

Book Reviews

Piccardi, L. and W.B. Masse (eds.), 2007. *Myth and Geology*. Geological Society Special Publication 273. London: The Geological Society

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This handsome volume bears witness to the growth and maturation of a relatively new direction in the respective disciplines of geology and comparative mythology. The term ‘geomythology’ was coined by geologist Dorothy Vitaliano in 1966 (Vitaliano, 1973), but it took substantial time for the subject to get off the ground. As the principal editor, geologist Luigi Piccardi, points out in the preface (p. vii), the validity of this fledgling interdisciplinary field has recently been endorsed by ‘respected scientific journals’, including *Science*, and, for what it is worth, the popular on-line encyclopaedia *Wikipedia* (s. v. ‘Myth and geology’).

The diversity of topics addressed by the 44 contributors to this volume in 25 articles testifies to the seemingly inexhaustible potential of the subject. Topics include, among others, geological information embedded in the sacred epics of India; a catalogue of meteorites recorded in classical literature; echoes of earthquakes, landslides and tsunamis in traditions from the northern Pacific coast of America and Japan; possible reflexes of palaeoseismics in Californian petroglyphs, Scandinavian mythology and traditions from Afghanistan; mythical reports of rising islands in Oceania and of exploding lakes in Africa; South American myths of catastrophist import; traditions hinting at comets and tsunamis from Australia and New Zealand; and traditional perceptions concerning fossils among indigenous peoples of North America and in England. Covering material from every inhabited continent, these papers are thus indicative of the global distribution of human traditions related to geological phenomena. Three other chapters help to place aspects of geomythology within a historical framework: Bruce Masse, Elizabeth Wayland Barber, Luigi Piccardi and Paul Barber address ‘the nature of myth and its role in science’ (pp. 9–28); Michael Roberts expands on changing geological concepts of time since 1550 (pp. 39–49); and Wolfgang Berger discusses ‘the discovery of the ice age’ (pp. 271–278).

A concomitant advantage to the large number of participating scholars is that it qualifies geomythology as a veritable ‘school of thought’, occupying a legitimate position within the history of successive paradigms both in mythology and geology.

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The occasional forays of past thinkers into this area – an example which comes to mind is Christian Blinkenberg's early exploration of human traditions concerning rock crystals and fossils dubbed 'thunderstones' (1911), acknowledged on p. 282 – were bound to be ignored as lone voices, arguably writing before the time was 'ripe' for such ideas. Now, strength in numbers, combined with the steep expertise of the specialists contributing to *Myth and Geology*, lend the interdisciplinary synthesis the status and attention it deserves. Moreover, a familiar pitfall of scientific approaches to mythology in general is that its researchers are trained scientists lacking sufficient background in the humanities. For example, attempts to extract and evaluate information about past environmental disasters from historical materials by dendrochronologist Mike Baillie (1999), cometologists Victor Clube and William Napier (1982, 1990) or nuclear scientist Richard Firestone and geologist Allen West (2006) have suffered from this academic imbalance. Although the majority of contributors to this volume are still scientists by profession, the book maintains credibility throughout, as the depth and adequacy of historical research shows across the board. The input from a healthy dose of humanities-based scholars, including mythologists Elizabeth and Paul Barber, theologian Michael Roberts, historian of religion Gregory Smits, anthropologist Eugenia Shanklin, rock art specialist Grahame Walsh, and classicist Adrienne Mayor has undoubtedly helped to ensure that historical sources were selected and perused judiciously. Patrick Nunn, Ronna Pastorizo and Bruce Masse are very well versed in the mythological traditions they examine; Masse, in particular, joins the fray with an impressive track record of publications on mostly Polynesian and South American material. Most of the essays contained in this book thus meet the highest standards of research and source analysis, even through the spectacles of historians, philologists, anthropologists or archaeologists – and that is precisely the fruit one would hope to see from an interdisciplinary adventure of this scope. The future looks bright, therefore, and the editors are to be congratulated on a highly meritable study.

The sole instances where the argument is carried more by an imaginative than a careful reading of the sources appear to be two articles concerned with Icelandic mythology. In Nils-Axel Mörner's interpretation of the myth of the Fenris Wolf (pp. 117–120), the mythological analysis is relatively poor and no primary sources have been cited; Grant's *Introduction to Viking Mythology* (2003) will not do. And Wolfgang Berger's identification of Ice Age memories in the Eddic tradition (pp. 275–277) fails to convince for at least two reasons. First, the author would need to argue that the 'icy' episodes of the *Eddas* originated in northern Europe prior to 3 000 BCE at the latest, yet at that time the Indo-European ancestors of the peoples speaking Scandinavian languages were still roaming the steppes north of the Black Sea; during the fourth millennium BCE, they would still have occupied their earliest homeland in the Armenian highlands (Gamkrelidze & Ivanov, 1995), far from the glacial world of the Arctic. In order to maintain his hypothesis, it is incumbent on Berger to demonstrate that the motifs of ice and the rime giants traced to a non-Indo-European, possibly Uralic element subsumed in the later population of Iceland. And second, if the intention is to identify

