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ARCHAEOASTRONOMY AND BEDOUIN STAR-LORE IN THE ROCK ART OF THE NEGEV DESERT

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ABSTRACT

The archaeological record of the Late Neolithic – Chalcolithic – Early Bronze Age of the Negev Desert exhibits prevalent east to west orientations. This is understood in literature as an expression of preoccupations that characterized emerging pastoralist elites, namely: after-life beliefs, mortuary cult and ancestor worship. Such archaeological remains are generally explained as astronomical alignments and are tentatively related to the position of the setting sun on the day of the summer solstice. Orientation seems to be also the central theme in the oral traditions of contemporary pastoralists. While the material remains exhibit orientation in space, the oral traditions, which are illustrated at their best in star-lore, exhibit an orientation in time: the cyclic renewal of seasons is observed in the east to west passage of stars and asterisms. As material and spiritual expressions of the beliefs that characterize pastoral nomads, the archaeological record and star-lore seem to be closely related. However, due to polar shift and the precession of equinoxes, contemporary star-lore orientates itself differently from its Chalcolithic – Early Bronze Age forerunner, therefore it cannot reflect the spatial orientation exhibited by *tumuli* fields, walls, *masseboth* and other remains from the said periods, except in a very approximate manner. A significant precession of equinoxes occurred in the early phases of the Middle Bronze Age. The event apparently left a deep mark on cultures worldwide and it was likely paralleled by shifts in symbolism. Moreover, in the Negev, the precession was also accompanied by a climatic deterioration. Nomadic mythology and star-lore had to re-adjust to the new coordinates that superseded an apparently perfect previous order. The majority of the rock art corpus in the Negev is dated – based on stylistic considerations – to the period that preceded the shift. However, a few of the engravings attributed to the Early Bronze Age become meaningful only when related to the changes that occurred during and after the precession of the equinoxes. Other petroglyphs reflect precisely Chalcolithic – Early Bronze Age realities, but their symbolic implications outlived the astronomical context in which they were conceived and are still meaningful to the Bedouin pastoralists of today.

KEYWORDS: Aldebaran, Antares, astronomical alignments, equinoxes, petroglyphs, polar shift, precession, star-lore

1. INTRODUCTION

The correlation between the positions of the stars Antares and Aldebaran and the dominant east to west orientation of numerous Chalcolithic - Early Bronze Age archaeological sites was tentatively introduced in a previous paper (Steiner 2016), to which this article is a sequel. The literature describing these complexes is very cautious in its approach and it generally associates the prevalent orientations with the position of the setting sun on the day of the summer solstice (Rosen, 2007). For example, the sacred precinct on the Saharonim Plateau in the Ramon Crater is related to a black hill to the west and to the sun setting behind it on the day of the June solstice. The orientation exhibited by the complex and the large number of shrines and burial mounds (tumuli) found there are interpreted as reflecting a preoccupation with after-life, dead cult and ancestor worship of an emerging pastoral elite. However, an azimuth deviation of 2° to 8° from the point where the sun sets is observed and explained with the polar shift that occurred since the Chalcolithic-Early Bronze Age, the archaeological periods to which the complex is dated (*ibid.*). Another site, the Zin-Mehia alignment, seems to follow the pattern of the Ramat Saharonim precinct (Steiner, 2010; 2016). Judging by the suggested age of the oldest rock engravings found there (Anati, 1986; 2015) the alignment was conceived at the same time. The azimuth deviations do not correspond to those measured at the Ramat Saharonim precinct, and a correlation of this site with the setting sun of the summer solstice is very unlikely.

Even when the combined effects of polar shift and the precession of the equinoxes is taken into consideration, the orientation of the alignment only approximates that presumed to have had determined the layout of the Ramat Saharonim structures. However, while researching the Zin-Mehia alignment, the author has noticed a correlation between the orientation of the site and the nocturnal/heliacal rising/setting of the stars Antares and Aldebaran, at the beginning of June and the end of November (Steiner, 2010; 2016). When the first petroglyphs at the site were carved into the rock, at approximately $> 4,000$ BP (Anati, pers. comm.), the two stars marked precisely the location of the September and June equinoxes (Berger, 1976). Because these two red stars also seem to play a role in renewal, transformation and other concepts related to dead cult and after-life beliefs (*cf.* Steiner, 2016), their association with archaeological sites - that apparently reflect the same preoccupations - should be reassessed.

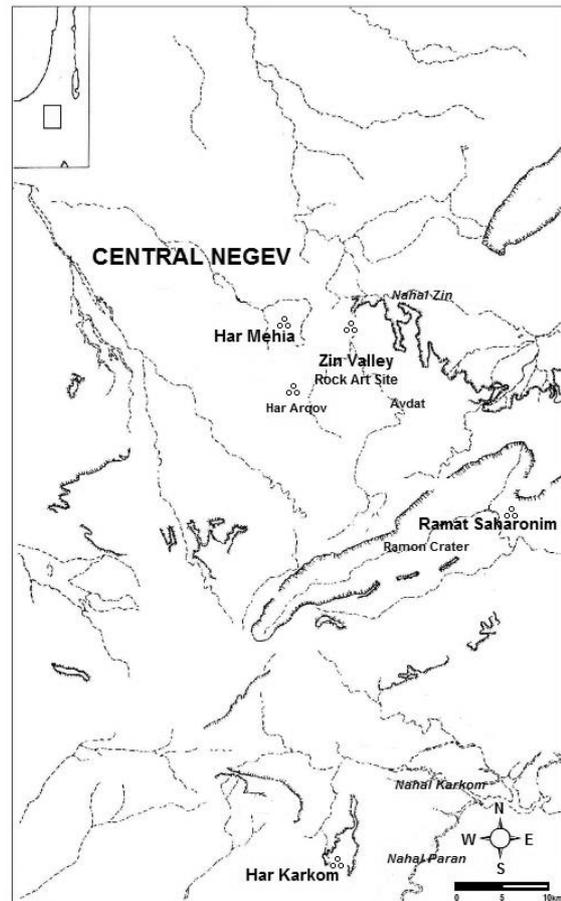


Figure 1. Map of the Central Negev (Israel) showing the sites mentioned in the text

In the same paper (*ibid.*), a link between an iconic figure that is featured in the rock art of the Negev, southern Jordan and northern Hejaz, and the two stars was also proposed. One of the locations where the engraving is found is the Zin-Mehia alignment. Moreover, when this 'icon' is related to modern Bedouin star-lore, it is possible to place it into the sky, with the help of clues provided not only by oral traditions, but also by the contexts in which it appears, the orientation of the rock faces on which it is engraved, the position of the stars that mark the seasons, and the shapes of the constellations. The suggested position of the icon in the night sky, and the graphic concept behind the composition - with its accent on symmetry - seems to further emphasize the relationship between Antares and Aldebaran on one hand, and between the markers of the rainy and dry seasons on the other. Its location in the circumpolar area, to the left (from the perspective of the stars) of the constellation which is traditionally identified as the 'seat of God' (Tomkins, 1971; Magli, 2015), led the author to float the conclusion that the icon was the symbol of a 'goddess' associated with rebirth, cyclic renewal and transformation, in the desert. These concepts are related to what was

perceived as fertility, in the sown. The goddess seems to symbolize not only the preoccupations, but also the ideals and the hopes of the nomads who engraved her figure in the rock, and who built the east to west oriented funerary complexes mentioned above. However, Bedouin star-lore (Bailey, 1974; Steiner, 2010) establishes correlations in the contemporary sky that are slightly different from those that were probably emphasized 5,000 years ago. Likewise, the goddess may fit perfectly in a sky where the arrival of the much-awaited rains is foretold by the nocturnal rising of certain stars and asterisms whose position in heaven and the time of their appearance are determined by the present inclination of the Earth's axis, but let us not forget that the goddess was worshipped by people who lived at a time when the north-star was not Polaris, but Thuban, and the vernal equinox was not located in the constellation Pisces, as it is today, but in Taurus (Dreyer, 1953; Pannekoek, 1961; Berger, 1976).

