

## Chelyabinsk, Zond IV, and a possible first-century fireball of historical importance

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**Abstract**—The well-recorded Chelyabinsk event, the Tunguska event, and the re-entry of the Zond IV vehicle offer opportunities to compare reactions of modern eyewitnesses to eyewitness accounts of possible ancient fireball events. The first-century book, *Acts of the Apostles*, gives three separate descriptions of a bright light “from heaven,” which occurred probably in the 30s (C.E.) near Damascus, Syria. The details offer a strikingly good match to a Chelyabinsk-class or Tunguska-class fireball. Among the most impressive, unexpected consistencies with modern knowledge is the first-century description of symptoms of temporary blindness caused by exposure to intense radiation, matching a condition now known as photokeratitis. An analysis of the re-entry of debris from the Russian Zond IV over the eastern United States in 1968 shows how actual *perceived* phenomena in an unfamiliar natural celestial apparition are often *conceived* by the observer in terms of current cultural conceptions, and it is suggested that this happened also in the first-century case.

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### INTRODUCTION AND BACKGROUND

More than 380 video records and witness interviews documented the explosive entry of an asteroid fragment over Chelyabinsk in 2013 (Brown 2013; Popova et al. 2013). These records offer an opportunity to improve our understanding of the appearance of such events and their physiological/psychological effect on witnesses, including witnesses of similar events in ancient times. Such modern scientific records may thus allow us to analyze ancient observations representing the rare class of bolides that occur on the order of once per century—events that have been well recorded only a few times in human history.

Here, we propose that three accounts of a famous historical event, recorded on the road to Damascus in the first-century Biblical account, *Acts of the Apostles* (or the Book of Acts), are consistent with observations of the Tunguska and Chelyabinsk fireball phenomena, in terms not only of the fireball behavior, but also in terms of human responses.

In an early presentation of this work (Hartmann 2013), I speculated that the possibility of this famous event involving a fireball must have been suggested earlier, although I had been unable to find an example. During my preparation of a revised version of this

article, MAPS editor Tim Jull (personal communication, 2014) pointed out such a suggestion. In 1897, the English polymath Sabine Baring-Gould suggested, in a biographical book on Saul of Tarsus, that “the fall of a meteorite” had been involved in the case studied here.<sup>1</sup> Today, armed with new data, we can make a much more detailed appraisal.

As background to this study, note that meteoritic phenomena were known to intellectuals in Rome, but probably not as well known to most citizens of the Palestine region. For example, the first-century Roman philosopher, Seneca, discussed

<sup>1</sup>Baring-Gould (his first name, Sabine, applied to a male in this case) said he was interested in the “human side” of Paul, and wrote that “Whereas to those who accompanied him, the flash of light and crash that followed were an explosion of electric fire, or the fall of a meteorite, to Paul it was something much more.” Baring-Gould graduated from Cambridge; served as a rector; made collections of rural English folk songs; initiated archeological studies of ancient burials in his area; wrote novels; produced nonfiction about medieval myths (werewolves!) and the lives of saints; and is known for creating hymns, including the words for “Onward Christian Soldiers.” His brief wording of the idea is rather misleading, as there is no record of the others actually attributing the event to a meteorite fall, “electric fire,” or anything else, but Baring-Gould clearly concluded that the sequence of brilliant light and noise described in Acts could have involved meteoritic phenomena.

...those fires which the atmosphere drives across the sky. They move obliquely at very high speeds... The fires have many different shapes... We have more than once seen a flaming light in the shape of a huge ball which was then dissipated in mid-flight... For the time being, I guess this: fires of this sort come into existence because the atmosphere undergoes severe friction... (Translation by Corcoran 1971, pp. 15–17.)

Because the event on the road to Damascus marked a crucial step in a major world religion, iconographic or symbolic circumstances have accumulated that make the case rather different from most known fireball events. I make two responses to this: First, this article is not intended to address religious or theological issues, but merely to compare a set of reported first-century observations with what is now known, as we might do with any other reports in historical texts. Let us assume for the moment a working hypothesis of a fireball event, and test it against modern knowledge. Second, a fruitful “scholarly/historical” approach to first-century Biblical texts can be traced back to 1774–1778, when the writings of a German professor of Oriental languages, Hermann Reimarus, were posthumously published (Schweitzer 1906, Ch. 2). Reimarus had developed the then-revolutionary idea that New Testament texts can be addressed and analyzed as surviving copies of historical memoirs “written by believers” (his words), perhaps with various later interpolations, rather than as divine dictations. Reimarus’s approach led to better understanding of the historical settings and origins of the surviving texts themselves (Schweitzer 1906; Ehrman 2003), and allowed the possibility that at least some specific, unusual events, described as supernatural at the time, could have been rare natural phenomena. The sciences of astronomy and meteoritics have long accepted the idea that useful information may be derived from reports of ancient comets (even if originally described as fiery omens), and from studies of certain meteorites, whether preserved in specially designed prehistoric crypts (Heineman and Brady 1929), first-century temples (Acts 19:35), or medieval cathedrals (Marvin 2007, p. B12). Thus, as twenty-first-century scientists, we should allow exploratory scholarly studies of intriguing historical incidents that might be explained by modern knowledge, regardless of whether the early texts are associated with modern religions.

The first-century texts are quoted here, as they are translated in the “Revised Standard Version” of the New Testament, first published in 1946 and 1951, and revised in 1952 after oversight by various scholarly committees. This choice is not based on any claim that this translation is best, but simply because it may be the

most familiar and influential modern version to most readers. The paragraphing is my own. To help the reader identify the texts, I use the traditional chapter/verse notation instead of year/page notation.

### ACCOUNTS OF THE UNUSUAL EVENT

“Acts of the Apostles” gives three separate accounts of an event witnessed by Saul of Tarsus and a group of his friends as they approached Damascus on a road stretching ~310 km from Jerusalem, bent on arresting early Christians for violating earlier religious traditions. As they reported themselves, they did not fully comprehend what they were seeing. The first version is in third person; the latter two versions are in first person because they are quoted as Saul’s own testimony on two later occasions.

*Version 1* (Acts 9:1–9): This third-person account may have been written by Luke, a physician and later acquaintance of Saul, who probably heard Saul describe his adventures. Luke is usually cited as the author/compiler of Acts (Ehrman 2003; see also the Reliability of the Reports: Perception, Conception, and Reporting section).

...Saul, still breathing threats and murder against the disciples of the Lord [Jesus of Nazareth], went to the high priest [in Jerusalem] and asked him for letters to the synagogues at Damascus, so that if he found any [citizens] belonging to the Way [i.e., the teachings of Jesus], men or women, he might bring them, bound, to Jerusalem.

Now as he journeyed, he approached Damascus... suddenly a light from heaven flashed about him. And he fell to the ground and heard a voice saying to him, “Saul, Saul, why do you persecute me?”

