

THE BOX TORTOISES OF NORTH AMERICA.

By W. E. TAYLOR.

IN THE discussion of the genus *Terrapene** it is my purpose to present, in detail, the osteological characters and the geographical distribution of the genus. In doing this I have had the privilege of examining a great number of specimens, representing approximately the whole distribution of the genus in the United States and Mexico.†

History and nomenclature.—From very early times systematic zoologists have mentioned the common box tortoise, under various names, as occurring in North America. Over sixty authors have given one or more species as found in various localities. But most of these writers merely mention the names of the species, while localities, if given, are indefinite. A full discussion of these writings would be out of place in this article, and hence I content myself with barely mentioning a few of the most important papers, the authors of which have reported new species or proposed new names.

Edwards, in 1751, gives a good figure of *Terrapene carolina*.

Linnæus, in his tenth edition of the *Systema Naturæ*, 1758, mentions *Testudo carolina* as from Carolina. His description was taken from Edwards.

Gray, in 1844, described *Emys kinosternoides*, which may be *Terrapene triunguis*, Agassiz.

Gray, in the Proceedings of the Zoological Society of London, 1849, describes *Onychotria mexicana* as from Mexico.

Agassiz, in his Contributions to the Natural History of the United States, 1857, describes *Cistudo virginea* (Gmelin), *Cistudo triunguis*,

* This is the generic name, which has to be used for the American box tortoises. *Cistuda*, Fleming, 1822, is a synonym of *Terrapene*, Merrem, 1820.

† The author is under special obligations to Dr. G. Baur, Assistant Professor, University of Chicago, for material aid in the preparation of this paper, the synonymies being, for the greater part, prepared from his manuscripts, and to the authorities of the U. S. National Museum for the loan of valuable specimens. He has also to thank the following gentlemen for specimens from various parts of the country, viz: Prof. H. Garman, Prof. S. S. Maxwell, Prof. Benjamin B. Penfield, Dr. O. P. Hay, Mr. Gustave Kohn, Mr. Julius Hurter, Mr. Roy R. Larkin, Prof. Theo. D. A. Cockerell, Prof. H. B. Duncanson, Dr. Adolph Meyer, and Prof. J. D. Bruner.

Cistudo ornata, and *Cistudo major*, the first being *Testudo carolina* of Linnaeus, while the last three were recognized as new species.

Strauch, in his *Vertheilung der Schildkröten*, 1865, included all of our American forms under *Terrapene carinata*, Linnaeus.

Cope, in his Check-List of North American Batrachia and Reptilia, 1875, recognizes *Cistudo clausa*, subspecies *clausa* (Gmelin and Holbrook), *C. clausa*, subspecies *triunguis*, and *C. ornata*. He placed *Testudo carolina* of Linnaeus under the genus *Testudo*.

True, in Yarrow's Check-List of North America Reptilia and Batrachia, 1883, recognizes *Cistudo carolina*, *C. carolina triunguis*, and *C. ornata*.

Boulenger, in his Catalogue of Chelonians in the British Museum, 1888, admits but two species, as follows: *Cistudo carolina*, *C. carolina* var. *kinosternoides*, *Cistudo carolina* var. *major*, *C. carolina* var. *mexicana*, and *C. ornata*.

Baur, in the American Naturalist, 1893, after making a study of the osteology of *Terrapene*, adopts the following species: *Terrapene major*, *T. carolina*, *T. mexicana*, *T. triunguis*, and *T. ornata*.

By continuing the work of Dr. Baur, and adding to the collections already made by him, I am able to confirm his observations, and, at the same time, to add a new species.

I recognize the following species: *Terrapene major*, *T. bauri*, *T. carolina*, *T. mexicana*, *T. triunguis*, and *T. ornata*.

Not until within the last few years has the osteology of our forms been carefully studied. Gray overlooked the rudimentary quadrato-jugal in *T. carolina*. Agassiz, in his characterization of the genus, speaks of the temporal arch as "either cartilaginous or only partially ossified," forgetting the fact that *T. major*, described by him, possesses a well-developed zygomatic arch.

Boulenger gives the absence of a bony temporal arch as characteristic for *Terrapene*.

Brühl gives a figure of the skull of *Terrapene carolina*, but overlooked the quadrato-jugal.

Baur, in the Zoologischer Anzeiger for 1888, No. 296, first pointed out the fact that *T. carolina* possesses a rudimentary quadrato-jugal, contrary to the opinion held by Gray and others. Later, in Science, No. 426, 1891, he gave the osteological characters of *Terrapene major*, *T. carolina*, and *T. ornata*; and still later, in the American Naturalist, 1893, the complete osteological characters and general descriptions of *T. major*, *T. carolina*, *T. mexicana*, *T. triunguis*, and *T. ornata* were given.

The geographical distribution of *Terrapene* has never been completely worked out. Most authors have merely given a few localities or the range of each species in a general way.

Agassiz, in 1857, gives *T. carolina* (*Cistudo virginea*) as the north eastern type and erroneously states that it "has the most extensive range" of the genus. He also mentions *Terrapene* (*Cistudo*) *triunguis*

as the western and southwestern type, and *Terrapene (Cistudo) ornata* as the northwestern type. Owing to the limited data accessible he failed to recognize that the last-named species is the western form, from the Yellowstone to the Rio Grande. He also mentions *Terrapene (Cistudo) major* as the southern and southeastern type of the genus.

Cope, in 1875, states that *Terrapene carolina* is found in the "Eastern region and Louisianian and Floridian districts;" *T. triunguis* in the "austroriparian region to Georgia, eastern Pennsylvania," and *T. ornata* in the "Central region."

Baur, in 1893, gives the geographical distribution of the species as follows: *T. major*, "Southern States;" *T. carolina*, "Eastern States to Indiana;" *T. mexicana*, "Mexico;" *T. triunguis*, "Louisiana, Arkansas, Indian Territory, Mississippi, Georgia;" *T. ornata*, "Central States."

The writer's notes on the geographical distribution of *Terrapene* will be given under a separate heading.

Genus TERRAPENE, Merrem.

