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This volume is dedicated to Dr. Rainer Zangerl

New Fossil Polychaete from Essex, Illinois

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INTRODUCTION

The special requirements for the fossilization of soft-bodied animals have rarely been met in the history of life. The two most diverse fossil faunas with soft-bodied animals have been the Middle Cambrian Burgess Shale (Whittington, 1971) and the Solenhofen Limestone (Walther, 1904). A newer discovery, high in diversity and abundance, is the Essex fauna, associated with the Mazon Creek flora and distinct from the freshwater Braidwood fauna in being composed of marine animals (Johnson and Richardson, 1966; Richardson and Johnson, 1971). The Essex fauna is contained in ironstone concretions embedded in Middle Pennsylvanian Francis Creek Shale. The Essex fauna has been collected principally from Peabody Coal Company Pit Eleven near Essex, Illinois, in Will and Kankakee counties. The concretions weather out of the shale after the shale is stripped in recovery of Illinois Coal 2.

†Deceased September 23, 1976.

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Annelid worms of the class Polychaeta comprise about 3 per cent of all Essex fossils. About 1,500 polychaetes are in Field Museum of Natural History (FMNH) collections; over 5,000 more are in private collections.

The Essex polychaetes are a diverse group with 15-20 species. Two of these species have already been described from mineralized tubes, *Spirorbis carbonarius* Dawson and *Howellitubus whitfieldorum* Richardson, 1956. The other species are known only from body fossils. They were probably either free-living or inhabited temporary, unmineralized tubes. One of these species, the easiest to place in a modern classification system, is described below. This species accounts for about 10 per cent of all polychaete fossils in the fauna. One-hundred-fifty specimens are available at Field Museum; an additional 500 to 600 specimens were inspected in private collections. Abundance and extraordinary preservation make this the best known of all fossil worms. Description of the remaining species and an assessment of the importance of this polychaete fauna in the fossil record are in preparation.

DESCRIPTION OF SPECIES

Phylum Annelida
Class Polychaeta
Order Eunicida
Superfamily Eunicea
Family Eunicidae

Esconites, new genus

Since but a single species is known, the characterization of the genus is the same as that of the species.

Genotype: **Esconites zelus**, new species. Figures 1-11.

Diagnosis.—Moderate-sized, complete specimens ranging in length from 39-140 mm. with 23-80 similar segments. Two palps and five prostomial antennae. Jaw apparatus with well-developed wing-like mandibles; short, broad carriers; forceps (maxilla I) without denticles; four additional toothed maxillae on left side; three additional maxillae on right side (right maxillae III and IV probably fused). First few segments after prostomium probably apodous. Pectinate branchiae present anteriorly; long parapodial cirri present posteriorly; short, conical neuropodial cirri present on at least some segments. Parapodia biramous: the neuropodia with two to four aciculae and a bundle of long, fine setae; the notopodia

FIG. 1. Holotype, showing jaw apparatus and aciculae; photograph made under xylene to minimize reflections from uneven rock surface and to increase contrast between jaws and aciculae and the rock matrix. FMNH PE 11207.

