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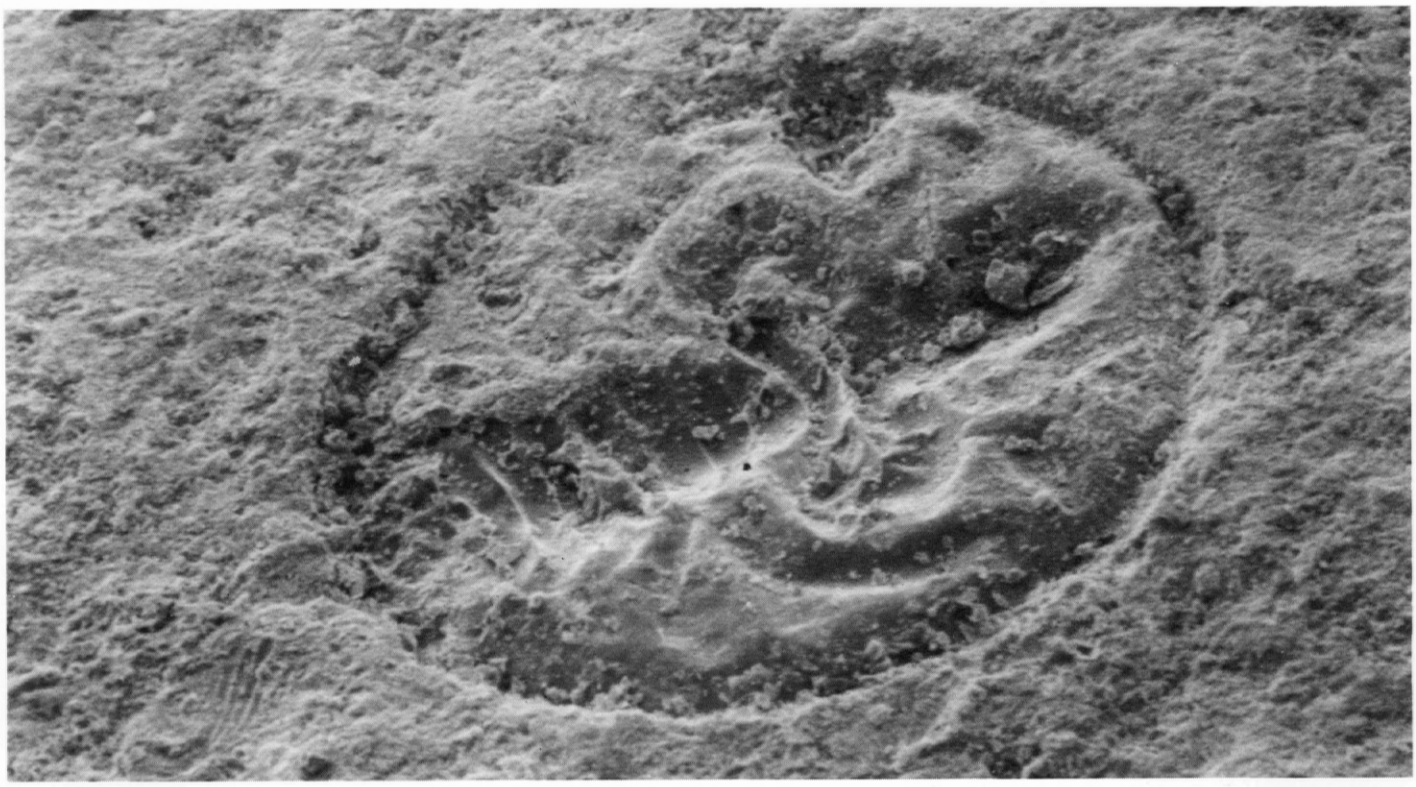

Arthur Boucot and J.Granville Johnson

Two paleontologists follow different adaptive strategies

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Cover

Top photo shows the imprint of an olive whitefly larva Aleurolobus (Aleurodes) olivinus Silvestri, *on the surface of a fossil olive-leaf (37,000 years B.P.) from Santorini island, Greece. The lower photo is a pupa of the olive whitefly on an extant* Olea *leaf. The arrangement of the larvae on the leaf surface, their shape and size (0.625 mm in longest diameter), and even the imprint of the parallel striated rim of the larvae resemble the extant forms so closely that one can be certain that they belong to the same species. The larvae of the olive whitefly are today very common on olive leaves. Thus, the plant-animal* (Olea-Aleurolobus) *relationship of the 37,000-years-old horizon shows that the co-evolutionary relations have not changed since that time.*

(Reprinted from: "Fossil plants from Weichselian interstadials, Santorini, (Greece) II" by W. L. Friedrich in Papers and Proceedings of the Second International Scientific Congress, Santorini, Greece, August 1978)

Oregon State University

Fossils have been called "the witnesses to our biological and geological past." These earlier forms of life fixed in stone—some so unusual as to seem creatures from other worlds— have fascinated man since the beginning of time.

Paleontology, the study of fossils and fossilization phenomena, has made enormous strides since the end of the eighteenth century. Although the fossil record is far from complete, paleontologists have played an important role in our understanding of the evolution of the earth and of living organisms.

New fossils are being discovered constantly. For example, when brachiopod genera (fossil sea shells) were comprehensively reviewed in 1965, 1,500 had been listed. Today, the number of known brachiopod genera has doubled. Other scientific advances of the last three decades, including radioactive dating techniques, have made possible new degees of accuracy in interpreting data from fossils.

Paleontologists Arthur Boucot and J. Granville Johnson, have taught and conducted research in paleontology, biostratigraphy, paleobiogeography, paleoecology, and evolution in the Department of Geology since 1969. Their scientific and personal association dates back to the late fifties when Dr. Boucot, who was then at the California Institute of Technology and already an authority on Devonian brachiopods, guided Johnson's Ph.D. dissertation on that topic. They continued to work together when Johnson, after completing his doctorate at UCLA, went to work with Boucot at Caltech first, and later briefly at the University of Pennsylvania.

Although both scientists still share many basic interests and occasionally collaborate (they have cooperated on more than forty publications to date), their individual research efforts have moved in different directions. The association has long ceased to be that of mentor and student. Johnson has established his own reputation as a scientist and a teacher, producing fundamental interpretative work of geological processes.

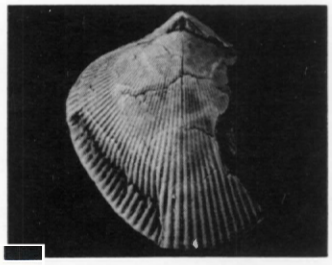
Their respective roles within their chosen discipline are different. Boucot's energies in the last ten years have been channeled toward understanding the evolutionary and environmental implications of his life-long study of fossils and more recently of fossil communities. He now views himself as a paleoecologist, evolutionist, and historical biogeographer. Johnson, on the other hand, thinks of himself primarily as a geologist who uses fossils and the fossil record as a means of understanding large scale geological processes of the past.

