A NEW PROTODONATAN FROM THE GRAND CANYON.¹

BY F. M. CARPENTER.

Through the kindness of Dr. David White of the United States Geological Survey I have had the opportunity of studying three fossil insects, which he collected about a year ago in the Hermit Shale (Lower Permian) of the Grand Canyon. Two of these specimens are so incompletely preserved that their exact affinities cannot be determined; one appears to be the posterior half of the abdomen of an Odonate insect, and the other, a forewing of a blattid. The third fossil, however, is a nearly complete wing of a Protodonatan, described below as *Typus whitei*, n. sp., and is particularly interesting because of its close relationship with *Typus gilmorei* Carp., also from the Hermit Shale². This latter species, which is based upon a specimen collected by C. W. Gilmore in 1926, is the only fossil insect previously known from the Grand Canyon.

The order Protodonata was originally established by Brongniart in 1884, and later extended by Handlirsch to include a series of Odonate insects, occurring in the Carboniferous and Permian formations of both hemispheres. Although the order has usually been considered to be directly ancestral to the Odonata, the recent researches of R. J. Tillyard have led him to conclude that these two orders are parallel groups, derived from a common stem, the Carboniferous Megasecoptera. The meganeurid genus, *Typus* Sell., includes only the genotype, *T. permianus* Sell., from the Lower Permian of Kansas, in addition to the Grand Canyon species. All three of these species were large in comparison with most living insects, having an expanse of about eight inches, but were small beside the 28 inch *Meganeura monyi* Brongn., from Commeny. The new species is a little smaller than the genotype.

¹Contribution from the Entomological Laboratory of the Bussey Institution of Harvard University, no. 299.

²Carpenter, F. M. Proc. U. S. N. M., 71, art. 23. 1927.

³Sellards, E. H. Amer. Journ. Sci., (4) 22: 249-258, 1906.

TYPUS WHITEI CARPENTER

***Typus whitei*, n. sp.**

Described from a nearly complete forewing, with the following characteristics: wing rather broad, with a pointed apex, and reduced anal area; hind margin greatly curved. Length of wing, 9.3 cm.; estimated width, at middle of wing, 2.2 cm. Rs arising close to the base of the wing, not far from the origin of R1; R2 and R3 diverging well beyond the middle of the wing; M+R straight at base, but diverging downwards after the origin of R1; Cu2 and 1A deeply undulated, the curves of these veins corresponding; 2A straight; Cu2 reaching the hind margin of

Fig. 1. Venation of *Typus whitei* new species from the Hermit Shale of the Grand Canyon.

Sc, subcosta (concave); R, radius (convex); Rs, radial sector (concave); Ma, anterior media (convex); Cu2, Posterior cubatus (concave); 1A, first anal (convex); 2A, second anal (concave).

the wing at a point about two-thirds the wing-length from the base. The costal margin has been entirely macerated away, only the apical parts of Sc and R1 remaining. There are a few cross-veins visible between the bases of M+R, Cu2, and 1A.

Holotype: catalogue number 71713, United States National Museum; collected by Dr. David White on the Bright Angel Trail, Grand Canyon National Park, Arizona, under the auspices of the Carnegie Institution.

Horizon: Lower Permian.

At first glance this wing might be taken for the hindwing of *T. gilmorei* Carp., since it is slightly shorter and broader than the latter. But the reduced anal area is not at all characteristic of a hindwing of the Protodonata, as far as the order is known to us, and the differences in venation can hardly be explained in this manner. The most obvious of these differences is that the

undulations of Cu2 and 1A in *T. whitei* exactly correspond, which is not true of *T. gilmorei*.

This new fossil, being much better preserved than the type of *T. gilmorei*, shows very clearly the position of the origin of Rs, which was obscure in the latter specimen. In all probability the origin of Rs in *gilmorei* was similar to that in Dr. White's specimen, and not as suggested in my description of the former.

EXPLANATION OF PLATE 5.

Photograph of holotype of *Typus whitei*, n. sp., from the Hermit Shale of the Grand Canyon. (x 1.5).

SOME CUBAN CICADIDÆ, CERCOPIDÆ AND MEMBRACIDÆ.—A CORRECTION.

BY J. G. MYERS.

In the list of Cuban cicadas (*Psyche* XXXV, p. 120) there is an error due to a misplaced correction in the proofs. The second species should be omitted entirely, the third should be *Odopæa sagrae* (Guér.), while the sixth should read as follows.—

Juanaria pæyi (Guér.) in de la Sagra, *Hist. fis. nat. Cuba*, p. 425, 1857; syn. *Juanaria mimica* Distant, *Ann. Mag. Nat. Hist.*, (8) IX, p. 644, 1912. To Mr. Wm. T. Davis is due the credit of discovering this synonymy.