



When the aurora went global

by Marinus Anthony van der Sluijs © 2021

We live in uninteresting times, at least with regard to heavenly phenomena.

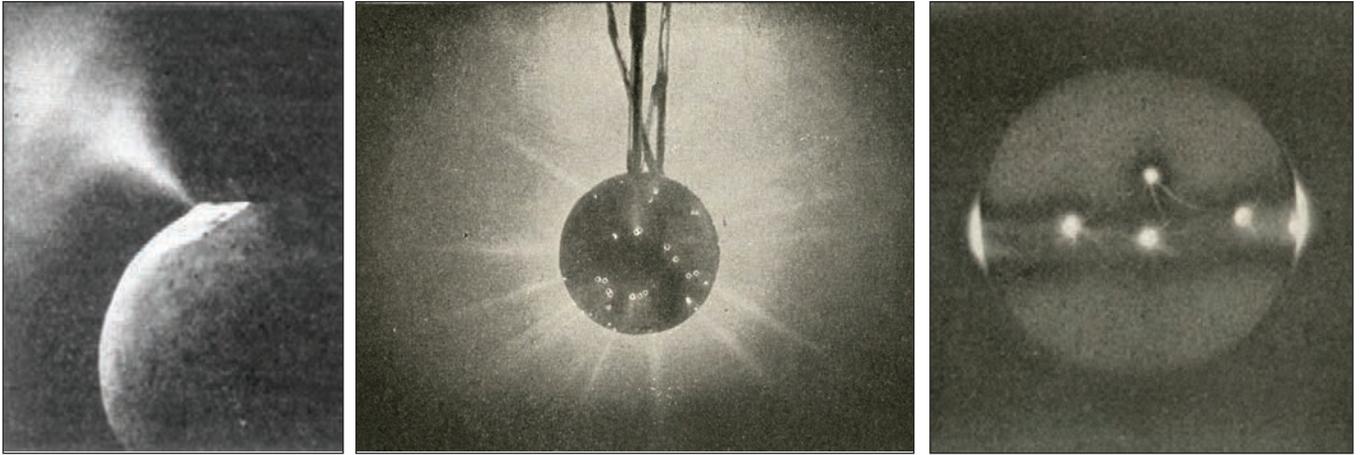
– George Siscoe

Geomagnetic Reversals and the Aurora

The Earth has its own magnetic field, dominated by two poles that usually reside not too far from the two rotational poles. This field acts as a protective bubble—called the magnetosphere—against radiation from the Sun and from space beyond the Solar System. What happens when it loses strength? In what is called a geomagnetic reversal, the magnetosphere contracts while the field's two main poles cross the equator and trade places. The field contains a number of smaller poles that momentarily gain prominence and may also shift around. The inevitable increase in cosmic rays may effect

climate change, for example by stimulating cloud formation. Raised levels of ultraviolet radiation and precipitation of radioactive elements could have a deleterious impact on life, while the changed magnetism may even influence some biological or psychological functions directly, for better or worse. This much has often been written about.

Geomagnetic field structure determines the shape of the polar aurora. How would a weak geomagnetic field change the aurora? Scientists largely neglected this question, probably because the aurora is quite inconsequential, no matter how splendid it may be. The northern and southern lights leave no direct traces on the surface and have no demonstrable effect on weather or climate. But what if a magnetic reversal had happened when humans were around? People have always tended



Experiments on terrellae (miniature Earths) have long been used for modelling planetary magnetic fields and aurorae or solar features such as sunspots and the corona. These images were produced by Kristian Birkeland in 1901–1913. The cone of light (left) replicates a polar cusp. If visible as an aurora, it would look much like a mythical *axis mundi* or cosmic column. During a geomagnetic excursion, there may have been several auroral foci with curious shapes, like the radial "pencils" and "starfish" in the other two images. These could be terrestrial counterparts to solar filaments and sunspots.

to concentrate in places where the aurora is seldom seen, if at all. Dramatic changes in the lights' geographical distribution and appearance could have aroused interest and left traces in culture. Some of the most striking scenes may have been represented in art, replicated in building plans, re-enacted in ritual performances or remembered in orally transmitted tales embellished by the imagination, including the copious use of metaphorical language—that is to say, myths. Auroral physicists and anthropologists could have a field day comparing notes on what such aurorae looked like.

