

Red lights in the sky, hunger in sight. Aurora borealis and famine between experience and rhetoric in the early Middle Ages.

Luzes vermelhas no céu. Auroras boreais e fome, entre a experiência e a retórica na Alta Idade Média.

ANDREA MARASCHI¹

University of Iceland
andri.maraschi@gmail.com

Texto recebido em /Text submitted on 28/09/2017

Texto aprovado em /Text approved on 01/02/2018

Abstract: The purpose of the present paper is to analyse the mental and cultural attitudes of early medieval people towards one celestial “unidentified” phenomenon: aurora borealis. Celestial signs were often – but not always - interpreted on the basis of biblical prophecies, as visible words through which God forewarned humanity of future major events like the death of a king, pestilence, or famine. Attention will be mainly focused on the latter aspect, and specifically on the potential connection between the signs associated with the end of times in the Gospels, and actual records of aurorae, which were in turn interpreted as proving and confirming biblical prophecies. Aurora borealis seems to have generated anxiety about climate and hunger and to have enjoyed a particularly bad reputation, the reasons depending either on the moral purposes of related records, the rhetorical strategies they offered, or the actual emotional impact they had on the observers.

Keywords: Aurora borealis; Famine; Eschatology; Early medieval Europe; Early medieval astronomy.

Resumo: O objetivo deste artigo é analisar as atitudes mentais e culturais das pessoas da Alta Idade Média perante um fenómeno celestial ‘não identificado’: a aurora boreal. Os sinais celestiais eram frequentemente – mas nem sempre – identificados da mesma maneira que as profecias bíblicas, como palavras visíveis com as que Deus anunciava à humanidade os acontecimentos futuros mais relevantes, como a morte de um rei, a peste ou a fome. Normalmente eram as últimas as que mais atenção levavam, e sobre tudo a potencial conexão entre os sinais associados com o fim dos tempos dos Salmos e os registos de auroras, interpretadas no sentido de provar ou confirmar as profecias bíblicas. A aurora boreal parece ter causado preocupações em relação com o clima e a fome, e também ter tido bastante má reputação, mas os motivos relacionavam-se às vezes com os propósitos morais dos registos, outras com as estratégias retóricas que utilizavam, e algumas umas com o impacto emocional que tiveram nas testemunhas.

Palavras-chave: Aurora boreal; Fome; Eschatologia; Europa Alta Idade Média; Astronomia na Alta Idade Média.

¹ Post Doc at the Faculty of History and Philosophy - University of Iceland, The Árni Magnússon Institute for Icelandic Studies, Suðurgata, 101 Reykjavík. Presently, the author is Lecturer in Medieval History at the Department LeLia (Lettere Lingue Arti) of the University of Bari, via Michele Garruba 6, 70121 Bari (Italy). andrea.maraschi@uniba.it.

1. Multicoloured ranks, dragons, and fires in the skies

If celestial ordinary phenomena such as meteors, comets, bolides, eclipses, solar haloes, *parhelia* and others were known to early medieval intellectuals and can be tracked in the sources, there is no scientific medieval classification of aurora borealis (Dall’Olmo 1980; Martínez Usó, Marco Castillo 2017). Its relationship with solar activity was unknown, and it was mostly interpreted as an ill omen: it was believed it forewarned mankind of famine, bad weather, pestilence, war, the death of a king, and so on. Therefore, in the absence of a scientific description in early medieval times, researchers and scholars have had to scan the sources in search of supposed records of auroral displays (Frobesius 1739; Mairan 1754; Link 1962; Newton 1972; Stothers 1979a). Various terms were employed to indicate possible aurorae, which are quite indicative of the observers’ mental attitude, even though some of them might have referred to other phenomena, at times: since northern lights in continental and southern Europe were mostly associated with the colour red, aurora might have been confused with the reddening of the sky at dawn or sunset, for instance. As will be noted, though, many descriptions reflect the actual structure and movements of northern lights in a fairly logical way, and can safely be interpreted as descriptions of auroral displays especially when lights were said to have appeared in the northern direction. An important deductive method is to start from records of aurorae of different colours than red, which can thus be hardly mistaken for other phenomena: Flodoard of Reims, for instance, recorded that *acies diversorum colorum in caelo visae sunt mense Decembrio* in 940 (“ranks [of soldiers] of different colours were seen in the sky in December”, *Annales a. 919-966*: 388), placing an emphasis on the sharp-edged form which resembled a line of infantry deployed in the heavens (in conjunction with the severe episodes of famine in Europe from 940 to 945, as we will see later).

This formula was undoubtedly one of the more commonly used, and comparisons with other similar descriptions show a systematic parallel between auroras and calamities: the annals of the Abbey of Sens record that, at the beginning of February 919, *igneae candidae diversorumque colorum acies* (“red, white and variously-coloured ranks”), which were seen moving as if they were to strike a blow, were interpreted as predicting the Christian-Moorish war in Spain in 920 (*Annales sanctae Columbae Senonensis a. 708-1218*: 104). Flodoard’s annals, in turn, record strange “distortions” of nature: in 920, in the area of Reims, honey was found in spikes of grain, and flowers were found in certain mature trees and fruits; in 921, the summer was particularly hot

in northern France, and a great drought hit the area from July to September (*Annales a. 919-966*: 369).

The *Fragmentum Chronici Fontanellensis* records two different cases in one. In the late winter of 842, in northern France, “ranks appeared in the sky” *prima hora noctis* (“in the first hour the night”), that is just after sunset: this indication would suggest that the phenomenon might not have been an aurora, since northern lights could hardly be seen at such low latitudes before complete darkness (Martínez Usó, Marco Castillo 2017: 2). But then, according to the same source, “dreadful ranks were seen in the sky in the second hour of the night” in the north, east and west: its structure (sharp-edged), colours (white, black, red, green), location in the sky, and the fact that it was visible when it was dark, suggests that both this and the previous phenomena were indeed auroral displays (*Fragmentum Chronici Fontanellensis a. 841-859*: 301-302). They were regarded as ill omens predicting the earthquake and the cough outbreak that caused many deaths in the area the following November: and, in fact, the winter between 842 and 843 was extremely cold and long-lasting, with severe consequences for agriculture, livestock, and beekeeping, according to the Frankish historian Nithard (*Historiarium libri III*: 49).

