states that Haase has been rearing an egg-parasite of the genus Trichogramma in Petri dishes, where it can readily be secured in very large numbers. It may be mentioned incidentally that the same idea has occurred to American workers and that insects of the same genus are now being reared in this way in California for use against the codling moth, especially in the walnut groves. He treats of the control of insects by diseases, and mentions good results obtained by Schwangart with fungi that destroy the larvae of Cochylis. He also treats of resistant plants and of the desirable qualities of insecticides in general. It is interesting to note that, even before the war, a German forest warden named Zimmerman obtained a patent in Germany on the process of combating insects by means of airplanes, a method which has been developed in this country since the war and which is entering into a promising commercial phase.

The address closes with a strong plea to his audience, which he stated comprised the largest forum of German scientists, to turn their attention toward applied entomology and to assist in manifold ways in the work against injurious insects.

It is a strong paper and quite worthy of Escherich. He realizes that the insect problem is a world problem, and is trying to prove this to the scientific men of Germany.

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## PALEONTOLOGICAL AND GEOLOGICAL INVESTIGATIONS IN THE JOHN DAY REGION OF EASTERN OREGON

A COORDINATED program of research, rather unique in the range and the detailed nature of the studies included in it, is being conducted in the John Day region of eastern Oregon. Through investigations in vertebrate and invertebrate paleontology, paleobotany and physical geology, an attempt is being made to construct as completely as possible the history of the development of animal and plant life and of geologic and climatic changes in this part of the northwest in the later eras of geologic time.

President John C. Merriam, of the Carnegie Institution of Washington, is both directing the project and participating actively in the field and laboratory investigations. The studies are an extension of researches initiated in this region by Dr. Merriam more than twenty-five years ago. The program is being prosecuted under the auspices of the Carnegie Institution of Washington; other institutions which have been cooperating are the University of California, the University of Oregon and the California Institute of Technology.

Mammalian fossil remains in important quantities have been collected in the John Day Basin from three formations, of Oligocene, Miocene and Pliocene age. In the thirty-five years beginning in the late sixties quite large collections were made and studied by Condon, Marsh, Cope, Scott, Merriam and Sinclair. In the last quarter-century many others have contributed to our knowledge of these faunas, largely through study of materials gathered in the field during the earlier period. As part of the present program of research notable additions have been made to the fossil material through further collecting; these furnish an adequate basis for a revision of the faunas from the John Day formation and for a better understanding of the mammalian assemblages from the Miocene and the Pliocene Rattlesnake deposits. These faunas are being studied by Dr. Merriam and by Dr. Chester Stock of the California Institute of Technology, and several preliminary reports are either in preparation or have already appeared. In addition to indicating the age and correlation of the formations and aiding in determining the climatic and topographic conditions under which the rocks were deposited, these rather large collections give a vivid picture of the animal life which existed in this region during certain periods of the Cenozoic era.

The paleobotany of the region is being investigated by Dr. R. W. Chaney, research associate of the Carnegie Institution. Large collections of fossil plants have been made and studied, representing the forests and smaller associated plant life of Clarno, John Day, and Mascall time. Results already published contribute to the taxonomy of Tertiary fossil plants, and the ecology of the floras. Important interpretations of the fossil plant assemblages have been made on the basis of the ecologic relationships of certain modern floras. Significant facts regarding the age and the climatic and other conditions of deposition of the formations which contain them have been brought to light.

The invertebrate paleontology of eastern Oregon, especially of the older horizons lying beneath the Tertiary continental deposits, is being studied by Dr. E. L. Packard, of the University of Oregon, who has secured excellent collections of cephalopods and other marine invertebrates. Numerous new forms have been recognized in these faunas, and are being described. The last invasion of the sea into eastern Oregon occurred apparently in Chico Cretaceous time, and Dr. Packard is attempting to ascertain from these isolated strata—the only Pacific Cretaceous exposed east of the Cascades—something of the position of the Cretaceous shorelines and the topography and climate of the adjacent land masses. Pre-Cretaceous horizons bearing faunas probably not recognized here-

tofore in eastern Oregon have also been discovered and are being studied.

