

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 70. OCTOBER 1853.

XXIII.—*On some new species of Trigonina from the Inferior Oolite of the Cotteswolds, with preliminary Remarks upon that Genus.*
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[With a Plate.]

“Not only by their numbers, but still more by the richness of their specific divisions, by the peculiar prominence of individualization, do the species of the remarkable genus *Trigonina* attain their maximum point in the lower chalk.”—L. VON BUCH, *Betrachtungen über die Verbreitung und die Grenzen der Kreide Bildungen*. Bonn, 1849.

TRIGONIA and *Pholadomya* are the two organic forms which pre-eminently serve to impress a distinctive character upon the Testacea of the Oolite rocks in whatever country they are discovered, and accordingly from the time when fossil shells were regarded as mere freaks of nature, we find that authors depicted their *Hippocephaloides* and *Bucardites*. But conspicuous as is the position which *Trigonina* holds throughout the Oolites, the quotation above chosen, and the passages which immediately follow, are not the less true and worthy of notice; they evince the strong impression made upon the mind of a distinguished and veteran palæontologist by the remarkable prominence which the genus *Trigonina* holds amongst the Cretaceous Conchifera, both in its numbers and world-wide distribution, a prominence which appears not the less remarkable when we remember that the leading sectional oolitic forms of the genus had already nearly disappeared, and that a little higher in the series even the cretaceous forms exhibit a rapid diminution, until in the upper chalk a trifling remnant alone remains to indicate the forthcoming extinction of the fossil *Trigoniæ*, a loss which is not the

* Read to the Cotteswold Naturalists' Club, July 19, 1853.
Ann. & Mag. N. Hist. Ser. 2. Vol. xii.

less strongly felt upon a contemplation of the altered, and in some measure degenerated characters of the living species. But if the attributes claimed for the genus at the æra which immediately precedes the extinction of the Cretaceous species are well founded, it will, I think, appear equally evident that at its primal æra in the earlier portion of the Oolitic system the genus had already acquired that prominence amongst the Testacea which Von Buch has so vividly described, and that the forms, dimensions, and ornamentations of the species were scarcely less characteristic and varied. Upon numbering the entire recorded species of *Trigonia*, it will be found that about two-thirds are proper to the Oolitic rocks; and although some little abatement must be made, for instances in which young individuals, varieties, or mere casts have been erected into distinct species, the predominance of Oolitic forms will remain, inasmuch as the Cretaceous species are not exempt from similar errors of augmentation. The inadequate manner in which the Inferior Oolite *Trigoniae* have been illustrated, will appear, when it is stated that of the sixteen species recorded in the present paper, four only will be found illustrated in the range of English literature; a fifth occurs in the 'Mémoire sur les Trigonées' of Agassiz, and two others are on the eve of being published in a 'Monograph of the Palæontographical Society,' leaving upwards of nine species unfigured, a number which will be admitted to be remarkable when we remember that M. D'Orbigny has only enumerated seven in his 'Prodrome de Paléontologie' for the Terrain Bajocien of the whole of France, and M. Agassiz twelve from the entire lower Oolite rocks of Germany, France and Switzerland. The present examination of Inferior Oolite species has been suggested by the frequent occurrence in collections of *Trigonia costata*, *clavellata* and *angulata*, or of shells bearing those names, pertaining to nearly the entire series of the Oolitic rocks of England and France; the aspect of these shells is so varied and dissimilar, that they agree with each other and with the typical forms of those species only, inasmuch as the first portion is costated, the second clavellated, and the remainder have their costæ bent to form an angle.

M. Agassiz, in his valuable memoir on *Trigonia*, arranged the species into upwards of eight sections, some of which appear to be separated by distinctions so transitive that it is scarcely possible to apply them to a large number of specimens, except in an arbitrary and unsatisfactory manner; a more simple arrangement here proposed will probably answer every practical purpose, and has at least the advantage of being more readily understood and applied; the genus will thus form six sections, of which one, the Pectines, is recent only; the five fossil sections consisting of

the *Costatæ*, the *Clavellatæ*, the *Quadrataæ*, the *Scabræ*, and the *Glabræ*. The *Costatæ* have a figure more arched than the other sectional forms; they have smooth regular longitudinal ribs, which are separated from the posterior slope or area by a carina more or less prominent, but which, with advance of age, often becomes nearly obliterated; this is the *marginal carina*; the area has transverse striations which are frequently decussated by longitudinal plications, and by one or two, more prominent than the others, that which bounds the area posteriorly being the *inner carina*; should a third carina be present between the two others, it is the *median carina*; the lanceolate space posterior to the ligament is always plicated or reticulated.