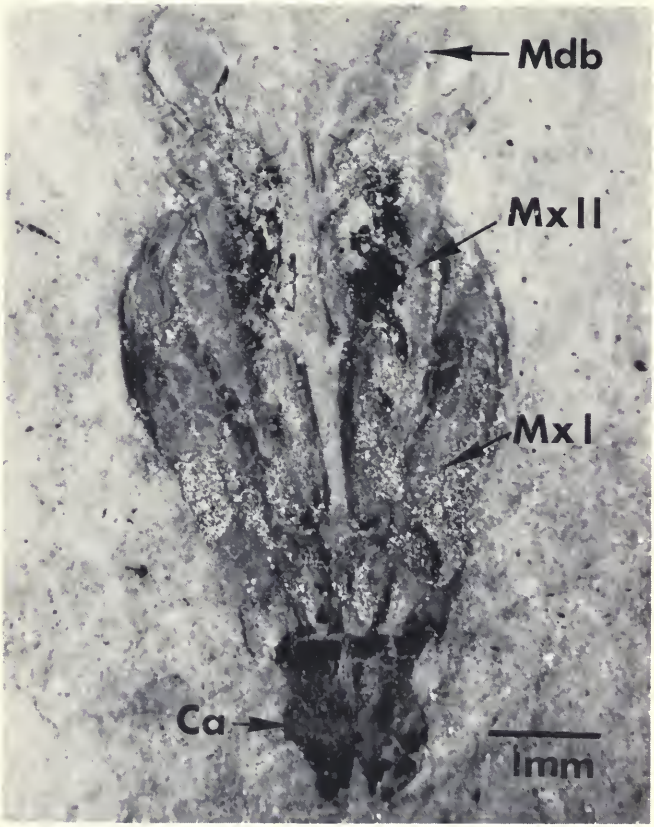

FIG. 2. Jaw apparatus of *E. zelus*: typical preservation with maxillary plates and mandibles pressed together; FMNH PE 11207, holotype.

Abbreviations used in Figures 2-5: Ca, carriers; Mdb, mandibles; Mx I - Mx V, maxillae; L, left side; R, right side.

with one to three aciculae and a smaller bundle of short, fine setae. Two anal cirri.

Holotype.—FMNH PE 11207 (figs. 1, 2), collected in Pit Eleven of the Peabody Coal Company.

Jaw apparatus.—Although the whole worm is preserved, the best diagnostic feature for the recognition of *E. zelus* is the jaw apparatus, visible in two-thirds of the specimens. When the apparatus is not visible, either the jaws have not been contained in the plane of cleavage of the concretion or concretion has split and weathered be-

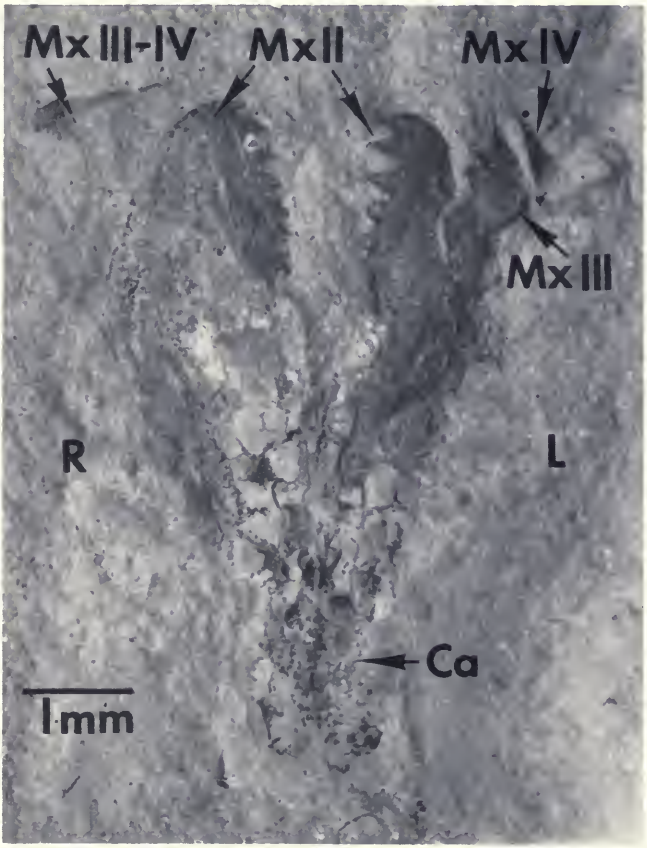

FIG. 3. Jaw apparatus: unusual preservation with jaws spread showing maxillae from the ventral side. Specimen from Piecko Collection, HTP 862. Abbreviations as in Figure 2.

fore collection and the jaws have been lost. Jaws are very seldom found separate from the body.

