

## THE SOUTH DEVON EARTHQUAKE OF CHRISTMAS DAY, 1923.

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ON the evening of Christmas Day, 1923, a large area of South Devon was disturbed by an earthquake, which caused no damage to buildings, but was of unusual intensity for the neighbourhood.

The area affected was large, extending from the village of Bickleigh on the west to Broad Hempston on the east, and from Scorhill House on the north, southwards to the sea. The shock was felt or the sounds heard outside the bounds thus roughly indicated, but only by relatively few persons.

The east and west diameter of this area may be taken as nineteen miles; north and south it extended at least thirty-three miles. If the form is assumed to be that of an ellipse, with which the records agree fairly well, then the land area affected plus a small area under the sea would amount to approximately 510 square miles.

The greatest intensity recorded was that corresponding to the usually accepted isoseismal line "7," a shock which causes no damage to buildings, but throws down ornaments, vases, etc.; this, however, was only at isolated points, and there was a general mingling of strengths 7, 6, and 5; "six" corresponding to a shock which makes pictures swing on walls, and "five" being noted when an observer's seat is perceptibly raised or moved. The zone of greatest intensity is thus rather uncertainly bounded.

I circulated a series of questions, and am greatly indebted to all those, and they were by far the majority of the recipients, who kindly sent me their replies.

The enquiries were as follows:—

1. *Was any damage done to your buildings, were any walls or chimneys cracked, any bricks displaced, or any plaster loosened from walls or ceilings?* To this all my informants replied, "No."

The only damage to a building was reported by Mrs. Norrington, of Scorhill House, Gidleigh; at this house two plate-glass windows were cracked.

2. *Were any articles, such as mantel ornaments, or crockery, or shelves, and dressers thrown down?* The only undoubted instance is supplied by Mr. James Mortimer, who says that at *Swallerton*, six miles north of Ashburton, a looking-glass on a mantelpiece was shifted, and a china dog thrown down and broken.

3. *Were hanging lamps, or pictures, or jugs hanging on dressers set swinging?*

The Rev. Hingston-Randolph reports that the villagers of *Ringmore*, many of them, spoke to such movement. The Rev. S. Majendie answers "Yes" from *Thurlestone*. Mr. J. W. Morrison, of *Winsland*, near Totnes, writes: "Several photos on small easels and leaning against south wall were thrown down. Pictures hung on east wall of dining- and drawing-rooms moved out of the perpendicular as though building had lurched due north."

Mr. Luscombe, of Hall Farm, *Harford*, writes "Yes," so does Mr. W. H. Full, of Ivybridge. Dr. W. Starkey writes the same as regarding the Mental Hospital at Blackadon. Mr. R. H. Gill, of South Brent, says, "Yes, like a jerk." Mr. R. S. Coulton, of Well Park, *Dean Prior*, writes "Yes." Miss Beatrice Chase, of *Widecombe-in-the-Moor*, reports that in the house next hers a lamp "jumped up and down" on the table. At one house at least in *Ashburton* mantelpiece ornaments were shifted. *Swallerton* would also show this intensity; and finally Mr. Z. Stephens, of *Laughter Hole*, on the East Dart, writes: "Yes, especially pictures, which were swinging to and fro on the wall, and holly and paper decorations fell down."

Perhaps one ought to mention clock-weights, which were broken off at Manaton.

These answers give a narrow zone of greatest intensity, ranging due north and south, and extending from *Thurlestone* to *Laughter Hole*. The lesser conjugate diameter would appear to have passed through S. Brent, from a



little west of Harford to a little west of Totnes. The area includes Ashburton and Swallerton.

It will be seen that the ratio of the diameters, say, 23 miles N. and S. to 9 miles E. and W., is more extreme in the area of greatest intensity (1 to 0.39), than in the area over which the shock was perceptible (1 to 0.57); but the directions of the longer axes coincide, and the axes also coincided in position, a satisfactory result to obtain from observers who have had no previous training in such matters, and a result which cannot have been influenced by any theory the observers may have entertained.

4. *Could persons standing or sitting feel a vibration or shake of the ground?*

Of the observers within the disturbed area seventy-eight felt distinct vibration, eleven felt no vibration, one does not answer this question. Of the eleven who did not feel the vibration several were well within the area, and their neighbours in some cases felt the shaking very strongly. Except for a few scattered locations the "sound area" and the "shock area" were nearly coincident, the former slightly overlapping the latter. This is characteristic of lesser earthquakes.