The *Costatæ* are remarkably prominent in the lower and middle Oolite rocks; in the upper Oolites and lower portion of the Cretaceous series they diminish and almost disappear. The *Clavellatæ* accompany the *Costatæ* in their stratigraphical distribution; in this section I would include the *Clavellatæ*, the *Undulatæ*, and the *Scaphoides* of Agassiz, all of which have their costæ divided into tubercles, serrations, or irregular varices which are disposed in rows, either concentric, oblique or excentric; sometimes they are bent to form an angle after the manner of the *Goniomyæ*; the links which connect the one with the other of these features are too transitive to allow of any clear sectional divisions when they are applied to a large number of species, neither will the differences of form afford any more certain guide. In the *Clavellatæ*, as in the former sections, a carina more or less distinct separates the area from the tuberculated portion of the surface; the area is transversely striated and is never large; the lanceolate post-ligamental space is smooth, except in certain subcretaceous forms, which have the space strongly costated, as in the contemporaneous *Scabræ*, to which they form a passage; these are the *T. sulcataria*, Lam., *T. muricata*, Goldf., and *T. Lusitanica*, Sharpe.

The *Quadrataæ* have the figure rendered subquadrate by the largeness of the area, the upper border of which is nearly horizontal; its surface is flattened, and sometimes constitutes the larger half up the shell; there is no marginal carina, neither is there any clear line of separation between the area and the tuberculated portion of the surface; the *Quadrataæ* are fewer than the *Clavellatæ*, which they seem to replace in the Cretaceous and upper portion of the Oolitic system; *Trigonia nodosa*, Sow., is a well-known example. The *Scabræ* constitute a fourth and very natural section, which are distinguished not less by their figure than by the beauty and variety of their ornamentation; their figure indicates a change from the usual figure of the genus; it is crescentic rather than trigonal; the oblique costæ are elevated

and serrated; they are continued across the depressed area, the separating carina (marginal) being replaced only by a smooth groove. The stratigraphical distribution of the *Scabræ* is equally characteristic; they are exclusively Cretaceous, and seem to replace the *Costatæ* of the Oolitic rocks; *Trigonia alæformis* and *spinosa* are examples. The fifth section, or *Glabræ*, are destitute of costa, rows of tubercles or of carinæ upon the area; their sides have large longitudinal plications, and are nearly smooth; *Trigonia gibbosa* and *affinis* are examples: this section, of which few species are known, has not occurred beneath the upper division of the Oolitic rocks. The sixth section, or *Pectines*, is represented by the living species of our Australasian seas, in which both the form and ornaments of the surface differ materially from those of the fossil sections; the radiating crenulated costæ and toothed edges of the valves remind us of the *Limæ* and *Pectines*; the very partial flattening of the posterior slope and general figure nearly resembles *Cardium*, but the internal characters have nothing peculiar.

In tracing the vertical range of the species throughout the Oolitic rocks, it will be found that the facts coincide with others which have been recorded respecting the range of species pertaining to the other leading genera of Conchifera; it is rare that a species ranges beyond a single formation; and when its existence was further extended, it occurs usually in the newer formation, as a variety only, and bearing a physiognomy readily distinguished from that of the typical form. The aspect of the genus seems to have undergone a very gradual but continuous change throughout the secondary formations, by which the sectional forms of the lower Oolites were modified in the upper Oolites, and finally disappeared as the *Quadratæ* and *Scabræ* of the Cretaceous rocks acquired prominence; finally, between the latter and the recent *Pectines*, there occurs a chasm not less zoological than stratigraphical, in which we lose the links by which probably they were connected.