- 1820.—*Terrapene*, MERREM, Versuch eines Systems der Amphibien, p. 27 (type, *Testudo clausa*, GMELIN=*T. carolina*, LINNÆUS).—BAUR, Zool. Anz., 1888, No. 296; Science, XVII, 1891, p. 190; Proc. Amer. Philos. Soc., 1892, p. 245.
- 1822.—*Cistuda*, FLEMING, Philosophy of Zoology, II, p. 270.
- 1832.—*Diclidia* (part), RAFINESQUE, Atlantic Journal, I, p. 64 (in Analyse de la Nature, 1815, name only).
- 1835.—*Pyxidemys* (part), FITZINGER, Ann. Wiener Mus., I, p. 123.
- 1844.—*Emyoides*, GRAY, Catalogue of Tortoises in British Museum, p. 27.
- 1849.—*Onychotria*, GRAY, Proc. Zool. Soc. London, 1849, p. 17.
- 1857.—*Cistudo*, AGASSIZ, Contributions to the Natural History of the United States, I, p. 444.—BOULENGER, Catalogue of the Chelonians in British Museum, 1889, p. 114.—BAUR, Proc. Amer. Philos. Soc., 1892, p. 44.

KEY TO THE SPECIES OF TERREPENE.

I. Three digits on the hind foot.

1. Zygomatic arch complete. Webs absent. Phalanges on the fore foot 2-3-3-2, hind foot 2-3-3-2-1 BAURI, p. 576.
2. Zygomatic arch incomplete. Webs absent.
 - a. Number of phalanges in the fore foot 2-3-3-2-2, hind foot 2-3-3-3-1. Carapace tectiform MEXICANA, p. 579.
 - b. Number of phalanges in fore foot 2-3-3-2-2, hind foot 2-3-3-2-1. Carapace not tectiform TRIUNGUIS, p. 580.

II. Four digits on the hind foot.

1. Zygomatic arch complete. Webs distinct. Phalanges in the fore foot 2-3-3-3-2, hind foot 2-3-3-3-2 MAJOR, p. 575.
2. Zygomatic arch rudimentary. Digits slightly webbed. Phalanges in the fore foot 2-3-3-3-2, hind foot 2-3-3-3-2. Carapace keeled. . . CAROLINA, p. 577.
3. Zygomatic arch absent. Webs absent. Phalanges in the fore foot 2-2-2-2-2, hind foot 2-3-3-3-1. Carapace not keeled ORNATA, p. 581.

TERRAPENE MAJOR (A g a s s i z).

- 1857.—*Cistudo major*, AGASSIZ, Contributions to the Natural History of the United States, I, p. 445 (type in Mus. Comp. Zool., Cambridge, Mass.; locality of type, Mobile, Ala.).—GARMAN, Bull. Essex Inst., XVI, 1884, p. 10.

- 1865.—*Terrapene carinata* (part), STRAUCH, Mém. Acad. Sci. St. Petersb. (7), VIII, No. 13, p. 46.
- 1870.—*Cistudo carolina* var. *major*, GRAY, Supplement to the Catalogue of Shield Reptiles, p. 19.—BOULENGER, Catalogue of Chelonians in British Museum, 1889, p. 117.
- 1891.—*Terrapene major*, BAUR, Science, XVII, 1891, p. 190; Amer. Natural., XXVII, 1893, p. 677.

Quadrato-jugal well developed; zygomatic arch complete, and always present and relatively wider and more fully developed than in *T. bauri*. Maxilla distinctly notched. Upper branch of the scapula considerably longer than the inner branch (endo-scapula); digits with distinct well-developed webs. Number of phalanges in the forefoot, 2-3-3-2; hind foot, 2-3-3-2. Number of claws in the hind foot, 4.

Carapace oblong in horizontal outline; transverse outline semi-circular. Anterior margin but slightly curved; moderately compressed above and median ridge distinct. The width of the carapace compared to length varies from 10-12 to 10-14. First pleural plate more than half as wide as long. Ground color varying from black, yellowish olive or dark brown to very light dingy brown. The yellow spots are arranged in radiating lines but are not connected. The plastron is usually of a straw-yellow color with the dermal plates more or less faintly bordered with black or dark brown.

This species is found in regions adjacent to the Gulf coast of Florida, Alabama, Louisiana, and Texas.

List of specimens.

No.	Collector.	Collection.	Locality.
1	G. Kohn .....	.....	New Orleans, La.
2	G. Kohn .....	.....	Mandeville, La.
3	G. Kohn .....	.....	Galveston, Tex.
4	Dr. G. Baur* .....	.....	Nashville, Tenn.

* Not seen by the writer, but examined by Dr. Baur with reference to the points discussed in this paper.

TERRAPENE BAURI, new species.

Quadrato-jugal well developed; zygomatic arch complete, though not as wide as in *T. major*. Webs absent. Number of phalanges in the forefoot, 2-3-3-2; hind foot, 2-3-3-2-1. Number of claws on the hind foot, 3.

Carapace semicircular in transverse outline, imperfectly oblong in horizontal outline. Median ridge and keel distinct. First pleural plate more than three times as long as wide. Ratio of width to length of the carapace approximately 10 to 13.

Ground color of the carapace dark brown, sometimes slightly olive, marked with yellow, arranged in radiating lines rather than single spots; keel yellow. The markings of the carapace bear a very close resemblance to the extreme western species *T. ornata*, a species from which it is entirely separated geographically. Plastron yellowish with but few markings.

The type (No. 8352, U.S.N.M.) was collected in Florida by F. B. Meek.

The species is named for Dr. Baur, who first noticed the peculiarities of the type, but having only the one specimen considered it as an exceptional individual of *T. triunguis*.

List of specimens.

No.	Collector.	Collection.	Locality.
1	F. B. Meek	No. 8352. U. S. N. M.	Florida.

TERRAPENE CAROLINA (Linnaeus).

