

THE WINSTER EARTH TREMORS

by N.E. Worley and D. Nash

ABSTRACT

During the 1950s the village of Winster was affected by a series of small earth-tremors. Explanations for these erroneously included collapse of old mine workings or gas explosions therein. As a result of underground investigations of mine workings it was shown that collapse had not occurred, and the real explanation appears to be a continuation of the earthquake activity known to have occurred in the Midlands for several centuries.

On February 22nd, 1952 at 9.20 a.m. the village of Winster was shaken by a mild Earth tremor, which caused slight structural damage to the village - some houses in the main street losing chimney stacks. Elsewhere in Winster and surrounding areas, a noise and slight disturbance were felt, being likened by some observers to the explosion of petrol tanks. The tremor was recorded at the Durham University Geophysical Observatory at 0920.04 to 0920.42 hours, i.e. 38 seconds. Tillotson (1956) stated that it attained an intensity of VI on the modified Mercalli Scale. A second tremor was felt on the 15th April, 1952 at 7.35 p.m. which had a similar effect. Details of the extent of these earth tremors were recorded in some detail by Clift (1952) who was then County Geologist, and the diagrams (fig. 1) showing the areas affected were compiled by him. These showed that approximately 12.6 km² were affected, the epicentre of the tremor being located in the centre of Winster. More shocks of lower intensity were felt on February 24th and April 15th.

Great concern about the tremors grew within the village during 1952 and it was considered by some that collapse of the numerous extensive old lead mine workings surrounding the area were responsible. Others suggested that perhaps explosive gases had accumulated in the old workings and spontaneously exploded causing the disturbances. The Winster Parish Council, largely under the enlightened guidance of Mr. Thornton, therefore decided to approach the Operation Mole and Orpheus Caving Groups to carry out systematic exploration of the shafts and lead mine workings contained within the area. These investigations were aimed to establish whether collapse of mine workings had occurred or whether any evidence concerning gas accumulations and explosions could be found.

The records of these early explorations provide some of the earliest systematic investigations in this important but much neglected lead mining area.

PRINCIPAL MINES AND VEINS OF THE WINSTER AREA

Clearly an understanding of the distribution of mines, and the nature of the mineral veins, is necessary in order to determine if these were responsible for the earth tremors.

What little published documentary evidence is available suggests that numerous pipe veins are developed within the Winster area. These were first noted by Farey (1811) who described Orchard Pipe 50 ft beneath Winster itself (fig. 2) and mentioned other pipes, notably Plackett and Portaway. A more comprehensive map showing the distribution of mineral veins was prepared by Nuttall in 1768 (Fig. 4) (D.R.O. 504B. LP11). It is clear that from this evidence that pipe veins are commonly developed within the Winster area, an observation which may be significant. Pipe veins are large cavernous deposits and have been described in general terms by Worley (1978). By comparison with other pipes in the Derbyshire area it is clear that because of their cavernous nature they are more likely to collapse in response to the flow of underground water, and the unsystematic over-extraction of minerals by previous generations of lead miners. It, therefore, seemed logical that investigation of the pipe veins in the area should be carried out to determine their condition, and possible presence of explosive gases.

It was established that shafts existed within the area onto the Yatestooop, Plackett, Orchard (Wesson Mine), Painters Way and Limekiln Pipes. The location of the principal pipes is shown on the accompanying map (fig. 2).

The initial investigations concentrated upon the shafts associated with Plackett Mine as these were the closest to the village. It was discovered that an extensive system of mined passages and caves existed and a reconnaissance survey of these was compiled (fig. 3).

DESCRIPTION OF THE WORKINGS INVESTIGATED IN THE PLACKETT MINE

An intensive series of explorations were carried out in the Plackett Mine and most of the shafts leading into the mine were descended. Unfortunately due partly to the lack of equipment (the survey was made in 1952) and expertise only a low grade sketch survey was made, which is reproduced in fig. 3. The description of the mine is based upon the accompanying survey notes.