The aim of this paper is to test the validity of the correlations that the author has based on the comparison between contemporary star-lore and ancient rock engravings (Steiner, 2016). An attempt to reconstruct the location of the goddess in the Chalcolithic - Bronze Age sky is followed by the interpretation of two other rock engravings to which she seems directly related. The dating of these petroglyphs (Anati, 1985; 1986; 2015) is re-evaluated in the article and they are attributed to the period when the changes induced by the polar shift and the precession of the equinoxes occurred. Moreover, the shortcomings of still prevalent dating criteria (set by Anati, 1968a; 1968b; 1972; 1974) are highlighted, and their origins explained (Bednarik and Khan, 2005). Techniques such as archaeometallurgy (as in Steiner, 2016) and archaeoastronomy (in this paper) are recommended as fitting sub-disciplines of archaeological science that bear the potential to overcome the said shortcomings in dating and to place certain petroglyphs in a more realistic chronological context. The suggested archaeoastronomical approach and the dates derived from it are supported by the motifs depicted, which seem to reflect the new realities in the distribution of the seasons and the orientation of the stars. The author argues that the marked increase in the complexity of rock engravings during this period should be attributed to the need to explain and illustrate the changes, and to embed them in the human consciousness, via ritual. The motifs depicted seem to express the fear that the sun may vanish and the magic employed to restore it is also illustrated in the engravings. Zoomorphic figures that represent the constellations Taurus and Aries are drawn as

successive guardians of the sun, chased by heroic hunters (Rotblum, 2010), whose purpose is to re-establish the order that governed the world before the precession of the vernal equinox (Magli, 2015). As the polar and equinox precession was followed by an arid period with heavily felt repercussions on pastoral economy (Anati, 1985; Steiner 2010), the nostalgia for the previous order is understandable. The readiness of the nomad to accept metallurgist values, precisely in this period (Amzallag, 2008; 2009 Steiner, 2010; 2016) may also be rooted in his anxiety: the disappointment in the immutability of the laws governing the heavens, added to the spiritual affinity with copper-related symbolism, induced the nomad to look for more abstract, but at the same time more reliable alternatives. The heroic hunters who restore the cosmic order are associated in many mythologies with coppersmiths (Amzallag, 2008). The abandonment of the old stellar and lunar religion for the sake of an abstract deity, that is, the replacing of the God of Abraham with that of Jethro (ibid.) may be understood as the voicing of the disappointment caused by the changes that took place at the beginning of the Middle Bronze Age.

2. THE CONTEMPORARY SKY

2.1. *Equinoxes and Seasons*

The stories of Bedouin star-lore focus on asterisms stars and constellations which, in their turn, are associated with the seasons (Bailey, 1974). The nocturnal (at dusk) or heliacal (at dawn) rising of these predict the arrival or the end of the rainy and dry periods of the year (ibid.). The knowledge is based on observations that describe a sky that has been relatively stable for the last two millennia. The area around Polaris marks the position of the north celestial pole since immemorial times. The seasons are defined by equinoxes and solstices that occur against the same background of stars, year after year. The 1° shift of the constellations located on the 360° ecliptic (the apparent path of the sun in the sky) in 72 years is virtually imperceptible in one lifetime, and the accumulated 27° shift in the last 2,000 years, although noticeable, does not interfere too much with the distribution of the seasons. The spring equinox still occurs when the sun is in the constellation Pisces in March. The Bedouin relies on what he sees and the fact that scientists call the spring equinox "point zero Aries" does not impress him. Since 67 BC the vernal equinox, that is, when the sun crosses the celestial equator into the northern hemisphere at the point where the ecliptic and equatorial planes intersect each other, occurs in the constellation Pisces. At the diametrically opposite intersection of the two planes, the autumn equinox,

that is, the point on the ecliptic where the sun descends into the southern hemisphere, is in the constellation Virgo, since 780 BC. Before these dates, however, the sun crossed into the northern hemisphere in the constellation Aries and left it in the constellation Libra, due to an astronomical phenomenon called precession of the equinoxes (Pannekoek, 1961; Dreyer, 1953; Berger, 1976). Pisces, Aries, Virgo and Libra are only four of the twelve constellations located along the ecliptic, which form the zodiac. Because the zodiac was conceived as a celestial coordinate system meant to measure ecliptic longitude at the time when the vernal equinox still occurred in Aries, and because at the time of its conception the phenomenon of precession was unknown, longitude 0° is still located in Aries (instead of Pisces); longitude 90°, or the summer solstice in Cancer (instead of Gemini, or rather Taurus, to where it shifted in 1989); longitude 180° in Libra (instead of Virgo, where the autumn equinox actually occurs); and longitude 270°, the winter solstice, in Capricornus (instead of Sagittarius) (ibid.). In today's astrology, the imaginary zodiac became distinct from the stars (Evans, 2008; Parker, 2010). In astronomy, ecliptic longitude and nomenclature are still in use, although not related to the 30° arcs of the zodiacal signs, but to the real longitudinal extension of the constellations, as defined in 1930 by the IAU (Hilton et al., 2006). The desert nomad does not know much about the ecliptic, the celestial equator, precession and the zodiac, but solstices and equinoxes are important to him, as they mark the transition between seasons (Bailey, 1974; Steiner, 2010).

2.2. Winter and Summer Constellations; Bedouin Star-lore

To the Bedouin, the sky appears as being parted in two: the winter half and the summer half, that is, the part visible between October and May and its November to April counterpart. The first interval is associated with luck and plenty, while the second period with misfortune and hardship (Bailey, 1974; 'Id al Wadj, pers. comm.). The blessed part of the year is foretold by the rising of Canopus (as Suhayil in Arabic, in the constellation Vela) at daybreak, in the south, approximately two weeks after the flowering of the Canopus reed (*Urginaea maritima*). The first chilly winds start blowing at dawn, a release from the heat of the summer. In the second half of October the nocturnal rising of the Pleiades in the east, which coincides roughly with the disappearance of Antares from the sky, marks the beginning of the rainy season, called in the honor of the asterism Wasm-ath-Thuraya, which means "the sign of the Pleiades". The rains that fall in the 25-27

days marked by the asterism would bring forth the wadi-(riverbed) vegetation in the following spring. The next 25-day season begins with the rising of Aldebaran at sunset, also in the east, towards the end of November. The rains of Aldebaran would make the slopes above the wadis bloom in the following spring. The second half of December is the beginning of the third 25-day rainy interval, in which the rains of Betelgeuse fall. These are important to the vegetation that would sprout on the plateaux. The real cold weather sets in together with the nocturnal rising of Sirius in the east, in mid-January. It lasts for forty days and its Arabic name, Al-Arbainiyah, means just that. However, despite the discomfort, it is a very much-anticipated season because, during it, the seeds gather strength to burst into life at the end of the period marked by Sirius, when Ar-Rabi, that is, spring arrives (ibid.). The sun and its warmth make the vegetation sprout, the kids and lambs are born at this time of the year and the desert turns green. In anticipation of the blessings, the Bedouin become impatient with Orion, which dominates the sky during the winter months, and wish him gone. Sirius is seen as a Saluki dog that would chase Orion for forty days and forty nights, to allow the spring constellations to take its place in the sky ('Id al-Kashkhar and 'Id al-Wadj, pers. comm.). Orion would sink slowly under the western horizon to appear again, just as gradually, as Bootes, in the March sky. During the first days of May, when the Pleiades, Aldebaran and Orion do not rise anymore, and when Sirius also stops hanging above Canopus, the unlucky part of the year sets in (ibid; Bailey, 1974; Steiner, 2010). The extremely hot weather is followed by the nocturnal rising of Antares, towards the end of May. The rains of Antares bring forth poisonous vegetation, which replaces what is still left of the fodder that sprouted because of the rains of Aldebaran. The season known as As-Smayih, that is, summer sets in. Once a month, the moon passes through Sagittarius, Scorpius and Libra, for seven consecutive nights. These nights are dreaded by the Bedouin, who associates them with extreme bad luck (Bailey, 1974). When Bootes slowly starts disintegrating, the desert nomad sighs with relief: soon, the Canopus reed would bloom again...

Interestingly, at the Nabataean temple at Khirbet Tannur, one of the most intriguing items found was a 2nd Century AD Nabataean zodiac that seems to emphasize the partition of the year according to the considerations mentioned above. The symbols of the Nabataean zodiac conform to their Roman and Hellenistic counterparts - let us not forget that at this stage the Nabataeans were already a settled population that had assimilated Hellenistic beliefs and values. However, the most significant difference

in the Nabataean zodiac is the arrangement of the order of the houses within the zodiacal circle. The Nabataean zodiac found at Khirbet Tannur is extraordinary in its two opposite and completely separate halves - Aries to Virgo, and Pisces to Libra. Both halves start and culminate at the spring and autumn equinoxes (Liritzis et al., 2015). This may very well reflect the persistence of a nomadic desert star-lore that was inherited from the Nabataeans' pre-Hellenistic ancestors. Moreover, the depiction of the goddess Allat in the center of the zodiacal circle (ibid.) supports very well one of the main suggestions of this paper, namely, that a goddess-figure that appears at a number of rock art sites in the Negev Desert may arguably be associated with engravings that seem to depict the opposite - "blessed" vs. "cursed" - halves of year.