- 1758.—*Testudo carolina*, LINNÆUS, Systema Naturæ, 10 ed., I, p. 198 (from EDWARDS; locality, South Carolina); 12 ed., I, 1766, p. 852.—SCHNEIDER, Naturgeschichte der Schildkröten, 1783, p. 334.—GMELIN, Systema Naturæ, I, II, 1788, p. 1041.—BONNATERRE, Tableau Encyclopédique et Méthodique, Erpétologie, 1789, p. 28.—DONNDORFF, Zoologische Beyträge, III, 1798, p. 20.
- 1758.—*Testudo carinata*, LINNÆUS, Systema Naturæ, 10 ed., I, p. 198; 12 ed., I, 1766, p. 353.—SCHNEIDER, Naturgeschichte der Schildkröten, 1783, p. 361.—LACÉPÈDE, Histoire Naturelle des Quadrupèdes Ovipares et des Serpens, I, (Synops. méth.), 1788, p. 164.—BONNATERRE, Tableau Encyclopédique et Méthodique, Erpétologie, 1789, p. 28.—DONNDORFF, Zoologische Beyträge, III, 1798, p. 27.—SHAW, General Zoology, III, pt. I, 1802, p. 35.
- 1788.—*Testudo clausa*, GMELIN, Systema Naturæ, I, II, p. 1042.—SCHOEPPF, Historia Testudinum, 1792, p. 32, Pl. VII.—DONNDORFF, Zoologische Beyträge, III, 1798, p. 27.—SHAW, General Zoology, III, pt. I, 1802, p. 36, Pl. VII.—DAUDIN, Histoire Naturelle des Reptiles, III, 1803, p. 207, Pl. XXIII, figs. 1, 2.—LE CONTE, Annuals Lyc. Nat. Hist., New York, III, 1830, p. 124.
- 1788.—*Testudo brevi-caudata*, LACÉPÈDE, Histoire Naturelle des Quadrupèdes Ovipares et des Serpens, I (Synops. méth.), p. 169.
- 1789.—*Testudo incarcerata*, BONNATERRE, Tableau Encyclopédique et Méthodique, Erpétologie, p. 29.
- 1789.—*Testudo incarcerata-striata*, BONNATERRE, Tableau Encyclopédique et Méthodique, Erpétologie, p. 29.
- 1803.—*Testudo virgulata*, DAUDIN, Histoire Naturelle des Reptiles, III, p. 201, Pl. XXIII, figs. 3, 4.
- 1812.—*Emys clausa*, SCHWEIGGER, Königsberg. Arch. Naturwiss., I, pt. I, pp. 315, 438.—WAGLER, Natürliches System der Amphibien, p. 138.—SCHLEGEL, Fauna Japonica, Reptilia, 1833, p. 65.
- 1812.—*Emys virgulata*, SCHWEIGGER, Königsberg. Arch. Naturwiss., I, pt. I, pp. 316, 441.
- 1812.—*Emys schneideri*, SCHWEIGGER, Königsberg. Arch. Naturwiss., I, pt. I, pp. 317, 442.
- 1820.—*Terrapene clausa*, MERREM, Versuch eines Systems der Amphibien, p. 28.—FITZINGER, Neue Classification der Reptilien, 1826, p. 45.
- 1825.—*Terrapene carolina*, BELL, Zool. Journ., II, p. 309.—BAUR, Science, XVII, 1891, p. 190; Amer. Natural., XXVII, 1893, p. 677.
- 1825.—*Terrapene nebulosa*, BELL, Zool. Journ., II, p. 310.
- 1825.—*Cistuda clausa*, SAY, Journ. Acad. Nat. Sci. Phila., IV, pt. II, pp. 205, 214.—BONAPARTE, Cheloniorum Tabula Analytica, 1836, p. 6.
- 1826.—*Terrapene virgulata*, FITZINGER, Neue Classification der Reptilien, p. 45.
- 1827.—*Cistuda clausa*, HARLAN, American Herpetology, p. 73.
- 1830.—*Emys (Cistuda) clausa*, BONAPARTE, Sulla Seconda Edizione del Regno Animale Osservazioni, p. 162.

- 1831.—*Emys (Cistuda) carolina*, GRAY, in Griffith's Animal Kingdom, IX, Append., p. 7.
- 1831.—*Cistuda carolina*, GRAY, Synopsis Reptilium, I, p. 18.—HOLBROOK, North American Herpetology, 2 ed., I, 1842, p. 31, Pl. II.—DE KAY, Zoology of New York, pt. iii, 1842, p. 24, Pl. I., fig. 1.—GRAY, Catalogue of Tortoises in the British Museum, 1844, p. 30.
- 1835.—*Cistudo carolina*, DUMÉRIL and BIBRON, Erpétologie Générale, II, 1835, p. 210; IV, 1854, p. 224.—DUMÉRIL, Muséum d'Histoire Naturelle de Paris, Catalogue Méthodique de la Collection des Reptiles, 1851, p. 7 (part).—WIED, Nov. Acta Acad. Leop. Carol., XXXII, I, 1865, p. 1, Pl. I, fig. 1.—GRAY, Supplement to the Catalogue of Shield Reptiles, 1870, p. 19; Hand-list of Specimens of Shield Reptiles in the British Museum, 1873, p. 18.—TRUE, in YARROW, Bull. U. S. Nat. Mus. 24, 1883, p. 37.—BOULENGER, Catalogue of the Chelonians in the British Museum, 1889, p. 115, figs. 32, 33.—STRAUCH, Mém. Acad. Sci. St.-Petersb. (7) XXXVIII, No. 2, 1890, p. 62 (part).—BAUR, Proc. Amer. Philos. Soc., 1892, p. 44.
- 1835.—*Pyxidemys schneideri*, FITZINGER, Ann. Wiener Mus., I, p. 123.
- 1835.—*Pyxidemys virgulata*, FITZINGER, Ann. Wiener Mus., I, p. 123.
- 1835.—*Pyxidemys clausa*, FITZINGER, Ann. Wiener Mus., I, p. 123.
- 1857.—*Cistudo virginica*, AGASSIZ, Contributions to the Natural History of the United States, I, p. 445, Pl. IV, figs. 17-19; Pl. VIII, figs. 10-14.
- 1862.—*Terrapene carinata* (part), STRAUCH, Mém. Acad. Sci. St.-Petersb. (7) V, No. 7, p. 96; VIII, No. 13, 1865, p. 45.
- 1875.—*Cistudo clausa*, subsp. *clausa*, COPE, Bull. U. S. Nat. Mus. No. 1, p. 53.
- 1884.—*Cistudo carinatu*, S. GARMAN, Bull. Essex Inst., XVI, p. 10.
- 1892.—*Cistudo carolina* var. *carolina*, H. GARMAN, Bull. Ill. State Lab. Nat. Hist., III, p. 219.

