

THE GASTROPOD GENUS *Volutocristata* GARDNER AND BOWLES
(EOCENE; CALIFORNIA, MEXICO): A SYNONYM OF
LYRISCHAPA ALDRICH (EOCENE; GULF COAST)

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ABSTRACT

The volutid gastropod genus *Volutocristata* Gardner and Bowles, described from the Eocene of Mexico and California, is shown to be a synonym of the monotypic Gulf Coast Eocene genus *Lyrischapa* Aldrich. As here expanded, the genus *Lyrischapa* includes at least three species, each of which characterizes middle Eocene strata within a different region of North America: *L. harrisi* Aldrich, the type species, in the Gulf Coast region of the southeastern United States; *L. chiapasensis* (Gardner and Bowles), in southern Mexico on the Gulf of Mexico side of the continental divide; and *L. lajollaensis* (Hanna), on the Pacific Coast.

The ancestry and place of origin of *Lyrischapa* are unknown. The geographic distribution of the genus suggests an immediate center of dispersal in the Caribbean region. It may have evolved in that region or it may be an immigrant from the Tethyan paleobiogeographic province. Dispersal of *Lyrischapa* to the Pacific Coast was probably by way of a narrow seaway connection across southern Central America or northwestern South America.

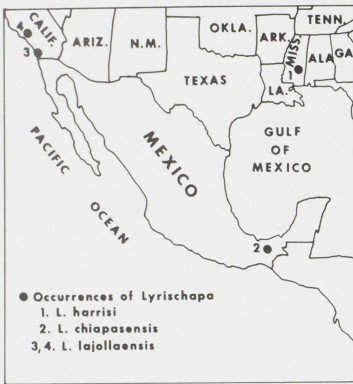
INTRODUCTION

Lyrischapa and *Volutocristata* are similar but poorly known volutid taxa that have been described from Eocene strata in widely separated regions of North America. *Lyrischapa* was erected by Aldrich (1911) as a monotypic genus from middle Eocene deposits (Cook Mountain Formation) in eastern Mississippi. Until recently, this genus has been known from only two small specimens (Palmer, 1937, p. 399). *Volutocristata* was proposed by Gardner and Bowles (1934) to include two similar volutid species: *Plejona lajollaensis* Hanna, from the middle Eocene ("Domenegine Stage") of southern California; and *Volutocristata chiapasensis* Gardner and Bowles, the type species, from the middle

Eocene of southern Mexico (Chiapas province). Examination of published illustrations of *Lyrischapa* and *Volutocristata* reveals that both taxa possess a distinctive *Conus*-like shape, with prominent peripheral spines. Their most apparent difference is size; figured specimens of *Volutocristata* are more than twice as large as those of *Lyrischapa*.

Recent collecting in the Cook Mountain Formation of eastern Mississippi has resulted in the discovery of several additional specimens of the monotype species *Lyrischapa harrisi* Aldrich, including specimens much larger than the holotype and comparable in size to those of *Volutocristata*. Comparison of these new specimens of *Lyrischapa* with those of *Volutocristata* (including types) reveals that, in addition to similar shape, these taxa also share other morphological attributes including: a bulbous, paucispiral, deviated protoconch; a high, narrow aperture with subparallel margins and a posterior exhalant sinus above the shoulder; an externally varicose and slightly everted outer lip; numerous deep-seated columellar folds, strongest anteriorly; and a shallow siphonal notch, with a correspondingly weak fasciole. Differences between these taxa are largely in the degree of development of these attributes. The close morphological similarity between *Lyrischapa* and *Volutocristata* leads me to conclude that they are congeneric. On the basis of priority, *Lyrischapa* is retained as the proper generic name for this distinctive group of volutid gastropods.

Although *Lyrischapa* and *Volutocristata* are considered congeneric, the species that have been assigned to these taxa appear to be distinct from one another. Accordingly, the genus *Lyrischapa*, as here constituted, includes three known species, each of which characterizes middle Eocene strata within a different region of North America (text figure 1): *L. harrisi* Aldrich, in the Gulf coastal plain of the



Text figure 1. Geographic distribution of *Lyrischapa*.

southeastern United States; *L. chiapasensis* (Gardner and Bowles), in southern Mexico on the Gulf of Mexico side of the continental divide; and *L. lajollaensis* (Hanna), on the Pacific Coast.

The ancestry and place of origin of *Lyrischapa* are unknown. The geographic distribution of the genus suggests an immediate center of dispersal within the Caribbean region. Perhaps *Lyrischapa* evolved from an unknown ancestor in the Caribbean region during Paleocene or early Eocene time and subsequently spread northward during the middle Eocene. Alternatively, the genus may be an immigrant from the Old World Tethyan paleobioge-

graphic province. Other mollusks with Tethyan affinities have been recognized in the Eocene faunas of the Caribbean region (Palmer, 1967). Entrance of *Lyrischapa* into the Pacific Coast region of North America was probably by way of a narrow seaway connection across southern Central America (Costa Rica, Panama) or northwestern South America (the Atrato trough of western Columbia). Narrow seaways apparently existed across this region during much of the Tertiary period (Olsson, 1932, p. 51-58; Nygren, 1950; Woodring, 1966).

