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LEIOPTERIA RAFINESQUII HALL
AND A NEW SPECIES OF THE GENUS
FROM THE THEDFORD-ARKONA REGION
OF SOUTHWESTERN ONTARIO

BY

GEORGE M. EHLERS and EDWARD P. WRIGHT



MUSEUM OF PALEONTOLOGY
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VOLUME XV

1. *Leiopteria rafinesquii* Hall and A New Species of the Genus from the Thedford-Arkona Region of Southwestern Ontario, by George M. Ehlers and Edward P. Wright. Pages 1-13, with 2 plates.

**LEIOPTERIA RAFINESQUII HALL AND A NEW SPECIES OF THE
GENUS FROM THE THEDFORD-ARKONA REGION
OF SOUTHWESTERN ONTARIO**

BY

GEORGE M. EHLERS and EDWARD P. WRIGHT

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INTRODUCTION

AS A RESULT of study of types of Hall's *Leiopteria rafinesquii* from New York and specimens of the genus from the Middle Devonian Arkona shale of Ontario, a lectotype of *L. rafinesquii* is here chosen and the Ontario specimens from the Arkona shale are classified as a new species. Success of the work was dependent on the co-operation of many people. The authors are particularly indebted to those mentioned below. We owe thanks to Mr. Charles A. Southworth of Thedford, Ontario, not only for the collection contributed by him, which forms the basis for this study, but, in the case of the junior author for over 20 years of helpful guidance in the field. We are grateful to Dr. G. A. Cooper, Curator, Division of Invertebrate Paleontology and Paleobotany of the United States National Museum, Washington, D. C., for counsel and direction and for his efforts in making available that museum's collection; to Dr. Winifred Goldring, retired State Paleontologist, and Clinton F. Kilfoyle, Associate Curator of the New York State Museum at Albany, New York, for valuable comments and for arranging the loan of Hall's specimens of *Leiopteria rafinesquii* and *L. dekayi*; to Dr. Madeleine A. Fritz, Associate Director of the Royal

Ontario Museum of Zoology and Palaeontology, Toronto, Ontario, for making available its collections; to Dr. Otto H. Haas of the American Museum of Natural History, New York City, who showed the junior author Hall's specimens of *Leiopteria laevis*, *L. bigsbyi*, *L. mitchelli*, *L. aviculoidea*, *L. greeni*, *L. rafinesquii*, and *L. conradi*; to Dr. Robert V. Kesling of the Museum of Paleontology, University of Michigan, for preparation of the map; to Dr. Henry van der Schalie of the Museum of Zoology, University of Michigan, for information regarding the morphology of *Leiopteria* and related genera; and to John M. Brigham and H. M. Wienert of the Museum of Paleontology, of the University of Michigan, for their expert, interested, and helpful assistance as preparators and photographers. Dr. Chester A. Arnold and Dr. Robert V. Kesling, both of the Museum of Paleontology, kindly criticized the typescript of this paper.

PREVIOUS WORK

Whiteaves (1898, p. 397) was the first to mention the occurrence of *Leiopteria* in the strata of the Thedford, Ontario, region. He stated:

"A few years ago the writer was informed by Professor Calvin that he had found a specimen of *Leiopteria Rafinesquii* in the Thedford region, and Mr. Schuchert writes that he collected a specimen, which he identifies with this species, in the 'upper third of the section' at Bartlett's Mills. The only *Leiopteria* from the Hamilton formation of Ontario that the writer has seen is a left valve, with only a portion of the posterior wing preserved, from Bartlett's Mills, in the collection of the Rev. Hector Currie, and it looks quite as much like *L. dekayi*, Hall, as *L. Rafinesquii*."

On the basis of its inclusion by Whiteaves in his list of fossils (1898, p. 416) and his quotation (p. 397) of Schuchert's communication in regard to the occurrence of the latter's specimen, Shimer and Grabau (1902, pp. 180-81) placed *Leiopteria rafinesquii* in their "upper shales," which are now recognized as part of the Widder formation.

Stauffer (1915) in his "Check List of the Devonian Faunas" (p. 228) included ". . . all forms known to occur in these formations in this province," and therein (p. 229) under "Fauna of the Hamilton Beds of Ontario" mentioned *Leiopteria rafinesquii* Hall. Nowhere in his report of localities in the Thedford-Arkona region and their faunas does he list *Leiopteria* as having been observed by himself.

