

# The astronomical heritage of pre-Hispanic societies in Venezuela: Total Eclipses of Sun reported in Petroglyphs

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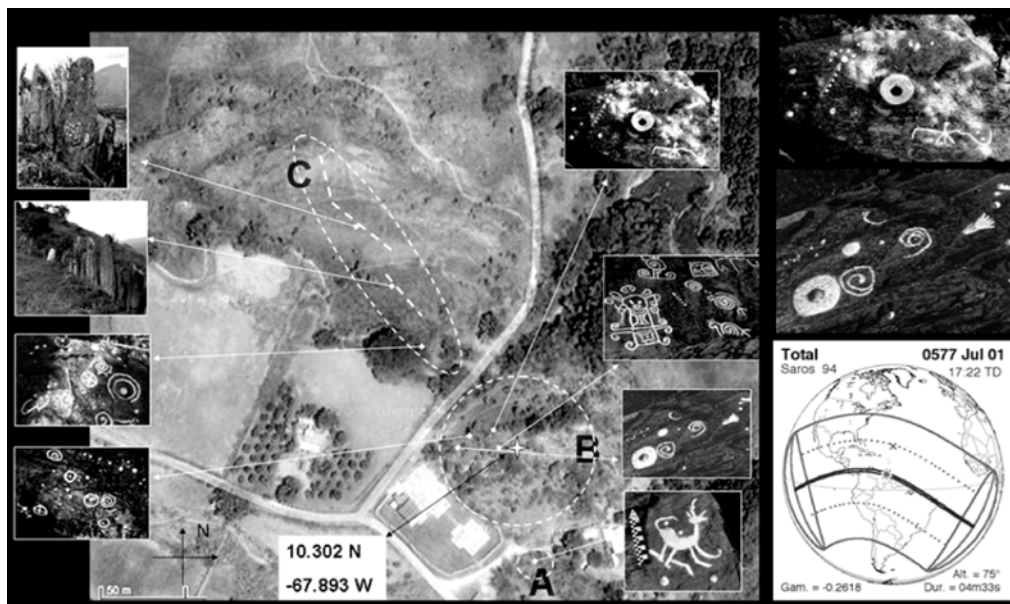
**Abstract.** Astronomical observations have been documented in pre-Hispanic cultures. However, little is known about the astronomical heritage of pre-Hispanic societies in Venezuela, since there are no evidence of an ancestral material culture as other regions of Meso and South America, and these native Venezuelan groups lacked a written, alphabetic or ideographic language. There are innumerable petroglyph deposits in almost all regions of Venezuela, especially near Lake Valencia (Carabobo state) and those of the Andean foothills (Barinas state). By means of computerized simulation and archaeoastronomy techniques, the occurrence of a total solar eclipse is verified: in July 1, 577 at the Viririma site; and another total solar eclipse at noon on May 16, 1398 at the Bum Bum site. It is concluded that the contemplation of the total eclipses of the Sun, must lead to the need for communication and recording, and lacking any type of writing, they drew the phenomenon, using the techniques and means at their disposal: engraving on rocks.

**Keywords.** archaeoastronomy: total solar eclipses, petroglyphs of Venezuela

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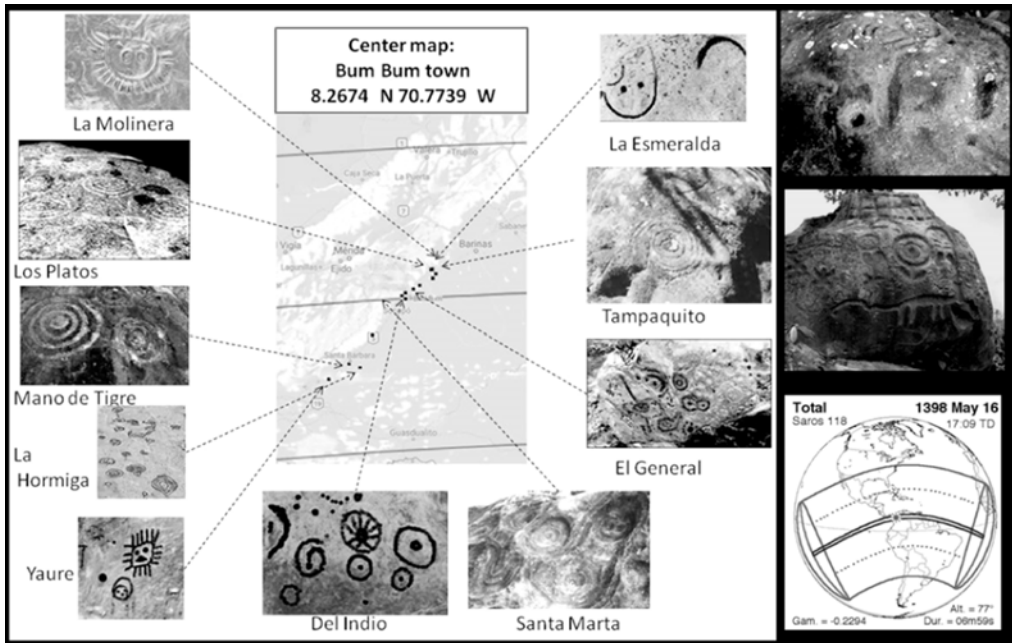
## 1. Contextualization

