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PROCTOTHYLACOCRINUS ESSERI, A NEW CRINOID FROM THE MIDDLE DEVONIAN SILICA FORMATION OF NORTHWESTERN OHIO

BY

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VOLUME XX

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4. *Proctothylacocrinus esseri,* a New Crinoid from the Middle Devonian Silica Formation of Northwestern Ohio, by Robert V. Kesling. Pages 75–87, with 5 plates.

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PROCTOTHYLACOCRINUS ESSERI, A NEW CRINOID FROM THE MIDDLE DEVONIAN SILICA FORMATION OF NORTHWESTERN OHIO

BY
ROBERT V. KESLING

ABSTRACT

A new species of *Proctothylacocrinus,* named *P. esseri,* has been found in the Middle Devonian Silica Formation of Ohio. It can be readily distinguished from the type species, *P. longus* Kier, also from the Silica Formation: its calyx is larger, its dorsal cup is wider, flaring ventrally; its *BB, RR,* and *RA* are more ornate, linked by narrow, high ridges; its indentations are deeper at the *IBB-BB* junctions and at the corners of *RA* and X_1; and the vertical ridges through X_1 and *RA* taper more abruptly on the anal sac. Although the holotype and only known specimen was not found in place, the discovery site suggests that the new species is older than any specimen of *P. longus.*

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INTRODUCTION

AN EXCEPTIONALLY GOOD crinoid of the genus *Proctothylacocrinus* was found in the North Quarry of the Medusa Portland Cement Company at Silica, Ohio, by Mr. Joe Esser, who generously donated it to the Museum of Paleontology of The University of Michigan. It was lying loose on an old dump pile in the northeast corner of the quarry. If this place is close to the original site of deposition, then this crinoid came from strata below unit 13 of Ehlers, Stumm, and Kesling (1951), the unit which yielded specimens of *Proctothylacocrinus longus* Kier. The thin layer of matrix on part of the specimen was hard, light buff-gray, calcareous shale, distinctly different from the soft, dark gray, arenaceous shale of unit 13.

The crinoid consists of two columnals, the calyx, part of a large anal sac, and a few *PBrBr* of each ray. The calyx is about 14 mm in diameter through the ends of the *RR* and the columnals are nearly 6 mm in diameter; hence the specimen is considerably larger than any known specimen of *Proctothylacocrinus longus*.

At first the crinoid was compared with specimens of *P. longus* to determine if it was a gerontic individual of that species. Not only does it differ in shape, proportions, and ornamentation, but specimens of *P. longus* show no ontogenetic trends which approach the features of the new crinoid. New illustrations of *P. longus* are added here for comparison with *P. esseri*.

The new species is named in honor of Mr. Esser, who discovered the holotype. It is deposited and catalogued in the Museum of Paleontology as UMMP 51744.

LOCALITIES

Both localities are in quarries of the Medusa Portland Cement Company at Silica, near Sylvania, Lucas County, Ohio. All specimens are from strata of the Middle Devonian Silica Formation.

Locality

1. North Quarry, from side of dump pile in north northeast extension of the quarry. Specimen presumed to have come from strata below Unit 13 of Ehlers, Stumm, and Kesling (1951, p. 19). Matrix is gray shale. Specimen collected by Joe Esser in September, 1964.
2. South Quarry, from exposures on west wall of quarry. Unit 13 of Ehlers, Stumm, and Kesling (1951, p. 19). Specimens collected by Porter M. Kier in 1951.

SYSTEMATIC DESCRIPTIONS

Subclass INADUNATA Wachsmuth and Springer
Order CLADOIDEA Moore and Laudon
Suborder DENDROCRINOIDEA Bather
Family Proctothylacocrinidae Kier

The main difference between the Proctothylacocrinidae and the Dendrocrinidae emphasized by Kier in creating the former is that its *RA* was beside X_1 instead of below it. As shown in the figures of 13 specimens of *Proctothylacocrinus longus* Kier (Pl. III, Figs. 1, 3, 4, 7; Pl. IV, Figs. 1, 4, 5; Pl. V, Figs. 1, 3, 5, 8, 9, 11), the *RA* lies below the X_1 in the type species of the type and only genus of the Proctothylacocrinidae. The other differences mentioned by Kier (1952, p. 71) are that the calyx is smaller and the *RR* facets wider in the Proctothylacocrinidae. Size is a poor taxonomic

criterion. The main difference between the Proctothylacocrinidae and the Dendrocrinidae is that the former has very large *RR* facets, fairly wide and very deep, whereas the latter has narrow curved *RR* facets.

