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[WITH TWENTY-SEVEN PLATES].

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Hab.—Cardwell, Rockingham Bay, Queensland, Gould Island in Rockingham Bay. (*Mr. C. E. Beddome.*)

- * *Var. a.*—Thinner, darker in color on the upper surface, granulation finer, light yellowish band following the suture spirally to the Apex.

Diam. maj. 13, min. $10\frac{1}{2}$, alt. 8 lines.

- * *Var. b.*—Thicker, light straw yellow, upper surface granulated obliquely rugosely striated, keel more distinctly seen on the periphery; peristome scarcely reflected at the columellar margin.

Diam. maj. $11\frac{3}{4}$, min. $9\frac{3}{4}$, alt. 7 lines.

The two varieties come from Gould Island, and are much smaller than those from the Mainland.

* 6. *HELIX BEDDOMÆ*, NEW SP., pl. 8, fig. 7.

Shell umbilicated, globose, inflated, very thin, distinctly obliquely striated, granulated from left to right, taking somewhat of a zig-zag form, smoky yellow, with a chestnut band under the suture, having a faint broad one above, giving it a darker color; body whorl from the periphery, dark chestnut; spine somewhat globular, suture smooth; whorls $5\frac{1}{2}$, slightly convex, slowly increasing, the last roundly convex, descending a little in front; aperture nearly diagonal, roundly lunate; peristome below slightly raised somewhat in the form of a small obtuse callus like tooth, bluish white, very little expanded or reflected; margins rather distant, joined by a thin bluish white callus; columellar margin broadly expanded and reflected on the umbilicus.

Diam. maj. 23, min. 18, alt. 17 lines.

Hab.—20 miles north-west of Cardwell, Rockingham Bay, Queensland, in the ranges at an altitude of 3,500 feet. (*Mr. C. E. Beddome.*)

This beautiful shell is very thin, the granulations on its surface are distinctly seen with the naked eye, some run straight, some oblique or zigzag; the sculpture can only be compared to a fine double cross-cut file. The species is allied in color to *Helix bipartita*, Fer.

7. *VOLUTA BEDNALLI*, NEW SP., pl. 8, fig. 3.

Shell ovately fusiform, longitudinally distinctly striated, white, with four reddish brown transverse bands, the upper just beneath the suture, one above being much finer; spire rather elevated, apex obtuse; ornamented with rather broad waved longitudinal reddish brown lines breaking off in the centre in the form of blotches; whorls 6, convex, the last forming nearly the whole of the shell, aperture narrow, white within; columella straight, covered with a thin callus, furnished with four plaits, the two upper being nearly transverse, the lower two nearly oblique.

Length 39, diam. 15 lines.

Hab.—Port Darwin, north coast of Australia. (*Mr. William Thompson Bednall.*)

Only a single specimen of this fine species has been obtained, its peculiar regular longitudinal thread-like striæ, and transverse and longitudinally waved reddish brown bands breaking off into blotches in the centre on the dorsal surface, mark a species that will never get confused with such species as *piperita*, *Macgillivrayi*, *Ruckeri*, *Kingi*, *Sclateri*, *Angasi*, *undulata*, *Turneri*, *volva*, *reticulata*, *Reevei*, *Lorcisi*, and *Ellioti*.

I take great pleasure in naming this after its owner, Mr. W. Thompson Bednall, a zealous collector of shells from North and South Australia.

On *Bulimus Dufresnii*.

By the Rev. J. E. TENISON-WOODS, F.G.S., F.L.S., Hon. Cor.
Mem. Linn. Soc., N.S.W., &c., &c.

Plate VII.