The jaws are visible in only two dimensions; that is, in the plane of fracture of the concretion. Because the mandibles and maxillae are usually preserved pressed closely together, it is difficult to distinguish individual elements (fig. 2). No single specimen is preserved with all elements visible. Because the elements are either fragmented or preserved only as impressions or as a carbon film, attempts to obtain whole jaws by dissolving concentrations in acid have failed.

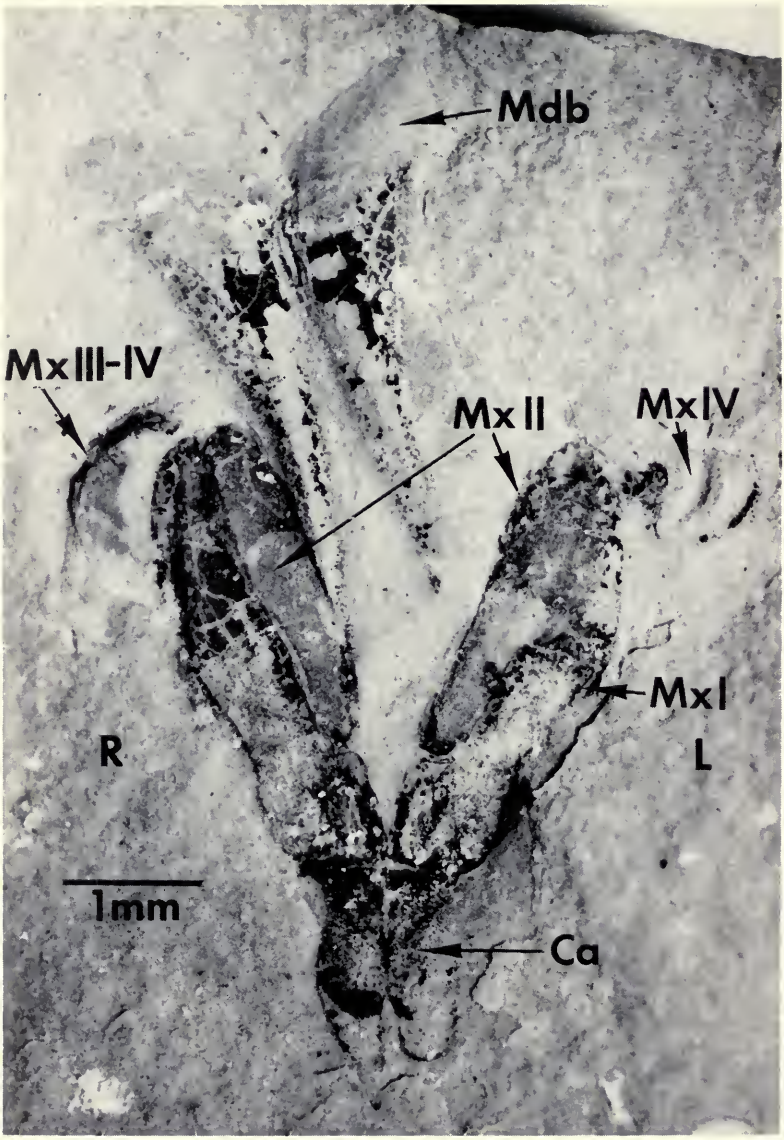

FIG. 4. Ventral view of jaw apparatus showing mandibles and spread maxillae. FMNH PE2288, collected and donated by Mr. and Mrs. Francis Wolff. Abbreviations as in Figure 2.