In Venezuela there are no architectural remains similar in development and elaboration to the Aztec, Mayan or Inca cultures, and the native Venezuelan groups lacked a written, alphabetic or ideographic language. However there are many rock art stations in all the country. Close the lake of Valencia, (Carabobo state) in the central region is Virgirima archaeological complex (+10.302N –67.893W), the most important lithic site of Venezuela, with an area of approximately twelve hectares. Characterized by the profusion and variety of its rock formations, expressed through megalithic alignments, rocky piles used in the delimitation of spaces and above all by the existence a hundred rocks with petroglyphs in bas-relief. Also In the Venezuelan Andean foothills, of the Barinas state, there also are many sites with ancient rock art expression, all are petroglyphs in bas-relief, without pigmentation and isolates of the other archaeological evidence. The extensive area under study covers the northern or Andean foothills in three municipalities of the Barinas State, around of the Bum Bum town (+8.2674N –70.7339W). The petroglyphs in Bum Bum archaeological complex are not grouped together but rather scattered, mostly on streams and rivers, or in erratic blocks of the alluvial valleys in the plains east of the Andean mountain range. The Bum Bum petroglyphs present a greater profusion of details and a more elaborate abrasion technique; however stylistic similarities



**Figure 1.** Virginia Archaeological station. Rock art representation of Total Solar Eclipse of the 577 Jul 01.

suggest that they were made by Arauquinoid groups that migrated to the western plains between the 10th and 12th centuries. It is important to emphasize that the great majority of the petroglyphs are of a naturalist-realist type with a predominance of zoomorphic representations. The figurative features seem to indicate the importance of representing the surrounding natural world (fauna, natural phenomena, etc.) above that of the cultural world (anthropomorphic representations), and suggests a society with a close dependence on nature. Maybe in an egalitarian tribal organization, where the shaman (chief-priest) would have had an important role as a mediator between man-nature, and the woman as a symbol of the reproduction of the human force of work. The Venezuelan petroglyphs are engraved in bas-relief in erratic blocks that emerge naturally or in rocks arranged in their natural immersion slope. They were made by percussion and rubbing, and they lack pigmentation. They represent zoomorphic figures together with many geometric figures of coupled points, concentric circles, spirals, and few anthropomorphic representations. Its meaning, motivation and precise dating are unknown (Albarrán (2012)), beyond the free interpretation of its contents, without relation to the material culture of the ethnic groups that created it, mainly due to the absence of other evidence that allows its interpretation and dating. The petroglyphs do not show remains of any pigmentation; the false black or white color displayed (figs. 1, 2) is a photo manipulation to enhance the contrast. The grooves could have been made with hexagonal quartz crystal, abundant in the region, whose hardness is greater than metamorphic rocks of the substrate. The cuts, grooves and holes were made by successive drilling as evidenced by a half-finished rock found. Additionally there are several petroglyphs with representations of simple geometric figures (points, circles, semicircles and lines). One interpretation is their association with the sun, half moon and constellations, which could recall some possible and ancient eclipse of the Sun. Using the big date in NASA Eclipse web site (Espenak (2006)), we found which were the possible recorded total solar eclipses in the Venezuelan neo-Indian period: -100 BC until the Colon era.



**Figure 2.** The extensive area of Andean foothills surrounding of the Bum Bum town. Rock art representation of conspicuous Total Solar Eclipse of the 1378 May 16.

