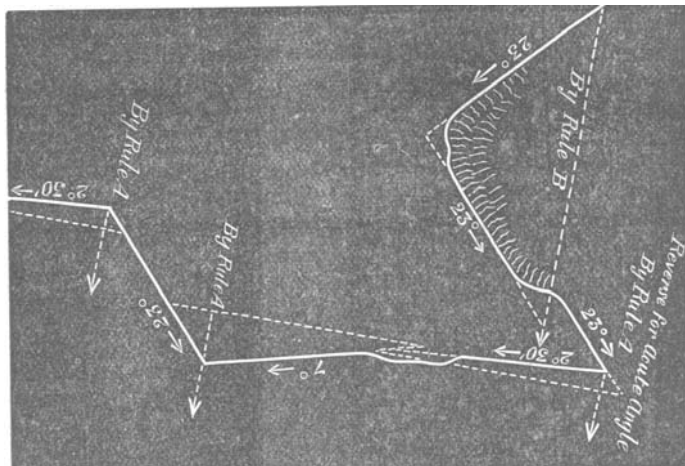


Note.—These rules will not apply unaltered to lines of apparent dip enclosing *acute* angles, which in practice are rarely found. In such cases a horizontal triangle constructed by the *reverse* rule, *i.e.* on the other side of either line of observed dip, will give the result required.

FIG. 3.



The quarry represented in Fig. 3 may be taken as an example of obtaining the true dip by these methods. The operation being repeated under varying conditions with the same result.

H. M. GEOLOGICAL SURVEY.

W. H. PENNING.

#### THICKNESS OF THE OXFORD CLAY.

SIR,—As few of your readers may possibly see my Lecture on the Water Supply to Houses and Towns with especial reference to Oxford, I beg to enclose an extract from it, having reference to a question which is of some geological interest, *viz.* the thickness of the Oxford clay in this district. The inquiries I had occasion to make respecting the practicability of an artesian well at Oxford led me to doubt previous conclusions. In the following extract from my pamphlet I give the geological grounds on which I arrived at this different result.

“We know generally that the Oolites become thinner in their range eastward, but the Oxford clay has, on the contrary, been thought to become thicker, and it has been generally stated, on the evidence chiefly of the boring made at Wytham<sup>1</sup> in 1829, that at Oxford it is 600 ft. thick, or more.

“I am satisfied however, that there is some error in the construction put on that section, and that the thickness of the Oxford clay here is much less than that estimate. A record of the boring has been preserved, which shows it to have been carried through a succession of

<sup>1</sup> Three miles N.N.W. from Oxford.

clay and rock strata, to the depth of 632 feet. Unfortunately the record was drawn up by coal-miners, who have employed the terms in common use in the coal-fields, and no specimens have been preserved which would have enabled us to correct the deficiencies of description; nevertheless there is sufficient evidence, on independent grounds, to show that the strata, so far from belonging all to the Oxford clay, include probably the whole of the Oolitic series, and part of the Lias.

“My reasons for believing the assignment wrong are these: in the Oxford clay, whether seen in sections at St. Clement’s, Oxford, Summertown, or elsewhere, no beds of rock are met with,—nothing but a few seams of septaria, nor have any been found in the outcrop or pits of the lower division of this formation at Kirtlington or North Leigh, or in any well-sections. The 10 ft. of Kelloway rock which lies at the base of the Oxford clay in Wiltshire, has not been recognized in Oxfordshire. The alternation of thick beds of rock, some of them 30 ft. thick, and of a light colour, such as described in the Wytham boring, is entirely unknown in the Oxford clay of any part of England. I should therefore exclude these rock strata, and restrict the Oxford clay at Wytham to the strata numbered 1 to 24 inclusive, the total thickness of which is 273 ft. No. 25, ‘a strong blue rock,’ 10½ ft. thick, I should refer to the Cornbrash; No. 26 to 32, alternating clays and rock 33 ft. thick, to the Forest Marble; No. 33 to 50, consisting of grey and light coloured rocks, two of them 30 ft. thick, with seams of clay, altogether 131½ ft. thick, to the Great Oolite; No. 51 and 55, together 14½ ft., to the rubbly Inferior Oolite of Fowler; while the thin seam of ironstone and the clays with ironstone, No. 53 to 59, which were penetrated to the depth of 170 ft., may represent the Marlstone and Lower Lias; the Upper Lias, which at Fowler is reduced to a thickness of 5 ft., has here apparently thinned out.

“If we compare the section grouped in this manner with the dimensions and characters of the several Oolitic formations immediately north of Oxford, as described by Prof. Phillips,<sup>1</sup> Prof. Hull,<sup>2</sup> and Mr. Green,<sup>3</sup> they will be found to agree very closely.