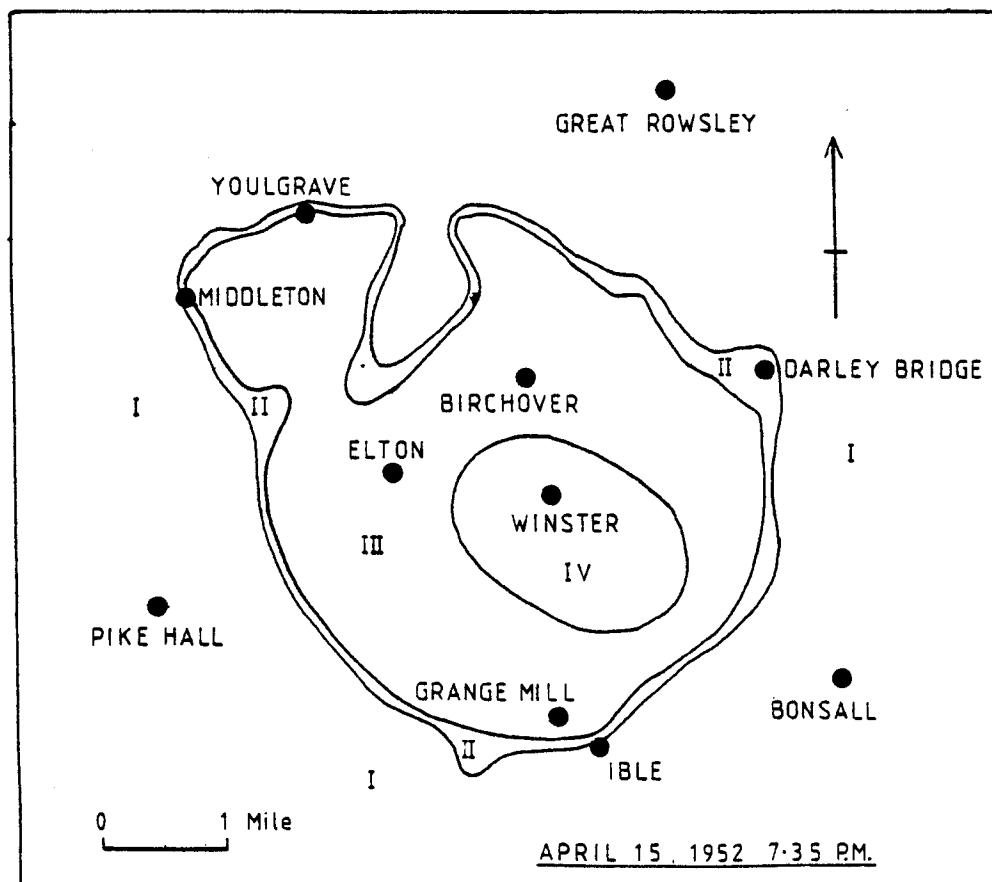
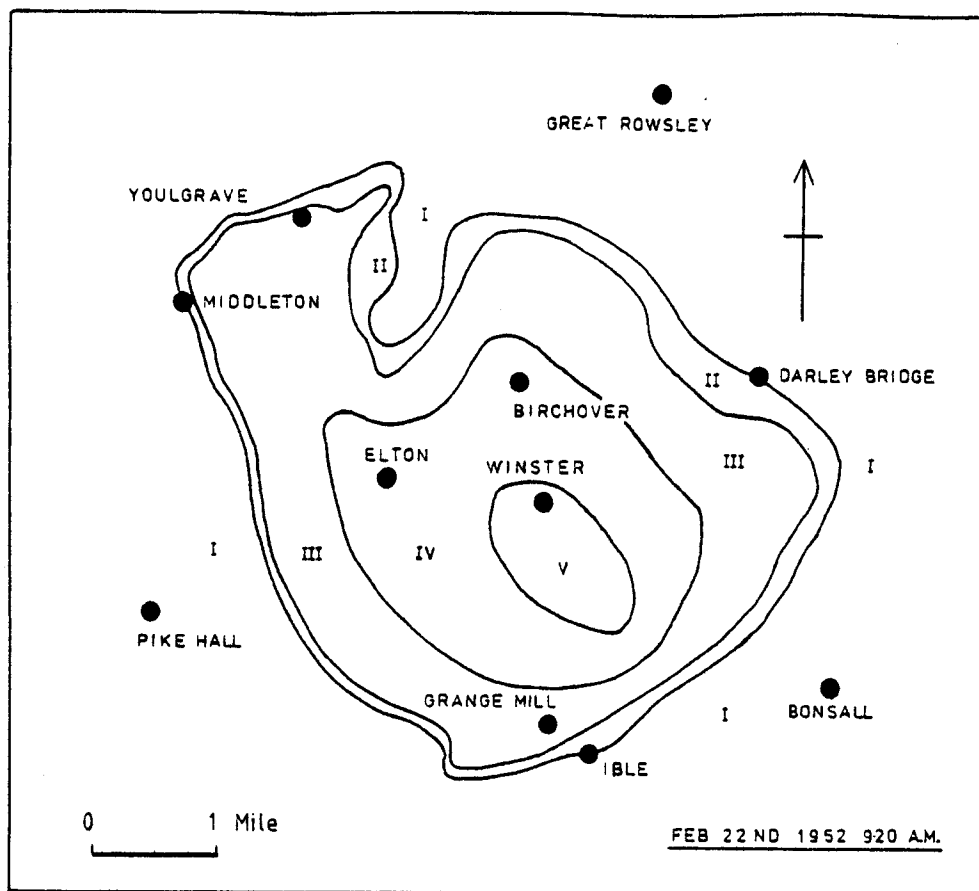
