6. Notes on the Families and Genera of Tortoises (*Testudinata*), and on the Characters afforded by the study of their Skulls. By Dr. JOHN EDWARD GRAY, F.R.S., V.P.Z.S., F.L.S.

(Plate XV.)

Papers on the skulls of *Chelydidæ* and on the skulls of the Asiatic and African species of *Trionychidæ* were read at meetings of this Society in 1867, and I was enabled to found on the study of their skulls what appeared to me to be more natural arrangements of the species into genera and larger groups. I wished to follow the same plan with regard to the other families of *Testudinata*, but I was stopped by want of material.

The British Museum has since then received some additional skulls and skeletons; and I hope that, with these and with the examination of the heads and mouths of the specimens in spirits and stuffed, I have been able to place the characters of the genera and to group the genera into sections on a firmer basis than that hitherto used, and thus to add to our knowledge of these neglected animals.

Anatomists have been content to study the osteology of the three or four larger groups of the Tortoises, and have paid very little attention to the skulls, much less to the skeletons, of the genera or other smaller groups; and very few skeletons or skulls have been figured.

To give some idea of the little attention hitherto paid to the subject and of the difficulty that existed of examining the skeletons and skulls of them, the Museum of the College of Surgeons, when Professor Owen printed his Catalogue of the osteological series in that collection, only contained the skulls or skeletons of five species of *Testudinidæ*, of one of the *Cistudinidæ*, of two *Emydidæ*, and of one of the *Chelydradæ*. I am glad to say that the collection has been lately increased by the addition of several other skeletons and skulls.

To remedy this evil, I have exerted myself to bring together the skeletons and skulls of as many specimens of Tortoises as I could procure for the British Museum collection; and there are now in that collection 78 complete skeletons, and 59 skulls, besides bones of parts of the body, belonging to 67 species, as follows:—

	Species.	Skeletons.	Skulls.
Testudinidæ	13	22	10
Cistudinidæ	3	5	—
Emydidæ	22	24	5
Chelydradæ	6	8	—
Chelydidæ	7	6	6
Trionychidæ	12	6	17
Cheloniadæ	3	6	15
Spargidæ	1	1	6

In my paper on the skulls of *Chelydidæ* (P. Z. S. 1864, p. 128) I divided them into two groups—one having the temporal muscles

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almost entirely covered with a bony case formed of the dilated zygomatic arch, as in the Sea-Turtles (*Cheloniadæ*), and the other with those muscles only covered with skin, and protected externally by a broad band-like zygomatic arch, as in the Tortoises (*Testudinidæ* and *Trionychidæ*); and I observed that the same difference in the form of the skull was to be observed in the genera of the *Emydidæ*; but some genera, as *Geoemyda* and *Cistudo*, like several genera of *Chelydidæ*, are even without any zygomatic arch, the temporal muscles being only covered with skin between the orbit and the tympanic bone as on the temple and crown.

The families may be divided, according to the state of the temple, thus:—

	Temple bony.	Temple fleshy.
I. Feet clavate. Terrestrial	.....	*Testudinidæ*.
II. Feet palmate. Fluviatile.		
A. Thorax covered with bony plates.		
a. Pelvis free below; sternal shields 8 or 12	*Platysternidæ*.	*Cistudinidæ*. *Emydidæ*. *Chelydradæ*.
b. Pelvis attached to the sternum; sternal shields 13	*Podocephalidæ*.	*Chelydidæ*.
B. Thorax covered with skin	.....	*Trionychidæ*.
III. Feet fin-shaped	*Cheloniadæ*. *Spargidiidæ*.	

The horny beak of these animals not only forms a cutting instrument for the separation of the food from the mass, but it also covers the chewing surface on the sides of the jaws, there being a more or less extended plate on the inside of the jaws for this purpose. In some the surface of the bone and the horny covering is smooth, as in *Malaclemys* and *Chelydra*. In general there are one or more ridges on the upper jaw fitting into grooves in the lower jaw. In the Tortoises and some of the more terrestrial *Emydidæ*, the ridge and groove are simple; in the more aquatic Terrapins (as *Pseudemys* and *Batagur*) they are more numerous and wider. Unfortunately, the form of the masticating surface is not to be usually seen in stuffed specimens; so that it is only known in a limited number of species. It must have great influence, or, rather, it shows that there is great variation in the habits of the animals, and ought to be studied for the natural arrangement of the groups. Indeed I can only regard the notes I am now making as the breaking of the sod, and consider that much has to be done before one can arrive at a satisfactory history of the habits and structure of these creatures, and form an arrangement of them consistent with their habits and manners and peculiarities.

I. LAND-TORTOISES—TESTUDINIDÆ.

Skull solid. Orbit complete, lateral, large, hinder edge moderate. Zygomatic arch strong, well developed, united to the ear-bone behind, with a large cavity for the temporal muscle above. Temporal muscles covered with skin or horny plates.

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They may be divided into sections thus :—

Section I. Sternal shields 12, regularly arranged in pairs on each side of the central line. Pectoral plates large, like the others.

A. The inguinal plates moderate; the nostrils in a square fleshy nose, between the upper edge of the beak and the frontal plates; thorax solid. TESTUDININA.

1. TESTUDO. Gular plates separate. Claws 4 . 5. Alveolar plate with two ridges.

2. PELTASTES. Gular plates separate. Claws 4 . 5. Alveolar plate with an indistinct ridge.

3. HOMOPUS. Gular plates separate. Claws 4 . 4.

4. PYXIS. Gular plates separate. The front lobe of the sternum mobile.

5. CHERSINA. Gular plates united and produced.

B. The inguinal plates very large; the nostrils in a notch on each side of the upper edge of the beak; thorax, hinder part mobile. KINIXYINA.

6. KINIXYS.

Section II. Sternal shields 10, arranged in five pairs. The two pectoral shields small, short, triangular, far apart, on the sides at the hinder edge of the axillæ. MANOURINA.

7. MANOURIA. This genus, before the animal was known, was erroneously arranged in *Emydidæ*.

1. TESTUDO.

The skull has a well-developed zygomatic arch. The palate is deeply concave, especially in front; and there are three more or less distant, narrow, elevated, parallel longitudinal ribs on it behind the internal nostrils, which are placed in front of the palate. The alveolar margin of the upper jaw broad, with two ridges parallel to and as long as the outer margin of the beak. The central ridge is divided into conical teeth; the inner marginal ridge higher and with a more even edge. The nostrils are placed in a more or less square fleshy muffle, which is situated on the upper edge of the horny beak.

The genus may be divided into two sections by the form of the alveolar surface of the lower jaw :—

a. Lower jaw narrow, with a deep groove extending the whole length of the edge; front of upper jaw with a central notch and two slight prominences. TESTUDO.
Testudo indica, T. planiceps, T. tabulata, T. radiata.

b. Lower jaw narrow in front, with a short deep groove as long as the hinder half of the outer margin. SCAPIA.
T. (*Scapia*) *falconeri.*

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The hinder part of the skull over and near the ethmoid bones varies considerably, and affords very good characters for the distinction of the species.

1. TESTUDO INDICA, Gray.

Testudo indica, (skull figured) Cuvier Oss. Foss. v. t. f. ; copied, Wagler, N. Syst. Amph. t. 6. f. 51, 52, 53 ; Gray, Cat. Shield Reptiles in B. M. t. 35. fig. 1.

T. elephantopus, Owen, Cat. Osteol. Mus. Col. Surg. p. 194. no. 1011 (skeleton), 1058 (skull).

Skull—length $5\frac{3}{4}$ inches, width at zygomatic condyles $4\frac{1}{2}$; the alveolar plate in the upper jaw broad, with a central and marginal ridge, and a groove in the lower jaw, the whole length of the margin.

There is a skeleton of a small adult specimen of this species in the British Museum.

2. TESTUDO PLANICEPS.

T. planiceps, (skull figured) Gray, Cat. Shield Reptiles in B. M. t. 34.

Skull—length $5\frac{1}{4}$ inches, width over zygomatic arches $4\frac{1}{4}$; the alveolar plate in the upper jaw narrower, with a central and marginal ridge, and a groove in the lower jaw, the whole length of the margin.

3. TESTUDO TABULATA.

T. tabulata, (skeleton) Wiedemann, Arch. Zool. ii. 181 ; Wagler, N. Syst. Amph. t. 6. f. 1–6 ; Owen, Cat. Osteol. Mus. Coll. Surg. p. 200. no. 1044 (skeleton with mutilated skull), 1046 (skull ?).

Var. *Testudo boiei*, Wagler, N. Syst. Amph. t. 6. f. 7–13.

Junior ? *T. denticulata*, Owen, Cat. Osteol. Mus. Coll. Surg. p. 201. no. 1045 (skull); not Green.

The upper jaw with a high triangular ridge, and the lower with a deep triangular groove with a very high inner edge, parallel to and nearly as long as the short-edged outer margin, only represented in the front of the upper jaw by the broad, deep, central, anterior pit. The upper jaw with a notch on each side of the centre, and the lower with a broad, compressed, conical projection. Palate very deep nearly the whole length, deeper on each side in front, with three laminar ridges, the middle one being the most distinct. The ethmoid bones smooth, without any distinctly raised ridge on each side.

There are a skeleton and two skulls appearing to belong to this species in the British Museum. Length of the skull of the skeleton, from nose to condyle, $2\frac{1}{3}$ inches ; width at zygomatic arches $1\frac{2}{3}$ inch. Length of largest separate skull 2 inches 5 lines, width $1\frac{3}{4}$ inch. There is also in the Museum the skeleton of a small but adult specimen of the variety, with very deeply sulcated shields. They differ from each other somewhat in the depth, and slightly in the form of the concavity in the palate, and in the strength of the margin on

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the side of the hinder part of the palate within the temporal muscles. They all three vary in the form of the ethmoid bone: in one it is nearly square, with evenly truncated front edge; in the other two it is more elongated, and the middle of the front edge is more or less projecting in front.

Of the skeleton of a young specimen in the British Museum the skull is well formed; it has the symphysis between the two bones very narrow; the beak has the three anterior notches, and the alveolar ridges or grooves, as in the adult.

A half-grown specimen from Xeberos, obtained from Mr. Higgins, in spirit, has the head black, the crown and cheeks yellow-varied, the two oblong longitudinal shields on the nose and the small shield edging the upper part of the orbit pure white; a small spot on each temple and a large shield between the orbit and the upper edge of the tympanic cavity yellow.

4. TESTUDO RADIATA.

Testudo radiata, Cuv. Oss. Foss. v. 193, t. 12, 13; Wagler, N. Syst. Amph. t. 10. f. 37, 40, t. 11 (skeleton).

The skull of the skeleton in the British Museum is solid, heavy, rather longer than wide in the widest part; crown rather convex; nose erect; sides of face concave; orbit large; zygomatic arch strong, broad, convex, about as wide as the small oblong tympanic cavity. Palate very deeply concave in front, gradually shelving off to the ethmoid, with three narrow laminar longitudinal ridges near together in the centre of the concavity. Ethmoid bone narrow, with a narrow, linear, rather arched ridge on each side. Lower jaw with a deep narrow groove parallel to and as long as the short outer margin, and with a prominence in front. The skull is 2 inches long from the nose to the condyle, and $1\frac{3}{4}$ inch wide over the zygomatic arches, which is the widest part. The mastoid bone, in the different species of Tortoises, differs greatly in shape; in this species it is short, with a shelving outer surface; it is always hollow, forming a tympanic cavity.

5. TESTUDO (SCAPIA) FALCONERI. B.M.

Skull solid, oblong; face broad, rounded in front. The groove on the palate very deep and wide. The upper jaw with three narrow ridges—one on each edge of the margin, and a short one intermediate between them; the outer margin high and without any teeth. Lower jaw with a sharp edge, a rather acute sharp edge in the front part, and with a sharp inner ridge rather more than half the length of the side, separated from the outer edge by a deep groove.

Hab. India?

Length of skull from nose to condyle $3\frac{1}{8}$ inches; width 2 inches 5 lines, of forehead between orbits $2\frac{1}{8}$ inches; length of outer edge of upper jaw 1 inch 8 lines.

The skull above described was received in Dr. Falconer's collection, which was presented to the British Museum by his brother on his

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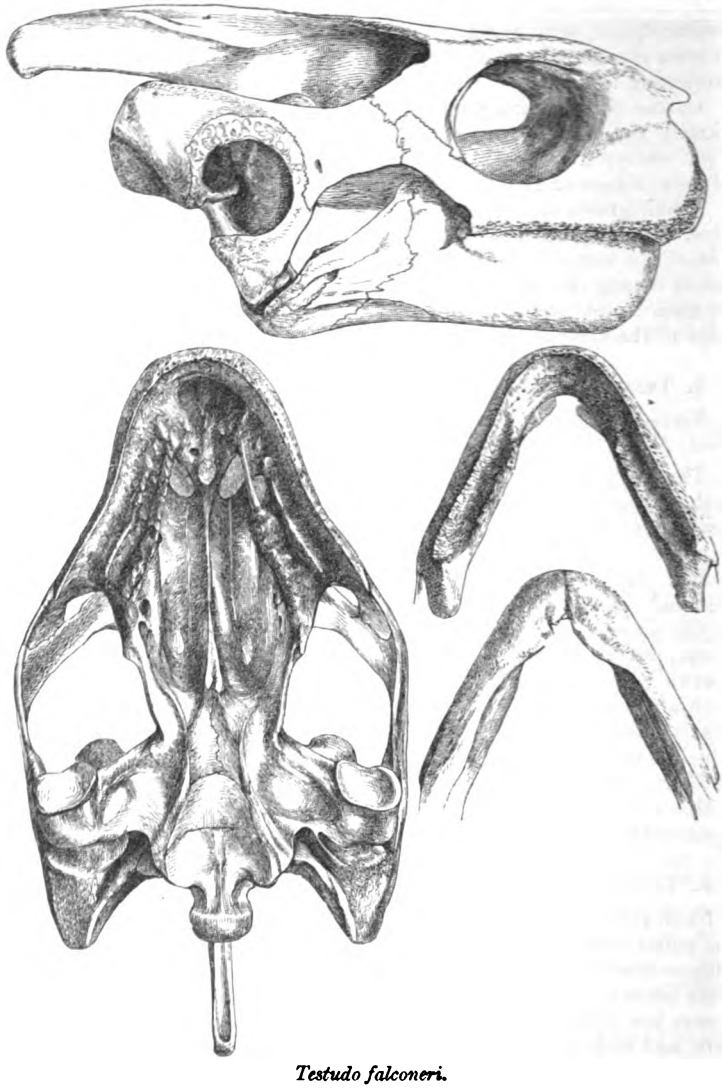
Fig. 1.



Testudo falconeri.

Note.—The figures are all of the natural size, except when otherwise stated.

death. It is most probably from India, and perhaps from the mountain-regions. It is evidently the skull of a very large species of the genus and very distinct from *Testudo indica*, the skull of which was figured in the 'Catalogue of Shield Reptiles in the British

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Museum,' t. 35. f. 1, and the larger *Testudo planiceps*, figured in the same work, t. 34, and only known from a skull in the Museum collection. From its size, it is most probably the skull of one of the Black Tortoises of Asia that have been called *Testudo indica*, which are found spread over all parts of the Asiatic region, also on the islands off the east coast of Africa, and in California and the Galapagos, and of which certain variations in form were regarded by the older writers as denoting distinct species. Modern writers on the subject have united these into a single species under the name of *Testudo indica*.

Testudo falconeri and *T. planiceps* having been described from skulls in museums, without any knowledge of the thoraces of the animals to which they belonged, I am not able to say if they are identical with any of the Tortoises which have been described from thoraces only, under the names of *Testudo elephantopus*, *T. nigra*, *T. dussumieri*, *T. gigantea*, *T. vosmaeri*, *T. nigrita*, *T. daudini*, *T. elephantina*, *T. perraultii*, and *T. peltastes*. This is one of those instances which ought to teach naturalists caution in determining species without the examination of all the parts of the animal, the skull as well as the thorax.

The Tortoises that have been called *T. indica* are found in India, Africa, and America, or rather on the islands of these two latter continents; and it has been supposed that they have been introduced to these places by ships, as they are sometimes collected and used as food aboard ship. Some say they were introduced into India, and the original habitat of the species is unknown. Perhaps the discovery that there are several species confounded under the name of *T. indica* may solve this problem.

There is a large species of Tortoise from India named *Manouria fusca*, the skull of which has somewhat the general form of that of *Testudo falconeri*; but the latter differs in having a broad, well-developed zygomatic arch, the arch in *Manouria fusca* being slender and weak.

2. Peltastes.

The alveolar margin of the upper jaw rather broad in the hinder part, interrupted in front by a broad concavity over the anterior internal nostril; the broad hinder part with a slightly raised ridge and a similar raised inner edge nearly parallel to the margin of the jaw; the front of the jaws has two slight prominences, separated by a slight notch. Lower jaw slender, with a short edge in front, and with a rather deep rounded groove with a very thin inner edge occupying the inner surface of the hinder half of the margin.

1. Peltastes elongatus.

Testudo elongata, Gray, P. Z. S. 1861, p. 139.

Hab. India.