Grabau and Shimer (1909, p. 425) and Shimer and Shrock (1944, p. 385) both attribute *Leiopteria rafinesquii* to the Hamilton of Ontario.

MATERIAL STUDIED

The literature refers to the Reverend Hector Currie and to Professor Charles Schuchert as the only persons who have reported collecting *Leiopt-*

teria in the region. The Currie Collection is lodged in the Royal Ontario Museum of Zoology and Palaeontology at Toronto, Ontario. His specimen from Bartlett's Mills is No. 1788H. It has an incomplete posterior wing, which suggests that it is the individual which was the subject of Whiteaves' comment (cited above). The Royal Ontario Museum also contains four other specimens of *Leiopteria* (No. 2125H) from "Hamilton-Thedford, Ontario" in its Kearney Collection and two more (Nos. 1416H and 2069H) collected by Sir E. Walker. All six are labeled "*Leiopteria rafinesquii* Hall."

Schuchert's specimens, a right valve and a left valve, are No. 26493 in the United States National Museum Collection. Contrary to Whiteaves' report (1898, p. 397) that these came from "the upper third of the section," they are labeled as "Hamilton (Lower third) Bartlett's Mills, Ontario." Moreover, they are marked as having been collected by C. Schuchert in 1895 and as identified by him. The statement attributed to Schuchert by Whiteaves that the fossils came from the "upper third" of the section is apparently an error, unfortunately perpetuated by subsequent authors. The source of the fossil, if one accepts the statement of the label accompanying the specimen, must have been the "lower third" of the section, that is, the Arkona shale.

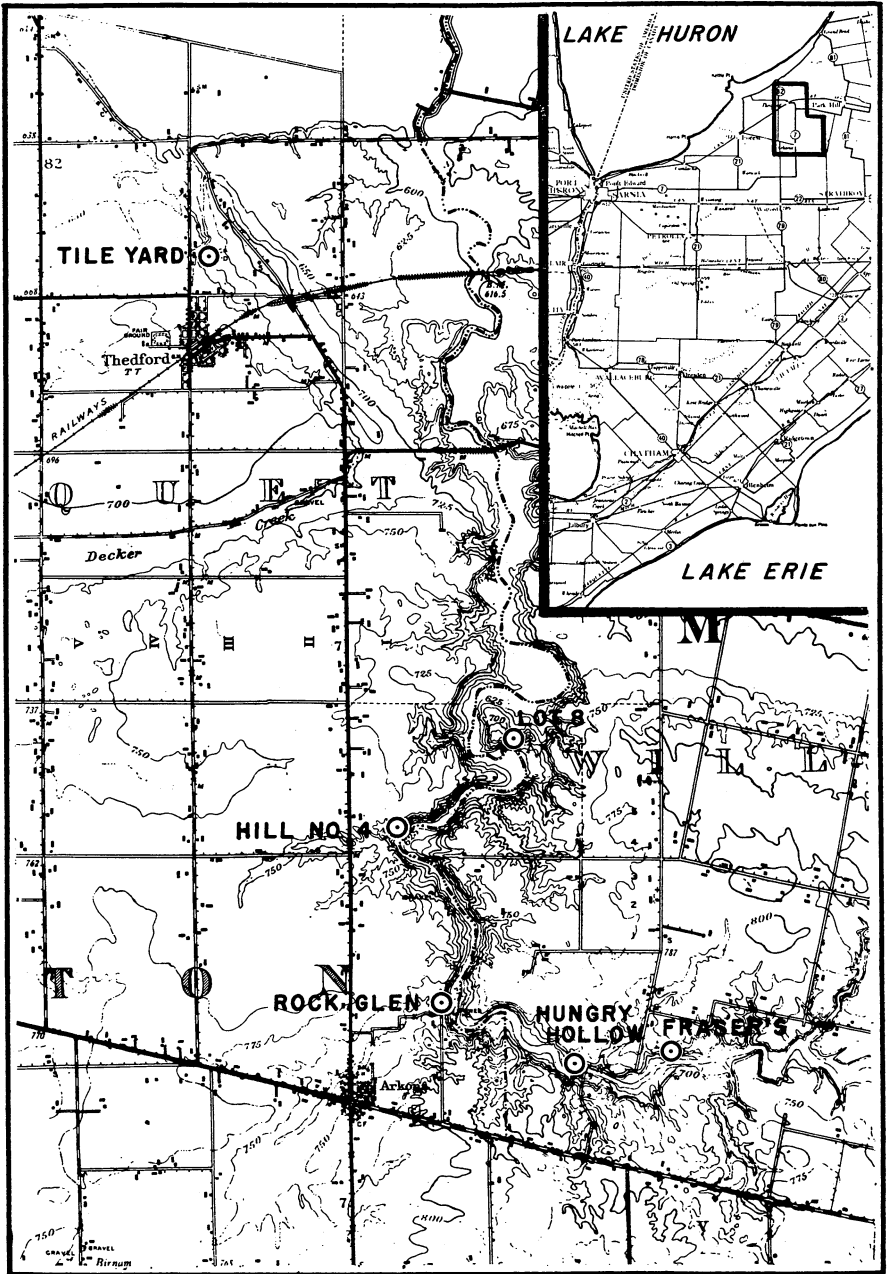
The specimens of *Leiopteria* in the Washington and Toronto collections have been compared with over 200 specimens of the genus obtained by the authors from the Arkona shale. The authors' description of *Leiopteria ausablensis*, sp. nov., is based on the last-mentioned material, which is deposited and catalogued in the Museum of Paleontology of the University of Michigan. All specimens are from exposures of the shale along the Ausable River, which flows through a part of West Williams Township, Middlesex County, and come from the localities listed below.