Dr. Merriam published an excellent summary of the physical geology of the John Day region in 1901. No detailed mapping of the geology had been done, however, before the present program was initiated. The region is a key area for the whole northern Great Basin Province in that a larger number of post-Jurassic formations is exposed here than at any other locality. In no other district are the great Columbia lava fields dissected so as to expose earlier Tertiary formations so extensively.

To facilitate geologic mapping the U. S. Geological Survey, under a cooperative arrangement with the Carnegie Institution, has made topographic maps of two areas: the Mitchell Quadrangle of about 750 square miles, and the Picture Gorge Special Quadrangle of about 56 square miles (on large scale). The writer has finished the geologic mapping of the latter area and has nearly completed the Mitchell Quadrangle. The areal and structural studies are as detailed as the scales of the two maps permit.

The formations exposed are: a pre-Cretaceous crystalline complex; Chico, upper Cretaceous; Clarno, Eocene or Oligocene; John Day, upper Oligocene; Columbia lavas, middle or upper Miocene; Mascall, middle or upper Miocene; and Rattlesnake, Pliocene. All the contacts excepting the Columbia lava-Mascall and perhaps the Clarno-John Day are very striking nonconformities. Both an exceedingly eventful geologic history and a very interesting series of gemorphic changes are evidenced by the results of the mapping.

The investigations in all phases of the John Day program are being continued during the summer of 1927.

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## SCIENTIFIC APPARATUS AND LABORATORY METHODS

### THE STUDY OF RHIZOPUS IN THE GENERAL COURSE OF BOTANY

IN many botanical laboratory courses it is the custom to study bread mold as a mass of hyphae covering bread or some other medium and to mount some of the mycelial mass on a glass slide, teasing it out for further observation of the vegetative structure. This method has seemed unsatisfactory, and I wish to suggest another method which has been used with success in the course in general botany at Macalester College.

Between two glass slides (5 cm. × 11½ cm.) are placed several layers of filter-paper of the same size as the glass slides, the interior portions of which have been cut out so as to form a border of filter paper about one centimeter wide. A small piece (2 or 3 cu. mm.) of the moist bread on which the culture is growing is placed between the glass slides in the center of the band of filter-paper. The slides are then tied together with thread, the filter-paper moistened by dipping the edges of the slides in water and the whole mount placed under a bell-jar. In about two or three days the stolonifers will extend outward in various directions from the moist bread, and wherever they come in contact with the glass surface rhizoid-like hyphae and sporangiophores are produced. This may now be studied either with the compound microscope or with the binocular microscope.

This enables the student to trace the stolonifers with ease from their origin to their attachments to the glass and to study the sporangiophores and rhizoid-like hyphae in their natural positions without any disturbance of the hyphae or any danger of their drying during the study.

The above described damp chamber is practically the same as that used by Dr. R. E. Jeffs in his studies of root-hair elongation and described in the *American Journal of Botany* 12: 577–606, 1925.

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## SPECIAL ARTICLES

### THE VARIABILITY OF LONG DIFFRACTION SPACINGS IN PARAFFIN WAXES

So much interest is being manifested in the polymorphism of long chain compounds, particularly the fatty acids (Piper, Malkin and Austin, *J. Chem. Soc.* 1926, 2310; deBoer, *Nature,* 119, 50, 635 (1927); Thibaud, *Compt. rend.* 184, 24, 96 (1927); Müller, *Proc. Roy. Soc.* 114-A, 542 (1927), that it seems advisable to report the results of some X-ray experiments with ordinary commercial paraffin waxes. Only one mention of X-ray studies of these complex mixtures of many hydrocarbons has been made, that of Piper, Brown and Dyment (*J. Chem. Soc.* 127, 2194 (1925) who found that the lines of the $C_{28}$ hydrocarbon appeared alone for a paraffin wax although this fraction furnished only 16 per cent. of the mixture and other members as high as $C_{32}$ were probably present.

In the present investigation samples were prepared from waxes melting at 135, 130, 125 and 120° F. by solidifying on glass plates and photographing in an oscillating spectrograph with copper Kα rays.