

MARS ROCKS IN ANCIENT MYTH AND MODERN SCIENCE

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On June 28th, 1911, the inhabitants of Nakhla, Egypt, were treated to a spectacular meteor shower. As it turns out, one of these rocks almost certainly came from the planet Mars, nearly 50 million miles away. The difficulty in dislodging a meteorite from the red planet, much less transporting one to Earth, has prompted several noted authorities to doubt their Martian origin. The meteorite's chemical imprint, however, not unlike the DNA-evidence in a murder trial, leaves little doubt about its place of origin. Nor did this rock alone make the journey. To date, ten Martian meteorites have been identified, half of them being observed falls. The recognition that these rocks hail from Mars has been called one of the most important findings of the space age.

Meteorites have long aroused interest, being objects of worship in numerous ancient cultures, their heavenly origin no doubt contributing to their numinous appeal.¹ That meteorites were extraterrestrial in nature was certainly known to the skywatchers of Mesopotamia, China, and Greece. At some point, however, this knowledge became lost. Thomas Jefferson, for example, was in the majority in rejecting the possibility that rocks could fall from the sky.² Confronted with a report of a meteorite-fall in Connecticut, Jefferson is said to have quipped: "It is easier to believe that Yankee professors would lie than that stones would fall from heaven." And this was in 1807!

Reviewing the history of meteoritics, Dodd commented upon this strange turn of events:

"That meteorites came from beyond the Earth is both a very old and a new idea...The ancient Greeks and Chinese also regarded meteorites as objects from the heavens, but this perception, like so much else of value, was lost to Western culture during the long intellectual night that we call the Dark Ages...Although several important meteorite falls were recovered and described during the second half of the eighteenth century, the few

men who suggested that they came from beyond the Earth were either ridiculed or ignored.”³

It is not surprising, perhaps, given this history, that disbelief and hostility originally greeted the proposal that meteorites could make their way to Earth from Mars.⁴

The idea that meteorites from Mars could impact Earth is not new. Several decades prior to these relatively recent and wholly unexpected developments, Immanuel Velikovsky claimed that rocks from Mars had only recently menaced the Earth. Velikovsky drew this conclusion upon the basis of ancient testimony, which described Mars as participating in spectacular cataclysms involving the Earth and various neighboring bodies. In *Worlds in Collision*, Velikovsky described the events associated with the near passage of Venus and Mars as follows:

“When Mars clashed with Venus, asteroids, meteorites, and gases were torn from [Venus’ comet-like tail], and began a semi-independent existence, some following the orbit of Mars, some other paths. These swarms of meteorites with their gaseous appendages were newborn comets; flying in bands and taking various shapes, they made an uncanny impression. Those which followed Mars closely looked like a troop following their leader. They also ran along different orbits, grew quickly from small to giant size, and terrorized the peoples of the earth.”⁵

Velikovsky’s thesis, needless to say, met with nearly unanimous hostility and disbelief among astronomers. A reappraisal of the evidence bearing on the question, however, suggests that Velikovsky deserves great credit for anticipating the Martian origin of certain meteorites. And if the author of *Worlds in Collision* was on the right track with regards to the spectacular circumstances behind the arrival of these meteorites, their significance for a proper understanding of the evolution of the solar system far surpasses anything imagined by conventional astronomers.

In what follows, we will first review the evidence which suggests that these meteorites are actually from Mars. We will then summarize and briefly examine the various theories as to how the rocks came to be expelled from the red planet and make their way to the Earth. Then we will return to Velikovsky’s thesis of planetary catastrophism, offering further support for the idea that Mars only recently moved in very close proximity to the Earth, raining forth extraterrestrial debris of one form or another, including fiery bolides.

THE SNC-METEORITES

The SNC-meteorites take their name from Shergotty, Nakhla and Chassigny, three different but closely related achondritic classes of igneous rock.⁶ The basaltic shergottites resemble eucrites in mineralogy and are regarded as the product of volcanic flows (lavas). Their name derives from Shergotty, India, the scene in 1865 of the fall of several meteorites. Included in this class are the following meteorites: Shergotty, Zagami, EET79001, ALH77005, and LEW88516, the latter two bodies being Lherzolites.

The nakhlites, on the other hand, are pyroxenites consisting mainly of augite. They received their name from an Egyptian site—El Nakhla el Baharia—where over 40 stones fell in 1911.⁷ Included in this class are the following rocks: Nakhla, Lafayette, and Governador Valadares.

The lone Chassigny meteorite is a dunite consisting mainly of iron-rich olivine. It fell in France in 1815.⁸ The tenth Martian rock, ALH84001, has only recently been identified as Martian in nature.⁹ It is a cataclastic, coarse-grained orthopyroxenite and is thought to have properties unique among these bodies.

Although visually dissimilar, the three classes of meteorites share numerous features in common. Most of these rocks contain iron-rich silicates and iron oxides, clear evidence that they were created in a rather iron-rich environment.¹⁰ And all of the SNCs show very similar oxygen-isotope compositions, these abundances being distinct from those characteristic of the Earth or Moon.¹¹

The SNCs are also similar in their relatively young ages. By measuring the decay products of various radioactive isotopes in igneous rocks, it is thought to be possible to determine how long ago the rocks solidified. Known as the crystallization age, the measures obtained for the Nakhlites and Chassigny were on the order of ~1.3 billion years, compared to the 4.4 to 4.6 Gyr typical of meteorites of the igneous variety.¹² This age is unique among all meteorites—the youngest lunar meteorites are > 3.0 Gyr—and clearly marks these particular rocks as anomalous. Inasmuch as it is commonly believed that only planets could retain the high internal temperatures necessary to produce magmas billions of years after accretion, a planet was sought as the parent of these particular meteorites.¹³ According to Dodd, these crystallization age analyses have “shown beyond reasonable doubt that all of them [the SNCs] come from the same body, certainly a planet and probably Mars.”¹⁴