Arthur Boucot: Brachiopods, Fossil Communities, and Evolution

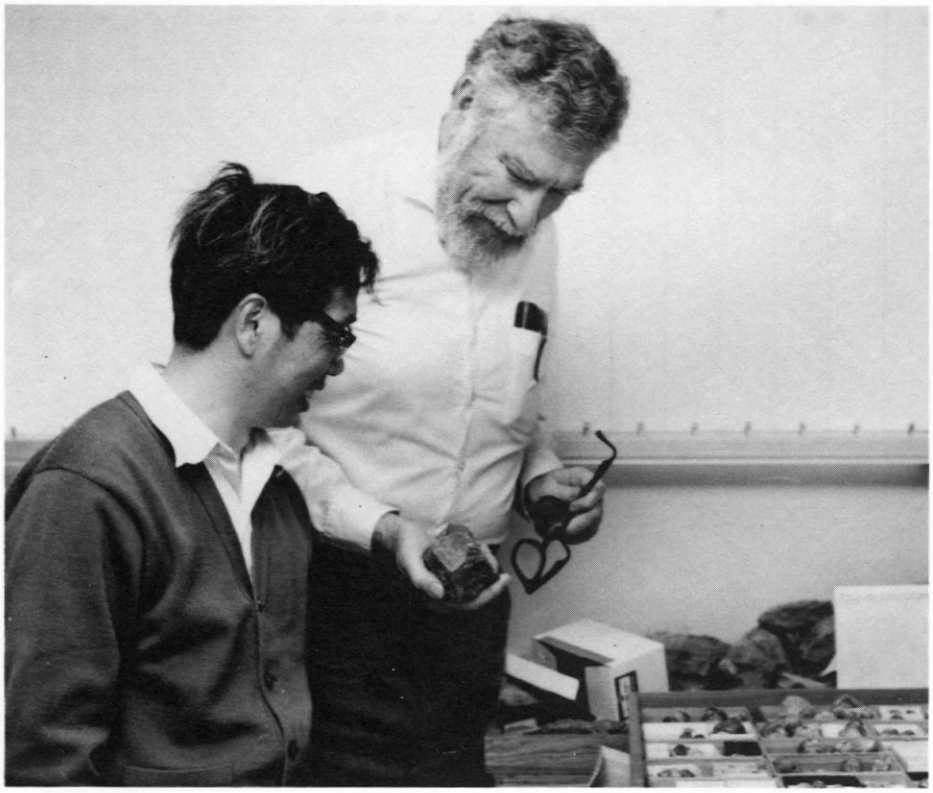
"Traditionally," says Boucot, "most paleontologists spend their earlier years in the careful description of fossils and their later years in considering the implications of these descriptions and of varied geological correlates."

Boucot has always been interested in fossils, but he began their serious study as a graduate student at Harvard University in 1948. A returning veteran of World War II, he concentrated on the study of Silurian-Lower Devonian brachiopods—fossils of marine organisms similar to clams—from the middle Paleozoic era (370-430 million years ago).

"Until 1970 or so," continues Boucot, "I spent my time learning the trade—describing and classifying fossils, and determining relative ages of Silurian and Devonian fossil beds on a global scale." This is an understatement because Boucot did more than just "learn his trade" in those twenty years.



Brachiopod (Globithyris; *scale in mm) from the Early Devonian found in central Arabia.*



Elwyn Obert

Arthur Boucot (right) discusses brachiopods from China with Chen Yuan-ren, a geology professor from Chengdu Geological College in Chengdu, Sichuan, China. Chen, also a paleoecologist, has come to OSU for a two-year period to study with Dr. Boucot.

All evidence points to the fact that wood-boring beetles (Pithyogenes chalcographus) *have been constructing complex set of chambers as they do today for over 20 million years. The chamber patterns of larval beetles have not altered. They are so distinctive that foresters and entomologists can easily recognize their presence in this Miocene quartzite from Lower Silesia, Poland.*

(Reprinted from "Present-day types of trace in the Neogene sequence; their problems of nomenclature and preservation" by A. Radwanski in Trace Fossils 2, *Proceedings of an International Symposium held at Sydney, Australia, 23, 24 August 1976 as part of the 25th International Geological Congress)*

He published voluminously—more than 150 papers by 1970— and traveled to every corner of the world from Greenland to Australia and from Canada to South America, for field work and to attend international conferences where he was often invited to speak. In 1968, he was a National Academy of Sciences Exchange Fellow to the Soviet Union. This level of activity continues today. He is now a member of several international commissions and is presently chairman of Project Ecostratigraphy, an international correlation program sponsored by UNESCO and the International Union of Geologic Sciences. He received a Senior Scholar appointment from the National Academy of Sciences in the summer of 1980 and was one of the first U.S. scientists to visit China, where he spent five months studying Silurian-Devonian correlation, biogeography, and community ecology.

"In the last ten years," explains Boucot, "I have become increasingly interested in the significance of my paleontological findings in terms of organic evolution, for ultimately the one central question is: 'How does evolution work?' Since I have been at OSU, I have retooled myself and informally taken another degree in the life sciences, in an effort to find out more about fundamental evolutionary problems."

As a result, he has become deeply involved in paleoecology. He combines his expertise in fossils and his knowledge of biological processes to understand the environments that sustained earlier forms of life and their evolution. Although he has continued to do basic paleontology, in the last five years he has devoted more of his time to historical biogeography, the study of the distribution of plants and animals in time and space. He has given special attention to those fossil organisms that appear to have coevolved because they were dependent on each other for survival. The result of some of this work has been a recently published 450-page volume entitled *Principles of Benthic Marine Paleoecology* (Academic Press).

Boucot explains that most previous work in evolution was effectively summarized about 25 years ago by George Gaylord Simpson, who recorded attributes of changing morphology preserved in the fossil record. Little was done by Simpson, or anyone else since, on the fossil record of populations—that is, the study of communities or associations of organisms.

"It had become obvious to me during my years of work with fossils," continues Boucot, "that certain species would regularly appear in close association with each other in different locations and at different times. These recurring regularities led me to pay particular attention to fossil communities and their abundance relationships.

From my observations of species living in level bottom marine environments, I have formulated some generalizations that can be applied to other environments."

Biologists have debated for years whether organisms evolved independently from one another or whether they coevolved. Many biologists view evolution as a race where predators and prey constantly evolve to improve their rate of survival. From his investigations of fossil communities, Boucot has come to the conclusion that changes in community groups were abrupt rather than gradual.

"Most of Phanerozoic time (the Paleozoic, Mesozoic, and Cenozoic eras) was taken up by ecologic stability and fixity and not by change," he says. He has reason to believe that for millions of years organisms may have changed some minor morphological attribute but not their basic physiology, their behavior, or their capability to adapt to new associations. Their behavior appears to have been remarkably conservative for millions of years except at certain intervals of great upheaval—the nature of which is still a matter of speculation.

At this point, Boucot brings up the unexplained example of clams versus brachiopods. During the Paleozoic era, brachiopods were more numerous than clams. Although these organisms were similar and shared the same environments, they did not depend on each other for survival. About 200 million years ago, at the end of the Paleozoic period, clams apparently became more prevalent and largely supplanted brachiopods. It was a sudden and unexplained change.

The great controversy about evolution, gradual or abrupt, goes on. Boucot after his lengthy observations of fossil communities has formulated his opinions. He recently stated: ". . . one might almost view the bulk of species level evolution as tightly governed by coevolutionary factors of a most stable type that do not permit many changes in the generic contents of communities nor in the relative abundances of their constituent species. I would conclude that ecology has held evolutionary change within very narrow limits, except for that small number of critical, revolutionary time intervals when major community types were completely reconstituted during times of major adaptive radiation."

While more detailed studies are needed, paleontologists of different inclinations can contribute to a more accurate understanding of the evolutionary process by adding yet another dimension to the biologist's perspective.

Elwyn Obert

J. Granville Johnson (right) and graduate student John Graham discuss a project designed to find depositional environments of Devonian rocks in central Nevada.

J. Granville Johnson: Biostratigraphy and its Applications

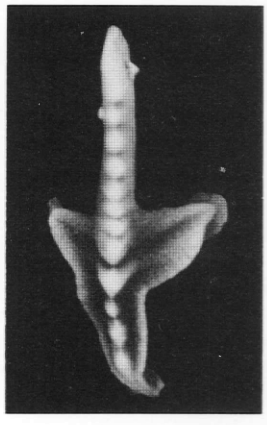
"The ultimate goal for me, as for many other scientists," says Johnson, "is to be able to use all data collected over the years of research to achieve a broad synthesis. In my case, this means developing significant interpretations that account for geologic events on a continental, or even global, scale."

Since coming to OSU, approximately twelve years ago, Johnson has moved steadily in that direction. His knowledge of Devonian fossils and his ability to date rock formations from that period are such that he can look at all of North America and make inferences about fundamental relationships in the tectonic development of the continent.

