

On the Cycadeoideae, a family of fossil plants found on the oolite quarries of the Isle of Portland / [William Buckland].

Contributors

Buckland, William, 1784-1856.

Publication/Creation

[London] : [publisher not identified], [1828]

Persistent URL

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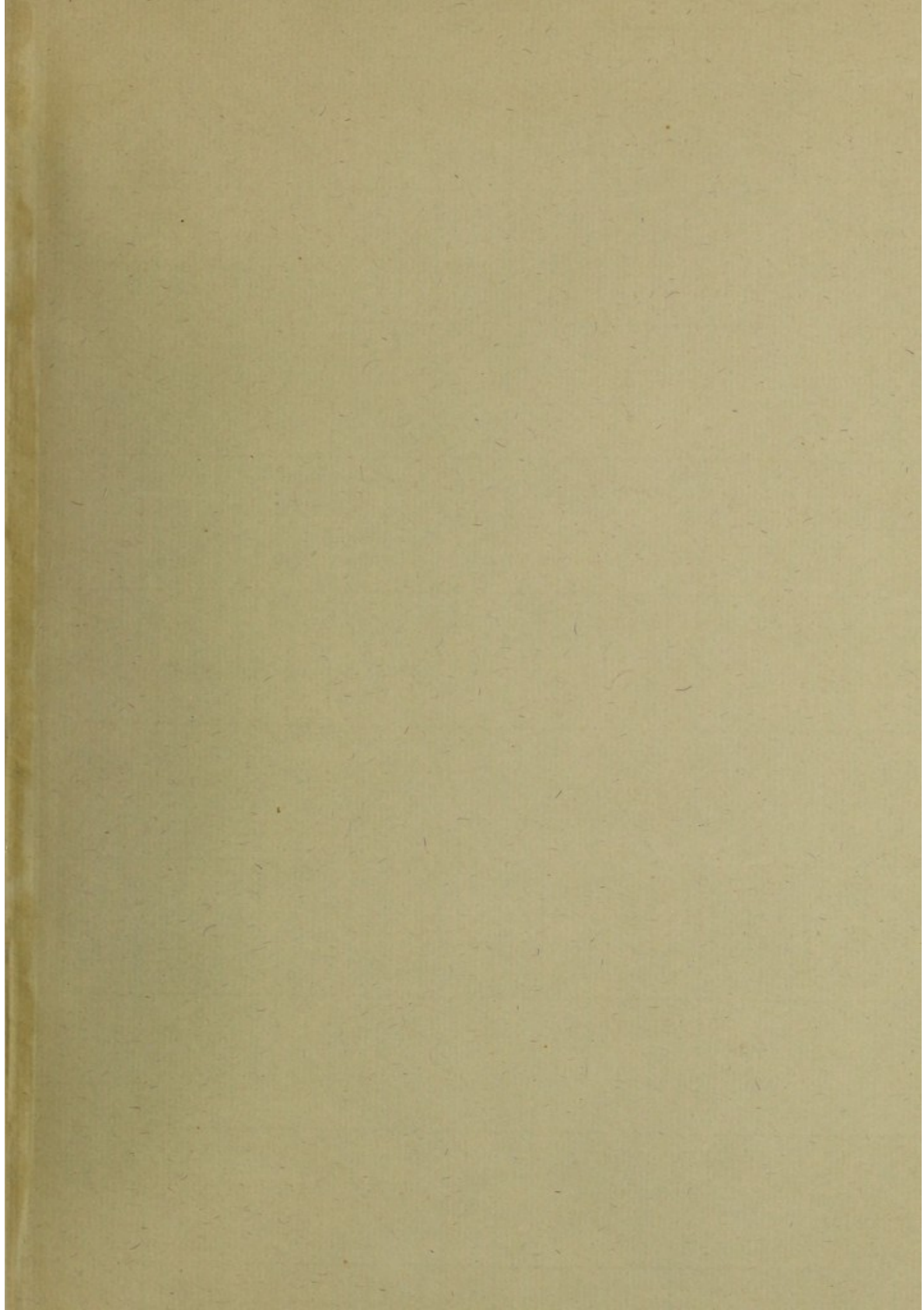
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XXVII.—*On the Cycadeoideæ, a Family of Fossil Plants found in the Oolite Quarries of the Isle of Portland.*

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[Read June 6th, 1828.]

ABOUT twenty years ago I saw for the first time specimens of these fossil plants, in the collection of H. H. Henley, Esq. of Sandringham near Lynn. They had been procured by him from the celebrated freestone quarries of the Isle of Portland, where they were known to the workmen by the name of petrified birds-nests, their external form bearing a rude resemblance to the shape and size of a common crow's nest.

My attention has been recalled to this subject by a communication which I received in 1825 from Sir George Grey of Portsmouth, who transmitted to me a similar fossil found also in the Isle of Portland, and permitted me to make the drawings of it represented in Plate XLVII.

On my showing this specimen to Mr. Webster, he informed me that he had presented two similar fossils from Portland to the Geological Society of London*. There are also three more specimens in the museum of Mr. Sowerby, two of which he has kindly permitted me to engrave in Plates XLVIII. and XLIX. These specimens are all exclusively from the Isle of Portland.

The mineral condition of these plants is almost entirely siliceous, varying from coarse granular chert to imperfect chalcedony; it resembles that of the petrified trees which abound in Portland and often measure many feet both in length and circumference, in some of which Mr. Brown has recognised

* Mr. Webster informs me that he found these plants accompanied by large silicified trunks of dicotyledonous trees, in a stratum which he designates by the workman's name of Dirt-bed, being about one foot thick, consisting of a dark brown substance, and containing much earthy lignite; it lies immediately above the Portland building-stone, and divides it from slaty calcareous beds, which Mr. Webster doubts whether to refer to the Portland or to the Purbeck series. See Mr. Webster's paper on the Purbeck and Portland Beds, Geol. Trans. 2d series, vol. ii. Part I.

the structure of coniferous wood*. The limestone adjacent to these trees is itself pervaded by silex, and contains beds and nodules of chert.