Quadrato-jugal rudimentary, triangular in shape and connected with the quadrate only. Zygomatic arch absent. Maxillary, distinctly beaked but not notched. Cervicals and their processes relatively short. Upper branch of the scapula somewhat longer than the inner branch (endoscapula), but not so long as in *T. major*. Number of phalanges in forefoot, 2-3-3-3-2 or 2-3-3-2-2; hind foot, 2-3-3-3-2. Digits slightly webbed. Claws in the hind foot, 4. First pleural plate approximately twice as long as wide.

Carapace ovoid in outline; ratio of width to length in adults, about as 10 to 12. Not compressed above; keel distinct and median ridge absent. Color dark brown or blackish, marked by yellowish or brownish radiating spots and lines. Often the keel is marked by an interrupted yellow or brownish yellow line.

Plastron oval in outline, with distinct shoulders on each side of the hinge area. Ground color dull yellow, variously blotched and mottled with lavender brown.

Kentucky and Tennessee specimens are the most beautiful of our North American forms, and may possibly be entitled to rank as a variety of *T. carolina*. The carapace is ovoid in horizontal outline; semiovoid in transverse section. The general color is black or very dark brown, marked by bright yellow, sometimes the latter color prevailing. The posterior portions of the second, third, and fourth vertebral plates are marked by distinct but irregular quadrate blotches which are broadly bordered by bright yellow. The upper portions of the first, second, and third costal plates are similarly marked. The

spaces in front of these blotches on the vertebral plates and below them on the costal plates are marked by spots and radiating blotches of yellow. The presence of a distinct keel and the absence of a median depression are points readily distinguished. The plastron is yellow, irregularly blotched and mottled with much brown and black, broadest across the femorals. The upper portion of the head and neck is brown, slightly specked with yellow; a yellow line beginning at the posterior of the eye runs back over the ear and the posterior of the skull. Mandible, throat, and lower neck light yellow. Upper scales of the legs grayish; lower scales mostly orange or reddish. The individual described is a female collected at Midway, Ky., by Prof. H. Garman. Another specimen very similar but younger was sent me by Prof. S. S. Maxwell. This one was collected at the mouth of Billingtons Creek, near Lovelaceville, Ballard County, Ky., in the extreme western portion of the State, where the writer has often observed other specimens. Prof. Benj. B. Penfield, of Nashville, Tenn., sent me two specimens which agree with the Kentucky individuals in every point except that a distinct triangular quadrato-jugal was present.

In general form and osteological characters this variety grades into, if it is not identical with, typical specimens of *T. carolina*, and may be regarded as the southern extension of this species. Hence the distribution of *T. carolina* may be given as eastern United States, south to Carolinas, Georgia, Tennessee, and Kentucky, reaching the Mississippi, west to eastern Illinois and Wisconsin, and north to Canada.

List of specimens.

No.	Collector.	Collection.	Locality.
1	Dr. G. Baur.....	.....	Indiana.
2	..do.....	.....	do.
3	..do.....	.....	New Haven, Conn.
4	..do.....	.....	do.
5	L. Stejneger.....	.....	Washington, D. C.
6	J. D. Figgins.....	No. 20544, U. S. N. M.....	Kensington, Md.
7	Prof. S. S. Maxwell..	.....	Lovelaceville, Ky.
8	Prof. H. Garman.....	.....	Midway, Ky.
9	Dr. O. P. Hay.....	.....	Kentucky.
10	Prof. B. B. Penfield..	.....	Nashville, Tenn.
11	..do.....	.....	do.
12	P. S. Young.....	No. 11600, U. S. N. M.....	Rock Creek, D. C.
13	Frank Burns.....	No. 14624, U. S. N. M.....	Darlington, S. C.
14	J. D. Ridgway.....	No. 14670, U. S. N. M.....	Wheatland, Ind.
15	..do.....	No. 14670, U. S. N. M.....	do.
16	.....	No. 8539 (?).	Carlisle, Pa.
17	B. A. Bean.....	No. 13583, U. S. N. M.....	Bainbridge, Pa.
18	Dr. G. Baur.....	.....	Albany, N. Y.
19	..do.....	.....	do.

TERRAPENE MEXICANA (Gray).

1849.—*Oxychotria mexicana*, GRAY, Proc. Zool. Soc. London, 1849, p. 17, Pl. II (type in British Museum; locality of type, Mexico).—DUGÈS, La Naturelleza (2), 1888, p. 11.

1855.—*Cistudo mexicana*, GRAY, Catalogue of Shield Reptiles in the British Museum, p. 40; Supplement to the Catalogue of Shield Reptiles, 1870, p. 19.—BOCOURT, Mission Scientifique au Mexique, Reptiles, fasc. 1, 1870, p. 17 (part).—GÜNTHER, Biologia Centrali-Americana, Reptilia, 1885, p. 1.—COPE, Bull. U. S. Nat. Mus. 32, 1887, p. 21.

1889.—*Cistudo carolina* var. *mexicana*, BOULENGER, Catalogue of Chelonians in the British Museum, p. 118.

1891.—*Terrapene mexicana*, BAUR., Science, XVII, 1891, p. 191; Amer. Natural, 1893, p. 677.

Quadrato-jugal very rudimentary; connected with the quadrate and rather elongated. Zygomatic arch absent. Upper branch of the scapula as in *T. major*. No webs between the digits and only three claws on the hind foot. Number of phalanges in the forefoot 2-3-3-2-2; in hind foot 2-3-3-3-1. Maxilla not notched.

Carapace oval in horizontal outline; rather triangular in transverse outline. Ratio of width to length in adults approximately 10 to 13. The additional plate found between the fourth and fifth vertebral plates seems to be characteristic. First pleural plate more than three times as long as wide.

Color of the carapace brownish yellow marked by dark brown radiating lines and irregular spots. Head yellow, irregularly marked by black or dark brown. Throat yellow, posterior neck light brown.

