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MEGALITHIC ASTRONOMY OF EASTER ISLAND: A REASSESSMENT

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The Background

Ten years have passed since the publication of *The ancient solar observatories of Rapanui* by the astronomer William Liller,[1] while his seminal paper "The megalithic astronomy of Easter Island" appeared in this journal five years earlier;[2] and to our knowledge, no further archaeo- or ethno-astronomical research on the island has been published since. Liller's work is today considered the most reliable source for the astronomy of the ancient inhabitants of Easter Island (or Rapa Nui, as locals, including those of Chilean origin, prefer to call it). This is clearly reflected in Liller's authorship of a recent review on Polynesia in a book of ancient astronomies worldwide,[3] and in most recent good-quality popular books about Rapanui culture.[4] Liller's writings build on William Mulloy's work carried out in the 1960s and '70s,[5] later confirmed in the 1980s by Liller's research team.[6] The ethnographical evidence recovered by these and other authors[7] establishes the following:

(i) The Rapanui people had a detailed knowledge of the sky. Several celestial bodies, such as the sun, the moon, certain planets (especially Mars), and the brightest stars, were named, and used to measure time. Celestial phenomena such as comets and meteorites were also named.

(ii) There were places where celestial bodies were observed by community astronomer-priests. Singularly, early informants mention a cave near the Hanga Roa Catholic Cemetery and Ahu Okahu, which is named Ana Ui Hetu'u ("the cave for observing stars"). According to these informants, this cave "was an observatory where priests watched the stars, and a school where candidates for priesthood where instructed in the science of the stars". An outcrop in the Poike Peninsula (see Figure 1) is called Ko Te Papa Ui Hetu'u ("rock for seeing the stars"). Interestingly, it has several fishhook petroglyphs. Katherine Routledge reported there was a boulder with several cupules representing a star map approximately 200 metres from Ko Te Papa Ui Hetu'u.[8]

(iii) Informants also mentioned that Tu'u Ko Ihu, a culture hero, placed six boulders representing the Pleiades near Ahu Hihina Tangi Kotea "to remind people that the Pleiades are sometime dangerous and could bring death".[9]

(iv) Structures shaped like conical towers and known as *tupa* may have been used as observatories; however, not all sources agree on this point.[10]

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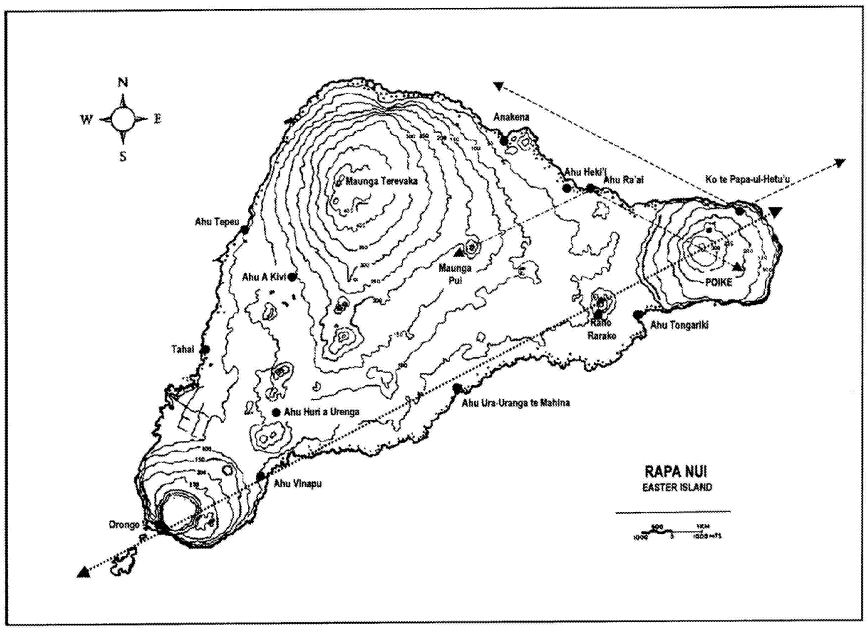

FIG. 1. Map of Rapa Nui showing the most important monuments and locations discussed in the text. The solstitial alignments of Ahu Ra'ai (dot-dashed line) and Orongo-Poike (dotted line) are also indicated. Dashed lines shows the rise and set positions of the Pleiades ("Matariki" in Rapanui) as seen from the rock "for seeing the stars". See text for further discussion.