LOCALITIES

The locations of several places in the Thedford-Arkona region, points at which the Arkona shale is well exposed, are indicated on Map 1. Five sites that provided the material examined are as follows:

LOCALITY

1. North bank of the Ausable River on the farm of Robert Fraser, about 3 miles east of Arkona, West Williams Township, Middlesex County, Ontario, and about 1 mile north of the road leading east from Arkona (Fraser's, Map 1).
2. South bank of the Ausable River east of the bridge at Hungry Hollow, West Williams Township, Middlesex County, Ontario, about 2 miles east and about $\frac{1}{4}$ mile north of the center of Arkona (Hungry Hollow, Map 1).
3. North bank of the Ausable River west of the bridge at Hungry Hollow (Hungry Hollow, Map 1).



MAP 1. The Thedford-Arkona region, Ontario, showing the locations of the best exposures of Arkona, Hungry Hollow, and Widder strata.

4. East bank of the Ausable River north of the dam at Rock Glen, West Williams Township, Middlesex County, Ontario, about $\frac{1}{2}$ mile north and about 1 mile east of the center of Arkona (Rock Glen, Map 1).
5. North bank of the Ausable River on Lot 8, West Williams Township, Middlesex County, Ontario, about 3 miles north and about $1\frac{1}{4}$ miles east of Arkona (Lot 8, Map 1).

STRATIGRAPHY

Shimer and Grabau (1902, pp. 159, 160), who made the first extensive study of the rocks of the Thedford region, stated that Calvin in 1888 (pp. 81–86) called attention to the three-fold division of the Hamilton strata, but that the thickness of the middle, coral-bearing part is less than he indicated. Although the details of the stratigraphic relationships and classification of the Middle Devonian Hamilton group of the Thedford-Arkona region must await further investigation, three of the stratigraphic units are well established and known from many exposures. In ascending order, they are the Arkona shale, the Hungry Hollow formation, and the Widder formation. Together they compose Calvin's three-fold division of the Hamilton group.

Leiopteria is most frequent in the limestone lenses of the Arkona shale at Hungry Hollow, formerly known as Bartlett's Mill (Nicholson, 1874, p. 17) and as Marsh's or Marshall's Mill (Stauffer, 1915, p. 156). These lenses of gray encrinal limestone, which range in thickness from a quarter of an inch to 2 inches, are reported by Shimer and Grabau (1902, p. 158), Williams (1913, route map and composite section, p. 103), and Stauffer (1915, p. 157) as lying approximately 25 feet below the "Encrinal limestone," now regarded as a part of the Hungry Hollow formation. *Leiopteria* also appears in concretionary blocks of calcareous gray shale in the Arkona formation.

