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On the STATUS of CHELONIA DEPRESSA, *Garman*

By Dene B. Fry, Junior Assistant.

(Plates xix-xxii., and Figs. 38-49.)

The recent species of marine turtles represent the few surviving forms of a once flourishing group, which reached its zenith probably in late Mesozoic times. There no longer exist such gigantic and diversified monsters as *Archelon*, *Protostega*, and *Miolania*, but such a uniformity of structure prevails that only four allied genera are admitted. It is natural that three of these, which occasionally visit the European coasts, should have been known to Linnæus, but it is surprising that the remaining two, *Colpochelys kempii*, Garman, and *Chelonia depressa*, Garman, should have remained unknown to naturalists till comparatively recently, showing that even now we cannot safely consider our knowledge of the marine turtles as complete.

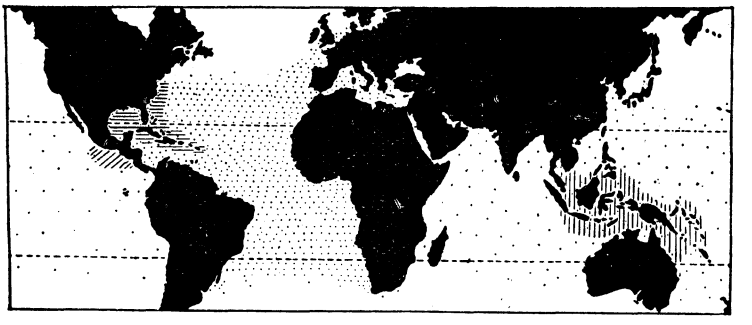

Fig. 38.—Map showing the areas from which the various marine turtles have been recorded. The true habitats are rather more restricted. The thickly dotted area shows the distribution of *Chelonia mydas*, *Caretta caretta*, and *Eretmochelys imbricata*. The sparsely dotted region = *Chelonia japonica*, *Caretta olivacea*, and *Eretmochelys squamosa*. Horizontal striæ = *Colpochelys kempii*. Perpendicular striæ = *Chelonia depressa*. Oblique striæ = *Caretta remivaga*. (a supposed species needing confirmation).

Of the five[1] marine turtles, the Green, Hawksbill, and Loggerhead are almost cosmopolitan in habitat, the other two being peculiarly restricted (fig. 38). *Colpochelys kempii* is recorded only from the Gulf of Mexico and as far north as

[1] A sixth species of turtle has been described by Dr. Hay (Proc. U.S. Nat. Mus., xxxiv., 1908, p. 194, pl. x., fig. 1-3, pl. xi., fig. 5) as *Caretta remivaga*, from the Gulf of Tehuantepec, Western Coast of Mexico. It is founded on two skulls, one of which was earlier referred by Dr. Baur (Amer. Nat., xxiv., 1809, p. 487) to *Lepidochelys olivacea*, Esch., and it certainly needs confirmation.

Atlantic City, New Jersey, on the Atlantic Coast of the United States, while *Chelonia depressa* is known from the East Indies, Northern and North Eastern Coasts of Australia and Torres Strait.

The limited habitats of *Colpochelys* and *C. depressa* suggest that (1) these two species are more recent specialisations,[2] and (2) that they are weaker swimmers, lacking the nomadic instincts of the better known forms. The distribution of each points to their having arisen in the two great coral-reef areas of the world, the former from a *Caretta*-like ancestor in the West Indies, and the latter from a *C. mydas*-like stock in the tropics of the Eastern Hemisphere.

Dr. R. E. Coker[3] points out that, as *Colpochelys* breeds considerably before *Caretta*, in fact in the winter instead of the summer months, this difference in breeding habit may suggest the possible means of isolation of the two forms in past times. This cannot be said of *C. depressa* however, for it breeds all the year round, but peculiarly with a slight falling off in the months August to November which chiefly form the breeding season of *C. mydas*. Nevertheless, that *C. depressa* is a weaker swimmer than *C. mydas* is evident, for the flippers are much smaller and not so well supported by hard, horny plates, while the reflexed margins and broader body cannot be so well suited to a speedy passage through the water. It is quite possible then, that the former character, arising through some local influence, may have been a factor in the past separation of *C. depressa* from a *C. mydas*-like ancestor.

The Green, Hawksbill, and Loggerhead turtles have by some authors[4, 5], been recognised as each constituting two species, one confined to the Atlantic Oceans and the other to the Pacific and Indian Oceans. No clear definitions of the Pacific species have yet appeared, the Atlantic forms being

[2] The presence of highly developed areolæ (see post), which I regard as a specialised advance on the "larval shields" of *C. mydas*, and a slight reduction in the extent of the temporal roof (see post), lend support to this view.

[3] Coker—Bull. N. Carol. Geol. Surv., 14, 1906, p. 60.

[4] Garman—Bull. Mus. Comp. Zool., v., 1880, p. 123, and Bull. U.S. Nat. Mus., 25, 1884, p. 301.

[5] Stejneger—Bull. U.S. Nat. Mus., 58, 1907, p. 506.

regarded as the true Linnean species, and on this account I regard the division as one needing confirmation, although, to show the significance of such a separation, their distribution is illustrated in fig. 38 as though it was an established one.

Chelonia depressa is a species founded by Mr. Samuel Garman [6] in 1881, on some young and adult specimens in the Museum of Comparative Zoology at Havard University, from the East Indies and North Australia. In his "Catalogue of the Chelonians in the British Museum," published in 1889, Dr. G. A. Boulenger[7] considered this species as synonymous with the Green Turtle, *Chelonia mydas*. In May 1890, Dr. George Baur[8] examined the type specimen and came to the conclusion that, not only was Dr. Boulenger's transference wrong, but that in his opinion Garman's species was generically distinct. Later, in 1908, Mr. A. R. McCulloch[9] described a new genus and species of turtle from Port Darwin, North Australia, under the name of *Natator tessellatus*. At the time he had only a young example possessing very distinctly areolated scutes, quite absent in Garman's older specimens, and which, without an intermediate series, certainly appeared very different. I am now able to show that, as McCulloch's type otherwise agrees with Garman's specimens. they must be considered as belonging to the same species, for the areolæ prove to be present in the juvenile condition only. It is mainly with the young stages resembling McCulloch's type that this paper deals.

Chelonia depressa was, until quite recently known from Garman's type specimens only. Then Mr. McCulloch described *Natator* whose identity of course was not recognised. While arranging the Chelonians in the Australian Museum I discovered two other young examples, one of which was just hatched, and the other an intermediate stage between this and the type specimen of *Natator*. Another turtle, about twice the size of the type of McCulloch's genus, was collected by Messrs. C. Hedley and A. R. McCulloch at Murray Island, and differs from the type of *Natator* in having soft scutes which are quite smooth and altogether free from areolæ. The general

[6] Garman—Bull. Mus. Comp. Zool., vi., 1881, p. 124.

[7] Boulenger—Brit. Mus. Cat. Chelonia, 1889, p. 182.

[8] Baur—Amer. Nat., xxiv., 1890, p. 487.

[9] McCulloch—Rec. Austr. Mus., vii., 1908, p. 126, pls. xxvi-xxvii.

resemblance, however, was very striking, and on placing the four side by side in order of age, it became evident that it was only an older form than the type specimen. This largest specimen, about ten-and-a-half inches in length, appears to be comparable to Garman's youngest ones. *Chelonia depressa* then, emerges from the egg with each scute covered by a "larval shield" which, as the animal grows. becomes an areola almost identical with that found in land tortoises; this is finally shed before the turtle reaches maturity, leaving the smooth scutes described by Garman and figured on Pls. xxi-xxii. As far as I can ascertain these areolæ are unique amongst marine turtles.

Whilst recently at the Queensland Museum in Brisbane Mr. McCulloch was shown some young turtles which he recognised as his *Natator tessellatus*. Mr. H. A. Longman informed him that they were the specimens referred to by Mr. J. Douglas Ogilby[10] as possible hybrids between *Eretmochelys imbricata* and *Caretta caretta*. Later, four other specimens were found, and three of them were kindly forwarded to me by the Director, Dr. R. Hamlyn-Harris, which, with the four Australian Museum examples, make ten specimens in all. Seven of these I have been able to examine, and, with all their data, they are as follow :—

Specimen 1—(Pl. xix., fig. 1 and figs. 39 a-b, 44a).

Loc.—Port Darwin, Northern Territory, North Australia. Collected by Mr. Hugh W. Christie, Lighthouse-keeper at Point Charles. This specimen is evidently just hatched, and is in the Australian Museum.

Specimen 2.

Loc.—New Guinea? Lent by the Queensland Museum, Evidently just hatched.

Specimen 3.

Loc.—New Guinea? Lent by the Queensland Museum. Slightly older than the above.

Specimen 4—(figs. 39 c-d and 44b).

Loc.—Torres Strait. Collected by Mr. Alex. Morton, March 1879. Slightly older than specimen No. 3. In the Australian Museum Collection.