And he said, “Who are you, Lord?”

And he said, “I am Jesus, whom you are persecuting: but rise and enter the city and you will be told what to do.”

The men who were traveling with him stood speechless, hearing the voice but seeing no one. Saul arose from the ground; and when his eyes were opened, he could see nothing; so they led him by the hand and brought him into Damascus. And for three days he was without sight ... a disciple at Damascus named Ananías [came to the house where Saul was staying,] laying hands on him ... and immediately something like scales fell from his eyes and he regained his sight.”

Encouraged by the people who took care of him in Damascus, Saul reflected on what he had perceived. Later documents, including one of his own letters to his followers in Galatia, tell us that he eventually began preaching the new belief system, Christianity, under a newly adopted, Latinized name, Paul. Having begun as an enemy of the new religion, he eventually went down in history as St. Paul, the principal architect of the spread of Christianity around the Mediterranean, around 40–60 C.E.

His new views outraged traditionalists in Jerusalem. In one confrontation, they arrested him and brought him before Roman occupation authorities, not only for teaching against older traditions but also for bringing Greeks into the Jerusalem temple compound. He pointed out to the officiating Roman authorities that he had been born in Tarsus, and that this made him, technically, a citizen of Rome. The Roman tribune allowed him to speak to the mob who had accosted him. The account of his speech is in the first person. It adds a detail or two to version 1, but is so similar that it may be an edited version of the same (earlier?) source.

*Version 2 (Acts 22:6–13):*

I journeyed to Damascus to [arrest] those who were there and bring them in bonds to Jerusalem to be punished. As I made my journey and drew near to Damascus, about noon a great light from heaven suddenly shown about me. And I fell to the ground and heard a voice saying to me, “Saul, Saul, why do you persecute me?”

And I answered, “Who are you, Lord?”

And he said to me, “I am Jesus of Nazareth, whom you are persecuting.”

Now those who were with me saw the light but did not hear the voice of the one who was speaking to me. And I said, “What shall I do, Lord?”

And the Lord said to me, “Rise, and go into Damascus, and there you will be told all that is appointed for you to do.” And when I could not see because of the brightness of that light, I was led by the hand by those who were with me, and came into Damascus. And one Ananías, a devout man according to the law, well-spoken of by all the Jews who lived there, came to me, and standing by me said to me, “Brother Saul, receive your sight.” And in that hour I received my sight and saw him.

Following the above arrest in Jerusalem, a Roman procurator, Felix, detained Paul for 2 years in Caesaría,

during which Paul could consult with his friends and with Felix himself. Felix retired around 58 C.E. and a new procurator, Porcius Festus, took up the case. When King Herod Agrippa II and his wife arrived to welcome Festus into office, Festus brought Paul before the king as an intriguing case that needed attention. This provided the setting for a third version, in which Paul recounts the story, with new details, to King Agrippa and his court.

*Version 3 (Acts 26:12–20):*

... I journeyed to Damascus with the authority ... of the chief priests. At midday, O king, I saw on the way a light from heaven, brighter than the sun, shining round me and those who journeyed with me. And when we had all fallen to the ground, I heard a voice, saying to me in the Hebrew language, “Saul, Saul, why do you persecute me? It hurts you to kick against the goads.”<sup>2</sup>

And I said, “Who are you, Lord?”

And the Lord said, “I am Jesus whom you are persecuting. But rise and stand upon your feet; for I have appeared to you for this purpose, to appoint you to serve and to bear witness to the things in which you have seen me ... delivering you from the people and from the Gentiles—to whom I send you to open their eyes...” [This passage goes on with a long speech justifying Paul’s preaching to the Gentiles, possibly inserted by the writer (or later editors?) of Acts.]

Wherefore, O King Agrippa, I was not disobedient to the heavenly vision, but declared first to those at Damascus, then at Jerusalem and throughout all the country of Judea, and also to the Gentiles, that they should repent [a term connoting “change their ways,” as opposed to “ask forgiveness”] and turn to God and perform deeds worthy of their repentance. ...

The Book of Acts adds at this point that as Paul “... made his defense, Festus said with a loud voice, ‘Paul you are mad; your great learning is turning you mad!’ But Paul said, ‘I am not mad, most excellent Festus, but I am speaking the sober truth.’”

An interesting detail is that Paul’s speech to King Agrippa reports a voice telling him that he is “kicking against the goads,” thus suggesting (unwittingly admitting?) a struggle with his conscience about his attacks on his countrymen. This internal unrest may have primed him to make his extraordinary 180° change

<sup>2</sup>“Goads:” irritating thorns or spurs, as in an irritant that goads one to take action.

from enemy to promoter of the new beliefs, after experiencing a once-in-a-lifetime astronomical event.

### THE KEY WITNESS: BACKGROUND AND PERSONALITY

In extraordinary cases associated with specific witnesses, it is usually helpful to have some knowledge of the witnesses themselves. Thus, it seems useful to comment on biographical knowledge about Saul/Paul. His own letters, as well as the Book of Acts, indicate that he gravitated toward passionately held beliefs, even as he changed from one belief system to another. Acts (22:3) quotes Paul as describing his own education. He says he was raised in Jerusalem “at the feet of” the rabbi Gamaliel—a respected Jerusalem religious teacher who, as a local leader after the execution of Jesus of Nazareth, urged leniency toward Peter and the other apostles during their Jerusalem arrests, in order to avoid creating new martyrs (Acts 5:33–39). Paul reportedly said that under Gamaliel, he was “educated according to the strict manner of the law of our fathers, being zealous for God . . .” (Acts 22:3).

In Saul/Paul’s original role as an associate of the Pharisees, he was reportedly present as a “consenting” witness at the stoning and death of a rising Christian proselytizer, Stephen, reportedly holding the cloaks of those doing the stoning (Acts 7:58, 8:1, 23:21). Saul then continued to persecute any of his countrymen who adopted the new messianic beliefs, which he saw as a perversion of the traditions he had been taught. “Saul laid waste the church, and, entering house after house, he dragged off men and women and committed them to prison” (Acts 8:3). In his own letter to followers in Galatia, Paul remarks that his followers already “have heard of my former life in Judaism, how I persecuted the church of God violently and tried to destroy it; and I advanced . . . beyond many of my own age . . . so extremely zealous was I for the traditions of my fathers” (Galatians 1:13–14).

Certain letters of Paul, such as the one quoted above, are believed to be among the earliest surviving Christian documents, which add to their historical validity, since there is less likelihood of embellishments, which were common later (Schweitzer 1906; Ehrman 2003). However, not all “letters of Paul,” whether included or not in the New Testament, are accepted by modern scholars as authentic. Among the most universally accepted are the first two letters to the Corinthians, and letters to the Galatians (one is cited above) and Romans (Burkett 2002, p. 293; Ehrman 2003, p. 38). I have used only letters on that list.

