along its boundaries; and I regard the chert pebbles above described as relics of such rocks, they having been separated out from the mother-limestone by the delicate sifting power of running water. The shaly rocks of the Harwich deep boring probably belong likewise to the Carboniferous period, and those of Meux's Brewery are true Devonian. The recent deep boring at Turnford also discovered Devonian rocks, and that at Ware Silurian (Wenlock Limestone), and the relations of these beds are such that, as Mr. Etheridge writes, "Should the dip of these Hertfordshire Silurians prove to lie to the south, we may anticipate the more ancient series further north towards Cambridge."¹ The dip of the Hertfordshire Silurians is proved to lie to the south, and thus we find the details of the ancient barrier, so far as yet known, strongly supporting our independent conclusions that the more ancient Palæozoic pebbles were derived from this source. And at this period the old dividing ridge must have been suffering active marine denudation from waves, and the wash of strong currents between the two N. and S. seas; the advancing waters steadily widening the gaps in the old barrier as it gradually disappeared beneath the sea surface. The conditions were therefore peculiarly favourable to the formation of pebble beds, and then it was that our Upware and Potton pebbles were formed, the Jurassic ones mainly from the western shores in Cambridgeshire and Bedfordshire, and the Carboniferous and older Palæozoic from the destruction of the ancient barrier.² The Rhyolite pebbles may have been obtained, like many of the quartzites, indirectly through the New Red Sandstone.

Lastly, inquiring what we can learn from these fragments as relics of beds since destroyed by denudation, we find the Jurassic chert pointing to the former existence of Jurassic limestone near to this area, and the abundance of Mountain Limestone chert proves a great denudation of the Carboniferous formation. But little evidence appears bearing upon the question whether Coal-bearing beds now form part of the Palæozoic ridge; but the more ancient pebbles testify to the existence of the older Silurian and Cambrian rocks beneath the Cretaceous series near Cambridge, as independently predicted by Mr. Etheridge.

The almost exclusive presence of chert in the Portlandian pebble beds of Berkshire suggests that only the Carboniferous rocks were exposed to denudation in Upper Jurassic times, the Mountain Limestone wrapper being not yet eaten through so as to expose the more ancient core-rocks of the axis.

VI.—NOTE ON THE WELL LATELY SUNK AT WOKINGHAM, BERKS.

By Prof. T. RUPERT JONES, F.R.S., F.G.S.

HAVING been favoured by Mr. T. M. Quill, who has of late successfully completed an artesian well at Wokingham, with opportunities of examining the specimens brought up from the well, and with his own notes on the progress and results of the boring,

¹ Popular Science Review, 1879, vol. iii. p. 293.

² Mr. J. J. Harris Teall suggested, in 1875, that the Lydian stone came from Palæozoic rocks to the east.—Sedgwick Prize Essay, 1875, p. 38.

I have drawn up a tabular statement of the strata pierced on that occasion. The well was begun in May, 1879, in the London Clay, on the low ground at the foot of the hill of Bagshot Sand on which Wokingham stands, near the junction of the S.W. and S.E. Railways. A 6-foot shaft was sunk for 264 feet, penetrating the London Clay; a 24-inch pipe, through $6\frac{1}{2}$ feet of sand and clay of the "Basement Bed," then reached a water-bearing sand of the same series; and a pipe (16-inch) and bore-hole were continued for 138 feet, down to 408 feet, at a level of 64 feet in the Chalk, where an abundant supply of water was obtained. The 16-inch pipe was sunk to 355 feet, having sunk several feet in the Chalk by its own weight (18 tons) on the cutting edge of its "shoe." From 355 feet down to 408 feet, a 15-inch bore-hole was made in the solid Chalk and flints, without any pipe to line it. The pipe traversed the lower part ($3\frac{1}{2}$ feet) of the "Basement Bed of the London Clay," $54\frac{1}{2}$ feet of mottled clays and sand of the "Woolwich and Reading Series" (with water in sand at 295 feet), and 16 feet of the sands and "Bottom Bed" of that formation, before it entered the Chalk. No Oyster shells were observed in the "Bottom Bed." The grey colour attributed to the upper portion of the Chalk (at 344' to 352') may have been caused by the admixture of greenish sand occupying perforations in the Chalk, as in other parts of Berkshire.

