Transactions of Illinois Academy of Sciences
(1984), Volume 77, 3 and 4, pp. 207-218

# *SPIRIFERELLINA LATA* LANE IN THE UPPERMOST CHESTERIAN IN THE BIRD SPRING GROUP AT ARROW CANYON, CLARK COUNTY, NEVADA.

Daniel W. Petersen and Ralph L. Langeheim, Jr.
Department of Geology
University of Illinois
Urbana, Illinois 61801

## ABSTRACT

*Spiriferellina lata* Lane ranges from the uppermost Indian Springs Formation to at least the top of the Mississippian in the Bird Spring Group at Arrow Canyon, Clark County, Nevada.

## INTRODUCTION

This study was undertaken to document occurence of *Spiriferellina lata* in the uppermost Chesterian at Arrow Canyon, Clark County, Nevada. *S. lata* is a member of the distinctive fauna of the Chesterian-Morrowan transition in the southern part of the Cordilleran miogeosyncline. Determination of its range of morphologic variation and its precise Chesterian occurences at Arrow Canyon is significant because the Arrow Canyon section is an important reference standard for Carboniferous correlations in western North America.

## PRIOR INVESTIGATIONS

The Arrow Canyon sequence has been subjected to several statigraphic investigations, several of which, have included consideration of *S. lata*. Coogan (1962, 1964) reported this brachiopod as *Reticulariina spinosa* in his unit 41 at Arrow Canyon. Langenheim and Langenheim (1965) cite occurence of *Punctospirifer campestris* in their unit 6 in a faunal list of fossils collected in reconnaisance of the Bird Spring Group at Arrow Canyon. It is the same brachiopod that is under investigation in this report. Webster (1969) provided a conodont zonation for the Bird Spring Group at Arrow Canyon and also reports *S. lata* as *Spiriferellina* sp. in his units 22, 24, 25, 26, 27 at our study locality.

The entire Bird Spring Group in Arrow Canyon was measured by Amoco Production Corporation. Their stratigraphic bench marks, placed at intervals of 1.5 meters of thickness, are used as standards of measurement in this report.

## LOCATION

Arrow Canyon is in the E 1/2, section 11, and S 1/2, section 12, T. 14 S., and R. 64 E., and SW 1/4, section 7, T. 14 S., R. 65 E., Clark County, Nevada. The canyon is reached by proceeding 11 miles northwest of Glendale, Nevada, on Nevada Route 168, turning left on a secondary road and continuing for 0.4 miles, at this point turn right on a jeep road at south margin of the wash. The collecting locality is about a mile up the wash just below the upper gorge of Arrow Canyon proper. The specimens were obtained from the east cliff face of an east-west trending strike valley underlying the Indian Springs Group, about 200 yards north of the drainage line in Arrow Canyon (Fig 1).

## PROCEDURES

Field work for this report was done during the first two weeks in January, 1984. After locating previously determined system and series boundaries and the Amoco benchmarks, samples were taken from the units and etched in a 10% solution of commercial grade hydrochloric acid.

## LITHOSTRATIGRAPHY

The 100 feet of strata just below the Mississippian-Pennsylvanian boundary at Arrow Canyon are mostly grey, massive to thick-bedded limestone (Figs. 2,3). Several prominent brachiopod biostromes occur within these units. Fossils are mostly silicified and well preserved. The base of the column rests is at the top of the predominantly shaly part of the Indian Springs Formation and is composed of interbedded shale and buff colored limestone, also belonging to the Indian Springs Formation. The succeeding grey, massive, medium-grained limestone is part of the Bird Spring Bsc unit (Langeheim, R.L., 1962). The Mississippian-Pennsylvanian boundary is at the base of the limestone conglomerate, unit 29, as defined by Webster (Webster and Lane, 1967, Webster, 1969, Webster and Langenheim, 1979). This is succeeded by a shaly unit, unit 30, and a massive, silty, cross-bedded limestone unit, unit 31A.

Lane, Brenckle, and West (1983 a,b) have suggested several possible alternate positions for the Mississippian-Pennsylvanian boundary, ranging from 12.5 meters below the conglomerate to 12.35 meters above the conglomerate.

*Spiriferellina lata* occurs in all of the units shown on the column except units 30 A and C, 29, 23 and 21. The specimens which possess spines are from unit 24E occurring with specimens lacking spines.