During a recent interview, Johnson stressed the fact that some of his most significant work has received strong input from students he has taught, especially at the graduate level. Students are the greatest critics, and they demand a certain level of generalization that he might not demand of himself.

Johnson's relationship with students is special and one of mutual respect. In 1977, he received the College of Science Carter Teaching Award for "inspirational" teaching. The fact that he was selected again and again by students—to become a finalist eight times—needs little comment. In the case of Johnson, the word "inspirational" is inded appropriate. He is disabled with the sequelae of bulbar poliomyelitis and requires a respirator at all times.

His interests—paleontology, biostratigraphy, paleogeography, and paleoecology—all stem from the same basic data. He began learning about fossils as a master's degree candidate in geology at UCLA, when he had accumulated a large collection of fossils. Looking back on the early years of his career at Caltech with colleague Arthur Boucot, Johnson notes that he and Boucot did more than just systematic paleontology. They also studied Devonian biogeography on a global scale.



Lower Devonian conodont (Ozarkadina delta) *from Ikes Canyon in the Toquima Range, Central Nevada.*

Johnson has received continuous support from the National Science Foundation since 1971 for research leading to a standard biostratigraphic sequence for the Devonian period for all of Western North America. Initially, he worked with fossils from Nevada and surrounding areas because he saw a potential for finding information on which to build such a standard. Geologists from the Canadian Geological Survey supplied fossils and information that allowed him to assemble a vertical and lateral sequence of faunas for the Devonian period that centered in Nevada and stretched from Southern California to the Canadian Arctic. This sequence showed the patterns of evolution through time and space and what animal communities lived side by side in those paleoenvironments.

A few years ago, Johnson began cooperating with Gilbert Klapper, a University of Iowa authority on conodonts. Once thought to be fish teeth, conodonts are fossilized microscopic hard parts of marine organisms (conodontophorids) that shared the same environment of brachiopods. The cooperation between Johnson and Klapper was logical. Johnson has processed rocks to extract brachiopods for years. Most of these same rocks contain an abundance of conodonts, recoverable through well known procedures.

Johnson could see great advantages in integrating the development of brachiopods and conodonts—two very different animals—by tracing their evolutionary history. While the two organisms shared the same environments, their environmental tolerances were different. Brachiopods, once they became mature, lived on ocean bottoms and did not move around. Responsive to their environment, their continued existence depended on the continued existence of that environment. Conodonts, on the other hand, were either floaters or more probably swimmers, and their evolutionary patterns were not subject to the same restrictions. The time scale based on these two groups added precision and more utility to his biostratigraphic standard.

Johnson and Klapper recently worked very closely on a fundamental paper that summarized the world-wide distribution of Devonian conodonts and interpreted the causes for their distribution.

"Working with others is extremely stimulating," comments Johnson. "The exchange of ideas works magic and makes me want to work that much harder. In this particular paper, 'Endemism and Dispersal of Devonian Conodonts,' we worked very closely, in a way I had never done with anyone else. He came here on a three-month sabbatical leave, and we sat side by side every day writing together—each of us alternatively coming up with a sentence at a time."

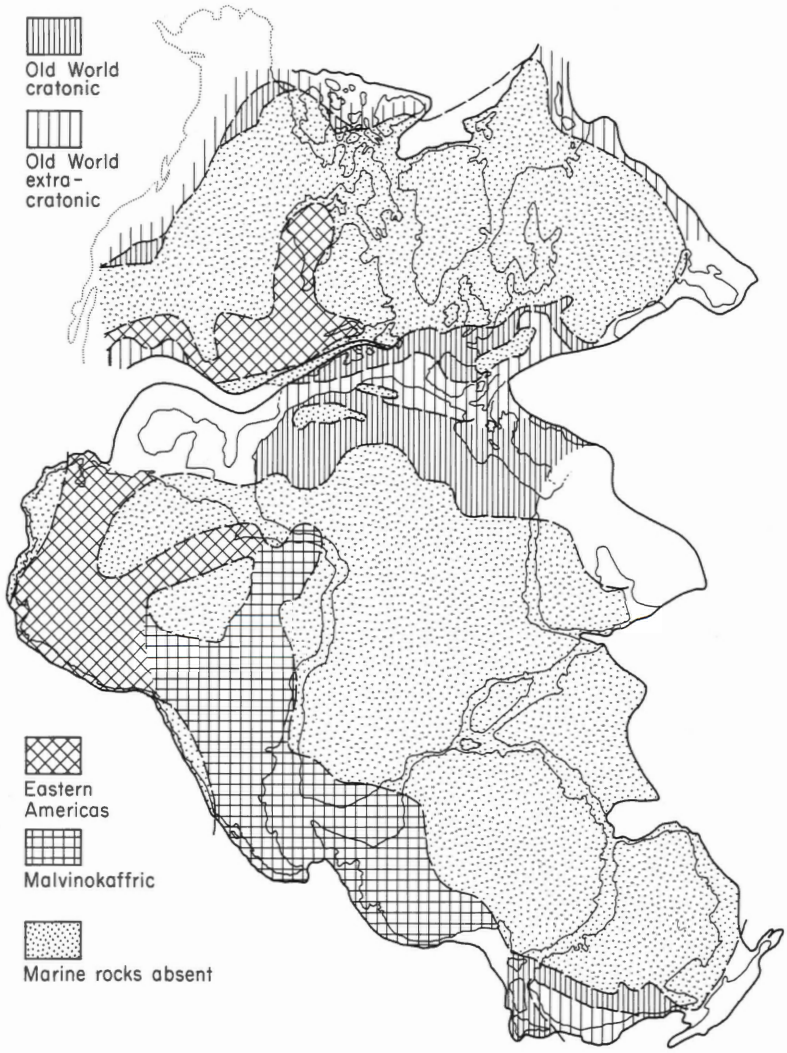
Johnson has published results of his work at a rapid pace. He is often asked to give papers at professional conferences; however, his colleagues or his students must present his work since he is unable to travel. When most geologists spend their summers out on the field, Johnson stays on campus and spends his time writing.

His most recent research project involves the study of Devonian eustatic fluctuation—that is, fluctuations of sea level during Devonian times. The implications of this study are important because a rigorously constructed eustatic curve can be a new, universal scale of reference for all geologic events.

"I first attempted this sort of work ten years ago," explains Johnson, "but I did not have enough data at the time. Now I am in a better position to look at the rock record and develop some conclusions about eustatic fluctuations."

It is possible to study the geologic record and infer whether the water level at certain locations rose at a high or low rate. For example, a reef is evidence of rapid growth, and its presence indicates that the water level must have risen rapidly. Also, a shallow water limestone overlain by black shale indicates an abrupt depositional change that occurred when the water deepened.

The record of these changes can be found in the pertinent literature; however, it is not known when they occurred. Johnson now feels confident that he can date all major Devonian water fluctuations at important locations on a global scale by examining the evolutionary record of conodonts in relation to those changes.