[10] Ogilby—Proc. Roy. Soc. Q'land., xix., 1905, p. 17 (footnote), Keppel Bay, Queensland.

Specimen 5—(Pl. xix., fig. 2).
Loc.—New Guinea? Lent by the Queensland Museum. Slightly older than the preceding one.

Specimen 6—(figs. 40 a-b and 44c).
Loc.—Port Darwin, Northern Territory. North Australia. Collected by Mr. Hugh W. Christie, in June, 1908. This specimen is the type of *Natator tessellatus*, McCulloch, and is in the Australian Museum Collection.

Specimen 7—(Pls. xxi-xxii., and figs. 41 a-b, 42, 44d, 45b, 46b, 47 a-b, 48a, 49f).
Loc.—Murray Island, Torres Strait. Collected by Messrs. C. Hedley and A. R. McCulloch, in September, 1907. This specimen is more than twice the size of the type specimen of *Natator tessellatus*. The head has been cast and skeletonised. In the Australian Museum Collection.

I wish to express my thanks to the following gentlemen who have in various ways assisted me in the preparation of the these pages:—Dr. G. A. Boulenger, of the British Museum; Dr. H. L. Kesteven, of the University of Sydney; Dr. R. Hamlyn-Harris, Director, and Mr. H. A. Longman, of the Queensland Museum, Brisbane; and lastly Mr. A. R. McCulloch, whose kindly interest and advice has been a great help to me.

An early reference to CHELONIA DEPRESSA.—Mr. C. Hedley very kindly called my attention to a note made by John Macgillivray in his "Narrative of the Voyage of H. M. S. 'Rattlesnake,'" which almost certainly applies to this species:—"Turtle forms an important article of food, and four different kinds are distinguished at Cape York and the Prince of Wales Islands. Three of these can be identified as the Green, the Hawksbill, and the Loggerhead species, and the fourth is a small one which I never saw."[11] This information was given to Macgillivray by the natives who were known to be very keen discriminators between even closely allied forms. The specimen of *Chelonia depressa* figured on Pls. xxi-xxii, was bought from the natives of Murray Island, who also recognised it as distinct from the Green Turtle. As we now have an authentic

[11] Macgillivray—Narr. Voy. "Rattlesnake," ii., 1852, p. 21.

specimen of *C. depressa* from Cape York and another from Murray Island near by, there seems to be little doubt that Macgillivray must be credited with the first reference to this species.

Notes on habits, etc.—It is of interest here to note that the Murray Island specimen of *C. depressa* was fed by the natives on herrings, which it ate freely. It appears however, that this need not necessarily be its natural food, for Mr. R. L. Ditmars[12] has recently recorded *Chelonia mydas*, which we have been wont to regard as exclusively herbivorous, feeding freely in captivity on fish, mussels, etc. He writes:—"All showed a preference for fish over other food; they would also eat mussels, oysters and clams—after the mollusks had been removed from their shells; an occasional turtle would nibble at sea-weeds, but immediately left such food when a dead fish was thrown into the tank. Without doubt, while in a wild state, the Green Turtle necessarily feeds largely on marine vegetation." I have examined many yards of Green Turtle intestine in quest of Entozoa, and, although animal food abounded in the vicinity, nothing of that nature was found. As the form of the jaws differs very little[13] from that of *C. mydas*, it is more than probable that under natural conditions *C. depressa* is also herbivorous, which is certainly borne out by Mr. H. W. Christie's remarks quoted below. Throughout the animal kingdom there is no lack of evidence of animals in captivity preferring, and even thriving on a diet that is absolutely strange to them in a natural state.

Mr. Hugh W. Christie, is very firm in his belief as to the distinctness of *C. depressa* from *C. mydas* and forwards the following very interesting notes:—"*C. depressa* is purely a vegetarian so far as my observations go, as also are *C. mydas* and *Eretmochelys imbricata*, whereas the blacks say *Caretta caretta* eats shell-fish, but I have had no chance of observing it. *C. depressa* lays its eggs on all the sandy beaches round here and on some of the islands, namely—Indian, Baresand, Quail

[12] Ditmars—Reptiles of the World, 1910, p. 47.

[13] In a paper by Dr. Baur on various turtles he notes what he considers an important difference in the lower jaw of *C. depressa* (Amer. Nat., xxiv., 1890, p. 487). In the young skull at my disposal the differences are very slight (see post).

and West Peron. On the last mentioned island, possessing five miles of beach, I counted thirteen nests within a space of twenty yards. They come and lay on the beach near the lighthouse, usually at spring-tide. The next spring-tide they return and lay very near the same spot, and so on, for five or six months. They do not seem to have any particular breeding season, but towards the end of the dry season, in the months of August, September and October, there is, if anything, a little slacking off. The females usually lay at night time, and with the aid of a hurricane lamp, of which they take not the slightest notice, I have often watched them preparing their nests and laying their eggs. They twist about so as to harden the surface somewhat before commencing to dig. The hind flippers alone are used in excavating and are worked alternately, being turned outwards like a scoop, a sharp jerk throwing the sand a yard away. The hole made is eight or nine inchs in diameter and one foot or more deep. She then moves her vent over the hole and fifty or sixty eggs are laid in about five minutes. The average number of eggs laid is fifty; the greatest number I have seen is seventy-eight, and the smallest twenty-four. The hole is then filled in and a large mound scraped over it, the front flippers being used for this—thus the eggs are eighteen to twenty-four inches from the surface. She then makes for the sea. The period of incubation is about six weeks. When leaving the nest the young do not run together but spread out and run fan-wise to the water, as I have counted fifty-two separate tracks. The eggs and meat are a great source of food to the blacks; I have eaten hundreds of the eggs but find the meat disagreeable and not nearly so good as that of *C. mydas*.[14] I never saw these turtles basking in the sun. They are apparently a nervous creature in the water but when up on the beaches laying they take notice of nothing and will crawl over a sleeping black or through his camp fire. *C. depressa* is much flatter than *C. mydas* and is shell-less—that is, there are no hard plates, but a leathery skin only envelops the bony skeleton. *C. depressa* is known to the Larrakeyah tribe of blacks as 'Adymer,' to the Bierly tribe as 'Ballan,' and to the Wogite tribe as 'Ingering.'"

[14] This may perhaps be the secret of the absence of this species from the turtle market, and thus, indirectly, the reason for its having been overlooked for so long.

The identity of NATATOR TESSELLATUS *with* CHELONIA DEPRESSA.—I have little doubt that *Natator tessellatus*, McCulloch, founded on a juvenile specimen, is only the young stage of the turtle described by Garman, from adult material, as *Chelonia depressa*. Nevertheless, when McCulloch's description is compared with Garman's, numerous discrepancies will be noticed. To a great extent these are accounted for by one or the other of two reasons. (1) McCulloch's type seems younger than any of the specimens mentioned by Garman as "young"; (2) Garman's types, according to Baur, are dried specimens, whilst McCulloch's type, and indeed all the specimens known to me, are spirit or formaline specimens. The first would account for Garman's statement that the plates are smooth in both the young and adult. The second for the remark that the paddles are indented between the digits, which is easily understood, as they are covered by soft wrinkled skin instead of hard horny supporting plates as in *C. mydas*; this last character seems to have escaped Garman's notice. I am at a loss to understand his statement that in the young the carapace has three low ridges. There is certainly no trace of them in my specimen, but perhaps this too can be accounted for by the shrinkage due to drying.

The status of the genus NATATOR, *McCulloch.*—Garman[15] described *Chelonia depressa*, of which *Natator tessellatus*, McCulloch,[16] becomes a synonym, as a new species only. On examining the type specimen, nine years later, Dr. Baur[17] made the following remarks:—"*Chelonia depressa*, Garman, which is considered by Boulenger as a synonym of *Chelonia mydas*..... does not belong to the genus Chelonia at all.....The lower jaw has a greatly developed hook very much like *Lepidochelys kempii*, Garman, but there is a median ridge on the symphysis, something like *Lepidochelys olivaceus*, Eschsch. Until the skull of this species is known it is impossible to decide whether it belongs to Thalassochelys, Lepidochelys, or, what I think probable, to a new genus." If *Chelonia depressa* really represents a distinct genus, therefore, Mr. McCulloch's name *Natator* must be used to designate it, but as shown by the following pages, a final judgment is best reserved until the adult skull has been studied.

[15] Garman—Bull. Mus. Comp. Zool., vi., 1881, p. 124.
[16] McCulloch—Rec. Austr. Mus., vii., 1908, p. 126.
[17] Baur—Amer. Nat., xxiv., 1890, p. 487.

