasii* dominated grass-oak woodland of Sequoia National Park. The results reported involved the use of plotless sampling techniques in selected stands in the grass-oak community. These stands range from 1300 to 4500 feet in elevation and include a combination of fire and grazing history. Edaphic factors in each of the stands are also considered.

Vertical Distribution of Fuel Volume and Surface Area in Slash

James K. Brown

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A modification of the line intersect technique utilizing randomly located sampling planes 30 cm. wide and in 20 cm. high strata to the top of the slash showed that about 70 per cent of the volume and surface area of spruce-fir logging slash lies below the mid-depth of the slash. Volume and surface area decreased progressively from the ground up through the slash. Material 0-1 cm. in diameter was distributed vertically in the same proportions as for all material. Old slash in the first 20 cm. above the ground contained a higher proportion of material over 1 cm. in diameter than new slash. Quantity of slash averaged 118 tons/ac. dry weight with 1.7 tons/ac. composed of material 0-1 cm. in diameter. Bulk density of slash decreased vertically and averaged 0.038 g./cc. Bulk density for all material was 33 times greater than for material 0-1 cm. in diameter.

Taxonomy of the Intermountain Aconites (Ranunculaceae)

Rex Cates

Department of Botany, University of Washington

This study dealt with the Intermountain aconites of which the chromosome number of $n=8$ was obtained.

The bumblebees, *Bombus rufocinctus* Cresson, *B. appositus* Cresson, and *B. centralis* Cresson, are the major pollinators of the allogamous aconites.

Two-dimensional thin layer chromatography of cauline leaf extracts showed that the Intermountain aconites studied here consist of one chemical group.

The overall evidence indicates that the Intermountain aconites consist of one species, *Aconitum columbianum* Nutt., with two varieties, variety *Columbianum* and *ochroleucum* A. Nels.

Depreciative Behavior in Forest Campgrounds—An Exploratory Study

Roger Clark

College of Forest Resources, University of Washington

Frederick L. Campbell

Department of Sociology, University of Washington

John C. Hendee

Pacific Northwest Forestry and Range Experiment Station, Seattle, Washington

Vandalism, theft, littering, rule violation, and nuisance behaviors were studied in three campgrounds during 1968 using participant observation techniques. Information was gathered on the extent and character of such behavior and factors associated with its occurrence. Empirical data based on structured observation schedules indicated a number of factors associated with depreciative behavior and possible methods of control. The study will continue through another field season to take advantage of exploratory findings.

Gravity Results in the State of Washington
Z. F. Danes

University of Puget Sound

Strong Bouguer gravity minima are associated with the Olympic and Cascade Mountains and with the Puget Sound. Gravity maxima accompany the Coast Ranges and the adjacent Vancouver Island. The Columbia Plateau is a broad gravity low with a local maxima over the greatest thicknesses of basalts.

The isostatic anomalies of all the mountain ranges are about + 50 mgal, while the Puget Sound anomaly is close to -100 mgal and the Columbia Plateau is in an isostatic equilibrium.

Gravity trends show sudden east-west offsets, indicating a system of right-lateral faults, cutting across the Cascade batholith. The Cascade volcanic peaks may have developed where the lateral motion brought the faulted face of the batholith in juxtaposition with basalt.

All the principal features can be visualized as due to convection processes in the asthenosphere.

A Reconnaissance of Ring Dikes and Related Features in the Upper Crab Creek Drainage Area

Fred L. Dayharsh
Kelso, Washington

and

John R. Norberg
Spokane, Washington

A large number of ring dike complexes have been found in the Upper Crab Creek drainage area, occurring singly and in clusters in both major and minor scabland channels. Their annular topographic form results from the dissection of one or more concentrically circular, steeply outward dipping basalt dikes which are usually more resistant than the rock which they intrude. Associated basalt flows often exhibit a slight radial dip outward from the center. Field observation to date indicates evidence of both doming and subsidence.

Related features include: linear dikes, fracture zones, pre-flood soil deposits, magnetite rich sand, and fans.

These ring dike complexes may be significant evidence of both the nature and the origin of the basalt flows in which they occur.

Some Ecological Implications of Fog Drip
Roger del Moral

Department of Botany, University of Washington

Fog drip as a mechanism for redistributing phytotoxic chemicals within the community has never been demonstrated. My studies of *Eucalyptus globulus* revealed that the phenolic phytotoxins chlorogenic, *p*-coumaric, and gentisic acids were leached from foliage and concentrated in soil. Bioassay of this fog drip revealed substantial toxicity to germinating seeds. Soil did not interfere with this toxicity. The characteristic absence of herbs beneath the canopy of these trees was apparently due to this allelopathic mechanism. Redistribution of toxic and stimulatory compounds by fog and rain drip undoubtedly alters the structure and *alpha* diversity of communities.