In the discrimination of species, it is of importance to have correct ideas of the surface-markings which distinguish their young condition. In the *Clavellatæ* generally, the young shells have their concentric costæ continued across the area; the costæ are slightly tumid and projecting when they cross the position of the marginal carina: in several instances the young of this section have smooth undivided costæ, and such species as in the adult state have their costæ forming an angle or undulation, do not exhibit any trace of such a feature until five or more costæ have been formed. But if in the rudimentary condition we are often unable to distinguish forms which subsequently become widely separated, the individuals of a species are in their imma-

ture stage all alike; they exhibit no traces of that law which is afterwards developed to form varieties of a species. A common feature observable in the *Clavellatæ* and *Quadrataæ* which tends to mask the species, consists in a confused or reticulated disposition of the tubercles, which no longer form regular concentric or curved rows; the tubercles also become irregular in size, or they are partially flattened and confluent in the rows; it is not clear to what causes are to be attributed this unequal secretion of shell by the mantle at the lower border; it is however quite distinct from another and final change observable in aged shells, when the mantle ceases altogether to secrete ornaments upon the surface; in the latter case a change occurs (sometimes sudden), in which the carinæ upon the area, and the tubercles upon the sides of the shell simultaneously disappear, the last-formed portion of the surface being altogether destitute of ornament.

The mineral character of the beds in which *Trigonia* occurs is very various; clays, argillaceous limestones, chalk, calcareous oolitic freestone, and shelly oolitic drift equally contain it, but the latter kind of deposit does not seem to have been favourable for its development; for although specimens are abundant the size is dwarfed, and by far the larger number perished in the earlier stages of their growth.

In England the oldest stratum which contains *Trigonia* is the Lias of Yorkshire, which produces the *T. literata*. Phillips records it in the lower, and Williamson in the upper Lias, but the same formation has not furnished a single example of the genus throughout the middle and west of England; in Switzerland and Germany the upper Lias has five species, none of which have been identified in England. In the Cotteswold Hills, *Trigonia* is first found in the beds of ferruginous oolite which immediately overlie the sands at the base of the formation, and which abound with *Ammonites*, *Belemnites* and *Nautili*, but the *Trigoniæ* are not numerous, and are only of three species; in the freestone beds higher in the series, and which are so largely developed in Gloucestershire, some local deposits have many species of *Trigonia*, but the genus does not acquire any particular prominence; it is only upon reaching the ragstones of the upper division of the formation that we find *Trigonia* in abundance; there it is associated with a large assemblage of bivalve mollusks, and less commonly with Echinodermata and Corals, but in either case the impressions of *Trigonia* often constitute a large proportion of the entire mass of the rock.

The Inferior Oolite, in common with the middle and lower Oolitic rocks generally, contains, according to the present arrangement, two sections only of the genus *Trigonia*.

In the following descriptions of species, the references to such

as have been before figured and described are given as concisely as possible.

COSTATÆ.

Trigonia costata, Lam. Var. 1. *costata*. Var. 2. *multicosta*.
Var. 3. *pulla*. Var. 4. *sculpta*.

T. costatula, Lyc.

T. exigua, Lyc.

T. tenuicosta, Lyc.

T. hemisphærica, Lyc.

CLAVELLATÆ.