Geomagnetic Excursions

To be sure, the most recent geomagnetic reversal took place long before the emergence of *Homo sapiens*—773,000 years ago. However, incomplete reversals called geomagnetic excursions occur far more frequently, perhaps every 10,000 years or so. On such occasions, the two main magnetic poles attempt to swap, but do not manage to reach the higher latitudes of the opposite hemisphere or to remain there and instead end up back on their original hemisphere. The magnetic field still weakens, but less than during full-blown reversals. Like reversals, excursions—or at least those whose existence is beyond doubt—have not taken place within the time of written history. Therefore, our knowledge about them is equally theoretical. Yet there is a good possibility that prehistoric humans lived through a few, and preserved aspects of them in their traditions.

This exciting possibility has rarely been entertained. One early exception was made in 1976 by American physicist George Siscoe. At that time, experts had just recognised excursions as a separate category of events and evidence had emerged for some at the end of the last glacial period. Siscoe realised that aurorae forming

around the Earth's minor magnetic poles should at such times have been a regular sight at middle latitudes. Perceived as vigorous spirits, they could have inspired designs in the rock art and plastic art of prehistoric Europe. This promising insight has failed to catch on, but that could be about to change with the recent publication of *The Earth's Aurora*, the second volume in the series *On the Origin of Myths in Catastrophic Experience*.

Global Patterns in Creation Myths

Based on 20 years of full-time research, these books approach the topic from the opposite direction. Instead of asking whether the aurorae of reversals or excursions could have influenced early human traditions, they start with the central problem posed by the world's vast reservoir of creation myths: why are these myths so stunningly similar around the globe in profuse counterintuitive detail and what could they have been based on?

As a first in comparative mythology, the books offer a thorough breakdown of the global blueprint or template that seems to underlie thousands of origin myths from the Inuit and Sakha in the arctic and subarctic zones all the way down to all the way down to the original inhabitants of Australia and Tierra del Fuego. More than 400 recurrent motifs are distilled, none of which are simple expressions of the natural world as it appears to us today. Some salient examples are: an "age of myth", "age of the gods" or "age of creation" preceding the current order; a low and dark sky raised by one or more protagonists; one or more suns or moons that moved too fast, too slowly or not at all, failed to set, hung too low in the sky or shone with too little or too much strength; a conspicuous tree, mountain, rope, stairway or ladder to the sky, traversed by mythical beings with remarkable

traits; and a devastating flood, fire or tempest decimating such a former race.

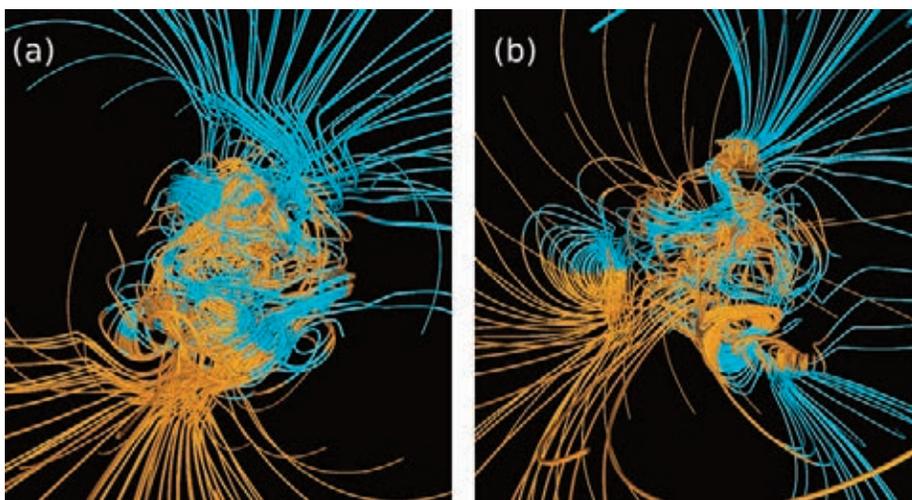
These abundant narrative elements typically stand in an intricate spatial or chronological relationship to each other; they comprise a complex web of information that can be seen as the skeletal framework beneath the plethora of traditions in their historical forms. For example, the lifting of the originally low and oppressive sky was accomplished by means of the rapid rising of one or more world pillars or giant beings; the peculiar low or stationary sun prevailed at the time when the sky was low; and so on.

