

VIII. NEW TECHNOLOGIES AND METHODS IN CULTURAL ASTRONOMY

COSMIC CATASTROPHES AND CULTURAL DISASTERS IN PREHISTORIC TIMES? THE CHANCES AND LIMITATIONS OF A VERIFICATION

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Abstract

In the past three decades cosmic events such as supernovae and the impact of large meteorites have undergone a remarkable renaissance in being considered as a trigger of radical change, not only on geological timescales but also among prehistoric cultures. In such theories, archaeological horizons indicative of destruction events are combined with evidence from dendro-chronology, ice-core analysis, mythical traditions etc. and are put forward as evidence for cultural disasters caused by cosmic events. This paper critically scrutinizes the underlying concepts of “cosmic catastrophe” and “cultural disaster” as well as the methods that are meant to corroborate them. Special emphasis is placed upon the limitations that show up in analyzing myth and folklore.

Key words: catastrophe, cultural downturn, prehistory, supernova, impact, geomythology, myth.

Introduction

In the 1980s the idea achieved prominence that the impact of a large asteroid had caused the extinction of the dinosaurs and the end of the Cretaceous Period, thus heralding the revival of the 19th-century geological concept of catastrophism. The term “catastrophism” refers to the theory that sudden, short-lived, violent events such as eruptions of volcanoes, extreme floods, or earthquakes were essential triggers for geological processes of change. In the new hypothesis, the impact of large meteorites or comets became seriously considered as a potential agent in catastrophism. This conjecture was further fuelled by the observable break-up of the comet Shoemaker-Levy 9 and the impact of the fragments into Jupiter in 1994. More and more consideration was given to the question of whether supernovae, dense debris from comets or the impact of large meteorites could not only trigger geological processes but could also pose a threat to human civilizations and might have influenced history. Within the last twenty years a number of publications have presented evidence that claims to show the catastrophic effects of such cosmic events on prehistoric or ancient civilizations, mostly with worldwide or at least continent-wide consequences. We can briefly summarize five typical theories.

- Firestone et al (2006): The debris of a supernova put a dramatic end to the Clovis culture in North America in about 11000 BC.
- Allan and Delair (1997): The products of a supernova completely disarranged the solar system and caused a world-wide catastrophe in 9500 BC.
- Tollmann (1993): The break-off of a gigantic comet caused multiple impacts and world-wide catastrophes in 7750 BC. All major religions are an attempt to cope with this apocalyptic experience, as are many cultural monuments (Stonehenge, the pyramids, etc.).
- Clube and Napier (1982): Since the 3rd millennium BC, clouds of cometary debris (Taurids) have produced impacts that affected the Earth and caused dust-events that resulted in worldwide climatic downturns. Major celestial gods originally represented comets; and cultural/political crises coincided with phases of increased meteoritic activity.
- Baillie (2000): Closely passing comets or clouds of cometary debris caused worldwide climatic downturns in particular years during the last three millennia; these events correspond to cultural/political changes.

Methodically, these theories face a fundamental problem: with the exception of Firestone's, they lack any of the geological, mineralogical or chemical evidence accepted throughout the world as proof of an impact or of material related to a cosmic event: there are no craters, no rocks with impact-induced shock-metamorphism, nor any material providing relevant cosmochemical data. The conclusion that cultural disasters occurred that were induced by a cosmic trigger is based on combining archaeological horizons of presumably sudden destruction, or historical records of social disturbance, with the results of dendrochronology, ice-core analysis, mythical traditions, etc. Thus the question arises: what different possibilities exist of verifying cosmic catastrophes and related cultural disasters in prehistoric times? And what obstacles are encountered?

Theoretical considerations

The definition of the terms "catastrophe" and "disaster" – especially in connection with "culture" – is fiercely disputed in the scientific literature. The least common denominator is to say that "catastrophe" means an abrupt, violent event with human victims. Any further possible aspects such as changes in political and societal coherence, abandonment of a region or changes in material culture are controversial if used to try to characterize a "catastrophe" (Torrence 2002). It is important to be aware of this fact, because in everyday speech the term "catastrophe" is applied very loosely to any awful event, and a catastrophe can seem all the more disastrous the more unimaginable its trigger is. The authors of the theories cited above do not give an account of their concepts of "catastrophe" and "cultural disaster". For them it seems to be self-evident that the presumed cosmic event must inevitably been disastrous on a worldwide scale and that such a disaster could not result in anything other than abrupt cultural change. Furthermore, another underlying theoretical assumption remains implicit: that abrupt cultural change is very probably caused by an external catastrophic event. These theoretical assumptions influence the data that are considered to verify a cosmic catastrophe, and especially the willingness to accept cultural change (different examples of which are presumed to be contemporaneous) in many different regions and myths from all over the world, as being triggered by a cosmic catastrophe. The problems of this approach are illustrated by examining some methodological considerations.