SYSTEMATIC DESCRIPTIONS

- Phylum MOLLUSCA
- Class GASTROPODA
- Subclass PROSOBRANCHIA
- Order NEOGASTROPODA
- Family VOLUTIDAE
- Subfamily FULGORARIINAE Pilsbry and Olsson, 1954
- Genus LYRISCHAPA Aldrich, 1911

Lyrischapa ALDRICH, 1911, *Bulls. Amer. Paleontology*, v. 5, no. 22, p. 11. Type species (by monotypy): *Lyrischapa harrisi* Aldrich.
Volutocristata GARDNER and BOWLES, 1934, *Wash. Acad. Sci., Jour.*, v. 24, no. 6, p. 245. Type species (by original designation): *Volutocristata chiapasensis* Gardner and Bowles.

Diagnosis: Large, obconical volutid shells with a low, coeloconoid spire; prominent peripheral spines; a bulbous, paucispiral, deviated protoconch; a high, narrow aperture with subparallel margins and a posterior exhalent sinus above the shoulder; an externally varicose and slightly everted outer lip; numerous deep-seated columellar folds, strongest anteriorly; and a shallow siphonal notch, which forms a weak fasciole.

PLATE 1
(all figures × 2)

- Figures 1-3. *Lyrischapa harrisi* Aldrich..... 120
1. PRI 2355 (holotype); height 18 mm, diameter 10 mm (copied from Palmer, 1937, pl. 57, figs. 1, 2).
 Locality: Three and a half miles south of Quitman, Mississippi. Cook Mountain Formation, upper middle Eocene.
 2. MSGS-02; height (almost complete) 20.5 mm, diameter 11.2 mm.
 Locality: TU 907. Cook Mountain Formation, upper middle Eocene.
 3. MSGS-01; height (incomplete) 40.3 mm, diameter (slightly compressed) 24.7 mm.
 Locality: TU 907. Cook Mountain Formation, upper middle Eocene.

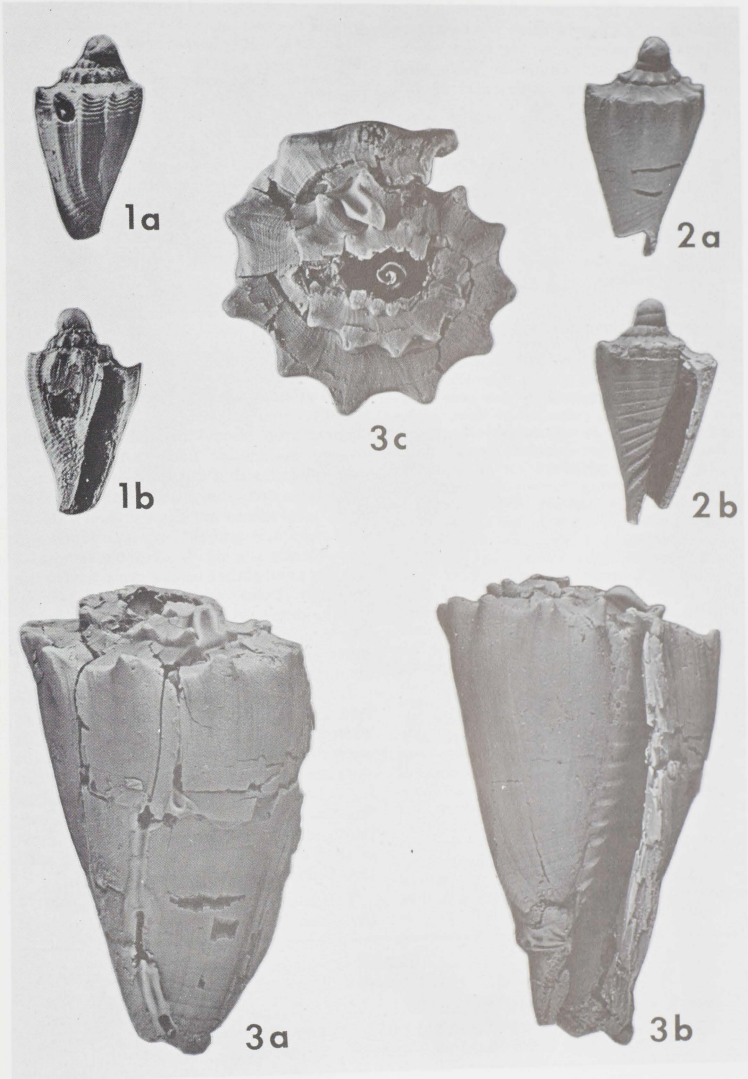


PLATE 1

Discussion: Reference of *Lyrischapa* to its subfamily Fulgorariinae is based upon the bulbous, paucispiral, deviated protoconch; numerous columellar folds; and shallow siphonal notch, with a correspondingly weak fasciole.