Genus *Proctothylacocrinus* Kier

Description.—Dorsal cup relatively small, consisting of 5 small *IBB*, 5 large *BB*, 5 *RR*, a rather large *RA*, and X_1; junctions of plates indented. *IBB* circlet only slightly larger than adjacent columnal, tips of *IBB* inserted between *BB*. *RR* with wide facets, followed by several *PBrBr* in each ray. Arms branched several times, non-pinnulate. Tegmen fully occupied by long anal sac. *RA* and X_1 followed by series of plates tapering into typical short, ribbed plates of anal sac.

Proctothylacocrinus esseri, sp. nov.

(Pl. I, Figs. 1–5; Pl. II, Figs. 1–2)

Description.—Dorsal cup flaring ventrally from *IBB* circlet, its sides forming an angle of 70 degrees. *IBB* set in circlet only a little wider than adjacent columnal; ventral tip of each *IB* sublanceolate, extending between *BB* and ending at *B-B-IB* junction. *IB-IB-B* junction marked by small circular pit. *BB* large, forming complete circlet (Pl. I, Fig. 2); those of AB, DE, and AE interrays hexagonal (Pl. I, Fig. 4), each bordered by 2 *RR*, 2 *BB*, and 2 *IBB*; those of BC and CD interrays septagonal (Pl. I, Figs. 1, 5), that of BC interray bordered by 2 *RR*, *RA*, 2 *BB*, and 2 *IBB*, that of CD interray bordered by *RA*, X_1, *R*, 2 *BB*, and 2 *IBB*; each *B* ornamented by short dorsal ridges to adjacent *IBB* (around *IB-IB-B* pit; see Pl. II, Fig. 2), low ridges to adjacent *BB* (Pl. I, Figs. 1, 4, 5), and high ridges to adjacent *RR* (Pl. I, Fig. 4) and/or *RA* and X_1 (Pl. I, Fig. 5).

RR slightly smaller than *BB*, the circlet interrupted in CD interray by *RA* and X_1; each *R* pentagonal, dorsally acuminate and bordered ventrally by PBr_1; *RR* of A, B, and E rays also bordered by 2 *RR* and 2 *BB* (Pl. I, Fig. 4); that of C ray bordered by *R*, *B*, *RA*, and a plate of the anal sac (Pl. I, Fig. 5); that of D ray bordered by *R*, X_1, and 2 *BB* (Pl. I, Fig. 1); each *R* with 4 ridges extending to adjacent plates except PBr_1. *RR* facets large, subovate (Pl. I, Figs. 3, 4), but not extending full width of plate (Pl. I, Fig. 4). *RA* nearly as large as *R*, pentagonal (Pl. I, Fig. 5), with radiating ridges to 2 *BB*, *R*, X_1, and the succeeding ventral plate. X_1 about the same size as *RA*, hexagonal (Pl. I, Fig. 1), with ridges to adjacent plates: *B*, *RA*, *R*, X_2, and the two lateroventral plates of the anal sac.

Anal sac occupying full tegminal region, robust, composed of 8 series

of plates (Pl. I, Figs. 1, 3, 4); typical plates short and wide, with a vertical ridge and a pair of thin close-set ridges to each side. X_2 with tapered vertical ridge; X_3 with central node; succeeding plates of series typical of anal sac. Plate above *RA* like X_1 but smaller; the next plate in series intermediate between X_2 and X_3; the next plate with small central node, and additional plates typical of anal sac.

Only a few proximal *PBrBr* known in each arm. *PBrBr* large, proximally tapered, articulating facets elongate suboval (Pl. II, Fig. 1), deeply incised by narrow ambulacral groove.