Plastron curved in the region of the abdominal and femoral plates, and distinctly mucronate posteriorly. Color, whitish yellow, the posterior border of each dermal plate bordered with smoky brown.

City of Mexico and Tampico, Mexico.

List of specimens.

No.	Collector.	Collection.	Locality.
1	Dr. Herrera.....	Dr. G. Baur.....	Mexico.

TERRAPENE TRIUNGUIS (Agassiz).

1831.—? *Emys kinosternoides*, GRAY, in Griffith's Animal Kingdom, IX, Append., p. 12; Synopsis Reptilium, 1831, p. 32.

1835.—*Emys cinosternoides*, DUMÉRIL et BIBRON, Erpétologie Générale, II, p. 303; IX, 1854, p. 227. DUMÉRIL Muséum d'Histoire Naturelle, Catalogue Méthodique de la Collection des Reptiles, 1851, p. 12.

1844.—*Emys (Emyoides) kinosternoides*, GRAY, Catalogue of Tortoises in the British Museum, p. 27.

1857.—*Cistudo triunguis*, AGASSIZ, Contributions to the Natural History of the United States, I, p. 445, Pl. VII (type in Mus. Comp. Zool., Cambridge, Mass.; locality of type, Louisiana).—GARMAN, Bull. Essex Inst., XVI, 1884, p. 10.

1865.—*Terrapene carinata* (part), STRAUCH, Mém. Acad. Sci. St. Petersb., (7) VIII, No. 13, p. 45.

1875.—*Cistudo clausa* subsp. *triunguis*, COPE, Bull. U. S. Nat. Mus., I, p. 53.

1883.—*Cistudo carolina triunguis*, TRUE in Yarrow, Bull. U. S. Nat. Mus. 24, p. 37.

1889.—*Cistudo carolina* var. *cinosternoides*, BOULENGER, Catalogue of Chelonians in the British Museum, p. 117.

1890.—*Cistudo carolina* (part), STRAUCH, Mém. Acad. Sci., St. Petersb., (7) XXXVIII, 2, p. 62.

1891.—*Terrapene cinosternoides*, BAUR, Science, XVII, 1891, p. 191.

1893.—*Terrapene triunguis*, BAUR, Amer. Natural., 1893, p. 677.

Quadrato-jugal rudimentary and triangular; connected with the quadrate only. Zygomatic arch absent. Scapula as in *T. major*. No webs between the digits, and only three claws on the hind foot. Phalanges in the forefoot, 2-3-3-2-2; hind foot, 2-3-3-2-1. Maxillæ slightly notched. Cervicals and their processes relatively short.

Carapace moderately oval, keeled, and slightly compressed. Ratio of width of carapace to length in adults about 10 to 13. First pleural plate similar to *T. bauri*. Ground color dark-brown or olive-yellow, much mottled with yellow.

Plastron oval. Ground color yellow, much mottled with brown.

The Louisiana form seems to be a dwarf variety of this species and is peculiar to Louisiana. They were first noticed by Agassiz who states: "Had I not noticed a few larger specimens from the Osage River and from Georgia, I should not hesitate to consider them as a distinct species." They are characterized by their relatively small size, peculiar markings, and rather full development of the quadrato-jugal. Some times the quadrato-jugal is sufficiently developed to come into contact, if not uniting, with the jugal. These individuals are readily distinguished by their small size, three toes, and general color. In color they vary from pale yellow or dusky to dark brown, marked by small radially distributed yellow spots, often only few in number. The fact that they grade into larger forms of other localities prevents them from being ranked as a separate species.

Mississippi, Louisiana, Arkansas, Indian Territory, southern Missouri and Kansas, and Texas.

List of specimens.

No.	Collector.	Collection.	Locality.
1	G. Kohn .....	.....	New Orleans, La.
2	do .....	.....	do.
3	do .....	.....	do.
4	do .....	.....	Mandeville, La.
5	do .....	.....	do.
6	do .....	.....	do.
7	Dr. O. P. Hay .....	.....	Shubuta, Miss.
8	Julius Hurter .....	.....	St. Louis, Mo.
9	do .....	.....	do.
10	Dr. Kennerly	No. 53, U. S. N. M.	Fort Inge to San Antonio, Tex.
11	.....	No. 7345, U. S. N. M.	Wailes, Miss.
12	.....	No. 303 (7174), Mus. Phila. Acad. Sci.	Mill Creek, Chickasaw Nation, Ind. T.
13	.....	No. 304 (7177), Mus. Phila. Acad. Sci.	Fort Arbuckle, Ind. T.
14	Dr. E. Palmer	No. 305 (7192), Mus. Phila. Acad. Sci.	Fort Gibson, Ind. T.

TERRAPENE ORNATA (A g a s s i z).

1857.—*Cistudo ornata*, AGASSIZ, Contributions to the Natural History of the United States, I, p. 445, Pl. III, figs. 12, 13 (type in Mus. Comp. Zool., Cambridge, Mass.; locality of type, Upper Missouri, Iowa).—COPE, Bull. U. S. Nat. Mus. 1, 1875, p. 53; Bull. U. S. Nat. Mus. 17, 1880, p. 13.—TRUE in Yarrow, Bull. U. S. Nat. Mus. 24, 1883, p. 37.—GARMAN, Bull. Essex Inst., XVI, 1884, p. 10.—BOULENGER, Catalogue of Chelonians in the British Museum, 1889, p. 118.—H. GARMAN, Bull. Ill. State Lab. Nat. Hist., III, 1892, p. 220.

1891.—*Terrapene ornata*, BAUR, Science, XVII, 1891, p. 191; Amer. Natural., 1893, p. 678.

Quadrato-jugal entirely absent, and hence zygomatic arch never present. Postorbital arch much more slender than in other species. Maxillæ notched. Cervicals and their processes relatively very short. Upper branch of the scapula of the same length as the inner branch (endoscapula). Digits without distinct webs. Number of phalanges in forelimb, 2-2-2-2-2; hind limb, 2-3-3-3-1. Number of claws in the hind foot, 4.

Carapace in horizontal outline broadly oval; much compressed above; medium ridge usually present, but the keel always absent, even in the young. Interpleural foramina between the ribs of the first and second dorsal vertebræ almost obsolete. Ratio of the width to the length of the carapace in adults, never exceeding ten to twelve, rarely more than ten to eleven. The depression of the carapace is usually so great as to render the outline of a transverse section almost oblong in shape.

