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479 pp. and v. m. p.

animal in the attitude of the Woodpeckers, while building in the cavities of rocks.

We have but few of this family in St. Vincent: among them is a Swallow which roosts, and I believe builds, in the rock of the sea shore. It is curious to observe this bird in calm weather skimming patiently along the sea in search of insects, evidently ignorant of the fact that they are confined to fresh water, and do not sport on the surface of salt waters.

[To be continued.] 527

ART. XLII. *Observations on the Jaw of a Fossil Mammiferous animal, found in the Stonesfield slate. By W. J. BRODERIP, Esq., Sec. G. S., F.L.S., &c.*

SOME years have elapsed since an ancient stone-mason, living at Heddington, who used to collect for me, made his appearance in my rooms at Oxford with two specimens of the lower jaws of mammiferous animals, imbedded in Stonesfield slate, fresh from the quarry. At the same time he brought several other very fine Stonesfield fossils, the result of the same trip. One of the jaws was purchased by my friend Professor Buckland, who exclaimed against my retaining both, and the other I lent to him some time ago. Dr. Buckland's specimen, which wants incisor and canine teeth, has been examined by M. Cuvier, and is figured by M. Prevost as an illustration to his "*Observations sur les schistes calcaires Oolitiques de Stonesfield en Angleterre,*" &c.; * the other was lost, after the Professor had returned it; and the loss was, most unjustly, as I must now acknowledge, attributed to him. To my no small gratification this specimen has just been found, and forms the subject of the following sketch.

In the Professor's "*Notice on the Megalosaurus, or great fossil Lizard of Stonesfield,*"† the following passage occurs. "The

* Ann. des Sciences Nat. Avr. 1825.

† Transactions of the Geological Society, vol. I. p. 390. Second series.

other animals that are found at Stonesfield are not less extraordinary than the Megalosaurus itself. Among the most remarkable are two portions of the jaw of the Didelphys or Opossum, being of the size of a small Kangaroo Rat; and belonging to a family which now exists chiefly in America, Southern Asia, and New Holland. I refer the fossil in question to this family on the authority of M. Cuvier, who has examined it; and, without the highest sanction, I should have hesitated to announce such a fact, as it forms a case hitherto unique in the discoveries of geology: viz. that of the remains of a land quadruped being found in a formation subjacent to chalk."

The learned author of the article "on the Transactions of the Geological Society of London," in the 34th vol. of the Quarterly Review, after referring to this passage, says, * "As this fact is completely at variance with all preceding observations, it is not surprising that it has been received with some scepticism. M. Constant Prevost, who has himself visited Stonesfield, has lately published a memoir, in which every argument that can be urged to invalidate Dr. Buckland's opinion is put forth with great ability and with a spirit of fairness; but all this has not in the least shaken our reliance on the accuracy of the statement. In the first place it is admitted that the remains in question were decidedly imbedded in the Stonesfield slate. To this stratum "in working the quarries at Stonesfield, they descend by vertical shafts through a solid rock of cornbrash and stratified clay, more than 40 feet thick."† M. Cuvier, who has re-examined the fossil in question since the objection was started, still pronounces the animal to have been mammiferous, resembling an Opossum, although of an extinct genus, and differing from all known carnivorous mammalia in having ten teeth in a series in the lower jaw.

The ten teeth represented in the figure accompanying M. Prevost's memoir,‡ are evidently grinders, and somewhat resemble the molar teeth of my specimen, which has, however, only seven grinders; and, when it was lent to Dr. Buckland, they were the only teeth apparent. He, however, caused the stone to be

* P. 529.

† Trans. Geol. Soc. vol. i. p. 393. Second Series.

