



ratio 0.38; WIBB 7.7; WIB 3.7; HB 9.2; WB 10.5; HR 8.9; WR 16.0; WS 4.6.

*Remarks.*—The cup of *Metaperimestocrinus squarrosus* lacks part of the posterior interradius and the adjoining part of the C radial. However, enough ossicles are present to show that the radial is in contact clockwise with the C radial, posterior basal, D radial, and anal-X. the radial probably supports the right tube plate as well. The space left by the broken-out fragment suggests such a relationship. Primibrachs were not found articulated with the cup, but they are confidently assigned to this specimen on the basis of the ornamentation.

*Metaperimestocrinus squarrosus* differs from *M. verrucosus* in its coarser ornamentation on the elevated areas on the radials and basals and non-spinose IB<sub>r1</sub>.

The specific name, *squarrosus*, is Latin meaning rough with processes, in reference to the coarse tuberculate ornamentation.

*Material.*—One nearly complete cup and several loose ossicles from the Middle Morrow part of the Bird Spring Formation, Arrow Canyon, Nevada.

*Types.*—Holotype, 43124; paratypes, 43125.

Genus STENOPECRINUS Strimple, 1961

Type species.—*Perimestocrinus planus* Strimple, 1952, original designation

STENOPECRINUS PEDERSENORUM Webster & Lane,  
n. sp.

Pl. 56, figs. 10,11

*Description.*—Cup very low truncate-bowl-shaped with a deep narrow stem invagination on flat base. Five? IBB, restricted to base of invagination, covered by matrix. Five BB, strongly convex longitudinally, proximal parts downflaring forming walls of basal impression, distal tip upflaring, visible in side view. Five pentagonal RR, strongly convex longitudinally, slightly convex laterally, proximal tips touch basal plane, shallow narrow notch at distal end of interradial sutures. Facet does not occupy full width of radial, slopes outward at 20-25°; outer ligament area narrow, ligament moderately shallow? pit less than one-third width of radial; transverse ridge denticulate. Posterior interradius wide, concave laterally. Three anals: RA pentagonal, adjoins in a clockwise direction C radial, BC basal, CD basal, anal-X and rt; anal-X hexagonal less than one-third in cup; and rt, hexagonal, only proximal tip below summit. Associated first primibrach large, axillary, spinose in distal portion. Dorsal surfaces of cup plates not ornamented. Stem, arms, and anal sac unknown.

*Measurements* (mm).—H 7.5; W 24.4; H/W ratio 0.31; WIBB 4.8 (approximate); HB 7.8 (approximate); WB 6.0; HR 7.6; WR 13.6.

*Remarks.*—Preservation of the only specimen

#### EXPLANATION OF PLATE 56

All figures are  $\times 1$  unless indicated otherwise

- FIGS. 1-6—*Pentremites aridus* Webster & Lane, n.sp. 1,2,6, paratype 34187, lateral, basal, and oral views respectively of a fragmentary specimen that was ground unsuccessfully to determine the number of hydrospires folds,  $\times 2$ . 3, paratype 34189, exterior view of radial,  $\times 2$ . 4, holotype 34186, lateral view, specimen crushed. 5, paratype 34188, lateral view, specimen crushed.
- 7,8—*Pentremites crystalensis* Macurda. Hypotype 34190, oral and lateral views respectively.
- 9—*Platycrinites?* sp. Hypotype 47207, four columnals.
- 10,11—*Stenopecrinus pedersenorum* Webster & Lane, n.sp. Holotype 43121, basal and CD-interray views of dorsal cup.
- 12—Family Ampelocrinidae, Species B. Hypotype 47205, lateral view of crushed partial crown.
- 13,17—*Delocrinus* sp. Hypotype NAM G2.8691, lateral and basal views respectively,  $\times 2$ .
- 14,15—*Poteroicrinites cavus* Webster & Lane, n.sp. Holotype 47206, anterior and posterior views respectively.
- 16—Family Sagenocrinitidae, Species A. Hypotype NAM G2.8688, D-ray view of partial crown.
- 18—*Schedexocrinus* sp. Hypotype 47202, CD-interray view of crushed partial crown.
- 19,20—*Synarmocrinus carrizoensis* Webster & Lane, n.sp. Holotype NAM G2.8690, BC-interray and E-ray views of crushed partial crown.

of *Stenopocrinus pedersenorum* is poor and numerous details of the facet are not observable. The associated C-ray primibrach was less than a centimeter out of articulated position and was removed from the matrix along with the cup.

*Stenopocrinus pedersenorum* is more closely related to reported species from the Missouri Series of the Midcontinent than one from the Morrow Series of the same region. *Stenopocrinus pedersenorum* is easily distinguished from *S. moseleyi* Strimple and *S. hexagonus* Strimple on the basis of ornamentation as the latter two species have granular ornamentation. *Stenopocrinus pedersenorum* has shorter primibrachs than *S. planus* Strimple and *S. politus* (Moore).