Other descriptions help modern scholars identify such *acies* as northern lights. The monk Richer of Reims, who wrote his *Historiae* in the second half of the tenth century, describes the *ignae acies* and the “bleeding fires” which lit up the sky over Reims in 934 as “darts or serpents”: a plague soon followed, claiming victims among the population (*Historiarum libri III a. 884-995*: 586). Similar descriptions recur in later records, as well. Just for reference, the annals of St. Pantaleon’s Church in Cologne report that a night around the half of July 1241, a *figura ignea ad modus draconis* (“fiery figure in the shape of a dragon”) was seen flying in the sky over Cologne, the Rhine, and Westphalia, “with a big head and a shining, oblong and thick body, and a slender red tail”: in the same year, the Mongols brought terror, hunger and death to Europe, all the way to the Alps (*Annales sancti Pantaleonis Coloniensis*: 536).

The vocabulary of auroral displays features many more expressions, including the generic *signum*, as in the case of the *mirabile signum in caelo, variis coloribus permixtum* that was seen in 1117 in central Europe, which in Christian terms explicitly signified a “sign from God” (*Annales Sancti Disibodi a. 891-1200*: 22-23). This specific sign appeared (together with an eclipse) in conjunction with famine (*Chronicon s. Andreae castri Cameracesii*: 546), an earthquake, and huge floods in the whole continent and especially in Italy, to the point that a fast of three days was proclaimed in the entire peninsula to invoke God’s mercy.

The term *signum*, already used in Roman sources to indicate a variety of celestial phenomena, would be assigned eschatological significance in early medieval times (Dall’Olmo 1980), and would be systematically connected with biblical prophecies.

From a Christian perspective, there was a divine order in all things (as suggested by Isidore of Seville in his *Etymologiarum sive originum libri XX*, cl. 182, with reference to Gn 1:16-18), even in those that were apparently “unordinary” (de Nie 1987: 27-69). According to the Holy Scriptures, events altering the invariable order of nature were, in some sense, miraculous displays of God’s powers themselves (McCluskey 1998: 31), and signs in the sky were meant to forewarn about the nearing of the end of times. Indeed, when the disciples asked Jesus “...quanto haec erunt et quod signum cum fieri incipient” (“when will these things happen? And what will be the sign that they are about to take place?”, Lk 21:7, referring to the end of the world), Christ replied that, among other tragic occurrences, “terraemotus magni erunt per loca et pestilentiae et fames terroresque de caelo et signa magna erunt” (“there will be great earthquakes, famines and pestilences in various places, and fearful events and great signs from heaven”, Lk 21:11).

When focusing on the early Middle Ages, the importance of these biblical references should not be overlooked, but not stressed either. The relationship between celestial *signa*, plague and hunger soon became a recurrent element with a solid tradition within the context of early medieval chronicles and annals (Foot 2010: 25; Bartlett 2008: 51-70), but the case of northern lights requires deeper investigation. Displays of aurora borealis were occasionally visible at low latitudes² due to the absence of light pollution, and, as seen above, their spectacular features, their unordinary occurrence and their chromatic properties may have well suggested a connection with troops deployed for battle, blood and, in general, ensuing catastrophes: in this sense, instinctive emotional reactions and literary models may have overlapped. Nonetheless, records of aurora borealis were more likely based on actual observation, since biblical models were lacking: indeed, even if some scholars have argued that Ezekiel’s vision of a “nubes magna, et ignis involvens...quasi carboneum ignis ardentis” from north (Ez 1; Link 1967 lists two more biblical passages; Eather 1980; Silverman 1998; Siscoe et al. 2002) may have referred to an auroral display, such descriptions are rather vague, and the possibility that aurora could be seen 100 km south of Babylon (where the scene has been placed by scholars) is rare, at the very least.

Greek sources were reticent about auroral displays, too, unlike Roman

² That is, from areas in which our sources were written down.

ones. Actually, many kinds of celestial phenomena appear in classical texts (Krauss 1930; de Saint-Denis 1942; Jiménez Delgado 1961a, 1961b; Rawson 1971; Barrett 1978; Hartog 2000; Rasmussen, 2003: 16; Stothers 1979a, 1979b, 2007: 82; Solow 2005; Ramsey 2006), and Livy and his contemporaries used to ascribe such supernatural signs to the gods. As has been noted, on the contrary, early medieval intellectuals and – generally speaking – common people would see the hand of demons or the Lord behind celestial phenomena (Foot 2010: 30-31). The latter has been usually addressed as “providentialism” by scholars (Bennett 2005, 2007: 181-183; Palmer 2014: 108; Meyer and Mayer 1973; Cameron 1993; Hodgson 1989), the “theory of everything” of Christianity (Cameron 1993: 121).

The authors of our sources, mainly monks, were interested in natural phenomena, but they did not benefit much from the Greco-Roman astronomical tradition (McCluskey 1990: 9; Stahl 1962: 250-251), unlike in the Islamic world³: in the words of Stephen McCluskey, “in the early Middle Ages the Bible came to supplant the works of antique authors as the core of the education of medieval clerics and lay men and women” (McCluskey 1998: 29). As Paul Dutton and Sarah Foot have suggested, however, to draw such a conclusion does not do justice to the nuances of people’s reactions, which should not be simplistically catalogued as “collective” cultural and historical experiences (Dutton 2008: 167-168; Foot 2010: 32).

Here follows the analysis of a few emblematic cases from – mostly but not exclusively – chronicles and annals from the fifth to the tenth century, which in all likelihood refer to aurora borealis⁴. The aim is to answer the question of whether the fear of auroral displays may have derived from their alleged relationship with episodes of famine and from their potential interpretation as prophecies of the end of times; or, alternatively, whether such a connection was nothing else than a rhetorical device recalling biblical models; or if, finally, it depended on their mere chromatic and visual characteristics and on the writers’ experience (bearing in mind that these were not neutral observers; Dutton 2008: 168).

2. The dawn of the Middle Ages are red coloured

According to the sources, the major military and political events that shaped late antique and early medieval Europe were ushered in by auroral

³ In the Islamic world scientists practiced the most advanced astronomy of their times (Kennedy 1998).