Average Thickness of Strata at Charlbury, Woodstock, and Enslow Bridge.				Thickness of the Strata at the Wytham boring.			
	ft.			Beds.	ft.	in.	
Cornbrash ... ..	9	} 179	}	No. 25 ... ..	10	6	} 190 6
Forest Marble ... ..	25			„ 26—32 ... ..	33	0	
Great Oolite—Upper ... ..	60			„ 33—50 } ... ..	131	6	
Lower... ..	70			„ 51, 55 ... ..	14	6	
Inferior Oolite ... ..	15			wanting?			
Upper Lias ... ..	8						
Marlstone and Lower Lias	400			„ 56, 59 ... ..	170	6 <sup>4</sup>	

“A few years later, another boring was made at St. Clement’s in search of water. No particulars are preserved. It was 420 ft. deep, and is merely stated to have been through 265 ft. of clay, and 135 ft.

<sup>1</sup> Geology of Oxford, pp. 139, 297, and 495.

<sup>2</sup> Mem. Geol. Survey, Geol. of Sheet No. 45 S.W., pp. 14, 26, and 30.

<sup>3</sup> Ibid., Geol. of Sheet No. 45, p. 9 et seq.

<sup>4</sup> Described as a uniform bed of clunch (clay) with ironstone.

(should be 155) of rock. These beds have also been assigned to the Oxford clay, but Mr. Stackpole speaks of the rock below a depth of 265 ft. as referable to the Great Oolite; but upon what evidence he does not say. If, however, a nearly horizontal line (the dip of the strata is nearly horizontal) be prolonged, from the level at which we have placed the Oxford clay at Wytham, it will be found to coincide almost exactly with the base of the clay at St. Clement's, and both series would naturally fall into the same category."

I conclude, therefore, that instead of being 600 ft. thick and more, the Oxford clay in the neighbourhood of Oxford does not exceed 320 to 350 ft., and further, there is evidence to believe that the Lower Lias itself thins out at no great distance, and even that the New Red Sandstone is at no great depth beneath Oxford. Besides its geological bearing, this is important in case, at some future period, of any attempt to search for coal in Oxfordshire or Buckinghamshire.

E.—SECTION OF WYTHAM BORING.

(From Phillips's "Geology of Oxford," p. 296.)

"The following is a summary of the results obtained in this remarkable boring, copied from a section presented to the Oxford Museum in 1849, by the Earl of Abingdon. The terms employed by the workmen are used in the coal-fields of Staffordshire for strata somewhat analogous:—

	ft.	in.		ft.	in.
1. Loamy ground ... ..	12	0	29. Blue rock ... ..	1	6
2. Quicksand and water ...	3	0	30. Clunch and clunch bines ...	6	0
3. Blue clunch ... ..	68	6	31. Grey rock ... ..	18	0
4. Light clunch ... ..	1	6	32. Dark parting clunch ... ..	0	6
5. Blue clunch ... ..	28	6	33. Light rock ... ..	30	3
6. Clunch bines ... ..	4	6	34. Light parting clunch bines	0	9
7. Blue clunch ... ..	29	0	35. Light rock ... ..	5	0
8. Clunch bines ... ..	2	0	36. Very dark parting ... ..	2	0
9. Blue clunch ... ..	28	0	37. Grey rock ... ..	1	4
10. Brown clunch ... ..	3	0	38. Dark parting ... ..	0	8
11. Mingled ground ... ..	11	6	39. Clunch bines ... ..	7	6
12. Strong grey rock ... ..	1	0	40. Grey rock ... ..	3	0
13. Grey clunch ... ..	2	0	41. Dark parting ... ..	1	6
14. Brown clunch ... ..	1	6	42. Grey rock ... ..	2	6
15. Mingled ground ... ..	17	0	43. Blue Bines ... ..	2	0
16. Blue clunch bines ... ..	6	0	44. Mingled ground ... ..	3	0
17. Mingled ground ... ..	4	0	45. Blue rock ... ..	9	0
18. Blue clunch ... ..	17	6	46. Dark ground ... ..	1	6
19. Mingled ground ... ..	9	6	47. Mingled ground ... ..	7	6
20. Blue clunch ... ..	5	0	48. Light rock ... ..	16	6
21. Dark blue rock ... ..	3	6	49. Black bat ... ..	2	0
22. Dark parting clunch ... ..	0	6	50. Rock ... ..	35	6
23. Dark blue rock ... ..	2	6	51. Mingled ground ... ..	11	6
24. Dark clunch ... ..	11	6	52 to 55. Mingled ground ...	3	0
25. Strong blue rock ... ..	10	6	56. Ironstone ... ..	0	4
26. Dark parting clunch ... ..	1	0	57. } Clunch mixed with ironstone	132	0
27. Strong blue rock ... ..	5	6	58. }		
28. Strong parting clunch ...	0	6	59. Dark clunch ... ..	2	0

"The boring was carried to the depth of 211 yards, the strata the same as that at 596 feet."—C. WEBB.

"The boring was made in 1829."

JOSEPH PRESTWICH.