Niflheim, the realm of cold, with Ice Age northern Europe, while the opposing world of fire, Muspelheim, corresponds to ‘warm winds from the south’ (p. 275), as the text appears to argue, the polar scheme of cosmogony in Icelandic mythology is effectively ‘Euhemerised’ by its transposition from an unorganised primordial state of universal chaos to the map of Europe. Such a take on cosmic domains described in creation myths is uncommon and at the very least needs to be justified in a historical context, e.g. in relation to polarised cosmologies of the Zoroastrian type. A priori, a more attractive understanding of the term ‘Midgard’, based on the original passage in Snorri’s *Edda* (*Gylfaginning*, 8), is that it denoted the circular earth as opposed to the bits of land beyond the ocean that surrounds it, which are referred to as ‘Utgard’; far from based on a ‘Eurocentric’ impression of the world, the underlying scheme is arguably more akin to that expressed in the famous Babylonian world map (ninth century BCE or later), on which seven or eight triangular outlying districts, labelled as *nagû* or ‘districts’, are arranged in a circle around the world ocean (see Unger, 1970:20–22; West, 1997:145; Horowitz, 1998:20ff.).

As a pioneering publication facing so many intellectual challenges, meanwhile, *Myth and Geology* can hardly be blamed for a lack of clarity concerning the exact delineation of the subject, leaving the reader struggling with a sense of terminological imprecision and questions about the ramifications of geomythology for the meaning and origin of myth. The chapters on the place of geomythology within the theory of mythology and the history of science as a whole are a welcome start, but by no means definitive. Specifically, although ‘geomythology’ is certainly an attractive label, its application in the text does not always seem apposite. The conceptual difficulties surrounding the use of the term in this book can be grouped under three headings.

First, the ‘mythological’ part of ‘geomythology’ is liberally extended to various other types of information from human history than mythology per se. Beyond the constraints of Old World literature, it is fair enough to concede with Masse et al that “‘Legend’ and ‘myth’ are largely synonymous terms” (p. 9), allowing, e.g., three ‘popular legends’ from the Iranian world (pp. 126–127) or the Hebrew story of the destruction of Sodom and Gomorrah (pp. 133–142) to be discussed alongside proper myths such as Maui’s fishing up of islands (pp. 143–163) or South American myths of earth-ravaging fires and floods (pp. 177–202). Yet, in general, it would be pushing the understanding of ‘mythology’ too much to make it include petroglyphs (pp. 107–115), historical records of meteorite falls (pp. 215–225), or folklore terminology for fossils (pp. 279–294). Images on rocks and traditional explanations of meteorites or fossils often exhibit an intricate relationship with myth, but in essence they remain different fields of data. A far more satisfactory catch-all designation of such data would be ‘human tradition’, as the actual purpose of geomythology is to examine any conceivable type of human tradition, including myths, rituals, traditional costumes, songs, architecture or knowledge, with a bearing on geological phenomena. The trouble is, of course, that the word ‘tradition’ does not make for a convenient, Latinate constituent of a composite

noun. In the absence of a better term, ‘-mythology’ may just have to do (cf. Vitaliano, 1973:3).

A second problem with the use of the word ‘geomythology’ is that the ‘geology’ is sometimes made to include astronomical and atmospheric phenomena. This happens, for example, when Bryant, Walsh and Abbott treat native Australian comet traditions (pp. 203–206), d’Orazio enumerates classical observations of meteorite falls (pp. 215–225), or Masse and Masse sketch the anxiety caused in some South American cultures upon the observation of electrophonic bolides (p. 193). While Bruce Masse apparently draws a fairly clear line between the geological myths presented in this volume and cometary myths, as discussed in other publications of his (e.g., 1995, 1998; Masse et al, in press), Piccardi explicitly extends his definition of ‘geomythology’ from ‘geological phenomena and aspects’ to one ‘in a broad sense including astronomical ones (comets, eclipses, meteor impacts, etc.)’ (p. vii). Obviously, objects found on earth that owe their origin to direct influence from the atmosphere, such as meteorites, tektites and fulgurites, can lay claim to geological, meteorological or astronomical status with equal rights, yet eclipses, comets, meteor showers, and a host of other phenomena such as rainbows, lightning, haloes, the zodiacal light, the aurorae and all stars and planets have no place in geology as such. Masse, while making another point, quite rightly contrasts ‘Earthly geological events and processes’ with ‘the sky’, ‘not simply the fixed celestial heavens of regularly moving and largely predictable stars, constellations, planets, Sun and Moon, but also ... the abode of a large number of transient phenomena and events such as comets, novae, meteors and meteor storms, eclipses, auroras, and other such celestial and meteorological happenings’ as two distinct classes of ‘natural events and processes’ that have impinged on human tradition (p. 17). The study of ‘traditional’ knowledge of celestial bodies and their movements, as well as of transient events in the heavens, is a respectable discipline in its own right, which is generally called ‘history of astronomy’ when pertaining to the literate societies of the Old World, ‘cultural astronomy’ or ‘ethnic astronomy’ with reference to all other cultures when observed by these societies, and ‘archaeoastronomy’ in relation to archaeological, usually prehistoric evidence for conceptions about the sky.

