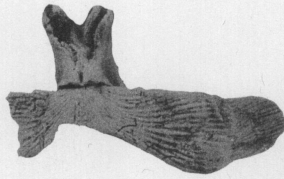
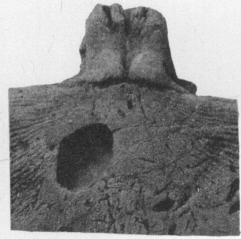


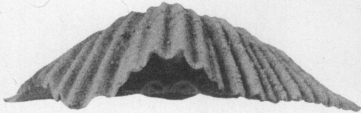
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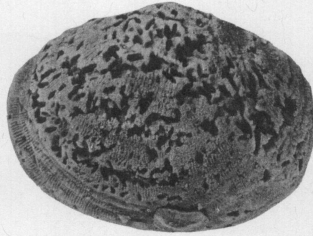
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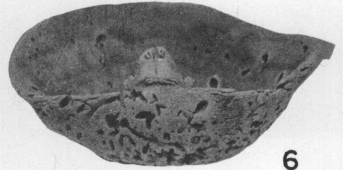
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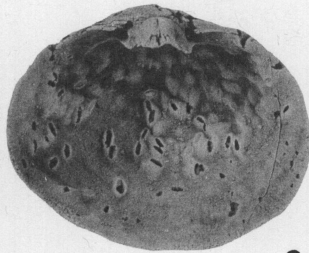
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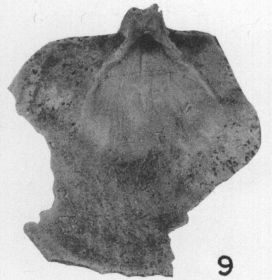
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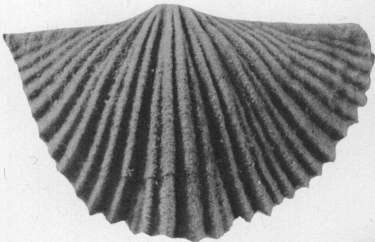
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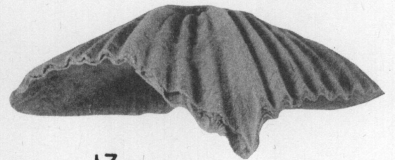
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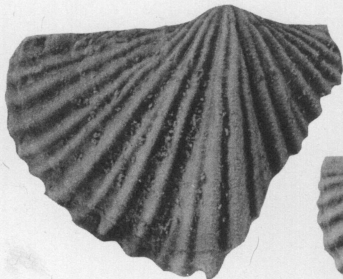
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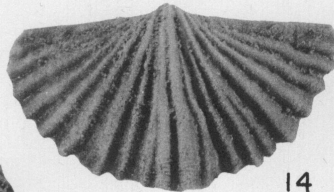
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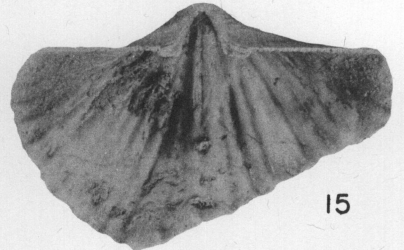
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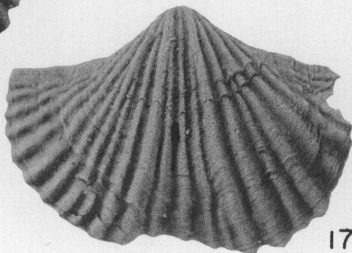
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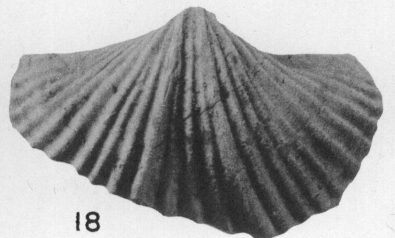
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Family SPIRIFERIDAE King, 1846
Genus ANTHRACOSPIRIFER Lane, n. gen.

Diagnosis.—Spiriferidae having an undivided median sulcal costa originating at the ventral beak; two to eight undivided lateral sulcal costae that originate from the sides of the sulcus; and six to 13 costae on each lateral slope, inner ones of which split in both valves. Dental lamellae reach floor of the pedicle valve, bounding the postero-lateral edge of the muscle field. Dorsal area with prominent vertical grooves and denticulate edge.