‡ Pl. 18. fig. 1, 2.

carefully scraped away, and there appear, in addition, a canine tooth and three incisors. There is room also for a fourth: the end of the jaw is fractured, and there are traces of what may be the alveolus of a fourth incisor. With this addition, the specimen would give the exact number of teeth in the half of a lower jaw of a *Didelphis*, viz. four incisors, one canine, seven grinders. The fossil, which is in high preservation, is imbedded in a slab of Stonesfield slate, together with *Trigonia* and other marine exuviae; the whole mass exhibiting the oolitic structure in the most satisfactory manner.

My specimen consists of the right half of a lower jaw, the inside of which is presented to view, [Pl. XI.] To say nothing of the difference of form in the jaw-bone, M. Prevost's figure gives us the representation of a portion of a lower jaw with ten grinders therein: my fossil has only seven, and appears to have been part of an animal generically different. The teeth are distinctly separated, and those who are best qualified to judge are of opinion that the jaw did not belong to a young individual. The well defined ridges and decided features of the bone denote a full grown animal: the sharpness of the teeth makes it probable that it was not an aged one.

We have now the figures and descriptions of two specimens of mammiferous animals which have been found at Stonesfield: they are apparently referable to two genera; and, notwithstanding the opinion expressed by M. Prevost, I will venture to add that they have been found in the true oolitic series lying far beneath the chalk.

But, it appears, that there is yet another specimen. M. Prevost in his memoir * says, "A ma connaissance, il a été trouvé déjà à Stonesfield, *trois* échantillons de mâchoire inférieure qui paraissent provenir d'animaux de la même espèce; l'un est dans le musée de l'université d'Oxford, l'autre est possédé par une personne qui réside à Londres, et le troisième a été rapporté par M. Brochant du dernier voyage qu'il a fait en Angleterre: ce dernier échantillon est bien moins parfait que celui d'Oxford, dont je donne ici le dessein de grandeur naturelle, pl. 18., fig. 1, et un autre dessein quadruple, pl. 18, fig. 2."

* P. 47, of the extract.

If the author of these observations be the person residing in London, who is mentioned above as the possessor of one of the three specimens, he must be allowed to doubt the identity of the species, for the reasons above given. If any other resident in London possesses a specimen of the jaw of a mammiferous animal imbedded in the Stonesfield slate, there will be no less than four instances of mammiferous remains from the same locality: but we never have heard of more than three.

It might have been desirable to keep back this notice till M. Cuvier had seen and pronounced on the specimen now figured: but it has been so long lost to the scientific world, and it is, unless the writer is deceived by persons of high authority in such matters, of so much interest to geologists, that he no longer feels justified in delaying the appearance of the figure. He has the less anxiety on the subject of the imperfections of this hasty sketch, being well assured that the learned Professor, who first publicly noticed the discovery of mammiferous remains in a stratum far below the chalk, will amply supply all omissions and inaccuracies, when he gives to the world the result of his researches, in his promised description of the most remarkable remains that occur at Stonesfield.*

As the history of this animal rests only upon the portion of its lower jaw, figured in the plate accompanying the present memoir, (for the specimen figured by M. Prevost appears to have belonged to a different animal,) it would perhaps be presumptuous in me to pronounce on its generic identity with *Didelphis*, Cuv. But until some more able anatomist shall correct the generic name, I may be permitted, for the sake of convenience and perspicuity, to name it *Didelphis Bucklandi*.†

* See Geol. Trans. vol. I. p. 394. Second series.

† It may not be uninteresting to note, that a recent species of *Trigonia* (figured by Mr. G. B. Sowerby in his account of some rare shells brought from the Pearl islands) has very lately been discovered on the coast of Australia, that land of marsupial animals. Our specimen lies imbedded with a number of fossil shells of that genus. The individuals are of the same species so frequently found at Stonesfield; and, as that species appears not to be named, I propose, at the suggestion of Mr. James Sowerby, to name it *Trigonia impressa*. The shells are most numerous on the under side of the slab.