The ground color of the carapace varies from very dark-brown, marked with bright-yellow radiating lines with a yellow median line, to very light colors with no markings. Third vertebral plate less than two-thirds as long as wide, being in all other species relatively longer.

Plastron widest across the abdominal plates. Ground color brown, marked by irregular yellow lines. Posterior to the hinge ligament these lines show a tendency to become longitudinal, while on the anterior of the hinge ligament these lines are mostly transverse.

East of the Rocky Mountains to Wisconsin, eastern Illinois, central Indian Territory, and eastern Texas.

List of specimens.

No.	Collector.	Collection.	Locality.
1	Dr. G. Baur .....	.....	Lawrence, Kans.
2	do .....	.....	Indiana (?).
3	do .....	.....	Kansas; Logan County.
4	do .....	.....	do.
5	Dr. O. P. Hay .....	.....	do.
6	do .....	.....	Kansas.
7	Prof. T. D. A. Cockerell .....	.....	Las Cruces, N. Mex.
8	Roy R. Larkin .....	.....	do.
9	Prof. J. D. Bruner .....	.....	El Paso, Tex.
10	William Lloyd	No. 16484, U. S. N. M ..	South of Devil's River, Texas.
11	do	No. 20959, U. S. N. M ..	Corpus Christi, Tex.
12	Dr. Kennerly	No. 52, U. S. N. M	San Antonio to Fort Inge, Tex.
13	Prof. H. B. Duncanson ..	.....	Peru, Nebr.
14	Hayden	No. 7541, U. S. N. M ..	Sand Hills, Nebraska.
15	Kennicott	No. 7542, U. S. N. M ..	Illinois.
16	Hayden	No. 57, U. S. N. M	Yellowstone (River).
17	do	do	do.
18	Bailey	No. 15861, U. S. N. M ..	Kennedy, Nebr.
19	Julius Hurter	No. 16491, U. S. N. M ..	St. Louis, Mo.
20	Palmer	No. 7177, U. S. N. M ..	Old Fort Cobb, Okla.
21	W. S. Wood	No. 156, U. S. N. M ..	Republican River, Nebraska.
22	do	No. 156, U. S. N. M ..	do.
23	Dr. Hayden	U. S. N. M	Fort Laramie, Wyo.
24	Dr. Meyer .....	.....	Kankakee, Ill.

GENERAL REMARKS.

The geographical distribution of *Terrapene* offers many interesting phases for study. The relatively fixed habits of the species of the genus render their variations more or less local in character. Good illustra-

tions of this fact are seen in the *T. ornata* of Texas and the *T. trianguis* of Louisiana and southwestern Arkansas and southeastern Indian Territory. But, notwithstanding these conditions, the specific characters are maintained throughout the range of each species, as has been shown.

Terrapene major may be said to be strictly a gulf species, having for its range the gulf coast from the Rio Grande to Florida, possibly including southern Georgia. The specimens examined by me seem to be larger in the average than individuals of other species, and in general osteological characters they certainly represent the primitive form of the genus. They possess a well-developed quadratojugal, a complete zygomatic arch, and are distinguished from *T. bauri* by the number of phalanges, color pattern, and webbed digits, there being four claws on each hind foot.

Terrapene bauri may be said to belong to the peninsula of Florida, possibly including southern Georgia. It resembles *T. major* in having a complete bony zygomatic arch and *T. trianguis* in having but three toes on the hind foot, while it differs from either in the number of its phalanges. The color markings of the type, excepting plastron, are almost identical with *T. ornata*, a species from which *T. bauri* is completely separated both by osteological characters and geographically. The specimens mentioned by Agassiz as three-toed specimens of *T. carolina* from North Carolina, and *T. trianguis* from Georgia may belong to this species.

Terrapene carolina is found in the northeastern United States, extending from the St. Lawrence and Great Lakes south to the Carolinas and Tennessee and west to the Mississippi River in Kentucky and to eastern Illinois.* This species seems to exist in greatest abundance in New Jersey and adjacent regions, but Dr. Hinds informs me that it is very common at Lebanon, Tenn. It seems to be, in a certain sense, the mountain species, being found throughout the mountains of Pennsylvania, as well as elsewhere, and seems to be coextensive with the Alleghany range southward. It is characterized by its rudimentary quadratojugal, the hooked upper jaw, and the presence of a distinct keel on the carapace, the number of phalanges, and its slightly webbed digits.

* Unfortunately I am unable to speak definitely as to the precise western limit of *T. carolina* north of the Ohio River. The specimens reported by Prof. H. Garman as from various points in southwestern Illinois are inaccessible at the time of writing, owing to alterations now being made in the museum at Champaign, Ill. Prof. W. K. Higley, in his catalogue of Wisconsin reptiles, mentions *T. carolina* as collected at the following places in Wisconsin, namely, Walworth County, two specimens; Milwaukee; Pine Lake; La Crosse; and Green Bay. Not having had an opportunity to examine Prof. Higley's specimens, I have been unable to verify his identifications. Mr. Hurter, in his catalogue of St. Louis reptiles, mentions one specimen of *T. carolina*, but since it is the only one which has been found in that locality he rather infers that it was brought into St. Louis. This inference is made more probable by the fact that the individual was found in the elevator yards.

On the south it adjoins or overlaps the territory of *T. bauri* and *T. triunguis*, while on the west it overlaps the *T. triunguis* and *T. ornata* for a comparatively short distance. Its principal characters remain constant whether the specimens be taken from the Atlantic coast, the mountains of Pennsylvania and Tennessee, or the prairies of Ohio and Indiana. Specimens from Kentucky and Tennessee exhibit certain peculiarities in color markings. These peculiarities have been discussed fully under the specific characters of *T. carolina*.

Terrapene mexicana is at once distinguished by its tectiform carapace, rudimentary quadrato-jugal, and the number of phalanges. Several authors have reported this species from the City of Mexico, and Bocourt mentions one specimen as from Tampico, Mexico—the most northerly locality reported. These meager data would hardly justify me in outlining its range.