2.3. The Goddess in the Sky

There are two rocks in the Negev, almost 100 km away from each other (in the dry riverbed of Nahal Zin, on the already mentioned Zin-Mehia alignment and in Nahal Zihor, in the southern Negev), on which the same figure is engraved. It is an abstract image, but at the same time strikingly

anthropomorphic: an oval, with a line drawn as its extension are transformed into an ankh-like figure because of a second line that intersects that under the oval. The "arms" formed this way are similarly engraved on both rocks: the right arm (from the observer's perspective) is a two-horned serpent and the left arm ends in an exaggerated three-fingered hand (which is connected to a zoomorphic figure in Nahal Zin). The arms alone are a well-known symbol of mediation between the worlds, which is often used to represent the shaman, whose role was precisely that (Lewis-Williams and Dowson, 1988). Variations of the petroglyph are also found on Har Karkom (where the "ankh" is drawn beside a hand, or only the arms are engraved in the rock, without the "body"), in southern Jordan (where the central figure is a male, and the right arm holds a snake instead of being one itself), in eastern Jordan (where it is very similar to that found in Nahal Zihor) and in Spain (where the figure is markedly feminine, with her arms blended with the figures of a male and female wild sheep, but where the serpent is only an element of the petroglyph and not the arm of the central figure).

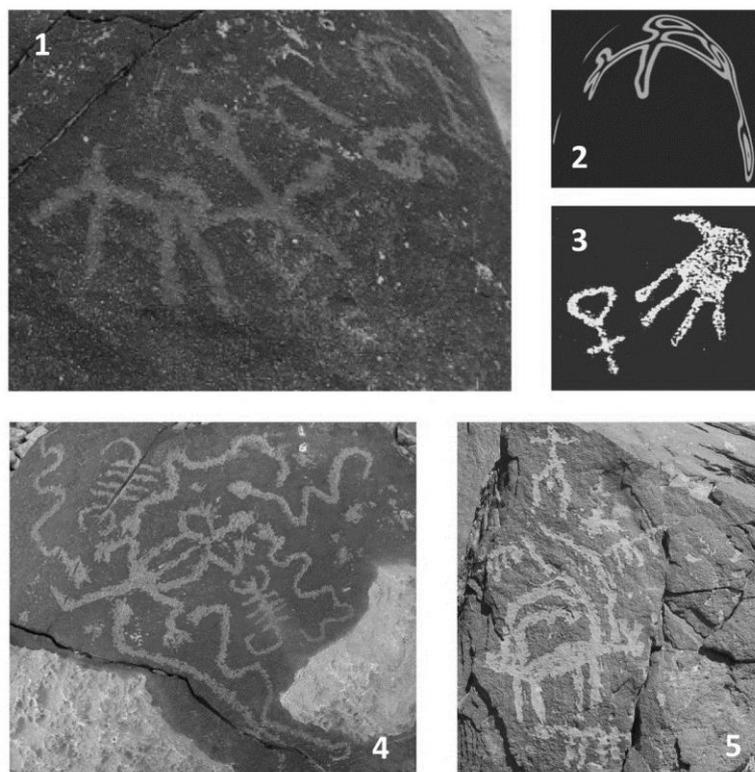


Figure 2. The petroglyphs discussed in the text: 1 Nahal Zin; 2 Nahal Zihor; 3,4,5 Har Karkom. (photographs and sketches by the author)

The last-mentioned engraving resembles very much the drawing on the 8th century BC Lachish ewer, where the central icon is not anthropomorphic, but it is represented as a six-branched menorah. The two latter are representations of the fertility goddess Astarte (as inherited from Phoenicia, before she became the abstract Tanit of the Carthaginians) and the Canaanite Ashera. The unmistakable "maleness" of the Jordanian petroglyph is explained in a previous article (Steiner, 2016) that describes the goddess. The Negev engravings are presumably also icons of the goddess. She was associated with fertility in the sown (Phoenicia and Canaan), which would mean rebirth, renewal and transformation in the desert (the southern Levant), where fertility was a rather utopian concept, associated with Paradise (Steiner, 2010; 2016). In this case, the goddess may also be associated with after-life which, in its turn, can be related to concepts like renewal and rebirth. Her presence on the Zin-Mehia alignment also seems to illustrate these concepts (*ibid.*). Her zoomorphic companions seem to be male (or adult) and female (or kid) ibex, or gazelle (Nahal Zin), and Barbary sheep (Spain), and they are symmetrically placed to the left and to the right of the goddess, who in this case is the "tree of life," on which the animals feed.

The concepts of transformation, rebirth and renewal are also well-illustrated in the stories about the stars (Bailey, 1974). The passage of seasons, which is the main theme of nomadic star-lore, is likewise east to west oriented: the position of the equinoxes, the setting or rising of marker stars and the correlations between stars like Antares and Aldebaran, which are complementary to each other (they cannot be observed at the same time in the sky, they are both red, and they mark diametrically opposed directions and seasons). Antares is always associated with the west and the after-world, whereas Aldebaran with the east and with life (Van der Waerden, 1953; Tomkins, 1971; Magli, 2015). The goddess seems to be responsible at the same time for the concepts that determined the spatial east to west orientation of archaeological alignments (rebirth, after-life), and the temporal east to west orientation of star-lore (renewal, passage). As archaeological remains like alignments, tumuli fields and walls display characteristics related to astronomy (Steiner, 2016), a parallel between star-lore and after-life beliefs does not seem out of place. In this case, the common denominators would be the figure of the goddess (which symbolizes renewal and rebirth) and the stars Antares and Aldebaran (which define the orientation of renewal and rebirth in physical and ritual space).

In many rock engravings, a marked affinity to the starry night sky may be recognized. This does not

mean that they are "star maps," but that the stories told by petroglyphs are the same with those related by the stars. Because archaeological alignments are understood even by mainstream scholars as related to astronomical orientations (Avner, 1984; Haiman, 2000; Granot, pers. comm.), rock art associated with these - or dated to the period in which the alignments were conceived and built - should be related to the same astronomical factors that influenced the orientation of the alignments. In this context, the goddess, who is clearly related to the prevalent east to west symbolic orientation of renewal, should also be found between the stars, with respect to the directions that seem to have had influenced the archaeological alignments. Indeed, her position in heaven describes precisely her attributes. Her shape would locate her to the left of Draco (from the perspective of the stars): the head almost on the north-star and the body along the axis of the constellation Cepheus (Steiner, 2016). The main star of this constellation is Alderamin, or Adh Dhira al Yamin in Arabic, which means "the right forearm." The palm at the end of the forearm and its exaggerated fingers would fit perfectly the constellation Cassiopeia, which is also called Khaf, "the palm," by the Bedouin. It is also known as Khaf al Habib, or "the henna-dyed hand," and it is thought to represent the hand of Fatima, the daughter of Muhammad (Kunitzsch, 1959). The opposite (left, snake-) arm would be in this case the tail of Draco (or the neck of the camel - see below) and the two-horned head of the snake would correspond to the asterism at the end of the tail (neck), with its two prominent stars, Rastaban and Eltanin.

Draco is at the center of the circumpolar area and it can be seen all year long. Because of its reliability, it was imagined in the antiquity as the "seat of God" (Tomkins, 1971; Magli, 2015). In Bedouin star-lore this is still mentioned, although in a figurative way. The constellation is not God, but a reminder (sign-lesson, or ayah) of His existence: it is the figure of a ten-month pregnant she-camel that was miraculously brought forth from the rock by the Thamudic prophet Salih, in order to prove the existence of God to the unbelievers (Poret, 2010 [Qur'an, surah 8]). Indeed, the shape of the constellation resembles that of a camel. The goddess is positioned at the left of this constellation, like Ashera is always at the left of Ba'al or Yhwh and like the broad female masseboth are in most cases at the left of the narrow male ones (Avner, 1990; 2001). These stelae were thought to contain the essence of deities and were erected starting with the 10th millennium BC, to biblical times (*ibid.*). The constellations and asterisms on which the body of

the goddess is traced are also in the circumpolar area today and are visible all year long.

The location of the goddess becomes even more significant when the directions to which her arms are pointing are considered: the snake-arm points straight to Antares, while the middle finger of the hand that is Cassiopeia points to Aldebaran. The arc described by her spread fingers encompasses all the "lucky" stars and asterisms of the winter sky: Hamal, the Pleiades, Aldebaran, Capella, Betelgeuse and Sirius. As the two arms resemble the symbol of the shaman in his role as mediator, it may be stated that the goddess is mediating between the world of Aldebaran and that of Antares, that is, between east and west. The tailed tumuli described in *The Goddess and the Copper Snake* (Steiner, 2016) seem to have the same role, not only because of their orientation, but also because of their shape which, if drawn on paper (or rather on rock), would also resemble the symbol of the ritual specialist. Although the head of the goddess is roughly positioned under the north-star, it points straight to the brilliant Regulus in the constellation Leo. In the opposite direction, the axis of her body may be extended to the prominent star Fomalhaut, in Pisces Austrinis. These four stars were once called the "archangel stars": Michael (Aldebaran) watcher of the east, Oriel (Antares) watcher of the west, Raphael (Regulus) watcher of the north and Gabriel (Fomalhaut), watcher of the south (Van der Waerden, 1953; Pannekoek, 1961). To the ancient Persians they were known as the Four Royal Stars. Moreover, 5,000 years ago they marked the equinoxes and the solstices: Aldebaran the vernal equinox, Antares the autumn equinox, Regulus the summer solstice and Fomalhaut the winter solstice (ibid.).