Dr. Fitton has kindly furnished the following communication : and I cannot help supposing, that if a geologist of so much experience as M. Prevost is acknowledged to be, had enjoyed an opportunity of studying throughout the relations of the Stonesfield slate, he would hardly have entertained the theory which he has suggested.

DESCRIPTION OF PLATE XI.

Fig. 1. The jaw in situ, of its natural size. The dimensions of the slab, (which is reduced in the figure,) are $5\frac{1}{4}$ inches by $5\frac{1}{2}$. Length of the jaw, 1 inch 4-10ths : breadth, 2-10ths ; at the coronoid process, 9-20ths.

Fig. 2. The jaw magnified twice in length.*

Fig. 3. The second molar tooth magnified six times.

ART. XLIII. *On the Strata from whence the Fossil described in the preceding Notice was obtained.* By W. H. FITTON, M.D., F.R.S., Pres. G.S.

[In a Letter addressed to W. J. BRODERIP, Esq.]

10th December, 1827.

MY DEAR SIR,

MY acquaintance with Stonesfield was derived from an excursion made last spring, in company with Messrs. Oeynhausén and Dechen of Berlin, two distinguished Prussian geologists, who were at that time travelling in England ; and I now send at your desire some account of the strata that have furnished your very interesting specimen,—though my notes were not taken with any view to publication, and probably require several corrections. Our visit was too short to admit of detailed enquiry ; but we saw quite enough to be convinced that the beds including the assemblage of fossil remains that has excited so much attention, are a conformable portion of the general descending series of England ; the true place of which cannot be far distant from that assigned to them by Smith, Greenough, Conybeare, Buckland, and other

* The teeth, as here represented, are too crowded.

English geologists. And I have no doubt that more extensive examination would have removed all uncertainty upon this subject from the mind of my friend Mr. Constant Prevost,* with whose candour and accuracy as an observer, I have had frequent opportunities of becoming acquainted.

