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SILICIFIED TURBELLARIA FROM CALICO MOUNTAINS NODULES

W. DWIGHT PIERCE
Drawings by the author.

The following is the fifth report of the writer's investigation of fossils from calcareous petroliferous nodules formed in a Miocene lake in the area which is now the Calico Mountains, San Bernardino County, California (See Bull. So. Calif. Acad. Sci., 57:13-24; 58:72-78; 58:79-83; and 59:40-49).

The material herein discussed constitutes a first record of fossil preservation for the Class Turbellaria. Only by instantaneous death and preservation, and catalytic replacement of the tissues by colloidal silica can this material be explained.

Included are six specimens of flat worms representing three species, belonging to three families; also 360 eggs of one type, and 53 eggs of another type, believed also to be Turbellarian. The material was extracted by formic acid from nodules found in six quarter sections of the southeast mountain mass of the Calico Mountains, at altitudes 2500 to 2800 ft., and was collected at 10 sites, in 12 lots, by 8 persons. The extracted specimens are now mounted in balsam on fourteen microscope slides in the collections of the Los Angeles County Museum. See Table 1 for essential data.

CLASS TURBELLARIA

Free-living flat worms, with cellular or syncitial epidermis; body undivided; life cycle simple.

While common in fresh waters, these worms are so soft that none have ever been recorded in Paleontology. We now have three silicified types from the Miocene.

ORDER RHABDOCOELA

Small Turbellaria with complete digestive tract; intestine sac-like, without evident diverticula.

Specimen 4065 (Plate 44, Figure 1) is a very thin disc of pale yellowish color, slightly convex dorsally and concave ventrally. The eye spots are complex and near the anterior lateral margin. The mouth opening is ventral, close to the anterior third, and has two organs extending forward. The intestine is dimly outlined from mouth to penis bulb, which is elongate. The male gonopore is terminal with long canal to the antrum, into which three canals lead, the middle one probably connected to the penis bulb. There are a number of tactile hairs on the margin of the body.

TABLE 1. DATA ON TUBELLARIAN WORMS AND EGGS FROM NODULES

Objects Worms	No.	Measure mm.	Spec. No.	Nodule No.	¼ Sect. R1E R2E	Site	Lot	Altitude	Collector
Rhabdocoela	1	0.809x0.42	4065	12825	SW18	84	171	2800	D. Weissman
Tricladida Rhynchodemidae	1	3.57 x0.44	4359	2855	SW18	2D	20	2700	Dara Shilo
Planariidae	1	1.59 x0.307	2721	31	SW18	2	1	2650-2800	W. D. Pierce
	2	0.48 x0.0769	1179	6568	SW24	15	84	2500	Chas. Artman
	1	1.00 x0.288	4316	12582	SW24	101B	167		John Carr
Eggs Type I	345	0.19 diam.	4235	3231	SW24	15	25	2500	G. Kanakoff
	15	0.21 diam.	4245	16054	NE24	92	218		G. Kanakoff
Type II	1	0.23 diam.	4215	3231	SW24	15	25	2500	G. Kanakoff
	1	0.21 diam.	4197	10193	SW24	15	104	2500	G. Kanakoff
	2	0.25-0.26	2299	21	SW18	2	1	2650-2800	Jeanne Hotchkiss
	15	0.21-0.23	2966	12733	SE18	74	169		John Carr
	5	0.21-0.23	2715	13608	NE19	17F	185	2700	G. Kanakoff
	1	0.23	3813	4741	NE19	25	60	2725	John Carr
	3	0.21	4222	27062	NE19	?	319	?	Laura Rouse
	25	0.19-0.25	2962	17505	NW19	?	258	?	Laura Rouse

It is excluded from Order Acoela, family Proporidae, in which the genus *Afronta* has a terminal genital opening, but no intestine.

According to Ludwig von Graff (1905. Monograph of Turbellaria II Rhabdocoela. in Das Tierreich, lief. 23) all of the families with terminal genital opening fall in the suborder Lecithophora.