The markedly symmetric figure of the goddess may be called an iconic image, not only because it is found in more than one location, but also because of its apparent relatedness to the concepts of renewal, transformation, rebirth and after-life (Steiner, 2010; 2016). The symmetry also emphasizes the conceptual and physical east to west orientation, which is clearly associated with the categories listed above. Furthermore, its location between the four cardinal stars link the icon directly to the prevalent orientations exhibited by archaeological alignments, and also to the distribution of the seasons, which is the central motif of nomadic star-lore.

2.4. *The Goddess Today*

Another detail related to the proposed location of the goddess is that in the contemporary sky, which is defined by the present axial tilt and the stars which are the backdrop of the equinoxes, she stretches her

arms precisely over those 90° of ecliptic longitude that are situated between the winter solstice and the spring equinox (see Figure 3.). This means that she must have been related directly to the increasingly longer days that characterize the period between the December solstice and the March equinox, and to the renewal of life that is heralded by the latter. Hence, her tentative identification with Ashera becomes justified. In the illustration below, the grey dotted lines that intersect each other in Polaris delineate the 90° arcs on the ecliptic between today's solstices and equinoxes. Note the position of the goddess between the winter solstice and the spring equinox, as described above. Instead of zodiacal signs the constellations on the ecliptic are illustrated with petroglyphs from Har Karkom (when a correlation between the two can be determined), or with the first three letters of the names of the constellations. The black lines, circles and arcs should be ignored meanwhile, as they are meant to illustrate how the sky looked 5,000 years ago. The illustration is not drawn to scale or with mathematical precision, just like petroglyphs are not, because they are meant to tell stories and not to be astrological maps.

The zoomorphic composition at the left seems to be a combination of the constellations Orion, Taurus and Aries (note the three dots, which were incised in the rock with the clear purpose not to leave any doubt about what the petroglyph was supposed to convey - it is Orion's Belt). All the "lucky" stars mentioned in the text are located in and around this engraving. It would be very tempting and quite logical to interpret it as an illustration of the winter sky. In a measure it is, only that the petroglyph is dated to a period (Early Bronze Age [Anati, 1985]) when due to the axial tilt and the different backdrop of stars against which the equinoxes occurred, the seasons were different than today's, hence they could not have been foretold by the marker stars used as references by contemporary nomads. An Early Middle Bronze Age dating would already qualify it as an illustration of an almost contemporary winter sky. The same applies to the partial reproduction of a petroglyph at the right side of the figure, which depicts the constellations Scorpius, Libra, Virgo and Bootes (the latter is easily identified in the original rock engraving, due to a few details, which leave no doubt about the figure being the constellation [see Steiner, 2016]). These constellations dominate the summer sky and because of their negative image in Bedouin star-lore (Bailey, 1974), and because they represent animals associated with the scorching heat of summer, it would be tempting, again, to interpret the petroglyph as an illustration of the summer sky. Without taking into consideration the age of the

engraving (dated to EBA [Anati, 1985]), such an interpretation would be very logical: Bootes, the bird-like lizard, sinks slowly behind the horizon immediately after the autumn equinox, devoured by snakes and scorpions toward the end of summer. The stripe on the lizards back only seems to emphasize its relatedness to the equinox that divides the two seasons. This is in a way the correct interpretation of the engraving, only that instead of a seasonal story, the composition rather relates a one-time EBA/MBA event, and the snakes and scorpions are more like the biblical "sarafim" than common reptiles and arachnids. Just like in the case of the composition diametrically opposed to it, in which the ibex and the ram are not common animals, but mythical heroes or villains. However, both compositions are within those quarters of the ecliptic plane that border the one occupied by the goddess. Symbolically seen, their interpretation is meaningful, as both petroglyphs are clearly related to the goddess: her snake-arm points to the heart of the scorpion (Antares) and the middle finger of the opposite hand to the bull's eye (Aldebaran). The

length of her body is on the line that unites Regulus and Fomalhaut. Although the Nahal Zin goddess is a relatively recent engraving (Iron Age, or even later, [ibid.]), its Nahal Zihor replica, judging by the patina covering it, was incised into the rock at an earlier period. The composition was in all probability conceived to illustrate the realities of the Early to Middle Bronze Age I sky. The depiction of the same icon after almost a millennium, when the equinoxes and the seasons were already different from those of the Early Bronze Age, only emphasizes the importance of the goddess. The continuity of motifs may also be observed in the case of other engravings at the Zin-Mehia site. The orientation of the alignment, and the age of the earliest engravings on it, point to a Chalcolithic-Early Bronze Age origin (Anati, pers. comm.). Apparently, the site did not lose its importance, and the numerous petroglyphs engraved during the Iron Age, and even later, show a continuity of traditions in which the goddess or, rather, the concepts that she represented, played a key-role.

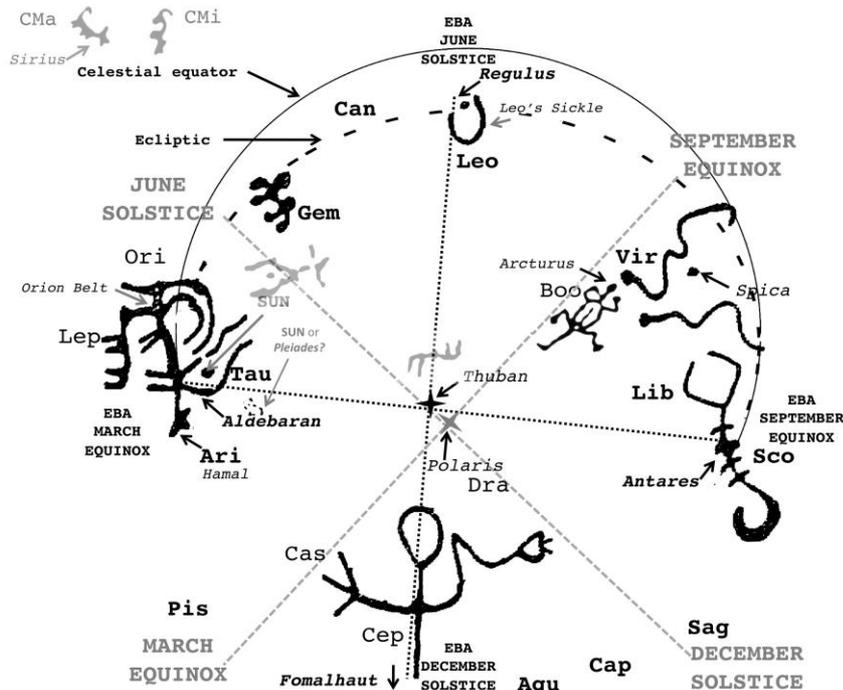


Figure 3. Contemporary (grey) and Early Bronze Age (black) equinoxes and solstices correlated with petroglyphs suggested to represent the winter (left, Har Karkom) and summer (right, Har Karkom) constellations. A "goddess" icon was inserted (center, Nahal Zihor) in order to illustrate her role in the transition from season to season. (drawing based on photographs by the author)

Indeed, the ethnicity and economy of all the documented inhabitants of the area - from Shasu nomads, Nabataeans and Thamudic tribes, to the present-day Janabib and 'Azazme Bedouin, who were all Semitic nomadic herders of North Arabian origin who made the Negev Highlands their home and marked its rocks with their signs attesting their

territorial claims (Khan, 2000) - points toward a parallel, conceptual continuity. On the rocks bearing their tribal signs (wusum), they also engraved their stories and 'magic,' in order to attract blessing and abundance to the claimed grazing and watering grounds. "Bedouin" dominated the ethnographic landscape even through the Idumaeans, Nabataean,

Roman and Byzantine stable periods (Fabian, 2005). Throughout much of the past millennium and a half since the end of the Byzantine era, the Negev Desert accommodated such pastoral nomads of various tribal identities whose migratory paths took them from Arabia across the Negev, into the Sinai and beyond, and back again to the Sinai and Negev, where wusum engraved during the first period of occupation were recognized as valid territorial markings, and to which new ones were added as a re-confirmation of ancestral rights (Abu Rabi'a, 2001; Galilee et al., 2013; Isaac, 1992; Sharon, 1975; Khan, 2000. NOTE: a recent publication on Arabian rock art brings up all these issues, MAA (2017)). This pattern seems to be also the case for the present inhabitants

of the area, the Janabib, whose oral traditions narrate a >1,400 years history (Bailey, 1989). The Nahal Zin "goddess" petroglyph is in Janabib territory, and the site where it was engraved was – judging by the presence of Bronze Age, Iron Age, Nabataean, Thamudic and Janabib engravings – continuously used for fertility-related ritual practices (Mailland, 2015; Steiner, 2016). The same phenomenon was observed in the case of other Arabian rock art sites where, according to R.G. Bednarik (2017, pers. comm.), certain Bedouin groups have apparently defied the restrictions imposed by Islam for 1,400 years and are continuing to the present time to create rock art and use pre-existing rock art for ceremonial purposes.