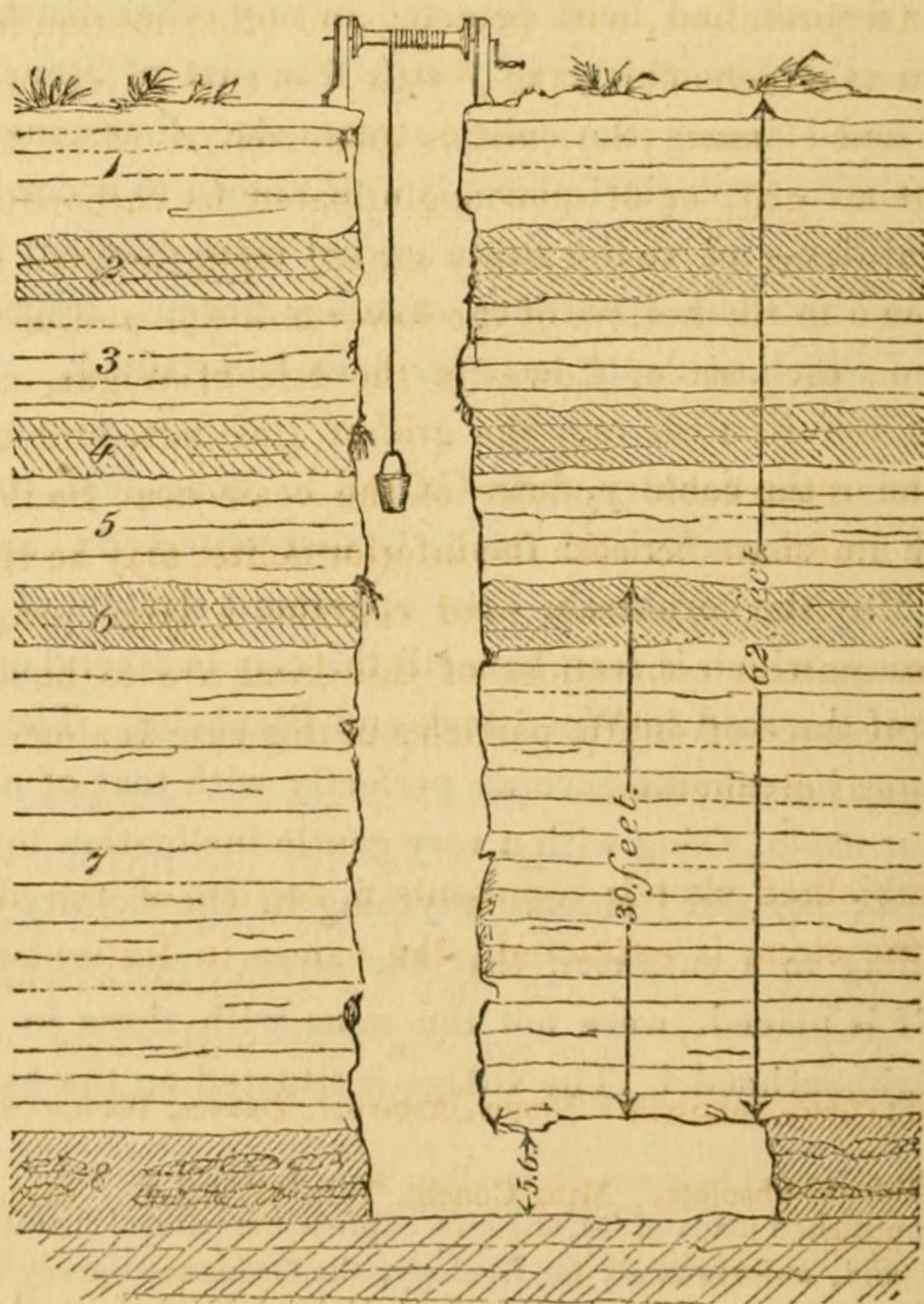
The only question in the present case is, whether the Stonesfield slate is to be considered as one of the group of strata constituting the great oolite?—in short, whether it is inferior to the Oxford clay? The precise place of the slate, and the form of its equivalents in other quarters, are distinct considerations: and the evidence in proof of its true situation might be complete, although no similar deposit had been detected in any other district. But, though no other assemblage of *fossils* like that of Stonesfield has yet been found among the oolitic strata, slaty limestone, holding nearly the same geological place, is well known to occur in several other localities—where the strata are not more different from each other than the distant portions of other groups, respecting the identity of which no doubt has ever been entertained.

In crossing the country, from Oxford to Stonesfield, the Oxford clay with its characteristic fossils is first observed; and this is succeeded by the cornbrash,—the uppermost stratum of the great oolitic group, which is seen beneath the clay in several quarries on the sides of the road to Woodstock and Blenheim. The aspect of the country hereabouts accords perfectly with that of a series of continuous strata, rising with a very gentle inclination towards the north west; nor did I observe anything in the vicinity of Stonesfield leading to a suspicion that the strata upon which the village itself is placed, were not the same with those in its immediate neighbourhood.† The village is situated on the brow of one

* See Annales des Sciences Naturelles, tom. 4. 1825. p. 389.

† The published maps of Oxfordshire express the natural features very imperfectly; and, unfortunately for Geology, the Ordnance Survey has not yet been engraved. But on examining the large unpublished maps at the Ordnance drawing-room, I could see nothing indicating any departure from the general structure in that which represents the country around Stonesfield; though in several other cases, the features of the Ordnance maps correspond with the variations of the strata.

of the lateral vallies, that contribute streamlets to the Evenlode, a tortuous rivulet, the general course of which is from north-west to south-east; and the beds that supply the "slate" (as it is called), are, on an average, about fifty feet below the summits, and are excavated by numerous workings on both sides of the ravines; the agreement between the strata thus disclosed in the separate shafts affording the most satisfactory proof that can be imagined of their continuity. We descended by one of these shafts into a drift or gallery; and what we saw, the workmen assured us, might be taken as fairly representing the section of the pits in general.—



1. Rubbly limestone; (Cornbrash.)
2. Clay, with *Terebratulites*, &c.
3. "Rock". Limestone.
4. Blue clay.

5. "Rock". Oolite.
6. Blue clay.
7. "Rag." Oolitic limestone.
8. Sandy bed, containing the "Slate".