Columnals large, their articulating facets decagram-shaped with 10 radiating lanceolate areas outlined by slotlike pits (Pl. I, Fig. 2); each columnal relatively short, with median encircling ridge; on each side of ridge, 10 short ridges alternate with 10 shallow V-shaped depressions, thus forming decagram outline of facets (Pl. II, Figs. 1–2).

Remarks.—Several obvious differences separate the new species from the type species of *Proctothylacocrinus,* in addition to the size. These are summarized in Table I.

Occurrence.—Locality 1.

Holotype.—UMMP 51744.

Proctothylacocrinus longus Kier

(Pl. III, Figs. 1–7; Pl. IV, Figs. 1–6; Pl. V, Figs. 1–12)

Proctothylacocrinus longus Kier, 1952, pp. 72–73; Pl. II, Figs. 1–4, Pl. IV, Fig. 1.

Description.—Dorsal cup expanding gradually from *IBB* circlet, its sides forming an angle of about 40 degrees. *IBB* circlet only slightly wider than adjacent columnal; ventral tip of each *IB* acuminate, extending between *BB*. *IB-IB-B* junction marked by small circular pit (Pl. III, Fig. 5). *BB* large, forming complete circlet, their junctions lying in vertical grooves (Pl. III, Fig. 4; Pl. IV, Figs. 5–6); those of AB, DE, and AE interrays hexagonal (Fig. 1), with broad ridges to *RR* and smaller ridges to *IBB* (around pits); those of BC and CD interrays septagonal (Pl. V, Figs. 3, 8, 9 ,11), with broad ridges to ventrally adjacent plates.

RR smaller than *BB,* each pentagonal, dorsally acuminate, with a wide *R-PBr*$_1$ suture about three-fourths the width of the plate; broad ridges to dorsally adjacent plates, but grooves along the sides (Fig. 1). *RA* nearly as large as *R,* pentagonal (Pl. III, Figs. 3, 4, 7), with broad ridges to each side and corners depressed, the ridges to *R, B* of CD interray, and succeeding ventral plate more prominent than those to X_1 and *B* of BC interray. X_1 smaller than *RA,* with very large vertical ridge (Pl. III, Figs. 1, 4;

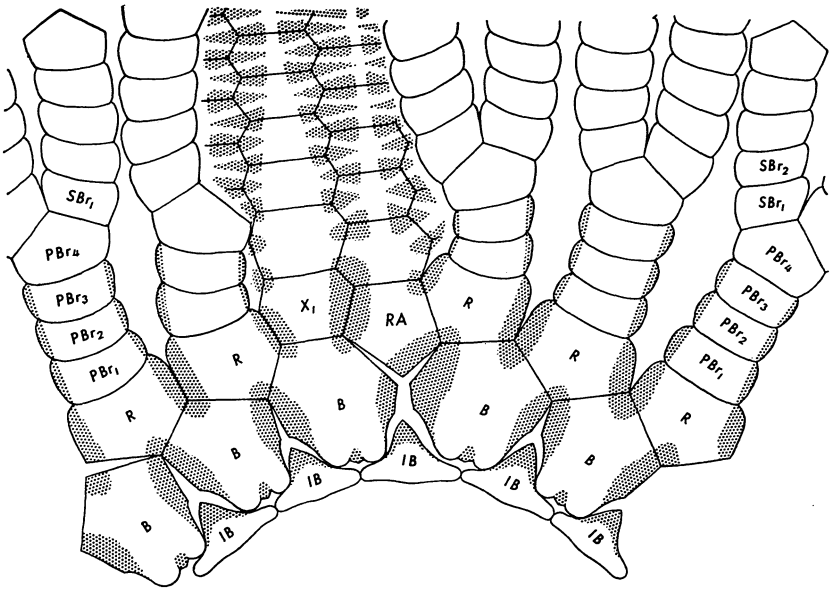

FIG. 1. Labeled plate diagram of *Proctothylacocrinus longus* Kier, based primarily on paratype UMMP 27694.

