# A FOSSIL INSECT FROM THE LOWER PERMIAN OF THE GRAND CANYON

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In the latter part of April, 1926, Mr. C. W. Gilmore, returning to the National Museum with a collection of footprints from the Hermit Shale of the Grand Canyon, found among these fossils a large insect wing (Order Protodonata), which had previously been unnoticed. This specimen was forwarded to me by Dr. A. Wetmore, to whom I am also indebted for this opportunity of studying the first fossil insect from the Grand Canyon.

The term "Hermit Shale" was applied by Noble (1922) to the strata previously designated as the "Shale of the Supai Formation," included between the Cocconcino Sandstone (Permian) and the unconformity topping the Lower Supai Sandstone (Pennsylvania). Typical exposures of the Hermit Shale have been described and figured in the writings of Noble (1914, 1922) and Schuchert (1918), on the Paleozoic of the Grand Canyon, and many of the following comments on the geology and paleontology of the deposit have been derived from these sources. The Hermit Shale is a marked contrast to other Paleozoic insect deposits, which are usually characterized by discouragingly small exposures. At the Hermit Basin the shale is from 267 to 317 feet thick; at the Bass Canyon it is 332 feet thick; at the west end of the Kaibab division it is more than 500 feet thick, and may reach 775 feet at the Kaibab Canyon. Noble (1922) described the beds as consisting of deep brick-red shales and fine-grained friable sandstones. "The beds differ little from one another in composition and consist essentially of sandy mud colored by red ferritic pigment. * * * Many beds exhibit sun cracks and rain prints, and some beds are ripple marked."

Fossils from the Hermit Shale are few in number, but are sufficient to determine the geological position of the deposit. The first specimens were found by Schuchert in 1915. "Just below the sign 'Red Top' in the lower turn of the Hermit Trail and immediately above the thick upper sandstone of the Lower Supai are seen thin-bedded red shaly sandstones alternating with deep red zones of shale. The surfaces of the glistening and smooth platy sandstones are replete with the fillings of the small prisms of interbedded sun-cracked shales, and are often rain-pitted, and further marked by the feet impres-

sions of fresh-water amphibians * * * *Megapezia* (?) *coloradensis* [Lull, 1918], and *Exocampe* (?) *delicatula* [Lull, 1918]. Some of the tracks are distinct impressions of the feet, and others are mere strokes of the toes. In these same beds also occur plant remains in very fragmentary condition which were badly macerated and coated with a slime of red mud during their entombment. They are therefore difficult to determine, but after much effort Dr. David White tentatively identified them as *Callipteris* sp., cf. *C. conferta*, *Walchia* cf. *W. gracilis*, *Gigantopteris*, and cf. *Sphenophyllum*" (Schuchert, 1918). The footprints are of little value in determining the age of the deposit, but the plants led Doctor White to consider the Lower Permian as most probable. "The condition of preservation of the fragments is so bad that caution is necessary in basing conclusions of any kind on the material submitted. However, the presence of *Gigantopteris*, *Walchia*, and probably of *Callipteris*, if my tentative generic classification of the latter is correct, points to the Lower Permian age of the flora" (Schuchert, 1918).

In 1916 Doctor Noble made a second collection of plant material from the beds at the Hermit Trail. This collection was again examined by Doctor White, who determined the species as *Pecopteris* (?) species, *Alethopteris* (?) species, and *Callipteris* (?) species, which once more indicated that the beds were Permian age, or possibly the very latest Pennsylvania. In 1920 Noble again collected at the Hermit Basin, in addition to a few other plants, a well-preserved specimen of a species of *Callipteris*. In connection with this specimen Doctor White said: "* * * This evidence practically confirms conclusively the opinions based on fragments previously collected * * * and is of itself probably adequate to prove the Permian age of the Hermit Shale" (Noble, 1922).

The rock containing the insect is clearly from the "fine grained friable sandstone," rather than from the shale bed, and is a poor type of rock for the proper preservation of an insect. The surface is very rough and irregular, and the wing shows signs of maceration, as in the case of the plants examined by Doctor White. The condition of the specimen is rendered even worse by the lack of the reverse, which appears to have broken away with the obverse half of the center of the wing. Had the fossil represented a new group of insects, it would have been impossible to determine its affinities with any degree of satisfaction. Fortunately, the species is easily recognized as belonging to the Order Protodonata, and may be placed in a genus already established by Sellards.

## Family MEGANEURIDAE

The subfamily Typinae, to which this new species unquestionably belongs, consists of two genera from the Lower Permian of Kansas:

*Typus* Sellards, and *Megatypus* Tillyard. *Typus* may be distinguished (Tillyard, 1925) by having $R_3$ arising before the middle of the wing; AC, a simple cross-vein situated obliquely between two normal cross-veins; a single row of cellulose between 1A and 2A; and wings about ten centimeters long. In *Megatypus*, $R_3$ originates beyond the middle of the wing; AC is a strongly formed (concave), oblique vein connecting $Cu_2$ with 1A; there are two or more rows of cellules between 1A and 2A; and the wings are from 18 to 30 centimeters long. In the fossil from the Grand Canyon there are no traces of cellules or of the anal crossing, but the absence of AC suggests that this vein was only weakly developed, as in *Typus*, and not well developed, as in *Megatypus*. $R_3$ arises at least slightly basally of the middle of the wing, which is 10.5 cm. long, so that this species, although lacking many other features, may be placed in the genus *Typus* with very little chance of error.