On the other hand, archaeological evidence indicates that:

(i) As Liller has already suggested,[11] most of Rapa Nui's ceremonial platforms (or *ahu*) were topographically orientated with the platforms' back walls parallel to the shoreline and the statues (*moai*) facing inland, looking at the village before them (see Figure 2). Accordingly, these do not seem to be astronomically oriented, although there are exceptions.

(ii) Those *ahu* near the coast but not parallel to it tend to be aligned with the equinoxes or solstices. Similarly, altars located inland, i.e. half a kilometre or more from the coast, seem to be aligned with the equinoxes or solstices.[12]

(iii) Several impressive *ahu* (including those classified by Englert as the island's "most outstanding monuments"[13]) seem to be astronomically orientated. Tepeu, Vinapu II (Tahiri), Hekii I and Tongariki showed solstitial alignments, while Vinapu I, Hekii II and A Kivi showed equinoctial alignments.[14] In addition, Ahu Ra'ai, whose name is linked to the Rapanui word for sun (*Raa*), is located at a place where on the summer (December) solstice one can observe the sun rising over the conspicuous peak of Pu A Katiki in Poike, and setting over the hilltop of Maunga Pui (see Figure 1)[15].

(iv) There is an important astronomical connection between the ceremonial village of Orongo and Poike: from Structure 1, in Complex A in Orongo, it is possible to observe the sun rise over the peak of Poike during the winter (June) solstice (see Figure 1).

(v) Ahu Huri A Urenga, an isolated inland *ahu* with a single *moai*, has a very particular orientation and placement and may be interpreted as a solar observatory. It seems that the altar together with five cupules etched on a nearby rock was used as a "solar ranging device" to predict and observe the sunrise and sunset on the winter (June) solstice and/or on the equinoxes.[16]

According to Liller, "the evidence presented is virtually irrefutable" and "as many as twenty Rapanui stone temples were constructed to mark the directions to important sunrises and sunsets".[17] He was convinced that the original Rapanui settlers observed the solstices and the equinoxes for either ceremonial or practical

FIG. 2. The recently and superbly restored Ahu Tongariki, Rapa Nui's most impressive altar, showing the characteristic ceremonial platform (*ahu*) topped with statues (*moai*). Like most altars, the platform's back wall is parallel to the coast. Some have suggested that the wall's perpendicular is oriented to the summer (December) solstice sunrise. However, the present writers suggest that the *moai* also face the setting of Matariki (the Pleiades) over Rano Raraku. The peak at the centre is Pu-a-katiki, the highest point in Poike Peninsula. See the text for further discussion. (Photograph by J. A. Belmonte.)

(calendrical) purposes, and his resulting book was appropriately titled *Ancient solar observatories*. His support of the "solar ranging device" in Ahu Huri A Urenga (the five cupules mentioned under (v) above) is intriguing since Georgia Lee and he[18] doubted Ferdon's proposal that a similar device consisting of four cupules found at Orongo was used to predict the seasons.[19]

