XIX. NOTES ON LAMELLIBRANCHS IN THE INDIAN MUSEUM.

(Plate IX.)

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1. *ARCIDOPSIS FOOTEI* (THEOBALD).

Theobald in 1876 [1] described a peculiar species of Unionid from the Gutparba Falls, Kistna River, under the name *Unio footei*. His Latin description, drawn up from two specimens with much decayed beaks, is incomplete in many respects. The existence of the type-specimens is very doubtful, and Theobald's incomplete description was all that was available to Simpson [2] at the time of the preparation of his synopsis of the Naiadae. The peculiarities of shell-structure mentioned in Theobald's description led Simpson to create a new genus (*Arcidopsis*) for this species, but he added the following qualifying foot-note:—"Unfortunately Theobald's Latin description is not at all complete. No laterals are mentioned and he says nothing of the color of the epidermis or of the nacre. The beaks were too much worn in his specimens to give any characters. The shell resembles some of the Arcas of the *Barbatia* group, and may not belong to the Unionidae at all." The concluding remark seems to be due to Theobald making a casual comparison between the shape of this species and that of *Arca subtorta* in the note following his description. Preston's [3] description is merely a verbatim copy of the accounts in Theobald's and Simpson's works; he even ignored two more recent memoirs that refer to this species. The first of these is the incomplete monograph of Unionidae by Haas,[4] in which the author, besides reproducing the description and the two figures in Theobald's paper, gives a full description with three figures of a shell from Mysore, preserved in the Frankfürt Museum. This specimen Haas assigns doubtfully to Theobald's species. It is, however, clear from this description and the rather poor figures of the hinge, that the specimen does not belong to this species but is probably an *Indonaia*. The second work is an elaboration by Simpson[5] of his "Synopsis." In this monograph he gives

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[1] *Journ. As. Soc. Bengal*, XV, p. 187, pl. xiv, figs. 9, 9a (1876).
[2] *Proc. U. S. Nat. Mus.* XXII, p. 861 (1900).
[3] *Faun. Brit. Ind. Freshw. Moll.*, p. 196 (1915).
[4] Mart. and Chemn., *Conch. Cab.* ed. Küster, *Die Unioniden*, pp. 119-121, pl. xi, figs. 2-4 (1910-1914).
[5] *Desc. Cat. Naiades*, III, pp. 1191-1192 (Michigan, 1914).

as complete an account of *A. footei* as can be adduced from Theobald's description and figures. He also includes in the references (without any comment, however,) the monograph by Haas cited above.

It is, therefore, of interest to be able to record the discovery of two complete young shells and the left valve of a full-grown specimen in the collections of the Zoological Survey of India. These can be assigned definitely to this species and may, owing to uncertainty as to the existence of the original types, be taken as the *neotypes* of *A. footei*.

The specimens were collected by Dr. F. H. Gravely in April, 1912, at Taloshi in the Koyna valley, Satara District, Bombay Presidency, at an altitude of about 2,000 feet.

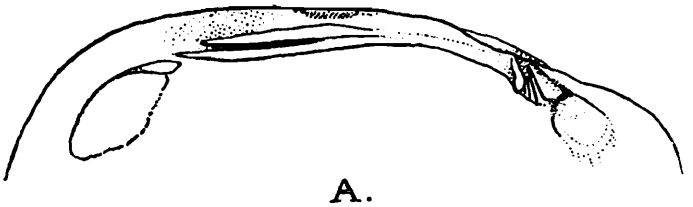
The locality "Gutparba falls" may be considered here. No falls of this name are known on the Kistna River, but a tributary of the Kistna is known as the Ghatprabha and it is evident that the name Gutparba is only an old way of spelling Ghatprabha. The course of this stream is described in the Gazetteer[1] of the Bijapur District as follows:—"The Ghatprabha rises near the edge of the Sahyádris almost twenty-five miles west of the town of Belgaum. After an easterly course of about 140 miles through Belgaum and the Southern Marátha states, it enters Bagálkot three miles north of Kaládgi. Through Bagálkot it runs nearly east for about twenty miles, and then immediately below the town of Bagálkot turns suddenly north. Between Bagálkot and Yerkal, about five miles north of Bagálkot, it forces its way through two chains of hills, a pretty country with picturesque views of hills and water. Beyond the second range it enters the Krishna valley and falls into the Krishna about fifteen miles to the north-east opposite Chimalgi." The Koyna valley lies to the north-west of the Ghatprabha valley, and the Koyna, another tributary of the Kistna, flows through it. Dr. Gravely's specimens therefore extend the range of the species, but not beyond the river-system from which it was originally described.