## DESCRIPTION OF THE MEASURED SECTION

| Unit | Thickness | Description |
|---|---|---|
| 31B | +4.3ft 1.30m | Sandy limestone, grey, weathers tan to rust, massive, small scale cross-bedding. |

| Unit | Thickness | Description |
|---|---|---|
| 31A | 5.7ft 1.75m | Sandy limestone, light grey, weathers rust brown, massive, silicified cross-bedding approximately 0.3m high by 1m long. |
| 30C | 3.9ft 1.19m | Shale, light grey, weathers yellow, blocky, non-resistant, 3" arenaceous stringers at base. |
| 30B | 0.3ft 0.09m | Limestone, grey, stained yellow, 2" bedding, contains some chert. |
| 30A | 0.2ft 0.06m | Shale, light grey, stained yellow, thin-bedded, non-resistant. |
| 29 | 1.0ft .31m | Limestone conglomerate, chocolate brown, weathers same, limestone clasts as much as 1.5", constant thickness. |
| 28B | 1.0ft .31m | Limestone, light grey, weathers same, thin discontinuous bedding, calcite filled fractures. |
| 28A | 4.2ft 1.28m | Limestone, light grey, weathers same, thick-bedded to massive, calcite filled fractures, bioclastic. |
| 27 | 3.3ft 1.01m | Shaly limestone, light grey, weathers same, thin-bedded, calcite filled fractures, earthy smell, some brachiopods. |
| 26F | 1.0ft 0.31m | Limestone, light grey, weathers same, medium- to thin-bedded, calcite filled fractures. |
| 26E | 1.0ft 0.31m | Limestone, light grey, weathers same, thin-bedded, calcite filled fractures, some brachiopods. |
| 26D | 14.7ft 4.39m | Limestone, light grey, weathers same, thick-bedded to massive, calcite filled fractures, discontinuous chert beds, silicified brachiopod biostromes, *Spiriferellina* abundant, cliff former. |
| 26C | 0.9ft .28m | Limy shale, grey, weathers light grey, poorly bedded, fossiliferous. |
| 26B | 23.7ft 7.22m | Limestone, light grey, weathers same, massive to thick-bedded, chert beds, brachiopod biostrome, cliff former. |
| 26A | 1.8ft 0.55m | Limestone, light grey, weathers same, medium- to thin-bedded at bottom, coarse-grained, *Spiriferillina* biostrome. |
| 25 | 0.6ft 0.18m | Shale, light grey, weathers same, non-resistant, calcareous. |
| 24E | 2.6ft 0.79m | Limestone, light grey, weathers rust, medium-bedded, bioclastic, fine-grained. |

| Unit | Thickness | Description |
|---|---|---|
| 24D | 0.1ft 0.03m | Shale, light grey, weathers same, non-resistant. |
| 24C | 2.7ft 0.82m | Limestone, light grey, weathers same, thick-bedded, fine-grained, some cross-bedding, bioclastic. |
| 24B | 1.2ft 0.37m | Shaly limestone, light grey, weathers same, fine-bedded, cross-bedded. |
| 24A | 6.8ft 2.12m | Limestone, light grey, weathers rust, thick-bedded to massive, abundant fossils, crypto-crystalline. |
| 23 | 2.0ft 0.61m | Limestone, buff, weathers same, non-resistant, bioclastic. |
| 22B | 1.6ft 0.49m | Shale, green to red, weathers red, non-resistant, blocky. |
| 22A | 2.9ft 0.88m | Limestone, grey to brown, weathers rust, medium- to thick-bedded, cryptocrystalline with calcite megacrysts in cracks, abundant spirifers at top, bench former. |
| 21 | +0.5ft 0.15m | Shale, light green, weathers same, non-resistant, blocky. |

## SYSTEMATICS

Higher systematics are from The Treatise of Invertebrate Paleontology, Part H, Brachiopoda (Moore (ed.), 1969). The concept of *Spiriferellina* is based on Campbell's redescription of the genotypes of *Spiriferellina*, *Punctospirifer*, and *Reticularina*. Type specimens are in the collection of the Department of Geology, University of Illinois, Urbana, Illinois.