LYRISCHAPA HARRISI Aldrich

Plate 1, figs. 1-3; Plate 2, figs. 1a, 1b

Lyria ? sp. DALL, 1890, p. 69, pl. 6, fig. 5a.

Voluta ? sp. ind. DALL, 1890, p. 77, 90, pl. 6, fig. 5a.

Lyrischapa harrisi ALDRICH, 1911, p. 11, pl. 4, fig. 8. PALMER, 1937, p. 399, pl. 57, figs. 1, 2. PALMER and BRANN, 1966, p. 744.

Diagnosis: A *Lyrischapa* with a large, strongly deviated protoconch; acute peripheral spines; a wide concave ramp above the shoulder; widely and almost equally spaced columellar folds, which diminish regularly in size posteriorly; and a thin parietal callus, which does not extend above the suture with the preceding whorl.

Description: Large, obconical, strongly shouldered, with acute peripheral spines and a wide gently concave ramp. Spire low, coeloconoid. Protoconch large, bulbous, smooth, strongly deviated, of two or two and one-half whorls, tip slightly immersed. Post-nuclear whorls four, rapidly expanding, each succeeding whorl enveloping the preceding almost to the shoulder. Early post-nuclear whorls ornamented with 11 to 15 strong costae, which gradually develop into erect, open peripheral spines on the later whorls. Spiral ornamentation of numerous fine lirae, strongest on the early whorls, evanescent on the later whorls. Anterior half of adult body whorl incised with a series of widely spaced oblique spiral grooves, strongest anteriorly. Suture distinct, adpressed to slightly impressed, almost flush with the shoulder on the later whorls. Aperture high, narrow, with subparallel margins and a shallow exhalant sinus above the shoulder. Outer lip smooth, varicose and slightly everted in the adult. Inner lip with 11 or 12 widely and almost equally spaced columellar folds, strongest anteriorly, diminishing regularly in size posteriorly, those on the parietal region reduced to fine lirae. Parietal callus thin, not extending above the suture with the pre-

ceding whorl. Siphonal notch shallow, forming a weak fasciole.

Dimensions of holotype: height 18 mm, diameter 10 mm.

Holotype: Paleontological Research Institution (PRI) no. 2355.

Type locality: "Three and a half miles south of Quitman, Mississippi" (Aldrich, 1911, p. 11).

Other localities: Four and a half miles southwest from Enterprise, Clarke County, Mississippi (Palmer and Brann, 1966, p. 744); TU 907; TU 924.

Occurrence: Cook Mountain Formation, eastern Mississippi; late middle Eocene.

Figured specimens: PRI 2355 (holotype); MSGS-01, MSGS-02, locality TU 907; PRI 30014, locality TU 924. Unfigured specimen: PRI 30015, locality TU 924. Material examined: Six specimens, including two apical fragments.

Discussion: *Lyrischapa harrisi* is distinguished from the other two known species of the genus by a larger protoconch, more rapidly expanding whorls, a broader sub-sutural area above the shoulder, evenly spaced columellar folds, and a thinner parietal callus that does not extend above the suture with the preceding whorl. The peripheral spines are shorter than those of *L. lajollaensis* and the ramp is wider and more gently sloping. *L. chiapasensis* has a narrow shelf rather than a ramp above the shoulder, blunt rather than acute peripheral spines, and a more depressed spire. The columellar folds of *L. chiapasensis* are more closely spaced and more variable in strength than those of *L. harrisi*.

Lyrischapa harrisi is not a common species in the Cook Mountain Formation of eastern Mississippi. Although it has been recorded from four localities, only eight specimens (including apical fragments) have been found. The species occurs in fine-grained glauconitic sandstone in association with a diverse molluscan fauna, including the stratigraphically restricted species *Cubitostrea sellaeformis* (Conrad).

The late middle Eocene age assigned to the Cook Mountain Formation in eastern

PLATE 2 (all figures × 2)

- Figure 1. *Lyrischapa harrisi* Aldrich 120
 PRI 30014; height (incomplete) 38.5 mm, diameter 34.2 mm.
 Locality: TU 924. Cook Mountain Formation, upper middle Eocene.
- Figure 2. *Lyrischapa chiapasensis* (Gardner and Bowles) 122
 USNM 373044; height (almost complete) 39.5 mm, diameter 23.5 mm.
 Locality: USGS 13230. San Juan Formation (?), middle Eocene.

