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Autor: Miller, A.K. / Thompson, M.L.
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Beiträge zur Kenntnis tropisch-amerikanischer Tertiärmollusken.

VI. Some Tertiary Nautiloids from Venezuela and Trinidad.[1])

By **A. K. Miller** and **M. L. Thompson**, Iowa City.

With 4 plates (VII—X) and 3 text figures.

Contents.

I. Introduction.

Through the courtesy of Dr. R. Rutsch we have been permitted to study six collections of South American Tertiary nautiloids which are the property of the Museum of Natural History of Basel. Two of these collections, which were made by Drs. H. G. Kugler and E. Lehner, came from the " Paleocene " of Trinidad, whereas the other four, which were made by Drs. O. Gutzwiller, H. G. Kugler, P. Meesmann, A. Senn and C. Wiedenmayer, came from the uppermost Eocene and the Miocene of Venezuela. Altogether the collections contain twenty-two specimens, most of which are fairly complete and rather well preserved. Insofar as we have been able to ascertain, this is one of the finest assemblages of South American Tertiary nautiloids that has been brought together, and we wish to take advantage of this opportunity to express our sincere thanks to Dr. Rutsch for entrusting us with such valuable material.

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[1]) For No. V, see Eclogae geol. Helv. 29 (p. 187) 1936.

Although locally nautiloids are abundant in the Eocene of Trinidad, they seem to have escaped the attention of the early paleontologists who visited there. However, in 1926 HARRIS (28) figured (but did not describe) two forms from that island. One of these he identified as *Hercoglossa ulrichi* (WHITE), whereas the other he referred with question to *H. peruviana* BERRY. Two years later LIDDLE (10) also mentioned the occurrence of the first of these two species in Trinidad.

The specimen which HARRIS figured as *H. ulrichi* came from the Soldado formation (basal Eocene or " Paleocene ") at Marac Quarry, in the south-central part of Trinidad. HARRIS states that this form is very abundant in the limestone at that quarry, and we have nine specimens from there, all of which appear to be conspecific with the one figured by HARRIS. Also, we have a large worn specimen from San Fernando, about 20 miles northwest of Marac Quarry, which can hardly be identified specifically but which appears to represent the same species. These specimens, like all known representatives of *Hercoglossa*, are rather similar to *H. ulrichi*, which was originally described from the Midway (basal Eocene or " Paleocene ") of Arkansas but has since been found in the same group of strata in Texas, Tennessee, Mississippi, and Alabama. However, a detailed comparison of the Trinidad specimens with typical representatives from North America has convinced us that the form from the Southern Hemisphere represents a distinct species, and we are proposing below the name **H. harrisi** for it. In Europe, Asia, and Africa the genus *Hercoglossa* (of which *Enclimatoceras* is a synonym) occurs widespread in both the Upper Cretaceous and the Eocene, but in the Americas it is not known to occur outside of the Eocene. The rather striking similarity of *H. harrisi* to several congeneric forms that occur in the Midway group of the Gulf Coastal Plain of North America can be said to corroborate the now generally accepted correlation of the Soldado with the Midway.

The Trinidad specimen which HARRIS figured as *Hercoglossa peruviana*? seems to be unique, and there is nothing like it in the collections we are studying. It is stated to attain a maximum diameter of 200 mm. and a maximum width of 125 mm. It was found by Mr. GERALD A. WARING " loose on the basal beds " at Bontour Point, but " from the appearance of its component materials it would seem to belong to the Upper Eocene [Jackson equivalent] beds here represented ". Insofar as we can tell from the published illustrations, this specimen represents the genus *Hercoglossa* rather than *Cimomia*, whereas *H. peruviana* is more or less intermediate between typical *Hercoglossa* and typical *Cimomia*. It almost certainly represents an unnamed species, and it appears to resemble *H. restinensis* MILLER & THOMPSON much more closely than it does *H. peruviana*—the type specimens of both *H. peruviana* and *H. restinensis* came from

the Restin formation of northwestern Peru, which is upper Middle Eocene (Claiborne) in age.

Representatives of the genus *Aturia*, which is world-wide in its distribution, were long ago reported from the island of Martinique in the Caribbean region, and more recently they have been noted in Panama, Colombia, Peru, Argentina, Chile and the Chilean portion of Tierra del Fuego. Nevertheless, insofar as we have been able to ascertain, none has so far been recorded from Venezuela, and it was therefore more or less of a surprise to us to find that all of the eleven specimens in the collections that we are studying from three localities in northwestern Venezuela belong in the genus *Aturia*. Seven of these, which came from two closely adjacent localities in the state of Lara and are uppermost Eocene in age, appear to represent *Aturia peruviana* OLSSON, which was based on specimens from the Upper Eocene and the Oligocene of northwestern Peru. Furthermore, ANDERSON (1) has described and illustrated a specimen from the uppermost Eocene near El Carmen in northern Colombia that appears to represent the same species, and the occurrence of these conspecific cephalopods in northwestern Venezuela, northern Colombia, and northwestern Peru can be said to support rather strongly MAURY's (13) contention that the Upper Eocene can be traced " interruptedly... across northern South America from Soldado Rock [between Trinidad and Venezuela] through Venezuela and Colombia to Peru." IDDINGS & OLSSON (7, p. 16) state that in northwestern Peru the Upper Eocene " brought the introduction of a new marine fauna which continued in a modified form into the Oligocene ", and presumably this statement was based in part on the fact that *A. peruviana* appears in northwestern Peru in the Upper Eocene and ranges up into the Lower?, Middle, and Upper Oligocene. Very little information indeed is available in regard to the representatives of *Aturia* which occur in Panama. However, according to OLSSON (21, p. 590) the beds in which they have been found there are to be correlated with the early Upper Eocene Talara formation of northern Peru, and therefore it is not improbable that the species represented is *A. peruviana.*