On my submitting our new fossils to Mr. Brown and Mr. Loddiges, they immediately recognised a resemblance to the genera *Zamia* and *Cycas*, which compose the existing family of *Cycadeæ*, a resemblance which further investigation has tended fully to establish: and as their structure will be best explained by comparison with the recent *Zamia* and recent *Cycas*, I have given transverse sections of them both, wherein we find remarkable analogies to the two fossil species we are about to establish†. In the *Zamia horrida* of the Cape of Good Hope the transverse section exhibits one narrow circle, composed of radiating plates, placed in the cellular substance that forms the stem or body of the plant; and nearly at equal distance between its centre and circumference‡, and in a section near the base of *Cycas revoluta*§, we have two narrow circles of radiating plates, placed also in the cellular substance that forms the stem, and both of them nearer to the centre than to the circumference of the plant; the outermost of these circles is the most narrow.

Neither *Zamia* nor *Cycas* has any covering of true bark, but the stem is inclosed in a thick case made up of the persistent bases of decayed leaves: each of these terminates externally in a lozenge-shaped impression or scar, the convex surface of which formed the joint from which a leaf had fallen off. A dense and continuous series of these leaf-joints entirely surrounding the stem gives it more the appearance of a pine-apple or enormous fir-cone, than of a vegetable trunk||. On comparing these peculiarities of structure with those displayed in our fossil specimens, we recognise a correspondence highly curious and satisfactory. Like the recent *Cycadeæ*, our fossil stems are inclosed in no true bark, but have a thick case made up of the flat persistent bases of decayed leaves, which at their inner extremity touch the cellular tissue of the body of the trunk, and terminate externally in an oblong gibbous joint resembling the leaf-joints of *Zamia horrida*¶. These bases of leaves rise upwards,

* Dr. Fitton has recently discovered a fossil much resembling a small strobilus, about two inches long and one inch and a half wide, in the quarries of Quainton near Aylesbury, which are probably in the same formation as those of Portland.

† There are five known species of *Cycas*, and about seventeen species of *Zamia*, which Persoon has grouped together into the family of *Cycadeæ*. The difficulty that has attended the arrangement of this family from its intermediate place between the ferns, the palms, and the *Coniferæ*, to each of which it possesses certain points of approximation, and the discussions respecting it which still occupy some of the most eminent botanists of our day, give a peculiar interest to the discovery of fossil plants so nearly allied to the *Cycadeæ* as those which form the subject of the present memoir.

‡ Plate XLVI. fig. 3.

§ Ibid. fig. 1.

|| See Plate XLVI. fig. 4.

¶ See Plate XLVII. fig. 4.

and are most perfect near the summit of the trunk* : but lower down, the oldest of them lie horizontally and at right angles to the trunk, which they entirely encircle, and are more and more compressed as they are nearer to the root. In form, position, and structure, as far as it can be recognised, these parts resemble what we find in the recent Cycadeæ. As yet no leaves have been found adherent to any of the fossil plants. At the summit of most of them there is a cavity, the contents of which appear to have been removed before petrification took place : the relation of this cavity to the trunk and leaves may be seen by comparison with living plants of *Zamia horrida*, *Cycas circinalis*, and *C. revoluta*, referred to in the note †. Although the trunk is so tall in *Cycas circinalis* as sometimes to exceed thirty feet in height, it rarely attains six feet in *Cycas revoluta*, and in other species is much shorter. The trunk of many *Zamia* is also very short. In the fossil specimens yet discovered, it varies from five inches to a foot in height, and from eight to fifteen inches in diameter. Their different forms will be best understood by referring to the accompanying Plates ‡. They are generally terminated downwards by a broad flat base without any adherent roots ; but traces of the commencement of roots, having a cavity at their centre, are visible in Sir G. Grey's specimen§. At the base of other specimens there is only a coarse irregular reticulation, apparently connected with the commencement of roots. The interior of these stems presents two varieties of structure, which we find accompanied respectively by a corresponding variation of external form, size and character, in the bases of the leaves. These differences are sufficient, in the opinion of Mr. Brown, to establish a new family, to which we may refer the two extinct species before us, the one resembling a recent *Zamia*, the other resembling a recent *Cycas* ; and to which, from its near approximation to the existing family of Cycadeæ, the name of *Cycadeoideæ* seems appropriate.

In the largest and most abundant species (*Cycadeoidea megalophylla*||) the bases of the leaves vary from one to three inches in length, having nearly the form and size of those of *Zamia horrida*, and measuring from one fourth of an inch to an inch in the shorter, and from one to two inches in the longer diameter of their transverse section. The trunk is short and flat, and exhibits a deep cavity at its summit resembling a bird's nest.

The origin and use of this cavity is rendered perfectly intelligible by com-

* Plate XLVII. fig. 1.

† See at Plate XLVI. fig. 4. a plant of *Zamia horrida* ; and in Curtis's Botanical Magazine for June 1828, Plate 2826, a male plant of *C. circinalis* in flower ; and in Transactions of the Linnean Society, vol. vi. Pl. 29. a female plant of *C. revoluta* in fruit.

‡ Plate XLVII. XLVIII. XLIX.

§ Plate XLVII. fig. 2.

|| Plate XLVII. and XLVIII.

paring it with that at the summit of the *Cycas revoluta* which bore fruit at Farnham in 1799, of which a description and plate are given by Sir J. Smith*. This cavity is surrounded with a magnificent crown of leaves, whose stalks are set round its margin like the bases of the leaves in our fossil specimen†. The cavity itself is occupied by a cluster of fronds producing the fruit or drupæ; and it is a striking coincidence, that Sir J. Smith, in describing this cavity, makes use of the same comparison (hollow like a bird's nest) which has been applied by the quarry-men at Portland to the fossils I am now associating with the recent *Cycadeæ*. In the central cavity of this fossil there are no remains of fronds or fruit, but a convex mass of cellular tissue, which probably formed the support of the proliferous fronds. Where the trunk is broken below the summit‡, we find the same central mass of cellular tissue as in the transverse section of the stems of recent *Zamia* and *Cycades*.