The Age of the "Columbia River Basalts" Near Astoria, Oregon

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Foundation Sciences, Inc., Portland, Oregon

The dating of "Columbia River Basalt" flows in Western Oregon and Washington has been based on their supposed interbedding with the beds near Astoria, Oregon which have been dated by some as Middle Miocene.

This paper suggests that the Basalt flows near Astoria, Oregon are not related to the Astoria shales which are Middle Oligocene to Lower Miocene in age, and that an unconformity spanning the Middle Miocene exists between the shales and the "Columbia River Basalt." The Basalt is probably Upper Miocene to Lower Pliocene in age.

Subalpine Tree Groups in the Western North Cascades

George W. Douglas

Department of Forest Resources
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The study area consisted of all the higher mountains west of the Cascade crest from Glacier Peak to the Canadian border. This area represents a relatively homogeneous ecological province.

The subalpine zone is defined here as the forested meadows between the forest-line and the tree-line. Ten coniferous species occur within the zone. Of these, six are rare and may be referred to as strangers in the zone. The remaining four are generally found as groups on four different habitats.

The first habitat is that of the numerous avalanche tracks. Alaska-cedar (*Chamaecyparis nootkatensis* [D. Don] Spach), along with the more prolific *Alnus sinuata* (Regal) Rydb., is able to withstand the constant snowslides by bending downhill. On sites where disturbances are infrequent, subalpine fir (*Abies lasiocarpa* [Hook.] Nutt.) also is able to grow.

Another habitat is found on the rock outcrops and ridges of the zone. Where soil has formed, mountain hemlock (*Tsuga mertensiana* [Bong.] Carr.) is able to become established. Subalpine fir, although infrequent, may also pioneer on this type of habitat. Pacific silver fir (*Abies amabilis* [Dougl.] Forbes), a common species in the zone, is infrequent on these sites as a seral species.

The third habitat is found on the deep, well-drained soils of south- or west-sloping meadows. Subalpine fir is usually the main occupant of these slopes although Pacific silver fir and mountain hemlock may occur sporadically. The soil formation of these slopes is relatively rare in the western North Cascades.

The final habitat situation, the most common, occurs on the poorly drained soils of the mountain meadows. The tree groups, usually formed on mounds, are pioneered by mountain hemlock, although occasionally subalpine fir is also a pioneer. The group then enlarges on the periphery, with both mountain hemlock and Pacific silver fir as the major components. Alaska-cedar and subalpine fir are infrequently also seral species. There was no evidence of any single species being climax in these groups.

Geohydrology of the Columbia Basin Project Area, Washington

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The permeability of the basalt ranges from 10 to 40 gpd/ft²; specific yield ranges from .001 to .010. Permeable zones represent

about 10 to 25 percent of total thickness, and have little hydraulic connection.

Unconsolidated sedimentary material overlying the basalt ranges from a few feet to about 900 feet. Permeabilities vary from 100 gpd/ft² in fine-grained material to over 10,000 gpd/ft² in sand and gravel. Specific yield ranges from .01 in fine-grained material to .20 in sand and gravel.

Ground-water flow is controlled primarily by regional geologic structures, and the hydrologic properties of the material above the basalt.

Growth Performance of Frosted Douglas-Fir Seedlings

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Oregon

A hard early frost in September 1965 severely damaged Douglas-fir seedlings at the U.S. Forest Service Wind River Nursery near Carson, Wash. Subsequent growth in two unrelated outplanting studies revealed several interesting things about frosted seedlings. Many apparently undamaged seedlings actually had dead terminal buds. Seedlings left in the seedbed over winter recovered better from frost damage than those lifted soon after being damaged. Frost-damaged seedlings had greater growth potential than undamaged seedlings; they also showed greater tendency than undamaged seedlings to produce a second flush of growth late in the season and to develop multiple leaders.

s- and p-Wave $\pi-\pi$ Phase Shifts at Low Energies

Bryan F. Gore

The Lorentz invariant $\pi-\pi$ scattering amplitude is investigated on the basis of the analyticity and unitarity of the S-matrix. The assumptions of elastic unitarity and approximate crossing symmetry allow the calculation of subtracted dispersion integrals for s- and p- partial waves. Of the seven parameters introduced, five are fixed by derivative conditions to third order from crossing symmetry, the others by the requirement that the p-wave solution exhibit a resonance of mass 750 MeV and width 110 MeV. Computations are iterated by computer.

Five different parameterizations are investigated; nine solutions are found belonging to three parameterizations. Six of the solutions belong to one parameterization; the remainder are similar. Various model calculations reported in the literature yield solutions similar to ours but no model has produced our complete spectrum. A "best" solution is selected on the basis of self-consistency and lack of nearby physical sheet poles of the scattering amplitude. It is characterized by s -wave phase shifts dropping from threshold. Phase shift decreases at the ρ meson mass are $72 \pm 3^\circ$ for $I = 0$ and $41 \pm 4^\circ$ for $I = 2$. The p -wave phase shift is similar to that of a Breit-Wigner resonance but does not approach 180° as rapidly. Scattering lengths are $\mu a_0^0 = -.69 \pm .04$, $\mu a_0^2 = -.37 \pm .03$ and $\mu^2 a_1^1 = .028$.