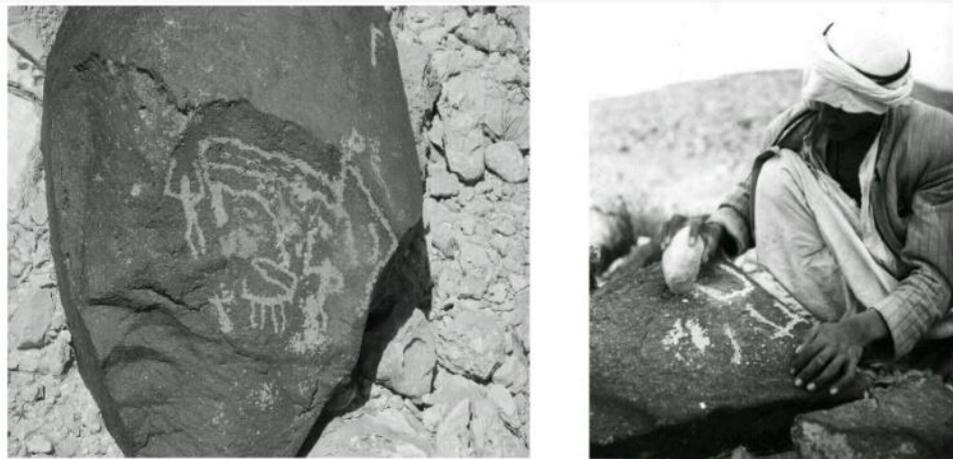


Figure 4. Left: a petroglyph from the Avdat area that, judging by its degree of patination, was engraved recently, during the Bedouin period. However, the motif depicted appears frequently in engravings that were dated to the Early Bronze Age. (photograph by the author) Right: The Bedouin of the Negev have never given up the practice of leaving their marks on rock faces. (photograph by Emmanuel Anati 1954; republished in Expression 15, 2017)

3. THE CHALCOLITHIC – EARLY BRONZE AGE SKY

3.1. Equinoxes and Seasons

Despite the preliminary conclusions above, to the contemporary Bedouin the Chalcolithic-Early Bronze Age sky would have looked unfamiliar. Although they would have recognized the same stars, in the same relative positions to each other, they would have heard different stories about them. The north-star would not have been Polaris, as it is today, but Thuban in the constellation Draco, which is only one fifth as bright as Polaris. Thuban was the star closest to the celestial pole from 3,942 BC to 1,850 BC, when the much brighter star Kochab (Ursa minor) superseded it (Burnham, 1978). Bootes, which was closer to the pole than it is today, was a permanent feature in the sky, while Cassiopeia disappeared seasonally (ibid.). Even the familiar stars would have risen and set at different times and the rains would

have been associated not with Ath-Thuraya (Pleiades), Imjayid (Aldebaran) and Al Jawza (Betelgeuse), but with other stars. The equinoxes and solstices would have occurred against the backdrop of different stars, too. Aldebaran and Antares marked precisely the location of the spring and autumn equinoxes in 3,044 and 3,052 respectively, while Regulus marked the summer solstice in 2,345 BC and Fomalhaut the winter solstice in 2,582 BC (Berger, 1976). These dates fall within the archaeological period known as the Early Bronze Age. The vernal equinox, which is considered the most important not only in astrology, but also to the nomad, was associated with the constellation Taurus until 1,865 BC (Middle Bronze Age), when it passed into Aries. The autumn equinox, on the other hand, stayed within the constellation Scorpius until 729 BC (Iron Age), when it passed into Virgo (to the ancients, the constellation Libra was part of Scorpius, or to be more precise, the stars of Libra

were imagined to be the pinchers of the scorpion – the equinox passed from Scorpius into what we know today as Libra at around 1,850 BC). The June solstice passed from Leo into Cancer in 1,458 BC (Late Bronze Age) and the December solstice from Aquarius/Pisces Austrinus into Capricornus at around the same time (*ibid.*).

The backdrop of stars against which equinoxes occur and the location of the celestial pole are complementary phenomena. The equinoxes are located in the points where the celestial equator intersects the ecliptic. When the axis of the Earth changes its inclination, the equatorial plane of the Earth moves with it. As the celestial equator is just the Earth's equator projected onto the celestial sphere, it moves as the Earth's equatorial plane moves, and the intersection with the ecliptic also moves with it. The positions of the poles and equator on Earth do not change, only the orientation of the Earth against the fixed stars (*ibid.*; Dreyer, 1953; Evans, 1998).

3.2. *Antares and Aldebaran*

To the nomad, the stars are part of everyday-life. The dry air of the desert makes them appear bigger and closer, and their passage through night, season and year is observed and memorized with care. The symmetry displayed by the Early Bronze Age sky must have impressed the nomad, whose skyward orientation in matters related to faith was described and analyzed elsewhere (Steiner, 2016). The association of the four cardinal stars with the equinoxes and solstices only strengthened the belief that the seasonal cycle of renewal and life was not incidental, but carefully planned and a part of the cosmic order. Closely related to renewal and life are rebirth and after-life. Placing the four categories within the coordinates of such a meaningful sky seems logical. When around 3,000 BC the equinoxes coincided precisely with the locations of the two red stars Aldebaran and Antares (see above), which are on the two ends of the Milky Way (which in many beliefs was thought to be the path taken by the soul after death [Magli, 2015]) and were associated not only with the east and the west, but also with life (vernal equinox, rebirth, Aldebaran) and death (autumn equinox, decay, Antares), the significance of the sky only gained in importance. In the Early Bronze Age, Antares was not the brilliant red star of today: at some times it was brighter, while at other times it seemed to fade (Burnham, 1978; Parker, 2010). This may also be one of the reasons of its association with a world very different from Aldebaran's, where life was supreme. The color of the stars was also important, as red was associated, since times immemorial, with transformation and

renewal (Wilmsen, 2009). The ochre-painted bones found in prehistoric secondary burials hint at the relatedness of the color either with rebirth, or with after-life beliefs (Gilead, 2002). The magic that surrounded copper reflected the fascination with the physical properties of the red metal, which also illustrated, in a palpable way, the concepts of transformation and renewal (Amzallag, 2008, 2009; Steiner, 2010, 2016). As Antares and Aldebaran are precisely those that from all the fixed stars are the closest to the orbit of the moon, occultations were a common phenomenon – the moon was another symbol of renewal (Bastoni-Brioschi, 1998; Mailland, 2015; Wachtel, 2014), and the association of the said stars with it must have had a marked symbolic meaning.

Antares and Aldebaran are equally distanced from the celestial pole, which at that time was the star Thuban. They are seen in the night sky during cardinally opposed seasons, and when one of them sets at dawn, its counterpart rises. While Aldebaran follows the path of the sun, Antares follows that of the moon, and vice versa. They can never be seen at the same time, as life and death do not belong together. The arms of the goddess mediate between their worlds, which never meet, except in the twilight zone to which only shamans or priests have access. Until around 1,850 BC the constellations to which the two stars belong (Taurus and Scorpius) marked the spring and autumn equinoxes, while the summer and winter solstices were associated with Regulus (Leo) and Fomalhaut (Pisces Austrinis) (Berger, 1976).