In the opinion of the present authors, *Leiopteria* does not occur in the Hungry Hollow or Widder formations.

VALIDITY OF GENERIC IDENTIFICATION

Hall first mentioned the genus *Leiopteria* in explanations to plates published in January 1883. The plates and their explanations were made for insertion in Part 1 of Hall's "Lamellibranchiata" monograph, which appeared in 1884. In this monograph (Hall, 1884c), information in regard to the 1883 publication of the explanations and plates is given under the descriptions of several species of *Leiopteria* (see pp. 158–66, 172).

Hall's description of *Leiopteria* appeared in the "First Annual Report

of the State Geologist of New York" in 1884. His full text (1884*a*, p. 14) is as follows:

Leiopteria, Hall. Shell aviculoid, oblique, subrhomboidal. Anterior extremity auriculate; wing large, extremity produced. Test without proper rays. Ligament external. Ligamental area marked by fine parallel longitudinal striae. Hinge with one or two oblique slender lateral teeth. The cavity of the beak is partially separated from the anterior end by a short partition or diaphragm.

Examples—*Leiopteria rafinesquii*. Pl. iv, figs. 9, 10.

—*Leiopteria dekayi*. Pl. iv, fig. 11.

Some time later in 1884, Hall (1884*b*, p. 406*c*) republished the above description of *Leiopteria* with the word "clavicle" replacing "diaphragm," the last word in his earlier description. Apparently still later that same year, Hall (1884*c*, p. xiii) republished without change of text his description given in the "First Annual Report of the State Geologist of New York." Although Hall named *Leiopteria rafinesquii* and *L. dekayi* as typical species, he did not indicate which one was the type for the genus. S. A. Miller (1889, p. 484), however, established *Leiopteria dekayi* Hall as the type species, a decision in which Shimer and Shrock (1944, p. 383) have concurred.

The shells in the collection under study as well as the specimens in the Toronto and Washington collections possess the surface attributes set forth in the generic description quoted above. From comparison with the syntypes of *Leiopteria dekayi*, these specimens have the generic characteristics emphasized by Hall, except that certain internal features to which he referred are neither discernible in his types nor in the individuals in our collection.

DESIGNATION OF LECTOTYPE FOR *Leiopteria rafinesquii* HALL

In spite of the fact that Whiteaves remarked (1898, p. 397), ". . . it looks quite as much like *Leiopteria dekayi*, Hall . . .," the species from the Thedford-Arkona region has been hitherto identified as *Leiopteria rafinesquii* Hall. Hall figured five specimens of *L. rafinesquii*. One is a right valve that is not positively identifiable as that of this species. Another, not seen by us, is an individual from the Corniferous limestone of Delaware, Ohio. We have, however, made a critical comparison of the remaining three. On his plates, Hall restored the missing wing tips to the New York State Museum specimens No. 2661 (1884*c*, Pl. XX, Fig. 6) and No. 2663 (1884*c*, Pl. LXXXVIII, Fig. 27). He also drew in the margin of No. 2663 and the obscured auricles of No. 2662 (1884*c*, Pl. XX, Fig. 7) and No. 2663.

The New York State Museum specimen No. 2663 was used by Grabau and Shimer (1909, Fig. 555c) as illustrative of *L. rafinesquii*, and later by Shimer and Shrock (1944, Pl. 149, Fig. 4) for the same purpose. The individual they selected shows little evidence of distortion from compression of the enclosing strata. Its strongly elevated growth lines and form are characteristic of *L. rafinesquii*. The form of Hall's three specimens agrees fairly well with his description.

Hall did not designate a type. Particularly because the specimen mentioned above was illustrated in the widely circulated textbooks by Grabau and Shimer and Shimer and Shrock, it seemed fitting to select the New York State Museum specimen No. 2663 (Hall, 1884c, Pl. LXXXVIII, Fig. 27) to typify the species and it is here designated the lectotype.

Hall (1884c, explanation to Pl. LXXXVIII and p. 162) stated that this individual came from the shales of the Hamilton group, Bellona, Yates County, New York. In a personal communication to the senior author Clinton F. Kilfoyle, of the New York State Museum, wrote that the specimen is not accompanied by a locality number. The only information on its occurrence, therefore, is that given in Hall's text. According to D. D. Luther (1906, p. 38) the only Hamilton shale in that area is Moscow. Dr. G. Arthur Cooper, of the United States National Museum, has examined this specimen and finds nothing about its matrix to suggest any origin other than the Moscow formation.