Insofar as the natural world, from a naïve, earth-bound perspective, can roughly be divided into a ‘terrestrial’ and a ‘celestial’ component, it would seem sensible to distinguish between ‘geomythology’ and the mythology of atmospheric, astral or celestial phenomena. The latter, unfortunately, still suffers from a bad intellectual hangover from the exaggerated claims of universal astronomical wisdom propounded by the Pan-Babylonianist movement during the early twentieth century. Concurrent with the burgeoning interest in geomythology, however, the astronomical elements in mythological traditions have enjoyed renewed scholarly attention in recent decades, and ought to be seen as an interdisciplinary exercise in their own right, which forms the natural complement to geomythology. As examples of this direction one could cite Bobrowsky and Rickman’s edited volume on the reflexes of comet impacts in human society (2007); Peratt’s on-going modelling of a high-energy density aurora in the early

Holocene that was recorded in non-figurative petroglyphs, pictographs and geoglyphs around the world, and, arguably, in mythological traditions as well (Peratt, 2003; Peratt et al, 2007); or fresh indications that knowledge of the relative sequence of planets in space as far as Saturn was present in Egypt and Babylonia before the heyday of Greek science, where it may have found expression in the colour scheme of Neo-Babylonian ziggurats (James & Van der Sluijs, 2008). In order to avoid any undesired association of such recent developments with Pan-Babylonianists, it is here proposed that the study of meteorological and astronomical influences on human traditions be referred to as *cosmomythology*.

Geomythology and ‘cosmomythology’ conjointly represent a 21st-century revival of the old ‘naturalist’ school of mythology, sharing the central premise that many traditional myths express phenomena in the natural environment that have been directly witnessed. This paradigm opposes the ‘introspective’ and structuralist psychosociological models preferred by mythologists during most of the twentieth century, that were championed by thinkers such as Sigmund Freud, Carl Jung, Joseph Campbell, Émile Durkheim, Georges Dumézil, and Claude Lévi-Strauss (a brief overview is offered by Masse et al, pp. 11–14). In deference to the limited explanatory power of the theories expounded by these authorities, especially in view of any mythological references to the external, natural world, the nascent fields of geomythology and ‘cosmomythology’ can together be regarded as a modern continuation of the nineteenth-century ‘nature school’, which sought to invoke the ordinary properties of the sun, the moon, vegetal life, and so forth as the inspirational source of prominent mythical themes. Yet unlike the old school, the modern interdisciplinary approach is initiated by scientists rather than humanities-based scholars and, accordingly, benefits from the immensely improved state of geology, geophysics, climatology, plasma physics, astronomy, and related scientific disciplines enjoyed today, exploiting cutting-edge scientific knowledge rather than the anodyne stereotypes of a sterile Copernican cosmos devoid of any change or electromagnetic forces, as were used in earlier, now obsolete attempts to ‘decode’ cosmological content in mythical data. Placing far less emphasis on elaborate metaphors and the linguistic aspect of the names of mythical characters, while steering clear of the danger to ‘do mythology’ without adequate control over the primary source material, the new proponents of ‘nature mythology’ recognise the ‘myth-inspiring’ capacity of short-lived, dramatic events – such as tsunamis, volcanic eruptions, aurorae, lightning or meteor showers – instead of less ‘awe-inspiring’ and more predictable spectacles such as the sunrise or the lunar cycle. As Masse et al put it:

Several of the most damaging geophysical catastrophes like earthquakes, tsunamis, volcanic eruptions or meteorite impacts were probably recorded in myths, for two reasons: first because they were very unusual and mysterious phenomena, and second, because their impact on local societies made them important events to be remembered. ... Cosmogonic myths represent a rich and largely untapped data set concerning the most dramatic natural events and processes experienced by cultural groups during the past several thousand years. (p. 16, 177; cf. Vitaliano, 1973:11)

The recognition that myths were mostly about striking rather than mundane events typifies the new brand of nature mythology. *Transient natural phenomena*, both on earth and in the sky, are now acknowledged as credible sources of inspiration for widespread mythical themes. The psychosociological theories espoused by the likes of Jung and Lévi-Strauss, meanwhile, retain much of their value, as the representation of physical prototypes by mythical symbols, such as ‘dragons’ or ‘gods’, required psychological input that exposes much of the mental and cultural preoccupations of the people involved (compare Masse et al, p. 17f., 25). Yet rather than to elevate these catalysing psychological and sociological influences to the status of inspiring myths of their own accord, geomythology and ‘cosmomythology’, like the old-school naturalists, do more justice to the claims of historicity and veracity made by the originators and transmitters of the relevant myths themselves:

Astronomy shares with the Earth sciences a kindred relationship in that both can be used not only to demonstrate the reality of many myths but also to serve as vehicles by which to mine myths for important information about these natural processes and events ... At the very least, our various geomythology researches provide us with a profound respect and appreciation for the observational powers of our ancestors ... (Masse et al, p. 10f., 26)