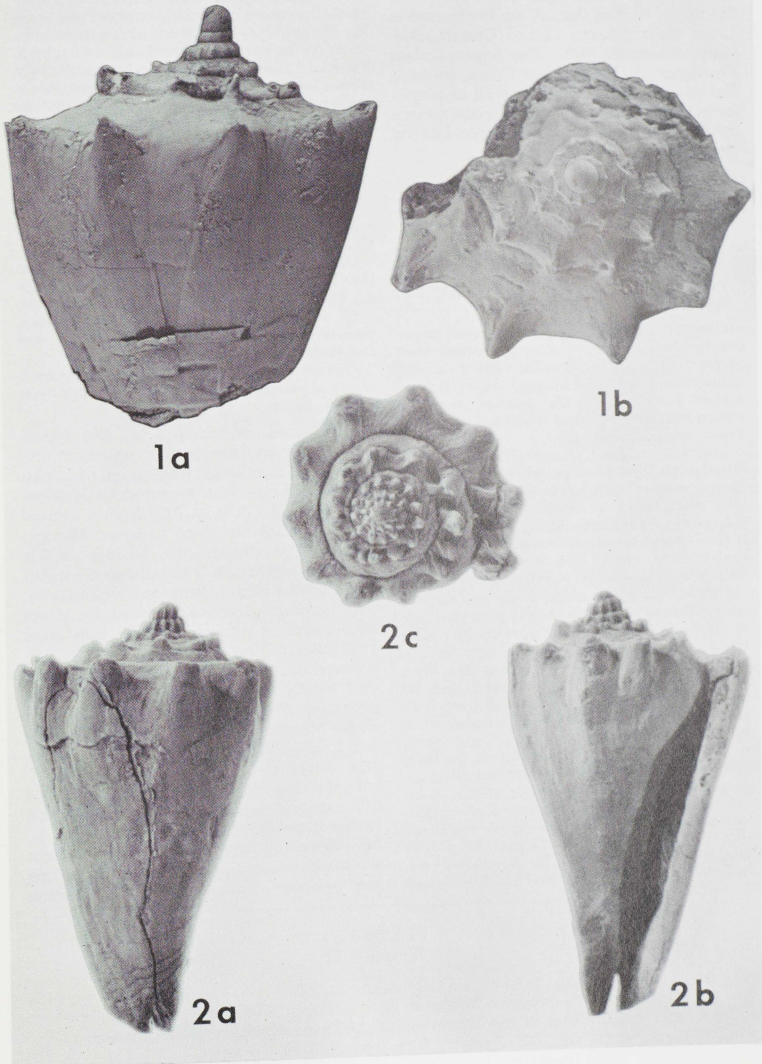


PLATE 2

Mississippi is based upon correlation with the upper part of the Lisbon Formation at Little Stave Creek, Clarke County, Alabama (Stenzel, 1949). The upper Lisbon Formation at Little Stave Creek contains *Cubittostrea sellaeformis* as well as planktonic foraminifers and calcareous nannofossils indicative of a late middle Eocene age (Bandy, 1949; Bybell, 1975).

LYRISCHAPA CHIAPASENSIS (Gardner and Bowles)

Plate 2, figs. 2a-2c

Volutocristata chiapasensis GARDNER and BOWLES, 1934, p. 248, figs. 10-12. MALDONADO-KOERDELL, 1950, p. 213, 214, figs. 42, 43.

Diagnosis: A *Lyrischapa* with a small protoconch; blunt peripheral spines; a narrow shelf above the shoulder; columellar folds of variable strength and spacing, strongest anteriorly; and a thick parietal callus that extends above the suture with the preceding whorl and partly envelops the peripheral spines.

Description: Large, obconical, strongly shouldered, with short blunt peripheral spines and a narrow concave shelf above the shoulder. Spire low, coeloconoid. Protoconch badly worn on the specimens available, small, of approximately two whorls, apparently not strongly deviated. Post-nuclear whorls five, rapidly expanding, each succeeding whorl enveloping the preceding almost to the shoulder. Early post-nuclear whorls ornamented with 11 to 13 prominent axial costae, which gradually develop into erect blunt peripheral spines on the later whorls. Spiral ornamentation of numerous fine lirae, strongest on the early whorls, evanescing on the later whorls. Anterior half of body whorl incised with widely spaced oblique spiral grooves, strongest anteriorly. Suture distinct, impressed, undulating around the axial costae on the early whorls, linear and slightly channeled along the parietal callus band on the later whorls. Aperture high, narrow, with subparallel margins and a shallow exhalant sinus above the shoulder. Outer lip smooth, varicose and slightly everted in the adult. Inner lip with 10 or 11 columellar folds, deep-seated and barely emergent

at the aperture, the anterior fold most prominent, the others of variable strength and spacing but gradually diminishing in size posteriorly, those on the parietal wall reduced to faint lirae. Parietal callus thick, extending posteriorly above the suture and partly enveloping the peripheral spines on the preceding whorl. Siphonal notch shallow, forming a weak fasciole.