There are two skulls of this kind in the British Museum, the smaller sent by Professor Oldham with the thorax, which proves it to be the skull of *T. elongata*; the larger one was presented by the

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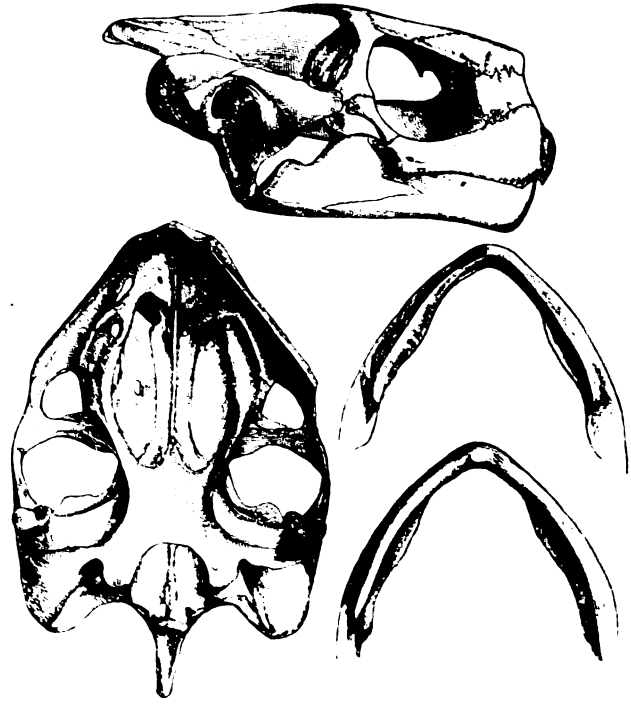
brother of Dr. Falconer on the death of the Doctor. The larger skull (from Dr. Falconer) is $2\frac{1}{8}$ inches long, $1\frac{1}{8}$ inch wide; the other (from Professor Oldham) is 1 inch 11 lines long, and $1\frac{1}{2}$ inch wide.

Fig. 2.



Peltastes elongatus.

The thorax has all the characters of *Testudo*. Claws 5.4. The nostrils in a fleshy disk, with a slight notch in the upper edge of the beak, directly under and partly enclosing them. Palate deeply concave nearly the whole length, with three laminar longitudinal ridges in the centre of it. Ethmoid bone flat, with a more or less distinct raised marginal edge.

Young specimen in spirit, from Pegu, obtained from Mr. Theobald:—Thorax oblong, hemispherical, rather convex, dull brown; centre of dorsal shield blackish; sternum yellow, black in the centre; nuchal shield short, square; the four lateral hinder marginal shields produced into an acute point behind; the caudal shield broad, with a straight denticulated hinder edge, with a longer acute point at each end; legs and feet very dark olive.

Hab. Pegu (*Theobald*).

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2. PELTASTES? SULCATUS.

Testudo sulcata, Miller, Gray, Cat. Shield Rept. B. M. p. 9.
Hab. Africa.

Skeleton in the British Museum. Skull imperfect, the nose and lower jaw having been crushed; but from what remains I suspect that it belongs to the genus *Peltastes*.

The skull is high and short, rather like the skull of *Testudo indica*. The central ridge on the palate is very high and laminar, much higher than the ridge on each side of it. Zygomatic arch broad and short and convex. Tympanic cavity imperfect behind; the mastoid bone is large and entirely hollow, forming a tympanic cavity. Length of skull from nose to condyle $2\frac{3}{4}$ inches, width at zygomatic arches 2 inches.

3. PELTASTES GRÆCUS.

Skeleton in the British Museum. Skull thin; the upper alveolar edge with a regular groove parallel to the margin, with a sharp ridge on the inner margin; the lower jaw with a regular triangular groove parallel to the whole of the lateral margin.

There is a very pretty specimen (young) of *P. græcus*, in spirit, in the British Museum, from the valley of the Minder, Asia Minor, presented by Mr. R. MacAndrew.

There are two skulls in the British Museum received from Mr. Yarrell as the skulls of *Testudo græca*. They are evidently of a very distinct species; they both belong to the genus *Peltastes*.

4. PELTASTES GEOGRAPHICUS?

Skull of a smaller species in the Museum of the College of Surgeons, without any number. From the size, probably the skull of *Testudo geographica*.

Skull short, broad, crown flat, broad, truncated in front; nose-hole very large, square; orbit large, lateral; zygomatic arch slender, rather convex; tympanic cavity oblong, erect; mastoid bone half-oval, hollow, labial edge even, with three slight teeth in front; the palate very concave; the alveolar surface very narrow in front, wider behind, with a very slight submarginal ridge on the hinder part of it. Lower jaw weaker; alveolar edge narrow, with a swollen dentary groove behind, about two-thirds of the length of the outer side of the bone, and with a very slightly raised point in front.

5. PELTASTES? MARGINATUS.

Skull figured as the *Caret*, Spix, Cephal. t. 4. f. 12–15.

4. PYXIS.

PYXIS ARACHNOIDEA, var. *oblonga*.

Skeleton in the British Museum, received from Leyden. It is exactly like the oblong specimens figured by Duméril and Bibron, Erp. Gén. t. 13. f. 2.

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Skull small, thin; crown convex, arched; nose-hole very large, with a deep oblong notch in the upper edge; orbit very large; side of face shelving; the hinder edge of the orbit very thin; zygomatic arch very slender, short; tympanic cavity small, oblong, erect. Lower jaw slender. Beak of upper jaw with a smooth edge, and entire in front. The alveolar edges narrow, parallel, linear, simple; internal nostril like exterior. The thorax is very like that of some of the varieties of *Testudo stellata*, which is a very variable species both in size and surfaces; so that one might almost regard it as only a variety of it. The sternum is divided by a straight suture between the second and third pairs of plates; the second pair large, with a straight posterior edge. The abdominal or the fourth pair of plates very large; the first or gular plate small, narrower than the small anal ones.

5. CHERSINA.

CHERSINA ANGULATA.

Testudo angulata, Owen, Cat. Osteol. M. C. S. p. 201. n. 1050 (skeleton), 1051 (skeleton of trunk and extremities).

Skeleton in the British Museum.

Back edge of the orbit thin; zygomatic arch short, rather slender from the middle part of the back edge of the orbit; tympanic cavity small; nose-hole large, square; nostril in a small granular disk; orbit large, lateral; upper beak with three anterior teeth, with a deep notch in the upper edge for the nose-disk. Lower jaw weak, the beak with a short central hook. The alveolar surface of the upper jaw linear, rather wider behind, with a very short central ridge. Lower jaw sharp-edged in front, rather wider on the hinder half of the margin, with a middle groove for the ridge on the upper jaw.

6. KINIXYS.

KINIXYS BELLIANA.

Sheath of the upper jaw very high, with the nostril in a notch in its upper edge, between it and the front edge of the frontal shields; of lower jaw high, convex in front. Zygomatic arch (as seen through the skin in the stuffed specimen) convex, narrow from the back of the orbit to the upper front part of the oblong tympanic cavity.

7. MANOURIA.

MANOURIA FUSCA.

The stuffed specimen shows that the skull is oblong, forehead flat, face short; orbit large, lateral, rounded; zygomatic arch weak and thin, compared with the same bone in *Testudo*; the tympanic bone surrounding the ear is deep-seated; the mastoid is not prominent as is usually the case in Land-Tortoises.

II. The TERRAPINS or FRESHWATER TORTOISES.

After a patient examination of the skulls and skeletons and a revision of the specimens of the Freshwater Tortoises, or Terrapins,

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in the British Museum, which have hitherto been referred to the family *Emydidæ* as defined in the 'Catalogue of Shield Reptiles in the British Museum,' published in 1855, I think they may be more conveniently divided into four very natural groups, which may be called families. These groups may be thus characterized:—

I. *The temporal muscle covered with skin, and generally protected by a narrow band-like zygomatic arch.*

1. CISTUDINIDÆ. The sternum united to the thorax by a cartilaginous lateral suture, and divided transversely into two moveable portions.

2. CHELYDRADÆ. The sternum united to the thorax by a bony symphysis, covered with from 7 to 11 shields; the middle portion fixed to the thorax; the front and hinder portions often separated from it by a transverse suture and moveable.

3. EMYDIDÆ. The sternum united to the thorax by a bony symphysis, solid, and covered with 12 shields.

II. *The temporal muscle covered with a bony hood formed by the extension of the zygomatic arch. Head very large. Sternal shields* 11.

4. PLATYSTERNIDÆ. Asiatic.

Fam. I. CISTUDINIDÆ or BOX-TORTOISES.

Head moderate, covered with a hard thin skin. Eyes lateral or subsuperior; pupil annular. Temporal muscle covered with the skin and (except in *Cistudo*) protected by a band-like zygomatic arch. Thorax covered with horny plates. Sternum very broad, attached to the thorax by a *ligamentous suture*, covered at the sides by the pectoral and abdominal shields, and divided across into two parts by a suture between the pectoral and abdominal plates. Sternal shields 12; the axillary and inguinal plates very small or wanting. The mastoid bone is excavated to form a tympanic cell.

I have little to add to my monograph of the species of the family printed in the 'Proceedings' of the Society for 1863, p. 173, except that the temporal muscle of the North-American genus *Cistudo* is only covered with skin, and the skull is destitute of any zygomatic arch between the orbit and the tympanic bone. In this respect, as well as in the position of the suture between the sternum and the thorax, this genus differs from the *Lutremys* of Europe and the genera found in Asia, all of which have a well-developed zygomatic arch for the protection of the temporal muscle.

The skull of *Lutremys* of Europe is figured by Cuvier, Bojanus, and Wagler. I am not aware that the skull of the very common *Cistudo clausa* has been figured or described. I have not seen any specimen of the Californian *Cistudo blondinsia*; but, judging from the figure of the animal in Holbrook's 'North-American Herpeto-

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logy,' p. 39, t. 3, it appears to agree with the other American species. If it does, this is another reason why it should not be referred to the genus *Lutremys*, in which Agassiz has placed it in his 'Contributions.'

Tribe I. Cistudinina or North-American Box-Tortoises.

The temporal muscle only covered with skin. The skull without any zygomatic arch between the orbit and the ear-bones. Lobes of the sternum moveable at all ages, unequal; front shorter, almost free from the symphysis; the hind fixed, narrow, elongate.

1. Cistudo.

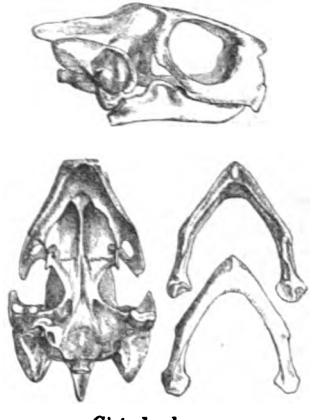
Cistudo clausa.

Skeleton in the British Museum.

Cistudo clausa, Owen, Cat. Mus. R. C. S. p. 192. n. 998 (skeleton), 1009 (skull of young).

Professor Owen describes a peculiarity in the neural arch of the atlas and the other vertebræ, and in the bones of the feet; but he does not notice the absence of the zygomatic arch in the skull.

Fig. 3.



Cistudo clausa.

Skull in College-of-Surgeons Museum, No. 999:—Nose-hole square, moderate; orbit excessively large; tympanic cavity oblong, erect; upper jaw with a straight lateral edge and a broad central part; palate flat, internal nasal apertures anterior, with a broad triangular concavity behind them with a central ridge; alveolar plate smooth, narrow in front, rather wider behind; alveolar surface of the lower jaw rather wide, concave.

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Tribe II. Lutremyina or Old-World Cistudinidæ.

The temporal muscle protected by a well-developed band-like zygomatic arch. Sternal lobes more or less moveable, subequal; both lobes forming part of the lateral symphysis.

* *Lobes of the sternum moveable at all ages.*

2. Pyxidea, Gray, P. Z. S. 1863, p. 175.

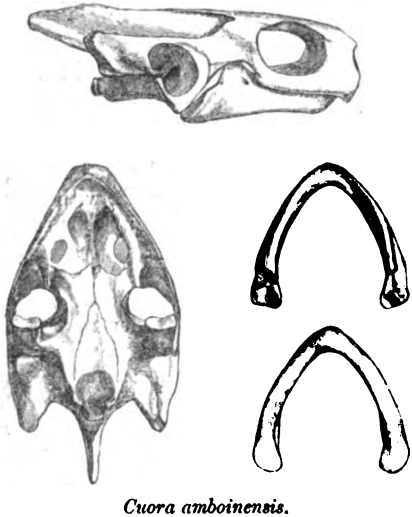
Pyxidia mouhotii.

The skull (as seen through the skin in the preserved specimen) is trigonal, flat on the sides; the crown flat, triangular, short, scarcely produced behind the hinder edge of the orbit; truncate behind, rather more produced in the centre; zygomatic arch flat, weak, narrowed in the centre, much narrower than the orbit in front, and gradually dilating so as to be almost half as broad as the front edge of the tympanic cavity behind; orbit rather large, lateral; beak of the upper jaw entire, with a strong central hook.

3. Cistoclemmys, Gray, P. Z. S. 1863, p. 175.

4. Cuora, Gray, P. Z. S. 1855, p. 198; 1863, p. 176.

Fig. 4.



Cuora amboinensis.

Cuora amboinensis.

Skeleton in the British Museum.

Skull rather elongate, rhombic, ovate; crown flat; nose erect; nose-cavity square, moderate; orbit large, oblong, transverse, lateral;

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zygomatic arch complete, broad in front, narrowed behind and attached to the upper front part of the tympanic cavity; mastoid bone acute behind, keeled on the outer upper side, hollow; palate flat; internal nostrils anterior, with a short, oblong, slightly sunken concavity behind, each separated from the other by a blunt ridge; alveolar plate very narrow, linear, with a slight ridge on the inner margin; upper beak with a smooth edge and an entire, recurved, sharp tip. Lower jaw moderately strong, rounded below in front; lower beak with a simple sharp edge, rather produced and acute in front, with a slightly concave linear inner margin.

5. Pyxiclemmys, Gray, P. Z. S. 1863.

6. Lutremys, Gray, P. Z. S. 1855 & 1863.

The anatomy of the animal is well described by Bojanus. The skull is figured by Cuvier (Oss. Foss. v. t. 11. f. 13–16) and Wagler (in N. Syst. Amph. t. 5. f. xv.–xviii.). There is a skeleton in the British Museum; it has a well-developed zygomatic arch.

7. Notochelys, Gray, P. Z. S. 1863.

** *Lobes of the sternum moveable in the young state, often becoming anchylosed.*

8. Cyclemys, Gray, P. Z. S. 1855, p. 198, 1863, p. 177.

The thorax convex or depressed. The sternum flat or slightly convex, with the lateral symphyses well marked, truncated before and notched behind; the cross suture indistinctly marked and narrow, more or less obliterated in the adult, covered with the produced front edge of the ventral shields. The legs covered with large, band-like thin plates in front. The toes banded above, the front one short, webbed. The hind feet flattened, with the toes broadly webbed; the hinder edge keeled and angularly produced.

Cyclemys orbiculata.

Skeleton in the British Museum, from Java.

Skull elongate; zygomatic arch rather narrow, distinct. The alveolar surface of the upper jaw is narrow, with a well-marked longitudinal groove the whole length of the outer edge, and with a raised internal margin. Edge of the upper jaw rather arched on the side, with a small central tooth. The lower jaw with a simple, short edge shelving inwards in the centre, and with a rather concave surface on the inner side, and a sharp, produced central anterior process.

Fam. II. Chelydradæ.

Head large, covered with a thin, hard skin, or hard bony plates; temporal muscle large, covered with the skin, and protected on the edge by a well-developed band-like zygomatic arch. Eyes lateral or

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superior, often rather close together. Thorax covered with horny plates. Sternum attached to the thorax by a bony symphysis, generally small (compared with the size of the thorax) and cross-like, sometimes large (nearly as big as the thorax); sternal shields variable in number from 7 to 11, never 12. Toes short, spreading, webbed to the claws, shielded above.

Skull with a well-developed zygomatic arch, extending from the orbit to the tympanic cavity, leaving a large wide space for the temporal muscles. Palate flat; internal nostrils anterior. Alveolar plate narrow, simple. Iris annular, without any spot on the sides.

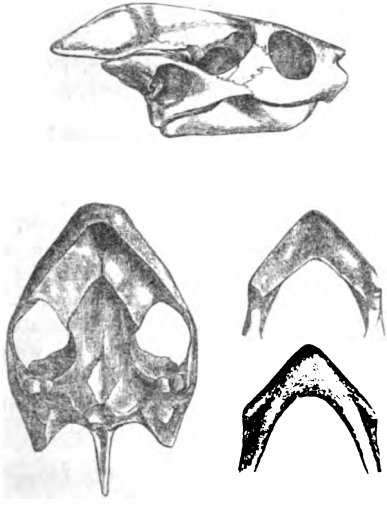
Section I. CRUCISTERNA. The sternum small, cross-like, narrow at the ends. Head and tail large.

Tribe I. CHELYDRAINA. Sternum solid, cross-like, acute before; sternal plates 10, with a broad one (the displaced abdominal plate) on each side over the produced sides of the sternum. Palate flat; internal nostrils anterior. Alveolar plate flat, rather broad.

1. MACROCHELYS, Gray, P. Z. S. 1855, p. 200 = *Gypsochelys*, Agassiz; (skull figured) Gray, Catalogue of Shield Reptiles, t. 38, 39, 40. The alveolar plate very broad. Eyes lateral, distant.

2. CHELYDRA, (skull figured) Gray, Cat. Shield Reptiles, t. 38 & 40. f. 2. Alveolar plate moderate. Eyes superior, rather close together.

Fig. 5.



Staurotypus salvinii.

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Tribe II. STAUROTYPINA. Sternum cross-like, middle portion narrow, covered by the abdominal plates, and extended to the thorax; the front and hinder lobes often moveable on the central fixed one. Axillary and inguinal plates large; sternal plates 7; the gular, humeral, and pectoral plates of each side united; the femoral and anal small, united into one large ventral shield.

3. STAUROTYPUS, Wagler; Gray, P. Z. S. 1864, p. 127.

STAUROTYPUS SALVINII. (Fig. 5, p. 179.)

4. STAUREMYS, Gray, P. Z. S. 1864, p. 127.

Tribe III. AROMOCHELYINA. Sternum truncated in front, nicked behind; sternal shields 11; gular pair united into a narrow linear shield. Head large; zygomatic arch very broad, strong, arched.