T. striata, Sow.

T. duplicata, Sow.

T. angulata, Sow.

T. signata, Ag.

T. tuberculosa, Lyc.

T. v.-costata, Lyc.

T. clavo-costata, Lyc.

T. Phillipsi, Mor. & Lyc. var.

T. subglobosa, Mor. & Lyc.

T. gemmata, Lyc.

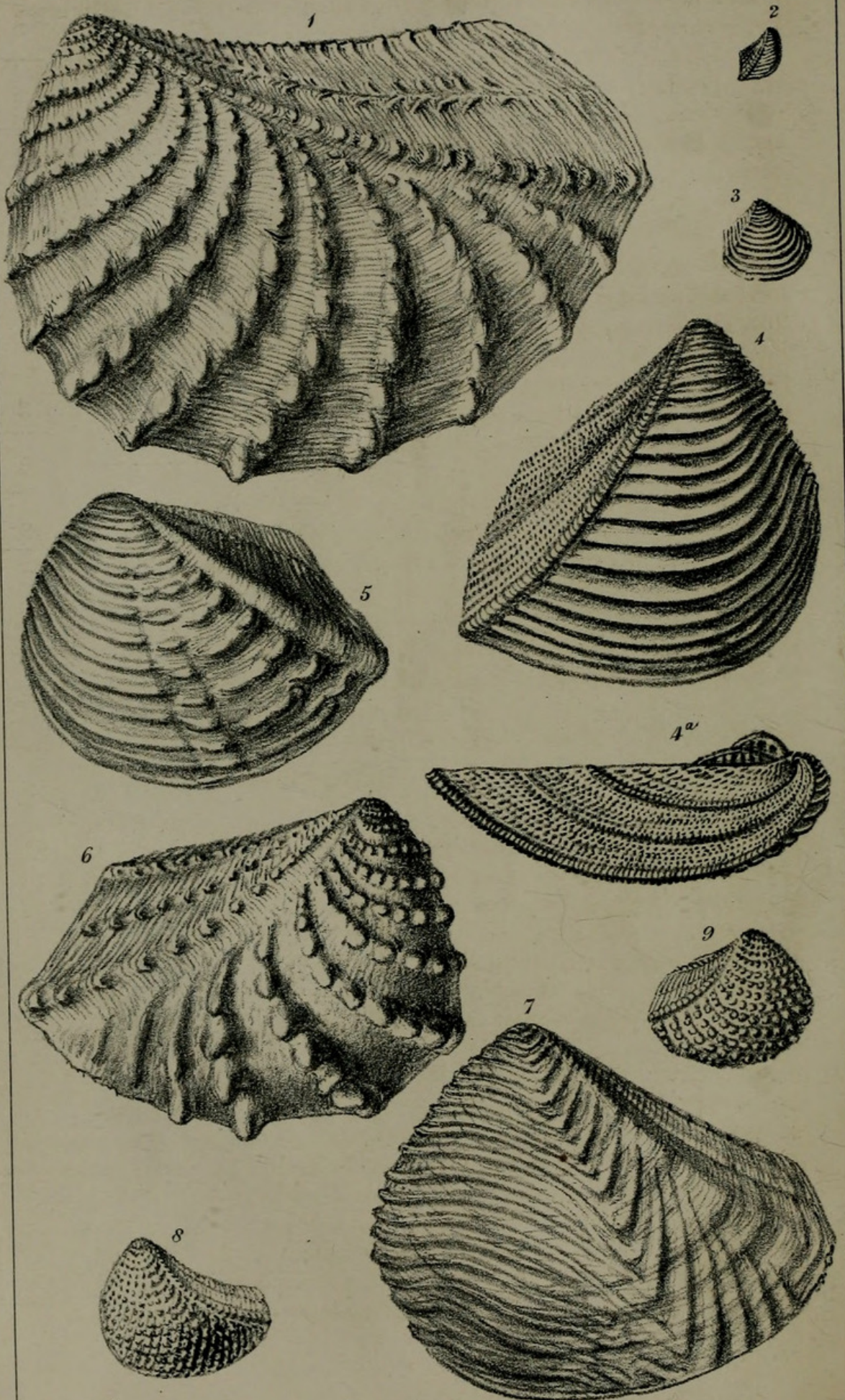
T. decorata, Lyc.

Trigonia tenuicosta, Lycett, n. sp. Pl. XI. fig. 4 a.

Shell subhemispherical, moderately large, the anterior and inferior borders rounded, the posterior border slightly concave; umbones pointed, prominent and recurved; costæ very numerous, not much elevated, closely arranged, gracefully curved and almost united to the marginal carina; area very large, its surface forms a considerable angle with the costated surface of the shell; it has three carinæ, the median and inner of which are small but distinct, and finely striated throughout their length; the marginal carina is delicate, striated, rather acute and very much curved; the spaces between the carinæ are very finely reticulated, the lanceolate space between the inner carinæ is large and very finely reticulated.

The great convexity of the valves and incurved figure of the umbones produces a considerable curvature in the marginal carina, and the costated portion of the shell near to the umbones is very narrow; the length of the marginal carina is somewhat greater than the diameter of the shell at right angles to it. From *Trigonia costata* it is distinguished by the more acute recurved apex, by the small and finely striated marginal carina, by the delicate and finely striated median and inner carinæ; the costæ are much more numerous, and are scarcely separated from the





marginal carina ; the entire form is smaller and unlike *T. costata* ; the area is alike in both the valves.

It is somewhat rare ; all the examples have been obtained in the upper division of the Inferior Oolite.

Professor Buckman has obtained it near Cheltenham ; my own specimens are from the Gryphite grit of Rodborough Hill near Stroud.

Trigonia hemisphærica, Lycett, n. s. Pl. XI. fig. 2.