The following are the details:—

At top 1 foot of surface soil.			Strata passed through in sinking the well at Wokingham, Berks.
Thickness of Beds in feet.	Depth in feet.		
263 feet of London Clay.	(263 feet of London Clay.)	1	London Clay, fawn-coloured (weathered).
		5	Rusty-brown (weathered); with small Bivalves (<i>Cardium</i>).
		12	Blue and compact (drying on exposure to dark-grey); Septarium, with large Bivalve (<i>Cyprina</i>).
		14	Septarium, with small <i>Cardium</i> ; <i>Pholadomya virgulosa</i> (pearly), large and small, in the clay.
		18	Large <i>Nautilus</i> in septarium.
		45	<i>Cyprina planata</i> (large), several.
		52	Seam of rounded flint shingle of large and small pebbles, grey-mottled outside, whitish within.
		62	<i>Pholadomya virgulosa</i> .
		70	<i>Panopæa intermedia</i> . (Loamy from 70' to 82', with water.)
		70½	Septarium with pyrites.
		73	Thin seam of black (flint?) sand.
		73½	Septarium.
		81	Septaria: 1 foot.
		90	<i>Pholadomya virgulosa</i> (pearly).
		95	Septarium with pyrites; and nodule of pyrites, irregular in shape.
		120	<i>Teredo</i> , piece of thick tube.
		125 to 137	} Loamy.
		147	
		155	<i>Pinna</i> , crushed fragment.
		162	Septarium.
		184	<i>Dentalium</i> , <i>Acteon</i> (pyritous), and <i>Natica</i> in the clay; and a septarium.
		189	Septarium.

Thickness of Beds in feet.	Depth in feet.	Strata passed through in sinking the well at Wokingham, Berks.
54 feet of Clays, mottled and various, with some sand.—“Woolwich and Reading Beds.”		209 Flint pebbles, large, $3\frac{1}{2}$ " long, and 6" long by $3\frac{1}{4}$ " thick, grey-mottled outside, white and yellowish within, with yellow and faint umber concentric colours in middle, with grey spots, somewhat like Choanite structure.
		210 Cement-stone in flat nodules, with irregular perforations, ¹ roughly striated on their inside (Fucoidal).
		225 <i>Astarte</i> ($\frac{1}{2}$ " long).
		228 Septarium.
		235 <i>Astarte</i> ($\frac{1}{2}$ " long)
		259 Cement-stones, and beneath them a seam of black sand, with water.
	1'	264 Dark-grey loam sand and shale; with Bivalves (<i>Cytherea tenuissima</i> , about $1\frac{1}{4}$ "). Water here, at 120 gallons an hour.
	1'	265 Fine quartzose sand, with green grains and a little mica: <i>Ditrupa</i> .
	2'	266 Cement-stones.
	1'	268 Dark sand with shells.
	$1\frac{1}{2}$ '	269 Clay, and flat nodule of pyrites, containing fragment of large Bivalves, and rough perforations like those in the Cement-stone at 210 feet.
	3'	270 $\frac{1}{2}$ Sand and sandstone (as at 265'), with <i>Ditrupa</i> ; small black flint pebbles, and a small angular piece of rock. Thin seams of clay in the sand. Water rose 126 feet in the shaft, and would probably have risen 150' had it not been pumped.
	$\frac{1}{2}$ '	273 $\frac{1}{2}$ Glauconitic clay.
	$\frac{1}{2}$ '	274 Mottled clay.
	4'	276 Reddish clay.
	5'	280 Brownish clay.
	4'	285 Mottled clay.
	1'	289 Sandy clay.
	1'	290 Friable clay and sandstone.
	2'	291 Brown loamy clay.
	2'	293 Hard mottled clay.
	2'	295 Grey sand and water. Water suddenly burst up the 16" pipe, and rose to within 42 feet of the surface.
	2'	297 Loamy clay.
	2'	299 Seam of sand with clay.
	2'	301 Mottled green clay.
	3'	303 Sandy clay.
	$6\frac{1}{2}$ '	306 Mottled brown and red clay.
10 feet of sandy and pebbly "Basement Bed" of the London Clay.	$1\frac{1}{2}$ '	312 $\frac{1}{2}$ Sandy clay.
	2'	314 Greenish loamy clay.
	1'	316 Mottled clay.
	4'	317 Brown clay.
	$\frac{1}{2}$ '	321 Grey sand.
	$3\frac{1}{2}$ '	321 $\frac{1}{2}$ Mottled clay, with thin seams of greenish sand.
	3'	325 Mottled clay with sand.