The process of describing and cataloguing various representatives of our Australian fauna has proceeded so far that I think the time has come when we can commence to call attention to the many variations to which species are subject, probably also, to reduce considerably the number of species and even genera. No one can question that a very great number of our species will have to be reduced as observations are extended; and in no department will this be more necessary than in that of the land

shells. Yet it must not be imagined that this is due to a fault in the observers or to any recklessness in the multiplication of species. In some cases, it has been from the necessary difficulties attending scientific observations in a new country. I don't mean as to synonymy, or the description by two persons each unaware of the other's labours, but the necessarily incomplete manner in which observations must be made in the first instance. Thus an explorer may find one or two specimens of a shell which is very common and subject to great variation. Another may find the variety and regard it a species. No one can blame the observer. He is doing what is best for the interest of science. He remarks certain differences, and, if they are valid and important, he has no right to assume that the species with which he has to deal is specifically one with some other. He should in the interest of science state his suspicions and point out the resemblance, and when intermediate varieties have been found, but not until then, the group should be united, and the variation described. The material for doing this is rapidly accumulating in our hands. And perhaps as it does so, it may not be out of place to remark that the greatest consideration and respect should be shown to the pioneers of science. It is a great temptation to young observers to glorify themselves at the expense of the mistakes of their predecessors, or on the superior knowledge which has accumulated since their time. But they little realize how very large is the debt that we owe to those men, and how their labours, incomplete or faulty as they may have been, represent an amount of care, study, industry, and zeal that we cannot easily command at the present. Perhaps I may be pardoned for transcribing a remark of Dr. Philip P. Carpenter on this subject, which will have all the more weight as it comes from one of the most eminent conchologists of later times. He says, "An instructive lesson in candour and forbearance may be learnt by comparing together the works of any two naturalists of equal celebrity, or by comparing either of these with the types. With the best desire for accuracy and the greatest care, it is hardly possible for an author to describe so that his readers shall

see shells as he sees them. If this be true of such full and precise diagnosis as those of Adams and Gould, how much greater must be the difficulty to foreigners of recognizing shells from the brief descriptions of Broderip, Lamarck, and the older writers generally."*

I make these remarks because in the species with which I propose to deal it will be seen that different authors have described differently even when those authors were of such high authority, as Quoy and Gaimard, and Baron Ferussac; and I trust, as our Australian science advances, and as old errors are cleared away, the philosophers to come will as much distinguish themselves by modesty, patience, justice, and candour, as zeal, industry, and self sacrifice have adorned those who have passed away.

The variations on the shell I now call attention to are instructive in another way. They show peculiarities which mimic even generic differences in marine shells. Shape, color, and size are often relied upon as specific distinctions, and in many instances no doubt they are. But in *Bulimus Dufrenoyi*,† the size varies in an extraordinary degree, and so does the color, but within certain limits. If it were not for those limits, the shape would lead us astray, for it varies from almost cylindrical to globular. But the lip is at times sinuous to an extent which would make it like a *Daphnella* among marine shells. All these variations in what is undoubtedly the same species are not dependent either upon climate or station, and they point to one useful conclusion, which is, that land shells may vary so widely and completely that there is no antecedent improbability that our numerous species may be found to belong to a comparatively few specific types.

The shell now under notice belongs to the genus *Bulimus* (*Βουλιμία* great hunger or voracity) which was erected by Scopoli in 1786.‡ I need not give any reference to the host of

* Review of Prof. C. B. Adams Cat. of the Shells of Panama, by Philip P. Carpenter, B.A., &c. Zool. Soc. Proc. June, 1863.

† Written *B. Dufrenoyi* by Quoy and Gaimard, in order, I suppose, more completely to Latinize the name.

‡ In his *Deliciae Faunae at Flor. Insubr.*, according to Brugiere but more probably in the *Introd. ad Hist. Natur.*, Prague, 1777.