5. AROMOCHELYS, Gray, P. Z. S. 1855, p. 199, = *Goniochelys* and *Omotheca*, Agassiz, 1857.

Section II. KINOSTERNA or Double-flapped Box-Tortoises. Sternum broad; sternal shields 8 or 11; the short process that unites the sternum to the thorax covered with the elongated axillary and inguinal plates; front and hinder lobes of the sternum generally moveable on the fixed central portion. Internal nostrils anterior. Alveolar plate flat.

Tribe IV. KINOSTERNINA.

7. SWANKA, Gray, Cat. Shield Reptiles.

8. KINOSTERNON, Fitzinger; Gray, P. Z. S. 1855, p. 398, = *Thyrosternon* and *Platythyra*, Agassiz, 1857.

CHELYDRA SERPENTINA, Gray, Cat. Shield Reptiles, t. 40. f. 2. B.M.

Skull depressed, very broad behind, crown rhombic, sides of the face shelving outwards; orbit very large, anterior, subsuperior on the shelving side of the face; the cavity for the temporal muscle very wide; the zygomatic arch very broad, broader than the orbit and much broader than the oblong erect tympanic cavity. The palate flat, internal nostrils in the front of the palate, the outer edge sharp, with a central anterior bony hook, and with a broad, flat, smooth alveolar plate parallel to the outer edges. The lower jaw moderately strong, narrow in front, with a conical central bony process, and with a smooth, shelving, rather concave band inside the sharp margin.

A young specimen in spirits, which was brought from North America, and presented by Mr. Arthur Russell, F.Z.S., is very beautifully painted on the sternum and underside of the margin of the

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thorax. The sternum is black, with symmetrical variously shaped white spots, most abundant near the outer edge; the underside of the margin of the thorax is yellow, varied with dark edges to the shields. The animal is pale brown and more or less yellow-spotted. There is a series of triangular yellow spots on the lower edge of the lower beak.

AROMOCHELYS ODORATA.

An adult specimen, in spirits, in the British Museum, from North America, presented by Odo Russell, Esq.

Head large; nose produced, conical, acute, shelving to the mouth below; nostrils surrounded by a very small fleshy margin. Head dark olive, punctulated, with a narrow white streak from the upper and the lower edge of the nose, the upper streak edging the crown over the orbit to the nape; the lower diverging under the eye and tympanum and crossing the beak. The lower beak with a streak on each side of the centre in front, diverging to the chin on the lower edge of the horny sheath. Neck with streak of roundish confluent spots.

SWANKA.

The sternal lobes as broad, or nearly as broad, as the opening of the thorax, rounded in front, and rounded or very slightly truncated behind.

a. *The sterno-costal suture and the abdominal shields as long as the front sternal lobe; hinder lobe rounded at the ends. Thorax three-keeled. Vertebral plate elongate.*

1. SWANKA SCORPOIDES.

Kinosternon scorpoides, Gray, Cat. Shield Reptiles, p. 44.

Cinosternon scorpoides, Wagler, N. Syst. Amphib. t. 5. f. xxxi.–xxxvii. (skull); Owen, Cat. Osteol. Mus. C. S. p. 191. n. 992 (skeleton).

Skeleton in the College of Surgeons, No. 992. Skull thin, light; nose rather produced; crown rhombic, flat; sides of face flat; orbit moderate, lateral; zygomatic arch very broad, strong, nearly flat. Palate flat. The alveolar edge smooth, rather wider behind. Internal nostrils close, anterior between the fronts of the alveolar plates. Lower jaw rather strong, broad, and convex, in front more slender than the sides; the upper edge broad, rather concave, with an acute central process.

The two small specimens from M. Sallé both with rather rough and worn dorsal shields. One of them is keeled the whole length of the back, and the other only keeled over the hinder part of the back. They both have the front lobe of the sternum very nearly of the same length as the rather long abdominal shield. I cannot take on myself to say if they are of two species or only varieties of the same without having more information respecting them and the development of the animals.

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b. *The sterno-costal suture and the abdominal shields not so long as the front lobe of the sternum; hinder lobe rounded behind. Thorax not keeled. Vertebral plate longer than broad.*

2. SWANKA MACULATA.

The sides of the head, neck, and throat grey, with a few indistinct dark-edged subcylindrical spots, largest on the front of the chin; fore legs with three cartilaginous ridges. Thorax dark olive. Sternum-ridges and lower side of margin yellow, with dark spots on areoles of shields. The fore and hinder ends of sternum regularly rounded. Vertebral shields longer than broad.

Hab. Mexico (*Sallé*); Vera Paz (*Salvin*).

A specimen in spirit, collected by M. Sallé in Mexico. The sternum and underside of the margin pale yellow; the areola of the third and fourth pairs of sternal plates, which are situated on the outer side of the anterior transverse suture, is surrounded by an irregular-shaped brown ring. A more or less obscure indication of such a ring is to be seen surrounding the areola of the other sternal plates. The areola is on the outer hinder side of all the sternal shields, except of the fourth or abdominal pair, where it is on the front outer angle.

Two large specimens in spirit, from the Lower Forest of Vera Paz, received from Mr. O. Salvin. They are like those from Mexico, but darker below. The head is large, very hard, and the beak and temporal muscles very strong. The two beards are in front of the chin, quite near the hinder edge of the lower beak. The zygomatic arch is wide, strong, and rather convex. Toes very strong, short, with a few bands above near the ends, with narrow webs to the claws. The fore legs with the skin smooth, and three oblique, arched, sharp-edged horny cross ridges just above the feet, the lower one the shortest.

In the band over the orbit this species agrees with *Kinosternon hippocrepis*, figured from a young specimen, Gray, Cat. Shield Rept. t. 20 c. f. 3, 4; but the sternum is much broader than in that species, and more completely closes the cavity of the thorax. Thorax about 4 inches long.

A large well-grown specimen in spirit in the British Museum, received from M. Brandt of Hamburg as from North America. The skull is pale olive, speckled with darker brown; thorax pale bright brown, the underside of the margin of the thorax being uniform blackish brown.

Four specimens in spirit, obtained by M. Sallé at Papalco Apoia; but it is not stated that they were from the same district. If they were, it will go to prove that the height of the front lobe, as compared with the length of the abdominal shield, is probably a character of age and not of specific distinction. They each have a speckled or mottled neck, and are without any head-streak. The two larger specimens vary in other particulars, but probably from local circumstances, as one has a good smooth shield, and of the other the shield is rugose and covered with mud and algæ, and the whole specimen

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looks as if it had lived in dirty water. They both have the front lobe of the sternum about one-fourth of its length longer than the abdominal shields, which are short.

c. *The sterno-costal suture and the abdominal shields not so long as the front lobe of the sternum; the hinder lobe of the sternum slightly truncated behind. Thorax not keeled. Vertebral plates as broad as long.*

3. SWANKA FASCIATA.

Head olive, with a dark-edged pale streak from the nostril, over the eye, to the upper part of the tympanum (it is narrow before, and wider behind the eyes), and with a streak from the lower edge of the orbit, over the angle of the jaw on the side of the neck; occiput and back of neck white-spotted. The lobes of the sternum are rather narrower than the opening of the thorax.

Hab. ——? (from *M. Brandt*).

KINOSTERNON.

1. KINOSTERNON PENNSYLVANICUM.

The skull in the British Museum is depressed, ovate triangular, crown rhombic, narrow behind, short, only slightly produced behind the orbits; orbit lateral, large; zygomatic arch broad, rather convex and prominent behind, including the whole front edge of the small tympanic cavity; palate deeply concave in the centre, with three longitudinal ridges on each side of the central line, very narrow behind; upper jaw with a broad intermediate ledge edged with a slightly raised ridge; lower jaw with a shelving edge to the back, and hooked in front.

2. KINOSTERNON HIRTIPES, Wagler, N. Syst. Amph.

The skull is figured by Wagler in N. Syst. Amph. t. 5. f. xxxi.–xxxviii. The figure is very like the skull of *Chelydra*.

Fam. III. EMYDIDÆ or TRUE TERRAPINS.

When my two papers on the skulls of Chelydradæ and Trionychidæ were published, I hoped that some of the American zoologists, who have so many species of one group (Emydidæ) living in their country, and consequently at their command, would take up the subject. But they have not done so; and as the British Museum has received a few more specimens, I have determined to do the best I can with the specimens at my command, and the figures of the specimens that have been published by Wagler and others.

It is to be regretted that Agassiz, in his notes on the American Terrapins in his 'Contributions,' has confined his attention so completely to the external characters, and the development of the young animal. He does make some observations on the form of the jaws; but they are so indistinct and general that they afford very little information.

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The family Emydidæ, as now restricted, may be thus divided:—

Section I. AMPHIBIOCLEMMYS. The alveolar surface of the upper and lower jaws linear, narrow, with a sharp outer edge. Internal nostrils in front of the palate. Toes short, strong, erect, and included in the skin to the claws, or more or less expanded and united by a narrow scaly webb to the claws. These species are amphibious, and some of them more or less terrestrial.

Subsection 1. *The temporal muscle only covered with skin, without being protected by any band-like zygomatic arch in the skull uniting the orbit to the ear-cavity of the temporal bone. Eyes lateral. Toes short, strong, conical, free or very slightly webbed. Legs covered with short triangular scales.*

Tribe I. GEOEMYDINA.

1. GEOEMYDA. The alveolar surface of the jaws has not been examined.

2. MELANOCHELYS.

Subsection 2. *The temporal muscle protected on the outer side by a distinctly band-like zygomatic arch extending between the orbit and the tympanic cavity.*

Tribe II. GEOCLEMMYDINA. Toes short, enclosed in the skin to the claws. Legs covered with thick, hard, triangular scales. Eyes lateral (or subsuperior); pupil annular. Jaws with a narrow alveolar plate. Internal nostrils in front of the palate.

* *Eyes lateral.*

3. GEOCLEMMYS, Gray, Cat. Shield Rept. p. 17.

** *Eyes subsuperior, on the margin of the crown.*

4. NICORIA, Gray, Cat. Shield Rept. p. 17.

5. RHINOCLEMMYS, Fitzinger.

Tribe III. EMYDINA. Toes strong, short, spreading, covered above with bands of transverse shields, united by a narrow web to the claws. Jaws with a narrow alveolar surface. Internal nostrils in the front of the palate. Head covered with a thin, hard skin. Eyes subsuperior, with a dark spot on each side of the pupil.

6. EMYS.

7. CLEMMYS.

8. CHRYSEMYS, Gray, Cat. Shield Rept. p. 32.

9. GRAPTEMYS, Agassiz. *Emys* §§, Gray, Cat. Shield Rept. 29.

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10. Callichelys, Gray, Ann. and Mag. N. H. xii. 1863, p. 176.

11. Deirochelys, Agassiz.

I have not been able to examine the alveolar edge of the last three genera; they may belong to the next tribe.

Section II. Hydroclemmys. The alveolar surface of the upper and lower jaws broad, expanded, covering more or less of the sides of the front of the palate, so that the internal nostrils open near the middle of the palate. Lower jaw strong. Toes webbed.

Tribe IV. Malaclemmydina. The alveolar surface smooth. Toes strong, spreading, covered with a soft skin. Eyes subsuperior; pupils annular, without any lateral spot.

i. *The upper or alveolar surface of the under jaw broad, concave, rather narrower on the hinder part of the side. Internal nostrils subposterior, behind the middle of the alveolar surface.*

* *Front of the palate, before the internal nostrils, with a broad central groove. Eyes subsuperior* (Estuarian).

12. Malaclemmys, Gray, Cat. Shield Rept. p. 37.

** *Front of the palate, before the interior nostrils, simple. Eyes lateral.*

13. Damonia.

ii. *The upper or alveolar surface of the under jaw wide, angular, concave in front, narrow and sharp-edged on the sides behind. Internal nostrils subanterior.*

14. Glyptemys.

iii. *The upper or alveolar surface of the lower jaw narrow, sharp-edged in front, wider and flattened on the hinder part of the sides. Internal nostrils subanterior.*

15. Bellia. Skin of neck and limbs with very minute granular scales.

Tribe V. Batagurina. Head large, nose rather produced; angles of the mouth covered with minute scales. The alveolar surface of the jaws very broad, with one or two strong ridges or grooves. Internal nostrils subposterior. Toes elongate, weak, expanded, covered with small scales, united by broad webs to the claws; hind feet fringed. The cavity of the thorax much contracted on each side at each end by broad, erect, internal, bony lateral plates. Asia.

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A. *Claws* 4 . 4. *Head covered with a soft skin, divided into small shields on the crown and temple. Nose conical, produced. The chin with a series of distinct shields at the under edge of the beak. The alveolar surface of the jaws very wide, with two well-marked subparallel ridges. Gular shield short, band-like.*

16. TETRAONYX. *Batagur*, Gray, Cat. Shield Rept. p. 35.

B. *Claws* 5 . 4. *Head covered with a thin skin. Nose subconical, more or less produced. Alveolar surface of the jaws with a single well-marked angular ridge. Gular shields triangular, moderate.*

a. *The alveolar surface of the jaws very wide and well-developed, with a denticulated ridge parallel to the outer edge. The internal edge of the alveolar surface, which edges the internal nostrils, is denticulated; it must not be confounded with the second ridge in the genus* Tetraonyx.

17. KACHUGA, Gray, Cat. Shield Rept. p. 35.

b. *The alveolar surface narrower, with a single well-marked acute ridge. Back of the thorax high, subangular; keels subnodose. The sternum high, keeled on each side.*

18. PANGSHURA.

Tribe VI. PSEUDEMYDINA. The alveolar surface of the jaws very broad, with one or two strong ridges or grooves. Internal nostrils subposterior. Toes elongate, slender, covered with a few small bands, united by broad webs to the claws. Hind feet fringed. The cavity of the thorax simple, not much contracted at the ends. America.

* *Sternal costal suture simple, normal.*

19. PSEUDEMYS, Gray, Cat. Shield Rept. p. 33.

20. TRACHEMYS, Agassiz.

** *Sterno-costal suture with four sterno-lateral shields.*

21. DERMATEMYS, Gray, Cat. Shield Rept. p. 49.

Tribe I. GEOEMYDINA.

1. GEOEMYDA.

GEOEMYDA GRANDIS. The skull (as seen through the skin) in a very large old and a younger stuffed specimen, like the skull of *Cistudo*, is destitute of any zygomatic arch uniting the orbit to the ear-cavity of the temporal bone, the temple and temporal muscles behind the orbit being only covered with a skin protected by thin, small, tessellated plates.

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A second half-grown specimen agrees with the very large old specimen above noticed in the absence of the zygoma.

2. Melanochelys.

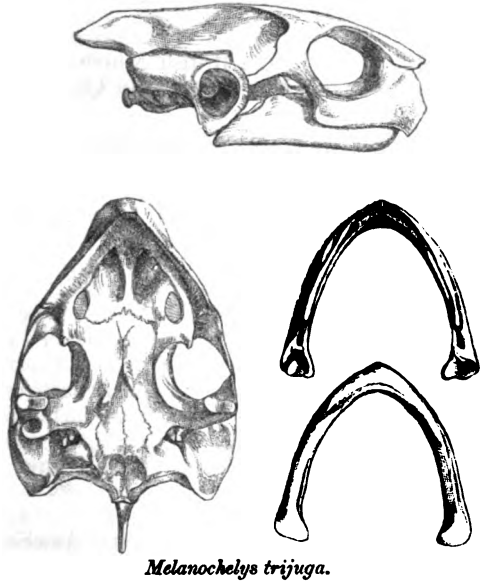
The thorax oblong, three-keeled. Vertebral plates broad, six-sided. Skull rather depressed; zygomatic arch imperfect, tapering behind, and not reaching the tympanic bone; lower jaw weak; the alveolar surface narrow, linear. Toes strong, webbed to the claws.

Melanochelys trijuga.

Emys trijuga, Gray, Cat. Shield Reptiles in B.M. t. 37. f. 2 ("*E. subtrijuga*," not good, zygomatic arch too broad and extending to the ear-bone).

Skull (as seen through the skin in the stuffed specimen) ovate, elongate, triangular in front; sides of the face nearly erect; orbit lateral, subsuperior, large; nose rather narrow; crown rather convex, elongate rhombic, narrowed and produced behind; from the

Fig. 6.



Melanochelys trijuga.

hinder point to the back edge of the orbit more than once and one-half the distance of the latter from the end of the nose; zygomatic arch rudimentary, very slender, linear, extending from the middle of the back edge of the orbit to the upper part of the front edge of the large tympanic cavity, which has a narrow, rounded edge; sheath of the upper jaw with a simple straight edge, without any

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central hook; the lower jaw moderately strong, covered in front with a convex horny sheath. Toes strong, included in the skin to the claws, covered above with band-like shields.

A skull received from Mr. Oldham, which appears to belong to this species, may be thus described:—Skull depressed, nose nearly erect from upper lip; crown rather convex, tapering behind; orbit large, circular, lateral, subsuperior; zygomatic arch *imperfect*, rather broad in front, about half as broad as the back edge of the orbit, and tapering off behind just before it reaches the upper edge of the small circular tympanic cavity; palate flat, broad, with a short shallow concavity behind each internal nostril; the lateral edge of the upper jaw nearly straight, with a slightly produced broad central beak, and with a narrow alveolar plate having a slight groove parallel to the short outer edge for the greater part of its length; lower jaw weak, erect on the side, shelving in front, with a central conical prominence in front, and with a straight, thin, sharp edge, without any dilatation of any kind.

Tribe II. Geoclemmydina.

3. Geoclemmys.

1. Geoclemmys guttata.

A beautiful skeleton is in the British Museum, and a skeleton without lower jaw in the Museum of the College of Surgeons, no. 977*a*.

Skull thin, crown slightly arched, nose erect; orbit lateral, very large; zygomatic arch broad, short; palate flat behind; lower jaw slender; side edges of the upper jaw slightly arched, and with a notch in front; alveolar groove very narrow, even; mastoid bone conical, produced, hollow. Toes short, strong.