⁴ Due to reasons of space, I have omitted examples featuring ambiguous descriptions which do not necessarily refer to auroral displays.

displays. The “*terribile signum columnae*” (“frightening sign, like a column”) of the year 388 mentioned by the Gallic chronicler of 452 (*Chronica Gallica a CCCCLII*, a. 388: 648; Muhlberger 1990: 152-160) was probably linked with the defeat of the Western Roman Emperor Magnus Maximus against Theodosius I, and the same chronicler associated the “*igne super nube*” (“fiery cloud”) which appeared over Constantinople in 395 with Theodosius’ death and the division of the empire into two parts (*Chronica Gallica a CCCCLII*, a. 395: 650; Cameron 2001: 47). But many of said displays were connected more specifically with episodes of devastation and hunger. Hydatius, the bishop of Aquae Flaviae (modern Chaves, Portugal, ca. 428-469), wrote in his chronicle of his times that Attila’s defeat at the Catalaunian Plains in the June of 451 was preceded by certain signs on the 3rd of April, among which an earthquake and the appearance of red, fiery spears in the sky in the northern direction (*Chronicon*: 883)5. Hydatius was probably a direct observer, and among the first Christian chroniclers to employ such formulas. His description is quite sensible, since in the Mediterranean skies northern lights generally appear as “red or yellowish white” (Stothers 1979a: 85; Silverman 1998)6. On the same line, Gregory the Great recorded that in 568 (the year of the Lombard invasion of Italy) many people witnessed *terribilia signa* all over Italian skies, namely “fiery swords and ranks” from the northern direction (*Dialogi*, vol. 260, 3, XXXVIII: 430)7: they were, as Paul the Deacon added two centuries later, the omen of the swords of the Lombards that would soon gleam with the blood of their victims (the chromatic parallel is clear; *Historia Langobardorum*, 2, 5: 75)8. Interestingly, as the mid-ninth century diocesan history of Naples would remark – drawing upon both Gregory and Paul – the Lombard invasion would be accompanied by *famis nimia* (“a great famine”) in the Italian peninsula (*Gesta episcoporum Neapolitanorum*, 20: 412): in fact, the connection between celestial phenomena and episodes of hunger would continue to recur quite frequently. This rhetorical (and mental) scheme can be found in many a historical source from the Middle Ages. It was perpetuated for centuries, also due to the practice of textual borrowing, as just seen: this, however, does not imply that records of auroral displays were exploited as

5 “...ab Aquilonis plaga coelum rubens sicut ignis aut sanguis efficitur, intermixtis per igneum ruborem lineis clarioribus in speciem hastarum rutilantium deformatis...”

6 Umberto Dall’Olmo shows that, in both classical and in medieval times (thus, mainly, in the Mediterranean regions), northern lights were often associated with the idea of “bleeding” (Dall’Olmo 1980: 13-14).

7 “Mox enim illa terribilia in coelo signa secuta sunt, ut hastae atque acies igneae ab Aquilonis parte viderentur.”

8 “Continuo apud Italiam terribilia noctu signa visa sunt, hoc est igneae acies in caelo apparuerunt, eum scilicet qui postea effusus est sanguinem coruscantes.” Franklin Krauss observed that Greek and Roman intellectuals were aware that clouds could sometimes embody psychological projections (Krauss 1930: 79).

mere literary devices. Although medieval historiography “tended to telescope events” (Dutton 2008: 173), ancient records of strange phenomena should be respected for what they are, for what reactions they elicited, and for how they were explained by intellectuals.

3. Gregory of Tours, northern lights, and God’s presence in the unfolding of history (538-594 A.D.)

One of the most remarkable resources within the context of early medieval astronomical events is, undoubtedly, Gregory of Tours’ *Libri historiarum X* (henceforth: *LH*). The bishop of Tours showed a pronounced interest in the topic, as suggested by his concise manual on stars and monastic timekeeping, *De cursu stellarum* (McCluskey 1990; Obrist 2002). The numerous descriptions of portents in *LH* are particularly illuminating about their interpretation by a portion of Christian intellectuals (de Nie 1994: 78). For instance, Gregory reports that the plague that wreaked death and havoc on Clermont in 563 was announced by unmistakable signs: the appearance of three or four suns, the coming of a comet, the partial darkening and discolouring of the sun, and by the sky catching fire (“caelum ardere visum est”, a red aurora; *LH*, IV, 31: 164-165)⁹. We may assume that Gregory, who probably learned his astronomy from reading Martianus Capella (Bergmann and Schlosser 1987; Montgomery 2000: 55, fn. 25; McCluskey 1998: 101; cf. Eastwood 2007: 20), had read about other cases of solar haloes, *parhelia* or sun dogs (Fabian 2001: 80-81) that occurred in the past¹⁰, that he knew the astronomical and physical causes of solar eclipses, and that he had read other accounts of auroral displays (whence the formula *caelum ardere visum est*)¹¹. But the *rustici* of the region did not, most certainly: they are described as being terrified before such supernatural prodigies¹², hounded by a “persistent lack of confidence in the cosmos” (Tuan 1979: 80).

For his part, Gregory did not believe in astrology (*De cursu stellarum ratio*, 16, 413), but the notion of heavenly portents as omens was based on a solid Christian historiographical tradition (Halfond 2012: §7). The key

⁹ “Similiter et ante cladem Arvernam magna regionem illam prodigia terruerunt. [...] Nam et stilla, quam quidam comiten vocant, radium tamquam gladium habens, super regionem illam per annum integrum apparuit, et caelum ardere visum est...”

¹⁰ For example, Aristotle, *Meteorology*, III, 2. Cf. Cicero, *De re publica*, I, X; Lucius Apuleius, *Apologia*, xvi. See Johnson (2009).

¹¹ See Halfond (2012): §5, fn. 4, and de Nie 1987, where the authors remark that Gregory of Tours distinguished *signa* (Christian prodigies) from *auspicia* (Pagan beliefs).

¹² Gregory may have had in mind Eccl 12:1-2.

was to remind the reader that this was the way by which God historically forewarned humankind of future major events (de Nie 2002: 265). One night in 577, while in Paris, Gregory saw twenty rays of light shining from north and moving in the heavens (*LH*, V, 18: 223-224)¹³: he was not able to provide any explanation but, he said, “I suppose [*credo*] they announced Merovech’s death”. While witnessing (or simply recording) similar *prodigia*, Gregory’s encyclopedia was the Bible. For example, he did not hesitate to interpret the great famine which, in 591, oppressed Angers, Nantes and Le Mans, and the pestilence that, in the same year, attacked the province of Marseilles (*LH*, X, 25: 517-518), on the basis of Mt 24:7-8: “...et erunt pestilentiae et fames et terraemotus per loca” (“There will be plagues and famines and earthquakes in various places”). Despite Devroey’s punctual observation about the change in the perception of the causes of famine from the Merovingian to the Carolingian period (from natural disaster, to an outcome of sin; Devroey 2014), Gregory of Tours shows that celestial phenomena and events on Earth were tightly bound to each other. *Signa* were not just witnessed and recorded, but also inserted within a purely Christian narratological framework: if, indeed, the Gospel of Matthew adds that “multi pseudoprophetae surgent et seducent multos” (“many false prophets will appear and deceive many people”, Mt 24:11), Gregory symptomatically records that, at the time of the aforementioned famine and plague, a man from Bourges said he was Christ and deceived more than three thousand people.