This nexus of interrelated themes harking back to a "lost universe" was documented in its own terms—that is, in mythical parlance—in an earlier series of six volumes entitled *Traditional Cosmology: The Global Mythology of Cosmic Creation and Destruction* (2011–2018). This work was groundbreaking in itself, but the resulting "protomyth" cries out for a real-world explanation.

A Geomagnetic Application of Catastrophism

In trying to establish the physical nature of these puzzling mythical conditions, the basic approach is a revival of the old catastrophist philosophy. This contends that the planet and its life forms have not just evolved through an endless succession of minute changes in a steady, linear fashion, as the "uniformitarians" teach, but especially through short-lived episodes of widespread upheaval. In the catastrophist view, natural events not seen to happen in recent centuries have been a major driver of geological and biological change. Within the most recent segment of geological time, they could have left their imprints on human memories and institutions as well.

The myths often located the main actors and their associated "mythscape" in the sky. Accordingly, adventurous minds of a catastrophist bent traditionally sought their provenance in the interplanetary realm of comets, asteroids and planets. Planets on stray courses or giant comets and asteroids fragmenting and bombarding the Earth would have provided the ultimate content of many traditions. This angle was par for the course prior to the Space Age, when relatively little was still known about near-Earth space. However, solutions closer to home have become available with the increasing exploration of the Earth's finely structured magnetosphere and its dynamic interaction with the solar wind. Sure enough, the old storytellers just as often claimed the deities existed "on" Earth or very close to it,



Computer simulation from the 1990s of magnetic flow patterns in Earth's liquid core (a) before and (b) during a polarity reversal (Source: Gary A. Glatzmaier)

suggesting a possible atmospheric identity. These books offer a geomagnetic complement or alternative to earlier scenarios relying on close encounters with comets, erratic behaviour of planets and such like.

Auroral Mythology

The aurora tends to elicit deep emotions from its observers. Even some of the most level-headed scientists of the past would wax lyrical upon exposure to it. It is, therefore, not surprising that routine auroral displays at higher latitudes and rarer ones at lower latitudes were historically often expressed in symbolic or mythologising terms, both knowingly and naively, as opposed to dispassionate scientific jargon. The alluring transformations invited personification of the lights as living entities. Some common-folk descriptions involved celestial serpents, armies with swords or spears, the rising



It is easy to see how a towering atmospheric plasma tube of long duration could have inspired tales of a luminous tree, rope, ladder or stairway joining Earth to heaven.

of a night sun, and spirits of the dead engrossed in a ball game.