No representatives of the genus *Aturia* have been described previously from the Miocene rocks of northern South America, and the Miocene specimens that we are describing below from Paraguaná Peninsula (Falcón, Venezuela) appear to be unique. Hence we are not able to confirm or suggest any correlations with beds in near-by areas, and of course we would not care to attempt " long-distance " correlations based on the similarity of only one species. The beds on Martinique in which *Aturia* occurs are stated (5) to be Miocene in age, but that determination was made long ago (1903) and the single cephalopod found was neither illustrated nor described.

II. Description of species.

Hercoglossa harrisi MILLER & THOMPSON, n. sp.

Plate VII, figures 1, 2.

Hercoglossa ulrichi HARRIS, 1926, Johns Hopkins Univ. Studies in Geol., No. 7, p. 99, pl. 18, fig. 14. [Not *H. ulrichi* WHITE 1884.]

Hercoglossa ulrichi LIDDLE, 1928, The Geology of Venezuela and Trinidad, p. 451.

Hercoglossa ulrichi SCHUCHERT, 1935, Historical geology of the Antillean-Caribbean region or the lands bordering the Gulf of Mexico and the Caribbean Sea, p. 702.

Conch, which at maturity consists of at least four or five volutions, is sublenticular, nautiliconic, rapidly expanded orad, and large. According to HARRIS representatives of this species attain a maximum diameter, measured across the umbilicus, of as much as 320 mm. Early volutions of conch are considerably wider than high and are rather broadly rounded ventrally as well as laterally. However, as conch attains full maturity whorls become distinctly higher than wide, rather narrowly rounded ventrally, very broadly rounded laterally, and rather deeply impressed dorsally—the depth of the impressed zone in large individuals is equal to slightly more than one-third the height of the conch.

Umbilicus small, inconspicuous, and closed. Diameter of umbilicus is equal to only about one-sixth that of specimen. Umbilical shoulders rounded and not very distinct, and maximum width of conch is attained slightly ventrad of umbilical shoulders.

Living chamber at least three-fifths of a volution in length. Apertural margins not preserved on any of specimens available for study, but traces of increments of growth indicate that aperture was marked by a broad deep rounded ventral sinus and on either side of it a low broad rounded salient which extended clear to the umbilicus. On the outer surface of the test the increments of growth are rather prominent and give the shell more or less of a ribbed appearance, but the internal mold is smooth (or essentially so). The test is thin, and on early mature specimens its thickness measures less than ½ mm.

Camerae moderate in length, but somewhat variable—in typical specimens there are ten or more camerae in each volution of the mature portion of the phragmacone. The septa are only slightly concave transversely, but they are rather strongly sigmoidal dorso-ventrally as their ventral portion is curved strongly orad and their dorsal portion is curved apicad. At maturity each suture forms a large broad rather low very broadly rounded ventral saddle, and on either side of it a narrower (but nevertheless very broad) rather shallow rounded asymmetrical lateral lobe, a narrower higher narrowly rounded dorso-lateral saddle which centers slightly outside (ventrad of) the umbilical shoulder, a rounded lobe which centers on the umbilical wall, and a broader lower rounded asymmetrical saddle located on the lateral side of the impressed zone and extending to the rather broad rounded dorsal lobe (see text figure 1).

Siphuncle small, circular in cross section, located distinctly nearer the venter than the dorsum (the bottom of the impressed zone), and apparently orthochoanitic in structure as it is composed of cylindrical segments. Relative length of septal necks and connecting rings not determined.

Remarks. — The above description is based on nine specimens from Marac Quarry, Trinidad, but in addition the collections we are studying contain one large specimen from " San Fernando-Vista Bella ", about 20 miles northwest of Marac Quarry. This latter specimen is so badly worn that it can not be identified specifically with any reasonable degree of certainty, but it does not appear to differ materially from the Marac Quarry forms. In its present worn condition, it attains a maximum diameter, measured across the umbilicus, of about 185 mm. and a maximum width of about 80 mm. It is composed throughout of " red-splotched " glauconitic limestone.

According to LIDDLE (10), the living chambers of many of the representatives of this species at Marac Quarry are " filled with gilsonite, or with liquid asphaltic oil ", and in one of the specimens we are studying the camerae of the phragmacone contain gilsonite or a related substance.