McCulloch[18] separated the genus *Natator* from *Chelonia* as follows:—"From that genus, however, it is separated by the different arrangement of the shields of the head, and the distinctly paired nuchal. Also the upper shields of both head and body have each a large symmetrical areola placed rather behind their centres." The most important of these characters, the paired nuchal, we now know to be inconstant. It is not present in any of Garman's examples. In the four Australian Museum specimens it is divided in the type alone, while Mr. Longman informs me it is paired only in two cases out of the six in the Queensland Museum. The head shields do not differ fundamentally from those of *C. mydas*, the most important differences being the larger supraocular in *C. depressa* and the presence of only three[19] postocular scales instead of four or five. The areolated shields of the young, and the soft, integumentary covering of the half-grown specimen, are good distinguishing characters, and may prove of generic value when further adult material comes to light. The rounder outline, the deeper nuchal bay, and the reflexed marginals, together with the predominance of wrinkled skin on the flippers, are, without any knowledge of the adult condition, good specific characters only. The differences noted in the jaws of the two forms by Dr. Baur[20] are not present[21] in my specimens. The single young skull available to me (see post and figs. 47a-b, 48a, and 49f) diverges considerably from that of *C. mydas*, but here again we are in ignorance of the true adult characters. It will thus be seen that the re-discovery of the adult is very desirable, for on its condition hinges the whole question of the validity of the genus *Natator*. Meanwhile, however, in the absence of any established features on which to characterise that genus, it seems best to regard it as synonymous with *Chelonia*. In this view Mr. McCulloch concurs with me.

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[18] McCulloch—Rec. Austr. Mus., vii., 1908, p. 126.

[19] Garman—Bull. Mus. Comp. Zool., vi., 1881, p. 125 gives the "postorbitals" as 3-4.

[20] Baur—Amer. Nat., xxiv., 1890, p. 487.

[21] I think it is possible that the produced horny sheath of the lower jaw, which would be present in a stuffed specimen, is the real cause of Dr. Baur's remarks. On the removal of this however, the jaws are almost identical with those of *C. mydas*.

Key to the two species of CHELONIA :—

(a)—Young with distinct areolæ. Three postocular shields. Carapace bow-shaped in transverse section. Limbs covered mainly by wrinkled skin.....
C. depressa, Garman.

(b)—Young with only very thin scales covering the scutes. Four or five postoculars. Carapace tectiform in transverse section. Limbs covered by hard horny plates.....
C. mydas, Linnæus.

Re-description and Synonymy of CHELONIA DEPRESSA.—The dried condition of Garman's specimens has been the cause of several misleading statements. On this account I have not intercalated his remarks in the re-description which follows :—

CHELONIA DEPRESSA, *Garman.*

(Plates xix., xxi., xxii.; Figs. 39, 40, 41a and b, 42, 44, 45b, 46b,47 a and b, 48a, 49f).

Chelonia depressa, Garman, Bull. Mus. Comp. Zool., vi., 1881, p. 124.
Chelonia ? depressa, Baur, Amer. Nat., xxiv., 1890, p. 487.
Chelone mydas, Boulenger, Brit. Mus. Cat. Chelonia, 1889, p. 183 (part).
Natator tessellatus, McCulloch, Rec. Austr. Mus., vii., 1908, p. 126, pls. xxvi-xxvii.

Head (figs. 39, 40, 41a-b) :—Very much like that of *C. mydas ;* once and one quarter (in very young specimens) to once and one third as long as broad. Præfrontals only as long as the supraocular, longer than the parietal ; separated from the maxilliary sheath antero-laterally by an area of smooth skin which connects the fleshy nasal region with the soft-parts surrounding the eye. Frontal pentagonal, longer than broad ; three-quarters (in very young examples) or two-thirds the length of the præfrontals ; as long as or slightly shorter (in the oldest specimen) than the parietal. Parietal broader than long, pentagonal or octagonal, smaller than in *C. mydas.* A single narrow band-like post-parietal which may be divided into three, is present in the young specimens ; in the oldest specimen it is much broader, owing to the backward growth of the parietal bone which it covers, but is still divided into three. In *C. mydas* I have noted the same variation in growth but in that species it is almost always paired, in one case only

have I seen it divided into three. One, sometimes two temporal shields in contact with the parietal. Below the supraocular three scales (postoculars) border the orbit posteriorly, the lower, situated in such a position as to be designated a subocular, is very pointed anteriorly. Posterior to these are seven to nine small shields while in *C. mydas* there are twelve to fourteen, or even more. In very young examples all the scales have areolæ, but in the oldest specimen they are quite smooth. The areola covers the whole scale in newly hatched examples, becoming situated within the border in older specimens owing to the peripheral growth of the scute.

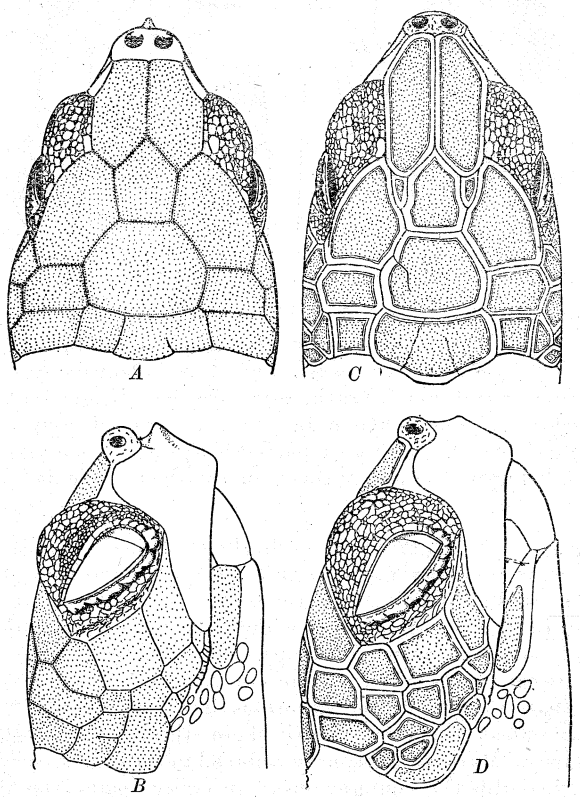


Fig. 39.—*Chelonia depressa*, Garm. a. and b, dorsal and lateral view of head of specimen No. 1. c and d, same of specimen No. 4 (enlarged).

The upper jaw is nicked at the tip in young specimens, but it gets gradually shallower with age. Owing to this Λ-shaped bay the biting edge presents a slightly sigmoid curve. Lower jaw with the horny sheath produced at the tip into a rather strong, hooked, beak-like process. Not serrated in the young, or only faintly so.

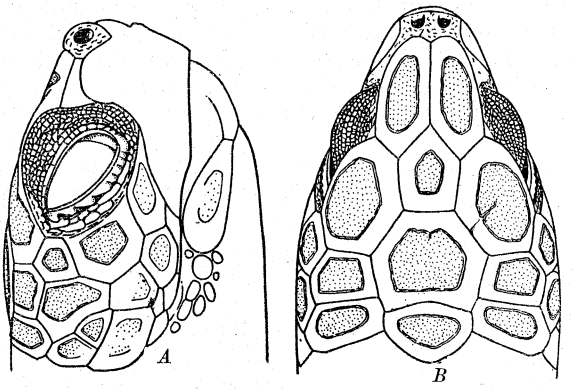


Fig. 40.—*Chelonia depressa*, Garm. Lateral and dorsal views of the head of the type specimen of *Natator tessellatus*, McCull. (Specimen No. 6 enlarged).

The head differs mainly from that of *C. mydas* in the following points :—The præfrontals do not form a suture anteriorly with the maxilliary sheath, and are not longer than the supraocular. There are only three instead of four or five postocular scales. The post-parietals are never symmetrically paired, being undivided or three in number. Areolæ present in the young.

Carapace (figs. 42-44) : — Slightly arched, broadly oval but never shield-shaped, only slightly narrower behind than in front; lateral edges reflexed ; strongly serrated and spined in the specimens in which areolæ persist, but less strongly serrated in the oldest specimen. In transverse section the carapace presents the lines of a bow. Nuchal slightly emarginate in very young examples but very deeply concave in the oldest specimen ; paired in three out of the ten specimens. Marginals strongly reflexed in the oldest specimens, but deflexed in the younger ones ; in twelve pairs, the first of which are rarely in contact with the first vertebral shield ;

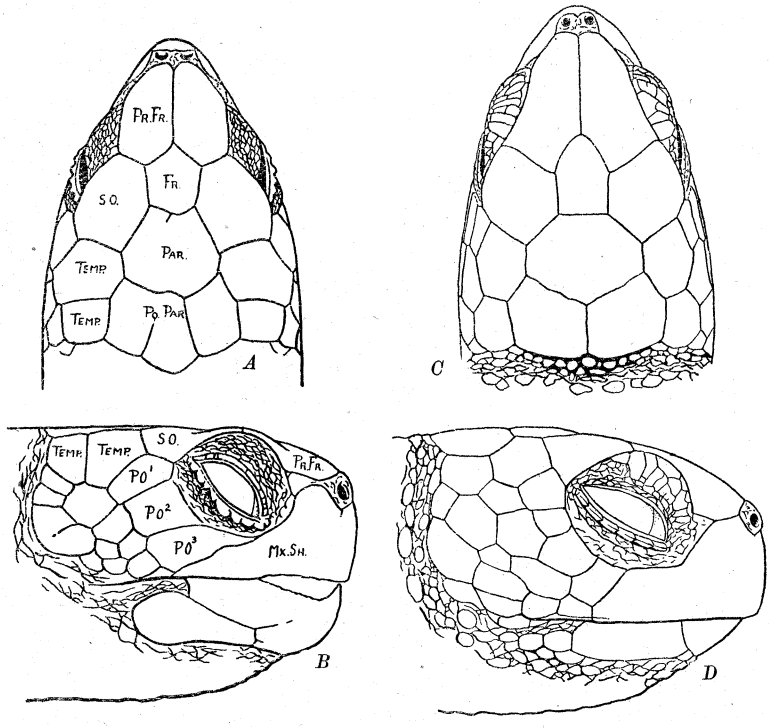


Fig. 41.—*a.* and *b.*, dorsal and lateral view of head of *Chelonia depressa*, Garm. (specimen No. 7). *c.* and *d*, same of *Chelonia mydas*, L. from a specimen of approximately the same size as that of *C. depressa*.

