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AT HARVARD COLLEGE
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# NOTES ON THE AMERICAN SOFT-SHELL TURTLES WITH SPECIAL REFERENCE TO *AMYDA AGASSIZII*

By Leonhard Stejneger

With Thirty Plates

CAMBRIDGE, MASS., U. S. A.
PRINTED FOR THE MUSEUM
May, 1944

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# NOTES ON THE AMERICAN SOFT-SHELL TURTLES WITH SPECIAL REFERENCE TO *AMYDA AGASSIZII*

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# PREFATORY NOTE

BY

T. Barbour

As has been well known, for many, many years before his death Doctor Stejneger was engaged in the preparation of a general treatise on the fresh water and land Testudinata of North America. After his death it was found that by far the greatest part of his notes were in the fragmentary state that often holds in an early stage of preparation for publication. The only section which might be said to be in publishable form and to reflect the mature conclusions of the author was this part comprising his summary of the genus Amyda. For many and obvious reasons it seems desirable to bring this to public attention and by the same token it seems presumptuous to change it.

The Museum of Comparative Zoölogy has the good fortune to present to the public what will perhaps be the last example of the work of this distinguished veteran worker in our field. By the consent of the authorities of the United States National Museum this institution has permission to publish this work, a tribute of honor and respect to the author, being published here only because the situation induced by the state of war makes it inconvenient for the Government Printing Office to handle the work at this time.

No. 1.—*Notes on the American Soft-Shell Turtles with Special Reference to Amyda agassizii*[1]

By Leonhard Stejneger

## INTRODUCTION

The number of living indigenous soft-shell turtles of the family *Trionychidae* in North America is less than a half dozen, while more than a half hundred fossil forms, the earliest dating as far back as the Cretaceous, have been described by paleontologists from the same region which embraces the habitable part of North America east of the Rocky Mountains and northern Mexico.

The living American forms have been considered from time to time by prominent herpetologists as belonging to several genera under varying names, according to their views on the genotypes. Thus Agassiz recognized three genera and so did Baur and Hay; Cope and True reduced the generic subdivisions to two. Boulenger, Siebenrock, and recent systematists have regarded them as congeneric; the name has varied accordingly.

## NOMENCLATURE

In the early stages of systematic herpetology, before the idea of the "genotype" had become generally accepted, there was no fixed rule which would designate the type of genera with more than one species. A sort of "selection by the first reviser" was early practiced. Thus if an author subsequent to the creator of a plurispecific genus, in subdividing the latter, retained this name for a single species, applying one or more new names to the rest of the species, his selection, as a rule, was respected, and thus the idea of type selection by "elimination" became a more or less general practice. But because of the unwillingness or ignorance of some workers and the varying and uncertain application of this method, great confusion in the nomenclature of genera resulted. This is what happened to Geoffroy's generic term *Trionyx* (1809), which has been the cause of so much confusion. In 1816 Oken was the first one to subdivide the plurispecific genus, reserving as he did the name *Trionyx* for the single species *T. granosa*, leaving the others under the name *Amyda*. In 1830 Wagler reported Oken's monotypic selection of *Trionyx granosa*, but substituted *Aspidonectes* for *Amyda*. The confusion was caused by Gray who in his

[1] Published with the aid of a special gift from Mr. G. R. Agassiz.

Synopsis Reptilium, 1831, erected the monotypic genus *Emyda* for the same species. He did so in ignorance of Wagler's action and after seeing Wagler's work called attention to it in the "Additions and Corrections" in the same work, p. 78. Yet in the "Catalogue" of 1844 and his later writings he still retained *Emyda*. Gray was followed by Boulenger and many writers since 1889, in spite of Baur and Hay who in 1898 and 1904, like Bonaparte in 1836[1] and 1857[2], upheld Wagler's action.

Following these dissertations by Baur and Hay, the case of the genotypes of the genera *Amyda* and *Trionyx* was discussed by me in 1905 (Science, new ser., vol. 25, Feb. 10, 1905, pp. 228–229), consequently before the adoption (1908) of the present wording of Article 30 of the International Rules of Zoological Nomenclature. In 1905 the argument was based on the proeess of elimination, which at that time was considered the legitimate process. On that occasion, the type of *Trionyx* was decided to have been selected in 1816 by Oken as first revisor by segregating *Trionyx granosus*, supposed to be synonymous with Geoffroy's *T. coromandelicus*, as the sole species in the restricted genus.

However, the adoption in 1908 of the changed form of Article 30 apparently nullified previously accepted type selections unless they were couched in the stringent language of the new version.

The new Article 30 was framed and phrased for the purpose of doing away with the uncertainties of personal interpretation unavoidable in the process of elimination. It was intended that the new rule should be applied literally; hence the first article (I a) reads: "When in the original publication of a genus, one of the species is *definitely designated* as type, this species *shall be accepted* as type, *regardless* of any other considerations." (Italics mine.) To emphasize this intention the last paragraph of the article was inserted as follows: "The meaning of the expression 'select the type' is to be *rigidly* construed. Mention of a species as an illustration or example of a genus does not constitute a selection of a type." (Italics mine.)

Applied to the case in hand the facts are these:

In the original publication of *Trionyx* by Geoffroy in 1809 (Ann. Mus. Hist. Nat., Paris, **14**, pp. 1–20, pls. 1–5) none of the many species was *definitely designated* as type. Not in the body of the text proper,

[1] Cheloniorum Tabula Analytica, p. 8: "22 AMYDA, Schweigger (*Aspidonectes* WAGL. *Trionyx* GRAY. BELL. *Gymnopus*, DUM." "23. TRIONYX WAGL. (*Emyda*, GRAY. BELL. *Cryptopas* DUM.)"

[2] Contrib, Nat. Hist. United States, **1**, p.330: "Trionyx proper . . . . . in contradistinction to Aspidonectes"; see also pp. 394–395.

but *in the Explication des planches* (*explanation of the plates*) at the end of the article, occurs, however, the following mention of the trionyx of Egypt as an illustration and example of the genus, which was omitted in the simultaneous reprint of the article in the Bulletin of the Philomatic Society of Paris:

"Le trionyx d'Egypte, représenté planche I, *vue en dessous et de côté*, nous donnant une idée exacte du port et des caractères génériques des trionyx, nous sommes bornés, dans les planches suivantes, à faire figurer les seules parties caractéristiques des autres espèces, telles que leurs carapaces en A, et leurs plastrons en B." [1]

Even if this kind of mention as an "illustration and example" may be characterized as a "clear intention" it is *certainly not a definite designation rigidly construed.*

Consequently, Geoffroy having failed to definitely designate *T. aegyptiacus* as the type of *Trionyx*, it was left to the first subsequent author to select the type, and that was done by Fitzinger in 1843 (Syst. Rept., p. 30) who *selected T. coromandelicus* Geoffroy,[2] "and *such designation* is not subject to change."

Having now disposed of the type designation of *Trionyx* for a genus[3] in the subfamily *Cyclanorbinae*, the question of the status and type of *Amyda* arises.

Among the new species described by Geoffroy in the same paper of 1809, is the *Trionyx javanicus* (Ann., p. 15). After a brief diagnosis he added the following synonym:

"*Amyda javanica* SCHWEIGGER, dans un manuscrit communiqué à l'Institut."

This publication of Schweigger's monotypic generic name *Amyda* clearly establishes its availability for the species congeneric with his *Amyda javanica*, the description of which by Geoffroy is regarded as identical with Boddaert's *Testudo cartilaginea* of 1770.

Fitzinger's use (1835) of the name *Amyda* for a section (=subgenus) with *Trionyx subplanus* as type, and Agassiz's subsequent (1857) application of the same name for another genus with *Amyda mutica* as type are consequently both void. *Dogania* is the proper name for the former; *Euamyda* is now available for *A. mutica* as a generic or subgeneric name.

[1] The Egyptian trionyx, represented on pl. 1, *viewed from below and from the side*, gives us an exact idea of the aspect and the generic characters of the trionyxes; we limit ourselves in the following plates to figure only the parts characteristic of the other species, such as their carapaces in A and their plastrons in B.

[2] *Trionyx coromandelicus* Geoffroy, 1809, is a synonym of *Testudo granosa* Schoepff, 1792

[3] Synonyms: *Emyda* Gray, 1831 (not of Rafinesque, 1815); *Lissemys* Malcolm Smith, 1931.

## Genus Amyda[1] Schweigger

1809. *Amyda* SCHWEIGGER in Geoffroy, Ann. Mus. Hist. Nat., Paris, **14**, p. 1 (monotype *Amyda javanicus* = *T. cartilagineus*).

1816. *Amyda* OKEN, Lehrb. Zool., **2**, p. 348 (type designated by Stejneger, 1907, *Trionyx euphraticus*).

1830. *Aspidonectes* WAGLER, Nat. Syst. Amphib., p. 134 (type designated 1843 by Fitzinger, *Trionyx aegyptiacus* = *T. triunguis*).

1831. *Trionyx* GRAY, Synops. Rept., p. 45 (type *T. ferox*) (not of Oken, 1816; Wagner 1830).

1835. *Gymnopus* DUMÉRIL and BIBRON, Erpét. Gén., **2**, p. 472 (substitute name for *Aspidonectes* Wagler) (p. 484 *Gymnopodus*, laps. calam.)

1835. *Platypeltis* FITZINGER, Ann. Wien Mus., **1**, pp. 120, 127 (type designated by Fitzinger 1843, *Platypeltis ferox*.)

1835. *Pelodiscus* FITZINGER, Ann. Wien Mus., **1**, pp. 120, 127 (type designated by Fitzinger 1843, *P. sinensis*.)

1842. *Aspedonectes* HOLBROOK, North Amer. Herp. 2 Ed, **2**, p. 18 (emendation).

1843. *Potamochelys* FITZINGER, Syst. Rept., p. 30 (monotype *Aspidonectes javanicus*).

1844. *Tyrse* GRAY, Cat. Tort. Brit. Mus., p. 47 (type *T. nilotica* = *T. triunguis*).

1856. *Tryonix* SAGER, Peninsular Journ. Medic Coll. Sci., **3**, no. 8, Feb. 1856, p. 361 (emendation).

1857. *Amyda* AGASSIZ, Contr. Nat. Hist. United States, **1**, p. 398 (monotype *A. mutica*) (not of Schweigger).

1864. *Rafetus* GRAY, Proc. Zool. Soc. London, May 1864, p. 81 (monotype *T. euphraticus*).

1864. *Aspilus* GRAY, Proc. Zool. Soc. London, 1864 (p. 83) (type *Aspilus cariniferus*).

1869. *Callinia* GRAY, Proc. Zool. Soc. London, 1869, p. 221 (type, *T. spiniferus*).

1895. *Platyrettis* KIRSCH, Bull. U. S. Fish Comm. 1894, p. 333; typogr. err.? for Platypeltis).

1900. *Aspidonectus* BEYER, Proc. Louisiana Soc. Nat., 1897–1899, p. 43 (emendation).

[1] Name of uncertain origin, but apparently a variant of Emys, a river turtle. In the synonymy, the numerous generic terms based on exclusively Old World species have been omitted. Reference to these may be found in Bulletin United States National Museum No. 58, 1907, p. 514.

The generally accepted five species of the wider genus *Amyda* in North America naturally fall into three groups.

1. The *A. mutica* group, by Agassiz considered a distinct genus and by many accepted as a subgenus (for which the name *Eüamyda* may be substituted as *Amyda* Agassiz is preoccupied).
2. The *A. ferox* group including the species *A. ferox*, *spinifera* and *emoryi*.
3. The *A. agassizii* group containing only one species on this continent.

The external appearance of these turtles is so much alike that the early naturalists had difficulty in diagnosing them properly, with the result that their taxonomic history is full of misidentifications and misconceptions, even to the extent that the first group, at least on one occasion, has been suspected of being only the sexual form of one of the species of the second group.

As in so many of the Old World soft-shelled turtles the *essential* characters are recognizable only in the bony structure, so also in our American species. The most important ones are found in the skull and the plastral bones and they will form the main subject of the following discussion.

## Skull Characters

The relative proportions of the skulls, their component bones and the size and shape of the various fossae and foramina vary enormously with age, hence comparisons have to be made between specimens of about the same size. The individual variability, which is considerable, increases with age very often to such a degree,—for instance the enormous expansion of the alveolar surfaces in the old specimens of *A. ferox*,—as to make even group definition difficult. Measurements of a large number of skulls have therefore to be made, and as skulls of approximately equal size are rarely to be had, the measurements have to be reduced to percentages of some standard dimension. As such I have selected the basicranial length (posterior edge of occipital condyle to tip of snout). The analysis of numerous measurements has convinced me that skulls with a basicranial length between 40 and 70 mm. (average about 55 mm.) practically represent the normal proportions of important cranial dimensions of our American trionychids. The relative proportions of the various parts have at that size reached a sufficient stability and the figures consequently are comparable *inter se*. Unfortunately, series of skulls of soft-shelled turtles are not numer-

ous in museums, especially when reduced to specimens with a basicranial length between 40 and 70 millimeters, hence the tables presented below, based as they are exclusively on United States National Museum material, total only 41 specimens; nevertheless, the figures are believed to be fairly representative.

An inspection of table 1 will show that *Amyda agassizii* possesses smaller internal choanae (*ch*, plate 1, fig. 2) than the other species, but a slightly larger intermaxillary foramen (*int. max. for.*, plate 1, fig. 2). Were it not for the latter fact the distance between the intermaxillary foramen and the choanae would have been greater than it is, (viz. 12.5 against only 7.7 to 9.7) in the other species; in other words, in *A. agassizii* the longitudinal diameter of the choanae equals their distance from the intermaxillary foramen, while in the others it is much greater, in *A. ferox* even averaging twice as much.

The table further shows the greater width of the alveolar surface of *A. agassizii* at the intermediary age of these specimens, but older males (over 70 mm. basicranial length) of *A. ferox* acquire an increasing width of the alveolar surfaces far exceeding in proportion even that of *A. agassizii* (plate 30). The width of the alveolar surface of the mandible in *A. agassizii* is twice, or nearly twice, as wide as in the others of the corresponding size.

On the underside of the skull *A. agassizii*, in addition to the small size of the choanae and the greater width of the alveolar surface, is characterized by the position of the suture between the palatines and the basisphenoid relative to the posterior edge of the temporal fossa. This is coincident with the different shape of the opening of the temporal fossa, the posterior edge of which is much wider and nearly at a right angle to the axis of the skull. If therefore a line is drawn across the base of the skull at the level of this edge, the line passes nearly through the palatine-basisphenoid suture, while in the other species it crosses the basisphenoid at or slightly anterior to the middle (plates 1, fig. 1; 6, 30.

The skull of *A. mutica* is unique among the Amydas in the slenderness and delicacy of its bones, especially those of the snout, which is exceedingly narrow and elongated. The distance from the tip to the posterior rim of the orbit is much greater than from this point to the posterior edge of the tympanic cavity, while in the other American species it is much shorter. This difference is mainly caused by the reduction in *A. mutica* of the temporal fossa, the diameter of which is about six tenths of that of the orbit, while in the other species it equals or averages even slightly greater than the orbit. The weakness

of the *A. mutica* skull is further emphasized by the narrowness of the interorbital space and the practical absence of an alveolar surface on the mandible.

The normal skulls of the remaining American species, *A. ferox*, *A. spinifera* and *A. emoryi* are essentially alike and present no striking differences from the normal Amyda skull. They agree with *A. agassizii* in the greater massiveness of the bones and general proportions of the parts. With *A. mutica* they agree in the longer choanae and the consequent shorter distance of the latter from the intermaxillary foramen.

Table 1

Cranial measurements reduced to basicranial length of skull

| | A. agassizi | A. ferox | A. spinifera | A. emoryi | A. ferox group collectively | A. mutica |
|---|---|---|---|---|---|---|
| Basicranial length in millimeters, average | 51.8 | 58.3 | 53.8 | 54.0 | | 42.8 |
| Range of b. l. of specimens | 44–70 | 45–70 | 46–69 | 44–69 | | 40–48 |
| Number of specimens measured | 8 | 12 | 9 | 9 | 30 | 6 |
| Tip of snout to orbit | 28.6 | 24.9 | 26.0 | 25.2 | 25.4 | 28.7[1] |
| Orbit, horizontal diameter | 19.1 | 20.0 | 19.9 | 20.2 | 20.0 | 20.6 |
| Orbit to tympanic cavity | 31.7 | 36.0 | 27.1 | 31.5 | 31.5 | 20.6 |
| Temporal fossa, longest diameter | 19.3 | 23.7 | 19.3 | 20.7 | 21.2 | 12.6 |
| Interorbital width | 8.5 | 6.0 | 7.4 | 7.8 | 7.1 | 5.1 |
| Maxillary alveolar surface, width | 11.4 | 6.8 | 7.4 | 8.9 | 7.7 | 5.1 |
| Internal choanae, length | 12.7 | 15.4 | 16.2 | 15.4 | 15.7 | 14.7 |
| Choanae to intermaxillary foramen | 12.7 | 7.7 | 9.1 | 8.9 | 8.6 | 9.8 |
| Intermaxillary foramen, length | 12.2 | 11.3 | 11.2 | 9.8 | 10.8 | 15.6 |
| Mandibular symphysis, length | 19.5 | 11.8 | 13.2 | 14.3 | 13.1 | 20.3 |
| Mandibular alveolar surface, width | 10.6 | 5.5 | 5.4 | 5.9 | 5.6 | ..... |

[1] Four specimens only, due to the fact that the bones—intermaxillaries and maxillaries of this species are so fragile or poorly ossified that they were lost or mutilated in the preparation of the others. The omission in *A. mutica* of a measurement of the alveolar width of the mandible indicates that it is so slightly indicated that it almost may be said to be nonexisting.

The great changes in shape, proportions, color pattern and structure of the soft-shelled turtles according to sex, age, and individual variability make it impracticable to construct a workable key to the species, hence I have confined myself to specimens in their early maturity, when the critical characters have assumed a relative and comparable stability unaffected by the rapid changes of youth and the often exaggerated individual peculiarities of old age. As the specific differences in the skull appear fully developed and most easily appreciated in skulls between 40 and 70 mm. in basicranial length, I have selected such specimens as norms to which other sizes may be more or less successfully referred, pointing out the deviations, as shown in the available material, under the headings of the various species. As the sexual differences are comparatively slight they have been ignored in the key, though it may be pointed out here that the adult males differ visibly from the females in the tail extending considerably beyond the carapace while in the females it about reaches the edge of the disk; in possessing a smaller head and a greater expansion of the plastral callosities.

It is finally to be emphasized that specimens may be met with which depart so far from the norm that they defy positive identification by the registered characters alone or in combination. Such cases are not particularly rare among the Testudinata.

*Key to young adult specimens of North American soft-shelled turtles*

$a^1$ Neurals normally 8, separating all the pleurals; entoplastron bent at an angle of about 100° or more; a central callosity normally on entoplastron; temporal fossa of skull small, the longest diameter less than two thirds the long diameter of the orbit; distance from orbit to tympanic cavity about equals diameter of orbit; intermaxillaries (premaxillaries) narrowly touch or are separated by the maxillaries. Nostrils rounded, septum between them rather wide and without lateral projecting ridge; no tubercles on the leathery disk of carapace or its anterior edge (*mutica* group; subgenus *Euamyda*).

Amyda mutica, (p. 14)

$a^2$ Neurals normally 7 (occasionally 8), last pair of pleurals in contact; entoplastron bent at an angle of about 90° or less; no callosity on entoplastron; temporal fossa on skull about equal to or longer than long diameter or orbit; distance from orbit to

tympanic cavity much greater than diameter of orbit; maxillaries in contact above intermaxillaries (premaxillaries). Nostrils crescent-shaped, internal ridge projecting on each side from the narrow septum between them; leathery disk of carapace with tubercles at least on anterior edge.

$b^1$ Length of inner bony choanae greater than their distance from intermaxillary foramen; mandibular symphysis less or equal to length of choanae (*ferox* group).

$c^1$ Sculpture of bony carapace coarsely grained, usually with numerous irregular, more or less continuous and anastomosing longitudinal ridges. (Leathery carapace of *young* with longitudinal rows of tubercles; coloration peculiar.

Amyda ferox, (p. 25)

$c^2$ Sculpture of bony carapace finely grained; (leathery disk of carapace of *young* smooth; coloration of upper surfaces gray, more or less marked with small dusky ocellae, or solid spots or lines; plastron uniform white).

$d^1$ Tubercles on anterior edge of leathery carapace well developed, normally triangular and pointed; distinct tubercles covering anterior and posterior flaps.

$e^1$ Bony carapace without raised bony knobs or "warts"; (young with one marginal dusky line on posterior part of leathery carapace).

Amyda spinifera, (p. 43)

$e^2$ Adult with strong tubercles on the hind part of carapace "supported there by prominent bony warts of the bony plates"; (in young margin of the leathery carapace marked posteriorly by at least two parallel dusky lines).

Amyda spinifera aspera, (p. 56)

$d^2$ Tubercles on anterior edge of leathery carapace poorly developed, short and bluntly rounded; tubercles on both flaps, if present, quite minute, except in very old specimens.

Amyda emoryi, (p. 65)

$b^2$ Length of inner bony choanae equals their distance from intermaxillary foramen; mandibular symphysis longer than length of choanae (*agassizii* group).

Amyda agassizii, (p. 72)

### The *mutica* group

The only species so far known in this group deviates in its characters and their combination quantitatively more from any of the others in the genus, so much in fact that it has been regarded by outstanding zoologists such as Agassiz, Cope, True, and Baur as representing a "good" genus. However, the differences are of a character that rather suggest relationship with the *ferox* group than a separate phylogeny. The difference in the number and relations of neurals does not seem to have any genetic significance in the genus *Amyda*. The long drawn out and slender snout with the occasional separation of the maxillaries at the apex and the shortening of the temporal-tympanic region indicate modifications due to some food specialization with which the absence of the dermal ridge in the nostrils at the tip of the proboscis and the thickening of the septum may be correlated.[1] In fact, there is indication of the ridge inside, though not reaching the opening of the nostrils. The extreme development of the plastral callosities is purely quantitative and is closely approached in old specimens of *Amyda emoryi*, and a small callosity on the entoplastron is often observable in other specimens of the genus. The more circular shape of the body outline is rather a juvenile character with which the obtuse angle of the epiplastral bones is correlated. In none of the characters does the *A. mutica* show any approach to any other group in the genus, particularly not to any of the Old World soft-shell turtles, so that there seems to be no convenience in recognizing it as a separate genus.[2]

### Amyda mutica[3] (Lesueur)

Plates 2, 3, 4

1827. *Trionyx muticus* LESUEUR, Mém. Mus. Hist. Nat. Paris, **15**, Dec. 1827, p. 263, pl. 7 (type-locality, Wabash River, New Harmony, Indiana; type Paris Mus. No. 787; Lesueur, collector).—LE CONTE, Ann. Lyc. Nat. Hist. New York, **3**, 1830, p. 95.—GRAY, Syn. Rept.,

[1] Holbrook, curiously enough, who especially called attention to the "two characters which always exist", viz. the "total absence of spines or tubercles" and the "great difference of the nostrils" in describing the latter speaks of them as "closely approximated" in both *ferox* (in which he included *spinifera*) and *mutica* (North American Herpetology, Edit. 2, **2**, p. 13 and p. 19) while in reality they "are widely apart" in the latter, as pointed out by Agassiz (Contrib. U. S. Nat. Hist., **1**, p. 398).

[2] Should the statement made by Dr. Stockwell (Journ. Comp. Med. Surg., **9**, 1888, p. 29) be corroborated, viz., that "the marginal ossicles in *A. mutica* are rudimentary; in *A. spinifer* altogether wanting," the question of the generic status of *A. mutica* might well be reopened.

[3] Latin, *muticus*, docked, dehorned, with reference to the absence of spines on the anterior edge of the leathery carapace.

pt. 1, 1831, p. 46; Cat. Tort. Brit. Mus., 1844, p. 50; Cat. Shields Rept. Brit. Mus., p. 1, March 8, 1856, p. 69.—DUMÉRIL AND BIBRON, Erp. Gén., **2**, 1835, p. 482 (lapsus for *Gymnopus*).—HARLAN, Med. Phys. Res., 1835, p. 159 (Ohio River and tributaries).—WIED, Reise Nord-Amerika, **1**, pt. 3, 1838, p. 140 (Pittsburgh, Pa.).—HOLBROOK, North Amer. Herpet., 1 ed., **4**, 1840, p. 17, pl. 2 (Mississippi and tributaries); 2 ed., **2**, 1842, p. 19, pl. 2 (Mississippi and tributary streams).—DE KAY, Zool. New York, Rept., 1842, p. 7 (Ohio River).—TROOST, Seventh Geol. Rep. Tennessee, 1844, p. 39 (Tennessee; *miticus* misprint).—DUMÉRIL, Cat. Meth. Rept. Mus. Paris, pt. 1, 1851, p. 22 (types).—STRAUCH, Mém. Acad. Sci. St. Pétersbourg, ser. 7, **5**, No. 7, 1862, p. 174; **8**, No. 13, 1865, p. 125; **38**, No. 2, 1890, p. 118.—HOY, Geology of Wisconsin, **1**, 1883, (p. 423) (Wisconsin).—BOULENGER, Cat. Chel. Brit. Mus., 1889, p. 260, fig. 68 (Mississippi, Ohio and Saint Lawrence).—HAY, Indiana Geol. 17 Rep., 1892, p. 551; Batr. Rept. Indiana, 1893, p. 143 (Indiana: Delphi; Madison; Terre Haute. Illinois: Mt. Carmel).—HURTER, Trans. Acad. Sci. St. Louis, **6**, 1892, p. 259 (Missouri: Mississippi River near St. Louis).—SIEBENROCK, Sitz. Ber. Akad. Wiss. Wien, Math.-Nat. Kl., **111**, 1902, p. 822, fig. 5 (plastron); Zool. Jahrb. Suppl., **10**, pt. 3, 1909, p. 605; Ann. Naturh. Hofmus. Wien, **27**, 1913, p. 214, sep. p. 44 (plastron); Verh. Zool. Bot. Ges. Wien, **73**, Aug. 1923, p. 192.—DITMARS, Reptile Book, 1907, p. 78, pl. 27, low. fig. (St. Louis, Mo.).—OVER, South Dakota Geol. Nat. Hist. Surv. Bull. 12, Oct. 1923, p. 18, pl. 7 (Missouri Riv. and eastward, South Dakota).

*Gymnopodus muticus* DUMÉRIL, Arch. Mus. Hist. Nat. Paris, **7**, 1855, p. 203.

*Gymnopus muticus* DUMÉRIL and BIBRON, Erpét. Gén. **9**, 1854, p. 236.—WIED, Nova Acta Leopold.-Carol., **32**, pt. 1, 1865, p. 54 (Ft. Mackenzie, Missouri River, 6–8 miles below Cedar Isl., South Dakota).