Shell small, its length not exceeding 3 lines, very much arched, so that the diameter through both the valves slightly exceeds the length ; the umbones are scarcely recurved, acute, contiguous ; the area is large, flattened, forming a considerable angle with the other portion of the shell ; it has numerous fine longitudinal plications faintly traced, there is no median carina, and the inner carina is very small ; the marginal carina is acute, elevated and finely serrated ; the other surface has numerous closely arranged longitudinal costæ, which are united to the marginal carina.

The large number of costæ and the characters of the area induce me to regard this as the adult condition of the species, notwithstanding the small dimensions.

A single specimen is my authority ; it is from the bed of hard pale calcareous mudstone, a local deposit which in the Nailsworth valley replaces the bed of Oolite marl and abounds with *Nerinaea*.

Trigonia costatula, Lycett. Pl. XI. fig. 5.

Trigonia costatula, Lycett in Ann. & Mag. Nat. Hist. 1850, p. 421.

Shell subtrigonal, convex ; umbones mesial, not prominent nor recurved, anterior side produced and rounded, posterior side truncated ; area flattened, finely striated transversely, divided longitudinally into two equal portions by a groove and bounded by two low carinæ ; the marginal carina is imperfectly serrated, it is of moderate size and but little curved ; the inner carina is nearly smooth ; the space between the inner carinæ is smooth and very narrow or lanceolate ; the costæ are numerous (about 21), moderately prominent and closely arranged ; they are but little curved, are separated from the marginal carina by a plain surface, their direction being nearly horizontal or conformable to the inferior border. In the ultimate stage of growth the costæ posteriorly are broken more or less into several portions, which, however, continue to follow the general direction of the costæ. In the immature form the costæ are not separated from the marginal carina, and the area is traversed transversely by an equal number of prominent plications ; but these gradually vanish, and the costæ become disunited from the carina, which then becomes

serrated. The truncation at the posterior extremity is so considerable that the breadth of the area at that part is equal to half the entire length of the shell, or to three-fifths of the height; the length of the marginal carina is 20 lines.

The upper portion of the middle division of the Inferior Oolite has furnished the few specimens which have been procured; the locality is Scar Hill near Nailsworth.

Trigonia exigua, Lycett, n. sp. Pl. XI. fig. 3.

Shell small, subtrigonal, depressed; umbones mesial, not recurved, anterior border nearly straight, oblique, posterior border truncated; area moderately large, flattened, transversely ribbed, and having an obscure oblique mesial furrow, no distinct carinae, the marginal carina being replaced by a series of small nodulous elevations upon the posterior extremities of the costae. Costae smooth, curved, closely arranged, rounded, and slightly bent upwards as they approach the area, their number being about fourteen.

The costae upon the area are smaller and rather more numerous, for an intercalated rib is sometimes added. Specimens vary from 2 to 5 lines in length, the latter dimensions seeming to represent the adult form.

From *T. costatula* it is distinguished by the much smaller dimensions and by the absence of any distinct marginal carina, the costae being continued over its position upon the area.

Trigonia concinna, Römer, Nord. Ool. Nachtrag. p. 35. tab. 19. fig. 21. approximates to our shell in the general figure and disposition of the costae, but his shell would appear to have greater convexity and a larger area, and the costae upon the area appear to be as large as those upon the other portion of the surface; it is therefore probably a distinct species.

Our little shell occurs not uncommonly in the shelly freestone of Leckhampton Hill; it has also occurred in the same beds near to Nailsworth.

Trigonia v.-costata, Lycett. Pl. XI. fig. 7.

Trigonia v.-costata, Lycett in Ann. & Mag. Nat. Hist. 1850, p. 422.

Shell ovately trigonal, moderately convex, anterior and inferior margins rounded, posterior margin straight or slightly concave; umbones obtuse, slightly recurved; area narrow, flattened, its upper portion transversely plicated, its lower portion nearly smooth, divided in its middle by an obliquely longitudinal furrow; marginal and inner carinae but faintly marked and striated, the inner carina being crossed by several varices. The costae are very numerous, smooth and regular, they are directed from the

anterior border obliquely downwards and backwards nearly straight to the middle of the shell, and there form acute angles with varices which proceed upwards nearly vertically to the marginal carina; the varices are slightly nodulous, they are fewer and larger than the anterior costæ. The first eight or nine costæ form only curvatures, and are not broken into two portions.

