PALEONTOLOGY.—*Certain pleurotomariid gastropods from the Carboniferous of New Mexico and Texas.*[1] GEORGE H. GIRTY, U. S. Geological Survey.

I. TAOSIA, A NEW GENUS OF HIGH-SPIRED PLEUROTOMARIAS WITH COMMENTS ON TAOSIA COPEI WHITE

The genus *Taosia* is based on *Murchisonia copei* White of which the original specimens were found near Taos, New Mexico, hence the new name.

Taosia possesses a combination of characters not found in any pleurotomarioid shell known to me. Indeed, my ever-helpful and erudite friend, J. Brookes Knight, tells me that he had independently marked down *Murchisonia copei* as typifying a new genus though he has generously yielded me the privilege of describing it. The following characters should be noted:

The long, slender shape; the large number of volutions (possibly as many as 15); the shape of the whorl, which is angulated about midway so that the external surface is sharply differentiated into two zones; the overlap of the whorls to a line well below the carina so that the spire is flanged like a screw; the position of the slitband, midway in the upper zone instead of on the carina; the wide slitband and short slit; the shell composed of two layers; the solid axis without even a false umbilicus; the very tenuous inner lip; the all but complete absence of sculpture. This last statement contemplates a distinction between sculpture and configuration. The carina would come under the head of configuration; the two raised lines which form the boundaries of the slitband would be structural; the delicate lines of growth are not in any true sense sculpture, and the only feature under that head would be the single revolving line on the lower surface.

Taosia is very similar to *Goniasma* in configuration (for example figures 15 to 19), but aside from numerous less significant differences it is distinguished by the position of the slitband which in *Taosia* is situated above the carina midway on the upper surface of the volution, but in *Goniasma* is situated just below the carina on the lower surface. From *Lophospira* also *Taosia* is distinguished by the position of the slitband which is situated not on the carina but above it and it is likewise distinguished by its imperforate axis, by the absence of revolving lirae (on the type species at least) and by other characters.

Taosia copei, though it has never been cited since its original description in 1881, at least in descriptive literature, is not by any means a rare species. I have collected it myself at Taos where it was originally found; it is fairly common in the McCoy formation in Colorado from which specimens were sent to me by I. A. Keyte and it is rather abundant in rocks identified as the Magdalena limestone and exposed in the western foothills of the Frank-

[1] Published by permission of the Director, Geological Survey, U. S. Department of the Interior. Received August 29, 1938.

lin Mountains north of El Paso. The specimens from the Franklin Mountains are not only abundant but in a better state of preservation than those that I have seen from the other localities. I have figured several of them to illustrate the genus and have based the subjoined comments on *Taosia copei* upon them. The rocks at Taos from which *T. copei* was described are, I believe, regarded as Magdalena limestone.

Toasia copei White Figs. 1–7

White's description which accurately covers the salient characters of *Taosia copei* may advantageously be quoted at this point, especially as the species has never appeared in descriptive literature since it was established in 1881.[2]

"Shell slender, apical angle 20° to 25°; full number of volutions apparently about fifteen, all strongly angulated, the angle being more or less distinctly carinated; carina not crenulate; angle situated nearer to the proximal than the distal border of the volutions; spiral band occupying the middle of the outer flattened side of the volutions, of moderate width, inconspicuous, and bordered on each of its sides by a raised line; the remainder of the outer surface of the volutions marked only by fine lines of growth; the proximal side of the last volution marked by one distinct revolving raised line near the carina."

"Length of adult shells from 25 to 30 millimeters."

T. copei is very abundant in my collections from the Franklin Mountains and many of the specimens are in an excellent state of preservation, though none has been observed that is not broken at the apical end and also at the aperture. Observations based on this material enable me to add some characters to those noted by White. His description allows the apical angle a variation of from 20 to 25 degrees; this is true of the common run of specimens but would hardly cover the extremes. The species attains a size considerably greater than that of the types. The final volution may have a diameter as great as 15 mm and an individual of that size is estimated to have been as long as 40 mm.

If specimens the size of the types consist of about 15 volutions, these larger specimens should probably be credited with about two more. The number given in the original description, however, seems to be excessive. The larger of the two types apparently comprises not more than 6 volutions; it is hardly conceivable that 9 volutions are lacking from the broken spire, and only a few volutions can be added at the proximal end if the length of a mature specimen is but 30 mm. Specimens in the present collection, for instance the one represented by figure 2, support the doubt expressed above. This specimen is very similar to the larger type, but is slightly less incomplete. Not more than half a volution is missing at the aperture where the shell has a diameter of 10 mm. The diameter at the broken apex is 2 mm and the actual length 24 mm. The number of volutions is 7. With an allowance for breakage the original length may be reckoned as 30 mm and with an allowance for the broken aperture the number of volutions except for

[2] White, C. A. U. S. Geol. Survey West of the 100th Merid. 3 (suppl., Appendix): XXXI, pl. 3, figs. 10a, b. 1881.

those missing in the spire, may be reckoned as 8. It does not seem likely that 7 volutions are missing from the spire, or in other words that the shell, at a diameter of 2 mm, had accomplished 7 volutions.

The most conspicuous surface feature is of course the carina which on the final volution is situated somewhat below the middle but on the turns of the spire much below the middle. The screw-like shape of the spire is a notable feature of most specimens but the flange of the screw is unsymmetrical, short and strongly oblique on the lower side, long and more gently oblique on the upper. Some variation in shape is occasioned by variation in the direction and in the width of the narrow zone below the carina.