According to Paul and the author/compiler of Acts, it was the unusual event on the road to Damascus that

caused him to renounce his former life as an enemy of Christianity, and become the pivotal character in spreading Christianity, arguing that the new teachings applied not only to the Jewish community of Palestine, but to the whole known world. He was frequently arrested, essentially (from local officials’ point of view) for disturbing the peace with his ardent proselytizing.

Ignoring arrests and criticism, Paul continued to have a sense of his own exceptionalism. In his letter to the Galatians (1:15–16), he says that “he who had set me apart before I was born, and had called me through his grace, was pleased to reveal his Son to me, in order that I might preach him among the Gentiles.” It is important here that he apparently often retold the story of his conversion, both in person and in letters. Since there is no known record or claim that Paul ever met Jesus, the phrase “reveal his son to me,” above, appears to refer to the event on the road to Damascus, and is mentioned in a way that assumes his readers knew the story. Another allusion to the event occurs in his first letter to the congregation in Corinth (I Corinthians 15:4–8, considered authentic and thought to date from some years before the “Book of Acts”). Here, he lists various previously reported apparitions of the resurrected Jesus, recounting that Jesus “appeared [first] to Cephas [the apostle Peter], then to the twelve . . . Last of all . . . he appeared also to me [even though] I am unfit . . . because I persecuted the church . . .” This appearance presumably refers to his experience on the road to Damascus, a reference that again assumes no further explanation to his readers was needed, since he had often described that event.

### RELIABILITY OF THE REPORTS: PERCEPTION, CONCEPTION, AND REPORTING

Did the reported bright light and noise on the road to Damascus correspond to a real event? In the worst case, it could be a tale made up by later followers to justify Saul’s conversion. First, we ask what is the historicity and reliability of the book of Acts as a source. The text (or at least the earliest copies we have today) was probably compiled in the 60s C.E., since it references events that occurred ca. 61 C.E. but does not reveal awareness of the Roman destruction of Jerusalem in 70 C.E. As mentioned above, the main author/compiler is believed to be Luke, a physician who accompanied Paul on at least some of his proselytizing journeys (ca. 40–60 C.E.) throughout much of the Mediterranean world, including Turkey, Greece, and Rome. In support of our use of Acts as a source, the accounts of Paul’s travels include at least some details that have testable historical veracity. For example, Acts 18:12–17, describing one of Paul’s frequent arrests by



local authorities, mentions that during a case in the Achaia, near Corinth, he was judged by a Roman official named Junius Gallio. Latin inscriptions confirm that Gallio was the proconsul in Achaia in the interval 51–52 A.D., or possibly 53 A.D.; Gallio is known also as the brother of the famous Roman philosopher, Seneca, mentioned above (Encyclopedia Britannica 1990).

To summarize the above reports, we have two oblique allusions to the Damascus event in Paul's own letters, where Paul indicates his conception that he had received divine communication from Jesus, plus three detailed descriptions of the event in the book of Acts. The fact that the book of Acts contains three separate accounts of the same event suggests the book was assembled from multiple documents recounting Paul's story, synthesized into one "book" by Luke or later editors. At the same time, it suggests that the author/compiler kept all three versions because of the importance of the event to Paul's story. The three versions work to our advantage, as they give us three quasi-independent accounts.

The accounts recorded in "Acts" have an additional ring of authenticity, because they do not try to place the event in some private or hidden context. (To cite a contrary example, the resurrected Jesus was reported in one instance to have appeared to some apostles "behind locked doors" in the gospel attributed to John.) "Acts," instead, asserts that Paul's "light from heaven" appeared in the presence of other travelers, and that his resulting temporary blindness was witnessed by the community in Damascus, and that Paul told the story in public gatherings, in front of Roman officials and even in Herod Agrippa's court. To fabricate such a story a few decades later would have been risky, since details might have been subject to confirmation with the other surviving witnesses and/or perhaps with Roman court records. Based on such evidence, we proceed with our working hypothesis that some anomalous event did happen, and that modern scholars, knowing what we know today about celestial events and human responses, might usefully attempt to analyze it.

This situation raises the issue of how to respond scientifically to the reports of one-time events. This problem was addressed by two investigations in which the author participated. The first was the U.S. Air Force-sponsored examination of UFO reports by the "Condon Committee" (Hartmann 1969). A relevant comment was made at a December 1969 symposium of the American Association for the Advancement of Science, organized to sum up scientists' responses to the Condon Committee report. A participant (no reference available) commented on his World War II experience in dealing with intelligence reports about anomalous events and possible

U-boat sightings in the North Atlantic, saying that when an incident was reported, his group typically found that, indeed, "something happened" . . . but not necessarily the specific events that had been reported.

This comment conveys an important truth. In the same vein, the author was asked to participate in the 1970s House of Representatives review of President Kennedy's assassination in front of dozens of witnesses. Here, it was notable that years later, the number of shots fired was still disputed, not to mention the larger-scale circumstances (Hartmann 1979; Select Committee on Assassinations 1979:47ff, 516, 599 note 40). Documents surviving centuries from now could contain various versions of that event, even though it was much better recorded than the event reported by Paul.

How, then, can we approach reports of singular events with a scientific attitude? During the Condon Committee study of reports of anomalous celestial events, three phases in any given event were distinguished: *perception*, *conception*, and *reporting* (Hartmann 1969). "*Perception*" refers to the external, objective event, i.e., the actual stimuli being perceived by an observer. "*Conception*" refers to the interpretation of that perception, the conception, within the mind of the observer, of what was seen. A key fact here is that this conception is usually filtered through the observer's own culturally based understanding of what is plausible. "*Reporting*" refers to versions encountered still later by the analyst or scholar; these are often second- or third-hand accounts of people who talked to the witness, or from accounts written by later journalists. Our problem is that we must always work backwards from the received reports, through the conception, to the actual perceived event—with evidence only that "something" actually occurred. The test in our present case is whether the reports and conceptions fit modern data, such as Chelyabinsk data, or conceptions of satellite re-entries (see *A Modern Case Study of Perception, Conception, and Reporting of a Celestial Event: The Zond IV Reentry* section).

A complicating hazard in this work is the divergence of later "reporting" from the actual initial reports. An example occurs in the historical "reporting" of Paul's experience in later media. Version 1, quoted above, specifically says that the witnesses saw no one, yet many medieval paintings and frescos, handed down to us from later centuries, show Paul and his friends witnessing Jesus or other celestial figures appearing before them. Examples are "Livre d'Heures d'Étienne Chevalier," by Jean Foquet, ca. 1455; "The Conversion of Saul," by Michelangelo, ca. 1543; and "Conversion of St. Paul on the Road to Damascus," by Hans Spaekart, ca. 1575. These images are available on the web. Such medieval, nth-hand "misreporting" of the event contributes to

misconceptions of the event still common today. Popular modern (mis)conceptions must be identified and set aside while analyzing ancient reports.

