Signs of η Carinae Outburst in Artifacts of Ancient Bolivia

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Abstract Recent HST and X-ray photos of η Carinae reveal the bipolar gaseous lobes—the Homunculus Nebula—created by the star's "Great Eruption of 1843." From debris gases on the outskirts beyond the two gaseous lobes, astrophysicists surmise an earlier outburst. The 1999 Chandra X-ray photo of the horseshoe-shaped outer nebula surrounding the bipolar lobes indicates an earlier outburst occurring over a thousand years ago.

Because η Carinae is so far south, it is entirely possible that the outburst would not have been seen by the Chinese and other observers in the northern hemisphere. Researchers are looking for possible recordings by early southern hemisphere observers.

Pre-Incan artifacts excavated in Bolivia may provide an answer. In the script and artwork carvings on a monolith stone statue, an artifact of the Tiahuanacan culture, are signs possibly depicting the earlier outburst of η Carinae—the recordings of a star that suddenly brightened in their night sky. Two small stones from the same era and also found on the south shore of Lake Titicaca may also show depictions related to this brightening.

1. Introduction: Bolivia—observations of Pokotia's stone monolith statue

In December 2001, the Bolivian archaeological team led by Dr. Bernardo Biados and Freddy Arce began to make a systematic search through the national museums of Bolivia in La Paz, photographing and recording inscriptions and artwork on stone statues and other artifacts.

On December 15, 2001, Biados and his team photographed the inscriptions on the front side of a stone monolith statue in the Buck Collection housed at the Museum of Metals (also called the Gold Museum) in La Paz. The statue (Figure 1) measuring 1.3 meters tall and 0.3 meter wide had been excavated earlier at Pokotia, a little known pre-Incan archaeological site six kilometers southeast of the more famous pre-Incan ruins of Tiahuanaco, home of Gate of the Sun. Both sites are just south of Lake Titicaca and a few kilometers from La Paz (Biados 2002).

On December 18, 2001, Biados and his team turned the statue around, revealing a graph of patterns on the back side that had not been viewed by the public before. A rubbing (Figure 2) of the graph of patterns and inscriptions was made and photographed. Along the right side of the graph are inscriptions, but in the left column is a "leaning cross," the shape and angle of Crux, the Southern Cross, as it appears about 45 degrees above the southeastern horizon after its rising. In the two blocks to the immediate right of the "leaning cross" are two symbols that could possibly be depicting the brightening of a star.

On seeing this (and a rougher similar depiction on the front side of the monolith statue), I looked up Crux, the Southern Cross, on the "Starry Night" computer sky program (Space Software 2002) to see if a supernova had occurred to the right (west) of the Southern Cross. There was η Carinae in approximately the right location, just to the right (west) of the slanting Southern Cross when the Southern Cross is about 45 degrees above the southeastern horizon (see Figure 3).

Would a sudden brightening of an existing star, or the "appearing of a new star," be noticed by the early inhabitants of Tiahuanaco and Pokotia? Would the brightening star be in a significant part of their astronomical sky?

2. A brief survey of η Car's observed activity

η Carinae, the magnificent luminous blue variable, has intrigued variable star observers for the past 160 years. In 1843, η Carinae rose to a magnitude -1 star, making it the second brightest star in the night sky. Then it steadily decreased in brightness. Then again in 1890, another increase occurred, followed by a steady decline from 1900 until about 1950. From 1950 to 1990, a slow steady increase in brightness occurred, with a sharper increase in 1999 to magnitude 4.8, which coincided nicely with the newly obtained optical, X-ray, ultraviolet, and radio images of η Carinae (AAVSO 2000).

By July 2002, η Carinae's magnitude was reported by Stan Walker and other New Zealand variable star observers to be about magnitude 5.15 *V* (Figure 4), a little fainter than in 2000 (Walker 2002).

After the optical performance of its mirror was improved in 1993, the Hubble Space Telescope (HST) photographed its first clear image of η Carinae (Figure 5), revealing the bipolar explosion of the Homunculus Nebula with equatorial ejections, surrounded by a wispy, filamentary outer nebula. Each bi-lobe of the Homunculus was a solar system-width across. The outer wispy nebula was 2–3 light years across, parts of it traveling at various speeds (Hester 1994).