The upper part of the volution, from the carina to the suture above, is essentially flat or faintly concave; rarely faintly convex. It is traversed by two slender raised lines which divide it into three zones of approximately equal width though the upper zone is commonly somewhat wider than the others. The middle zone, which is of course the slit band, varies considerably in width and this entails a variation in the relative widths of all three zones. A third raised line occurs on the lower surface of the volutions. The zone contained between this line and the carina is about equal in width to the zones that occur on the upper surface, being about as wide as the upper one and somewhat wider than the two lower ones, but where the lowest of the three is especially wide, the two zones, one above and the other below the carina, are of equal width. This raised line or slender ridge on the lower side of the volution is apt to be a little stronger than the two that define the slitband, and it is unsymmetrical in shape, much more sharply defined on the side facing the carina than on the side facing the axis. The volutions embrace up to this ridge more or less precisely, so that it is inconspicuous in the spire; an ensuing volution is more apt to project a trifle beyond it than to fail in reaching it. Both conditions are sometimes found in the same specimen.

The surface is practically without sculpture and marked by growth lines alone but these though fine are very distinct. They are, however, slightly less distinct on the slit band than anywhere else. Except for the slitband they show a certain periodicity, for at fairly regular intervals an incised line or stria is somewhat stronger than the rest. They are slightly arched (convex side toward the aperture) and rather strongly oblique fom the suture backward; in the slitband itself, with a sharp change in direction, they form fine regular concave arcs; below the slitband they again abruptly change direction, becoming for a distance gently convex with a slant somewhat forward, though subsequently they straighten out and pass directly to the axis. It is impossible to give the locus at which this change in shape and direction takes place, for the change is at the same time gradual and slight, but in general terms the growth lines are curved and have an appreciable forward obliquity as far as the carina, and are straight and direct from the ridge below the carina to the axis.

The axis is solid; the peristome appears to be folded back upon itself in the axial region without creating an excavation or even an obscure false umbilicus. An inner lip seems to be developed, though commonly it is little in evidence. As a rule the inner lip merely dims or obscures the growth lines within the aperture; on an occasional specimen it makes a more substantial coating. The slit was probably very short. None of my specimens is complete at the aperture, but several appear to be but slightly broken, and even on these the slit is missing; the slit-band can be traced to the broken edge of the peristome.

The shell consists of two distinct layers, a fact which is very conspicuous in many of the specimens from the Franklin Mountains. In these specimens the outer layer has a polished look and a brownish color which, upon closer examination, is found to be a mottling of light brown and black. The growth lines also, though fine, are very clear. Where this outer layer is removed as it is entirely on some specimens and over parts of others, the inner and thicker layer is seen to be lusterless and almost black; it fails to retain or retains but faintly the lines of growth so that on specimens of this sort and on many specimens from other areas, it would be difficult to recognize the slitband as such and consequently the relation of these shells as belonging to the Pleurotomariidae. The type specimens together with other specimens that I have seen from Taos and also the specimens from Colorado are black and show the growth lines less clearly than those from the Franklin Mountains. I have not been able to satisfy myself whether they have lost the superficial layer or are merely not quite so well preserved. The latter explanation seems the more probable one.

Horizon and locality.—Magdalena limestone: Taos, New Mexico (station 6687); McCoy, Colorado (station 8606); 8 miles southwest of Vinton, Texas (station 7067) and other localities in the foothills west of the Franklin Mountains.

II. SOME HIGH-SPIRED PLEUROTOMARIAS FROM LA LUZ CANYON, NEW MEXICO

Rocks that have been classed as Magdalena limestone in various parts of New Mexico contain unlike faunas and may not have been deposited contemporaneously. In the first instance we have the typical Magdalena in the district of that name; in passing up the Rio Grande valley faunas of a different facies are found at Santa Fe and still more different ones at Taos; to the southeast rocks called Magdalena occur in the Sacramento Mountains and others still farther south in the Franklin and Hueco Mountains of Texas. Some of the faunal differences encountered in these different areas will probably prove to be provincial and due to selective environment, but I believe that age differences are also indicated.

In the Sacramento Mountains in La Luz canyon there is a considerable thickness of limestone and shale which seems loosely to have been classed as Magdalena but which contains a fauna different from the typical Magdalena and which is, if I am not mistaken, younger. The fauna in question is dominated by the gastropoda and appears to be related to some of the Cisco faunas of central Texas. It is remarkable for the number and variety of high-spired pleurotomarias such as were formerly classed in the genus *Murchisonia.* These shells came within the purview of collateral studies undertaken in connection with the new genus *Taosia.* I do not recall ever having seen these elongated pleurotomarias in such abundance and was interested, in view of the general similarity of their appearance, to find that they

belong to three distinct genera, *Goniasma*, *Phymatopleura* and *Taosia*. The facts seem of sufficient general interest to be made a matter of record.

Before leaving this subject I may mention that the shale near Tularosa which furnished the cephalopods described by Boese[3] and later by Miller[4] belong to this same series of rocks. Both writers believe, and in my opinion quite rightly, that the cephalopods indicate a Pennsylvanian age. Boese, for some reason, thought that the beds at Tularosa represented the Abo sandstone and on that ground challenged the Permian age of the Abo. The Permian age of the Abo was never too secure and the formation may prove to be Pennsylvanian, but not on the evidence advanced by Boese. So far as I am aware, the typical fauna of the Abo (at the entrance to Abo Canyon) does not contain a single species in common with the fauna of the shale at Tularosa and especially contains none of the cephalopods on which the Pennsylvanian age of the Abo was predicated; and it seems strange to set up a claim that the Abo was Pennsylvanian instead of Permian on the evidence of fossils that did not come from any recognized outcrop of the Abo but were found in rocks at a remote locality and associated with a fauna quite different from the Abo fauna. It is probable that Boese did not know about the difference of faunal association in one sense, but he must have known that none of the species which led him to think that the Abo was Pennsylvanian in age had been identified in an Abo fauna.