Celestial phenomena should have looked all the more impressive in the deep, dark medieval skies, especially on the occasion of rare ones like auroras (at least for what concerns central and southern Europe; Phillips 1995: 15; Fabian 2001: 83). As noted earlier, Gregory would often employ the expression *caelum ardere visum est* to describe them, quite common since at least Seneca’s and Livy’s day. Already at the time of Hesiod’s *Theogony* (eighth or seventh century B.C.) formulas such as “fiery sky dragons” or “flaming heavens” were seemingly used to describe auroral appearances (Stothers 1979a: 85): definitions that are quite telling in themselves. Gregory would also employ, among others: “fiery pillars” and “big beacon” (*columnae igneae* and *pharus magna*, *LH*, VII, 11: 333), in conjunction with vines bearing deformed fruits; “shiny rays” (*radii relucens*, *LH*, VI, 33: 304), in conjunction with locusts devastating trees, vines, forests, and fruits¹⁴; “splendour”, “gleam”

¹³ “Cum autem apud Parisius moraremur, signa in caelo apparuerunt, id est viginti radii a parte aquilonis, qui ab oriente surgentes, ad occidentem properabant; ex quibus unus prolixior et alius supereminens, ut est in sublime elevatus, mox defecit, et sic reliqui qui secuti fuerant evanuerunt. Credo, interitum Merovechi pronuntiassent.”

¹⁴ Cf. *LH*, VIII, 17: 384, which Gregory expected to be the sign that some plague would be sent from heaven; *LH*, IX, 5: 416, in conjunction with vines bearing deformed fruits, a poor grape harvest, heavy rainfalls.

(*fulgor*, *LH*, IV, 51: 187), “like that we once saw before the death of Clothar”. These, and the other terms employed to describe aurora borealis all express astonishment and terror, as Gregory himself occasionally confirms: “Et ecce! dum eos miraremur attoniti”, said about bright rays of light and blood-red clouds which he saw in the north, east and west (*LH*, VIII, 17: 384). Not only, then, chroniclers input their own personal and original descriptions of auroral displays, avoiding systematic quotations of earlier records, but they also left traces of their instinctive reactions as observers engaged with astronomy.

Interestingly, most if not all of the supposed records of auroral displays betrayed shock, and were connected with episodes of famine or with calamities which hit fields, vineyards, orchards, forests (and the livestock, as a consequence). The reasons for this were different, potentially: they could be

- a) the result of actual observation;
- b) literary devices with implicit moral purposes (Riché 1976, 204; Ashley 1994);
- c) a way to connect history with God’s plans for mankind (De Nie 1987, pp. 27-69; Halfond 2012).

A combination of a) and c) seems to be a sensible answer, as auroral displays may have well astounded their witnesses, and may have been plausibly interpreted by Christian intellectuals on the basis of biblical prophecies (De Nie 1994: 82). But a more complete perspective of the matter will possibly emerge from the analysis of further sources in the following section.

4. Auroras and hunger (sixth-tenth century)

Lights of various kinds continued to illuminate nocturnal landscapes in the following decades, according to our sources, and were often interpreted as ominous warnings of dire events to come. “Nothing, to the medieval scholar, was what it superficially seemed” (Tuan 1979: 107), Yi-Fu Tuan noted, maybe overlooking that medieval scholars could also be quite naturalistic at times. Nonetheless, the very fact that these phenomena were recorded in chronicles and annals implies that they were considered part of history and, in some sense, they were proof that history was unfolding along its predetermined path. Records of supposed auroral displays must always be contextualised, since they were generally used to emphasise certain political events: in the ninth century, for instance, the bishop of Ravenna Agnellus wrote that the death of the emperor Justinian (565) was portended by “red signs in the sky”

(*Liber pontificalis ecclesiae Ravennatis*, 90: 336)¹⁵. The recurrence of such a formula makes it difficult to assess whether it was based on the observation of reality or if it simply became a literary motif at some point. In any case, it is important to remember that this was *the* historical reality Agnellus and his contemporaries wanted to crystallize, preserve and perpetuate: it embodied their view of the world and of themselves.

The following examples are quite telling, in this sense. If the sky could truly forewarn mankind of incoming catastrophes, indeed, the celestial phenomena that occurred in the 780s did not promise anything good (Landes 1988: 191-192). Many Carolingian annals report strange *signa* appearing during that decade, some of which plausibly refer to auroras: in 781, many had their clothes marked with the sign of the cross, and both the earth and the sky began bleeding (*Annales Fuldenses sive Annales regni Francorum orientalis*: 10); after huge floods in 784-785 (*Annales Laureshamenses*: 32), “fearsome ranks” were seen in the sky in 786, “so great that nothing like it had occurred in our times” (*Annales Laureshamenses*: 33). “Tonitrua et fulgura immensa” (“great thunder and lightning”) then destroyed buildings and killed many people and birds, a glowing arch appeared at night among the clouds, and eventually a deadly plague finished off the job (*Fragmentum Annalium Chesnii [Annales Laureshamenses]*: 33). Were these the symptoms of a horrific event that was about to shake and devastate Europe? (Palmer 2014: 131).

Actually, in the following year (787), according to the *Anglo-Saxon Chronicle* (*The Anglo-Saxon Chronicle*, A.D. 787), the coasts of southern England were raided by the Vikings (Somerville and McDonald 2013: 16 ff.). Interestingly, only the manuscripts D, E and F of the *Chronicle*, which are later confluations of a northern version of the text (known as “Northern Recension”; Cesario 2016), record that in 793 the skies spoke again: “Here terrible portents came about over the land of Northumbria, and miserably frightened the people”, the *Anglo-Saxon Chronicle* reads. There were whirlwinds, lightning, and “fiery dragons were seen flying in the air”, and they were followed by “a great famine” (“fyrenne dracan wæron gesewene on þam lifte fleogende. þam tacnum sona fyligde mycel hunger”; *The Anglo-Saxon Chronicle*, A.D. 793, 55 and 57); eventually, the Lindisfarne abbey was plundered (Cavill 2001: 8; Logan, 2005: 25-26). There is no doubt that England was hit by famine in the years 792-793

¹⁵ “Et apparuerunt signa rubra in caelo...”. Here we can be particularly sure about the distance of the text from the biblical archetype. Agnellus based his work on the Roman *Liber pontificalis* (sixth century, with later additions down to 870), and he drew from various sources such as the works of Gregory of Tours and Gregory the Great, lists of the bishops of Ravenna, Paul the Deacon’s *Historia Langobardorum*, the *Chronicon* of Maximian, the *Passio* of St. Apollinaris, documents of the Ravennate church, inscriptions and dedications on buildings, and oral tradition (Mauskopf/Deliyannis 2001: 17).