Dimensions of holotype: height (almost complete) 39.5 mm, diameter 23.5 mm.

Holotype: U. S. National Museum (USNM) no. 373044.

Type locality: USGS loc. 13230, about 12 miles east-northeast of Sayula, province of Chiapas, Mexico.

Other localities: "Caimba, Pichucalco Region (Municipio de Ixtacomitan)," province of Chiapas, Mexico (Maldonado-Koerdell, 1950, p. 213).

Occurrence: Stratigraphic position uncertain, probably San Juan Formation of Frost and Langenheim (1974); middle Eocene.

Figured specimen: USNM 373044 (holotype). Material examined: holotype and paratype (USNM 373045).

Discussion: In addition to the types, eight other specimens (four apparent juveniles and four apical fragments) of *L. chiapasensis* have been reported by Maldonado-Koerdell (1950, p. 213) from a second locality in northwestern Chiapas, Mexico.

The exact stratigraphic position of this species is uncertain. The published locality descriptions include only geographic data. The species probably occurs in strata equivalent or referable to the San Juan Formation of Frost and Langenheim (1974), a nearshore marine and continental clastic unit widely distributed in central Chiapas province. Frost and Langenheim (1974, p. 21-23) have assigned the San Juan Formation to the middle Eocene based upon species of larger foraminifera and corals.

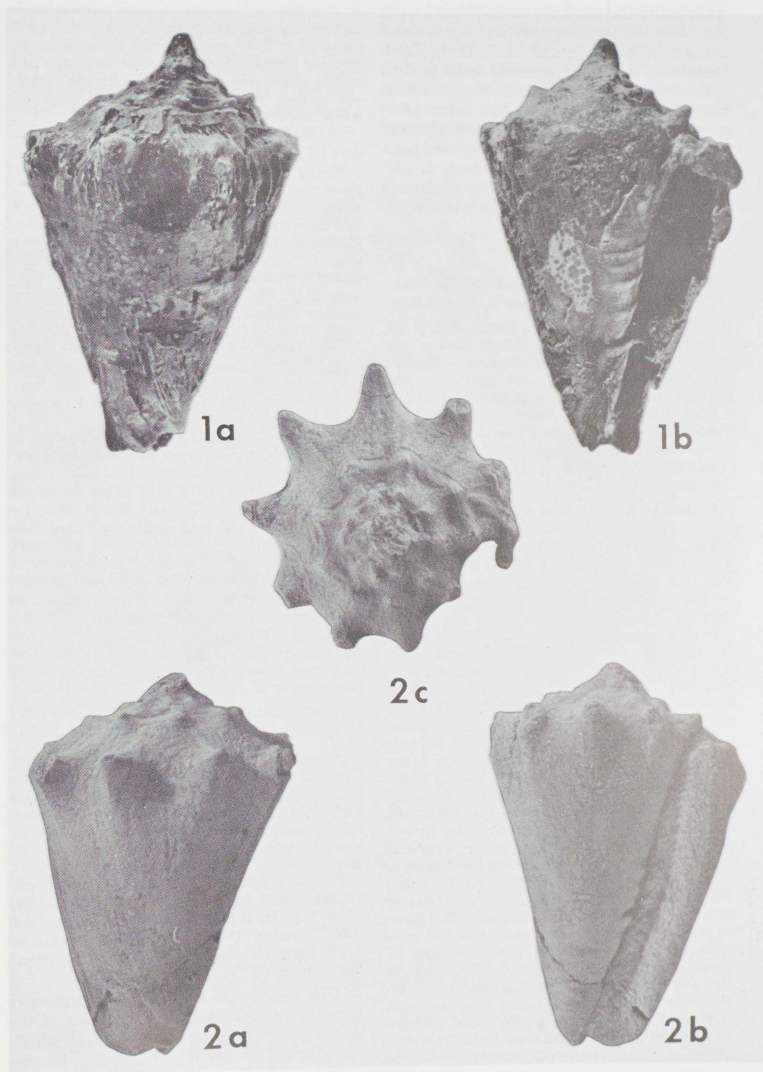
Lyrischapa chiapasensis appears to be more closely related to *L. lajollaensis* than to the type species. Resemblances to *L. lajollaensis* include the small protoconch, the thick parietal callus that partly envelops the peripheral spines on the preceding

PLATE 3

(all figures $\times 2$)

Figures 1, 2. *Lyrischapa lajollaensis* (Hanna) 124

1. UCMP 30911 (holotype); height 40 mm, diameter 23.8 mm (copy of photograph in the files of the University of California Museum of Paleontology). Locality: UCMP 5062. Ardath Shale, lower middle Eocene.
2. UCMP 14634 (neotype); height (incomplete) 34.8 mm, diameter 25.1 mm. Locality: UCR 4922 (= UCMP 5062). Ardath Shale, lower middle Eocene.



whorl, and the variable strength and spacing of the columellar folds. *Lyrischapa chiapasensis* is distinguished from *L. lajollaensis* by a more depressed spire, a shelf rather than a ramp above the shoulder, shorter and less pointed but more erect peripheral spines, a more anteriorly situated suture, and more closely spaced columellar folds. Differences between *L. chiapasensis* and *L. harrisi* have already been noted under the discussion of the latter species.