The SNCs also share high volatile contents. This feature likewise supports the hypothesis that these bodies originated on a large body with a gravitational field great enough to retain volatiles. For various reasons, a body larger than the Moon is believed to be required.¹⁵

Rare earth element analysis can also be brought to bear on the question of the meteorites’ place of origin. It indicates the presence of garnet materials in the source region of the shergottites, which suggests a source region pressure of >40 kbars, consistent with the view that the SNC parent body was likely larger than the Moon.¹⁶

Several other characteristics of these rocks are of interest. The individual minerals show some disturbance at ~180 million years in the U-Pb, Rb-Sr, and Ar-Ar clocks. This is thought by some to represent the date of impact which ejected the SNCs from their parent body.¹⁷

Finally, and perhaps most importantly, analysis of the noble gases trapped in some of the shergottites (EETA79001 and ALHA77005) has revealed the clear signature of Mars.¹⁸ According to McSween, “the measured abundances and isotopic compositions of Ar, Kr, Xe, and N are unique among meteorites and closely resemble the composition of the Martian atmosphere analyzed by Viking.”¹⁹ Dodd likewise

acknowledges the probable Martian character of these noble gases, adding that “the only plausible explanation for this observation is that the meteorite trapped these atmospheric gases during shock melting.”²⁰

In addition to the noble gases, one of the meteorites in question shows traces of nitrogen with an unusual isotopic composition consistent with a Martian origin.²¹ Here Pepin and Carr report: “Subsequent laboratory work on EETA 79001 revealed a pronounced enrichment of ^{15}N , consistent with the isotopically heavy nitrogen that distinguishes the atmosphere of Mars from virtually all other volatile reservoirs in the solar system.”²² This last finding was deemed particularly significant by McSween.²³

Several other characteristics of these meteorites are also consistent with a Martian origin. One of the SNCs—Nakhla—shows traces of water, for example (Mars is known to have once had large amounts of water, now apparently gone).²⁴ Iron-bearing minerals in various shergottites, similarly, are just barely magnetized, implying that the parent body had a weak magnetic field (recent measurements of Mars’ magnetic field suggest that it is most probably quite weak).²⁵

SCENARIOS OF EJECTION AND TRANSPORT

If it is generally agreed that the SNCs are indeed from Mars, the means of their ejection off our red neighbor and transport to Earth has been a subject of much speculation and controversy. As noted earlier, leading authorities question whether it is possible for an impact to dislodge appropriate-sized rocks with enough force to overcome the gravity of the planet.²⁶ Here Wasson offered the following observation: “The key unresolved question is whether an impact could eject >10-m blocks from Mars with velocities in excess of the escape velocity of $5 \text{ km times s}^{-1}$.”²⁷

McSween, similarly, with reference to the prevailing view that the SNCs originated from Mars, observes that “this particular consensus is not universally held, however, because of the serious (some would say insurmountable) problems in removing rocks of a suitable size from the Martian surface.”²⁸

McSween summarizes the problem as follows:

“It has generally been supposed that any smaller fragments that could be ejected from planets by impact mechanisms would have experienced such a high degree of shock that they would be pulverized, melted, or even vaporized. Yet no other natural means of meteoroid ejection seems possible. The energy of rapidly expanding gases during volcanic eruptions is too small to accelerate fragments to planetary escape velocities, and other geologic phenomena are even less capable launching mechanisms.”²⁹

The conventional view is that a meteorite impact released the rocks from Mars millions of years ago. Vickery and Melosh, for example, offered the following opinion: “The dynamically most plausible explanation for the martian origin of the SNC meteorites is that they were ejected from Mars in a single, very large magnitude event ~200 Ma ago.”³⁰

Others, however, have criticized this view. Pointing to various discrepancies in the cosmic ray exposure ages of the respective meteorites³¹, McSween argues that it is

unlikely that such data can be reconciled with a single impact scenario. Shergotty and ALHA 77005, for example, have exposure values of 2.6 million years, while that of EETA 79001 is only 0.5 m.y. The nakhlites and Chassigny, on the other hand, have exposure ages of 11 million years.³² How are we to explain these findings if the meteorites were all ejected in one impact-event 200 million years ago?

Various scenarios have been advanced to account for the exposure-data.³³ One possibility—discussed by Vickery and Melosh—is to assume that the various SNCs were originally part of a much larger body which subsequently became fragmented in space at times corresponding to their cosmic-ray exposure ages. Dissenting from the chronology of Vickery and Melosh, McSween elaborated upon this hypothesis as follows:

“[In the most likely scenario] one event at 11 m.y. ago could eject a number of small to moderately sized fragments from various locations around the crater perimeter. The smaller ones immediately recorded cosmic ray exposure, but the larger ones were unaffected until subsequent breakup in space at 2.5 and 0.5 m.y. ago. In this model, ejected fragments would be in the size range of approximately 1-20 m, and the major impact that caused shock metamorphism in the shergottites would not have been the ejection event.”³⁴

More recent attempts to accommodate the data from cosmic ray analyses have held that three different impact events were involved. A. Banin et al., for example, argue as follows:

“Using rare gas data for SNC meteorites, Ott (1988) argued that the introduction of the (Martian) atmosphere component by shock must have occurred rather recently and cannot be ascribed to a 180 Myr event. This contradicts the model originally proposed by Nyquist et al. (1979) according to which the SNC meteorites were ejected from the parent body in a single major impact event 180 Myr ago in fragments large enough to be shielded from cosmic-ray exposure since that time. The new evidence suggests that it is more likely that SNC meteorites were ejected from Mars in three considerably smaller impact events at times corresponding to the three groups of cosmic ray exposure ages, i.e., 0.5 Myr ejection of EETA 79001, 2.6 Myr ago ejection of Shergotty, Zagami and ALHA 77005, and 11-Myr ago ejection of the nakhlites and Chassigny (Bogard et al. 1984).”³⁵

It is noteworthy, however, that this scenario involving three separate events was discarded by Vickery and Melosh in no uncertain terms.³⁶