Theobald's description of the shell of *A. footei* is incomplete, and the following description, based on the Koyna valley specimens, is therefore given:—

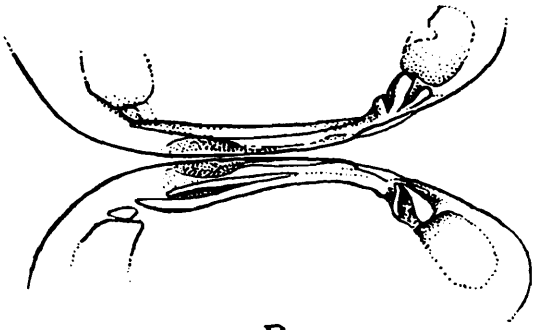
Shell moderately large and thick; elongate, subrhomboidal, very inequilateral. The dorsal and ventral outlines are nearly straight and parallel in the young, but owing to an antero-downward slope of the dorsal side become greatly inclined in the adult thereby greatly reducing the length of the anterior margin. Anterior margin strongly truncated above, rounded below; posterior margin truncated above and also truncated below in the young, but evenly rounded in the adult. A small but distinct posterior wing, better marked in the young than in the full-grown specimens. Umbonal region prominent, slightly swollen and

[1] *Gazetteer of the Bombay Presidency—Bijapur*, by J. M. Campbell (Bombay, 1884).

opposed in the young, becoming depressed and less marked in older specimens; sculptured with numerous low corrugated ridges arising from an eccentrically situated nucleus, and radiating outwards on the two sides but more or less parallel in the middle region; a few very minute striae also run transversely in this region. Older specimens with the beak much eroded and bleached and showing barely any striations. Shells swollen in the middle but depressed in front, below and behind. Periostracum coarse, with strong vertical ridges in the young radiating outwards, some with a well marked **V**-shaped course. In adult shells the striations less marked but distinct; a few minute transverse concentric ridges



A.



B.

FIG. 1.—*Arcidopsis footei* (Theobald).

A. Hinge of the left valve of adult specimen, $\times 1\frac{1}{2}$.
B. Hinges and scars of the young specimen, $\times 2$.

also visible in both young and adults; regions of growth well marked. Periostracum of a yellowish brown colour with a few light green striae along the vertical striae, specially distinct in the young specimens. Nacre pearly white, iridescent. Hinge strongly developed; pseudocardinals three in the right valve with the middle tooth best developed, two in the left, the outer being much the larger; all these teeth vertically striate in adult shells. Laterals lamellar, nearly straight, one in the right, two in the left valve, in which the lower ridge is better developed, being longer and stouter than the upper. Muscular scars moderately impressed; anterior scars confluent, posterior scars distinct. Pallial line distinct though not deeply marked.

Measurements of Shells (in millimetres).

	A.	B.	C. (Single left valve).
Length	17·1	25·2	43·4
Breadth	10·2	13·8	23·2
Height	7	8·5	7·1

Shells. No. M $\frac{7673}{1}$, M $\frac{7675-6}{1}$, Zoological Survey of India (*Ind. Mus.*).

Relationships. Simpson's remark quoted already regarding the mollusc being doubtfully a Unionid is not justified in view of the specimens now discovered. The genus *Arcidopsis* has a superficial resemblance to another Indian genus, *Trapezoideus*, Simpson, but there does not seem to be any true relationship. It is, however, impossible to discuss its true position until the anatomy has been investigated. I do not agree with Haas (*loc. cit.*) in considering *A. footei* as probably being congeneric with species like *Trapezoideus misellus* (Morelet), for the specimens before me more distinctly show that they do not belong to the genus *Trapezoideus*, the resemblance with this genus being purely superficial.