Terrapene triunguis in many respects shows a peculiar distribution. Roughly speaking it may be said to occupy the swampy districts of the Lower Mississippi and bordering territory. It is found in the southern half of the State of Mississippi, and passing into the extreme southwestern portion of Illinois is found as far north as St. Louis, Mo.; thence west in the Osage River Valley in eastern Kansas; thence southwest to the Arkansas River and its tributaries in Indian Territory; thence to Matagorda Bay bordering the gulf from the Rio Grande to Alabama. This species is characterized by its rudimentary triangular quadrato-jugal, its number of phalanges and webless digits, three claws on the hind foot, its keeled carapace with its slight median depression.

Both Dr. Baur and O. P. Hay inform me that in southwestern Arkansas and central and eastern Indian Territory specimens are often found which are greenish yellow and without spots, but marked individuals are also present in the same region. Specimens from Louisiana are rather small, having a dwarfed appearance, and are somewhat peculiar in their markings. Their osteological characters, also, are somewhat variable. However, typical specimens of the species are found in this region.

Terrapene ornata is found from the Rocky Mountains east to Lake Michigan and Indiana, south to the Ozark Mountains, and east to western Indian Territory and central Texas, and from the Rio Grande River north to the Yellowstone River. This species may be said to belong to the plains and the table-lands. In Kansas, where it becomes extremely numerous, Prof. Cragin speaks of it as so abundant as to become a nuisance as a cumberer of the ground. It seems to subsist and thrive in our most arid climates, being found in the sand hills of Nebraska and the barren regions of New Mexico and Texas. In its geographical distribution it seems to be governed more by soil, rainfall, and vegetation than latitude. Throughout all its range it is characterized by the entire absence of the quadrato-jugal, the possession of only two phalanges in each digit in the forefoot, its broadly oval carapace, with a median ridge but without keel, a plastron widest across the abdominal

plates, and the variegated markings of the carapace. Texas specimens are somewhat stouter and more compact, and often individuals possessing no color markings are found, but, notwithstanding these exceptions, the species is remarkably constant throughout its range. It occupies a larger territory than all other species combined.

In the taxonomy of *Terrapene*, as first noted by Dr. Baur, the modification of the zygomatic arch occupies an important position. The quadrato-jugal is well developed in primitive forms of the genus, rudimentary in intermediate forms, and absent in *T. ornata*, the most specialized species.

The skull of a species belonging to a closely related genus, *Cyclemmys amboinensis*, is represented in fig. 1. In this species the elongated quadrato-jugal (*b*) lies along the anterior border of the quadrate completely separating the latter, as well as the squamosal, from the jugal (*c*) and postfrontal (*a*). The postfrontal is much elongated and widened, and with the jugal and quadrato-jugal forms a complete zygomatic arch.

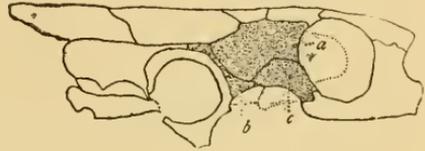


Fig. 1.

SKULL OF CYCLEMMYS AMBOINENSIS.

a.—Postfrontal. b.—Quadrato-jugal. c.—Jugal.

Fig. 2 shows the zygomatic arch of *T. major*. The postfrontal has retreated and in this species forms a narrow club-shaped bone just posterior to the orbit and takes no part in the formation of the zygomatic arch. However, a complete arch is present, composed of the somewhat quadrangular quadrato-jugal and the jugal.

Fig. 3 illustrates the structure of the zygomatic arch of *T. bauri*, a form, in this respect, closely related to *T. major*. It will be noticed that this arch is more slender than in *T. major*.

In *T. carolina* (fig. 4) the quadrato-jugal is rudimentary and is not connected with the jugal, and hence the bony zygomatic arch is incomplete.

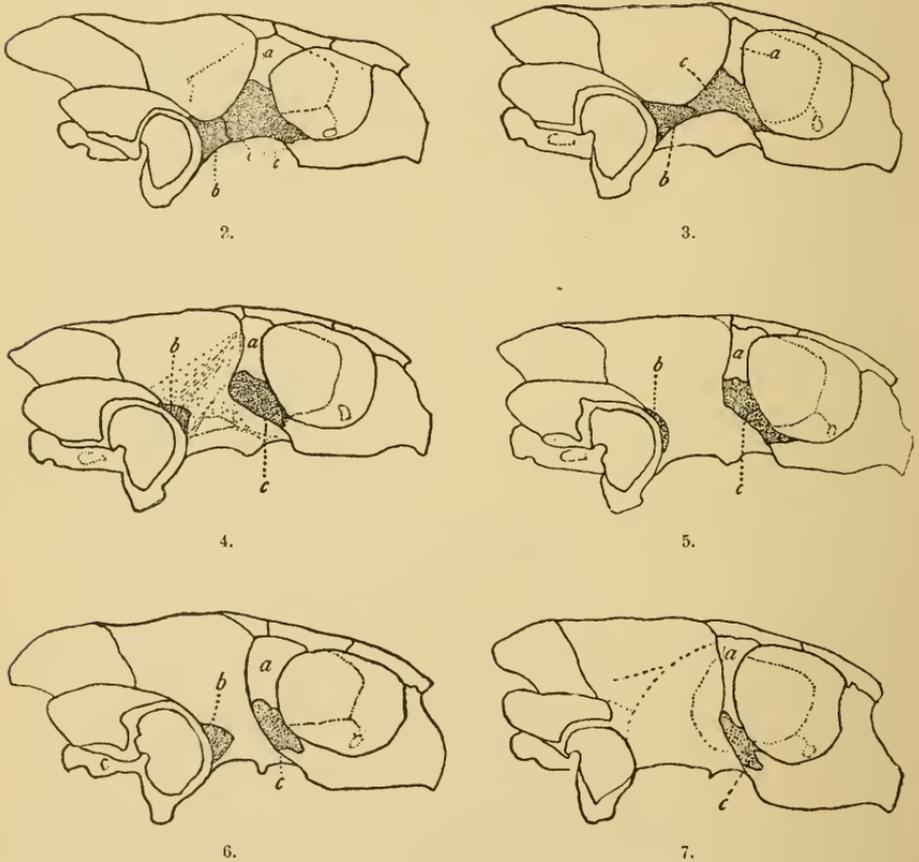
In *T. mexicana* (fig. 5) the zygomatic arch is incomplete, and the quadrato-jugal has been reduced to a very small remnant. The same thing may be said of *T. triunguis* (fig. 6), except that in this species the quadrato-jugal is more nearly triangular. In *T. ornata* (fig. 7) the zygomatic arch has completely disappeared.