Other problems arise from the fact that the various SNCs experienced different degrees of shock. The shergottites, for example, show clear evidence of intense shock, yet the nakhlites and Chassigny do not. This is hardly what would be expected if these rocks were dislodged from Mars as a result of a single major impact. Warren summarized this objection as follows:

“The main argument against a Mars-SNC connection has always been that ejection off a planet is expected to entail extremely high shock pressures. Yet these meteorites, which are up to 40 kg in mass, show only low to moderate degrees of shock.”³⁷

According to Dodd, the finding of lightly shocked lunar meteorites in Antarctica alleviates—but does not entirely remove—the objection that meteorites could make their way from Mars to Earth:

“The Antarctic finds indicate that recognizable meteoritic material can make its way from the moon to the Earth, but they do not prove that virtually unshocked samples could make a longer trip from a bigger body. The problem of delivering SNC meteorites remains a serious objection to a planetary source for such meteorites.”³⁸

How then did these meteorites come to be ejected and make their way to the Earth? One proposal suggested that oblique impacts—upon ricocheting—could eject large fragments and accelerate them to escape velocity. Another model held that impacts on Mars would vaporize permafrost thereby providing additional acceleration to the ejecting fragments. For various reasons³⁹, these models have since been abandoned.

H. Melosh, an early critic of the idea that the SNCs could be Martian in origin, offered a model whereby it is possible for planetary impacts to eject a requisite amount of near-surface material without significant shocking through a process known as spallation.⁴⁰ This hypothesis has since been supported by various experimental tests and is currently regarded as the most likely explanation for the ejection of the SNCs from Mars.⁴¹ Briefly, it is known that upon meteorite-impact the surface of a planetary body is subject to varying degrees of stress. At the site of the impact, the impacting body would be pulverized and/or vaporized, producing a wave of stress whose force drops off sharply with distance. Rocks close to the site of impact are melted or pulverized. At a certain distance, however, the various shock waves act so as to cancel out each other to some extent. McSween summarizes this phenomenon as follows:

“Rocks very near the ground surface experience several kinds of shock waves that partially cancel each other. This area of wave interference offers a shelter from the full force of the shock wave. Calculations indicate that some of this near-surface material will spall off as relatively unshocked fragments and can be accelerated to high speeds.”⁴²

Alas, there are problems with this theory as well. According to the spallation model, the size of the ejecta fragments is directly dependent on the size of the impact and thus on the size of the resulting crater. As we have seen, Melosh himself favored a single impact event at ~180 million years involving an ejection of all SNC bodies in pieces on the order of 6-7 meters, the latter constraint being required in order to account for the shielding from cosmic rays. In order to eject this much rock a fairly large impact is necessary, and thus Melosh sought a crater on the order of 100 km in diameter. Craters of this size, however, are exceedingly rare in areas of recent volcanic activity (datable to ~200 million years).

If, on the other hand, one favors the ejection of modestly sized rocks (meter or submeter-sized) from much younger sites (10-12 million years old)—the view currently defended by McSween—the dynamical problems associated with large impacts are diminished, as is the necessity of finding craters 100 km in diameter (one

30 km in diameter would do, although this represents the largest crater known to be included in the “young” terrane of Mars). Here, however, one is presented with a question as to why SNCs resulting from such relatively minor impacts would be over-represented compared with those expected from major impacts observable elsewhere on Mars (i.e., if spallation is directly dependent upon the size of the impact, one would expect SNCs resulting from larger impacts in older terrane to predominate)? Stated another way, if most of the Martian terrane is known to be much older than ~180 million years, and it is known to be the site of the largest impacts, where are the SNCs from those regions?

McSween admitted the theoretical difficulty presented by the predominance of younger rocks in a recent review:

“It is perplexing that all of the martian geological units from which we have samples are very young...because geological units of these ages constitute only a small portion of the surface of Mars...The problem of having so many young meteorites is especially acute, particularly if multiple impact events are postulated to explain the groupings of cosmic-ray exposure ages. Areas volcanically resurfaced during the Amazonian period (which is thought to encompass rocks of 1.3 Ga and younger) amount to only 16% of the martian surface, and late Amazonian (corresponding to 180-Ma old rocks) volcanic activity constitutes a mere 2%.”⁴³

In short, the currently favored theory as to the origin of the SNCs requires that three (or four) separate impacts somehow managed to strike a mere 16% of the Martian surface, all within a geologically short period of time (some eleven million years). Probability alone would appear to argue against this view.

Other problems arise regarding the meteorites’ means and time of transport to Earth. For example, if one is to believe the currently prevailing view that three separate impact events are required to explain the rocks’ ejection from Mars, one is greeted with the remarkable coincidence that meteorites originating from events millions of years ago—and millions of years apart—managed to descend upon Earth within a period of about a century or so in order to be observed by man.

It must be admitted, however, that very little is known about the amount of time required to get the SNCs to the Earth. According to McSween, who cites Wetherill’s model, roughly one third of the ejected material would reach Earth within 10 million years.⁴⁴

Granted the difficulties of accounting for the ejection and transport of these odd meteorites, Dodd, perhaps, summarized the opinion of many astronomers when he wrote as follows: “Just how these meteorites escaped from Mars remains unclear, but most meteoriticists are now quite sure that they did.”⁴⁵

THE ANCIENT TESTIMONY

An entirely different explanation for the presence of Martian meteorites upon Earth emerges upon consideration of ancient literature. As I have documented elsewhere⁴⁶, the planet Mars was worshipped by most ancient peoples. It follows that the red planet was the subject of much attention by ancient skywatchers, who

regarded it as an malevolent force to be feared and propitiated. Indeed, Mars was associated with spectacular disasters of one form or another, not the least of which was a great flood of water descending from the sky.⁴⁷

Following Velikovsky's lead—but also modifying and elaborating upon his conclusions and chronology—I have confirmed that the ancients described Mars as being much closer in recent times, close enough, in fact, to dominate the skies.⁴⁸ Various Babylonian omens, for example, associate Mars with prodigious eclipses of the Sun. Consider the following omen: “If the Sun goes down (by a Darkness/Eclipse) and Mars stands in its place, there will be an Usurpator.”⁴⁹ As a result of such reports, Gossman concluded that “Mars [was] the star of the Darkness/Eclipse.”⁵⁰ Given Mars' current orbit, an association between that planet and eclipses is difficult to understand, the red planet never being in a position to be involved in eclipses of the sun. Yet if Mars only recently moved upon a different orbit, one much closer to the Earth, the Babylon reports become easier to understand. And the same is true with regards to the presence of Martian meteorites upon terrestrial landscape.