### A MODERN CASE STUDY OF PERCEPTION, CONCEPTION, AND REPORTING OF A CELESTIAL EVENT: THE ZOND IV REENTRY

An important modern example further illuminates the sociological aspects of differences between *perceptions*, *conceptions* and *reports* of fireballs. It was the re-entry of debris from the Russian Zond IV satellite, on a trajectory from Kentucky to Pennsylvania at 9:45 P.M. on March 3, 1968. During investigations by the U.S. Air Force-sponsored Condon Committee, 78 reports were collected by the Air Force, and examined systematically (Hartmann 1969). Of these, about 30 were considered detailed enough for analysis.

The *perceived event*, as known from tracking networks, involved the fragmentation of the spacecraft into a string of luminous fragments, moving together, and stretched out along the trajectory in the evening sky. The *conceptions* and *reports*, however, were wildly varied. Of the ~30 best reports, 12 witnesses correctly *conceived* and *reported* what they had seen as the entry of a fireball or satellite. Other witnesses, probably less informed about celestial phenomena, manifested other cultural concepts of the times. A first stage of subtle misconception and reporting was that 17 out of 30 reports described a “formation of lights,” or lights flying “in formation,” which, at least in common parlance, suggests some sort of nonrandom, artificial, or even conscious control. Five witnesses (including some of the last group) described seeing a cigar-shaped or rocket-shaped (black) object with attached lights; these witnesses *conceived* that if lights were traveling together, they must be attached to a nonluminous object; so they *reported* seeing the “black” elongated object. Three witnesses, presumably with earnest sincerity, reported not only an object, but an object with illuminated windows.

Journalist and historian of Soviet space exploration, James Oberg (2014), supported the above Zond IV work with documentation of the Kosmos 20 booster re-entry and breakup over Ukraine in 1963. In this case, about half the collected eyewitness reports described the phenomenon more or less correctly, but about half of the collected reports (possibly a sample biased toward extraordinary results) described an elongated flying object with “mounted lights” (Oberg’s description), jet exhaust, etc. Oberg concluded that the study offers “validation” of the above work on the Zond IV event.

In short, these cases, where the nature of the celestial event is actually known, confirm that we can expect some

fraction of witnesses of unusual celestial events to misreport what was actually observed. They show that not only the reports of an event, but also the initial conception of what was seen, may be radically different from the stimuli that was actually perceived, in ways that depend on cultural images already in the mind of the observer. And yet it may be possible, using later knowledge, to reconstruct what was actually being perceived.

Adopting these cautionary ideas about perception, conception, and reporting, we suggest that the three reports in the Book of Acts reflect conceptions and reporting of a real incident—not necessarily with quantitative precision, but accurately enough that we can use our current understanding to sort through the reports and conceptions and work backward toward some sense of what was initially perceived. Interestingly, the Book of Act (in the second version quoted above) confirms the above effects, in which not all witnesses reported the same thing. This version says that “those who were with [Paul] ... did not hear the voice of the one who was speaking to [him].”

### KEY OBSERVATIONS

We now list and analyze important questions answered by observations, listed here by version number, “V,” from the Accounts of the Unusual Event section. Here, I refer to the protagonist during the Damascus incident by his then-name, “Saul,” but refer to him years later when he recounts the event as “Paul.”

- \* *Did all the witnesses see the bright light?*
- V1: Noncommittal on this point.  
 V2: “... those who were with me saw the light.”  
 V3: “... I saw on the way a light from heaven, brighter than the sun, shining round me and those who journeyed with me.”

*Analysis:* The available data imply that the whole party saw the light.

- \* *What was the nature of the light?*
- V1: “... suddenly a light from heaven flashed about him ...”  
 V2: “... about noon a great light from heaven suddenly shown about me”  
 V3: “At midday ... I saw ... a light from heaven, brighter than the sun, shining round me and those who journeyed with me.”

*Analysis:* All three accounts say the light came “from heaven.” As shown in more detail in this list of

questions below, this translation can be taken as referring to a light in the sky. In support of this, the phrases such as “flashed about him,” “shown about me,” and “shining round me” suggest a light that was first noticed as an illumination of the landscape, as is not unexpected for people traveling along a road, not watching the sky. Terms such as “flashed” and “shown round” suggest at least the possibility that the brighter-than-Sun light source was moving, and that the travelers first noted shadows swinging around them (a striking, disorienting effect also well seen in some videos of the Chelyabinsk event). Flare-ups associated with meteoroid breakup (well seen in Chelyabinsk videos) may also be involved in the term “flashing.”

- \* *Did the witnesses encounter or report a human figure?*
- V1: The people traveling with him heard the “voice” but saw no one.
- V2: His companions saw the light but did not hear the “voice of the one who was speaking to me.” No mention of a figure.
- V3: “When we had all fallen to the ground, I heard a voice . . .” No mention of a figure.

*Analysis:* No. In spite of the fact that medieval religious imagery, mentioned earlier, propagates images with celestial personages in the sky, we have a specific assertion from the original manuscript (V1) that the witnesses around Saul “saw no one.”

- \* *What was the nature of the sound?*
- V1: . . . as he journeyed he approached Damascus . . . suddenly a light from heaven flashed about him. And he fell to the ground and heard a voice . . .
- V2: As I . . . drew near to Damascus, about noon a great light from heaven suddenly shown about me. And I fell to the ground and heard a voice . . . Now those who were with me saw the light but did not hear the voice of the one who was speaking to me.
- V3: I saw on the way a light from heaven . . . When we had all fallen to the ground, I heard a voice . . .

*Analysis:* In all three versions, the sound is mentioned in the sentence *after* the celestial light flashes around them. V3 specifically implies that the sound came after “. . . we had all fallen to the ground,” hence,

again, after the light was first seen. This is typical of a fireball explosion, in which the sounds of the explosion, and/or shock wave, arrive after the luminous phenomena (see also the Comparison with Reactions to the Chelyabinsk Event and Other Historic Fireballs section).