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doubt").—BURT, Occas. Pap. Mus. Zool. Univ. Michigan, No. 189, Dec. 12, 1927, p. 9 (Manhattan, Riley Co., Kansas); Amer. Midland Natural., **16**, No. 3, 1935, p. 321 (Barber and Reno Cos., Kansas).—POPE and DICKINSON, Bull. Publ. Mus. Milwaukee, **8**, No. 1, April 3, 1928, p. 82, pl. 21, figs. 5–6 (Wisconsin: Mississippi River counties; Crawford and Pepin Cos.).—JORDAN, Man. Vert. Northeast, U. S. (13 ed.) 1929, p. 254 (Middle and Northern tributaries, Miss. and St. Lawrence rivers.)—ORTENBURGER and FREEMAN, Publ. Univ. Oklahoma Biol. Surv., **2**, 1930, p. 188 (Oklahoma: Alfalfa and Comanche Cos.).—WALKER, Copeia, 1931, No. 1, p. 12 (Scioto and Brown Cos., Ohio).—BOYER and HEINZE, Trans. Acad. Sci. St. Louis, **26**, No. 4, Apr. 1, 1934, p. 199 (Missouri: Jefferson Co.: Meranac River).—RUST, Blatt. Aquar. Terrarienk., **45**, 1934, p. ; sep. p. 12.—TAYLOR, Univ. Kansas Sci. Bull., **22**, No. 11, Apr. 15, 1935, p. 218 (Arkansas: Duvall Bluff, Prairie Co.; Lewisville, Lafayette Co.).—DELLINGER and BLACK, Occas. Pap. Univ. Arkansas, No. 1, June 1938, p. 46 (Arkansas: Garland, Jefferson, Lafayette, Prairie, Pulaski, Sebastian, Franklin and Lawrence Cos.).—SOLA, Bull. New York Zool. Soc., **34**, No. 5, Sept.-Oct., 1931, pp. 134, 142, 155, fig. 7 upper (western) part of Pennsylvania along Lake Erie).—CAHN, Illinois Biol. Monogr., **16**, Nos. 1–2, Aug. 31, 1937, p. 176; pls. 24, 30 fig. a; map 19 (Illinois).—CONANT, Amer. Midland Natural., **20**, No. 1, July, 1938, p. 154, pl. 21, fig. 1 (left), fig. 2 (Ohio: Scioto, Muskingum and Ohio Rivers; map).—PARKER, Rep. Reelfoot Lake Biol. Sta., **3**, Jan. 1939, p. 88 (Tennessee: Reelfoot Lake, nowhere abundant).—WELTER and CARR, Copeia, 1939, No. 3, Sept. 9, p. 130 (Kentucky, east.: Triplet Co.; Fox, Fleming Co.; rare).—LOGIER, Roy. Ontario Mus. Zool. Hanb. No. 4, p. 57 (Ontario: Lake Erie, probably misidentified).—GENTRY, Rep. Reelfoot Lake Biol. Sta., **5**, Jan. 1941, p. 75 (Tennessee: Pickett Co.); Journ. Tennessee Acad. Sci., **16**, No. 3, 1941, p. 332 (Tennessee: Obey River, Pickett Co.).—ANDERSON, Bull. Chicago Acad. Sci., **6**, No. 11, 1942, p. 219 (Missouri: Jackson Co.: Fry's Lake).—PETERS, Copeia, 1942, No. 3, Oct. 8, p. 183 (Illinois: Cumberland Co.).

1864. *Potamochelys* ? *microcephala* GRAY, Proc. Zool. Soc. London, 1864 (p. 87) (type-locality, Sarawak, Borneo!!; type in British Museum).
*Callinia microcephala* GRAY, Proc. Zool. Soc. London, 1869 (p. 222); 1873, p. 62, fig. 11; Suppl. Cat. Shield Rept. Brit. Mus., pt. 1, 1870, p. 108; Hand-list Shield Rept. Brit. Mus., 1873, p. 83.

*Types.* In the Musée d'Histoire Naturelle at Paris, No. 787 is a shell on the plastron of which is written: "Trionix mutica Lesueur. Wabash River par moi . . . . . aout 1827", and on a paper label pasted on the underside of the stand: "Tortue qui n'a point le bord desou

disque spineaux & que j'ai designée sou le nom de *mutica* dans . . . . . précèdente note accompagniée de figure que je vous ai fait passer [?] C. A. Lesueur." It is designated as the type on the printed label. The bony carapace is 106 mm. in length and 107 mm. in width. A pair of fontanelles between first pair of pleurals; 8 neurals separate the pleurals.

No. 788 is a cotype retained by Lesueur until 1844 when it was acquired by the Museum. It is a larger, mounted specimen, the bony carapace measuring 134 mm. in length, 147 mm. in width; fontanelles obliterated; 8 neurals, but last pair of pleurals broadly in contact. Underside of stand inscribed "Gymnopus muticus Lesueur. Wabash. Acquis de Mr. Lesueur 1844" (Lesueur died December 12, 1846).

The so-called "Spineless" or "Brown Softshell Turtle", the smaller of our American species, may be easily recognized by the characters given in the key. In the adolescent and adult carapaces the absolute absence of tubercles on the anterior edge of the leathery disk will identify the *A. mutica* even when the head is missing or the proboscis is so mutilated as to defy examination. At the stage when the very young specimens of all the species are nearly circular in outline and the tubercles on the anterior edge of carapace of those species normally possessing them may in some individuals be so indistinct as to be doubtful, the oval nostrils without the septal tubercle will positively identify *A. mutica.*

The other differential characters keyed are not always to be relied on because of individual variation. Thus while normally the number of pleurals is 7 pairs, separated the entire length of the bony carapace by a series of 8 neurals, there are many and significant exceptions. Thus, as already mentioned, the mounted cotype of the species in the Paris Museum has the last pair of pleurals broadly in contact. Similarly the U.S.N.M. 102910 has the eighth pair of pleurals in contact for at least half their length; No. 54734 has all the pleurals separated by the 8 neurals, but it has only 6 pleurals on the right side, against 7 on the left; U.S.N.M. 92605, 95134 and 029261 have only 7 neurals and 7 pairs of pleurals and the last pair is broadly in contact behind the neurals. While visiting the Museum of Comparative Zoölogy during the early days of these investigations, I examined two specimens, both unfortunately at that time without numbers and locality, one adolescent with the seventh pair of pleurals in contact behind the neurals, while the second, an adult skeleton with a bony carapace measuring 140 mm. in length and 150 mm. in width, was still more abnormal having 8 pleurals on the right side, against 7 on the left, and with 9 neurals separating all the pleurals.

The greater angular width of the entoplastron is quite characteristic of this species, but it is sometimes questionable in application because of difficulty of exact measurement. However, it is useful where other characters are irregular or in case one has to identify a disassociated plastron or a single bone. The great extension of the plastral callosities in the males is also a character of value, though the callosities on old male *A. emoryi* may reach similar proportions on the hyo-, hypo-, and xiphi-plastra. A central callosity is normally present in *A. mutica* on the entoplastron though exceptional in the other species. Small callosities on the epiplastra are not uncommon in *A. mutica,* though rare in the others.

The sutural meeting of the maxillaries on the upper side of the snout above the premaxillary (intermaxillary) is one of the characters of the trionychid skulls, and is probably a normal or at least original condition in *A. mutica,* but as noted above the extreme tapering and hence weakening of the snout in this species results in the frequent loss of these parts in the preparation of the skulls. In my series of *A. mutica* skulls there are only four perfect specimens and in one of these, No. 102677, the maxillaries are plainly in contact on the upper side, above the premaxillary, while in the others, Nos. 53521, 54733 and 029261, the maxillaries are separated by the premaxillary.

A negative character of the young *A. mutica* is the absence of ocellated or solid black rounded spots on the carapace, and of a defined angular figure on top of the snout at the base of the proboscis. In a general way the coloration is less distinctive than in the other species. The yellowish margin of the leathery carapace seems to be definitely wider.

The coloration and pattern in this as well as the other species of the genus becomes gradually more obscure with age, and varies individually as well as locally according to environmental conditions. It may therefore not be unwelcome if I include a few color descriptions of living or freshly killed specimens which have come under my observation when comparison with Ridgway's "Nomenclature of Colors for Naturalists" (1886) was possible.

On September 4, 1934, the National Museum received from C. R. Rogers two live specimens taken in Medicine Lodge River, one mile SW of Lake City, Barber Co., Kansas. Description was at once made: U.S.N.M. No. 95185, young adult female (leathery disk about 200 mm.). Iris bright "buff", the ring nicked slightly in front and behind by a small blackish spot.—General color above nearly uniform "tawny" with very faint mottlings of lighter "tawny-ochraceous" and darker "raw umber", especially on the posterior flap, on which a faint

submarginal dusky line borders the pale margin which is lightly suffused with "rufous"; top and sides of head like back with a sharply defined band of "ochraceous buff" narrowly edged with dusky; the band continues—though fainter—anteriorly through the eye on to the canthus rostralis converging towards the base of the proboscis without meeting that of the other side; from the side of the occiput indication of the band—though more irregular—on the side of the neck; underside with a fine network of red blood vessels shining through imparting a pinkish tinge to the soft parts which fades gradually through "lavender" and "pearl blue" into "china-blue" on the palms, soles and digits merging on the underside of the webs into "tawny ochraceous" exteriorly and more pinkish interiorly; throat and chin like the soles; lower lips whitish; callosities pale "fawn-color" tinged centrally with blueish.

The other specimen, No. 95186, is a much smaller male (leathery carapace length about 135 mm.) (pl. 3). Iris, a pale yellowish ring, but the black spots are somewhat larger than in the older specimen. Colors are also essentially like the latter, but the "ochraceous buff" postocular band has the edges even better defined and on the side of the neck joins the pale color of the underside which is sharply set off from that of the upper side and extends onto the upper lip; the band is only indicated in front of the eye by a small elongated triangular spot of pale "ochraceous".

About the same time the National Museum received two live specimens from J. H. Hall, collected in Mississippi (Marion County, Columbia), both females. No. 95133, the larger one (disk approximately 185 mm. long). Iris bright buff yellow with a black horizontal bar. General color above "clay color" with irregular blotches of pale "raw sienna"; marginal dark ring on carapace broken, faint, "hair-brown"; upper side of neck washed with "tawny ochraceous"; postocular stripe dull "buff-yellow", edged with dusky ("hair-brown"); front legs above as well as dorsal and lateral surface of neck sprinkled with small dusky spots; hind feet pale "olive yellow" with slightly larger and darker dots and marblings; webs verging on "clay color"; underside of plastron "flesh color", which on the white ground of the legs changes into "pale blue" and on the soles and front feet verges on "heliotrope purple"; underside of webs pinkish towards the edge; claws horny white; callosities (none on epiplastra) "vinaceous-cinnamon". No fork figure on top of snout; no spots or definite dusky markings on soles.

The smaller specimen, No. 95134 (leathery disk approximately 155 mm.) essentially as the larger one.

Table 2

Cranial measurements of *mutica* in millimeters

| | 54733 Iowa, Fairport | 53521 Iowa, Fairport | 029261 ? | 51528 Kansas | 54734 Iowa, Fairport | 102677 Tennessee, Reelfoot Lake | 102910 Tennessee, Reelfoot Lake | Average of 7 specimens |
|---|---|---|---|---|---|---|---|---|
| Basicranial length | 40.0 | 41.0 | 42.0 | ... | 43.0 | 48.0 | ... | 42.8 |
| Tip of snout to orbit | 11.5 | 11.0 | 12 | ... | ... | 14.5 | ... | 12.3 |
| Orbit, horizontal diameter | 8.0 | 8.5 | [illegible] | 9.0 | 9.0 | 9.5 | 7.0 | 8.6 |
| Orbit to tympanic cavity | 8.0 | 8.0 | | 8.5 | 9.0 | 10.0 | 9.0 | 8.8 |
| Temporal fossa, longest diameter | 5.0 | 4.5 | 5 | 6.0 | 5.0 | 6.0 | 5.0 | 5.3 |
| Interorbital width | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.1 |
| Maxillary alveolar surface, width | 2.0 | 2.5 | 2.0 | 1.5 | 2.0 | 2.5 | 2.0 | 2.1 |
| Internal choanae, length | 6.0 | 7.0 | 6.5 | 6.0 | 6.0 | 6.5 | 7.0 | 6.7 |
| Choanae to intermaxillary foramen | 4.0 | 4.0 | 4.0 | 4.0 | 4.5 | 5.0 | 4.0 | 4.2 |
| Intermaxillary foramen, length | 6.0 | 6.5 | 6.5 | ... | 8.0 | 6.5 | ... | 6.7 |
| Mandibular symphysis, length | 8.0 | 8.5 | 8.0 | ... | 9.0 | 10.0 | 8.0 | 8.6 |
| Mandibular alveolar surface, width | ... | ... | ... | ... | ... | ... | ... | ... |

The colors of a freshly killed male specimen (leathery disk 204 mm. long) collected by Dr. C. E. Burt in Kansas, Reno County, 6 miles E. of Turon (U.S.N.M. No. 95259) were as follows: Ground color "broccoli brown" mottled with numerous very irregular and more or less anastomizing, ragged-edged "sepia" spots occupying as much space as

the ground color; posterior edge of disk pale tinged with "burnt umber"; no submarginal blackish line; upper soft parts same broccoli brown with very small and faint irregular "sepia" dots; a very pale "russet" band, raggedly edged with blackish, from canthus rostralis through eye and over ear slanting on side of neck halfway down the neck; pale lines in front of eyes do not meet those on snout nor is there trace of a connecting line forming fork or triangle at base of proboscis; underside whitish with a faint glaucous blue gray tinge on throat, underside of neck and feet; no dusky markings on feet; callosities, including the small central one on entoplastron, pale blueish "plumbeous".

Geographical Distribution

Mississippi River and tributaries; north to South Dakota and Minnesota; east to western Pennsylvania; west to Kansas, Oklahoma & Texas.

Recorded from northern localities on the Trinity, Brazos and Colorado Rivers.

Agassiz (Contr. Nat. Hist. U. S., **1**, p. 404, footnote) writes, "DeKay's *Trionyx ocellatus* is *Amyda mutica*," a statement which seems to be erroneous. The reference to DeKay's *Trionyx ocellatus* appears to be the following note in his Zoology of New York (pt. 3, 1842, p. 7) under *Trionyx ferox* [DeKay = *T. spiniferus*]: "The description given above [p. 6: "anterior margin in the adult with numerous pointed tubercles, which may be faintly and distantly traced in the young"] was taken several years since, from a specimen obtained in the Mohawk River. . . . The specimen, as I then thought, varied so much from any description of the *ferox* within my reach, that I considered it to be new, and named it *ocellatus*." The description of the Mohawk River specimen is clearly that of an adult *A. spinifera*, and cannot be taken as the record of *A. mutica* in the Mohawk River. DeKay's mention that he suspected *ferox* and *muticus* to be identical probably caused Agassiz's statement.

List of specimens in U. S. National Museum

| | | |
|---|---|---|
| 4783 (2) ♂ adol., ♂ adol. | ? | ? |
| 7646 ♂ adol. | Mo., St. Louis | Engelmann |
| 7647 juv. | " " | ? |
| 7655 juv. | Miss., Monticello | Helen Tennison |
| 7659–60 (2) | Ill. | Kennicott |
| 7746 | Ark., Arkansas R. near Ft. Smith | Lt. Whipple |

| | | | |
|---|---|---|---|
| 8337 ♀ ad. | Indiana, Madison | | |
| 9615 ♂ adol. | Ill., Mt. Carmel | Mrs. M. E. Turner | |
| 9646 ♂ adol. | " " | Robert Ridgway | May, 1878 |
| 9647 ♂ adol. | " " | " | " |
| 9650 ♂ adol. | " " | " | " |
| 9651 ♂ adol. | " " | " | " |
| 9727 ♀ ad. | " " | J. Schneck | " |
| 11629 juv. | ? | ? | |
| 11630 ♀ adol. | ? | ? | |
| 12794 (2) juv. ♂♂ | Ill., Mt. Carmel | J. Schneck | |
| 13549 | ? | ? | |
| 14780 juv. | Mo., St. Louis | J. Hurter | Dec. 20, 1887 |
| 19626 ♀ ad. | ? | ? | |
| 19627 ♀ adol. | ? | ? | |
| 21418 ♀ | ? | ? | |
| 22629 juv. | Tex., Sabine R., 5 mi. S. Longview. | Jordan & Gilbert | 1884 |
| 029261 ad. | ? | Dr. G. Baur | |
| 45735–8 | Iowa, Fairport, Mississippi R. | Snyder | June 2, 1916 |
| 52528 ♂ ad. | Kansas | Roy L. Moodie | |
| 52116–8 juv. | Ill., Olney | Robert Ridgway | |
| 53521 ♀ ad. | Iowa, Fairport | Bur. Fisheries | Apr. 24, 1911 |
| 54733 ♀ ad. | " " | J. Snyder | |
| 54734 ♀ ad. | " " | " | Aug. 8, 1916 |
| 54742 | " " (Mississippi R.) | " | May 8, 1916 |
| 55525 | Mo., St. Louis | J. Hurter | Mar. 23, 1907 |
| 55526 | " | " | May 14, 1913 |
| 55527 | Ark., Jeff. Co. | " | 1899 |
| 55528 | " Little Rock | " | June 1, 1900 |
| 55600 | Tex., McLennan Co. | J. Hurter | 1896 |
| 59267 ♀ ad. | Mo., Alexandria | E. Stringham | June 5, 1916 |
| 59268–9 | Minn., Homer | F. Schrader | Sept. 8, 1916 |
| 59276 | Ill., betw. Warsaw & Hamilton | E. Stringham | Aug. 23, 1916 |
| 59278 ♀ ad. | Mo., Alexandria | " | June 5, 1916 |
| 59281 | Iowa, Keokuk | " | Aug. 16, 1916 |
| 59282 | " " | " | June 7, 1916 |
| 59283 | " " | " | July 1, 1916 |
| 59284 | " " | " | June 7, 1916 |
| 59982 | "Central U.S." | O. P. Hay | |
| 60054–6 | Iowa, Fairport | Bur. Fish. | |
| 60561 | Mo. St. Louis | J. Hurter | |

| | | | |
|---|---|---|---|
| 71547 | Okla., 6 mi. E. Ingersoll | A. I. Ortenburger | |
| 92605 ♂ adol. | Miss., Greenville | S. F. Hildebrand | May 29, 1933 |
| 95133–4 ♀ adol. | Miss., Columbia | J. H. Hall | Aug. 1934 |
| 95185 ♀ ad. | Kans., 1 mi. S.W. Lake City | C. R. Rogers | Aug. 31, 1934 |
| 95186 ♂ juv. | Kans., 1 mi. S.W. Lake City | " | " |
| 95259 ♂ | Kans., 6 mi. E. Turon | C. E. Burt | May 25, 1934 |
| 95260 ♀ adol. | " " " | " | " |
| 95415 ♀ adol. | " 3 mi. S.E. Oxford | " | 1934 |
| 100422 ♀ adol. | La., Rayville | " | Aug., 1935 |
| 100813 pull. | Kans., Wakeeney | O. P. Hay | |
| 102612–3 | Ill., 5 mi. S. Savannah | P. Bartsch | July 29, 1907 |
| 102677 ♀ ad. | Tenn., Reelfoot Lake | W. M. Perrygo & C. Lingebach | May 6, 1937 |
| 102910 ♀ ad. | " " " | W. M. Perrygo & C. Lingebach | May 8, 1937 |
| 115939 | [Miss.] | [B. C. Wailes] | |

## The *ferox* Group

Although quite distinct, the three species included form a rather close group chiefly characterized by the uniformity of their skulls. Common for all three is the large opening of the inner choanae with the concomitant shortness of the distance of the latter from the intermaxillary foramen, which distinguish them from the *agassizii* group, while the normal proportion of the preorbital region sets them off from the *mutica* group. This statement may seem strange in view of the opinion of many early competent herpetologists who refer to the species of the *ferox* group under two different generic terms, a situation caused by the confusion of the identity of the specimens which served as basis for the generic concept, as will be shown later on.

Externally the *ferox* group differs from the *mutica* group by the crescentic shape of the nasal openings, a character shared by all the other species of the genus, and by the presence of the dermal tubercles on the carapace. From the *agassizii* group, however, there is no obvious external character by which to distinguish them as a group.

Within the group, the species from which its name is taken (because the oldest one known) is most easily identified in the adult stage from the other American species by the coarseness of the sculpture of its bony callosities (pls. 9, 10), and in the early juvenile stage by its unique coloration (pl. 19). The greater extension of the plastral flap anteriorly beyond the carapace is also a noteworthy feature.

## Amyda ferox[1] (Schneider)

### Plates 5–10

1783.—*Testudo ferox* SCHNEIDER, Naturg. Schildkr., p. 330 (Savannah River, Georgia; type in Brit. Mus.; Dr. A. Garden, collector) (based on Pennant, Philos. Trans., **61**, pt. 1, p. 266).—GMELIN, Syst. Nat., **1**, pt. 3, 1789, p. 1039.—SCHOEPFF, Naturg. Schildkr., pt. 5, 1795, p. 102; Hist. Testud., pt. 5, 1795, p. 88 (based on Pennant).—SHAW, Gen. Zool., **3**, 1802, p. 64, pl. 17.—LATREILLE, Hist. Nat. Rept., **1**, 1801, p. 165 (based on Pennant).—DAUDIN, Hist. Nat. Rept., **2**, 1802, p. 69 (based on Pennant).

*Trionyx ferox* SCHWEIGGER, Königsberg. Arch. Naturw. Math., **1**, 1812, pt. 3, p. 285 (Carolina and Florida); pt. 4, p. 363; Prodr. Mon. Chelon., pt. 1, 1814, p. 15.—MERREM, Tent. Syst. Amph., 1820, p. 20.—SAY, Journ. Acad. Nat. Sci. Philadelphia, ser. 1, **4**, pt. 2, 1825, p. 218 (part: Carolina; Georgia).—HARLAN, Journ. Acad. Nat. Sci. Philadelphia, **6**, Feb. 1827, p. 32 (part: many of the rivers of the southern states, not observed to exist further south [north ?] than South Carolina); Medic. Phys. Res., 1835, p. 158.—Le CONTE, Ann. Lyc. Nat. Hist., New York, **3**, 1830, p. 93 (part: Rivers of Georgia and Florida, north to Savannah).—GRAY, Synops, Rept., 1831, p. 45 (part); Cat. Tort. Brit. Mus., 1844, p. 49 (part); Cat. Shield Rept. Brit. Mus., pt. 1, March 1856, p. 68 (part); HOLBROOK, North Amer. Herpet., ed. 1, **4**, 1840, p. 9, pl. 1 (part: Savannah and rivers emptying into northern border of Gulf of Mexico); ed. 2, **2**, 1842, p. 11, pl. 1 (part); in White's Statistics of Georgia, 1849, Fauna and Flora, p. 13 (Georgia).—STRAUCH, Mém. Acad. Sci. St. Pétersbourg, ser. 7, **5**, no. 7, 1862, p. 173 (part); **8**, no. 15, 1865 p. 122.—BOULENGER, Cat. Chel. Brit. Mus., 1889, p. 259 (Georgia, Louisiana).—DITMARS, Rept. Book, 1907, p. 74, pl. 26, lower fig. (Georgia, Florida, Louisiana).—SIEBENROCK, Sitzungsbr. Akad. Wiss. Wien, Math. Nat. Cl., **91**, pt. 1, Oct. 1902, p. 829; Zool. Jahrb. Suppl., **10**, pt. 3, 1909, p. 603 (Georgia, Florida west to Louisiana); Verh. Zool. Bot. Ges. Wien, **73**, Aug. 1923, p. 181.—BRIMLEY, Proc. Biol. Soc. Washington, **23**, 1910, p. 18 (Georgia: Mimsville; Florida: Orlando; Belleaire; Green Cove Springs; St. Petersburg).—DECKERT, Copeia, No. 54, Feb. 17, 1918, p. 31 (Jacksonville, Duval Co., Fla.).—FLOWER, Proc. Zool. Soc. London, ser. A, 1937, pt. 1, Apr. 15, pp. 16, 37 (age: 25 years +).—POPE, Turtles of the United States and Canada, 1939, p. 303, pl. figs. 94–97 (Southeastern Atlantic and Gulf Coastal Plain).

[1] Ferocious, the specific name evidently refers to the following sentence in Dr. Garden's original description: "As the animal is very fierce, when it is attacked or disturbed, it often raises itself on its legs, and will leap forward to bite its disturber or enemy, which it does with great fury and violence".

*Amyda ferox* OKEN, Lehrb. Zool., **2**, 1816, p. 348.—STEJNEGER and BARBOUR, Check List North Amer. Amph. Rept., ed. 1, 1917, p. 124 (South Carolina to Florida and Louisiana); ed. 2, 1923, p. 140; ed. 3, 1933, p. 153; ed. 4, 1939, p. 171.—SHUFELDT, Aquat. Life, **5**, 1920, p. 27 (Georgia to Florida and Louisiana; habits).—LÖDING, Alabama Mus. Nat. Hist., Paper No. 5, Sept. 1922, p. 47 (Fig Island, Mobile Co., Ala.).—PRATT, Man. Vert. United States, 1923, p. 250.—WRIGHT, Ecology, **7**, Jan. 1926, p. 84, pl. 5, fig. 3 (Okefinokee region, Ga.).—CORRINGTON, Copeia, 1927, No. 165, Dec. 23, p. 101 (Pascagoula Swamp, near Biloxi, Harrison Co., Miss.).—PICKENS, Copeia, 1927, No. 165, Dec. 23, p. 43 (South Carolina).—JORDAN, Man. Vert. Northeast U.S., (13 ed.) 1929, p. 255 S.C. to Fla. & La.—CONANT, Bull. Antiven. Inst. America, **4**, No. 3, Dec. 1930, p. 63 (Florida: Seminole; 15 m. E. of Sarasota; 18 m. S. of Ft. Myers).—HALTOM, Alabama Mus. Nat. Hist., Pap. No. 11, 1931, p. 141 (pl. 39) (Alabama part, Mobile Co., Fig Isl.).—VAN HYNING, Copeia, 1933, No. 1, Apr. 5, p. 7 (Alachua Co., Fla., moderately common).—DeSOLA and ABRAMS, Copeia, 1933, No. 1, Apr. 3, p. 12 (Okefinokee Swamp, Ga.).—ALLEN, Amer. Mus. Novit., No. 542, June 20, 1932, p. 20 (Mississippi: Hancock Co.).—RUST, Blätt. Aquar. Terrarienk., **45**, 1934, sep. p. 12.

*Platypeltis ferox* FITZINGER, Syst. Rept., 1843, p. 30.—AGASSIZ, Contr. Nat. Hist. United States, **1**, 1857, p. 401 (southern states, Georgia to western Louisiana).—GRAY, Proc. Zool. Soc. London, 1869 (p. 214); 1873 (p. 58) (part).—TRUE, Fish. Industr. United States, sect. 1, 1884, p. 152.—BAUR, Proc. Amer. Philos. Soc., **31**, 1893, p. 220.—LÖNNBERG, Proc. U. S. Nat. Mus., **17**, 1894, p. 317 (southern Florida).—WRIGHT and BISHOP, Proc. Acad. Nat. Sci. Philadelphia, vol 67, 1915, p. 119, pl. 1, figs. 1, 2, 4; pl. 2, fig. 6 (Okefinokee Swamp, Georgia).