I have checked the area of greatest intensity by selecting those stations at which the observers, not content with answering this question with a plain "Yes," have added such words as "decidedly," "very distinctly," or other intensive.

At the Bungalow, *Slade, near Kingsbridge*, three persons felt the ground shake, and two ladies were much alarmed. At *Woodleigh* a boy was so alarmed that he did not speak for one hour afterward. At *Diptford*, hand-bells hanging in a cottage "spoke." Near *Harberton*, at Winsland, the vibration is described as "very pronounced." At the Priory, *Totnes*, the observer felt "as if lifted up and set down again." From *Ivybridge* the answers are: "Yes, decidedly"; "The floor seemed to sink perceptibly"; "The wheels of an invalid chair in which a person was sitting, moved to the alarm of the occupant"; "Most decidedly." *Cornwood* replies were: "Very much indeed" and "Certainly"; the station-master reported a very strong vibration—he was at the time of the shock kneeling on the floor, searching for an article which had been dropped. Turning for a moment to the south-west,

at *Yealmbridge*, there was "a very decided vibration." At *Blackadon*, near *Bittaford*, the sensation was "as if something had got under and heaved the building up." At *South Brent*, the observers answer, "The floor vibrated very strongly"; "Yes, very distinctly." From *Great Aish* the reply is: "Yes, very much so," and from *Glazebrook*, "Most certainly." At *Court Gate*, *Harbourneford*, "The ground shook terribly under us." *Brent Moor House* records, "Distinctly." From *Holne* the reply is: "Yes, a very strong vibration, which made the floor jumpy." *Sherberton*, in the *Dart Valley*, gives answer: "Yes, very much"; and *Peatcot Farm*, "Yes, very much so." Mr. Stephens, of *Laughter Hole*, writes: "Yes, everything seemed to be on the shake." Miss Beatrice Chase replies from *Venton*, *Widecombe*: "Yes, indeed. I was sitting at dinner on the ground-floor, and the whole floor felt to give a roll like a big wave under a boat. My mother was upstairs in bed, and the bed shook." At *King's Barrow*, *North Bovey*, the reply is: "Yes, very distinct."

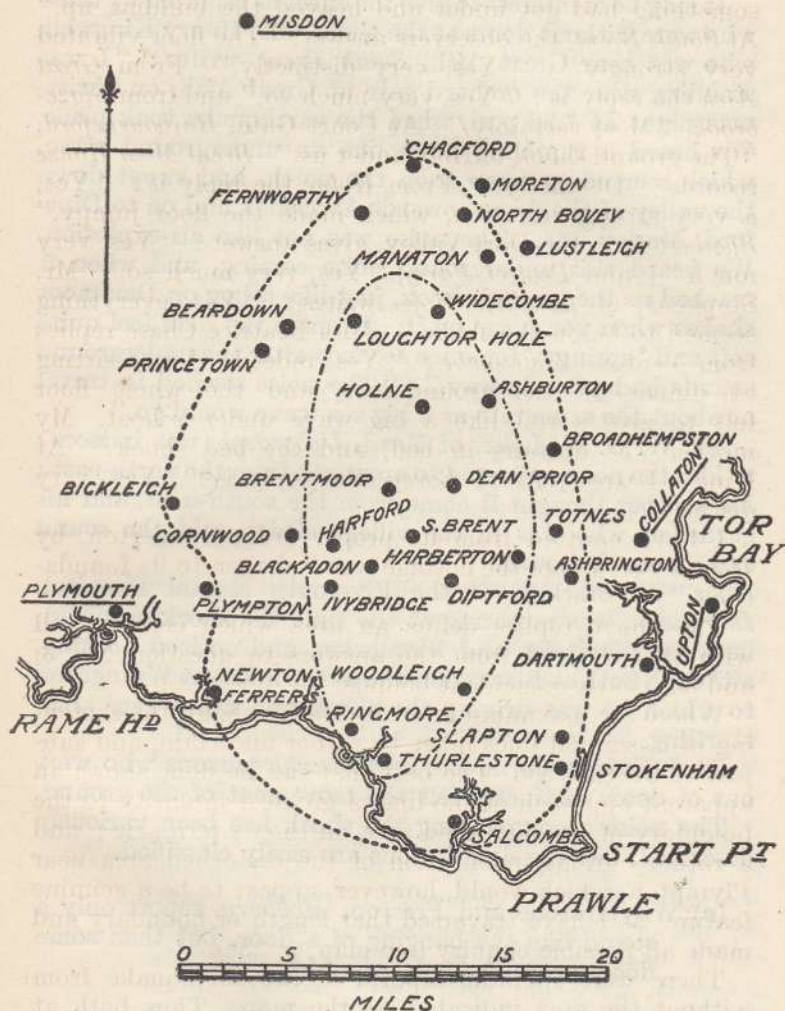
I have omitted from its proper order *Swallerton*, by *Hound Tor*, where the cottage was "shaken to its foundations."