Near the circumference of both specimens there is a laminated circle as in the trunk of a recent *Zamia*, but differing in that it is much broader and placed nearer the circumference of the stem: the large and visible plates of this circle, when magnified with a lens§, appear made up of smaller plates almost invisible to the naked eye, more numerous and closer to each other than in the laminated circles of recent *Zamia*.

Between this radiating circle and the outer case of leaf-stalks, is a narrow band, or ring, of minutely cellular substance, analogous to the similar but much broader band of cellular tissue that divides the radiating circles from the bases of the leaves in the recent *Cycadeæ*||.

In the second and smaller species (*Cycadeoidea microphylla*) the bases of the leaves are also lozenge-shaped and about an inch in length, but small and numerous, much like those of the *Xanthorrhœa* or gum-plant of New South Wales. The trunk is longer in proportion to its width, whilst its transverse section exhibits at the centre the same indistinctly cellular appearance as the species last described; but near the circumference instead of one it has two laminated circles, and exterior to each of these a narrow band devoid of laminæ, analogous to the two bands of cellular substance that are placed in similar relation to the two laminated circles in a recent *Cycas*¶.

These two circles, like the one circle of *Cycadeoidea megalophylla*, approach the circumference, whilst those in *Zamia* and *Cycas* are placed nearer the centre of the stem.

* Transactions of the Linnean Society, Plate 29. p. 312.

† Plate XLVII. fig. 1.

‡ See Plate XLVIII.

§ Plate XLVIII. fig. 2. & 3.

|| See Plate XLVII. fig. 1. Plate XLVIII. fig. 1. & 3. Plate XLVI. fig. 1. & 3.

¶ See Plate XLIX. fig. 1. & 2; and Pl. XLVI. fig. 1.

There is also a further analogy between this fossil species and the recent *Cycas* *, viz. that in each case the outermost of the plated circles is the most narrow of the two, and the cellular band between them is in both cases also narrow.

The engraving of *Cycas revoluta* or *Todda Panna*†, copied from Vol. iii. Plate 21. of the *Hortus Malabaricus*, exhibits many plated circles divided from one another by narrow cellular bands, and these also are placed nearer to the centre than to the circumference of the stem.

It appears, therefore, that the external position and greater breadth of the laminated circle, or circles, in the Cycadeoideæ are the two most important distinctions that can be drawn from the specimens before us, between the structure of the stem in these extinct fossils and in the recent *Zamia* and *Cycas*. These distinctions also afford a character whereby this family approaches nearer than the Cycadeæ to the more perfect structure of dicotyledonous woods; and in this respect it may be considered to hold a higher place in the scale of vegetable creation, and to supply from the fossil world a link that helps to fill the distant interval which separates the structure of the trunk in the Cycadeæ from that in the nearest existing family to them, viz. the Coniferae, which they perfectly resemble in the character of their organs of fructification. They however exhibit no traces of vessels such as radiate from the centre and form the silver grain in the more perfect kinds of wood ‡.

As yet, the stems of Cycadeoideæ have been observed in no other formation than the Portland stone, the geological position of which, in the upper part of the oolite series, is well known from the descriptions of Mr. Webster and of Messrs. Conybeare and Phillips, and no leaves have been noticed with them; but leaves of plants nearly allied, and perhaps belonging to this family, have been found near Whitby in the oolite formation, immediately above the lias, in the imperfect coal strata of the Cleaveland Moorlands; some of these are engraved by Messrs. Bird and Young§: others are in a collection from the same coal-field, made last year by Mr. Featherstonhaugh, and afford two

* Plate XLVI. fig. 1.

† Plate XLVI. fig. 2.

‡ “ Dans tout le règne végétal, il n'est aucune famille des plantes qui ait plus de rapports et de ressemblance avec les Conifères, que celle des Cycadées. Ces rapports nous semblent si grands, que nous pensons qu'il est impossible de distinguer ces deux familles, ni par des caractères tirés de leur fleurs, ni par des caractères puisés dans l'organisation de leur fruits. Les seuls signes distinctifs qui existent réellement entr'elles, consistent uniquement dans leur port et la structure anatomique de leur tige, que en effet est fort différente dans l'un et l'autre groupe.”—*Richard, Mémoire sur les Conifères et les Cycadées*. 1826. p. 183.

§ Plate 2. fig. 2. and 7; and Plate 3. fig. 2. Geological Survey of Yorkshire Coast.

varieties of leaves resembling those of *Cycadeæ*, but which cannot be identified with any known species of that family.

M. Adolphe Brongniart also *, in his account of the coal-field of Höer in Scania, the age of which is decidedly much more recent than the coal of Newcastle, and probably identical with the oolitic coal-field of Whitby, describes the occurrence therein of fronds of four species of plants, that have an analogy to the family of *Cycadeæ*; and are accompanied by other vegetables differing entirely from those of the regular and more ancient coal strata. There is also a strong resemblance to the *Cycadeæ* in some leaves I possess from the oolitic slate of Stonesfield.

From the same Stonesfield slate I have a fossil amentum called by Count Sternberg *Conites Bucklandii*, of which he has published a short account in his "*Flore du Monde Primitif* †," with a figure copied from a drawing by the late Mr. Sowerby. He describes it as a cone eight inches long and three inches in diameter, with scales most like those of the *Pinus Abies*, but not entirely agreeing with them, nor with those of any known species of cone; and proposes to refer it to a new genus among the *Carpolites*. This *Conites* so much resembles the amentum of *Cycas circinalis*, which blossomed in Edinburgh in May 1827, and of which an engraving and description are given by Dr. Hooker in the *Botanical Magazine* ‡, as to induce me to believe that it may be the amentum of a *Cycadeoidea*; but a much more minute comparison of the structures both of the fossil and of the amentum of a living *Cycas* than I have at present the means of making, must be undertaken before this point can be considered as established.

