

continuous and the optic properties vary rapidly with the composition, as shown in fig. 4. In this series the optic plane changes position as the optic angle passes through zero.

It is a pleasure to acknowledge that this article has been improved, especially by the addition of the foregoing summary, as a result of suggestions received from Professor U. S. Grant of Northwestern University.

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ART. XX.—*Fossil Caddice Fly Cases from the Green River Formation of Wyoming*; by W. H. BRADLEY.¹

During the field season of 1923 while the writer was engaged in mapping the Tertiary sediments north of the Rock Springs uplift in Wyoming, two different types of fossil Trichoptera larval cases were found which are unique in that they are constructed almost wholly of Ostracod valves. They seemed of sufficient interest to justify their description.

Cases somewhat similar to the first one here described were found in the upper part of the Green River or basal part of the Bridger formation in the vicinity of Lead Creek, Wyo., by A. C. Peale and described by S. H. Scudder.² Both kinds of cases found in the past season, however, present notable differences in architecture and kinds of materials used from those described by Scudder.

Chilostigma (?) *ostracoderma* Bradley, n. sp.—The larval case is cylindrical and perfectly straight, having a slight but uniform taper toward the caudal end. The dimensions are: length, 15.5-17 mm.; outside diameter, 4-4.5 mm. at the cephalic end and 3-4 mm. at the caudal end; inside diameters vary from 2.2-2.75 mm. Ostracod valves are used exclusively in its construction. The architecture of the case is simple. The shells are laid on

¹ Published by permission of the Director, U. S. Geological Survey.

² Scudder, S. H., An account of some insects of unusual interest from the Tertiary rocks of Colorado and Wyoming, U. S. Geol. and Geog. Survey Terr., Bull., vol. 4, pp. 542-543, 1878.

in a very neat and compact mosaic in which there is no indication of a spiral arrangement. Usually the rigid, limy ostracod valves, which measure .7-1.0 mm. in length and .4-.5 mm. in width, are arranged so that their major axes are nearly at right angles to the long axis of the case. A very stout sheath of silk must have formed the lining and cement since there is but a single layer of shells and only rarely is a fossil case found crushed in. Several of the cases which were broken off short show plainly that the caudal end was sealed by the same careful mosaic of Ostracods as is found in the rest of the fossil. Most of the cases are empty except for an occasional heap of Ostracods which must have been washed in after the emergence of the nymph. These free shells and the interior of the cases are coated with a very thin layer of calcite.

Classification.—The dimensions of the case, its architecture, and type of material used indicate that it probably belonged to the Limnophilidæ. The carefully sealed caudal end, the evident gregarious habit at time of pupation, and the measurements are all remarkably similar to the cases of the living genus *Chilostigma* described by Lloyd.³

Occurrence.—These cases were found in two localities in the valley of Jack Morrow Creek, Wyo. (Sec. 25, T. 25 N., R. 103 W. and Sec. 18, T. 24 N., R. 103 W.). Both collections came from oolitic limestones near the base of the Tipton tongue of the Green River formation of Eocene age. In both specimens the cases are very numerous and make conspicuous layers which alternate with Ostracod-bearing marl in the oolite.

Micrasema (?) *tessellatum* Bradley, n. sp.—The second type of larval case is much smaller. It is cylindrical, either straight or very slightly curved and does not taper. The dimensions are: length 10-16 mm., inside diameter 1.3-1.7 mm., thickness of wall about .25 mm. Ostracod shells make up the major portion of the mosaic of these cases, but minute plates of biotite, oolite grains, and well-rounded grains of a deeply altered green mineral are also present. The constituents of the mosaic have no definite

³ Lloyd, John Thomas, The biology of North American Caddice Fly larvæ: Bull. Lloyd Library No. 21, Ent. ser. No. 1, pp. 70-72, Cincinnati, Ohio, Feb. 1921.

arrangement and are more widely and irregularly spaced than in *C. ostracoderma*, a fact which probably indicates that the rigidity of the case was largely due to the silk sheath. It is impossible to determine from the material at hand whether the cases were closed or open.

The Ostracods used in the smaller cases are rarely more than .2 mm. in length and half that in both width and depth; their valves are rigid, calcareous, highly arched and unornamented. Their apparently excessive thickness is due in part to a surficial deposit of calcite. A rather thick deposit of white amorphous calcium carbonate coats the cases, most of which are filled with clear crystalline calcite. That the insect larva was gregarious at time of pupation at least, there can be no doubt. In a single hand specimen there are hundreds of individual cases, roughly parallel and apparently built in tiers. This crudely ranked habit of the cases was observed to hold through at least a foot of the rock from which the specimen was taken.

Classification.—The comparatively great length of the cases, their small diameters, together with the habit of living in very large colonies, suggest comparison with *Micrasema*, McLachlan, a living genus of the Sericostomatidae, the larvae and cases of which are described by Rousseau.⁴ This comparison is still further strengthened by the fact that the fossil forms occur in a nodular limestone of algal origin which was probably formed in more or less well aerated water at the ancient lake margin.

Occurrence.—These cases were also found in the valley of Jack Morrow Creek, Wyo. (Sec. 14, T. 25 N., R. 103 W.) in the Green River formation, but from the base of the Laney shale member. The alga reefs form a transition zone at the base of this member.

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⁴ Rousseau, E. and others, *Les Larves et nymphes aquatiques des insectes d' Europe*, vol. I, pp. 878-884, 1921.