The species is named in honor of Mr. and Mrs. Chris Pedersen of Moapa, Nevada.

*Material*.—One cup with an associated primibrach from the basal Atoka part of the Bird Spring Formation, Arrow Canyon, Nevada.

*Types*.—Holotype, 43121.

Genus SCHEDEXOCRINUS Strimple, 1961

Type species.—*Schedexocrinus gibberellus*  
Strimple, 1961, original designation

SCHEDEXOCRINUS sp.

Pl. 56, fig. 18

*Remarks*.—A moderately large crushed partial crown is referred to *Schedexocrinus* because there are three anals in the discoid? cup, cup plates are thick and tumid, radial facets slope outward, the axillary IBrr<sub>1</sub> protrude outwardly on the distal tips, proximal secundibrachs are low wide plates, visible higher axillary brachials (IIBrr<sub>1</sub>) have slender elongate spines projecting outwardly from distal tips, and the arms are uniserial. The specimen clearly is related to *Schedexocrinus gibberellus* Strimple from the Desmoines Series of Oklahoma, but differs in that cup plates are more tumid, the spines on the IIBrr<sub>4</sub> are longer and more slender, and the radial notches are barely perceptible. Because the infrabasal cirlet and basals are not exposed and the specimen is badly deformed by crushing, a specific name is not proposed.

*Material*.—One crushed partial crown, hypotype 47202 from UCLA locality 5154, Carrizo Creek, Naco Formation, Desmoines, Arizona.

Genus SCIADIOCRINUS Moore & Plummer, 1938

Type species.—*Hydreionocrinus acanthophorus*  
Meek & Worthen, 1870 original designation

SCIADIOCRINUS BREWI Webster & Lane, n. sp.

Pl. 57, figs. 6-9

*Description*.—Dorsal cup small, low bowl-shaped to subdiscoid, hexagonal in outline

viewed from above or below, moderately deep basal invagination, sides flaring outward. Infrabasals five, dart shaped, slightly higher than wide; cirlet pentagonal, proximal half subhorizontal, bearing round, radially crenulate stem impression; distal half slightly downflaring; not visible in side view. Basals five, hexagonal, higher than wide, strongly recurved longitudinally, concave transversely; proximal portions slightly downflaring, forming walls of basal invagination; distal tips upflaring, barely visible in side view; CD basal heptagonal, in contact with C and D radials, BC and DE basals, C and D IBB, anal-X, and radianal interbasal sutures short. Radials five, pentagonal, twice as wide as high, strongly convex longitudinally, gently convex transversely; proximal tips horizontal, forming base of cup; distal portions widely outflaring; distinct radial notches. Radial facet three-fourths width of radial, sloping strongly outward at 33°; outer ligament area shallow, vertical, not quite as wide as facet; outer marginal ridge narrow, faintly denticulate on some radials, extending width of facet to merge with transverse ridge on distal tips; outer ligament furrow distinct, slightly wider than ligament pit, merging with ligament pit furrow on distal tips; outer ligament ridge narrow, weakly denticulate, slightly wider than ligament pit, does not merge with transverse ridge; ligament pit central, moderately deep, 2.1 mm wide, horizontal, slightly less than one-third width of facet; ligament pit furrow shallow; transverse ridge denticulate distally, with deepest denticles proximally, nondenticulate above ligament pit; inner ligament area deep, divided into two halves by broad shallow intermuscular furrow and central pit; lateral furrow short, distinct, extending to distal tips of facet, grades into shallow undulatory muscle area ventrally, oblique ridge faint, nondenticulate; lateral ridge broad arcuate; adsutural slope steep against lateral ridge grading into shallow furrow between lateral ridge and interradianal suture; intermuscular notch approximately one-third as deep as facet, separated from intermuscular furrow by narrow ridge. Anal notch moderately wide, shallow, three anals below radial summit; radianal small, rectangular, in contact with C radial, CD basal, anal-X, and right tube plate; anal-X moderately large, approximately one-third below radial summit, adjoined by CD basal, D radial, D primibrach, two tube plates, right tube plate, and radianal; right tube plate missing but sutures show proximal portion would have been below radial summit. Arms unknown. Column round, consisting of three distinct columnal types: large and small nodals, and smaller internodals; large nodals prominent, radially crenulate, edges

strongly rounded, not all bearing cirri, adjoined by internodals; small nodals gently rounded distally, few bearing cirri; internodals radially crenulate, weakly rounded to flat on edges, adjoined by large nodal on one side and smaller nodal on opposite side.

*Measurements* (mm).—H, 3.0; W, 15.0; H/W ratio, 0.20; WIBB, 4.6; W stem impression, 2.5; depth basal invagination, 2.3; HIB, 2.6; WIB, 2.4; HB, 3.7; WB, 3.0; HR, 4.1; WR, 8.2. Nodal 3 mm from proximal columnal: H, 1.7; W, 3.9; adjacent distad internodal: H, 0.5; W, 3.2; adjacent distad smaller nodal: H, 1.0; W, 3.4.