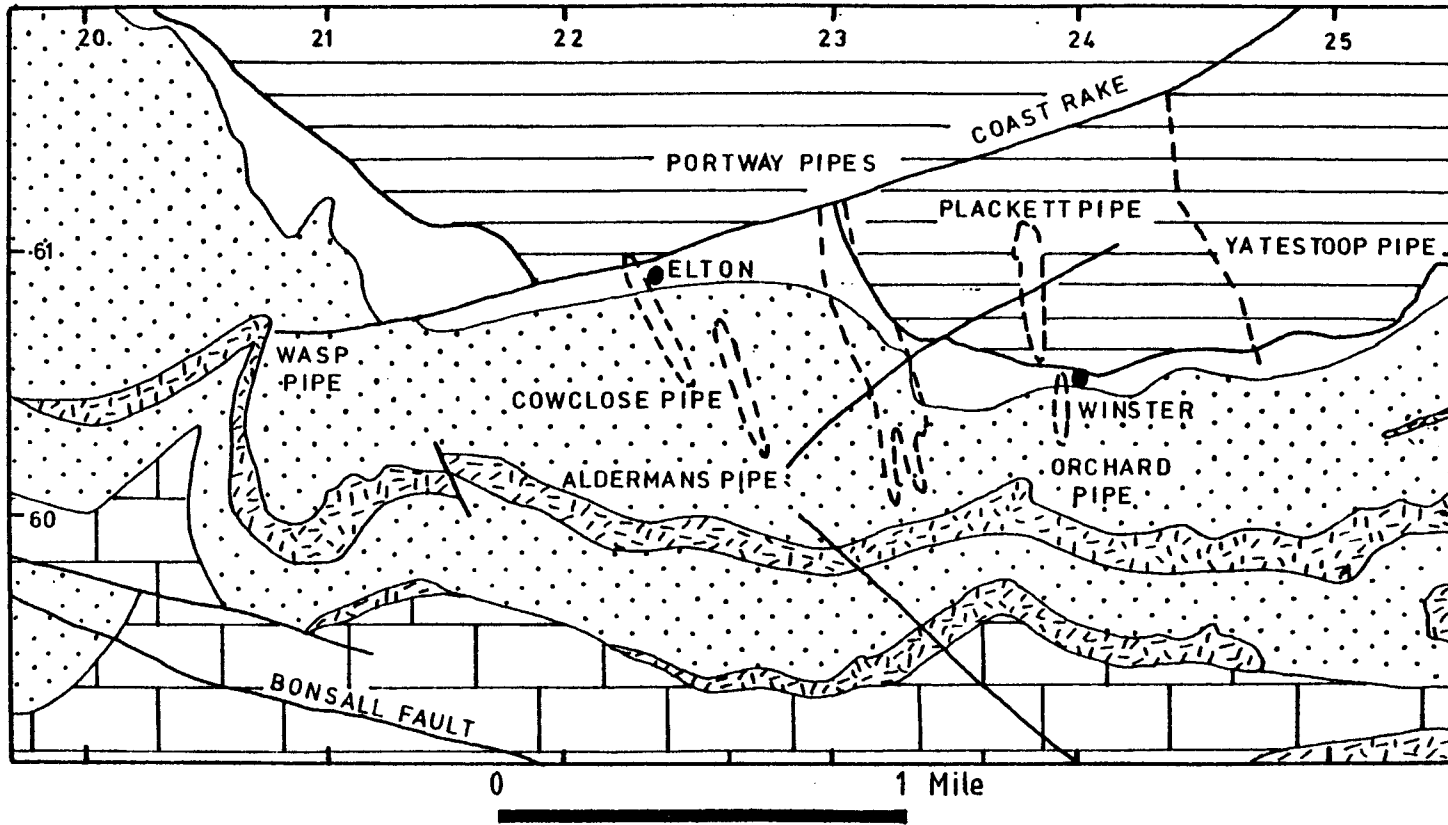