(Cesario 2016: 155), and Carolingian sources inform us of severe food crises in continental Europe as well, which urged Charlemagne to ask both the ecclesiastical and secular powerful persons of his reign to feed four starving poor each until the following harvest (Devroey 2014). As for the interpretation of said *fyrenne dracan*, scholars have generally regarded it as either a description of meteor showers, comets, or as a biblical reference to the *ignitos serpentes* of Numbers 21:6 (Cesario 2016: 155-158), which God sent among the Israelites to admonish them. Nonetheless, evidence coming from our sources suggests that Marilina Cesario is right in holding that the chronicler actually witnessed northern lights (Cesario 2016: 161), which were then loaded with allegorical significance.

To no surprise, the Hungarian invasion was preceded by similar ominous portents, as well: Richer of Reims reports that in 937, before the Magyars raided Sens, Berry and the neighbourhood of Reims (Hildinger 2001: 86), the skies “were seen to catch on fire” in the northern direction (*Historiarum libri IIII a. 884-995*: 589)¹⁶. War, plague and hunger – the stereotypical attributes of the end of the world according to the biblical archetype – were then systematically announced by celestial phenomena, and often by red signs in the sky. Famine was not exclusively portended by northern lights, however: a number of sources record that the *maxima fames* and the livestock plague of 941 that hit “the entire world” were preceded by the appearance of a comet, an event which was presented just as an equation (“Cometes apparuit. Et fames subsequuta”, “A comet appeared. And famine ensued”; *Annales Leodienses a. 58-1054*: 16; see also *Annales Sangallenses Maiores*: 78 and other contemporary sources). Between rhetoric and observation, though, the parallel between supposed auroral displays and calamities concerning food production and supplies seems a proper “theme” in early medieval documents: the extraordinarily harsh winter of 927 (*Annales Augienses*, I, 68), which Regino of Prüm dated to 928, was followed by “*acies igneae in caelo*” in March, according to Flodoard of Reims, the major Frankish chronicler of the tenth century (*Annales a. 919-966*: 377); hunger and aurora, in turn, ushered in a deadly plague in Gaul and Germany. The question of whether the expression “ranks in the sky” did actually refer to northern lights is indirectly answered by Flodoard himself: in a more descriptive vein, indeed, he writes that the plague that hit Reims in 934 was announced by “ranks that were seen roaming the sky resembling a fiery serpent”¹⁷ (*Annales a. 919-966*: 382).

Could this all just be a matter of mere rhetoric?

¹⁶ “Et nocte diei succedente, caeli pars prodigiose flammis erumpentibus in septentrione ardere visa est. Qua etiam mox prosequitur et Hungarorum per Gallias repentina persecutio.” Here, Richer draws on Flodoard’s *Annales*: “Caeli pars ardere visa et Hungarorum persecutio ab eadem parte per Franciam insecuta est...” (*Annales a. 919-966*: 384).

¹⁷ “Igneae Remis in caelo acies visae sunt discurrere, et quasi serpens igneus...”

5. Conclusions: motif or experience?

Celestial phenomena played a fundamental role in the recording of history in early medieval times. The boundary between rhetoric and experience was subtle, given the importance of biblical parallels for Christian chroniclers, who would zealously search in the sky for symptoms of the incoming end of the world. Aurora borealis, though, seems to represent an exception, since no clear account of northern lights is featured in the Bible, thus no explicit literary model was available to chroniclers and annalists. The “unconscious” association of the appearance of northern lights with calamities (among which crops failures, livestock plagues, floods, and deformed fruits) might have simply been instinctive: this was true until very recent times, if the red aurora borealis that lit up the sky over Wheeling (West Virginia) in 1859 was still thought to foretell “war, famine, freezing, cold, death, pestilence, and even the end of the world” (*Wheeling daily intelligencer*, 01 Sept. 1859)18. This connection was totally logical, after all: aurora borealis is not a regularly visible event at low latitudes such as in continental and southern Europe, and its very structure and chromatic characteristics may have reasonably elicited dread and anxiety, even though the observers could associate it with either God or the actions of demons. The fact that accounts of the appearance of northern lights are often accompanied by records of famines, military devastations, and other agricultural calamities (featured in the same sources and in other contemporary ones) suggests that the relationship between auroral displays and hunger was thought to be validated by “evidence” - although said evidence was, in fact, totally coincidental. The association of celestial ill omens with famine is anything but surprising, and emerges among a number of ancient civilizations (Taub 2003): if human history has not been characterized by the persistence of hunger, indeed, it was definitely pervaded by the “fear of hunger” (Montanari 1999: 183), as logical for societies with low agrarian surpluses and limited technological resources that depended mainly on grains for nourishment (Tuan 1979: 80; Foot 2010: 33).

Among other *signa*, aurora borealis seems to have occupied an in-between position: on one hand, it could be rhetorically catalogued as yet another celestial phenomena to be interpreted eschatologically on the basis of biblical prophecies; on the other hand, early medieval records of aurora borealis have been validated by modern scholarship, and the fear associated with auroral displays may well have derived from actual observations of this phenome-

¹⁸ Eather (1980) at, respectively, p. 69 and 97, notes that the same belief was common in eighteenth-century Russia and North America.

non and from the instinctive sense of danger caused by red or multicoloured waves sparkling in the sky, which resembled ranks of soldiers, dragons, fires, or blood. It seems thus fair to conclude that McCluskey's idea, according to which in early medieval times the Bible replaced natural philosophy as the main key to the understanding of nature, may be dismissed as incomplete. On the contrary, both these perspectives were probably endorsed (Foot 2010: 39), with their respective role depending on the writer, his context, and the purposes of his work.

In conclusion, the present contribution wants to make a step beyond the traditional terms in which the "eschatology/observation" dichotomy has been discussed, and to endorse James T. Palmer's statement that "eschatology and apocalypticism thrived on immediate personal experience" more than on abstract elements such as dates or other escalating patterns of signs (Palmer 2014: 146): northern lights had an emotional dimension, behind the filters of historiography, textual borrowing and biblical prophecies. This means that a literary reading alone does not do justice to our sources: chroniclers and annalists did engage with early medieval astronomy (Borst 1993: ch. 4; Warntjes 2014), and chose to emphasize the eschatological or experiential dimension of celestial phenomena depending on their specific aim.