Paleogeography and brachiopod faunal realms during Early Devonian time of Euramerica (Europe and North America, then combined) and Gondwanaland (South America, Africa, Antarctica, Australia, and peninsular India, then combined). (Reprinted from "Devonian brachiopod biostratigraphy" by J. Granville Johnson *in the Devonian System,* Special Papers in Paleontology 23, 1979)

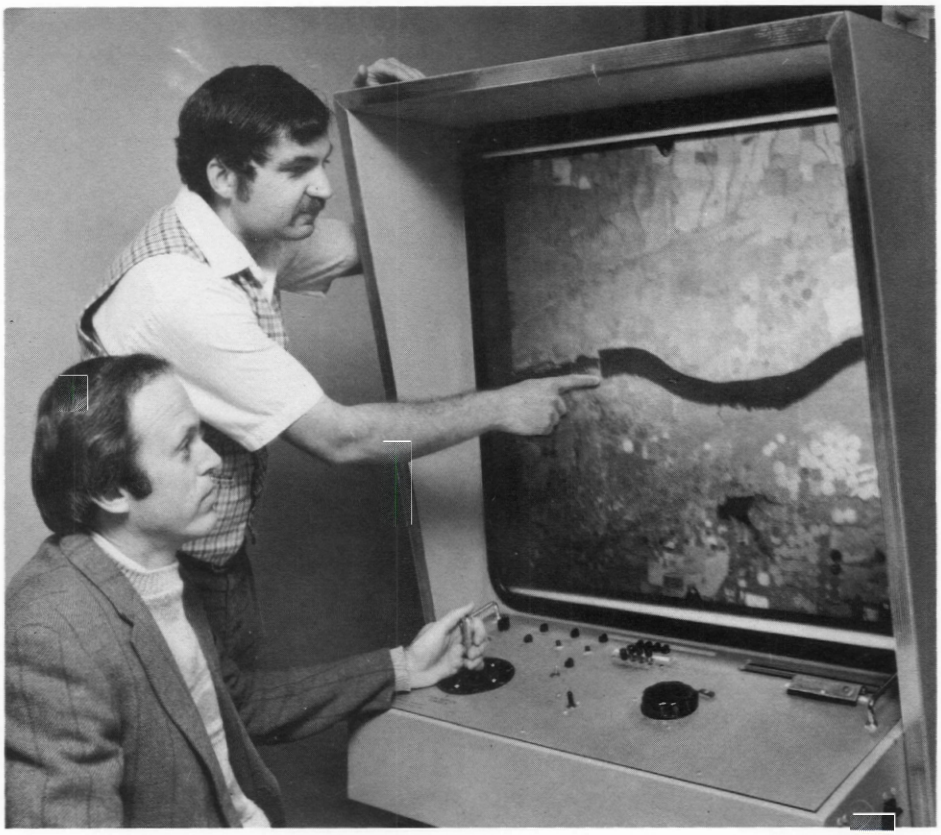
Geography Department Acquires Landsat I Imagery

The Department of Geography at Oregon State University now holds the entire collection of imagery taken by NASA's Landsat I—the first Earth Resources Technology Satellite. This valuable collection, which is conservatively estimated at more than seven million dollars, was recently donated to OSU by the U.S. Department of Agriculture. The gift consists of more than 700,000 film negatives of the earth's surface taken by Landsat I between 1972 and 1978.

Landsat I was the first of a succession of unmanned satellites designed to monitor the continents and adjacent coastal waters to collect data needed for many practical applications. Orbiting in an almost perfect orbit at an altitude of 917 km (570 miles) above the earth, Landsat I could take an image of a given area every 18 days. However, cloud cover reduced that number for many areas that, like Oregon, are persistently covered by clouds during many months of the year. A Landsat scene covers approximately 34,225 km² (13,225 sq miles), but film resolution allows features as small as 80 m in length to be distinguished as separate entities.

Such photographs are invaluable to scientists in many disciplines. For example, Landsat high-resolution photos can be used by investigators concerned with distribution, growth, and measurements of both natural and cultivated vegetation; by geographers and geologists interested in map updating and the study of landforms; and by oceanographers, hydrologists, and environmentalists in diverse applications.

Geography chairman Thomas Maresh, who actively sought to secure the collection for OSU, believes that the University is fortunate in having been selected to receive the entire Landsat I imagery. Three other institutions share the smaller collections of negatives taken by Landsat II and III after 1978—the University of Arizona, the University of California at Santa Barbara, and the University of Wisconsin at Milwaukee. All four universities have agreed to code and classify the imagery in the same manner to simplify interinstitutional exchanges.



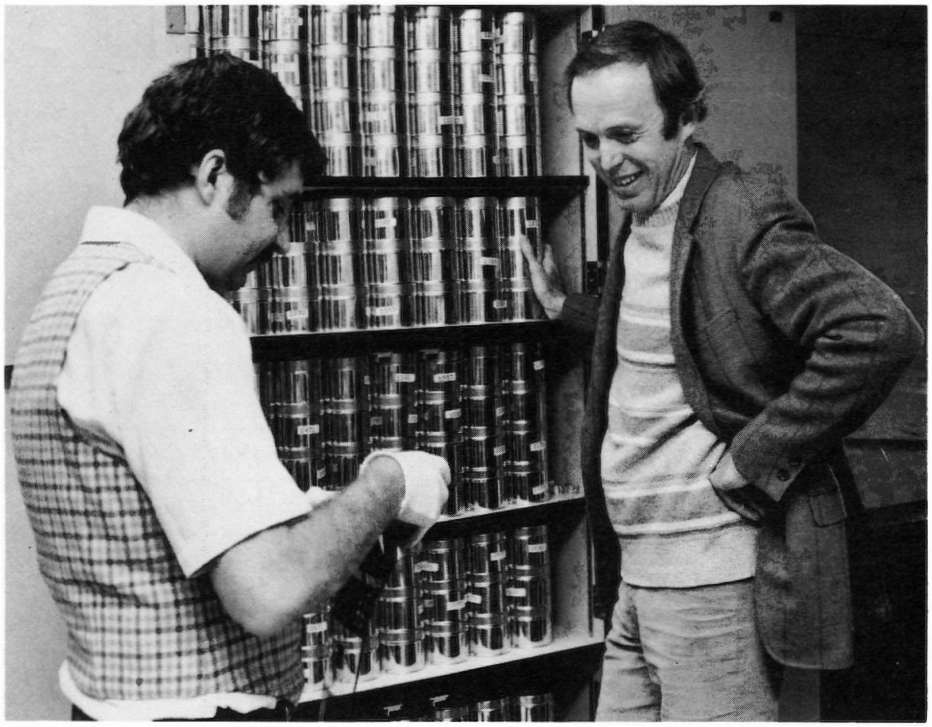
Elwyn Obert

Professors Thomas Maresh (seated) and Jon Kimerling examine a Landsat image on the Variscan Viewer. Clearly visible on the screen is the Columbia River in the vicinity of McNary Dam. The 70 mm negative has been enlarged 30 times.

"The U.S. Department of Agriculture is interested primarily in current Landsat photos to monitor agricultural production around the world," explains Maresh. "It does not have the facilities to store negatives from former flights and at the same time make them available to those scientists interested in using the imagery for their own research. With this intent, the USDA selected four universities with established research programs as recipients of the collections."

"We want to make this new resource available to anyone who wishes to use it," continues Dr. Maresh, "but we also want to protect it. The collection is stored in our remote sensing laboratory, and it has been indexed so that an image of a given area can be retrieved easily through a microfiche index system. The film is handled with special care only by graduate students who are familiar with the imagery. Faculty members in our department deserve special recognition for their resourcefulness in obtaining special equipment needed to utilize the four-spectral band negatives."

Such equipment includes color enlargers, a contact printmaker, and a Variscan Viewer—an amazing piece of equipment that uses high-quality optics to project segments of film on a large viewing screen. The Variscan Viewer can enlarge negatives up to 30 times without loss of quality.



Elwyn Obert

Thomas Maresh looks on as Jon Kimerling wearing white cotton gloves carefully handles Landsat film.

The Department of Geography at OSU is strong in low- and intermediate-level image interpretation. Geographers Robert Frenkel, Philip Jackson, Jon Kimerling, and Charles Rosenfeld have expertise in both areas. Now they will be able to extend their work with the aid of satellite imagery.

Landsat images are especially useful research tools for faculty and students who wish to compare present regional data with those of a decade ago. For example, geography professors Jon Kimerling and Charles Rosenfeld are studying down-wind emissions from the Boardman Power Plant in eastern Oregon to monitor their possible effect on vegetation. They observe emissions with a variety of photographic imagery, such as thermal infrared and SLAR (side-looking airborne radar). The availability of Landsat imagery will add yet another comparative dimension to their observations.

Department of Chemistry Receives Instructional Grant

The Department of Chemistry has received a substantial grant from the Northwest Area Foundation to improve chemistry instruction. Approximately 2,000 students a year enroll in introductory chemistry courses and several hundred more in advanced classes.