2. *LAMELLIDENS JENKINSIANUS* (BENSON) AND ITS SUBSPECIES.

In his catalogue of the Asiatic Naiades in the Indian Museum[1] Preston described a new species of the genus *Parreyssia*, Conrad, from a single dead shell from Dacca, Eastern Bengal. This form he named *P daccaensis*. His description of the species is very short, being only a comparison with *P. jeddeni* (Theobald), to which he considered it to be closely allied. In his later work[2] in the "Fauna" series he did not add anything to his original description, but published figures of the type-shell. In Simpson's "Catalogue,"[3] which was published before the "Fauna" volume, Preston's original description is included without comment.

Whilst identifying a small collection of Unionids made by myself and Babu D. N. Sen, of the Bengal Fisheries Department, at Dacca and other places in the vicinity, I found on examining the type-specimen of *P. daccaensis* that the shell did not belong to the genus *Parreyssia* and that Preston was certainly mistaken in describing it as a new species of that genus. With the above-mentioned collection from the type-locality and other places in the district of Dacca, as also the large collections in the Indian Museum, I have been led to the following conclusions :— (1) Preston's *P. daccaensis* is a young shell of a highly peculiar but hitherto unrecognized form of Benson's *Unio jenkinsianus*,[4] (2) Benson's *Unio jenkinsianus* is not a distinct species of the genus *Lamellidens*, as Simpson doubtfully believed, nor is it an abnormal form of *L. marginalis*

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[1] *Rec. Ind. Mus.* VII, p. 300 (1912).
[2] *Faun. Brit. Ind. Freshw.-Moll.* pp. 65, 66, figs. 16, 1—3 (1915).
[3] *Descr. Cat. Naiades*, p. 1114 (Detroit, Michigan, 1914).
[4] *Ann. Mag. Nat. Hist.* X, p. 185 (1862).

or *L. corrianus* as Hanley and Theobald[1] considered the unique type before them to be. It is indeed a form closely allied to *L. marginalis* through Hanley and Theobald's var. *obesa*. I cannot agree with Preston in regarding *L. jenkinsianus* as a subspecies of *L. marginalis*, and (3) the form *Unio marginalis* var. *obesa* of Hanley and Theobald must be considered as a species distinct from *L. marginalis* on both anatomical and malacological grounds. It is a large, rather thick-shelled form which appears to be very like the ancestral form, from which the thick-shelled forms *obesa*, *jenkinsianus* and *daccaensis* have been evolved. It shows only a slight modification from the closely allied *L. marginalis*, with which it has up to now been confused.

The ancestral type of shell in this group of series is the form to which Hanley and Theobald gave the name *obesa* in 1876. They did not properly describe the form but published the following note in the explanation of their plate;— "A giant form, which does not exhibit the ochraceous band, and is peculiarly swollen. It comes between the var. *lata* and the typical form. The upper anterior tooth is almost linear; the lateral are not bent at the extremity and the upper one in the left valve is scarcely developed." Their figure of the shell imperfectly shows the hinge in the right valve only, but this and the outline and form of the shell as shown in the full-size figure of the left valve are quite enough for distinguishing the form. Neither Preston nor Simpson added anything to the above meagre description. Benson's name *jenkinsianus* was given fourteen years earlier, but the form to which he assigned this name is only subspecifically distinct from Hanley and Theobald's *obesa*. Under the circumstances our only course is to describe *obesa* as a subspecies of *jenkinsianus*, which, owing to the priority of Benson's name, has to be taken as the name of this group of forms. Preston's name *daccaensis* is retained for the rather peculiar subspecies noted already, as a young shell of it was given this name. The relationships of these forms with one another and of the group as a whole with *L. marginalis* may be expressed as follows:—

L. jenkinsianus subsp. *daccaensis*.

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L. jenkinsianus.