When compared with the "rationalistic" mood underlying Roman prodigy lists (Rawson 1971: 158; Lindahl et al. 2000, I: 20), it is fair to assume that the political, military, cultural and economic trends of the early medieval period might have led Christian intellectuals to lay a stronger emphasis on auroral displays, due to their ecclesiastical education and their providentialist interpretation of history. Yet, northern lights primarily belonged to the realm of experience, an emotionally engaging experience, by all odds.

Primary sources

Agnellus of Ravenna, *Liber pontificalis ecclesiae Ravennatis*. MGH SSRL, ed. Oswald Holder-Egger. Hannover: Hahn, 1878. 265-391.

Annales Augienses, Pars prima a. 709-858, MGH SS, 1, ed. Georg H. Pertz. Hannover: Hahn: 1826, 67-68.

Annales Fuldenses sive Annales regni Francorum orientalis, MGH SSRG, 7, ed. Georg H. Pertz and Friedrich Kurze. Hannover: Hahn, 1891.

Annales Laureshamenses, MGH SS, 1, ed. Georg H. Pertz. Hannover: Hahn, 1826, 22-39.

Annales Leodienses a. 58-1054, MGH SS, 4, ed. Georg H. Pertz. Hannover: Hahn, 1841, 9-20.

Annales Sanctae Columbae Senonensis a. 708-1218, MGH SS, 1, ed. Georg H. Pertz.

- Hannover: Hahn, 1826, 102-109.
- Annales Sancti Disibodi a. 891-1200*, MGH SS, 17, ed. G. Waitz. Hannover: Hahn, 1861, 4-30.
- Annales Sancti Maximini Trevirensis a. 538-987*, MGH SS, 4, ed. Georg H. Pertz. Hannover: Hahn, 1841, 5-7.
- Annales Sancti Pantaleonis Coloniensis*, MGH SS, 22, ed. Hermann Cardauns. Hannover: Hahn, 1872, 529-547.
- Annales Sangallenses Maiores*, Pars altera a. 919-1056, MGH SS, 1, ed. Georg. H. Pertz. Hannover: Hahn, 1826, 78-85.
- Aristotle, *Meteorology*, trans. E. W. Webster, in Jonathan Barnes, ed., *The Complete Works of Aristotle*. Princeton: Princeton University Press, 1984.
- Chronica Gallica a CCCCLII*, MGH AA, 9, ed. T. Mommsen. Berlin: Weidmann, 1892, 615-666.
- Chronicon Salernitanum a. 747-974*, MGH SS, 3, ed. Georg H. Pertz. Hannover: Hahn, 1839, 467-561.
- Chronicon S. Andreae castri Cameracesii*, MGH SS, 7, ed. L. C. Bethmann. Hannover: Hahn, 1846, 326-550.
- Cicero, *De re publica*, in *Cicero's Tusculan Disputations, Also, Treatises On The Nature Of The Gods, And On The Commonwealth*, trans. C. D. Yonge. New York: Harper & Brothers, 1877.
- Flodoard of Reims, *Annales a. 919-966*, MGH SS 3, ed. Georg H. Pertz. Hannover: Hahn, 1839, 363-407.
- Fragmentum Chronici Fontanellensis a. 841-859*, MGH SS, 2, ed. Georg H. Pertz. Hannover: Hahn, 1829, 301-304.
- Gesta episcoporum Neapolitanorum*. Pars prima (1-745), MGH SSRL, ed. G. Waitz. Hannover: Hahn, 1878, 402-424.
- Gregory of Tours, *De cursu stellarum ratio*, in *Gregorii episcopi Turonensis miracula et opera minora*, MGH SSRM, 1, 2, ed. Bruno Krusch. Hannover: Hahn, 1885, 404-422.
- Gregory of Tours, *Libri historiarum X*, MGH, SSRM, 1, 1, ed. Bruno Krusch and Wilhelm Levison. Hannover: Hahn 1885, repr. 1951.
- Gregory the Great, *Dialogi*, ed. Adalbert de Vogüé, *Sources Chrétiennes*, 3 vols, 251, 260, 265. Paris: Les Éditions du Cerf, 1978-1980.
- Hydatius, *Chronicon*, PL 51, ed. J.-P. Migne. Paris: Garnier 1861, 873-890.
- Isidore of Seville, *Etymologiarum sive originum libri XX*, ed. W. M. Lindsay. Oxford: Clarendon, 1966. Translation: *The Etymologies of Isidore of Seville*, trans. Stephen A. Barney et al. Cambridge: Cambridge University Press: 2006.
- Lucius Apuleius, *Apologia*, in Id., *The Apologia and Florida of Apuleius of Madaura*, trans. H. E. Butler. Oxford: Clarendon Press, 1909.
- Nithard, *Historiarum libri IIII*, MGH SSRG, 44, ed. Ernest Müller. Hannover-Leipzig, Hahn: 1907.
- Paul the Deacon, *Historia Langobardorum*, MGH SSRL, saec. VI-IX, ed. Georg Waitz and

- Ludwig Bethmann. Hannover: Hahn, 1878, 12-192.
- Paulus Orosius, *Adversus paganos historiarum libri septem*, ed. J. P. Migne, PL 31. Paris: Garnier, 1846, cll. 663-1174. Translation: *Orosio. Le storie contro i Pagani*, trans. Adolf Lippold. Milano: Lorenzo Valla, 1976.
- Richer of Reims, *Historiarum libri IIII a. 884-995*, MGH SS, 3, ed. Georg H. Pertz. Hannover: Hahn, 1839, 561-657.
- The Anglo-Saxon Chronicle: A Collaborative Edition. Vol. 6 MS. D*, ed. G. P. Cubbin. Cambridge: D. S. Brewer, 1996; *Vol. 7, MS. E*, ed. Susan Irvine. Cambridge: D. S. Brewer, 2004; *Vol. 8, MS. F*, ed. Peter S. Baker. Cambridge: D. S. Brewer, 2000.
- The Anglo-Saxon Chronicle*, ed. and trans. M. Swanton. New York: Routledge, 1998.
- Wheeling daily intelligencer*, 01 Sept. 1859. *Chronicing America: Historic American Newspapers*. Lib. of Congress., <http://chronicingamerica.loc.gov/lccn/sn86092535/1859-09-01/ed-1/seq-3/>
- * All biblical quotations are from: *Biblia Sacra Vulgata. Editio Quinta*, eds. Robert Weber and Roger Gryson. Stuttgart: Deutsche Bibelgesellschaft (electronic version retrieved from The Scholarly Bible Portal of the German Bible Society, available online at <http://www.academic-bible.com/en/online-bibles/vulgate/>).