Discussion

The first author is cautious regarding certain concepts in archaeoastronomy. He has been living and working on Easter Island as a field archaeologist and ethnographer for nearly forty years, and he has also lived and carried out archaeological and ethnographic research on other islands in Polynesia for the Archaeological Survey of French Polynesia. He has recorded and mapped hundreds of ceremonial sites on Tahiti, Huahine, Raiatea, Ra'ivavae and Tubuai in the Austral Islands, and on all the inhabited islands of the Marquesas Islands. After several years of working for the Archaeological Survey of French Polynesia, he concluded that none of the ceremonial altars he had surveyed showed significant solar orientations, and he found it significant too that Polynesian ethnographic literature makes no mention of a solar cult.[20] However, he agrees that Polynesians may have oriented some of their ceremonial altars to places where certain celestial bodies rise and set, and that they may have had devices to interpret the movement of the stars which they used for ceremonial, calendrical, and/or navigational purposes. For this reason he has suggested that the supposed solstitial orientation of a number of sites in Mangareva may be better interpreted as a stellar orientation to the Pleiades.

However, and most important for this paper, the first author has been also involved in an effort to make a comprehensive compilation of Rapa Nui's existing ethnographic record, collected either by him in personal interviews or by earlier researchers.[21] Table 1 lists the nucleus of his own results relating to the traditional Rapanui names for a number of stars, planets, and asterisms. Indeed, several of these names are common to other islands of Polynesia.[22] Among them, we can find the most prominent stars in Rapa Nui's night sky (Vega, Sirius, Canopus, Antares, etc.) and several individual asterisms: Kete (Aldebaran, δ, θ and ε Tau), Matariki (the Pleiades), and Tautoru (Orion's Belt). Of these asterisms, the Pleiades seems to have been the most important for several reasons discussed later in this article (see Table 2), followed in importance by Orion's Belt. The asterism called Nga Vaka was formed by the bright pair of α Cen and β Cen, and was important for mythological and navigational reasons as discussed in Table 1. Unfortunately this list is surely incomplete since it is very likely that the Rapanui lost much of this information in the mid-nineteenth century, when many Rapanui chiefs and specialized priests were kidnapped and sold as indentured labourers and household servants in Lima.

In July 2003, the second author visited Rapa Nui and with Edwards researched various sources concerning the ancient Rapanui's knowledge of astronomy. Some sources had been published long ago, others consisted of more recent ethnographic

TABLE 1: Rapanui stars. Information recorded by the first author from various local informants, who pointed out particular stars and asterisms that were later correlated to an astronomical atlas.

Rapanui	Translation	Star or Asterism	Comments
Hetu'u Ahiahi	Evening Star	Venus	
Hetu'u Popohanga	Morning Star	Venus	
Matamea	Red Eye	Mars	Its appearance was probably considered a bad omen. It was viewed from an "observatory" in Poike, and was associated with the biennial Koro festivals.
Te Ngo'e	The Ngo'e, a fabulous marine creature	Milky Way	Identified with a fabulous marine creature or fish.
Veri Hariu	The large-looking worm/ centipede	Vega	
Ko Toe Ko Peu Renga	The remainder of the beautiful pick-axe/ energy	β Aur and Capella	
Te Hau Vaero	The headdress of bird's tailfeathers	Castor and Pollux	
Matariki	Small eyes	The Pleiades	One of the most important asterisms for the Rapanui people (see Table 2).
Tautoru	The three handsome ones	Belt of Orion	Key for the Paina festival (see Table 2). Considered a supernatural being accompanied by his two sons.
Tau Ehu	Beautiful firebrand	Rigel	The dead wife of the former.
E Tui	The expelled	Orion	Curiously, they were considered to be six stars.
Te Pou O Te Rangi	The Post of the Sky	Sirius	This star was considered to bring winter together with Tautoru.
Tau A Eru Ehu	Two beautiful firebrands	X and Y CMa	Two undetermined bright stars in the area of Canis Major.
Taura Nukunuku	Nukunuku's rope	Procyon and β CMi	
Po Roroa	The great darkness	Canopus	A very important star. It was related to the Paina festival and the planting season.
Veri Koreha	The giant eel	Fomalhaut	
Rei A Tanga	The breastplate of Tangaroa	Antares	This star was probably important because it crosses the island's zenith. Another source claimed that the Rapanui name for Antares was Ko Pu Tui ("The Hole of the Expelled").
Nga Vaka	The canoe	α Cen and β Cen	These represented the two canoes used by Hotu Matu'a and Ava Rei Pua to discover and populate Rapa Nui. They may also have been used as navigation signals.
Mata Te Tautoru	The eyes of the three handsome ones	Stars in Crux	The three brightest stars of the Southern Cross.
Te Tatauro	The cross	Crux	A modern name for Crux.
Po Orongo	Orongo's darkness	Achernar	
Nga Toa Rere	The flying sugarcane	Ursa Major	
Nga Rau Hiva	The leaf from Hiva	The Hyades	Hiva was the homeland of Hotu Matu'a, Rapa Nui's legendary founder.
Ko Para Tihiri	Tahiri's club	Arturus	
Ko Te Mata Pu Nui	The eye with the big opening	Spica	
Kete	The basket	Aldebaran, δ, θ and ε Tau	Four stars. They portended abundance.