The species which approaches most nearly to the present shell is *T. angulata*, Sow., but the figure of the two is different; the latter shell is more elongated and rostrated, the posterior border is much more concave, the umbones are more recurved, and consequently the marginal carina is more curved and elongated; the costæ are less numerous, less regular, and the varices are larger and more distantly arranged; they form with the costæ rather an undulation than an angle, and are more conspicuously tuberculated.

In the young state the two forms would more nearly resemble each other, but even in that condition the costæ are more closely arranged in *T. v.-costata*. Some examples in the British Museum of a *Trigonia* collected by Miss Baker in the ferruginous Oolite of Northampton may be the young condition of the species; to the same species may also be referred some small shells from the Dogger of the Yorkshire coast; these have smooth, straight, oblique costæ, bent at a considerable angle, and have been labelled in collections *T. angulata*. The small *T. tripartita*, Forbes, from the Oolite of the Hebrides, has a certain degree of resemblance to our species, but the varices in that shell are fewer and much larger.

From *T. undulata*, From., our shell is distinguished by the less convex form and absence of large tubercles upon the marginal carina; the arrangement of the costæ is nearly similar, but in our species they are much more numerous.

In the Cotteswolds *T. v.-costata* has occurred very rarely in the middle or freestone division near to Stroud, and my friend Dr. Wright has obtained two specimens in the ragstones of the upper division near to Cheltenham.

Trigonia decorata, Lycett, n. sp. Pl. XI. fig. 1.

Shell ovately trigonal, somewhat depressed; umbones obtuse not recurved, anterior and inferior borders rounded, posterior border lengthened and straight; area flattened, striated transversely, ornamented with three faintly traced carinæ, or rather as many lines of closely arranged very small regular tubercles, the inner carina having in addition at its upper part a few irregular transverse plications or varices; there is also a median

divisional sulcus, which passes parallel to the median row of tubercles upon the area. The clavellated portion of the shell has a very numerous series of rows of concentric tubercles; the tubercles are small near to the marginal carina, and become larger towards the middle of the curvature; they are distinct, rounded, closely arranged (15 or 16 being contained in a row), the number of rows being about twenty, the whole of which are distinctly tuberculated; the lines of growth upon the sides of the shell are fine and distinct. The dimensions are equal to the largest examples of the clavellated *Trigonia*.

This elegant shell is nearly allied to *T. perlata*, Ag., which is an Oxford clay species; in that shell however the umbones are more recurved, the carinæ have much larger tubercles, and the median carina has in addition a series of transverse varices which are absent in *T. decorata*. It has sometimes been mistaken for *T. clavellata*, but differs from that well-known form in the following particulars.

The Inferior Oolite shell is less elongated, the umbones are not recurved, the posterior border is not concave, the general figure has less convexity, the area is more flattened, and the lanceolate space is much smaller and not striated; the rows of costæ are more numerous; the tubercles are more numerous, more closely arranged and less prominent. Another large clavellated species, the *T. muricata*, Goldf., approaches more nearly to the figure of our shell, but the Portuguese species has the area much more narrow, the costæ are less numerous, but much more elevated, the tubercles being larger and more distantly arranged.

The figure likewise closely agrees with *T. Bronnii*, Ag., from the Terraine à Chailles or Oxford clay; but the ornamentation of our species, both upon the area and the sides of the shell, is more minute and delicate, with more numerous rows of costæ, the carinæ having no distinct elevation as in the species of Agassiz.

Trigonia decorata occurs abundantly in the Trigonia grit throughout the Cotteswolds, but the test is very fragile, and is difficult to detach from the hard matrix. Rodborough Hill near Stroud has produced it in great numbers.

Trigonia gemmata, Lycett, n. sp. Pl. XI. fig. 8.

Shell small, ovately trigonal, excavated and somewhat rostrated posteriorly, rounded anteriorly; umbones obtuse, somewhat recurved, surface moderately convex; area narrow, transversely striated and bounded on each side by a narrow, elevated and striated carina, which is also gracefully curled; costæ numerous, closely arranged, elevated, acute; the upper third of the valves has concentrically curved and finely tuberculated costæ, those

which succeed are directed from the carina obliquely downwards ; they are straight, are regularly and densely serrated, the spaces between the costæ forming narrow deep grooves.

T. duplicata, Sow., approaches our shell in the general figure and in the arrangement of the costæ, but the latter costæ of *T. duplicata* are dichotomous and waved, the serrations being irregular ; neither of these features are observable in our shell.