Secondary sources

- ASHLEY, Scott (1994). "The power of symbols: interpreting portents in the Carolingian empire", *Medieval History*, 4, 34-50.
- BARRETT, Anthony A. (1978). "Observations of Comets in Greek and Roman Sources before AD 410", *Journal of the Royal Astronomical Society of Canada*, 72, 82-106.
- BARTLETT, Robert (2008). *The Natural and the Supernatural in the Middle Ages*. New York: Cambridge University Press.
- BENNETT, Brian P. (2005). "Sign Languages: Divination and Providentialism in the Primary Chronicle of Kevian Rus", *Slavonic and East European Review*, 83, 3, 373-395.
- BENNETT, Brian P. (2007). "Hermetic Histories: Divine Providence and Conspiracy Theory", *Numen*, 54, 2, 174-209.
- BERGMANN, Werner, and SCHLOSSER, Wolfhard (1987). "Gregor von Tours und der Rote Sirius: Untersuchungen zu den astronomischen Angaben in *De cursu stellarum ratio*", *Francia*, 15, 43-74.
- BLOCH, Raymond (1963). *Le prodiges dans l'Antiquité classique (Grèce, Étrurie et Rome)*. Paris: Presses Universitaires de France.
- BORST, Arno (1993). *The Ordering of Time: From the Ancient Computus to the Modern Computer* (trans. Andrew Winnard). Chicago: The University of Chicago Press.
- CAMERON, Alan (2001). "Oracles and Earthquakes: A Note on the Theodosian Sibyl", in Claudia SODE and Sarola TAKÁCS (eds.), *Novum Millennium. Studies on Byzantine History and Culture Dedicated to Paul Speck*. London: Routledge, 45-52.

- CAMERON, Averil (1993). "Divine Providence in Late Antiquity", in Leo HOWE and Alan WAIN (eds.), *Predicting the Future*. Cambridge: Cambridge University Press, 118-143.
- CAVILL, Paul (2001). *Vikings: Fear and Faith in Anglo-Saxon England*. London: Harper Collins.
- CESARIO, Marilina (2016). "Fyrenne Dracan in the Anglo-Saxon Chronicle", in Maren CLEGG HYER and Jill FREDERICK (eds.), *Textiles, Text, Intertext. Essays in Honour of Gale R. Owen-Crocker*. Woodbridge: The Boydell Press, 153-170.
- DALL'OLMO, Umberto (1978). "Meteors, Meteor Showers and Meteorites in the Middle Ages: From European Medieval Sources", *Journal for the History of Astronomy*, 9, 123-134.
- DALL'OLMO, Umberto (1980). "Latin terminology relating to aurorae, comets, meteors, and novae", *Journal for the History of Astronomy*, 11, 10-27.
- DE NIE, Giselle (1987). *Views from a many-windowed tower: studies of imagination in the works of Gregory of Tours*. Amsterdam: Rodopi.
- DE NIE, Giselle (1994). "Gregory of Tours' Smile: Spiritual Reality, Imagination and Earthly Events in the 'Histories'", in Anton SCHARER and Georg SCHEIBELREITER (eds.), *Historiographie im frühen Mittelalter*. Vienna: R. Oldenbourg, 1994, 68-95.
- DE NIE, Giselle (2002). "History and Miracle: Gregory's Use of Metaphor", in Kathleen MITCHELL and Ian WOOD (ed.), *The World of Gregory of Tours*. Leiden: Brill, 261-279.
- DE SAINT-DENIS, Eugène (1942). "Les énumérations de prodiges dans l'oeuvre de Tite-Live", *Revue de Philologie*, 16, 126-142.
- DEVROEY, Jean-Pierre (2014). "Food and Politics", in *A Cultural history of food in the early Medieval Age*. London: Berg, 73-89.
- DUTTON, Paul E. (2008). "Observations on Early Medieval Weather in General, Bloody Rain in Particular", in Jennifer R. DAVIS and Michael MCCORMICK (eds.), *The Long Morning of Medieval Europe: New Directions in Early Medieval Studies*. Aldershot: Ashgate, 167-180.
- EASTWOOD, Bruce (2007). *Ordering the Heavens: Roman Astronomy and Cosmology in the Carolingian Renaissance*. Leiden: Brill.
- EATHER, Robert H. (1980). *Majestic Lights: The Aurora in Science, History, and the Arts*. Washington, D.C.: AGU.
- FABIAN, Stephen M. (2001). *Patterns in the Sky. An Introduction to Ethnoastronomy*. Long Grove: Waveland Press.
- FLINT, Valerie (1991). *The Rise of Magic in Early Medieval Europe*. Oxford: Oxford University Press.
- FOOT, Sarah (2010). "Plenty, Portents and Plague: Ecclesiastical Readings of the Natural World in Early Medieval Europe", in Peter CLARKE and Tony CLAYDON (eds.), *Studies in Church History vol. 46: God's Bounty? The Churches and the Natural World*. Woodbridge: Boydell Press, 15-41.

