

A Marvellous Sign and a Fiery Globe: A Medieval English Report of Ball Lightning

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We describe an entry in a twelfth century monastic chronicle, compiled and composed by Gervase of Canterbury (c.1145-c.1210), which gives a credible description of ball lightning. It predates the earliest known report of the phenomenon from England by nearly four hundred and fifty years. The meteorological descriptions in Gervase's 1195 report are examined in the context of the purpose of the chronicle and we compare them with modern reports of ball lightning.

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Ball lightning is now generally accepted by the scientific community as a phenomenon that exists in its own right, rather than being a misinterpretation of other meteorological effects. Although the mechanism for its formation is not understood, most reports associate it with active thunderstorms, (Shmatov and Stephan, 2019). Most reliable descriptions date from after the beginning of the twentieth century (Keul, 2021) and characterize it as a bright, roughly spherical ball which varies in colour from red to yellow, white or blue. It has substantial horizontal motion and lasts for up to a minute or more before disappearing either silently or in an explosion (Shmatov and Stephan, 2019).

The earliest claimed reports of ball lightning, which date to the Classical Period (ter Haar, 1989), are, on careful examination, difficult to distinguish from lightning bolts and the first convincing description comes from the sixth century. In his *History of the Franks*, Gregory of Tours told how, in the city of Tours on Sunday 31 January 583,

‘the bell had just rung for matins. The people had got up and were on their way to church. The sky was overcast and it was raining. Suddenly, a great ball of fire fell from the sky and moved a considerable distance through the air, shining so brightly that visibility was as clear as at high noon. Then it disappeared once more behind a cloud and darkness fell again.’ (Thorpe, 1974 p.353).

The passage is reproduced here as it serves to correct a few errors of detail in ter Haar’s (1989) paraphrase. It should be noted that the church service of matins was said before dawn, which would have occurred at approximately half past eight Central European Time, so this account would represent one of the less common reports of ball lightning occurring in the early morning (Smirnov, 1993, p.159). There is no qualification on the ‘great’ size of the object; the mean estimated diameter of ball lightning spheres reported by modern observers was determined to be 23 ± 5 cm by Smirnov, 1993, p.178 though there are reports of spheres over several metres across. The estimate of the average brightness of ball lightning is 1500 ± 200 lm, or a 100W incandescent light bulb, and this would probably be enough to convince a sixth-century observer that they could see as well as in daylight. There are, though, modern reports of much brighter ball lightning. Although not explicit, the reference by Gregory of Tours to the object moving a considerable distance through the air suggests that there was significant lateral movement. He went on to note that the rivers rose much higher than usual and that in the Paris region, the Seine and Marne were so flooded that many boats were wrecked. Later in the text

(Thorpe, 1974 p.364) Gregory interpreted the great ball of fire as a portent which had presaged the death of King Chilperic's son.

What is currently regarded as the earliest report of ball lightning from England, (Rowe, 1905), is that relating to the great Widecombe thunderstorm of 21 October 1638. Although 'Master Lyle with many others in the Church did see presently after the darknesse, as it were a great ball of fire and most terrible lightening come in at the window', (Rowe, 1905), there was evidently a simultaneous bolt lightning strike on the tower as, 'therewithal the roofof the Church in the lower part against the Tower [was caused] to rend and gape wide open ... all the roofof the Church is terribly torn and a great part thereof broken into the Church by some great stones, that were torne off the Tower.' (Rowe, 1905). The complication of the lightning bolt which caused death, injury and damage makes the description of the fireball that came through the window difficult to disentangle from phenomena associated with the strike itself. One may assume that the man whose 'head was broken, his skull rent into three pieces, and his braines throwne upon the ground whole', (Rowe, 1905), was a victim of falling timber or masonry rather than ball lightning. The next early modern observation, by Sanches Dorta in 1783 in Brazil, is less ambiguous, (Farrona and Vaquero, 2012).

During research into the veracity of reports of celestial phenomena by the twelfth-century chronicler, Gervase of Canterbury, we discovered what seems to be a much earlier account of ball lightning in England. Gervase's *Chronicle* seems to have been composed around 1200 or so and the description of a meteorological marvel which is consistent with ball lightning is recorded on 7 June 1195. Medieval writings rarely survive in the author's original version and Gervase's chronicle and other works survive now in three manuscripts (one in the British Library, and two in Cambridge, fig.1). The Latin text was edited by Bishop William Stubbs in 1879; there is no translation into English. The entry of interest here (translated by G.E.M.G from Stubbs (1879, p.529-530)), is as follows:

'On the 7th of the ides of June [1195], around the sixth hour, a marvellous sign descended near London. For the densest and darkest cloud appeared in the air growing strongly with the sun shining brightly all around. In the middle of this, growing from an uncovered opening, like the opening of a mill, I know not what [was the] white colour [that] ran out. That, growing into a spherical shape under the black cloud, remained suspended between the Thames and the lodgings of the bishop of Norwich. From there a sort-of fiery globe threw itself down into

the river; with a spinning motion it dropped time and again below the walls of the previously mentioned bishop's household.'