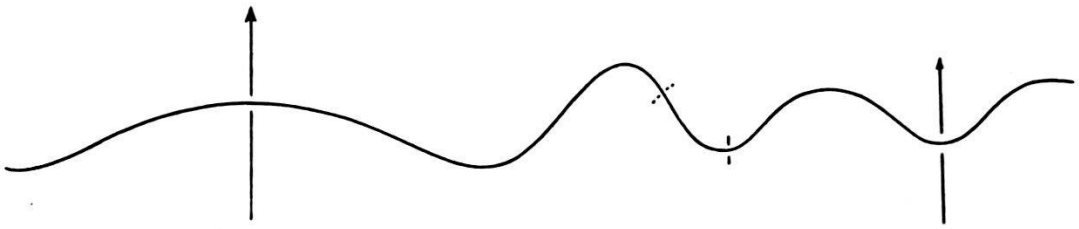

Fig. 1. Diagrammatic representation[2])

of a mature suture of *Hercoglossa harrisi* MILLER & THOMPSON, n. sp., × $^2/_3$. (Based on the holotype, which is represented by figures 1 and 2 on plate VII, and on one paratype.)

This species is being named in honor of Professor GILBERT D. HARRIS, who has done so much to further our knowledge of American Tertiary faunas.

H. harrisi is a rather primitive member of the genus *Hercoglossa*, and some of the most distinctive of its specific characters are to be found in the shape of its sutures. That is, in comparison with the congeneric forms that have been described from the Midway group of the Gulf Coastal Plain of North America [including *H. ulrichi* (WHITE)] and those known from the Landana beds of Portuguese West Africa, the ventral saddle of the sutures of *H. harrisi* is low, the lateral lobe is shallow, and the dorso-lateral saddle is relatively narrow—these characteristics are reminiscent of *Cimomia* from which *Hercoglossa* arose. Of the two forms known from the Restin formation of Peru, the sutures of *H. restinensis* MILLER & THOMPSON are similar

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[2]) A direct comparison of this diagram with those made from celluloid "peels" will of course reveal a difference in general curvature which should be discounted.

to those of the Midway and Landana forms, but those of *H. peruviana* BERRY [as figured by BERRY (2) and STEINMANN (26)] are very similar in some respects to those of *H. harrisi*. However, the conch of *H. harrisi* is considerably narrower than is that of *H. peruviana*, and the position of the siphuncle is quite different in the two species. Also, the specimen from the Upper? Eocene of Bontour Point, Trinidad, which in 1926 HARRIS (28) figured as *H. peruviana*? is a more nearly globular form, and its sutures are farther advanced than are those of *H. harrisi*. *Eutrephoceras pernambucense* MAURY (12) [= *Nautilus sowerbyanus* WHITE (30) not D'ORBIGNY] of the Lower Eocene of Brazil is not at all close to the form under consideration, and it should be referred to the genus *Cimomia*.

Occurrence. — Abundant in the basal Eocene Soldado formation at Marac Quarry in the south-central part of Trinidad, where it is stated to occur in association with many typical Eocene forms, notably a *Venericardia* of the *V. planicosta* group and a gastropod that is either identical or very close to *Turritella mortoni* CONRAD—this locality is designated No. *22* by RUTSCH (19, p. 175). Also, as mentioned above, we are referring with question to this species a large worn specimen from the Soldado formation occurring in blocks in the basal conglomerate of the Mount Moriah formation outcropping in the Vista Bella Estate at San Fernando (locality No. *25*).

LIDDLE (10) states that the fauna with which *H. harrisi* is associated at Marac Quarry occurs in some of the oldest beds exposed on Isla Soldado and that " near Inciarte in the State of Zulia, in the northwestern part of Venezuela, these fossils occur at the base of the Third Coal horizon of the lower part of the Misoa-Trujillo formation ". Peculiarly enough, no representatives of the genus *Hercoglossa* have so far been recorded from either Isla Soldado or Venezuela, but it seems likely that *H. harrisi* will be found at both places.

Types. — All of the specimens, holotype and paratypes, on which this species is being based are to be deposited in the Museum of Natural History at Basel, together with the specimen from San Fernando which we are referring with question to this species.

Aturia peruviana OLSSON.

Plate VIII, figures 1—4; Plate IX, figure 5.

Aturia alabamensis peruviana OLSSON, 1928, Bull. Am. Pal., vol. 14, pp. 96—99, pl. 24, figs. 1—3.

(?) *Aturia colombiana* ANDERSON, 1928, California Acad. Sci., Proc., 4th ser., vol. 17, pp. 17—18, text figs. 2, 3, pl. 1, fig. 10.

(?) *Aturia alabamensis peruviana*? SCHENCK, 1931, California Univ. Publications, Bull. Dept. Geol. Sci., vol. 19, p. 456 (footnote 53).

Conch nautiliconic, subdiscoidal, and moderately large—phragmacone attains a diameter, mesured across the umbilicus, of at least 110 mm. Whorls compressed, flattened laterally (with lateral sides of conch converging slightly ventrad), rounded ventrally, impressed dorsally, and about two-thirds as wide as high—impressed zone is about two-fifths as deep as conch is high. Length of living chamber not known. Growth-lines indicate that aperture is marked by a deep rounded ventral or hyponomic sinus and on either side of it a broad moderately high rounded lateral salient which extends to the umbilicus. Umbilicus small, closed, and rather inconspicuous—filled to a large extent by an umbilical callus. Umbilical shoulders low, broadly rounded, and indefinite.

Test smooth and marked by only the growth-lines which are very distinct but which leave no trace on the internal mold. At the adoral end of the specimen represented by figures 3 and 4 on plate VIII the test is about three-fifths mm. thick.