Plagioclase Mineralogy of the Rock Creek Flow, Columbia River Basalts

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A detailed study of plagioclase in the Rock Creek basalt reveals significant relationships among chemical composition and structural state and texture.

The An content of the groundmass plagioclase varies inversely with size and directly with the amount of associated glass. The rate of cooling, after extrusion, determined the composition of the groundmass plagioclase.

The structural state of the groundmass and phenocryst plagioclase ranges from high to intermediate disorder. Two groups have been differentiated: (1) Groundmass plagioclase in a lower structural state than phenocrysts; the groundmass plagioclase is more calcic than An_{50} and of small size, (2) Groundmass plagioclase in a higher structural state than phenocrysts; groundmass plagioclase generally less calcic than An_{50} and of large size. In addition, the latter group contains smaller amounts of glass than those of group one. The reversal in structural state relationship between the phenocrysts and groundmass of (2) is probably due to the sluggishness of the transformation from order to disorder in plagioclase less calcic than An_{50} .

Geochronology of the Columbia River ("Yakima") Basalt in Central Washington

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Five Columbia River Basalt K/A dates (Mobil Oil Corp.) from type region, central Washington are: (1) Fifth flow from base; 10.7 miles northwest of Ellensburg (SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 28, T19N, R17E); unconformably overlain by type Ellensburg; 16.6 ± 0.6 , 16.1 ± 0.6 . (2) Highest TRM reversed flow below Museum; south flank Baldy Mountain, U.S. 97 (NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 9, T15N, R19E); 15.2 ± 0.7 , 15.1 ± 0.4 . (3) Museum Flow; opposite Wymer, U.S. 97 (SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 33, T16N, R19E); south flank Baldy Mountain, U.S. 97 (NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 9, T15N, R19E); overlies Rocky Coulee; underlies Vantage; 16.9 ± 1.1 , 16.5 ± 0.8 , 15.5 ± 0.6 . (4) Roza Flow; Roza Gap, tunnel on U.S. 97 (SE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 9, T14N, R19E); overlies Squaw Creek Diatomite; unconformably underlies Ellensburg; 16.8 ± 0.8 , 16.5 ± 1.0 , 16.4 ± 0.5 , 16.2 ± 0.7 , 16.4 ± 0.8 , 13.3 ± 0.5 . (5) Pomona Flow; quarry (SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 17, T14N, R19E); intra-Ellensburg; 13.3 ± 1.3 , 13.1 ± 1.3 , 12.3 ± 2.2 , 11.9 ± 2.1 .

Ancestral Hybridization in *Juniperus* Detected through Gas-Chromatography

Robert S. Irving

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Hybridization is a salient evolutionary stimulus. Although extant gene flow is readily monitored, even more important ancestral gene exchange is often illusive in its documentation. Chemosystematic studies with *Juniperus mexicana* of northern Mexico tentatively suggest its origin as a stabilized ancestral hybrid between *J. ashei* and *J. virginiana*. By examining the terpenes through gas-chromatography over 40 chemical differences between the putative parents have been revealed. The hybrid, *J. mexicana*, possesses a summation of these parental compounds contributed by the genomes of *ashei* and *virginiana*. An examination of the morphology also points to a hybrid origin, although the characters are few in number and intergrading.

Comparison of Columbia River Basalts and Snake River Basalts

Robert W. Jones

University of Idaho

Miocene Columbia River Basalts form laterally extensive flows that are olivine-poor, thick, columnar, and massive. Quaternary Snake River Basalts of eastern Idaho form coalescing shield volcanoes of olivine-rich flows that are thin, poorly columnar, and have pahoehoe tops, abundant lava tubes, low silica, and high iron plus magnesia. Pliocene-Quaternary basalts of south-central Oregon resemble Snake River Basalts in the field but resemble Columbia River Basalts chemically. All have different modes of eruption: Columbia River Basalts—elongated dike swarms; Snake River Basalts, a plexus of short fissures; and Pliocene-Quaternary basalts, margins of fault blocks.

Language Training for Future Foresters

Wendell M. Keck, Editor

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Language training usually provided in forestry curricula fails to prepare the student to do the kinds of writing that will be required of him in pursuit of his career. The forester's language training should be based on generally recognized needs for skillful communication rather than on traditional course offerings by English departments. Forestry schools should evaluate students' communication skills from performance tests rather than simply relying on grades from courses in English.