Description.—Medium to small Spiriferidae with shell wider than long. Lateral costae angular to rounded, one to four inner costae bifurcating next to fold and sulcus. Simple median sulcal costa originating at or near umbo and two to six lateral sulcal costae originating from the inner sides of costae bounding the sulcus. Two to eight costae compose the fold, the median two of which originate at the beak and are most prominent. The outermost lateral costae of the fold may bifurcate. Interarea of pedicle valve relatively low, concave, vertically grooved and slightly denticulate at margin. In the interior of the pedicle valve the dental amellae reach the floor of the valve for a

short distance anterior to the beak. Adductor scars slightly elevated, long, narrow and separated by a narrow groove. Diductor scars impressed, situated at antero-lateral margins of adductors, indistinct. Interior of brachial valve with long, tubular dental sockets, small sessile vertically striate cardinal process, and a short median ridge on the floor of the valve. The adductor scars are faint, apparently long and narrow, and situated principally on the inner surfaces of the sulci bounding the fold.

Type Species.—*Anthracospirifer birdspringensis*, n. sp.

Remarks.—No previously described spiriferid genus serves as a suitable repository for Pennsylvanian species long assigned to the genus *Spirifer*. The modern tendency to restrict *Spirifer* to large, short-hinged shells with multicostate fold and sulcus and a high triangular area closely similar to *S. striatus*, the type species, means that many Mississippian and all Pennsylvanian species must be placed elsewhere (see Brown, 1953, p. 58, pl. 5, fig. 6; Campbell, 1957, p. 67). American Mississippian species such as *S. rowleyi* and *S. grimesi* are of the type of *S. striatus* and should remain in *Spirifer*.

Among described genera *Unispirifer* Campbell and *Brachythyryna* Fredericks are

EXPLANATION OF PLATE 44

All figures $\times 2$ unless otherwise indicated.

- FIGS. 1-3, 5-6, 8-9—*Orihotetes occidentalis* Lane, n. sp. 1-3, external views showing variation in cardinal process, hypotypes, U.C.L.A. 34816, 34817 and 34818, respectively; 5, 6, 8, external, posterior and internal views of brachial valve, cotype, U.C.L.A. 34813, $\times 1$; 9, internal view of brachial valve showing socket plates and muscle scars, paratype, U.C.L.A. 34815, $\times 1$. 4, 7, 10-18—*Anthracospirifer birdspringensis* Lane, n. sp. 4, 7, 10, 11, anterior, internal, external and side views of brachial valve, cotype, U.C.L.A. 34810; 12, 13, 15, 18, side, anterior, internal and external views of pedicle valve, cotype, U.C.L.A. 34807; 14, 16, external views of brachial valves, paratypes, U.C.L.A. 34812 and 34811, respectively; 17, external view of pedicle valve, paratype, U.C.L.A. 34808.

judged to be most closely allied to *Anthracospirifer*. *Unispirifer* shares the vertically grooved interarea, presence of a median costa in sulcus, and absence of intercalated costae between primary and median sulcal costae with *Anthracospirifer*. As interpreted by Campbell (1957) his genus consists of shells that are commonly larger, more transverse, have many more costae on lateral slopes than *Anthracospirifer*. In addition, the median and primary costae of the sulcus of the former genus originate at the beak, rather than just the median costa, and the median costa commonly bifurcates once some distance from the umbo, rather than remain simple. *Brachythyrina* is closely similar to *Anthracospirifer* externally but differs in lacking dental plates descending to the floor of the pedicle valve.

Species assigned to *Anthracospirifer*, in addition to the type species, include *Spirifer matheri* Dunbar & Condra, *Spirifer opimus* Hall, *S. occiduus* Sadlick, and *S. oliveirai* Mendes.

The name *Anthracospirifer* is an allusion to the occurrence of this genus in the Coal Measures, or Pennsylvanian.

ANTHRACOSPIRIFER BIRD-
SPRINGENSIS Lane, n. sp.