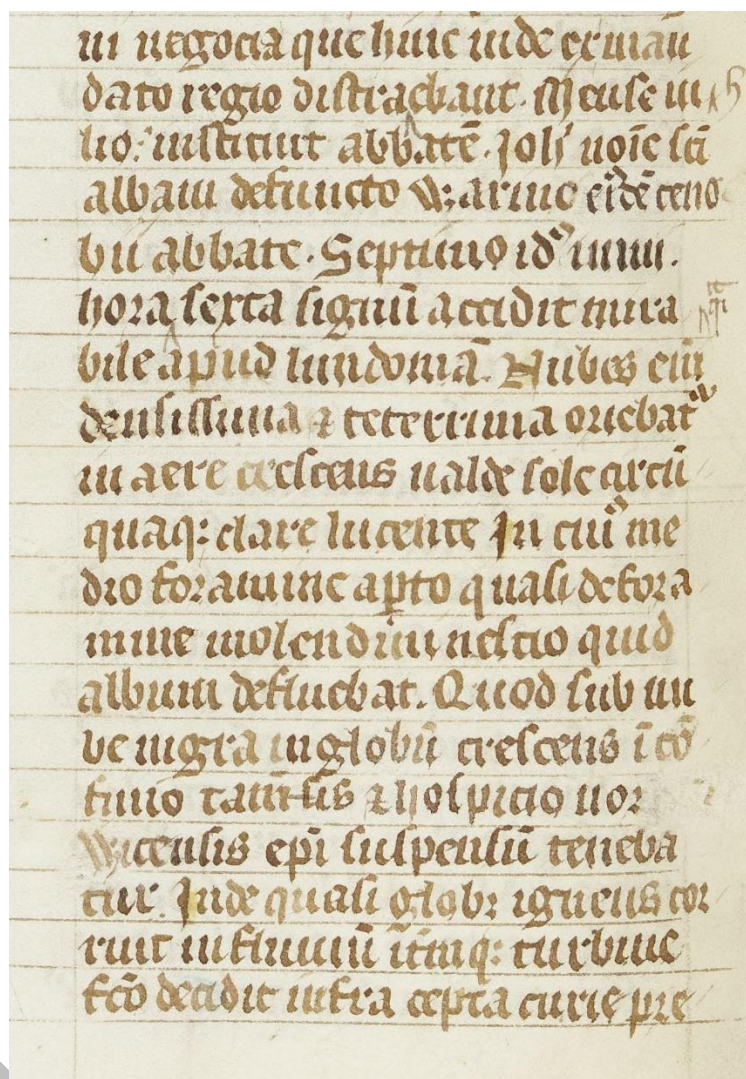


Fig.1 Part of the passage in a manuscript of Gervase's Chronicle which describes the fiery globe. [Reproduced under Creative Commons licence, courtesy of Trinity College, Cambridge]

Before examining the passage and the intriguing phenomenon it captures, it is worth considering Gervase's credentials as a reliable witness. Born in about 1145, little is known about his early years until he became a Benedictine monk at Christ Church Cathedral Priory in Canterbury. There he passed the whole of his adult life, taking his final vows as a monk in 1163, and holding the office of sacristan (in charge of the sacristy where the vestments and altar vessels were kept) from 1193 to 1197. His writings focus on the history of the Cathedral Priory, especially its contemporary history. They included a famous description of the rebuilding of the choir of the Cathedral after a fire in 1174, records of disputes with neighbouring

houses and an Archbishop of Canterbury, as well as chronicling of the actions of the king and his nobles, particularly where they related to Canterbury. Gervase's writing career, over the period from about 1180 until his death in about 1210, was wide-ranging, creative, and careful.