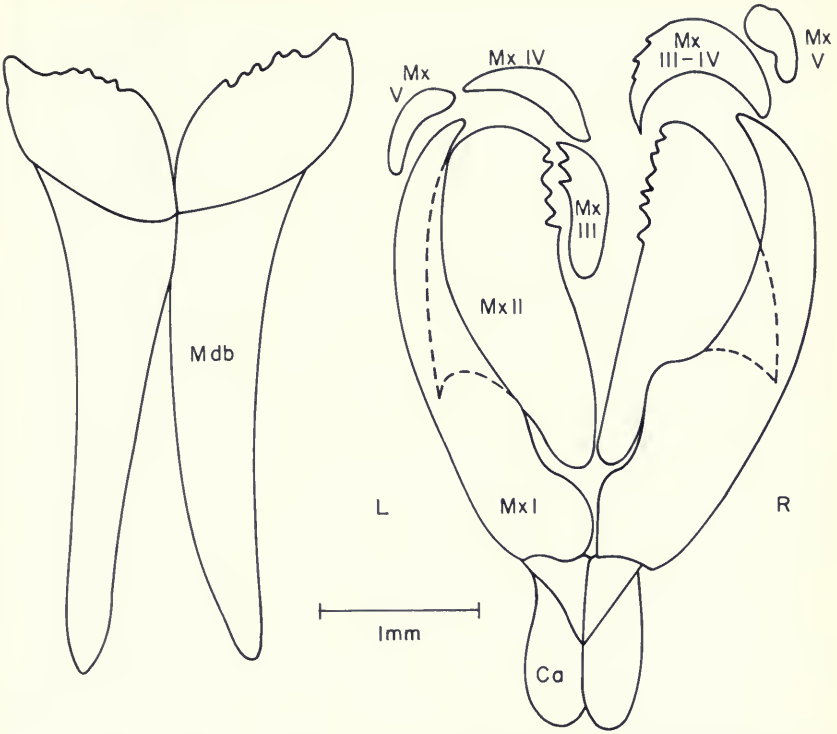

FIG. 5. Reconstruction of jaw apparatus based on many specimens, dorsal view. Abbreviations as in Figure 2.

Reconstruction of most details of the jaw apparatus has been possible, however, because many specimens are available, with some variation in the plane of cleavage relative to the jaws and in the degree of spreading of the jaws (figs. 3, 4). The mandibles are ventral to the maxillae and fused anteriorly (figs. 4, 5). They are about the same length as the combined maxillae and carriers, from 4-6 mm., and half as wide as long. The anterior blades are heavy, apparently calcified, and concave dorsally with from four to six denticles.

The maxillae rest in carriers (figs. 2, 4, 5) which are fused into one plate and are slightly longer than wide, with the posterior edges rounded. Maxillae I, or the forceps (figs. 2, 4, 5), are symmetrical with only one distal denticle. Maxillae II (figs. 3, 4, 5) are asymmetrical, with six or seven denticles on the right side and five denticles on the left. The left maxilla III is usually preserved closely

FIG. 6. Specimen preserved with tentacles and branchiae; jaws poorly preserved. Piecko Collection, HTP 5499. Ruled line represents 1 cm.

FIG. 7. Notopodial setae extending from parapodia, and polychaete body (darker areas). Aciculae and notopodia lie below the plane of cleavage of the concretion. Specimen in Caponera Collection.

Abbreviations for Figures 7-10: B, branchia; NeA, neuropodial aciculae; NeC, neuropodial cirrus; NeS, neuropodial setae; NoA, notopodial aciculae; NoS, notopodial setae; PB, polychaete body.

pressed to maxilla II and has at least three denticles (figs. 3, 5). Right maxilla III appears to be missing (fig. 3), perhaps having fused with maxilla IV, as in Recent eunicids (Day, 1967). The right maxilla IV is large and prominent, with an uncertain number of denticles. Some specimens show small maxillae V, both right and left.

Prostomium.—The anterior outline of *E. zelus* is seldom clear, but a few specimens show two palps. Also rare are specimens with tentacles. Twenty specimens displayed from one to five tentacles. Three was the most common condition (seven specimens) (fig. 6), with the median tentacle longer (7-8 mm.) than the laterals (5-6 mm.). Because two specimens were seen that had, in addition, a short tentacle on each side of the longer three, *E. zelus* may have a total of five prostomial tentacles, as in Recent eunicids. Conversely, the two short distal tentacles may be tentacular cirri attached to the peristome. Tentacles in all specimens are poorly preserved as light traces on the rock (fig. 6); no information about their morphology is available.