- FROBESIIUS, Iohannes Nicolaus (1739). *Nova et antiqua luminis atque aurorae borealis spectacula*. Helmstädt: Weygandt.
- HALFOND, Gregory (2012). “*Tenebrae Refulgeant: Celestial Signa in Gregory of Tours*”, *A Journal of Early Medieval Northwestern Europe*, 15: (<http://www.heroicage.org/issues/15/halfond.php#rasm2003>)
- HARTOG, François (2000). “The invention of history: the pre-history of a concept from Homer to Herodotus”, *History and Theory*, 39, 384-395.
- HILDINGER, Erik (2001). *Warriors of the Steppe: Military History of Central Asia, 500 B.C. To 1700 A.D.* Cambridge: First Da Capo Press.
- HODGSON, Peter C. (1989). *God in History*. Nashville: Abingdon.
- JIMÉNEZ DELGADO, José (1961a). “Importancia de los prodigios en Tito Livio”, *Helmantica*, 12, 27-46.
- JIMÉNEZ DELGADO, José (1961b). “Clasificación de los prodigios titolivianos”, *Helmantica*, 12, 441-461.
- JOHNSON, Monte R. (2009). “The Aristotelian Explanation of the Halo”, *Apeiron: a Journal for Ancient Philosophy and Science*, 42, 325-357.
- KELLEY, David H., MILONE, Eugene F. (2011). *Exploring Ancient Skies. A Survey of Ancient and Cultural Astronomy*. 2nd ed. New York: Springer.
- KENNEDY, Edward S. (1998). *Astronomy and Astrology in the Medieval Islamic World*. Aldershot: Ashgate.
- KRAUSS, Franklin B. (1930). *An Interpretation of the Omens, Portents, and Prodigies Recorded by Livy, Tacitus, and Suetonius*. Philadelphia: University of Pennsylvania.
- LAKE, Justin (ed.) (2013). *Prologues to Ancient and Medieval History: A Reader*. Toronto: University of Toronto Press.
- LANDES, Richard (1988). “Lest the Millennium be fulfilled: Apocalyptic Expectations and the Pattern of Western Chronography 100-800 CE”, in Werner VERBEKE et al. (eds.), *The Use and Abuse of Eschatology in the Middle Ages*. Leuven: Leuven University Press, 137-211.
- LEVISON, Wilhelm (1946). *England and the Continent in the eighth century. The Ford lectures delivered in Oxford in the Hilary term*. Repr.: Oxford: Clarendon Press.
- LINDAHL, Carl et al. (eds.) (2000). *Medieval Folklore: An Encyclopedia of Myths, Legends, Tales, Beliefs, and Customs*, 2 vols. Santa Barbara-Denver-Oxford: ABC-CLIO.
- LINK, František (1962). “Observations et catalogue des aurores boréales apparues en Occident de 626 à 1600”, *Geofysikální sborník*, 10, 297-387.
- LINK, František (1967). “On the History of the Aurora Borealis”, *Vistas in Astronomy*, 9, 297-306.
- LOGAN, F. Donald (2005). *The Vikings in History*. 3rd ed. New York: Routledge.
- MACBAIN, Bruce (1982). *Prodigy and Expiation: A Study in Religion and Politics in Republican Rome*. Brussels: Latomus.
- MAIRAN, Jean Jacques d’Ortous de (1754). *Traité physique et historique de l’aurore boréale*. Paris: Imprimerie Royale.

- MARTÍNEZ USÓ, María José, MARCO CASTILLO, F. J. (2017). “A Review of the Dall’Olmo Survey of Meteors, Meteor Showers and Meteorites in the Middle Ages from Medieval European Sources”, *Journal for the History of Astronomy*, 1-59.
- MASTROROSA, Ida Gilda (2012). “Calamità e prodigi nella storia di Roma repubblicana: la rilettura tardoantica di Orosio”, *Rursus*, 8 (<http://rursus.revues.org/1084>).
- MAUSKOPF DELIYANNIS, Deborah (2001). “Year-Dates in the Early Middle Ages”, in Chris HUMPHREY and W. M. ORMROD (eds.), *Time in the Medieval World*. York: York Medieval Press, 5-22.
- MCCLUSKEY, Stephen C. (1990). “Gregory of Tours, Monastic Timekeeping, and Early Christian Attitudes to Astronomy”, *Isis*, 81, 1, 8-22.
- MCCLUSKEY, Stephen C. (1998). *Astronomies and Cultures in Early Medieval Europe*. Cambridge: Cambridge University Press.
- MEYER Carl S., MAYER, Herbert T. (eds.) (1973). *The Caring God: Perspectives on Providence*. St. Louis: Concordia.
- MONTANARI, Massimo (1999). “Peasants, Warriors, Priests. Images of Society and Styles of Diet”, in Massimo MONTANARI and Jean-Louis FLANDRIN (eds.), *Food: A Culinary History* (trans. Albert Sonnenfeld). New York: Columbia University Press, 178-185.
- MONTGOMERY, Scott L. (2000). *Science in Translation: Movements of Knowledge Through Cultures and Time*. Chicago: The University of Chicago Press.
- MUHLBERGER, Steven (1990). *The Fifth-Century Chroniclers: Prosper, Hydatius and the Gallic Chronicler of 452*. Leeds: F. Cairns.
- NEWTON, Robert R. (1972). *Medieval Chronicles and the Rotation of the Earth*. Baltimore: Johns Hopkins University Press.
- OBRIST, Barbara (2002). “Les Manuscrits du *De cursu stellarum* de Grégoire de Tours et le manuscrit, Laon, Bibliothèque Municipale 422”, *Scriptorium* 56, 335-345.
- PALMER, James T. (2014). *The Apocalypse in the Early Middle Ages*. Cambridge: Cambridge University Press.
- PHILLIPS, Kenneth J. H. (1995). *Guide to the Sun*. Repr. Cambridge: Press Syndicate of the University of Cambridge.
- RAMSEY, John T. (2006). “A Descriptive Catalogue of Greco-Roman Comets from 500 BC to AD 400”, *Syllecta Classica*, 17, 1-242.
- RASMUSSEN, Susanne W. (2003). *Public Portents in Republican Rome*. Rome: «L’Erma» di Bretschneider.
- RAWSON, Elizabeth. (1971). “Prodigy Lists and the Use of the Annales Maximi”, *The Classical Quarterly*, 2, 21, 1, 158-169.
- RICHÉ, Pierre (1976). *Education and Culture in the Barbarian West: Sixth Through Eighth Centuries* (trans. John J. Contreni). Columbia, SC: University of South Carolina Press.
- SILVERMAN, Samuel (1998). “Early auroral observations”, *Journal of Atmospheric and Terrestrial Physics*, 60, 997-1006.

- SISCOE, George L. et al. (2002). "Ezekiel and the Northern Lights: Biblical Aurora Seems Plausible", *Eos*, 83, 16, 173-179.
- SOLOW, Andrew (2005). "On Celestial Events, Auroral Activity, and the Solar Cycle in Classical Antiquity", *Earth and Planetary Science Letters*, 232, 67-70.
- SOMERVILLE, Angus A., MCDONALD, Andrew (2013). *The Vikings and Their Age*. Toronto: University of Toronto Press.
- STAHL, William H. (1962). *Roman Science: Origins, Development, and Influence to the Later Middle Ages*. Madison: University of Wisconsin Press.
- STOTHERS, Richard (1979a). "Ancient Aurorae", *Isis*, 70, 85-95.
- STOTHERS, Richard (1979b). "Solar Activity Cycle during Classical Antiquity", *Astronomy and Astrophysics*, 77, 121-127.
- STOTHERS, Richard (2007). "Unidentified Flying Objects in Classical Antiquity", *The Classical Journal*, 103, 1, 79-92.
- TAUB, Liba (2003). *Ancient Meteorology*. London-New York: Routledge.
- TUAN, Yi-Fu (1979). *Landscapes of Fear*. New York: Pantheon Books.
- VAN NUFFELEN, Peter (2012). *Orosius and the Rhetoric of History*. Oxford: Oxford University Press.
- WARNTJES, Immo (2010). "An Irish Eclipse Prediction of AD 754: the Earliest in the Latin West", *Peritia*, 24-25, 108-115.