A final issue with the concept of ‘geomythology’ concerns the question of origins of mythical motifs. What does it mean when a tradition identifies local dinosaur bones as the remnants of a dragon? Piccardi specifies that ‘Geomythology indicates every case in which the origin of myths and legends can be shown to contain references to geological phenomena and aspects ...’ (p. vii). Masse et al concur when they identify the subject as ‘the study of the geological origin of myths and legends’ (p. 10). But is a dragon myth sufficiently explained when a traditional opinion identifies reptilian fossils with dragons? Has it really been demonstrated that such fossils account for the *origin* of the dragon motif? A more careful assessment would be to treat a ‘mythological’ correlation between fossils and myths as just that – a correlation, which can equally be interpreted as a *reflex* or the origin of a dragon myth. It is perfectly conceivable that people not exposed to the ‘modern’ interpretation of fossils would have interpreted these as the tangible remains and visible proof of the former existence of creatures they already knew from pre-existing beliefs. This line of reasoning is followed by Van der Geer et al (2008:87, emphasis mine), who argued with respect to the fossils at the Siwalik Hills in north India (compare p. 246) that ‘The abundance of bones is likely to have *contributed* to the mythologising of the battle and its hundreds of heroes ... It is likely that the many petrified bones, molars, and tusks found on the surface of the Siwalik Hills in the same area became *integrated* into an *already existing* story of an important battle.’ The advantage of interpretations of this type is that they allow alternative, yet no less scientific explanations of numerous aspects of the relevant myths that the fossils alone could not account for. The widespread association of mythical dragons with earthquakes, carving out waterways, lightning, a gemstone which they jealously guard, luminosity, flight, the night sky, and so on receives no illumination from the mere observation of fossils alone.

Localisation is a common tendency in mythology, which Barber and Barber (2004) may wish to add to their insightful repertoire of ‘myth principles’: whenever a specific feature of the local landscape reminds ‘traditional’ people of an aspect of the mythological landscape, the myth will be localised and adapted to that setting. Fossil finds in the Siwalik Hills apparently fuelled localisation of the mythic war described in the *Mahābhārata* in this area. There is reason to believe that the discovery of amber in a pungent body of water, such as associated with the river Po, the Rhône, or the ‘Isle of Ammon’ in Ethiopia (Euripides, *Hippolytus*, 735–741; Aristotle, *On Marvellous Things Heard*, 81 (836a–b); Pliny, *Naturalis Historia*, 37. 11. 31–33, 38; Pausanias, *Periegesis*, 5. 12. 7; Apollonius Rhodius, *Argonautica*, 4. 595–628; Strabo, *Geography*, 5. 1. 9 (215); Nonnus, *Dionysiaca*, 23. 89–93; 38. 92–102), was sometimes employed as an argument for identification of the scene as the mythical Eridanus, in which Phaethon had drowned following his spectacular plunge from the sky. Awareness of this tendency to localise myths helps to illuminate questions of origins. For example, the spectacle of Etna’s eruptions, on Sicily, famously prompted Greeks to identify the volcano as the burial place of the dragon Typhon (p. 16), yet as ‘Vertreter der vulkanischen Kräfte’ the same monster was also localised in Cilicia, Egypt, Syria and the Caucasus mountains (Worms, 1953:36); according to Virgil (*Aeneid*, 9. 715–716), Lucan (*Pharsalia*, 5. 99–101), Strabo (*Geography*, 13. 4. 6 (626C–627A)), and others, Typhon was interred beneath the island of Inarime, the modern Ischia, opposite Naples. When it is further considered that the motif of Typhon’s burial belongs to the wider, mythological theme of a dragon chained underneath a mountain (see Olrik, 1922:84, 98, 100 for parallels) and the perception of a dragon in the smoky furnace of a volcano requires a prior concept of a fiery dragon, Typhon’s link with Etna, far from explaining the *origin* of the myth, emerges as a localised *reflex* or *expression* of a pre-existing tale, inspired by the scenery on Sicily. It is suspected that Masse et al will agree with this and, in fairness, their wording that ‘the imprisonment of Typhoon [sic!] under the volcano Etna, has been interpreted as a memory of some period of intense activity of Etna and other volcanoes in the Mediterranean’, is irreproachable when stated in this form. Much could be gained, however, if a careful distinction were to be made consistently between correlations of mythological and geological data, and the significance of those correlations in terms of origins.

Ideally, ‘local’ motifs are carefully balanced against ‘global’ ones for each individual tradition. Nunn and Pastorizo acknowledge that the Polynesian variations on the theme of fishing up islands exemplify the much more widespread theme of ‘land-raising myths’ (p. 145). What are the implications of this understanding for origins? When viewed in their original, narrative context, ‘land-raising myths’ typically belong to the genre of creation mythology. At best, it seems, geohazards experienced in the Pacific could have modified and reinforced an archaic, existing motif that itself rooted in a more widespread mythical substratum. If ‘fishing up’ myths are held to ‘recall catastrophic events, ranging from volcanic eruptions, earthquakes to large waves’ taking place at different points in time (p. 150), the original events underlying the myths are viewed

as repetitive occurrences of an on-going nature. To what extent does this contravene the understanding that Maui's fishing up of islands was a creative activity limited to *illud tempus*, a mythological era of creation that traditional societies would set apart from the 'present' time? Any attempt to explain a mythological tradition needs to take into account whether the mythical event was originally perceived as a one-off historical occurrence, such as the fall of a meteorite at Campo del Cielo (pp. 193–197), a generic event, such as the occasional spotting of 'Thunderbirds' or the fall of 'thunderstones', or a creative event that supposedly transpired just once at a distant time in the past. If Maui's island-making activities are transposed from a mythical era of creation to intermittent moments in the present age, one is also left wondering what the referents of Maui's implements and of Maui himself are in the natural phenomena that are being observed?