V1 and V2, if taken literally, might seem inconsistent, in that V1 says Saul heard a voice but V2 says the others did not hear a voice speaking, in the translation we have cited. An important clue is buried here, however. Decades ago, biblical scholars realized that there is an ambiguity in early Greek manuscripts about the word translated here as “voice.” Depending on subtleties of the case of objective-case nouns used with the verb describing hearing or sound, the word usually translated as “voice” can have a connotation more like “sound” or “noise” (Robertson 1930; Summers 1950; Vincent 1975; Thayer 1979). The Revised Standard Version translators used “voice” in all cases, but we may have a usage here something like English idiomatic usages, such as “the voice of the guns,” or “the thunder told us to go inside.” In that view, the intent of the passage is consistent with a fireball: A bright light appeared and most of the travelers fell to the ground, after which everyone heard some sort of *noise*. Saul clearly conceived of this noise as the celestial “*voice*” of Jesus giving him personal instructions, consistent with his self-described, zealous personality, but, as stated in V2, none of the others conceived of this sound as a “voice” or a person speaking. In a widely cited text, *Essentials of New Testament Greek*, Summers (1950, p. 51) discusses the correct translation of the two versions, V1 and V2, and concludes “both constructions say the same thing; the companions of Saul did not understand what the voice said to Saul; to them it was unintelligible sound.”

In summary, if we combine V1, V2, and V3, we can argue that all of the party witnessed the phenomenon, but that, excluding Saul, the other witnesses saw no one and heard no one speaking—consistent with a fireball.

- \* *Do New Testament precedents exist for one witness conceiving of a divine voice speaking to him while others heard only a thunderous sound?*

*Analysis:* Yes. A passage in the gospel account attributed to John (12: 27–29), portrays an incident in Jerusalem during the final week of Jesus’s life, in which Jesus is speaking to a crowd, and some enthusiasts among them said that “a voice came from heaven,”

possibly an angel, speaking about glorifying the name of God. John then remarks, however, that “The crowd standing by heard it and said that it had thundered.” Without making any judgment about what might or might not have happened on that day, we have here a first-century writer portraying as plausible the idea that some people in a crowd might hear what could be described as a thunderous noise, yet others in the same crowd could conceive and report it as a divine voice. This passage greatly strengthens our hypothesis that the noise of a fireball could have been conceived by a zealous first-century partisan to be a divine voice speaking from heaven.

\* *Is it possible that “light from heaven” did not refer to the sky, but to an inner or supernatural light?*

V1, V2, and V3 all refer to the light as “light from heaven.” Some prepublication reviews of this paper suggested that “heaven” in this case does not refer to the sky, but in some way to a figurative concept or metaphysical manifestation. In the case cited just above, from the book attributed to John, the fact that a reported “voice . . . from heaven” is explained by other observers as ordinary thunder strongly implies that “heaven,” in that translation, indeed refers in the ordinary way to the sky, not to a metaphysical concept. Thus we infer that the “light from heaven” refers to a light in the sky, not a metaphysical, or metaphorical concept.

\* *Who fell to the ground and when?*

V1 and V3 might appear to be inconsistent, at first glance.

- V1: Saul “fell to the ground,” but then it is stated that “The men who were traveling with him stood speechless, hearing the voice but seeing no one.”
- V2: Paul tells his listeners that he fell to the ground, but does not specify whether the others did.
- V3: Paul tells Agrippa’s court “. . . we had all fallen to the ground . . .”

*Analysis:* Perhaps the most plausible synthesis is that most or all of the travelers, including Saul, were knocked to the ground by a shock wave, and/or fell from fear and emotional shock, but that in the first moments after the flashing light and noise, some of the others began to stand before Saul did. Then they “stood

speechless,” stupefied by what had happened, while Saul was still on the ground, pondering his conception that what he had heard was a divine voice, and realizing his vision problems. In support of this, we note that during the Chelyabinsk event, “directly below the fireball’s path, the shock wave was strong enough to blow people off their feet” (Popova et al. 2013, p. 1070).

\* *What was the nature of Saul’s blindness?*

- V1: Saul arose from the ground; and when his eyes were opened, he could see nothing; so they led him by the hand and brought him into Damascus. And for three days he was without sight . . .
- V2: And when I could not see because of the brightness of that light, I was led by the hand to those who were with me, and came into Damascus. [Here, at some point, care was offered by a respected citizen in the Jewish community, and] “in that hour I received my sight.” The specific time of his recovery is not specified.
- V3: Curiously, this account does not mention the blindness.

*Analysis:* V2 is important because it indicates that the blindness was caused specifically by looking at the bright light. The others, not blinded, must have avoided this problem, presumably by looking away or shielding their eyes, as was common at Chelyabinsk (Popova et al. 2013). V1, alone, adds that the blindness lasted three days. Here, we must be careful because the Biblical-era counting system often referred to days on which events occurred, but not elapsed time. Most famously, Jesus is said to have risen on the third day. According to the reports in the Bible, however, the time *interval* in the tomb lasted roughly 1½ days—from Friday late afternoon until Sunday some time before dawn.<sup>3</sup>

To clarify, if the event (specified in V2 as noontime) happened on what we call Wednesday, with arrival in Damascus at some point after that, and with Saul regaining his sight between midday and sunset on Friday, Saul could have been reported as being without sight for three days, but the actual duration would have been closer to two days. Based on the above scenario we conclude that Saul’s vision impairment occurred

<sup>3</sup>Based on my informal sampling, when I have asked friends “How long was Jesus in the tomb?” most say he was in the tomb for three days. (I suggest readers try this test on their friends.) A related point is that in the Jewish style of reckoning days, the new day began at sunset.



during a time *interval* somewhere between ~45 and ~54 hours.

Interestingly, a form of temporary blindness from intense light, known as *photokeratitis*, is well documented (as pointed out by an audience member, to whom I owe thanks, during the presentation of these ideas at the Meteoritical Society meeting, 2013). As described by medical specialist Reed Brozen (2014), the condition is caused by exposure to bright light, and generally attributed to the ultraviolet (UV) component of the light. It is a common malady for welders if glare protection is inadequate. It may start as much as a few hours after exposure. Brozen mentions that recovery of the outer, epithelial layer of the eye typically occurs “within 36–72 hours” of exposure. Our independent estimate of 45–54 hours falls within this range.

A key factor in Saul’s blindness is thus the brightness of the event. V3 describes the Damascus event as being “brighter than the sun.” In astronomical terms, the sun is listed at  $-26.7$  magnitude. From available data, Brown (2013) estimated peak brightness at astronomical magnitude of  $-28$  for the Chelyabinsk fireball (about three times as bright as the Sun). Popova et al. (2013), estimated peak brightness at  $-27.3 \pm 0.5$  magnitude, about  $1.1\text{--}2.8 \times$  brighter than the Sun. Because the Damascus travelers were under noonday light, and suddenly saw a still brighter illumination, we must assume that the source was at least comparable to the Sun, and if the light cast prominent shadows, swirling among the travelers, then it was probably brighter than the Sun.