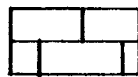
Fig. 1. Shock intensity maps of the 1952 Winsters earth tremors contoured on the Mercalli scale (after Clift MS).

Fig. 2.

GEOLOGICAL MAP OF THE WINSTER AREA



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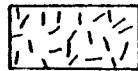
HOPTONWOOD LST.



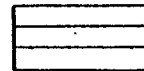
MATLOCK LST. GP.



CAWDOR/EYAM LST. GP.



BASALT LAVAS



NAMURIAN STRATA

Based on Worley 1978

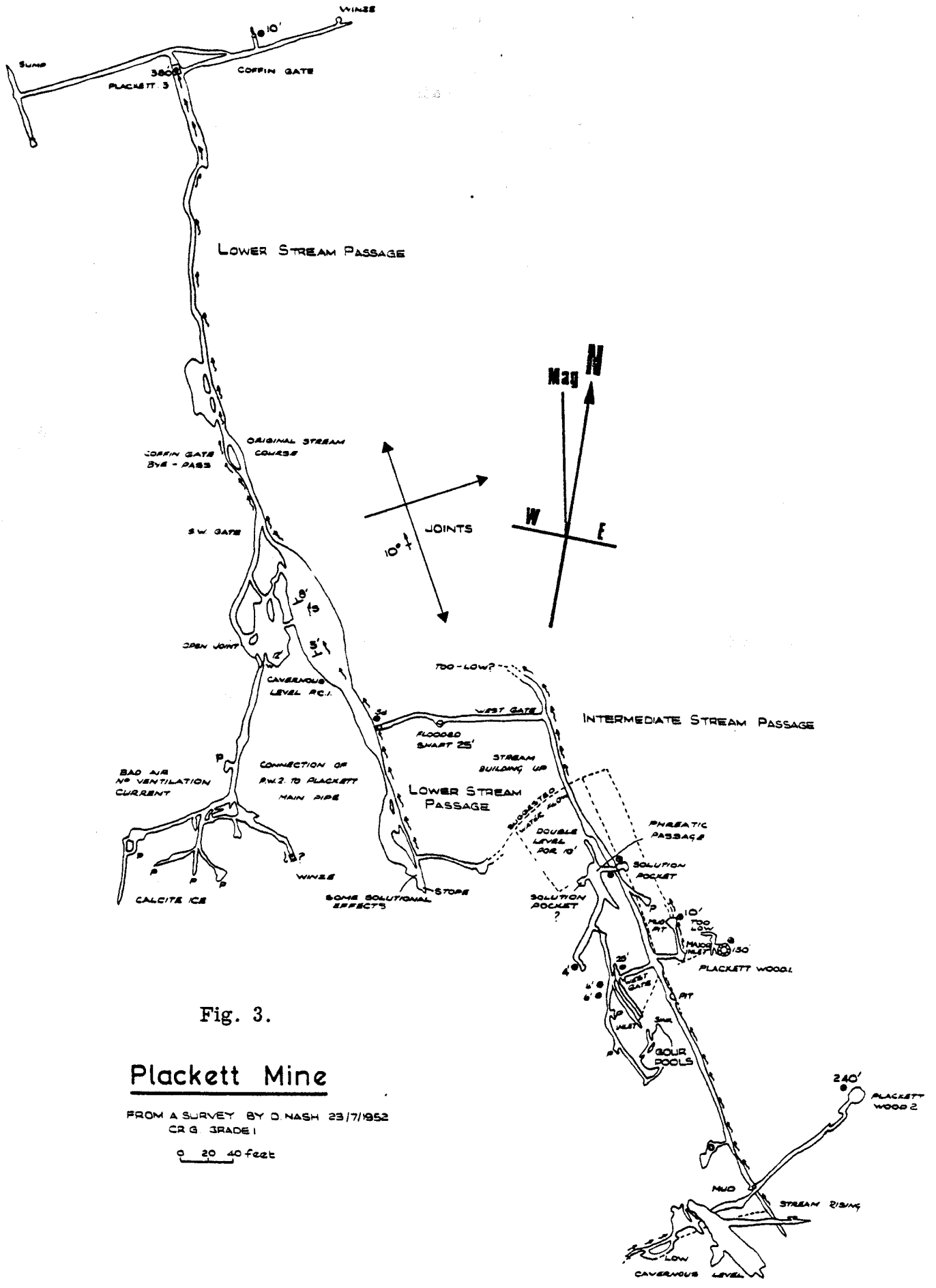


Fig. 3.