Underground Distribution of Electric Power

Saul Kessler and Mark F. Adams

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A significant temperature dependence of standard Cu: $CuSO_4 \cdot 5H_2O$ electrodes for measuring earth potentials was noted in preliminary laboratory experiments. These temperature related potential differences were verified in extensive field tests.

Other laboratory field investigations of corrosion hazards to underground residential distribution (URD) circuits showed:

- 1) how to predict performance of URD circuit components by accelerated methods;
- 2) how to evaluate URD cables and connectors in situ to detect deterioration or damage thereby anticipating and avoiding disastrous electric power failures;
- 3) how to interpret surface manifestations from various loadings of a directly buried URD circuit.

Cameron Mountain Landslides, Southern Medicine Bow Mountains, Colorado

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Eastern Washington State College

Abundant landslides in the massive granites composing Cameron Mountain suggest a unique physical setting. Rockslides and rock slumps of different ages and sizes occur on the steep flanks. Amphitheater-like features resembling cirques are probably scars of older rock-slumps.

Major causal factors are probably oversteepening of the encircling glaciated canyo and possible faulting. Northwest trending lineaments (some with troughs and undrained depressions) parallel the structural trend of the range and are probably fault traces. The lineaments are independent of topography, can be traced for at least two miles and occur just above the pseudocirques.

Elk Sedge Establishment

G. O. Klock

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Many conservationists feel that certain select native grass and grass-like plants provide the most desirable soil stabilization cover on wildlands. One such plant is Elk sedge (*Carex geyeri* Boott). Elk sedge, with an extensive fibrous root system and high drought resistance, may be one of the most important native forage species and soil binders on the National Forest lands of Oregon and Washington. Quick establishment of this species on disturbed sites would be desirable. Reproduction from seed in the laboratory has not been successful

Transplanting "cores" or clones at the laboratory was initiated to investigate this method of reproduction and the plants' response to fertilization. Establishment by transplanting was successful, and Elk sedge showed positive response to nitrogen and potassium fertilization.

Use of a Starter Fertilizer for Vegetation Establishment

G. O. Klock

Forest Service, U.S. Department of Agriculture, Pacific Northwest Forest and Range Experiment Station, Forest Hydrology Laboratory, Wenatchee, Washington

A successful soil stabilization program to prevent erosion requires the establishment of a vigorous ground cover immediately following site disturbance. The proper use of a starter fertilizer to meet this requirement has been demonstrated in the laboratory and in field investigations on newly developed ski slopes near Wenatchee, Washington. Crested wheatgrass (*Agropyron cristatum* [L.] Gaertn.) was planted in the greenhouse on unfertilized soil from the ski slopes. Seedlings emerged but did not develop once the seed energy had been exhausted. In 56 days the same soil fertilized with a prescription prognosticated by soil chemical analysis produced up to 1.72 tons per acre of oven-dry material. Field plots established on the ski slopes in August 1968 confirm the validity of our greenhouse diagnosis.

A Technique for Estimating Relative Numbers of Bacteria in Wood Samples

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Many studies of fungi in wood have indicated the prevalence of bacteria in wood of living trees. The role of these bacteria is unknown, although they are suspected of causing wetwood, a xylem disease, and of being responsible for the brash nature of discolored heartwood in *Populus* species. Bacteria are also thought to be an important link in the succession of microorganisms which precede primary wood rotting organisms.

Population studies on bacteria in wood require some method of estimating the relative numbers of bacteria. No methods were found in the very modest literature of tree bacteriology. The following method was satisfactory for this purpose. Samples were taken from green, frozen-stored bolts of trembling aspen (*Populus tremuloides* Michx.). Cross-sectional disks, 1 inch thick, were cut from the bolt and divided into sapwood, heartwood, and diseased wood (wetwood). From these, cylinders of wood (0.5-inch diameter) were cut with a gasket cutter—essentially a hollow round chisel. Wood cylinders were then dipped and flamed with alcohol and placed in a presterilized length of rubber tubing, 8 inches long, 0.5-inch inside diameter. The "loaded" tubing was placed under a hydraulic press and the sap expressed at 3000 psi. The press was slanted so the sap would run out the end of the tubing and be caught in a presterilized vial. Expressed sap was diluted by standard dilution techniques and plated on different media. Differences in bacterial counts were readily detectable using this method.

Advantages include the ability to determine the relative number of bacterial colonies in different wood types (e.g., sapwood vs heartwood) or in wood treated in different ways. With proper dilution, individual colony color and shape can be seen and it is easy to get pure cultures of any colonies. Also, one can test differential growth response by using several media.

Columbia River Basalts of the Grand Coulee Area

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Three distinctive flow assemblages are exposed in the Grand Coulee area. The Roza Basalt Member, which contains from one to three porphyritic basalt flows, is overlain by the nonporphyritic Priest Rapids Member (up to four flows) and underlain by a porphyritic assemblage of as many as four Frenchman Springs Basalt Member flows. The larger but less abundant plagioclase phenocrysts in the Frenchman Springs flows serve to distinguish these flows from the Roza flows. Fine-grained, possibly pyro-

clastic, interbeds that separate the members represent periods of volcanic quiescence. The lithologically similar flows within each assemblage are in tight contact with one another and were extruded in rapid succession.