The photokeratitis UV connection raises a question about the amount of UV intensity (thermal? atmospheric emission lines?) associated with brighter-than-the-Sun fireball explosions, since UV light is commonly associated with photokeratitis. The process of fireball UV radiation appears to be poorly understood. Nonetheless, Jenniskens et al. (2013) reported a case of sunburn and skin peeling associated with the Chelyabinsk fireball, suggesting UV phenomena. Popova et al. (2013) in their later, more comprehensive report, reported 25 cases of sunburn out of 1113 people who responded to an Internet survey (2.2%); also, among 453 witnesses close enough to experience “body injuries or inconveniences,” 48% reported “eyes hurt”; 6.4% reported “concussion or mental confusion, upset, or exhaustion”; 5.3% sunburn; and 2.9% retinal burns. Popova et al. (2013) noted that most people instinctively turned away from the brightest flash and avoided injury to their eyes. Precise medical diagnosis of “retinal burn” was less well established as many witnesses did not seek medical assistance, and the percentages are affected by the geographic distribution

of the witnesses interviewed. Popova et al. (2013) state that  $1000 \text{ J/m}^2$  are needed at UV wavelengths to cause sunburn effects, but calculate that at ~30 km from a 6000K object (the Chelyabinsk fireball), the UV dose would have been only  $\sim 200 \text{ J m}^{-2}$ , perhaps augmented by reflection from snow. Based on such data, the putative Damascus fireball may have been several times brighter than the Chelyabinsk event, and/or Saul, in a state of fervent rapture, may have stared at it longer than the other witnesses.

The description of the restoration of Saul’s sight provides important, unexpected support for our thesis. V1 mentions that under the care of Ananías, “something like scales fell” from Saul’s eyes. This odd-seeming passage has often been translated in other versions with figurative, rather than literal, connotations: “It seemed as if a veil was taken from his eyes and he was able to see” (Basic English Bible). Here, however, we note that in severe photokeratitis, a phenomenon known as “epithelial desquamation” can occur in the epithelial (surface) layer of the eye (Brozen 2014). “Desquamation” is defined in medical usage as “to peel off in the form of *scales*” (Webster’s Third New International Dictionary 1966) coming from a Latin root *desquamare*, meaning “to scrape the *scales* off a fish ...the shedding of the outermost membrane or layer of a tissue...” It is also called skin peeling, matching the sunburn cases mentioned by Jenniskens et al. (2013) and Popova et al. (2013).

To summarize, the accounts in Acts are consistent with the interpretation that Saul, conceiving a divine event, stared at a fireball and experienced significant photokeratitis and, after roughly 45–54 hours, his sight returned with some shedding of damaged epithelial membrane. Such striking agreement between the first-century accounts and modern meteoritical and medical knowledge seems unlikely if the story of an extraordinary heavenly event had been made up by later, medically uninformed apologists for Paul.

\* *How close to Damascus was Saul’s party when the incident happened?*

V1: ... as he journeyed he approached Damascus ...

V2: As I made my journey and drew near to Damascus ...

V3: “... I journeyed to Damascus.” Non-committal on distance from Damascus.

*Analysis:* The reports appear at first too vague to answer our question, but we can estimate the distance from information in the preceding bulleted item. We inferred that Saul’s vision problem lasted between 45

and 54 hours, and his sight returned in Damascus. Thus, the party must have reached Damascus within that total elapsed time of roughly 45–54 hours. Travel rates are notoriously variable but typical rates among sixteenth century New World exploring pedestrian parties, led along roads and trails in the American Southwest, suggest sustained averages of ~27 km per day (where “day” generally means a daylight period of travel), with a maximum of ~48 km per day under pressure (Hartmann 1997).

Paul says the crucial incident happened around noon. To make matters more clear, assume that the putative fireball was seen around noon on a Wednesday. In that case, the travelers have ~6 more hours of travel time on Wednesday, ~13 hours on Thursday, and perhaps 3–10 h after dawn on Friday to arrive, meet with friends such as Ananías, and recover on Friday. That gives a range of ~22 to 29 daylight travel hours. Since V1 and V2 say the party was leading a blinded man by the hand, we assume that the stressed but excited party traveled no more than the average pedestrian rate of 27 km/day, say ~20 to ~27 km day<sup>-1</sup>, or an average of roughly 1.7–2.2 km h<sup>-1</sup> in daylight (including stops). Thus, their location during the crucial event on the road to Damascus can be estimated as being on the order of 37–64 km south of Damascus on the Jerusalem-Damascus road.

#### COMPARISON WITH REACTIONS TO THE CHELYABINSK EVENT AND OTHER HISTORIC FIREBALLS

The Chelyabinsk event allows us to compare well-documented reactions, in the case of a modern fireball, to reported reactions in the case of the event on the road to Damascus. From the above observations, we infer that the Chelyabinsk fireball was around 1.1–3 times as bright as the Sun, and that the putative “Damascus fireball” could have been somewhat brighter than the Chelyabinsk object.

A first question: Is our hypothesis contradicted by lack of historic meteorite or fireball reports from Damascus? This involves three issues (1) should known meteorites be expected if our hypothesis is correct; (2) was the putative fireball within sight of Damascus; and, (3) if so, should we expect any record of the fireball to have survived (other than Paul’s)? As for (1), more likely than not, the travelers and the city of Damascus were not directly under the trajectory, so they would probably not have known of any meteorite falls. The largest Chelyabinsk meteorite fragment, recovered from a lake, fell about 40–50 km from the city of Chelyabinsk. Meteorites recovered in nearby rural, first-century areas may not have been preserved or recorded.

Moreover, this fireball, like Tunguska, may not have dropped any recoverable material. We conclude that lack of known meteorites does not disprove our hypothesis. Regarding (2), we can offer more analysis. At Chelyabinsk, maximum luminosity occurred at altitude  $29.7 \pm 0.7$  km, and reported “damage” (unspecified) was scattered in an ellipse with radii roughly  $30 \times 50$  km from “ground zero” (Popova et al. 2013). “Ground zero” is defined here as below the point of maximum brightness. The town of Chelyabinsk, with many broken windows and moderate structural damage to some buildings, was about 36 km from ground zero. Some of the spectacular car-dashboard videos showing the brilliant flare-ups at low elevation angles, were made from distances probably around 35–50 km from the fireball itself.

In the case of the putative Damascus fireball, the most luminous event may have been tens of kilometers from the observers, as with the fireball seen from Chelyabinsk. We have no way of knowing, however, whether the putative fireball was north, south, east, or west of Saul’s location. If 50 km to the north, it could have been over Damascus, in which case damage could have occurred, and nearly all residents would have been aware that something significant had happened. (Note, however, that the most easily or commonly observed damage at Chelyabinsk was blowout of glass windows, which would have been absent in first-century Damascus.) If it exploded 50 km to the south of Saul’s group, it could have been ~100 km south of the city, and had it been a Chelyabinsk-like event, it would been just beyond the distance of noticeable damage, and the object at brightest luminosity would have been only about 17° above the horizon. To match the reports of Saul’s blindness, the putative fireball may have been somewhat larger and brighter than the Chelyabinsk object; in that case, numbers of people, outdoors in Damascus, may have been aware of it. As for item (3), little evidence exists to suggest that records of specific, anomalous transitory events in random first-century cities survive until today. There are few systematic records of earthquakes, and even when bright comets were recorded in some ancient cities, no records survive from other cities at the similar latitudes, due in part to cultural factors (Kronk 1999).