LYRISCHAPA LAJOLLAENSIS (Hanna)

Plate 3, figs. 1, 2; Plate 4, figs. 1-3

Pejona lajollaensis HANNA, 1927, p. 320, pl. 52, figs. 1, 2. KEEN and BENTSON, 1944, p. 183.

Volutospira (Pejona) lajollaensis (Hanna).

CLARK, 1929, pl. 9, figs. 11, 12.

Plejona lajollaensis Hanna. KEEN and BENTSON, 1944, p. 184.

Volutocristata lajollaensis (Hanna). GARDNER and BOWLES, 1934, p. 246, fig. 13. KEEN and BENTSON, 1944, p. 229. GIVENS, 1974, p. 88.

Diagnosis: A *Lyrischapa* with a small, slightly deviated protoconch; acute peripheral spines; a narrow concave ramp above the shoulder; columellar folds of variable strength and spacing; and a thick parietal callus, which extends above the suture with the preceding whorl and partly envelops the peripheral spines.

Description: Large, obconical, strongly shouldered, with acute peripheral spines and a narrow gently to steeply inclined concave ramp. Spire low, coeloconoid. Protoconch small, bulbous, smooth, slightly deviated, of two and one-half whorls, tip slightly immersed. Post-nuclear whorls five or six in the adult, rapidly expanding in size, each whorl of the adult part of the shell enveloping the preceding whorl up to the shoulder so that only the tips of the peripheral spines are exposed. Early post-nuclear whorls ornamented with 9 to 12 strong axial costae, which gradually develop into acute peripheral spines on the later whorls. Spiral sculpture of numerous fine lirae, strongest on the early whorls, evanescent on the later whorls. Anterior half of adult body whorl incised with a series of oblique spiral grooves, strongest and most closely spaced anteriorly. Suture distinct, adpressed to slightly impressed, undulatory around the peripheral spines, almost flush with the shoulder on the later whorls. Aperture high, narrow, with subparallel margins and a moderately deep posterior exhalant sinus above the shoulder. Outer lip smooth, varicose and slightly everted in the adult. Inner lip with 9 to 14 columellar folds, the first or second fold from the anterior end the strongest, the others variable

in strength and spacing but gradually diminishing in size posteriorly, those on the parietal wall reduced to fine lirae. Parietal callus thick, extending slightly above the suture with the preceding whorl and partly enveloping the peripheral spines. Siphonal notch shallow, forming a weak fasciole.

Dimensions of holotype: height 40 mm, diameter 23.8 mm.

Holotype: University of California Museum of Paleontology (UCMP) no. 30911. According to written communication from Joseph Peck, Principal Museum Scientist of the University of California Museum of Paleontology, the holotype of *Pejona lajollaensis* Hanna was lost about 10 years ago while out on loan to another institution. Mr. Peck reports that the circumstances surrounding the loss are such that it is very unlikely that the holotype will ever be found. Therefore, another specimen from the type locality is designated below as neotype of this species.

Type locality: UCMP 5062 (= neotype locality UCR 4922, described below).

Neotype: UCMP 14634 (here designated).

Dimensions of neotype: height (incomplete) 34.8 mm, diameter 25.1 mm.

Neotype locality: UCR 4922, at lat. 32° 53' 43" N., long. 117° 15' 6" W., about 12 feet below top of sea cliff at south end of Torrey Pines State Park, 340 feet south of north end of Torrey Pines Scenic Drive, Del Mar 7.5 minute quadrangle (1967 ed.). Ardath Shale, near top; early middle Eocene, *Rhabdosphaera inflata* Subzone of Bukry (1973), "Domengine Stage" in the provincial Pacific Coast mega-invertebrate chronology (Bukry and Kennedy, 1969; Kennedy and Moore, 1971; Givens, 1974, p. 27-28; Berggren et al., 1978, p. 72).

Other localities: UCR 4923, UCR 4699, UCR 1, UCR 7719, UCR 1838, USGS 12632.

Occurrence: Upper Ardath Shale, San Diego County; upper Lajas Formation, Ventura County; Juncal Formation, beds containing the *Turritella wasana applinae* fauna of Givens (1974), northern Ventura County. Middle Eocene ("Domengine Stage") of southern California.