Relation of Failure of Neuromuscular Transmission to Onset of Denervation Supersensitivity in Frog Sartorius Muscle

Leonard Levine

Pacific University

In frogs (*Rana pipiens*) kept at 22°C, denervated sartorius muscles do not increase significantly in sensitivity to acetylcholine until after neuromuscular transmission fails on the fifth day. Thereafter supersensitivity develops rapidly, rising to 25X by the tenth day. In frogs kept at 4°C after denervation, sartorius muscles retain indirect excitability until the sixth week, and acetylcholine sensitivity remains unchanged. When frogs are transferred from 22°C to 4°C on the seventh day after denervation, sartorius muscles show no further gain in sensitivity for at least the next 10 days. Thus denervation supersensitivity in skeletal muscle involves two temperature-dependent processes: (a) loss of a neural trophic factor and (b) formation or unmasking of acetylcholine receptors in the muscle membrane. (Supported in part by USPHS Grant NB-07138-02.)

Neoglacial Moraines in the Vicinity of Mount Deception

William A. Long

Port Townsend, Washington

Mount Deception at 7788 feet is the second highest mountain on the Olympic Peninsula. A succession of three morainal sets on the north side of this mountain is evidence for three episodes of glacier advance within the Neoglaciation.

The earliest glacier advanced 1½ miles to a down-valley maximum and left terminal deposits on the floor of Royal Basin at about 5100 feet altitude. Moraine slopes are stabilized, support old-growth trees, and have a forest litter composed in part of rotted logs and trunks.

The intermediate and youngest moraines occur around the margins of existing ice and

snow bodies less than one mile from the cirque headwalls. They contain large angular boulders, have unstable slopes, and soil is very thin and patchy. Basal core tree ring count from scattered firs growing on the intermediate moraines indicates that this ice advance occurred a minimum of 1: years ago. No trees grow on the youngest moraines.

Neoglacial moraines in Deception Basin, on the north side of Mount Mystery, are mapped and described. A 200-foot high embankment of unstable debris appears to mark the terminus of late Neoglacial ice, and behind lie many subtle recessional moraines.

A Preliminary Report on the Glaciation of the Middle Entiat Mountains, Washington

William A. Long

Port Townsend, Washington

The broad, rolling, 5000- to 6500-foot high upland of the middle Entiat Mountains was occupied by a small Pleistocene ice cap with at least four outlet glaciers. Marble Creek and Mad River glaciers deposited well defined end moraines; Tommy Creek and Three Creek glaciers joined a 34-mile long valley glacier that built an end moraine on the Entiat River.

The principal products of glaciation on the Entiat upland are well rounded rock bosses and widely scattered patches of smoothed and striated bedrock, whose spatial distribution confirms that an ice cap lay on its surface.

One episode of glaciation is recognized; it is considered Wisconsin and predates Glacier Peak volcano pumice-ash which is widespread on the upland and is on all moraines.

A Portable Apparatus for Estimating Stomatal Aperture in Conifers

William Lopushinsky

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Design and use of a compact, portable apparatus for estimating stomatal aperture in conifers by a pressure-infiltration method is described. Results of tests with Douglas-fi

and several infiltration fluids are presented. A transpiration test with ponderosa pine and a 57-percent alcohol solution showed that the stomata can be considered fully open at an infiltration pressure of 10 psi or less, and essentially closed at 40 psi. Determination of end point was more precise with open and closed stomata than with partially closed stomata. Infiltration pressure decreased with increasing needle age.

Prediction of Soil Water Behavior in a Forest Ecosystem

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Soil water behavior was examined in a forest ecosystem at Cedar River Watershed near Landsburg, Washington. Tension lysimeters are installed so that the soil and rooting systems are undisturbed. Flowmeters are coupled with the lysimeters to measure flow of soil water through the soil profile. A data logger continuously records environmental data as well as soil water flow. The soil is derived from a coarse glacial outwash material. Time lapse and flow rates of soil water movement between the soil horizons are predicted from precipitation.