As for witnesses falling to the ground at Chelyabinsk, I am not aware of any film of outdoor witnesses falling to the ground, other than being knocked down by the shock wave, during the event. Videos from car dashboards indicate that drivers kept control of their vehicles, at least during the luminous phases of the event.

Marat Ahmetvaleev (2013), a Russian photographer and blogger, “was taking pictures . . . in a Chelyabinsk

park ... when suddenly I saw a bright flash with my peripheral vision [and] I turned [the camera] toward the object.” His account continues with useful physiological detail:

At the same time I started to hear a sound that resembled white noise with a slight rustle and crackle. The sound ... barely audible ... lasted for the meteor’s entire flight. In the first seconds, my heartbeat and breathing sped up, and my hand started to shake. When the flash’s brightness peaked, I felt strong heat on my face, but it lasted just a split second. I also felt a strong pain in my eyes from the intense glare.

This report testifies to the physiological/emotional effect on a witness. The “rustle and crackle” is typical of descriptions of electrophonic sounds, also reported at Chelyabinsk by Popova et al. (2013). Such (apparently internalized) sounds might have initiated Saul’s conception of a voice criticizing him. Sears (1974) discussed some of the wide variety of reported fireball sounds, including explosions (85% of fireballs), whistling (45%), rumbling (35%), and impact sounds (20%). The “strong pain” in Ahmetvelev’s eyes supports that the Chelyabinsk event reached the threshold where temporary eye damage could result.

The Tunguska event in 1908 offers additional witness reactions at a higher energy level. Popova et al. (2013) cite estimates of Chelyabinsk energy at 470–590 kT but list Tunguska at 3000–50,000 kT. Most witnesses at Tunguska were considerably farther away than those at Chelyabinsk.

In the context of supernatural conceptions, *Science* writer Roy Gallant (1995), who traveled to the 1908 Siberian explosion site, noted local belief in a divine or supernatural connection to the fireball, reporting that members of the hunting-based culture who populated the region attributed the phenomenon to an appearance of their fire god. This gives a modern example of witnesses assigning a divine connection to an extremely energetic fireball.

Russian meteoriticist E. L. Krinov (1966) reached the Tunguska site in the late 1920s and interviewed witnesses more conversant with Euro-Russian culture. These witnesses typically described the event more objectively than the rural hunters, yet within their own somewhat medieval framework, in which the sky could split, revealing a fiery, heavenly light from beyond. To take the best example, a key witness, S. B. Semenov, was blown off a porch and knocked unconscious at a trading station located ~60 km from ground zero. He and a few others at the station were among the closest Euro-Russian witnesses. Krinov interviewed him 22 years later and recorded this recollection:

... suddenly ... the sky was split in two, and high above the forest [Semenov indicated about 50°], the whole northern sky appeared to be covered with fire. At that moment, I felt great heat, as if my shirt had caught fire. I wanted to pull off my shirt and throw it away, but at that moment there was a bang in the sky and a mighty crash was heard. I was thrown on the ground [about 7 meters] from the porch and for a moment I lost consciousness. My wife ran out and carried me into the hut. The crash was followed by noise like stones falling from the sky, or guns firing ....

Krinov cites another researcher, L. A. Kulik, who, also 22 years after the event, interviewed Semenov’s daughter who witnessed the fireball at the same distance, ~60 km. (The two witnesses may have influenced each other’s testimony.) She said,

I saw the sky ... open to the ground and fire pour out. We were terrified, but the sky closed again, and immediately afterwards bangs like gun-shots were heard .... Whether it was hot or not when the fire appeared, I don’t remember .... The fire was brighter than the sun .... The noises at first were very loud, and seemed to be right above our heads, and then they became quieter.

The “opening” of the sky with fire pouring out, and immediate “closing” of the sky, are reminiscent of the Chelyabinsk fireball’s explosive flare-up, which briefly overexposed most videos, then subsided.

Krinov (1966) interviewed another witness at the same trading station, ~60 km from ground zero, 19 years after the event. This witness gave a more narrative sense of the time gap between the flash and the noise, noting that after the “fierce heat,” he went into his hut and was about to sit down when “a crash echoed, earth came sprinkling down from the ceilings, the oven door flew off the Russian stove ... and one window pane in the hut was smashed. After this, a sound like the roar of thunder was heard, getting farther and farther away to the north.”

Further support for the emotional effect of bright fireballs comes from written accounts of the May 14, 1864, fireball in France which dropped the Orgueil carbonaceous chondrites (Gounelle and Zolensky 2014). This fireball was apparently less bright than the Sun, since six agricultural workers in the region, under a partly cloudy sky, reported the sound (like a terrible rumble of thunder followed by a cannon blast), but not the fireball, light, or meteorites. The first newspaper account, on May 17, was written by a retired professor of physics, and reported that people were frightened by the event, and a villager guiding his cow was so

frightened that he almost fainted when he reached a nearby village. Such reactions strengthen our impression that early observers, unfamiliar with modern meteoritics, had strong emotional reactions at such perplexing, once-in-a-lifetime experiences, and affirm that at least some witnesses reporting dramatic meteorite-producing fireballs do not see or report meteorite falls.

Sears (1988) gives several additional examples that illustrate conceptions and reports based on cultural norms, as well as the complications of perceived sounds. These come from eyewitness accounts of several meteorite falls observed in Arkansas:

The 1886 Cabin Creek iron, in mid-afternoon (Sears 1988, pp. 7–8): Accounts assembled at the time said “the noise was heard [120 km] away and likened to a loud report followed by a hissing sound as if hot metal had come in contact with water . . . teams of horses 56 km distant became frightened, broke loose, and ran away. . . .”

The 1930 408 kg Paragould fall at 4:00 A.M. (Sears 1988, pp. 5–6): Witnesses were driving a horse-drawn cart when a bright object passed overhead “as bright as day,” and “went out” in the southwest. The light did not bother the horses, who were “accustomed to bright automobile lights, and the boys drove on for perhaps a hundred yards.” Then, “an explosion jarred things like an earthquake . . . and caused the horses to plunge . . . following this a roar as though a big train were passing rolled back along the path of the meteor. It crashed back to overhead in ‘no time’ and then on to the northeast, the rumbling being audible for perhaps half a minute.”