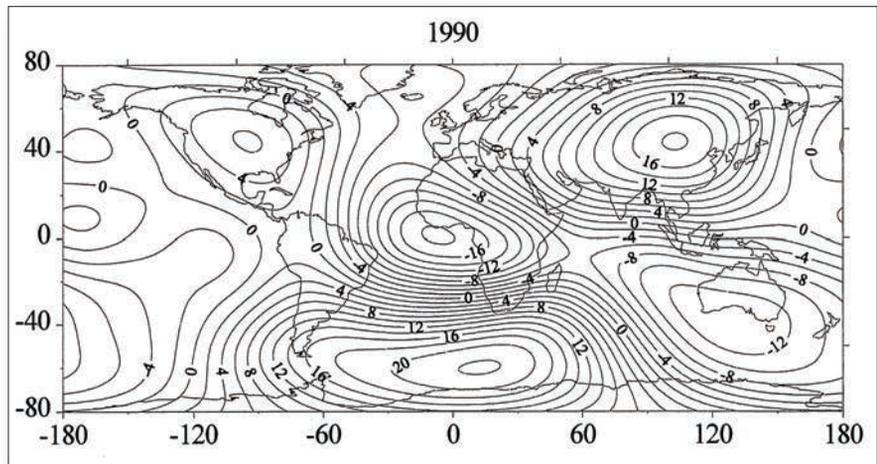
The scope of such "auroral mythology" could be widened to include more hypothetical applications. Perhaps the first to think along such lines—magnetic field lines, so to speak—was one Dominus of Larissa (AD c.420–c.480), a Syrian-Jewish mathematician who reduced the famous Greek myth of Phaethon and his burning of the world to an allegorical account of the phenomenon now called the aurora. Closer to the present, one could cite the French scientist Jean-Jacques d'Ortous de Mairan (1678–1771) and the Russian ethnologist and politician Nikolay Gondatti (1860/1863–1946). The former argued that the ancient Greek belief in a divine assembly on Mount Olympus sprang from sporadic observation of the aurora borealis over the mountain's distant peaks to the north; the latter saw echoes of the northern lights in myths of a calamitous "fire flood" told by the Mansi and Khanty nations of western Siberia.

None of these thinkers were catastrophists. Although they would sometimes deal with myths about catastrophes, the explanations they proffered invoked the familiar aurora, behaving as it does today. Yet why were a number of societies on opposite sides of the equator so mortally afraid of the aurora, or did they claim that it had been far more active in the past? Could there have been radically different manifestations of the polar light in times past that gave rise to colourful stories in the same way as the known auroral myths, be it that the character of these stories has so far gone unrecognised? Only the rarest of scholars has paused to contemplate such a possible "catastrophist" dimension to auroral mythology.

An Intense Aurora

As seen, Siscoe pondered the cultural vestiges of aurorae that would have appeared with greater frequency in unusual geographical zones. Creation myths played no part in his thinking, but were addressed by some who considered profound changes in the auroral profile without resort to reversals and excursions.

Surprisingly enough, the idea that the aurora could be scaled up was aired as early as 1808–1822, when the eccentric French "protosocialist" Charles Fourier (1772–1837) envisioned the cyclical growth of a large "boreal crown" and its austral complement somewhat like polar versions of Saturn's rings. The human race would prosper in the incessant brilliant light and preserve some memory of it in its pining for a lost "golden age". These claims were little more than fantasy, however.



The vertical component of the intensity of the geomagnetic non-dipole field at the Earth's surface for 1990, showing several positive and negative poles. (Image: R.T. Merrill, M.W. McElhinny and P.L. McFadden, *The Magnetic Field of the Earth* (1996), p. 54)

More recent incarnations of the bold concept of an "intense aurora" went beyond mere "crowns", but were intellectually more palatable. Two Canadians, Roger Ashton and Milton Zysman (1936–2019), put their very different respective mechanisms forward in 1987. The one involved an "auroroid" hologram of polarised stratospheric light, the other an upward extension of the aurora. In 2003–2011, a thought experiment in the latter vein received a more proper scientific formulation, drawing on cutting-edge theory and experimentation alike. In those years the American plasma physicist Anthony Peratt argued that a sustained increase in the intensity and height of the polar aurora prompted people everywhere to capture snapshots of it in the form of petroglyphs, rock paintings and geoglyphs. This could have happened repeatedly between 12,000 and 4000 years ago.