Taosia percostata n. sp. Figs. 12–14

Shell of moderate size, very long and tapering, composed of a large number of angulated volutions. Spire much constricted at the suture to which the surfaces of the volutions converge from the angulation. Specimens are not rare, although owing doubtless to their slender shape, all of those examined are fragmentary. The largest seen does not have a diameter at the aperture as great as 10 millimeters. The length, the number of volutions, and other characters which are to be ascertained only from complete specimens, cannot be given.

In the final volution the angulation is situated at about the mid-height and it is reinforced, as of course it is in all the other volutions, by a carina which may be stout and rounded or more slender and angular. The surface between the suture and the carina is slightly concave with a steep descent from above. The surface below the carina is rounded and it has a fairly strong inward slope to its union with the solid columella. In the spire the carina is situated well below the middle of the exposed portion of the volutions, the long slope above having a steep descent and the short slope below passing more strongly inward. The almost flat upper surface of the volution is divided by two revolving lirae into 3 zones which are of about equal size

[3] BOESE, EMIL. Am. Jour. Sci. (4) 49: 51–60. 1920.
[4] MILLER, A. K. Jour. Pal. 6: 59–93. 1932.

though the median one is apt to be somewhat the widest and the one below the suture somewhat the narrowest. The upper of the two lirae may be poorly developed or possibly even undeveloped, especially on some of the earlier volutions. The lower one, on the contrary, is regularly present. The lower surface of the last volution is rather coarsely and strongly striated, being marked by 5 or 6 stout revolving costae, separated by deep and somewhat wider grooves or striae. The volutions embrace to the second spiral costa below the carina, the top of which can be distinguished in many specimens as a slight projection above the suture. Transversely the surface is marked by fine growth lines which tend to form slender fascicles, although these are inconspicuous except on the lower surface where they may be sufficiently strong to produce nodes in places on the revolving costae.

The slitband is, with little doubt, the lowest of the 3 zones on the upper surface, that which is just above the carina. The growth lines descending from the suture have a backward slant and also a backward curve as they near the spiral lira that forms the upper boundary of this zone. Similarly on the lower surface of the last volution the growth lines are gently convex toward the aperture, and have a rather strong backward obliquity to, and apparently onto, the carina. The growth lines, which everywhere else are rather distinct, become fainter near the boundaries of this zone which itself rarely shows any markings at all. The inference is fairly strong from the deflection of the growth lines above and below it, that this zone is, in fact, the slitband, and the inference is strengthened by very rare occurrences there of growth lines that are distinguishable and that make characteristic concave arcs. The upper boundary of the slitband, then, is formed by the first revolving lira above the carina. The slitband does not, on the other side, extend to the edge of the carina but it is there as if abruptly depressed below a narrow elevated rim.

The upper surface of the volutions in this species shows a most deceptive resemblance to that of *Taosia copei*, but in *T. copei* the slitband occupies the median of the 3 zones into which the upper surface is divided, whereas in *T. percostata* it occupies the lowest zone. I am not sure that this should not constitute a subgeneric difference. In other respects, too, the species show marked differences. *T. percostata* has 5 or more spiral costae on the surface below the carina, whereas *T. copei* has but one. It also exposes a broader surface below the carina in the volutions of the spire, and that surface is divided by a stout revolving costa, whereas the corresponding part of *T. copei* is not only narrow but smooth. These differences contribute to make the shape of the shell as a whole markedly different in the two species, the present one being conspicuous for the depth of the spiral constriction at the bottom of which lies the suture. In shape *T. percostata* much more closely resembles the associated species *T. crenulata* and *Goniasma lasallensis*, but all three have such marked peculiarities in one or more details that with identifiable specimens there is no danger of confusion.

Horizon and locality.—Magdalena limestone (?); La Luz canyon, east of La Luz, N. M. (station 6686).

Taosia crenulata n. sp. Figs. 8–11

Shell rather large, very elongate, strongly turreted. Volutions probably 10 or more, though complete specimens are unknown. Spire perhaps twice as high as the final volution. Spiral angle variable, some specimens being very long and slender. Volutions strongly angulated, giving the shell a conspicuously helicoid shape. The angular periphery of the volutions forms a

crenulated carina which may be very prominent and in the final volution is situated at about the mid-height but in the spire divides the visible part of the volutions very unequally—the lower part being much narrower than the upper.

The upper surface of the final volution is essentially planate and descends more or less steeply from the suture. It is traversed by two raised spiral lines defining the slitband. The three zones created in this way are of nearly the same width though the upper zone is apt to be a little wider than the slitband and the lower zone a little narrower. It is commonly somewhat concave spreading out to the carina.

The lower surface of the final volution is about equally divided between an upper part which is flat, depressed, and smooth and a lower part which is gently convex and coarsely costate, both parts descending with about the same inward obliquity until the lower one joins the solid columella. The costate part of the lower surface bears about five rather widely spaced revolving costae, of which the highest is especially large and strong and the lowest small and weak. The upper smooth part of the lower surface appears depressed because of its position between the prominent carina above and the first strong revolving costa below. The volutions overlap to the lower margin of the flat depressed zone, and the prominent costa below it is rarely distinguishable in the spire.

The surface, aside from the two raised lines on the upper surface that contain the slitband and the costae on the lower part of the lower surface (not visible on the spire), is practically devoid of spiral markings. Some specimens, however, develop an inconspicuous spiral line or faint angulation between the slitband and the suture. This feature may make its appearance on the later whorls without being distinguishable on the earlier ones of the same specimen. Sporadically, also, for it has been observed on only one specimen, a few fine irregular spiral lirae may be developed on the upper or sunken part of the lower surface and visible thus on the spire.