Pl. IV, Figs. 4, 5). X_2 as large or larger than X_1, most of its area occupied by large vertical ridge. At least two plates above *RA* with tapering vertical ridge wider than the ridge of other anal sac plates in the series. At least four plates above X_1 with gradually tapering vertical ridge wider than the ridge of other anal sac plates in the series.

Anal sac occupying all of tegminal region, very long, strong but flexible, composed of 8 series of plates (Pl. III, Figs. 6–7). Typical plates nearly as high as wide, hexagonal, with radiating ridges to sides.

PBrBr variable in number; typically 4 *PBrBr* in each of A, B, and E rays and 3 *PBrBr* in each of C and D rays (see Tables III and IV). Arms branched many times; 4 or 5 *SBrBr* in each half-ray and 6 to 9 *TBrBr* in each quarter-ray. Arms non-pinnulate.

Columnals nearly circular, decagonal, each with encircling median ridge.

Remarks.—This species is compared with *P. esseri* in Table I. In Table II, selected measurements of an ontogenetic series of specimens show no trends leading to *P. esseri.* The variability of *PBrBr* is emphasized in Tables III and IV. It will be noted that UMMP 51659 (Pl. III, Fig. 2) has 7 *PBrBr* in the C ray; possibly this is the result of an aborted

branch in this ray, since no other specimen approaches this number (Table IV). No other C or D ray contains more than 4 *PBrBr*.

Occurrence.—Locality 2.

Illustrated specimens.—Paratype UMMP 27694; hypotypes UMMP 51655–51662, 51724–51727.

TABLE I

DIFFERENCES BETWEEN *PROCTOTHYLACOCRINUS LONGUS* KIER AND *P. ESSERI*, SP. NOV.

	P. longus Kier	*P. esseri*, sp. nov.
BB	Separated by deep grooves	Joined by low ridges
Dorsal cup	Relatively narrow	Relatively wide
RR	Broad ridges to adjacent plates	Narrow ridges to adjacent plates (except $PBrBr_1$)
RA	Broad ridges to adjacent plates	Narrow ridges to all adjacent plates
X_2	Vertical ridge broad	Vertical ridge rather narrow
Anal series	X_1 through X_5 distinct from typical anal sac plates	Only X_1 through X_3 distinguishable from typical anal sac plates.
Anal sac	Plates nearly as high as wide	Plates very short
Columnals	Facets with shallow indentations, nearly decagon-shaped	Facets with distinct indentations, definitely decagram-shaped

TABLE II

SELECTED MEASUREMENTS OF *PROCTOTHYLACOCRINUS* SPECIMENS.

a–angle formed by sides of dorsal cup as viewed posteriorly (in degrees).
h–perpendicular distance from dorsal end of *B* in CD interray to ventral edges of *RR* in C and D rays (in millimeters).
w–distance between outermost ventral edges of RR in C and D rays (in mm).
x–length of X_1 (anal *x*) (in mm).
r–perpendicular distance from dorsal tip of *RA* to ventral edges of *RR* in C and D rays (in mm).

Specimen No.	Pl.	Figs.	*a*	*h*	*w*	*x*	*r*	*w/h*	*x/h*	*r/h*
P. longus Kier										
51727	V	5–6	38	1.9	2.8	0.8	0.7	1.48	.42	.37
51724	V	1–2	46	2.2	4.0	0.9	1.3	1.82	.41	.59
51658	V	9–10	41	2.5	4.6	1.2	1.5	1.84	.48	.60
51661	IV	1–2	35	2.6	4.4	1.2	1.6	1.69	.46	.62
51655	III	6–7	42	3.0	5.9	1.6	1.9	1.97	.56	.63
51726	V	7–8	51	3.0	5.7	1.6	1.6	1.90	.53	.53
51660	V	3–4	41	3.2	5.9	1.4	1.7	1.84	.44	.53
51725	IV	3–4	42	3.3	5.8	1.4	2.0	1.76	.42	.61
51659	III	1–2	46	3.3	6.2	1.6	2.2	1.88	.48	.67
27694	IV	5–6	40	3.3	6.5	1.2	1.9	1.97	.36	.58
51657	III	4–5	36	3.5	6.3	1.7	2.0	1.80	.49	.57
51662	V	11–12	40	3.6	6.5	1.8	2.2	1.81	.50	.61
51656	III	3	49	3.8	7.5	1.8	2.4	1.97	.47	.63
27693 (Holotype)			51	3.8	7.7	1.9	1.9	2.03	.50	.50
P. esseri, sp. nov.										
51744 ♣	I	1–5	70	5.4	12.1	4.0	2.8	2.24	.74	.52

TABLE III

PRIMIBRACHIALS IN EACH RAY OF *PROCTOTHYLACOCRINUS LONGUS* KIER.