The World Axis in a New Light

The term *axis mundi* or "world axis" is an astronomical designation of the rotational axis formerly believed to pass through the Earth at the centre of the Universe. Hellenistic philosophers had conceived of it as a necessary consequence of the daily rotation of either a spherical Earth or the surrounding spherical cosmos, apparent in the movement of the celestial bodies. Almost immediately, a trend arose to treat some existing mythical imagery like sky-scraping giants and mountains as emblems of this majestic central column; Aristotle did so for the famous figure of Atlas and the pattern was followed wherever Greek astronomy was adopted, often on the flimsiest of documentary evidence.

In the early 1880s, the American theologian William Warren (1833–1929) effectively founded the modern study of the mythical *axis mundi*—"axonology", one might say—with his theory that the Earth's spin axis with

its extensions into space was poetically represented by all manner of pillars and other markers of a sacred cosmic centre in the cosmological belief systems of numerous traditional societies, with an implication that such features were believed to terminate at the celestial pole. Mircea Eliade (1907–1986), the prolific Romanian-American historian of religions, promoted a similar diluted understanding around the mid-20th century and has been followed quite uncritically by scores of anthropologists since.

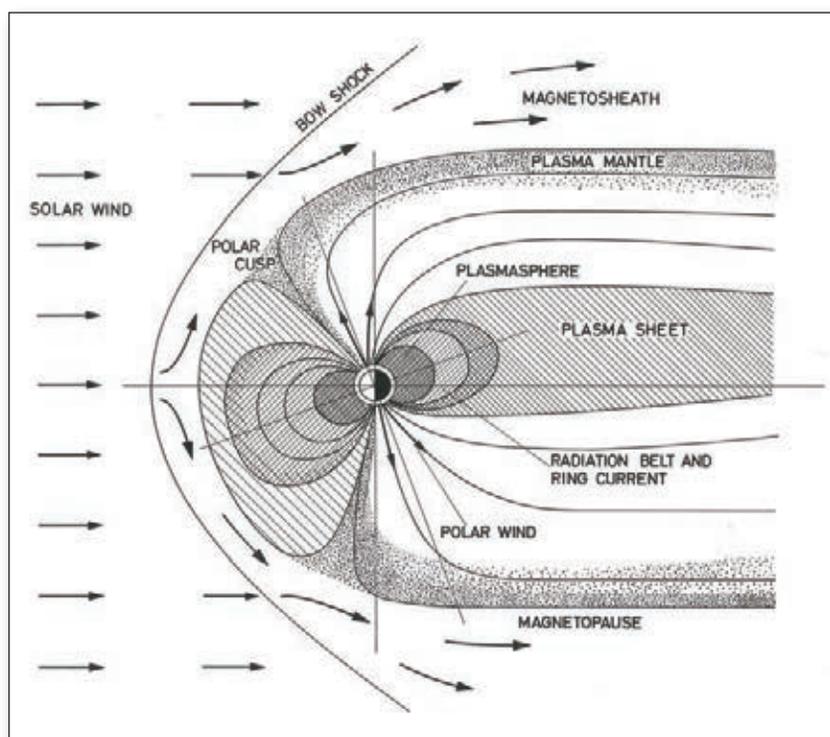
Putting a catastrophist spin on the subject, American researcher David Talbott first stated categorically—in the 1970s—that these myriad cultural expressions of a cosmic axis were not mere figments of a rich archaic imagination, but owed much to the shared observation of some actual polar entity, stupendous and dazzling. It was this conception that Ashton and Zysman strove to accommodate by postulating variations on the aurora. Peratt's model centred on a z-pinch plasma over the south geographical pole, undergoing instabilities discovered only recently in high-energy-density laboratory experiments. Peratt would not dispute the mythical connotations, but elaborated only on the column's connection with rock art and other tangible data.

The idea was thought-provoking, but ran into insurmountable difficulties. A fixed stationary column of limited width—no matter how tall—could never be perceived on the opposite hemisphere. How, then, could extremely similar accounts of it be attested in myths worldwide? Having the column move around would hardly help, as it went through an evolutionary sequence of forms that is likewise recorded globally from start to finish. Also, geographical and magnetic poles are not the same thing. It is far from obvious why an intense aurora would be centred on the former.