Geochemistry of the Mesozoic Tholeiites of the Southern Continents

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During the Mesozoic, very large volumes of tholeiitic basaltic magmas were intruded into, or were erupted upon, essentially flatlying continental to shallow marine sediments in South Africa, South America, Antarctica and Tasmania. Trace element geochemical data on a limited number of South African dolerites and South American dolerites and basalts show that these magmas may have been derived from the upper mantle with little modification. In contrast, the Antarctic and Tasmanian dolerites, which are geochemically remarkably similar to one another, exhibit unusually high U/K, Th/K, and initial Sr^{87}/Sr^{86} ratios, together with low K/Rb values. The observed ratios are similar to those found in crustal rocks. Thermal and

geochemical arguments indicate that it is unlikely that the Antarctic and Tasmanian basaltic magmas were generated in the crust. An upper mantle source for the magma is suggested, implying that either the upper mantle is markedly inhomogeneous or that the magmas were subsequently strongly contaminated by crustal material. (Publication authorized by the Director, U.S. Geological Survey)

Phorate Persistence in a Forest Soil

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Phorate (0-0-diethyl S-ethylthiomethyl phosphorodithioate), a highly toxic systemic insecticide, was applied broadcast on the forest floor at rates of 1, 10, and 100 pounds per acre in a stand of young Pacific silver fir [*Abies amabilis* (Dougl.) Forbes] at each of two western Oregon locations in May 1966. Persistence of phorate and its metabolites (measured as phosphorothiolate sulfone) was determined at the end of each of the first two growing seasons.

Mean concentrations in the forest-floor after six months were 2.04, 0.58-, and 631-ppm phorate and 2.78-, 26.56-, and 238-ppm metabolite for the 1-, 10-, and 100 pound-per-acre rates, respectively. Complete degradation was quite rapid at the two lower rates as indicated by total residues of 8.40 and 9.98 per cent of chemical applied for the forest floor and surface 12 inches of soil combined. At the 100-pound rate, however, 97.87 per cent of the total chemical applied was still present in the forest floor and soil as phorate or its metabolites. Some downward movement had taken place but less than 4 per cent of the total residue was found below the 3-inch soil depth. After 18 months, measurable levels of both phorate and its metabolites were still present in the forest floor and soil. At the highest rate of application, the mean total residue was 4.50 pounds per acre.

Poria Weirli: Where Are We and Where Do We Go From Here?

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Poria weirli root rot of Douglas fir (*Pseudotsuga menziesii* [Mirb.] Franco) and other conifers in the West has been known to forest pathologists for nearly 40 years. Observations and studies conducted since its discovery on Vancouver Island have revealed many details of its habits of growth and sporulation, conditions for survival, manner of spread, host species, infection requirements, and other aspects of its physiology and ecology.

This knowledge, though still incomplete, is being used in current studies to determine if control can be obtained by regulation of species composition, fertilization, mechanical disturbance of site, tree breeding, thinning, and regulation of initial spacing. Each of these approaches has its advantages and disadvantages, and as yet none has been developed to the point of practical control.

Palynology of Interflow Sediments from the Std. Oil Co. of Calif., Rattlesnake Hills No. 1 Well, Benton County, Washington

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A well drilled on the Rattlesnake Hills anticline, Section 15, T11N, R24E, bottomed in basalt at 10,655 feet. Interflow coal and shale cuttings were recovered from the 2100-4800 foot interval. Eight coal and two brown shale samples processed for palynomorphs yielded abundant pollen and spores and some freshwater algae.

The assemblages are interpreted as being post-Eocene or early Oligocene "subtropical" and pre-early or middle Miocene "warm temperate" (pre-Compositae) in aspect. The suggested age of the 2100-4800 foot interval is middle Oligocene to late Oligocene or early Miocene, thus implying ages of Oligocene to Eocene for older groups of flows in the lower half of the well.

Apparent Chromosome Homology in Ocelot (*Felis pardalis*), Margay (*F. wiedii*) and Domestic Cat (*F. catus*)

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Current estimates of the phylogenetic separation of Old and New World species of *Felis* indicate that it occurred over a million and a half years ago. Karyotype analysis of chromosomes of *F. catus* (an Old World species), and *F. pardalis* and *F. wiedii* (New World species) shows that some chromosomes have diverged by at least one structural change, but most of them are morphologically similar. Among the similar pairs, the tritiated thymidine terminal labeling patterns of two which can be easily identified are so similar that they indicate these pairs may well be homologous.

Structural Analysis of Tectonites in the Northport District, Washington

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Near Northport in northeastern Washington, quartzite and schist of the lower Cambrian Gypsy quartzite and phyllite and limestone of the overlying Maitlen phyllite have been deformed twice and possibly three times.

The first deformation produced a large overturned isoclinal anticline, the axial plane of which strikes N.65°E. and dips 60°S. This fold and the related parasitic folds (F_1) plunge 30° 1.48°W. Strong axial plane cleavage developed in the quartzites and shearing occurred along these surfaces.

The second deformation resulted in crenulation and kink folding of the S_1 surface. The F_1 axes and the F_2 axes are parallel. The F_2 axial planes strike about N.42°E. and dip almost vertically, approximately parallel to the cleavage (S_2) in the schist.

Poles normal to S_2 surfaces and F_2 axial planes lie on a stereogram great circle suggesting a possible third stage of folding with an axis plunging 20° S.42°W., or nearly parallel to the F_1 and F_2 axes.