Thus dispersed through various members of the grand oolite formation or Jura limestone we have trunks and leaves, and perhaps organs of fructification, that may with much probability be all referred to our new fossil family of *Cycadeoideæ*. We have the trunks in Portland, the leaves at Whitby and in Scania, and both leaves and amenta? at Stonesfield; and though we are as yet without materials to show the specific relations of these parts to one another, we have evidence to prove the duration of one, or both, the cognate families of *Cycadeæ* and *Cycadeoideæ* to have extended from nearly the lowest to the uppermost beds of the oolite series.

M. Adolphe Brongniart has pointed out the inferences with respect to climate that may be drawn from the varying character of vegetable life in the three grand epochs of geological formation: viz. the great carboniferous

* *Annales des Sciences Naturelles*, vol. iv. p. 200.

† Part 3. p. 40. and Plate 30.

‡ For June 1828. Plate 2826.

period; the period of the secondary strata from lias to chalk inclusive; and the period of the tertiary strata above the chalk.

The plants before us render it probable that the climate of these regions, at the time when the oolites were deposited, was of the same warm temperature with that which produces a large proportion of the existing Cycadeæ. M. Adolphe Brongniart is also of opinion that it exceeded the temperature of our modern tropics at a still more early period when it maintained the extraordinary vegetation of the great coal formation; and that it was less than tropical, though warmer than it is at present, in the period to which we owe our tertiary strata. To this theory I see much reason to incline, and confidently look forward to its future developement in the examination of the Flora of the fossil world, which he is now so actively conducting.

period; the period of the secondary, from the time of the deposition of the drift, to the time of the deposition of the tertiary; and the period of the tertiary, from the time of the deposition of the tertiary, to the time of the deposition of the quaternary.

The plants before us render it probable that the climate of these regions at the time when the coals were deposited, was of the same nature as the climate of the present day. It is probable that the temperature was such as to allow of the growth of the plants which are now found in the same regions. It is probable that the climate was such as to allow of the growth of the plants which are now found in the same regions.

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EXPLANATION OF THE PLATES.

PLATES XLVI. XLVII. XLVIII. XLIX.

Illustrate Professor Buckland's paper on the Cycadeoideæ, a family of fossil plants found in the oolitic series of the Isle of Portland.

PLATE XLVI.

Fig. 1. Section near the base of a *Cycas revoluta*, in the possession of Mr. R. Brown, from a plant that died at Kew. The thinness of the outer case, composed of the bases of leaves, arises from its proximity to the root. The body of the trunk is a mass of spongy pith-like cellular tissue, in which are imbedded two laminated circles of unequal width near the centre: in the cellular tissue is much farinaceous matter.

Fig. 2. Section of *Cycas circinalis* or Todda Panna, copied from Pl. XXI. vol. iii. of Rheede's *Hortus Malabaricus*. This stem, like fig. 1, is composed of a pith-like substance containing sago, in which seven laminated circles are disposed near the centre, with a broad ring of cellular matter exterior to the outer circle. According to this drawing, the case of the trunk has smooth rings, and is not so entirely composed of the bases of leaves and stipules as in the recent specimen of *Cycas circinalis*, engraved by Dr. Hooker, Pl. 2826 of Curtis's Bot. Mag. July, 1828: and as there can be no doubt of the accuracy of this plate, it is probable that in the older drawing of Rheede, this part of the structure was incorrectly represented. Dr. Hooker observes that in Richard's plate, as in that of Rheede, the stems are strongly annulated, more so than Dr. Hamilton ever saw them on the growing plant. For further details connected with this subject, see Richard's *Mémoires sur les Conifères et Cycadées*; Mr. R. Brown's Appendix to Capt. King's Narrative of a Survey of the Coast of Australia; and Curtis's Bot. Mag. No. 18 and 19, New Series, June and July, 1828.

Fig. 3. represents a section of a *Zamia horrida*, in the possession of Charles Stokes, Esq. made in the direction of the line A B fig. 4.

Fig. 4. Reduced representation of a living plant of *Zamia horrida*.

PLATE XLVII.

Cycadeoidea megalophylla.—The peculiar features of this specimen have been so fully explained in the text, as to render further description needless.

PLATE XLVIII.

Cycadeoidea megalophylla.—This specimen supplies the structure of important parts of the fossil Caudex, which are scarcely visible to the naked eye. The magnified