Phylum Brachiopoda Dumeril, 1806
Class Articulata Huxley, 1869
Order Spiriferida Waagen, 1883
Sudorder Spiriferidina Waagen, 1883
Superfamily Spiriferinacea Davidson, 1884
Family Spiriferinidae Davidson, 1884
Genus *Spiriferellina* Fredricks, 1918
*Spiriferellina lata* Lane, 1963

Figs. 4-23

*Spiriferellina lata*, Lane, 1963, pl. 45 fig. 1, 2, 4-14, p389.
*Punctospirifer campestris*, (White), Langenheim, 1964, pl. 6, no. 9, p93-94, *pars*, specimens from locations b4972; 5199.

Shell ranges from small to medium size. The largest are 27mm wide by 20mm long and the smallest 6mm wide and 5mm in length. The shell is biconvex and generally semi circular in outline. Some specimens are slightly extended on the hingeline. Irregular shapes also occur.

The greatest width is at or within 3mm of the hingeline. The shell is coarsely punctate and granular. Strong imbricate growth lamellae ornament both valves, becoming more prominent and more widely spaced at the anterior margin, with spacing as wide as 7 per cm. Some shells also have a row of spines in the axis of the sulcus and on the axis of the fold. Scattered spines also exist on the shell surface. Only six specimens among an estimated 50, retained their spines. Table 1 indicates the sizes of four specimens which were articulated.

The pedicle valve is moderately convex transversely and horizontally and is more convex toward the anterior and slightly more convex towards the sides. The interarea is aspacline and about 1/3 as high as wide. The beak is incurved. The umbo ranges from strongly inflated to moderately inflated. Four simple angular plicae are present, the three closest to the sulcus being strongly developed. A fourth weak plication is on the hingeline of some specimens. The outer plicae do not originate at the beak. The valve interior contains a septum ranging from 1/3 of the length of the shell to the entire length of the shell.

The brachial valve is smaller and less convex than the pedicle valve. It is longitudinally semiovate. Tranversly, the flanks are increasingly convex. The beak is small. The brachial valve is orthocline and lacks an interarea. In most specimens, the medial plication is distinctly higher than the lateral plicae but it is about the same height in a few individuals. Otherwise, the plicae resemble those of the pedicle valve. The cardinal process is very small and subovate in outline. The inner hinge plates are triangular, where meeting the cardinal process. They form a "V". The outer hinge plates are subtriangular meeting the shell at a right angle. Thin dental plates extend along the floor of the valve for approximately the shell length.

Hypotypes A6353-A6355, A6359, A6360 collected from Unit 26D between A51 and A52; A6356 collected from Unit 26D between A52 and A53; A6357 collected from Unit 24C between A44 and A45; and A6358 collected from Unit 26A between A45 and A46. Also, approximately 75 additional specimens were available for study.

## DISCUSSION AND CONCLUSIONS

The Arrow Canyon specimens were assigned to *Spiriferellina* instead of *Punctospirifer* and *Reticulariina* after comparison with the genotypes as redescribed by Campbell (1959). *Spiriferellina* spp. are distinguished by 4-6 low, angular plicae, imbricate growth lamellae and micro-ornamentation of fine granules. *Punctospirifer* spp. tend to have more, but less angular plicae; and a wider and more rounded sulcus. *Reticulariina* spp. are distinguished by large, elliptical, hollow spines or spine scars. Most of the Arrow Canyon specimens lack large elliptical spines characteristic of most *Reticulariina*. Nevada spinose specimens, however, slightly resemble *Reticulariina spinosa* (Norwood and Pratten, 1855), but the spines are too small and too numerous for assignment to *Reticulariina*. The plicae are too few, too angular, and the sulcus too wide for assignment to *Punctospirifer*.

*S. lata* was first described in Clark County, Nevada by N.G. Lane (1963). His described materials closely resemble some of the Arrow Canyon specimens. The Arrow Canyon specimens differ, however, in that some have spines, longer or shorter median septa or an outline that is either more or less alate. Based upon faunal associations, Lane (1963) concluded that *S. lata* was Morrowan. Lane's

material, however, appears to have been collected from limestone directly above the shaly part of the Indian Springs Formation of the Bird Spring Group as are the Arrow Canyon specimens. These rocks, now are placed in the uppermost Chesterian (Webster, 1969). In addition, the faunal association described by Lane in the Spring Mountains is the same as that of the Arrow Canyon spirifer. Thus it appears that morphologic differences between the two collections reflect individual diversity.