Similar plunges of the F_1 , F_2 , and possible F_3 folds suggest that all three deformations are the product of the same stress field operating during one orogenic epoch.

Post-Miocene Erosion of Basalt in Southeastern Washington

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Field evidence from the Lewiston Monocline suggests stripping of basalt flows in a manner reminiscent of the Great Denudation of the Colorado Plateau. The rimrock flow above the Lewiston Basin can be traced into the stratigraphically lowest of a series of flatirons above which a section at least 940 feet thick projects into the air. The crest of the Blue Mountain Anticline to the south has been stripped of all but a few residual buttes and resistant dikes that persist as cockscomb ridges. The step toes of Southeastern Washington appear therefore to be exhumed features.

Chromosome Mosaicism in Male Calico Cats

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Male cats with orange and black mosaic colors in their coats are most frequently found to have a chromosome constitution of $2N+1 XXY$. Some cats have been shown to be mosaics of $2N XX/3N XXY$ or XXY , or $2N XX/2N XY$. A cat currently under study has a $2N XY$ or normal male constitution. To account for the presence of the two colors in his coat, it is postulated that he is a mosaic of two lines of male cells, one having the orange factor, the other having the black on the X chromosome.

An Improved Cuvette for Measuring Transpiration in the Field

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Fundamentals of the cuvette technique are reviewed and discussed with emphasis on the principal problems involved. Various attempts to surmount these problems are discussed and evaluated.

A list of design considerations is developed and from these considerations a cuvette system is proposed. Details are given concerning construction and operation of the system along with the results of some field trials.

The Effect of L-proline on Wound Vessel Member Differentiation in *Coleus*

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The addition of L-proline to *Coleus* stem explants has a highly stimulatory effect on auxin-induced xylem differentiation in explanted tissues cultured on sucrose-agar. This effect was observed only when the L-proline treatment preceded the addition of exogenous auxin. The results are discussed in terms of the extension hypothesis of auxin action.

Aspects of Evolution in the Xylariaceae

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The Xylariaceae is an ancient family of wood- and dung-inhabiting perithecial Ascomycetes. A few of the genera most frequently represented in collections made in temperate climates are *Rosellinia*, *Xylaria*, *Hypoxyton*, *Daldinia*, and *Nummularia*. The taxonomic limits of each of these genera are uncertain. The relationships among species within each of these genera, and among species of different genera, are largely obscure. I have taken a cytotoxic approach toward understanding directions and mechanisms of evolution in the Xylariaceae. Attempts are being made to correlate cytological data—including chromosome numbers, behavior of meiotic chromosomes, patterns of ascospore nucleation, and gross and fine structure of ascospores—with gross morphological and histological aspects of perithecial and stromatal development and with host and substrate ranges and with pathogenicity.

Stimulation of Hypogeal Germination of Lily Seed by Incubation at 20°C

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Some species of the genus *Lilium* which have hypogeal germination seem to be stimulated to earlier and more consistent

germination by incubation for from one to six weeks at 20 to 30°C before incubation at temperatures suitable for germination. For *L. columbianum*, germination is 90 to 100 per cent in eight weeks, with the first one to three weeks at 20°C, followed by 10°C, whereas controls at 10°C have only about 50 per cent germination. *L. auratum*, *auratum* hybrids, and *L. speciosum* germinate in about seven weeks with the first two, three, or four weeks at 25°C or six weeks at 20°C followed by 17°C.

Lichens of Turnbull National Wildlife Refuge

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Studies made during 1967 and 1968 in the Turnbull National Wildlife Refuge near Cheney, Washington give information about the lichen flora of a relatively undisturbed *Pinus ponderosa* forest. Some 50 lichen species in 20 genera and 13 families are represented in the Refuge.

Amounts of Bark Available from Some Commercial Trees of British Columbia

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Some factors that determine distribution of thickness and percentage of bark have been analyzed for the commercial tree species of British Columbia. Methods have been developed for estimation of bark specific gravity and have been used primarily in simulation of forest fuel weights for Douglas fir, western hemlock, and western red cedar. Data obtained also will have applications in biomass studies and in estimation of bark available for various commercial purposes.

Local Centers of Miocene Volcanism Along Coastal Oregon and Washington

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Middle to upper Miocene basalt flows,

pillow lavas, and breccias and associated sills, dikes, and stocks along coastal Oregon and Washington form three petrochemically distinct units. Basalt in each unit is uniform in composition even though the numerous local vents occur over a north-south distance of more than 100 miles. The three units are virtually identical in composition to basalt flows of the Yakima and late Yakima type (Waters, 1961) and Pomona Basalt of Schmincke (1967) on the Columbia Plateau. Extrusion of three basalt sequences of the same age and composition from eruptive centers up to 400 miles apart has important implications on crust and mantle structure and magma genesis.