The total depth of this shaft, to the bottom of the drift, or horizontal gallery where the slate is dug, was about sixty-eight feet; the drift itself being between five and six feet in height. About twenty-five feet of the lower beds (7.) consisted of fine-grained oolitic lime-stone, containing casts of spiral univalves and bivalves* ; and the remainder, or upper part, (1. to 6.) of alternations of clay, with limestone, probably belonging to the corn-brash,—the beds of which at top are rubbly, and lower down oolitic. The lowest of these clay beds (6.) is of a greenish hue; it effervesces slightly with acids, and falls to pieces in water like fullers' earth: and the upper bed of clay (2.) contains numerous plicated terebratulites, with pectens, and other marine fossils.†

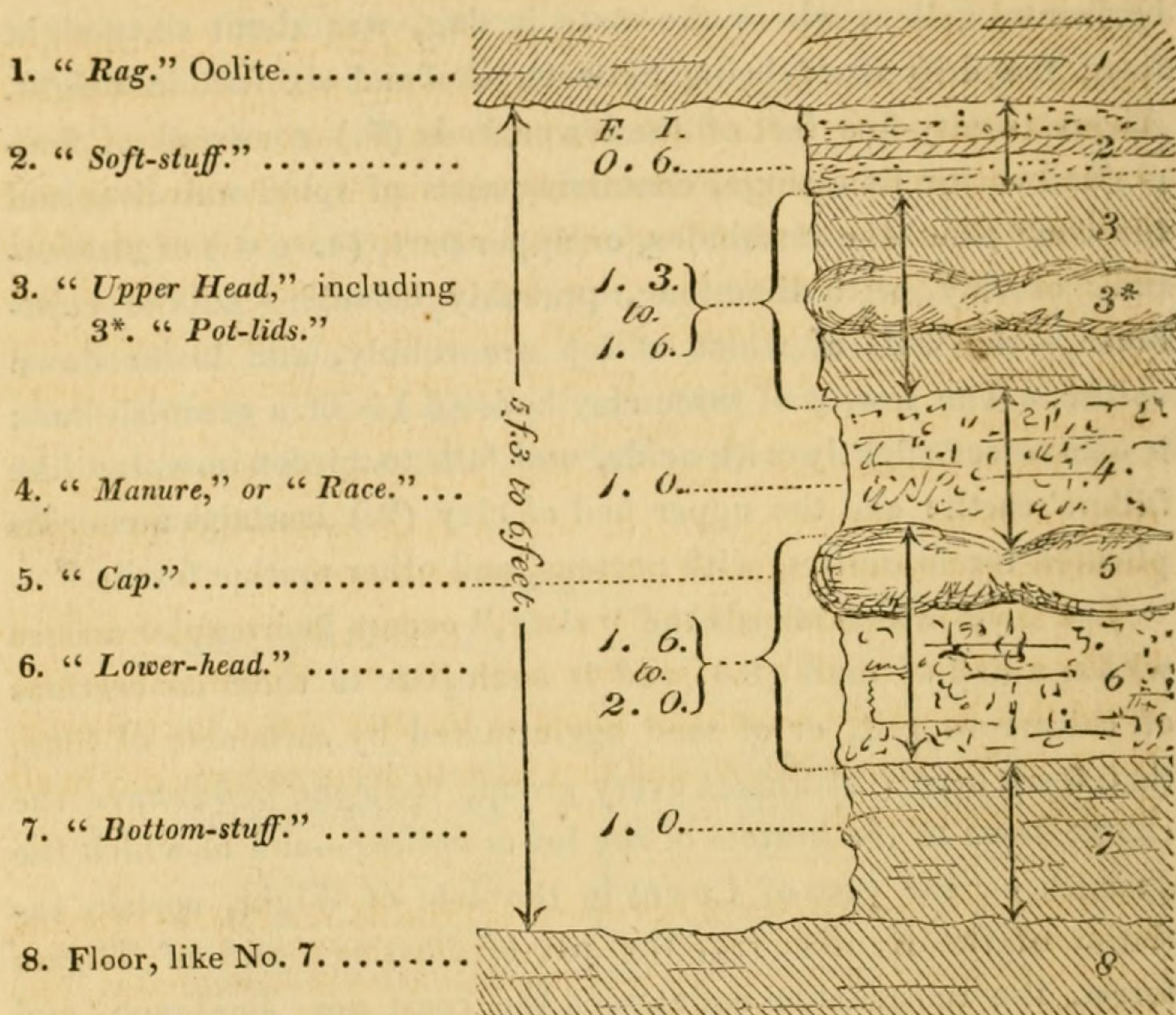
The stone which affords the "slate," occurs in irregular masses within a bed of sand (8.), and is analogous to those concretions of calcareous grit, or of sand agglutinated by carbonate of lime, that form a part of almost every group, from the beds above the chalk, down to the bottom of the lower oolite;—and of which the quarries on the east of Cowes in the Isle of Wight, certain varieties of the Kentish rag, the grit of Hastings, and of Tilgate forest, the remarkable nodules of the coast near Boulogne, and the gritty limestone beneath the inferior oolite, may be cited as examples. In fact, wherever sand contains a large proportion of calcareous matter, concretions of this kind are to be expected; and the presence of oolitic particles in this case is almost the only mineralogical distinction.