SYSTEMATIC DESCRIPTION OF NEW SPECIES

Phylum MOLLUSCA

Class PELECYPODA

Order ANISOMYARIA

Family Leiopteriidae Mallieux, 1931

Subfamily Leiopteriinae Mallieux, 1920

Genus *Leiopteria* Hall, 1882, emend. Spriesterbach, 1909

Genotype.—*Leiopteria dekayi* Hall, 1833, explanation of plates, by designation of S. A. Miller, 1889, p. 484.

***Leiopteria ausablensis*, sp. nov.**

(Pl. I, Figs. 6-10; Pl. II, Figs. 1-14)

Description.—Shell alate, smaller than most species of the genus. Body narrow above, obliquely ovate. Height equal to or slightly greater than length. Margins regularly curved; the postbasal side extended; anterior margin directed downward and backward in a gentle curve from a shallow byssal sulcus below an anterior auricle.

Left valve convex; height greater than that of right valve; umbo gibbous. Right valve less convex than left valve, especially below umbo; height about 10 per cent greater than length. Body of right valve less distinctly defined than that of left valve.

Hinge line straight from a point just anterior to beaks of the valves to its posterior extremity; this part of hinge line about 80 per cent of the length of the shell. Anterior to beaks hinge line directed forward and slightly downward.

Beak of left valve acute, directed forward, and situated a short distance above the hinge line and immediately posterior to auricle. Umbonal region gibbous, subtending an angle of about 50 degrees to the hinge line. Beak of right valve directed forward.

Auricle short, convex, obtuse, with a shallow byssal sulcus; imperceptibly separated from body of shell. Border of a byssal notch suggested by slightly and outwardly flexed anterior margins of byssal sulci of right valves of two specimens. Wing moderately large and flat; edge concave; extremity acute.

Test thin, smooth. Growth of test marked by low subparallel ridges, very narrow and distantly spaced in younger parts of shells and wider and closely spaced in older parts; some ridges wider and slightly higher than those adjacent, apparently formed by longer halts in the rate of shell secretion. Growth ridges forming a modified "S" pattern; their anterior sweep beginning at the juncture of the body and wing, a line through which, from posterior of beak to posterior of wing, subtends an angle of about 34 degrees to the hinge line.

Position of ligament apparently indicated in part by a low rounded ridge composing the dorsal margin of the wing of each valve and by another similar, shorter, though prominent, ridge extending forward along the upper part of the auricle from the beaks of each valve.

Typical specimens of *Leiopteria ausablensis*, sp. nov., in the collection studied have the measurements given in Table I.

TABLE I

Types	Illustrated	Measurements (in mm.)	
		Length	Height
Paratype No. 38112	Pl. II; Figs. 9-11	15	18
Paratype No. 38113	Pl. II; Figs. 12-14	20	22
Holotype No. 38114	Pl. I; Fig. 10	22	23
Paratype No. 38115	Pl. I; Fig. 6	26	27
Paratype No. 38116	Pl. II; Fig. 7, 8	27	27

In most specimens the length to height ratio increases with maturity, giving to older shells an appearance of greater obliquity.

Remarks.—Internal structures and the attachment of the ligament have not been seen in any specimen. Beaks are imperfectly preserved on all shells we have studied.

Leiopteria ausablensis differs from *L. rafinesquii* in being smaller and more erect and in having a markedly smooth instead of lamellose shell surface. Its beak and auricle are less prominent than those of *L. rafinesquii*.

Leiopteria ausablensis is smaller than *L. dekeyi* but resembles the latter in obliquity. It approaches *L. dekeyi* in smoothness of external surface of right valve, and both differ markedly from the lamellose surface of *L. rafinesquii*. The auricle of *L. ausablensis* appears as an extension of the body of the shell; that of *L. dekeyi* is distinctly differentiated from the body. The beaks of *L. ausablensis* are not as prominent and do not protrude above the hinge to as great an extent as in *L. dekeyi*.