The Arrow Canyon specimens first were assigned to *Punctospirifer campestris* (Langenheim, V.A.M., 1964; Langenheim and Langenheim, 1965) and were considered conspecific with the *Punctospirifer campestris* described by B.O. Lane (1962). Those from unit 6 in her measured section are part of the same population described in this work but were collected at the foot of the slope on the north wall of the canyon a few hundred feet south of our collecting locality. Her specimens from unit 33 are too few and too poorly preserved for careful comparison with my collection. *S. lata* from Langenheim's unit 6 and our collection differ from *Punctospirifer campestris* (White) described by Lane which have twice as many lateral plicae as the Arrow Canyon specimens as well as a markedly wider sulcus.

Abundant *Spiriferellina lata* Lane are a prominent component of the latest Chesterian fauna of the Indian Springs Formation and BSc formation of the Bird Spring Group at Arrow Canyon. Morphologic diversity in the collections from Arrow Canyon transcends that described by Lane (1963) at Lee Canyon.

## BIBLIOGRAPHY


Campbell, K.S.W. 1959. The type species of three upper Paleozoic punctate Speriferoids. Paleontology 1:351-363.

Coogan, A.H. 1962. Early Pennsylvanian, biostratigraphy and sedimentation of the Ely Basin, Nevada. Unpub. Ph. D. dissertation, University of Illinois, Urbana, 90p.

_____ ____. 1964. Early Pennsylvanian history of the Ely Basin, Nevada. Amer. Assoc. Petrol. Geol. Bulletin 48:487-495.

Girty, G.H. 1903. The Carboniferous formations and faunas of Colorado. United States Geological Survey Professional Paper 16, 546p.

Lane, B.O. 1962. The fauna of the Ely Group in the Illipah area of Nevada. Jour. Paleontology 36:888-911.

Lane, H.R., P.L. Brenckle, and R. West. 1983. Arrow Canyon, Nevada - A potential mid-Carboniferous boundary stratotype section (abstract), p.16. *In* Saunders, B.W., I.U.G.S. Subcommission on Carboniferous Stratigraphy, No. 4, 29p.

Lane, H.R., P.L. Brenckle, R. West. 1983. A potential mid-Carboniferous boundary stratotype section (abstract), p. 359. *In* X Cong. de Estrat. y del. Carbonifero, Madrid, Resumenes, 509p.

Lane, N.G. 1963. A silicified Morrowan brachiopod faunule from the Bird Spring Formation, southern Nevada. Jour. Paleontology 37:379-392.

Langenheim, R.L., Jr., B.W. Carss, J.B. Kennerly, V.A. McCutcheon, and R.H. Waines. 1962. Paleozoic section in Arrow Canyon Range, Clark County, Nevada. Amer. Assoc. Petrol. Geol. Bulletin 46:592-609.

Langenheim, V.A.M. 1964. Pennsylvanian and Permian paleontology and stratigraphy of Arrow Canyon, Arrow Canyon Range, Clark County Nevada. Unpub. M.S. thesis, University of California, Berkely, 194p.

Langeheim, V.A.M. and R.L. Langenheim Jr. 1965. The Bird Spring Group, Chesterian through Wolfcampian at Arrow Canyon, Arrow Canyon Range, Clark County Nevada. Trans. Ill. State Acad. Sci. 58:225-240.

Moore, R.C., (ed). 1965. Treatise on invertebrate paleontology, Part H, Brachiopoda: University of Kansas Press and Geological Society of America, 2 vols. 927p.

Norwood, J.G. and H. Pratten. 1855. Notice of Fossils of the Western States belonging to the genera *Spirifer*, *Bellephron*, *Pleurotomaria*, *Macrocheilus*, *Natica*, and *Loxonema*, with descriptions of eight new characteristic species. Jour. Acad. Nat. Sci., Phil. (2) 3:71,72.

Sutherland, P.K. and F.H. Harlow. 1973. Pennsylvanian brachiopods and biostratigraphy in southern Sangre de Cristo Mountains, New Mexico. New Mex. Bur. Mines and Mineral Res. Mem. 27, 173p.