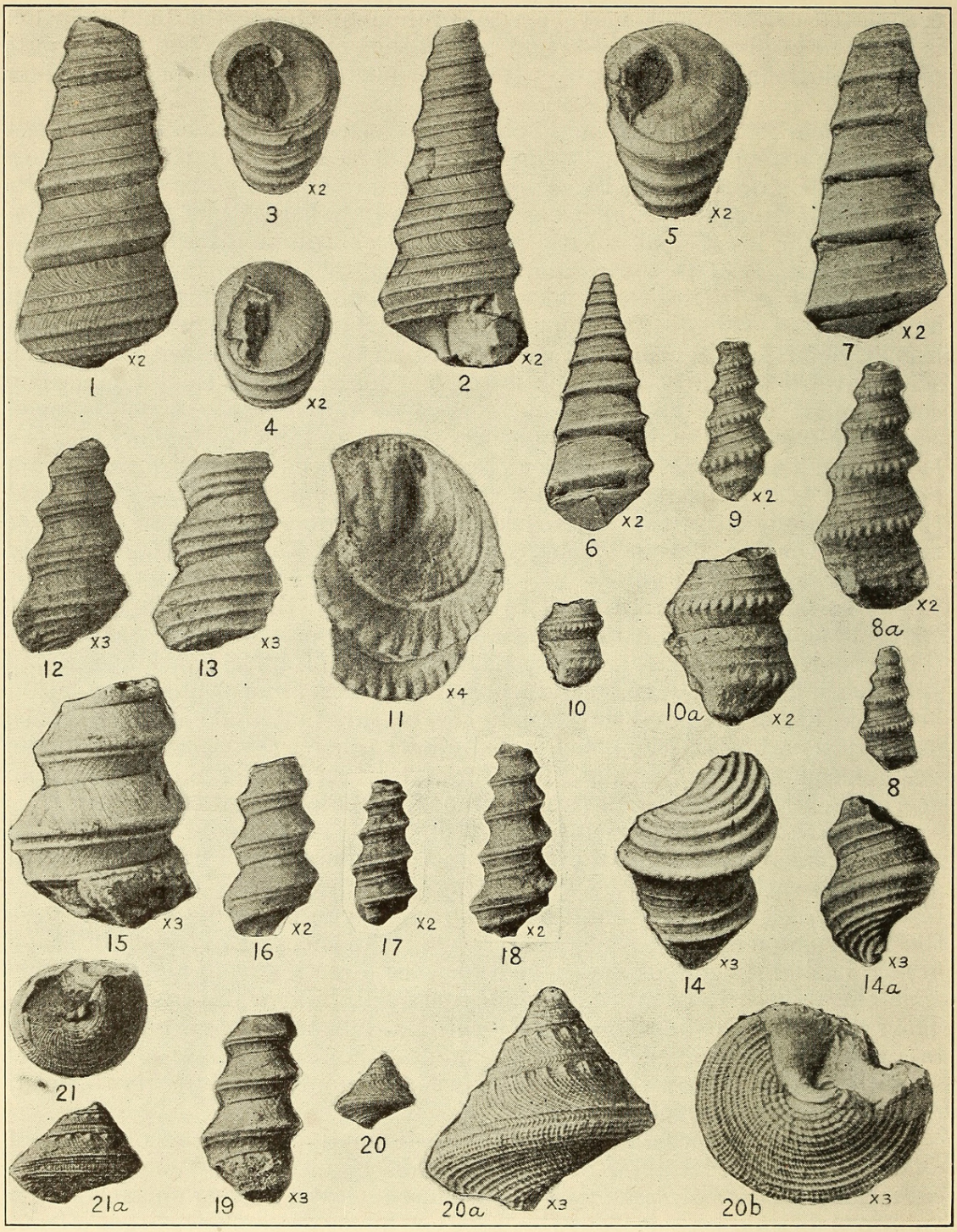
Transversely the surface markings consist of incremental lines which have at first a gentle convexity and a strong backward slant. They are rarely distinguishable in the slitband but where they can be made out they have the usual shape of short concave arcs. From the slitband to the carina they are again slightly convex and have a forward direction from above. On this zone the growth lines are more or less strongly and regularly fasciculate. The fasciculation is but slight at the slitband but near the carina it rapidly becomes very strong, producing the nodes or coarse strong crenulations above described. Below the carina the fasciculation is again greatly reduced, the fascicles being regular but weak.

It hardly seems necessary to specify the distinctive characters of *T. crenulata.* The nodose character of the carina distinguishes it at once from *T. copei* and from *T. percostata;* in addition, the costate lower surface of the volutions distinguishes it from *T. copei* and the position of the slitband from *T. percostata. T. crenulata* like *T. percostata* developed costae on the lower surface of the volutions but apparently the development differed materially in detail.

Horizon and locality.—Magdalena limestone (?); La Luz canyon, east of La Luz, New Mexico (station 6686).

Genus **Goniasma** Tomlin

When I propose the generic name *Goniospira* in 1915 the facilities for ascertaining names that were not available through preoccupation were not



Figs. 1–7.—*Taosia copei* White. Figs. 1–5. Five specimens from the Magdalena limestone (?) of the Franklin Mountains. These specimens show the growth lines very clearly. The photographs have been retouched but this character in figs. 1 and 2 has not been exaggerated. The original of fig. 2 has proportions similar to the larger of the two cotypes. Figs. 3, 4 and 5 show the basal surface of the final volution and the imperforate columella. Fig. 5 shows well the revolving lira on the lower surface of the final volution; it can also be seen in figs. 1 and 2. Fig. 2 appears to have a second lira, but the lower one is merely the broken edge of a volution that has been lost. The original of fig. 3 shows the inner lip more clearly than most specimens. It is thin but sufficient to conceal the growth lines along a very distinct line; the deposit is darker than the superficial layer and of the same tint as the inner layer of the shell. If the

what they are today. It seems that *Goniospira* had been used by Cossman in 1895 and by Donald in 1902 so that availing himself of this fact Tomlin[5] in 1929 proposed *Goniasma* as a substitute. The following species, *Murchisonia lasallensis* Worthen, which was made the genotype of *Goniospira* remains the genotype of *Goniasma*.