Pl. 44, figs. 4,7,10-18; Pl. 45, fig. 3

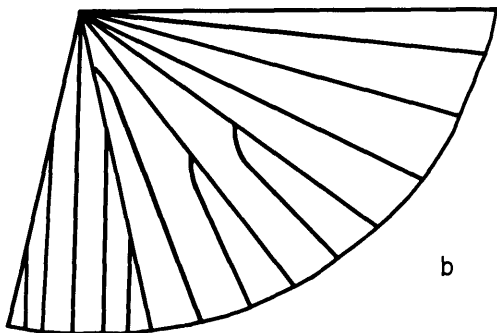
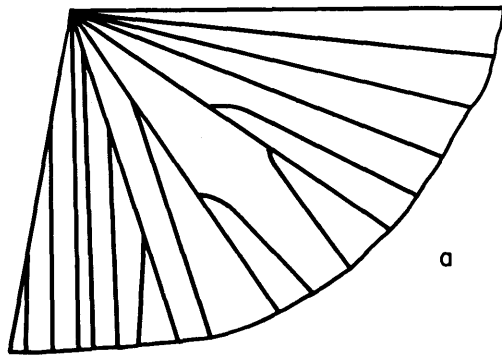
Description.—Shell approximately twice as wide as long. Lateral costae up to 13 in number, but seven to nine most common, sharp crested, subequal in width to intercostal sulci. On the pedicle valve the innermost lateral costa originates from the side of the primary costa bounding the sulcus, one or two mm. posterior to the origination of the primary sulcal costae. The second and third lateral costae begin at the umbo and each one splits off a small costa on its median side some distance from the umbo. In the brachial valve the primary costa next to the fold bifurcates equally into two costae two or three mm. from the beak. The outer of these two costae gives off a small secondary costa on its outer side 7 or 8 mm. from the beak. The second primary costa splits off a small costa on its outer side about 4 mm. from the beak, and one on its inner side adjacent to the second bifurcation of the innermost primary costa. The median two primary

costae of the lateral slope account for six costae at the anterior margin of a mature brachial valve. More laterally placed costae are all simple. Three or five costae are present in the sulcus and the sulcal angle is 25 to 27 degrees. Brachial valves longer than 11 or 12 mm. have six costae on the fold, smaller valves have only four. Faint radial striae can be observed on well preserved specimens, as can concentric lamellae. The ventral interarea is relatively low, concave, and exhibits vertical grooves as well as horizontal striae. The delthyrium is open, higher than wide, with a small callus at the apex. Brachial interarea is narrow but distinct and extends the full width of the shell. The interior of the valves is as described for the genus.

Remarks.—This species is to be compared with *A. occiduus*, *A. opimus* and *A. matheri*. Based on Sadlick's (1960) designation of a lectotype for *A. occiduus*, *A. birdspringensis* is smaller, has fewer lateral and sulcal costae and a more rounded anterior and lateral margin. It agrees with *A. occiduus* in its shape, extended hingeline, presence of a rather strong median intercostal sulcus in the fold and shape of costae. The new species is like *A. opimus* in size and number of costae on lateral slopes, but its width considerably exceeds length, the valves are less convex, it has up to three divided lateral costae instead of one, and the lateral extremities are more extended. The lectotype of *A. occiduus*, as well as specimens figured by Dunbar & Condra (1932), has lateral margins rather distinctly set off from the anterior margin of the fold and sulcus. The new species has rounded margins extending forward from the ears. *Anthracospirifer matheri* is much like *A. birdspringensis*, especially in shape and contour, but has more numerous costae on lateral slopes and in fold and sulcus. Mather's specimens (1915, pl. 12, figs. 5, 6) figured as *S. rockymontanus*, are more closely similar to the species being described here than the lectotype selected by Sadlick (Mather, pl. 12, fig. 4).

The name of the new species is in reference to its occurrence in the Bird Spring Formation of southern Nevada.

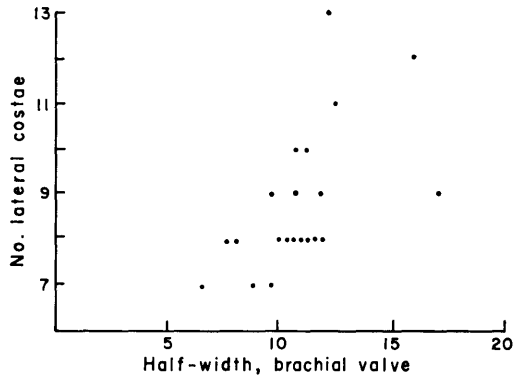
Types.—U.C.L.A. specimen nos. 34807 (pedicle) and 34810 (brachial) are desig-



TEXT-FIG. 4—Schematic representation of costal arrangement in (a) brachial valve and (b) pedicle valve of *Anthracospirifer birdspringensis*, n. sp.

nated cotypes. Specimens no. 34808 and 34809 (pedicle) and 34811 and 34812 (brachial) are designated paratypes.