*Remarks*.—*Sciadiocrinus brewi* n.sp. differs from previously described species in that the plates are less tumid, the radianal is not in contact with the BC basal and anal-X is more nearly or proportionately less below the radial summit.

The species is named for Douglas Brew, who discovered the Carrizo Creek locality and collected many of the specimens, including *Sciadiocrinus brewi*.

*Material*.—One dorsal cup and proximal part of column is the holotype NAM G2.8689 from Carrizo Creek, Naco Formation (Desmoinesian), Arizona.

Family SCYTAOCRINIDAE Moore & Laudon,  
1943

Genus SCYTAOCRINUS Wschsmuth & Springer,  
1880

Type species.—*Schaphiocrinus robustus* Hall,  
1861 (1872), original designation

SCYTAOCRINUS RECONDITUS  
Webster & Lane, n. sp.

Pl. 55, figs. 5, 14

*Description*.—Crown elongate cylindrical; cup medium conical; arms dichotomous, long. Cup wider than high, slightly turbinate; five IBB, proximal parts horizontal with stem impression, distal three-fourths upflaring, visible in side view; five hexagonal BB (CD basal heptagonal), slightly higher than wide, gently convex transversely, moderately convex longitudinally; five pentagonal RR (C radial hexagonal), wider than high, gently convex transversely and longitudinally, distal part nearly vertical; facet full width of radial, details not observed. Three anals; RA quadrangular, in contact with C radial, BC basal, CD basal, and anal-X; anal-X large, pentagonal, in contact with C radial, RA, CD basal, D radial, D IBr, and rt, only distal tip extends above summit; rt, pentagonal, proximal tip below summit. Ten arms, long, wide, slightly convex transversely. Five IBr, wider than high,

strongly convex transversely, nearly straight longitudinally, axillary. More than 20 IBr in each arm, proximal ones quadrangular uniserial, distal ones wedge-shaped to cuneate uniserial with interspersed biserial brachials. Stem round; anal sac unknown. Ornamentation obliterated by silicification, if originally present.

*Measurements* (mm).—HC 44.8 (incomplete); H 10.3; W (maximum) 14.7; W (minimum) 13.2; W (average) 13.9; H/W ratio 0.74; WS 4.0; WIBB 7.7; WIB 3.6; HB 7.0; WB 6.3; HR 6.0; WR 8.0; HIBr 6.2; WIBr 7.7; HIIBr<sub>1</sub> 3.6; WIIBr<sub>1</sub> 4.1; HIIBr<sub>2</sub> 2.2; WIIBr<sub>2</sub> 4.0; HIIBr<sub>3</sub> 1.8; WIIBr<sub>3</sub> 4.0; HIIBr<sub>4</sub> 1.1; WIIBr<sub>4</sub> 4.0; HIIBr<sub>5</sub> 1.1; WIIBr<sub>5</sub> 4.0.

*Remarks*.—The holotype and only specimen of *Scytalocrinus reconditus* is silicified and due to weathering only partially preserved. Great care was taken in determining sutures which are nearly obliterated by silicification. *Scytalocrinus reconditus* shows an advanced evolutionary trend in the posterior interradius with the right tube plate nearly removed from the dorsal cup and not in contact with the radianals. The only species of *Scytalocrinus* reported from the Morrow Series, *S. sansabensis* Moore & Plummer, is smaller, has more rounded arms, and a more primitive arrangement of the anals.

The specific name, *reconditus*, is Latin meaning hidden, concealed, and alludes to the nearly "hidden" sutures on the specimen.

*Material*.—One crown from the Chester part of the Bird Spring Formation at the Kane Springs Wash West section.

*Types*.—Holotype, 34191.

Family AMPELOCRINIDAE Kirk, 1942.

Genus AESIOCRINUS Miller & Gurley, 1890

Type species.—*Aesiocrinus magnificus* Miller & Gurley, 1890, original designation

AESIOCRINUS? INFLATUS Webster & Lane n. sp.

Pl. 57, fig. 26

*Description*.—Cup small, low flat-bottomed bowl-shaped, with steep-walled stem impression. Five IBB, strongly convex longitudinally and transversely, giving a bulbous appearance to IBB, downflaring proximal part covered by stem impression, distal part flat to slightly upflaring, exterior bulbous, barely visible in side view; five hexagonal BB (CD basal heptagonal, distal end flattened for reception of anal-X), slightly wider than high, strongly convex longitudinally and transversely making them appear bulbous, proximal part subhorizontal, distal tips approaching vertical; five pentagonal RR, moderately convex longitudinally, twice as wide as high; facet extends full width of R, features

unknown; anal-X large, partly below summit, supported by CD basal. Cup plates lack ornamentation except for bulbous nature of IBB and BB producing an impressed suture appearance for the cup. Two IBr in C ray, only ray exposed, and IBr<sub>2</sub> probably axillary. Distal brachials quadrangular, strongly convex ventrally, bipinnulate. Stem impression subpentagonal; column and anal sac unknown.