A systematic and stringent distinction between 'local' and more widespread motifs will likely prove beneficial to mythical theory, as it serves to clarify the limitations of what can be explained in each case. As an example, the Greek myth of Typhon's rebellion against Zeus is suggestive of the emergence of a prodigious, smoky column touching the zenith, whose dislodgement restored peace to an imperilled world. A plausible historical prototype of the story is the Hittite myth of the 'diorite giant' Ullikummi (this is the 'bellowing young giant' of p. 21), perhaps along with the column of fire and cloud in the Hebrew tradition of *exodus* from Egypt (*Exodus* 13:21–22). Sufficiently similar parallels for such 'smoky pillar gods' are not widely found in the mythologies of cultures outside the ancient Near East, however.¹ Consequently, the traditions of Ullikummi and Typhon appear to be a local, Levantine theme that may very well – in its familiar forms – trace to observations of the Plinian eruption of Thera during the mid-second millennium BCE. This local set of myths, in other words, can be matched with a local geological event, yet there are other, more widespread myths that may very well need to be explained with geological or cosmological events transpiring on a much larger, possibly global scale. In such cases, explanations resorting to local phenomena will usually be found inadequate. When, for example, 'Hugh Falconer ... suggested that the giant tortoise that supports the primordial world ... might very well be based on the actual fossils of the giant tortoise *Colossochelys*, found in the Siwalik Hills' (Van der Geer et al, 2008:75), one objection is that the cosmological motif of an earth-bearing tortoise is not limited to India, but is well attested for unrelated cultures in Central and North America (e.g. for the Seneca Iroquois, see Converse, 1908:33–35). Again, when Mayor (p. 246, with 2005:73; compare Strabo, *Geography*, 16. 2. 7; Malalas, *Chronicon*, 8. 197) makes a case that the river Orontes was named after a mythical giant of that name, identified as the dragon, Typhon, whose skeleton was identified in Tiberius' time with bones retrieved from the clay of the dry riverbed, she may like to take on board that dragons worldwide were thought to have had a propensity for carving out rivers; examples come from the mythology of the Fon people, of Benin (Mercier, 1954:221), native Australian communities along the Murray River (Smyth, 1878:456) and the Drysdale River (Hernández, 1961:118), and quite a few others. Finally, when

Berger ventures to explain the Icelandic myth of the creation of the world out of the body parts of the giant Ymir in terms of post-glacial northern Europe emerging from the ice (pp. 275–277), he would be well advised to take notice of the global extent of the motif of creation following dismemberment of a primordial giant (see conveniently Baumann, 1986:passim). In cases such as these, fossil bones or other aspects of the landscape appear to have corroborated, not originated – pre-existent stories that were shared with numerous cultures from around the world. Where does this leave the ultimate explanations for these earlier, more archaic motifs?

Recurrent mythical motifs of a practically global distribution tend to belong to a body of traditions that can conveniently be called ‘creation myths’. Examples of such motifs are the presence of a primordial era of absolute darkness, during which not even the stars were seen; the original proximity of ‘heaven’ and earth, followed by the eventual separation of these; original close contact between the ‘ancestors’ or ‘gods’ in the sky and the ‘people’ or ‘animals’ on earth; the construction of four sky pillars at the cardinal directions and a single pillar in the centre, ‘navel’ or ‘heart’ of the world; the presence of a circular ‘ocean’ surrounding the disc of the earth; the existence of a hole in the sky, sometimes situated at the pole, and a corresponding aperture in the earth; and so forth. In these and other cases, the near-universal distribution of a motif can never just be assumed and needs to be conclusively demonstrated first. As the comparative analysis progresses, some notions that would at first have seemed isolated and anomalous turn out to be surprisingly widespread and to belong to this ‘global’ stratum. Masse and Masse (p. 192) weed out a number of ‘fantastic images’ from the myths they discuss, yet baffling themes such as a sky that was made of stone, or a former sun that never moved, have been attested widely. As an example of the latter, a Javanese creation narrative, concerned with the time ‘before the heavens and earth were created’, casually informs: ‘The continual presence of the sun and moon occasioned perpetual day’ (*Manik Maya*, 1, tr. Raffles, 1817:206). And, according to the Maraura people of New South Wales, ‘at one time the sun never moved, and ... Nurelli, being tired of an eternal day, ordered it to go down to the west’ (Howitt, 1904:428), while, in a part of Victoria, it was agreed that ‘at the beginning the Sun did not set. It was at all times day, and the blacks grew weary ...’ (Smyth, 1878:430).

Mythical ‘archetypes’ of this type are much harder to fathom from a scientific point of view, but differ from more clearly ‘local’ themes in scale alone, not in essence. As continent-wide or global catastrophes are necessarily much rarer than environmental upheaval on a smaller scale, the phenomenology of such events is far harder to reconstruct, but progress is being made. Firestone, West et al (2007) presented evidence that a comet impacted on North America in $\pm 10\,900$ BCE, on the boundary between the Pleistocene and the Holocene. An event of this magnitude, which may also have triggered an intense geomagnetic storm, offers a promising explanatory framework for widespread mythical motifs of the type enumerated above. Masse and Masse submitted that ‘a period of intense darkness during daytime hours could logically result from several phenomena, including solar eclipses, dust storms, smoke from mass fires,

volcanic ash plumes, or the stratospheric dust loading from the coma of a dusty large near-Earth comet ... ' (p. 187). Along those lines, the darkness that prevailed prior to creation – according to countless creation myths worldwide – may ultimately be associated with the comet impact hypothesised by the team of Firestone and West. In brief, geomythologists as well as 'cosmomythologists' are advised to develop a greater sensitivity for the scale of any given mythical motifs; the gamut from local to global stories arguably reflects a corresponding difference in scale of the physical phenomena that triggered these tales.