Methodological considerations

1. One of the fundamental methodological issues in dealing with catastrophes as possible cultural triggers

is that of *exact dating*. A catastrophe is defined as an abrupt event, and in the case of a cosmic event, e.g. the impact of a big meteorite, "abrupt" does not mean within decades but within just a few minutes. Exact dating is needed in order to provide a firm basis for deciding whether an extreme natural event was only accidentally correlated to an episode of cultural change or whether it actually triggered it (Torrence and Grattan 2002, p. 2). In this context, the low accuracy of many dating methods used in prehistory is disturbing: for example, C14-dates, with an accuracy of around ± 50 years at best, will not enable us to determine whether a culture was already was in decline and then hit by an impact, or whether the impact caused the cultural downturn. Dendrochronology, a dating-method that in principle is of high precision, is less precise for prehistory. For many regions and periods there exist only floating dendrochronologies, which means that they are not absolutely fixed to calendar years but correlated to C14-dates, which are inaccurate as just mentioned. Problems in correlating indications of climatic downturns found in the dendrochronological data with big volcanic eruptions and even with cultural downturns are strongly debated in the relevant literature (Sadler and Grattan 1999), and these problems also apply to catastrophes of cosmic origin. Another problem occurs with the widespread stylistic dating of archaeological cultures. Stylistic dating in prehistory floats in time and, like C14, is insufficiently precise to pinpoint a catastrophe and its possible cultural effects.

These examples of three leading dating methods illustrate the fundamental problem of determining the precise date of a cosmic catastrophe in prehistory and thus of establishing its possible effect on cultural change.

2. A number of other factors also complicate the *evaluation of the cultural effects* of a cosmic catastrophe. A cosmic impact, for example, causes different effects on different scales depending on many factors (Tollmann and Tollmann 1993, p. 27-88). The scale of the air blast, the thickness and spatial extension of the layer of ejecta, the intensity of wild-fires, and the intensity of acid rain and toxic gases all interact with and affect the topography of the target area, vegetation and its seasonal development, climatic conditions, etc. Studies in volcanism, where somewhat similar phenomena are encountered, show us the broad range of effects that might have influenced the environment and thus society after an impact (Blong 1984, p.311-350). The different scales of environmental effects interact in turn with the circumstances of the affected society and influence the human responses such as the duration of abandonment of the target area and eventual changes in economic subsistence, social coherence, material culture and religious beliefs (Torrence 2002).

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To handle these complex problems of interacting effects as well as those of exact dating, interdisciplinary research – undertaken in cooperation with geologists, archaeologists and other specialists – is indispensable, and it is essential to cross-check the results from the different disciplines.

In addition to the use of methods from the natural sciences and archaeology, something that regularly plays an important part in theories postulating a causal link between cosmic catastrophes and cultural disasters in prehistory is the study of myths (on the difficulties of defining “myth” see Masse et al 2007, p. 9-14). Often, traditions from different cultures all over the world and of an unknown age are mixed up in the argument. Therefore it must be asked what possibilities are opened up by, and what limits should be placed on, the use of myths to verify cosmic catastrophes and related cultural change.

3. *Do myths retain the memory of disastrous cosmic events?* This question raises a long-standing issue in the theory of myth: whether myths in general may reflect concrete historical events. For three decades, “geomythology” – a term coined by Dorothy Vitaliano – has put new life into the old problem. “Geomythology indicates every case in which the origin of myths and legends can be shown to contain references to geological phenomena and aspects, in a broad sense including astronomical ones (comets, eclipses, meteor impacts etc.)” (Piccardi and Masse 2007, Preface p.VII). Vitaliano differentiated between two kinds of geological folklore: “...that in which some geologic feature... has inspired a folklore explanation, and that which is the garbled explanation of some actual geologic event, usually a natural catastrophe” (Piccardi and Masse 2007, Preface p. VII).

Within the last few years a number of studies have been published that – through an interdisciplinary approach combining mythological and geological research – have succeeded in establishing that certain folklore has a concrete geological background. Examples include the changing ice-cover of two bays in Alaska between 1400 and 1800 AD (Vitaliano 1973, p.30-31), megatsunami events in the region of Australia (Bryant et al. 2007), earthquakes on the northeast coast of America (Ludwin and Smits 2007), and several prehistoric and historical volcanic eruptions (Vitaliano 1973, p.122-141). Among the last of these, the genesis of Crater Lake by the eruption of Mt. Mazama (USA) about 7700 years ago, as reflected in a myth of the Klamath natives (Masse and Masse 2007, p. 18-19), is actually a datable event. So too is a volcanic eruption on the island of Lipari (Italy) in the 6th century AD, reflected in a legend of San Calogero (Vitaliano 1973, p.141).