Webster, G.D. 1969. Chester through Derry conodonts and stratigraphy of Northern Clark and Southern Lincoln Counties, Nevada. Univ. Calif. Publ. in Geol. Sci. v. 79, 121p.

Webster G.D. and N.G. Lane. 1967. Mississippian-Pennsylvanian boundary in southern Nevada. P.502-552 *in* C. Teichert and E.L. Yochelson (eds.), Essays in paleontological stratigraphy, R.C. Moore Commemerative Volume. Dept. Geol. Univ. Kansas, Special Publication 2, 626p.

Webster, G.D. and R.L. Langenheim Jr. 1979. Stop description - Seventh day: Clark County, Nevada. P. 78-80 *in* Beus, S.S. and R.R. Rawson (eds.), Carboniferous stratigraphy in the Grand Canyon country, northern Arizona and southern Nevada, Field trip No. 13. Ninth Internat. Cong. Carboniferous Strat. Geol., The Amer. Geol. Inst. 138p.

White, C.A. 1874. Preliminary report upon invertebrate fossils collected by the expeditions of 1871, 1872, and 1873, with descriptions of new species: Geographical and geological explorations and surveys west of the one hundredth meridian: U.S. Army Eng. Dept., Washington, 27p.

_____ _____. 1877. Reports upon the invertebrate fossils collected in portions of Nevada, Utah, Colorado, New Mexico, and Arizona by parties of the expeditions of 1871, 1872, 1873, and 1874. Report of the expedition of geographical and geological surveys out of Nevada, Utah, Colorado, New Mexico, and Arizona: United States Army Engineer Department, Washington, V. 4, pt. 1, 219p.

Table 1. Dimensions of articulated *Spiriferellina lata*.

| Specimen | Width | Length | Height |
|---|---|---|---|
| A6359 | 6.2mm | 4.5mm | 3.8mm |
| A6357 | 13.9mm | 9.5mm | 7.3mm |
| A6353 | 21.9mm | 17.2mm | 16.6mm |
| A6360 | 15.0mm | 13.4mm | 10.2mm |

## EXPLANATION OF FIGURES

Fig. 1. Location Map of Arrow Canyon.
Fig. 2. Upper part of the columnar section.

Fig. 3. Lower part of the columnar section.

Figs. 4-8. Hypotype A6353, X1.

4. Dorsal exterior
5. Ventral exterior
6. Posterior
7. Anterior
8. Lateral

Figs. 9-11. Hypotype A6354, X1, alate pedicle valve.

9. Exterior
10. Interior
11. Lateral

Fig. 12. Hypotype A6355, X1, pedicle valve rounded posterior.

Figs. 13-15. Hypotype A6356, X1, brachial valve.