*Measurements* (mm).—H 3.7; W 12.7 (approximate); H/W ratio 0.29; WS 1.1; WIBB 4.5; WIB 1.8; HB 4.2; WB 4.6; HR 2.9; WR 5.8; HIBr<sub>1</sub> 1.5; HIIBr<sub>1</sub> 1.8.

*Remarks*.—Because the direction of slope of the radial facet is unknown at present in *Aesiocrinus? inflatus*, the generic assignment is questioned. The holotype and paratype with associated distal arm fragments of *A? inflatus* were found on one small slab of ferruginous limestone. The description is based on the holotype except for features of the distal part of the arms. *Aesiocrinus? inflatus* is easily distinguished from other reported species of *Aesiocrinus* by the bulbous nature of the infrabasals and basals.

The specific name, *inflatus*, is Latin meaning puffed up, swollen, and refers to the inflated nature of the IBB and BB.

*Material*.—Two partial crowns on one slab from the upper shales of the Indian Springs Formation at the Dry Lake Section.

*Types*.—Holotype, 34184; paratype, 34185.

GENUS AND SPECIES UNKNOWN  
SPECIES B

Pl. 56, fig. 12

*Description*.—Dorsal cup small, bowl-shaped, with deep basal concavity including infrabasals and proximal one-third of basals; basals gently convex; radials twice as wide as high, facet equal in width to plate; number of anal plates unknown but probably only one anal in cup; primibrach 1 wide, low, in close suture with tapering, axillary primibrach 2; at least two additional branches occur higher on the arms; secundibrach 3 or 4 axillary; arms uniserial, brachials low, strongly rounded.

*Remarks*.—The crushed and incomplete specimen on which this description is based has the two primibrachs, with primaxil a triangular, tapering plate, typical of the Ampelocrinidae. The specimen cannot be assigned to *Aesiocrinus* or *Cymbiocrinus*, both of which have only 10 arms, nor to *Ampelocrinus*, which has a convex base and infrabasals visible in side view. The arms of *Moundocrinus* are not known and the genus may be synonymous with *Aesiocrinus*. *Allosocri-*

*nus* has only five arms. Because the specimen is imperfect no attempt is made here to assign it to a genus.

*Material*.—One crushed partial crown is hypotype 47205, from UCLA locality 5245, 100 ft. stratigraphically above loc. 5245-108 (Webster, 1969). South wall of Arrow Canyon at right angle bend as canyon bends west; associated with abundant horn corals.

Family ERISOCRINIDAE S. A. Miller, 1889

Genus ENDELOCINUS Moore & Plummer, 1940

Type species.—*Eupachyrcrinus fayettensis*  
Worthen, 1873, original designation

ENDELOCINUS SOLUS Webster & Lane, n. sp.  
Pl. 57, figs. 22-25

*Description*.—Dorsal cup broad, low, truncate bowl-shaped; deep basal invagination; base flattened; sides vertical to slightly outflaring. Infrabasal cirlet fused, steeply downflared, not visible from side view, distal tips visible around proximal columnals. Five hexagonal basals (except for heptagonal CD basal, flattened on distal tip for reception of anal), slightly tumid, wider than high, strongly recurved, proximal ends only slightly below level of distal tips, proximal ends form major part of basal invagination, distal tips curve sharply inward to form major part of obvious dimple at point of mutual articulation with two superjacent radials. Five pentagonal radials, moderately tumid, nearly twice as wide as high, proximal tips moderately inflated forming dimple at point of mutual articulation with two subjacent basals.

Radial facet wide, deep, gently slopes outward; outer ligament area narrow, as wide as radial, no marginal furrow or ridge; outer ligament ridge denticulate, coalesces with transverse ridge on distal tips; ligament pit furrow faint, present only at ends of ligament pit; ligament pit, central deep, less than one-third width of radial, slopes ventrally under transverse ridge; transverse ridge denticulate, as wide as radial; inner ligament area divided into two mirror-image halves by broad shallow intermuscular furrow; no central pit, intermuscular furrow grades ventrally into broad intermuscular notch; oblique furrow shallow, grades into intermuscular furrow; oblique ridge faint, grades into muscle area; muscle area irregular to hummocky on lateral ends, becoming slightly undulating on inner ends before grading into intermuscular furrow. Three primibrachs present, all axillary, significant difference in heights, E-ray IBr highest, C-ray IBr lowest. Column round; axial canal and lumen pentalobate.

*Measurements* (mm).—H 7.0; W 17.8; H/W ratio 0.39; depth of basal invagination 2.5 (approximate); WIBB 4.3; HB 6.2; WB 7.3; HR 5.7; WR 10.0; H anal-X 3.4; W anal-X 3.0; HIAx (B ray) 4.9; WIAx (B ray) 9.9; HIAx (C ray) 4.4; WIAx (C ray) 9.3; HIAx (E ray) 5.4; WIAx (E ray) 9.8; W proximal columnals 1.9.