¹ These perforations are similar in character to those in the surface of the Chalk underlying the "Bottom Bed" of the Woolwich-and-Reading series at Reading and Newbury. These oblique and irregular holes, crossing one another, have been referred, with great probability, by Mr. Hudleston, F.G.S., to "roots of marine plants" growing on the sea-bottom ("Proceedings Geol. Assoc." vol. iv. p. 521). Some of the perforations in the Chalk at Newbury (I may remark) are more horizontal than the others, are situated below the oblique holes, and are filled with a granular (perhaps fucoidal) chalky material.

	Thickness of Beds in feet.	Depth in feet.	Strata passed through in sinking the well at Wokingham, Berks.
16 feet of Sand and "Bottom Bed."	15'	328	Grey sand (with a thin seam of clay at 335 feet).
	1'	343	Green sand, with green-coated pebbles (few) and sub-angular flints.
64 feet of Chalk.	8'	344	Soft grey ¹ chalk.
	11'	352	Band of flints and clear white chalk.
	3'	363	White chalk with scattered flint nodules.
	5'	366	White chalk.
	31'	371	Band of flint, and others at intervals down to 402'.
	6'	402	Band of flint (over 12'), with soft chalk under it, which yielded water at 15,000 gallons an hour ² (May 28, 1880).
		408	Hard rock (flint), not pierced.

We must bear in mind, that in boring it is not always easy to be certain of the exact character of the beds to a few inches, as the material gets mixed up to some extent in the boring tools.

Some published sections of the Tertiary strata in this part of England, which may be useful in comparison, are to be found in the Quart. Journ. Geol. Soc. vol. x. p. 89; vol. xxxi. p. 451; Memoirs Geol. Survey, vol. iv. p. 423, etc.

VII.—NOTES ON THE VERTEBRATA OF THE PRE-GLACIAL FOREST BED SERIES OF THE EAST OF ENGLAND.

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PART II.—CARNIVORA.

ON THE OCCURRENCE OF THE GLUTTON, *Gulo luscus*, LINN., IN THE "FOREST BED" OF MUNDESELEY, NORFOLK.³

IN some notes communicated to the GEOLOGICAL MAGAZINE last April (p. 152), attention was called to the fact that remains of the Glutton had been recently obtained from the "Forest Bed." So much interest is attached to the discovery of an animal, which at the present day is restricted to the cold northern regions, along with Elephant and other remains, which seem to indicate a warm climate, that it has been thought desirable to give some account of the discovery. I am indebted to Mr. R. Fitch, of Norwich, to whom the specimen belongs, for his courtesy in submitting it to me for examination. It is a portion of a lower jaw with teeth, of a Glutton, *Gulo luscus*, Linn., a genus which, although known to occur in the fossil state, has hitherto only been obtained from Cave deposits.

The occurrence of the Glutton in Britain was first intimated by MM. Boyd Dawkins and Sanford in the year 1866 (Pal. Soc.), but it was not until 1871 (Q.J.G.S. vol. xxvii. p. 406) that the former gentleman described the lower jaw of this species, which had been obtained by MM. Hughes and Heaton from the cave at Plas Heaton.

¹ This greenness may have been due to the intermixture of sand lying in perforations in the top of the Chalk.

² At 70 feet below the surface.

³ Read before the Geological Society of London, May 12, 1880.