Figured specimens: UCMP 30911 (holotype); UCMP 14634 (neotype); UCR 7719/4, locality UCR 7719; UCR 1838/1, locality UCR 1838; UCR 1/601, locality UCR 1. Unfigured specimen: UCR 1/602, locality UCR 1. Material examined: ten specimens.

Discussion: On the basis of numbers of specimens, this is the best known of the three species of *Lyrischapa*. It is widely distributed in strata of middle Eocene ("Domengine") age in southern California and is particularly common in the Lajas Formation in Ventura County.

Lyrischapa lajollaensis shows some variation in height of spire; steepness of the subsutural ramp; and number, strength, and spacing of columellar folds. One young specimen (UCR 1838/1) from the Llajas Formation has evenly spaced columellar folds that diminish regularly in

strength posteriorly, similar to those of *L. harrisi*. The other specimens examined, however, have folds of variable strength and spacing. The neotype (UCMP 14634) shows remnants of a checkerboard color pattern on the body whorl. *L. lajollaensis* attains a maximum size considerably larger

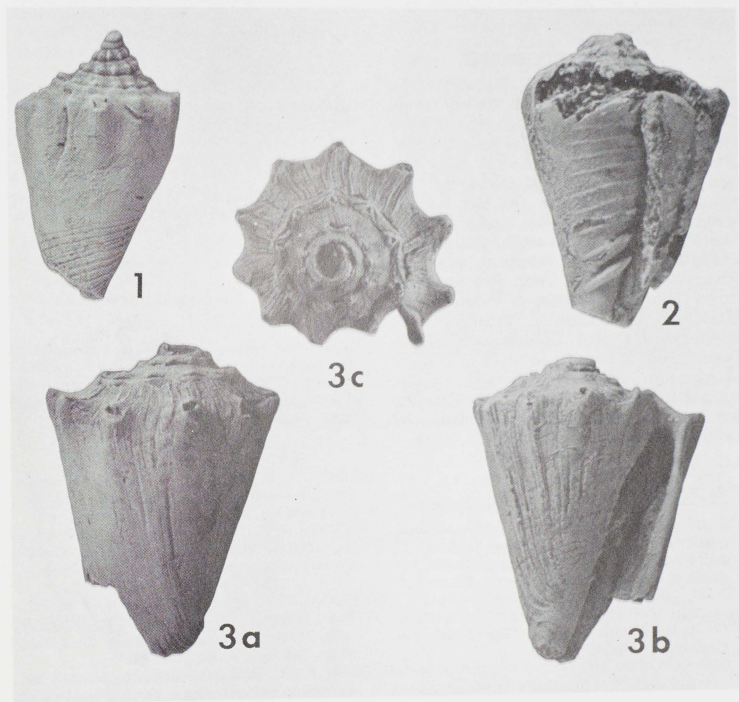


PLATE 4
(all figures $\times 2$)

- Figures 1-3. *Lyrischapa lajollaensis* (Hanna)..... 124
1. UCR 7719/4; height 24.1 mm, diameter (slightly increased by distortion) 13.5 mm.
Locality: UCR 7719. Llajas Formation, middle Eocene.
 2. UCR 1838/1; height (incomplete) 26.4 mm, diameter 18.3 mm.
Locality: UCR 1838. Llajas Formation, middle Eocene.
 3. UCR 1/601; height (incomplete) 28.0 mm, diameter 21.5 mm.
Locality: UCR 1. Llajas Formation, middle Eocene.

than is indicated by the figured specimens. An unfigured internal mold (UCR 1/602) from the Llajas Formation, lacking the tip of the spire and the anterior third of the body whorl, has a height of 52 mm and a diameter of 47 mm. The complete shell probably exceeded 70 mm in height.

Comparison of *L. lajollaensis* with *L. harrisi* and *L. chiapasensis* has been made under the discussions of those species.

ACKNOWLEDGMENTS

I am grateful to David T. Dockery of the Mississippi State Geological Survey for allowing me to examine specimens of *Lyrischapa harrisi* in his collections and for photographing these specimens. Appreciation is also expressed to the following individuals and institutions for the loan of specimens utilized in this study: Jack D. Mount, Director of Museum, Department of Earth Sciences, University of California, Riverside; Joseph H. Peck, Principal Museum Scientist, Museum of Paleontology, University of California, Berkeley; and Frederick J. Collier, Collections Manager, Department of Paleobiology, U. S. National Museum of Natural History. Finally, special thanks are due my wife Florence for her assistance in the collection and preparation of specimens for this study.

LOCALITY DATA

Tulane University Locality Numbers

- TU 907. Cook Mountain Formation, southwest corner of junction of Mississippi Highway 15 and Interstate 20, behind Texaco Station, just north of Newton, Newton County, Mississippi.
 TU 924. Cook Mountain Formation, roadcut 2.7 miles east of Mississippi Highway 15 at Newton, on road to Poplar Springs Church, Newton County, Mississippi.