*Remarks.*—*Endelocrinus solus* is most closely related to *E. bransoni* Strimple, reported from the Desmoines Series in Oklahoma, but differs from the latter in having a deeper basal invagination with the proximal ends of the basals forming a larger part of the invagination, a fused infrabasal cirlet, and less tumid radials.

With the exception of *Endelocrinus matheri* (Moore & Plummer, 1938) Strimple, 1960, an allocation here questioned, all reported species of the genus are from rocks of Desmoines through Wolfcamp age from the Midcontinent region. Moore and Plummer, 1938 (p. 289-291; Pl. 13, fig. 3; Pl. 14, figs. 7a-d; Pl. 16, figs. 1a-c; Text-fig. 32), described *Delocrinus matheri* from the Brentwood Limestone near Fort Gibson, Oklahoma, making no mention of the species having impressed sutures or dimplelike depressions at the angles of the cup plates (a diagnostic feature of *Endelocrinus*) nor is there any suggestion of this feature on any of the illustrations. Also, when Moore & Plummer erected *Endelocrinus*, they (1940, p. 254) listed *D. matheri* as a species of *Delocrinus*. Their original generic assignment is here accepted. Another specimen from the Brentwood Limestone identified as *Endelocrinus matheri* (Moore & Plummer) by Strimple (1960, p. 153) may be an endelocrinid. If so, it is probably a new species and further corroborates a Morrow age as the recognized lower range of *Endelocrinus*.

The specific name is derived from the Latin *solus* meaning alone.

*Material.*—One partial crown from the Middle Morrow part of the Bird Spring Formation, Arrow Canyon, Nevada.

*Types.*—Holotype, 43120.

ENDELOCRINUS sp.  
Pl. 57, figs. 16,21

*Description.*—Crown incomplete, intermediate size; dorsal cup low bowl-shaped, deep basal concavity, all plates smooth, suture impressed. Infrabasal cirlet downflaring confined to basal concavity. Basals five, wider than high, strongly recurved longitudinally, gently convex transversely; proximal parts outflaring slightly, forming walls of basal concavity; distal portions slightly outflaring, distal tips depressed; CD

basal flattened distally for reception of anal X. Radials five, nearly twice as wide as high, gently convex longitudinally and transversely; proximal tips depressed, distal portions vertical; radial facet extending full width of radial. Anal-X lost, would have projected below radial summit in contact with C radial, CD basal, and D radial. Probably ten biserial arms, only parts of A and E rays preserved; primibrach 1 axillary, slightly over twice as wide as high, distal tips sharply protruded outward; secondibrachs wider than high, moderately convex transversely, slightly convex longitudinally, increasingly cuneate distally; biserial above IIBrr<sub>3</sub>. Stem and anal sac unknown.

*Measurements* (mm).—H 9.6; W 22.8; H/W ratio 0.42; WIBB 5.2; HB 7.7; WB 9.1; HR 7.3; WR 13.5; HIBrr<sub>1</sub> 5.7; WIBrr<sub>1</sub> 12.7; HIIIBrr<sub>1</sub> 4.0; WIIIBrr<sub>1</sub> 7.6; HIIIBrr<sub>2</sub> 2.7; WIBrr<sub>2</sub> 6.0.

*Remarks.*—The size, impressed sutures, prominent basal concavity, and tendency of the brachials to become biserial distally illustrate the relationship of this specimen to *Endelocrinus*. Burke (1967) discussed the variation in arm structure of *Endelocrinus* noting that only distal parts of the arms are biserial in some species, whereas others are essentially biserial throughout. *Endelocrinus* sp. is most similar to *E. undulatus* (Strimple) however the arms become biserial with the IIBrr<sub>4</sub> in *E. sp.* and IIBrr<sub>2</sub> in *E. undulatus*. Because the specimen of *E. sp.* is slightly crushed, not complete, and better specimens may be found with additional collecting, a species is not designated.

*Material.*—One partial crown, hypotype NAM G2.8692, from UCLA Loc. 5154, Naco Formation (Desmoines), eastern Arizona.

Genus DELOCRINUS Miller & Gurley, 1890

Type species.—*Poteriocrinus hemisphericus*  
Shumard, 1850, original designation  
(Miller & Gurley, 1890)

DELOCRINUS sp.

Pl. 56, figs. 13,17

*Description.*—Dorsal cup small, low flat-bottomed bowl-shaped; moderately deep basal invagination; sides evenly rounded, vertical in distal portions. Infrabasal cirlet covered by round proximal columnal. Basals five, slightly wider than high, strongly recurved longitudinally, gently convex transversely; proximal ends form walls of basal invagination, distal tips subvertical; posterior basal flattened on distal tip for reception of anal-X. Radials five, pentagonal, wider than high, proximal tips gently incurved, distal tips vertical. Outline circular in

oral or aboral view; interradius not depressed; all plates smooth.