PR. FR.—*praefrontal.* FR.—*frontal.* SO.—*supraocular.* PAR.—*parietal.* TEMP.—*temporal.* PO. PAR.—*post-parietal.* MX. SH.—*maxillary sheath.*

those of the posterior half, as long as or slightly longer than broad; each with the areola situated towards the postero-lateral border and produced into a spine. Costal shields in four pairs; the areolæ when present, placed towards the inner and posterior borders. Vertebrals five in number, much broader in the younger than in the older specimens (fig. 44), with the areolæ placed nearer the posterior than the anterior border.

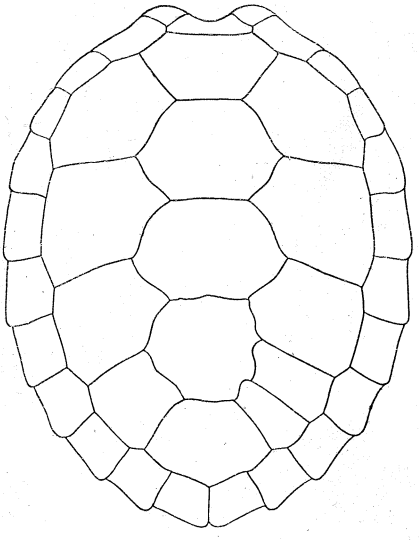


Fig. 42.—*Chelonia depressa*, Garm. Carapace of specimen No. 7.

In the type specimen (No. 6) the shields are rather soft but distinctly horny, and exhibit distinct concentrically arranged tortoise-shell markings. In the five younger ones they are covered by the strongly pitted areolæ to such an extent as to prevent a satisfactory examination of this character. In the largest one however (No. 7), in which the areolæ have presumably been shed, the boundaries are marked by very fine furrows, while they are quite soft, almost fleshy to the touch, and not at all horny.

The carapace then, differs markedly from *C. mydas* in the following points:—Instead of being tectiform in transverse section, owing to the reflexed marginals it presents the curves of a bow. It is also more depressed in the median line. The outline is an almost even broad oval, but slightly longer than broad, with a much deeper nuchal bay. The nuchal shield is sometimes divided. The marginals are strongly reflexed except in very young specimens whose rotundity is no doubt due to their recent accommodation within the egg. Areolæ are present in very young examples.

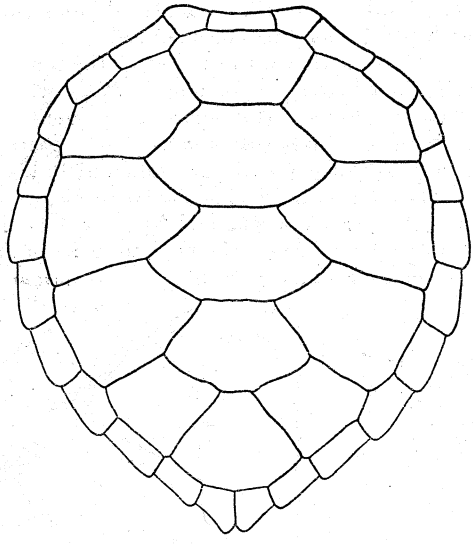


Fig. 43.—*Chelonia mydas*, Linn. Carapace of a specimen about 200 m.m. long, from Queensland.

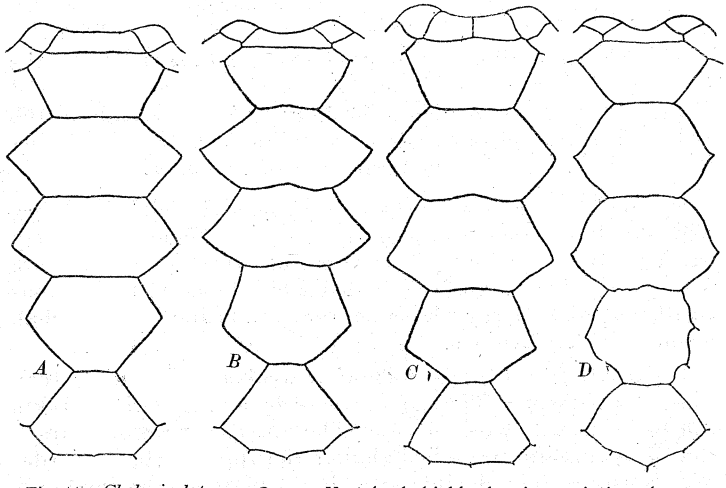


Fig. 44.—*Chelonia depressa*, Garm. Vertebral shields showing variations due to age. *a*, specimen No. 1; *b*, specimen No. 4; *c*, specimen No. 6; *d*, specimen No. 7. For the respective lengths of these specimens see the table on p

Plastron (fig. 45b) :—With strongly sloping sides in the region of the bridge, and with pronounced plastral ridges in the young. Of the median sutures that of the femorals is the longest. A distinct (7th) pair of small plates wedged in between the hinder part of the anals is present in all the specimens. Inframarginals sub-equal, in four pairs ; a single shield between the first one and the humeral, but no distinct row of plates (brachials) bordering the pectorals, humerals and gulars as in *C. mydas* (figs. 45a and b). Areolæ ill-defined, smooth and most prominent on the median series of shields, the plastral ridges passing through them.

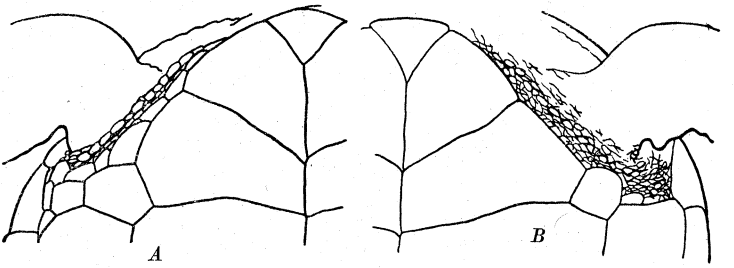


Fig. 45.—*a*, *Chelonia mydas*, Linn. Axilla and anterior half of plastron. *b*, *Chelonia depressa*, Garm. Axilla and anterior half of plastron of specimen No. 7.

The plastron differs from that of *C. mydas* chiefly by the presence of a small pair of shields posterior to the anals, and in the strongly sloping sides, due to the reflexed margin of the body. The absence of a ring of small brachial plates bordering the shields in the axilliary region is also characteristic.

Soft-parts :—The soft-parts of the head and neck have a very different appearance to those of *C. mydas*, being very finely wrinkled and of a fine leathery texture. In *C. mydas* the skin is very coarsely wrinkled and folded, and is beset with numerous small, roundish, horny plates, on the eyelids and in the nuchal, mental, and tail regions.

Fore-limbs (fig. 46b) :—Somewhat weaker and smaller than those of *C. mydas*. They are covered by a finely wrinkled skin except in the following places. The anterior margin bears a row of squammiform arched plates ; the upper posterior border has a series of thin, flexible, spatulate scutes, the proximal ones being slightly separated from one another ; a row of weak plates

mark distinctly the position of an underlying phalanx. Under-surfaces like the upper but lacking the posterior row of horny plates, the wrinkled skin extending to that margin. There are sometimes indications of two claws but generally only one is distinct.

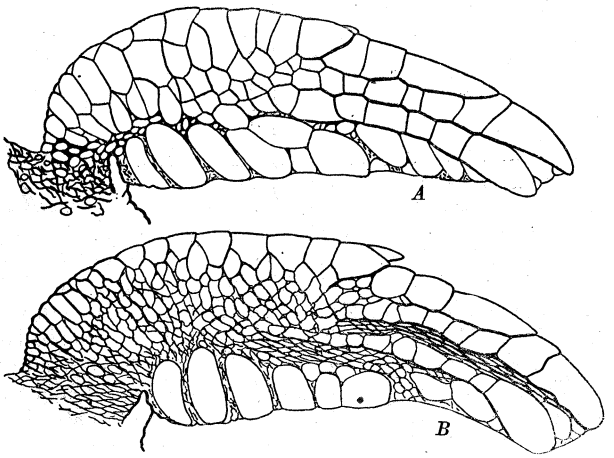


Fig 46.—*a, Chelonia mydas*, Linn. Dorsal view of right flipper. *b, Chelonia depressa*, Garm. Dorsal view of right flipper of specimen No. 7.