*Aspidonectes ferox* COPE, Bull. U. S. Nat. Mus., No. 1, 1875, p. 51 (Georgia to western Louisiana),—TRUE, in H. S. Thompson, South Carolina, 1883, p. 238 (South Carolina); Bull. U. S. Nat. Mus., No. 24, 1883, p. 29 (part: Palatka, Putnam Co., Fla.; Charleston, S. C.).—DAVIS and RICE, Illinois State Lab. Nat. Hist. Bull. No. 5, 1883, p. 52 (Georgia to western Louisiana).—SHUFELT, Rep. U.S. Nat. Mus. 1892 (1893) p. 32 (cast U.S.N.M. No. 8899).—BAUR, Amer. Natural., **22**, 1888 (p. 1121).—COKER, Bull. North Carolina Geol. Surv., **14**, 1906, p. 66 (North Carolina, introduced ?).—GOFF and GOFF, Copeia, 1935, No. 3, Oct. 15, p. 156 (Griffin, Lake Co., Fla.; incubation).

1788.—*Testudo mollis* LACÉPÈDE, Hist. Nat. Quadr. Ovip. Serp., **1**, Synops. Meth. Quadr. Ovip., tab. between pp. 618 and 619 (based on Pennant).—BONNATERRE, Tabl. Enc. Méth. Erpét., 1789, p. 25.

1795.—*Testudo* (*ferox* ?) *verrucosa* SCHOEPFF, Naturg. Schildkr., pt. 5, p. 105 (based on Bartram's Trav. North and South Carolina, 1791, p. 177) (type locality, eastern Florida); Hist. Testud., pt. 5, 1795, p. 90.

1801.—*Testudo bartrami* DAUDIN, Hist. Nat. Rept., **2**, p. 74 (based on Bartram, Voy. Amer. Septentr., vol. 1, p. 307).—HARPER, Amer. Midland Natural., **23**, No. 3, May 1940, p. 717 (Halfway Pond, Putnam Co., Florida, "restricted type locality").

*Trionyx bartrami* GEOFFROY-ST. HILAIRE, Ann. Mus. Hist. Nat. Paris, **14**, Aug. 1809 (p. 18).—Le CONTE, Ann. Lyc. Nat. Hist. New York, **3**, 1830, p. 96 (St. John's River, Fla.).

1809 ?.—*Trionyx carinatus* GEOFFROY-ST. HILAIRE, Nouv. Bull. Soc. Philom. Paris, **1**, No. 22, July 1809, p. 365 (type locality unknown; type in Paris Mus.); Ann. Mus. Hist. Nat. Paris, **14**, Aug. 1809, p. 14, pl. 4.

1809.—*Trionyx georgianus* GEOFFROY-ST. HILAIRE, Nouv. Bull. Soc. Philomat. Paris, **1**, No. 22, July 1809, p. 367 (substitute name for *T. ferox* "Pennant").

1809.—*Trionyx georgicus* GEOFFROY-ST. HILAIRE, Ann. Mus. Hist. Nat. Paris, **14**, Aug. 1809, p. 17 (variant).

1812 ?.—*Trionyx brongniarti* SCHWEIGGER, Königsberg. Arch. Naturw. Math., **1**, p. 288 (substitute name of *Trionyx carinatus*); Prodr. Mon. Chelon., 1814, p. 18.

1835.—*Gymnopus spiniferus* DUMÉRIL and BIBRON, Erpét. Gén., **2**, p. 477 (part: Rivers of Georgia and Florida).

1835.—*Trionyx harlani* "Bell" HARLAN, Medic. Phys. Research, p. 159 (type locality, East Florida; type in "Mus. of Bell; Lond.").—DeKAY, Zool. New York, Rept., 1842, p. 7 (East Florida).

*Types.* The type of *Testudo ferox* is still extant in the British Museum.[1] The species was discovered, described and illustrated by an American; his descriptions and illustrations were published by one of the most outstanding English zoologists of the period in the foremost scientific journal of Europe; Linnaeus himself was simultaneously notified of its discovery. Yet, for twelve years it remained without a systematic name, until a German bestowed on it the name by which it is specifically known. This unusual nomenclatorial history and the inaccessibility of the original description to most zoologists justify its reproduction here with a brief account of the related circumstances.

Dr. Alexander Garden, of Charleston, who was an ardent student of

[1] According to Shaw (Gen. Zool., **3**, pt. 1, 1802), the specimen was already then in the British Museum. In 1831 Gray (Syn. Rept., p. 46) confirms that statement and adds that Pennant gave the type specimen to the Royal Society. In 1844 and 1856 he records it as the "Specimen described and figured by Pennant, (restuffed)."

the natural history of the Carolinas, became possessed of an adult specimen of the first softshell turtle reported from America. On December 24, 1770, he wrote to his friend Mr. John Ellis in London as follows:[1]

"I have one or two things which I think will please him [Thomas Pennant]; he shall have them by one of our spring ships; one of them is a species of Turtle, as yet nondescript. It is amazing how Catesby omitted this. It is found in abundance in the Savannah river, in Altamaha, and East Florida. It is a fresh water animal, grows to a great size, and is as delicate as the Green Turtle, having a large leathery cover over its back, and a head very like a Mole. I intend to send a copy of my account of this animal to Mr. Pennant for his American Zoology, and if I can get a drawing of it copied, I will send him that. If I can obtain another Turtle, I shall send you one stuffed. It has a relation to the first species of Linnaeus's last edition of the Systema Naturae."[2]

Early next spring he kept his promise and sent Pennant the description as well as a preserved specimen. Another, better specimen, he forwarded at the same time to Mr. Ellis with a drawing made from life. This specimen with the drawing and the letter Pennant laid before the Royal Society in London on May 2, 1771, in the Philosophical Transactions of which, vol. 61, they were published. Dr. Garden does not state exactly whence the specimens came. In his letter he says that "they are not commonly got here in Charles-town, though by chance this last summer, I had two sent me", but as he mentions Savannah and Altamaha rivers, it may be inferred that the two turtles were sent him from one of those rivers, or one from each of them. One of the specimens, "the specimen described and figured by Pennant (restuffed)", according to Gray is the type in British Museum.

Dr. Garden's original description follows:

[p. 268] "They are found in large quantities in Savannah and Altamaha rivers; and I have been told that they are very common in the rivers in East Florida.

They grow to very large sizes, though the largest that ever I heard of was seventy pounds.

The Turtle, which I now have by me, weighs twenty pounds; and probably, when I first got it, it might have weighed from twenty-five to thirty pounds, as I have observed that it has grown poorer every

[1] Smith, J. E.: A Selection of the Correspondence of Linnaeus and other Naturalists. London, 1821, **1**, p. 580.

[2] Linnaeus, Systema Naturae, ed. 12, **1**, 1766, p. 350 (*Testudo coriacea*).

day. I have had it now near three months, and I never could observe that it has eaten any thing that has been given it, though a variety of things have been tried.

It is twenty inches long from one end of the shell or covering to the other, and fourteen inches and a half broad. The colour of this shell or covering, in general, is dark brown, with a greenish cast.

The middle part is hard, strong, and bony; but all round the sides, especially towards the tail and hindermost part, it is cartilaginous, soft and pliable, resembling thick tanned sole-leather, yielding very easily to any force in any direction whatever, but thick enough and strong enough to defend the animal from any injury. All the hind part of the back is full of oblong smooth knobs; and the fore part, just where it covers the head and neck, is studded full of large knobs. The under side of this plate is very [p. 269] beautiful, of a lively whitish colour, interspersed with innumerable very fine ramifications of blood vessels, running from the margin of the plate into larger and larger branches, until the sight of them is at once lost by their entering the body of the animal.

The under, or belly plate, or rather *sternum*, is of a fair whitish colour, and extended forward two or three inches more than the back plate, so that the head rests on it very conveniently. The hind part of this plate is hard and bony, shaped very much like a man's riding saddle, with two pieces for the thighs to rest on. The fore part of the plate is pliable and cartilaginous.

The head is somewhat triangular and attenuated, rather apparently small for the animal, but growing gradually larger towards the neck, which is thick and long, and easily extended out (neck of the present subject was thirteen inches and a half long) to a great length, or drawn back again under the shell or plate.

The eyes are placed in the fore and upper part of the head, near to one another, having pretty large loose palpebrae. The pupil is small and lively, surrounded by a lemon-coloured *iris*, perfectly round, and giving much life and fire to the eyes. When danger approaches, or when it goes to sleep, it covers its eyes, by bringing the inner and loose part of the lower palpebrae over its eye, like a *membrana nictitans*.

The upper lip and under lip are both large, but especially the upper. The *mandibula* are both entire, each being one entire bone all round, of the same shape as the mouth.

[p. 270] The nostrils are the most singular part, being a cartilaginous production of at least three quarters of an inch, beyond the upper and fore angle or point of the upper lip, perforated with two apertures

reaching back and opening into the roof of its mouth, having a smooth *septum* but fimbriated upon each side. This, at first sight, in some manner resembles the snout of the mole; but it is tender, thin and transparent, and cannot be intended for digging in the earth or land.

The arms are thick and strong, consisting of three distinct joints, viz. the upper, the fore arm, and hand. The hands have each five fingers, of which the three first are shorter and stronger, and furnished with strong nails, or rather claws. The two last fingers have more joints, but are smaller, and, instead of being furnished with claws, are covered with the membrane, which is extended even beyond their extremities. Towards the back or hind part, there are two spurious fingers, which just serve to support the membrane when extended. The upper side of these arms and hands are covered with a wrinkled loose skin, of a dusky greenish colour. The legs consist of the same number of joints, and have the same number of toes as there are fingers on the fore-feet, and these are furnished with nails in the same manner, only there is but one spurious toe. Both the fore and hind legs are thick, strong, and muscular; and as the animal is very fierce, when it is attacked or disturbed, it often raises itself on its legs, and will leap forward to bite its disturber or enemy, which it does with great fury and violence.

[p. 271] They are likewise very strong, and of a lively whitish colour, because they are generally, if not always, covered with the upper plate, which, as I said before, is extended a great way behind.

The tail is large and thick, and generally as long as the hind part of the upper plate. The anus is placed about an inch from the extremity of the tail on the inside.

The turtle, from which these characters were taken, was a female; after she came into my possession she laid fifteen eggs, and about the same number were taken out of the belly when she died. The eggs were nearly an inch diameter, and perfectly spherical.

It is esteemed very good eating, and said by many to be more delicate than the green turtle."

On June 20, 1771, Dr. Garden wrote a letter in Latin to Linnaeus which is translated as follows:[1]

> "I have described and have lately sent to our friends Ellis and Pennant, a new and very rare species of river *Testudo*, known here by the name of the Softshelled Turtle, because the covering of its back, especially towards the sides, is of a softish, leathery, very

[1] Smith, op. cit. p. 336.

flexible substance. This animal is found in the larger fresh-water rivers of East Florida, Georgia and South Carolina."

Dr. Garden probably was hoping that Linnaeus might have hastened to supply the still missing *nomen triviale* as he did five years earlier with Garden's no less startling discovery of *Siren lacertina*.

It will be noted that Dr. Garden himself, in the letter to Linnaeus, identified the new discovery with the softshell occurring in East Florida, and, subsequently, naturalists applied the name *ferox* indiscriminately to all specimens from North America. Therefore, when Lesueur in 1827 described *T. spiniferus* as a distinct species and his great countrymen Cuvier and Duméril declared it to be only the young of *T. ferox*, the identity of the two names was generally accepted, even by Holbrook (1842) and Gray (1856).[1] Not until 1857 when Agassiz demonstrated the distinctness of *spiniferus* did it become generally recognized, although even Boulenger's treatment (1889) shows that the true characters of *T. ferox*, as represented by the type specimen, were not completely understood.

The type specimen in British Museum was examined by Dr. Georg Baur on September 7, 1888, as closely as the circumstances then permitted. He noted particularly its "sehr rauhe Ornament" (very rough sculpture), and "Keine Spines, sondern Tuberkel" (no spines, but tubercles) evidently as compared with *spiniferus;* "Schädel vom Typus des Exempl. von Lucas. Vorderer Theil stark beschädigt, stark vorn abfallend. Unterkief. ganz von jenem Typus. Jugale mit minim. unt. Fortsaz." (Skull of the type of Lucas' specimen. Front part much injured, greatly inclining anteriorly. Lower jaw entirely of that type. Jugal with minimal lower process). He sums up thus: "Resultat: Type von *Platypeltis ferox* Exemplar von Lucas."

Lucas' "exemplar" is U.S.N.M. 8899 (tintag read upside down 6688 by Baur in his notes) which Baur had been studying with F. A. Lucas, then curator of the division of comparative anatomy in the National Museum. No. 8899 is a fine disarticulated skeleton still in the Museum, of approximately the same size as Dr. Garden's type, and was collected by Professor S. F. Baird, April 1877, in the St. John's River, Florida, probably not far from Jacksonville. A fine plaster cast painted by Schindler from his color sketch of the living specimen is on exhibition in the Museum. A photograph of it was published in the report of the Museum for 1882, pl. 32.

[1] For some unexplained reason, however, Duméril and Bibron ignored the priority rights of *ferox* and called the combination which included the South Carolina to Florida records *Gymnopus spiniferus*. Possibly as a disguised protest against Geoffroy's inefficient substitution of *Trionyx* for Schweigger's earlier *Emyda*.

Thanks to the authorities of the British Museum I have been permitted to examine the type and can confirm completely Dr. Baur's result as demonstrated by the photographs side by side (pl. 5) of the two specimens and the measurements in table 1.

*Type of Trionyx harlani.* In the Medical and Physical Researches published by him in 1835 Dr. Richard Harlan includes on p. 159 the description of a Trionyx as follows:

> "*Trionyx Harlani*
>
> *Trionyx Harlani*, Bell, Monogr. Test. pl.
>
> *Char.* *Body* more ventricose, soft portions of the shell less extensive than in the other species. In general appearance approaching more to the genus Emys.
>
> Inhabits East Florida. Mus. of Bell, Lond."

I have not been able to locate any such plate in Bell's Monograph of the Testudinata. Bell, in correspondence, may have indicated that he had in his collection a specimen from East Florida which he intended to figure in his unfinished Monograph under the above name, but there is no such plate among the unedited ones published in 1872 under the title: "Tortoises, Terrapins and Turtles", neither have I found any record of what became of Bell's specimen. J. E. Gray in the introduction of his catalogue of the Tortoises in British Museum, notices that "the specimens presented by . . . . Thomas Bell, Esq. [may be regarded] as the types of the species described in his various papers, and in his very beautiful Monograph of the Testudinata. . . . . [by] Dr. Richard Harlan, and Messrs. Edward and Henry Doubleday, as the types of the North-American species described by Say, Harlan, and others," but he has no reference to any softshell from Florida, nor is there in any of the later catalogs.

*External characters.* While the skull characters are only available in dubious and critical cases, normal specimens of *A. ferox* within the group are not difficult to identify, the older ones by the coarseness of the sculpture of the bony carapace; the very young ones by their unique coloration.

The coarseness of the sculpture of the bony carapace of *A. ferox* is not confined to the general network of vermiculations of the surface, but it is commonly specialized into a series of more or less prominent longitudinal welts. The difference in relative size and pattern of the pits and ridges which constitute the character of the "sculpture" is difficult to describe, but a comparison of the samples figured (pls. 7, 9, 10) explains it better than words.

The unique coloration of the hatchlings and the very young speci-

mens constitutes the most obvious and characteristic feature of the species, but unfortunately disappears with age. In all the other species the young are of a more or less pale olive or tawny ground color, either uniform or marked with dusky or blackish specks of varying shape, but mostly round dots, which when larger assume the form of ocelli with a lighter center, combined with a nearly uniform white plastron (except for the pinkish tinge due to the fine blood vessels shining through in the living specimens). The prevailing feature is the darkness and the saturation of the pigmentation, the big dark blotches on the carapace, and the dark slate gray underside, in combination with the strong contrast of the light pattern on the head and the margin of the carapace, detailed description of which will be given below.

The anterior flap of the leathery plastron is longer and less circular than in the other species, often extending a considerable distance forward beyond that of carapace, but it appears to vary individually and is difficult of precise definition because of absence of suitably fixed points from which to measure.

The shape of the outline of the disk, however, is somewhat different in the young of *A. ferox*, in as much as it is less circular than in the other species, as will appear from table 3 which presents the measurements of five hatchlings of the same brood. Similar proportions are shown by one collected by Dr. Francis Harper in the Okefinokee Swamp (U.S.N.M. 84603), viz. length of leathery carapace 39.5 mm. and width 32.5 mm. It is also well illustrated in the photograph of No. 61087, pl. 17, fig. a.

Table 3

*Amyda ferox*, pullus

Florida: Polk Co., Auburndale

| | 61083 | 61084 | 61085 | 61086 | 61087 | Average |
|---|---|---|---|---|---|---|
| Length of leathery disk mm. | 38.0 | 40.5 | 40.0 | 41.0 | 45.0 | 40.9 |
| Width of leathery disk mm. | 33.5 | 35.5 | 34.0 | 34.0 | 37.0 | 34.8 |
| Height of body mm. | 12.5 | 12.0 | 12.5 | 12.0 | 14.0 | 12.6 |

*Size.* *Amyda ferox* is apparently the largest of the North American softshell turtles. Authentic measurements of large carapaces are few

and those available are of dubious value, due to uncertainty as to identification, condition of specimen when measured, and method of measurement whether in a straight line or along the curvature of the shell. The largest Agassiz "had ever seen or heard of" was one from Natchez "which measured eighteen inches and a half [470 mm.] from the front to the hind margin of the carapace" (Contrib. Nat. Hist. U. S., vol. 1, p. 401). The largest specimen now in the National Museum is an old skin, with the skull in (U.S.N.M. No. 38123 from "Florida" which measures about 17 inches along the curvature (430 mm.). Its zygomatic width is 68 mm. The plaster cast of No. 8899—(in exhibition series) is 438 mm. long; over the curvature it measures 460 mm. (18 inches); zygomatic width 67 mm.

But larger specimens may exist, or have been living in Florida not long ago. The National Museum has a series of 16 weathered skulls picked up by Dr. E. A. Mearns near Kissimee about the beginning of this century, 14 of them larger than that of the 18 inch specimen mentioned above (No. 8899). The basicranial length of this one is 92 mm., the corresponding dimension of the 14 Kissimee skulls range from 95 to 114 mm. (aver. 103) with the zygomatic width varying between 65 and 80 mm. (aver. 73).

## Abnormal alveolar surfaces

This series of 16 skulls of evidently very old specimens shows an extraordinary development which deserves special attention.

In the normal skulls of the species in all our specimens with a basicranial length below 90 mm. the lateral outline of the snout anterior to the orbit tapers towards the end in a fairly straight line, and the narrow maxillary alveolar surface follows almost parallel, as in the other species of the *ferox* group, irrespective of sex and age.

However, in the series of 16 Mearns skulls with basicranial length above 84 mm. we find two different styles of snout outline and alveolar surface as recorded in table 4.

For the illustration of the extremes of the width of the alveolar surface and the outline of the maxilla it is only necessary to refer to plate 6. While greatly reduced the figures convey the difference between the two series as the figures are of the same relative size.

Evidently the abnormal development of the maxilla as represented by plate 6, figs. 3 and 4 are due to old age since we do not find it in the smaller and younger specimens. It at once recalls similar conditions in some Chinese species of the genus, upon which Father Heude, in

Table 4

Alveolar width and outline of snout in a series of very old *A. ferox*.

| Snout outline straight | | | Snout outline strongly convex | | |
|---|---|---|---|---|---|
| U.S.N.M. No. | Greatest alveolar width | Basicranial length | Basicranial length | Greatest alveolar width | U.S.N.M. No. |
| 029459 | 7.5 mm. | 114 mm. | ..... | ..... | ..... |
| ..... | ..... | ..... | 108 mm. | 21.5 mm. | 029464 |
| ..... | ..... | ..... | 107 mm. | 15.5 mm. | 029458 |
| ..... | ..... | ..... | 106 mm. | 14.0 mm. | 029454 |
| ..... | ..... | ..... | 105 mm. | 14.0 mm. | 029470 |
| ..... | ..... | ..... | 105 mm. | 16.0 mm. | 029457 |
| ..... | ..... | ..... | 104 mm. | 18.0 mm. | 029463 |
| ..... | ..... | ..... | 104 mm. | 11.5 mm. | 029451 |
| ..... | ..... | ..... | 101 mm. | 15.0 mm. | 029450 |
| ..... | ..... | ..... | 101 mm. | 11.5 mm. | 029460 |
| ..... | ..... | ..... | 100 mm. | 14.0 mm. | 029455 |
| 029456 | 7.5 mm. | 100 mm. | ..... | ..... | ..... |
| ..... | ..... | ..... | 97 mm. | 11.5 mm. | 029453 |
| ..... | ..... | ..... | 95 mm. | 9.5 mm. | 029452 |
| 029475 | 6.8 mm. | 92 mm. | ..... | ..... | ..... |
| ..... | ..... | ..... | 84 mm. | 12.0 mm. | 029462 |

1880,[1] based the description of numerous new genera and species. I need only refer to his pictures of *Caeloguathus novemcostatus*, pl. 5; *Tortisternum novemcostatum*, pl. 6; *Cinctisternum bicinctum*, pl. 9; and especially *Ceramopelta latirostris*, pl. 7. Notwithstanding the fact that he did not obtain any young specimens with these characteristics Heude regarded them as specific or generic differences. Boulenger in cataloguing the softshell turtles in the British Museum (1889, p. 243) was "unable to find . . . . . a single young specimen with the molar-like alveolar surfaces" but having "found in three species, viz. *T. triunguis* (Africa), *T. cartilagineus* (E. Indies), and *T. sinensis* (China)

[1] Mém. Hist. Nat. Emp. Chinois, **1**, pp. 1–38, pls. 1–9.

examples of the two types, *i.e.* on the one hand sharp-edged, comparatively narrow jaws, and on the other hand broad crushing alveolar surfaces nearly meeting on the median line in front of the choanae, in specimens which, in other respects, are undistinguishable, . . . . . [he] arrived at the conclusion that we may be in presence of a case of dimorphism caused by a difference of diet."

This idea of a "dimorphism" due to a difference of diet does not seem convincing. That it is not the result of old age alone seems obvious from the fact that so many old skulls of the same size and presumably age do not show the abnormality. That it is not due to a change of diet affecting the whole population seems also obvious since the Kissimee series are all practically from the same locality. That the difference is not a local one is proved by a weathered skull almost identical with Kissimee No. 029462 of the above table, picked up by Dr. Francis Harper in the Okefinokee Swamp (U.S.N.M. No. 59727) which with a basicranial length of 88 mm. has a maxillary alveolar width of 11 mm. The fact that in the series the largest skull is normal and the smallest abnormal coupled with the other fact that all the largest authentically sexed specimens in the collection are female and normal, while among the preserved specimens no abnormal male has been recorded, suggest that the difference may be due to sex. If so, does that indicate an individual preference among the old males for a certain kind of diet?

*The normal skull.* As repeatedly noted the skull of *A. ferox* is built on the same plan as that of *spinifera* and *emoryi* and differs but slightly in the proportionate size and relation of the various bones, but the individual variation is so great that in some cases it is even difficult to decide to which species an isolated skull without locality record belongs. *A. ferox*, however, may generally be diagnosed as having the narrowest interocular width, the shortest distance between choanae and intermaxillary foramen, and, in the medium-sized skulls, the narrowest maxillary alveolar surface. It also averages the greatest length from orbit to tympanic cavity combined with the shortest and weakest mandibular symphysis. The interorbital space is usually less in width than one third of the longest diameter of the temporal fossa, while in the others it is usually more than one third. The anterior processes of the prefrontals as a rule are longer and slenderer and the angle projecting into the posterior border of the nasal fossa is consequently more acute. In the older and younger specimens these differences become more obscure or may be entirely obliterated.

In a series of skulls of this group a rather common feature may be

noted in the larger specimens of *A. ferox*. While in the palate of the other species the maxillaries are in contact practically the whole length between the choanae and the intermaxillary foramen, they may be entirely or partly separated by the vomer which in many skulls may be seen as a fork enclosing the posterior end of the foramen as shown in all the figures on pl. 6 (very large specimens).

*Coloration.* Old specimens of this, as well as the other species, show but little of the characteristic normal coloration and pattern of the species. In *A. ferox* more or less faint remnants of the large brownish blotches on the carapace may be made out on the generally dingy "Isabella" colored ground, or disappear in the blackish or brownish variations of the latter. But as previously indicated, the very young ones display a distinctive and peculiar color and pattern, unknown until figured by Ditmars (1907) and described by Wright and Funkhouser (1915). Some of the specimens received by the National Museum were either alive or freshly killed and their descriptions with reference to a standard color nomenclature (Ridgway's Nomenclature of Colors for Naturalists, 1886) were made:

U.S.N.M. No. 61087. Auburndale, Polk Co., Florida, collected by N. R. Wood, summer of 1918. Pullus. Length of leathery carapace, 45 mm. Leathery plastron extending anteriorly beyond carapace 6 mm. Iris pale silver gray with a horizontal black bar.—Upper surface of carapace tawny olive (Ridgway, pl. iii, fig. 17) with dusky (dark sepia) spots and a narrow well-defined outer edge of bright ochraceous (R. v, 7) in strong contrast; underside of carapace and plastron slate-gray (R. ii, 5) with scattered clay-colored spots on the former and the anterior edge of plastron, the outer edge of disk narrowly ochraceous, as above, though less bright; upper side of head, neck and legs olive (R. iii, 9) with clay-colored marblings; from anterior angle of eyes to middle of proboscis an inverted Y-shaped, pale clay-colored figure, the fork situated halfway between eye and base of proboscis; side of head olive with a wide well-defined angular band of yellowish buff extending from posterior corner of eye to base of lower jaw; another similar band, but slightly broken and brighter, almost cadmium-orange (R. vi, 2) anteriorly, originating behind the former and descending on the neck to past the middle; a third band, paler buff, curving around the corner of the mouth almost meeting below the corresponding band of the other side on the posterior third of the neck; a fourth, median band between the last ones; soft skin of feet almost "plumbeous" (R. ii, 15) underneath.

Four other specimens of the same brood, Nos. 61083–86, are colored

essentially as the above. The numbers, sizes, shape and arrangement of the dark blotches on the carapace vary to a great extent and so does consequently the light network (really the ground color of the carapace) separating them, it being slightly wider in the specimen figured (pl. 19, fig. a). There is one feature common to all and of some significance, viz. the more or less parallel arrangement of the outer blotches on the posterior flap, those of the outer row nearly forming a continuous dark line, the next row also coalescing on the posterior half, thus clearly indicating the blackish submarginal rings of the other species, as shown in the illustration just quoted.