genera included under this name but it was probably adopted from Adanson (*Hist. Nat. du Senegal. Coquillages. Paris 1757*), and included *Limnæa*, *Bithynia*, and *Succinea*. It is now restricted to ovo-viviparous land shells, oblong and turreted in form, and with the longitudinal margins unequal, toothless, or dentate, columella entire, revolute externally, or nearly simple; peristome simple or expanded. The species are very numerous, and they are divided into many genera and subgenera by various authors. Some copy the etymology of Adanson and write "*Bulinus*," but Messrs. Adams restrict this to fluviatile shells as probably its author intended, and they define their *Bulimus* thus: "Shell solid sub-imperforate, or with the perforation covered, oval, or ovately oblong, last whorl ventricose equalling the spire; aperture oblong oval, columella rather straight, rarely plicate; peristome thick, expanded, reflected and sometimes arcuate, the margins joined by a callus, the columella dilated, reflected.*" They thus restrict the genus to those species proper to tropical America. They make a genus named *Placostylus* which they derive from Beck† in which they place imperforate shells, oblong-conic, rugosely striated, last whorl a little shorter than the spire, aperture oblong, oval, or irregular; columella tortuous, arcuately plicate, peristome thick, reflexly expanded, the margins united by a shining tuberculated callus, the columellar (margin?) dilated, appressed‡. The genus would seem to come very close to *Auricula* in appearance. Its geographical range according to the authors is the Australian Islands, New Caledonia, and Australia. But none of the species enumerated by the authors occur in Australia. The sub-genus *Caryodes*, Albers,|| was adopted by them from the author just named, for solid imperforate oblong oval shells with plaits at the suture, the last whorl equalling the spire, a rather straight columella and a simple obtuse peristome. They include in this section *Bulimus Baconi* Benson (*Ann. Nat. Hist.*, vol. 13, p. 19, 1854) and *B. Dufresnii*. Dr. Cox, in his *Monograph of Australian Land Shells*,§ very properly removes *B. Baconi* from

* *Genera of Recent Mollusca*, vol. 2, p. 146.

† *Index. Mollusc. Principis Christ. Frederici*, 4-to, Hafn., 1837.

‡ *Adams loc. cit.*, p. 153, pl. 75, fig. 5.

|| *Helicæen*, Albers, Leipzig, 1860, 2nd edit., p. 223, Genus *Buliminus*.

§ P. 73.

the subgenus as it is perforate, but he includes in it another species *Bulimus Angasianus*, described by Pfeiffer in the *Zool. Soc. Proc.*, 1863, p. 528. I shall now proceed to notice the remarks of the more important authors on *B. Dufresnii*. It may be remarked in passing that Albers included his *Caryodes* as a subgenus of *Buliminus* Ehrenberg, which was for ovate or ovately conical thin land shells, whose ovate aperture did not reach or did not exceed the whole length, with a peristome often expanded, unequal margins and a narrow simple columella.

Bulimus Dufresnii was originally described by Leach, in the *Zoological Miscellany*, vol. 2, page 153 to 154, and plate 120. Dr. Leach, as most readers are aware, was a curator of the British Museum, whose ability according to Swainson was equal to his zeal, and who in trying to bring order into the vast unweildy collection over which he was placed, fell a sacrifice to incessant labour. In trying to arrange some of the curiosities pouring in from the colonies, he described some of our land shells, and *Bulimus Dufresnii* was amongst them. I have not seen his diagnosis, but it is only of consequence now to observe that he classed the shell as a *Helix*. In 1827, when Messrs. Quoy and Gaimard visited Tasmania in the *Astrolabe*,* they met with this species and were able to make complete observations on the shell and on the animal which they characterize thus: "*Helix, testa ovata, oleaformi, imperforata, longitrorsum tenuiter striata anfractibus quinque, convexis, ultimo fasciis luteis et fuscis cincto; apertura ampla, subsemilunata, labro simplici.*"—(Shell ovate olive shaped, imperforate reddish, finely striate lengthwise, convex, whorls five, last zoned with yellow and brown bands; aperture ample, somewhat semilunar, labrum simple.)

To this description they add the following remarks: "The shell of this elegant species is of the size and shape of a little olive, solid, quite oval with a large and obtuse spire, the whorls of which are rounded, wide, the last larger than all the others together and ventricose. The aperture is rather large and a little semilunar; the peristome is simple, somewhat thick, the

* *Voyage de l'Astrolabe, Zoologie* vol. 2, p. 118; also, plate 10, fig. 1 to 3.

columella slightly twisted and white.* There is only a very faint umbilicus. The shell is finely striate lengthwise. These striae widen on the edge of the sutures where they form little irregular folds. The general color is a greenish yellow, streaked with brown encircled on the last two whorls of the spire with a little chestnut brown band, bordered by yellow lines at the two sides; a wide brown band proceeds from the summit of the peristome, turns round the columella, and is prolonged anteriorly on to the last whorl. The summit of the spire is brownish. In its young state the shell is globular, with a rounded aperture, in which the brown bands are perceptible. The animal has long posterior tentacles, while the anterior ones are of medium length. The mouth is in the midst of a muzzle of two lobes. All the upper part of the body as well as the sides are brown or almost black, shot with reddish. The foot is yellow underneath and when fully extended hardly reaches behind the shell. This *Helix* inhabits the Island of Van Dieman. It is not very common. We found it hidden under stones on the hills around Hobart Town. Some individuals were provided with an epiphragma.† Length 11 lines, thickness 5.