Hind-limbs :—The hind-limbs resemble the anterior pair in being covered by wrinkled skin instead of horny scales as in *C. mydas*. There are only one or two plates indicating the underlying digits. A single, well developed claw is present.

The limbs are markedly weaker than in *C. mydas*, and, in correlation with the other soft parts, are covered by a finely wrinkled integument which is not beset with juxtaposed horny scutes as in that species (figs. 46a and b).

Colour :—The scutes of the upper surfaces of the young specimens are uniform brown, in one case showing distinct tortoise-shell markings in concentric rings ; the areolæ are of a somewhat lighter brown, and when frayed or worn, peel off in mica-like flakes. The flippers have light yellowish borders and a dark grey or blackish patch on the distal half. The oldest specimen is drab-grey above, with greenish-olive flippers. Head shields sometimes bordered with yellowish. Lower temporal plates and under surfaces uniform light yellowish-olive.

Measurements in millimetres.

Specimen Number.	1	2	3	4	5	6 Type	7
Length of carapace ...	62	62	71	73	75	115	258.
Width of carapace ...	48	48	64	62	68	100	212.
Length of head to postparietal	22	22	24	24	24	29	65
Width of head	18	17.5	18	18	18.5	23	50
Length of fore-limb ...	50	48	54	53	50	78	145
Length of hind-limb ...	34	33	36	34	33	43	100
Length of tail, from anus	6	6	6	6	6	6.5	13

Locs. :—The Australian Museum possesses specimens from Port Darwin, Northern Territory; Cape York, Queensland; and Murray Island, Torres Strait. In the Queensland Museum are three examples from Keppel Bay, Central Eastern Queensland. From Macgillivray's note quoted above (p. 163), it appears that this species occurs at Prince of Wales Island near Cape York; this is certainly to be expected. Garman gives the type localities as East Indies and North Australia. The present known distribution may be stated as the East Indies, northern coast of Australia, islands of Torres Strait, and eastern coast of Queensland (fig. 38).

"*Larval shields*" *or areolæ; their structure, variation, and growth* :—What are here termed "larval shields" are the temporary superficial scales which, during the infancy of the turtle, cover more or less completely the real scutes of the head, carapace, and plastron. As the underlying scute extends its area peripherally the larval shield withdraws from its edges, those of the carapace and plastron becoming situated eccentrically, rather behind the centre of the scute. At this stage the larval shields are comparable to the so called "areolæ" of land tortoises (particularly those of the family Testudinidæ) described by Agassiz[22] and Coker.[23] The areolæ of tortoises are stated by Gadow[24] to become added to year by year by a layer of horn, and, in some forms, although they are periodically shed, the last formed stratum of horn serves as the

[22] Agassiz—Nat. Hist. U.S., i., p. 259.

[23] Coker—Bull. N. Carol. Geol. Surv., 14, 1906, p. 26.

[24] Gadow—Cambr. Nat. Hist., Reptiles, 1901, p. 326.

base of a new one beneath which are developed other layers, preserving the shape and size of the original areola. The areolæ of these tortoises then, would appear to serve some definite function throughout life and cannot in a true sense be regarded as "larval" characters. In the case of the turtle however, at the time of hatching, these shields have reached their maximum development, and from then onwards, owing to the wear and tear to which they are naturally subjected, they become gradually reduced, till little more than a flakey, tissue-paper-like remnant remains. They are then shed, leaving the bare scute of the adult.

These "larval shields" occur in both *Chelonia mydas* and *C. depressa*, but differ considerably in their degree of development, and in no stage of the former can they be called areolæ. The figures on Pls. xix. and xx. represent almost identical stages of the two species and a comparison shows that in *C. mydas* they are much thinner and devoid of the deep pits shown in the other species. The material in the Australian Museum leads me to the conclusion that the larval shields are shed much earlier in the common Green Turtle than in *C. depressa*.

The reduction due to erosion of the areolæ in *Chelonia depressa* is very noticeable when the specimens are placed in order of age. This can be followed by examining in turn the newly hatched example (Pl.xix.), the somewhat older specimen beside it, McCulloch's figure[25] of his type, and the semi-mature specimen on Pls. xxi. and xxii. Figs. 39 to 41a and b show this reduction of the areolæ on the head shields of specimens Nos. 1, 4, 6, and 7. The newly hatched examples possess thick, deeply pitted larval shields which become gradually reduced along the series of older specimens till, in the type example they are reduced to the thickness of paper with frayed, mica-like edges, and on which the granulations remain as the faintest impressions. At some stage between that of the type example and specimen No. 7, the areolæ are shed, leaving the smooth, almost leathery scute.

Although the areolæ of *C. depressa* differ from those of Testudinian Tortoises in the absence of any trace of post-embryonic growth, they must be considered as morphologically homologous, and, whatever may be their use in the land tortoises, there seems little doubt that in *C. depressa* they function in the young stages simply as a protection for the underlying scutes, which are of an unusually soft nature.

[25] McCulloch—Rec. Austr. Mus., vii., 1908, pls. xxvi. and xxvii.

Notes on the skull of CHELONIA DEPRESSA:—The single skull of *C. depressa* at my disposal belonged to the largest specimen, measuring 258 m.m. along the carapace (Pls. xxi. and xxii). Although this example possesses most of its adult characteristics it is, of course, still a very young one. In the Museum collection there are only three skulls of *C. mydas*. However, Dr. H. L. Kesteven has supplemented my poor material by kindly allowing me to examine the four specimens used in the preparation of his paper[26] on the "Anatomy of the Head of the Green Turtle, Part i., The Skull."

Measurements:—The following are the measurements, in millimetres, of the skull of *C. depressa* and of a small specimen of *C. mydas* of approximately the same size.

	C. DEPRESSA	C. MYDAS
Length, to tip of supraoccipital blade	63.	52.
Width (greatest) from squamosal to squamosal	45	33.
Width, medianally between the orbits	15	20
Depth, at quadrate condyle	32	27
Depth, from lower edge of postfrontal to quadrate condyle	17	14
Length of parieto-squamosal suture	1	4
Length (greatest) of parietal	29	25
Width (greatest) of parietal	14	12.
Length of frontals along their suture	14	12.
Width of frontal, along the fronto-parietal suture ...	9	8
Width (greatest) of frontal, at the outer-angle	9	11
Length (greatest) of postfrontal	30	22
Length of orbit...	24	22
Height of orbit...	18	16
Length from orbit to posterior margin of skull	20	17

[26] Kesteven—Proc. Roy. Soc. N.S. Wales, xliv., 1910, pp. 368-400, pls. xx.-xxxiii.

Osteology :—With only a single skull of *C. depressa* it is not practicable to compare the bones in detail as disarticulation would be necessary, so that only the more striking and tangible characters are dealt with.

In general outline the skulls of *Chelonia mydas* and *C. depressa* are not strikingly different, but the former is slightly broader and much wider in the supraorbital region.

The parietal bones of the two species differ somewhat. In *C. mydas* they form a suture of considerable length (an inch or more in adult specimens) with the squamosal. Even in the very young specimen this is quite distinct, but naturally increases in extent with the backward growth of the parietal. In *C. depressa* however (figs. 47 and 48a), the post-frontal extends so far back as almost to enter the hinder border, allowing only a mere splinter of the parietal, about a millimetre in width, to connect with the squamosal. In *C. depressa* (fig. 47a) the fronto-parietal suture is tranverse, whereas in the common Green Turtle it is in the form of an arc, the convexity of which is directed forwards.

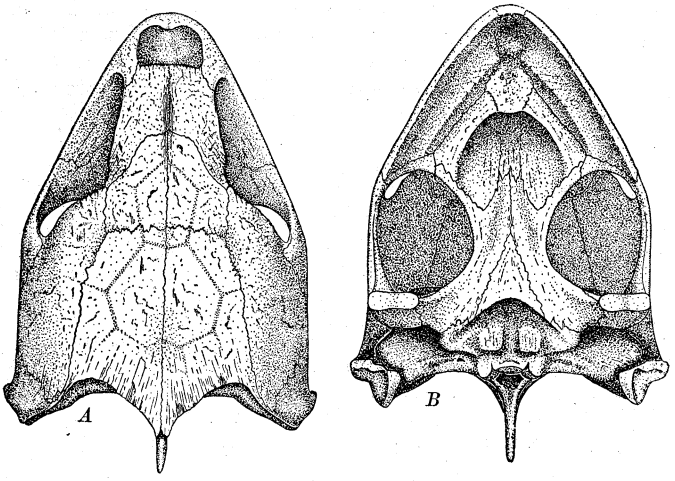


Fig. 47.—*Chelonia depressa*, Garman. Dorsal and ventral views of skull of specimen No. 7. Reduced slightly.