Plackett Mine

FROM A SURVEY BY D. NASH 23/7/1952
CR 3 GRADE 1

0 20 40 feet

Investigations were carried out from the Plackett Plantation Shaft, which is about 200 feet deep. A level at 185 feet led to the southwest and ended where a gritstone-lined drain or small sough entered the workings from the southwest, sinking after some 35 feet. It was possible to continue by descending a small shaft in the floor of the level, about 100 feet southwest of Plantation Shaft. This led after about 20 feet into a small level, in which a substantial stream flowed, presumably containing the water seen entering from the gritstone-lined drain.

A cross-cut led westwards from the level which eventually ended in a series of pipe-vein caverns. It was possible to squeeze through a tight passage again on the west which led into a series of joint-controlled passages that rose over the pipe vein caverns.

Continuing along the main level led westwards via another cross-cut, and a 25 foot winze into another north-northwest-trending passage. This passage was some 10 feet in width but soon narrowed southwards after some 100 feet, where a sough level discharged water into the passage. Following downstream led through a cavernous level where the stream had cut a deep trench. A number of branch passages to the west followed into a large cavern, roughly oval in shape, attaining some 40 feet in height. The floor of the cavern was covered by loose boulders of limestone. It was possible to leave this cavern via a level to the southwest into a complex series of workings which were partly flooded and poorly ventilated.

The main level continued to the north where an interesting coffin level by-pass had been driven. The stream sank into a 25 ft deep sump which continued to surface and is known as the Main Shaft. A number of cross-cut coffin levels were explored beyond this and these end after intersecting a number of cross-joints. A winze driven up one of these was not investigated owing to the limited amount of equipment available at that time.

Dye-testing was carried out on the various stream passages and the dotted lines on the survey show the postulated passage of water within the mine.

It is possible to compare the survey (fig. 3) with the plan of veins in the area prepared by J. Nuttall in 1768 showing Portaway, Plackett, Yatestoop, Limekiln and Drake pipes (fig. 4). Not all the veins can be recognised but little doubt exists over those named, notably, East Vein, Main Vein, the Blackwork, and Blackwork Break.

It was abundantly clear from the survey carried out that no collapse of the Plackett Mine Workings had occurred on a sufficient scale to cause earth tremors in Winstar. No accumulations of gas were found during the explorations.

Although surface investigations of many of the other mines in the district was initiated, it seemed at the time that it was a safe conclusion that mine collapse or explosions underground were not responsible for the earth tremors. Therefore due to the difficulties of access, and substantial depth of the other mines, investigations were terminated.