Is there any ancient testimony associating Mars with meteorites, or with the hurling of stones from heaven? Indeed there is, and it is quite compelling.

The most extensive analysis of the ancient traditions surrounding meteorites is that of Judith Bjorkman. Bjorkman showed that the ancient Babylonians, among others, held surprisingly sophisticated views about the nature of meteorites. Bjorkman summarized her findings as follows:

“The texts show that the peoples of the ancient Near East knew of and were able to describe shooting stars, meteors, fireballs, meteor showers, and comets. They were also aware of the extra-terrestrial origin of meteorites, including iron meteorites.”⁵¹

While there are many points of interest in these ancient texts, not the least of which is the association of meteorites with eclipses of the Sun⁵², we are primarily interested here in reports concerning Mars. Suffice it to say that the ancient Babylonians specifically referred to meteorites falling from the planet Mars, making such objects the subject of various omens. Witness the following example: “If in the sky a meteor (train) from a planet [Mustabarru mutanu=Mars] appears: destruction of cattle will occur in the land.”⁵³ Yet another text has the following passage: “If a fireball [meteor] (coming from) Mars is seen...”⁵⁴

If such reports reflect reliable eye-witness testimony—the view defended by Bjorkman⁵⁵—and meteorites were indeed witnessed emanating from or circling Mars, it stands to reason that the various gods identified with the red planet might likewise be associated with the hurling of rocks, with celestial demons of one form or another, or with various other phenomena typically associated with the fall of meteorites. And such is indeed the case.

NERGAL AND INDRA

The dreadful war-god Nergal—expressly identified with the planet Mars—is associated with a demonic entourage in various Babylonian texts. Thus, an early

hymn to Nergal invokes him as the “leader and sender of evil demons.”⁵⁶ A hymn quoted by Velikovsky describes the cohorts of Nergal/Mars as follows: “Great giants, raging demons, with awesome numbers, run at his right and at his left.”⁵⁷ If such hymns celebrate various celestial prodigies associated with the warrior-planet, as appears most probable, it is possible that meteoritic phenomena inspired a portion of their imagery.⁵⁸

Nergal is elsewhere described as hurling great rocks from heaven. A hymn translated by Bollenrucher reads as follows: “You hurl the towering stone, shattering all plants. You hurl the stone in fury, shattering the plants in rage.”⁵⁹ In the image of the planet Mars hurling great rocks from heaven it is possible to see a reference to the fall of meteorites.⁶⁰

The Vedic counterpart to the Babylonian Nergal, as I have documented⁶¹, was the war-god Indra. Like Nergal/Mars, Indra was intimately associated with eclipses of the “Sun” and various other extraordinary celestial disturbances. And like Nergal, Indra was described as hurling great bolides.

Indra’s celestial missiles were described as follows in one Vedic hymn: “Thou hurlest forth from heaven the iron missile.”⁶² A similar passage is the following: “And men have faith in Indra, the resplendent one, what time he hurleth down his bolt, his dart of death.”⁶³ Commenting on this passage, Griffith—the editor of the *Rig Veda*—notes that: “In this verse Indra is represented as a terrible God, and in the following verse as sometimes sending ‘affliction’.”⁶⁴

As is well-known, Indra’s weapon of choice was the *vajra*, typically understood as a thunderbolt. Indra’s heaven-hurled weapon, however, is elsewhere said to be composed of metal or stone. Here Gonda observes: “Although Indra’s weapon is usually explicitly designated by the term *vajra*, and *vajra* is generally described as metallic (*ayasa*), it is incidentally spoken of as a rock (*parvata*) or ‘stone of, or: from, the heavens’ (*divo asmanam*).”⁶⁵

In Vedic hymns the word *vajra* is frequently paired with the epithet *adrivant*, literally “possessing stones (rocks) or a stone (rock).”⁶⁶ Here scholars have traditionally assumed that this was an allusion to Indra’s hurling rocks, as with a sling.⁶⁷

Yet, whether we regard Indra’s sky-borne missile as being composed of iron or stone, it is obvious that by *vajra* no ordinary “lightning-stroke” is meant, as the fall of stones does not typically accompany the latter phenomenon. How then are we to interpret Indra’s heaven-hurled “stone”?

If we approach the matter from the standpoint of comparative religion, we find that many ancient peoples likewise described “thunderbolts” as stones thrown from heaven. Blinkenberg, for example, in his landmark study of the thunderweapon in ancient lore, summarized the ancient conception of lightning as follows: “The lightning, then, is produced by a stone which shoots down from heaven to earth.”⁶⁸ Meteors, in accordance with this belief, were identified with thunderstones throughout the ancient world.⁶⁹ G. Wainright, surveying the conceptions of the

ancient Egyptians, concluded that: “In religion the meteorite and the thunderbolt are the same thing.”⁷⁰ Virtually identical beliefs prevailed in aboriginal Mesoamerica.⁷¹

If the original reference for Indra’s heaven-hurled bolt was to a meteor-like object, both descriptions of the *vajra*—rock and metallic rock—would be equally appropriate, many meteorites being composed of iron. The planet Mars, moreover, was regarded as the iron-planet *par excellence* by ancient skywatchers and medieval alchemists alike.⁷²