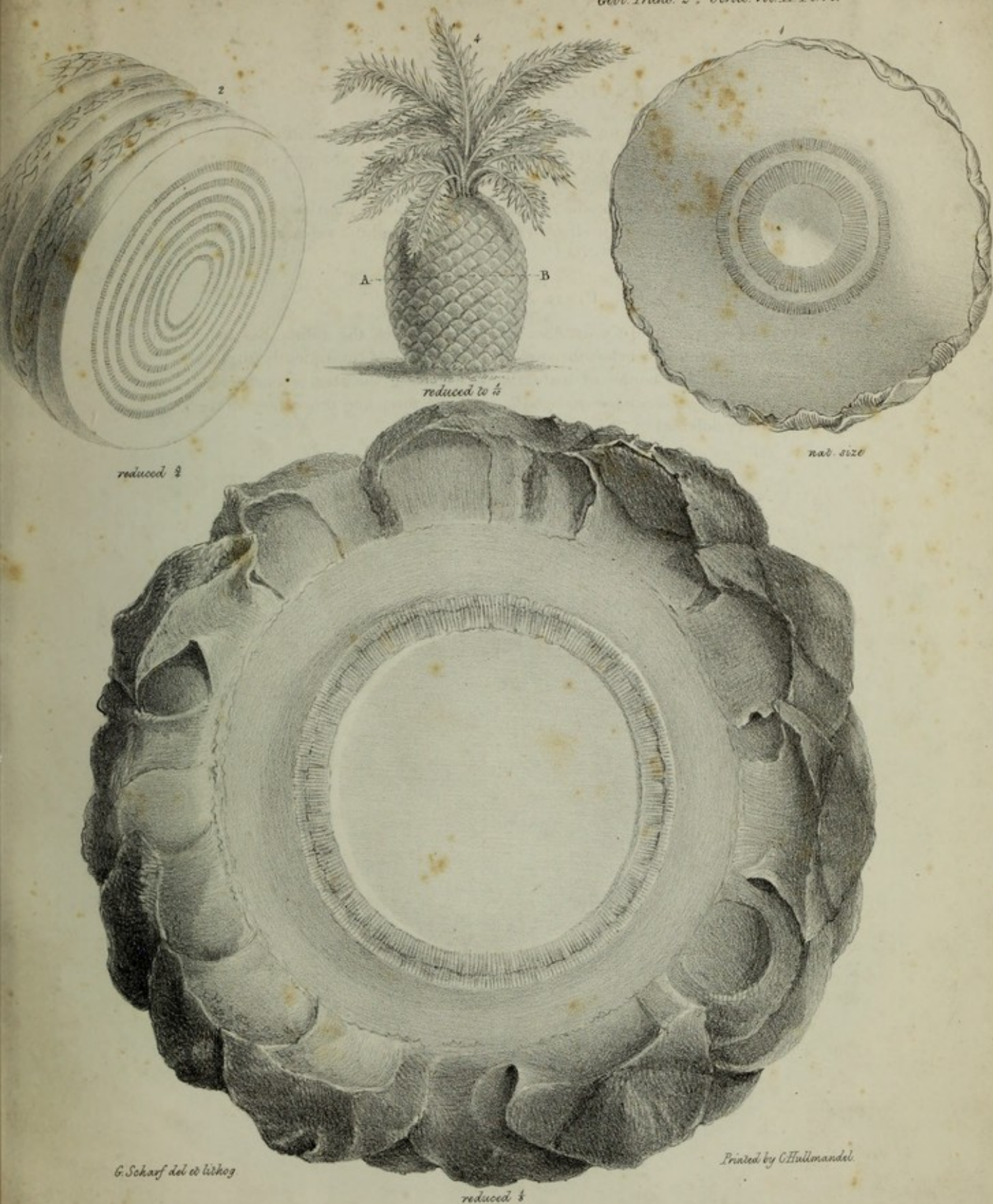
EXPLANATION OF THE PLATES.

appearance represented at fig. 2, is distinctly to be seen with a small lens on the parts of the laminated circle A B C, which are converted into chalcedony : where the stone is more coarse, the internal structure is less apparent.

Fig. 3, is taken from the bottom of the specimen, and shows the junction of the laminated circle with the external cellular ring and central cellular substance.

PLATE XLIX.

This is the only specimen of *Cycadeoidea microphylla* which the author has seen. The transverse section is below the summit of the stem, and consequently displays no central cavity : the border of leaf-stalks surrounding the stem is much more narrow than in *Cycadeoidea megalophylla*, and the form and proportions of the plant are very different.