13. Exterior
14. Interior
15. Lateral

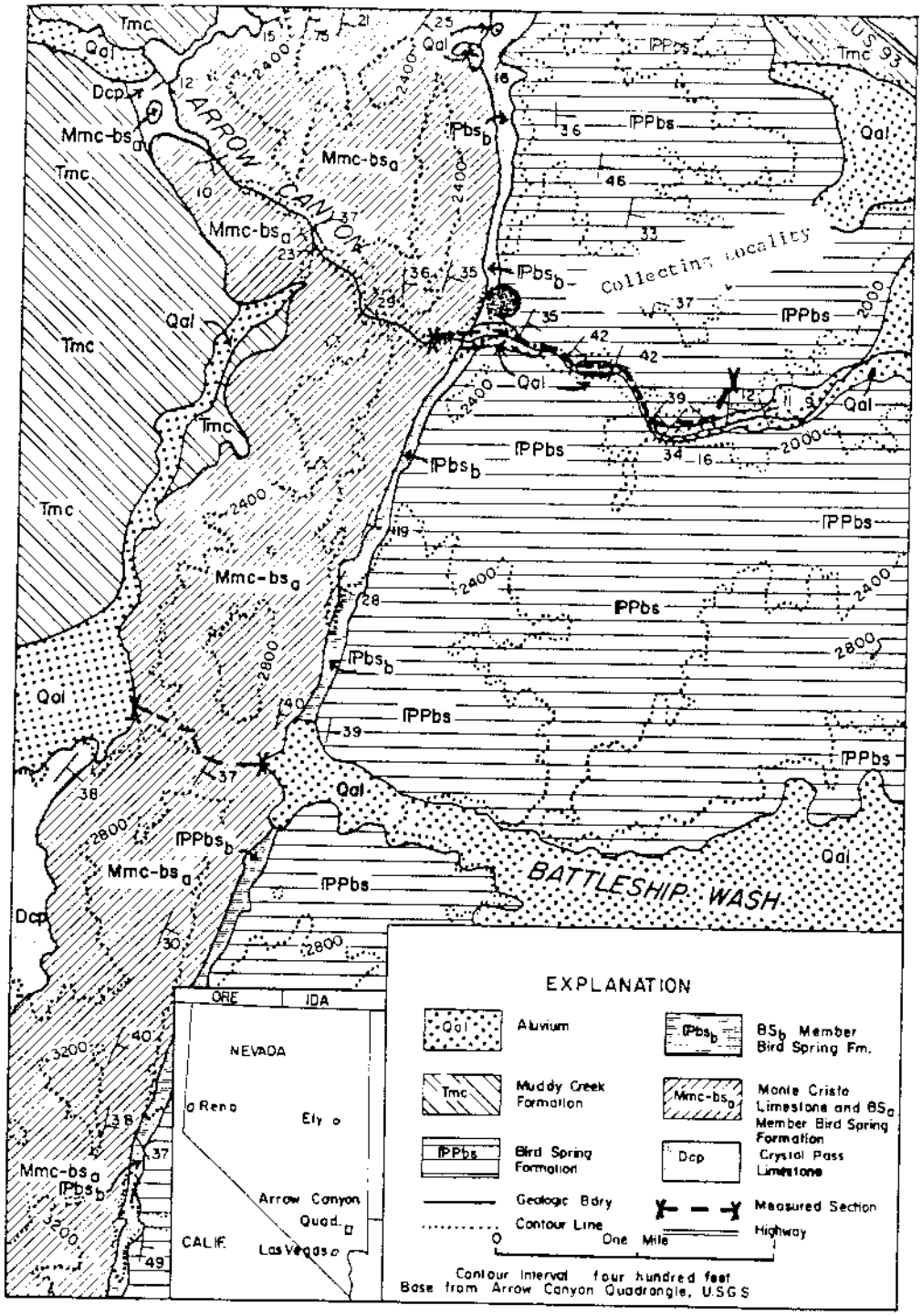
Figs. 16-20. Hypotype A6357, *Spiriferellina lata* with preserved spines.

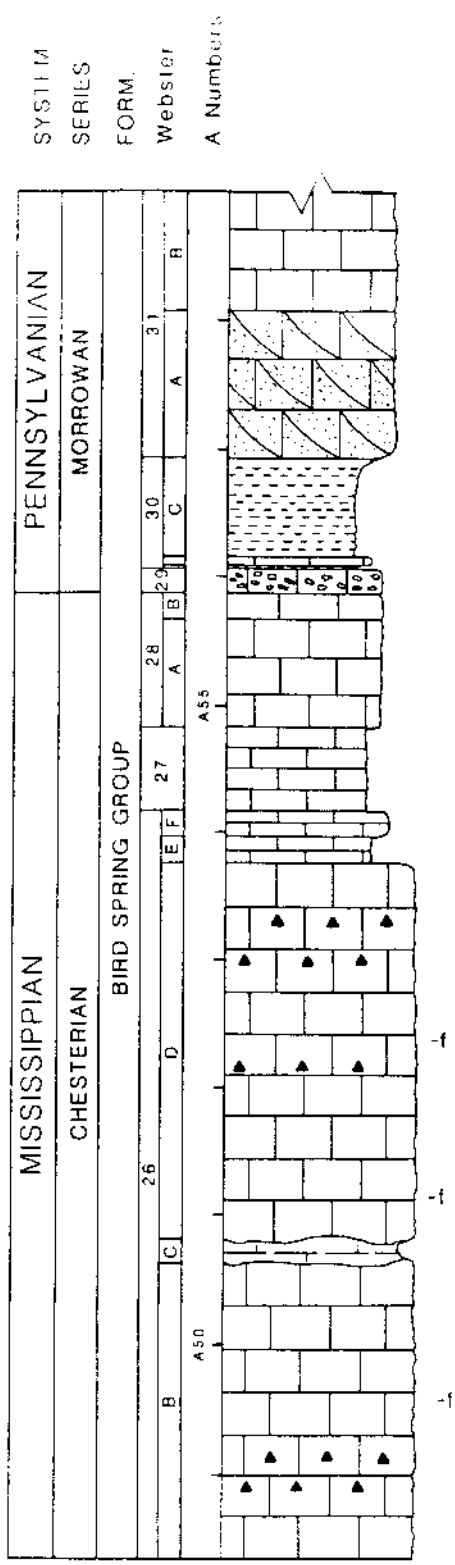
16. Pedicle exterior X4
17. Pedicle exterior X2
18. Pedicle interior with short septum X2
19. Brachial exterior X2
20. Brachial interior X2