*Measurements* (mm).—H 7.1; W 15.9; H/W ratio 0.45; W of visible columnal 2.6; HB (est) 6.4; WB 7.2; HR 6.2; WR 10.0.

*Remarks*.—Because only one specimen of *Delocrinus* sp. was found and the specimen is not suitable to serve as a holotype, a species is not designated. *Delocrinus* sp. is most similar to *D. vulgatus* Moore & Plummer, 1940, reported from the Virgil Series of Texas and Oklahoma, but has a higher H/W ratio (0.45 vs 0.35–0.37) than *D. vulgatus*.

*Material*.—One dorsal cup, hypotype NAM G2.8691 from Loc. 5154, Naco Formation (Des Moines), eastern Arizona.

#### Genus ERISOCRINUS Meek & Worthen, 1865

Type species.—*Erisocrinus typus* Meek & Worthen, 1865, original designation

*Erisocrinus typus* Meek & Worthen, 1873  
Pl. 57, figs. 19,20

See MOORE & PLUMMER, 1940 for synonymy.

*Erisocrinus typus* Meek & Worthen, MOORE & LAUDON, 1943, p. 135, Pl. 6, fig. 3; STRIMPLE, 1959, p. 120, Pl. 1, figs. 14–17, Pl. 2, figs. 2–5; STRIMPLE, 1960, p. 155, fig. 2D.

*Erisocrinus mediator* STRIMPLE, 1962, p. 14, Pl. 8, figs. 4–7.

*Description*.—See Moore & Plummer, 1940, p. 153.

*Measurements* (mm).—H 9.1; W 24.0; H/W ratio 0.38; WIBB 6.4; WIB 3.0; HIB 3.8; HB 7.7; WB 9.0; HR 7.5; WR 14.4.

*Remarks*.—Measurements, height/width ratio, and shape clearly indicate the close relationship between the Paradox Basin specimen and Moore & Plummer's (1940) emended description of *Erisocrinus typus*. Strimple (1962) described several specimens from the Oologah Formation (Des Moines) of Oklahoma, naming *E. mediator*. Noting that *E. mediator* is most comparable to *E. typus*, he distinguished the former from the latter by the lower height/width ratio (0.37 vs 0.40–0.42) and observed (p. 15) that *E. typus* "has a mild outward flare to the dorsal cup." There is some variation in the faint outward flare of the cup as shown by Moore & Plummer's illustrations (figs. 25a–c, p. 153). Strimple's illustration of *E. mediator* (Pl. 8, figs. 4–5) show the same profile as figure 25b of Moore & Plummer. Because these differences in the H/W ratios and shape are not considered to be of sufficient magnitude to permit recognition of *E. mediator* as a distinct species, it is considered a junior synonym of *E. typus*.

*Erisocrinus typus* is now recognized from

Des Moines strata of Illinois (Meek & Worthen, 1865), Nebraska (Meek & Worthen, 1865, as *E. nebrascensis*), Oklahoma (Strimple, 1938, 1959, 1962, the latter as *E. mediator*), Texas (Moore & Plummer, 1940) and Utah, herein. Furthermore, Moore & Plummer recognized *E. typus* from the Missouri Series of Texas.

*Material*.—One dorsal cup, hypotype 47204 from 4857-1, Paradox Formation, Des Moinesian, Ruplee Anticline, Utah.

#### Genus PARADELOCINUS Moore & Plummer, 1938

Type species.—*Paradelocrinus aequabilis* Moore & Plummer, 1937, original designation

*Paradelocrinus nederi* Webster & Lane, n. sp.  
Pl. 57, figs. 1–3

*Description*.—Dorsal cup large, low bowl-shaped; rounded pentagonal in outline viewed from above or below; deep basal invagination, plates ornamented with fine papillae; base flat; sides become vertical in distal portions and incurved on distal tips. Infrabasal circlet small subhorizontal, restricted to top of basal concavity, not visible in side view, distal portions downflaring. Basals five, longer than wide, moderately recurved longitudinally, gently convex transversely; proximal portions downflaring forming walls of basal concavity; distal tips upflaring, visible in side view. Radials five, twice as wide as high, moderately convex longitudinally, gently convex transversely; proximal tips incurved at base of cup; distal edges slightly incurved; radial facet occupies full width of radial. Anal notch small but clearly evident in side view of cup. Arms, column, and tegmen unknown.

*Measurements*.—See Table 3.

*Remarks*.—*Paradelocrinus nederi* n. sp. has a deeper basal concavity and relatively smaller infrabasal circlet than other described species assigned to the genus.

The species is named in honor of Irving Neder who found the holotype.