SUBORDER LECITHOPHORA

Libbie Henrietta Hyman (1951. The Invertebrates: Platyhelminthes and Rhynchocoela. The Acoelomate Bilateria. vo. II, p. 59) defines this suborder as "Rhabdocoels with bulbose pharynx, paired protonephridia, ventral gonopores, germovitellaria, or separate ovaries and yolk glands; reproduction exclusively sexual; fresh water, marine, or terrestrial, mostly free-living, some commensal or parasitic.

In this suborder, the families Umagillidae (Anoplodiidae), Cylindrostomidae (Genostomatidate), Byrsophlebidae, and Gyratricidae have the genital opening terminal. The first three families are parasitic, the last predaceous.

It is not the function of the writer in this article to name this fine specimen, as many of the characters used in the group are too obscure for delineation. However the characters delineated by Hyman and by von Graff seem to bring this specimen into the Section Typhloplanoida.

In Hyman's classification the section Typhloplanoida is composed of Lecithophora without a proboscis, pharynx usually of rosulate type, mouth ventral, back from tip; with one or two gonopores.

ORDER TRICLADIDA

SUBORDER TERRICOLA

FAMILY RHYNCHODEMIDAE

The largest Turbellarian so far found is Specimen 4359 (Plate 44, Figure 2). The intestinal canal lies diagonally, indicating a twisting of the body. The shape is elongate, stem-like. The eye spots are near the anterior lateral margin. The mouth opening is ventral at the anterior fifth of the body. A faint double line forward from the mouth indicates the division of the two forward portions of the intestines, while the posterior part lies in a diagonal position. The posterior half of the body is crystal clear. The body is constricted behind the middle. There are clusters of tactile hairs not far behind the mouth on each side, and a few other hairs behind. At posterior quarter on right side is a genital pore with a well defined covering flap; and nearer the apex on the left side is another pore with a smaller flap.

SUBORDER PALUDICOLA

FAMILY PLANARIIDAE

Four specimens of planarians (Plate 44, Figures 1-3) have been extracted by acid from the nodules as listed in the table. These tiny flat worms have typical eye spots, rounded head, pointed apex, and the side view of one shows the mouth opening. They are speckled, but show no describable details of the internal structure.

CLASS TURBELLARIA (?)

In the second paper of the nodule series (Bull. So. Calif. Acad. Sci. 58:72-78) the writer recorded for the first time the

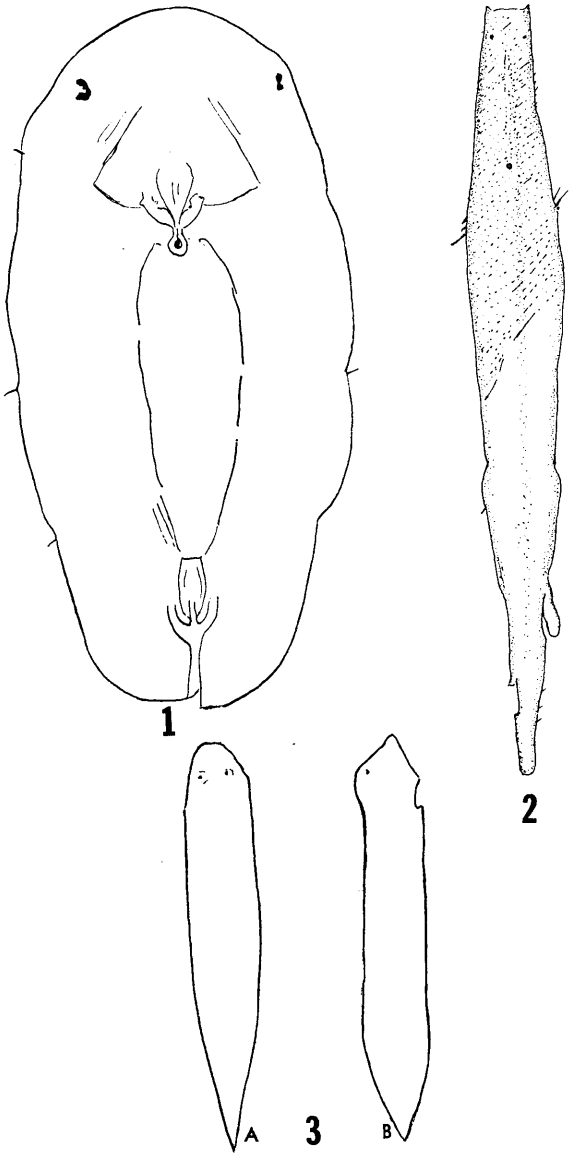

PLATE 44

Fig. 1. Fossil Rhabdocoele, Specimen 4065; length 0.809 mm.
Fig. 2. Fossil Rhynchodemid, Specimen 4359; length 3.57 mm.
Fig. 3. Two fossil Planarians, Specimen 1179; length 0.48 mm.