Specimen No.	A	B	C	D	E	Mean
51727	4	4	–	4	4	4.0
51724	4	3	3	3	3	3.2
51658	4	4	–	3	4	3.8
51661	3*	3	3	3	3	3.0
51655	4	4	–	3	4	3.8
51726	4	–	–	3	4	3.7
51660	4	4	3	3	4	3.6
51725	4	–	–	3	3	3.3
51659	5	5	7	4	5	5.2
27694	4	4	3	3	4	3.6
51657	4	–	4	4	4	4.0
51662	5	4	4	3	–	4.0
51656	–	–	3	3	–	3.0
27693	4	4	3	4	4	3.8

*Aborted branch.

TABLE IV

SUMMARY OF PRIMIBRACHIALS IN RAYS OF *PROCTOTHYLACOCRINUS LONGUS* KIER.

	Ray				
Number of *PBrBr*	A	B	C	D	E
7	0	0	1	0	0
6	0	0	0	0	0
5	2	1	0	0	1
4	10	7	2	4	8
3	1	2	6	10	3
Mean	4.1	3.9	3.7	3.3	3.8

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PLATES

EXPLANATION OF PLATE I

(All figures × 3; specimen from Locality 1)

PAGE

Proctothylacocrinus esseri, sp. nov. 77

FIGS. 1–5. Views centered on CD (posterior) interray, dorsum, venter, A (anterior) ray, and CD (posterior) interray inclined. Holotype UMMP 51744.