[5] TOMLIN, J. R. LEB. Malac. Soc. London, Proc. **19**: 22–24. 1929.

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basal part of the specimen is regarded as a circle, the inner lip occupies about one-sixth of the circumference from the line of matrix. This character is not brought out in the illustration. Figs. 6, 7. Unretouched photographs of the two cotypes from Taos, N. M., made by J. Brookes Knight, who sent me the prints here published. The cotypes have apparently lost the epidermal layer or at all events do not show the lines of growth at all clearly.

Figs. 8–11.—*Taosia crenulata*, n. sp. Four specimens from La Luz Canyon, N. M. The slitband is situated between the two spiral ridges on the upper surface of the whorls of the spire, the surface lying between the suture above and the nodose carina below. The growth lines slope backward to this zone from above and from below but the concave lines on the slitband are obscure or not visible at all. These features are shown by the originals of figs. 8 and 10. The original of fig. 8 has a faint auxiliary lira a short distance below the slitband and at least 2 fine and faint lirae on the surface between the carina and the suture below. Fig. 11 shows the lower surface of the final volution with its solid columella and spiral lirae. The large spiral lira may be compared to the one similarly placed on *Taosia copei*.

Figs. 12–14.—*Taosia percostata*, n. sp. Three specimens from La Luz Canyon, N. M. These specimens have only one regular revolving lira on the whorls of the spire between the suture above and the carina below and on the original of fig. 13 the carina is not much the larger of the two. This specimen has a faint auxiliary lira which is not well shown by the figure a short distance below the suture. In fig. 14 a corresponding lira is shown, but the regular lira forming the upper boundary of the slitband is hardly visible due to the prominence of the carina and the foreshortening of the surface immediately above it. The growth lines slope backward to the regular revolving lira which marks the upper limit of the slitband; the lower limit is indistinct but is on or just above the top of the carina. The slitband here is above the carina as it is in *Taosia copei* but instead of being situated about midway in the upper surface it occupies the lower third. Fig. 14 shows the strong spiral costae on the basal part of the final volution.

Figs. 15–19.—*Goniasma lasallensis* Worthen. Five specimens from La Luz Canyon, N. M. In this species and genus the slitband has a position corresponding to that of *Taosia percostata*, except that it is just below instead of just above the carina. The growth lines slope backward from below (well shown by the originals of figs. 15 and 16) and apparently come to an end at the spiral costa below the carina which forms the lower limit of the slitband. Its upper limit is indistinct but is situated upon the crest or just below the crest of the carina. The growth lines on the upper surface of the volution bend backward near the carina and can be traced to its crest. The lower surface of the final volution has a prominent angulation or lira somewhat as in *Taosia copei*. Fig. 17 should be more strongly angulated.

Figs. 20–21a.—*Phymatopleura brazoensis* Shumard. Figs. 20–20b. Three figures of a specimen from the Wayland shale, near Graham, Texas (station 7442). This specimen has about 13 spiral lirae on the lateral surface with about 3 additional ones on the nodose ridge below the suture. This is only one of numerous varieties that can be found in a large collection. Fig. 20b shows how the "inner lip" is really a resorbed area. The sculpture at the left comes to an end abruptly along a well defined line at or near the aperture while the smooth area to the right stands at a lower level. Figs. 21–21a. Two views of a specimen from the upper part of the Graham shale at Graham, Texas. In this specimen the nodes are farther apart and the slitband has an auxiliary lira below the median one so that the lower half of the slitband, in that degree, appears to be a part of the under surface.

Goniasma lasallensis Worthen

Murchisonia lasallensis. Worthen, Illinois Geol. Survey, Rept. **8**: 141, pl. 25, figs. 7, 72. 1890. Upper Coal Measures: LaSalle, Ill.

Worthenia? lasallensis? Girty, U. S. Geol. Survey, Prof. Paper **16**: 457. 1903. Hermosa formation: San Juan region, Colo.

Goniospira lasallensis. Girty, Missouri Bureau Geol. & Mines (2) **13**: 356, pl. 30, figs. 7–8a. 1915. Lansing formation: Kenmoor, St. Joseph, Weston, Leavenworth, Lansing, Iatan and Smithville, Mo.

It was perhaps somewhat rash to correct Worthen's description on the strength of my specimens without having seen his, but his description is evidently deficient in details that are apparently shown by his figures as well as being self-contradictory. The corrections which I ventured to make concern the features described in these terms. "On the last volution there is a flattened band below the carina which is bounded below by a slight elevation." The form from Missouri that I referred to *G. lasallensis* and consequently the one on which the genus *Goniospira* was in the final analysis based answers to this description except that in my form both the carina and the elevation below it are double. That is, the carina has a revolving lira a short distance below it and the "slight elevation" is formed by two revolving lirae separated by a narrow groove. In Worthen's schematic figure each of these features is represented by a double line. This suggests that each line represents the top of a ridge and as such an interpretation agrees with the character of my form, it seems to be the correct one. Each pair of lines, however, may be intended to outline a single ridge. One important omission in Worthen's description is his failure to specify the location of the slitband. As the slitband so commonly occupies the carina in the Pleurotomariids, perhaps such a position is implied. The slitband in my form does indeed occur there but it is not situated on the carina which is angular but just below it, its lower boundary being formed by the revolving lira that accompanies it. Worthen's reference to a "flattened band" in the passage quoted above and his failure to mention the slitband in any other way led me to believe that that expression was intended to designate the slitband. This probably was a misconception. Worthen also says, "Neither the flattened band nor the elevation below it extend to the other volutions." This is certainly not true of my specimens and it obviously is not true of Worthen's for it is contradicted by his figures and by another part of his description in which he says that the volutions "are separated by a profound suture." The expression just quoted agrees with his figures which represent the shell as being screw-like in shape, the lower side of each angulated whorl of the spire being nothing else than the aforesaid "flattened band." If the flattened band did not show in the volutions of the spire the volutions would embrace to the carina, and the spire would have smooth sides instead of being made sinuous by a deep constriction. In the form on which the genus Goniospira was based the volutions embrace to the paired lirae on the lower surface.