Parapodia.—The outlines of parapodia are occasionally preserved, but parapodial morphology can best be inferred from impressions left by aciculae and setae. Aciculae are preserved in 37 per cent of the specimens, setae in 33 per cent, though often aciculae and setae are not preserved together. The aciculae occur in two groups (fig. 7). There is a dorsal group of three or four aciculae, 1.5-2 mm. long. The ventral aciculae, one to three per parapodium, are shorter — 1-1.5 mm. This arrangement agrees well with Recent *Eunice* spp., which are uniramous but do in some species have a single short dorsal aciculae. The setae, although of indeterminate microscopic morphology, are also in some respects arranged as in Recent *Eunice* spp: there is a group of long, fine dorsal setae, perhaps 11 or more (fig. 8), and a group of shorter ventral setae, perhaps five to seven. However, *E. zelus* differs from all Recent eunicids: in a few specimens where both groups of aciculae and both groups of setae are preserved, it appears that the dorsal aciculae and setae are arranged in a manner relative to the ventral groups which would only be possible if the two groups were on separate lobes (fig. 9). We must conclude that *E. zelus* had biramous parapodia (fig. 10).

The parapodia of *E. zelus* carry pectinate branchiae, at least on the anterior segments. Six per cent of the specimens show traces of

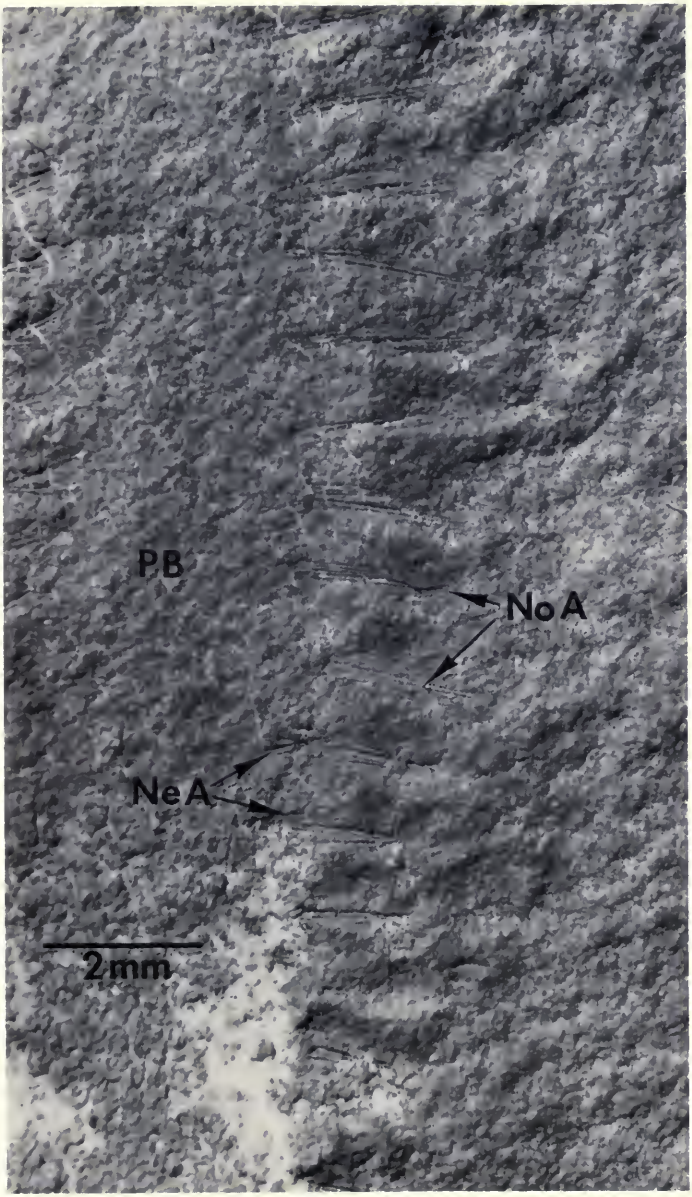

FIG. 8. Ventral view of both notopodial and neuropodial aciculae; no setae visible; specimen HTP 859 in Piecko Collection. Abbreviations as in Figure 7.