TABLE 2. Rapa Nui's lunar/stellar calendar. The left column shows the twelve months of the lunar calendar, grouped in four different seasons. The right column shows the Rapanui activities and/or periods determined by the appearance or disappearance of stars. This information was obtained by the authors from local informers in the past decades and has been recently interpreted in astronomical terms.

Month (Season)	Astronomical event (H: heliacal; C: Cosmic; R: Rising; S: Setting)
Ko Te Maro (Tonga Nui)	First entire lunation of the new year (see below), probably including the winter solstice (21 June). The Ariki Mau authorized the organization of the Tangata Manu (Bird-man) ceremonies with the apparition of Tautoru (Orion's belt, HR 22 June). Ritual tattooing took place in Orongo with the apparition of Veri Hariu (Vega, CR 27 July).
Anakena (Tonga Nui)	Depending on the source, it was considered the first lunar month of the year (first after the winter solstice on 21 June). Migratory birds arrived to nest on the island.
Hora Iti (Hora Iti)	The Tangata Manu (Bird-man) competition took place.
Hora Nui (Hora Nui)	When Matariki (the Pleiades) shine for the first time after twilight (CR 16 Nov.), it is the beginning of the Hora Nui season (time of abundance). The fishing season opened. Rituals in honour of the ancestors took place.
Tangaroa Uri (Hora Nui)	The Paina festival started when Tautoru (Orion's Belt) was high in the night sky (CR 1 Dec.) and another bright star was setting in the west (probably one of the Nga Vaka stars (α Cen and β Cen)).
Ko Ruti (Hora Nui)	Sweet potato harvest.
Ko Koro (Hora Nui)	The Koro festival began with the apparition of Matamea (Mars). Since Mars has a synodic period of 780 days, this planet does not appear at the same time every year. Evidence indicates that the Koro festival was celebrated biennially. The festival was celebrated when Tautoru (Orion's belt) appeared in the night sky.
Ko Tuaharo (Hora Nui)	The Paina festival ended when Po Roroa (Canopus) appeared for the last time in the sky at dawn (CS 14 Feb.).
Ko Te Hetu'u (Tonga Iti)	The disappearance of Matariki (the Pleiades) before the crescent of Tara Hau (HS 18 April) signalled suffering for humankind. The fishing season closed and the months of war began.
Ko Tara Hau (Tonga Iti)	The first complete lunation of the bleakest season (Tonga Iti).
Ko Te Vai Tu'u Nui (Tonga Iti)	The planting season began with the rising of Po Roroa (Canopus) before sunrise (HR 21 May) and the eel-fishing season started when Veri Hariu (Vega) disappeared at dawn (CS 30 May).
Ko Te Vai Tu'u Potu (Tonga Iti)	The new year began with the first crescent after the rising of Matariki (the Pleiades, HR 12 June) and the setting of Tautoru (Orion's belt, HS 6 June).