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L. jenkinsianus subsp. *obesa*.

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L. marginalis.

In a recent paper[2] Dr. Annandale and I described a Unionid from Seistan under the name *L. marginalis* subsp. *rhadinaeus*.

[1] *Conch. Ind.* p. 19, pl. xli, fig. 4 (1876).

[2] *Rec. Ind. Mus.* XVIII, pp. 59—62, fig. 9 (A,B), pl. iii, figs. 9, 10; pl, viii, figs. 7—11 (1919).

We remarked on the resemblance of the hinge of this form to that of *L. jenkinsianus*. This resemblance is, however, superficial only, for the pseudocardinal teeth in *rhadinaeus* are much thinner and broader than in *L. jenkinsianus* and the laterals are not so well developed. The shape of the shell also is different resembling more the true *L. marginalis* than any of the forms of *L. jenkinsianus*.

Photographs of typical specimens of different forms of the latter are given on pl. IX, and of the hinge-teeth of the three forms in text-fig. 2.

Lamellidens jenkinsianus (Benson) subsp. **obesa** (Hanley and Theobald).

(Pl. IX, figs. 1, 2.)

1877. *Unio marginalis* var. *obesa*, Hanley and Theobald, *op. cit*, p. 20, pl. xliii, fig. 3.

I describe this subspecies before the typical form of the species since the shell is of a more central type and this treatment of the species makes it easier to understand the relationships of the different forms.

The shell in this species is elongate, subelliptical, posteriorly produced into a spatulate process about the middle line of the shell; rather thick, convex and greatly inflated; beaks rather small but swollen, incurved and meeting in the middle line above, with low somewhat curved corrugations in the young but eroded in full-grown specimens; surface marked with low concentric ridges corresponding to the regions of growth. Dorsal slope nearly straight in young but truncated anteriorly in adults, ventral margin straight or only slightly sinuate in its anterior part, curving up in a regular slope posteriorly to form the lower border of the spatulate process; anterior margin broad, regularly curved; posterior margin narrow, rounded; posterior ridge straight or slightly curved and with a narrow post-dorsal wing. Epidermis yellowish to dark brown in the young, becoming dark brown or even black sometimes intersparsed with yellowish-brown concentric bars in the adult. Right valve with two lamellar pseudocardinals, of which the lower is well developed, strong and rugose, in some specimens more so than in others, and a single lamellar lateral, which is rather long, originates from just below the beak and is only slightly arched. Left valve with a well developed pseudocardinal, thick and more ragged than those of the right valve and lying in front of the beak, another pad-like tooth originating from underneath the beak itself is also present, and two blade-like slightly arched laterals of which the upper does not extend to the beak. Muscle-scars shallow, but more impressed than in *L. marginalis*; anterior ones separate, posterior confluent. Ligament very long and strongly developed. Nacre bluish tinged with salmon, in young specimens showing a purple band along the edge, iridescent.

