Meteor Showers in the Script

by Hutch Kinsman

Evidence of meteors seems to have appeared in the Maya region in the 4th century AD in the form of flaming arrows hurled by atlatls by Spearthrower Owl, a figure from Teotihuacan (Freidel, Schele and Parker, 1993:301-302, figures 7.9 and 7.10). Interpreted as meteors by Taube (2000:298, figure 10.17d), the atlatls held by Spearthrower Owl are depicted in hieroglyphics on Tikal Stela 31 (coordinates G21 and H28). Yax K'uk' Mo', founding ruler of Copan is carved on Altar Q holding a flaming dart that Taube likens to shooting stars (2000:296). See figure 1 below.

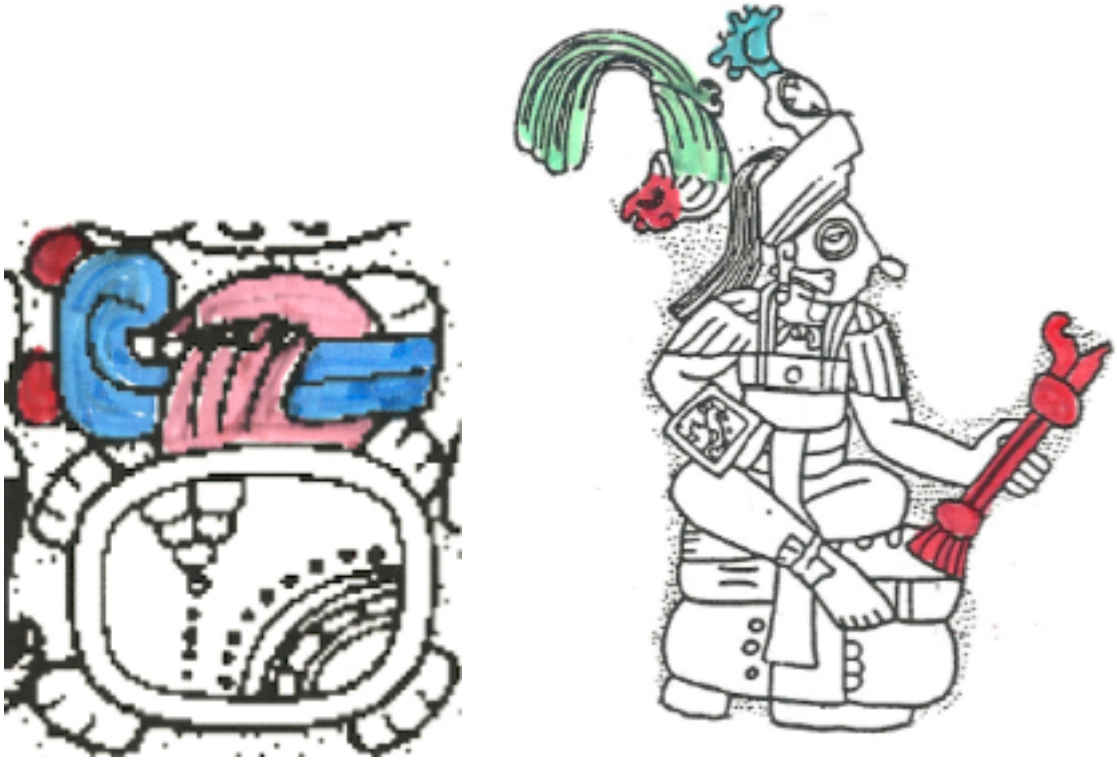

Figure 1. a. Spear-thrower Owl glyph from Tikal Stela 31; stars are indicated by red circles attached to the end of the atlatl (coordinate G21)(drawing by W Coe). b. Copan Founder Yax K'uk' Mo' holding flaming dart (drawing by L. Schele).