Wright and Funkhouser (Proc. Acad. Nat. Sci. Philadelphia, vol. 67, 1915, p. 122) note that "as the specimens become older, the gayly colored markings of the carapace become less distinct and have disappeared on turtles which have attained a length of 6 inches [152 mm.]." The National Museum has a specimen (No. 56804) from Irwin Co., Georgia, the carapace length of which is 100 mm., which still shows the pattern as described above, but the tubercles on the disk are all well developed.

Their further statement that with age "the plastron grows lighter in color and the head uniformly darker with the markings obsolete", is borne out by the following description made in July 1919 of a live male specimen (now U.S.N.M. No. 62217) from Georgia, Berrien County, with a leathery disk about 235 mm. long and 195 mm. wide: Iris brownish gray with a brassy edge against the pupil. Carapace dark "raw umber" (R. iii, fig. 14) with large dusky, more or less confluent irregular marblings; top of head, neck and legs "sepia" (R. iii, fig. 3) with paler marblings; proboscis, snout, sides of head, and lips strongly washed with "cinnamon" (R. iii, fig. 20); a dark brown mark across the forehead in front of eyes continued behind them to the ear as a series of spots, and a few spots of the same color behind corner of mouth; on underside of neck back of the skull three longitudinal white, dusky-edged marks; underside of body white; digits and webs strongly washed with plumbeous (R. ii, fig. 15).

Some larger specimens may still retain traces of the original pattern. A full grown male (U.S.N.M. No. 60496, carapace length 316 mm.) collected at Auburndale, Florida, was received alive on February 28, 1918, and its colors at once described by me as follows: Iris dark silvery gray with a darker horizontal bar and the inner edge forming a complete bright narrow silvery ring sharply defining the pupil; inside of nostrils dark pink; inside of mouth pale flesh-color. Ground color of carapace bistre with anastomozing, ill-defined lines (10 to 15 mm. wide)

of tawny olive, which isolate islands of the ground color of varying sizes but averaging perhaps 25 mm. in diameter; neck and legs above dark olive, head anteriorly suffused with cinnamon changing to pink on proboscis; underside pinkish white, on neck suffused with dark purplish gray on which dusky-edged cream-colored lines here and there with touches of orange; palms and soles dark olive.

*Aberrant Color Phase.* A color anomaly shown by a specimen, the history and description of which, because of the uniqueness of the pigmentation deserves to be recorded, is in the National Museum.

On April 11, 1881, there was entered in the Museum register of reptiles a consignment of living specimens collected in March by James Bell at Gainesville, Florida. Among them was an "Aspidonectes" of which the artist Z. Schindler on April 9 had made a water-color sketch for use in later painting the plaster cast for the "exhibition series". The specimen, a female (No. 10545, carapace 225 mm. long, 168 mm. wide), now a skin with skull separate, the color sketch, and the painted plaster cast (slightly broken) are still in the Museum. The water-color sketch and the oil-painted cast agree in all essentials, except that the cast is (now) considerably darker. The skull and other structural characters are those of a normal *Amyda ferox*, but the color is an extreme case of erythrochroism. The ground color of the carapace in the water-color agrees closely with what Ridgway calls "mummy brown" (R. iii, fig. 10), while in the cast it is more like his "chestnut" (R. iv, fig. 9); the throat and front of neck are "rufous" (R. iv, fig. 7) in both, though lighter in the former; top of head, back of neck, and upper side of legs raw umber (R. iii, fig. 14) in the water-color sketch while in the cast they are dark sepia washed with rufous; the most conspicuous feature is the band from beneath the eye on the auricular and temporal region which is bright vermilion in both paintings—(reminding one of the corresponding band in *Pseudemys elegans*) and edged with a narrow dusky line anteriorly above and below. The underside, judging from the color sketch (and the specimen) was uniform white.

## Geographical distribution

Florida north to South Carolina and west along the Gulf Coast to Louisiana.

Table 5

Cranial measurements of *A. ferox* in millimeters

| | Type: Georgia: Savannah River Brit. Mus. | 8899 Florida: St. Johns River Baird | 029475 Florida: Osceola Co. Kissimee Mearns | 029452 Florida: Osceola Co. Kissimee Mearns | 61352 Florida: Sarasota Co. Lake Myakka Barrett | Average of 5 Specimens | 19621 Georgia: Darien (Altamaha R.) | 029619 Georgia: Baker Co., Mimsville | 10545 Florida Alachua Co., Gainesville | 86828 Florida Collier Co., Birdon ? Bartsch |
|---|---|---|---|---|---|---|---|---|---|---|
| Basicranial length . . . mm. | 95.0 | 92.0 | 92.0 | 95.0 | 95.0 | 93.8 | 45.0 | 45.0 | 51.0 | 52.0 |
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| Tip of snout to orbit . . . . | 22.5 | 22.5 | 22.0 | 23.0 | 22.5 | 22.5 | 11.0 | 11.5 | 13.0 | 13.5 |
| Horizontal diameter of orbit | 15.5 | 17.0 | 16.5 | 16.5 | 15.5 | 16.2 | 9.5 | 9.0 | 10.0 | 11.0 |
| Orbit to tympanic cavity . | 38.0 | 36.5 | 35.0 | 37.5 | 35.5 | 36.5 | 15.0 | 13.0 | 16.0 | 17.0 |
| Longest diameter of temporal fossa . . . . . | 25.5 | 26.0 | 25.0 | 25.0 | 27.0 | 25.7 | 11.0 | 11.0 | 11.0 | 12.0 |
| Interorbital width . . . . . | ? | 6.5 | 7.0 | 8.0 | 5.0 | 6.6 | 2.5 | 3.0 | 2.5 | 2.5 |
| Width of maxillary alveole | 6.00 | 5.0 | 7.0 | 7.0 | 5.0 | 6.0 | 3.0 | 3.0 | 3.5 | 3.0 |
| Length of internal choanae | 15.5 | 13.5 | 14.5 | 14.0 | 14.5 | 14.4 | 7.0 | 7.0 | 7.0 | 7.5 |
| Internal choanae to intermaxillary foramen . . . . . | 7.0 | 7.5 | 8.0 | 8.5 | 7.5 | 7.7 | 3.5 | 3.0 | 4.0 | 3.0 |
| Length of intermaxillary foramen . . . . . | 7.0 | 12.0 | 10.0 | 9.0 | 10.0 | 9.6 | 5.0 | 5.0 | 5.0 | 6.0 |
| Length of mandibular symphysis . . . . . | 13.5 | 11.5 | 10.0 | 15.5 | 11.5 | 12.4 | — | 5.0 | 5.0 | 6.0 |
| Width of mandibular alveole surface . . . . . | 5.5 | 3.0 | 3.0 | 7.0 | 5.0 | 4.7 | 2.5 | 2.5 | 3.0 | 3.0 |

Table 5 (continued)

Cranial measurements of *A. ferox* in millimeters

| | 86492 Florida: Brady | 60532 Florida: Polk Co., Auburndale N. Wood | 029339 Florida: Lake Co., Eustis | 71156 Florida: Hillsborough Co., Plant City | 84079 Florida: Dade Co., 15 m. from Miami: Brady | 62217 Georgia: Berrien Co. | 9670 So.Carolina: Charleston Co., Charleston | 84080 Florida: Brady | Average of 12 Specimens |
|---|---|---|---|---|---|---|---|---|---|
| Basicranial length.....mm. | 60.0 | 61.0 | 62.0 | 62.0 | 62.0 | 63.0 | 68.0 | 70.0 | 58.3 |
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| Tip of snout to orbit..... | 14.5 | 14.0 | 16.0 | 16.0 | 16.0 | 15.5 | 17.0 | 16.5 | 14.5 |
| Horizontal diameter of orbit..... | 11.0 | 13.0 | 12.0 | 12.0 | 14.0 | 13.0 | 13.0 | 13.0 | 11.7 |
| Orbit to tympanic cavity..... | 19.0 | 19.0 | 20.5 | 21.0 | 19.0 | 22.0 | 23.0 | 23.0 | 19.0 |
| Longest diameter of temporal fossa. | 13.0 | 13.0 | 15.0 | 16.0 | 14.5 | 16.0 | 17.0 | 16.0 | 13.8 |
| Interorbital width..... | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 4.5 | 4.0 | 4.0 | 3.5 |
| Width of maxillary alveole..... | 5.0 | 3.5 | 4.5 | 5.0 | 4.0 | 5.0 | 4.0 | 4.0 | 4.0 |
| Length of internal choanae..... | 9.0 | 11.0 | 10.0 | 9.0 | 11.0 | 10.0 | 9.5 | 10.0 | 9.0 |
| Internal choanae to intermaxillary foramen..... | 4.5 | 4.5 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 6.0 | 4.5 |
| Length of intermaxillary foramen.... | 7.0 | 7.0 | 6.5 | 7.0 | 8.0 | 8.0 | 7.0 | 7.5 | 6.6 |
| Length of mandibular symphysis... | 6.0 | 7.0 | 8.0 | 8.0 | 7.5 | 7.5 | 8.0 | 7.5 | 6.9 |
| Width of mandibular alveole surface | 3.0 | 3.0 | — | 4.0 | 3.0 | 4.0 | 4.0 | 3.5 | 3.2 |

## List of specimens in U. S. National Museum

| | | | |
|---|---|---|---|
| 4373 | Fla., Palatka | T. Glover | |
| 7651 | " " | " | |
| 8708 | Ga., Milledgeville | T. H. Bean | July, 1876 |
| 8899 ♀ ad. | " St. Johns R. | S. F. Baird | Apr. 3, 1877 |
| 9670 ♂ adol. | S. C., Charleston | C. C. Leslie | May, 1878 |
| 10545 ♀ adol. | Fla., Gainesville | J. Bell | Mar., 1881 |
| 10704 | " " | " | |
| 19621 adol. | Ga., Darien | ? | |
| 20189 adol. | Fla., Eustis | T. Holm | March, 1893 |
| 26035 juv. | " ponds near Welaka | W. C. Kendall | Mar. 20, 1897 |
| 29210 ♀ ad. | " | E. A. Mearns | |
| 029339 adol. | " Eustis | H. J. Webber | |
| 029448–9 | " Kissimmee | E. A. Mearns | |
| 029450–1 | | | |
| 029452–9 ♂ ad. | " " | " | |
| 029460–2 ♂ ad. | " " | " | |
| 029463 ♂ ad. | " " | " | |
| 029464–6 ♂ ad. | " " | " | |
| 029467–8 | " " | " | |
| 029470 ♂ ad. | " " | " | |
| 029474 ♀ ad. | " " | " | |
| 029475 ♀ ad. | " " | " | |
| 029619 adol. | Ga., Mimsville | C. S. Brimley | |
| 38123 ♀ ad. | Fla. | M. L. Odell | |
| 38980–1 juv. | Ga., Mimsville | C. S. Brimley | June 19, 1909 |
| 51184 juv. | Fla., ponds near Tampa | Evermann & Kendall | Nov. 3, 1896 |
| 51417–20 hf-gr. | " St. Petersburg | C. S. Brimley | |
| 51421 juv. | " Orlando | " | |
| 52476–83 | Fla., Eureka | C. S. Brimley | Aug. 12, 1915 |
| 55316 ♂ ad. | Fla., Vero | I. M. Weills | |
| 56804 juv. | Ga. Irwin Co. | J. Hurter | Oct. 15, 1902 |
| 56805 | Fla., Orlando | " | July, 1911 |
| 56806 | " Hillsboro Co. | " | June 15, 1910 |
| 56807 ad. | " Bronson | " | 1891 |
| 59318 | " Sebastian | F. Harper | Feb. 23, 1917 |
| 59727–8 (skullls only) ♂ ad. | Fla., Lake Okeechobee | F. Harper | Feb. 6, 1917 |
| 60496 ♂ ad. | " [Auburndale] | N. R. Wood | Feb., 1918 |
| 60532 adol. | " Auburndale | " | " |
| 60533 ad. | " " | " | " |
| 60534 ♀ ad. | " " | " | " |

| | | | |
|---|---|---|---|
| 60547 ♂ ad. | Fla., Auburndale | N. R. Wood | 1918 |
| 60556 juv. | " " | " | Mar., 1918 |
| 60828 eggs | " Homestead | C. A. Mosier | |
| 60902–4 | " Eureka | C. S. Brimley | 1918 |
| 61031 | " Gulfport | A. G. Reynolds | |
| 61083–7 pull. | " Auburndale | N. R. Wood | July 22, 1918 |
| 61096–109 | " " | " | Aug. 24, 1918 |
| 61352 ♀ ad. | " Lake Miakka | C. M. Barrett | June 18, 1918 |
| 62217 ♂ adol. | Ga., Banks Mill Pond | U.S. Bur. Fish. | |
| 63343 | Fla., Auburndale | N. R. Wood | 1920 |
| 70398 | Ga., Mimsville | C. R. Brimley | |
| 71068–9 | ? | ? | |
| 71156 adol. | Fla., Plant City | C. R. Aschemeier | 1926 |
| 71681 [1] | S.C., Greenwood | Dr. Barrett | |
| 73199 | Fla., Delray | J. D. Thieme | |
| 80963 | Fla. | F. H. Benjamin | Apr., 1930 |
| 84079 | " 15 mi. from Miami | M. K. Brady | 1930 |
| 84080 | " Orlando | E. T. Evans | " |
| 84603 pull. | Ga., Chesser's Id., Okefinokee Swamp | F. Harper | July 21, 1931 |
| 86492 ♂ | Fla., 15 mi. from Miami | M. K. Brady | Mar., 1932 |
| 86828 ♂ adol. | " nr. Birdon | P. Bartsch | Aug., 1932 |
| 95767 ♂ adol. | " Lake Iamonia | C. R. Aschemeier | Feb. 16, 1935 |
| 103736 Juv. | " Silver Lake | " | Mar. 7, 1938 |

### Amyda spinifera (Lesueur)

Agassiz, in 1857, while demonstrating the distinctness of Lesueur's species described 30 years before from the Wabash River against the contention of contemporary authors that it was only the young of *Amyda ferox*, at the same time established three additional species, *Aspidonectes asper* from the state of Mississippi, *A. nuchalis* from Tennessee, and *A. emoryi* from Texas. The latter has been generally accepted, *nuchalis* has been generally ignored, and *asper* only recently recognized as a distinguishable race of *A. spinifera*. As such it will be treated below trinominally.

The characters attributed to *A. nuchalis* have lost their significance after the accumulation of additional material of *A. spinifera*, and the study of available series of specimens in connection with the present investigation have not yielded data indicating a separable group populating the upper reaches of the Tennessee and Cumberland Rivers.

[1] Identity questioned.

## AMYDA SPINIFERA SPINIFERA[1] (Lesueur)

Plates 11–15

1825.—*Trionyx ferox* SAY, Journ. Acad. Nat. Sci., ser. 1, **4**, pt. 2, p. 218 (part: Mississippi, Ohio, and Missouri Rivers; New York, etc.) (not of Schneider).—LeCONTE, Ann. Lyc. Nat. Hist., New York, **3**, 1830, p. 93 (part: all streams which run into the Mississippi).—HARLAN, Med. Phys. Res., 1835, p. 158 (part).—SCHLEGEL, Fauna Japon., Rept., 1838, p. 30, pl. 5, fig. 5 (Cumberland, Tennessee and Ohio Rivers).—HOLBROOK, North Amer. Herpet., 1 ed., **4**, 1840, p. 9 (part); 2 ed., **2**, 1842, p. 11, pl. 1 (part: Mississippi; great northern lakes; Mohawk River, New York).—DeKAY, Zool. New York, pt. 3, Rept., 1842, p. 6, fig. 11 (Mohawk River; Hudson River near Albany, New York).—TROOST, Seventh Geol. Tennessee, 1844, p. 39 (Tennessee).—THOMPSON, Hist. Vermont, 1853, p. 29 (Vermont: Rivers Lamoille and Winooski).—GRAY, Cat. Tort. Brit. Mus., 1844, p. 49 (part); Cat. Shield Rept., **1**, 1856, p. 68 (part).—KENNICOTT, Trans. Illinois Agric. Soc., **1**, 1855, p. 591 (Illinois: Cook Co., Lake Michigan).—STRAUCH, Mém. Acad. Sci. St. Pétersbourg, ser. 7, **5**, no. 7, 1862 (part); **8**, no. 13, 1865, p. 122 (part).—DITMARS, Reptile Book, 1907, pl. 27, upper fig. (not of text).—GADOW, Cambridge Nat. Hist., **8**, 1901, p. 408 (part), p. 409, fig. 92 (North America).

*Amyda ferox* ORTENBURGER, Copeia, no. 170, May 1929, p. 12 (Oklahoma: LeFlore Co.); p. 28 (Oklahoma: Rogers Co.).

1827.—*Trionyx spiniferus* LESUEUR, Mém. Mus. Hist. Nat. Paris, **15**, Dec. 1827, p. 258, pl. 6 (type-locality, Wabash River, New Harmony, Indiana; types in Paris Mus.; Lesueur, collector).—WIED, Reise Nord-Amerika, **1**, pt. 3, 1838, pp. 140, 141 (Pittsburgh, Pa.); Voy. Amér. Nord, **3**, 1843, p. 242.—HAY, Indiana Geol. 17 Rep., 1892, p. 554; Batr. Rept. Indiana, 1893, p. 146 (Indiana: generally distributed).—HURTER, Trans. Acad. Sci. St. Louis, **6**, 1892, p. 260 (Missouri: Mississippi River, Merimac River, and Illinois River).—HAHN, Proc. U. S. Nat. Mus., **35**, Dec. 1908, p. 567 (Lawrence Co., Ill.).—SIEBENROCK, Zool. Jahrb. Suppl., **10**, pt. 3, 1909, p. 604 (Mississippi River and tributaries; St. Lawrence River; Hudson River); Verh. Zool.-Bot. Ges. Wien, **73**, Aug. 1923, p. 186.—THOMPSON, Thirteenth Rep. Michigan Acad. Sci., 1911, pp. 106, 107, fig. 1 (Cass Co., Michigan).—ELLIS and HENDERSON, Univ. Colorado Stud., **10**, no. 2, May 1913, p. 112 (Colorado: Weld Co.: Evans, Cache la Poudre, South Platte River, and Greeley).

[1] Spine bearing, with reference to the pointed shape of the tubercles margining the anterior flap of the leathery carapace, characteristic of older specimens.

*Gymnopus spiniferus* DUMÉRIL and BIBRON, Erpét. Gén., **2**, 1835, p. 477 (atlas, pl. 22, fig. 1) (Wabash River).—DUMÉRIL, Cat. Méth. Coll. Rept. Mus. Hist. Nat. Paris, 1851, p. 22 (Wabash River).—SAGER, Peninsular Journ. Med. Collat. Sci., **3**, no. 8, 1856, p. 361 (anatomy).—WIED, Nova Acta Acad. Leopold.-Carol., **32**, pt. 1, 1865, p. 48 (Wabash River).

*Gymnopodus spiniferus* DUMÉRIL, Arch. Mus. Hist. Nat., **7**, 1856, p. 203.

*Aspidonectes spiniferus* RHOADS, Proc. Acad. Nat. Sci. Philadelphia, 1895, p. 386 (Tennessee: Samburg, Obion Co.).

*Aspidonectes spinifer* AGASSIZ, Contr. Nat. Hist. United States, **1**, 1857, p. 403; vol. 2, pl. 6, figs. 1–2 (Lake Champlain; Lake Ontario and Erie; New York, Pennsylvania, Ohio, Indiana, Illinois, Missouri, Michigan, Wisconsin, Iowa, Ft. Union, Montana).—MILES, First Biennial Rep. Geol. Surv. Michigan, 1861, pp. 232, 233 (Michigan: as far W. as Genessee Co.).—ALLEN, Proc. Boston Soc. Nat. Hist., 1874, p. 69 (Musselshell and Yellowstone Rivers, Montana).—COPE, Bull. U. S. Nat. Mus., No. 1, 1875, p. 51.—JORDAN, Man. Vert. North Amer., ed. 3, 1880, p. 168; ed. 5, 1888, p. 206 (Canada to Kentucky and Minnesota); ed. 8, 1899, p. 206.—CRAGIN, Trans. Kansas Acad. Sci., **2**, 1881, p. 116 (Kansas: Franklin and Douglas Cos.).—CONES and YARROW, Bull. U. S. Geol. Geogr. Surv., **4**, 1878, p. 261.—SMITH, Rep. Geol. Survey Ohio, **4**, 1882, p. 668 (all streams flowing into Ohio and Lake Erie).—TRUE, Bull. U. S. Nat. Mus., No. 24, 1883, p. 29 (Webster City, Iowa; Mt. Carmel, Illinois; Fox River, Illinois; Ft. Laramie, Nebraska); Fish. Industr. United States, Sect. 1, 1884, p. 152.—HOY, Geol. Wisconsin, Surv. 1873–1879, **1**, 1883, p. 423 (Western Wisconsin).—DAVIS and RICE, Illinois State Lab. Nat. Hist., Bull. No. 5, 1883, p. 52 (north of Ohio River); Bull. Chicago Acad. Sci., **1**, no. 3, 1883, p. 32 (Illinois).—HOY, Geol. Wisconsin, **1**, 1883, p. 423 (Wisconsin).—HUGHES, Bull. Brookville Soc. Nat. Hist., No. 2, 1884, p. 41 (Franklin Co., Indiana).—STOCKWELL, Journ. Comp. Med. Surg., **9**, 1888, p. 28.—HIGLEY, Trans. Wisconsin Acad. Sci., **7**, 1889, p. 159 (south and west Wisconsin).—GARMAN, H., Bull. Illinois State Lab. Nat. Hist., **3**, 1892, p. 246 (throughout Illinois: Rock Creek, Kendall Co.; Plano; Oregon, Ogle Co.; Peoria, Peoria Co.; Bluff Lake, Union Co.; Wabash River, Mt. Carmel).—KIRSCH, Bull. U. S. Fish Comm. 1894 (1895), p. 81 (Eel River, Indiana).—McLAIN, Notes Coll. Rept. Arkansas, 1899, p. 1 (Bloomington, Monroe Co., Indiana).—SMITH, Proc. Linn. Soc. New York, 1898–99, No. 11, 1899, p. 24.—RAMSEY, Proc. Indiana Acad. Sci., 1900 (1901), p. 224 (Lake Winona, Indiana).—ATKINSON, Ann. Carnegie Mus. Pittsburgh, **1**, 1901, p. 154 (Monongahela River,

Pennsylvania).—MORSE, Ohio Natural., **1**, no. 8, 1901, p. 127 (Columbus, Ohio); Proc. Ohio Acad. Sci., **4**, pt. 3, Spec. Pap. No. 9, 1904, p. 138 (Ohio: Columbus; Sandusky; London).—PAULMIER, New York State Mus. Bull. 51, 1902, p. 392 (Lakes Ontario and Erie; through Erie Canal to Hudson River).—CLARK, Rep. 4 Michigan Acad. Sci., 1904, p. 193 (Eaton Co., Michigan).—JORDAN, Man. Vert. Anim. U. S., 1904, p. 206.—GIBBS, NOTESTEIN and CLARK, Rep. 7, Michigan Acad. Sci., 1905, p. 110 (Michigan: Brookfield, Ann Arbor, Olivet, Kalamazoo, Van Buren, Montcalm and Allegan Cos.).—STONE, Amer. Natural., **40**, 1906, p. 168 (into Delaware Valley; Cooper's Creek and Warren Co., New Jersey; Allegheny River, western Pennsylvania).—NASH, Check List Vertebr. Ontario, 1906, p. 17 (Canada: Ontario, western part; one record Ottawa River).—FOWLER, Rep. New Jersey State Mus., 1906 (1907), p. 211, pl. 57 (Cooper's Creek; Paulin's Kill, Hainesburg, Warren Co., New Jersey, introduced).—SURFACE, Zool. Bull. Pennsylvania Dep. Agric., **6**, nos. 4–5, 1 Sept., 1908, p. 121, fig. 2 (Pennsylvania: Indiana Co.; Somerset Co.).—REED and WRIGHT, Proc. Amer. Philos. Soc., **48**, 1909, p. 408 (Cayuga Lake, New York).

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75 (Tennessee: Clay Co., Overton Co.); Journ. Tennessee Acad. Sci., **16**, no. 3, 1941, p. 332 (Tennessee: Overton, Fentress, Pickett, Jackson, and Clay Cos.).—CAGLE, Copeia, 1942, no. 3, Oct. 8, p. 155 (Illinois: Jackson and Williamson Cos.)

*Platypeltis spinifera* RUTHVEN and THOMPSON, Herpet. Michigan, 1912, p. 129 (Michigan).—THOMPSON, Misc. Pap. Zool. Michigan, 1916, p. 63 (Monroe Co., Michigan).

1827.—*Trionyx ocellatus* LESUEUR, Mém. Mus. Hist. Nat. Paris, **15**, Dec. 1827, p. 261 (type-locality, New Harmony, Indiana).—DEKAY, Zool. New York, pt. 3, Reptiles, 1842, p. 7 (Mohawk River, New York).

1838.—*Trionyx annulifer* WIED, Reise Nord-Amerika, **1**, pt. 3, p. 140 (type-locality, Ohio River at Pittsburgh, Pennsylvania); Voy. Amér. Nord., **3**, 1843, pp. 242–243.

1844.—*Tyrse argus* GRAY, Cat. Tort. Brit. Mus., p. 48 (type-locality, "West Africa, Sierra Leone?"; type in Brit. Mus.; Lord Derby, collector); Knowlsley Menag., 1846 (pl. —).

*Trionyx argus* GRAY, Cat. Shield Rept. Brit. Mus., pt. 1, March 8, 1856, p. 68.

1856. *Trionyx annulatus* "Wied", GRAY, Cat. Shield Rept. Brit. Mus., pt. 1, March 8, 1856, p. 69 (lapsus in synonymy).

1857. *Aspidonectes nuchalis* AGASSIZ, Contr. Nat. Hist. United States, **1**, p. 406 (type-localities, Cumberland and Tennessee rivers; cotypes, Mus. Comp. Zoöl., nos. 1623–1625, Cumberland river).—COPE, Bull. U. S. Nat. Mus., no. 1, 1871, p. 51.—TRUE, Bull. U. S. Nat. Mus., no. 24, 1883, p. 5; Fish. Industr. United States, sect. 1, 1884, p. 152 (middle western states).—DAVIS and RICE, Illinois State Lab. Nat. Hist., Bull. No. 5, 1883, p. 52 (Cumberland and Upper Tennessee Rivers).—JORDAN, Man. Vert. Anim. North United States, ed. 5, 1888, p. 206 (Cumberland and Upper Tennessee Rivers); ed. 8, 1899, p. 206.—RHOADS, Proc. Acad. Nat. Sci. Philadelphia, 1895, p. 404 (Cumberland River, near Nashville).

1861. *Amyda mutica* MILES, First Biennial Rep. Geol. Surv. Michigan, pp. 2323, 233 (Michigan). (Not of Lesueur).—SMITH, Science News Suppl., **1**, 1879, p. 7 (Michigan).—KIRSCH, Bull. U. S. Fish Comm. 1894 (1895), p. 41 (Indiana: Eel River); p. 333 (Maumee Riv., Ohio).