Occurrence.—Sites along Ausable River, Thedford-Arkona region, Ontario, localities 1–5 (Map 1). Gray shale and lenses of gray, crinoidal limestone in Middle Devonian Arkona shale about 25 feet below top of this stratigraphic unit.

Leiopteria ausablensis is associated with the brachiopods, *Chonetes* sp., *Mucrospirifer arkonensis* (Shimer and Grabau), and “*Schuchertella*” sp., the gastropod *Platyceras arkonense* (Shimer and Grabau), the questionable gastropod *Tentaculites attenuatus* Hall; several species of ostracods; and the crinoid *Arthroacantha carpenteri* (Hinde). The most common of these fossils are *Mucrospirifer arkonensis* and *Tentaculites attenuatus*.

Types.—Holotype No. 38114; paratypes Nos. 38111–38113, 38115–38119.

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Submitted for publication August 25, 1958

PLATES

EXPLANATION OF PLATE I

- | | PAGE |
|---|------|
| <i>Leiopteria rafinesquii</i> Hall | 6 |
| FIG. 1. Left valve of lectotype. New York State Museum No. 2663. Moscow shale, Bellona, New York. $\times 1$. | |
| FIG. 2. Hall's drawing of lectotype with missing parts of valve restored. $\times 1$. | |
| <i>Leiopteria dekayi</i> Hall | 10 |
| FIG. 3. Left valve of syntype. New York State Museum No. 2640. Hamilton group (drift), Cooperstown, New York. $\times 1$. | |
| FIG. 4. Hall's drawing of syntype with some missing parts of valve restored. $\times 1$. | |
| <i>Leiopteria ausablensis</i> , sp. nov. | 7 |
| FIG. 5. Right valve and umbonal region of left valve of an incomplete, slightly crushed shell. Paratype No. 38111. Arkona shale. Locality 1 (Fraser's, Map 1). $\times 2$. | |
| FIG. 6. Left valve of a large shell, with parts of anterior border, auricle, and wing missing. Arkona shale. Bryozoan, <i>Hederella</i> sp., attached to body of valve. Paratype No. 38115. Crinoidal lens in Arkona shale. Locality 2 (Map 1). $\times 1$. | |
| FIG. 7. Right valve and part of left valve of a small incomplete weathered shell, showing part of auricle and byssal sulcus. Paratype No. 38117. Crinoidal lens in Arkona shale. Locality 2 (Map 1). $\times 2$. | |
| FIG. 8. Paratype No. 38117 enlarged to show prominent, convex ridge extending forward from beak of each valve along upper margin of auricle. Anterior edge of auricle in left valve represented by a narrow, elongate sigmoidal ridge that extends upward from an oval object at upper left of a conspicuous crinoid columnal to another, much worn columnal lodged between the broken ends of the ridges on auricle. Left of prominent columnal, anterior margin of byssal sulcus slightly flexed outward (toward observer); flexed margin may be border of byssal notch. $\times 4$. | |
| FIG. 9. Anterior of paratype No. 38117 showing structures described in Figure 8. $\times 8$. | |
| FIG. 10. Nearly complete left valve of a shell of medium size. Holotype, No. 38114. Crinoidal lens in Arkona shale. Locality 2 (Map 1). $\times 1$. | |