From around the mid-1170s, Gervase's accounts bear the hallmarks of personal experience. He reported dates and times of solar eclipses remarkably accurately and comprehensively. These are all the more impressive when considering that observation of partial eclipses was visually challenging in medieval times. In a detailed account of the partial eclipse of 13 September 1178, Gervase accurately describes the turning of the horns of the partly obscured solar disc to point downwards, as well as the changing colours close to maximum eclipse (Gasper and Tanner, 2020). The dates and times of lunar eclipses are accurately noted, though more succinctly. His description of the splitting of the image of the moon on 18 June 1178 has received recent attention since Hartung (1976) suggested that the effect was associated with the formation of the far-side lunar crater Giordano Bruno. We have subsequently shown that the carefully recorded details in the report can be explained in terms of atmospheric refraction and total external reflection from a hot column of air above a fire such as used for metal working or bell-casting (Gasper and Tanner, 2020). This, together with the recent identification of other similar reports in other chronicles, effectively refutes any link to lunar meteorites.

Given that Gervase appears to be a reliable reporter, the implications for his description of the fiery globe on the Thames on 7 June 1195 are considerable. By this date, Gervase was about 50 years old, (monks regularly lived into their 70s and older in the period), and a figure of some experience. The report was most probably not from his own eye-witness, but told to him at second-hand, as in the case of the splitting image of the moon some two decades earlier. In 1195, as in 1178, the details do stand up to scrutiny, however they were acquired by Gervase. With respect to the timing of the 1195 incident, it should be noted that the medieval day was divided into twelve hours of day and twelve hours of night so the length of an hour was not equal through the year. The sixth hour would always have been near noon, which is statistically the most probable time for seeing ball lightning (Smirnov, 1993). In terms of the shape observed, the description of a dark and dense cloud forming from something like the opening in a mill, could be aligned with a dark cloud at the apex of a cumulonimbus incus cloud in the shape of an inverted pyramid, fig. 2, the latter being like an inverted pyramidal hopper for feeding grain into the centre opening of rotating millstones. There is evidence of such wooden hoppers being used since the Anglo-Saxon period and their use persisted through the Early

Modern period into the twentieth century. They are preserved at mills such as Mapledurham and Stretton in the U.K. Figure 3 shows an illustration of such a hopper in a thirteenth century manuscript.



Fig. 2 Cumulonimbus clouds over Chandler, Arizona in 2018, showing the inverted pyramid with the dark cloud beneath. [Image reproduced by kind permission of Mircea Goia, Phoenix, AZ, USA]

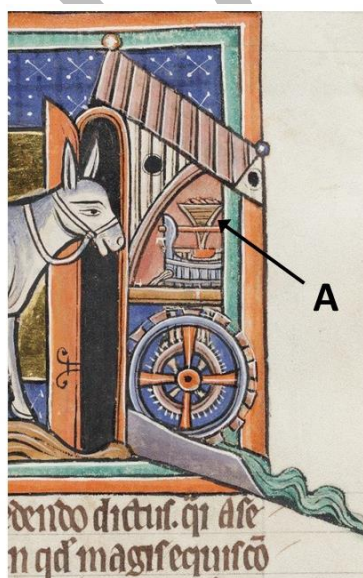


Fig. 3 Part of an illustration in a manuscript dating from the second quarter of the 13th century showing an inverted pyramidal hopper (A) for feeding grain between the mill stones driven by an undershot water wheel. [Oxford, Bodleian Library MS. Bodl. 764, f. 44r, © Bodleian Libraries, University of Oxford. CC-BY-NC 4.0. F: <https://digital.bodleian.ox.ac.uk/objects/e6ad6426-6ff5-4c33-a078-ca518b36ca49/>]

The descriptions of a white substance coming out of the dark cloud, forming into a spinning fiery sphere and then having some lateral motion are all very similar to historic and contemporary descriptions of ball lightning (Smirnov, 1993). For example, Keul (2021 p.51) reports a 1977 account in which the ball lightning turned from bluish-white to yellow, orange and red. Gervase's account also contains details, such as the fire-ball dropping down to the Thames and then repeatedly disappearing below the walls of the residence of the bishop of Norwich, that give credence to an interpretation of the report as ball lightning. The bishop of Norwich's lodgings mentioned by Gervase were located west of the city of London, close to what is now Charing Cross, and were only about 150 metres from the River Thames (Gatehouse Gazetteer, 2015). The movements of the twelfth-century phenomenon also match those of a number of modern observers who report spinning spheres or discs (Keul, 2021) and certainly concur with horizontal motion identified in the majority of modern cases (Smirnov, 1993 p.167).

In conclusion, it can be affirmed that the 1195 entry in the Chronicle of Gervase of Canterbury is a credible description of ball lightning that pre-dates the Widecombe event by well over four centuries.

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