Other hymns suggest that Indra was associated with a meteoritic phenomenon spanning the visible heavens. Thus, various passages in the *Rig Veda* relate that Indra’s gargantuan form dominated the skies, extending from heaven to earth: “The heaven itself attained not to thy greatness when with one hip of thine the earth was shadowed.”⁷³ Griffith compares this passage to another in which Indra announces: “One side of me is in the sky, and I have drawn the other down.”⁷⁴ Gonda, similarly, cites I:103:1, which likewise places a part of Indra in heaven and the rest over earth. Here Gonda points out that, “both parts combine so as to form a *ketu* (which may mean ‘ensign’, but also ‘an unusual phenomenon such as a comet or meteor’).”⁷⁵ The unusual apparition associated with Indra’s *ketu*, quite possibly, was a string of fiery meteorites hovering over the Earth like the proverbial sword of Damocles, thus uniting, as it were, heaven and earth. If Indra was the planet Mars, as the evidence seems to indicate, we have here an apparent reference to meteorites being strung out between Mars and the Earth.⁷⁶

Also relevant here is Indra’s intimate association with the Maruts, described in the *Rig Veda* as a celestial troop, as “men of heaven”.⁷⁷ It is with the aid of the Maruts that Indra accomplishes his greatest feats. Identifying Indra with Mars, Velikovsky speculated that the Maruts had some relation to meteoritic phenomena, perhaps being meteorites attending the red planet.⁷⁸ Velikovsky’s conjecture receives support from the fact that the Maruts are said to shine in heaven like blazing fires, or like brilliant snakes.⁷⁹ They were also much feared for the terrible noise and commotion they wrought in heaven: “At their coming heaven as it were roars with fear.”⁸⁰ Does this not recall the terrible noise which frequently accompanies meteorites as they enter the Earth’s atmosphere?

The Maruts are elsewhere said to hurl down rocks from heaven. A Vedic hymn quoted by Velikovsky reads as follows:

“You the powerful, who shine with your spears, shaking even what is unshakable by strength...Hurling the stone in the flight...All beings are afraid of the Maruts. May your march be brilliant, O Maruts...Shining like snakes. May that straightforward shaft of yours, O Maruts, bounteous givers, be far from us, and far the stone which you hurl!”⁸¹

A similar passage is the following:

“This hymn will I make for the Marut host who bright in native splendor cast the mountains down...They gleam with lightning, Heroes, Casters of the Stone, wind-rapid Maruts, overthrowers of the hills, oft through desire to rain coming with storm of hail,

roaring in onset, violent and exceedingly strong...O Bounteous radiant Maruts, Heroes of the sky..."⁸²

RUDRA

The Maruts are elsewhere associated with the war-god Rudra, the latter known to share numerous features in common with Indra, various authorities suspecting an original identity of the two gods.⁸³ Rudra is repeatedly invoked as the father of the Maruts;⁸⁴ the celestial host, in turn, was called variously *rudrah* or *rudriyah*, "Rudra's sons" or "Rudra's men".⁸⁵

Rudra's archetypal role as a leader of a host of demonic beings earned him the name *Bhutipati*.⁸⁶ The demonic beings, like Rudra himself, were described as riding the wind, roaring, and being of a brilliant red color.⁸⁷ Ernst Arbman, upon observing that the Maruts represent an essential aspect of Rudra's cult, confesses that he is at a loss to explain their original significance.⁸⁸

Various Vedic hymns speak of the evil associated with Rudra's "arrows" or missiles, which rain forth from heaven, slaying men and cattle. If the Maruts are to be understood as a meteoritic phenomenon, as Velikovsky proposed, the passages which associate Rudra with the fall of rocks from heaven become readily understandable. Consider the following Vedic hymn:

"Father of the Maruts...O Rudra, praised, be gracious to the singer: let thy hosts spare us and smite down another...May Rudra's missile turn aside and spare us, the great wrath of the impetuous One avoid us."⁸⁹

Here Rudra is described by the very same epithet as Indra and Nergal—impetuous—as indeed are Mars-gods throughout the ancient world, a testament, in all likelihood, to the irascible and fickle nature typically accorded the red planet.⁹⁰

A similar passage reads as follows:

"To Rudra we bring these songs, whose bow is firm and strong, the self-dependent God with swiftly-flying shafts...the Conqueror whom none may overcome, armed with sharp-pointed weapons: may he hear our call...May thy bright arrow which, shot down by thee from heaven, flieth upon the earth, pass us uninjured by...Slay us not, nor abandon us, O Rudra."⁹¹

Apparent here is the ominous specter of the god, dealing out death indiscriminately with his heaven-hurled shafts or "arrows".

Yet another passage from the *Rig Veda*:

"To the strong Rudra bring we these our songs of praise, to him the Lord of Heroes, ...Him with the braided hair we call with reverence down, the wild-boar of the sky, the red, the dazzling shape...To him the Marut's father...Far be thy dart that killeth men or cattle: thy bliss be with us, O thou Lord of Heroes."⁹²

Throughout the *Rig Veda* and later Vedic tradition, Rudra's malefic nature is everywhere apparent. Macdonnell summarizes this aspect of his cult as follows:

“Malevolence is frequently attributed to Rudra in the R.V.; for the hymns addressed to him chiefly express fear of his terrible shafts and deprecation of his wrath. He is implored not to slay or injure...to avert his great malevolence and his bolt from his worshippers...His ill will and anger are deprecated...He once even receives the epithet ‘man-slaying’ [as does Ares and many another Martian god]...Rudra’s malevolence is still more prominent in the later Vedic texts...He is invoked not to assail his worshippers with celestial fire and to cause the lightning to descend elsewhere. He is even said to assail with fever, cough, and poison...Even the gods were afraid of the strung bow and the arrows of Rudra, lest he should destroy them. Under the name of Mahadeva he is said to slay cattle...His hosts, which attack man and beast with disease and death receive the bloody entrails of the victim...as their peculiar share of the sacrifice.”⁹³