2. Geoclemmys sebæ.

Specimen in spirit in the British Museum. Nose rather produced, shelving to the lip below, triangular, soft, in a notch on the upper edge of the upper beak; alveolar process linear, marginal; upper beak with a straight edge and a very slight acute central notch, lower hooked and acute in front. Toes short, included in the skin to the base, but slightly separate, conical, with a central series of narrow six-sided scales above; web very slight, if any.

3. Geoclemmys muhlenbergii.

An adult specimen in spirit, from North America, with the yellow spots on the occiput well-marked. The beaks have an even lateral edge and an acute notch in the centre in front; the lower beak convex and rounded below; crown rather convex, dark olive, with black spots. Toes united in the skin to the claws, with a few band-shaped shields above. The upper alveolar surfaces rather broadly linear, with a submarginal internal ridge; the lower with a continuous submarginal groove, rather broad, and produced, with a sharp edge, in front.

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4. GEOCLEMMYS CALLOCEPHALUS, Gray, P. Z. S. 1863, p. 254.

The upper beak with an acute central notch; the alveolar surface linear, with a submarginal ridge on the upper, and a narrow groove in the lower jaw.

4. NICORIA.

NICORIA SPENGLERI.

Skull (as seen through the skin in the stuffed specimen) narrow, rather acute in front, flat on the sides; orbit very large, lateral; zygomatic arch broad, flat, as wide as the back edge of the orbit, as wide behind as the rather small tympanic cavity; lower jaw rather weak, with a large inferior space, rather rounded in front. The sheath of the upper jaw is strongly and acutely hooked at the tip, and entire on the edge. Palate ——? The toes enclosed in the skin to the claws, covered with band-like shields.

5. RHINOCLEMMYS, Fitz.

This genus may be divided thus:—

* *The sternum flat longitudinally, and very slightly elevated at the sides under the sterno-costal symphyses.*

1. RHINOCLEMMYS ANNULATA.

** *The sternum slightly arched longitudinally, and much elevated at the sides under the sterno-costal symphyses.*

2. RHINOCLEMMYS SCABRA.

Crown flat, with a spot before each eye, and an oblong band on the crown, over back part of orbits.

Skeleton in the British Museum received from the Utrecht Museum. Skull elongate, rather solid; nose erect, shelving beneath; crown rather convex; orbit large, circular, lateral; sides of the face nearly erect; zygomatic arch very broad, forming part of the temple above, slightly convex on sides; mastoid bone rather elongate; edge of upper beak straight, with a slight central notch. Palate flat; internal nostrils anterior, with a short, rather deep oblong concavity behind each, separated by a strong central ridge. Alveolar surface narrow, linear, with a slight sunken groove, edged internally by a slightly raised sharp edge. Lower jaw wider; upper surface slightly prominent in front, with a sharp edge having a slightly concave linear depression on the inner side. Toes short, strong.

Specimen in spirit in the British Museum. Skull ovate rhombic, rather elongate, sides of the face flat, erect; nose short; orbit large, subsuperior, on the outer edge of the crown; crown rhombic, produced, and acute behind; rather longer from the hinder edge to the hinder edge of the orbit than from that part to the end of the nose; zygomatic arch thin, flat, dilated, forming part of the crown in front, narrow and only attached to the upper front part of the small subtrigonal tympanic cavity; upper jaw with a narrow double edge, the edges parallel and separated by a rather deep narrow groove; lower

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jaw moderate, nearly erect and with a narrow simple edge rather produced into an acute point in front. Palate flat, broad, with a triangular flat plate over the interior nostrils in front, and with a slight central keel with a slight concavity on each side just behind the openings of the internal nostrils. Toes short, imbedded in the skin to the base of the claws.

Tribe III. Emydina.

6. Emys.

1. Emys japonica.

An adult specimen from Japan, in spirit. Thorax oblong; dorsal shields broad, six-sided, with a well-marked large central areola of the same shape and with a few concentric ridges, and more or less distinct radiating grooves and some rather nodulose radiating ridges, dark-brown or black varied with orange rays or lines, the areola of the marginal plate near the outer hinder edge; sternum and lower side of the margin uniform black. Legs and tail uniform black. Head ovate rhombic, longer than broad, crown and sides olive-black. Neck with longitudinal ridges and conical short spine-like scales, those on the back of the neck being the largest. Crown flat; eyes lateral, subsuperior; nose truncated, rounded in front; edge of the beak even, without any central notch; lower beak weak. Alveolar surface narrow, linear, with a submarginal ridge on the upper, and a groove on the lower jaw; lower jaw scarcely thick, with the edge produced into a sharp point in front. Tail conical, elongate, flat above, with a pale streak on each side of the upper surface. Front legs covered with rather large scales; the hind legs and feet spinulose.

2. Emys tristrami.

Head oblong trigonal, half as long again as wide (to the end of crown-ridge); eyes subsuperior; temple and jaws with a few dark-edged pale sinuous lines; temple, between orbit and the wide zygomatic arch, short, flat; lower jaw strong; alveolar surface of both jaws linear, marginal; internal nostrils subanterior.

Hab. Holy Land.

See also *Emys* undetermined, Gray, Cat. Shield Rept. in B. M. t. 35. f. 3 (skull).

7. Clemmys.

Clemmys caspica.

Clemmys caspica, Wagler, Nat. Syst. Amph. t. 5. f. iv., v. (skull figured).

A specimen in spirit (from Arabia Petræa?), purchased of the Rev. H. Tristram. Thorax oblong; nuchal plate broad. The upper surface of each marginal plate with a subcentral darker-edged cross streak, sometimes dilated and extended into a streak along the upper edge of the plate. Back pale olive, with indistinct paler yellowish reticulated lines edged with black; sternum and underside of the margin black, with irregular-sized subtriangular yellow spots on the

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outer side of each sternal shield and a pale blotch on the outer edge of the inguinal shield. Head and neck olive, sides of the neck and throat with numerous black-edged pale parallel streaks. Legs with irregular rather broad black-edged pale streaks. Beaks olive, rounded in front; upper with a slight acute central notch with a slight tooth on each side of it.

8. Chrysemys.

Chrysemys picta.

Emys picta, Owen, Cat. Osteol. Mus. C. S. p. 189. no. 964 (skull and thorax).

Skull in the Museum of the College of Surgeons, no. 964. Skull rather solid, crown very flat; orbits large, oblong, forming part of the crown-edge; nose-hole moderate, labial edge even, with two small close teeth quite in front; zygomatic arch broad, strong, convex externally; palate flat; internal nostrils quite anterior, with a concavity in front between, and with a slight oblong concavity behind each, separated by a slight raised central ridge; lower jaw depressed, rather broad in front and on the sides, rather convex externally (the jaws are fastened together).

There is also a skull of a smaller specimen, no. 967. The alveolar surface of the upper jaw linear, with a slight narrow raised ridge parallel to the outer edge, and occupying the middle, half its length. Lower jaw depressed; alveolar surface linear, with a well-marked groove with a sharp raised edge on each side for the greater part of its length, except in front, where the jaw is thinner, simple, and acute.

11. Deirochelys.

? Deirochelys reticulata, Agassiz.

A young specimen in spirits, received from Mr. Arthur Russell, from North America, under this name. It is most beautifully ornamented, both on the back and sternum, with dark-edged rings and irregular marks; the beaks are most beautifully ornamented with regular black-edged yellow streaks diverging from the nose across the lower beak, so as to form the lines on the throat; the underside of the lower beak is convex. The alveolar surface of the upper and lower jaw rather wide; the upper with a very slightly raised narrow submarginal ridge; the lower jaw with a regular well-marked continuous submarginal groove.

Tribe IV. Malaclemmydina.

12. Malaclemmys.

Malaclemmys concentrica.

Two skeletons in the British Museum. Skull broad, ovate trigonal, rather depressed, sides of the face rounded; crown flat, rhombic, hinder end narrow, extended into a crest, as long from the hinder edge of the orbit as that part is from the end of the nose;

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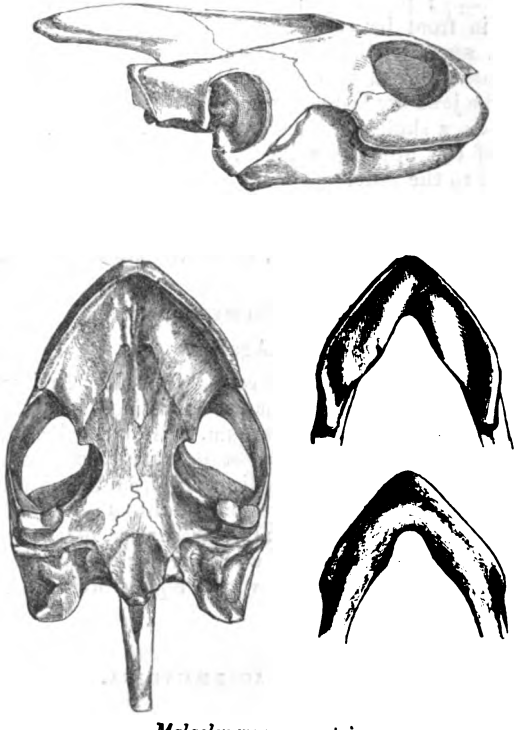
orbit lateral, superior, on the outer edge of the crown; zygomatic arch strong, broad, convex, rather wider than the orbit in front, so much so that the circular tympanic cavity behind is rather contracted in the middle. The palate flat; internal nostrils near the centre of the palate, from under a rather convex plate in front, and with a central keel in the wide sunken space behind them. The alveolar surface of the upper jaw very wide, quite simple, occupying all the front of the palate but a central triangular space, without any internal ridge. The lower jaw very strong, flattened out in front and on the sides of the front, without any gonyx, the upper edge simple, with a very broad, shelving, concave inner aveolar surface and an acute central point. Toes rather elongate, webbed to the claws, with band-like shields above.

Fig. 7.



Malaclemmys concentrica.

Skull in the Museum of the College of Surgeons, no. 1057, without horny sheath. The palate flat; the aveolar process very wide, smooth, rather convex on the front part of the inner edge. The part of the palate behind the internal nostrils broad, slightly sunken,

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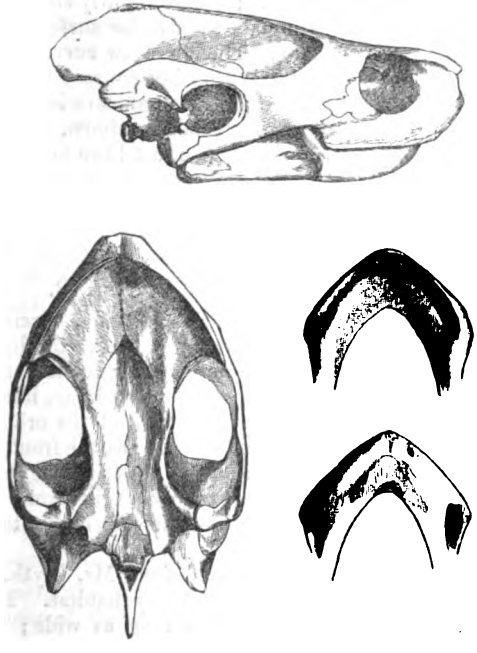
flat, with three rather thick ridges, the central one long, the side ones short. The lower jaw very strong, thick, bent up in the centre in front and acute; the alveolar surface very broad, slightly concave the whole length of the sides. Length 1 inch 7½ lines, width 1 inch 5 lines.

13. Damonia.

Head very large, covered with a hard thin skin. Nose high, truncated; nostrils in a small disk notched out on the upper edge of the very high convex upper beak. Eyes lateral, subsuperior. Sides of the face shelving outwards below. Zygomatic arch strong, wide. The labial edges of the upper beak slightly arched, bent inwards. Lower jaw very strong, convex and rounded in front below, with a strong, sharp-edged, broad central tip. The alveolar disk of the upper and lower jaws very broad, the upper flat, and the lower

Fig. 8.



Damonia macrocephala.

concave. The internal nostrils subcentral, with a short oblong sunken space behind each. The thorax oblong, more or less distinctly three-keeled; the vertebral shields six-sided, as broad behind as before; marginal plates dilated over the hinder limbs. Sternal

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plates regular. Toes strong, covered with band-like shields, united, to the claws, by a very narrow web covered with scales; hind toes longest. Asiatic.

The skull and palate similar to those of *Malaclemmys*, but the feet, shell, and head different.

1. DAMONIA MACROCEPHALA.

Geoclemmys macrocephala, Gray, P. Z. S. 1859, p. 479, t. XXI., 1861, p. 139.

Emys trijuga, Mus. Utrecht.

Hab. Siam and Cambogia.

The skull (as seen through the skin in the stuffed specimen) has a very broad, strong, rather convex zygomatic arch between the orbit and the ear-cavity; crown broad, flat, trigonal, broader and truncated behind.

Skeleton in the British Museum. Skull large; nose rather produced, conical; crown flat, rhombic, short; orbit lateral, very large; zygomatic arch very broad, short; palate slightly concave; internal nostrils near the middle of the palate; alveolar surface of the upper jaw rather arched, very convex. The lower jaw curved upwards and acute at the tip, with a very broad, rather concave alveolar surface the whole of the length, broader and most concave in front.

There is a second skeleton, of a small specimen, of this species, which, from the bad state of the shell, must have been kept in confinement for a long time.

2. DAMONIA REEVESII.

Emys reevesii, Gray, Syn. Rept. 73.

Geoclemys reevesii, Gray, Cat. Shield Rept. p. 18.

Skull (as seen through the skin in the stuffed specimen) small, ovate trigonal; crown rhomboid, rather convex, produced in the centre behind, about as long from the back edge of the orbit as from the nose to that part of the skull; orbit rather large, lateral; zygomatic arch short, broad, wider than the back of the orbit, and confluent with the crown above, not quite so wide as the front edge of the tympanic cavity behind. Sheath of the upper jaw simple, without any central hook. Lower jaw strong, convex in front, and with a convex horny sheath. Toes enclosed in the skin nearly to the claws, covered above with band-like shields.

An adult specimen in spirit, obtained from Mr. Blyth, most probably from India, but received without any habitat. Head large, strong; crown flat and short, not so long as wide; nose high, rather shelving to the mouth; eyes lateral; cheek flat; temple and zygomatic process convex. Upper beak very large and thick, with a straight edge without any central notch; the lower curved and acute in front, convex beneath. The alveolar processes very broad; upper rather convex and rugose; lower rather concave and broad the whole length of the side of the jaw. Neck and feet lead-coloured, without any streak. The thorax solid, thick, oblong, with three very ob-

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scure keels, the central one broad, and the lateral ones narrower, about one-fourth of the width of the shield from the upper edge. The back dull olive, the chest black, the underside of the margin pale yellowish. Toes strong, united in the skin to the claws, with a few shields above; claws acute, black. Tail moderate, conical, tapering at the end. The 1st vertebral plate rather longer than wide, narrowed behind, with a concave hinder edge; the 2nd, 3rd, and 4th vertebrals as wide as long, with a rounded front and an arched hinder edge, the 2nd and 3rd wider behind than in front, and the 4th wider in front than behind.

This specimen chiefly differs from typical *D. reevesii* in the larger size, the larger head, and a difference in the form of the dorsal shield; but all this may depend on age and nourishment; and what were considered adult *D. reevesii* may have been young animals.

3. DAMONIA HAMILTONII.

Geoclemys hamiltonii, Gray, Cat. Shield Rept. p. 17.

Skull (as seen through the skin in the stuffed specimen) ovate trigonal, sides flattened; orbit lateral, rather large; crown rhombic, rather convex in the middle, concave over the orbits, produced behind, about once and a half as long from the back edge of the orbit as from that point to the tip of the nose; zygomatic arch very short, broad, confluent with the crown above, and much wider than the orbit in front, as wide as the tympanic cavity behind; sheath of the upper jaw simple, without any central hook; lower jaw strong, convex, and covered with a horny sheath in front; toes enclosed in the skin to the claws, with band-like shields above, claws small.

A specimen in spirits in the British Museum. The head moderate; nose with each nostril in an oblong soft space; the upper beak with a simple short edge, rounded in front; lower beak with an acute produced centre. Alveolar surface of the upper jaw wide, linear, convex and rugose on the sides; alveolar surface of the front of the lower jaw broad, rugose, concave in the upper surface, narrow on the sides. Toes broadly webbed, crenulated on the edges, with a series of hexangular larger scales on the upper surface.

This animal has the feet of *Batagur*; but the cavity of the skull is not contracted at the ends as in that group.

4. DAMONIA NIGRICANS.

Emys nigricans, Gray, Cat. Shield Rept. p. 20, t. 6.

Skull (as seen through the skin of the stuffed specimen) oblong triangular, sides of face flattish; orbit lateral, rather large; crown nearly flat, with an arched hinder edge, which is about as far behind the hinder edge of the orbit as that part is from the end of the nose; zygomatic arch flat, as wide in front as the back edge of the orbit, and as the front edge of the tympanic cavity behind; the sheath of the upper jaw rather notched at the tip, with a simple edge; lower jaw broad, convex, and covered with a broad horny sheath in front. Toes slightly webbed to the claws.

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14. Glyptemys.

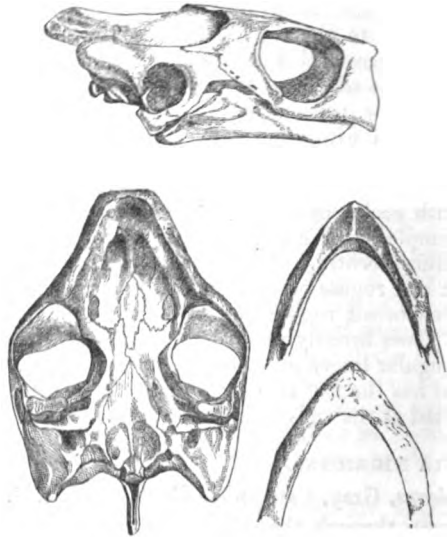
Glyptemys pulchella, Agassiz.