It is very rare ; the largest specimen is an inch and a quarter in length upon the marginal carina, and an inch in the opposite direction. I have only seen two specimens.

Near Nailsworth, in the freestone beds.

Trigonia tuberculosa, Lycett. Pl. XI. fig. 9.

Trigonia tuberculosa, Lycett in Ann. & Mag. Nat. Hist. 1850, p. 422.

Shell small, depressed, ovately trigonal ; umbones recurved, anterior and inferior borders rounded, posterior border slightly excavated ; area small, transversely striated, the striations being large and irregular ; marginal and inner carinæ narrow, elevated and striated ; the tuberculated costæ are numerous (18 in the adult), curved concentrically with very densely arranged tubercles ; the tubercles are rather depressed, ovate or clavate, their longer diameter directed downwards.

A pretty little species distinguished from the young of *T. striata* by the more numerous costæ and by the peculiarities of the tubercles.

It is rare ; for the present example I am indebted to the kindness of the Rev. P. B. Brodie, who has procured several specimens in the shelly freestone of Leckhampton Hill.

Trigonia clavo-costata, Lycett. Pl. XI. fig. 6.

Trigonia clavo-costata, Lycett in Ann. & Mag. Nat. Hist. 1850, p. 425.

Shell subtrigonal ; umbones obtuse, not recurved, anterior side produced, its border rounded, posterior border straight, oblique and truncated ; area flattened, finely striated transversely and tricarinated ; the marginal and median carinæ have regular moderate-sized tubercles, the inner carina has numerous transverse plications ; the other portion of the surface is ornamented with a few rows of concentric tubercles ; the tubercles are large, about eight in a row, the first two or three, and the latter one or two rows consisting of costæ which are not divided into tubercles.

Compared with *Trigonia decorata*, it is smaller and shorter posteriorly, the area has finer striations, the carinæ have larger and more distantly arranged tubercles, the concentric costæ have

much larger tubercles; they are about half as numerous as in *T. decorata*; lastly, the few primal costæ are smooth, in the other species they are tuberculated.

A specimen in the cabinet of the author, and a second in that of Dr. Wright, are the only examples with which I am acquainted; they are nearly of equal dimensions, and agree in all their characteristic features.

Length upon the marginal carina $1\frac{3}{4}$ inch, opposite measurement $1\frac{1}{2}$ inch.

The building-stone of the Inferior Oolite which forms the upper portion of its middle division is the seat of this species, which has been obtained in the vicinity of Nailsworth.

Trigonia costata.

Trigonia costata, Lam., Sow., Zeilen, Deshayes, &c.

Typical form *Costata*.

Anterior border truncated; umbones prominent, recurved; area slightly concave, with denticulated oblique plications, which differ in the two valves, the area of the right valve having two, three, or four large plications upon its anterior half, and no distinct median carina; the area of the left valve has a distinct median carina, and four or five plications upon each side of it; the inner and marginal carinæ are prominent and dentated, the latter separated from the longitudinal costæ by a depression; lanceolate space between the inner carinæ reticulated; longitudinal costæ slightly undulated, with a graceful double curvature resembling an elongated letter *f*.

Var. 2. *multicosta*.

This variety is much smaller than the typical shell; it is somewhat more depressed, its anterior border scarcely truncated, the area more finely reticulated, the costæ equal in number to the typical form, but more delicate and closely arranged; *multicosta* only attains about half the linear dimensions of the typical form; it has occurred only in the bed called Gryphite grit.

Var. 3. *pulla*. *T. pullus*, Sow.

This small variety occurs both in the Inferior and Great Oolite of the Cotteswolds; the larger specimens have a length upon the marginal carina not exceeding 20 lines, but few specimens are so large. The anterior border is not truncated, the carinæ and the intercarinal plications are prominent; in the Inferior Oolite it occurs in the freestone beds.

Var. 4. *sculpta*.