Measurements.—Arrangement of costae on fold, sulcus, and lateral slopes is shown in Text-fig. 4. Relationship of width of brachial valve to number of lateral costae is shown in



but is not present in many. Four costae are on each lateral slope, including costae that bound the sulcus. The inner one or two costae originate at the beak, the outer two along the hinge. Postero-lateral surface of valve smooth next to interarea. Pedicle area triangular, strongly concave, at right angles to plane of commissure next to hinge, and curving regularly upward to beak. Brachial valve has three or four high angular costae on each lateral slope. Only the median two costae originate at the beak. Fold high, straight sided and subrounded to flat on top. Narrow interarea extends width of the valve.

Surface of both valves is covered by small, closely spaced, slightly elliptical granules. These are up to 0.2 mm. in maximum dimension, larger and more prominent on flanks of costae, apparently absent in the bottom of intercostal sulci, but present on some specimens on the crests of costae. There are 2.5 to 4 granules in 1 mm. radially on the flanks of costae. Shell substance is coarsely punctate, the punctae arranged in more or less irregular longitudinal rows, 6 to 8 in 1 mm. Growth lamellae irregularly developed on both valves, more crowded and becoming imbricated near anterior margins, but individual lamellae may occur any distance from the beaks.

Interior of pedicle valve with a high, short median septum that extends less than one half the length of the shell anteriorly. Dental teeth prominent, supported by short, inconspicuous dental plates that extend only a short distance along the floor of the valve from the apex of the delthyrium. In the brachial valve two inconspicuous ridges, one on top of each sulcus bordering the fold, bound the muscle scar field. A faint median ridge on the bottom of the trough formed internally by the fold extends slightly farther forward than the lateral ridges. The cardinal process is small, a rounded knob.

Discussion.—Several points of difference between this species and the type, *S. cristata*, recently redescribed by Campbell (1959) can be noted. The granules or pustules of *S. lata* are larger and more widely spaced, the species is more transverse, larger in mature shells, and has fewer lateral costae. The species most closely resembling *S. lata* is *Reticulariina atava* Chronic from the lower Per-

mian of Peru. The latter species is somewhat more mucronate, has up to six costae on a side and the anterior margin is straight rather than gently rounded. Pennsylvanian *Spiriferellina* such as *S. campestris* White commonly are smaller, less transverse, and have more lateral costae than does *S. lata*.

The species is assigned to *Spiriferellina* because imbricate growth lamellae, present in *Punctospirifer*, are lacking, and large spines, characteristic of *Reticulariina*, are not present. Among other Spiriferinidae *Crenispirifer* Stehli was considered, but it lacks a median elevation in the sulcus and the costae are relatively higher and more angular. Presumably the median sulcal elevation was not firmly established in this lower Pennsylvanian species of *Spiriferellina*, because only about one half the larger specimens show this feature. Small shells do not exhibit the character.

Types.—U.C.L.A. specimen nos. 34800 (pedicle) and 34804 (brachial) are designated cotypes. Specimens 34801 and 34802 (pedicle) and 34805 and 34806 (brachial) are designated paratypes.

Measurements.—The length and width of 39 brachial valves are shown in Text-fig. 6. Principal measurements of the types are shown in Table 4.

Family ATHYRIDAE Davidson, 1884

Genus COMPOSITA Brown, 1849

COMPOSITA OVATA Mather, 1915

Pl. 45, figs. 15-18

Composita ovata MATHER, 1915, p. 202, pl. 14, figs. 6-6c; DUNBAR & CONDRA, 1932, p. 370, pl. 43, figs. 14-19.

Composita wasatchensis MATHER (not White), 1915, p. 200, pl. 14, figs. 7-10.

Remarks.—Specimens of *Composita* identified as *C. ovata* are similar to that species in their oval outline, relatively unpronounced fold and sulcus that do not originate until the shells attain a length of 15 or 20 mm., and in the lack of a protruding tongue of the fold and sulcus at the anterior margin of mature shells. Few large complete valves have been recovered, the shells are quite thin and break up easily. The silicified *Composita* in this sample invariably are lighter colored than shells of other brachiopods. A sequence of brachial valves shows that the hinge plate

TABLE 4—MEASUREMENTS, IN MM., OF *Spiriferellina lata*, N. SP.