Geoclemys pulchella, Gray, Cat. Shield Rept. p. 18.

The skeleton of a large specimen which had been in confinement, with the bones separate, in the British Museum, prepared by Dr. Günther. The skull with a broad, very flat forehead, and high, square nose; the latter granular, the lower half sunk in a deep wide notch in the upper edge of the upper beak. Upper beak high, with an acute central notch. Lower jaw strong, thick and convex in front. Zygomatic arch strong, convex. Orbit large, quite lateral, with a narrow lower hinder edge. Palate concave in front, flat behind; internal nostrils large, anterior. The alveolar surface of the upper jaw rather broad, smooth, with a slight concavity in front; of the lower jaw broad in front, narrower on the sides, regularly concave.

The broad front of the alveolar surface of the lower jaw separates these animals from the genus *Geoclemmys*; and therefore I have adopted Agassiz's generic name.

Fig. 9.



Glyptemys pulchella.

A large specimen in spirit in the British Museum. Skull rather thin, ovate rhombic, sides flat; orbit very large, subsuperior, in the upper margin of the crown; crown rhomboid, produced into an acute point behind, the hinder end as far from the hinder edge of the orbit as that part is from the end of the nose; zygomatic arch short, broad, rather broader in front than the back edge of the orbit,

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about as large as the small circular tympanic cavity behind, but attached to the temple rather below the upper margin of the tympanic cavity. The upper jaw (with the sheath on) has a sharp edge with a broad internal groove edged on the inner side by a slight ridge. Palate rather concave, especially in front. The sheath of the upper jaw with a slightly bidentate notch in front, and simple straight sides. The lower jaw strong, erect on the sides, shelving, convex, and rounded in front, covered with a horny sheath, and with a central acute point.

15. BELLIA.

Head very large, short, covered with a thin and hard skin, over the orbit and other fleshy parts covered with very small granular scales. Nose high, truncated in front; nostrils in the upper edge of the horny beak. Beak of the upper jaw high, convex, with broadly arched dependent sides and a central notch. Lower jaw strong, convex in front, with a central acute sharp-edged point. Thorax oblong; back three-keeled; vertebral plates elongate subtrigonal, areola of discal shields with a narrow longitudinal ridge. Toes strong, expanded, with transverse band-like shields, united, to the claws, by a narrow scaly web. Asiatic.

Skull solid. Nose-hole square; the front and sides of the upper lips shelving inwards. Orbit large, oblong, subquadrangular, lateral. Palate flat, internal nostrils anterior, with a short oblong concavity behind each. Alveolar plates moderate, band-like, rather wider behind, rather concave. Lower jaw short, strong, convex in front, and wide and thick behind, with a conical central prominence and a broad flat alveolar edge that is broader behind and with a very slightly raised outer margin.

Bellia has the large head, with dependent lips, of *Damonia*; but the alveolar surface of the upper jaw is not so wide, and the inner nostrils are anterior.

BELLIA CRASSICOLLIS.

Emys crassicollis, Bell; Gray, Cat. Shield Rept. B. M. p. 20.

Skull (as seen through the skin of the stuffed specimen) broad, depressed, ovate, sides shelving outwards; orbit subsuperior, on the lateral edge of the crown; crown flat, rhomboid, broader in front, rather produced and narrow in the middle of the hinder edge, which is almost as far from the back edge of the orbit as that part from the end of the nose; zygomatic arch short, broad, convex, forming part of the crown, and wider than the back edge of the orbit in front, not quite so wide as the front edge of the tympanic cavity behind; edge of tympanic cavity rounded; sheath of the upper jaw very strong, and high in front and on the sides, lower margin truncated in the middle, and larger and arched on the sides; the lower jaw strong, short, broad in front, covered with a broad horny sheath. Toes strong, short, webbed to the claws, covered with band-like shields. Feet like those of the American *Emydidæ*.

Skeleton of a half-grown specimen in the British Museum, re-

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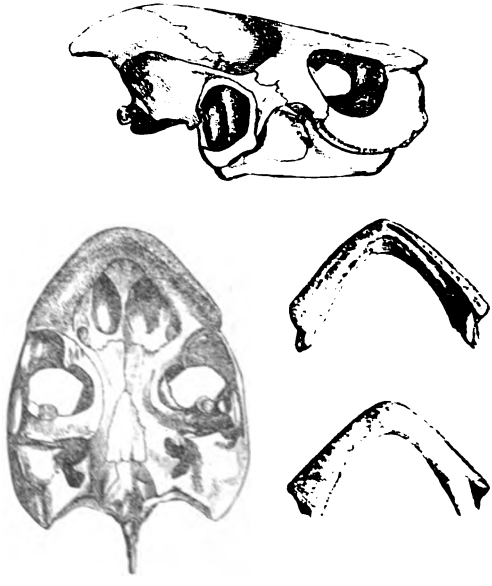
ceived from Holland as "*Clemmys sprengleri*." The head of the younger specimens is rather more slender and thinner than that of the adult.

A young specimen in spirit, sent with an adult and a half-grown specimen from Borneo, and presented by Mr. Dillwyn. The head is black, with an elongated yellowish white spot over each orbit, extended towards the nostrils, and a large round opake pure-white spot on each temple over the zygomatic arch, a triangular white spot on each side of the lower jaw, and a small white spot on the side of the head under the tympanum.

The head of the adult specimen has not these distinct spots; but the region of the orbit and temple is varied with white. Unfortunately, however, the older specimens are not in such a good state as the young one.

Fig. 10.



Bellia crassicollis.

Two skulls in the Museum, sent by Prof. Oldham, are very solid; nose rather produced, conical; nose-hole in front large, four-sided; cheeks shelving outwards; crown flat, rhombic, narrow and acute behind; zygomatic process moderately broad, from back of orbit to the upper front half of the oblong tympanic cavity; orbit oblong, large. The labial edge of the upper jaw arched on each side and overlapping. The palate nearly flat, with a concavity in front behind each internal nostril. The alveolar plate broad, flat, smooth, broader behind, and with a slight oblong central pit and a larger

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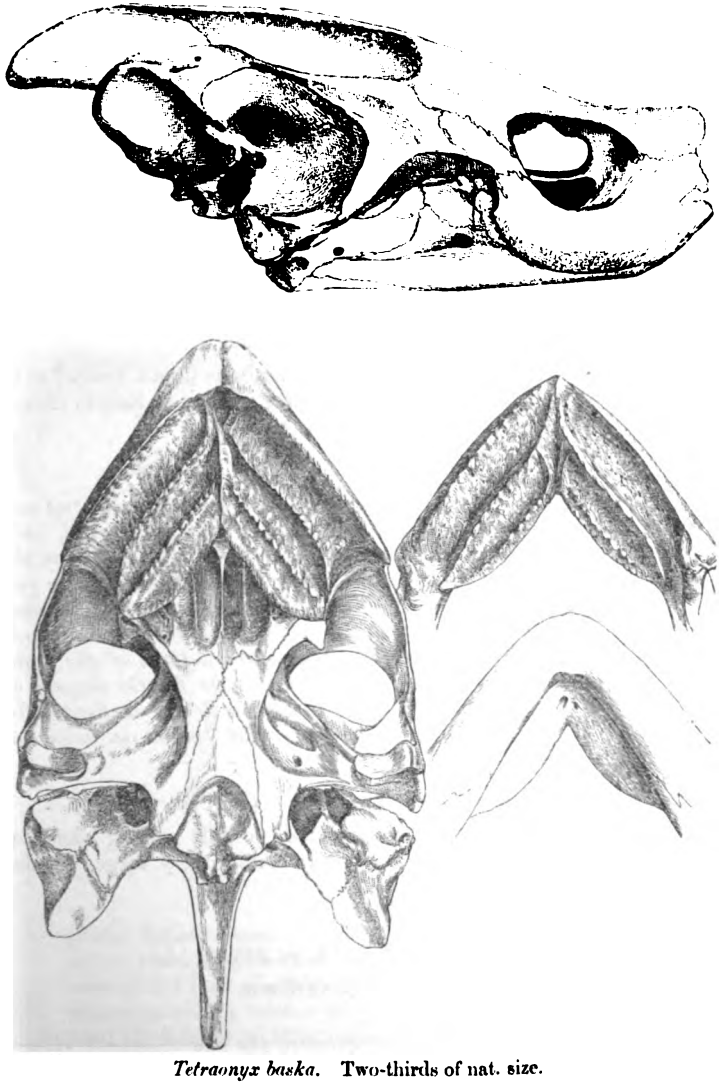
central concavity behind it. Lower jaw very strong, short, with a narrow erect front edge ending in a central conical prominence; broad and flattened out behind, especially just before the condyle. The tympanic concavity opens into the larger cavity that occupies the whole of the mastoid bone.

Fig. 11.



Tetraonyx baska. Two-thirds of nat. size.

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Tribe V. BATAGURINA.

16. TETRAONYX.

TETRAONYX BASKA. (Fig. 11, p. 199.)

Batagur baska, Gray, Cat. Shield Rept. p. 35. Skull B.M.

17. KACHUGA.

* *The upper jaw with a short very distinct central longitudinal dentated ridge behind the deep conical pit in the front of the jaw, which commences between the ends of the secondary ridges. The lower jaw with a deep longitudinal groove in front behind the central conical prominence on the edge.*

† *Palate flat, with two very deep oblong concavities, one behind each of the internal nostrils. The ridges of the upper jaw are elongate, and the anterior central ridge is broad at the base, with a deep broad concavity on each side between the sphenoid and condyle. The inner surface of the front part of the lower jaw is erect, without any expanded plate.* BATAGURELLA.

1. KACHUGA PEGUENSIS. (Fig. 12, p. 201.)

The concavities behind the internal nasals as broad behind as in front; orbit large, irregular, oblong, nearly as high as long in front.

Hab. India. Presented by W. Theobald, Esq.

The thorax is unknown.

†† *Palate narrow, concave, with a ridge on each side and two moderately deep concavities behind each internal nostril, each marked with a central longitudinal ridge. The ridges on the upper jaw short, and the anterior central ridge narrow and sharp-edged. The front part of the lower surface of the temporal bone, between the condyle and sphenoid, shelves upward, not forming a broad cavity. The inner surfaces of the front part of the lower jaw have a shelving plate for the support of the inner longitudinal ridge on the upper dental surface. The orbit regular, oblong, moderate. The thorax is unknown.* KACHUGA.

2. KACHUGA TRILINEATA, Theobald. (Fig. 13, p. 202.)

The concavities behind the internal nostrils oblong elongate, narrow, narrower and deeper behind; orbits very large, regular oblong, much longer than high.

Hab. India. Skull Brit. Mus.

3. KACHUGA OLDHAMI. (Fig. 14, p. 203.)

Hab. India. Presented by Prof. Oldham.

** *The upper jaw with a notch between the two divergent ridges, and an indistinct broad longitudinal ridge in the centre of the*

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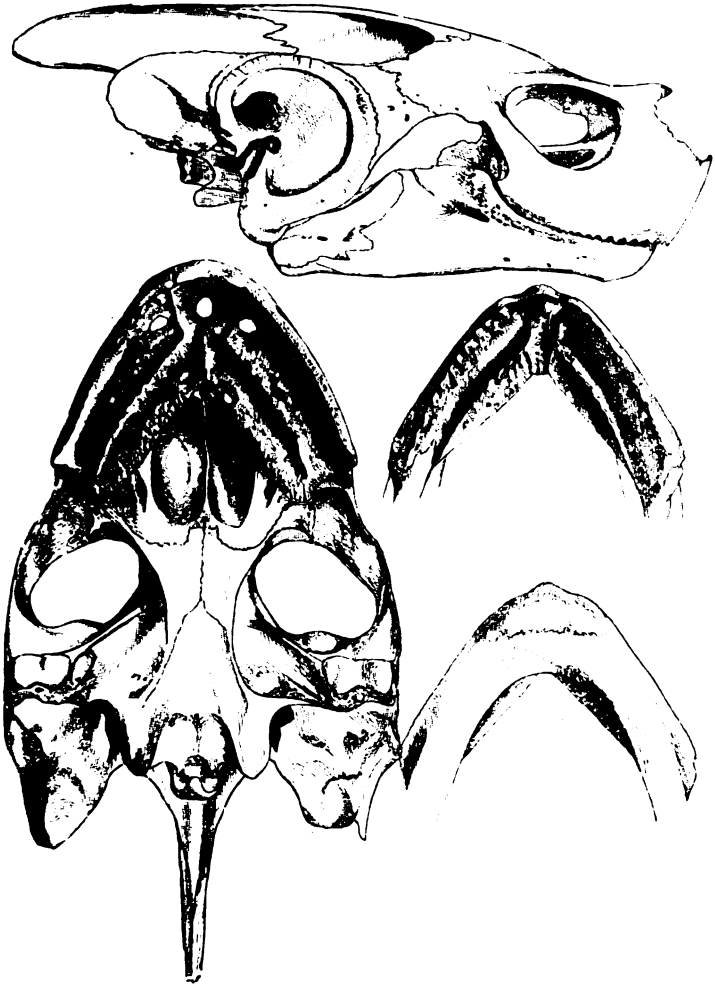
Fig. 12.



Kachuga peguensis. Two-thirds nat. size.

plates behind them. The lower jaw with a distinct sharp-edged short longitudinal central ridge just between the back edge of the conical marginal prominences and the middle of the diverging ridges, and a deep ovate longitudinal concavity behind the middle of those ridges: the lower jaw with a slightly shelving plate for the support of the diverging dental ridges. The palate narrow, rather concave, with a very deep oblong

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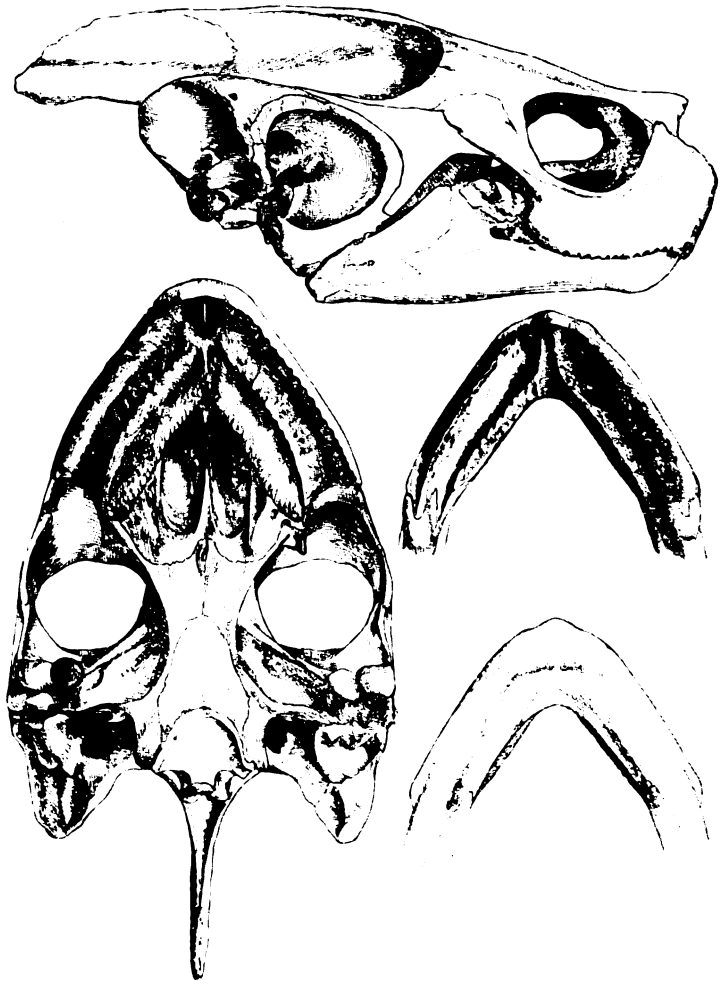
Fig. 13.



Kachuga trilineata. Two-thirds nat. size.

concavity behind each internal nostril. The orbit regular oblong, longer than high. DONGOKA.

4. KACHUGA HARDWICKII.

***Batagur dongoka*, Gray, Cat. Shield Rept. in B. M. t. 36. f. 1 (skull).**

Hab. Nepal (***B. H. Hodgson, Esq.***).

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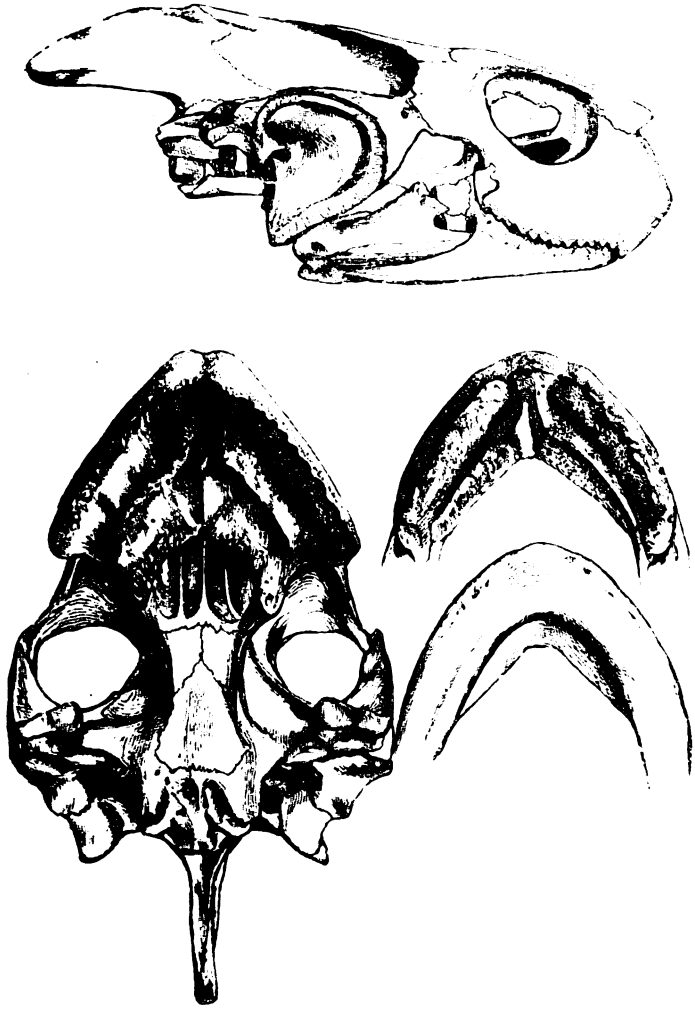
Fig. 14.