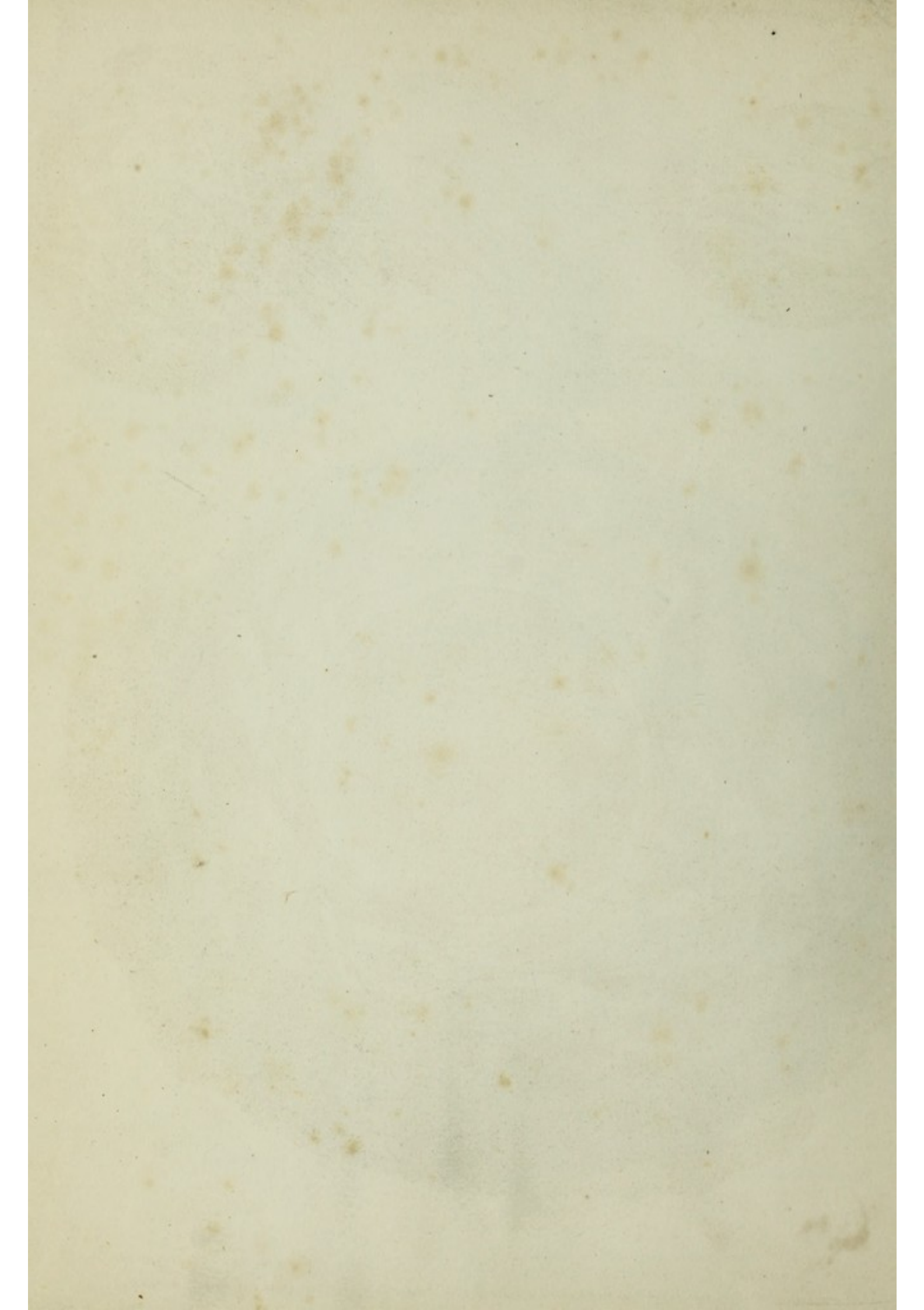


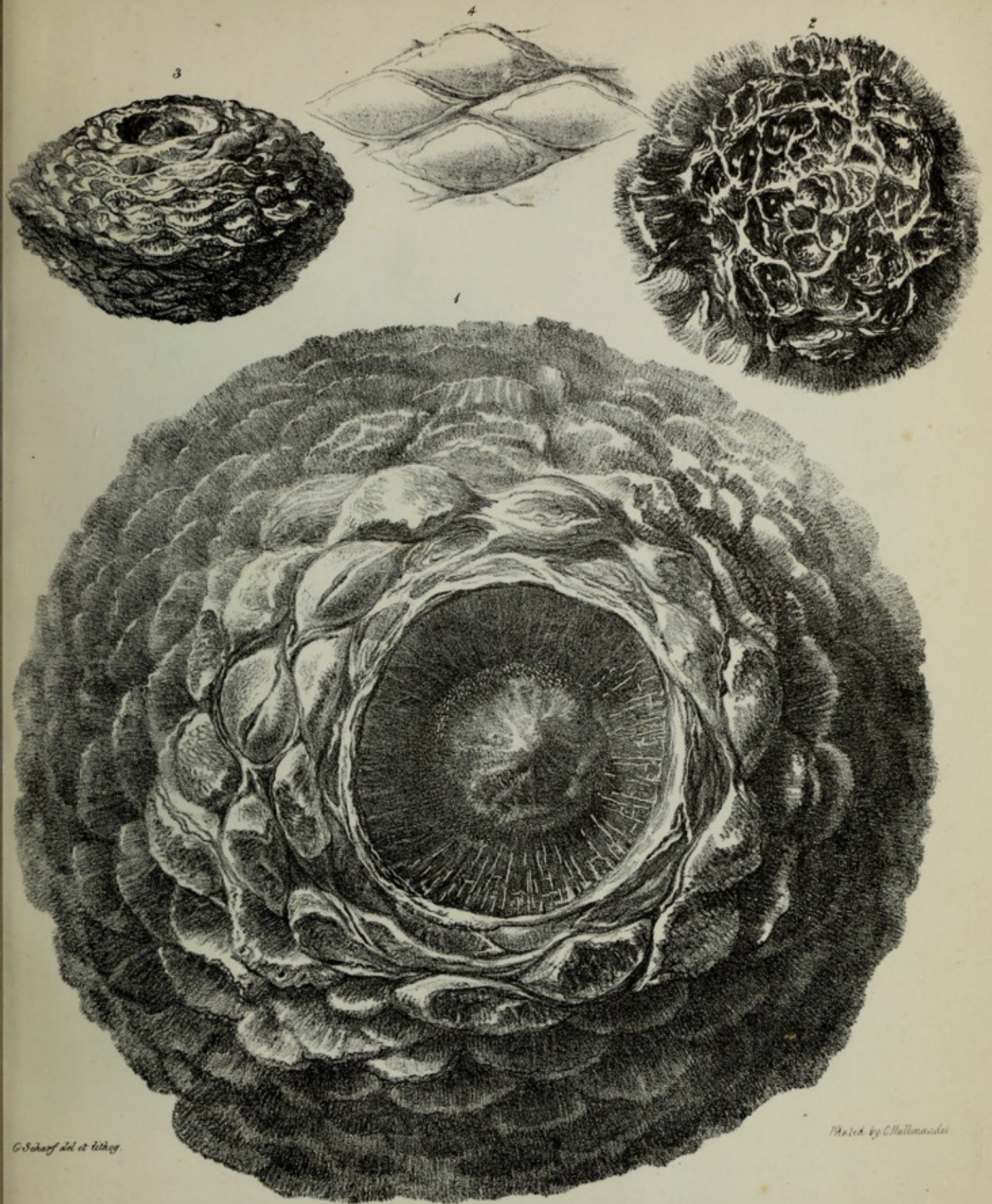
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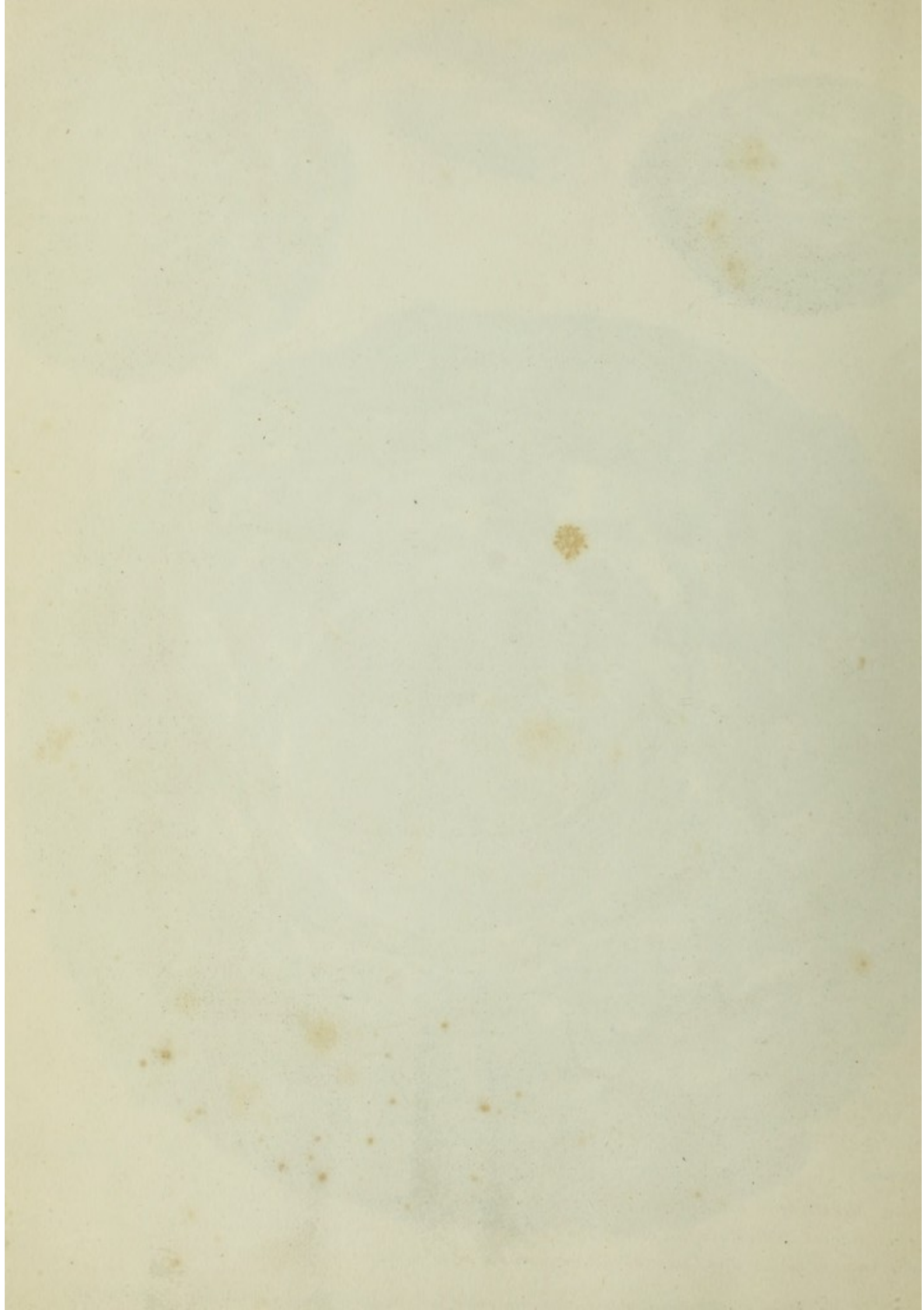
- N^o 1. Section near the Base of a *Cycas revoluta*, in possession of R. Brown Esq.
 2. Section of *Cycas circinalis* 'Toda-panna' of Horius Malabaricus Vol. III. Pl. 21.
 3. Section of *Zamia Horrida*, near the centre of the Caudex, taken at the line A.B. in Fig. 4.
 4. Trunk of a *Zamia Horrida*, with its leaves.