In this connection the modification of the phalanges seems worthy of our attention. In all species there are five digits in each foot, and on the fore foot of each there are five well-developed claws. However, in the fore foot the number of phalanges varies, the number being in *T. major*, *T. bauri*, and usually *T. carolina*, 2-3-3-3-2; in *T. mexicana*, *T. triunguis*, and sometimes *T. carolina*, 2-3-3-2-2, and in *T. ornata*, 2-2-2-2-2.

The hind foot of *T. major*, *T. carolina*, and *T. ornata* possesses four claws, while in the remaining species but three claws are present. With

reference to the number of phalanges in each hind foot the species are as follows: *T. major* and *T. carolina*, 2-3-3-3-2, the same number as in the fore foot; *T. ornata* and *T. mexicana*, 2-3-3-3-1; *T. bauri* and *T. triunguis*, 2-3-3-2-1.

The loss of the phalanges on the hind foot might be accounted for by supposing that the distal phalange does not develop. But in the case of the fore foot, where the full number of claws are still present, the distal phalange evidently does not disappear. Hence the reduction



Figs. 2-7.

SKULLS OF TERRAPENE.

Showing modification of the zygomatic arch in different species.

a, Postfrontal. b, Quadrato-jugal. c, Jugal.

(For explanation of figures see page 585.)

must take place either by the coossification of two phalanges, or a phalange and a metacarpal, or by the disappearance of a phalange.

Zehntner, 1890, after studying the development of the Alpine Swift, *Cypselus melba*, concludes that the reduction in the number of phalanges takes place in this species by coossification. He states that in the fourth digit the first phalange probably unites with the fourth metatarsal, while the third and fourth phalanges unite with each other.

Also the second and third phalanges of the third digit unite. Hence in the *Cypselus*, notwithstanding that in the early stages of growth the normal number of phalanges for birds, 2-3-4-5, is developed, in this genus the number of phalanges in adults is 2-3-3-3.

Pfitzner, 1890, discusses the reduction of the number of phalanges in the little toe of man. In embryos and young children he found the normal number of phalanges 3, but in the case of older children the middle and the end phalanges usually unite, though in some instances the middle phalange disappeared.

In *Terrapene* I have not been able to determine the method of the reduction in the number of phalanges since embryological material of *T. ornata* has not been obtained. I hope to be able to investigate this question further at a later date. But, in the examination of younger specimens, I find no evidences of coossification such as would probably be indicated by the disproportionate length of a phalange formed by the union of two phalanges.

The distribution of the species of *Terrapene* presents several interesting problems. It seems probable that all of our species are derived from one form. The closeness of the relations of the species would seem to indicate that our forms are varieties rather than species. However, at least two difficulties are in the way of this conclusion. First, there can be no question but that if we take two extremes of development of the species of the genus, for instance, *T. major* and *T. ornata* or *T. carolina* and *T. ornata*, we must recognize them as separate species. But since other intermediate forms seemingly connect these species, if the closeness of relations be considered as indicating varietal characteristics only, we are forced to consider all species as varieties, a conclusion that would seem to be erroneous. Second, while the relations indicated by a study of the different species seems close, yet the distinctions seem definite and fixed, even where the ranges of the species overlap. The study of a number of specimens seems to indicate that the different species are derived from one form, and that afterwards, by isolation, caused possibly by geological and climatic agencies, they became distinct. When we remember the comparatively fixed abode of these animals it seems reasonable to suppose that these changes might have been brought about by relatively simple agencies which need not necessarily have acted simultaneously. Hence, it would seem proper to classify each form as a distinct species, each possessing certain fixed osteological characters. If these conclusions be true then it would seem most reasonable to suppose that *T. ornata* has become more distinct from the other species by its comparatively longer isolation, aided by the generally arid climate of its habitat.

It will at once be noticed that of the species found within the United States each occurs in a district which, in certain geographical features, is peculiar to itself. *T. ornata* occupies a district peculiar in its arid climate and, for the most part, sandy soil. *T. triunguis* is found in the

low swampy regions of the Mississippi and its tributaries, the climatic conditions here being the reverse of the district occupied by *T. ornata*. *T. carolina* occurs in both the mountains and plains, yet its climatic surroundings are somewhat uniform and peculiar to its region. *T. bauri* inhabits the peninsula of Florida, while *T. major* is found adjacent to the gulf coast, the two species occupying districts each peculiar in itself.

Another peculiar fact in the distribution of *Terrapene* is that, so far not a single species has been reported west of the Rocky Mountains, notwithstanding its great abundance on the table-lands east of these mountains.

For an explanation of the cause of this fact we can only surmise. It is well known that in the Alleghany Mountains *T. carolina* ascends to a height of several thousand feet, as high, probably, as any other species of our chelonians. Prof. Cockerell and Mr. Ray R. Larkin have sent us specimens of *T. ornata*, collected at Las Cruces, N. Mexico, between five and six thousand feet above the sea level. Possibly the true explanation of the fact that *Terrapene* has not been found west of the Rockies may be accounted for by the great elevation and consequent climate of the mountains. If this explanation be the true one, then it is only a question of time when the *Terrapene* will find its way over the Rocky Mountain range.

The information extant and the material at our command, we regret to say, does not permit us to accurately outline the limits of the species either south or north of the United States boundary lines. It seems probable that at least one or more of our species may extend into Mexico, though no such record exists. Neither do we have any authentic record of the existence of the *Terrapene* in British America, though it is possible, if not probable that specimens will ultimately be found there. However, if we judge from the comparatively small number of specimens found on the northern borders of the United States, the species can not be abundant north of the boundary line.

UNIVERSITY OF CHICAGO,

Chicago, Illinois, June 1, 1894.