Not surprisingly for such a fertile field of exploration, much additional material and many suggestions for future research can be offered. What is missed in McNamara's discussion of 'thunderstones' (pp. 279–294) is a clear analysis of the rationale for the ancient and widespread association of such objects with lightning and thunder. The notion that fossils and prehistoric stone axes are sometimes exposed to the surface in the wake of thunderstorms (e.g. Van der Geer et al, 2008:83, 85) leaves unexplained why folklorists do not also learn of 'windstones' or 'rainstones' – just why did so many traditional societies single out thunder or lightning as the depositing agent? The charred appearance of some prehistoric or palaeontological objects might suggest deposition during a thunderstorm, but does not characterise the large majority of 'thunderstones'. A possibility worth considering is that the motif of stones descending in the lightning ultimately traced to knowledge of objects that actually do form in association with lightning, i.e. of fulgurites, or with meteorites or airbursts, i.e. of tektites, if the blazing trail of the meteor was confused with 'lightning'. How could such 'thunderstones' have come to be linked to Neolithic celts or fossil Echinoids? Regarding the former, if they had been recognised as ancient implements, albeit non-metallic ones, they could have been 'confused' with 'thunderstones' because axes used to be made of meteoric iron at least in parts of the Near East (e.g. Rickard, 1930:325; Wainwright, 1932:160, 163; 1933:50; 1934:33; Bjorkman, 1973:110, 113f., 124–126; King-Hele, 1975:3; Hutchison, 1983:27; Roth, 1993:70–72). Fossil Echinoids, meanwhile, may have been linked to thunderstones for their star-shaped patterns, which may naïvely have suggested to some that they were 'fallen stars'. Alternatively, it may be significant that there is some similarity between their radial symmetry and the prongs of the Vedic lightning weapon, the *vájra*, when viewed transversely. In Tibet, ceremonial representations of the *vájra*, known as *rdo-rje* 'were often cast from meteorite iron' (Beer, 2003:88), yet the traditional shape of the *vájra* itself still requires elucidation.

To d'Orazio's helpful catalogue of meteorites in Greek and Latin literature (pp. 215–225), which is complemented by Bjorkman's treatment of meteorites in cuneiform texts (1973), one could add an early hunch that the *omphalós* at Delphi may have substituted an earlier meteorite venerated in cult (Roscher, 1913:124); and the *argós lithos* or 'unwrought stone' worshipped at Gythium, Laconia, as Zeus Kappótas or 'Zeus fallen down' (Pausanias, *Periegesis*, 3. 22. 1, with Farnell, 1896:102–103). Plutarch's mention of 'a very large fiery body' observed in the sky prior to the fall of the meteorite at Aegospotamoi (p. 217) is confirmed by Pliny (*Naturalis Historia*, 2. 59 (149)) as well

as in Aristotle's intimation that 'its fall coincided with the appearance of a comet in the west' (*Meteorologica*, 1. 7 (344b), tr. Lee, 1952:54–55). Although d'Orazio 'was not able to find a mention' of the 'heavenly origin' of the meteorite of Artemis at Ephesus in classical literature (p. 221), the Hittite *Annals of Muršili II* (thirteenth century BCE) do state that a ^{GI8}*kal-mi-ša-na-aš* or 'thunderbolt' fell at Apašaš – which is Ephesus – while the king and his army were marching towards the land of Arzawa:

Wie ich aber marschierte, wie ich da zum Gebirge Lawaša gelangte,
da zeigte der stolze Wettergott, mein Herr, seine göttliche Macht,
und einen Donnerkeil schmetterte er hin. Und den Donnerkeil sah mein Heer,
auch das Land Arzawa sah ihn, und der Donnerkeil ging hin
und traf das Land Arzawa, auch des Uḫḫa-LÚ-iš Stadt Apaša traf er ...
(Muršili II, *Ten Year Annals*, 17 (year 3), KBo. III 15-19 = 2 BoTU 48, tr. Götz
1967:46–49; cf. KUB. IV 15 = 2 BoTU 51A)

This may well have been the very meteorite that was subsequently placed in Artemis' temple (Garstang, 1947:225). Finally, the argument that Phaethon's fall was associated with the descent of a meteorite can be strengthened considerably on the basis of classical texts (see also Van der Sluijs, in press). Ovid's portrayal of Phaethon's crash as the fall of a meteor aside (*Metamorphoses*, 2. 320), the poet Gaius Valerius Flaccus (first century CE; *Argonautica*, 5. 471–478 (429–432)) characterised the charred remains of Phaethon and the chariot as *ater globus*, a 'black ball' or a 'dark globe', language that is strongly suggestive of a meteorite (Kugler, 1927:38). Further, the Byzantine chronicler, John Malalas (sixth century CE; *Chronographia*, 1. 3 (7); compare Tzetzes, *Chiliades*, 4. 367–388), regarded the legend of Phaethon as a corrupted memory of the notion that God, in the Biblical time of the 'giants', had dropped a 'ball of fire' onto the land of the Celts, which burned up the land and was extinguished in the river Jordan. More speculatively, might the 'amber tears' shed by Phaethon's sisters, on which classical mythographers placed so much emphasis, echo memories of tektites deposited at the time of Phaethon's 'thunderbolt'? The glassy substance of tektites and fulgurites, the extensive fields of Libyan Desert Glass, believed to be a 'form of impactite glass but of an exceptionally pure silica glass' (Norton, 2002:296 figure 12. 28), and Phaethon's intimate association with what the Greeks called 'Ethiopia' (Van der Sluijs, 2008) combine in a tantalising jigsaw puzzle with plenty of opportunity for geomorphologists to explore.