The above replies define an area which centres well with that derived from the answers to question No. 3, and has nearly coincident bounds.

Where the maximum intensity was so slight, the sketching of isoseismal lines must be rather uncertain, and subject to irregularity. The best that can be done shows an apparent approach of the line of greatest intensity to the boundary of the disturbed area on the eastern side; and a rather curious indentation of the disturbed area near *Plympton*, which would, however, appear to be a genuine feature, as I have traversed that length of boundary and made all possible enquiry (see map, p. 289).

There were sporadic reports of the earthquake from without the area indicated on the map. Thus both at *Plymouth* and *Stonehouse* the noise accompanying the shock was heard by a few. To the eastward, Mr. W. James Kingwell heard the accompanying noise at *Upton*, in the parish of *Brixham*; and Mr. P. S. Luscombe, of *Collaton*, *Paignton*, both heard the noise and felt the vibration; while on the north, Mr. R. W. Passmore, of *Misdon*, *Inwardleigh*, reports that doors and windows were rattled,





Isoseismal Lines, South Devon Earthquake, December 25, 1923.

MAP.—Outer dotted line marks limit of disturbed area; inner dotted line bounds area of greater intensity. Names underlined, outlying places where earthquake was felt or heard.

and there was a noise "like someone knocking iron in the distance"; no shock was felt.

It may be of interest to give the effect as reported by those who were without doors at the time. Mr. Henry Kingwell, who was near Great Aish, *South Brent*, writes: "I was standing near the orchard gate at Great Aish, on Christmas night at 7.32 p.m. when the earthquake took place. We heard a rumbling noise like an underground wave, which seemed to come from the north, and swept down the valley of the Avon towards Avonwick and on to Diptford, Morley, etc. The noise was not like an explosion. We heard this underground noise coming, and when it reached us the ground shook, just like a bog on Dartmoor shakes when you jump on it. It made the road feel quite soft and 'springy' for some seconds after the underground sounds had passed away." "The noise seemed to travel at about the same rate as a big sea wave would go."

Mr. W. G. W. Lake, of Mead, *Ugborough*, was indoors; to him the noise appeared to approach from the north-east; his brother thought it came from the south-west, and his gardener, who was in the village street, said the sound came from the south.

Dr. W. Starkey, of the Plymouth Mental Hospital, *Blackadon*, was motoring at the time the shock occurred, between *Blackadon* and *Wrangaton*, and noticed nothing, although both at *Blackadon* and at the house at *Wrangaton* to which he was driving the shock and noise were alike startling.

At *Ivybridge*, *Cornwood*, and *Shaugh* persons who were out of doors distinctly felt the movement of the ground.

The noise accompanying the shock has been variously described, but the descriptions are easily classified.

(a) Whympstone and Preston, *Modbury*, report only a sound like the banging of a door, but then some doors are sufficiently alarming.

(b) Thud or crash as of something falling, the falling article being very variously described thus: Child out of bed, *Ugborough*. Very heavy person out of bed, Strode, *Ermington*. Something falling in room above, *Sharpham*. Heavy furniture falling, Delamore, *Cornwood*. Heavy metal, *Thurlestone*. Tree falling, Efford, *Holbeton*. Chimney stack,



Glazebrook, *S. Brent*. Part of house, *Totnes*.  
Barn, *N. Bovey*.