Fig. 21. View of micro-ornamentation of hypotype A6354, X6.

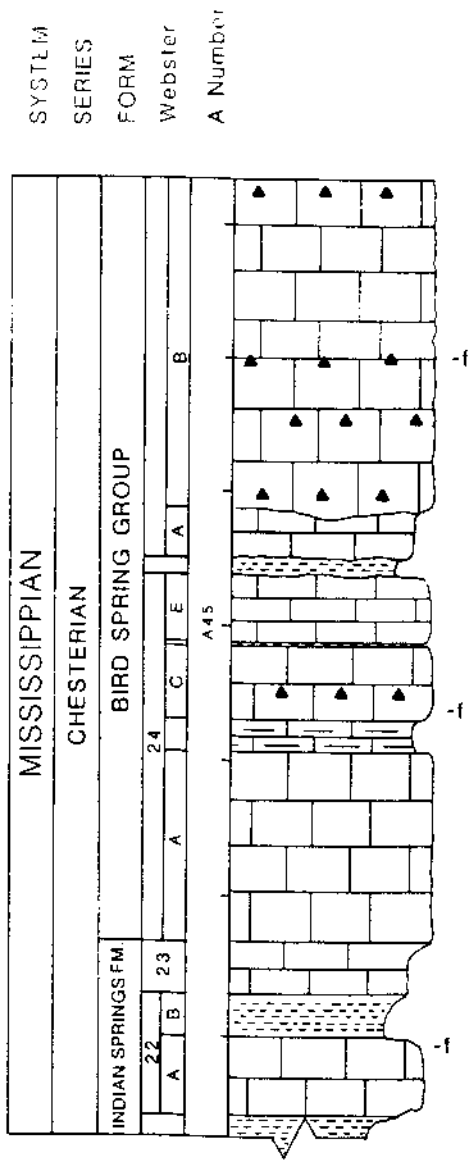
Fig. 22-23. Hypotype A6358, X1 pedicle valve with long septum.

22. Interior
23. Exterior


ARROW CANYON
BATTLESHIP WASH
US 93
Collecting Locality
Tmc
Qal
Dcp
Mmc-bs$_a$
IPPbs
IPbs$_b$
NEVADA
ORE
IDA
CALIF.
Reno
Ely
Las Vegas
Arrow Canyon Quad.
EXPLANATION
Alluvium
Muddy Creek Formation
Bird Spring Formation
Geologic Bdry
Contour Line
BS$_b$ Member Bird Spring Fm.
Monte Cristo Limestone and BS$_a$ Member Bird Spring Formation
Crystal Pass Limestone
Measured Section
Highway
One Mile
Contour Interval four hundred feet
Base from Arrow Canyon Quadrangle, U.S.G.S.