3.3. *Archaeological Alignments*

Although Regulus and Fomalhaut were equally important stars, the symbolic implications of Aldebaran and Antares, especially with respect to renewal, life, rebirth and after-life, seem to have been more significant. Placing these four categories within the coordinates of Aldebaran and Antares and taking into consideration that these were precisely the concepts reflected in the orientation of the archaeological alignments dated to the period (Steiner, 2016 and references therein), the placing of the alignments within the same ritual coordinates seems justified. The prevalent east to west orientation of tumuli lines and rock walls may be interpreted as the reflection of the symbolism ascribed to the two stars. Late Chalcolithic-Early Bronze Age archaeological complexes, in which masseboth, shrines, rock art sites and tumuli are distributed along the same orientation, may therefore be related to the positions and the roles of Antares and Aldebaran at the time when the complexes were conceived. The continued ritual

significance of the alignments in periods when the equinoxes ceased to be marked by the two stars, and the presence of petroglyphs that despite this fact still emphasize the complementary character of Aldebaran and Antares may be explained with the survival of the traditions that link the two stars with after-life beliefs. Even that since 1,850 BC they are not associated with the spring and autumn equinoxes, their relative position to each other made them into the prominent stars of winter and summer, and their symbolic meaning remained actual. The complementary character of the two red stars continued to define the cycles of seasonal renewal and decay, thus the parallel concepts of life, death and rebirth are still associated with them (ibid.). The fact that the image of the goddess was engraved on a boulder on the Zin-Mehia alignment during the Iron Age, and that the alignment still had a ritual meaning in relatively recent periods (as illustrated by the numerous Thamudic drawings and inscriptions from the 3rd century AD [Tsafir, 1996]) reflect the continuity of the traditions that were initially inspired by the two stars.

3.4. The Chalcolithic – Early Bronze Age Goddess

The symmetry displayed by the icon identified as the goddess seems to mirror the symmetry of the Late Chalcolithic-Early Bronze Age sky, in which her image fits perfectly. This is also recognizable in the illustration in Fig.3. With Thuban as the celestial pole, the intersection of the ecliptic with the celestial equator was located within the constellations of Taurus and Scorpius, on the two opposite ends of the Milky Way. Aldebaran and Antares marked the location of the vernal and autumn equinoxes, while Regulus and Fomalhaut marked the highest and lowest latitudes of the sun, with respect to the equatorial plane. The celestial equator during the Early Bronze Age was the constellation Hydra (Dreyer, 1953; Berger, 1976; Parker, 2010). In the illustration, the black circle is the celestial equator and the black interrupted arc represents the ecliptic. The outstretched arms of the goddess encompass precisely the 180° of the ecliptic between its two diametrically opposed intersections with the celestial equator, and point to Aldebaran (the March equinox) and Antares (the September equinox). Her head and body are accurately aligned with Regulus (the June solstice) and Fomalhaut (the December solstice). She is parting the dome of the sky projected on the ecliptic plane into four 90° slices which, in their turn, correspond to the four seasons. However, the four seasons that characterize temperate zones are not so sharply differentiated at subtropical latitudes. They rather represent transitions than seasons. The arms

of the goddess differentiate between the dry and the rainy parts of the year, which are separated by the vernal and autumn equinoxes. We do not know much about the seasonal distribution of rainfall during the Early Bronze Age, and the change in the axial tilt of the Earth that occurred since that period was paralleled by changes in climate (Anati, 1985), which probably shifted the months associated with the arrival of the rains. However, the Negev was still in the northern subtropical climatic zone, which is defined by rainy winters and dry summers. That Antares and Aldebaran had a key-role in the transition between the two important seasons is also emphasized by the equidistant position of the goddess between them. Because the image of the goddess fits perfectly in the Early Bronze Age sky, it can be assumed that the figure was conceived around 3,000 BC. However, with Thuban as the pole star, the palm of the goddess, Cassiopeia, sank under the horizon during the dry months. Its designation as the “cutoff hand” and its association with Fatima’s hand in contemporary star-lore (Kunitzsch, 1959) may be an ancient inheritance, which shows the esteem in which the constellation was held. Symbolically seen, the appearance of the hand in the sky must have been interpreted by the ancients as the sign that foretold the imminent arrival of the lucky constellations, at which the fingers were pointing. The rising of Cassiopeia was probably associated with plenty and blessings, very much like Fatima’s hand (also known as “khamisa”) is today. The other two petroglyphs, tentatively placed at the right and the left side of the central figure, are also dated to this period (Anati, 1985; 1986). However, it is difficult to guess their symbolic meaning in an Early Bronze Age context. They evidently represent the stars and constellations associated with the ecliptic longitudes at which the equinoxes occurred, but they do not tell a story. Although the dot between the horns of the animal that clearly represents Taurus depicts the position of the sun at the vernal equinox, which would date the engraving to precisely this period, this would still not explain the presence of the third zoomorphic figure, to the right of the bull. The drawings cannot be interpreted as references to the marker stars of seasons either, as the arrival of the rains in different climatic conditions was most likely foretold by other asterisms. These petroglyphs are carefully conceived complex compositions and not mere graffiti. If they were conceived to illustrate banal, everyday aspects, there should be more such engravings, but this couple is unique in its complexity and artistic presentation. The dynamism that characterizes the two compositions seems to express more than simple statements about the whereabouts of certain stars.

4. POLAR AND EQUINOX PRECESSION

4.1. Period

- Thuban was the star closest to the celestial pole from 3,942 BC until 1,850 BC when it was superseded by the much brighter star Kochab (Ursa minor).
- Aldebaran marked precisely the location of the spring equinox in 3,044 BC.
- Antares was associated with the autumn equinox in 3,052 BC.
- Regulus marked the summer solstice in 2,345 BC.
- Fomalhaut corresponded with the location of the winter solstice in 2,582 BC.
- The vernal equinox was associated with the constellation Taurus until 1,865 BC, when it passed into Aries.
- The autumn equinox passed from Scorpius into what we know today as Libra at around 1,850 BC.
- The June solstice passed from Leo into Cancer in 1,458 BC.
- The December solstice passed from Aquarius/Pisces Austrinus into Capricornus at around 1,450 BC.

Although these dates were already mentioned (Berger, 1996; Evans, 1998; Hilton et al., 2006), their listing together evidences that the astronomical stability that characterized the Late Chalcolithic and the Early Bronze Age (3,200 to 2,200 BC), came to an end during the Middle Bronze Age (2,200 BC to 1,550 BC) and the early phases of the Late Bronze Age (1,550 BC to 1,200 BC). The stable period was characterized by the millennia-long association of certain constellations with the equinoxes and solstices, which resulted in the reliability of the seasons. The beliefs, symbols, myths and star-lore, which emerged during this period mirrored the astronomical realities, to which material vestiges like oriented walls, alignments, tumuli lines, masseboth, etc., also confirmed (for a discussion see Avner, 1984; 2001; Haiman, 2000; Steiner, 2010; 2016). Beside the astronomical stability, of which the desert nomad did not know much, there was a parallel "orderliness" displayed by the relative position to each other of the stars and asterisms that were associated with the equinoxes and solstices. This was likely perceived as an evident proof of the beliefs, and the perfect symmetry depicted in the night sky was understood as divinely designed. However, the apparent position of the sun relative to the backdrop of the stars at some seasonally fixed time, say the vernal equinox, slowly regresses a full 360° through all twelve traditional constellations of the zodiac, at

the rate of about 1 degree every 71.6 years. This is known as the precession of the equinoxes, which in its turn is related to axial precession or, in other words, when the axis of the Earth changes its inclination, the equatorial plane of the Earth remains perpendicular to it, and the points of intersection with the ecliptic, where equinoxes occur, slowly precess (Berger, 1976). The positions of the poles and equator on Earth do not change, only the orientation of the Earth against the fixed stars. When Thuban was succeeded by Kochab as the pole-star, around 1,850 BC, the equatorial plane moved progressively, together with Earth's axis. The effect was the shift in the position of the equinoxes, as perceived by an observer on Earth, and around 1,850 BC the backdrop of stars against which the equinoxes occurred, was different (*ibid.*).