A species which can be identified with *Goniasma lasallensis* is very abundant at one locality in La Luz Canyon but as the specimens are considerably broken up their abundance is somewhat exaggerated. I have been unable to find any constant difference between the specimens from New Mexico and those from Missouri which I described in 1915. As compared with Worthen's figures of the type, some of them appear to be more slender and many appear to have the constriction in which the suture is situated considerably deeper

so that the sides of the spire are correspondingly more uneven. A few of these specimens developed a spiral thread on the lower surface of the volutions, midway between the slitband and the paired lirae below, on Worthen's "flattened band," that is.

In examining these specimens from New Mexico especial attention was directed to the slitband which is somewhat peculiar in not being as sharply defined as the slitband of most pleurotomarias and in lacking these lunettes or regularly spaced, concavely arched transverse lamellose lines by which the slitband is so commonly distinguished. The slitband is of course distinctly defined on its lower side but not on its upper, except by the angular or, in many specimens, rounded edge of the carina. Its identity, however, is shown by the deflection of the growth lines. As they descend from the suture, the growth lines are essentially straight and have a slight backward slant which, however, increases near the carina, giving them a curved appearance. They are apt to be faintly fasciculate in the upper part and to become somewhat less distinct below though on many specimens they can be seen running out onto the upper surface of the carina. Coming up from the suture below, the growth lines are also distinct to the revolving lira below the carina, but not beyond. They are nearly straight and commonly have a very pronounced backward slope toward the carina. Thus, it will be seen that the slitband as represented by the narrow channel between the carina and the lira below it, often fails to show even growth lines, though where they can be distinguished they have the characteristic shape of concave arcs. As stated above, while the slitband is not bounded on its upper side in the same way as on its lower, and to some extent does not appear to have a sharp boundary at all, many specimens show an incised line on the carina either following the crest of the carina or more commonly following a line just above the crest. Where most distinct this incised line on the carina is similar in appearance to the suture at the bottom of the constriction above, but on a smaller scale. The backwardly-curved ends of the growth-lines can sometimes be traced to this boundary at which they appear to terminate. This feature has been observed on so many specimens that I am inclined to believe it to be a constant one, with this qualification; it is most commonly observed where the carina is thick and rounded as the carina is apt to be on the larger whorls, and it is doubtfully to be observed where the carina is thin and sharp as the carina commonly is in the smaller ones. Accordingly, it would be a character that developed toward maturity. I am also inclined to believe that this incised line marks the real boundary of the slitband. The inference may possibly be drawn that as the shell increased in age the deposits at the slit, which create the slitband, became thickened, but thickened unequally, with the greatest accumulation in the upper part and that the size of the carina was increased by this accumulation.

Locality and horizon.—Magdalena limestone (?); La Luz canyon, east of La Luz, New Mexico (station 6686).

III. PHYMATOPLEURA, NEW GENERIC NAME, WITH COMMENTS ON P. BRAZOENSIS (SHUMARD)

When I proposed the generic term *Orestes* in 1911[6] for certain Pleurotomarioid shells, my investigations into nomenclature, which

[6] GIRTY, G. H. New York Acad. Sci., Annals **21**: 136. 1911; also U. S. Geol. Survey, Bull. **544**: 155. 1915.

were sincere but not comprehensive, indicated that the name was not preoccupied and the unusual character of the name itself, which was meant to commemorate the work of Orestes St. John, seemed a certain guarantee that it was not. My good friend J. Brookes Knight warned me some time ago that *Orestes* was preoccupied as a generic name and in fact I find that it had been used by Blackiston and Pryer, as long ago as 1880 and again by Redtenbacher in 1906. I take this opportunity, therefore, to propose *Phymatopleura* as a substitute with of course the same species, *Orestes nodosus* as the genotype.

I did not at the time know of, nor have since then come upon, any other species that could certainly[7] be grouped with *Orestes nodosus* except a little known species from Texas described by Shumard as *Pleurotomaria brazoensis*. It seems appropriate in this place to give a supplementary account of *Phymatopleura brazoensis* which was poorly described without illustrations.

In establishing *Orestes nodosus* as a new species, I compared it with *Pleurotomaria brazoensis*, using not only Shumard's description of that species but specimens from the Cisco formation that seemed to belong to it. The species from the Cisco that was employed in those comparisons is clearly the one that Plummer and Moore later figured as *Orestes brazoensis;* and not only is it certain that we are dealing with the same species, but it is almost equally certain that we are dealing with the species which Shumard described and which has lain for so long unrecognized.