SYSTEM
SERIES
FORM.
Webster
A Numbers
PENNSYLVANIAN
MISSISSIPPIAN
MORROWAN
CHESTERIAN
BIRD SPRING GROUP
26
27
28
29
30
31
A
B
C
D
E
F
A50
A55
-f
-f
-f


SCALE
feet
meters
0
1
2
3
4
5
6
0
1
2




EXPLANTION

LIMESTONE, THICK BEDDED TO

LIMESTONE, MEDIUM BEDDED

LIMESTONE, THIN BEDDED

SANDY LIMESTONE, CROSSBEDDED

CONGLOMERATE LIMESTONE

SHALE

CALCAREOUS SHALE

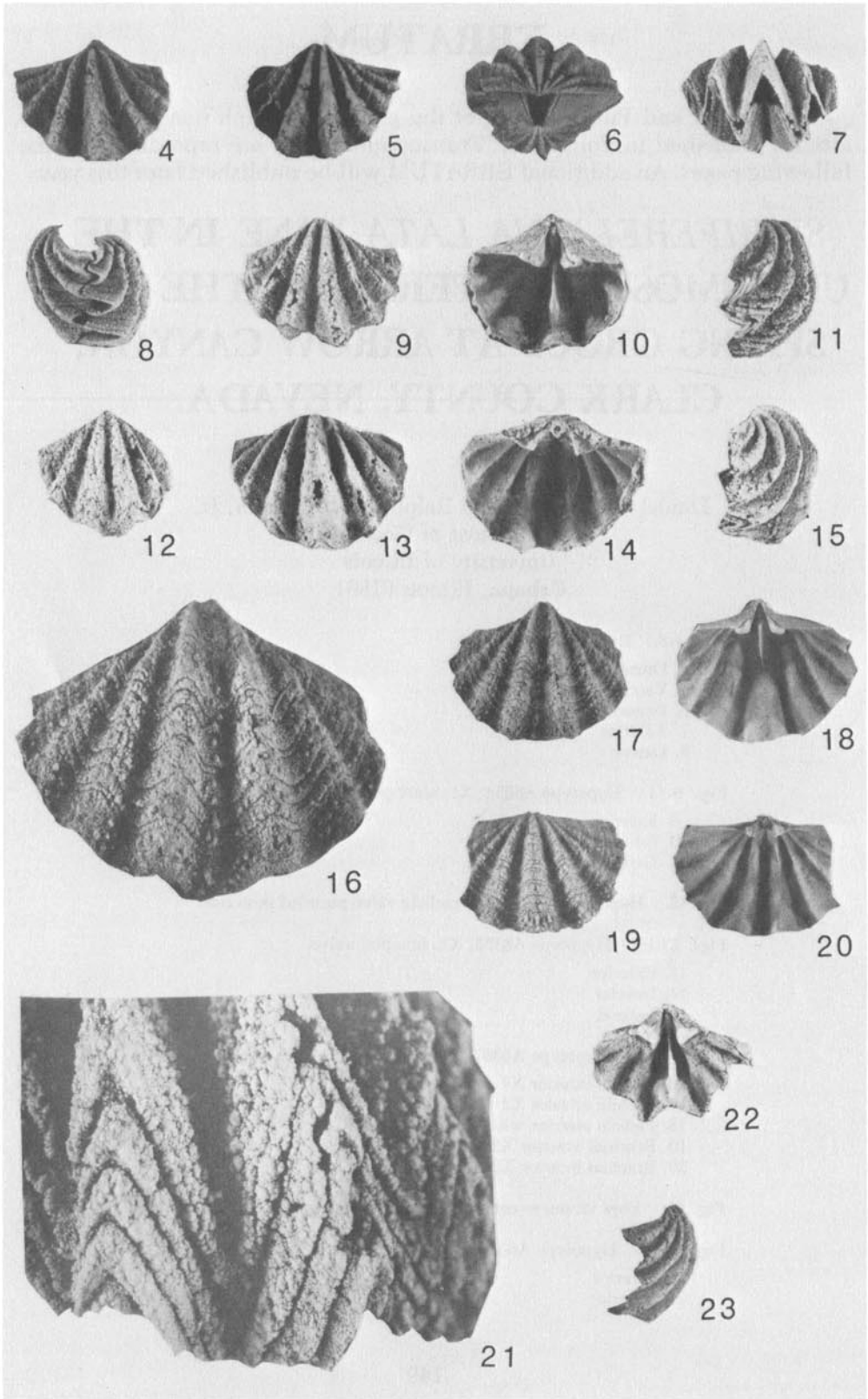
SHALEY LIMESTONE

CHERT

-f BRACHIOPOD BIOSTROME

SCALE

| feet | meters |
|---|---|
| 0 | 0 |
| 1 | |
| 2 | |
| 3 | 1 |
| 4 | |
| 5 | |
| 6 | 2 |


4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23