1865.—*Gymnopus olivaceus* WIED, Nova Acta Acad. Leopold.-Carol., **32**, pt. 1, p. 55, pl. 5 (type-locality, New Harmony, Wabash River, Illinois).

1869.—*Callinia spicifera* GRAY, Proc. Zool. Soc. London, 1869, pp. 222 (lapsus for *spinifera*).

1939.—*Amyda spinifera spinifera* STEJNEGER and BARBOUR, Check List N. A. Amph. Rept., ed. 4, p. 172; ed. 5, 1943, p. 213.—ANDERSON, Bull. Chicago Acad. Sci., **6**, no. 11, July 8, 1942, p. 219 (Missouri: Jackson Co.; Missouri River near Atherton).—EDGREN, Copeia, 1942, no. 3, Oct. 8, p. 180 (Michigan: Van Buren Co., Reynold Lake).—PETERS, Copeia, 1942, no. 3, Oct. 8, p. 183 (Illinois: Cumberland Co.).

## Geographical distribution

*Amyda spinifera* has been credited to the fauna of South Carolina on the strength of the specimen U.S.N.M. No. 7650 recorded in U. S. Nat. Mus. Bulletin No. 24 (1883), p. 29, as coming from "Abbeville, S. C.". It is also the record upon which is based True's record of the occurences of *Aspidonectes spinifer* in H. S. Thompson's, South Carolina, 1883, p. 238. The record is undoubtedly erroneous, the ascertainable facts being as follows:

The specimen, recently hatched, was one of the numerous neglected turtles found in the collection when Dr. G. Brown Goode took charge and tintagged and registered the specimens. He entered the present one in 1872 as No. 7650, the tin tag bearing that number. In the record book [in Brown Goode's handwriting] it is noted as an Aspidonectes [no specific name]; locality: "Abbeville S. C."; and no further remarks. There is now no other indication of its origin than an old torn scrap of paper in the bottle with "7650 Abbeville S.C." likewise in his handwriting. On the back of this label, however, there is—in very faded ink and in an entirely different handwriting—the remnant of an inscription, beginning and end clipped off, "ville Mis". If this remnant really is part of the original locality record, it seems probable that it may have read "Abbeville, Miss." and inadvertently attributed to South Carolina as the more familiar locality. The specimen is unquestionably an *Amyda spinifera*. The whole pattern of coloration is normal of that species, which of course at once excludes *A. ferox*. The single regularly defined submarginal dusky ring on the upper side of the disc likewise excludes *A. agassizii*, the species one would expect if it were collected in Abbeville, S. C. To make perfectly sure of its identity I have had the skull extracted. It shows all the characteristic features of *A. spinifera* as distinguished from *A. agassizii*.

Another erroneous record of *Trionyx spiniferus*, viz. in Pope's Turtles (1931) pl. 45, figs. 98, 99) showing excellent figures of two soft-shelled turtles from the region of Columbia, South Carolina, needs correction. Both pictures are plainly of *Amyda agassizii*.

Table 6

Cranial measurements of *A. spinifera* in millimeters

| | 54732 Iowa: Muscatine Co.; Fairport | 70397 Oklahoma: McCurtain Co. | 54421 Montana: Big Horn Co.; Crow Agency | 59265 Minnesota Winona Co.; Homer | 54731 Iowa: Muscatine Co.; Fairport | 54730 Iowa: Muscatine Co.; Fairport | 59264 Minnesota Winona Co.; Homer | 59263 Minnesota Winona Co.; Homer | 101386 Virginia: Smyth Co.; Seven Mile Ford | Average of 9 Specimens |
|---|---|---|---|---|---|---|---|---|---|---|
| Basicranial length . . . . mm. | 46.0 | 48.0 | 50.0 | 51.0 | 54.0 | 55.0 | 56.0 | 69.0 | 55.0 | 53.8 |
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| Tip of snout to orbit . . . . . | 13.0 | 12.5 | 13.0 | 13.0 | 14.0 | 14.0 | 14.0 | 18.5 | 14.0 | 14.0 |
| Horizontal diameter of orbit | 9.0 | 9.0 | 10.0 | 11.0 | 10.0 | 11.0 | 11.0 | 14.0 | 12.0 | 10.8 |
| Orbit to tympanic cavity . . | 12.0 | 13.0 | 14.0 | 13.0 | 14.0 | 15.0 | 16.0 | 20.0 | 14.5 | 14.6 |
| Longest diameter of temporal fossa . . . . . | 9.0 | 9.0 | 9.0 | 10.0 | 11.0 | 11.0 | 11.0 | 14.0 | 10.0 | 10.4 |
| Interorbital width . . . . . | 3.5 | 3.5 | 4.0 | 3.5 | 4.0 | 4.0 | 4.5 | 5.0 | 4.0 | 4.0 |
| Width of maxillary alveole . | 3.5 | 4.0 | 3.5 | 3.0 | 4.0 | 5.0 | 4.0 | 5.5 | 4.0 | 4.1 |
| Length of internal choanae . | 8.0 | 8.0 | 8.0 | 8.0 | 9.0 | 8.5 | 9.0 | 11.0 | 9.0 | 8.7 |
| Internal choanae to intermaxillary foramen . . . . . | 5.0 | 5.0 | 4.0 | 4.5 | 5.0 | 5.5 | 5.0 | 6.5 | 4.0 | 4.9 |
| Length of intermaxillary foramen . . . . . | 6.0 | 5.0 | 5.5 | 6.5 | 7.0 | 6.0 | 6.0 | 7.5 | 6.0 | 6.2 |
| Length of mandibular symphysis . . . . . | 6.0 | 7.0 | 7.0 | 6.0 | 7.0 | 7.0 | 7.0 | 10.0 | 7.0 | 7.1 |
| Width of mandibular alveole surface . . . . . | 2.5 | 2.5 | 3.0 | 2.5 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 | 2.9 |

Stockwell's reference to the occurrence of *Aspidonectes spinifer* "North of Athabasca Lake" (Journ. Compar. Medic. Surg., **9**, 1888, p. 28) must rest on some curious lapsus.

Where *Amyda spinifer* meets with *A. asper* is as yet conjectural. It extends at least as far south as the northern part of the State of Mississippi, for we have undoubted specimens from De Soto County (U.S.N.M. No. 92606) and Lake Washington, Washington County (No. 92607). A young male specimen from Madison Co., Northern Louisiana (No. 83985) is likewise this form with only one marginal stripe.

The Museum of Comparative Zoölogy has a specimen from Columbus, Ga (M.C.Z. 1606).

Mississippi River and tributaries, west to Colorado, north to Montana; St. Lawrence River and tributaries; east to Vermont, western New York. and Pennsylvania.

*A. nuchalis,* judging from the slight material at hand, is not a strongly differentiated form. The character chiefly relied on by Agassiz, "the most prominent specific character . . . the marked depression on either side of the blunt median keel," does not hold in a series of specimens. I find quite a number so characterized among typical *A. spinifera,* and while one of the specimens from near Sevierville, Tenn., has a rather flat bony carapace, the other has "the blunt keel, which extends along the median line and slopes uniformly upon the sides," exactly as he describes it diagnostically for *A. spinifera* (p. 404). The angle of the entoplastron, in the few examples examined, is somewhat more obtuse, between 90° and 95°, than in corresponding specimens of typical *A. spinifera.* The sharply defined ocelli on the carapace seem to be larger than in *A. spinifera* of the same age (size).

I do not at all understand Agassiz's note that "this species differs strikingly from *Asp. spinifer* in the much more elongated form of the male, and in the great development of the marginal spines and of the tubercles upon the carapace, which project very slightly in the male *Asp. spinifer.*" On the contrary, in our upper Tennessee specimens, presumably typical *A. nuchalis,* the carapace of the males is wider than in the females, and the spines on the anterior edge very much smaller, exactly as in typical *A. spinifera.*

U.S.N.M. 86677 from Cumberland Gap, and 86682 from 2 miles west of Sevierville, Tennesse, are typical "*nuchales.*"

*List of specimens in the U. S. National Museum*

| | | | |
|---|---|---|---|
| 58 | Mont., Ft. Union | F. V. Hayden | |
| 7163(029528) | Tenn., Nashville | J. Varden | |
| 7165(029529) | " " | " | |
| 7166(029530) | " " | " | |
| 7167 | " " | " | |
| 7169 juv. | " " | " | |
| 7648 ♂ adol. | Wyo., Ft. Laramie | F. V. Hayden | |
| 7649 | ? | ? | |
| 7650 pull. | Miss., Abbeville? | ? | |
| 7661 juv. | Ill. | R. Kennicott | |
| 8359 | Ind., Madison ? | ? | |
| 9654 | Ill., Mt. Carmel | R. Ridgway | May, 1878 |
| 9717 | Ill., Mt. Carmel | Mrs. L. M. Turner | June, 1878 |
| 9928 juv. | Iowa, Webster City | C. Aldrich | 1878 |
| 11625 juv. | ? | ? | |
| 11631 juv. | La., Prairie Mer Rouge | ? | |
| 12061 juv. | Ill., Mt. Carmel | L. M. Turner | |
| 14535 juv. | Mont., Ft. Custer | C. Bendire | |
| 14536 ♀ ad. | " " | " | |
| 16704 ♀ | Ala., Courtland | P. H. Kirch, E. O. Jones, and | May, 1889 |
| 16705 | " " | W. M. Andrews | " |
| 17823 juv. | Ark., Benton | Jordan & Gilbert | |
| 19622–3 ♀ ♂ adol. | ? | ? | |
| 19625 | ? | ? | |
| 21128–9 juv. | Ohio, Cuyahoga River | A. J. Woolman | July 25, 1893 |
| 21416–7 | ? | ? | |
| 21567–8 | Ohio, Edgerton | P. H. Kirsch | July 28, 1893 |
| 21569–70 | Ind., Fish Cr., near Hamilton | " | July 21, 1893 |
| 21571–7 | Ohio, Maumee Basin | " | 1893 |
| 22711 | Ind., Vincennes | R. Ridgway | |
| 24536 | Mont., Ft. Custer | C. Bendire | Mar. 8, 1886 |
| 26290 | Ohio, Franklin Co. | R. C. Osborn & E. C. Williamson | June, 1897 |
| 029014 ♀ | " Columbus | O. Davie | |
| 33494 | Ind., Lake Maxinkuckee | B. W. Evermann | July 21, 1900 |
| 33495 | " Yellow River north of Burr Oak | " | Oct. 3, 1900 |
| 33496–501 | " L. Maxinkuckee | | 1899–1900 |
| 33767 | W. Va., Dry Fork, Perryville | W. P. Hay | 1900 |

| | | | |
|---|---|---|---|
| 35404–8 | Ind., L. Maxinkuckee | H. W. Clark | 1900 |
| 36412 | Ill., Illinois R. | S. P. Bartlett | |
| 42583 juv. | Ind., Long Point, L. Maxinkuckee | Evermann & Clark | Oct. 5, 1906 |
| 42584 juv. | " L. Maxinkuckee | " " | |
| 42585 eggs | " " | " " | Nov. 17, 1906 |
| 42905–6 juv. | " Burlington | B. W. Evermann | 1899 |
| 50670 juv. | " Twin Lakes | H. W. Clark | July 2, 1909 |
| 51213 hf-gr. | Mich., Monroe Piers | C. Rutter | Aug. 13, 1894 |
| 51214 " | Ohio, Toledo, Grassy Point | " | Aug. 3, 1894 |
| 51529 ad. | Kansas | R. L. Moodie | |
| 53521 | Iowa, Fairport | Bur. Fisheries | Apr. 24, 1911 |
| 53522 | Ill., Hamilton | J. McAdams | May 1, 1915 |
| 53523–6 | Iowa, Fairport | E. Snyder | Oct. 1, 1914 |
| 54421 ♂ ad. | Mont., Crow Agency | M. A. Hanna | Aug. 5, 1916 |
| 54422–3 | " " | R. Kellogg | July 8, 1916 |
| 54730 ♀ adol. | Iowa, Fairport | J. Snyder | June, 1916 |
| 54731 ♀ adol. | " " | " | July 2, 1916 |
| 54732 | " " | " | " |
| 54739–41 | " " | " | May 8, 1916 |
| 54743–6 | " " | " | May, 1916 |
| 54747 | Ill., Meredosia | Freeland & Williams | 1908 |
| 55680 | " Madison Co. | J. Hurter | |
| 55681 | " Union Co. | " | |
| 55682 | Ky., Morgan Co. | " | |
| 55683 | Kans., Greenwood Co. | " | July-Aug., 1912 |
| 55684 | Mo. Stone Co. | " | June 27, 1908 |
| 55085 | " St. Louis Co. | " | 1913 |
| 55686 | " St. Louis | " | |
| 55687 | " " | " | Apr. 9, 1905 |
| 55688 | " Reynolds Co. | " | July 21, 1911 |
| 55689 | " Franklyn Co. | " | Aug. 20, 1911 |
| 55690 | " Washington Co. | " | June 25, 1911 |
| 59046 | " St. Louis | " | May 20, 1908 |
| 59263–6 ♀ adol. | Miss., Homer | F. Schrader | |
| 59267 ♀ | Mo., Alexandria | E. Stringham | June 5, 1916 |
| 59270–5 | Minn., Homer | F. Schrader | Sept. 8, 1916 |
| 59277 | Ill., between Warsaw and Hamilton | E. Stringham | Aug. 25, 1916 |
| 59279–80 | Mo., Canton | Bur. Fisheries | |
| 59285 | Iowa ? | " | |
| 59736 | Mont., Crow Agency | R. Kellogg | July 23, 1916 |
| 59956 | Ind., Madison | O. P. Hay | |
| 59979 ♂ juv. | Ind. ? | " | |

| | | | |
|---|---|---|---|
| 60571 juv. | Ill., Madison Co. | J. Hurter | |
| 70397 adol. | Okla., Red River, McCurtain Co. | A. I. Ortenburger | 1924 |
| 72387 | Ind., Knox | H. W. Clark | Aug. 12, 1909 |
| 73668–9 juv. | Miss., Greenwood | I. L. Towers | 1925 |
| 83985 ♂ adol. | La., 2 mi. E. of Mounds | C. E. Burt | June 30, 1931 |
| 86677 ♀ ad. | Tenn., 5 mi. S.E. Cumberland Gap | " | July 22, 1932 |
| 86681–2 ♂ adol. | " 2 mi. W. Sevierville | " | 1932 |
| 87164 juv. | " 2 mi. S. Kingston | " | July 27, 1932 |
| 90441–4 juv. | Kans., 1 mi. W. Winfield | " | Apr. 30, 1933 |
| 91022 juv. | " Winfield | L. Hoyle | May 28, 1933 |
| 92606 pull. | Miss., Lake Cormorant | S. F. Hildebrand | June 9, 1933 |
| 92607 juv. | " Greenville | " | May 31, 1933 |
| 93089–94 juv. | Mo., Dardenne Cr., St. Charles Co. | L. Hubricht | Aug. 16, 1931 |
| 95140 pull. | Miss., 1 mi. W. Yazoo City | C. E. Young | Aug. 13, 1934 |
| 95261 ♀ ad. | Kans., 2 mi. E. of Calista | C. E. Burt | May 25, 1934 |
| 95301 | " 11 mi. S.E. of Winfield | " | Aug. 31, 1934 |
| 95352 ♀ ad. | Ark., 7 mi. N.W. Natural Dam | " | June 7, 1934 |
| 95405 ♂ ad. | Mo., Glaize Creek, Jefferson Co. | A. A. Heinze | July 20, 1932 |
| 99862–75 | La., Red River near Shaw | C. E. Burt | 1935 |
| 100160 ♀ ad. | " Bayou Chene | " | June 17, 1935 |
| 100202–12 | " False River near New Roads | " | June 17, 1935 |
| 100420–1 | " Cane River near Natchitoches | " | June, 1935 |
| 100529–30 ♂ ♀ | Kans., Winfield | " | Aug. 12, 1935 |
| 100580 | " Lake City | " | June, 1935 |
| 100795 pull. | Ind., Irvington | O. P. Hay | |
| 101386 ♀ ad. | Va., Seven Mile Ford | A. Wetmore | June 1, 1935 |
| 102705 juv. | Miss., Belzoni | S. F. Hildebrand | July 10, 1936 |
| 102911 ♂ juv. | Tenn., Reelfoot Lake | W. M. Perrygo & C. Lingebach | May 8, 1937 |
| 102912 | " " " | W. M. Perrygo & C. Lingebach | " |
| 103477–9 juv. | Vt., Swanton | L. H. Babbitt | June 21, 1937 |

| | | | |
|---|---|---|---|
| 107786 | Tenn., Iron Creek near Willow Grove | G. Gentry | July 17, 1939 |
| 107787 | " mouth of Wolf River | " | July 19, 1939 |
| 109178 pull. | La., Jonesville | G. K. Payne | June, 1940 |
| 113228 juv. | " " | " | " |
| 115980 pull. | Miss., Deer Creek | C. Hollingsworth | June 24, 1940 |

## Amyda spinifera aspera[1] (Agassiz)

Plates 17, 18, 19c

1854.—*Trionyx ferox* WAILES, Rep. Agric. Geol. Mississippi, pp. 327, 331 (Mississippi) (not of Schneider).—*Platypeltis ferox* AGASSIZ, Contr. Nat. Hist. United States, **2**, 1857, pl. 6, fig. 3 (Mobile, Ala.; Mus. Comp. Zoöl., no. 1608A).—*Aspidonectes ferox* JORDAN, Man. Vert. North Amer., ed. 5, 1888, p. 206 (part).

1857.—*Aspidonectes asper* AGASSIZ, Contr. Nat. Hist. United States, **1**, p. 405 (type locality, Lake Concordia, La.; cotypes, U.S.N.M. no. 012349, Prof. B. L. C. Wailes, collector, and Mus. Comp. Zoöl., no. 37173).—COPE, Bull. U. S. Nat. Mus., no. 1, 1875, p. 51 (Lower Mississippi tributaries).—DAVIS and RICE, Illinois State Lab. Nat. Hist., Bull. no. 5, 1883, p. 52.—TRUE, Fish. Industr. United States, sect. 1, 1885, p. 152.—BAUR, Amer. Natural., **22**, 1888, p. 1122; Proc. Amer. Philos. Soc., **31**, July 1893, p. 217.—BEYER, Proc. Louisiana Soc. Nat. Hist., 1897–1899 (1900), p. 43 (Louisiana).

1892.—*Trionyx agassizii* HAY, Indiana Geol. 17 Rep., p. 552 (part); Batr. Rept. Indiana, 1893, p. 144 (part) (not of Bauer 1888).

1899.—*Aspidonectes agassizi* JORDAN, Man. Vert. North Amer., ed. 8, p. 206 (part only) (emendation) (not of Bauer).

1919.—*Amyda spinifera* BABCOCK, Mem. Boston Soc. Nat. Hist., **8**, no. 3, pl. 32 (not of text; not of Lesueur).—HALTOM, Alabama Mus. Nat. Hist., Mus. Pap. no. 11, 1931, p. 142 (Alabama: Marengo Co.: near Demopolis, Tombigbee River).

1923.—*Trionyx spiniferus agassizii* SIEBENROCK, Verh. Zool. Bot. Ges. Wien, **72**, Aug. 1923, p. 188 (part: West Louisiana).

1939.—*Amyda spinifera aspera* STEJNEGER and BARBOUR, Checklist N. Amer. Amph. Rept., ed. 4, p. 172 (Lower Mississippi tributaries in Louisiana and Mississippi); ed. 5, 1943, p. 213 (Lower Mississippi tributaries in Louisiana; rivers of Mississippi and Alabama).

[1] Latin: rough; probably with reference to the "prominent warts of the bony plates," which, according to Agassiz, "exist in no other species with which I am acquainted."

*Types and type locality.* The two specimens specifically mentioned by Agassiz as basis for his *A. asper* were "an imperfect skeleton . . . belonging to the Smithsonian Institution and prepared from a specimen forwarded by Professor B. L. C. Wailes of Washington, Mississippi," and "a stuffed specimen belonging to the Museum of the University of Oxford, that has been collected during the Geological Survey of Mississippi, under the superintendence of Professor Wailes."

In a letter dated Washington, Miss., 8: January, 1853, Professor B. L. C. Waile wrote to Professor S. F. Baird that he had forwarded to him a number of reptile specimens, among them "2 shells and crania of Trionyx ferox." They were entered in the register of the osteological collections of the Smithsonian Institution under the generic name Trionyx only by Professor Baird on March 21, 1853 as numbers 1084 and 1086, received from' 'B. L. C. Wailes, Washington, Miss." Of these specimens there are now in the National Museum: 1) a skull marked 1084; 2) a skull, with carapace and plastron in pieces (entoplastron and epiplastra missing), marked 1086; and 3) a carapace numbered 12349. The specimens have no original labels attached to them, but the numbers on the skulls are written on them in ink, and on the inside of the carapace of No. 12349 there is written with black ink in the same "professional" hand characteristic of all the specimens received from Wailes: "Trionyx ferox? Lake Concordia, Louisiana, 1851, B. L. C. Wailes." This is undoubtedly the "imperfect skeleton" examined by Agassiz; it is characterized by the "prominent warts of the bony plates" on the posterior part of the bony disk described by Agassiz (l.c. p. 406), which "bony warts exist in no other species with which I am acquainted."[1]

The second cotype, the "stuffed specimen" received from the University of Oxford, Mississippi, is in the Museum of Comparative Zoölogy (M.C.Z. no. 37173) where I was permitted to examine it. It is an adult male, inscribed in the same bold, handsome style as Wailes' other specimens Trionyx ferox, but no locality data. I made the following notes: "Bony disk 200 mm. long, 185 mm. wide; 7 neurals, seventh small; sculpture fine, of the *spinifer* style, with the bony tubercles on the seventh pleural described by Agassiz, tubercles on the posterior and anterior flaps of leathery disk, spinous tubercles on edge of carapace anteriorly between legs; callosities on plastron large, almost meeting on the mid-line; a median large triangular callosity

[1] Agassiz did not know the bony disk of the true *A. ferox* from Florida.

(sides about 25 mm.) on the entoplastron; entoplastral angle slightly less than 90°.

The specimens which Agassiz mentions as having been received "through the kindness of Mr. Winthrop Sargent of Natchez"[1] may be regarded as paratypes. One of them, a very large male (M.C.Z. no. 1597), I have examined and made the following measurements and notes:

| | |
|---|---|
| Total length of leathery carapace | 450 mm. |
| Width of leathery carapace | 370 " |
| Length of bony carapace | 240 " |
| Width of bony carapace (at pleural 4) | 240 " |
| Height of body (at neural 1) | 88 " |

Large rounded tubercles on front edge of leathery carapace; flat tubercles of about same size on front and hind flaps; callosities on xiphi-plastra meeting; closest approach of hyo-hypoplastral callosities 8 mm.; bony ridges comparable to those on bony carapace of U.S.N.M. no. 1086; sculpture somewhat coarser (because of larger size of specimen); entoplastral angle about 90°. Distinct traces of two black marginal rings on hind flap of carapace.

A young paratype, probably of the same origin (M.C.Z. no. 1622) with a recent label in lead pencil "No. 1622. *Type* Amyda asper (Agassiz) Lake St. John, Miss.[2] W. Sargent leg. et don." measures approximately 65 mm. in length and 57 mm. in width. The secondary marginal lines on the posterior flap of the carapace characteristic of normal individuals of the subspecies of corresponding age are represented by two series of closely set spots (pl. 16, fig 1).

*Notes on synonymy.* Special attention is called to the reference to Agassiz's illustration (Contrib., **2**, pl. 6, fig. 3) of a young specimen of *A. aspera* under the name *Platypeltis ferox*, as it apparently has given rise to great confusion among southern herpetologists who, because of it, have mistakenly identified young specimens from Alabama, Mississippi, and Louisiana. The young of the true *A. ferox* was unknown to Agassiz, but on account of the locality (Mobile) of the specimen figured and its similarity in color pattern to certain soft-shell turtles from South Carolina he assumed that it represented the Florida species. The original of the figure 3 appears to be still at the Museum of Comparative Zoölogy bearing the number 1608A. It turns out to be a

[1]Agassiz, in 1856, had J. Burkhart make colored illustrations from a female of the same lot of specimens which shows plainly the marginal black rings on the posterior flap. Reduced copies of the drawings are herewith presented (pls. 20, 21) through the kind permission of Dr. Thomas Barbour, Director of the Museum of Comparative Zoölogy.

[2] Possibly a slip for Louisiana.

young of Agassiz's own *Aspidonectes asper*, and the figure is herewith reproduced under its proper name (pl. 19, fig. c) for comparison with the young of the true *A. ferox* (pl. 19, fig. a and b).

Babcock's figure of *A. spinifera*, as quoted above, does not represent the true nominate form of that species, but is either an *A. spinifera aspera* or an *A. agassizii*. Dr. Babcock, in a letter of December 13, 1933, kindly informs me that the picture was made, during his absence in 1918, from a living specimen, the origin and disposition of which he has been unable to trace. The exact identification depends somewhat on the artist's accuracy. My best guess is that the specimen was an *A. aspera*, judging by the extreme length of the proboscis.

*Variation.* A series of four living young adults were presented in September, 1934, by Mr. S. E. Brand, of Canton, Mississippi, all taken in barrow pits, three on Pearl River and one on Big Black River. The specimens unquestionably represent the same form and, as highly instructive, some of the notes made at the time may be of interest, the color designations in quotation marks having reference to Ridgway's Nomenclature of Colors, 1886:—

U.S.N.M. no. 95191, ♀ ad. Iris clear "primrose yellow" with black horizontal bar not quite reaching pupil. General color above "tawny-olive," head, neck, and legs densely speckled with dark brown, carapace with obscure, irregular blotches of "raw umber," in the center of which one or more small blackish spots form interrupted ocelli, the two outer rows of which posteriorly assume the form of short lines parallel with the submarginal ring; marginal edge dull "olive-buff," top of head like carapace with the shallow fork on the snout chiefly indicated by the black outlines; side of head like top down to the lips; a slightly paler postocular band tinged with yellow and narrowly but very distinctly margined with black, the upper line continuing backward the whole length of the neck; upper side of legs slightly paler than carapace and more tinged with olive; under side pale flesh color caused by the fine network of blood vessels shining through the white ground color; plastral callosities pale "vinaceous-cinnamon" more or less tinged with bluish; under side of feet tinged with "verditer blue" with a wash of yellow deepening towards the outer margin, inner half spotless, outer half, including web, marked with heavy blackish anastomozing lines and spots; claws yellowish white; under side of neck faintly mottled with obscure "pinkish vinaceous" spots; throat strongly washed with "pale blue"; lips and under side of proboscis tinged with "gallstone-yellow." Tubercles on anterior edge of carapace triangular, pointed, about 3 mm. long; anterior flap densely

crowded with smaller and blunter tubercles of various sizes; posterior flap with larger, oblong, blunt tubercles, fairly regularly spaced; carapace posteriorly with similar but lower and longer tubercles in fairly regular longitudinal series. Skin covering nuchal of bony carapace with a median longitudinal series of about 4 enlarged tubercles extending on to anterior leathery flap. Fontanelles between nuchal and first pair of pleurals covered with smooth skin upon which are a few tubercles. Callosities covering plastral bones rather small, leaving median fontanelles larger than xiphiplastral callosities; no trace of callosities on entoplastron and ectoplastron; entoplastral angle 90°.