*Material*.—Two dorsal cups, holotype 47200

TABLE 3—MEASUREMENTS IN MM OF TYPE SPECIMENS OF *PARADELOCINUS NEDERI*, N. SP.

	Holotype (Slightly crushed)	Paratype (Moderately crushed)
H	8.1	—
W	27.8	—
H/W	0.29	—
WIBB	5.4	—
HB	11.5	—
WB	9.7	9.1
HR	8.3	8.9
WR	16.6	19.0

and paratype 47201 from Loc. 5154, Naco Formation, Desmoinesian, eastern Arizona.

Family ETHELOCRINIDAE Strimple, 1961

Genus PARETHELOCRINUS Strimple, 1961

Type species *Parethelocrinus ellipticus* Strimple, 1961; original designation

PARETHELOCRINUS sp.

Pl. 57, fig. 17

*Description*.—Dorsal cup broken and largely missing; infrabasals with a narrow deep basal concavity; cup plates smooth; at least one anal plate is preserved in the cup; arms branch on primibrach 1 in all rays; on the posterior side of the C and D rays secundibrach 1 is axillary, resulting in 12 arms in the crown; arms biserial above secundibrach 2.

*Measurements* (mm).—HC (almost complete) 36.9; H (approx.) 6.1; HIB (approx.) 2.8; WIB 2.5; HB (incomplete) 4.5; WB 6.0; HR 4.5; WR 6.8; HIBrr, 4.0; WIBrr, 6.7; HIIBrr<sub>1</sub> 2.6; WIIBrr<sub>1</sub> 3.9; HIIBrr<sub>2</sub> 2.9; WIIBrr<sub>2</sub> 1.6.

*Remarks*.—Presence of more than 10 biserial arms allies this species with the Ethelocrinidae. The preserved parts of radials and one basal indicate that prominent nodose ornament characteristic of *Ethelocrinus* is absent, consequently the specimen is assigned to *Parethelocrinus*, which has faint nodose or granulose ornament.

*Material*.—One incomplete compressed crown, hypotype 47203, from the Naco Formation, Middle Pennsylvanian, Kohl's Ranch, Arizona, center sec. 21, T. 11 N., R. 12 E., Promontory Butte Quadrangle.

Genus SYNARMOCRINUS Lane, 1964

Type species.—*Synarmocrinus brachiatus* Lane, 1964, original designation

SYNARMOCRINUS CARRIZOENSIS

Webster & Lane, n. sp.

Pl. 56, figs. 19, 20

*Description*.—Crown large, slender; dorsal cup crushed, probably globose, sutures impressed, cup plates and primibrachs covered with irregular coarse nodes and ridgelets. Infrabasal cirlet large, upflaring, visible in side view; infrabasals five, dart-shaped, higher than wide, gently convex longitudinally and transversely; proximal half outflaring; distal half vertical with tips inflaring slightly. Radials five, pentagonal, widest between bases of interradial sutures; proximal tips; distal portions weakly inflaring; radial facet occupies full width of distal edge. Two anals below radial summit: radianal large, in contact with C radial, BC basal, CD basal, D

radial, and anal-X; anal-X hexagonal, projecting above radial summit, in contact with C radial, radianal, D radial, D primibrach, tube plate, and C primibrach. Arms ten, uniserial, long, slender, convex externally, interlocking laterally up to arm girdle; primibrach axillary in all rays, over twice as wide as high, distal tip sharply extended between first secundibrachs for approximately one-third height of secundibrach; IIBrr<sub>1</sub> not quite twice as wide as high, strongly convex transversely; all higher secundibrachs approximately four times as wide as high, slightly cuneate. Pinnules not observed but one attachment scar only on widest end of each brach.

*Measurements* (mm).—HC (incomplete) 90.0; H (crushed) 21.7; WIBB 15.6; W stem impression 7.8; HIB (estimated) 8.2; WIB 7.5; HB 13.6; WB 16.7; HR 12.5; WR 19.4; HIBrr, 7.7; WIBrr, 19.0; HIIBrr, 4.6; WIIBrr, 8.3; HIIBrr<sub>2</sub> 1.7; WIIBrr<sub>2</sub> 7.5.

*Remarks*.—*Synarmocrinus carrizoensis* n. sp. is the first species of this genus reported from the Desmoinesian. Two species, *S. brachiatus* Lane and *S. fundundus* Strimple are known from the Atokan; one species, *S. depressus* Washburn is known from the Morrowan. *Synarmocrinus carrizoensis* is easily distinguished by the upflaring infrabasals and the less regular arrangement of the ornamentation. *Synarmocrinus carrizoensis* is similar to *S. brachiatus* in the arrangement of anal-X, in that anal-X is not in contact with the CD basal but rather rests on the radianal.