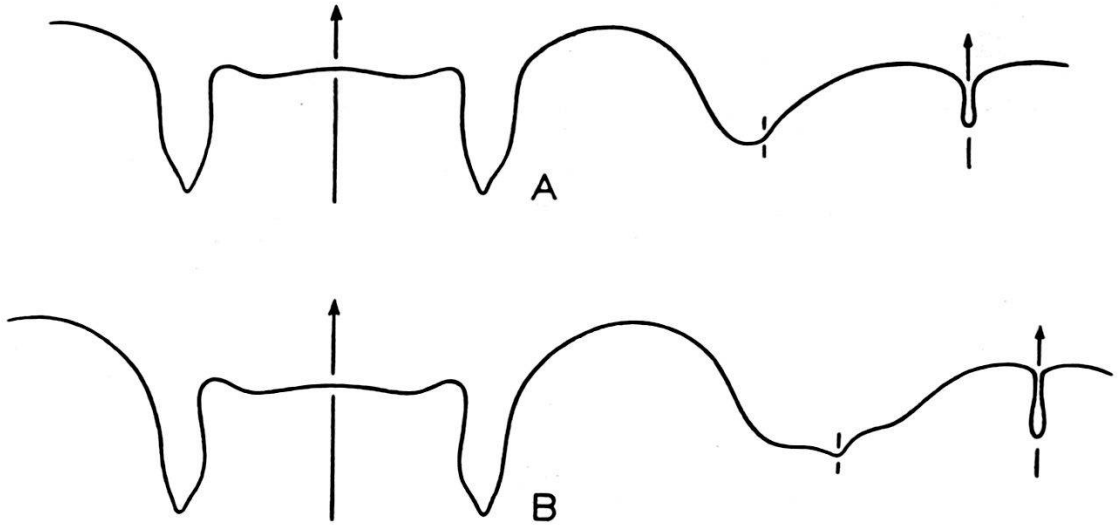

Fig. 2. Diagrammatic representations

of mature sutures of (A) *Aturia peruviana* OLSSON, × 1, based on the specimen represented by figures 1 and 2 on plate VIII, and (B) *Aturia curvilineata* MILLER & THOMPSON, n. sp., × 0.6, based on the holotype.

Septa moderately closely spaced and in the mature portion of the phragmacone there are about fifteen camerae to the volution. At maturity each suture forms a high broad almost flat more or less square-shouldered straight-sided ventral saddle and on either side of it a much narrower asymmetrical pointed tongue-shaped lateral lobe, a broad high broadly rounded lateral saddle, a moderately deep rather narrowly rounded asymmetrical lobe on the umbilical portions of the conch, and a broad rather shallow broadly rounded internal lateral saddle which extends to the deep narrow spatulate dorsal lobe (see text figure 2A). The top of the ventral saddle is slightly sinuous, and a pair of very shallow rounded secondary lobes, one on either side of the venter, divides it symmetrically into three low rounded secondary saddles. The lateral lobes of the sutures are long and the attenuate portion ("tip") of each is in contact with the preceding suture.

Siphuncle moderate in size—its diameter is equal to about one-twelfth the height of the conch—subdorsal in position, orthochoanitic in structure, and located in an infundibuliform subdorsal adapical flexure of the septa—we should

probably regard the septal necks as adapical extensions of this infundibular flexure, rather than regard the rather large adoral part of this flexure, into which the siphuncle proper seems to invaginate, as part of the septal necks. The thin-section represented by figure 5 on plate IX and by text figure 3 shows a median longitudinal section of the siphuncle in an adoral portion of the specimen represented by figures 1 and 2 on plate VIII—this thin-section elucidates the details of the structure of the siphuncle much better than any congeneric specimen we have ever studied. Both the septal necks and the connecting rings are about