In dimensions this well-marked variety equals the typical form ; in certain localities it occurs in the Gryphite grit in immense abundance ; it is distinguished from the typical form by several conspicuous characters ; the figure is less trigonal, the anterior border being destitute of any truncation ; the umbones have less prominence and are less recurved, the area is larger, flatter, it is less concave, and occupies a much larger proportion of the surface of the shell ; the marginal and inner carinæ are larger, less curved, and in common with the intercarinal plications, they are much more strongly dentated ; owing to this prominence of the plications the median carina is much less conspicuous, the posterior half of the area is more depressed than the anterior, so that a distinct mesial division is formed irrespective of the median carina. In the young state the median carina is distinct in each valve, but in progress of growth that of the right valve degenerates into one of the common oblique plications. The costæ are large and elevated, but they have not the graceful double curvature of the typical form.

This variety therefore differs from the typical form in its proportions, its general outline, and in the greater prominence of its surface ornaments ; but the peculiarity which distinguishes the species in the character of its area is present in all the varieties, and serves to separate them from all of the allied costated forms.

Trigonia costata is stated to occur over the whole of Europe, and there is even a presumed variety of it from Cutch, figured and described by Mr. James Sowerby in the 'Geol. Trans.' vol. v. 2nd Ser. ; it is, however, not improbable that a further acquaintance with the varieties of this shell and of allied costated species may lead eventually to altered views, both of their stratigraphical and geographical distribution.

The costated *Trigoniæ* from the lower Oolite of Switzerland, figured by Agassiz under the names of *T. lineolata* and *T. denticulata*, would appear from his figures and descriptions to be distinct from *T. costata* ; the accuracy of the figures in the 'Petrefacta' of Goldfuss is exemplified in the fidelity with which the artist has delineated the area of the right valve in the young specimen, although its peculiarities are not alluded to in the description ; the typical figure of Agassiz is correct, but it may as confidently be asserted, that the figure of the *right area* in the same plate has incautiously been transferred from the *left valve*, or it would have exhibited the peculiarities upon which I have insisted as marking the species.

Trigonia angulata, Sow.*Trigonia angulata*, Sow. Min. Con. tab. 508. fig. 1.*Trigonia clavellata*, Sow. Min. Con. tab. 87, the two lower figures.

Shell elongated and rostrated, posterior border concave, anterior border rounded; umbones recurved; area narrow, bounded by small crenated carinæ; costæ narrow, closely arranged, straight anteriorly, undulated posteriorly, where they form large tuberculated varices, the few last varices directed downwards. M. D'Orbigny (*Prodrome de Paléontologie*) considers *Trigonia undulata*, Fromberg, to be only a synonym of *T. angulata*: in this opinion I do not concur; the figure of the two shells is essentially different, *T. angulata* being much more elongated, and the umbones more recurved; the surface ornaments of the shells likewise differ; those of *T. angulata* are remarkably constant and invariable.

T. undulata has not been recognized in the Oolites of England; on the other hand, *T. angulata* has not been discovered upon the continent. *T. angulata* has occurred at many localities in the Cotteswolds, both in the middle and upper portions of the Inferior Oolite, but it is rare. The imperfect specimen of *T. angulata* from Little Sodbury, which is given in the two lower figures of table 87 of the 'Mineral Conchology' as *T. clavellata*, has been the source of much confusion to subsequent observers, and has led them to catalogue clavellated specimens (usually imperfectly exposed) as *Trigonia clavellata*; but the figure in the same work of *T. angulata* is so characteristic, that it may be relied upon when the shell itself cannot be obtained for comparison.

Trigonia duplicata, Sow.*Trigonia duplicata*, Sow. Min. Con. tab. 237. figs. 4, 5.

Shell slightly rostrated, area narrow, carinæ two in each valve, small, distinct; costæ narrow, serrated, the first few concentric, the others directed downwards, for the most part bifurcated and slightly waved. Should the *T. Proserpina* of D'Orbigny prove to be distinct from this species, it must possess peculiarities which are not alluded to in his '*Prodrome de Paléontologie*,' where the brief description given agrees with *T. duplicata*. M. Agassiz (probably from an imperfect knowledge of the species) has placed *T. duplicata* with the *Scabræ*, but the very distinct marginal carina and the area destitute of transverse costæ clearly remove it from that section, which first appeared with the species of the lower greensand.

T. duplicata occurs in the upper division of the Inferior Oolite in the Cotteswolds, where the external impressions are not un-



Lycett, John. 1853. "XXIII.—On some new species of *Trigonia* from the inferior oolite of the Cotteswolds, with preliminary remarks upon that genus." *The Annals and magazine of natural history; zoology, botany, and geology* 12, 225–240. <https://doi.org/10.1080/03745485709495034>.

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