In Ferussac and Deshayes' *Hist. Nat. des Mollusques*, vol. 2, part 2, p. 76, we find the following synonymy and notice. Leach is referred to as above. Quoy and Gaimard, ditto. *Ferussac. Prodomus*, pl. 48, n. 330, Bowditch *Elements of Conchology*,‡ pl. 8, fig. 21, Paris, 1822. Deshayes in Lamarck, vol. 8, p. 246, no. 54. Catlow's *Conchological Nomenclator*, p. 154, no. 112. *Orthostylis Dufrenoyi* Beck Ind., p. 50, no. 9. Pfeiffer *Monograph Heliceorum vivorum*, t. 2, p. 168, no. 444, Reeve *Icon.*, plate 37, fig. 219. Habitat: Van Dieman's Land. Shell oblong oval thick and solid with a somewhat elongated spire, convex, obtuse at the summit, five flattened whorls joined by a suture bordered by a slight plaited margin. Last whorl rather large, subcylindrical convex at the base and imperforate. The aperture is of medium size, oval, dilated at the base, attenuated

* All these details show that the species would not enter into Ehrenberg's genus *Buliminus*.
† I can hardly tell what is referred to here.

‡ A very meritorious work including the animals and fossil genera: published in Paris, little known to English readers. It has become very scarce.

behind, its edge without being reflected, is not quite trenchant. It is obtuse and in profile it shows lengthwise a convex sinuosity in front. The columella is short and rather conspicuously twisted on itself. A left margin rather thick is detached and abuts on the upper end of the opening. Coarse lines of growth cover the surface, but generally they are almost effaced. The surface is marked with fine punctuations which disappear insensibly towards the base. The color of this shell is a little variable. It is of a uniform maroon brown. The last whorls bears a cincture formed of a whitish band rather broad, parted into two equal portions by a narrow and very neat brown zone. The interior is of a pale violet brown. There is a variety which is described as much smaller, narrower and subcylindrical. The large individuals are 37 millim. long, 20 wide and the variety is 29 by 13.

This description gives us an idea of how little is really gained by elaborate and minute details. From what will appear subsequently, or by consulting the plate, it will be seen how few of these particulars of color and shape are definite. The specimens referred to would be nearer fig. 4 than any other, and that is rather an exceptional form. The figures in Ferussac's Atlas are highly colored, and would not readily be recognized.

The description of Reeve is very brief. He says, "Shell cylindrically ovate, olive shaped, obtuse at the apex; whorls five to six in number minutely granulated towards the apex, crenulated along the margin; columella slightly receding, lip simple; yellowish green, banded and lineated with dark olive brown. The painting of this species is mostly represented by a conspicuous central band, with fine longitudinally waved lines above and below it." The coloring of Reeve's figure leaves much to be desired; and, in general, I think such figures are better left uncolored.

I shall now proceed to examine the variations to which the species is subject. First, as to the shape. It will be seen from fig. 1, 6, of the plate that when the shell emerges from the egg, it is obliquely sub-orbicular, and that subsequently it is generally