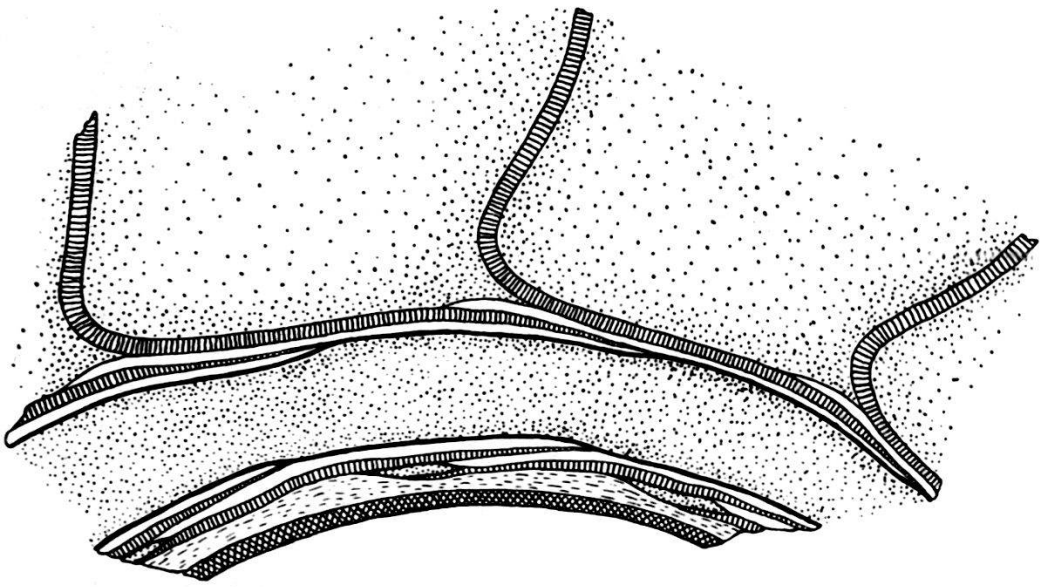

Fig. 3. Median longitudinal section, × 3,

of part of a mature volution of the phragmacone of *Aturia peruviana* Olsson. showing the structure of the siphuncle. This diagrammatic drawing is based on the thin-section represented by figure 5 on plate IX, and it shows clearly the two layers of the dorsal wall of the conch and the long septal necks and connecting rings of the siphuncle. (The outer layer of the dorsal wall of the conch is cross-hatched whereas the inner is marked with dashed lines; the septa and the septal necks are marked with cross lines; the connecting rings are left clear; the innermost layer or lining of the siphuncle is solid black; and the calcareous fillings of the camerae and the siphuncle, which were introduced during fossilization, are stippled.)

one and one-half times as long as the camerae, but they overlap for about one-third of their length so that combined they are only about two and one-half times as long as the camerae. The adapical portion of each septal neck invaginates into the adoral portion of the adjacent connecting ring, and the connecting ring in turn invaginates into the next septal neck apicad. Although the septal necks are considerably longer than the camerae, adjacent septal necks are not in contact (as they are in the holochoanites) for they are separated from one another by the connecting rings. On the inside of the siphuncle there is a continuous thin lamellar deposit or layer which is essentially cylindrical in form and covers over septal necks and connecting rings alike—we have never observed a homologous

deposit in any of the numerous nautiloids that we have sectioned, and insofar as we are aware no morphological term has been coined for this lining of the siphuncle though apparently it has been observed previously. Although we are not entirely certain about the structures shown in the extreme dorsal portion of our thin-section, it appears that the dorsal wall of the conch is composed of two layers, the outer (dorsal) one of which is regular in thickness, whereas the inner one is thick along the adoral portions of the camerae but relatively thin along the adapical portion. The septal necks appear to be cemented to the thicker portions of this inner layer of the test throughout the entire length of these portions, and thin adoral continuations of the septal necks (which should probably be regarded as dorsal portions of the septa) extend orad for about half the length of the thinner portions of the inner layer of the test and are cemented to it. The siphuncle is then in direct contact with the dorsal wall of the conch along the thicker portions of the inner layer of that wall, and along the thinner portions it is only slightly removed from it. Both of the layers of the test as well as the septal necks and the connecting rings are lamellar in structure in the thin-section we are studying.

Remarks. — As noted by OLSSON (17), most of the numerous species of *Aturia* that have been named "are very similar, and it is still a question, how many really distinct species should be recognized." After careful consideration, we have referred our specimens to a Peruvian species as the details of the sutures of the two are strikingly similar, the general proportions of the conchs are approximately the same, and insofar as we can tell from the published illustrations and descriptions of the Peruvian types the siphuncles of the two forms do not differ materially. SCHENCK (20) states that the specimen from the Eocene of Bolívar, Colombia, for which ANDERSON (1) proposed the name *Aturia colombiana* is also referable to this Peruvian species, and he is probably correct, though we have not seen the specimen but merely plaster casts of it which were prepared for us through the courtesy of Dr. G. DALLAS HANNA of the California Academy of Sciences. *A. alabamensis* (MORTON), of which OLSSON considered *A. peruviana* a variety, is a more slender form, whereas *A. ziczac* (SOWERBY) appears to be less strongly compressed than the species under consideration.

All of these forms are, however, closely similar, and the genus *Aturia*, which is world-wide in its distribution, seems to range from the Eocene (or uppermost Cretaceous) up into the Pliocene with surprisingly little change. In 1921 von IHERING (8) proposed a subgeneric name *Sphenaturia* for some forms from southern South America, but as both SCHENCK (20) and SPATH (24) have pointed out, von IHERING apparently had an erroneous concept of *Aturia aturi* (BASTEROT), the genotype of *Aturia* (which was originally described from the Miocene of St. Paul de Dax in southwestern France) and the differences between the subgenotype of *Sphenaturia* and *A. aturi* do not seem to be of more than specific value. More recenlty STENZEL (27) has erected three subgenera of *Aturia: Aturia* s. s., *Nilaturia*, and *Brazaturia*. *Aturia* s. s. is stated to differ from the

other two subgenera particularly in that its siphonal collars are large and its siphuncle is centrodorsan rather than subdorsan in position. STENZEL apparently relied largely on FOORD's description of the siphuncle of *A. aturi*, rather than on his own observations, and illustrations of topotypes published by EDWARDS (4) and particularly of a specimen from Turin published by SPATH (25) seem to indicate that the siphuncle is not centrodorsan but subdorsan as in *Nilaturia* and *Brazaturia*. STENZEL states that in *Nilaturia* the lateral lobes of the sutures are rounded and not very deep and the dorsal lobe is deep and wide, but it should be taken into consideration that both of these are primitive characters and apparently STENZEL was studying small specimens which might change somewhat as they completed their ontogenetic development. It therefore seems to us that whereas the question of the generic or subgeneric division of the forms that are now grouped together under the generic name *Aturia* is deserving of very careful consideration, it will have to be done with a great deal of caution, and certainly to complete the work satisfactorily many more specimens than are now available to us will have to be examined critically.