Nor could the idea of a polar column explain why the world axis of myth was so widely believed to reach up from the Earth to the very "top" of the sky, which could be the zenith directly overhead. After all, the apparent altitude of the pole in the sky correlates with geographical latitude; at the equator the pole appears on the horizon. A lustrous pillar at one of the geographical poles would not exceed this apparent height. On reflection, the notion of a world pillar reaching to the pole as the highest portion of the sky could only have arisen among people in two categories: those living at very high latitudes, which were always an isolated few; and those who had theoretically worked out that the Earth is spherical. The latter are not in evidence prior to

the Greek philosophers, but traditions about the world pillar are.

Clearly, progress was hindered by the unanimous assumption of only one physical "axis", which had to coincide with the Earth's rotation axis. Moreover, many ancient cosmologies explicitly asserted the existence of several sky pillars, either bunched together or at different points on the horizon. The upshot is unassailable: the cosmic columns of myth and ritual originally had nothing to do with the Earth's rotation axis. They were based on multiple prodigious sky pillars scattered around the globe, some of which could have appeared motionless and others moving. Scholars would do well to revise their definition of an *axis mundi* or replace the term in many



The Earth's electromagnetic environment, showing the polar cusps on the dayside and the outflow of polar wind. (Image: © Götz Paschmann. R.H. Eather, *Majestic Lights* (1980), p. 219)

contexts by something less evocative of rotation, like *columna mundi* ("world column").

The Polar Columns Hypothesis

A geomagnetic reversal or excursion is the only physical model that could realistically hope to make sense of the curious condition of multiple moving and standing sky pillars. Neither Zysman nor Peratt linked the enhanced aurora to these phenomena. Yet much is to be gained from a return to Siscoe's speculations on "excursion aurorae" and their role in prehistoric art and belief. What if these aurorae differed not just in their frequency, intensity and geographical distribution, as

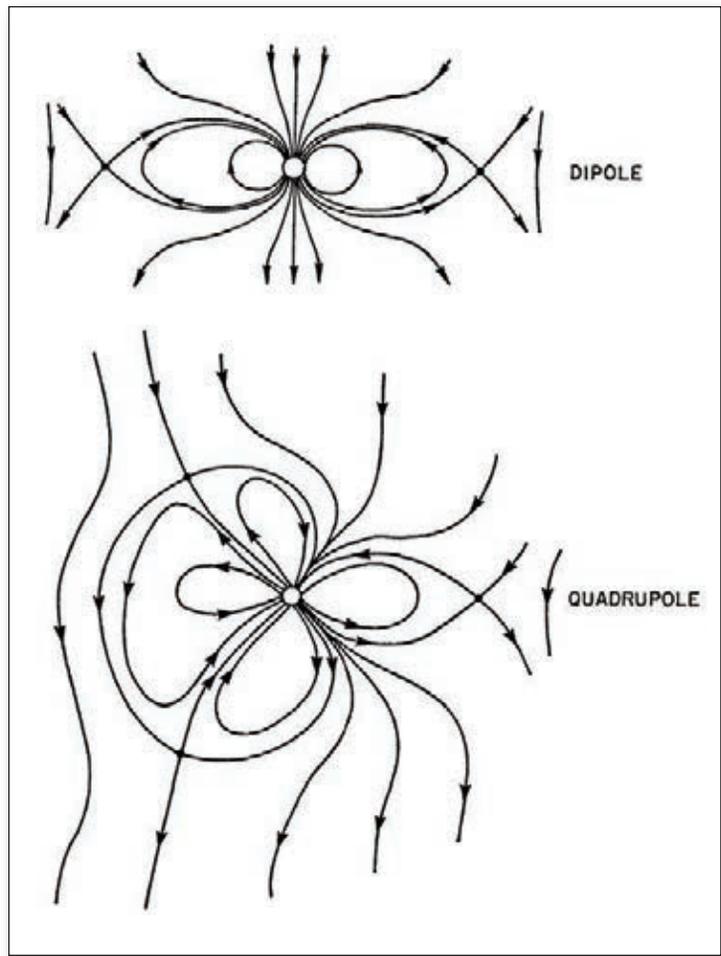
Siscoe fathomed, but also in their morphology?