University of California, Riverside

Locality Numbers

- UCR 1. Llajas Formation, east of road in Las Llajas Canyon, approx. 2 miles northeast of Marr Ranch on the first ridge northeast of spring at 1650-foot contour and approx. one-half mile due west of hill 2560, Santa Susana 15-minute quadrangle, Ventura County, California.
 UCR 1838. Llajas Formation, Member III-2, probably Las Llajas Canyon, Santa Susana Mountains, Ventura County, California.

UCR 4699. Juncal Formation, beds containing *Turritella wasana applinae* fauna (Givens, 1974), on crest of northwest-trending ridge south of the main fork of Park Canyon, 1600 ft S., 2600 ft E. of NW corner of sec. 13, T. 7 N., R. 22 W., San Guillermo 7.5 minute quadrangle (1943 ed.), Pine Mountain area, Ventura County, California.

UCR 4923. Ardath Shale, near top of unit, at lat. 32° 53' 33" N., long. 117° 15' 5" W., just below top of sea cliff at south end of Torrey Pines State Park, 335 meters south of the north end of Torrey Pines Scenic Drive, Del Mar 7.5 minute quadrangle (1967 ed.), San Diego County, California.

UCR 7719. Llajas Formation, at elevation of 1475 ft on north side of mouth of small gulley branching west from Las Llajas Canyon at spring between "Las" and "Llajas," 2750 ft south and 380 ft east of NW corner of Sec. 28 (projected), T. 3 N., R. 17 W., Santa Susana 7.5 minute quadrangle (1969 ed.), south slope of Santa Susana Mountains, Ventura County, California.

U. S. Geological Survey Locality Numbers

USGS 12632. Llajas Formation, on north side of the Simi Valley, on the east side of Las Llajas Canyon, 6850 ft South 17.5 East from Bench mark 2165, Santa Susana 15 minute quadrangle, Ventura County, California.

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 November 9, 1979

 REVIEW

READING THE ROCKS: the story of the Geological Survey of Canada, 1842-1972, by Morris Zaslow. Published by The Macmillan Company of Canada Limited, Ottawa, Canada, 1975, x + 599 pp., illus.,\$20.00

This handsome volume reviews in depth the first one hundred and thirty years of existence of The Geological Survey of Canada. In treating of the founding of the Survey and its early years, the author includes an abbreviated survey of the development of geology in Britain and America. Thus, much unexpected material is to be found within the pages of this book. The text is written in a pleasing style which adds much to its effectiveness and usefulness.

The role of Sir William E. Logan in the pioneer years of the Survey is emphasized and a color portrait of Sir William serves as the frontispiece for the work. The first section detailing the Formative Years is followed by three further sections dealing with the later history of the Survey in significant and thorough fashion. It is both comprehensive and well done.

Reading the Rocks is highly recommended for both geologists and historians of science. At the modest price of this volume, it represents quite a bargain for the interested reader.

--H.C.S.

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1965. Notes on comparison of *Eutrephoceras eyerdami* Palmer, 1961, and *Cimonia hesperia* Miller and Downs, 1950: Jour. Paleont., vol. 39, p. 155.
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- *1967. A comparison of certain Eocene Molluscs of the Americas with those of the western Tethys: Syst. Assoc. Publ. No. 7, Aspects of Tethyan Biogeography, p. 183-193.
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1977. The unpublished Velins of Lamarck (1802-1809); illustrations of fossils of the Paris Basin Eocene: Paleont. Res. Inst., 67 p., 53 pls.

REVIEW

THE GEOLOGY AND LANDSCAPES OF NEW JERSEY, by Peter E. Wolfe. Published by Crane Russack, New York, 1977, xii + 351 pp., illustrated,\$19.50

In the initial chapter of this book, the place of New Jersey in the *New Geology of Drifting Continents* is explored, including a brief historical review of *Continental Drift*, *Seafloor Spreading*, and *Plate Tectonics* concepts. The next four chapters consider the geological history of the New Jersey area Era by Era with the geologic distribution of the rocks of each segment of the geologic past and their structural and geological history. These are followed by chapters on Landscapes, Geomorphic Provinces, Landscapes of the New Jersey Highlands, Landscapes of the Piedmont Lowlands, Landscapes of the Coastal Plain, Coastal Margins and Shorelines, and finally, the Submerged Continental Margin. A glossary and an index are appended.

New Jersey has a remarkably diverse geologic rock column as well as a varied structural and geomorphic history. It provides an excellent vehicle for the novel approach of this work to geological study, and should be of substantial interest to all geologists as well as to those primarily concerned with the geology of New Jersey and environs.

--H.C.S.