(c) Like thunder, *Sheepstor*, *Postbridge*, *Peatcot Farm*, *Kingston*, *Trowlesworthy Warren*, *East Rook Cornwood*, *Stokenham*, *Lukesland*, *Harford* two localities, *Totnes*, *Princetown*, *S. Brent*. *Headlands Post Bridge*, distant thunder.

(d) Explosion, usually qualified as "big," and at times as more or less distant. *Yealmbridge*, *South Brent* three observers, one of whom says, "followed by a rumble," *Battisborough Holbeton* (like a mine exploded on the near shore), *Filham House Ivybridge*, *Cornwood*, *Harford*, *Wotter Shaugh*, *Blackadon*, *Dean Prior*, *Widcombe*, *Ringmore*, preceded by a hiss as of a rocket, *Stowford Ivybridge*, preceded by a rumble, *Highbury Ivybridge*, two explosions preceded by a rumble, *Brentmore House*, two explosions, preceded by a rumble.

Also compared to a distant big gun fired, *Upton*, *Brixham*.

(e) Rumbling noise, *Druid Ashburton*, *Sherberton*, *Ugborough*, *Slade near Kingsbridge*, *Woodleigh*, *Thornworthy*, *Cornwood*, *Harford*, *Totnes*, *Runnage*, *Kingsbridge*, *Princetown*, *Laughter Hole*. Rumbling after the shock, *Leusdon*.

Described as like an underground wave, *S. Brent*; as of a trolley going around in the cellar, *Totnes*; as a rumbling report, *Ivybridge*.

(f) Noise of a motor-car or other heavy vehicle, mainly described as "noisy" or "running away," or "very heavy." *Manaton*, *Scorhill Chagford*, *Belliver Farm*, *Hedgebarton Widcombe*, *Shaugh*, *Galmpton*, *Natsworthy Widcombe*, *Slade Kingsbridge*, *Halwell*, *Post Bridge*, *Modbury*, *Manaton*, *West Prawle*, *Broadhempston*, and from *King's Barrow N. Bovey*, "heavy wagon-load of stones passing and then shot out."

(g) No noise, but shock felt, *Chagford*, *Harbourneford*.

(h) Noise like a strong gust of wind, *Collaton Paignton*, *Leusdon*, *Diptford*, *Princetown*.

Now we may fairly divide these classified descriptions into three groups. If we took "Explosions" (*d*) by themselves, the records under this head number fourteen, strictly thirteen, as the Brixham record is not quite comparable to the others.

All these records of "explosions" come from within the area, which, on other grounds, has already been indicated as that of greater intensity. But (*d*), explosions, and (*b*), thuds and crashes, as of something falling, may well make one group, the description in each case involving either a sudden origin or a marked culmination of the sound. We then get in all twenty-two localities in our first group, and only two of them lie somewhat outside the area of more marked intensity of shock.

We may constitute class (*c*) as the second group; most unfortunately it is rather an uncertain one. Thunder varies so greatly both in volume and character, it may either be a rending overhead crash, or a long continued distant grumble. Twelve localities adopt this description, and only two of them are clearly outside the zone of greater intensity of shock.

The third group will include: (*a*) the banging of doors; (*e*), rumbling noises; and (*f*), noise as of motor-car, although this last is a little inadequate as fully expressing the experience of certain observers. At *Shaugh*, *S. Brent*, and elsewhere the noise is at times compared to a runaway motor-car, which comes to a violent end in a crash. Remembering this we are prepared to find this description used in localities where other observers prefer to speak of "explosions." This third group numbers thirty-three. (*h*) A noise like a strong gust of wind I leave ungrouped. The "explosion," when heard, was evidently sufficiently startling, the Rev. Charles R. Patey, of *Stowford*, *Ivybridge*, describes: "A momentary rumble, then a tremendous explosion, which shook doors and windows and seemed to cause the floor (upstairs) to rise. Followed immediately by a sound as though a very large building was collapsing just outside the house."

At *Harford Rectory* it was thought that a hot-water cylinder had burst, and at *Harford Ash* that a ceiling had fallen. At *South Brent* the gas-works were thought to have blown up, and at *Battisborough* a mine to have exploded on the shore.



I asked the following questions :—

7. *Was the noise heard before the shock was felt ?*
8. *Was the noise heard after the shock had passed ?*

Thirty-one replies are to the effect that the noise was heard first and continued to the occurrence of the shock, with which it ceased, at most lasting a few seconds.