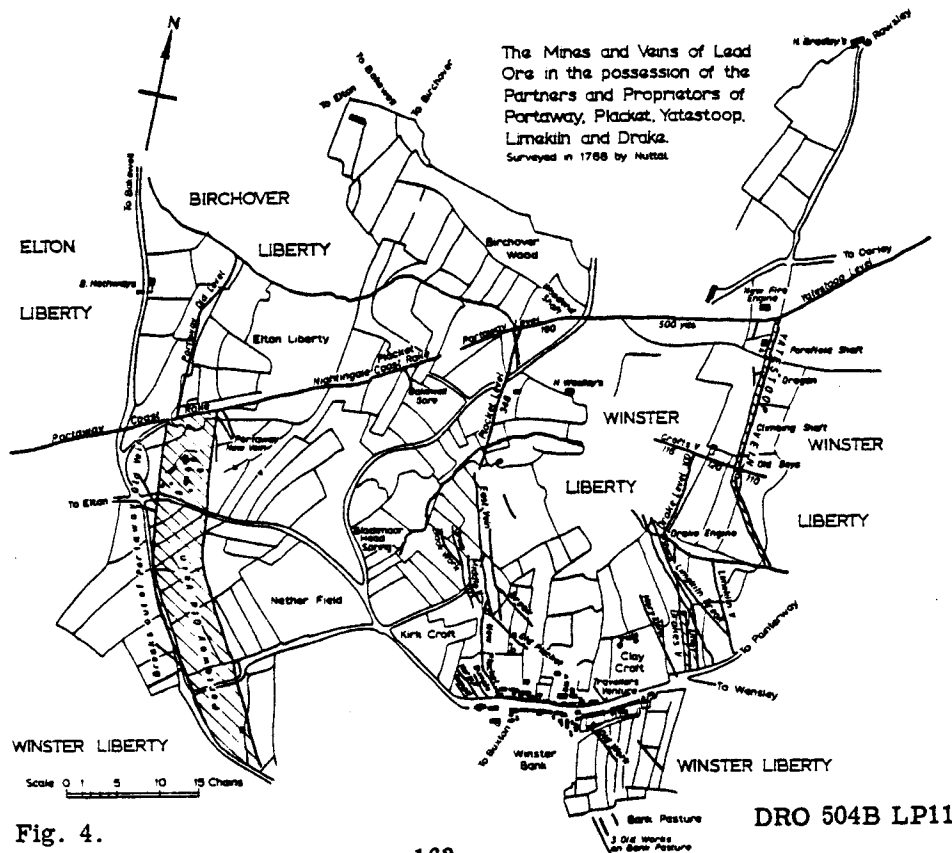


Fig. 4.

OTHER EARTH TREMORS IN THE EAST MIDLANDS

It seems that it is the wider geological setting of the Derbyshire limestone area that must be examined to provide clues concerning the origin of these earth tremors.

During the 1950s, earthquake activity was recorded at a number of localities in the East Midlands. The principal shocks were felt on January 10th, 1956 and February 11th, 1957. The latter was felt throughout the Midlands and it did some minor damage to coping stones, etc. The epicentre was at Diseworth, roughly midway between Derby and Leicester, and the focus was estimated to be between 12 and 13 km down. An after-shock was felt the following night, though it was not so strong.*

In his discussion of the Diseworth tremor, Dollar (1957) recognised three groups of seismic foci in the East Midlands: one is located about 11 miles west-northwest of Derby, with two epicentres, 1 mile east of Ashbourne and 3 miles west of Wirksworth. The latter is roughly the western limit of the Yokecliffe fault, and the activity might be taken to indicate that this fault extends to a great depth and that some movement is still taking place. Dollar suggested that the Winster tremors of 1952 and 1954 might be related to the same feature; however, it is quite possible that there are other deep-seated faults, and the Winster area is not far from the intersection of the Bonsall fault and the Coast Rake. Tillotson (1956) contended that the tremors were associated with adjustments along branches of faults associated with the Crich-Cromford belt of disturbance, which is effectively a southeasterly continuation of the Bonsall fault (Butcher, 1976). The other two foci noted by Dollar are at Beeston, west of Nottingham, and on the Derbyshire-Leicestershire border. Dollar suggested that these too could be related to major faults in the basement, and it is notable that all three of the foci are on the margins of the Widmerpool Gulf, a section of the middle Trent valley which subsided more rapidly and gained greater thicknesses of sediment in Carboniferous times than the Derbyshire "block" to the north (Kent, 1966, 1967). Maroof's (1976) gravity studies of the Derbyshire block have indicated the possibility of there being a comparable but less intense structural basin in the "basement" across the central narrow part of the Derbyshire limestone outcrop, and it is notable that Winster is on the southern flank of such a basin.

Before the 1950s there is a long record of earth tremors affecting the Midlands. Davison (1924) and Tillotson (1956) assembled records for shocks in 1084, 1180, 1678, 1734, 1738, 1784, 1795, 1857, 1865, 1872, 1873 and 1903-6. There is a crude periodicity of 50 years between groups of shocks. None of them is recorded as having had any effects in Derbyshire lead or coal mines, but the great Lisbon earthquake of November 1st, 1755 was certainly felt, as it was over much of western Europe. Rhodes (1824, pp. 65-6) gave a graphic description of its effects at Eyam, where five shocks were felt over a period of 20 minutes, damage was done to houses, fragments fell from the roof of lead mine workings and a chasm 150 yards long opened in a field.

CONCLUSIONS

From the discussion above it is clear that earth tremors are by no means unusual in the Midlands and that the Winster tremors must be included in this category. The explorations of the Plackett Mines, Wills Founder and others in the Winster area failed to reveal any evidence of large scale collapse of mine workings, or of the explosion of pockets of gas. Except for the remote Lisbon earthquake none of the tremors have caused damage in the mines, though they must still be considered a rare hazard in new Midland coal-mining areas. The filling of reservoirs overseas has been known to cause tremors and it is not impossible that this hazard could occur in the future in the Midlands.

ACKNOWLEDGEMENTS

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* Your editor felt the first shock at his home on the east side of Leicester. He was disturbed by the house vibrating, lights swinging and a noise like an express train tearing by, though there is no railway near.

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