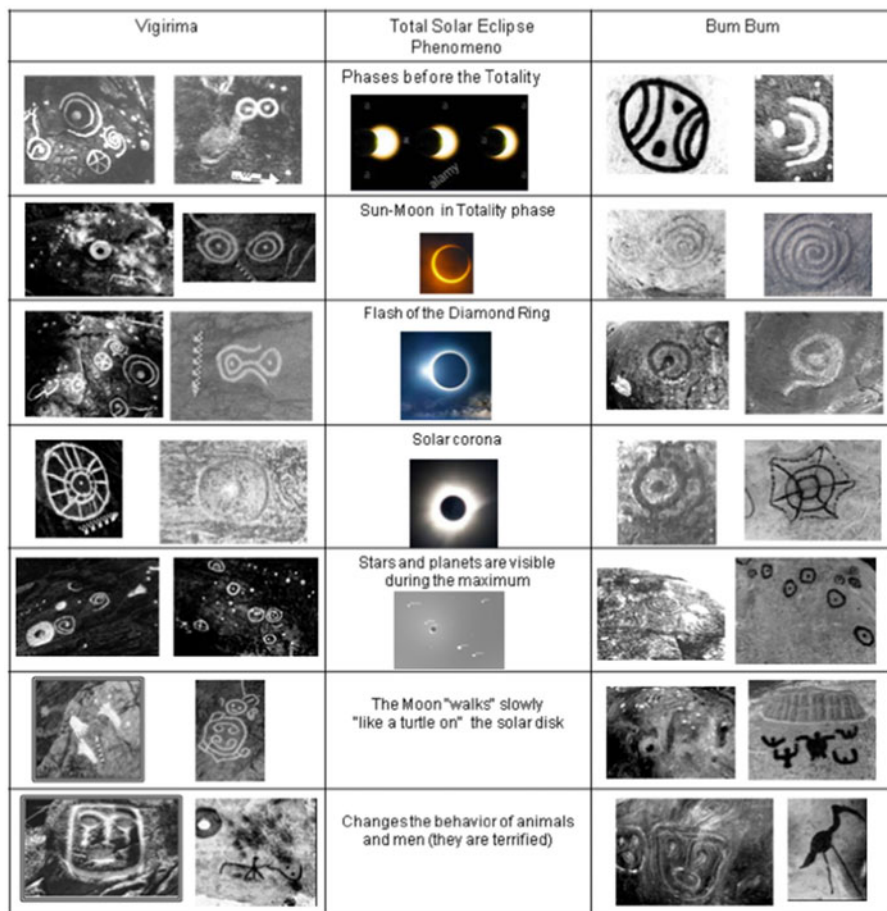
## 2. Virgirima Petroglyphs

A calculation of the astronomical position allows a contrast of the relative position of the planets and brightest stars with the apparent position of the sun and the moon during the eclipse for the geographical coordinates of the Vigirima (Falcón 2013). In several petroglyphs a notable point is represented near the eclipsed sun.

Only the eclipse of the year 577 presents Venus very close to the solar disk. Also, the foothills of the coastal mountain range limit the topographic horizon and visibility of eclipses near dawn and dusk. Only the eclipse of the year 577 occurred at midday, and it just had Venus in position very near to the zenith. There are even petroglyphs with a hole through the rock, surrounded by a bas-relief and with the representation of a nocturnal bird (Fig. 1). The archaeological complex of Vigirima is within the zone of totality, almost on the maximum line. The archaeological ceramic remains allow dating the occupation of the site between the 3rd and 8th centuries Falcón & *et al.* (2000). The ceramic chronology and the stylistic analysis of the petroglyphs coincide with the Eclipse of the 577 year.

## 3. Bum Bum Petroglyphs

In Bum Bum and their surrounding there are many petroglyphs with geometrical and abstracts symbol, maybe can be the representations about some Solar Total eclipse. The eclipse of the year 577 in Vigirima was not visible in that region, located more than 600 km away from the lake of Valencia. Using the big data of NASA web site Espenak (2006), there are five possibilities. The Andean mountain range to the northwest of the region limits the topographic horizon and the visibility of eclipses. These suggest the eclipse total of 1378 as the only possible. This eclipse was especially remarkable with almost 7 minutes of duration during the maximum, it occurred at midday with an altitude of  $78^\circ$  and with the 5 brightest objects in the sky after the sun and the moon. A phenomenon



**Figure 3.** Comparison of the Vigirima and Bum Bum petroglyphs with the phenomena associated with a solar eclipse.

as unique and spectacular as that solar eclipse, happened at midday, had to have a mark on the collective memory and shamanic practices associated. The probable view of the sky in Bum Bum shows the eclipse at 1:17 p.m., and lasting a temperature drop of up to ten degrees in a that tropical region. Such an unusual event must have motivated its imperishable memory, with the only means available: engraving on rocks (Fig. 2). Notice that, as Vigirima site, There is even petroglyphs with a hole through the rock, surrounded by a bas-relief (solar corona) and footprints, which may signify the slow transit in the sky.

In fig. 3 the interpretation of some petroglyphs found in relation to the phenomena associated with a Total Solar eclipse is synthesized

#### 4. Conclusions

The high frequency of representations of nature at a figurative level, in comparison with the anthropomorphic representations, indicate the importance of representing the surrounding natural world and suggests a society with a close dependence of the individual on nature. The stylistic similarity in the Vigirima and BumBum petroglyphs shows that they were made by ethnic groups of Arauquinoid origin that moved from the basin of Lake Valencia to the Andean piedmont between the X-IV centuries in accordance

with the ancestral settlement of Venezuela. We have seen how big data in astronomy also allows the reconstruction of ancient ethnology, understanding the archaeological significance and cultural heritage of a particular region. The contemplation of the total solar eclipse, must lead to the need of communication and recording, and due to the lack of written language, in the societies of the Venezuelan neindio, these aboriginal groups employed the techniques and means at their disposal: the draw engraved on rocks (petroglyphs). Also the using of big data in astronomy also allows the reconstruction of ancient ethnology, understanding the archaeological significance and cultural heritage of a particular region.

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