4.2. Effects and Fears

Any change that alters a perfect state is to the worse. The symbolic implications of the Earth's new orientation against the fixed stars were catastrophic. Order was exchanged for chaos, not only on the spiritual level, but also in aspects related to everyday life (Velikovsky, 1945). The precession triggered out an arid period (Anati, 1985) that would last until the Iron Age (1,200 BC). The Chalcolithic - Early Bronze Age - Middle Bronze Age I were characterized by high population densities in the Negev, which would be followed by a demographic hiatus (*ibid.*). The changes in climate started to be felt already at the close of the Early Bronze Age, which was a period of upheaval, from Egypt to Mesopotamia (Velikovsky, 1945). There are many catastrophist scenarios that describe this period, and there are also hypotheses that explain the sudden deterioration in climate and the precipitous end of the Egyptian Old Kingdom with a sudden, non-gradual polar shift (*ibid. et passim*). Interestingly, out of billions of stars, only one is called by that name: Kochab in Hebrew and Kawkab in Arabic both mean "star." This may serve as an indicator that the polar shift was a gradual process and the change in the inclination of the Earth's axis did not happen overnight. Thuban was not suddenly displaced by Polaris as the celestial pole, but gradually, with the star Kochab as an intermediate pole. The name was probably given to the star during the Middle Bronze Age I or after, when it was simply referred to as "the star." It must have been also made responsible for the changes and maybe it was forbidden to speak out its real name. In Bedouin star-lore Polaris is the killer of the hero called An-Na'ash, whose coffin, Ursa major, is carried by his three mourning daughters (Bailey, 1974). It seems plausible enough that the origin of the legend goes back to the days

when Thuban lost its role in heaven. Thuban did not “jump” to Polaris, just like the equinox did not jump from Taurus to Aries. Actually, Thuban, Kochab and Polaris are not the celestial poles, but the closest stars to it. 2,000 years ago, Polaris was still not the pole-star, although the equinox had already passed into Pisces. The latter is a constellation that occupies many longitudinal degrees. Although in astrology the zodiacal signs occupy only 30° on the ecliptic, in astronomy the length of the constellations varies (Hilton et al., 2006). Therefore, the passage of the vernal equinox from one zodiacal sign into the other does not imply that the celestial pole jumps from one star to another. The change in obliquity is known to attract climatic effects. However, these are gradual and cumulative, and are expressed by the lengthening or the shortening of the seasons in the two hemispheres. Today for example, summers are longer in the northern hemisphere (Berger, 1976). It seems that a critical point was reached at the beginning of the Middle Bronze Age, which led to a sudden deterioration in climate, the consequences of which were catastrophic (Velikovsky, 1945).

The symbolic consequences were just as far-reaching as the climatic ones. The changes in climate were probably correlated with the escape of the sun from between the horns of Taurus to Aries. The fear of losing it definitively must have been very real, together with the need to restore it and to re-establish the order that ruled the world prior to its escape, that is, before chaos took over on earth and in the sky (Rotblum, 2010). The ram was most likely thought to be the thief who stole the sun and who must therefore be hunted down. The epical hunt is apparently the theme of many Middle Bronze Age myths, worldwide (*ibid.*). It is depicted in the rock art of regions between which there were no cultural exchanges at that time. In the Negev, where the effects of the equinox shift were devastating, the story of the event must have also been carved in the rock.

4.3. *Rock Art and Mythical Re-orientation*

A closer look at the two petroglyphs that appear at the location of the Early Bronze Age equinoxes in Fig. 3. - in the light of the implications described above - may explain their complexity and dynamism. The zoomorphic figure seems to be a combined image, in which three animals are depicted as one. The ibex may be identified as Orion, because of the three dots that represent Orion's Belt, and because of its relative position to the horned animal facing the opposite direction, which is evidently Taurus. The dot between the horns of the latter - in this context - does not depict Aldebaran, but the position of the sun at the time of the Early

Bronze Age vernal equinox. The third animal does not display the impressive horns of the ibex or the bull, but it has smaller horns and markedly ovine features. Judging by its relative position to Orion and Taurus and by its size, it may be identified as Aries, the ram. Above it, in front of the dot between the horns of the bull, there is another dot surrounded by concentrically arranged lines. Although it could be interpreted as a depiction of the Pleiades in the context of contemporary star-lore, the detail is differently arranged and it is rather a representation of the sun. The rock engraving is apparently the story of the sun passing from Taurus into Aries around 1,850 BC. The patina covering it shows that the composition was drawn as it is, at the same time, and that the ram and the new position of the sun are not later additions. Thus, it must be dated to the Middle Bronze Age - this would mean that it is more recent than what its age was suggested to be (Anati, 1985; 1986; 2015).

Whereas the bull, the ram and the two suns tell the story of the equinox shift, Orion's role in the composition is not so clearly defined. It must be more than a simple reference to the position of the bull and the ram. The fact that it faces the opposite direction and that at its feet a fourth animal (constellation *Lepus*, Al-Arnab, the hare) does the same, implies that its presence is not incidental, but a part of the story. In the original engraving, there is an anthropomorphic figure with a dot between its legs, placed above the combined image of ibex, bull, ram, and hare. The latter is perceived as a symbol of fertility in contemporary star-lore (Bailey, 1974). The dot between the legs of the anthropomorphic figure and between the horns of the bull are complementary, and they illustrate the plenty associated with the spring equinox and the role of the ritual specialist's magic in the unfailing annual return of the plenty. Before the precession, Orion was on the path of the sun during the period of plenty that followed immediately the equinox. This may explain its presence in the composition, where the symbolism of the hare and the magic of the shaman try to spell Orion back to its place, with the hope that the bull, the ram and the sun would follow it. There are many engravings in the Negev that depict a hunt that seems related to the interpretations above. An animal - predominantly the ibex - with a dot between its horns is shown to be chased by two dogs, or hunted by a figure with a bow and with ideograms around its head, which would identify it, again, as the ritual specialist. This only shows that the engravings do not depict common hunt scenes (Eisenberg-Degen and Rosen, 2013; Mailland, 2015). The animal is sometimes chased in the direction of the precession, in which

case the engravings would illustrate the phenomenon. Gemini (the twins) and Canis major/minor (the dogs, of which the larger is Sirius) are apparently involved in the hunt. When the ibex is chased in the direction opposite to that of the precession, the petroglyphs seem to voice the wish to see Orion back on its proper longitude on the ecliptic, only a few degrees away from its intersection with the equatorial plane, as it was the case before the sun escaped from between the horns of the bull. Perseus may in this case be identified as the hunter/shaman who initiates the chase, which is rather a magical, figurative hunt. In today's context, the hunt expresses the wish to precipitate the arrival of spring and the plenty associated with it, which means that the dogs chase Orion towards Aries and Pisces, in other words, they chase the winter away - Bedouin star-lore describes this hunt ('Id al-Kashkhar and 'Id al-Wadj, pers. comm.). The second petroglyph in the illustration is placed diametrically opposed to that described above, at the location of the Early Bronze Age autumn equinox on the ecliptic. Like its counterpart, it also relates the story of the precession. At the time when Thuban was close to the celestial pole, the constellation Bootes - identified as the lizard in the engraving - was a constant feature in the sky, given its proximity to Thuban. Today it disappears shortly after the September equinox and it only returns after the March equinox. During the summer months, the constellation is almost overhead. The disappearance of such a prominent constellation from the circumpolar area was associated with the advance of the equinox from Scorpius to Libra, which occurred at the same time with that from Taurus to Aries. The snakes in the petroglyph can be very easily reconstructed as curves drawn along the main stars of Virgo (Steiner, 2016). The advance of the equinox on the ecliptic led to the banishment of the lizard from the circumpolar area and to its seasonal exile below the horizon. The figure of the lizard may be interpreted either as that of a villain responsible for the changes, or as that of a victim. In the first case Bootes would be a "fallen angel" banished from the circumpolar area (the seat of God) because of his guilt in triggering out the chaotic conditions that followed the precession of the equinoxes. The role of the scorpion and the snakes would be positive in this interpretation. If the lizard were a victim, the snakes and the scorpion would be the evil characters of the story. However, considering the relatedness of Antares to Aldebaran and the association of Scorpius with the autumn equinox during the Early Bronze Age, the seasonal exile of Bootes may be understood as a well-deserved punishment for some kind of involvement in the precession, which was probably

the subject of a long-forgotten Early Bronze Age story of which this rock engraving is the sole reminder. Again, it must be made clear that Bootes did not disappear from one autumn to the next, but was slowly "dismembered," through the decades. Poles and equinoxes do not "jump", but shift gradually. Another consequence of precession, parallel to the gradual disappearance of Bootes was that the "cut-off hand" of the goddess - the constellation Cassiopeia - became a constant feature in the sky. This did not happen overnight either, but it was a slow process. The increase in the popularity of the goddess during this period may have its roots in this interpretation (Achrati, 2003; Cornelius, 2000), which may also explain why an icon conceived during the Early Bronze Age would still be depicted in relatively recent petroglyphs. The constellation Draco, that is, the seat of God, the goddess, and the complementary character of Antares and Aldebaran are the only reminders of the Early Bronze Age order. The symbolic implications of the goddess are even more pronounced today: the arc described by her fingers encompasses progressively - between November and May - the constellations which were associated with the vernal equinox during the last 6,200 years, from Gemini to Pisces, while at the same time, the fingers also point at the lucky stars associated with plenty between late October and December. Between May and October, the snake-arm describes an arc from Sagittarius to Virgo, the ecliptic degrees associated with the autumn equinoxes, from prehistoric to modern times. Her outstretched arms - in the context presented in this paper - still mediate between the two celestial regions.