All these examples are cross-checked by the analysis of myths as well as geological and archaeological research. They provide evidence that at least some myths do encode knowledge of natural events, mostly of a catastrophic character, and that a very few of them do even keep the memory of a concrete, datable geological event.

What about concrete cosmic catastrophes reflected in myths? Tollmann, Firestone, Delair and others have claimed that myths from all over the world reflect the cosmic catastrophes that they espouse. The examples they present demonstrate the whole problem of interpreting myths. First, there is the problem of mythical iconography: how can it be decoded? Some examples may illustrate the difficulties: The term “comet” stemming from Greek “kométes” = “hairy star” also indicates a connection between hair and the celestial objects called “comets”. But (to take an example) a full head of splendid hair is well known as a symbol of power, strength, fertility and life-substance. Thus it would be mistaken to interpret every god or goddess whose splendid hair is emphasized as a comet. Another example is that of battling supernatural forces: The Tunguska event in 1908, very probably the explosion of a cosmic object, was described by the Evenki nomads as the battle of two shamans (Menges 1983, p. 5). But the volcanic eruption of Mt. Mazama mentioned above has also been described as the battle of two supernatural beings. Thus not every battle of such a kind signifies the explosion of a meteorite. Concerning the motifs of the “falling sky” and of “sudden darkness”, Masse and Masse (2007) have exemplarily demonstrated the need for analyzing the different ascriptions of these motifs to eclipses, ash-fall from volcanic eruptions, or darkness caused by a cosmic impact. Thus one motif may represent different meanings that have to be elicited and evaluated in each individual case. Awareness of this fact should prevent us adopting one-sided interpretation.

On the other hand, Tollmann and others have collected quite a number of traditions that depict the details of a fall and impact of a meteorite in an intriguing manner. At least some of those descriptions must be considered to reflect a cosmic event. But there is the problem that none of the authors can date any of these traditions; they simply ascribe them to their favourite cosmic catastrophe. Given that the frequency of small cosmic events like that at Tunguska is estimated to be between 100 and 1000 years, there are fundamental problems in differentiating which event is reflected in any particular mythical tradition. When myths from all over the world are then mixed up in order to “prove” a special cosmic event, this problem becomes especially evident. Do myths from many parts of the world and

many different cultures indeed reflect one big event? Or does one myth reflect a cosmic event in, let us say, 2000 BC in the Near East, another an event of 1400 BC in Europe, and the next an event of 300 BC in South America or of 700 AD in the Sahara? Similar mythical descriptions of potential cosmic events give no clue to the identity of the proposed events, because it is probable that similar events would be described in similar ways. Furthermore, myths float in time: in other words, over time a narrative nucleus may gather additional mythical material, or may itself be ascribed to a new context. Therefore, in the absence of a time frame for a given myth, there is no chance of ascribing it to a specific cosmic event.

There exist two ways to obtain an estimate of the probable date of a myth that is meant to represent a concrete cosmic event. The first is direct, and can be applied where the myth itself and/or its history of tradition gives clues to its date. This approach has been followed, for example, by Rappenglück and Rappenglück (2007). The other approach is indirect, where a mythical tradition contains elements that can be cross-checked by geological (and archaeological) evidence. The geological evidence itself can be dated and thus provides indirect dating for the mythical tradition. Masse and Masse (2007) have attempted this approach by comparing the geographical distribution of certain mythical motifs with existing geological clues relating to a specific cosmic event, the Campo del Cielo impact in South America, which has been dated to about 2000 BC. Such an approach requires a rare coincidence of detailed and well-preserved evidence provided by other disciplines like geology and archaeology. It is at the least very risky, if not improper, when dealing with a cosmic event claimed to have had worldwide effects, because in this case the countercheck by spatial distribution becomes invalid. In summary, only very rarely will it be possible to allocate a myth a time-frame that allows it to be ascribed it to a specific cosmic event.

I would summarize the main problems and chances of verifying that a prehistoric cultural disaster was caused by a cosmic catastrophe as follows.