The lateral interlocking of proximal brachials in *S. carrizoensis* as well as numerous other late Paleozoic inadunates undoubtedly added considerable rigidity to the organism when the arms were in the closed position. Strimple (1966, p. 8) stated that Lane (1964) in the original definition of the genus considered that the lateral interlocking of the proximal brachs represented a "fused or fixed condition. . ." Actually Lane (1964, p. 678) stated "proximal brachials fixed into dorsal cup by lateral interlocking with adjacent brachials" which clearly did not imply fused. We would interpret the lateral interlocking as stated above to add rigidity to the specimen in the closed position and possibly as Strimple suggested (1961) to act as a protective mechanism. Undoubtedly the interlocking restricted to some degree the mobility of the proximal parts of the arms. A possible advantage to the proximal interlocking may have allowed the organism to feed with only the distal parts of the arms during periods of stronger current action thereby reducing the drag on the specimen which would have been much greater with complete opening of the arms. During periods of



calmer currents the arms may have been more completely flexed allowing larger surface area for food gathering.

The specific name *carrizoensis* is in reference to Carrizo Creek along which the specimen was found.

*Material*.—One crushed slightly incomplete crown, the holotype NAM G2.8690 is from 5154 Naco Formation, Desmoinesian, Eastern Arizona.

Family AGASSIZOCRINIDAE S. A. Miller, 1889

Genus PARAGASSIZOCRINUS  
Moore & Plummer, 1940

Type species.—*Agassizocrinus tarri* Strimple, 1938, original designation

PARAGASSIZOCRINUS CALYCULOIDES (Lane)

Pl. 55, figs. 1-4, 6-13, 15-17, 24, 25, 27-29

*Polusocrinus calyculoides* LANE, 1964, p. 682, Pl. 112, figs. 1-3.

*Polusocrinus pachyplax* LANE, 1964, p. 682-683, Pl. 112, figs. 4-10; Text-fig. 1

*Globocrinus bulbosus* WASHBURN, 1968, p. 122, Pl. 2, figs. 1-6.

*Emended Description*.—Dorsal cup low, bowl-shaped to slightly bulbous, 1.5 to 2 times as wide as high; base flattened with slight basal

depression in immature specimens, moderately convex on mature individuals; sides evenly convex, becoming straight on posterior and lateral sides, remaining convex on anterior; sutures appear impressed due to convexity of plates.

Infrabasal cirplet five quadrangular diamond-shaped plates in immature specimens, proximal ends sharply incurved around small pentalobate stem impression; one fused plate in mature individuals; in stages of early fusing cirplet angularly pentalobate with continued growth angularity subdued and gerontic individuals show subangular scalloped sutures with proximal ends of basals; articular faces distinctly slope outward; IBB gently to moderately convex longitudinally and transversely with distal extremities visible in side view throughout growth; BC- and DE-interray sutures between IBB and BB slightly wider than A-B, CD-, and EA-interray sutures. Articular faces smooth.

Five hexagonal basals (CD basal is heptagonal, being flattened on proximal end for articulation with anal), gently to moderately convex transversely and longitudinally; EA and AB basals subequal height and width with slight lateral extension towards CD interrayer; BC and DE basals wider than high with obvious extension laterally towards CD interrayer; CD basal wider than high. All articular faces smooth.

#### EXPLANATION OF PLATE 57

All figures  $\times 1$  unless indicated otherwise

- FIGS. 1-3—*Paradelocrinus nederi* Webster & Lane, n.sp. Holotype 47200, ventral, dorsal, and lateral views respectively of dorsal cup.  
4,5—*Metaperimestocrinus squarrosus* Webster & Lane, n.sp. Holotype 43124, anterior and basal views of dorsal cup.  
6-9—*Sciadiocrinus brewi* Webster & Lane, n.sp. Holotype NAM G2.8689, 6,8,9, ventral, basal, and CD-interrayer views of dorsal cup, 7, side view of proximal columnals that belong to holotype dorsal cup,  $\times 2$ .  
10-15—*Metaperimestocrinus verrucosus* Webster & Lane, n.sp. 10-12, paratype 43129, CD-interrayer, basal, and A-ray views. 13-15 holotype 43126, basal, A-ray, and CD-interrayer views.  
16,21—*Endelocrinus* sp. Hypotype NAM G2.8692, E-ray and basal views of partial dorsal cup and arms.  
17—*Parethelocrinus* sp. Hypotype 47203, D-ray view of partial crown.  
18—Family, genus, and species unknown, Species D. Hypotype 43135, infrabasal cirplet and attached proximal columnals,  $\times 2$ .  
19,20—*Erisocrinus typus* Meek & Worthen. Hypotype 47204, basal and lateral views of dorsal cup.  
22-25—*Endelocrinus solus* Webster & Lane, n.sp. Holotype 43120, ventral, dorsal, A-ray and CD-interrayer views,  $\times 2$ .  
26—*Aesiocrinus? inflatus* Webster & Lane, n.sp. Holotype 34184, oblique view of partial crown,  $\times 2$ .  
27—Family, genus, and species unknown, Species C. Hypotype NAM G2.8693, lateral view of partial crown.