PLATE I

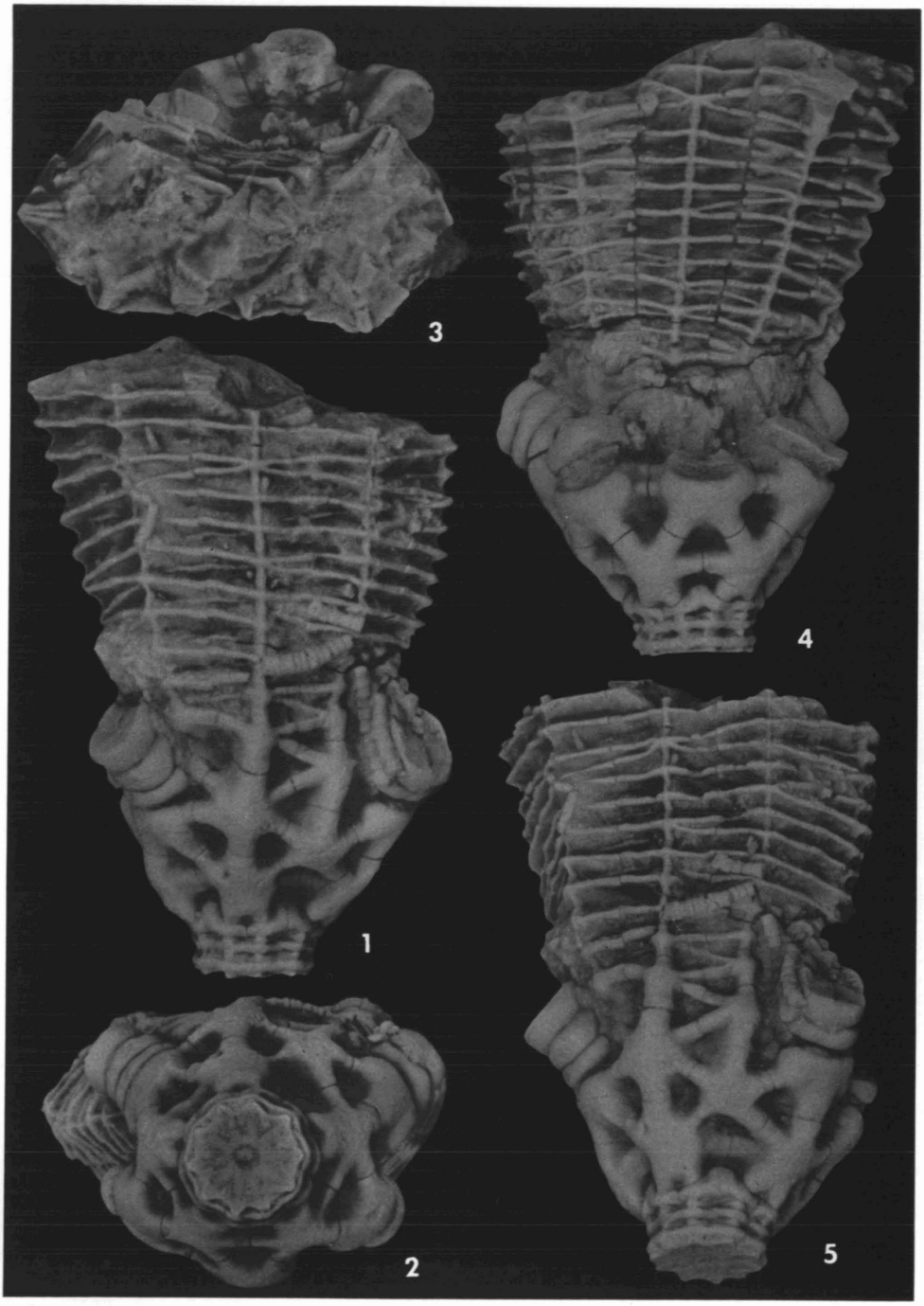

PLATE II

EXPLANATION OF PLATE II

(Both figures × 6; specimen from Locality 1)

PAGE

Proctothylacocrinus esseri, sp. nov. 77

FIGS. 1–2. Views of C ray dorsally inclined and D ray ventrally inclined. Holotype UMMP 51744.

EXPLANATION OF PLATE III

(All figures × 3; all specimens from Locality 2)

PAGE

Proctothylacocrinus longus Kier 78

FIGS. 1–2. Views centered on CD (posterior) interray and C ray. Hypotype UMMP 51659.

FIG. 3. View centered on CD (posterior) interray. Hypotype UMMP 51656. Very large specimen.

FIGS. 4–5. Views centered on CD (posterior) interray and DE interray. Hypotype UMMP 51657.

FIGS. 6–7. Views centered on A (anterior) ray and CD (posterior) interray. Hypotype UMMP 51655.