Kachuga oldhami. Nat. size.

5. KACHUGA AFFINIS.

A specimen of the young animal in spirit, from Penang, from the Cantor Collection, named *Tetraonyx junior* by Dr. Cantor. It has five distinct claws on the fore, and five on the hind feet. The shell is nearly circular, and the sides of the sternum are very sharply and strongly keeled. The upper beak is straight-edged, with two small

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acute teeth in the centre in front. The alveolar surfaces rather broad, the upper with a single triangular ridge separated by a central concavity; the lower with a single ridge parallel to the edge. The vertebral shield rugulose, with a broad flat-topped keel; the costal shields with an indistinct central keel more prominent behind, the part above the keel rugulose, that below it smooth; inguinal shields very wide.

6. KACHUGA BERDMOOREI.

There are two specimens in spirit, purchased of Mr. Theobald, in the British Museum. The alveolar surfaces of the upper and lower jaws very wide, as wide behind as before, rugulose, tubercular; the upper one with a very strong triangular submarginal ridge ending short of the centre and in front sharply turned towards the outer margin; the central part concave in front, and flat behind; the portion behind the ridge very broad. Lower jaw with a very strong triangular ridge stopping short of the centre, which is concave. The upper beak even on the side, with a broad triangular central nick with a slight tooth on each side; the lower with a short conical centre; the whole surface of the upper and the outer surface of the lower grooved and rugose. The nostrils small, circular, pierced in a horny plate that edges the nose and with a lower process produced downwards, on the upper edge of the beak.

Hab. ——?

18. PANGSHURA, Gray.

Pangshura, Gray, Cat. Shield Rept. p. 36.

The beaks of *Pangshura tecta*, in a specimen in spirit, are unlike the beaks of *Tetraonyx*; the gape is scaly, but the lower beak is broad in front, with a rather curved hinder edge, and there is a series of more or less distinctly separate long trigonal shields below the outer margin on the hinder part of the beak. The skin on the crown is continuous, without any grooves; the skin over the tympanum is soft, with some very obscure concentric wrinkles or grooves.

1. PANGSHURA TECTA.

Emys nomadicus, Theobald.

A specimen in spirit in the British Museum. The alveolar process wide on the upper and lower jaws. The upper jaw with a subcentral acute ridge interrupted in front by a central longitudinal ridge, and with an acute ridge on the inner margin which is continuous in the centre. Alveolar process in the lower jaw broad, with a strong triangular ridge parallel to the margin, and with a short central longitudinal ridge. Labial edge of the upper beak simple, of the lower beak acute and bent up in the middle.

Skull (as seen through the skin in the stuffed specimen) ovate rhombic, rather high in front, nearly erect on the sides; crown rhombic, produced and acute behind, rather longer from the pos-

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terior end to the back edge of the orbit than from that part to the end of the nose; eyes lateral, evebrows rather convex; zygomatic arch short, narrow, from the middle of the hinder edge of the orbit to the upper part of the front margin of the tympanic cavity, which is only furnished with a narrow edge. Sheath of the upper jaw with straight, closely denticulated edges; lower jaw strong, very convex, and covered with a horny sheath in front. Toes slender, with a few hexangular shields above, very broadly webbed; claws small.

2. PANGSHURA TENTORIUM.

Skull (as seen through the skin of the preserved specimen) very like that of *P. tecta*, but the crown is rather more produced behind, or rather the orbits are more in front of the head; the bony temple is broader behind the eyes; and the zygomatic arch is broader, being as wide as the upper half of the front edge of the tympanic cavity. The horny sheath of the upper jaw is rather sinuous, distinctly but closely denticulated. Toes slender, very widely webbed to the claws; claws small.

3. PANGSHURA DURA.

Skull (as seen through the skin of the stuffed specimen) ovate triangular, sides erect; orbit very large, subsuperior; crown rhombic, produced and acute behind, twice as long from the hinder end to the back edge of the orbit as the length from that part to the end of the nose; zygomatic arch short, convex, the front end forming part of the crown, and wider than the orbit, and the hinder part narrower and only attached to the upper part of the edge of the tympanic cavity. Sheath of the upper jaw broad, high, with a straight simple edge; lower jaw strong, covered with a convex horny sheath in front. Toes slender, broadly webbed to the claws.

Tribe VI. PSEUDEMYDINA.

19. PSEUDEMYS.

1. PSEUDEMYS SERRATA.

A mounted skeleton in the British Museum, from North America. Skull solid, crown flat, produced and narrow behind, very broad, square, high in front, shelving to the mouth below; the labial edge nearly straight, with a notch in front, and minutely denticulated on the margin. The zygomatic arch very broad, slightly convex externally; the mastoid bone produced horizontally, flat above externally, and keeled above, with a moderate-sized internal cavity. Palate concave behind the internal nostrils. The alveolar surface of the upper jaw flat, wide, rather produced behind; inner or palatine edge simple, and armed in front with a large tooth on each side of the centre, which is produced into a longitudinal sharp-edged irregular ridge parallel to the outer margin and nearer to it than to the inner edge of the alveolar surface. The lower jaw strong, much depressed and wide in front, and quite flat on the lower surface;

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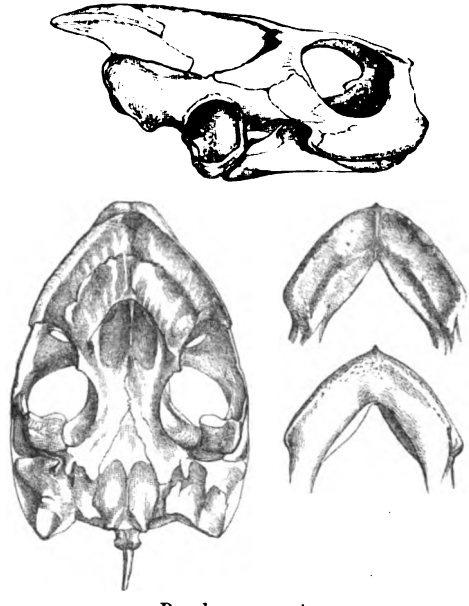
the alveolar surface broad, expanded, nearly as broad behind as in front, the centre of the outer edge produced and acute, with a large concavity on each side behind it, and with an irregular sharp-edged ridge nearer the inner edge than the outer margin, with a conical compressed prominence in front; the labial margin with a series of conical teeth.

Fig. 15.



Pseudemys serrata.

A second skull depressed, ovate, sides of the face shelving; nasal aperture very large; orbits very large, superior, separated by a very narrow space; crown rhombic, produced behind; zygomatic arch very broad, convex, nearly as wide as the back edge of the orbit and the front edge of the oval tympanic cavity. Upper jaw with a well-marked irregularly dentated ridge parallel with the outer edge, and a broad flat space behind it; there is a conical tooth on the front end of the ridge, and a deep conical pit on the front of the upper jaw. Hinder nasal opening arched in front, near the middle of the palate. The lower jaw strong, broad, expanded; lower surface flat; upper surface with a short denticulated marginal edge, and a conical central prominence in front, with a central longitudinal ridge and a stronger arched ridge parallel with the outer margin. Toes long, slender, broadly webbed.

2. PSEUDEMYS DECUSSATA.

Pseudemys decussata, Gray, Ann. & Mag. N. H. xii. p. 183.

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Emys decussata, Bell; Gray, Cat. Shield Rept. in B. M. t. 36. f. 2 (skull).

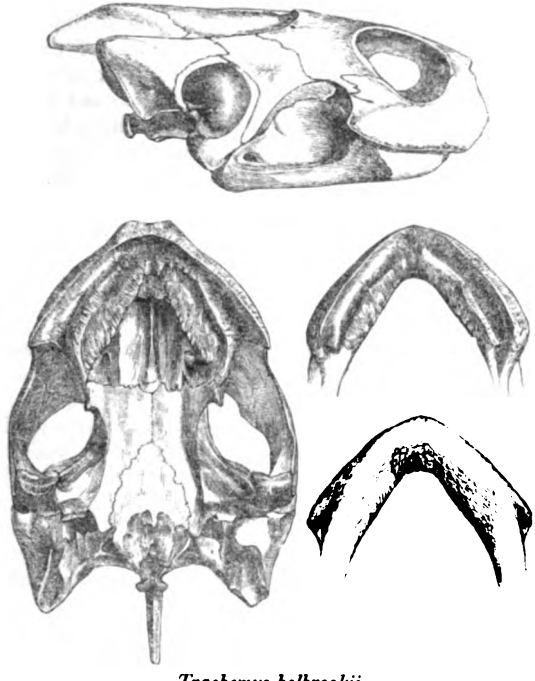
Skull in British Museum. The internal nostrils subanterior, between the converging alveolar plates; lower jaw with a short groove.

20. Trachemys.

Trachemys holbrookii.

Trachemys holbrookii, Gray, Ann. & Mag. N. H. xii. p. 181.
Emys cumberlandensis, Holbrook.

Fig. 16.



Trachemys holbrookii.

Skeleton (in separate bones) in the British Museum, prepared by Dr. Günther. Skull ovate, solid, crown quite flat, sides of face shelving outwards; nose rather produced beyond the mouth; orbit very large, lateral, subsuperior, upper hinder edge narrow; zygomatic arch very broad, convex; tympanic cavity subcircular. The edge of the jaws swollen, convex, labial edge rather arched, entire in front. The palate flat; internal nostrils large, subanterior, with an elongated broad slight concavity behind them. The alveolar

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surface broad, divided just over the internal nostrils by a large, thick central ridge parallel with the outer side, having a broad space on each side of it. Lower jaw strong, rather short, front and sides convex and rounded beneath; alveolar surface broad, with a short outer edge of an irregular narrow subcentral ridge parallel with the outer margin.

21. Dermatemys.

Dermatemys, Gray, Cat. Shield Reptiles in B. M. p. 49.

Skull figured by M. Aug. Duméril in the 'Archives du Muséum,' vi. p. 223, t. 15. "The alveolar surfaces are broad, with distinct dentated ridges, like those of the genera *Pseudemys* and *Batagur*." *Gray, P. Z. S.* 1864.

This genus was arranged, in the 'Catalogue of Shield Reptiles,' in the *Chelydradæ*, near *Chelydra*, on account of the additional shield on the suture; but at that time the thorax only was known. The animal, like the skull, is very like *Pseudemys* and *Batagur*. The specimen in spirit of the animal in the British Museum, received from Mr. Salvin, has very small gular shields, for the greater part of their length united, which gives them much the appearance of a single shield. This union and their small size give the animal at first sight the appearance of an *Hydraspis*, the gular shields being regarded as the intergular of that genus.

Fam. IV. Platysternidæ.

Head very large, covered with a thick, hard, bony case; upper jaw with a strong short-edged central hook. Skull thick, hard; zygomatic arch much dilated posteriorly and forming a bony covering over the temporal muscles. Toes 5.4, short, free at the ends; the three middle ones of the fore foot and the two middle ones of the hind foot longest; claws compressed, acute. Tail cylindrical, elongated, covered with rings of square shields. Thorax thin. Sternum solid, broad, attached to the thorax by a bony extension covered with the ends of the pectoral and abdominal plates; not transversely divided, separated from the marginal shields by a longitudinal series of small shields.

Emydidæ, *b*, Gray, Cat. Shield Reptiles, p. 49.

Emydidæ, § B, Gray, Cat. Tortoises in B. M. p. 13.

Platysternon.

Platysternon, Gray, Cat. Shield Rept. p. 49.

Fam. Chelydidæ.

In the 'Proceedings' of the Society for 1864, p. 128, I proposed an arrangement of the genera of this family founded on the examination of the skull of the genera which I then knew, and I figured some of them.

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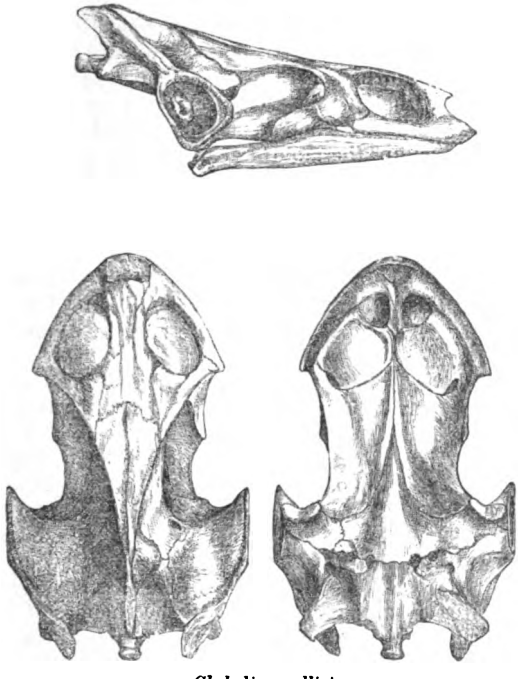
I have since obtained the skull of *Chelodina colliei*. It does not render necessary any alterations in the system; but I would propose that the place of the genus (*Chelodina*) in the series should be rather altered: instead of following *Hydraspis* in *Hydraspidina*, I think that it had better be arranged before it in that tribe, as the skull is more depressed and has a more slender lower jaw, and many other characters render it intermediate in form between the genera *Hydraspis* and *Chelys*.

Fig. 17.



Chelodina colliei.

Fam. TRIONYCHIDÆ.

When my "Revision of the Species of *Trionychidæ*" was read, on the 23rd February, 1864 (see P. Z. S. 1864, p. 76), I was in doubt whether the alveolar surface of the jaws of these animals did not change in form as the animal increased in age, this doubt being caused by receiving from West Africa skulls from the same locality which chiefly differed in size and in the form of the alveolar surface. The British Museum has since received other specimens from West Africa; and after examining them I am satisfied that the skulls referred to belonged to two species, and that the difference of form and structure above mentioned is permanent, and found in young speci-

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mens as well as old of the two species; and the examination of the jaws of the young specimens of other species in the Museum collection has convinced me that very little, if any, change of form occurs in the alveolar surface of the soft Mud-Turtles of the same species from youth to old age, and that the various forms of the alveolar surface afford excellent characters for the distinction of the species and genera of the group, and are also in conformity with their habits and food. Extending the examination to the mouth of old and young specimens of Tortoises of other families, I find that these characters are equally permanent in them.

When the above-mentioned essay was prepared, as we had only a limited number of skeletons, I was obliged to leave in it a number of species doubtful as to the genera to which they ought to be referred. Having discovered that the characters afforded by the alveolar process were the same in the young specimens as in the older ones, I was induced to examine the mouths of all the young specimens which we had in spirit in the British Museum; and finding that, by very careful preparation and manipulation, I could open the mouths of the stuffed specimens in the same collection without in the least degree injuring them, I have examined the mouth and alveolar surfaces in all of them, and thus satisfied myself of the permanence of the characters that these afford, and have been able to determine with certainty the systematic position of some species, which was before doubtful.

This reexamination has also shown me the permanence and the importance, as a specific character, of the manner in which the odd bone in front of the bony dorsal disk is developed, and whether it is in an early or late stage of its development that it becomes pitted like the rest of the bones of the disk, and when it becomes united to the front bone of it.

These additions to my knowledge of the structure and development of the animals induce me to propose the following amended arrangement of them. A natural arrangement of the genera can only be prepared by taking account of all the changes of the animal during growth, and deriving the characters from it in its perfect state. The young specimens are required in order to know the coloration of the species, the adult to know the perfect development of the sternal callosities, and those of intermediate ages to give the manner the odd bone in front of the dorsal disk is developed, and when and how it becomes fitted like the other bones of the back-shield; but this has rendered it impossible to interpolate in their proper place in the system those specimens in the Museum which are only in a young or imperfect state of development, not showing the sternal callosities or the true form of the dorsal disk.

The Mud-Turtles with depressed head and thin depressed skull have a very short face, and the eyes only a very short distance from the end of the nose; all the genera which have a higher, strong, hard skull have a short face and a convex rounded forehead, except *Tyrse*, which has an elongate conical face, and the eyes considerably further back.

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The genera of the latter group may be arranged according to the number of the sternal callosities, thus:—

I. Sternal callosities two, lateral: *Aspilus, Rafetus, Dogania.*
II. Sternal callosities four, lateral and anal: *Trionyx, Potamochelys, Pelochelys, Chitra, Tetrathyra, Platypeltis.*
III. Sternal callosities six, lateral, anal, and pectoral; the latter transverse and developed late: *Landemania.*
IV. Sternal callosities seven: *Heptathyra.*
V. Sternal callosities nine (or ten): *Emyda.*
VI. Sternal callosities fifteen, and often some subsidiary ones: *Cyclanosteus* and *Baikiea.*

The development of the pittings on the surface of the odd bone in front of the bony dorsal disk affords good generic characters.

1. It is smooth to a comparatively later period, even after the sternal callosities are developed in *Aspilus.*

2. It is pitted in the centre in very young, and gradually becomes more covered with pits in young specimens in *Trionyx, Potamochelys,* and *Tyrse.*

The Mud-Turtles with a depressed thin skull and very short face have a broad flat palate and scarcely any indication of a central groove in front of the internal nostrils, and only a slight depression, if any, behind them; whereas in the more or less oblong, thick, solid skulls the palate is more or less concave, and almost always has a central groove in front and two more or less deep concavities behind the internal nostrils. The extent and form of the depressions afford very good generic characters.