The subjoined sketch represents a section of the drift from whence the stone is extracted; the names in Italics being those

* Of the genera *Turritella*? *Venus*, *Astarte*? *Tellina*, *Pecten* (*vagans*?)

† *Terebratula obsoleta*. Min. Conch. Tab. 83. fig. 7. *Pecten fibrosus*. Tab. 136. fig. 2.

given to the beds by the workmen.—



1. The "Rag" which forms the roof, is a coarse soft calcareous stone, more or less oolitic.

2. The "Soft-stuff," occupying about six inches, consists of yellowish very sandy clay, including thin courses of fibrous transparent gypsum.

3. The "Upper head," from fifteen to eighteen inches thick, is composed of sand, of various consistency and fineness of grain, containing towards the lower part large flat or spheroidal concretions, of calcareous grit pervaded by oolitic particles,—which are most abundant in irregular seams parallel to the strata, and are rendered conspicuous by the darker greenish hue of the paste in which they are enveloped. These concretions, from a coarse resemblance, are called "Pot-lids"; and the rock which they consist of, with all the other useful stone of the pits, bears the common name of "Pendle."—It has in several places the character of a conglomerate; including smooth rounded pebbles of various sizes, cemented by oolite, and themselves also, composed principally of hard sparry oolitic stone, which differs very little from the cement except in form.

4. The "Manure", or "Race," consists of slaty friable sand-rock, effervescing strongly with acids, and including glittering particles appa-

rently of mica. The hue is yellowish gray, and the rifts are coated with yellowish carbonate of lime, crystallized in acute rhomboids.

5. and 6. The “*Cap*,” and “*Lower-head*” together, are from eighteen inches to two feet in thickness; the upper portion having a concretionary form like that of the “*Pot-lids*.” And the rock in both cases varies, from a very compact and fine grained grit, effervescing strongly with acids, and having in some places an almost sparry structure, to a stone of which the larger portion consists of oolitic particles. Nearly all the fossils that I have seen are contained in grit more or less oolitic, resembling that above described; and the greater number, including your specimens, appear to have been procured from these beds.†

7. The “*Bottom-stuff*,” about twelve inches thick, is a coarser variety of stone, consisting of grit, with a large proportion of oolitic particles, and an admixture of effervescent sand-rock.