The frontals in *C. depressa* (fig. 47a) do not enter into the formation of the upper border of the orbits. In all but one of the examples of *C. mydas* available to me, they do. In one specimen, however, lent me by Dr. Kesteven,[27] the præ and postfrontals meet in suture laterally excluding the frontal completely on each side from the orbital rim. This variation, which is certainly the exception rather than the rule, has been recorded by Dr. G. A. Boulenger[28] who has noticed it in both *C. mydas* and *Caretta caretta*. He records that in one specimen of *C. mydas* "the præ and postfrontal bones were in contact, excluding the frontal from the periphery of the orbit; in another the frontal separated the præfrontal from the postfrontal; whilst in a third, the former disposition was shown on the right side and the latter on the left."[29] This character has, by Dr. George Baur[30] and Dr. O. P. Hay[31] been allowed generic value, but with peculiar inconsistency on the part of the former author. He characterises the genus *Chelonia* as having the "orbit formed by: prefrontal, frontal, postfronto-orbital, jugal, maxilliary." Just below this definition however, he overlooks its generic value and unites *Colpochelys*, Garman, in which the frontals enter the orbital rim, with *Lepidochelys*, Fitzinger, in which the orbit is described as being bounded by the "prefrontal, postfronto-orbital, jugal, maxilliary." Dr. Hay[32] in his fine Monograph of the "Fossil Turtles of North America" recognises *Colpochelys* as synonymous with *Lepidochelys* after Dr. Baur, but later still[33] he regards it as distinct. He remarks[34] "Baur again referred to this species *(Colpochelys kempii)* in 1890 and

[27] This specimen was obtained from an hotel in Sydney and the locality is unknown. No record of its shield characters have been kept so that it is necessary to presume that it was otherwise identical with *C. mydas*. It is a coincidence too, that in this specimen the jugal meets the squamosal in suture as mentioned *ante* p. 181, an exceptional condition.

[28] Boulenger—Proc, Zool. Soc., 1890 (1891), p. 618.

[29] Hay—Proc. U.S. Nat. Mus., xxxiv., 1908, p. 196, records this last condition in *Caretta remivaga*, sp. nov.

[30] Baur—Amer. Nat., xxiv., 1890, p. 486.

[31] Hay—Proc. U.S. Nat. Mus., xxxiv., 1908, p. 183.

[32] Hay—Foss. Turtles N. Amer., Carnegie Inst., pub. 75., 1908, p. 8-10 and 16.

[33] Hay—Proc. U.S. Nat. Mus., xxxiv., 1908, p. 194.

[34] Hay—Proc. U.S. Nat. Mus., xxxiv., 1908, p. 184.

assigned it to the genus *Lepidochelys ;* but it fails to meet the requirements of this genus, as he defines it, in having the frontals entering the rim of the orbit." Thus we find this character allowed generic importance although Dr. Boulenger had earlier shown that it was just as variable in the allied *Caretta* as in the genus *Chelonia.* Dr. Hay[35] himself writes: "Boulenger has noted that occasionally in the loggerhead *(Caretta)* the frontal on one side or the other enters the rim of the orbit. Doubtless it will be found that sometimes the frontals of the bastard-turtle *(Colpochelys)* are excluded from the orbit; but such variations hardly affect the specific value of the character." It is indeed remarkable that such a variation should occur in two of the three well-known recent species of turtles, and, that in the two others less perfectly studied, the exceptional condition should occur, that in which the frontals do not enter the orbit. With further material it is very probable that not only the generic value (which I am not prepared to agree exists) but the specific value of this character will also disappear.

In *C. depressa* (fig. 47a) the length of the fronto-parietal suture equals the greatest width of the frontals, but in *C. mydas* the greatest width *i.e.* the width in the region where the frontal enters the orbital border, is almost half as great again. The greatest length of the frontals in *C. mydas* (not their length along the median suture) is also slightly longer. Owing to the broader interorbital region in the common Green Turtle and the extension (generally) of the frontal into the orbital border, they have a very different outline to those of *C. depressa.*

The quadratojugal not infrequently fails to meet the postfrontal in suture in *C. mydas*, and this is the condition of the bones in *C. depressa* (fig 48a). I have only seen one example of *C. mydas* in which the squamosal and jugal come into contact, thus separating the two bones, and that, peculiarly, is the specimen lent me by Dr. Kesteven, in which the frontal does not enter the orbital rim. In my smallest specimen (fig. 48b), the quadratojugal and postfrontal meet in suture on both sides, and, as the frontals enter the periphery of the orbits to comparatively the same extent as in adult specimens, neither of these characters can have anything to do with age, but must

[35] Hay—Proc. U.S. Nat. Mus., xxxiv., 1908, p. 191,

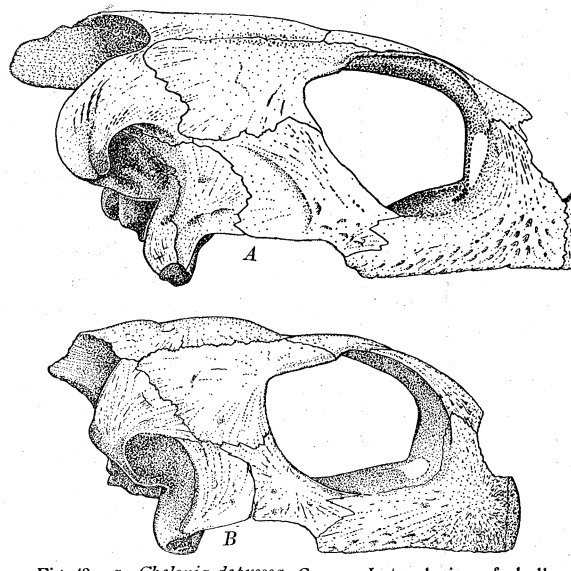


Fig. 48.—*a. Chelonia depressa*, Garm. Lateral view of skull of specimen No. 7. Enlarged slightly. *b. Chelonia mydas*, Linn. Lateral view of skull of a specimen approximately the same size as that of *C. depressa*.

be individual variations. This condition is apparently very uncommon, and was perhaps first recorded by Sir Richard Owen[36]—"In *Chel. mydas* the malar approaches the mastoid very closely and sometimes touches it by the posterior angle, thus separating the squamosal from the postfrontal." In recent osteological nomenclature the malar becomes the jugal, the mastoid is our squamosal, while Owen's squamosal is our quadratojugal. In the Green Turtle the anterior (jugular) flange of the quadratojugal is bayed ventrally to a lesser extent than in *C. depressa*, making the quadrate pedicle appear longer in the latter species.

It is in the basicranial constituents that the most reliable points of difference between the two species can be noticed. In some of these characters *Chelonia depressa* shows unmistakable resemblance to *Colpochelys kempii*, which has been beautifully figured by Dr. Hay.[37]

[36] Owen—Hist. Brit. Foss. Rept., i., 1849-84, p. 33.

[37] Hay—Foss. Turtles N. Amer., Carnegie Inst., publ. 75, 1908, pl. i., figs. 1-4, pl. ii., and Proc. U.S. Nat. Mus., xxxiv., 1908, pl. vi., pl. vii., figs. 2-4, pl. viii., fig. 2, pl. ix., figs. 2 and 4.

The pterygoids in *C. mydas* (fig. 49e) are medio-laterally emarginated by a large sulcus for the passage of the pterygo-mandibularis muscle. This is entirely absent in the skull of *C. depressa* (figs. 47b and 49f) giving a flatter and broader appearance to the roof of the pharynx. It will be very interesting to note the correlated modification of the pterygo-mandibularis muscle to suit this condition, which, judging from Gadow's[38] and Hay's[39] figures, prevails in *Caretta caretta* also (fig. 49b). In this species however, the pharyngeal roof is not so broad.

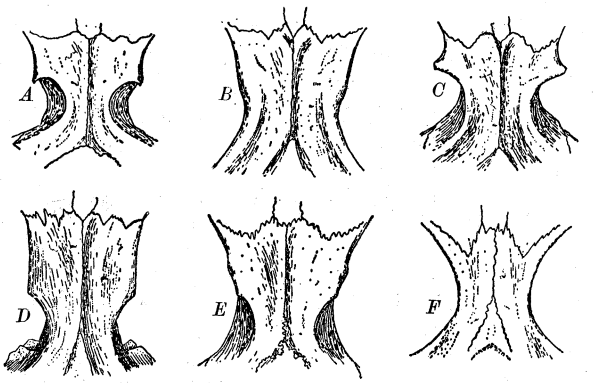


Fig. 49.—Pterygoid bones showing the variation of the pterygo-mandibular suleus in the various marine turtles.
a. Colpochelys kempii, Garm. *b. Caretta caretta*, Linn.
c. Caretta remivaga, Hay. *d. Eretmochelys imbricata*, Linn.
e. Chelonia mydas, Linn. *f. Chelonia depressa*, Garm.