The skulls of the *Trionychidæ* may be arranged in sections thus:—

1. The central groove in front of the internal nostrils narrow and—
   a. Deep: *Landemania, Sarbieria, Potamochelys,* ? *Platypeltis, Callinia,* ? *Emyda.*
   b. Very shallow: *Aspilus.*
2. Central groove in front of the internal nostrils short, triangular, narrow in front: *Cyclanosteus, Baikiea, Tetrathyra.*
3. Central groove in front of the internal nostrils wide and shallow, but well marked: *Trionyx, Rafetus, Dogania, Tyrse.*

The form of and the extent of the development on the edge of the jaws afford excellent characters, and show the differences in the habits of these animals. In the Mud-Turtles with depressed, thin, light skull, and short face, the alveolar edges of the jaws are thin and linear. In those which have a more or less high, solid, strong skull, the edge of the lower jaw and the surface of the upper one that meets it offer several variations. The genera may be arranged by the different forms of the alveolar surface, thus:—

1. The edge of the lower jaw flattened and broad in front and on the sides: *Trionyx, Aspilus, Rafetus, Baikiea.*

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2. The front edge of the lower jaw narrow; the inner surface of the front part of the jaw shelving inwards.

a. In some of these the hinder part of the sides of the edge is more or less expanded and flattened out into an alveolar disk: *Dogania, Potamochelys, Cyclanosteus.*

b. In others the sides of the edge are as narrow as the front part: *Tyrse, Platypeltis, Callinia.*

The genera of the family may be thus arranged:—

Section I. *The head ovate or oblong, face moderate. Skull strong, thick, solid.*

A. *The sternum contracted behind, without any flaps over the hind legs.*

a. Nostrils small, far apart, on the sides of the end of the proboscis.

1. AMYDA. *A. mutica.*

b. Nostrils moderate, circular, close together in the middle of the end of the proboscis, with a small lobe on the inner side.

* *Head short, forehead convex. The front and sides of the lower jaw with a broad, expanded, flat or slightly concave alveolar surface. Anterior palatine groove deep.*

α. Sternal callosities six.

2. LANDEMANIA. *L. irrorata.*

β. Sternal callosities four.

3. TRIONYX. Head short, forehead convex. Anterior palatine groove broad, shallow. Alveolar surface of the lower jaw broad, as wide in front as on the sides, rather concave, with a central longitudinal ridge in front. *Hab.* Asia. *T gangetica.*

4. FORDIA. Head short, forehead convex. Anterior palatine groove narrow, linear, deep. Alveolar surface of the lower jaw very broad, as wide in front as on the sides, flat, granular. *Hab.* Africa. *F. africana.*

5. SARBIERIA. Head rather elongate. Anterior palatine groove (in beak) narrow, deep, gradually becoming wider behind (in skull). Alveolar surface (of beak) in lower jaw regularly concave and smooth in front, and slightly concave on the sides. Odd anterior bone of dorsal disk free and smooth in the young specimens. *S. frenata.*

γ. Sternal callosities two, lateral.

6. ASPILUS. Head oblong, elongate. Alveolar surface of the upper jaw wider behind; of the lower jaw broad, rather wider in front

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than on the sides, flat, with a slight concavity on the outer and convexity on the inner side behind. Central anterior palatine groove in the beak narrow, linear, deep, in the skull narrow, elongate, but very slightly marked; the front of the palate is very deeply concave to the front edge of the internal nostrils, and then bent up on the sides of them. Internal nostrils oblong. *A. cariniferus*, P. Z. S. 1864, p. 83, f. 4–6.

7. Rafetus. Head broad, forehead convex. Skull rather longer than broad at the ears. Anterior central palatine groove broad and shallow, rather broader behind than in front. Alveolar surface of the jaws narrow, linear, in the upper jaw scarcely wider in front than behind, in the lower jaw rather wider in front, smooth, slightly concave on the sides, with an oblong slight concavity on each side; the concavity behind the internal nostrils deep, and rather narrower behind. Internal nostrils large, circular. *R. euphraticus*, P. Z. S. 1864, p. 81.

** *The front of the lower jaw with a shelving inner surface and a narrow sharp alveolar edge, and with a more or less dilated concave alveolar surface on the sides, rather narrow behind.*

α. *Face short, rounded; forehead convex; anterior central longitudinal palatine groove narrow, deep, short. Sternal callosities four.*

8. Potamochelys. The alveolar surface of the upper jaw convex, shelving outwards, elongate, only slightly wider behind; of lower jaw rather wide, concave, and shelving inwards in front, rather dilated on the hinder half of the sides, with a slightly shelving oblong concave surface. The upper jaw bent down in front. The palate flat behind; the central anterior palatine groove narrow, deep, short; internal nostrils oblong, anterior, in a deep cavity, partly hooded by the alveolar surfaces of the upper jaw, and with an elongate deep concavity behind each. *P. stellatus*, P. Z. S. 1864, p. 85, f. 7, 8.

β. *Face tapering on sides, narrow in front; forehead shelving. Anterior central palatine groove broad and shallow; internal nostrils oblong, large.*

9. Dogania. Head broad; face very short, narrow in front. Skull depressed, broad; underside of skull straight, not bent down in front. Anterior central palatine groove shallow, broad, rounded in front, very slightly narrowed behind. Alveolar surface of the upper jaw flat, broader behind, of lower jaw moderately broad, with a shelving upper surface, and a sharp, simple alveolar edge, rather expanded and flattened out behind and slightly concave on the surface. Internal nostrils oblong, large,

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obliquely longitudinal, with a short concavity behind each. Sternal callosities two, lateral, narrow. *D. subplana.*

10. PLATYPELTIS. Head oblong, rather depressed; face moderate, rounded in front. Front of the palate with a very wide, shallow concavity, which is rather narrowed and rounded in front, and gradually dilated behind. Alveolar surface of the jaws flat, rather wider behind, of the upper jaw flat in front, rather wider on the hinder part of the sides, with a raised longitudinal subcentral ridge; of the lower jaw broad, flat in front, with a sharp front edge, narrow in the front part and rather dilated on the hinder part of the sides, with a deep central longitudinal groove. Sternal callosities four; the lateral ones twice as wide on the inner as on the outer side; the hinder triangular, front edge sinuous and wider than the length of the straight inner sides. *P. ferox.* (From Pennant's specimen.)

11. TYRSE. Head elongate, face elongate, conical, narrow in front; forehead shelving. Skull, underside scarcely bent down in front. Palate nearly flat; central longitudinal concavity in front of the internal nostrils wide, much wider behind; internal nostrils small, rounded, with a short concavity behind each. The alveolar process of the upper jaw linear, elongate, scarcely wider behind. Lower jaw rather broad, with a shelving concavity on the upper surface in front, with a sharp alveolar edge which is rather wider and has a linear elongate concavity on the upper surface of the hinder half of the sides. Sternal callosities four, lateral and anal; anal triangular, rather broader than long. The hinder costal bones short, forming together a semicircle which is about two-fifths of the width of the costal pieces before them. *T. nilotica.*

12. CALLINIA. Head small, face short, tapering in front. Anterior palatine groove (in head with beak) narrow, linear, deep. Alveolar edge of the beak and upper jaw narrow, linear, tapering behind; of the lower jaw rather wide, shelving inwards, with a sharp edge in front, and narrow, short, and tapering to a point behind. Sternal callosities four, lateral and anal. *C. microcephala* and *C. spicifera.*

B. *Sternum dilated behind, with a flap on each side covering the hind legs.*

* *Margin of dorsal disk cartilaginous, without marginal bones. Anterior central palatine groove short, triangular, broader behind.* African.

13. CYCLANOSTEUS. Sternal callosities 15. Alveolar surface thin in front, broad on the sides. *C. senegalensis.*

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14. Baikiea. Sternal callosities 15 or more. Alveolar surface broad in front and on the sides. *B. elegans.*

** *Dorsal disk with marginal bones.* Asiatic.

15. Emyda. Sternal callosities 9 or 10. *E. punctata.*

Section II. *Head depressed, broad, face very short; eyes anterior. Skull depressed, thin and weak. Alveolar edge of the jaws thin. Palate flat.*

a. *Sternum dilated behind into flaps on each side covering the hind legs. Sternal callosities odd.*

16. Heptathyra. Sternal callosities seven. *H. frenata.*

b. *Sternum contracted behind, without any flaps over the hind legs. Sternal callosities in pairs.*

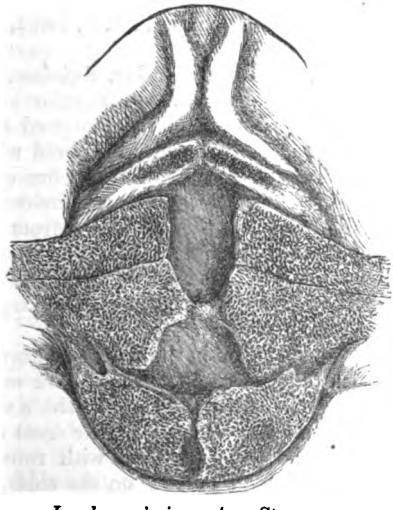
17. Pelochelys. *P. cantorii.*

18. Chitra. *C. indica.*

2. Landemania.

Head elongate; the odd bone in front of the dorsal shield in adult specimens pitted, and united to the first costal by a straight suture.

Fig. 18.



Landemania irrorata. Sternum.

Sternal callosities six—two sternal, two lateral, and two anal; the sternal pair narrow, transverse, and not developed until the animal

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is nearly adult. Jaws strong; alveolar surface broad in front and on the sides, rather broader on the sides behind, that of the lower jaw shelving inwards. The anterior central palatine groove deep, narrow in front, and wider behind.

1. LANDEMANIA IRRORATA.

Head and body closely speckled with minute white dots; the chin and underside of the throat with rather larger but similar white spots.

Trionyx peroculatus, Günther, MS. in B. M.

A specimen (which had been allowed to get dry) now in spirit, from Shanghai. Head black (face without any diverging lines), with very small white speckles very close together, and most of the same size and form, of underside (if any difference) very slightly larger; the skin of the back similarly and equally minutely white-dotted. Sternal callosities six; the anterior pair narrow, band-like, transverse, in the centre of the front of the sternum; lateral callosities narrow in the middle, very broad at the inner end; the anal broad, subtrigonal, united in the middle line by a truly dentated suture.

2. LANDEMANIA? PEROCELLATA.

Head olive, with diverging brown lines from the eyes and across the forehead; chin and throat with large white spots.

Trionyx perocellatus, Gray, Cat. Tort. B. M. p. 48; Cat. Shield Rept. p. 65, t. 31.

Potamochelys? perocellatus, Gray, P. Z. S. 1864, p. 86.

Hab. China and Chusan.

A specimen in spirit, received from Mr. Swinhoe, from Formosa. The front of the lower jaw with a flat triangular alveolar surface; the central groove in the palate before the internal nostrils narrow, deep, wider (sublunate) quite in front. Forehead with a narrow interrupted dark line from the front canthus of one eye to the other. Face with five diverging brown lines from the underside of the eye—the three front to the lower lip, the two hinder from the hinder canthus of the eye across the temple. Sternal callosities four; the hinder pair subtrigonal, with the angles rounded, and well separated. Sides of lower jaw, chin, and throat with large, symmetrical, but different-shaped white spots.

A stuffed half-grown specimen in the British Museum, from China. The bony dorsal disk oblong; the front odd bone united to the first costal by a straight edge, and rugose like it, with a very small pit on each side of the middle of the hind edge; the front edge with a few tubercles in the centre; the hinder flap with roundish tubercles. Sternal callosities four; lateral narrow on the sides, much wider in the middle; the hinder callosities ovate, oblique, with short convex sides and rounded ends. Head moderate; alveolar surface of the jaws broad, rather broader behind; the anterior central palatine groove deep, wide, and rather wider behind.

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3. Trionyx.

The odd bone of the dorsal disk covered with a pitted coat in the young animals. The genus may be divided into sections thus :—

* *Head short, broad (about as long as broad at the ear-bone), rounded in front. The alveolar surface of the lower jaw concave, with sharp raised inner and outer margins, and an indistinct short central ridge on the inner side of the front. The central palatine groove in front of the internal nostrils very wide, as wide in front as behind.*

1. Trionyx gangeticus.

** *The head rather elongate (rather longer than the breadth at the ears), rather tapering in front. The alveolar surface of the lower jaw as wide in front as on the sides, slightly concave, with a central longitudinal ridge across the front, and with a slight concavity on each side. The central anterior palatine groove shallow, narrow in front and wide behind.*

2. Trionyx jeudi. (Fig. 19, p. 218.)

Hab. Java? From the Museum of Prof. Lidth de Jeude.

This species is described from a fine adult skull received from the Utrecht Museum, which, no doubt, was obtained from some of the Dutch colonies. It is most distinct from the Indian species. I have named it after the Professor who formed the Museum. The front longitudinal ridge is very distinct in the jawbone, almost more so than in the horny beak of the jaw. The front of the jaw of the *T. gangeticus* is simply concave, without any indication of a ridge, but only a slight prominence on the inner part of the inner edge; and the alveolar surface on the sides of the lower jaw is flat and with a deep oblong concavity on each side.

In the British Museum there is the head of an adult animal in spirit that was purchased of Mr. Theobald, who obtained it in Pegu. It has the narrow central anterior palatine groove, and the cylindrical ridge across the front of the lower beak, of this section of the genus; but the ridge is only slightly raised and very different from that in the skull from Utrecht.

3. Trionyx formosus. (Plate XV. fig. 1.)

This species is described from a young specimen in spirit, procured by Mr. Theobald from Pegu.

The back shield olive, with four very large black-eyed spots, the central spot circular, black, with a narrow white margin, and a dark brown ring close to it, which is surrounded by a larger pale brown ring, separated from the inner one by a broad olive space. The outer ring forms part of a regular series of netted dark lines, which are symmetrical on the two sides of the keel, forming a large open space in the middle of the back, and a smaller one near the margin and on the hinder part of the disk. The underside of the margin of the disk sooty grey, paler in part, with a white edge on the margin

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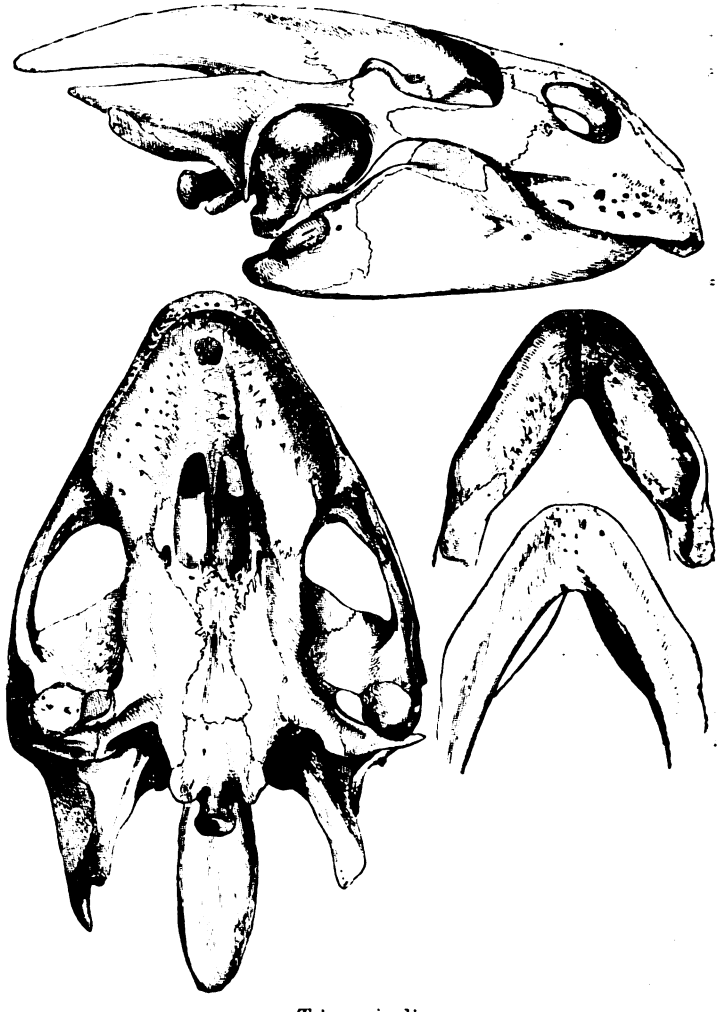
Fig. 19.



Trionyx jeudi.

of the shield. The upperside of the limbs olive, with small white spots. The head and back of the neck olive, varied with black-edged white spots, which are of various sizes, but symmetrically disposed on the two sides. There is a small oblong white spot on each temple, and an irregular larger white spot just before the angle of the mouth, and a large white spot below on each side, and a larger spot in centre of the hinder part of the gullet, and a series of small white

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spots on the flap of the upper lip. The hinder part of the head is encircled by a broad black-edged white band or collar, which is interrupted by a small olive spot in the middle of the back of the neck. The collar is broader and more diffused on the sides of the throat; it gives off a horizontal streak from its hinder side nearly as broad as itself, which is extended for a short distance on the sides of the neck. The alveolar surface of the lower jaw broad and slightly concave.

Hab. Pegu.

In its young state this *Trionyx* is one of the most ornamental species, the dorsal shield being decorated with four large eyed spots, each surrounded by several concentric rings of different width, and the white interrupted collar on the neck is very striking. It has the four large spots on the dorsal shield so common with the young state of *Trionyx gangeticus*, figured in that state in my 'Illustrations of Indian Zoology' as *Trionyx ocellatus*, which is copied from Dr. Buchanan Hamilton's drawing of *Testudo ocellatus*. But in this species and in the more advanced state of the young animal figured in my 'Indian Zoology' as *Trionyx hurum*, from another of Dr. Buchanan Hamilton's drawings, there is a yellow spot on each temple just behind the eyes; while in *T. ornatus* the temples are olive, and the white collar is much further back—as far from the back edge of the eyes as the eyes are from the tip of the nose.