This is the first part of a two part series discussing the Maya and meteor showers and whether or not the Maya recorded observations of either individual meteors or annual meteor showers. Information abounds in the literature to show that the Maya and other cultures in Mesoamerica were aware of at least individual

meteors and comets. The codex Telleriano-Remensis (www.famsi.org) records several "smoking stars", including the appearance of Halley's comet in the year 1531 (Köhler, 2002:2) on page 44r. Aveni discusses this record and more (2001:27, figure 9b). Kelley points out glyph B10 on Tikal Stela 5 that could be read *budz ek,* "smoking star" (1976:39, figure 9, 42).

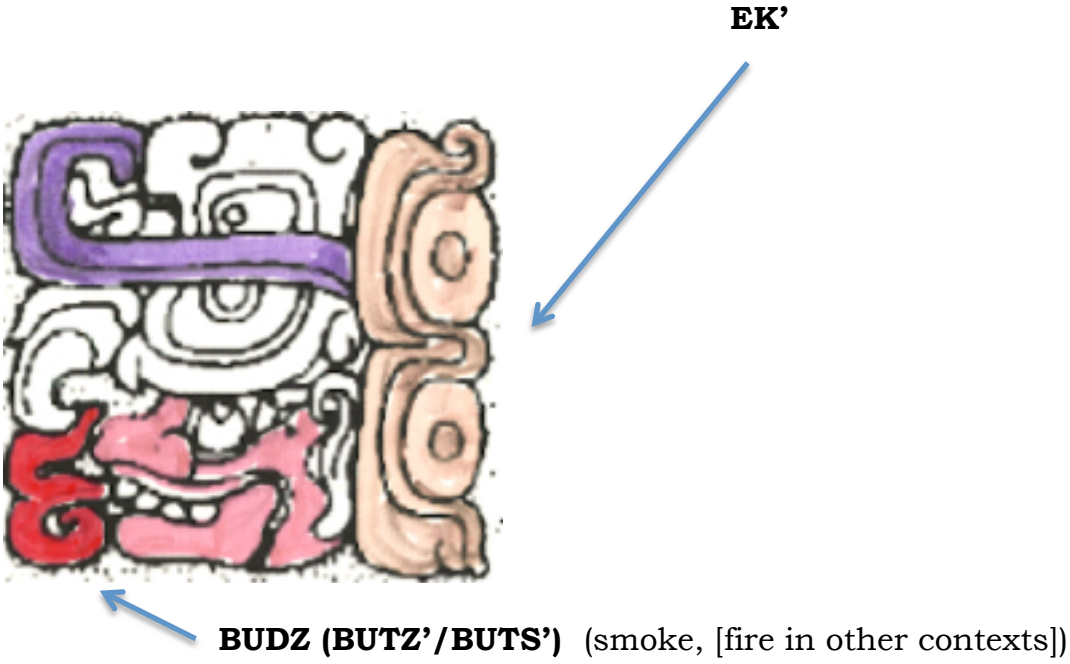

Figure 2. **BUDZ-EK'**. B10, tikal stela 5 (Drawing by W. Coe)(color added by author).

Milbrath mentions Kelley's *Budz Ek* and more historical and contemporary Maya information in her section on comets, meteors and supernovas (1999:250-251).

Picture 10 on page 58b in the eclipse table of the Dresden codex may be a depiction of a falling star (Kelley, 1976:40, figure 10). See figure 3 below.

A1

Figure 3. Picture 10, Dresden page 58b (Förstemann, 1880 [courtesy of Foundation for the Advancement of Mesoamerican Studies, Inc., online www.famsi.org/mayawriting/codices/dresden.html).

Glyph at A1 is interpreted as “falling star” due to the *star* sign attached to an upside-down body, while what may be termed “excrement” or even an obsidian blade itself may be found below the sky band between the figure’s legs. The term for “excrement” *ta’* is a homophone for *taj,* obsidian, another term for meteor.