ovate. But the width of the oval varies considerably. In the three specimens selected from St. Leonards, near Launceston, figs. 2 a, b, and c; one (fig. 2 a,) is almost globose; 2 b, is less so, while 2 c, is lengthened oval, much more attenuated at the apex than any other except fig. 5 b, a specimen from Bothwell.* This globular habit is not due to age, for in fig. 6 a, we have a full grown form from Ringarooma, which is even still more globose and tumid. In fig. 4, a specimen from Macquarie Harbor,† we have a globose form yet again differing from the preceding, and with a very obtuse spire. I have placed three shells side by side in the plate, namely fig. 3 a, 4, and 3 b, in order to show the contrast of the variation in shape. Figs. 3 a, and b, are from Port Davey‡, and fig. 4, as already stated, from Macquarie Harbor. In figs. 7 a, b, and c, we have other specimens from Macquarie Harbor, which equally vary in size and shape. I draw attention also to the form of the apex, which is very obtuse in fig. 4, 6 a and b; moderately so in 2 a and b, 3 a, 5 a, 7 b, and almost acute in 2 c, 7 c, 5 b. The form of the aperture is equally varied; in 2 a, 5 b, 7 a and b, and 4 it is subquadrate, while in 5 b, it is narrowly pyriform, in 2 b, 3 a, and 3 b, a little wider but of the same shape. In fig. 5 a, the last whorl is produced so as to make the form oblique. The columella is also extremely variable. In 2 a, it is very much bent, contorted, and truncate, while the inner lip is reflected, giving rise to a false umbilicus. This reflexion of the lip is seen also to a smaller extent in fig. 2 b, but no trace of it remains in fig. 2 c, where the pillar is twisted almost to a plait. In figs. 3 a and b, from Port Davey, there is no perceptible reflexion of the columella. When the animal is taken fresh out of the shell, the whole of the aperture and part of the columella has a kind of silky enamel, which is quite transparent, and allows the coloring of the shell to be seen very clearly. But if the shell becomes dead, this enamel alters to an opaque chalk white, and quite conceals the color of the aperture, though it must be a lining of the most

* About 50 miles north of Hobart, and St. Leonards is about 120 miles.

† Formerly a convict station on the west coast, but now uninhabited.

‡ On the extreme south west of the island, now only occupied by a few timber sawyers and splitters.

extreme tenuity. Generally the outer lip or labrum slopes away in a smooth acute edge. In figure 4 we have an instance of a distinct sinus near the suture very like what is seen in the marine genera *Daphnella*, *Bela*, *Mangelia*, &c. This is supposed to be connected with a slit in the posterior side of the mantle of the animal. In the shell figured, probably the animal had a mantle thrown more forward in the direction of the centre of the lips, and the apparent sinus is due to the secretion of the shell being more abundant in that direction. It affords a curious instance of an abnormal character being imitative and apt to deceive collectors who rely upon a single individual. The specimen, when handled, shows the sinus in a more remarkable manner than can be expressed in a figure. The plaits or rugose edges of the whorls at the suture are not visible on the larger specimens, while on the smaller they extend down the whole length of the shells. In some shells, and generally the small ones, the surface is shining and almost polished, but in the others, especially those which are globose, the surface is silky, and under the microscope has a decussated appearance like woven cloth. In these specimens the spiral striæ are close and conspicuous, especially towards the summit.

I have mentioned already that the color varies but within certain limits, and were it not for these limits and a certain general resemblance in the pattern, I am sure many species would have been made of *Bulimus Dufrenoyi*. This general resemblance is in the permanence of one or two spiral yellow bands on the basal whorl. The body color varies from light yellow (fig. 7a), chestnut brown (fig. 6a), rich deep maroon brown (fig. 4), and dull pale olive (fig. 6b). The last whorl has generally all underneath the spiral bands of a deeper color than the rest of the shell, and when the color is yellow or olive this is a deep rich brown. When there are two yellow bands the space between has a deep brown narrow band. There seem but few exceptions to this. Sometimes there are two of the brown bands. The width of the yellow band varies in every individual and its color. I have seen a shell of a pink white

with only one deep purple brown narrow band and no other band or color. Generally the bands at each side of the darker band vary from almost dull chrome to almost white. In fact it would be difficult to imagine anything like the varied pattern which are produced by the moderate materials of brown and yellow spiral bands.