On October 8, 1999, η Carinae was the eighth object imaged by the newly launched Chandra X-ray Observatory. The image of η Carinae was processed in three different X-ray wavelengths, and the most researched of these images (Figure 6) contains the energetic blue center (the Homunculus and the star, η Carinae, itself) surrounded by the exquisite horseshoe-shaped outer nebula imaged in soft X-ray wavelengths (Chandra web site 1999b).

The bi-lobed Homunculus Nebula accounts for the "Great Eruption of 1843." The equatorial eruption is believed to account for the increase in brightness in 1890.

The outer horseshoe-shaped nebula, at a temperature of 3 million Kelvins and about two light years in diameter, provides evidence of another large explosion that occurred over 1000 years ago. The blue cloud in the inner core is three light months in diameter and is much hotter. The white area inside the blue cloud is the hottest and may contain the "superstar." Temperature in the central region is 60 Kelvins. All three structures represent shock waves produced by matter rushing away from the superstar at supersonic speeds (Chandra 1999a).

Dr. Nathan Smith, University of Minnesota, speculated that the presence of the extreme outer nebular debris shown in the 1994 HST Hester optical image indicates an earlier eruption of η Carinae between 400 and 2000 years ago (Smith 1998). In 1999, after Chandra's X-ray image of the horseshoe-shaped outer nebula, it was speculated by the Chandra team that an earlier "great eruption" occurred more than a thousand years ago (Chandra press release 1999a).

Since the Great Eruption's sudden brightening of η Carinae to -1 magnitude was so noticeable in the 1840's, it is assumed that the earlier eruption more than a thousand years ago would also have been easily noticed by early observers in the southern hemisphere. η Carinae, being at -59° declination, probably was not observed by the Chinese or other observers in the northern hemisphere (Smith 1998).

Until January 2002, southern hemisphere recordings of an earlier eruption and brightening of η Carinae were yet to be discovered.

3. Astroarchaeological background

In 1000 A.D., the inhabitants on the south side of Lake Titicaca were not Incan. At the time of the Incan Empire (early 1400s to 1533 A.D.) Tiahuanaco was already in ruins. In approximately 1000 A.D., the inhabitants of Tiahuanaco and Pokotia were Aymara-speaking people. At that time, they were already a well developed culture. Agriculture, irrigation, trading, weaving, architecture, astronomy, and religious rituals were already well established. Though estimates vary, the Tiahuanacan empire existed from around 600 B.C. to 1200 A.D., with some estimates of the origin going back to 2000 B.C. This empire was centered near the south side of Lake Titicaca and included urban centers around the lake, as well as enclaves in different ecological zones from the eastern valleys to the Pacific coast. Its rapid expansion after 1000 A.D. and sudden collapse around 1200 A.D. are still poorly understood (U.S. Library of Congress 1999).

The research of Harvard anthropologist Gary Urton on ancient Andean constellations reveals that the newly brightening η Carinae would have been in a significant part of the early Andean sky over Tiahuanaco and Pokotia.

The Milky Way is the principal line or plane of orientation in Andean astronomy. In the ancient Andean sky, there were two kinds of constellations in or along the Milky Way: (1) "Dark-nebula constellations" within the Milky Way were animal figures outlined by dark nebulae (Urton 1981a, p. 111), and (2) "Star-to-star constellations" were mostly in or near the Milky Way and most were in the shape of various forms of crosses.

Both kinds of constellations were used by the early Andeans as time-keepers for planting or harvesting and as seasonal markers for solstices and equinoxes. The dark-nebula animal constellations were used for a reproduction schedule for the animals. In fact, the Milky Way is still used today as a functioning environmental calendar among the Andean people (Aveni 1996, p. 299).

The initial rising of each dark-nebula animal constellation during the year coincided with the yearly production or proliferation of that animal in the area (Urton 1981a, p. 111; see Figure 7). In order of rising throughout the year, they were:

1) Anaconda Snake—"Mach'Acuay";
2) Toad—"Hanp'atu"—located near η Carinae;
3) Tinamou (Partridge)—"Yutu"—same as our "Coal Sack," located at the bottom left of the Southern Cross;
4) Llama—The mama llama's eyes are Alpha and Beta Centauri. The dark nebula of Llama extends up to Scorpius;
5) Baby llama—a thinner dark nebula running parallel to the mama llama;
6) Fox—"Atoq"—a dark nebula ranging between Sagittarius and Scorpius.