Who or what, then, is Rudra? As the red boar of heaven, Rudra is to be identified with the planet Mars. His very name reflects his color—unique among the planets and relatively rare among prominent celestial bodies—the most likely etymology tracing it to an ancient word for “red” or “ruddy”.⁹⁴ As I have documented elsewhere, numerous ancient gods identified with Mars were named with a word signifying “red”. Here the Celtic war-god Rudiobus offers a case in point, identified by the ancients with the Latin god Mars and sharing a root in common with Rudra.⁹⁵

It is also noteworthy that Rudra’s darts are specifically associated with the death of cattle, the very calamity associated with Martian meteorites in Babylonian omens. Indeed, Rudra’s intimate association with the destruction of cattle was proverbial in Vedic and later Indian tradition.⁹⁶

How are we to interpret Rudra’s involvement with the death of cattle? Although it is probable that much of the bovine imagery associated with the escapades of Rudra/Mars is celestial in nature—witness the universality of the Bull of Heaven motive—it is not impossible that Martian meteorites actually discomfited terrestrial cattle. Support for this conjecture comes from the fact that one of the stones which fell at Shergotty is said to have killed a dog.⁹⁷

It is also significant that Rudra is intimately associated with the onset of sickness and pestilence.⁹⁸ As I have documented elsewhere, the planet Mars was associated with pestilence throughout the ancient world.⁹⁹ Here the pestilence-bringing “arrows” of Rudra offer a striking parallel to those associated with other Martian gods—the Greek Apollo, for example.¹⁰⁰

In light of the Vedic hymns crediting Rudra’s bolides with the destruction of cattle and the onset of disease, the possibility presents itself that Martian meteorites brought unusual pathogens in their wake, afflicting cattle as well as man. Whether there is any truth to this conjecture is difficult to say apart from the finding of pathogens in future Mars explorations, but it is intriguing to find that the idea that meteorites could produce sickness or pestilence is surprisingly widespread. Thus, in his discussion of the folklore surrounding meteorites Frazer cites the Namaqua tribe of Africa, who “are greatly afraid of the meteor which is vulgarly called a falling star, for they consider it a sign that sickness is coming upon the cattle, and to escape it they will immediately drive them to some other parts of the country. They call out to the star how many cattle they have, and beg of it not to send sickness.”¹⁰¹

This Namaquan prayer bears comparison with the Vedic prayers offered Rudra. And once again we recall the Babylonian omen associated with the planet Mars: “If in the sky a meteor (train) from a planet [Mustabarru mutanu=Mars] appears: destruction of cattle will occur in the land.”¹⁰²

CONCLUSION

In this essay we have reviewed two radically different theories in an attempt to explain the anomaly presented by the finding of Mars-rocks upon the Earth. The first, which we may term the conventional theory, speculates that one or several major meteoritic impacts upon Mars dislodged rocks from its surface—in the case of the nakhlites and Chassigny, without shocking the rocks to any significant extent—whereupon they began their long voyage towards Earth. These impacts are thought to have occurred many millions of years ago (two to two hundred, depending on various interpretations of the conflicting radiometric data presented by the meteorites in question). According to this scenario, the handful of SNCs witnessed to have fallen to Earth in the past century and a half arrived millions of years after their ejection off the red planet, these small rocks enduring the 50 million mile odyssey through space practically unscathed. A central tenet of the conventional theory, it goes without saying, holds that Mars has always moved upon its present orbit since it congealed from the primordial soup that was to become the solar system several billion years ago.

A wholly different explanation for the finding of Martian meteorites on terrestrial landscape results from a catastrophist theory of the recent history of the solar system. According to Velikovsky, the planet Mars only recently moved in close proximity to the Earth, participating in several spectacular cataclysms involving the Earth and its planetary neighbors. During these cataclysmic events, Mars was seen to hurl great bolides towards Earth, the capture of which was presumably made easy by the near passage of the red planet. If Velikovsky's thesis is valid, the prospect of finding Mars-rocks upon the Earth is readily understandable—nay inevitable.

Velikovsky's theory, as we have seen, rests upon ancient testimony from around the world. At the heart of the controversy surrounding his ideas lies the simple question: Can we, or can we not, take seriously the ancient reports surrounding the respective planets? As we have documented here and elsewhere, ancient testimony corroborates Velikovsky's general thesis of planetary-catastrophism again and again, often in more dramatic fashion than the pioneer himself ever realized. Thus, eye-witness reports of Martian meteorites falling to Earth—far from being confined to the last 150 years—actually go back several thousand years.

¹M. Eliade, *The Forge and the Crucible* (Chicago, 1978), pp. 19-26. H. Newton, "The Worship of Meteorites," *Am. Jour. of Science* 3 (January, 1897), pp. 1-14. J. Burke, *Cosmic Debris: Meteorites in History* (Berkeley, 1986), pp. 213-229.

²J. Burke, *op. cit.*, p. 5, observes that: "Most eighteenth-century natural philosophers either did not believe or doubted that meteorites fell."

³Robert Dodd, *Thunderstones and Shooting Stars* (Cambridge, 1986), pp. 51-52.

⁴H. McSween, *Meteorites and their Parent Bodies* (Cambridge, 1987), p. 147. The Martian origin of the SNCs was introduced by McSween and Edward Stolper in 1978.

⁵I. Velikovsky, *Worlds in Collision* (New York, 1950), pp. 284-285.

⁶A recent survey of the evidence bearing on these meteorites is that of H. McSween, "What we have learned about Mars from SNC meteorites," *Meteoritics* 29 (1994), pp. 757-779.

⁷H. McSween, "SNC Meteorites: Clues to Martian Petrologic Evolution?," *Reviews of Geophysics* 23:4 (1985), p. 391.

⁸J. Wasson, *Meteorites* (New York, 1985), p. 113.