PLATE I

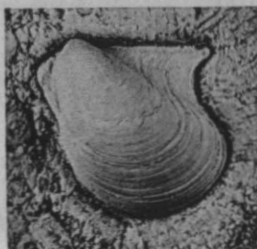
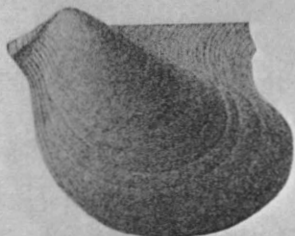
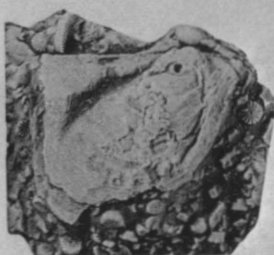
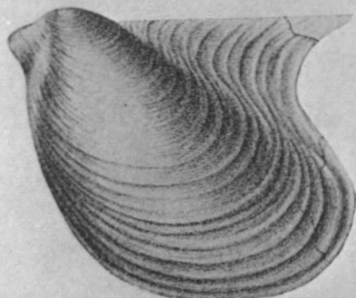
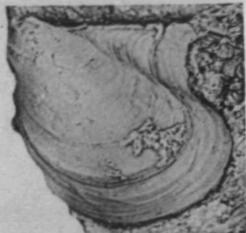
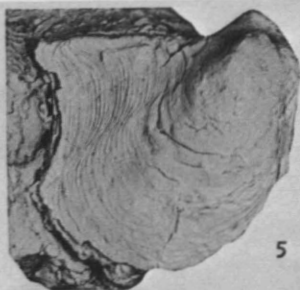
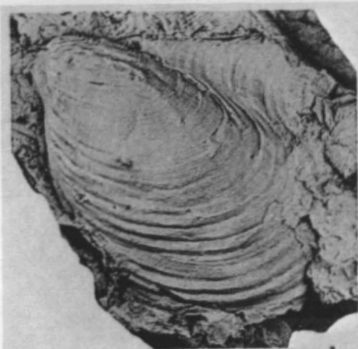
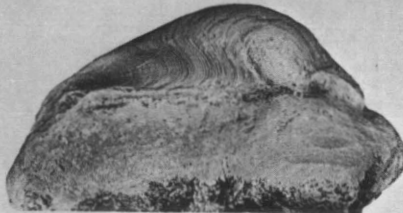
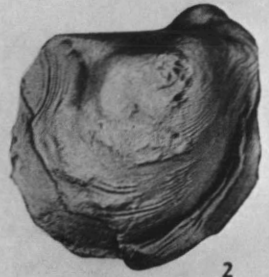


PLATE II



EXPLANATION OF PLATE II

- | | PAGE |
|--|------|
| <i>Leiopteria ausablensis</i> , sp. nov. | 7 |
| FIG. 1. Left valve of small, partly crushed and weathered shell, showing fine, closely spaced growth lines. Paratype No. 38118. Arkona shale. Locality 2 (Map 1). $\times 2$. | |
| FIG. 2. Paratype No. 38118, showing anterior part of right valve crushed laterally against inner surface of left valve. Margin of inner surface of left valve (2 mm. wide in illustration) exposed in front of broken, ridgelike, anterior edge of right valve. Slightly broken anterior edge of byssal sulcus of right valve flexed outward (toward observer), apparently representing border of a byssal notch. Umbo of left valve higher than that of right valve. Ridges on upper margins of auricle poorly preserved but recognizable. $\times 2$. | |
| FIG. 3. Dorsal view of paratype No. 38118, showing thickness and anterior-posterior curvatures of valves. $\times 2$. | |
| FIG. 4. Left valve of a much broken shell, showing fine growth lines. Bryozoan, <i>Hederella</i> sp., attached to body of valve. Paratype No. 38119. Arkona shale. Locality 2 (Map 1). $\times 2$. | |
| FIG. 5. Right valve and umbonal region of left valve of paratype No. 38119. $\times 2$. | |
| FIG. 6. Dorsal view of paratype No. 38119, showing thickness and anterior-posterior curvature of valves. Curvature of growth ridges between body and dorsal edge of valve well shown. $\times 2$. | |
| FIG. 7. Left valve of a large shell with well preserved body but imperfect auricle and wing. Paratype No. 38116. Crinoidal lens in Arkona shale. Locality 2 (Map 1). $\times 1$. | |
| FIG. 8. Dorsal view of paratype No. 38116, showing thickness and anterior-posterior curvature of valve. $\times 2$. | |
| FIG. 9. Left valve of a small nearly complete valve. Paratype No. 38112. Crinoidal lens in Arkona shale. Locality 2 (Map 1). $\times 1$. | |
| FIGS. 10, 11. Dorsal and anterior views of paratype No. 38112, showing curvatures of valve. $\times 2$. | |
| FIG. 12. Left valve of shell of medium size with parts of anterior, ventral, and posterior borders missing. Paratype No. 38113. Crinoidal lens in Arkona shale. Locality 2 (Map 1). $\times 1$. | |
| FIGS. 13, 14. Dorsal and anterior views of paratype No. 38113, showing curvatures of valve. Curvature of growth ridges between body and dorsal edge of valve well shown in Figure 13. $\times 2$. | |

