

WILLIAM SMITH'S EXPLANATION OF THE COLLIERS' DIAL, 1798

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There is a faintly pencilled note, dated 1798, in the William Smith archive at Oxford, which describes a collier's method for measuring directions of dip and strike in the East Somerset coalfield. It explains some otherwise obscure passages in John Strachey's published records of local stratigraphy (Strachey, 1719; 1727) and it illuminates William Smith's own interest in recording dip-directions of coals at collieries near High Littleton, where he had begun surveying work in 1791. His note is accompanied by drawings of two varieties of compass-dial, or circumferator, naming these collieries.

INTRODUCTION

Among William Smith's papers archived at the Oxford Museum is a faintly pencilled note remarking on colliers' dials, dated 24 August 1798:

Aug 24th 1798-

It seems by their [Colliers (struck out)] describing their dips & points by the Hours of the Day and night that they divide the Circle into 24 equal parts [which they call (struck out)] or hours - and in all probability [that (struck out)] the Colliers Compass was originally thus divided and numberd and from its resemblance to the face of a Clock or Dial and it still retains this name and its application to Colliery purposes both above and underground is called dialing by all the Colliers of this district.

The drawings accompanying Smith's note represent two dial faces executed individually with care, resembling sundials or clocks (Fig. 1). One dial is divided into 24 parts numbered so that twelve divisions, starting from top centre and moving clockwise to the right, represent the "hours" from XII midnight (North), through VI o'clock morning (East), to XII noon (South); and the other twelve divisions, continuing clockwise round the dial, represent the "hours" from XII noon (South) through VI o'clock evening (West), to XII midnight(North).

The second dial-face has two oppositely numbered 12-hour circles. An outer ring of numerals, marked "Day", begins at XII, top centre, and continues clockwise through III(East), VI(South), and IX (West) like a normal clock dial. A second, inner ring of numerals, marked "Night", also commences at XII, top centre, but is laid down counter-clockwise so that III on this ring is due West, VI is South and IX is due East. On this double dial, XII on both the outer and the inner rings coincides with North, and VI on both coincides with South; but due East can be read either as III in the afternoon or IX-morning, and, likewise, West can be read either as IX-evening or III-morning.

THE COLLIERS DIAL IN JOHN STRACHEY'S PAPERS

The first-described dial in Smith's note proves very informative, for with its help one can confidently interpret several arcane remarks by John Strachey on the structural attitudes of coal strata. For example, describing coals found in pits near Stanton Drew, close to his residence in Somerset, Strachey wrote in (1719 p.971) "Their drift or Course is to the Eleven a-Clock Sun, as they term it, they *pitch* to the Five a clock Morning, and

rise to land; consequently to the Five a-Clock Evening-Sun." And again, of the same coals, in 1727 (p11): "The Course of these Veins is to the Eleven-a-Clock Sun (as they term it) they rise to the Five a-Clock Afternoon, and pitch to the deep, to the Five a-Clock Morning."

Using the single 24-hour dial each "hour" of which is equivalent to 15°, or one twenty-fourth part of the 360° circumference these passages can be understood as follows:

Strike (drift or course) = N 165° E

Direction of dip (pitch) = N 75° E

Rise (dip + 180°) = N 255° E.

A present-day geological map of the area (British Geological Survey, 1962) shows the average strike direction of coals underground at Stanton Drew to be N 159° E, and a surface dip direction of N 74° E. The Royal Coal Commission's Map (Prestwich 1871) shows the Strike to be N 162° E. These readings are virtually the same as those recorded by John Strachey in 1719, and so testify to the reliability of his observations.

In another passage (1727 p15) apparently copied from Plot (1686) he wrote: "at *Cheddle* the Dip is S.W. by S. or to the 2 a-Clock Sun."² That direction on Smith's "24-hour" dial is N 210° E. On a mariners' compass, SW by S is actually N 213.75° E, though there is no reason why SW by S on the colliers' dial should not be N 210° E.

PENCILLED MARKS ON SMITH'S DIALS ARE DIP BEARINGS

Smith's short note on colliers' methods of orientation seems to apply only to the first-described dial face, though he wrote several colliery names and directions of alignment on both of them (Table 1 and Fig. 1). All the places mentioned are in the vicinity of High Littleton, where he was lodging from 1792 to 1795.

Though Smith made no other mention of it, he was evidently recording on these drawings of dials the dip directions among coals being worked in pits near High Littleton. That is quite clear when Smith's pencilled marks on the dials (Column 2 in the Table) are matched with later surveyed orientations (Column 4 in the Table). Only one of Smith's entries deviates much from the later findings, and it was marked with a cross as though it had been seen to be an error, namely the Paulton dip direction entered on Dial 1 at "9 o'clock morning", which on that dial is southeast. On Dial 2, the entry for Paulton is again shown at "9 o'clock morning", where it correctly represents