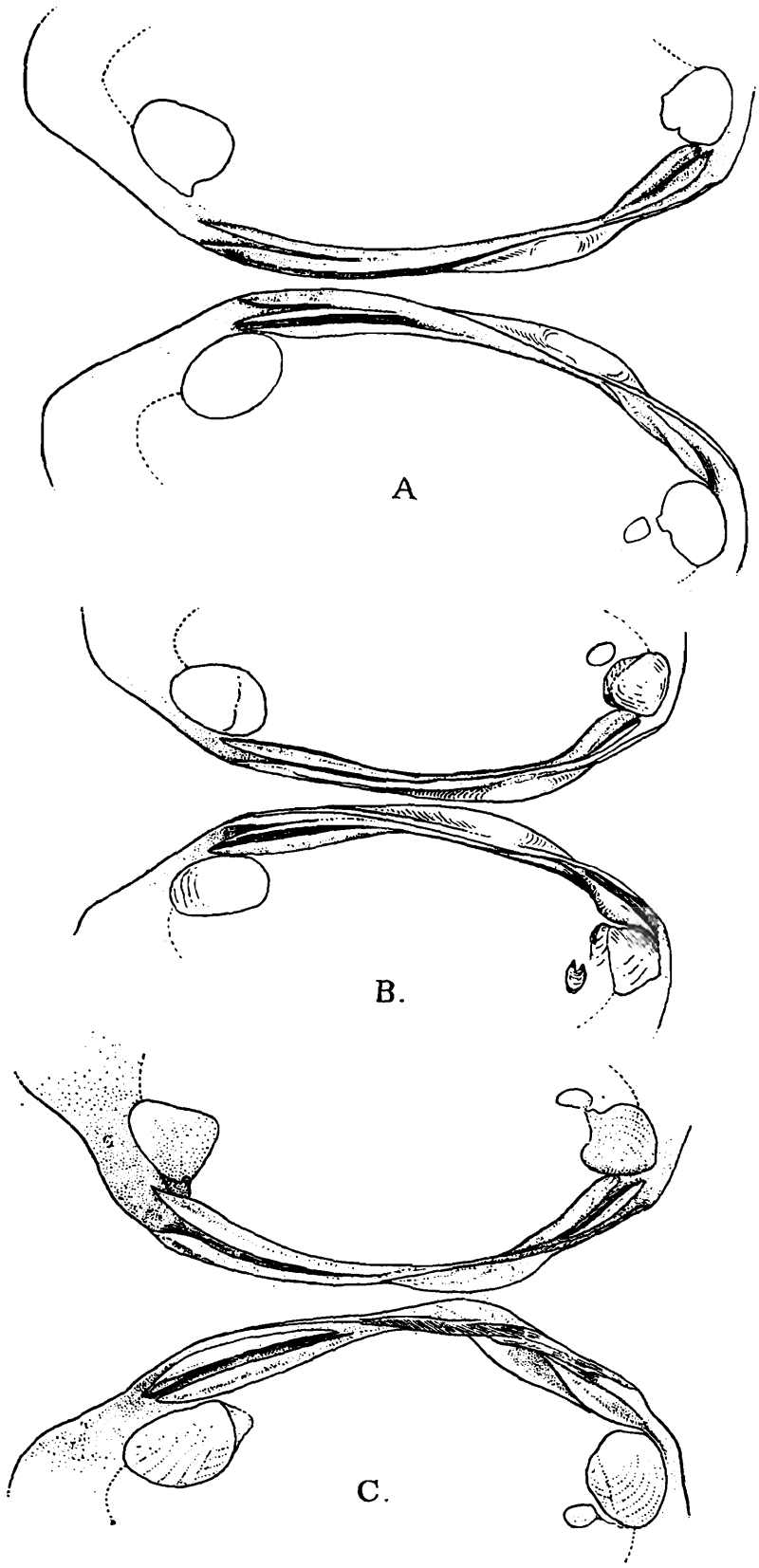

FIG. 2.—Hinge-teeth of *Lamellidens jenkinsianus* and its subspecies.
A. *L. jenkinsianus* subsp. *obesa*, shells from Upper Assam,
B. *L. jenkinsianus* (s.s.), shells from Upper Brahmaputra, Assam.
C. *L. jenkinsianus*, subsp. *daccaensis*, shells from Mirpur, Dacca District.

In a previous paper[1] I referred to the soft-parts of this form and included a description and drawing of its glochidium. A few further notes are here included. The inner pair of gills are much broader than the outer, and the outer pair of gills alone is marsupial. The palpi are elongate but rather shorter than in *L. marginalis*. The foot and the adductor and retractor muscles are very well developed. The branchial is double the size of the anal, which is of about the same size as the supra-anal. The animal on the whole has a much heavier build than that of *L. marginalis* and differs from it fundamentally in the outer pair of gills alone being marsupial.

The species though closely allied to *L. marginalis* differs from it in the heavier build of the shell, in the umbones being larger, more prominent and swollen, and in the hinge being more highly developed.