Other terms for comets and meteors or shooting stars found in the Maya dictionaries

The Maya Cordemex (Barrera, 1980) contains several entries for "cometa": *buts' ek' ,* "cometa crinito como el que apareció el año 1577 [cometa de cabellera, en otra part dice "cometa caudata", de cola] (page 72); *chamal ts'utan,* "cometas pequeños" (page 82)*; halal ek',* "cometa que corre" (175); *ik' omné*, "1, 111: cometa caudata o de cauda o cola. 2. *buts'ek'* (page 267); *k'ak'nah-ek'* , "cometa grande", (page 367).

Tzotzil lists *xojob k'ak'al*, "fiery comet", "cometa de los que echan rayos" from *xojob,* "sunbeam", "rayo del sol" (Laughlin, 1988:303).

Buts' means "smoke, to smoke, to make smoke", "humo, humear; hacer humo" in Barrera (ibid.:72) and also appears as entry 064, **b'utz'* s. "humo//smoke (Chl, Chn, Cht, Chr) (Kaufman and Norman, 1984:117). "Cometa que corre", 'comets that run' probably refers to meteors (Köhler, 2002:1). "*Chamal"* means 'tobacco' or 'cigar', and *ts'utan* (Barrera et al, 1980:894) means "sorcerer"; *chamal ts'utan* means "cigar of the devil" but Galindo (1994:111 referenced in Milbrath, 1999:250) says that "when these cigars are discarded, they are transformed into meteors." *Ik' omne'*, may refer to a comet as "spirit/wind foam/froth? tail?", "frothy tail wind/spirit?".

What this essay is not

This essay, however, is not about what has been seen or written about in the astronomical history of Mesoamerica. One can read the authors mentioned above such as Aveni, Milbrath, Taube and Köhler for valuable background information. In all the literature already written, however, there has been no mention of specific dates of meteor showers that have been observed in the New World. In fact, there has been no serious discussion of actual meteor showers the Maya might have seen. As careful as they were about recording celestial bodies and eclipses, undoubtedly the Maya kept records of annual events such as meteor showers, though these records as such surely must have been burned or otherwise destroyed. This essay is more about what the Maya could have seen and recorded, and may have embedded in the codices or Classic inscriptions. China, for instance, began making reliable recordings of observations starting in 687 BC; Japan and Korea also made early observations (Imoto and Hasegawa, 1958:134-137, Table 1).

Which meteor showers could the Maya have seen?

It is quite possible the Maya saw some showers that no other civilization saw in the historical record, but it is more likely that they observed some of the same showers that China, Japan, Korea and Europe recorded, if the ancient records are any indication (Imoto and Hasegawa, 1958:134-137)(Jenniskens, 2006:598-611). Some of the showers seen back then have no equivalent modern shower; these have been numbered by Jenniskens (ibid.). Most likely only four named modern showers however seen today could have been seen by the Pre-Classic and Classic Maya. Those are the Lyrids, Eta Aquariids, Perseids and Orionids, named for the constellation from which each shower apparently originates, Lyra, Aquarius, Perseus and Orion respectively.

Meteor Showers

What are meteor showers anyway? We occasionally see individual shooting stars or even bright fireballs, whereas a shower will have a display of these meteors of any where from 10 meteors per hour up to 100 per hour. These showery displays are actually the remnants of typically millimeter-sized or less dust particles that are ejected from a parent comet when that comet passes near the Sun (*perihelion*). These ejected dust particles, now called meteoroids, spread out but within the basic orbit of the comet itself. Soon the meteoroids are spread throughout the orbit in a meteoroid stream that may or may not be in the way of a planet such as earth that might fly through the stream. Once the meteoroid enters the Earth's atmosphere it is called a *meteor.* If the meteor impacts the ground it becomes a *meteorite.* Figure 4 shows the stream in its relation to the stars and planet earth and referenced from the Sun, but not dependent on seasonal aspects of the Sun.