⁹D. Mittlefehldt, "ALH84001, A cumulate orthopyroxenite member of the martian meteorite clan," *Meteoritics* 29 (1994), pp. 214-221.

¹⁰R. Dodd, *op. cit.*, p 142.

¹¹Personal communication from James Head, 10-16, 1994.

¹²R. Pepin & M. Carr, "Major Issues and Outstanding Questions," in H. Kieffer, B. Jakosky, C. Synder, & M. Matthews, eds., *Mars* (Tucson, 1992), p. 124. Measures obtained for the shergottites varied from 1.3 billion years ago to 180 million years, the discrepancy thought to be due to the intense shocking of these rocks, which could have reset some of the isotopic clocks.

¹³H. McSween, *Stardust to Planets* (New York, 1993), p. 95.

¹⁴R. Dodd, *op. cit.*, p. 142. These crystallization tests, however, are not without their problems of interpretation. Thus A. Banin et al note that other scientists have found wildly varying crystallization ages depending on the isotope used for the test. These authors offer the following conclusion: "Thus, it is possible that the large differences in the reported crystallization ages of SNC meteorites result from the fact that different isotope systems in different mineral phases date different events." See A. Banin et al, "Surface Chemistry and Mineralogy," in H. Kieffer, B. Jakosky, C. Synder, & M. Matthews, eds., *Mars* (Tucson, 1992), pp. 609-610.

¹⁵J. Wasson, *op. cit.*, p. 113.

¹⁶Personal communication from James Head, 10-16, 1994.

¹⁷*Ibid.*

¹⁸D. Bogard and P. Johnson, "Martian gases in an Antarctic meteorite?," *Science* 221 (1983), pp. 651-654.

¹⁹H. McSween, "SNC Meteorites: Are they Martian rocks?," *Geology* 12 (January, 1984), p. 5.

²⁰R. Dodd, *op. cit.*, p. 145.

²¹R. Becker & R. Pepin, "The case for a martian origin of the shergottites: nitrogen and noble gases in EETA 79001," *Earth and Planetary Science Letters* 69 (1984), pp. 225-242.

²²R. Pepin & M. Carr, "Major Issues and Outstanding Questions," in H. Kieffer, B. Jakosky, C. Synder, & M. Matthews, eds., *Mars* (Tucson, 1992), p. 125.

²³H. McSween, *Meteorites and their Parent Bodies* (Cambridge, 1987), p. 149.

²⁴H. McSween, *op. cit.*, p. 151. See also the discussion in M. Drake et al., "Fractionated martian atmosphere in the nakhlites?," *Meteoritics* 29 (1994), pp. 854-855.

²⁵H. McSween, *Stardust to Planets* (New York, 1993), p. 106.

²⁶Tom Van Flandern, author of *Dark Matter, Missing Planets & New Comets* (Berkeley, 1993), expressed this very objection to me at a recent symposium in Portland. For this reason, Van Flandern does not accept the SNCs as Martian in origin.

²⁷J. Wasson, *op. cit.*, p. 114.

²⁸H. McSween, *Meteorites and their Parent Bodies* (Cambridge, 1987), p. 152.

²⁹H. McSween, *op. cit.*, p. 206.

³⁰A. Vickery & H. Melosh, "The Large Crater Origin of SNC Meteorites," *Science* 237 (1987), p. 742.

³¹This measure is thought to represent the time spent as small bodies orbiting in space and exposed to cosmic radiation.

³²H. McSween, "SNC Meteorites: Clues to Martian Petrologic Evolution?," *Reviews of Geophysics* 23:4 (1985), p. 402.

³³See here the discussion in A. Vickery & H. Melosh, *op. cit.*, pp. 738-739.

³⁴H. McSween, "SNC Meteorites: Clues to Martian Petrologic Evolution?," *Reviews of Geophysics* 23:4 (1985), p. 405.

³⁵See A. Banin et al, "Surface Chemistry and Mineralogy," in H. Kieffer, B. Jakosky, C. Synder, & M. Matthews, eds., *Mars* (Tucson, 1992), p. 610.

³⁶A. Vickery & H. Melosh, *op. cit.*, p. 742.

³⁷P. Warren, "A Carbonate-rich Piece of Mars, Disguised as a Diogenite," *Meteoritics* 29 (1994), p. 153.

³⁸R. Dodd, *op. cit.*, pp. 143-144.

³⁹See the discussion in H. McSween, "What we have learned about Mars from SNC meteorites," *Meteoritics* 29 (1994), p. 774.

⁴⁰H. Melosh, "Impact ejection, spallation, and the origin of meteorites," *Icarus* 59 (1984), pp. 234-260.

⁴¹A. Gratz, W. Nellis, & N. Hinsey, "Observations of high-velocity, weakly shocked ejecta from experimental impacts," *Nature* 363 (June 10, 1993), pp. 522-524.

⁴²H. McSween, *op. cit.*, p. 207.

⁴³H. McSween, "What we have learned about Mars from SNC meteorites," *Meteoritics* 29 (1994), p. 763.

⁴⁴H. McSween, "SNC Meteorites: Clues to Martian Petrologic Evolution?," *Reviews of Geophysics* 23:4 (1985), p. 408.

⁴⁵R. Dodd, *op. cit.*, p. 145.

⁴⁶E. Cochrane, "On Mars and Pestilence", *Aeon* 3:4 (1993), pp. 59-79.

⁴⁷The ancient Babylonians, for example, regarded Mars as the "disaster bringer". See P. Gossman, *Planetarium Babylonicum* (Rome, 1950), p. 5.

⁴⁸See the discussion in E. Cochrane, "Indra," *Aeon* 2:4 (1991), pp. 49-76.

⁴⁹P. Gossman, *op. cit.*, p. 82.

⁵⁰P. Gossman, *op. cit.*, p. 132. In ancient Babylonian astronomical texts the planet Mars is routinely identified with the war-god Nergal. An early epithet of Nergal is *Lugul-du-su-a*, "the king who causes the sun to go down." See K. Tallquist, *Akkadische Gotterepitheta* (Helsinki, 1938), p. 390.