FIG. 9. Ventral view of notopodial and neuropodial aciculae-setae groups, showing independent arrangement. Specimen H322 from Herdina Collection. Abbreviations as in Figure 7.

at least a few branchiae: they have been seen as far forward as the 6th segment and as far back as the 34th segment of an average-sized worm (fig. 11). The fidelity with which these delicate tissues are preserved is remarkable. As many as 17 filaments can be counted per branchia.

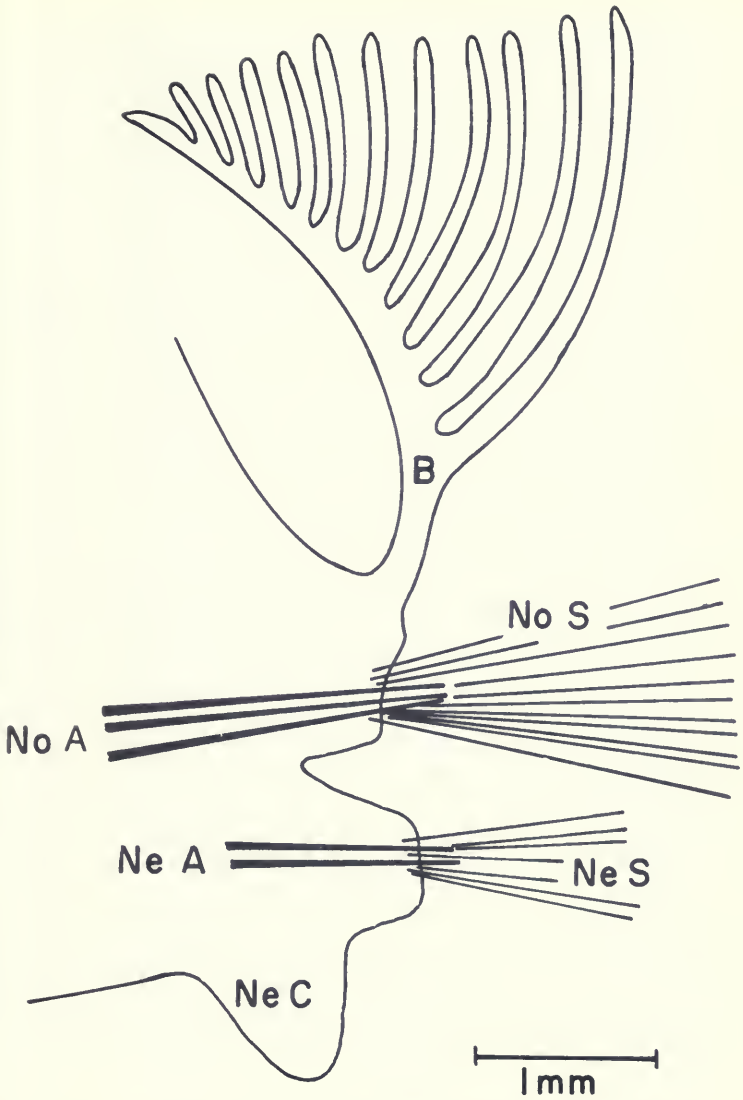

FIG. 10. Reconstruction of parapodium based on many specimens. Abbreviations as in Figure 7.

FIG. 11. Enlargement of middle segments of counterpart to specimen shown in Figure 2; branchiae with filaments can be seen.

A few specimens show parapodial cirri up to 12 mm. long on the posterior segments. It is probable that only the anterior segments carry branchiae, and that they are replaced by cirri posteriorly.