Occurrence. — Four of the seven specimens that we are referring to this species came from the Section La Enea-Baragua, in Quebrada Mamoncito near Sta. Rita, Lara, Venezuela (Locality number 2724). Some gastropods from this same locality were studied by RUTSCH (18), and some pelecypods by SEITZ & RUTSCH (22). According to these authors the containing beds are uppermost Eocene[3]) in age, and the cephalopods are, to say the least, compatible with this assignment. The other three specimens that we are referring to this species came from 100 m. east of the locality which yielded the four specimens just mentioned (Locality number 1144). The syntypes of this species came from the Saman formation (Upper Eocene), the Mirador conglomerate member of the Mancora formation (Middle Oligocene), and the Cone Hill shale member of the Heath formation (Upper Oligocene) at several localities in northwestern Peru. Also, specimens that may be conspecific occur in the Lower Oligocene Chira formation of northwestern Peru, and, as mentioned above, a specimen that probably represents the same species has been described from the uppermost Eocene of northern Colombia. This species, then, can be said to be rather widespread in northwestern South America and to range in age from Upper Eocene to Upper Oligocene.

Figured specimens. — All of the Venezuelan specimens that we are referring to this species, including both of those that we are figuring, are to be deposited in the Museum of Natural History at Basel.

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[3]) For the stratigraphical position of this horizon see Lit. 23, p. 60—70.

Aturia curvilineata MILLER & THOMPSON, n. sp.

Plate IX, figures 1—4; Plate X, figures 1, 2.

Conch, which at maturity consists of several volutions, is nautiliconic, subdiscoidal, and rather large—phragmacone attains a diameter, measured across the umbilicus, of at least 115 mm. Mature whorls are compressed, flattened laterally, rather broadly rounded ventrally, and deeply impressed dorsally. Maximum width of whorl is attained just ventrad of umbilical shoulders, and whorls are about two-thirds as wide as high and are impressed to a depth of about two-fifths their height. Umbilicus small and closed—filled to a large extent by an umbilical callus. Umbilical shoulders broadly rounded. Growth-lines, which are rather prominent on exterior of test but which leave no discernible trace on internal mold, form a deep ventral sinus and a single broad rounded salient on each of the lateral sides of the conch. On outer volution of holotype test, which is composed of at least two layers, is about $^3/_4$ mm. thick.

Septa rather closely spaced and camerae are therefore rather short—it is estimated that there are about fifteen of them to the volution. On the outer volution of the holotype each suture forms a very broad almost flat straight-sided ventral saddle and on either side of it a very much narrower asymmetrical pointed lateral lobe, a broad high broadly rounded lateral saddle, a broad rather deep asymmetrical lobe on the umbilical portions of the conch, and a broad rounded asymmetrical internal lateral saddle which extends to the very narrow spatulate dorsal lobe (see text figure 2B). The top of the ventral saddle is slightly sinuous, and a pair of shallow rounded secondary lobes, one on either side of the venter, divides it symmetrically into three low rounded secondary saddles. Also, the bottom of the lobe on the umbilical portions of the conch is sinuous, and a pair of low rounded saddles, one on either side of the umbilical seam, divides it into three small unequal lobes. Siphuncle moderate in size, located close to the dorsum in an adaptical infundibular flexure of the septa, and apparently similar in structure to that of *A. peruviana* which is described in detail above.

Remarks. — The above description is based entirely on the holotype, but the collections we are studying contain in addition three rather small specimens (paratypes) which we are referring to this species. All of these, including the holotype, came from one locality: Cantaure on the Paraguaná Peninsula which is also part of the state of Falcón[4]). Although the preservation of these paratypes is not all that could be desired, they serve to illustrate certain of the specific characters that can not be ascertained from the holotype. We prepared the specimen represented by figures 3 and 4 on plate 3 so that the first part of the first volution of the conch was revealed. This was not very well preserved but it showed that the extreme adapical portion of the conch is rapidly expanded orad and the first volution of the conch is so tightly coiled that the umbilical perforation is

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[4]) „About 500 m N of house "Cantaure" near Mesa de Cocodito, West of Pueblo Nuevo, Central Part of Paraguaná Peninsula, District Falcón, State of Falcón, North Venezuela" (information by Dr. C. WIEDENMAYER). See: Lit. 23, p. 80 and Bull. Am. Pal., vol. 16, p. 6 (locality Nr. 2207 of HODSON.)

very small. Also, by the time the conch has completed one full volution, at least its external sutures have developed all of the elements which they exhibit at maturity, and the growth-lines indicate that during the early stages of ontogenetic development the aperture assumes the shape which it possesses at maturity. In the adapical volutions of the conch the camerae are relatively longer than in the adoral volutions. Apparently the phragmacone of individuals that have completed their ontogenetic development forms at least three full volutions. We made a longitudinal section of an outer volution of the specimen just discussed in order to study the siphuncle. Unfortunately it was only moderately well preserved and we were not able to determine with certainty the details of its structure. Still, it is quite clear from this section that the siphuncle of this Miocene species occupies the same relative position and is of essentially the same size and shape as that of the Eocene species described above in considerable detail, and there appears to be no good reason to doubt that its construction is also essentially the same.