information collected by the first author, while others again were manuscripts that have never been published but were fortunately available to the authors.[23] Together they visited the vast majority of the relevant ceremonial sites (see Figure 1) and one thing became clear: most solstitial alignments could be interpreted as being oriented to the Pleiades and most equinoctial orientations could easily have been aligned to Orion's Belt.[24] Therefore, the data collected force one to reassess the works of other authors who argue that some Rapanui monuments are solar-oriented. Our

investigations indicate the following:

(i) Ahu A Kivi, a very particular inland altar with an azimuth of $266\frac{3}{4}°$, the only one whose *moai* seem to be facing toward the sea, may have been orientated to Alnitak (ζ Ori, the star at the centre of Orion's Belt, Tautoru in Rapanui). This corresponds to Rapa Nui's early period, in the second half of the first millennium. However, if either heliacal or cosmic settings were considered (in which cases the stars would be a little higher on the horizon, as shown in Figure 3), the alignment fitted perfectly with the monument's possible construction date in either the fourteenth or fifteenth century.[25] This is most relevant to the later discussion of the results in Table 2.

(ii) Other authors have argued that the back perpendicular to the façades of Ahu Vinapu I points to the sunrise on summer solstice, and that the same perpendicular in Ahu Vinapu II points to the sunrise on the equinox. However, according to our data, Ahu Vinapu I (az. ~$296\frac{1}{2}°$, angular height ~5°) may have been facing the setting of Matariki (the Pleiades) and Ahu Vinapu II (~273°, ~8°) the setting of Tautoru (Orion's Belt) as seen about 1200 A.D. The construction of these altars has been carbon-dated to 1050 with a margin of error to 1300 in both cases.[26] However, both altars

FIG. 3. The seven *moai* of Ahu A Kivi facing the sea at the helical setting of Tautoru (Orion's Belt) as seen in 1300 A.D. This astronomical event marked the New Year that started with the following new moon (see Table 2). (Image by J. A. Belmonte and SMM/IAC.)

are roughly parallel to the local coast and so perhaps the astronomical interpretation of their orientation should be dismissed.

(iii) The *moai* of Ahu Tepeu I (~118$\frac{3}{4}$°, ~3$\frac{1}{2}$°) and II (~109$\frac{1}{2}$°, ~4$\frac{1}{2}$°) face declinations around −27° and −19°, respectively. These orientations are not solstitial. However, lunar alignments close to the major and minor southern standstills are a possibility. This was approximately the range of the horizon where one could observe the rising of the full moon during the Rapanui month of Anakena, the first month of the year (roughly July; see Table 2).[27] Similarly, the *moai* of Ahu Hekii I faced moonset at the major southern standstill over the conical summit of Maunga Pui (and not the solstice). However, there is scarcely any proof of lunar alignments in Polynesia and these suggestions should be taken with caution.

(iv) Finally, the perpendicular of the peculiar Ahu Huri A Urenga (azimuth 64$\frac{3}{4}$°) and its single *moai* may be easily interpreted as pointing to the rising of Matariki (in particular its heliacal or cosmic rising, at an angular height of ~3°) around 1150 A.D. This corresponds to the altar's possible construction date which has been carbon dated to 1250 ± 250.[28] The authors' personal impression is that Huri A Urenga's "solar ranging device" was crudely constructed and even if high poles were inserted in the holes, the precision claimed by previous authors (around 0.1°) would have been very difficult to achieve even for expert observers. Consequently, the authors are sceptical of the claimed astronomical use of the set of cupules found at Huri A Urenga, which are little different from other cupules found elsewhere on the island.[29]