With specimens from the original locality and horizon the species can be identified with reasonable certainty but not otherwise. Consequently we find Meek in 1866 and Keyes in 1888 referring to *P. brazoensis* forms which were not only distinct from that species but distinct from each other. Meek's form is now known as *Pleurotomaria intertexta;* that of Keyes, so far as I am aware, is without a name. The figures given by Plummer and Moore show the general character of *P. brazoensis* but they are too small to show the sculpture in detail. Their figures were unaccompanied by a description just as Shumard's description was unaccompanied by figures and as Shumard's description is hard to come by (the work in which it was published being now rare) and as Plummer and Moore's figures are somewhat inadequate, it will be helpful to supply what seems to be lacking in each. Shu-

[7] It is not improbable that the *Pleurotomaria brazoensis* of Meek now known as *Pleurotomaria intertexta*, less probably the *Pleurotomaria brazoensis* of Keyes also belong under *Phymatopleura*. I have not, however, examined specimens of either species. Even if congeneric, however, both of them seem to be distinct from either *P. nodosa* or authentic *P. brazoensis*.

mard's description will be found below and the synonymy which precedes it comprises all the legitimate citations of the species.

Phymatopleura brazoensis (Shumard)

Pleurotomaria brazoensis. Shumard, St. Louis Acad. Sci. 1: 624. 1860. Coal Measures: Young Co., Texas, near Indian Reserve.

Orestes brazoensis. Girty, U. S. Geol. Survey, Bull. 544: 158. 1915.

Orestes brazoensis. University of Texas, Bull. 2132: 151, pl. 22, fig. 16, 16a. 1921. Graham formation (Wayland shale); South of Gunsight (loc. 80.2), Texas.

Shell small, conical, height a little greater than the width; spiral angle 67°; volutions about seven, flat or slightly concave, marked at base with two revolving carinae, between which occurs the band of the sinus; lower carina the larger and rounded; under surface of last volution somewhat tumid in the umbilical region, and flattened towards the periphery; suture depressed, linear; aperture subquadrate; columellar lip deflected above and partially closing in the umbilicus, which is very small; surface of volutions ornamented with from thirteen to fourteen rather strong, filiform striae, which are crossed by sharp transverse striae, giving to the surface a handsome, crenulated appearance; upper margin marked with a row of rather prominent lengthened tubercles; band of sinus moderately broad, excavated, having a single revolving line, and numerous arched transverse striae, corresponding in size to those above the band.

Length, 0.32; width, 0.29.

Formation and locality.—Young County, near the Indian Reserve. Found in bluish-gray marl, associated with *Myalina subquadrata, Chonetes mesoloba, Straparollus catilloides, Fusulina,* and other characteristic fossils of the Coal Measures. Texas State collection.

Shumard, I suspect, intended to write "cancellated" instead of "crenulated" in the above description (see also a comment by Meek) and he leaves the reader in doubt whether the "thirteen to fourteen" striae represents the total number on both the lateral and lower surfaces or the number on only one surface—if so, which? As he says that these striae are to be seen on the surface of the volutions (note the plural) and as only the lateral surface is to be seen on any volution but the last, it seems probable that he was ascribing 13 or 14 striae to that surface alone. This also agrees with his description of the surface as cancellated (if that was actually what he intended to say) for that term is very descriptive of the lateral surface but is much less applicable to the lower surface. Aside from this his description is quite accurate though, as it proved, hardly specific enough to prevent misinterpretation for neither Meek's form nor Keyes' closely resembles true *P. brazoensis.* The description is unsatisfactory chiefly in what is omitted in the way of detail and of the range of variation, for a good suite of specimens such as can be obtained with little difficulty (the species seems to be not uncommon in the general region and at the general horizon from which it was described) discloses that specimens which must be included in the species can differ rather widely. My own observations, which are sum-

marized in the following paragraphs, are based upon about 100 specimens of all sorts.

In the final volution the slitband is broad, oblique, and situated on the periphery which is at about the mid-height. The surface above is oblique and more or less concave, spreading outward near the slitband and ending in a knife-edged ridge which forms the upper boundary of the slitband. The surface, coming up from below, rounds inward slightly to inclose the slitband on its lower side; the slitband thus does not appear to be bounded below by a sharp ridge or lamella as on the upper side. In such specimens the most prominent part of the volution occurs just below the slitband. Sometimes, however, the surface just below the slitband, instead of being sharply rounded and prominent, retreats almost immediately and then the slitband appears to be bounded by a knife-edged ridge below as well as above. The volutions embrace almost to the slitband so that the suture has above it a very narrow and slight prominence, the peripheral region of the preceding volution, and below it a wider and more prominent ridge formed by the upper part of the volution following.

The feature last mentioned varies almost from specimen to specimen. In its most intensified form it is a well marked, broad, rounded ridge with additional elevations at short and regular intervals. In its least development both ridge and nodes are almost, if not entirely, obsolete. This, however, seems to be a condition of old age and it has been observed only on the final volution of a few specimens whose earlier volutions are marked in the normal manner.

The swollen zone below the suture may be broad or narrow and high or so low as to be hardly signalized at all except by the nodes that rise from it. The nodes may be rounded and hemispherical but more commonly they are somewhat elongated and compressed so as to be subangular on top. At the opposite extreme they are very thin and high, as if formed by one of the transverse lirae which, at a definite point below the suture, abruptly becomes thick and prominent. The nodes vary not only in shape but in strength and in spacing. They may be close together or much farther apart, and very conspicuous or very subdued, though always a feature sufficiently pronounced to attract the eye.

The side of the volution between the nodiferous zone and the slitband is marked by fine, regular transverse and revolving lirae of nearly equal strength and spacing, which make a regular reticulate ornamentation. On some specimens the intersection of these cancellating lines is marked by fine raised points, like short spinules, and probably this is a regular feature, though one not commonly preserved.