Perhaps one of the most distinctive characters of this species is the sinuosity of the umbilical portions of its sutures. However, inasmuch as the sutures of most of the numerous species of *Aturia* that have been named have not been described in detail or illustrated very explicitly, we are not certain as to just how distinctive this character is. Nevertheless, it serves well to differentiate this Miocene species from the Eocene form described above (compare text figures 2A and 2B).

Occurrence. — The holotype and the three paratypes came from the Miocene at Cantaure, Cocodito area, Paraguaná Peninsula, Falcón, Venezuela (Locality number 3892).

Types. — All four of the specimens on which this species is being based are to be deposited in the Museum of Natural History at Basel.

III. Literature.

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Explanation of plate VII.

Figs. 1, 2. *Hercoglossa harrisi* MILLER & THEMPSON, n. sp. Holotype. Page 62.

Lateral and ventral views, slightly less than × 1, of a well-preserved specimen from the Soldado formation (basal Eocene or "Paleocene") at Marac Quarry in the south-central part of Trinidad.

Explanation of plate VIII.

Figs. 1—4. *Aturia perûviana* OLSSON. Page 64.

Lateral and ventral views, all × 1, of two individuals. The specimen represented by figures 1 and 2 came from the uppermost Eocene in the Section La Enea-Baragua, in Quebrada Mamoncito, near Sta. Rita, Lara, Venezuela (Loc. No. 2724); and the specimen represented by figures 3 and 4 came from beds of the same age 100 m. east of this locality (Loc. No. 1144). (See also figure 5 on plate IX.)

Explanation of plate IX.

Figs. 1—4. *Aturia curvilineata* MILLER & THOMPSON, n. sp. Page 69.

Lateral and ventral views of two of the paratypes, both of which came from beds of Miocene age at Cantaure, Cocodito area, Paraguaná Peninsula, Falcón, Venezuela (Loc. No. 3892). Figures 1 and 2 are × 1, but figures 3 and 4 are × 1½. (See also figures 1 and 2 on plate X.)

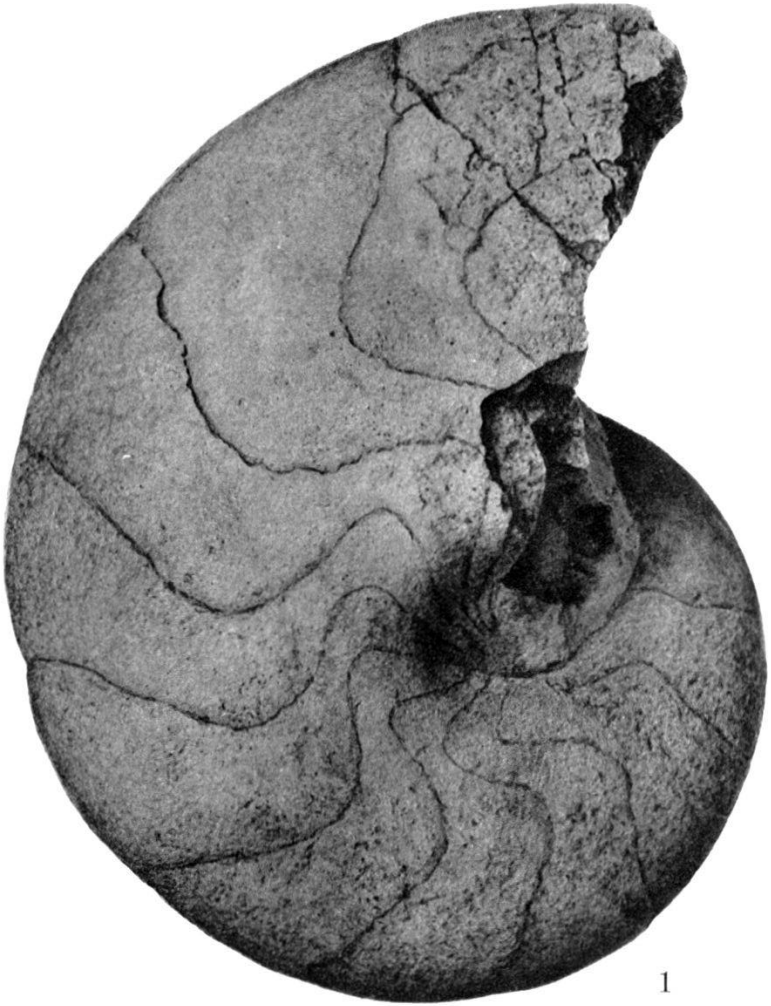
Fig. 5. *Aturia peruviana* OLSSON. Page 64.

Unretouched photograph, × 2½, of a median longitudinal section (a thin-section) of part of an adoral volution of the specimen represented by figures 1 and 2 on plate VIII, which came from the uppermost Eocene in the Section La Enea-Baragua, in Quebrada Mamoncito, near Sta. Rita, Lara, Venezuela (Loc. No. 2724). A diagrammatic drawing of this thin-section is included as text figure 3. (See also figures 1–4 on plate VIII.)

Explanation of plate X.

Figs. 1, 2. *Aturia curvilineata* MILLER & THOMPSON, n. sp. Holotype. Page 69.

Lateral and ventral views, × 1, of the holotype, which came from beds of Miocene age at Cantaure, Cocodito area, Paraguaná Peninsula, Falcón, Venezuela (Collection O. GUTZWILLER 1927). (See also figures 1–4 on plate IX).