The authors also visited other *ahu* whose names suggested a relationship with astronomical phenomena. In the case of Ahu Ra'ai they confirmed the altar's orientation to the sun's summer solstice rising over Pu-a-katiki and setting over Maunga Pui. Here the Pleiades were not involved. They also investigated *ahu* whose names included the word *mahina* (moon). These are Ahu Ura Uranga Te Mahina and Ahu Mahina, located on the island's southeastern coast and parallel to the coast as usual (see Figure 1). In these cases, the axes of the *ahu* (and not the perpendicular to the façade) pointed to Pu A Katiki. The horizon near this peak is where the major and minor northern moon standstills (which occur over other points of Poike Peninsula) would have taken place, and so these altars might support a lunar relationship. However, as mentioned before, the evidence for lunar alignments is weak and the authors think that the names of these altars may have a different origin.[30]

Finally, the authors decided to visit the remote area of Poike in search of other "astronomical" observatories. There they managed to find Ko Te Papa Ui Hetu'u, the already mentioned "rock for seeing the stars". This rock is an unimpressive flat boulder of some four square metres, with several fishhook engravings. Routledge mentions a spiral design that was also recorded by Lee. The location of the boulder immediately makes one wonder why the Rapanui sages would have gone to such a remote and inconspicuous spot to "observe the stars". However (and most importantly), some 200 metres to the WNW of the first boulder the authors located the other

FIG. 4. A "star map" etched on a boulder near the rock "for observing stars". It likely represents Matariki (the Pleiades), one of Rapanui's most important asterisms. Stones were placed in cupules to set the image in relief. The arrow scale is 10cm long. See text for further discussion. (Photograph by J. A. Belmonte.)

boulder with the hypothetical "star map". The engraving on the top of the second boulder is shown in Figure 4.

The authors placed ten different stones of matching sizes in the ten different cupules for the better identification of the cup-mark distribution. Had it not been for the ethnographic information reporting that this was a "star map", it would have been easy to dismiss this as another curious cup-mark engraving, similar to the hundreds of others scattered around the world for which many different interpretations have been suggested.[31] However, keeping in mind the "star map" reference, there is a striking and perhaps evident interpretation: the cupules may represent Matariki. For many cultures the Pleiades are considered to be six or seven stars; however, a keen-eyed observer can easily count as many as nine (or less frequently ten) stars distributed in two groups: a cluster of seven stars of different brightness curiously arranged in two almost parallel lines, and a couple of stars slightly separated from them (Pleione and Atlas). Thus, looking at the supposed star map, one may easily observe a challenging representation of Matariki (with one extra very small cup-mark to the south of the cluster; see Figure 4). The authors agree that the boulder with the "star map" in Poike Peninsula near the "rock for seeing the stars" could be actually a schematic representation of Matariki (the Pleiades), one of the most important asterisms of the

Rapanui culture, as will be clearly demonstrated below.[32]

The next logical step was to analyse other important ethnoastronomical sources of information regarding the Rapanui calendar and the different activities the Rapanui carried out during the year according to their interpretation of the stars. The bulk of this information was provided by various local informers working with the first author over the past forty years.[33] Table 2 presents the results of this investigation and the relevant astronomical phenomena of the Rapanui's major stars and asterisms: their heliacal and cosmic risings and their heliacal and cosmic (or 'achronical') settings.[34]

The implications of Table 2 are substantial, although there are unsolved matters to consider. These include the observation of Matamea (Mars) and its relation to the Koro feast in the month of Ko Koro, and the details of the celebration of the Paina festival of death, which was linked to the asterism Tautoru (Orion's Belt) and the star Po Roroa (Canopus).[35] However, these minor points do not diminish the outstanding importance of both Matariki (the Pleiades) and Tautoru (Orion's Belt) as markers of some of the most important activities and seasons in the Rapanui year.