Note that in the Tunguska case, the sound was perceived as moving forward along the flight path toward the point of the fireball’s explosion, whereas in the Paragould case the sound was perceived as moving *backward* along the path. The quality and movement of the reported sound perceived during such events depends on the distance from the airburst, its altitude, the angle between its trajectory and the surface (controlling the observer’s distance from points along the flight path), and probably also the terrain and atmospheric conditions. This highlights the fact that the sound, noise, or “voice” of a fireball, as perceived (and conceived) by an observer may be quite variable, with various reports mentioning thunderous noises, rattling noises, echoes, and even hissing noises, not to mention, as proposed here, messages from a heavenly realm.

## CONCLUSIONS

Reports that modern scholars obtain from witnesses of unusual events, such as fireballs and spacecraft reentry

events, depend on the witnesses’ and journalists’ cultural backgrounds, educations, and exposures to concepts of scientific observing. Historic incidents dating from centuries or millennia ago should thus be expected to represent culturally based conceptions.

In the case of the anomalous, but historically important first-century event reported on the road to Damascus in the three accounts in the Book of Acts, the sketchy nature of the ancient records prevents a decisive interpretation, but the data assembled here are remarkably consistent with a bright fireball, and suggest the following working hypothesis:

Saul, a self-described zealous ideologue, was on his way to Damascus with his friends, planning to arrest followers of a new religion. As they reached a point roughly 37–64 km south of that city, they witnessed a brilliant fireball in midday conditions. This explains their reports about a luminous, “heavenly” phenomenon. The fireball was plausibly 2–10 times brighter than the Sun, based on the descriptions and Saul’s resultant blindness. They first noticed the phenomenon in terms of enhanced, moving light source in the sky, its flare-ups, and their shadows swinging around them.

Most members of the group may have glanced up at the fireball, but then turned away because of the intense glare, as with many Chelyabinsk witnesses. Saul, being a zealous personality and susceptible to religious ecstasy, conceived of the event as a divine message, and therefore watched it intently, explaining why he was reported to be the only witness to have heard a voice, and why he was apparently the only witness to experience temporary blindness (consistent with the report that the object was brighter than the Sun). Saul and the other witnesses were emotionally shocked by this once-in-a-lifetime apparition, explaining why it was a pivotal event that caused Saul to reverse his belief system, change his name to Paul, and to recount the event later a number of times, according to accounts of his career.

A minute or so after the fireball’s appearance, it was accompanied by its shock wave and a thunderous, fearsome noise. Saul implies he fell to the ground even before the noise was heard. Whether stunned initially by the intense light, or knocked off their feet a few minutes later by the shock wave, most or all members of the party also fell to the ground. This is consistent with some medieval illustrations of other meteoritic phenomena, showing witnesses on the ground (Figs. 1 and 2), perhaps due to an emotional reaction, and it supports the statement in all three accounts in Acts about the observers falling to the ground.

As the noise died away, some other members of the group rose up and stood speechless, struck dumb by



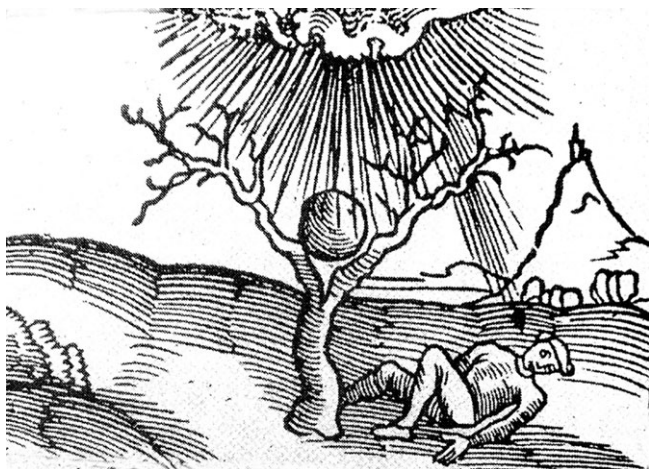


Fig. 1. Ca. 1517 drawing of a European meteorite fall, showing supine figure (from a 1517 Encyclopedia; see Marvin 2007, fig. 4a).

what had happened. Saul, having watched the fireball intently, began to rise but realized he could not see, consistent with reports of vision problems at Chelyabinsk. The party was already close to Damascus, and Saul's companions helped in leading him into the city.

Roughly 45–54 h later, in Damascus, as Saul began to recover his vision, “something like scales” fell away from his eyes. This striking phrase beautifully matches severe photokeratitis, with epithelial desquamation. This match is one of the strongest lines of evidence that the first-century accounts are reporting, as best they can, real phenomena.

The reader may be tempted to complain, “What are the chances that a now-famous individual like St. Paul would see and be influenced by such a rare event?” Such a response is perhaps the wrong way round, and too anthropocentric. First, Saul/Paul was not famous at the time of the event. Rather, the event produced much of his later ardent behavior, and hence, ultimately, his fame. Second, this response fails to take into account the stochastic nature of such events. If such a dramatic atmospheric explosion happens over land areas on the order of once every century, then from the asteroid's point of view, one might note that some entry events will be visible to thousands of persons, so we should ask, “What are the chances that no influential figures in history, have ever been emotionally affected by such events, especially in eras when people spent more time outdoors in contact with nature?”

Indeed, as mentioned in the Introduction and Background section, a direct religious connection is already known in several other historical fireballs and meteorites in the Euro-Mediterranean region. One comes from another incident in Paul's career. The Book



Fig. 2. Drawing of 1619 fireball over Moravia (Czech Republic), showing prone figure and apparent religious iconography in the sky. Meteorites were recovered. (From *Calandarium Perpetuum Deconomicum*, printed in Litomyšl.) See notes for cover of *Meteoritics & Planetary Science* 29, 1994).

of Acts describes one of Paul's arrests, this time in Ephesus (in modern Turkey). During the hubbub over Paul's fate, the town clerk gave a speech reportedly including the comment that everybody knew that the temple in Ephesus is “keeper of the great Artemis and of the sacred stone that fell from the sky” (Acts 19:35, Revised Standard Version 1953). Some earlier translations use the word “image” instead of “stone,” but the sense seems to be “sacred manifestation that fell from the sky,” and the phrase has widely been taken to mean that the temple housed a meteorite. In a similar way, the Ensisheim stone, which fell in Alsace in 1492, was kept in the local church (Marvin 2007, p. B12). In the same vein, the depiction of a 1619 fireball (Figure 2) shows three cross-like images in the sky next to the star-shaped fireball, suggesting a possible conception of a divine manifestation.

The possibility of a first-century report of a roughly once-per-century fireball has meteoritical/geophysical interest in its own right, but it may have a much larger sociological interest if it was significantly involved in the decisions that led to the initial spread of a major world religion. Thus, our conclusions here shade into much larger questions about the role of rare, stochastic, dramatic, astronomical events in influencing philosophical perceptions regarding humanity's relation to the universe.

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*Editorial Handling*—Dr. A. J. Timothy Jull

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