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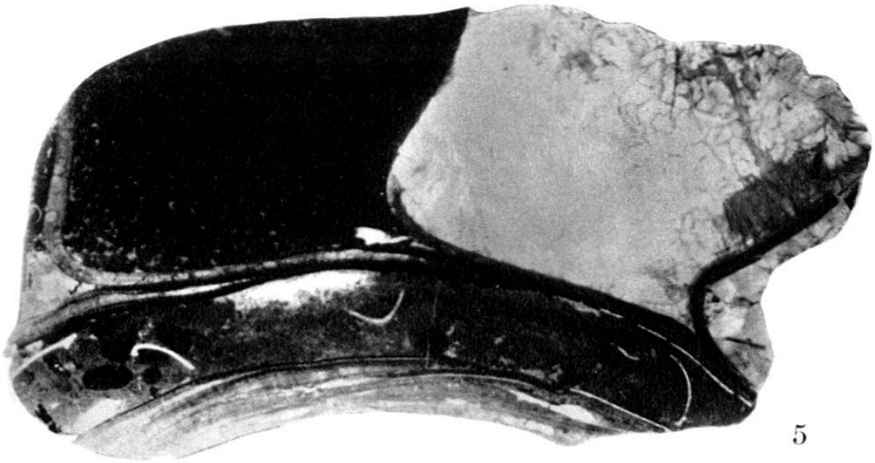

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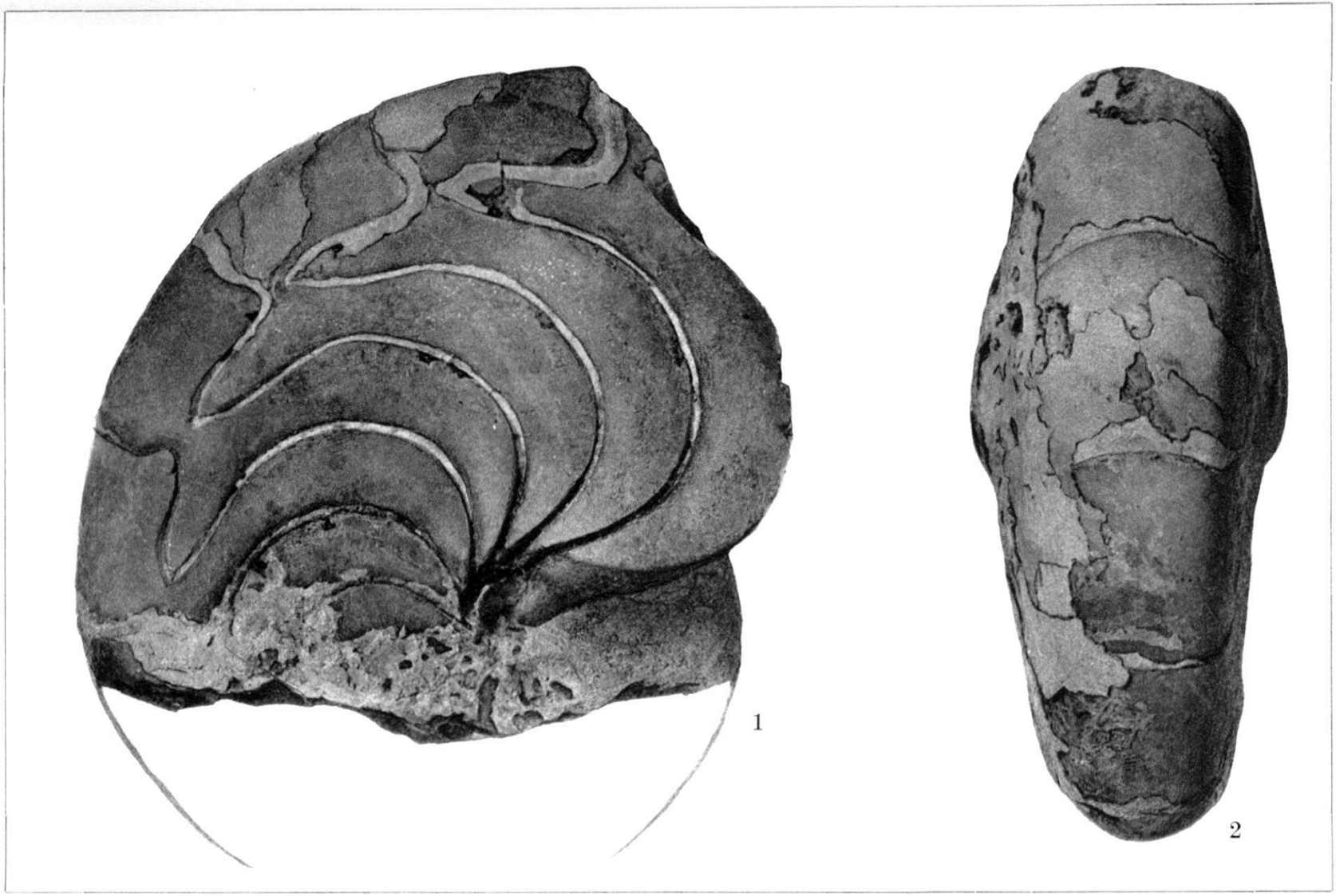

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