Feeder Dikes for Columbia River Basalt in Northeastern Oregon, Western Idaho, and Southeastern Washington

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Hundreds of feeder dikes for Columbia River basalt occur in a gigantic swarm that extends northward for 165 miles from the Snake River Plain to near Almota, Washington.

As many as 30 dikes per square mile occur near the axis of the swarm. Dikes generally are at least 18 feet wide and commonly 50 feet wide but seldom more than 75 feet wide. Few dikes are more than three miles long, but many are 1.5 miles long.

The dikes have the same general trend (north-northwest) as most post-Oligocene dike swarms of the Basin and Range structural province.

Truffle Production in Italy—An Example of Applied Myco-Ecology

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Certain species of truffles, the subterranean Ascomycetes of the order Tuberales, have been prized by gourmets in the Mediterranean area for at least two millennia. Because of their continuing high market value, they have long been objects of intense study.

That truffles occur only among roots of certain tree and shrub species was perceived

long ago, as were relationships of host age and vigor to total truffle production. We now know that truffles are obligate mycorrhizal fungi and, on this basis, can explain these phenomena of habitat and host. Moreover, even the unlettered truffle hunters, who have never heard the term "ecology," know that truffles are most likely to be found on calcareous soils and relatively warm sites.

During studies financed in part by the American Philosophical Society and the Society of the Sigma Xi, I observed current practices of "cultivating" and harvesting truffles in Italy. In some areas of the Apennines, whole hillsides are devoted to culture of the black truffle (*Tuber brumale* Vitt. and related species). Scrub vegetation that does not form mycorrhizae with the desired *Tuber* species is cleared and replaced with widely spaced oak plantations. Seedlings are either started on truffle-bearing soils and then transplanted or planted directly in holes that have been inoculated with soil from an established truffle site. Maximum truffle production occurs with oaks from about five to 30 years of age. Other mycorrhizal fungi evidently begin to replace the *Tuber* species with further aging of the stand. Accordingly, new seedlings are planted under truffle-producing oaks that are approaching 30 years of age. When the seedlings are about five years old, the older trees are cut.

No commercially valuable truffle species are native to North America. Enough is now known about the ecological requirements of these mycorrhizal fungi, however, that they probably could be introduced to areas of warm climate and calcareous soils in the United States.

Cytogeography of *Achillea millefolium* in Western North America

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A cytogeographic study is being made of the tetraploid ($n=18$) and hexaploid ($n=27$) chromosome forms of *Achillea millefolium* L. in western North America, in order to clarify their distributions, to determine if pentaploid hybrids are present at contact zones, and to correlate environmental conditions with the presence of

the tetraploid in the coastal area of the Siskiyou Mountains and on the Olympic Peninsula. Present data indicate that the distributional pattern is more complex than previously reported, involving overlapping ranges, the occurrence of mixed populations, disjunct populations, and penetration of one form into areas occupied by the other. Hypotheses are advanced as to the origin of the North American hexaploid chromosome form and its present pattern of distribution.

Maar Volcanoes, Western United States

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and

Richard Fisher

Board of Earth Sciences, University of California at Santa Cruz

Examination of more than 25 Maar-type volcanoes in the western United States indicates that all are surrounded by ejecta blankets (or by tuff rings) built chiefly of drastically chilled sideromelane, or its alteration product, palagonite tuff. An eruptive mechanism whereby rising basalt magma encountered either surface or underground water is thereby indicated. Further support of this mechanism is revealed by the graded, convolute, and surge-current bedding of the deposits, and by sedimentary inclusion within them. Bedding sags, accretionary lapilli, and rill channels are characteristic of deposits from wet subaerial eruption clouds.

Columbia River Basalt as a Critical Oregon Cascade Datum

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Numerous Oregon Cascade remnants of Columbia River Basalt overlie the Little Butte Complex with marked unconformity.

Proper employment of this regionally extensive sub-basalt discontinuity as a stratigraphic and structural datum discloses certain "units" of presumed *post-basalt* age (e.g., "Sardine-Rhododendron") actually to be misconstrued *pre-basalt* Little Butte. Thus, the successional order of major Cenozoic constituents has been inverted in much of the Oregon Cascades (Peck, et al., 1964).

Stratigraphic reordering and consequent structural reversion reveals that the basalts

have been arched *over* (rather than "downwarped" *into*) the range, and that the long-prevailing "volcanic pile" interpretation is therefore invalid.

Litter Production and Litter Accumulation in Red Alder Stands in Western Oregon

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Litter production in red alder communities two to 33 years old was higher than that reported for any community of the temperate regions. In 50 years, cumulative quantity of litter fall reaches about 340 tons/ha, the major part of which is decomposed and incorporated into mineral soil. A typically high litter production was determined also in communities of other nitrogen fixers suggesting that nitrogen fixation may be the main reason for the high litter production.