Hanley and Theobald's specimens of this form were obtained from the Irrawady river in Burma, but the species has a much wider range in Burma, Assam and Eastern Bengal. In the Indian Museum collection it is represented by specimens from Tonghoo, Burma; Silchar, Cachar and Sylhet, Assam; and from Chittagong and Dacca, Eastern Bengal.

Lamellidens jenkinsianus (Benson).

(Pl. IX, figs. 3, 4.)

1862. *Unio jenkinsianus*, Benson, *Ann. Mag. Nat. Hist.* X, p. 185.
1876. *Unio jenkinsianus*, Hanley and Theobald, *op. cit.* p. 19, pl. xli, fig. 4.
1900. *Lamellidens jenkinsianus*, Simpson, *Proc. U. S. Nat. Mus.* XXII, p. 857.
1914. *Lamellidens jenkinsianus*, Simpson, *Descr. Cat. Naiades*, pp. 1176, 1177.
1915. *Lamellidens marginalis*, subsp. *jenkinsianus*, Preston, *op. cit.* p. 184.

Benson's and Simpson's descriptions are fairly complete so far as the form of the shell is concerned, but as the peculiarities of the hinge have not been noticed by either author they are described here. Right valve with two pseudocardinals, of which the lower is rather long, extending from close above the scar of the anterior adductor muscle to the middle of the beak; it is very thick and heavily built, sometimes a little curved and very ragged; the upper one is usually thin and does not extend so far. There is a single blade-like lateral, rather shorter in the typical form but thicker and a little more arched. Left valve with a single pseudocardinal and a small pad-like tooth arising from the inner margin of the beak, and two lamellar teeth of the same type as in the typical form but thicker.

This form differs from the subsp. *obesa* in being less inflated and less deep but more solid and relatively more elongate, in the muscle-scars being more impressed and the hinge much more strongly developed.

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[1] *Rec. Ind. Mus.* XV, p. 145, fig. 1*a* (1918).

The specimens which I assign to this form are from the Upper Brahmaputra (Tezpur), Assam, and a few from Dacca, Eastern Bengal in the district in which the Ganges and the Brahmaputra are closely adjacent.

Subsp. **daccaensis** (Preston).

(Pl. IX, figs. 5-8.)

1912. *Parreyssia daccaensis*, Preston, *Rec. Ind. Mus.* VII, p. 300.
1914. *Parreyssia daccaensis*, Simpson, *op. cit.* p. 1114.
1915. *Parreyssia daccaensis*, Preston, *op. cit.* pp. 165, 166, figs. 16 (1-3).

Preston's species was founded on a single young shell, but in the Indian Museum collection there are now a large number of specimens of this species from Dacca and Mirpur, Eastern Bengal, a young shell from Bhagalpur, Bengal, and many shells from Sylhet, Assam.

The species resembles the typical form but is much shorter, broader, more convex, much more swollen, with the umbones more distinct and convex, with the upper margin very much more arched and the hinge still more strongly developed. The pseudocardinals and the lateral teeth are both much stouter and thicker, and the former are in many cases so striate and ragged as to recall the condition in the genus *Parreyssia*. The second or posterior pseudocardinal of the left valve, which projects from the margin of the beak about its middle, has become larger, somewhat subtriangular in outline and has assumed a real tooth-like shape. In some shells the spout or the spatulate process on the posterior margin described in the subsp. *obesa* is more marked than in others, but in this form it is situated a little below the middle line.

It may be pointed out here that the system of hinge-teeth of this form is not at all like that of *Parreyssia feddeni* (Theobald) as Preston thought. Unfortunately Theobald's original description of the hinge of *P. feddeni* is incomplete in that he describes the pseudocardinal as "in valve dextro singulo," whereas there is a second much thinner ridge above the thick and larger lower pseudocardinal. Preston did not point out this inaccuracy in describing the teeth of his species as similar to those of *P. feddeni*.

It is also of interest to note in connection with the thick-shelled Unionids of the group of *L. jenkinsianus* and its subspecies considered above, that their shells are of great economic importance in the provinces of Bengal and Assam. They form the greater part of the raw material for the pearl-button industry and are also burnt in large quantities for making lime.