⁵¹J. Bjorkman, *Meteors and Meteorites in the Ancient Near East* (Tempe, 1973), p. 94.

⁵²*Ibid.*, pp. 99-100. Similar traditions were preserved in Mesoamerica. See C. Trenary, "Universal Meteor Metaphors and Their Occurrence in Mesoamerican

Astronomy,” *Archaeoastronomy* 10 (1987-1988), p. 106. There Trenary writes as follows: “Astronomers are now aware that there is no connection between eclipses and meteor showers, but it seems odd that the Maya would have had such a concept.”

⁵³J. Bjorkman, *op. cit.*, p. 120.

⁵⁴*Ibid.*, p. 122.

⁵⁵*Ibid.*, p. 92.

⁵⁶F. Bohl, “Hymne an Nergal, den Gott der Unterwelt,” in *Opera Minora* (Groningen, 1953), p. 209. In the hymn in question, Bohl notes that Nergal here represents the “murderous” planet Mars.

⁵⁷I. Velikovsky, *op. cit.*, p. 285.

⁵⁸Detailed analysis of the demonic entourage associated with Nergal would take us too far afield. Suffice it to say here that these demons are intimately related to the 7-fold band associated with the polar configuration. See here the discussion of D. Cardona, “The Mystery of the Pleiades,” *Kronos* 3:4 (1978), pp. 38-40. That these bands were composed of meteoritic material is likely.

⁵⁹J. Bollenrucher, *Gebete und Hymnen an Nergal* (Leipzig, 1904), p. 46.

⁶⁰That Mars was frequently described as hurling comet-like bodies from heaven I have documented elsewhere. See “Indra’s Theft of the Sun-god’s Wheel,” *Aeon* 3:3 (1994), pp. 76-85.

⁶¹For Indra’s identification with the planet Mars, see E. Cochrane, “Indra,” *Aeon* 2:4 (1991), pp. 49-76.

⁶²I:121:9

⁶³I:55:5

⁶⁴R. Griffith, *The Hymns of the Rig Veda* (Delhi, 1973), p. 37.

⁶⁵J. Gonda, *Epithets in the Rig Veda* (S-Gravenhage, 1959), p. 63.

⁶⁶*Ibid.*, p. 60.

⁶⁷*Ibid.*, p. 61.

⁶⁸C. Blinkenberg, *The Thunderweapon in Religion and Folklore* (Cambridge, 1911), p. 32.

⁶⁹*Ibid.*, p. 13. See also M. Eliade, *op. cit.*, p. 20.

⁷⁰G. A. Wainright: “Letopolis,” *J. of Egyptian Archaeology* 18 (1932), p. 161.

⁷¹C. Trenary, “Universal Meteor Metaphors and Their Occurrence in Mesoamerican Astronomy,” *Archaeoastronomy* 10 (1987-1988), p. 99.

⁷²W. Roscher, “Planeten,” *RML* (Leipzig, 1884-1937), col. 2533-2534. C. Jung, *Mysterium Coniunctionis* (New York, 1970), p. 55.

⁷³III:32:11-12

⁷⁴R. Griffith, *op cit.*, p. 178. X:119:11

⁷⁵J. Gonda, *The Indra Hymns of the Rg Veda* (Leiden, 1989), p. 17.

⁷⁶Further support for this view comes from various Chinese manuscripts, which describe a comet-like banner emanating from the planet Mars. See here the discussion in M. Loewe, "The Han View of Comets," *The Museum of Far Eastern Antiquities Bulletin* 52 (1980), pp. 12-14.

⁷⁷II:36:2; V:54:10

⁷⁸I. Velikovsky, *op. cit.*, p. 287.

⁷⁹A. Macdonnell, *op. cit.*, p. 78.

⁸⁰*Ibid.*, p. 79.

⁸¹I. Velikovsky, *op. cit.*, p. 286, with reference to Hymn 85 (F. Max Muller's translation, 1891).

⁸²V:54:1-10

⁸³A. Macdonnell, *Vedic Mythology* (New York, 1974), p. 77.

⁸⁴I:114:6; 2:33:1

⁸⁵E. Arbman, *Rudra: Untersuchungen zum altindischen Glauben und Kultus* (Uppsala, 1922), p. 156.

⁸⁶E. Arbman, *op. cit.*, p. 215.

⁸⁷*Ibid.*, p. 277.

⁸⁸*Ibid.*, p. 156.

⁸⁹II:33:1-14

⁹⁰A Vedic hymn (IV:16:5) invokes Indra as follows: "Indra, Impetuous One, hath waxed immensely: he with his vastness hath filled earth and heaven."

⁹¹VII:46:1-4

⁹²I:114:1-10

⁹³A. Macdonnell, *op. cit.*, pp. 75-76.

⁹⁴M. & J. Stutley, *A Dictionary of Hinduism* (London, 1977), p. 253. See also the discussion in E. Arbman, *op. cit.*, p. 274, and A. Macdonnell, *op. cit.*, p. 77.

⁹⁵A. Ross, *Pagan Celtic Britain* (London, 1967), p. 170.

⁹⁶A. Macdonnell, *op. cit.*, pp. 75-76.

⁹⁷H. McSween, "SNC Meteorites: Clues to Martian Petrologic Evolution?," *Reviews of Geophysics* 23:4 (1985), p. 391.

⁹⁸A. Macdonnell, *op. cit.*, p. 76, with reference to A.V. 11:2:26

⁹⁹E. Cochrane, "On Mars and Pestilence", *Aeon* 3:4 (1993), pp. 59-79.

¹⁰⁰*Iliad* 1:44ff. See the discussion in E. Cochrane, "Apollo and the Planet Mars," *Aeon* 1:1 (1988), pp. 52-62.

¹⁰¹J. Frazer, *The Dying God* (London, 1920), p. 61.

¹⁰²*Ibid.*, p. 120.