1. The central issue is the need for some kind of certified *geological evidence*. Geological evidence and mythical tradition together can verify a cosmic impact at a certain time, but not a cultural downturn. Geological and archaeological evidence in combination are ideal to serve the purpose, and may be complemented by mythical evidence. But mythical tradition and archaeological evidence without the geological data are not sufficient to confirm a cosmic catastrophe as the trigger of a cultural disaster.

2. The core problem is *dating*: the geological dating, the archaeological dating of the affected culture in question, and the dating of myths. Very probably, a number of myths describe the fall of meteorites and even impacts of significant size; but without a dating framework, connecting a myth to a concrete catastrophe of cosmic origin and to a special cultural downturn is unsupportable.
3. Awareness that *mythical motifs have multiple meanings*.
4. The problem of *effects*: Even when there is good geological and archaeological (and perhaps even mythical) evidence of a cosmic event, the scale of its effects depends on so many factors that catastrophic cultural effects are not self-evident.
5. Avoiding *theoretical preoccupation*: Depending on many factors, human responses to natural catastrophes vary extremely. To be able to verify without prejudice the scale of a culture's response to a natural catastrophe, it is crucial to reflect seriously upon one's own concepts of "catastrophe", "cultural disaster" and "cultural change".

Under these conditions, is it possible to verify a prehistoric cultural disaster, triggered by a cosmic event? Maybe Firestone's research has the potential to do so. Research on the Chiemgau Impact, a large meteoritic impact in South-east Germany during the 1st millennium BC (Rappenglück and Rappenglück 2007) that might have influenced Celtic culture, might also have the potential, but more precise dating and a better knowledge of the scale of the effects are required.

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KOSMINĖS KATASTROFOS IR KULTŪRINĖS NELAIMĖS PRIEŠISTORINIAIS LAIKAIS. VERIFIKACIJOS GALIMYBĖS IR RIBOS

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Santrauka

Per pastaruosius tris dešimtmečius nepaprastai atgijo domėjimasis kosminių reiškinių, tokių kaip supernovos, didieji meteoritai bei jų smūgiai ir t. t., galėjusių lemti radikalius geologinių periodų pokyčius, įtaka priešistorės kultūrų kaitai. Tokios teorijos bando lyginti aptinkamus tam tikrų archeologinių sluoksnių

(horizontų) sunykimo faktus su dendrochronologinių ir ledynų tyrimų rezultatais, mitine tradicija ir t. t. Šie duomenys pateikiami kaip kosminių reiškinių sukeltų kultūrinių pokyčių įrodymai. Šis straipsnis kritiškai nagrinėja „kosminės katastrofos“ bei „kultūrinės nelaimės“ koncepcijas ir jas verifikuojančius metodus.

Svarbiausios galimybės ir problemos verifikuojant priešistorinių kultūrų pasikeitimus, sukeltus kosminių katastrofų, yra šios:

1. Geologiniai duomenys. Remiantis geologiniais duomenimis ir mitine tradicija, galima patikrinti kosminių reiškinių įtaką kultūroms tam tikru laiku, bet remiantis šiais duomenimis negalima interpretuoti kultūrinio nuosmukio. Geologinės ir archeologinės medžiagos derinimas padeda spręsti problemą ir gali būti papildytas mitologiniais duomenimis. Tačiau mitologinė tradicija ir archeologinė medžiaga be geologinių duomenų negali patikimai patvirtinti kosminių katastrofų sukeltų kultūrinių nuosmukių.
2. Esminė problema yra datavimas: geologinis datavimas, archeologinis kultūros datavimas (straipsnyje aptariamų poveikių lygmeniu) ir mitų datavimas. Daugumą mitų, pasakojančių apie meteoritų kritimą ir net jų dydį bei smūgio jėgą, dėl datavimo gairių nebuvimo sunku susieti su konkrečia kosminės prigimties katastrofa ir tam tikros kultūros nuosmukiu.
3. Mitinių motyvų supratimas ir naudojimas yra problemiškas, nes turi daugialypių prasmių.
4. Poveikio problema: net jei yra tinkama geologinė ir archeologinė medžiaga (ir, matyt, net mitinis klotas) jo padarinių mastas priklauso nuo daugelio veiksnių, todėl katastrofiški kultūriniai padariniai nėra savaime akivaizdūs.
5. Vengiant išankstinio teorinio nusistatymo: priklausydama nuo daugelio veiksnių žmonių reakcija į natūralias katastrofas yra nepaprastai įvairi. Siekiant išvengti išankstinių nusistatymų, verifikuojant kultūrinių atgarsių mastą, į gamtines katastrofas būtina rimtai kritiškai reflektuoti savo paties „katastrofos“ ir „kultūrinio nuosmukio“ ar „kultūrinės kaitos“ koncepcijas.

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