and probably of carbon dioxide. Reasons for this view will be set forth in detail in a later paper. Moreover, periodic reversal to beat backward means directing the main stream of hæmolymph toward the reproductive organs. This would seem to be a condition most favorable for the growth of the ovaries, which later in the female so fully fill the abdominal cavity.

"One swallow does not make a summer," and pupal circulation in this genus of butterflies may or may not be typical of that in all the different forms of higher insects with complete metamorphoses which make up such a large part of the animal kingdom. Few of them have colored blood, an unfortunate circumstance which is probably responsible for the fact that so little is known of periodic reversal of heart-beat. It has been described in the pupa of the silk-worm, however, by Bataillon.[5]

Periodic reversal in the direction of the heart-beat occurs, therefore, not only in Ascidians but is also an important characteristic of the metamorphosis of some and possibly most butterflies and moths. Wingless female moths are likely to prove an exception.

In the genus *Colias* periodic reversal of circulation is a most important feature in metamorphosis, as it may prove to be in other holometabolous insects.

JOHN H. GEROULD

DARTMOUTH COLLEGE

THE AGE OF THE PAYETTE FORMATION AND THE OLD EROSION SURFACE IN IDAHO[1]

THE Payette formation, of continental origin, underlies extensive areas in the Snake River Valley south and west of Boise and in neighboring parts of southwestern Idaho and southeastern Oregon. The age of these strata is a matter of interest because they are the principal key to the Tertiary history of this region, and because beds correlated with them have been used in recent years by Umpleby, Lindgren, Blackwelder, Mansfield and others in attempts to establish the age of the widely recognized old erosion surface of central Idaho.

Lindgren,[2] in 1900, divided the Tertiary sediments of the lower Snake River Valley into two formations. The younger, comprising nearly horizontal strata, he termed the Idaho formation, after Cope, and assigned it to the Pliocene. Merriam[3] has since studied and determined a mammalian fauna from the Idaho beds as representing a late stage of that epoch.

The name Payette was applied by Lindgren[4] to the older more deformed strata underlying the Idaho. The formation was originally considered to be upper Miocene in age on the basis of its flora, studied by Knowlton, but in 1900 Lindgren assigned the Payette to the Eocene because of a revision of the flora by Knowlton. In later years, in discussions of the age of the Idaho Erosion Surface, Umpleby has considered the Payette as Miocene and Lindgren has referred to it as "Miocene (or Eocene)." Chaney,[5] in 1918, on the basis of additional plant remains, said ". . . at this time the writer is satisfied to make the reference to the Miocene without further specification." It thus appears that difference of opinion has existed regarding the age of the Payette.

In the course of field studies in the Snake River region the writer secured remains of two mammalian faunas from the Payette. One occurs in the lower part of the formation, in beds beneath the interbedded rhyolite, about one mile north of Rockville, shown on the Silver City Quadrangle of the U. S. Geological Survey. The second was found in the same section in strata overlying the rhyolite, probably disconformably, near Sands, about 11 miles northeast of Rockville. The beds at both localities dip to the north beneath the nearly horizontal Idaho formation, from which they are easily discriminated by their attitude and lithology.

The Rockville or lower fauna includes a proboscidean of the *Tetrabelodon* type, a species of *Hypohippus* resembling other forms in that genus from middle and upper Miocene formations of the Great Basin province, *Merycodus* sp., a large camel, a rhinoceros, fish bones and freshwater shells. Proboscidean remains first occur in North America in the middle Miocene; they are not abundant until upper Miocene time. This fauna may represent the middle Miocene, but it is more probably of upper Miocene age, and possibly even lower Pliocene.

The small fauna from Sands consists mainly of fragmentary *Hipparion* teeth and rodent teeth. The former resemble most closely in their complicated enamel patterns *H. anthonyi* from eastern Oregon and the hipparions from the lower Pliocene Ricardo formation of the Mojave Desert described by Merriam. The age of the fauna is approximately lower Pliocene.

[5] Bataillon, E., 1893, "La métamorphose du ver à soie et le déterminisme évolutif," Bull. Sci. France et Belgique. Tome 25. (Quoted from Henneguy, L. F., 1904. Les Insectes, p. 533).

[1] Published with the permission of the director of the U. S. Geological Survey and the secretary of the Idaho Bureau of Mines and Geology.

[2] Twentieth Ann. Rept., U. S. Geol. Surv., Pt. 3, pp. 93–99, 1900.

[3] *Bull. Geol. Soc. Amer.*, Vol. 29, p. 162, 1918.