The heliacal rising of Matariki (the Pleiades) signalled the start of the Rapanui new year, and this was closely connected with the heliacal setting and rising of Tautoru (Orion's Belt) because they occurred at around the same time (see Table 2).[36] In fact, the heliacal rising of Matariki signalled the new year for most Polynesians (and ethnographic sources fail to mention the winter (June) solstice sunrise as marking the start of the new lunation cycle). The few Rapanui sources that indicate otherwise may show traces of a recent alien influence.[37] Tautoru (Orion's Belt) was also related to an important Rapanui festival called Paina; however, it was again Matariki (the Pleiades) that marked the start of the island's bountiful season (Hora Nui), the Rapanui's most important time of year, and so, for example, the fishing season opened with the cosmic rising of Matariki in mid-November. Conversely, Matariki's *hitu*, the heliacal setting in mid-April when it disappeared from the sky, marked the end of the bountiful period, the closing of the fishing season, and the start of the period when warfare was permitted.[38]

This information indicates that the correct observation of Matariki's crucial stations were fundamental to the ancient Rapanui. The authors believe this to be the key for interpreting the challenging questions posed earlier in this article concerning the Ko Te Papa Ui Hetu'u, the "rock for seeing the stars". The location of the boulder with the fishhook petroglyphs near the boulder with the cupules representing Matariki suggests that the petroglyphs may represent a sort of supernatural appeal for an abundant fishing season. Aside from Rapa Nui's remote and scarcely-populated north end on the slopes of Maunga Terevaka, these two boulders are located in the only place where Matariki's rising and setting (marking the new year and the opening and closing of the fishing season) could be observed over a clear open horizon across the sea (see Figure 1).

In the light of the present evidence we interpret the archaeoastronomical data as

follows. We endorse the suggestion that the equinoctial alignments found in several *ahu* (notably Ahu A Kivi, see Figure 3) are associated with the rising and/or setting of Tautoru (Orion's Belt). There is no evidence of equinoctial alignments elsewhere in Polynesia and when an east–west alignment was found in Nan Dawas, the largest building of the cyclopean city of Nan Madol, Esteban thought its orientation in fact to be to the rising of Orion's Belt.[39] We also propose the hypothesis that most solstitial alignments in Rapa Nui are in fact oriented to the rising and/or setting of Matariki (the Pleiades). Indeed, these alignments should be considered ritualistic and the *ahu* should not be considered observatories.

However, in the case of the June solstice and the new year beginning with the new moon following the heliacal rising of the Pleiades, it is important to consider both phenomena's proximity in time (June) and space (the same area of the horizon within a few degrees).[40] Thus, in some cases one may consider double ritual alignments, as for example with Ahu Uri A Urenga which has a single *moai*. This altar is oriented to a declination of some 22°, a little south of the winter solstice (June), but if we consider Matariki at an angular height of approximately 3° in 1250 A.D., it seems perhaps probable that the *ahu* was orientated to the rising and/or setting of Matariki (the Pleiades) in early June and the winter solstice on June 21.

With the information presented in this short report we are not challenging the excellent work of previous researchers, but rather demonstrating that most data should be reinterpreted in the light of new ethno-astronomical evidence. This evidence stresses the importance of certain stars, most notably the asterisms of Matariki (the Pleiades) and Tautoru (Orion's Belt). Together with the moon,[41] these were the most significant celestial bodies in Rapanui culture and, consequently, the objects towards which they diverted most of their attention (this presumably including the ritual orientation of certain sacred constructions). We also conclude that the last word on Rapa Nui's archaeoastronomy has not yet been said, since the island's monuments merit further study, as exemplified by the *tupa* and other conical towers called *pipihoreko* in what seems to be astronomical alignments near Ahu Ra'ai.[42] There is need for new and systematic fieldwork across the whole of Rapa Nui.