Chemistry Chairman T. Darrah Thomas and Professor Walter Loveland designed the proposal in cooperation with other chemistry faculty members to help offset shrinking state resources. Department heads are constantly faced with the problem of maintaining and enhancing instructional quality in the face of decreasing funds.

This private grant will be used to develop new experiments for advanced laboratory courses, to provide audio-tutorial guides for students using analytical instruments, and to develop self-instruction formats for specialized, advanced classes.

Some matching funds provided by the University, mostly from the Department of Chemistry and the Office of Undergraduate Studies, will pay for summer support of graduate students and faculty in the project, for needed supplies, and for the indirect costs of the program.

The Northwest Area Foundation is a Minnesota philanthropic organization whose goal is to help institutions provide high quality education. The OSU Department of Chemistry is one of only three departments in Oregon institutions that were awarded grants from the Northwest Area Foundation this year.

news & notes

ATMOSPHERIC SCIENCES

James W. Deardorff presented a seminar on turbulent entrainment and an undergraduate lecture on the atmospheric boundary layer in the Department of Atmospheric Sciences, University of California, Los Angeles, in early May.

Steven K. Esbensen gave a seminar in the Department of Atmospheric Sciences, University of California, Los Angeles, in early June. Following this visit, he participated in the 14th Technical Conference on Hurricanes and Tropical Meteorology at San Diego. Dr. Esbensen was the coauthor of two papers on the interaction between tropical cloud clusters and large-scale atmospheric motions given at the conference.

W. Lawrence Gates attended a meeting of the World Meteorological Organization's Working Group on Numerical Experimentation in Exeter, United Kingdom, in April. From May 17 to June 8, he visited the People's Republic of China as a member of a scientific delegation on mountain meteorology. He attended meetings and lectured in Peijing, Lanzhou, Shanghai, and Guanzhou (Canton).

Richard W. Katz was appointed chairman of the American Meteorological Society's Committee on Probability and Statistics in Atmospheric Sciences.

Alan H. Murphy is chairman of the organizing committee for the Second International Meeting on Statistical Climatology, which will be held in Lisbon, Portugal, in September 1983. Dr. Murphy recently was invited to give a series of lectures on forecast verification at a seminar/workshop to be held at the European Centre for Medium Range Weather Forecasts, Reading, England, in September 1982. In June, Dr. Murphy will serve as program cochairman of the American Meteorological Society's Ninth Conference on Weather Forecasting and Analysis in Seattle. He is coauthor of two papers presented at the conference.

Michael E. Schlesinger was an invited speaker at the Rotary district meeting at the OSU Foundation Center in April. He discussed climate change induced by increased atmospheric carbon dioxide. In May, Dr. Schlesinger surveyed current work on simulation of the climatic effects of increased CO_2 at the National Center for Atmospheric Research, Boulder, CO; the Goddard Institute for Space Studies, New York; and the Geophysical Fluid Dynamics Laboratory, Princeton University.

BIOCHEMISTRY AND BIOPHYSICS

Several members of the department attended the annual meeting of the Federation of American Societies for Experimental Biology in April in New Orleans, including faculty members ***Donald Reed, Wilbert Gamble, Michael Schimerlik,*** and ***Robert Becker;*** research associates ***Helena Vadi*** and ***Charles Schasteen*** and graduate students ***Christine Cremo*** and ***Sarla Purohit. Charles Schasteen*** and ***Christine Cremo*** presented papers. On the same trip, ***Donald J. Reed*** attended a meeting of the health effects review panel, U.S. Environmental Protection Agency, also in New Orleans. In mid-May, ***Dr. Reed*** was an invited participant at a Nobel Symposium on glutathione in Stockholm, Sweden

Wilbert R. Gamble served on a National Research Council review panel on postdoctoral fellowships, February 20-21, in Washington, DC.

W. Curtis Johnson presented a research seminar at Brookhaven National Laboratory in February. Research Associate ***Gary Causley*** gave a seminar at the University of Maine at Orono in early March and later in the month attended the meeting of the American Chemical Society in Las Vegas.

Christopher K. Mathews discussed his research on DNA precursor metabolism in virus-infected bacteria in two seminars at Evergreen State College, Olympia, WA, in March. ***Dr. Mathews*** served as principal organizer of the Oregon Biochemistry Molecular Biology Conference, held May 1 at the OSU Foundation Center. About 150 people gathered at the conference to hear talks by scientists from Oregon Health Sciences University, Reed College, the University of Oregon, and Oregon State University.

Michael J. Meredith, research associate with Dr. Reed, gave seminars at Vanderbilt University in Tennessee in February and in March at Smithkline Corporation in Philadelphia. ***Dr. Meredith*** has accepted an assistant professorship in the Department of Biochemistry at Vanderbilt University.

George D. Pearson presented a research seminar on adenovirus DNA replication on March 29, in the Department of Biochemistry, University of British Columbia.

Court Saunders gave research seminars at Texas Tech University, Lubbock, and at the new research laboratories of Monsanto Corporation, St. Louis, in March. ***Dr. Saunders*** has accepted a position as research biochemist at Monsanto. Also accepting new employment is recent graduate ***Jeffry Corden,*** who received his Ph.D. in the department in 1979. He has accepted an assistant professorship at Johns Hopkins University in Baltimore.

Henry W. Schaup presented a seminar on generation of targeted deletions in ribosomal RNA in the Department of Microbiology, University of Illinois, Urbana, in April.

Kensal E. van Holde, research associates ***Court Saunders*** and ***Greg Ide,*** and graduate students ***Tom Yager, Chris Szent-Gyorgyl,*** and ***Jennifer Saunders*** attended the West Coast chromatin meeting at Asilomar, CA, in December 1981. ***Dr. Van Holde*** was an invited participant in a symposium on chromatin structure and function at the University of British Columbia, Vancouver, in February. In early March, he presented research seminars at Arizona State University, the University of New Mexico, and New Mexico State University. In May, he participated in a site visit to evaluate the Department of Biochemistry at Colorado State University, Fort Collins.

BOTANY AND PLANT PATHOLOGY

Graduate student ***Dirk M. Anderson*** has been awarded a National Science Foundation Graduate Fellowship covering expenses and a stipend for three years of graduate work. He is investigating the molecular basis of host-parasite interaction.

Donald J. Armstrong presented two invited lectures, "Genetic regulation of cytokinin metabolism in *Phaseolus* tissue cultures" and "Perspectives in plant hormone research," at Marshall University, Huntington, WV, in February.

H. Ronald Cameron and ***Robert G. Linderman*** served as cochairmen for the 28th Soil Fungus Conference, which included a field trip to the Wind River forest nursery plus a two-day symposium at Timberline Lodge. Ninety participants represented research projects in the western half of the United States.

Kenton L. Chambers participated in a field collecting trip for research materials and data as consultant and co-investigator with Dr. James Price, Texas A & M University. The research, supported by a National Science Foundation research grant to Dr. Price, involves evolutionary genetics of native plant species of the genus *Microseris* occurring in west-central California.

Jerry F. Franklin presented the 12th Annual Henry J. Oosting Memorial Lecture in Ecology at Duke University in April. He spoke on "Recovery of surrounding ecosystems from the Mount St. Helen's eruptions." He was also Distinguished Professor of Ecology at Colorado State University, April 27-29.

Research Associate ***Dean W. Gabriel,*** graduate student ***Leslie J. Szabo,*** and Professor ***Dallice I. Mills*** attended the Beltsville VII Symposium on "Genetic engineering: applications to agriculture," which was sponsored by the U.S. Department of Agriculture at Beltsville, MD, in May. ***Leslie Szabo*** presented a paper, "An integrative plasmid of *Pseudomonas syringae* pv. *phaseolicola*" ***(Dallice I. Mills,*** coauthor).

Harold J. Jensen participated in the International Potato Center (CIP) Decennial Anniversary in Lima, Peru, at the end of February and early March. He also established experimental plots in Lima in accordance with his research grant with CIP.