PLATE III

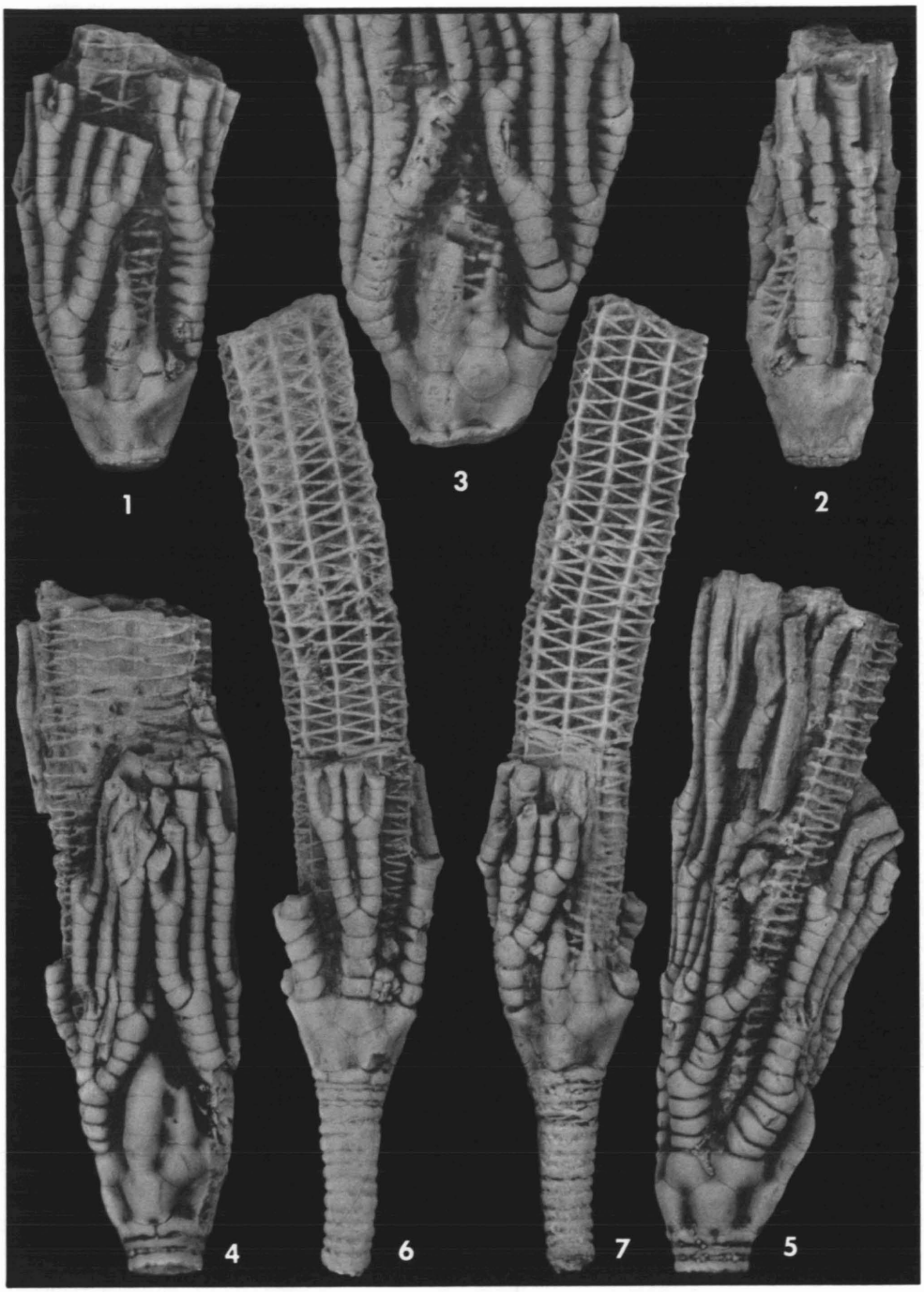

PLATE IV

EXPLANATION OF PLATE IV

(All figures × 3; all specimens from Locality 2)

PAGE

Proctothylacocrinus longus Kier 78

FIGS. 1–2. Views centered on CD (posterior) interray and C ray. Hypotype UMMP 51661. Dorsal cup relatively narrow.

FIGS. 3–4. Views centered on BC interray and CD (posterior) interray. Hypotype UMMP 51725. Dorsal border of X_1 (anal x) sloping toward ***RA*** instead of horizontal.

FIGS. 5–6. Views centered on CD (posterior) interray and AE interray. Paratype UMMP 27694. X_1 (anal x) unusually short.

EXPLANATION OF PLATE V

(All figures × 3; all specimens from Locality 2)

PAGE

Proctothylacocrinus longus Kier 78

FIGS. 1–2. Views centered on CD (posterior) interray and AE interray. Hypotype UMMP 51724.

FIGS. 3–4. Views centered on CD (posterior) interray and AB interray. Hypotype UMMP 51660.

FIGS. 5–6. Views centered on CD (posterior) interray and E ray Hypotype UMMP 51727.

FIGS. 7–8. Views centered on A (anterior) ray and CD (posterior) interray. Hypotype UMMP 51726.

FIGS. 9–10. Views centered on CD (posterior) interray and AE interray. Hypotype UMMP 51658.

FIGS. 11–12. Views centered on CD (posterior) interray and A (anterior) ray. Hypotype UMMP 51662.

E 0765 009 12C

PLATE V