Eighteen observers judge the noise and the shock to have been simultaneous, the former not appreciably preceding the latter.

Five persons say the noise preceded the shock, and continued for a few seconds after the shock had passed.

Seven persons say the shock preceded the noise.

An attempt to dissect this information geographically has proved hopeless. Thus Totnes returns answers falling respectively under each of the above heads. I conclude that throughout the area the noise was either simultaneous with the shock, or preceded it and practically terminated with the shock, or in the alternative in some few cases continued after it.

The few instances in which two slightly separated explosions are recorded, are paralleled by records of two and even three successive tremors. Thus at Princetown one observer is said to have felt three distinct tremors in close succession, and Major Conran believes that he distinguished two at Diptford.

The shock had been preceded by earth tremors occurring at intervals over many months and even several years. Mr. W. O. Pritchard, of Brentmoor House, about three miles north of Brent, is singularly well placed for noting such tremors, and he assures me that they had been fairly frequent, and often of sufficient intensity to disturb his dogs in their kennels. Miss Mitchell, of South Brent, also noted minor shocks prior to the Christmas Day earthquake. Some eight days before Christmas, 1923, Mrs. Vere Cholmondeley felt an earthquake at Glazebrook House, and the same shock was felt by Miss Kingwell, of Great Aish, this occurred at 4 a.m. Thus the Brent neighbourhood, which practically centres the disturbed area, has evidently been unstable for some time.

On Christmas Day, 1923, Mr. Chas. W. Osman, of Chagford, felt a distinct earth tremor at 5.20 p.m.; the verandah doors of his study and the double doors of

a bookcase rattled, and holly placed over pictures settled down with a rustle; there was a slight vibration of the chair in which he was seated reading. A similar slight shock occurred at about 7 p.m. There was no near traffic or other apparent cause for the tremors.

Mrs. Dodd, of Highcroft, Chagford, also reports a disturbance on Christmas Day, which she cannot closely time, but it was between 6.30 and 7.15 p.m.

About two years before this last shock a similar disturbance had been noted at Scorhill House, Gidleigh, as Mrs. Norrington kindly informs me.

It is notable that there were very certainly two shocks, and probably an earlier tremor, at Woodleigh on Christmas evening, 1923. Mrs. Nelson kindly writes, from the Rectory: "A gamekeeper, two miles from here said he felt a tremor in the afternoon of Christmas Day, about 5.0" (this agrees well with Mr. Osman's observation at Chagford). "Our people when in church about 7.20 heard a rumble and felt a shaking, but it was, say, at 7.40, that the worst shock came, when all were in their houses. It was most alarming and the sensation was so uncommon, all as it were underground. We ourselves felt as if a huge waggon was rolling outside our window in the drive, windows rattled and the room floor shook under our feet."

I have said nothing as to the precise hour of the principal shock; the best evidence is fairly accordant, and it may be placed at 7.35 p.m. within a very small limit of error.

It was an oversight on my part that I circulated no question as to any observed effect upon animals, domesticated or wild. Miss Varwell kindly collected for me one item of information on this point to the effect that "over to Fernworthy the cows took a proper lot of notice of it."

The cause of this earthquake must be sought in movement along a north and south fault, passing somewhere near, possibly slightly to the west of South Brent. Apparently this fault is not confined to the sedimentary rocks, but extends also to the granite of Dartmoor. Thus this tremor would be feebly reminiscent of the earthquakes which accompanied the elevation of the former mountain range of Devon and Cornwall. It was a shock so slight that no seismograph recorded it, but that neglect is the fate of many a British earthquake. The originating fault remains to be discovered, if that be possible.



To an inhabitant of a genuine earthquake country this paper would doubtless seem a considerable fuss about a trifling circumstance. May I plead that, small as it may have been, this was a well-conditioned earth-tremor, with all the evidences of authenticity which the most exacting could require ; that it was our own, and possessed of sufficient local patriotism to confine itself to Devon ; and that, if it did no harm, it was so much the better earthquake, and not to be treated as negligible because benign.

Finally, I would thank all those who have so kindly replied to my enquiries, and if some only of their names are herein recorded, that is an accident of situation and an accident only. I have received valued help from many and diverse friends, and I thank them all.