finding of fossil insect eggs. Some of these will be recorded in another paper; but in addition to insect, mite, and fairy shrimp eggs, there have appeared in the acid digestion of the nodules, two kinds of eggs which more closely resemble the Turbellarian type.

Turbellaria sometimes develop the eggs and offspring within the body; while others deposit eggs singly or in strips of gelatinous material. The yolkcells are usually not stored in the egg itself, but in special cells. Among the Tricladida the eggs are surrounded by yolk cells to form a capsule. Rhabdocoele eggs are generally laid singly, each enclosed in a rounded, oval, or hemispherical albuminoid shell or capsule. In Polycladida the worm ejects a continuous adhesive gelatinous thread containing a row of eggs. The eggs of Acoela are also enclosed in a delicate capsule embedded in gelatinous material.

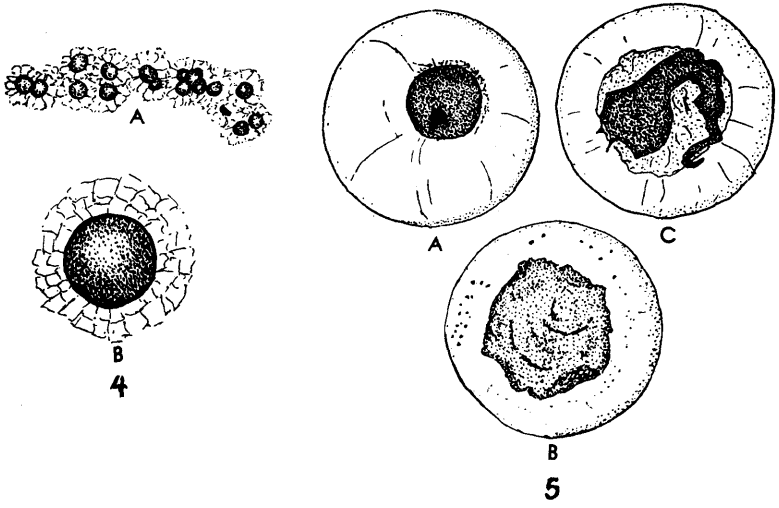

PLATE 45

Fig. 4. Fossil eggs, Type I, in ribbon, and enlarged single egg, thought to be Turbellarian, Specimen 4235; size of single egg 0.19 mm.

Fig. 5. Three fossil eggs, deposited singly, showing three phases of embryonic development, thought to be Turbellarian, Specimen 2962; size of eggs 0.19 to 0.25 mm.

Development is very rapid, so we may consider it very fortunate that the unusual conditions under which the Miocene nodule fossils were rapidly silicified, made possible the preservation of these delicate eggs.

We will make no attempt to assign these eggs to any family, but desire to record them now and alert the specialists to the fact that fossil eggs of the Miocene age, perfectly preserved three dimensionally, exist in the Calico Mountains nodules. As may be seen from the tabulation, these eggs are tiny.

The Type I eggs are spherical, black, surrounded by many gelatinous flakes and held together in long strips. The 345 contained in nodule 3231 were, for the most part in one mass of coiled strips. The actual egg proper measures 0.086 mm., but with the surrounding flakes the diameter averages 0.19 mm. These were found in two localities, two quarter sections. (Plate 45, Figure 4).

The Type II eggs are spherical consisting of a central egg enclosed in a clear convex capsule of smooth outer surface, each laid singly. In Nodule 17505 there were 25 eggs in different stages of development as shown in the illustration (Plate 45, Figure 5). The tiny egg proper may measure as little as 0.057 mm., within a clear mass measuring 0.23 mm. in diameter. These eggs have been found, as shown by the tabulation, in five quarter sections, in other words through the entire lake area.