Another feature of the parapodia is neuropodial cirri, which are inferred from the occasional specimen with small circular depressions, about 1 mm. in diameter, arranged distally to each side of the segments. The depressions are usually stained black, indicating that more than the usual amount of tissue was present. These are just the kinds of remnants to be expected from the short, conical neuropodial cirri that still occur on Recent *Eunice* spp. (fig. 10).

Anal cirri, while seen in only 1 per cent of the specimens, are nevertheless so well preserved when present that they are clearly a valid characteristic of this species. There are two cirri 10 mm. long on a 105-mm. worm.

Classification.—E. zelus bears a remarkably close correspondence to the modern genus *Eunice*, and there can be no doubt that this fossil genus belongs in the same family as *Eunice.* Hartman (1944) puts *Eunice* in the family Eunicidae and the superfamily Eunicea, which includes in addition the Onuphidae, Lysaretidae, Arabellidae, Lumbrinereidae, and Dorvilleidae. These families can be differentiated on the basis of jaw morphology. Day (1967), on the other hand, considers the phyletic distance between the members of Hartman's Eunicea to be less than that between other polychaete families and so makes them subfamilies of a single family Eunicidae. We follow Hartman's scheme because phyletic relationship is indicated in the superfamily classification and because of the importance of jaws as diagnostic characters in fossils.

In almost all characteristics preserved, *E. zelus* fits perfectly into the Eunicidae. The armature is indistinguishable from that of *Eunice.* The palps, tentacles, branchiae, and cirri also correspond. Only the biramous nature of the parapodia does not agree with *Eunice* spp. as presently defined. Indeed, biramous parapodia are not even found in the living Eunicea. But rather than create a new family or subfamily to accomodate this species, we choose to expand the definition of the family Eunicidae in view of the otherwise perfect correspondence. We would have difficulty justifying even the creation of a new genus if it were not for the discovery of the biramous parapodia with close scrutiny of hundreds of specimens.

We find it impossible to assign *E. zelus* to the ubiquitous scolecodont genus *Eunicites.* One reason for not placing the Essex species

in *Eunicites* relates to the type of the latter. For almost 100 years, whole-body fossils and isolated scolecodonts with any similarity to Recent eunicids have been assigned to *Eunicites*. This genus is based on specimens from the Jurassic Solenhofen described by Ehlers (1868). Jansonius and Craig (1971) propose that isolated scolecodonts no longer be assigned to this genus because they cannot be compared with the type species, since the jaws are very poorly preserved in the Solenhofen material. A second reason is that we agree with Keilan-Jaworowska (1968) and Jansonius and Craig (1971) that there should be two taxonomic systems; one system for articulated jaw apparatuses, and a parataxonomic system for isolated scolecodonts. To place the Essex species in *Eunicites* would make it congeneric with species ranging in age from Ordovician to Tertiary and undoubtedly representing several polychaete families. This could only serve to further deepen confusion in an area that is already a "taxonomic swamp."

Summary.—A new species of polychaete, *Esconites zelus*, is described from abundant material from the Essex fauna from the Middle Pennsylvanian Francis Creek Shale near Essex, Illinois. The large number of specimens and the details which are preserved in them make this one of the most complete descriptions that has ever been possible for a fossil polychaete. The worm resembles the Recent genus *Eunice* of the family Eunicidae in all details except for the lack of fusion of the notopodia and the neuropodia.

ACKNOWLEDGMENTS

The resurrection of the species described above has been greatly aided by two groups: collectors in the northern Illinois area and colleagues at Field Museum. We dedicate this new species, *Esconites zelus*, to the members of the Earth Sciences Club of Northern Illinois (ESCONI) in gratitude for their valuable co-operation in making their collections available for study, in lending specimens to Field Museum, and in donating particularly valuable specimens. Special thanks go to Mr. and Mrs. Ted Piecko, Mr. and Mrs. Francis Wolff, and Mr. and Mrs. Calvin George for generous donations of specimens. At Field Museum, Dr. Rainer Zangerl provided the genial matrix within which this study was made and Dr. Eugene S. Richardson, Jr., established valuable liaisons with collectors and gave advice and help generously.

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