Three or four of the spiral lirae occupy the swollen or nodose zone below the suture and these are commonly somewhat coarser than the rest; indeed, they may be much coarser. On the remainder of the lateral surface the number of spiral lirae may vary from about 10 to almost 20. Where the number is exceptionally large it may be attributed to the introduction of interstitial lirae, the character of which is occasionally suggested by their smaller size; this tends to create a sort of irregular alternation, though any pronounced alternation in size is exceptional. The difference in scale between the coarsely and finely striated shells is so marked that if extreme examples of each were found without intermediate forms and especially if found at different localities, they would undoubtedly be regarded as belonging to different species. The spiral lirae are commonly slender and rounded, but may be appreciably

stouter with a corresponding difference in spacing in which, of course, number also plays a part. The transverse lirae are thinner than the spiral ones, much like low, vertical lamellae. They may be spaced at the same intervals but may be much more closely arranged. Normally, however, the spiral lirae are numerous and essentially uniform in size, the transverse lirae slightly thinner and spaced at the same intervals, and the result a very regular and very fine cancellation.

Typically the slitband contains a single revolving lira, which may be very slender or relatively stout. Not uncommonly a second smaller lira is developed above or below the median one (as in figure 21a) and in a few specimens an additional lira is developed on both sides of it. The three lirae may be equal in size but more commonly the median one is the largest. Transversely the slitband is crossed at regular intervals by short slender raised lines in concave arcs, which in crossing the spiral lira (or lirae) create very small nodes. The transverse lirae in the slitband are rather commonly spaced at appreciably wider intervals than those on the lateral surface. On some specimens they are irregular in size and spacing, as if by intercalation, and where this occurs they may be more closely arranged than the transverse lirae above.

The basal surface is marked in much the same way as the lateral surface, only more coarsely, especially as regards the spiral lirae. These are on the whole thicker than the revolving lirae of the upper surface and are subject to greater inequality in size. Some of the large ones may be very large and some of the small ones very small and sometimes a more or less regular as well as a strong alternation in size can be observed. In number the revolving lirae may reach 20 or more. Although the lower surface is somewhat broader than the lateral surface and although it may not have many more revolving lirae, it appears more coarsely as well as more irregularly lirate because the lirae are thicker, and, where especially thick, they are rather crowded. A few lirae (4 more or less) on the sharply curving surface below the slit band are generally subequal in size and not so large as the larger ones on the rest of the lower surface while a few near the false umbilicus may attain a relatively enormous size.

The transverse lirae are thin and lamellose like those of the lateral surface and on the same specimen they have about the same spacing on both. A comparison in this item is difficult, however, because the transverse lirae above the slitband have to contract much less in passing upward to the suture than those below the slitband do in passing inward to the axis. Just below the slitband they may be larger and more widely spaced than they are just above it (or on the other hand, essentially the same in both respects), but shortly are reduced to or remain at parity. In crossing the lower surface to the axis they not only become finer but draw together with a tendency to coalesce.

As they converge toward the axis they become more or less strongly fasciculate and give rise to correspondingly large strong nodes on the exceptionally large spiral lirae that occur there.

The characters not touched upon are chiefly generic. The axis seems to be imperforate, though the inner lip is thickened and reflexed to form a small false umbilicus. Instead of an inner lip the surface markings are resorbed so that the surface within the aperture is smooth and slightly depressed below the sculptured surface outside of it.

It was probably this species which I cited as *Pleurotomaria Brazoensis* in

listing the collections made in Missouri by Hinds and Greene.[8] The specimens so identified are fairly numerous but most of them are so incrusted that their characters are imperfectly shown. These and other similar specimens from Oklahoma which I have seen at first appear to be distinct from *P. Brazoensis* by reason of their finer sculpture but they are also of a correspondingly smaller size. The general features appear to be about the same. Specimens from Texas vary so much in their sculpture that some do not differ materially from those from Missouri, and the specimens from Missouri differ from each other in this feature or in that. If the Missouri form is regarded as specifically distinct from the Texas forms there are differences in the content of each which are apparently equal in significance to the differences between them.

PALEOBOTANY.—*The fruit of* Trapa? microphylla *Lesquereux.*[1]

ROLAND W. BROWN and EDGAR HOULDSWORTH.

The complete four-parted rosettes of floating, compound leaves as well as the detached leaflets of plants purporting to be a species of water chestnut or caltrop called *Trapa? microphylla* Lesquereux, have long been known from Cretaceous and Eocene strata of the western interior of North America.[2] The surfaces of some slabs of rock, notably those from the Fort Union formation (Eocene) at Burns Ranch, 30 miles down the Yellowstone River from Glendive, Mont., are covered with them. Although much leaf material has been collected from this and numerous other localities in Wyoming, Montana, and Canada, none, until recently, was found with fruit attached. The specimens displaying fruit that are reported here were found in 1936 by Mr. Edgar Houldsworth of Regina, Saskatchewan, Canada, in the Ravenscrag formation (Eocene) cropping out in sec. 4, T. 2, R. 22 west of the 2nd meridian, in the Big Muddy Valley region of southern Saskatchewan.

The finding of these specimens with fruit attached establishes the affinity of numerous detached fruits that were found in previous collections but whose identity remained a mystery. Some of these have been figured and described as *Carpolithus*, *Viburnum*, *Nyssa*, etc. It is, however, not our purpose to give a synonymy of these species at this time.

The fruit of *Trapa? microphylla* averages 1 cm in length, is ovoid, the apex being slightly elongate and emarginate or cut at the end

[8] Missouri Bureau of Geology and Mines (2) **13**: 305. 1915.

[1] Published by permission of the Director, Geological Survey, Department of the Interior. Received November 21, 1938.

[2] E. W. BERRY has recently summarized the history and knowledge of this species in Geol. Survey Canada Mem. **182**: 61–64, pl. 19, figs. 1–11. 1935.