The multiple magnetic poles, drifting or standing, could readily account for such mythical staples as one or more "cosmic eggs", a circular serpent around the horizon, odd "suns" or "moons", an original land or island in the air, a heavenly bridge, and an arriving or departing creator or culture hero. These would simply be imaginative descriptions of auroral foci centred on these poles in the form of a ring or oval, a crescent or a patch similar to a so-called polar-cap aurora. A focus would appear to rotate because of the diurnal variation of the magnetic field and could be smaller than today's auroral ovals, rendering it visible from the surface as a whole. In many places, diffuse aurorae or airglow might give the impression of a low sky. Discrete plasma filaments illuminating more of the delicate magnetic field structure could be the source of myths about other arcs and a spider's web, thicket or labyrinth in a nascent sky.

The mechanism for pillars enduring and lofty enough to have inspired the not-so-tall tales of axes *mundi* is more challenging. The arresting vertical rays sometimes seen to sprout up from auroral arcs may provide a pointer, but are too slight and fleeting. Zysman and Peratt both seized on the escape of surplus gases from the polar regions of the lower atmosphere well into the magnetosphere, especially on occasion of geomagnetic storms. A drastic increase in the upward flow of atmospheric oxygen and nitrogen plasma along existing geomagnetic field lines should effectively elevate the aurora.

This "plasma fountain" of rising particles is called the polar or auroral wind. Citing evidence that it intensifies at times of reversals and excursions, the new books contend that its interaction with the stream of electrons from the Sun would be required for the emission of auroral light. Just like today, that influx would be concentrated in the magnetotail on the Earth's nightside, but notably also in the polar cusps on the dayside. Whereas the flow into the nightside segments of the magnetosphere is an intermittent diversion, that into the polar cusps is direct and almost continuous, albeit with less energetic particles. This means that an "intense aurora" lighting up a polar cusp could create the impression of a stable pillar of gentle light, placidly swaying in response again to the diurnal variation. For reversals and excursions, the consensus is that the minor poles acquire not only auroral zones, but their own cusps in "minimagnetospheres". Hence each pole could sport its own "Peratt column". Tied to magnetic poles, specifically as polar-cusp aurorae, the columns could still be regarded as "polar", even away from the rotational poles. This critical nuance enables one to speak of a "polar-columns hypothesis".

Due to dramatic changes in the Earth's albedo or reflectivity, it might even be that much of the Earth's



Theoretical field line configurations for a magnetic dipole field (top) and quadrupole field (bottom), with a uniform external field superposed. (Image: George Leonard Siscoe)

surface was shrouded in near-darkness at the time recalled in the traditions, alleviated mainly by the light of the towering columns and other aurorae, airglow, lightning and fire. As the dipole recovered and the magnetopause receded towards a more normal position, the visual expansion of the cusps could seem to bring about a lifting of the sky, while the increasing percolation of sunlight would be a "cosmic dawn" ushering in the cycle of day and night.

Parallels on Large and Small Scales

Short of living through one, knowledge about the details of a geomagnetic excursion can be expanded by comparison with possible analogues both in space and laboratories. Various other planets in the solar system exhibit aurorae. The vastly different characteristics of these and their associated magnetic fields offer instructive windows on what the Earth may have looked like at times of geomagnetic crisis. Clues can even be obtained from solar properties and processes. For instance, the auroral foci of a vigorous multipole field

could well be "earthspots" analogous to sunspots.

As for practical experimentation, scientists have traditionally modelled the Earth's magnetism and aurora on miniature representations of the Earth called terrellae. The new book contains a historical survey of work on terrellae and solculi—or "mini-suns"—from the 13th century onwards, based on much original research. A new proposition is that some effects on terrellae that are not recognised in the Earth's current state may come into play during geomagnetic reversals or excursions. Were diminutive versions of the mythical "low sky", "earthspots" and "world pillars" unintentionally recreated in laboratories?