Graduate students ***Kenneth B. Johnson*** and ***Marjorie L. Kirkland*** presented papers coauthored by ***Mary L. Powelson*** at the annual meeting of the Oregon Horticultural Society in January and at the Oregon Potato Growers meeting in Portland in January.

Charles M. Leach presented a paper, "Fungal growth on surfaces," at a special symposium of the British Mycological Society at the University of Glasgow, Scotland, in April. He also visited major research centers in the United Kingdom, where investigators are involved in dispersal of foliar plant diseases.

C. David McIntire gave invited seminars, "Benthic autotrophy in Oregon estuaries" and "A conceptual framework for process studies in lotic ecosystems," at the College of Marine Studies, University of Delaware, in March.

Dallice I. Mills served on a review panel for proposals on biological stress on plants for the U.S.D.A. Competitive Research Grants Office in Arlington, VA, in May.

Mary L. Powelson presented two papers at the 21st annual Washington Potato Grower Conference in Moses Lake, WA, in February.

Ralph S. Quatrano gave invited seminars in the Departments of Botany at the University of Washington and the University of British Columbia in March. He attended a meeting of the Editorial Board of the *Annual Review of Plant Physiology* at the Carnegie Institute of Washington in Stanford, CA, in March, and the Regional Northwest Developmental Biology meetings at the Friday Harbor Laboratory of the University of Washington, in April.

CHEMISTRY

Kenneth W. Hedberg and ***Lise Hedberg*** presented papers at the IXth Austin Symposium on Gas Phase Molecular Structure in Austin, TX, in early March.

James D. Ingle, Jr., gave a seminar, "Automation of analytical instrumentation with microprocessors," at the Hanford Graduate Studies Center in Richland, WA, in April.

Walter D. Loveland spent the month of March doing research at the European Center for Nuclear Research (CERN) in Geneva, Switzerland. He contributed papers on intermediate-energy heavy-ion reactions to the meeting of the German Physical Society in Karlsruhe in March and to the International Conference on Selected Aspects of Heavy-Ion Nuclear Reactions in Saclay, France, in early May.

Elliot N. Marvell gave one of the main lectures in the Garvan Medal Symposium at the meeting of the American Chemical Society in Las Vegas.

Joseph W. Nibler presented an invited talk, "Applications of three wave mixing spectroscopy," at the University of Nevada, Reno, in January. Following that presentation he and three associates, ***Dr. Shih-Yue Hou, Steve Bares,*** and ***George Pubanz,*** attended the meeting of the Western Spectroscopy Association at Asilomar, CA..

Richard W. Thies gave an invited lecture, "Hazards of dyes and pigments," in March at a conference sponsored by the University of British Columbia and entitled "Doing yourself in—the artist as casualty."

Larry C. Thomas presented a seminar on "Quantitations of aromatic hydrocarbon metabolites in aquatic organisms" at Portland State University in January. During the same month, he attended a meeting of the Society of Western Analytical Professors in Phoenix, AZ.

T. Darrah Thomas presented a seminar on "Relations between core-ionization energies and familiar chemical properties" at Utah State University in early May.

John C. Westall and ***John Baham*** (Soil Science) were directors of the Twelfth West Coast Water Chemistry Workshop and Conference held at Oregon State University at the end of May.

James D. White gave the 1982 H. Willard Davis Lecture at the University of South Carolina on March 12. Earlier in the month, ***Dr. White*** attended the NIH Bioorganic Chemistry Study Section.

COMPUTER SCIENCE

The Department of Computer Science sponsored a forum on computer science and high technology, which was held in Beaverton on April 22. The purpose of the forum was to explore possible avenues of cooperation among state government, industry, and education in an effort to stimulate the development of high technology in Oregon. Approximately 40 representatives from government, industry, and universities in Oregon attended the meeting. OSU computer science professor ***William S. Bregar*** introduced speakers from the governor's office, Hewlett-Packard, Intel Corporation, and Tektronix, Inc. ***Dr. Fred Tonge,*** chairman of the Department of Computer Science, spoke on computer science perspectives, and ***Dr. E. Rex Krueger,*** Vice-Chancellor for Educational Systems, OSSHE, gave the final remarks.

William S. Bregar attended the winter 1982 USENIX (UNIX Users) Conference in Santa Monica, CA, in January. In June, he will present a paper on "The use of production systems in the development of an expert tutor for algebra" (***B. Lantz,*** coauthor) at the 1982 annual ADCIS Conference in Vancouver, British Columbia.

Michael J. Freiling gave two invited lectures in March. He talked on "Extending database systems to handle more information" at the University of San Francisco and on "Implementation structures to support a semantic data model" at the Systems Development Corporation.

ENTOMOLOGY

Brian A. Croft joined the department as Professor of Entomology on January 1, 1982. Dr. Croft, a nationally renowned specialist in integrated pest management, was formerly at Michigan State University.

Bruce F. Eldridge presented a paper on surveillance, attractants, and repellents at a symposium on disease vector biology sponsored by USAID and held in Gainesville, FL, in April.

Gerald W. Krantz participated in a workshop on the potential of mites in biological control held at the University of California, Berkeley, in April. The workshop was sponsored jointly by the University of California and the U.S. Departmnt of Agriculture.

John D. Lattin is conducting a study of the applied systematic resources and services in the United States for the U.S. Department of Agriculture. The study is funded jointly by the Agricultural Research Service and the Cooperative State Research Service. Also, he has been appointed chairman of a committee of the Entomological Society of America to study and develop an inventory of the human resources in basic systematic entomology of the United States. Part of this study will be in cooperation with the Association of Systematic Collections.

Paul W. Oman was named the recipient of the C. W. Woodward Award for Outstanding Achievement in Entomology. Sponsored by the Pacific Branch of the Entomological Society of America, the award is being presented at the annual meeting in Tucson, AZ, in June, where Dr. Oman will give the annual address associated with the award.

Oregon was selected as one of 16 pilot states to participate in the new National Pest Survey and Detection Program being implemented by the U.S. Department of Agriculture. The program will develop a nation-wide, interactive data network on plant pests and associated information via computer. ***Glenn Fisher*** will be co-chairman for Oregon. Others involved in the organization of the entomological portion in Oregon include ***Joseph Capizzi, Brian A. Croft, Bruce F. Eldridge,*** and ***John D. Lattin.***

GENERAL SCIENCE

John P. Kelley attended the meetings of the Cascade Chapter Health Physics Society in Kelso, WA, in April.

Michael C. Mix participated in an invitational workshop on the current status of research on sublethal biological effects of environmental trace pollutants at Asilomar, CA, in March.

Toward the end of May, ***Robert C. Worrest*** was on the organizing committee and session chairman at the International Workshop on Biological Effects of UV-B Radiation sponsored by the U.S./Federal Republic of Germany Cooperative Environmental Research Agreement in München, West Germany. He presented a paper on "Impact of enhanced solar UV-B radiation on the marine ecosystem." During the week preceding the workshop, he presented invited lectures at the Universities of Freiburg and Carlsruhe. ***Dr. Worrest*** also attended the 1982 spring meeting of the Pacific Estuarine Research Society in Port Angeles, WA, in March. At that time he began a two-year term as president of the society.

GEOGRAPHY

Several members of the department presented papers as noted below at the meetings of the Association of American Geographers in San Antonio, TX, in late April. ***Gordon E. Matzke*** and ***John Gentile,*** "A viewpoint on the evolution of zoogeographical studies"; ***Keith W. Muckleston,*** "The relationship between floodplain regulations and assessed value of residential land: an Oregon case study"; ***Mary Lee Nolan,*** "High places, holy wells, and images in trees: site features and pilgrimage in Europe"; and ***James R. Pease,*** "A study of the characteristics of commercial agriculture in selected Oregon counties."