The basisphenoid of *C. depressa* (fig. 47b) extends much further anteriorly and separates the pterygoids along their median suture for a correspondingly greater extent. Although this varies a little with age in the Green Turtle it is never so pronounced in that species as in *C. depressa*. In this character it is approached by *Eretmochelys imbricata*[40] and *Colpochelys kempii* in both of which the basisphenoid is anteriorly more pointed than in *Chelonia mydas*. In the Green Turtle the basisphenoidal ridge is almost transverse and but slightly

[38] Gadow—Cambr. Nat. Hist., Rept., 1901, p. 379, fig. 84.
[39] Hay—Proc. U.S. Nat. Mus., xxxiv., 1908, pl. viii., fig. 1.
[40] Boulenger—Brit. Mus. Cat. Chelonia, 1889, p. 181, fig. 45.

convex anteriorly. In *C. depressa* (fig. 47b) this ridge is Λ-shaped and is more distinctly marked on the basi-pterygoid process of the bone *(processus basipterygoideus ossis basisphenoid* of Dr. Kesteven[41]). In this respect it bears a closer resemblance to all the other recent turtles than to *Chelonia mydas*. Ventrally the basioccipital has a strong median sulcus (fig. 47b) as in *Colpochelys kempii*, Garman, and the fossil *Chelone cuneiceps* of Owen. Regarding the latter Owen writes[42]—"The basioccipital is remarkable for the strong development of the tubercles for the insertion of the 'recti capitis antici' and for the depth of the groove between them." This describes almost exactly the condition exhibited by *C. depressa*, which resembles that of the bastard-turtle more than any other recent form.

In my specimen of *C. depressa* (fig. 47 and 48a) there is a slight but distinct reduction in the extent of the temporal roof. This is not due to a reduction in the length of the parietals but to an emargination in the region of the parieto-squamosal suture, which allows the somewhat larger post-frontal of *C. depressa* to actually extend slightly behind the deepest part of this bay. The oldest known fossil Chelonians possessed a well developed temporal roof, the significance of which has been masterfully explained by Dr. Hay,[43] who, with Baur, Cope, and others, regard it as probably handed down to them by their Cotylosaurian ancestors. These archaic Cheloneformes also possessed true nasal and lacrymal bones, which no longer persist in living marine turtles, though they are present as separate ossifications in some living members of the order. We find the recent Chelonidæ then, to be a peculiar mixture of the retention in some cases, and loss in others, of their most primitive characteristics.[44] If this character holds good in the adult skull it will be very interesting to note this slight reduction of a typically primordial condition in a living form, a specialisation suggested by Dr. Hay[45] to be correlated with the evolution of the Pleurodiran neck.

[41] Kesteven—Proc. Roy. Soc. N.S. Wales, xliv., 1910, pl. xxviii., fig. 42.

[42] Owen—Hist. Brit. Foss. Reptiles, i., 1849-1884, p. 33.

[43] Hay—Foss. Turtles N. Amer., Carnegie Inst., publ. 75, 1908, p. 19.

[44] Dr. Gadow (Cambr. Nat. Hist. Reptiles, 1901, p. 380) holds the opposite view, that the Chelonidæ are a specialised offshoot of the Cryptodira and that there is nothing primitive about them, except the complete series of inframarginal shields.

[45] Hay—Foss. Turtles N. Amer., Carnegie Inst., publ. 75., 1908, p. 19.

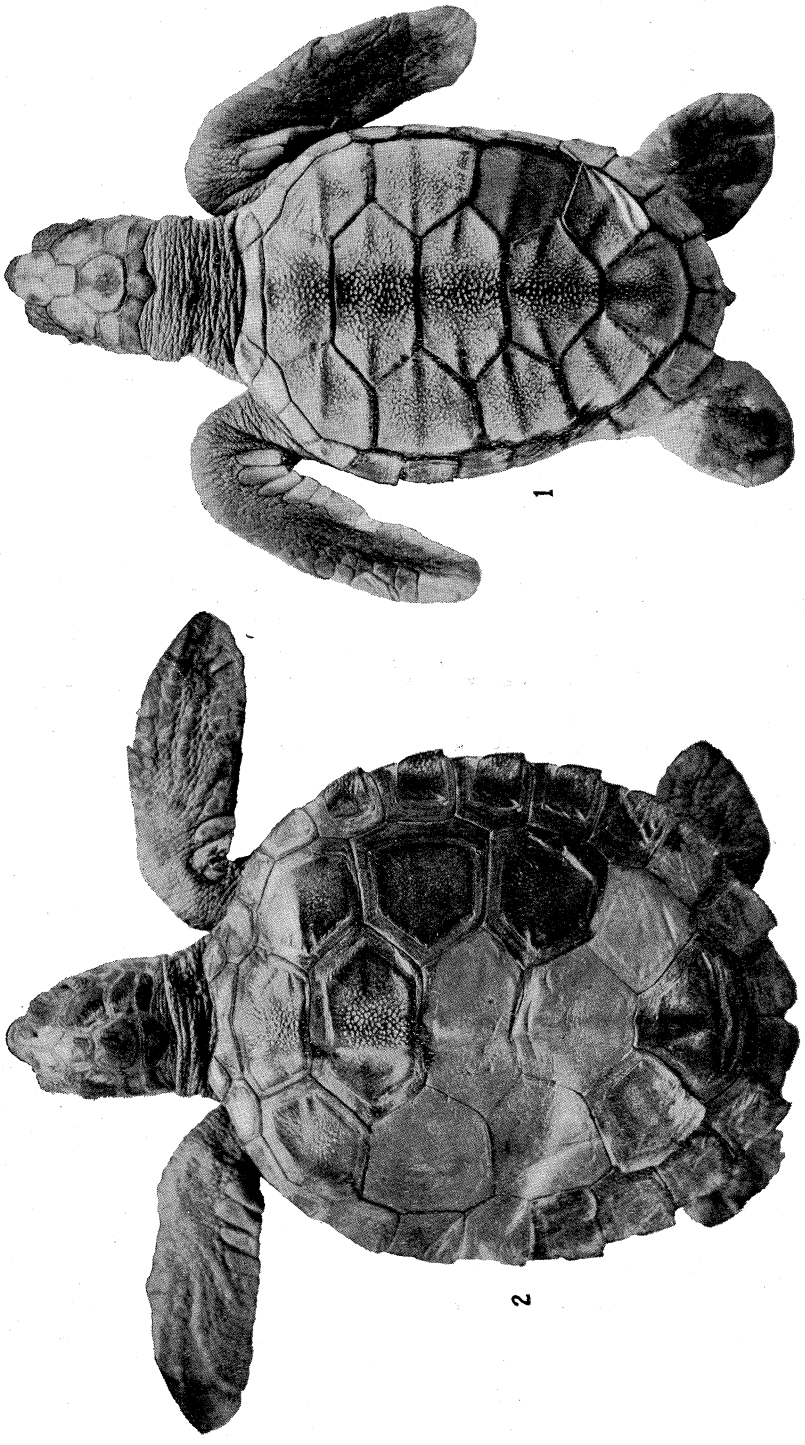
Resumè of the chief differences between the young skulls of both species of *Chelonia*.

CHELONIA DEPRESSA.	CHELONIA MYDAS.
Interorbital space, at the outer angle of the frontal, one third (·33) of the greatest width of the skull.	Interorbital space, at the outer angle of the frontals, two thirds (·60) of the greatest width of the skull.
Parieto-squamosal suture extremely small.	Parieto-squamosal suture always quite distinct, in adults up to $1\frac{1}{2}$ inches in length.
Fronto-parietal suture transverse.	Fronto-parietal suture strongly arched.
Length of the fronto-parietal suture equals the greatest width of the frontals.	Length of the fronto-parietal suture, two-thirds to three-quarters the greatest width of the frontals.
Pterygoids not constricted by a deep pterygo-mandibular sulcus on each side.	Pterygoids deeply constricted on each side by an oblique pterygo-mandibular sulcus.
Basisphenoidal ridge ∧-shaped and not deeper medially than laterally.	Basisphenoidal ridge ⌒-shaped, always straight and deepest in the median line.
Basioccipital ventrally with two strong tubercles separated by a deep median groove.	Basioccipital ventrally with a shallow open concavity right across the bone, the tubercles hardly discernable and widely separate.

EXPLANATION OF PLATE XIX.

Fig. 1. *Chelonia depressa*, Garman. A young specimen (No. 1) from Port Darwin, North Australia, regarded as just hatched. About natural size.

Fig. 2. *Chelonia depressa*, Garman. An older example (specimen No. 5) from New Guinea? About natural size.