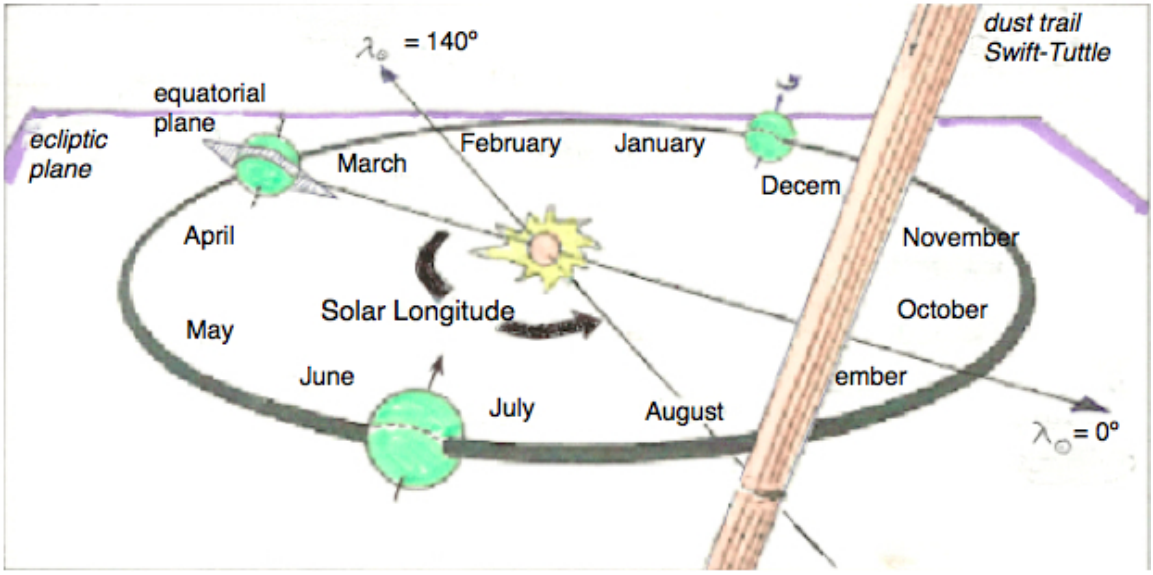

Figure 4. Meteoroid stream and definition of solar longitude. The modern day Perseid meteoroid stream is shown at a solar longitude of 140º, designated by the Greek letter *lambda* (from Jenniskens, 2006).

In the last 2000 years many of the meteoroid streams that we and the Maya have been interested in have maintained a somewhat relative constant position in relation to the stars. Knowing that the streams maintained a sidereal position was discovered in 1837 (Herrick, 1837:176-180). By knowing the length of the sidereal year of the Earth, one can figure out when the Earth will return to the same spot in space the next year or any other year. The current accepted length of the Earth sidereal year is 365.256 days. Recently Grofe determined that the Maya measured the length of the sidereal year as 365.255 days (2011:85) while this author determined another formula that the Maya may have used where the sidereal year equaled 365.259 days (in press: *Meteoroids 2013, Proceedings of the Astronomical Conference, held at A. M. University, Poznan, Poland, Aug. 26-30, 2013*)(also available online, http://crabsandglyphs.com, under "Meteor Showers).

Because of the tilt and wobble of the earth's axis, the peak number of the well-known Perseid meteor shower was seen (in the early morning) on August 12 in 2013 but would have been seen on July 23 back in AD 775, even though the position in space of the stream itself has not changed. Once a specific date has been converted to an absolute position of a body in its bearing to the Sun, called *solar longitude*, then dates of different years can be compared, as described below. Why would the Maya care about the sidereal length of the Earth year? One reason might be to track annual meteor showers.