8. I saw no specimens of the floor of the gallery, but it was described by the workmen as of the same nature with No. 7. The workmen also stated that bones are sometimes found in the *Rag* above the galleries, No. 1, in No. 2, and No. 4: and they seem to occur occasionally in all the beds enumerated.

† The shells, in the specimen represented in Plate XI, are *Trigonia impressa*, *Terebratula obsoleta*, *Avicula ovata*, and apparently two species of *Gryphæa*:—and these seem to be among the most abundant in the Stonesfield slate. Mr. Sowerby’s collection and my own contain the following species (including those last mentioned): many of which, it will be observed, are known to occur in other places, in the Cornbrash, or upper part of the great oolitic group.

UNIVALVES.	(BIVALVES.)
Nerita, two species; one banded; another banded and ribbed; both preserving their colour.	Mytilus, a new species .. not figured.
Turritella?	Ostrea—a plicated species.
Another spiral univalve.	——— probably another species.
	Pecten fibrosus T. 136. f. 2.
	——— obscurus T. 205. f. 1.
	———, a new species.... not figured.
	Pholadomya acuticostata. T. 546.
	Pinna (from Mr. Parkinson’s collection) not figured
	Plagiostoma,—nearest to cardiformis. T. 413. f. 3.
	Terebratula obsoleta T. 83. f. 7.
	——— maxillata ... T. 438. f. 4.
	Trigonia impressa (Sowerby) See Pl. XI.
	——— Prevost, Ann. des Sc. Nat. IV. Pl. 18. f. 22. 23.
BIVALVES.	
Astarte.	
Avicula ovata. Min. Conch. Tab. 512. f. 2.	
Gryphæa—two species; one of small size, another large T. 214. f. 1.	
Lima rudis. T. 214. f. 1.	
Modiola imbricata..... T. 212. f. 1.	
——— aliformis T. 259.	
———, a new species .. not figured.	

Several of the bones, remains of vegetables, and other fossils which occur at Stonesfield, have been enumerated in Dr. Buckland’s memoir on the Megalosaurus:—Geol. Trans. 2d Ser. I. page 390, &c.,—and in Mr. Prevost’s paper already referred to.

The best stone is that of the “*Pot-lids*”, or concretions between the upper-head and the race; and the masses are frequently bluish within, but cream-coloured on the outside. The blocks after being raised from the pits, are spread out on the surface, and exposed to the effects of frost; which splits, or renders them easily divisible, into flags or “slate,”—the fissures being parallel to the general stratification of the country.

The doubts which Mr. Prevost has expressed on the relations of the strata at Tilgate forest in Sussex, have been adverted to by Mr. Mantell, who has mentioned the chief distinctions between that remarkable deposit and the Stonesfield beds.* In fact, no point in the Geology of England is at present better determined, than the existence of a numerous and varied series of strata between those groups. The Tilgate grit it is true resembles that of Stonesfield, in its concretionary form and its connexion with sand; but it contains not a particle of oolite:—and grit of the same mineralogical character occurs not only in several other parts of the Hastings-sands, but occasionally throughout the Weald clay, thus pervading a series of strata decidedly different from the oolite in geological site: while the presence of freshwater shells at Tilgate, those of Stonesfield being marine, affords a Zoological character not less distinctive.

I remain, my dear SIR,

Very truly yours,

WM. HENRY FITTON.

W. J. Broderip, Esq.

* “Remarks on the geological position of the Strata in Tilgate Forest, Sussex.” Jameson’s Edinb. Philos. Journ. April to Dec. 1826, p. 162.—See also a Notice by Mr. Mantell, Geol. Trans. 2d Series, I. p. 131.

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