U.S.N.M. no. 95192, also from a "barrow pit" at the nearby Big Black River, a young adult ♀, smaller than 95191, is structurally almost identical with it, except for the smaller dimension and being slightly broader. The coloration of the living specimen was darker and more pronounced. Iris "ochraceous buff," black horizontal bar reaching pupil. Carapace "raw umber" with large irregularly buffy-edged blotches of "mummy brown," increasing towards and infringing upon the marginal "buffy" edge and its bordering dusky ring; towards the margin the blotches coalesce more or less so as to form three distinct but interrupted submarginal rings; color of upper side of neck, head, and legs like that of the carapace but more "tawny" and thickly sprinkled with heavy blackish spots; forked figure on top of snout deep "ochraceous buff," with very distinct black edges like the ochraceous postocular stripe; under side milk white strongly suffused with flesh-color; palms and soles strongly tinged with tawny, palms heavily marked with coarse blackish anastomozing lines and spots, soles almost devoid of markings, claws white, throat tinged with pale blue; callosities "vinaceous-cinnamon" with slight tinge of blue in center.

U.S.N.M. no. 95193, young adult ♂, from Pearl River, differs structurally from the two described females in showing no trace of fontanelles on carapace, in much larger plastral callosities than on xiphiplastra nearly meeting in the middle, those covering hyoplastra and hypoplastra only 4 mm. apart; in addition there is a large triangular callosity on the entoplastron; the row of tubercles on the edge of anterior flap of carapace barely indicated and no tubercles on flap and nuchal. In addition, the skin of the carapace, bony disk as well as lateral and posterior flaps, is densely sprinkled with very minute hard tubercles which make the skin feel like fine sandpaper. The color notes on the living specimens are as follows: Iris pale buff, black bar scarcely separated from pupil. Upper side nearly uniform "tawny olive," the region of the bony disk distinctly more olive; small, round,

dark brown spots of varying size scattered sparingly over the carapace; the normal margin not perceptibly lighter than rest of carapace and barely set off from it by the obscure dusky submarginal ring; no indications of additional rings by dark lines or spots; top of head and neck like back with minute black scattered dots; lips and sides of neck strongly washed with "gallstone yellow," with normal postocular stripe pattern indicated; fork figure on snout normal, buff colored, black-edged; legs above and feet coarsely spotted with black; upper side of tail like feet with lateral blackish lines converging backwards.

U.S.N.M. no. 95194, from the same locality, is also a male, and slightly smaller. It shares the same structural characteristics, only the tubercles on the anterior edge of carapace are slightly larger and more distinct; the outline of the soft carapace is more oval than rounded ovate; the xiphiplastral callosities are continuous, but the distance between the hyohypoplastral callosities is a trifle wider, and the entoplastral callosity somewhat smaller; the "sandpaper" effect of the back is very much alike, but a double series of larger flat tubercles on the mid-line of the 7th pleural is quite noticeable. The coloration is also much the same, only the ground color of the carapace is lighter, and the dark spots distinct, the chief difference being the interrupted rows of the three marginal rings; on the other hand, the dusky pattern elsewhere is finer; the pale edge of the leathery disk is slightly paler than the rest of the disk.

For an easier appreciation of the more striking variations, they are summarized in table 7. The differences are of various significance. As certainly indication of sex is the greater development of the plastral callosities of the males, besides the well-known difference in the length of the tail, the "sandpaper" effect seems to be peculiar to a certain age (or size, or season?) of young males; the greater development of the tubercles or "spines" may be correlated with sex or with age or with both, remembering that the females are larger than the males; the closing of the nuchal fontanelles of the carapace seems to take place much earlier in the males than in the females; the slight difference in the outline of the leathery disk (as seen from above) is not due to sex, and, at the stage of the specimen under discussion, not to age, though the general rule in these turtles is that the young are more circular than the old ones. None of the above characters seem to be of specific or subspecific significance. On the other hand, the presence of two or more concentric blackish rings inside the normal Amydan dusky ring delimiting the pale rim of the leathery carapace is of diagnostic value in defining the subspecies, but unfortunately it has a

tendency to be obscured or absorbed with age. Individual specimens may occasionally be found without these additional rings among normal populations, but they are the "intermediates" which justify the use of the trinominal nomenclature. On the other hand, it is significant that among a very large number of specimens from northernmost Montana to Louisiana and from Colorado to Lake Champlain, I have not seen an authentic specimen of *Amyda spinifer* with two or more submarginal rings.

## Geographical distribution

Lower Mississippi tributaries in Louisiana and Mississippi and Alabama.

### Table 7

Variations in young adult *A. aspera* from Mississippi

| | | Mississippi | | | |
|---|---|---|---|---|---|
| | | Pearl River | Black River | Pearl River | Pearl River |
| | | 95191 | 95192 | 95193 | 95194 |
| Sex | | ♀ | ♀ | ♂ | ♂ |
| Soft carapace length | mm. | 286 | 210 | 180 | 158 |
| " " width | mm. | 242 | 182 | 152 | 140 |
| Bony carapace length | mm. | 173 | 119 | 111 | 99 |
| " " width | mm. | 131 | 85 | 110 | 98 |
| Plastral callosities | | Small | Small | Large | Large |
| Callosity on entoplastron | | 0 | 0 | + | + |
| Spines on edge of carapace | | Large pointed | Median pointed | Small blunt | Small blunt |
| Tubercles on median line of front carapace flap | | + | + | 0 | 0 |
| Carapace skin "sandpapered" | | 0 | 0 | + | + |
| Carapace fontanelles | | + | + | 0 | 0 |
| Outline of carapace (from above) oval | | | + | | + |
| " " " " " ovate | | + | | + | |

### Intergrades ASPERA-SPINIFERA

It has been repeatedly asserted that the only differences by which specimens of *A. aspera* can be recognized in the adult state are "the very coarse and large tubercles of the front and hind part of the carapace, which extend, behind, even over the bony shield, and are there supported by prominent warts of the bony plates" (Agassiz, Contr., **1**, p. 406) and by the fact "that in younger specimens of Asp. asper there are . . . two or three black lines separating the pale rim of the posterior margin, whilst there is only one in Asp. spinifer." (Agassiz, l.c.). As Agassiz himself observes, these lines fade away "pretty soon."

Table 8

Cranial measurements of *A. aspera* in millimeters

| | 01086 Mississippi: Washington? | 01084 Mississippi | 029310L ouisiana: near Orleans | 68054 Louisiana: Roberts | 7654 Mississippi: Monticello | 029266 Louisiana | Average of 6 specimens |
|---|---|---|---|---|---|---|---|
| Basicranial length mm. | 63 | 63 | 63 | 37 | 23 | 69 | 53.0 |
| Tip of snout to orbit | 16 | 16 | 16 | 10 | 6 | 19 | 13.8 |
| Horizontal diameter of orbit | 12 | 10.5 | 12 | 8 | 5.5 | 13 | 10.1 |
| Orbit of tympanic cavity | 19 | 18.5 | 19 | 9 | 6 | 20.5 | 15.3 |
| Longest diameter of temporal fossa | 11 | 12 | 13 | 6.5 | 4 | 13 | 9.9 |
| Interorbital width | 5 | 6 | 5.5 | 3 | 2 | 5 | 4.4 |
| Width of maxillary alveole | 5.5 | 5 | 5 | 3 | 2 | 6 | 4.4 |
| Length of internal choanae | 10 | 9 | 9 | 6 | 5 | 10 | 8.1 |
| Internal choanae to intermaxillary foramen | 7 | 6.5 | 6 | 6 | 3 | 6.5 | 5.9 |
| Length of intermaxillary foramen | | 6.2 | 6.5 | 5 | 3 | 7 | 5.5 |
| Length of mandibular symphysis | 9 | — | 9 | 6 | 3 | 11.5 | 6.4 |
| Width of mandibular alveole surface | | | 4 | 2.5 | 2 | 5.5 | 3.5 |

Specimens of intermediate ages are difficult to identify with our present knowledge. Apparently the double or triple rings are not always a constant character. I have before me, through the courtesy of Miss Fannye A. Cook, a specimen collected about a mile or two southeast of Brookhaven, Lincoln Co., Mississippi, in a small tributary of the Bogue Chitto, Pearl River drainage. Its carapace measures only 43 mm. in length, hence it is quite young. It seems to be an aberrant specimen of *aspera*, the anomaly being in the absence of the second dark ring on the carapace margin. From its locality it ought to be *aspera*, but such abnormal (or "incompleted" or "reversed") specimens are known.

*List of specimens in the U. S. National Museum*

| | | | |
|---|---|---|---|
| 01084 | Miss., Washington? | B. L. C. Wailes | |
| 01086 | " " | " | Cotype of *Aspidenectes asper* Agassiz |
| 7653–4 | " Monticello | H. Tennison | |
| 012349 | La., Lake Concordia | B. L. C. Wailes | 1851 Cotype of *Aspidonectes asper* Agassiz |
| 13250 ♀ | " New Orleans | R. W. Shufeldt | 1883 |
| 029266 | " | S. W. Harvey | |
| 029310 ad. ♀ | " near New Orleans | U. S. Fish Comm. | |
| 66147 juv. | " Madisonville | ? | May 29, 1886 |
| 68054 ♂ adol. | " Roberts | R. F. Shaw | |
| 79350–1 juv. | Miss., 1 mi. W. of Melvin | R. Kellogg and N. Boss | Oct. 1929 |
| 83996 ♀ juv. | Ala., 3 mi. S.E. of Coatopa | C. E. Burt | July 1, 1931 |
| 95191 ♀ ad. | Miss., Pearl River | S. E. Brand | Aug. 1934 |
| 95192 ♀ adol. | " Big Black River | " | " |
| 95193 ♂ adol. | " Pearl River | " | " |
| 95194 ♂ adol. | " " | " | " |
| 100650 ♂ ad. | La., near Atchafalaya | C. E. Burt | June 17, 1935 |
| 100805 pull. | Miss., Enterprise | O. P. Hay | 1881 |
| 115979 ♀ adol. | " near Guntoun | E. & W. H. Patten | Aug. 4, 1940 |
| 115981 juv. | " Chookatonkchia Creek | H. L. Owens | June 30, 1941 |

## Amyda emoryi[1] (Agassiz)

Plates 24-25

1849. *Trionyx ferox* ROEMER, Texas, p. 171, p. 459 (at New Braunfels, Texas, in the Guadalupe and Comal Rivers).

1857.—*Aspidonectes emoryi* AGASSIZ, Contr. Nat. Hist. United States **1**, p. 407; **2**, pl. 6, figs. 4–5 (type-locality, Rio Grande River, near Brownsville, Texas; cotypes, U. S. Nat. Mus. No. 7855; Mus. Comp. Zoöl., Nos. 1909, 1913; Dr. Kennerly, collector; Williamson Co., Texas).—COPE, Bull. U. S. Nat. Mus., No. 1, 1875, p. 51 (Texas); No. 17, 1880, p. 13 (Dallas; Helotes Creek, near San Antonio, Texas).—TRUE, Bull. U. S. Nat. Mus., No. 24, 1883, p. 29 (Matamoras, Mexico; Texas: Brownsville, Rio Grande, Rio Seco, Braunfels; Old Fort Cobb, Oklahoma); Fish. Industr. United States, sect. 1, 1884, p. 152.—BEYER, Proc. Louisiana Soc. Nat., 1897–1898, p. 43 (Louisiana).—STRECKER, Trans. Texas Acad. Sci., **4**, pt. 2, no. 5, p. 6 (McLennan Co., Texas); Proc. Biol. Soc. Washington, **21**, March 21, 1908, p. 79 (Bazos, Bosque River, McLennan Co., Texas, abundant); **23**, 1910, p. 121 (Bullhide Creek, McLennan Co., Texas).

*Trionyx emoryi* BOULENGER, Cat. Chel. Brit. Mus., 1889, p. 258.—STRAUCH, Mém. Acad. Sci. St. Pétersbourg, ser. 7, **38**, no. 2, 1890, p. 117 (Texas).—DITMARS, Reptile Book, 1907, p. 78 (tributaries of the Rio Grande in Texas and Mexico).—SIEBENROCK, Zool. Jahrb., Suppl. **10**, pt. 3, 1909, p. 603 (Colmisneil, Tyler Co., South Bosque Riv., Texas); Verh. Zool. Bot. Ges. Wien, **73**, 1923, p. 190.—LINSDALE and GRESSITT, Copeia, 1937, no. 4, Dec. 31, pp. 222–225, figs. 1–3 (Colorado River: Delta, Lower California; Clark Co., Nevada; Mohave Co., Arizona; California Lakes, Imperial Co., California; transpl. to Colorado Riv.?).—LINSDALE, Proc. American Acad. Arts Sci., **73**, no. 8, May 1940, p. 255 (Nevada: Clark Co.: Colorado River).

*Amyda emoryi* STEJNEGER and BARBOUR, Checklist North Amer. Amph. Rept., ed. 1, 1917, p. 124 (Rivers of Texas, north into southern Oklahoma and Arkansas); ed. 2, 1923, p. 140; ed. 3, 1933, p. 153.—PRATT, Man. Vert. United States, 1923, p. 249.— ? HAY, Pan-Amer. Geol., **39**, March 1923, p. 119, pl. 9, figs. 2–4 (fossil, Brazos River at Pittbridge, Texas).—SCHMIDT, Copeia, no. 131, June 30, 1924, p. 64 (Arizona; introduced).—STRECKER, Baylor Univ. Bull., **27**, no. 3, Sept. 1924, p. 47 (eastern Oklahoma); Contr. Baylor Univ. Mus., no. 2, Jan. 15, 1926, p. 3 (Somervell Co., Texas); no. 3, Feb. 15, 1926, p. 4 (Liberty Co., Texas); no. 6, June 15, 1926, p. 8

[1] To Col. Wm. H. Emory, U.S.A., under whose command part of the type material was collected, "I take great pleasure, therefore, in dedicating this species to that distinguished officer." (Agassiz)

(Cibolo Creek, Boerne, Tex.); no. 7, July 15, 1926, p. 7 (Cedar Creek, Henderson Co., Tex.); no. 19, 1929, p. 15 (Trinity Riv., Ft. Worth, Tex.); no. 23, June, 1931, p. 16 (Colorado Riv., Trevis Co., Tex.); Baylor Bull., **38**, no. 3, Aug. 1935, p. 23 (Texas: Cibolo Creek), p. 32 (Texas: Real Co.).—ORTENBURGER, Proc. Oklahoma Acad. Sci., **6**, pt. 1, 1926, p. 100 (LeFlore Co., Oklahoma).—STRECKER and WILLIAMS, Contr. Baylor Univ. Mus., no. 12, Dec. 27, 1927, pp. 11, 15 (San Marcos and Blanco Rivers, Texas).—RUST, Blätt. Aquar. Terrarienk., **45**, 1934, p.—, sep., p. 12.—LITTLE and KELLER, Copeia, 1937, no. 4, Dec. 31, pp. 216, 221 (Mesilla Valley, Dona Ana Co., New Mexico).—GAIGE, Univ. Michigan Stud. Sci., **12**, 1937, p. 304 (Mexico, Tamaulipas, Rio Purificación, N. of Ciudad Victoria).—DELLINGER and BLACK, Occas. Pap. Univ. Arkansas Mus., no. 1, June 1938, p. 46 (? Arkansas: Salina Riv. near Benton? [probably Texas, U.S.N.M. no. 17823–L.S.]).—SMITH, Ann. Carnegie Mus. Pittsburgh, **27**, 1939, p. 312 (Mexico: Tamaulipas; Nuevo Laredo).

1870.—*Aspidonectes emyda* "Agassiz," GRAY, Suppl. Cat. Shield Rept. Brit. Mus., pt. 1, p. 95 (lapsus).

1870.—*Aspidonectes georgii* "Agassiz," GRAY, Suppl. Cat. Shield Rept. Brit. Mus., pt. 1, p. 109 (lapsus).

1893. *Platypeltis emoryii* BAUER, Proc. Amer. Philos. Soc., **31**, p. 220 (emendation).—*Amyda emoryii* STRECKER, Copeia, no. 162, 1927, p. 9 (food habits); Contr. Baylor Univ. Mus., no. 15, July 10, 1928, p. 6 (Bosque Riv. near Valley Mills, Bosque Co., Texas); no. 16, Aug. 4, 1928, p. 21 (Texas: vernacular names).

Agassiz (p. 407), as character aiding in identifying this species, calls attention to skin of the carapace being "dotted all over with small whitish tubercles like grains of sand." This is not a specific character, it seems to be a condition of the skin due to season or age, as similarly "sandpaper" specimens are encountered in several of the species.

*Skull.* The skulls of *A. emoryi* and *A. spinifera* are very much alike. The snout in *emoryi* is slightly shorter and somewhat broader anteriorly, the nasal cavity relatively shorter and the angle formed by the anterior processes of the prefrontal bones more obtuse. The alveolar surface of the maxillaries are somewhat wider. In these respects the *emoryi* are even closer to *A. ferox*.

As the differences in the skull between *A. spinifera* and *emoryi* are very slight, many skulls can hardly be told apart. In the former the choanae and the intermaxillary foramen average a trifle larger. The orbit in *A. spinifera* is also placed slightly more backward on the

average than in *A. emoryi*. As a consequence the snout appears a mere trifle longer. However, it is difficult to understand how Boulenger (Cat. Chel. Brit. Mus., 1889, pp. 245–246) came to diagnose *A. emoryi* as having "the snout (on the skull) obtuse, hardly as long as the diameter of the orbit," and the other two (*spinifera* and *ferox*) having it "a little longer." In 26 skulls measured by me the horizontal diameter of the orbits in *ferox*, *spinifera*, and *emoryi* averages 20.0, 19.6, and 19.1 mm respectively and the snout (as measured from the orbit) 24.9, 26.5, and 24.4 mm. In the six *emoryi* measured by me the snout is 2.5, 3.0, 4.0, 5.5, 1.5, and 2.0 mm longer than the orbit. The relative dimensions of snout and orbit are therefore unavailable as a diagnostic character. It should be noted, finally, that in *emoryi* the alveolar surface of the maxilla of medium sized skulls is slightly wider than in the other two, but too slightly and variably so to be of much help in diagnosing.

*Plastron.* Referring to Siebenrock's remarks about the plastron of *A. emoryi* (Sitz. Ber. Akad. Wiss. Wien, Math. Nat. Kl., **111**, 1902, p. 830) it is well to note that the bones are essentially as in *A. spinifera*. The entoplastral angle in adults seems to be more acute. The callosities appear to be more developed in a male (U.S.N.M. no. 26426); they are almost as large as in the *A. mutica* figured by him (p. 823, fig. 5), but of course without trace of callosities on entoplastron or epiplastra. The anterior portion of the epiplastra is rather long.

## Color of live specimens

Two adult males from Houston, Texas, are colored as follows. No. 94335 has the top of head and dorsal aspect of neck dark olive green, becoming gradually more green on posterior half of neck. Carapace, bony disk Van Dyke brown, bistre on the soft parts, with irregular blackish brown anastomozing spots. Sides of neck almost citron yellow fading into whitish on the middle line of the ventral aspect of the neck which anteriorly changes into verditer blue on the throat, darkening to almost indigo blue on mentum and outer half of lower jaw and tympanic region, and extending a little below and backwards on side of neck; the yellow of the side of the neck fades into a dull olive yellow with a few scattered, almost blackish spots.

Tubercles on anterior edge of soft carapace large (3–4 mm.), triangular, spaced apart by the width of their bases.

Underside white, also feet, but fingers and webs pale (dull) sage green with obscure dark marblings.

Their measurements differ as follows:

| | ♂ ad. 94335 | ♂ ad. 94336 |
|---|---|---|
| Soft carapace, long | 342 mm. | 354 mm. |
| " " " | 286 " | 288 " |
| Height of body | 86 " | 84 " |
| Tip of tail beyond carapace | 40 " | 32 " |

In No. 94336 the colors are essentially as in the other except that on head and neck the yellow is a little deeper and that there are a large number of small blackish spots on sides of head, even including lower eyelid, lips, and base of proboscis, and definite blackish lines running from eye obliquely backward to base of lower jaw which is also outlined by similar lines; dusky obscure large (average 15 mm.) ocellar markings on under side of neck. Tubercles like 94335.

Two specimens collected by Dr. and Mrs. A. H. Wright, U. S. N. M. nos. 94456–7 are colored as follows. In no. 94456 the neck and iris chrome yellow more or less pale, iris with horizontal black lens. Carapace above uniform wood brown. Marginal edge washed with chromium green. Upper soft parts of head and legs pale chromium green washed with wood brown on top and sides of head. Tail above white, with posterior central part dull chromium green washed with cadmium. Tubercles on carapace pale buff, minute, round, densely scattered over the whole carapace, hand, and soft parts. Underside white. Neck underneath very pale cadmium shading anteriorly into pale verditer blue washed with pale cadmium (on throat). Dark markings on throat strongly tinged with bluish. Fleshy lips pale cadmium yellow. Pale cadmium yellow on fork of snout fading away anteriorly. Triangle, base between eyes slightly angular.

No. 94457 has the same data, but a dark ring of minute blackish specks surrounding tubercles. Underside of foot same color as upper chromium green parts—spotted.

Table 9

Cranial measurements of *A. emoryi* in millimeters

| | 103658 Texas: Brewster Co.: at Boquillas | 94457 Texas Orange Co. Orange | 94335 Texas: Harris Co.: Near Houston | 71627 Arizona, Maricopa Co., Phoenix | 26426 Texas, Ft. Clark, Kinney Co. | 78417 Texas, Victoria Co. | 7,700 Texas, Comal Co. New Braunfels | 20846 Texas, Fort Hancock, Hudspeth Co. | 26477 Kinney Co., Ft. Clark | Average of 9 Specimens | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Basicranial length . . . . . mm. | 44.0 | 44.0 | 69.0 | 56.0 | 60.0 | 67.0 | 69.0 | 46.0 | 49.0 | 54.0 | % |
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| Tip of snout to orbit . . . . . | 10.0 | 10.0 | 18.0 | 13.0 | 15.0 | 16.0 | 17.0 | 11.5 | 12.0 | 13.6 | 25.2 |
| Horizontal diameter of orbit . . . | 10.0 | 10.0 | 12.5 | 10.5 | 12.0 | 12.0 | 11.5 | 10.0 | 10.0 | 10.9 | 20.2 |
| Orbit to tympanic cavity . . . . . | 13.0 | 12.0 | 21.0 | 17.0 | 19.0 | 20.0 | 22.5 | 13.0 | 14.0 | 17.0 | 31.5 |
| Longest diameter of temporal fossa . . . . . | 8.5 | 8.0 | 15.0 | 10.0 | 13.0 | 12.0 | 15.0 | 9.0 | 10.0 | 11.2 | 20.7 |
| Interorbital width . . . . . | 2.5 | 3.0 | 5.5 | 4.5 | 4.0 | 6.0 | 6.0 | 3.0 | 3.5 | 4.2 | 7.8 |
| Width of maxillary alveole . . . . . | 4.0 | 2.5 | 5.5 | 5.0 | 5.0 | 6.5 | 8.0 | 3.5 | 3.5 | 4.8 | 8.9 |
| Length of internal choanae . . . . . | 6.5 | 7.0 | 10.5 | 7.0 | 9.5 | 9.2 | 10.0 | 7.0 | 8.0 | 8.3 | 15.4 |
| Internal choanae to intermaxillary foramen . . . . . | 4.0 | 3.0 | 6.0 | 5.0 | 5.0 | 6.0 | 6.0 | 4.5 | 4.0 | 4.3 | 8.9 |
| Length of intermaxillary foramen | 4.0 | 4.5 | 6.0 | 5.0 | 6.0 | 6.0 | 7.0 | 4.0 | 5.5 | 5.3 | 9.8 |
| Length of mandibular symphysis | 6.0 | 6.0 | 9.0 | 7.0 | 10.0 | | 10.0 | 6.5 | 7.0 | 7.7 | 14.3 |
| Width of mandibular alveole surface . . . . . | 2.0 | 2.0 | 3.5 | 3.0 | 4.0 | | 6.0 | 3.0 | 2.5 | 3.2 | 5.9 |

Another male, U.S.N.M. 104240, from Pecos River, near Dryden, Terrell Co., Texas. F. M. Setzler, coll. shows still further variation.

Anterior border of disk very obscurely tuberculated. Skin on carapace shagreened like bony disk. Skin on flaps smooth, leathery: a round smooth area over each. The fontanelle smooth. Part of flap behind bony disk with a regular pattern of whitish "pimples" or tubercles, those along the middorsal line in pairs. No "sandpaper" effect. Palms and soles yellowish white, unspotted. Carapace (day or two after death): flap isabella color (Ridgway, pl. III, fig. 23); bony disk more tawny olive (fig. 17); neck and limbs above pale olive gray like pickled unripe olives, ventral half of neck yellowish white with a faint trace of a similarly colored band from lower edge of eye backwards along the neck. All upper soft parts with numerous black dots more or less arranged in longitudinal series.

## Geographical distribution

Rivers of Texas, north into southern Oklahoma and Arkansas, west (introduced?) to southeastern California, the adjacent portion of Lower California, and Clark County, Nevada; east to western Louisiana; northern Mexico.