With these suggestions out of the way, only a few minor quibbles remain. The sacred stone of Aphrodite worshipped at Paphos, Cyprus, was not black, but *leukēi* (dative singular) or 'white', according to the Greek philosopher, Maximus of Tyre (second century CE; *Oration*, 2. 8), though the whiteness 'might perhaps have been due to painting' (Antoniadi, 1939:178). The 'writings of the novelist Euhemerus' were not 'echoed by Herodotus' (p. 11) for the reason that Herodotus antedated Euhemerus by a century or so. The association of Mircea Eliade with the 'psychological school' of myth (p. 13) seems unwarranted; Eliade was notoriously reticent to elaborate on the

actual origins of mythological motifs. If anything, the statements he did make betray a close affinity with the nature school of the old-fashioned type:

... it is clear that we are faced with, respectively, a sky symbolism, or a symbolism of earth, of vegetation, of sun, of space, of time, and so on. We have good cause to look upon these various symbolisms as autonomous 'systems' in that they manifest more clearly, more fully, and with greater coherence what the hierophanies manifest in an individual, local and successive fashion (Eliade 1958:449f.)

It is doubtful whether any mythologist today would concur that, in Greek mythology, 'Eos and Hesperus represent the sun respectively in its crucial aspects of coming up in the morning (creating the day) and going down in the evening (cutting off the day)' (p. 20); there is no need for a modern-day Max Müller to challenge the ancient understanding of these entities as respectively the dawn and the evening star, the latter generally identifiable as Venus in that aspect. A useful avenue to explore in order to explain the apparent multiplicity of 'sun gods' in Greece or in Egypt is to consider that some may originally have had a very local character. For instance, although Helios was certainly a linear descendant of the Proto-Indo-European sun, his cult appears to have been prominent in Rhodes alone. There is no denying that the popularity of Euhemerism is in steep decline (p. 13), but the odd proponents are still encountered in twentieth-century literature; in 1959, the eminent mythologist, Joseph Fontenrose, revealed:

I do not consider myths to be the oldest kind of story to appear among mankind ... I would suggest that man's first narratives were accounts of striking events of the immediate past: extraordinary perils and adventures during hunts, migrations, explorations, encounters with strangers. Such elementary narratives would soon turn to legend (1959:464)

Mayor's argument that Quetzalcoatl's peregrinations may be reflected in various fossil impressions in bedrock (p. 249) loses some of its appeal in view of the anthropomorphic way in which this character is presented prior to his ascent to the sky from his funeral pyre; the suggestion put forward in the article may be maintained if the narration in the text, primarily *The Annals of Cuauhtitlan (Codex Chimalpopoca, 7. 22–46)*, was a Euhemerised retelling of a story that had originally involved a wandering feathered serpent, as is likely. The perceived resemblance of elephant skulls on Sicily to the mythical Cyclops (pp. 268ff.) seems forced, as the central nasal cavity in these skulls, at the position where the trunks would have been, is not circular in shape and could hardly have inspired the sobriquet *Kýklōps*, meaning 'round eye' or 'wheel eye'; one would rather expect **Mónōps*, 'single eye' or **Kéutrōps*, 'central eye'. Finally, the claim that 'a surprising number of different cultures seemingly recognized precession' (p. 17) does not stand up to scrutiny; the source appears to be De Santillana and Von Dechend's *Hamlet's Mill* (1969; discussed at more length in Barber & Barber, 2004:192–217), which, for all its erudition and sagacity, fails to prove its tenet that mythical traditions in different parts of the world encoded knowledge of the precession

of the equinoxes. Apart from a dearth of irrefragable evidence, the entire theory rests on the tacit assumption that such a slow and almost imperceptible process as the precession would have been interesting enough to ancient societies to weave stories about them, often coupled with elaborate ceremonial rituals and sacrifices. In the face of what is currently known about the violent history of climate and environment during the Holocene, this prerequisite can hardly be upheld. As stated, ‘myth-makers’ are far more likely to have derived their inspiration – for vivid, evocative stories such as the divine succession from Uranus to Cronus and then to Zeus – from spectacular events such as close encounters with comets and high-energy auroral displays than from the mind-boggling tedium of stellar precession.