In conclusion, the two other petroglyphs were most likely engraved immediately following the changes triggered out by the precession of the equinoxes, during the Middle Bronze Age. Their dating by Anati (1985) to an earlier period is challenged by the stories that they apparently tell. They were conceived and incised in the rock during the last phases of human habitation in the Negev, shortly before the demographical hiatus that would last until the Iron Age. Their location on Mount Karkom, one of the most sacred mountains in the Negev (*ibid.*), seems to be more than incidental. On the mountain, there are many other petroglyphs that were engraved around 4.200 BC, which corresponds to the beginning of the Chalcolithic. The date marks not only the start of an archaeological period, but also that of the long-lasting astronomical interval in which the four cardinal stars and the constellations to which they belong were associated with the equinoxes and the solstices. The early engravings on the mountain most likely illustrate the process of

mythic re-orientation to the “orderly” and symbolically meaningful Chalcolithic sky. Pastoralism became an established economy during a period of astronomical stability (Close, 2002; Haiman, 2002), to which its beliefs and symbols were adjusted and in which they were also mirrored (Rosen, 2007; Steiner, 2016). Given the longitudinal extension of both Taurus and Scorpius, the order lasted for almost two millennia and a half. The position of Antares and Aldebaran in these constellations and their symbolically complementary character only added to the significance of the cosmic order. At the beginning of the Middle Bronze Age, the visual effects and the climatic implications of the precession brought the long-lasting equilibrium to a relatively abrupt end (Berger, 1976). With chaos setting in, a mythological re-orientation became imperative. Apparently, the cult of a goddess associated with plenty and fertility gained in popularity during this period (Cornelius, 2014), when due to the arid conditions precipitated by the changes, these concepts became idealized and imagined to exist only in a better after-world.

5. CONCLUSION AND RECOMMENDATIONS

Even in the most cautious approaches to the subject, the prevalent east to west orientation displayed by purportedly Chalcolithic - Early Bronze Age tumuli lines, walls and other archaeological remains is recognized as being related to astronomical alignments, that is, solstices and equinoxes. Mortuary cult, ancestor worship and after-life beliefs are referred to when the orientation of the alignments is explained. As the function of rock art is also recognized to be ritual, when there are petroglyphs on such archaeological alignments, they must be regarded as graphic illustrations of the concepts and beliefs that inspired the orientation of the latter. Hence, rock art may also be approached from an archaeoastronomical perspective. However, the engravings cannot be placed haphazardly into the sky, and other factors than mere shape must also be considered. Contemporary nomadic star-lore may prove to be a useful instrument, as the cyclic renewal of seasons - which is apparently its main theme - may be related to the concepts of life, death, rebirth and transformation which, in their turn, are the concepts behind the topographical layout of the archaeological alignments. In a sense, star-lore also displays a prevalent east to west orientation: the cyclic renewal of seasons and life is associated with marker stars, which rise in the east and set in the west, or constellations, which are located either in the western or in the eastern celestial hemispheres, depending on the seasons in which they can be

observed and on their location with respect to the points on the ecliptic where the equinoxes occur.

An iconic figure that is engraved on a rock situated on one of the aforementioned alignments and two complex, and carefully executed petroglyphs - which are recognizable as depictions of constellations - were selected and placed into the sky. Not only that they fit perfectly, but they also seem to illustrate the stories related by Bedouin star-lore. The iconic figure - which was tentatively identified as a goddess - seems to define the seasons, and her arms point to the celestial areas where the two other petroglyphs were placed. Moreover, she seems to emphasize the relationship between the red stars Antares and Aldebaran which, besides being symbolically related in tradition, also have a key-role in the summer, respectively in the winter sky. The fingers of the goddess point at the marker stars of the rainy season. However, the two petroglyphs were dated to the Early Bronze Age, while Bedouin star-lore describes the contemporary sky and seasons. Due to axial and equinox precession, the Early Bronze Age climate was different than that described in Bedouin star-lore and the rains were likely predicted by other marker stars. Placing the icon and the two other petroglyphs into the Chalcolithic - Early Bronze Age sky, the former only gains in importance, whereas the two petroglyphs, although fitting the location of the vernal and autumn equinoxes, do not seem to state more than this mere fact. The arms of the goddess point to Aldebaran and Antares, the stars that marked the March and September equinoxes around 3,050 BC and her body is perfectly aligned between Regulus and Fomalhaut, which were associated with the summer and winter solstices. Her head is in the vicinity of Thuban, the polar star of the period. Her position leaves no doubt about the icon being conceived during the period discussed, and the fact that she also fits in the contemporary sky seems to be incidental, although her suggested location between Aldebaran and Antares is still meaningful. Thus, the initial presumption of the paper, namely that the icon was related to the concepts of renewal and passage in the case of star-lore, and to rebirth and after-life in the case of astronomically oriented alignments seems solid enough. The identification of the icon as a goddess associated with after-life beliefs during the Chalcolithic and Early Bronze Age is supported by its evident relatedness to the stars Aldebaran and Antares, which in their turn played important symbolic roles in the same beliefs. The other two petroglyphs become meaningful only when placed into the Middle Bronze Age I sky, in which they suddenly come alive. They illustrate the

precession of the equinoxes, which occurred around 1,850 BC.

The archaeoastronomical approach adopted in this paper contradicts the Early Bronze Age date that was attributed to the two petroglyphs. This may be a sign that the still widely accepted and employed dating techniques - based on a stylistic analysis of a small number of photos randomly taken by inexperienced travellers in the 1950s and extrapolated to all of Arabian and southern Levantine rock art should be reconsidered. The application of archaeometry is strongly recommended, especially because it is encouraged by the International Federation of Rock Art Organizations (IFRAO), of which the local Negev Rock Art Center (NRAC) is the newest (58th) member.

The precession was accompanied by heavy consequences in the Negev and the demographical hiatus between Middle Bronze Age II and the Iron Age may be attributed to it. The climatic catastrophe was accompanied by a symbolic catastrophe, perceived as the dissolution of the cosmic order into chaos. The Chalcolithic - Early Bronze Age sky was characterized by a perfect order, which is mirrored in the symmetry displayed by the goddess. The equinoxes and solstices were marked by the four cardinal stars, with the Milky Way stretching between Taurus and Scorpius, and the constellation Hydra as the celestial equator. This order lasted for a very long period, given the longitudinal extension of the constellations Taurus and Scorpius. The prevalent orientations exhibited by the archaeological alignments of the period reflect this order, in which the symbolic and astrological correlations between Aldebaran and Antares played a key-role. Thus, it is proposed that rather this relationship, than the direction of the sunset on the day of the summer solstice should be considered in the study of such alignments, and that the role played by a goddess in the beliefs that determined the construction of these alignments should also be researched. Her worship at these complexes may be indicated by the prevalence of broad female-masseboth over tall and narrow male-stones. As masseboth continued to be erected until relatively recent times, and also because symbols and icons conceived in the Early Bronze Age would be engraved in the rock thousands of years later, the

continuity in the archaeological data reflects a parallel continuity in beliefs. Apparently, the goddess still played a key-role during the Iron Age, as evidenced by the petroglyph in Nahal Zin. As Aldebaran and Antares are closely related to the goddess, their symbolic meaning outlived the astronomical context in which they rose to prominence, which is still recognizable in their central role in Bedouin star-lore and in the orientations observed by archaeological alignments, in relatively recent times. The persistence of the Ashera cult is the most palpable example of the continuity of beliefs crystallized in prehistoric periods.

In this paper, the connection of the present Bedouin population of the Negev Highlands to the rock art corpus found in their tribal lands becomes evident. Therefore, any decision regarding the research and protection of the said rock art should involve the elders of the Janabib and 'Azazme tribes, who should be recognized as the traditional owners of the petroglyphs. The IFRAO Code of Ethics (www.ifrao.com/wp-content/uploads/2014/06/ethic.doc) is very specific on this, and the literature that addresses rock art traditions in the southern Levant also highlights the connection of contemporary pastoralists to the rock art of their cultural and genetic ancestors. Having in mind that the inauguration of a National Park meant to familiarize the public with the rock art of past and present nomads is considered by the Negev Rock Art Center, following the ethical lines of IFRAO is strongly recommended in its planning. Moreover, given that rock art only offers a restricted spectrum of the culture that created it, a National Park should offer the public an encompassing picture of the traditions that are mirrored in the symbolism of the said rock art. I would recommend that the planned National Park should focus on the preservation and presentation of Bedouin nomadic culture as a whole, including herding, traditional dwelling and various cottage industries. Such an approach would be beneficial not only to the Janabib and 'Azazme Bedouin - to whom being part of such a protected area could offer recognition and legal status on their traditional lands - but also to the Negev Highlands Regional Council which, because of its interest in promoting tourism, would only profit from the revenues of a Bedouin Heritage National Park.

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