*List of specimens in the U. S. National Museum*

| | | | |
|---|---|---|---|
| 7176 | Okla., Old Ft. Cobb | E. Palmer | May 4, 1868 |
| 7614–20, 7662–25 | Mex., Matamoras, Tamaulipas | L. B. Couch | |
| 7628–33 | Mex., Matamoras, Tamaulipas | " | |
| 7635–6 | ? | ? | |
| 7637–8 juv. | Tex., Rio Bravo | A. Schott | |
| 7640 juv. | " Brazos R. | G. C. Shumard | |
| 7641 juv. | " El Paso del Norte | Dr. Webb | |
| 7642 ♂ adol. | " Brownsville | ? | |
| 7644 juv. | " " | ? | |
| 7700 (029536) ad. | " New Braunfels | ? | |
| 7701 juv. | " Rio Grande del Norte | G. Wurdemann | |
| 7747 juv. | " Rio Seco | Capt. Pope | |

| | | | |
|---|---|---|---|
| 7854 juv. | ? | ? | |
| 7855 juv. | Tex., Brownsville | Dr. Kennerly | (Cotype of *Aspidonectes emoryi* Agassiz) |
| 8925 | " " | J. C. Merrill | May, 1877 |
| 10789 juv. | " San Antonio | C. W. Schuermann | June 1879 |
| 17823 juv. | Ark., Benton | Jordan & Gilbert | |
| 19626–8 | ? | ? | |
| 20846 ♀ adol. | Tex., Ft. Hancock | E. A. Mearns | Jan. 28, 1893 |
| 21408 juv. | ? | ? | |
| 26426 ad. | Tex., Ft. Clark | E. A. Mearns | |
| 26427 ♀ ad. | " " | " | |
| 26428–36 | " " | " | |
| 45545 | " Boquillas | V. Bailey | May 25, 1901 |
| 46073 | " mouth of Devil's River | W. Lloyd | Sept. 26, 1890 |
| 46074 juv. | " Eagle Pass | " | Oct. 22, 1890 |
| 55601 | " McLennan Co. | J. Hurter | 1906 |
| 66147 juv. | La., Madisonville | ? | May 29, 1886 |
| 71627–8 adol. | Ariz., Phoenix | V. Housholder | May 1, 1926 |
| 78515–6 juv. | Tex., Coleto Creek | J. D. Mitchell | Oct., 1905 |
| 78517 | Tex., Guadalupe R. | J. D. Mitchell | Aug., 1912 |
| 83690 | " Christoval | C. E. Burt | Apr. 25, 1931 |
| 94335 ♂ ad. | " near Houston | A. C. Chandler | |
| 94336 ♂ ad. | " Houston | " | |
| 94456–7 | " Orange | A. H. Wright | Apr. 17, 1934 |
| 95386 ♂ juv. | " 16½ mi. S.E. of Caddo Lake | C. E. Burt | Apr. 1, 1934 |
| 95773 pull. | " Llano River, Kimble Co. | S. Mulaik | Aug. 10, 1933 |
| 100089 ♂ adol. | La., near Napoleonsville | C. E. Burt | 1935 |
| 100090 juv. | " " | " | " |
| 100380 ♂ adol. | " Plaquemine | " | June 8, 1935 |
| 100419 ♂ adol. | " Spanish Lake near St. Gabriel | " | June, 1935 |
| 103678 ♀ | Tex., Boquillas | T. Smith | Aug. 6, 1937 |
| 104240 ♀ ad. | " Pecos River near Dryden | F. M. Setzler | |

## Amyda agassizii[1] (Baur)

Plates 26–30

1857.—*Platypeltis ferox* AGASSIZ, Contr. Nat. Hist. United States, pt. 1, p. 401 (part) (not of Schneider).

*Aspidonectes ferox* COKER, North Carolina Geol. Surv., Bull. No. 14, 1906, p. 66 (South Carolina: Darlington Co., Society Hill, Peedee River).—CORRINGTON, Copeia, No. 172, Nov. 15, 1929, p. 82 (Congaree Riv., between Columbia and New Brookland, Lexington Co., South Carolina).

1888. *Platypeltis agassizii* BAUR, Amer. Natural., **22**, p. 1121 (type locality, Georgia; type M.C.Z. no. 37172).

*Pelodiscus agassizii* BAUR, Proc. Amer. Philos. Soc., **31**, July 1893, p. 218.

*Trionyx agassizii* HAY, Indiana Geol. 17 Rep., 1892, p. 552; Batr. Rept. Indiana, 1893, p. 144 (part, U.S.N.M. no. 8359).

1899. *Aspidonectes agassizii* JORDAN, Man. Vert. North Amer., ed. 8, p. 206 (part only: Ga.) (emendation).

1923. *Trionyx spiniferus agassizii* SIEBENROCK, Verh. Zool. Bot. Ver. Wien, **73**, Aug. 1923, p. 188 (part: Georgia).

1939.—*Trionyx spiniferus* POPE, Turtles U. S., Canada, pl. 45, figs. 98–99 (Broad River near Columbia, Richland Co., South Carolina) (not of LeSueur).

### The *agassizii* Group

In outward appearance *Amyda agassizii* differs very little from the members of the *spinifera* group, but the skull distinguishes it at once from all other American soft-shell turtles. In practically all the characters which differentiate it from them it agrees with the Asiatic members of the group represented by the collective *Amyda sinensis*. *A. agassizii* therefore may be treated as a member of a separate group, thus more insistently emphasizing its isolated position and insuring the positive identification of specimens from its comparatively restricted range in the United States.

Among Louis Agassiz's collection of colored drawings of turtles by Burkhardt (mostly from life) are several painted in November and December 1855, and inscribed as "*Trionyx ferox*, Ga. Dr. Daniel." They are excellent pictures of *Amyda agassizii*, two of an "adult" specimen (upper and lower surfaces) and one (upper side) of a young specimen, but unfortunately they are without indication of size and locality. They were sent to Agassiz by Dr. W. B. Daniel from Savannah, Ga. (Contr. Nat. Hist. U. S., **1**, p. 401). The fact that they

[1] Named for Louis Agassiz to indicate that the species was included by him in his account of *Platypeltis ferox*.

came from the recorded type locality of *T. ferox* evidently influenced Agassiz to regard these specimens as topotypical of *ferox* and hence he recorded them as such.

The status of Baur's *Platypeltis agassizii* has never been fully explained. In 1888 (Amer. Natural., vol 22, p. 1121) the name appears for the first time in the following sentence: "*Platypeltis ferox* of Agassiz is not *Testudo ferox* Schneider, but a new species, which may be called *Platypeltis Agassizii*." No further description or indication is given, but evidently reference is intended to Agassiz's account of the species in his Contribution to the Natural History of the United States, pt. 1, pp. 401–403. A careful examination of Agassiz's text compared with the material available to him at the time he wrote his account shows, that his *Platypeltis ferox* is a mixture of two species due to the fact that the ranges of both species overlap in Georgia and that the startling color pattern of the very young specimens of the true *Testudo ferox* of Schneider was unknown by him. Dr. Baur, in studying Agassiz's material in the Museum of Comparative Zoölogy, designated the specimen marked "Ferox Ga. No. 1" as the type of *P. agassizii* with his own hand, and it must be accepted as such.[1] In 1893, after having examined skulls and restudying the question of the generic relationships of the Trionychids (Proc. Amer. Philos. Soc., vol. 31, July 1893, p. 217) he came to the conclusion that his *P. agassizii* was not only specifically but generically different from Schneider's *P. ferox* and referred it to Fitzinger's genus *Pelodiscus* with several Asiatic species.

In the meantime Dr. O. P. Hay, assuming that Agassiz's (op. cit.) pl. 6, fig. 3, of his young *Platypeltis ferox* with the strongly marked two black marginal rings represented the young *P. agassizii* (which has a similar pattern), applied the name to the form which Agassiz had described earlier as *P. asper* (Indiana Geol. 17 Rep., 1892, p. 552; Batr. Rept. Indiana, 1893, Batr. Rept. Indiana, 1893, p. 144). This confusion between *A. agassizii* and *A. asper* before their diagnostic features were well understood was caused by the specimen U.S.N.M. No. 8359, a young *A. agassizii*, which was alluded to by Dr. Hay (op.cit.)—though without giving the number—under *A. agassizii* as follows: "This species belongs to the Southern States from South Carolina to Texas. A single specimen has been forwarded to the National Museum from Madison, Ind.". The specimen has the 2 black rings of the disk characteristic of *A. agassizii* very plainly marked (pl. 30,) and as this is also the normal pattern of the very young *A. asper*, Dr. Hay took

[1] In a letter dated Feb. 13, 93 to Stejneger, he wrote: "The only *Pelodiscus agassizii* which I have seen is at Cambridge Mus. (the type)."

Table 10

Cranial measurements of *A. agassizii* in millimeters

| | 66859 ♀ Georgia, Richmond Co. Augusta Hildebrand | S. Carolina: 71681 ♀ S. Carolina: Greenwood | 91310 ♀ McCormick Co. Savannah River | 029034 ♀ Georgia ? | 92583 Georgia | 92584 ♀ Georgia, Savannah | 91282 ♀ Georgia Lincoln Co. Savannah River | 8708 ♀ Georgia Baldwin Co. Milledgville | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Basicranial length....mm. | 44 | 48 | 49 | 54 | 56.5 | 70 | 50 | 44 | Avr. 8 opc. 52.8 | % of bel. |
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| Tip of snout to orbit..... | 12 | 13.5 | 14 | 15.5 | 15.5 | 20.5 | 14.5 | 12.5 | 14.8 | 28.6 |
| Horizontal diameter of orbit | 9 | 9 | 10 | 9 | 10.5 | 12 | 11 | 9 | 9.9 | 19.1 |
| Orbit of tympanic cavity.. | 12.5 | 14 | 14 | 18 | 18 | 27 | 14.5 | 13 | 16.4 | 31.7 |
| Longest diameter of temporal fossa..... | 8.5 | 8 | 9 | 10 | 11 | 17 | 9 | 8 | 10.0 | 19.3 |
| Interorbital width..... | 3 | 3 | 4 | 5.5 | 5 | 7 | 3.5 | 4 | 4.4 | 8.5 |
| Width of maxillary alveole. | 4.5 | 4.5 | 5 | 8 | 8 | 9 | 4 | 4 | 5.9 | 11.4 |
| Length of internal choanae. | 6 | 6 | 6.5 | 6.5 | 6.6 | 8.2 | 6.5 | 6 | 6.6 | 12.7 |
| Internal choanae to intermaxillary foramen..... | 5.5 | 6 | 6.5 | 7 | 7 | 9 | 6.5 | 5.5 | 6.6 | 12.7 |
| Length of intermaxillary foramen..... | 6 | 6 | 6 | 6.5 | 7.3 | 8 | 5 | 5.5 | 6.3 | 12.2 |
| Length of mandibular symphysis..... | 7.5 | 8 | 8 | 10 | 12 | 16 | 9 | —* | 10.1 | 19.5 |
| Width of mandibular alveole surface..... | 4 | 4 | 4 | 6 | 8 | 10 | 3.5 | 3 | 5.5 | 10.6 |

*Point broken.

for granted that the *agassizii* and *asper* were synonymous, an error followed by many subsequent authors.

The fact is that the locality "Madison, Ind." attributed to specimen No. 8359 in the original book of entry on June 25, 1875, is erroneous. There is no record as to the donor or collector of the specimen and it was entered on the book as part of an accumulation of miscellaneous material. It is catalogued as *Trionyx ferox* and there is no original label attached to the specimen, which only bears the tin-tag 8359, at a time when the Museum had started a campaign to collect *living* reptiles and amphibians to serve as models for the series of painted casts in the exhibition series of the North American vertebrate fauna. The tin-tagging and uncritical re-entry of many old specimens the record of which was lost has been the source of many errors. (Note reference to this specimen by Cahn in his Turtles of Illinois, 1937, p. 200, under *Amyda ferox*).

## Geographical Distribution

Rivers of Georgia and South Carolina; North into southern North Carolina.

*List of specimens in U. S. National Museum*

| | | | |
|---|---|---|---|
| 8359 juv. | Ind., Madison ?? | | |
| 8708 ♀ adol. | Ga., Milledgeville | T. H. Bean | July, 1876 |
| 029034 ♀ | Ga. ? | R. Hessel | |
| 30822 juv. | Ga., Baker Co. | Brimley Bros. | June 7, 1902 |
| 51981 (M.C.Z. 1598) ♂ adol. | Ga., Savannah | W. B. Daniel | |
| 66859 ♀ adol. | Ga., Augusta | S. F. Hildebrand | |
| 71681 ♀ adol. | S.C., Greenwood | Dr. Barrett, A. L. Pickens | |
| 91282–3 ad. ♀, juv. ♂ | Ga., above Price Id., Savannah River | E. H. Wood | July, 193 |
| 91310 ♀ adol. | S.C., 5 mi. W. of Plum Branch, Savannah R. | E. H. Wood | " |
| 91311–2 juv. | S.C., 5 mi. W. of Plum Branch, Savannah R. | " | " |
| 91491 juv. | S.C., Batesburg | L. Brodie | |
| 91533 | " Murray Lake | C. E. Burt | July 5, 1933 |
| 92521–3 ♂ adol. | " Parksville | K. McNeill | 1933 |
| 92583 (M.C.Z.) adol. | Ga. | | |
| 92584 (M.C.Z. 1601) ♀ | Ga., Savannah | | |

PLATES

PLATE 1

## PLATE 1

Skull of *Amyda* (*spinifera*)

Fig. 1. View from above. Fig. 2. View from below. Fig. 3. View from left side, including mandible. Fig. 4. View of mandible from above. Fig. 5. Anterior plastral outlines of *Amyda ferox* U.S.N.M. 60496 (upper); *Amyda emoryi* U.S.N.M. 94456 (middle); *Amyda spinifera* U.S.N.M. 101386 (lower).

| | |
|---|---|
| alv. mb. | Alveolar surface of mandible |
| alv. mx. | Alveolar surface of maxilla |
| art. | articular |
| boc. | basioccipital |
| bsp. | basisphenoid (parasphenoid) |
| cho. | choana |
| cond. | occipital condyle |
| cor. | coronoid |
| den. | dentary |
| exoc. | exoccipital |
| fr. | frontal |
| int. max. for. | intermaxillary foramen |
| ju. | jugal |
| mx. | maxillary |
| orb. | orbit |
| pa. | parietal |
| pal. | palatine |
| paoc. | paroccipital (opisthotic) |
| pm. | premaxillary (intermaxillary) |
| pof. | postfrontal (postorbital) |
| prf. | prefrontal |
| pro. | prootic (otosphenoid) |
| pt. | pterygoid |
| qj. | quadratojugal (paraquadratum) |
| qu. | quadrate |
| qu. art. | articulation of quadrate with lower jaw |
| s. ang. | supraangular |
| soc. | supraoccipital |
| splen. | splenial |
| sq. | squamosal |
| sym. | symphysial |
| temp. fossa | temporal fossa (inter temporal foramen) |
| tymp. cav. | tympanic cavity |
| vom. | vomer |

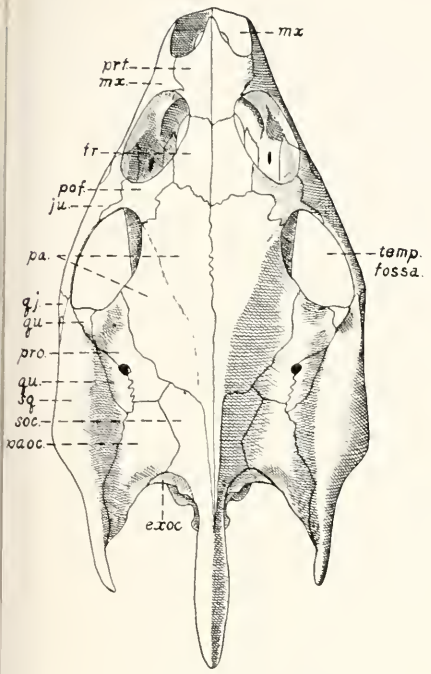



Fig. 1

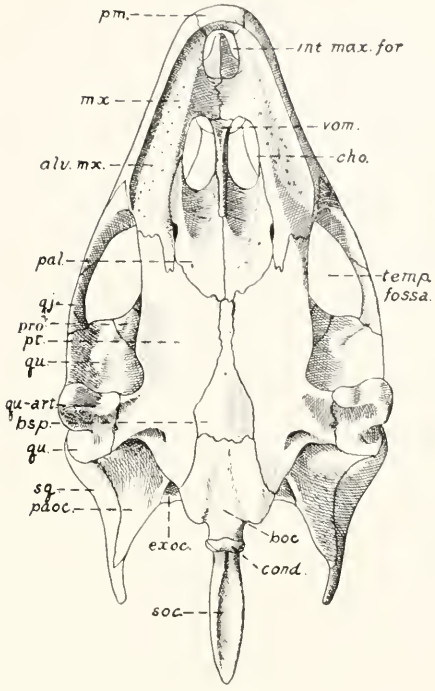



Fig. 2

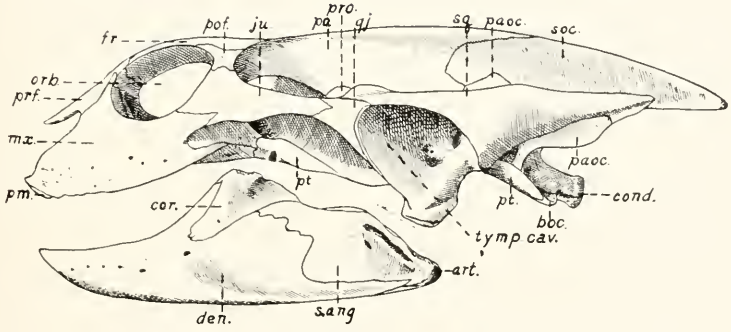



Fig. 3

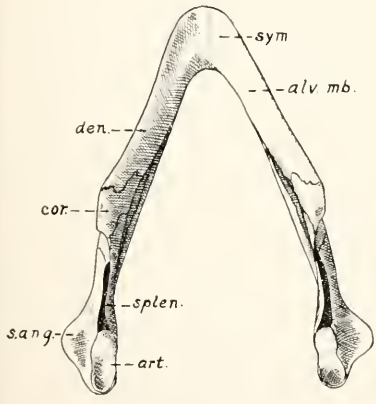



Fig. 4

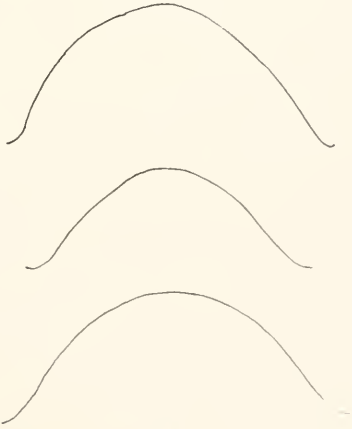


Fig. 5

PLATE 2

PLATE 2

*Amyda mutica* ♀, Fairport, Iowa. U.S.N.M. 53521.


53521
53521

PLATE 3

PLATE 3

Upper view of *Amyda mutica*, U.S.N.M. 95186 from Medicine Lodge River, near Lake City, Kansas. Also left side of head.

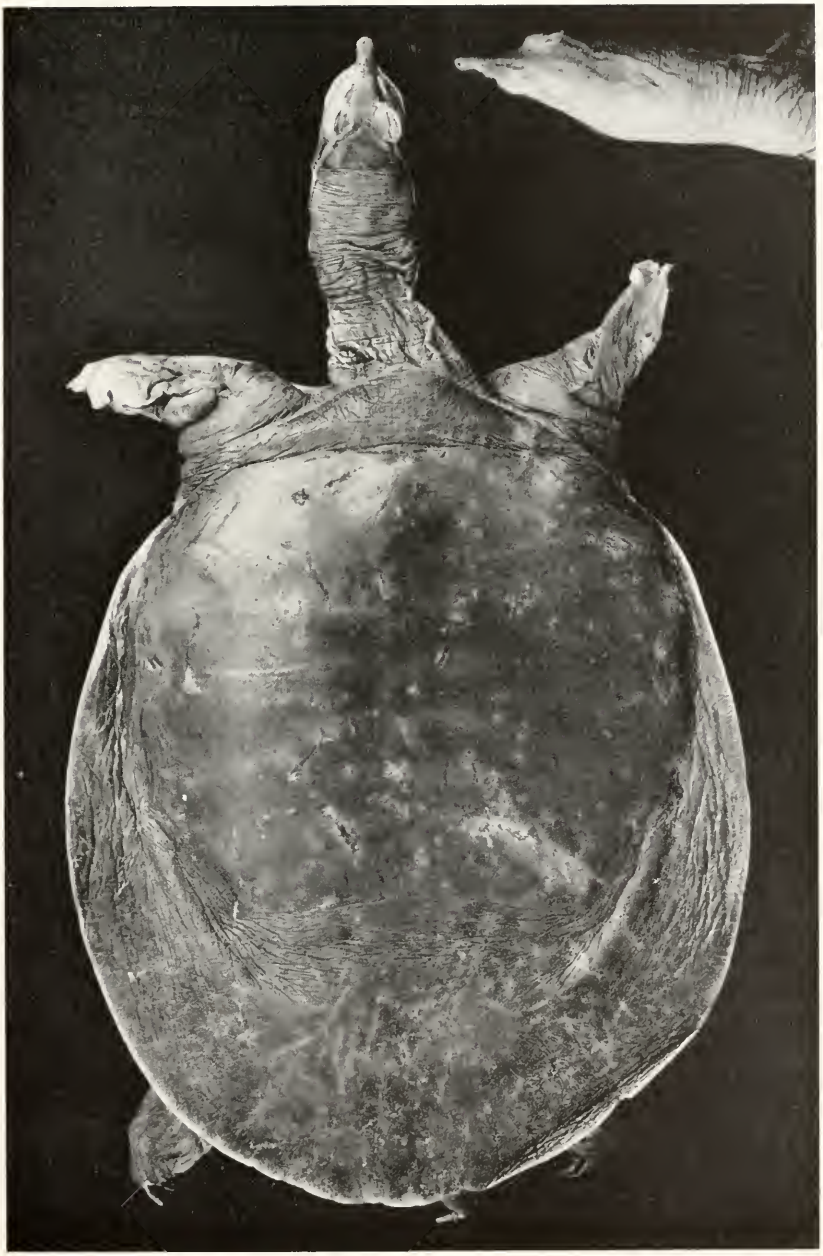


PLATE 4

PLATE 4

Lower view of *Amyda mutica*, U.S.N.M. 95186 from Medicine Lodge River, near Lake City, Kansas.

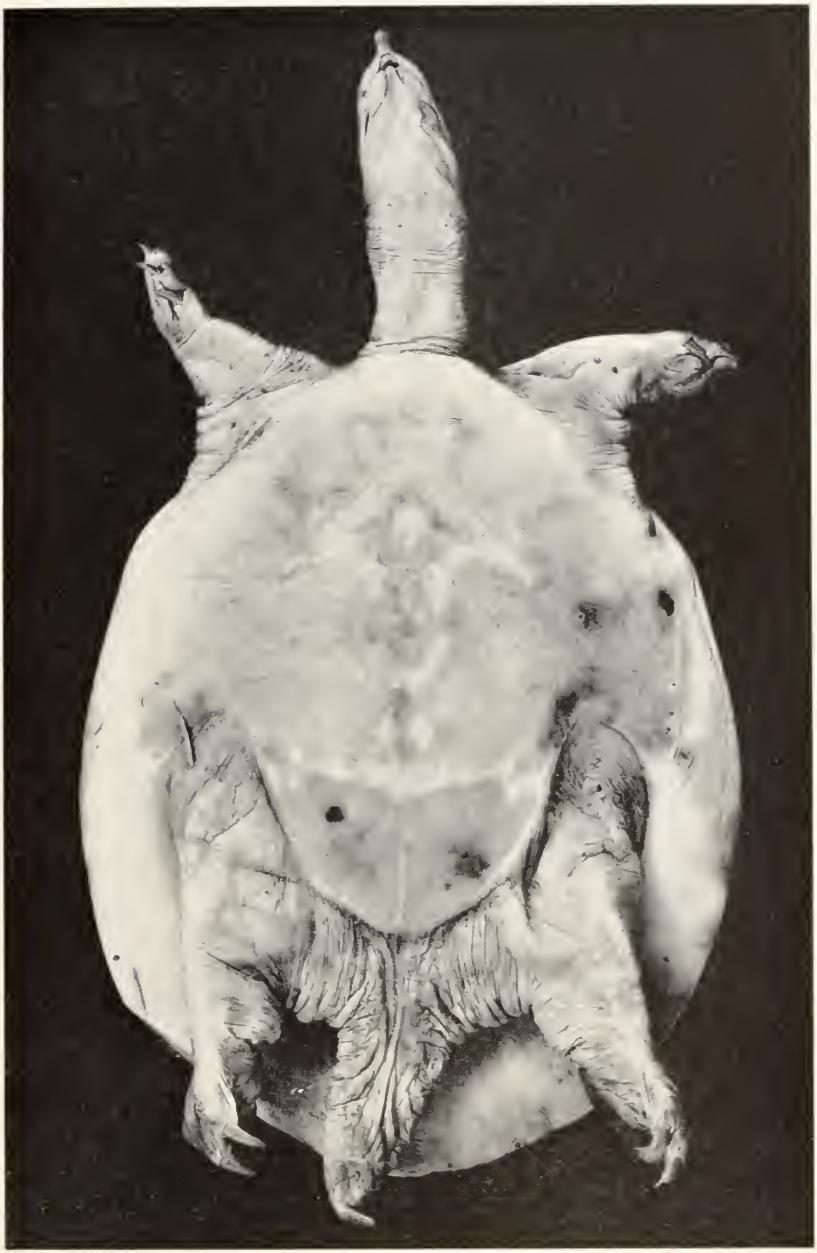


PLATE 5

PLATE 5

Skull of type of *Amyda ferox* in British Museum, from Georgia.

PLATE 6

## PLATE 6

Skulls of *Amyda ferox* (U.S.N.M. 029475, 029459, 029464 and 029462 from Kissimmee, Florida) showing extremes in the width of the alveolar surface and in the outline of the maxilla.

PLATE 7

PLATE 7

Upper view of *amyda ferox*, U.S.N.M. 86828, Tamiami Trail near Birdon, Florida.

PLATE 8

## PLATE 8

Lower view of *Amyda ferox*, U.S.N.M. 86828, Tamiami Trail near Birdon, Florida.

PLATE 9

PLATE 9

*Amyda ferox*, U.S.N.M. 86492 from Tamiami Trail about 15 miles from Miami City, Florida.

PLATE 10

PLATE 10

*Amyda ferox*, U.S.N.M. 60496 from Auburndale, Florida.

PLATE 11

PLATE 11

Upper view of *Amyda spinifera*, U.S.N.M. 101386 from Middle Fork, Holston River, Seven Mile Ford, Virginia.

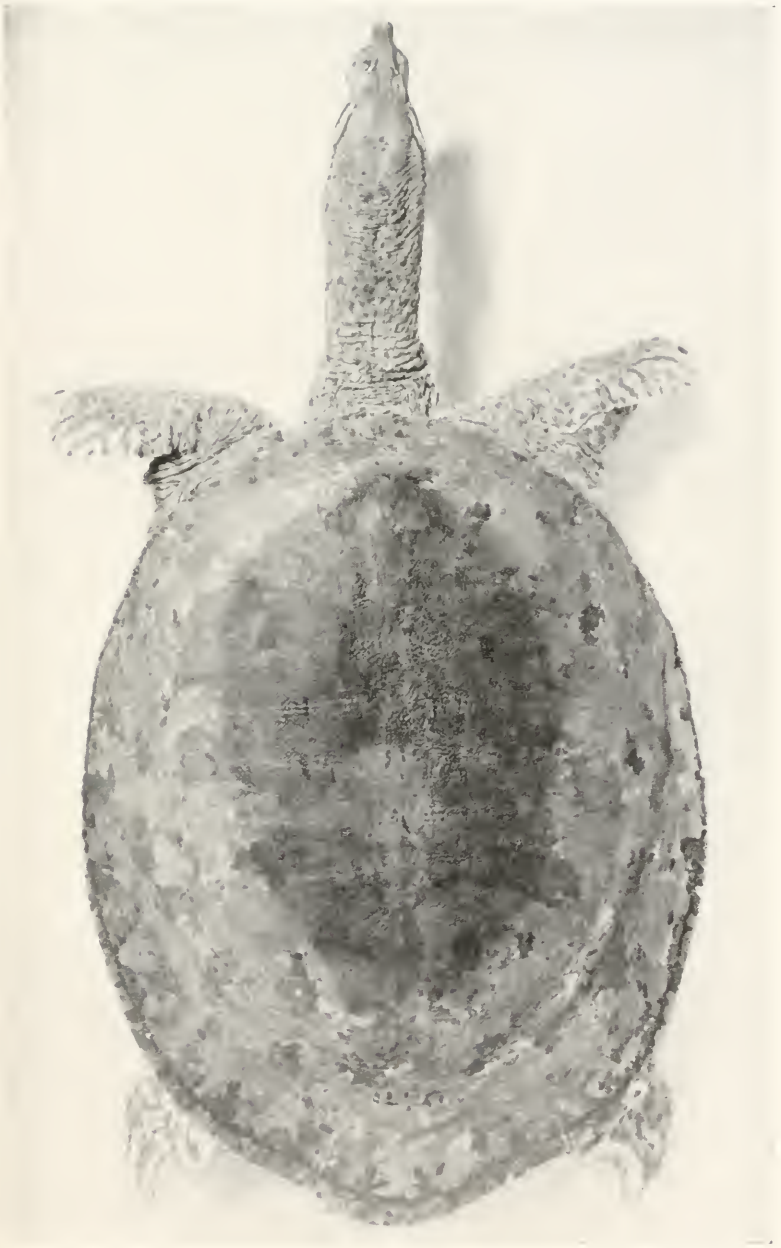


PLATE 12

PLATE 12

Lower view of *Amyda spinifera*, U.S.N.M. 101386 from Middle Fork, Holston River, Seven Mile Ford, Virginia.