We might further enquire what are the purposes served by these bands of color. My own idea is that they are in some way connected with the organs of reproduction. I have called attention in a paper read before the Society at the last meeting to a similar feature in the *Littorinæ*. The same peculiarity is observed in many of the Australian *Bulimi*. In *B. Baconi* there are two broad conspicuous chestnut bands, though from what we have seen in *B. Dufresnii*, we might expect them to be one or two, or broad or narrow, according to the individual. *Bulimus Angasianus*, Pfr., has two yellow bands; but we learn from Mr. Masters, through Dr. Cox, that there is a variety at its habitat (Port Lincoln, S.A.) which is of a beautiful bright yellow color with indications of a single spiral reddish line. In *B. melo*, Quoy and Gaimard, we have another variable species with spiral lines. Dr. Cox says with reference to this shell that "it differs from *B. Kingii* in diversity of markings, conspicuously differs from it in the first instance by its greater solidity and less lengthened form. Menke specifies four varieties. Pfeiffer gives descriptions of six, and my own collection could furnish others.*" *B. Bidwilli* is another species with spiral bands. The three just named are from Western Australia, but banded forms of coloring seem to be peculiar to the South of Australia and Tasmania, and spreading westward. All the *Bulimi* found on the east side of the continent are of entirely different style of coloring.

It must be remarked that when it said that the pattern of the coloring is constant within certain limits, that is because naturalists have regarded those without any bands of color to be of different species. There is a *Bulimus* without bands in Tasmania, which

* Dr. Cox, loc. cit., p. 75.

is named *B. Tasmanicus*.* It is a good deal different in shape from *B. Dufresnii*, but we have seen that such a feature is not of value. It would be interesting to keep some of the live individuals for some time, and see if the different species would breed together.

The egg of the *B. Dufresnii* calls for no particular remark, except for its size, which is disproportionately large to the animal which brings it forth. Just before breaking forth, the shell is very thin, amber colored, and almost developed into the form figured in the plate fig. 1 b. The shell as well as the egg is so exceedingly brittle that even an alteration of the temperature is sufficient to break it, and no doubt it is in this manner that the imprisoned animal escapes from its enclosure.

In conclusion, I must express my great obligations to Mr. W. Legrand, of Hobart, author of "*Monograph of Tasmanian Land Shells*."† He placed his very extensive collections entirely at my disposal for descriptions, and I need scarcely say such a number of varieties could be got together by no ordinary observer. I have also to thank Dr. J. C. Cox, for the use of his collection.

EXPLANATION OF PLATE 7.

- Fig. 1 a.—Egg of *Bulimus Dufresnii*.
 Fig. 1 b.—Shell just emerged from the egg.
 Fig. 2 a.b.c.—Specimens from St. Leonards, Launceston.
 Fig. 3 a.b. do. do. Port Davey.
 Fig. 4 do. do. Macquarie Harbor.
 Fig. 5 a.b. do. do. Bothwell.
 Fig. 6 a.b. do. do. Ringarooma.
 Fig. 7 a.b.c. do. do. Macquarie Harbor.

NOTE.—All the figures are natural size.

* It is much thinner than *B. Dufresnii*, more acute and only found near the coast. I have very little doubt that it is identical with *B. Kingii*, Gray, of Western Australia, which has the following synonymy according to Dr. Cox: *Helix trilineata*, Q. and G., and Ferussac, and Deshayes; *B. trilineatus*, Reeve; *B. Sayi*, Pfr. Proc. Zool. Soc., 1846, p. 114; *B. melo*, Var. *B. Menke* Moll. Nov. Holl., p. 7. The species is found in Western Australia, but no doubt has intermediate stations.

† Printed and published by the author, 1871; and I regret to add, the first edition was small and is now out of print. Copies are exceedingly scarce.



1a



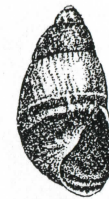
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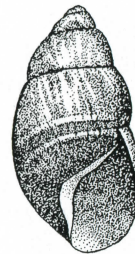
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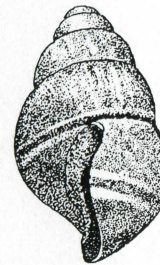
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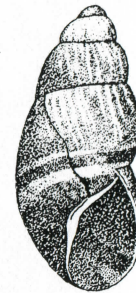
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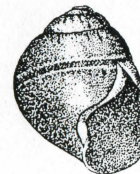
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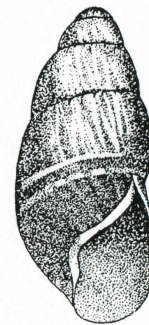
5b



5a



6a



6b



7a



7b



7c



7d