Rebecca S. Roberts, a 1982 Ph.D. graduate of the Department of Geography, received the Association of American Geographers Nystrom Award at the annual meeting in San Antonio, where she presented a paper on "The effects of large-lot zoning on the single-family housing." The Nystrom Award is given annually for the outstanding doctoral research in the nation. Dr. Roberts' research was directed by ***Dr. Thomas J. Maresh.*** This is the second consecutive year that the award has gone to an OSU graduate. The 1981 award went to ***Richard Marston,*** whose research was directed by ***Dr. Charles Rosenfeld.***

Graduate student ***John R. Gentile*** has been chosen to receive an Environmental Conservation Fellowship for 1982-83 from the National Wildlife Federation's Board of Directors.

Philip L. Jackson served as chairman of the geography section and presented a paper at the meetings of the Oregon Academy of Science in Corvallis last February.

A. Jon Kimerling organized a workshop on Cartographic Production and Reproduction at the annual March meeting of the American Congress on Surveying and Mapping in Denver. He also presented papers on diazo and xerographic map production.

Keith W. Muckleston has received a Fulbright Award for research. From September 1982 to February 1983, he will study comparative approaches to water resources management at the University of Freiburg, Federal Republic of Germany. ***Dr. Muckleston*** and ***Richard T. Brainerd*** presented a paper on comparative impacts of flooding and floodplain regulations on land values at the meetings of the Oregon Academy of Sciences in Corvallis in February. ***Keith Muckleston*** and ***Ken Cummins*** (Fisheries and Wildlife) gave a public presentation, "What is a riparian zone? Perspectives," at the Water Institute's spring seminar series on riparian zone management in Corvallis.

GEOLOGY

E. Julius Dasch has discovered the formula for success with his new G 300 course "Rocks and Stars" (subtitle: A Scientific and Sensual Guide to the Universe). The class—a combination of popular cosmology, geology, and planetology—covers a variety of topics. Guest speakers, films, and music add interest to the course. This term, outstanding guest speakers from outside OSU included ***Melvin Calvin,*** Nobel Laureate in chemistry; ***Joseph Boyce,*** Program Director of Planetary Geology at NASA, Washington, DC; ***Ronald Haybron,*** from NASA's Aerospace Education Services Project; ***Harold Masurski,*** Chief Scientist of the Center for Astrogeology, U.S. Geological Survey; and ***Brian O'Leary,*** scientist, author, and former astronaut.

Cyrus W. Field attended the annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers in Dallas, TX, during mid-February. He presented an invited paper, "Metalliferous sediments of the East Pacific Basin," at the Cameron Symposium on Unconventional Mineral Resources sponsored by the Society of Economic Geologists.

Alan R. Niem represented the Department of Geology in a March meeting with Governor Atiyeh, Assistant Secretary of the Department of Interior Dan Miller, and several representatives of the U.S. Geological Survey, the State Department of Geology and Mineral Industries, and the state's industry. The goal of the conference was to find new ways to develop Oregon's mineral and energy potential.

Robert S. Yeats, graduate students ***Hans Schwing*** and ***Greg Mack,*** and recent graduates ***Dave Hanson*** and ***Pat Jackson*** presented papers at the meeting of the Geological Society of America (Cordilleran Section), at Anaheim, CA, in April.

MATHEMATICS

Phillip M. Anselone gave an invited talk to the mathematics faculty at the University of Southern California in March.

M. Carme Calderer presented a paper at a meeting of the Society for Natural Philosophy at the University of Illinois, Urbana, in December 1981.

David H. Carlson gave a colloquium at the University of South Carolina at the end of April, just before presenting a selected talk on "Eigen values of tridiagonal matrices" at the Conference on Applied Linear Algebra, Society for Industrial and Applied Mathematics, Raleigh, NC.

Edward L. Kaplan, who retired from the Department of Mathematics in March 1981, has completed *Mathematical Programming and Games*. The book, published by John Wiley and Sons, is a major work. It will be used as a textbook for undergraduate and graduate courses.

William J. Firey attended as institutional representative a meeting of the Board of Trustees of the Mathematical Sciences Research Institute at the University of California, Berkeley, in February.

Richard M. Schori has been appointed for a three-year term to the Committee on Special Funds of the Mathematical Association of America.

J. Michael Shaughnessy presented an invited paper, "A causal analysis of attitude toward mathematics" (Tom Haladyna and Joan Shaughnessy, coauthors) at the New York meetings of the American Educational Research Association in March. In April, Dr. Shaughnessy gave a paper at the research presessions of the meetings of the National Council of Teachers of Mathematics in Toronto, Canada. ***Dr. William H. Burger*** also attended the conference.

Mathematics Invitational Tournament

Oregon State University was the host for the second annual Mathematics Invitational Tournament for top Oregon high school students on April 27. The tournament, sponsored by the Oregon Council of Teachers of Mathematics, was directed by OSU mathematics professors ***David Stacy*** and ***Howard Wilson*** with the help of mathematics chairman ***Richard Schori*** and professors ***Bill Burger*** and ***Stuart Thomas.***

About 200 students, who had placed in the top ten percent in regional contests across the state, entered the OSU tournament. The contest consisted of five categories or levels of competition: pre-algebra, algebra I, geometry, algebra II, and an open category for students in advanced classes.

Substantial prizes were awarded to the winners of each category—five portable calculators (three HP 11-C, one HP 41-C, and one HP 41-CV) donated by the Corvallis Division of ***Hewlett-Packard*** and two $1,000 scholarships provided by ***Tektronix, Inc.*** of Beaverton. These scholarships, however, could be awarded only to college-bound seniors.

Junior ***Stephen Thorsett*** of South Salem High School was the overall winner in the open class and received the Hewlett-Packard 41-CV calculator. Seniors ***Joe Pruett*** of Benson High School, Portland, and ***Jon Wiens*** of South Salem High School won the two $1,000 scholarships, which were presented by OSU Acting Vice-President ***Theran D. Parsons*** and Dean ***Thomas T. Sugihara,*** College of Science.

MICROBIOLOGY

Several faculty members, research associates, and graduate students presented papers at the meeting of the American Society for Microbiology in Atlanta, March 7-12.

Thomas M. Evans gave the following paper at that meeting: "Influence of medium composition on gas production by coliforms" (***J.R. Kaufman*** and ***R. J. Seidler,*** coauthors).

J. D. Greenwood and ***J. J. Calomiris,*** graduate students in Dr. Seidler's laboratory, respectively presented papers as follows: "Phenotypic characteristics and DNA base composition of *Vibrio fluvialis* and phenotypically similar *Vibrios*" (***D. L. Tison,*** coauthor) and "Selection of antibiotic resistant and metal tolerant bacteria during water treatment" (***J. L. Armstrong*** and ***D. S. Shigeno,*** coauthors). ***M. Nishibuchi,*** another graduate student, also gave a paper, "A common soluble antigen in *Vibrio vulnificus*" (***R. J. Seidler,*** coauthor).

Jo-Ann C. Leong attended the recombinant DNA Congress in Los Angeles in February.

Richard Y. Morita was in Chile from March 20 to April 16 to lecture at five universities. He also conducted research on *Thioploca* at the University of Conception, Chile, from March 23 to April 12.

Leo W. Parks presented research data and served as plenary lecturer on physical and enzymic studies on the function of sterols in fungal membranes at the International Symposium on the Biochemistry and Function of Isopentenoids in Plants at the University of California, Berkeley, in March. Dr. Parks also participated as an invited plenary lecturer in a specialized symposium on biotechnology of microorganisms in the production of fats and oils at the meeting of the American Oil Chemists Society in Toronto, Canada, in May.

William E. Sandine gave a lecture at the Department of Food Science, Iowa State University, in March.

David L. Tison gave a paper at the meeting of the American Society for Microbiology entitled "*Legionella* in aquatic habitats in the Mt. St. Helens blast zone" (***J.S. Baross*** and ***R. J. Seidler,*** coauthors).

In early February, ***James R. Winton,*** research associate in Dr. Fryer's laboratory, presented a paper, "The role of certification examinations in maintaining fish health," (***J.L. Fryer,*** coauthor), at a workshop on Quality Improvement in Finfish Aquaculture sponsored by Fish Culture and Fish Health Sections of the American Fisheries Society in collaboration with the Colorado Division of Wildlife at Boulder, CO.