Meteor showers: equating positions of the meteoroid stream over a long time period

The positions of these streams relative to the Sun are denoted by the term *solar longitude*, and indicate a very specific location in space along Earth's orbit measured from a known reference point (Jenniskens, 2006:158-159, Figure 11.4)(author's figure 4). That reference point is the vernal (spring) equinox, the intersection where the equatorial plane of the Earth crosses the Earth's orbital plane around the Sun (*ecliptic*). Astronomers also note the coordinate system in use whenever designating positions of objects in space, currently J2000, fixed to January 1.5, 2000 (Julian calendar, Universal Time). Solar longitude is basically the Earth's bearing to the Sun measured from that point in a full 360º circle. Annual meteor showers are typically labeled by their solar longitude, designated by the Greek letter *lambda*. Once a specific date is converted to the solar longitude, or absolute position in space, then the position of any body relative to the Sun, such as the Earth, can be compared to another body, such as a meteoroid or a meteoroid stream. If the meteoroid stream and the Earth have equal solar longitudes and are the same radial distance from the Sun, then a meteor shower will occur as the Earth passes through that stream. The Lyrid meteor shower occurs at a rather narrow solar longitude range of 32.0º-32.5º because it is a long-period shower with a high inclination angle relative to the ecliptic plane. The Eta Aquariid meteor shower occurs in the solar longitude range of 40.2º-45.0º, the Perseids from 137.8º-141.7º (see figure 4) and the Orionids from 201.9º to 207.5º.

Comets and meteoroid streams

Since every meteoroid stream originates from a parent comet, once the orbit of the comet is known, the orbit of the stream itself can be calculated (Jenniskens, 2006:10-11). The origination of the comet, then, determines the type of stream. There are basically three types of comets, classified according to their length of time in one orbit (*period*) and the inclination, or angle of the plane of that orbit to the orbital plane of the Earth around the Sun (ecliptic). Those types are long-

period (LP), Halley-type (HT) and Jupiter-family comets (JFC). Long-period comets originate from the large spherical cloud of cometary material surrounding our solar system known as the Oort Cloud (Oort, 1950:91) where the time of one orbit (*period*) is greater than 200 years. Halley-type comets also originate from the Oort Cloud and have a period greater than 20 years and less than 200 years. The orbits of long-period and Halley-type comets are usually inclined well out of the ecliptic. Jupiter-family comets usually originate from the Kuiper Belt and have a period 20 years or less and lie in the ecliptic plane, greatly affected by the gravitational pull of the planets because their farthest point from the Sun (*aphelion*) is about the same as the radius of the orbit of Jupiter (Edgeworth and Kuiper referenced in Jenniskens, 2006:62-65).

Ritual of the Bacabs and Meteor Showers

An important link seems to be made by Roys in the incantations for seizures in the Ritual of the Bacabs. Shamans interacted with the spiritual world through chants, dances, hallucinogens, incantations and conjuring, invoking deities such as the Bacabs. The macaw was known to be responsible for seizures and thus meteors that originated from the offspring of fire or fire-drilling in the Pleiades constellation, or “rattles of the rattlesnake,” from the area of the sky known as Na Ho’ Chan, or “First Five Sky” (1965:xix, 6-10). On the Classic ceramic vessel K688, twisted cords are shown in Na Ho‘ Chan which Taube interprets as fire-drilling besides the already known interpretation of rebirth and creation, in fact, Taube states that the making of fire is “tantamount to creation and birth” (2000:292). See figure 5 below.

Figure 5. Painting of Na Ho' Chan, "First Five Sky" with twisted cords that may represent fire-drilling and thus meteors and also rebirth and creation (courtesy of J. Kerr, ceramic vessel K688).

There is a term *mehen ek'* , "los astilejos; constelacion del cielo" (mtm [Motul Mayan-Spanish], Bolles, famsi.org) where "los astilejos" means the "fire-drillers" which Milbrath concludes is a constellation located somewhere in Orion and/or Gemini (1999:267). It seems that possibly "los astilejos" may mean something closer to "fire-sticks", the sticks used to drill fire. Since Orion contains the three stones or stars of the hearth of creation (Looper, 1995:24-29)(Schele, 1993:8)(Freidel et al, 1993:79-83)(Tedlock, 1992:29), it may be that the Orionid meteor shower is thought of as *the sparks from the fire sticks that started the original fire of creation*. A scene from the Madrid codex shows two god M figures in a fire- drilling fire scene. See figure 6 below.