Specimen No.:	Pedicle valve			Brachial valve		
	34800	34801	34802	34804	34805	34806
Maximum length	15.3	11.3	11.1	13.8	11.9	11.5
Maximum width	22.1	18.4	13.0	28.1*	24.0*	20.2*
Thickness	6.9	6.1	5.2	7.7	5.8	4.7
Height, interarea	4.8	3.7	3.3	1.2	0.8	0.7
Width, delthyrium	3.8	2.7	2.3	—	—	—
Number lateral costae	4	5	4	3	4	3

* Based on half-width.

is rather variable in shape, ranging from sub-quadrate to ones that are almost triangular in plan. A minute hole is commonly present in the center of the posterior edge of the hinge plate. *Composita ovata* is a common Pennsylvanian species, and although origi-

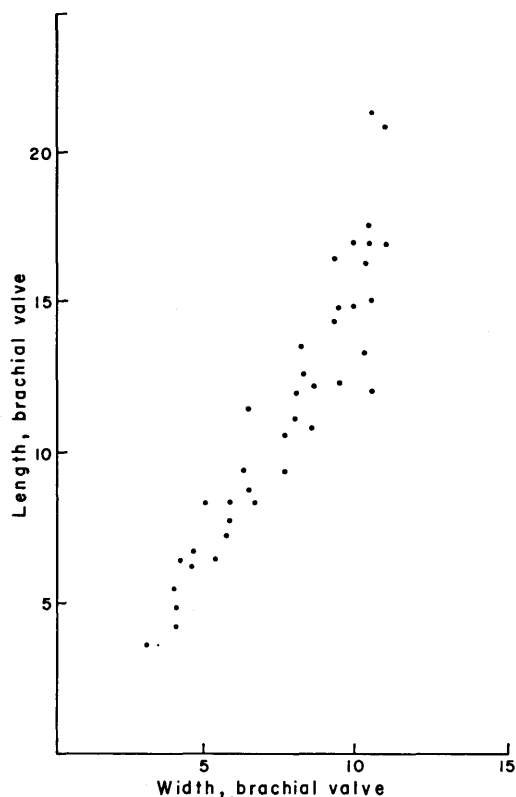
nally described from the Morrowan, it has been reported to range throughout the Pennsylvanian of the Midcontinent. It seems likely that some of the *Composita* figured and listed by Girty from Pennsylvanian rocks of the western United States as *C. subtilita* belong in this species.

Material.—Illustrated specimens of *C. ovata* are U.C.L.A. nos. 34829, pedicle valve, and 34830, brachial valve.

Measurements.—Pedicle valve no. 34829 has a width of 17.0, length of 17.1 and thickness of 5.8 mm. Brachial valve no. 34830 has a width of 18.8, length of 19.2, thickness of 8.8, height of fold, 3.9, width of fold, 9.8 mm.

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TEXT-FIG. 6—Length and width, in mm., of 39 brachial valves of *Spiriferellina lata*, n. sp.

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EXPLANATION OF PLATE 45

All figures $\times 2$.

- FIGS. 1,2,4-14—*Spiriferellina lata* Lane, n. sp. 1, external view of brachial valve, paratype, U.C.L.A. 34806; 2, external view of small pedicle valve, paratype, U.C.L.A. 34801; 4, internal view of pedicle valve, paratype, U.C.L.A. 34801; 5,8,11,13, side, anterior, internal and external views of pedicle valve, cotype, U.C.L.A. 34800; 6,7,9,12, side, anterior, external and internal views of brachial valve, cotype, U.C.L.A. 34804; 10, external view of pedicle valve showing median ridge in sulcus, hypotype, U.C.L.A. 34803; 14, external view of brachial valve, paratype, U.C.L.A. 34805.
- 3—*Anthracospirifer birdspringensis* Lane, n. sp. External view of small pedicle valve, paratype, U.C.L.A. 34809.
- 15-18—*Composita ovata* Mather. 15,16, external and internal views of pedicle valve, hypotype, U.C.L.A. 34829; 17,18, external and internal views of brachial valve, hypotype, U.C.L.A. 34830.