PHYSICS

Melvin Cutler and ***H. Rasolondramanitra*** presented two papers at the meeting of the American Physical Society in Dallas, TX, in March.

Victor Madsen attended the International Conference on Spin Excitation in Nuclei in Telluride, CO, in March.

STATISTICS

Jeffrey L. Arthur presented an invited paper at the TIMS/ORSA joint national meetings in Detroit in April.

Lyle D. Calvin participated in a review of the Department of Statistics at North Carolina State University in Raleigh, NC, at the end of March.

Stephen P. Mandel is a visiting professor in the Department of Statistics during spring term. He comes from the University of Otago, Dunedin, New Zealand. He has had recent visiting appointments at the University of Minnesota, University of Vermont, and the University of London.

Donald A. Pierce is on a special sixteen-month assignment at the Radiation Effects Research Foundation in Hiroshima, Japan. Dr. Pierce is a specialist in the analysis of survival data including the analysis of response-time data. The statistical techniques being developed and used by Dr. Pierce offer promise in dealing with low frequency events. They might be particularly useful with data associated with rare diseases. His work is sponsored by the United States and Japanese governments through the U.S. National Academy of Science.

Justus F. Seely attended as District Representative the meetings of the American Statistical Association Board of Directors in Washington, DC, in February and mid-May.

ZOOLOGY

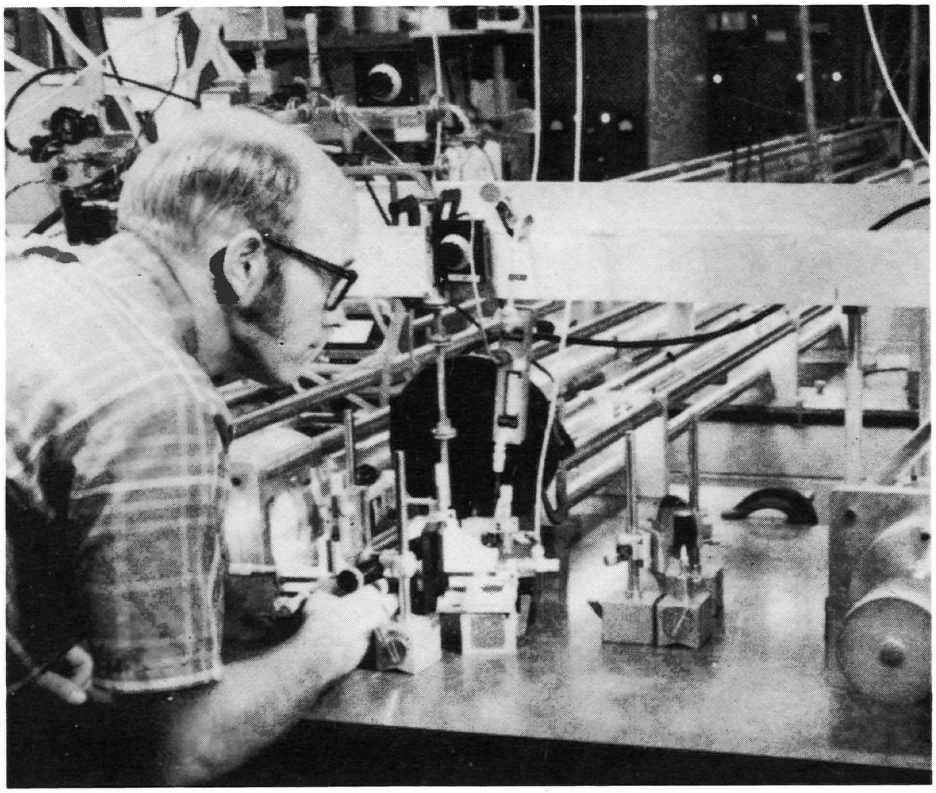
Andrew R. Blaustein presented an invited seminar, "Kin recognition in tadpoles," at the University of Nevada, Reno, in April.

Larry Miller presented a paper on amphibian sexual behavior (***F. L. Moore,*** coauthor) at the December 1981 national meeting of the American Society of Zoologists in Dallas, TX.

Paul A. Roberts gave a seminar entitled "Properties and evolutionary potential of newly induced tandem duplications in *Drosophilia melanogaster*" at the University of Oregon in March.

John Ruben gave an invited talk on "Extramechanical functions of the ophidian skeleton" at the meeting of the American Society of Zoologists in Dallas, TX. In January, he presented another invited talk, "Some dynamic aspects of the vertebrate skeleton," at Victoria University in British Columbia. Dr. Ruben will continue to study fossil vertebrates at the John Day Fossil Beds National Monument under sponsorship of the U.S. Park Service.

Alumni News



This photo of Kenneth Evenson (Ph.D. in Physics, 1964) appeared in the November-December '81 issue of Mosaic, *a publication of the National Science Foundation, as part of an article on the fundamental constants. Dr. Evenson received both Master's and Ph.D. degrees at OSU under the guidance of Professor David Burch. In 1972, in collaboration with other researchers, Evenson refined the measurement of the speed of light using a helium-neon laser. The result: 299,792,458 kilometers a second. For his improvement of the measurement of c by two orders of magnitude, Dr. Evenson was awarded the Cresson Medal of the National Bureau of Standards.*

Electron Microscopy Facility

A special agreement between the U.S.D.A. Forest Service and Oregon State University gives OSU researchers easy access to the Electron Microscopy Facility at the Forestry Sciences Laboratory.

This facility is intended especially for those investigators who want to perform their own electron microscopy. It is not a customer-service laboratory, but rather a "hands-on" facility.

The laboratory includes a scanning electron microscope (AMR 1200), a Philips 200 transmission electron microscope, an image analyzer, and other related equipment.

Dr. Pat Buckley of the Department of Zoology is coordinator for the facility and will be happy to supply additional information on its use and availability.

She can be reached at the Forestry Sciences Laboratory (757-4329).

To our readers:
The College of Science would like to hear about former OSU Science graduates and their scientific achievements.
Please, send appropriate information to:
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The Science Record
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student profile

Connee Sue Mitchell

Elwyn Obert

Connee Mitchell is a research assistant in the OSU Climatic Research Institute and a master's candidate in the Department of Atmospheric Sciences. An engineering physics major from Northeastern Oklahoma State University with a minor in mathematics, Connee has always followed with interest developments in our space program. In her senior year in college she was selected for participation in Columbia University's Summer Institute on Planets and Climate at the Goddard Institute for Space studies in New York.

"That was my first encounter with the field of atmospheric sciences," she says, "and I really enjoyed it. When I completed my B.S. degree in 1979, I knew that I wanted to go on to graduate school, but I wasn't sure what field to pursue. I decided then to accept an extended summer job in the Atmospheric and Geophysical Division of the Lawrence Livermore National Laboratory (LLNL) in California. My work there convinced me to go into atmospheric sciences."

At Livermore, Connee was involved in developing a code to analyze the sensitivity of the LLNL zonal atmospheric climate model. Those studies resulted in two published papers, one of which bears her name as first author. This paper reported on a doubled CO_2 experiment and recently appeared in the September 1981 issue of the *Journal of Atmospheric Sciences.*

Connee began her master's program at OSU in September 1980 under the guidance of Dr. Michael Schlesinger. Her present research concerns the utility of climate classification schemes, such as those of Köppen and Thornthwaite, in comparing results from the OSU Atmospheric General Circulation Model with nature and in identifying the change in climate due to increased atmospheric CO_2.

Connee returned to Livermore last summer to work for a few months with the same group she had worked for earlier. She hopes to become a permanent member of the team once she completes her master's degree. Studying climate variables takes up most of her time but is not her sole interest. Along with solving equations, developing computer programs, and taking classes in atmospheric sciences and oceanography, she manages to be physically active in folk dancing, cycling, and backpacking.