Dating Sites

Did any geomagnetic excursion actually transpire within the past 15,000 years or so, going by current scientific knowledge? Palaeomagnetism is the science in which past states of the Earth's magnetic field are reconstructed using data retrieved from suitable rocks or sediments of an approximately known age. Archaeomagnetism is the equivalent pursuit for archaeological objects such as bricks, pottery and kilns. The new book provides the most exhaustive and up-to-date listing available of palaeo- and archaeomagnetic evidence for at least two excursions that would have happened within human memory: the Gothenburg excursion towards the very end of the Pleistocene epoch and the Solovki excursion in the mid-Holocene. Each lasted a few millennia and in individual regions perhaps only centuries, befitting an "age of myth".

A subset of specialists dispute both excursions. Their objections are countered by the suggestion of a compromise: perhaps the relevant magnetic measurements can be interpreted such that the minor poles acquired more strength and the dipole field was tilted less than generally assumed by the defendants of the proposed excursions. Called a "minimum-effect excursion" or "pseudo-excursion", this type of transitional geomagnetic state had been theorised by physicists earlier. The polar-columns hypothesis might work even better on such a model.

Corollaries

The ramifications of all this are considerable. For one thing, it would turn out that the "creation" of the traditions was not the absolute beginning of the Earth or Universe, but a highly transformative process at a relatively recent time in the history of the Earth.

Second, the geomagnetic theory potentially sheds light on the rationale for the selection of sacred sites in ancient societies. Places struck by lightning or host to more elusive light phenomena such as "earthlights", ball lightning and UFOs were often set aside as hallowed and adorned with sanctuaries or monuments such as stone circles. Just so, prehistoric people could have sanctified

locations over which they observed the wondrous auroral foci expected for a geomagnetic excursion.

A third momentous implication would be that some of the most distinct components of the mythical landscape still exist today in the upper atmosphere or magnetosphere, but as magnetic structures and plasmas invisible to the human eye. The visual phenomena remembered in the ancient accounts—and possibly the associated mental states—may thus experience a comeback one day.

Synthesis

The ideas set forth in these books are not cast in stone or exclusive. While the input of professional physicists is warmly welcomed, future volumes in the series will examine evidence for widespread conflagrations and deluges, cosmic impacts and solar outbursts with equally substantial reverberations in myth and ritual. Psychosocial takes on myths in the spirit of Freud, Jung, Dumézil, Durkheim and Lévi-Strauss need not be invalid, but can be embedded layers of meaning secondary to the core narrative based on the physical causes, if they were not directly instrumental in the shaping of that narrative by the choice of metaphors.

That said, the geomagnetic hypothesis and other catastrophist interpretations may do more justice to the myths' traditional claim to truth than abstract or naturalistic theories limited to uniformitarian explanations, according to which, the tales effectively communicated nothing unusual. The scientific and historical truth value that can be accorded to these age-old stories may thus help to narrow the gap between Western science and non-Western world views. A renewed appreciation of ancient lore could serve as a binding factor uniting peoples from around the globe. A universal message is seen to come down to us from remote antiquity, able to ultimately reveal what was paradise; how its loss landed humanity in the mess it has been in since civilisation began; and, most importantly, the prospect of its restoration. Can we give it the green light?

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Marinus Anthony van der Sluijs holds a Master's Degree in Comparative and Historical Linguistics from Leiden University, The Netherlands, specialising in the Indo-European and Semitic language families. He was a Consulting Scholar at the University of Pennsylvania Museum of Archaeology and Anthropology (2009–2021) and has published in scholarly journals on diverse subjects in the history of science and of religions, comparative mythology, medieval literature and near-death studies. He can be contacted at <http://mythopedia.info/contact.html> and his books can be previewed and ordered from <https://mythopedia.info/books.html>.