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18. Lee and Liller, *op. cit.* (ref. 6).
19. E. N. Ferdon Jr, "The ceremonial site of Orongo", in *Archaeology of Easter Island: Reports of the Norwegian archaeological expedition to Easter Island and the East Pacific*, i, ed. by Thor Heyerdahl and Edwin N. Ferdon Jr (School of American Research and Museum of New Mexico, Santa Fé, 1961), 221–72.
20. See M. W. Makemson, *The Morning Star rises: An account of Polynesian astronomy* (New Haven, 1941); T. Gladwin, *East is a Big Bird: Navigation and logic on Puluwat Atoll* (Cambridge, MA, 1970); and D. Lewis, "Voyaging stars: Aspects of Polynesian and Micronesian astronomy", *Philosophical transactions of the Royal Society of London*, cclxxvi (1974), 133–48. See also C. L. N. Ruggles, "Astronomy, oral literature and landscape in ancient Hawai'i", *Archaeoastronomy: The journal of astronomy in culture*, xiv (1999), 33–86.
21. As for example, Routledge, *op. cit.* (ref. 7). Actually, only a very small part of Routledge's ethnographic notes were ever published. In 1981 the Royal Geographical Society released some of Routledge's unpublished notes to researchers of the Institute of Easter Island Studies of the University of Chile.
22. Makemson, *op. cit.* (ref. 20), reported as many as 772 names of stars and asterisms for Polynesia. Also relevant is R. K. Johnson and J. K. Mahelona, *Na Inoa Hoku: A catalogue of Hawaiian and Pacific star names* (Honolulu, 1975).
23. Following Routledge's field notes, kindly provided to the authors by the Institute of Easter Island Studies.
24. Actually, both authors were substantially surprised to find that they wholeheartedly agreed on this controversial point. The first author had suspected this for many years but had published nothing on the subject.
25. J. A. Van Tilburg, *Easter Island: Archaeology, ecology and culture* (London, 1994), 33.
26. Van Tilburg, *op. cit.* (ref. 25), 33.
27. In addition, this singular moon crossed the island's zenith several times.
28. Van Tilburg, *op. cit.* (ref. 25), 33.

29. For a review on the rock art of Rapa Nui, see G. Lee, *The rock art of Easter Island: Symbols of power, prayers to the gods* (Monumenta Archaeologica no. 17, The Institute of Archaeology, UCLA, 1992).
30. As suggested by Liller, *op. cit.* (ref. 1), 23. See also Liller, *op. cit.* (ref. 2), S29.
31. For a discussion of the different interpretations of cupules, see, for example, J. A. Belmonte and M. Hoskin, *Reflejo del cosmos: Atlas de arqueoastronomía del Mediterráneo antiguo* (Madrid, 2002), 91–101.
32. Liller, *op. cit.* (ref. 1), 36–37, also speculated on the identification of the Southern Cross and α Cen and β Cen (yet another important group of stars of Rapanui skies) in another set of cupules found elsewhere in the island.
33. Mr Felipe Teao and Mr Santiago Pakarati among many others. A more detailed report on the astronomy of Rapa Nui from ethnographical sources, clearly exceeding the aim of this paper, will be presented in E. Edwards's monograph *Rapa Nui: Cuando el Universo era una isla* (Universidad de Chile, in press).
34. For a good definition of these stellar events, see A. F. Aveni, *Skywatchers of ancient Mexico* (Austin, 1980), 114.
35. See also Van Tilburg, *op. cit.* (ref. 25), 85.
36. All the dates have been calculated for 1950, when most of our informers were active fishers and farmers.
37. As, for example, the information reported in Metraux, *op. cit.* (ref. 7), 52.
38. The term *hitu* describes the period of time when a certain star or asterism is not visible in the sky. The *hitu* of Matariki was especially nefarious. See E. Edwards, *op. cit.* (ref. 33).
39. See C. Esteban, "Some notes on orientations of prehistoric stone monuments in western Polynesia and Micronesia", *Archaeoastronomy: The journal of astronomy in culture*, xvii (2002–3), 31–47.
40. As suggested by Metraux, *op. cit.* (ref. 7), 52.
41. The importance of the moon will be illustrated elsewhere. See also Edwards, *op. cit.* (ref. 33).
42. As suggested in Edwards and Clark, *op. cit.* (ref. 13) and discussed in Edwards , *op. cit.* (ref. 33).