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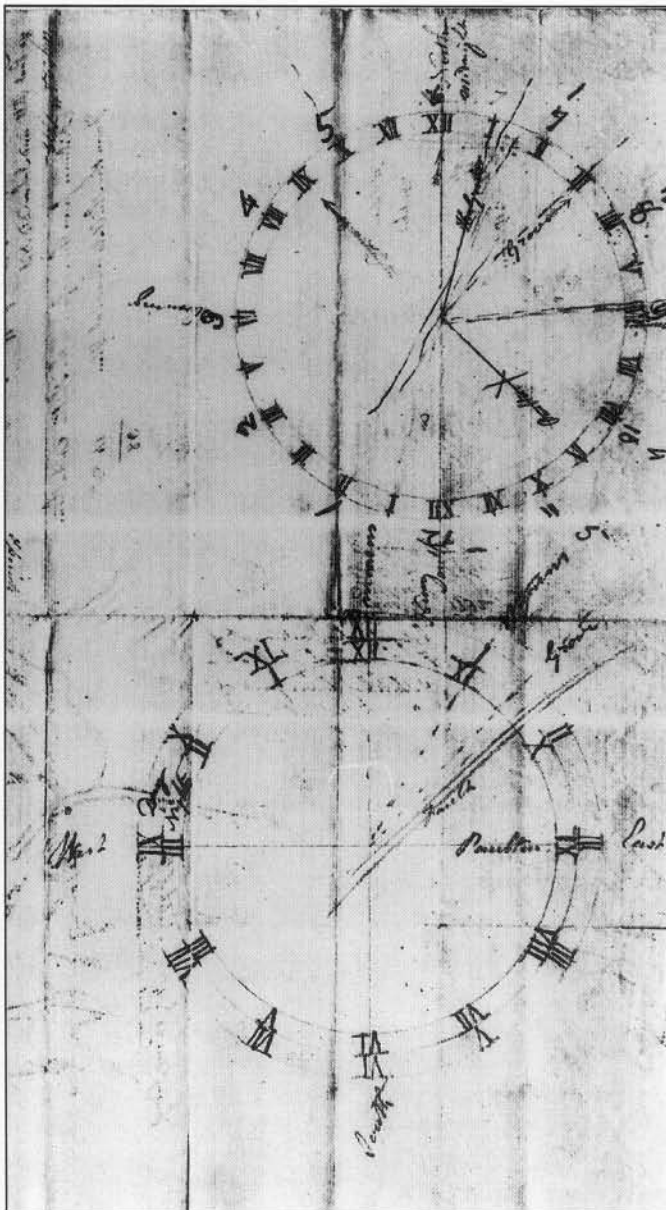
Table 1.

Pit Name	Dial Position Alignment	Compass Direction Indicated by Dial	Bearing of Coal Dip
Dial 1			
The Grove (1)	One, morning	N 15° E (E by N approx.)	N 30° E (5)
Grove (2)	Three, do.	N 45° E (Northeast)	NE (4)
[unnamed]	Six, do.	N 90° E (E Due East)	
Paulton (3)	Nine, do.	N 135° E (Southeast)	N 96° E (5)
Writhlington	Nine evening	N 315° E (Northwest)	NW (4)
Dial 2			
Mearns	12-noon & midnt	N 0° (Due North)	N 21° E (5)
Mearns	Eleven, morning	N 30° East (NE by N approx)	N 21° E (5)
Grove (2)	Ten-thirty, do.	N 45° E (North East)	NE (4)
Paulton (6)	Nine, morning	N90° E (Due East)	N 96° E (5)

- (1) Heighgrove, also called Woody Heighgrove.
 (2) Old Grove.
 (3) Cross-marked, as though in error.

- (4) Anstie (1873), Vertical Sections.
 (5) Royal Coal Commission Map (Prestwich 1871).
 (6) Engine Pit.

easterly dip. Was the unnamed East dip on Dial 1 a revised entry for Paulton?



MEDIEVAL ORIGIN OF DIALS

As Smith's note explains, a compass dial with its circumference divided into 24 parts was the means by which the colliers in the East Somerset coalfield made their observations of dip and strike directions. They would also have used it, just as importantly, perhaps, to survey the lie and direction of their workings underground in relation to landowners' rights above.

Such miners' dials date back certainly to the mid-16th century, for Georgius Agricola illustrated one in 1556 which, like Smith's Somerset example, was numbered clockwise from 12-north through 6-east to 12-south in 15° units or "hours", and then onward similarly from 12-south through 6-west to 12-north with a further 12 graduations (Agricola 1912 p147; Wolf 1935 p493).

Another point of interest, also perceived by Smith, was the connection between "dialing" and the taking of bearings by "hours." The word "dial" entered English from medieval Latin "dialis" and "dialiter", words which are respectively the adjective and adverb forms of "daily". Dials were thus 24-hour conceptions from the very beginning. They were not 32-point mariners' compasses, nor were they 360-degree land surveyors' circumferentors.

CONCLUSION

The memorandum by William Smith which is the subject of this short study is dated August 1798. At that date Smith had been employed by the Somerset Coal Canal Proprietors for five

Fig.1. Pencil sketches of two colliers' compass-dials which accompanied a memorandum by William Smith, dated 24 August 1798. One dial has a single ring of twenty-four neatly executed Roman numerals and several untidy marks indicating dip directions in named collieries. The second dial has two rings of twelve Roman numerals, and more rough orientation marks, including a fault (the double line). Published with permission of the Curator of Geological Collections, University Museum, Oxford.

years, mainly levelling and excavating along the line of the works and he was officially "the Surveyor". Smith had begun his local surveying work in the collieries on the Jones Estate in 1791; so by 1798 he had accumulated seven years of varied experience in the area.

This is not to question the date of his memorandum, only to remark that land surveyors of the time, including Smith, would have been acquainted with the circumferentor, an instrument similar to the miners' dial both in superficial appearance and practical application, though differing in its dial graduation. It was evidently the Somersetshire colliers' peculiar choice of "hours" to mark the dial of what seemed otherwise an ordinary circumferentor which caught Smith's attention.

ACKNOWLEDGEMENTS

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NOTES

1. Oxford University Museum Geological Collections, William Smith Archive, Box 26, Folder 5.

2. The passage in Plot (1686 p131) reads "... as about *Chedle* where the coal *dips* S.W. and by S. or as the *Miners* call it to the two a *Clock-Sun*, there the *rise* must be to the N.E. and by N. and the *row* or *streek* [strike] must lye N.W. and by N. and S.E. by S".

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