Figure 6. Two god M figures in fire-drilling scene from the Madrid codex, page M51a (Codex Madrid or Codex Tro-Cortesianus, courtesy of famsi.org).

Summary of Part 1

A background of information both on meteor showers and some pertinent notes from the Maya literature, both the Classic inscriptions and codices has been presented. Important points to remember are: annual meteor showers occur on a sidereal basis, that is in relation to the stars; definition of solar longitude, that is basically the bearing of a body in relation to the sun (in the ecliptic plane); and Ritual of the Bacabs makes an important connection of the scarlet macaw to fire and fire-drilling and thus meteors. An important question to keep in mind would be what would be a reason the Maya would care about the length of the Earth sidereal year.

References

Aveni, A. F.
2001 Skywatchers: A Revised and Updated Version of Skywatchers of Ancient Mexico, Universtiy of Texas Press, Austin.

Barrera, Vásquez, A.
1980 Diccionario Maya Cordemex: Maya-Español, Espaõl-Maya. Mérida, Yucatan. (Ediciones Cordemex).

Freidel, D., Schele, L., and Parker, J.
1993 Maya Cosmos: Three Thousand Years on the Shaman's Path. William Morrow and Company, Inc.: New York

Herrick, Edward C.
1837 On the Shooting Stars of August 9th and 10th, 1837; and on the Probability of the Annual Occurrence of a Meteoric Shower in August. American Journal of Science and Ards (1st series); Vol. 33.

Imoto, S. and Hasegawa, I., Historical Records of Meteor Showers in China
1958 Korea, and Japan, *Smiths. Contra. Astrophys.,* 2. 131 (upda.

Jenniskens, P.
2006 Meteor Showers and their Parent Comets, Cambridge University Press: Cambridge.

Kaufman, Terrence S. and William M. Norman
1984 *An Outline of Proto-Cholan Phonology, Morphology, and Vocabulary.* In: John Justeson and Lyle Campbell (eds.), Phoneticism in Mayan Hieroglyphic Writing. Institute for Mesoamerican Studies, Publication No. 9. Albany: State University of New York.

Kelly, David H.
1976 Deciphering the Maya Script, University of Texas Press: Austin.

Köhler, Ulrich
2002 Meteors and comets in Ancient Mexico, in Koeberl, c., and MacLeod, K. G., eds., Catastrophic Events and Mass Extinctions: Impacts and Beyond: Boulder, Colorado, Geological Society of America Special Paper 356, p. 1-6.

Laughlin, Robert M. with John B. Haviland
1988 The Great Tzotzil Dictionary of Santa Domingo Zinacantán, with Grammatical Analysis and Historical Commentary, Volume I.

Smithsonian Institution Press: Washington, D.C.

Looper, Mathew G., 1995, The Three Stones of Maya Creation Mythology at Quiriguá. *Mexicon XVII* (2):24-30.

Milbrath, Susan
1999 Star Gods of the Maya: Astronomy in Art, Folklore, and Calendars, University of Texas Press: Austin.

Schele, L., 1993, Creation and the Ritual of the Bacabs, *in* Texas Note 57, Texas Notes on Precolumbian Art, Writing, and Culture.

Taube, Karl A.
2000 The Turquoise Hearth: Fire, Self Sacrifice, and the Central Mexican Cult of War, in Mesoamerica's Classic Heritage: From Teotihuacan to the Aztecs, Eds. Carrasco, D., Jones, L. and Sessions, Scott, pp. 269-340. University Press of Colorado (2002).

Tedlock, Barbara, 1992, The Road of Light: Theory and Practice of Mayan Skywatching, in *The Sky in Mayan Literature*, ed. Aveni, p. 18-42. A. F. Oxford University Press.