PLATE 13

## PLATE 13

Head of *Amyda spinifera*, U.S.N.M. 101386 from Middle Fork, Holston River, Seven Mile Ford, Virginia.

PLATE 14

## PLATE 14

Cotype of *Amyda nuchalis*, Mus. Comp. Zoöl. 1623 from Cumberland River, Tennessee. Upper view.


1623

PLATE 15

## PLATE 15

Cotype of *Amyda nuchalis*, Mus. Comp. Zoöl. 1623 from Cumberland River, Tennessee. Lower view.

PLATE 16

## PLATE 16

Upper and lower views, and side of head of *Amyda spinifera aspera*. Cotype, Mus. Comp. Zoöl. 1622 from Lake John, Florida.

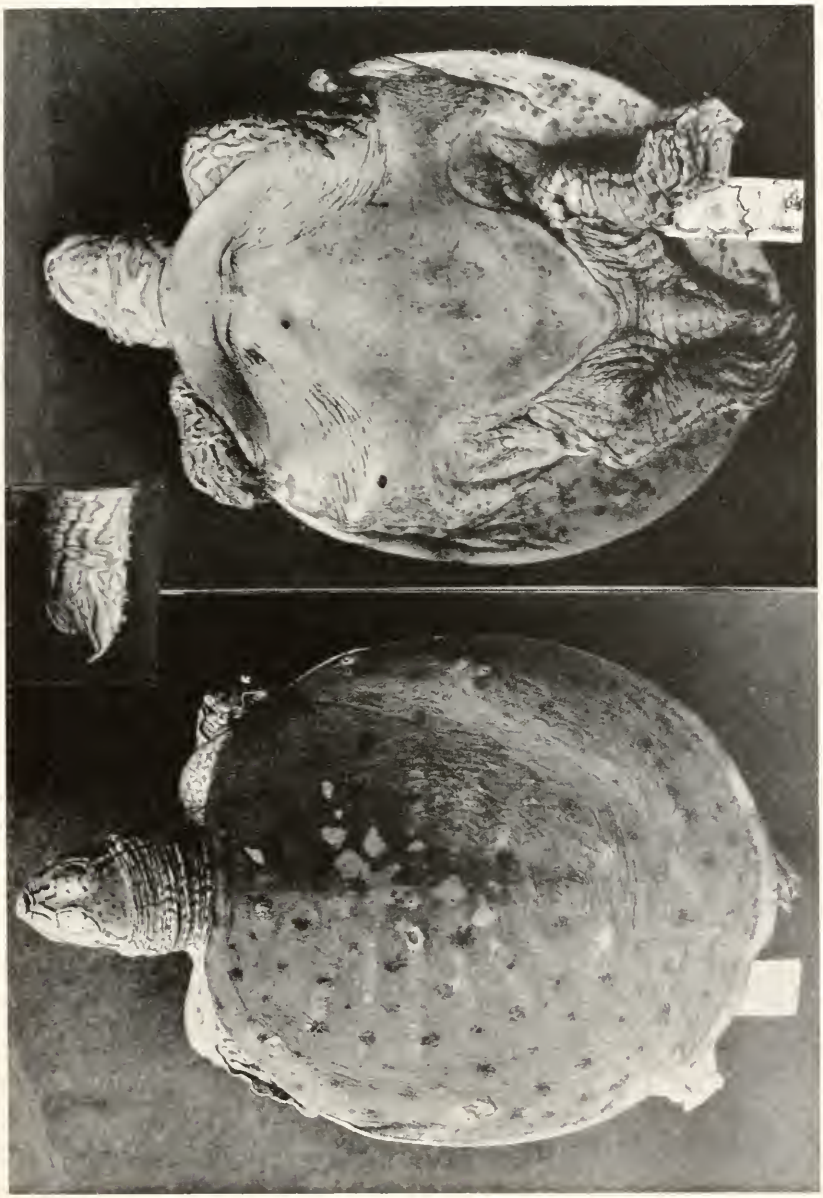


PLATE 17

## PLATE 17

*Amyda spinifera aspera*, U.S.N.M. 95191 from Canton, Mississippi. Upper view.

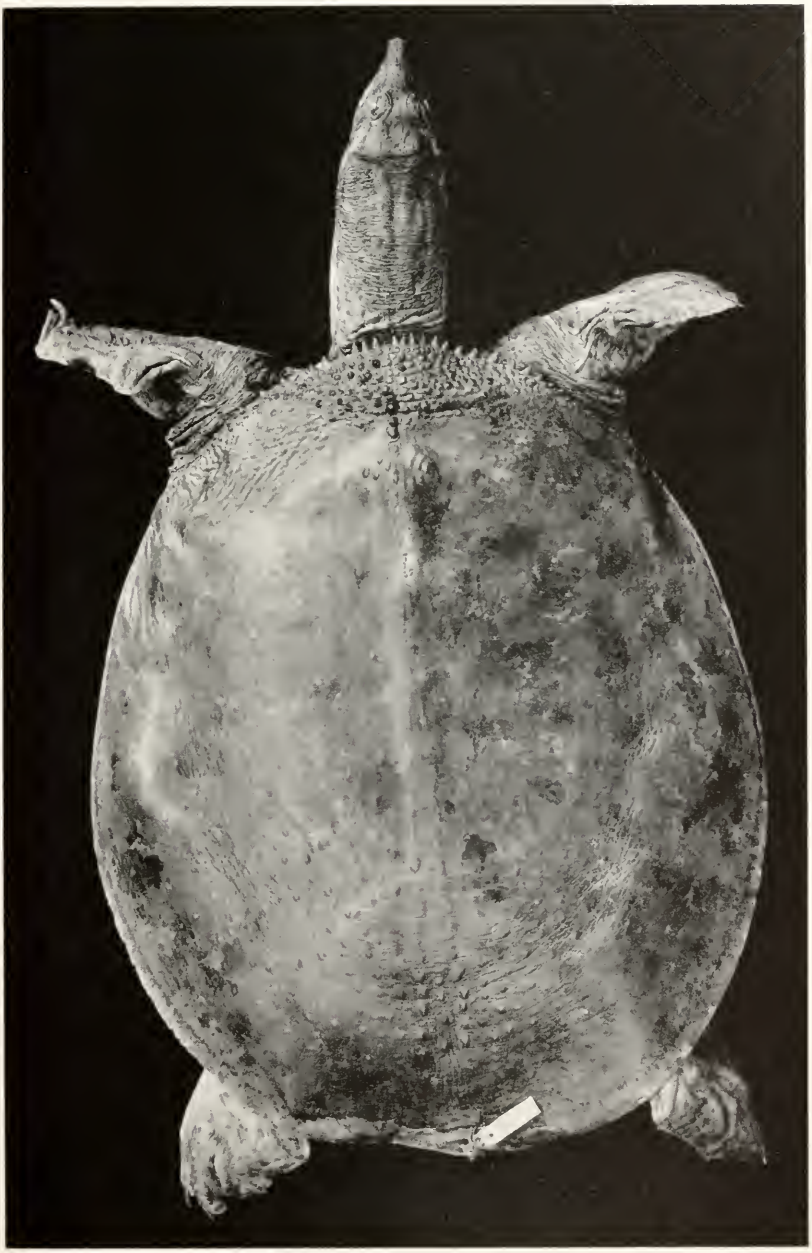


PLATE 18

## PLATE 18

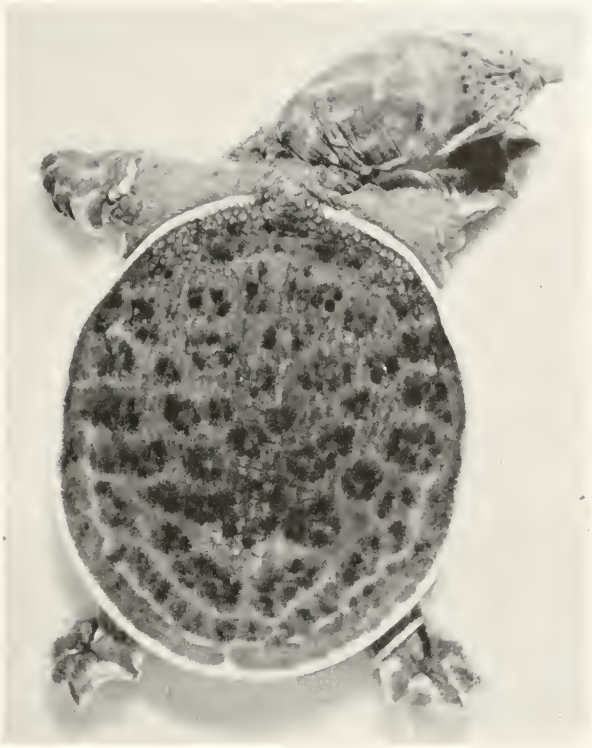
*Amyda spinifera aspera*, U.S.N.M. 95191 from Canton, Mississippi. Lower view.

PLATE 19

## PLATE 19

a. *Amyda ferox* juv., U.S.N.M. 61087 from Auburndale, Florida. b. *Amyda ferox* juv., U.S.N.M. 84603 from Chesser's Island, Okefinokee Swamp, Georgia. c. *Amyda aspera*, M.C.Z. 1608A from Mobile, Alabama.

a



b

c

PLATE 20

## PLATE 20

Agassiz drawing of *Amyda emoryi* (upper view) which corresponds fairly closely with the type (M.C.Z. 1910) collected at Brownsville, Texas by Col. Emory.

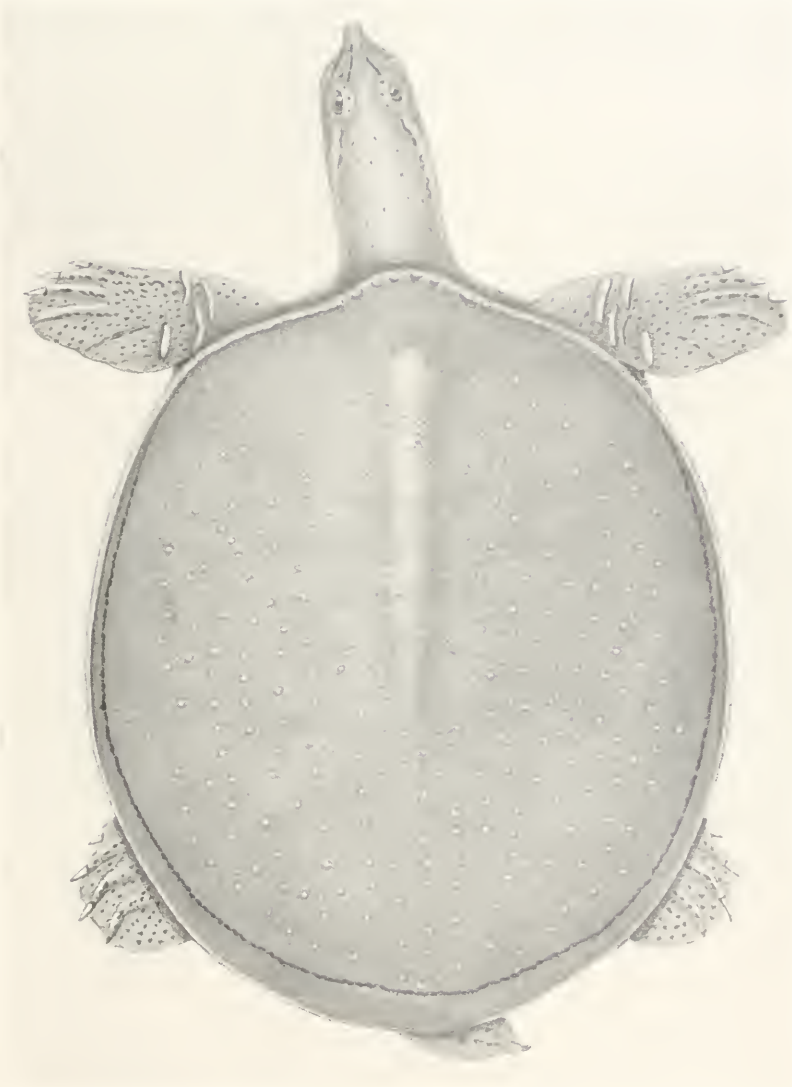


PLATE 21

## PLATE 21

Agassiz drawing of *Amyda emoryi* (lower view) which corresponds fairly closely with the type (M.C.Z. 1910) collected at Brownsville, Texas by Col. Emory.

PLATE 22

## PLATE 22

Skull of *Amyda emoryi*, U.S.N.M. 78517, collected at Guadalupe River, Victoria County, Texas by J. D. Mitchell.


7700

PLATE 23

PLATE 23

Upper view of *Amyda emoryi*, U.S.N.M. 94336 from near Houston, Texas.

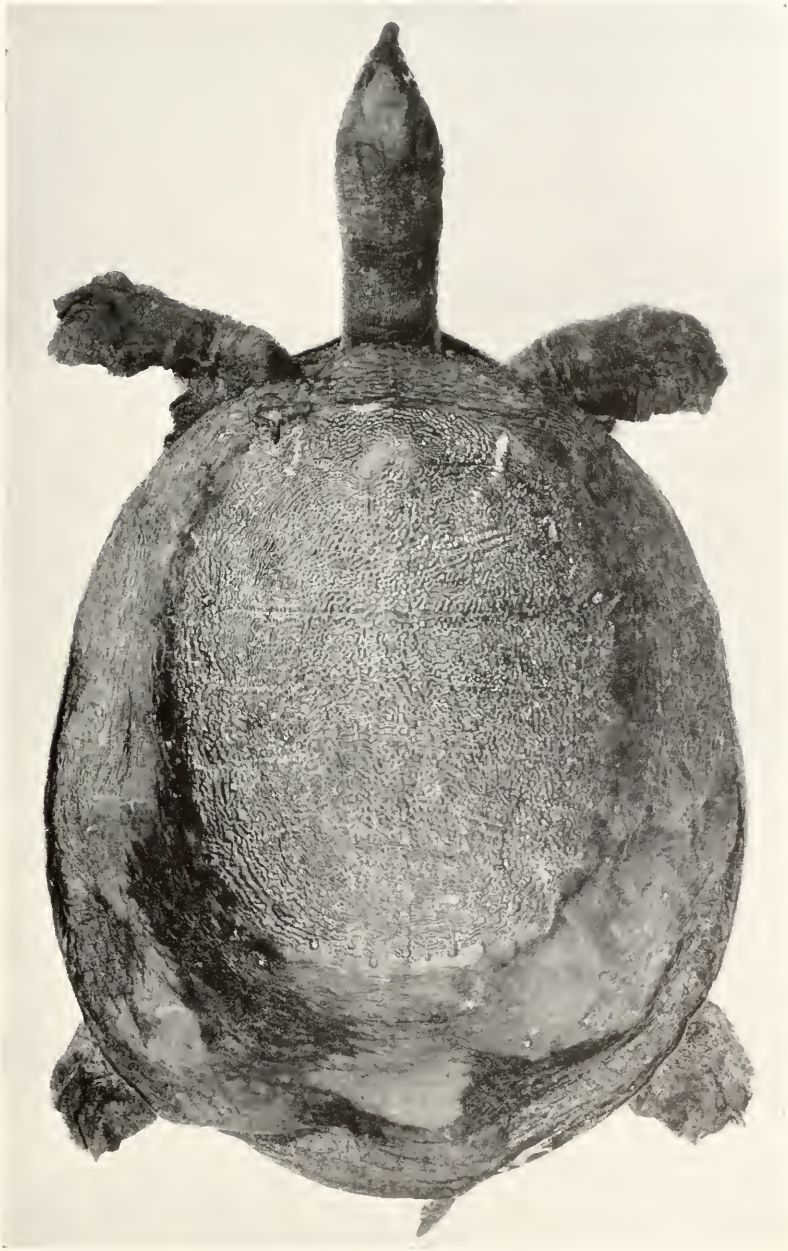


PLATE 24

PLATE 24

Lower view of *Amyda emoryi*, U.S.N.M. 94336 from near Houston, Texas.

PLATE 25

PLATE 25

Head of *Amyda emoryi*, U.S.N.M. 94336 from near Houston, Texas.

PLATE 26

## PLATE 26

*Amyda agassizii* Juv., U.S.N.M. 8359, wrongly recorded from Madison, Indiana. Upper view.

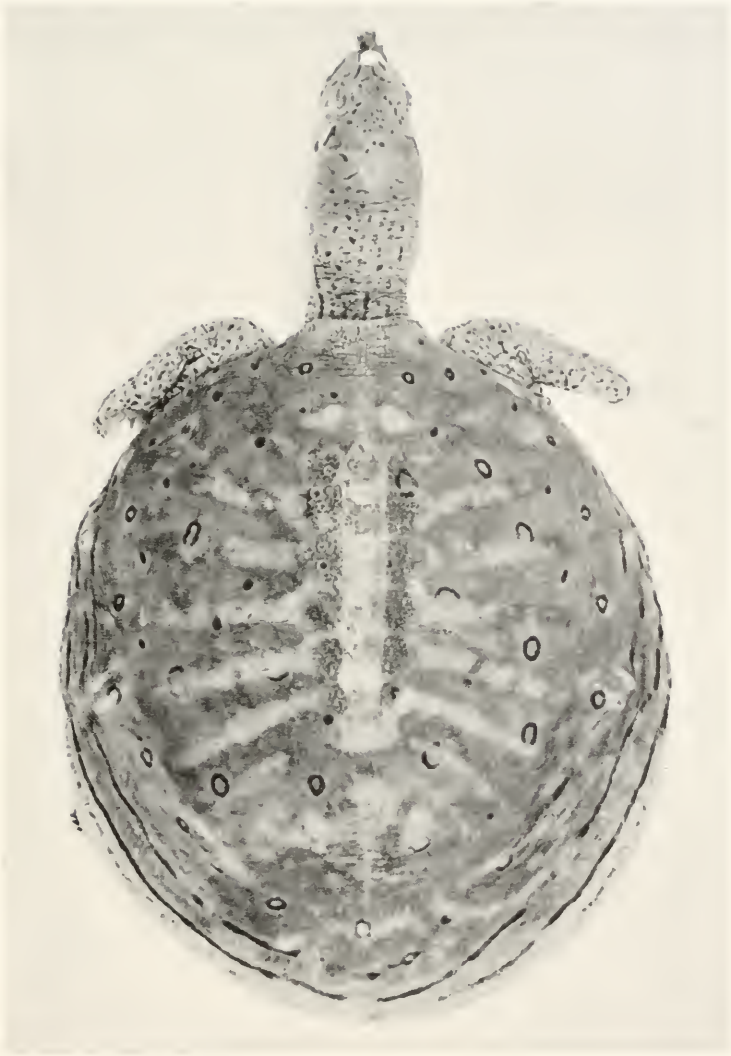


PLATE 27

## PLATE 27

Upper view of *Amyda agassizii*, U.S.N.M. 92521 from Parksville, South Carolina.

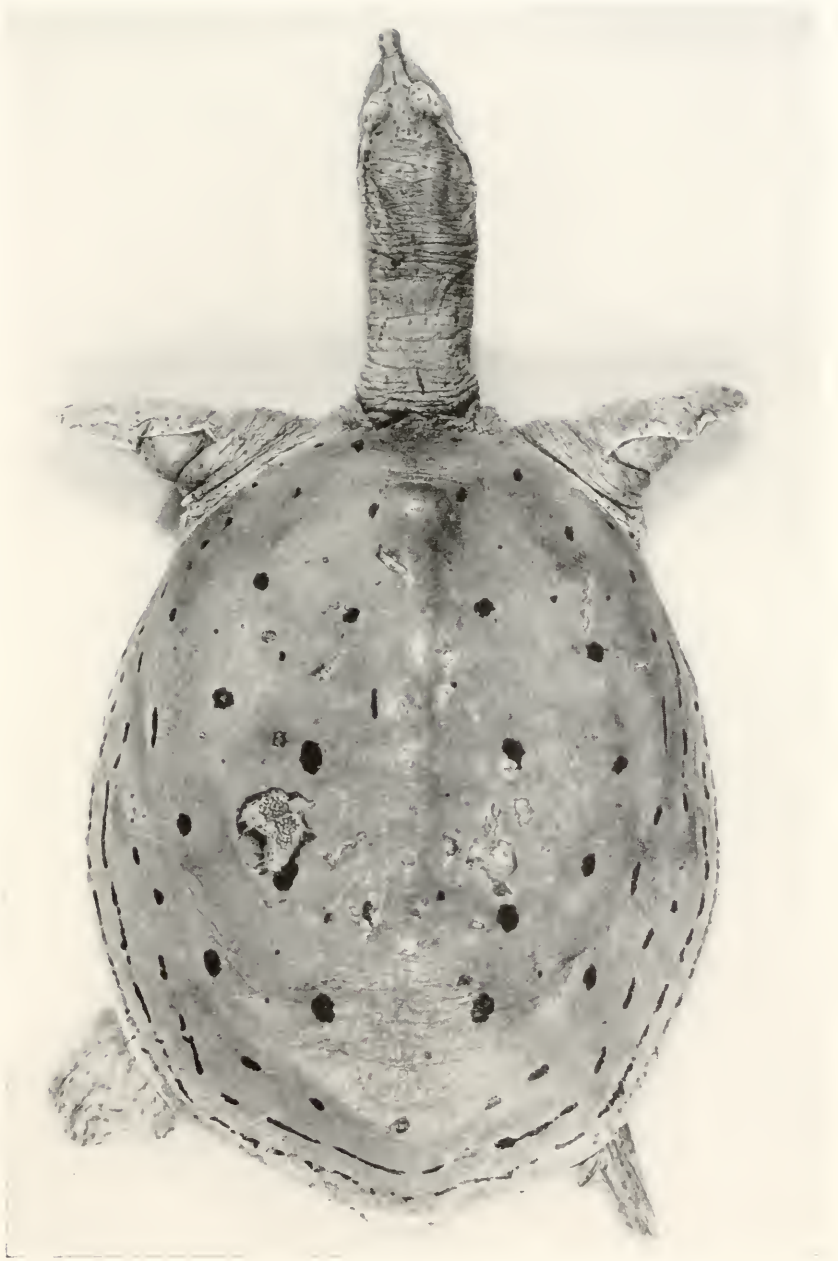


PLATE 28

## PLATE 28

Lower view of *Amyda agassizii*, U.S.N.M. 92521 from Parksville, South Carolina.

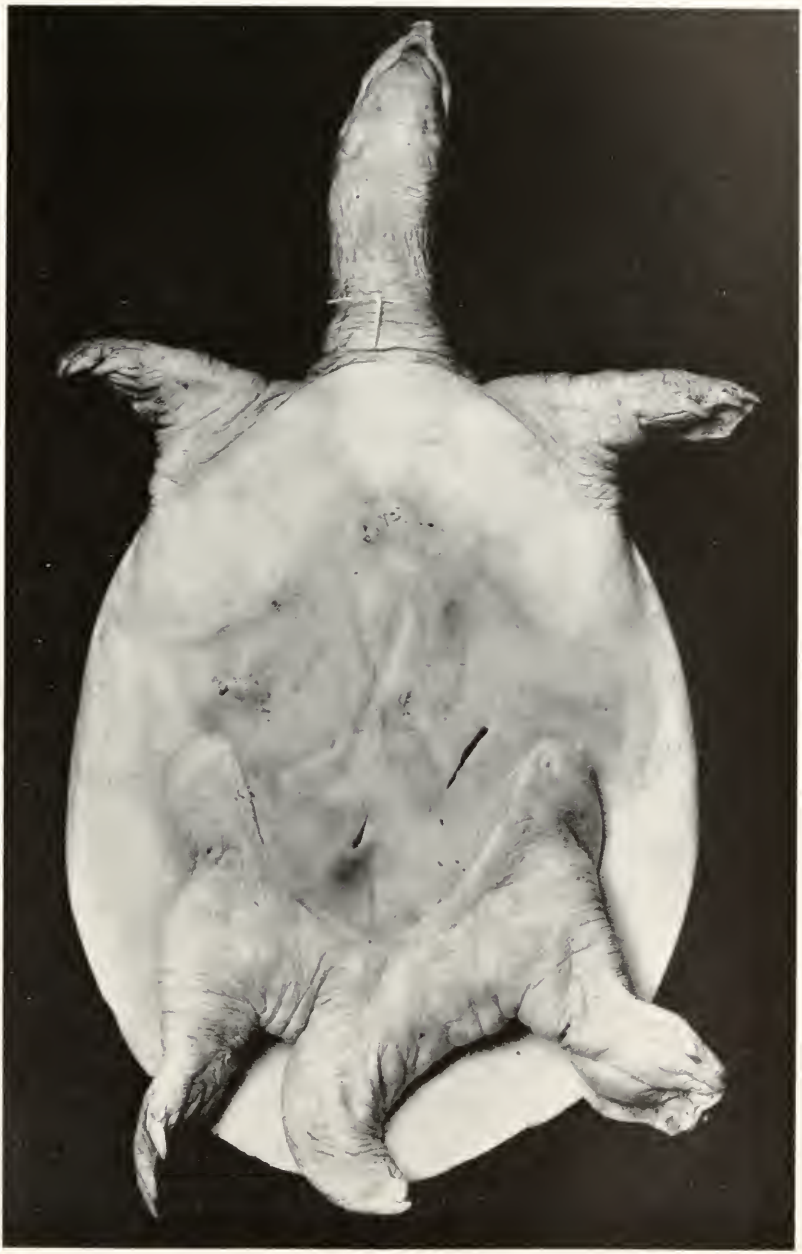


PLATE 29

PLATE 29

Head of *Amyda agassizii*, U.S.N.M. 92521 from Parksville, South Carolina.

PLATE 30

PLATE 30

Skull of *Amyda agassizii*, Philadelphia Acad. Nat. Sci. 106 (=371).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371.
10927