Plated by C. Hullmandel

Cycadeoidia Megalophylla; silicified in the Portland Pebble, now in possession of Sir Geo. Grey of Portsmouth.
 1. Top View, reduced $\frac{1}{4}$. 2. Base at the commencement of the roots, reduced $\frac{1}{4}$. 3. Side view, reduced $\frac{1}{2}$. 4. Scars of
 leaf stalks, in *Zamia Horrida*, reduced $\frac{1}{4}$

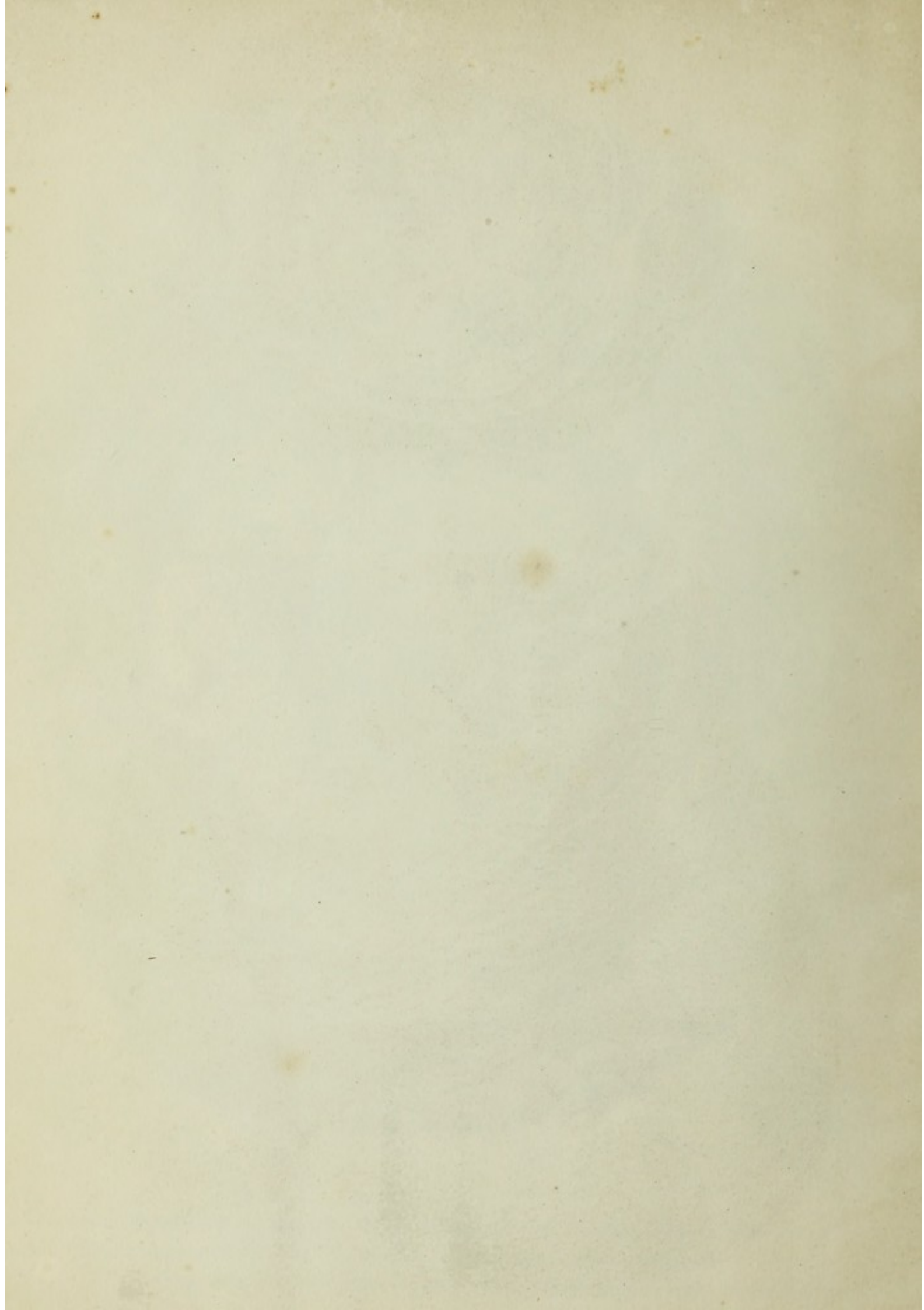


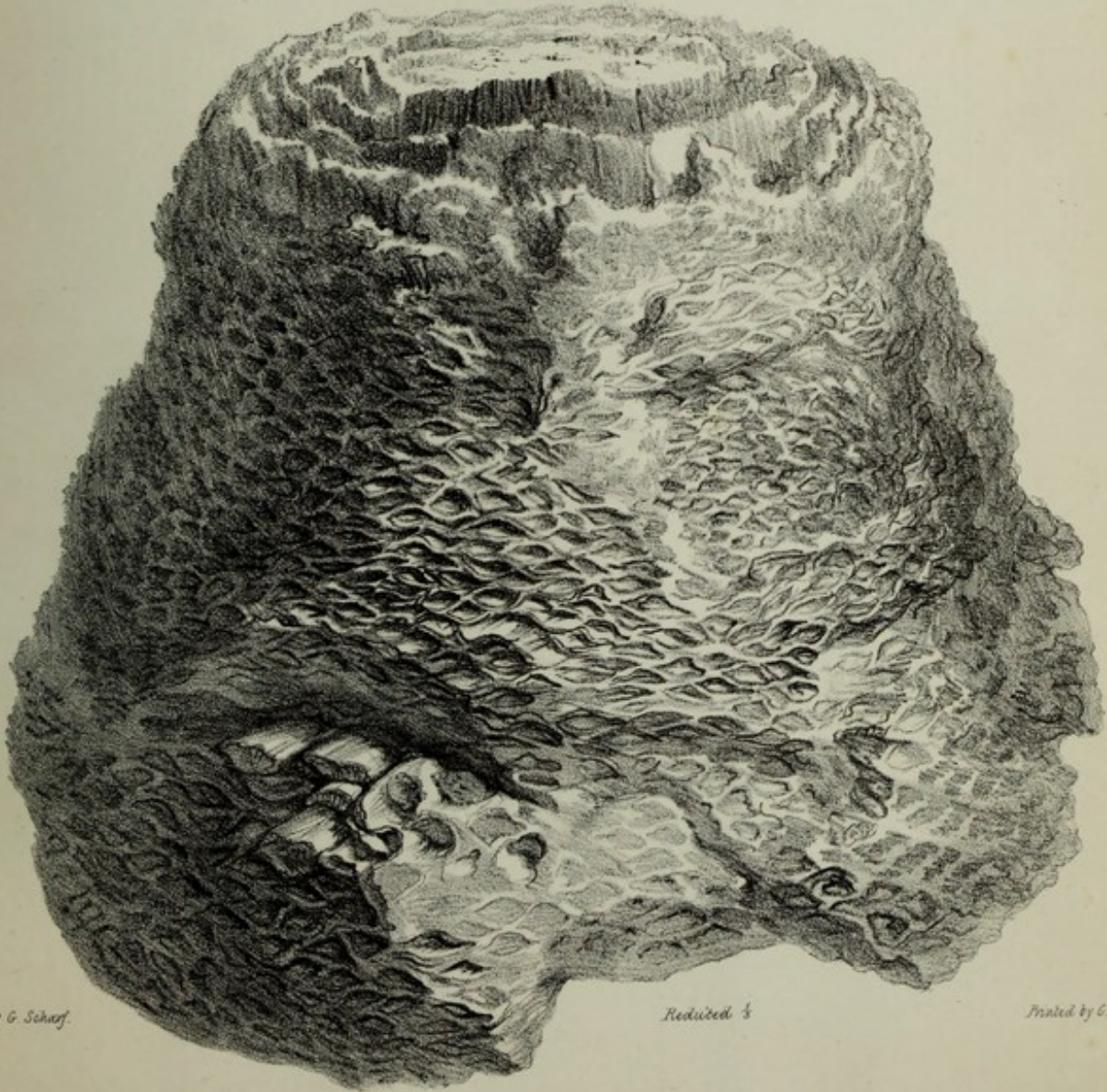


Lithog. from Nature by G. Scharf.

Printed by C. Hullmandel.

Cycadeoidea Megalophylla, silicified in the Portland Oolite, now in the Museum of Mr. Sowerby. 1. Section across the centre of the stem, reduced $\frac{1}{4}$. 2. Magnified portion, at the junction of the plated and external cellular circles at A B C. 3. Junction of plated circle with external cellular ring & internal cellular substance, most distinct at the back of the specimen.





Engr. from Nat. by G. Scharf.

Reduced $\frac{1}{2}$

Printed by G. H. Mulholland.