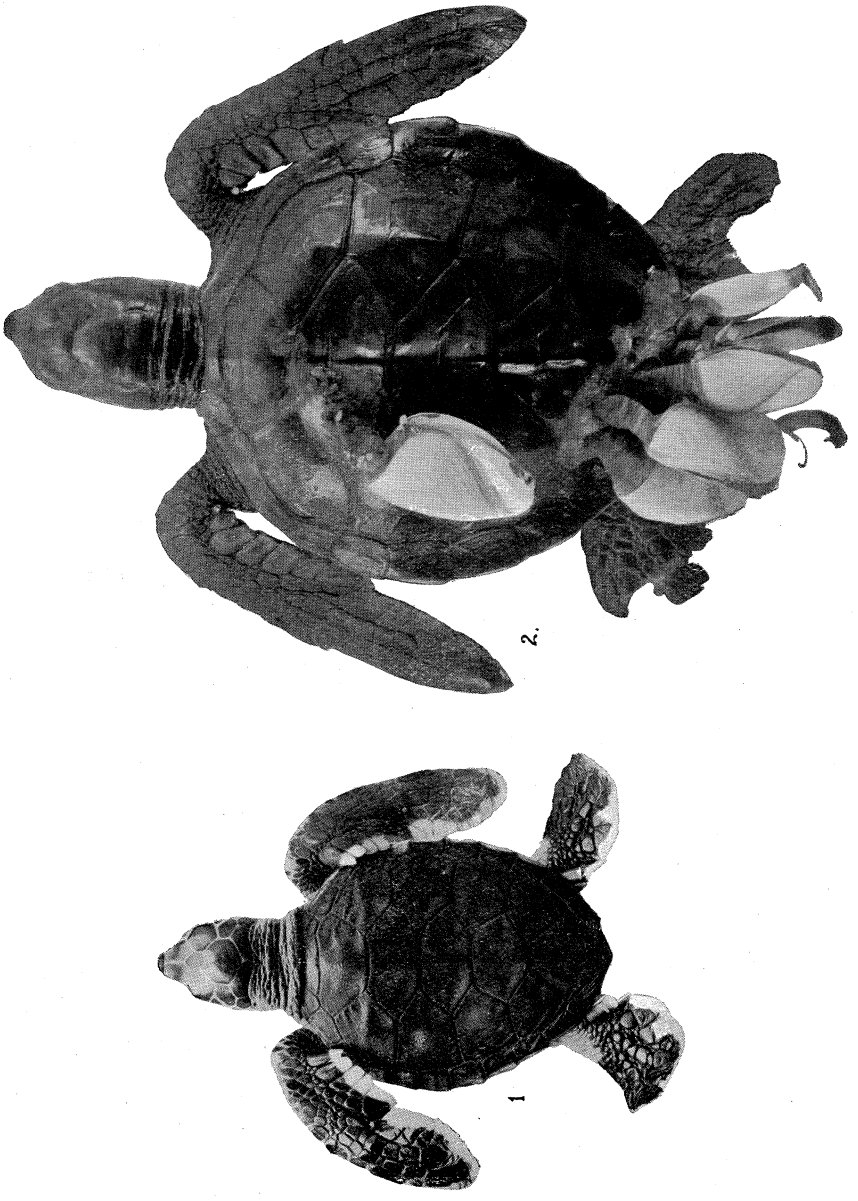


C. CLUTTON, Austr. Mus., photo.

EXPLANATION OF PLATE XX.

Fig. 1. *Chelonia mydas*, Linn. From a specimen regarded as just hatched, from Flint Island, Central South Pacific Ocean. About natural size.

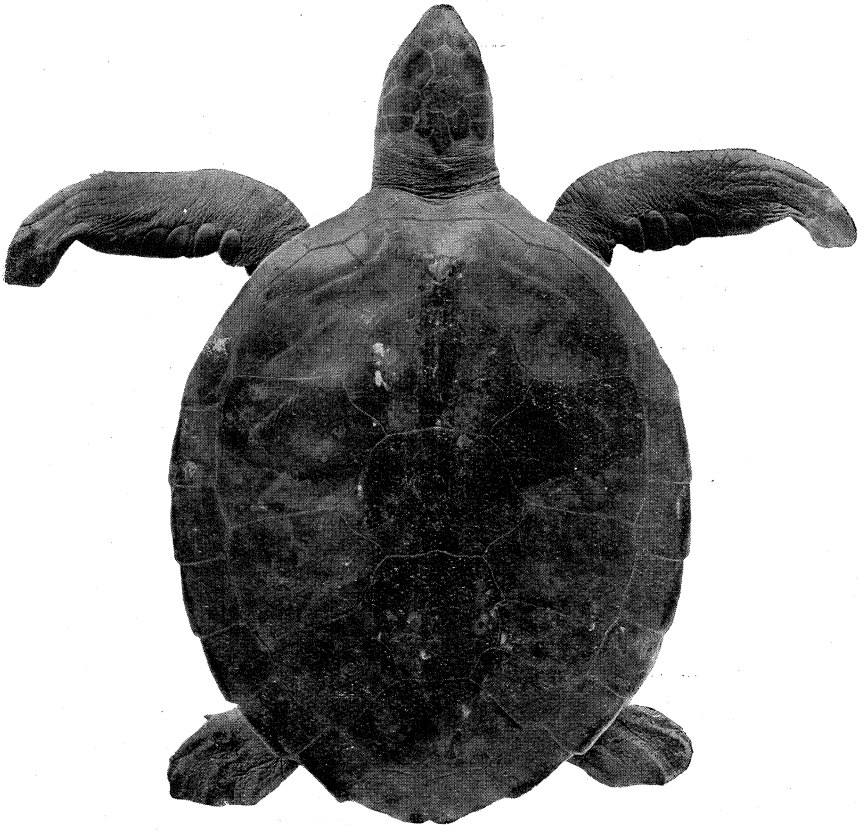
Fig. 2. *Chelonia mydas*, Linn. From a specimen captured at Botany Bay, near Sydney, New South Wales. About Natural size.



C. CLUTTON, Austr. Mus., photo.

EXPLANATION OF PLATE XXI.

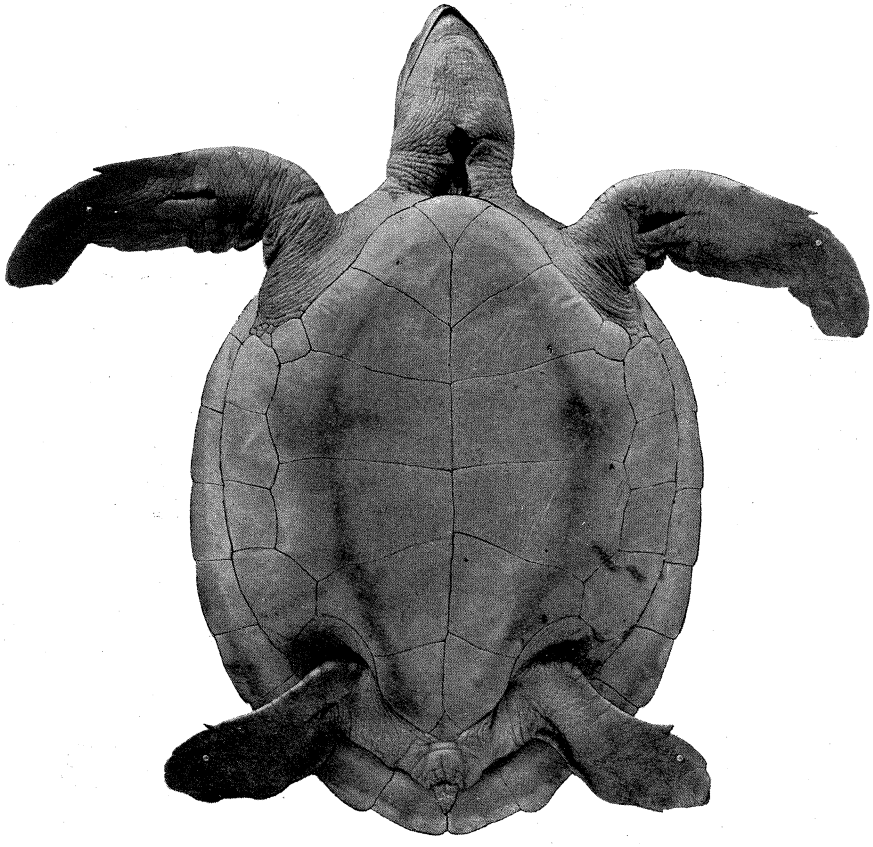
Chelonia depressa, Garman. From a specimen (No. 7) $10\frac{1}{2}$ inches long, from Murray Island, Torres Strait.



H. BARNES, JUNR., Austr. Mus., photo.

EXPLANATION OF PLATE XXII.

Chelonia depressa, Garman. From a specimen (No. 7) $10\frac{1}{2}$ inches long, from Murray Island, Torres Strait.



H. BARNES, JUNR., Austr. Mus., photo.

CATALOGUE SLIP.

Fry, D. B.— **59.813 (94.3) (95)**

On the Status of *Chelonia depressa*, Garm.

Rec. Austr. Mus., x., 7, 1913.