### Genus TYPUS Sellards

*Typus* Sellards, Amer. Journ. Sci., ser. 4, vol. 22, pp. 249–258, 1906.—Tillyard, Amer. Journ. Sci., ser. 5, vol. 10, pp. 41–62, 1925.

#### TYPUS GILMOREI, new species

Plate 1

Described from a nearly complete, left forewing, viewed from above, with the following characteristics: Wing narrow and elongate, with a pointed apex, and a reduced anal area; length of wing, 10.5 cm.; greatest width, at the middle of the wing, 2.3 cm.; width at the base, 1.5 cm.; precostal area small; Sc (concave) long, extending beyond the middle of the wing; $R_2$ and $R_3$ (both concave) apparently diverging at a point just basal of the middle of the wing; $Cu_2$ (concave) broadly undulated; 1A (convex) only slightly undulated. These are the only characters which can be assigned to the species with moderate certainty. The costal margin appears to have been macerated away, so that its shape is a question, but one would assume from the basal and apical portions that it was nearly straight. The furrow of the subcosta can be traced indistinctly along this missing area almost to the apex of the wing. The presence of this shallow furrow, which can be seen in the photograph, supports the idea of maceration, since it would indicate that although the front part of the wing membrane was badly decomposed, the strong subcosta was nevertheless able to make a faint impression in the sandy mud. The R+M stem is very obscure at the base, appearing as an interrupted and irregular series of projections. $R_1$ (convex), and $R_2$ and $R_3$ (both concave) are plainly visible at the middle of the wing, but the origin of the radial sector is very indistinct. The media is so obscure as to be almost invisible, except at the base where there is a suspicion of a convex ridge. $Cu_2$ (concave) is very distinct at the base, but the remainder has been broken away. 1A (convex)

and 2A (concave) are also distinct at the base, but only 2A can be traced to its extremity. There is a weak convex branch leading from 1A, and sending a few branchlets to the posterior margin of the wing. The only cross-veins to be seen are on the basal part of the costal area; the anal crossing is not preserved. This wing is about the same size as *Typus permianus* Sellards, but differs in having the hind margin more arched, and $Cu_2$ and 1A more distinctly undulated.

*Holotype*, Catalogue number 71279, U.S.N.M.

*Locality*, Hermit Shale, about one-quarter mile west of the sign "Red Top" on the Hermit Trail in the Grand Canyon National Park, Arizona.

*Horizon*, Lower Permian.

I have named this species for its collector, Mr. C. W. Gilmore, of the National Museum.

The taxonomic contribution of *Typus gilmorei*, new species, is not very great, because it is so poorly preserved, but it does add a new and interesting locality to the three others which have yielded Meganeurids: The Upper Carboniferous of Commentry, France; the Radstock Coal Measures of Somerset, England; and the Lower Permian limestone of Elmo, Kansas. Geologically, it is of interest also, for it confirms, if any confirmation is needed, the plant evidence referring the Hermit Shale to the Lower Permian, since it belongs to an order of insects known only from the uppermost Pennsylvanian and the Lower Permian, and readily falls into a genus from the latter horizon.

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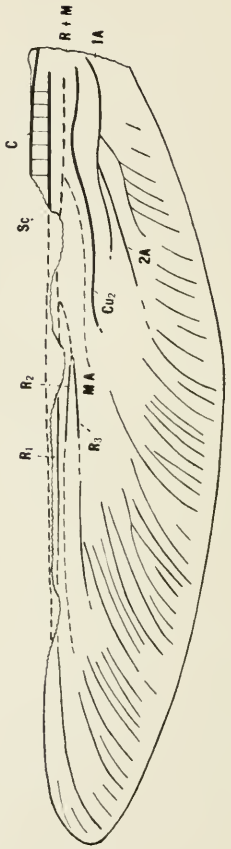
## EXPLANATION OF PLATE

FIG. 1. Photograph of holotype of *Typus gilmorei*, new species, from the Hermit Shale of the Grand Canyon. Natural size. Cat. No. 71279, U.S.N.M.

FIG. 2. Venation of *Typus gilmorei*, new species. C, costa (convex); Sc. subcosta (concave); $R_1$, radius (convex); $R_2$ and $R_3$, branches of the radial sector (both concave); MA, anterior branch of the media (convex); $Cu_2$, posterior branch of the cubitus (concave); 1A, first anal (convex); 2A, second anal (concave).




A FOSSIL INSECT FROM THE GRAND CANYON

FOR EXPLANATION OF PLATE SEE PAGE 4