On an editorial note, the book is beautifully presented and pleasant to read in the two-columns format used, though readers with other backgrounds than the sciences will lament the systematic absence of page numbers in bibliographical references. Mayor’s riveting overview of classical toponyms with palaeontological meaning (pp. 245–261) would have been more valuable if chapter and verse had been given for the classical passages. Moreover, the number of typographical errors is too large for comfort. Just a random selection of examples will suffice: ‘*primarily*’ (p. vii); ‘*ethnographisch*’ (p. 6, bibliography s. v. ‘Andree’); ‘mid-twentieth’ (p. 13); ‘Joseph Campbell is perhaps best known proponent’, with omission of ‘the’ (p. 13); ‘fossils bones’ (p. 15); ‘a number individual’, with omission of ‘of’ (p. 17); ‘Kalamath’ for ‘Klamath’ (p. 19); ‘runup’ for ‘run-up’ (p. 19); ‘so as reinforce’, omitting ‘to’ (p. 24); ‘Maurpertuis’ for ‘Maupertuis’ (p. 49); ‘framework’ (p. 70); ‘neither ... not ...’ for ‘nor’ (p. 77); ‘seventeenth’ and “the ‘the’” (p. 78 caption fig. 10); ‘entitled’ (p. 78); ‘Frazier’ for ‘Frazer’ (p. 88 and in bibliography); ‘interpeted’ (p. 133, abstract); ‘Nikvale’ (p. 187), ‘Nikvalé’ (p. 189 Table 2) and ‘Nikvklé’ (p. 189 Table 2 and in bibliography), all for ‘Nivaklé’; ‘*Chamacocco*’ for ‘Chamacoco’ (p. 189 Table 2); ‘Columbia’ for ‘Colombia’ (p. 192); ‘GRAN CHANCO’ for ‘GRAN CHACO’ (p. 194 Fig. 4); ‘Haethens’ for ‘Heathens’ (p. 216); ‘Metereology’ (p. 216); ‘foundation’ (p. 216); Greek *v* for *υ* (p. 218); ‘stole, steals’ (p. 223); ‘lighting’ for ‘lightning’ (p. 223); ‘believed hold’, omitting ‘to’ (p. 247); ‘preferencial’ (p. 263); ‘*elasmotrrium*’ (p. 268) for ‘*Elasmotherium*’, with capital initial letter for the zoological Genus; ‘Wrickamasinghe’ for ‘Wickramasinghe’ (p. 271 and in bibliography); ‘promotories’ (p. 273 within quotation); ‘perpetutation’ (p. 282); ‘Neoliothic’ (p. 283); ‘Blinkenburg’ for ‘Blinkenberg’ (p. 284); ‘buying the dead’ for ‘burying’ (p. 288); and ‘horizontonally’ (p. 291). Italian forms of names such as ‘Giorgio Cuvier’ (p. 263, 268), ‘Virgilio’ (p. 264), ‘Achemenide’ (p. 264), ‘*Teogonia*’ (p. 264), ‘Pausania’ (pp. 215–226), ‘Pythea’ (p. 224), ‘Verre’ (p. 216 *bis*, 223) and ‘Thebe’ (p. 220) are better understood in English as respectively ‘Georges Cuvier’, ‘Virgil’, ‘Achaemenides’, ‘*Theogony*’, ‘Pausanias’, ‘Pytheas’, ‘Verres’ and ‘Thebes’. In English, ‘destructured’ (p. 141) is not an accepted word, while few readers will realise that the oddly spelled ‘Oykumena’ (p. 142) is the *oikoumene* or the inhabited world known to the Greeks. Hyphenation, finally, is awkward throughout the book: ‘rep-resented’ (p. 20), ‘cat-astrophe’ (p. 21), ‘knowl-edge’ (p. 72), ‘tempor-ary’ (p. 79), ‘phenom-enon’ (p.

89), ‘ident-ified’ (p. 248), ‘Cretac-eous’ (p. 253), ‘mythol-ogy’, ‘palaeontol-ogists’ and ‘depos-its’ (p. 256), ‘fam-iliar’ (p. 259), ‘Cau-sewayed’ (p. 283), and many more.

In conclusion, this book is indispensable reading material for anyone wishing to keep up to date on developments in the theory of mythology or on Holocene events in geology. With Nur and Burgess (2008) and recent progress in ‘cosmomythology’, it provides a solid bedrock for a new ‘nature theory’ of myth.

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Notes

1. A possible additional parallel, hitherto unnoticed in this connection, is the Vedic fire god, Agni, whom the *Ṛg-Veda* (4. 6. 2-3, tr. Griffith, 1999: 205) portrays as one who ‘like a builder raised his smoke to heaven ... Eager he rises like the new-wrought pillar which, firmly set and fixed, anoints the victims.’ As another passage (1. 59. 1-2) locates this vaporous pillar, envisaged as a fiery tree, at the ‘navel’ of the earth, Agni’s countenance as a live pillar of fire is a representation of the *axis mundi*. As Indo-Iranian groups are known to have inhabited parts of the Armenian highlands until the mid-second millennium BCE and Agni has directly been attested in a cuneiform text as a Hatti deity (^d*Ag-ni-iš*, in KUB. VIII. 28, 1 l. 16; 2 l. 7, Friedrich, 1928:42), there is a good possibility that Agni’s pillar form was conceptualised in response to the same natural cause as the prosopography of Typhon and Ullikummi. On the other hand, the Agni column is entirely benevolent, lacking the threatening aspects of Ullikummi and Typhon, and is directly embedded in the narrative context of the creation myth, pushing apart heaven and earth.

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