[4] Eighteenth Ann. Rept., U. S. Geol. Surv., Pt. 3, pp. 632–634, 1898.

[5] *Am. Jour. Sci.*, Vol. IV, p. 220.

The age of the Payette is, therefore, middle Neocene. This accords with the stratigraphic evidence. The Payette overlies, probably comformably, the Columbia River lavas, which in other localities have been determined to be approximately middle Miocene in age.

Umpleby[6] originally advanced two reasons for considering the old erosion surface of central Idaho as old as Eocene. It was predicated that the sediments of Eocene age in the surrounding region had been derived from the peneplaned area during its reduction. The Payette was not included among these Eocene formations, perhaps because of its uncertain age and because it was believed to occupy valleys cut into the peneplane. But the Payette lies in post-Payette fault valleys and in diastrophic depressions of Payette and post-Payette date, and not in pre-Payette erosion valleys, in the uplifted region of southwestern Idaho. If we apply Umpleby's reasoning, based on derivation, this important body of sediments lying in an area adjacent to the peneplane would date the old surface as middle Neocene.

A second reason for considering the peneplane Eocene was that strata of supposed Miocene age occupied valleys cut during the Oligocene in the old surface in east-central Idaho. If again we use Umpleby's correlation and reasoning but recognize the upper Miocene age of the lower Payette and hence allow lower and middle Miocene time for the erosion of the valleys instead of the Oligocene, the erosion surface would be Oligocene in age instead of Eocene. If the valleys required less than lower and middle Miocene time for their excavation the erosion surface might even have been finished in lower Miocene time.

It appears therefore that, if we follow Umpleby's reasoning, the old surface is younger than Eocene.

JOHN P. BUWALDA

UNIVERSITY OF CALIFORNIA

ORGANIZATION OF THE WEST VIRGINIA ACADEMY OF SCIENCE

A MEETING for the purpose of organizing an Academy of Science was held at Morgantown, W. Va., under the auspices of the West Virginia Scientific Society on Friday, November 28, 1924.

After an address of welcome by President F. B. Trotter, the organization was effected and the following officers elected:

President, Dr. Geo. R. Bancroft, professor of physiological chemistry, School of Medicine, West Virginia University.

Vice-president, B. R. Weimer, professor of biology, Bethany College.

Secretary, Dr. John A. Eiesland, professor of mathematics, West Virginia University.

Treasurer, A. S. White, professor of social sciences, Marshall College.

The following sectional chairmen were elected for the ensuing year:

Biological section, A. M. Reese.
Chemistry and Pharmacy, Earl C. H. Davis.
Engineering, C. R. Jones.
Geology, Mining, John L. Tilton.
Mathematics, Physics and Philosophy, John Eiesland.
Social Sciences, J. E. Winter.

Special features of the meeting were a lecture by the Honorable A. B. Brooks, chief game and fish protector of West Virginia, on "Lighting the lamp of conservation in West Virginia," and, in the evening, an illustrated lecture by Dr. Francis H. Herrick, of Western Reserve University, on "Bird and animal instinct and intelligence."

The following papers were presented:

BIOLOGICAL SECTION

Microscopic Crustacea collected in the Canal Zone: G. S. DODDS.

Breeding of corn for resistance to smut (Ustilago zeae): R. J. GARBER.

Pit of pit vipers: A. M. REESE.

Habits of brook lampreys: W. S. BOURNE.

Some aspects of the axial gradient theory of structural relationship in organisms: B. R. WEIMER.

Discharge and dissemination of fungus spores: N. J. GIDDINGS.

Some aspects of the rôle of temperature in development: L. M. PEAIRS.

Smoke injury to vegetation: J. B. RHINE.

The development of the tetral wall and coats of the pollen grain: P. D. STRAUSBAUGH.

The West Virginia University course in public health: F. E. CHIDESTER.

Migration in animals: F. E. CHIDESTER.

Leaf mold of tomato: R. C. SPANGLER.

The female gametophyte of the Trillium sessile: R. C. SPANGLER.

Fresh water mussels—(Naiades): W. L. UTTERBACK.

CHEMISTRY AND PHARMACY

Synthesis with chloro-ethers: FRIEND E. CLARK.

Variation in mineral content in Morgantown City water: W. W. HODGE.

Molecular orientation on solids in gels: EARL C. H. DAVIES.

ENGINEERING

Bridge-building in West Virginia: R. P. DAVIS.

The use of the strain gage in engineering investigations: G. P. BOOMSLITER.

[6] "An old erosion surface in Idaho," *Jour. Geol.,* Vol. 20, p. 142, 1912.