The upper part of the head is olive, very closely and minutely dotted with black; the underside is uniform greyish white. The nostrils are very close together, with a slight lobe on the inner side of each. This may be the species indicated as a *Trionyx phayrei* by Mr. Theobald (Journ. Proc. Linn. Soc. vol. x. p. 18), but so indistinctly described as not to be recognizable.

4. Fordia.

Head short, broad; face short, forehead convex. Anterior palatine groove narrow, linear, deep. Alveolar surface of the beak of the upper jaw very wide, flat; of the beak of the lower jaw very broad, as wide in front as on the sides, acute, flat, granular, with a very indistinct indication of a longitudinal central ridge. The hinder pair of costals about half as broad as the pair of costals before them. Skull ——? *Hab.* Africa.

Known from *Trionyx* by the flatness and width of the alveolar surface of the beaks. I have named this genus after Mr. Ford, who has illustrated so many of my papers.

Fordia africana.

The head and neck (and most likely the other parts of the body, limbs, and dorsal shield) olive, minutely and regularly speckled with small white spots. The hinder sternal callosities triangular, rather longer than wide, straight in front and on the inner side, very acute behind.

Hab. Upper Nile, Chartoum (*Petherick*, adult male and female in the B. M.).

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These specimens are those referred to as having been sent from Chartoum by Mr. Petherick in the account of *Tyrse nilotica* in the P. Z. S. 1864, p. 88, where they were regarded as being specimens of the common Nilotic Mud-Tortoise; but the examination of the alveolar surface of the jaws at once showed that they had no affinity with that genus, but must be more allied to the Gangetic *Trionyx*; and then I observed that they had the shorter face of that group, which character had been previously overlooked. The alveolar surface of both jaws is very wide, nearly flat (not concave in front as in *Trionyx gangeticus*). The species is, no doubt, peculiar to the Upper Nile, and had not been before observed.

The examination of the alveolar surface of Du Chaillu's specimen, which had been named *Aspidonectes aspilus* by Mr. Cope, showed that it was (as I had previously determined it to be) identical with *Tyrse nilotica* of the Lower Nile. The head and neck of this large specimen, when the skin was wet, showed that it was speckled with white like the true Nilotic Mud-Tortoise *Tyrse nilotica*. The sternal callosities rather differ in form from those of *T. nilotica*; the hinder ones are larger, and more acute behind. The last of the ribs are also wider, compared with the others, than in that species.

A young specimen in spirit, from the Upper Nile, obtained from Mr. Petherick, probably belongs to this species. The head, neck, feet, and dorsal disk covered with close, small, dark-edged, annular white spots, those on the sides of the head and, especially, on the chin and throat being rather the largest.

5. Sarbieria.

Head rather large; eyes lateral, subsuperior. Jaws strong; alveolar surface (of beak) broad, broader and more dilated behind, surface shelving inwards,—of lower jaw deeply concave, smooth, and with a sharp edge in front, and slightly concave on the sides. The central anterior palatine groove narrow and deep, with a short slight dilatation in front and with rather diverging sides behind. Dorsal disk small. Costal bones separate. Front odd bone in the young and half-grown specimens separate, broad, transverse, and with a smooth upper surface. Sternal callosities four; lateral narrow on the outer side; anal ——?

This genus is in many respects allied to *Doyania*; but it appears to have four callosities, and the upper surface of the back is concave; it is narrow in front, and wider behind. But it is difficult to compare a head with the beak on with a prepared skull without a beak.

Sarbieria frenata.

Trionyx frenatus, Gray, Cat. Shield Rept. p. 67.
Potamochelys? frenatus, Gray, P. Z. S. 1864, p. 87.
Hab. Singapore (*Wallace*).

A stuffed specimen in the British Museum, "of a young female with full-sized eggs," from Mr. Wallace. The odd bone in front of the dorsal disk entirely covered with the skin, and smooth. The

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sternal callosities are scarcely developed, only showing a slight roughness on the surface. Head olive, with a black central streak from the snout to between the eyes, which divides behind into three diverging streaks on the crown and nape; a streak from the nose, through the eye, and continued on the temple, to the side of the neck. The alveolar surface of the upper and lower jaws very broad the whole length of the outer edges; the alveolar surface of the upper jaw is so large as to cover the greater part of the palate, much more so than in *Trionyx gangeticus*; in the lower jaw it is very broad, as broad behind as before, and slightly concave. The central palatine groove in front of the internal nostrils narrow, deep. The bones of the dorsal shield are distinctly marked and separate; the vertebral plates are very narrow, nearly twice as long as broad; the costal ones are linear, scarcely broader at the outer ends, the last one being the least and narrow at the outer end. The odd bone in front is quite separate from the granular buckler, covered with skin, and quite smooth. The lateral sternal callosities are scarcely developed, only showing a slight roughness on the surface. The hinder pair of sternal bones are broad at the inner end and united together in front of the inner edges by two broad lobes.

Very like the figure in Cuvier's 'Ossemens Fossiles,' v. t. 23. f. 5.

6. Aspilus.

The odd bone in front of the dorsal shield in the younger specimen is separate, and smooth on the upper surface, and it becomes pitted and united to the costal by a straight suture in the adult animal.

8. Potamochelys.

The odd anterior bone of the dorsal disk in the young animal is pitted on the surface and separate, but in the older ones it is united to the dorsal disk by a straight suture. The skull resembles that of *Cyclanosteus*.

12. Callinia.

Head small, elongate; face narrow, tapering; eyes lateral, superior. The jaws weak; the alveolar plates narrow at the hinder part, triangular and broader in front. The lower jaw slender, narrower at the hinder part of the sides. The central palatal groove in front of the internal nostrils rather wide and deep. The dorsal disk oblong, broad. The odd bone in front of the dorsal shield separate, transverse, and pitted in the young animal; in the older one it is united to the front costal bones by a straight edge with two round perforations, one on each side of the central part. The vertebral callosities narrow. The costal callosities scarcely broader at the outer edge, except the fifth and sixth pairs; the hinder pair short, and narrow at the outer ends. Sternal callosities four; the lateral pair broad on the inner side; the hinder or anal pair oblong triangular, oblique, with a straight inner edge.

Aspidonectes, sp., Agassiz, not Wagler.

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1. CALLINIA MICROCEPHALA.

Potamochelys? microcephalus, Gray, P. Z. S. 1864, p. 87.
Hab. Sarawak (Wallace).

2. CALLINIA SPICIFERA.

Trionyx spiciferus, Lesueur, Mém. Mus. xv. p. 258, t. 15.
Trionyx ferus, Holbrook, Herp. N. A. ii. t. 1.
Tyrse argus, Gray, Knowsley Menag. t.
Hab. North America.

14. BAIKIEA.

In the "Revision of the species of *Trionychidæ*," in the P. Z. S. 1864, p. 95, I figured the skull of an African Trionychid with a very broadly dilated concave alveolar surface to the jaws, which I considered might perhaps be the adult state of the jaws of *Cyclanosteus senegalensis*. In my paper on the genus *Tetrathyra*, in the Society's 'Proceedings' for 1865, I thought that it might perhaps be the skull of the Trionychid which I then described under the name of *Tetrathyra*. Since that time I have been able to examine the skull of a young Trionychid from Africa, which has the broadly expanded alveolar surface of the adult skull that I figured. This shows that the form of the alveolar surface does not depend on the age of the specimen, and that it is the character of an additional genus, which I have named after Dr. Balfour Baikie, from whom we have received so many species from Central and Western Africa.

Unfortunately there are only skulls of adult and a specimen in spirit of a young animal of this species; so that we do not know the form and number of the sternal callosities, especially those of the adult form. I suspect that the thorax in the British Museum, received with the jaws, may be that of an adult animal; but there is no material to show that this is the case. If it is, the sternal callosities are as in *Cyclanosteus* with some smaller additional ones in front, as in the specimen figured as *Cyclanosteus senegalensis*, var. *callosa*, Gray, P. Z. S. 1865, p. 424, f. 1.

BAIKIEA ELEGANS. (Plate XV. fig. 2.)

The young specimen in spirit has the back of the thorax dark olive-brown with large yellow spots, which are somewhat similar but not quite symmetrical on the two sides of the central keel; and there is a series of large but smaller square or roundish yellow spots on the margin. The sternum and under surface of the margin blackish, with yellow spots, and a narrow yellow edge to the lobes of the sternum. The underside of the shield is varied with yellow on the edges. Head grey-brown, white-spotted. Thorax white.

The young specimens of *Cyclanosteus senegalensis* in spirit are known from those of *Baikiea elegans* by having the white spots on the crown and sides of the head nearly of the same size; in *B. ele-*

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gans the spots on the crown are small and those on the sides of the head are larger and unequal-sized.

III. THE SEA-TURTLES—CHELONIA.

The common Turtle, covered with horny plates, has a skull as different from that of the coriaceous Turtle, which has the bones of the body covered with a soft skin, as the two animals are different in external appearance. I formerly regarded the coriaceous and the scale-bearing Turtles as forming two distinct families (Annals of Philosophy, 1825, vol. x. p. 212); but having received from Mr. Collie, as stated in the 'Catalogue of Shield Reptiles,' a skull of a true Chelonian as that of a coriaceous Turtle (*Sphargis*), and finding they were so much alike, I was induced to reconsider the question and to unite *Sphargis* and *Chelonia* in the same family, regarding them as distinct tribes characterized by the nature of the surface. Such a mistake was excusable, as I am not aware that the skull of the adult *Sphargis* is in any European collection, or has ever been figured, and I had overlooked the figure of the skull of the very young specimen that is given in Prof. John Wagler's 'New System of Amphibia,' t. 5. f. 1. In that work the skulls of the young *Chelonia* and young *Sphargis* are figured side by side; therefore the distinction can be easily seen. The great peculiarity of the skull of the genus *Sphargis* consists of the opening to the nose being in the upper part of the head, the nose-cavity being carried up by the elongated erect form of the intermaxillary bone; the orbits are also exceedingly large.

Fam. I. CHELONIADÆ.

Cheloniadæ, Gray, Ann. Phil. 1825, x. p. 212.

The thorax covered with distinct horny plates; the sterno-costal suture covered with a longitudinal series of sterno-lateral plates. Nose anterior, erect; the nostrils anterior, at the upper edge of the nose. Upper jaw simple, or rather hooked in front. Eyes moderate.

Skull oblong, crown flat behind; orbit moderate, nose truncate, erect; nostrils anterior, on the upper part of the nose. The intermaxillary bone small, narrow, short, erect.

The study of the skulls of these animals first led me to observe the importance of the alveolar chewing-surface of the jaws for distinguishing the genera. The Turtles may be divided into two groups thus:—

* *The alveolar surface of the upper jaw concave, broad, narrower behind, with a single linear central ridge. Lower concave, with a rather strong ridge on the inner side.* Carnivorous.

1. CARETTA.

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** *The alveolar surface of the upper jaw with two arched ridges, the inner one near the inner margin, the outer near the outer margin, and interrupted by a deep pit in front. Lower one strongly toothed on the edge, with a subcentral ridge, with a large conical prominence in the middle, and a deep pit on each side in front of it.* Algivorous.

2. CHELONIA.

3. MYDAS.

Chelonia††, Gray, Cat. Shield Rept. p. 75.

Fam. II. SPHARGIDIDÆ.

Sphargididæ, Gray, Ann. Phil. 1825, x. p. 212.

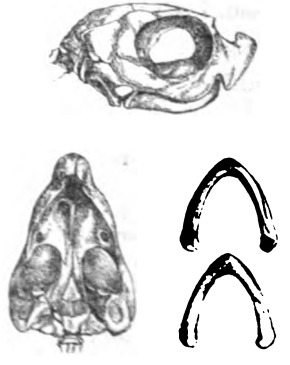
The thorax covered with a continuous soft skin. Nose blunt and broad; nostrils on the upper surface of the nose. Upper jaw with a deep notch on each side. Eyes very large.

Skull oblong; crown swollen, subglobose behind. Orbits very large. Nose-cavity superior, carried up by the elongated erect intermaxillary bone. Maxillary bone with a deep notch in the front of the lower edge, near the intermaxillary. Lower jaw produced, acute, bent up in front.

Dermatochelydæ, Fitzinger; Wagler, Amph. p. 20, t. 1. f. 1.
Sphargiidæ, Agassiz, Contrib.

SPHARGIS, Merrem=*Coriudo*, Fleming; *Sytina*, Wagler; *Dermatochelys*, Fitzinger.

Fig. 20.



Sphargis mercurialis.

Mr. E. Gerrard has prepared a beautiful skeleton of a very young specimen of this genus, about 4 inches long. It is a most curious preparation, with its odd-shaped head with very large nasal cavities and orbits, extremely large fore fins with extremely slender fingers,

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and a short hind foot like the skeleton of a human hand, with the short metatarsi and thumb springing from one side of the base of them, as if it might be opposable.

The fingers and toes five; the fingers long, slender, the second, third, and fourth very long, of four joints, lower large, the last joint small and short; the first and third toes of three joints, the first strongest, the fifth shortest. The hind feet much like the human hand. The toes short; the thumb short, stroug, from the base of the metatarsus, the other four toes longer, subequal, the third or middle toe being rather shorter, the second and fourth subequal, and the fifth rather the shortest and most slender. Sternal bone very narrow, only forming a large, oblong, elongated ring.

See also Wagler, N. Syst. Amph. t. 5.

DESCRIPTION OF PLATE XV.

Fig. 1. *Trionyx formosus*, p. 217.
2. *Baikiea elegans*, p. 222.

7. On the Incisor Teeth of the African Rhinoceros.

By Dr. J. E. Gray, F.R.S.

The skull of the nearly adult female specimen of *Rhinaster keitloa* in the British Museum killed by Mr. Jesse in Abyssinia has the small intermaxillary bones well preserved. They are not united together in front; the dental edge has unfortunately been injured in the carriage from Abyssinia; but they each exhibit small cylindrical blunt rudimentary incisor teeth. The intermaxillary of the right side has a large tooth on the hinder part; the intermaxillary on the left side has a middle-sized tooth in the middle of the dental surface, and a very small rudimentary tooth behind it near the hinder edge of the bone. These teeth would induce one to believe that in the perfect state there are two, or perhaps three, incisors in each intermaxillary; for close to the symphysis is a small alveolus in the front part of the dental margin on each intermaxillary; but these do not now contain any rudimentary teeth. Professor Vrolik has described the lower incisor teeth in the skull of the young African Rhinoceros (see Ann. d. Sci. 1837, p. 20, t. 1 B); but I believe that they have not before been observed in the adult animal.

If the observations of MM. Lefebvre, Petit, and Dillon, in the 'Voyage en Abyssinie,' Paris, are to be relied on, there must be other Rhinoceroses in Abyssinia than those we have yet seen. They state, "Il y a plusieurs espèces de Rhinoceros en Abyssinie. Il y en a qui ont deux, trois et quatre cornes: cela est certain; il l'est moins qu'il y en ait à cinq et six, mais on l'assure. Sur l'animal vivant elle est toujours mobile, sans os à l'intérieur" (pp. 26, 27).

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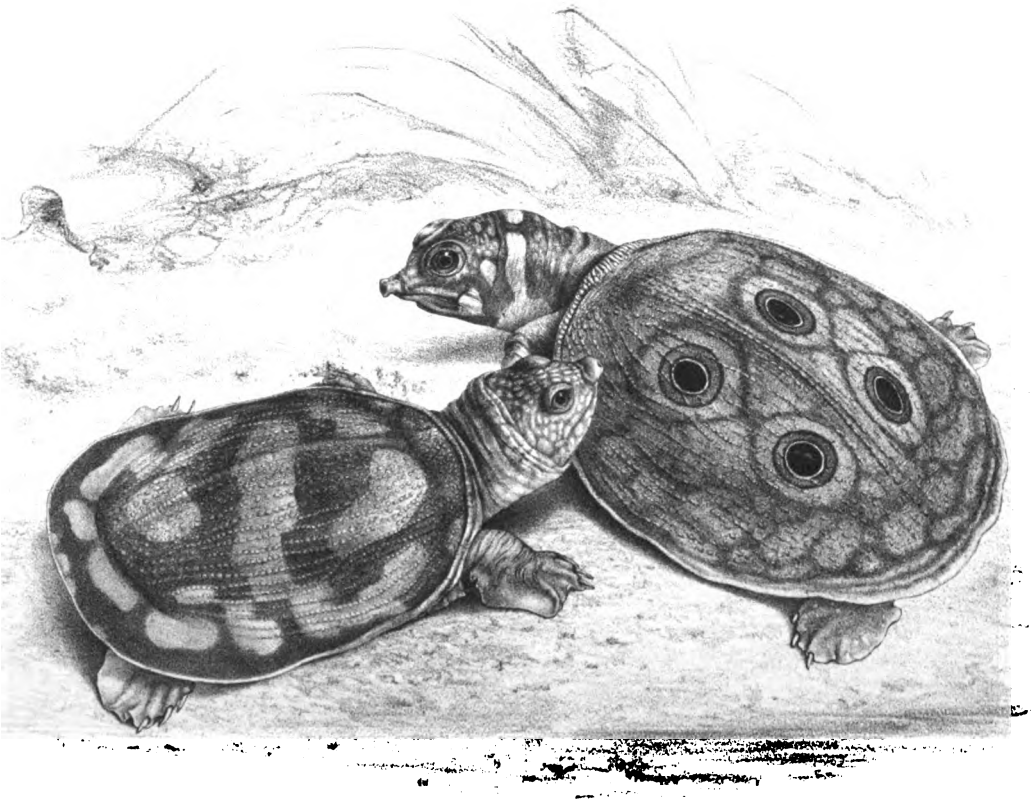

1 TRIONYX FORMOSUS 2 BAIKIEA ELEGANS

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