Most of the "star-to-star constellations" of the early Andeans were cross-shaped. The early Quechua word, "chacana," means "bridge" or "crossbeam." The cross-shaped star constellations formed bridges or crossbeams over the Milky Way, the Celestial River. The crosses were clustered at or near the two junctions where the ecliptic crossed the Milky Way, and thus were prominent "markers" at the June or December solstices (Urton 1981b, p. 147).

The Southern Cross was called Huchuy Cruz (Cross of the South) and was prominent at sunrise at the December solstice. Its opposite, the Hatan Cruz (Cross of the North), was prominent at sunrise near the June solstice. Hatan Cross included Castor, Procyon, η Geminorium, and μ Geminorium (Urton 1981b, p. 146–149).

The Southern Cross was also called "Yutucruz" for its proximity to the Yutu/Tinamou dark nebula. Pre-Spanish names for Crux (Southern Cross) were "chakana" (cross) and "catachillay" ("stars of the Southern Cross," Spanish "cruzero estrellas") (Urton 1981b, p. 130–131).

On the back of the Pokotia statue, the possible depiction of the Southern Cross in the slanted, leaning position at a 42–45 degree angle indicates that the time of η Carinae's outburst could be any date between December and May. In December, it could be seen slanting in the southeast in the early morning hours when the astronomer-priests were watching the December solstice skies. By March, the Southern Cross was rising at sunset and in the sky all night long, so the nearby η Carinae outburst could have been seen by all before sleep hours (Space Software 2002).

Whether early morning sighting in December or early evening sighting in March-April-May, the outburst of η Carinae, next to the dark nebulae "Toad" and "Yutu/Tinamou" and next to the prominent slanting-while-rising Southern Cross, would have been a spectacular sight for the early Tiahuanacan viewers—a brightening of a star, or the appearance of a "new" star where one had not previously been!

4. Bolivia—observations of Lake Titicaca stones

Another artifact that may be depicting the η Carinae outburst is a pre- Incan stone 7.5 × 17cm found on the southern shore of Lake Titicaca (Figure 8, top). An incised groove is possibly for incense, indicating it is some sort of ritual stone. One circle seems to be depicting the brightening of a star object. The other circle appears to be counting to the number 20, possibly indicating 20 days. It is possible that the stone is commemorating the η Carinae outburst, whose bright magnitude may have lasted 20 days.

A third pre-Incan artifact possibly depicting the η Carinae outburst is a small stone (Figure 8, bottom) also found on the southern shore of Lake Titicaca, which may have been used to start fires (Biados 2002). Carved into its surface are two small circles, each 1.5 cm in diameter. One circle within a circle may indicate the η Carinae outburst—a circle enlarging itself. The second circle encircles a rooster-type bird with a starburst (or sunburst) above its head. The bird may be the "pichiko," a small gray and black bird with a red collar whose morning call is heard shortly before the roosters begin to crow (making an association with pre-dawn time) (Urton 1981b, p. 17). Again, the number of dots around the circle may indicate the number of days that η Carinae was the brightest.

Both stones are dated circa 1000 A.D., and are now housed in the Museo de Arqueologia de Bolivia in LaPaz.

5. Conclusion

The outer horseshoe-shaped nebula in the 1999 Chandra image of η Carinae indicates that an eruption occurred more than a thousand years ago.

The graph of patterns on the back side of the Pokotia stone monolith statue are a possible depiction of an earlier eruption of η Carinae occurring more than a thousand years ago. The location of the slanted "leaning cross" positioned to the left of the "starburst patterns" matches the location of the Southern Cross to the left of η Carinae in the night sky.

The two circulo stone artifacts found on Lake Titicaca's southern shore may be supporting evidence for an η Car eruption observed by the early Andeans. The circles with star-burst patterns may depict the η Carinae eruption, and the circles with dots may indicate the amount of time that η Carinae was at its brightest.

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Figure 1 *(left)*. Full-length view of Pokotia stone monolith statue. *Courtesy Bernardo Biados.*

Figure 2 *(right)*. A "rubbing" of patterns on the back of the Pokotia statue. *Courtesy Bernardo Biados.*

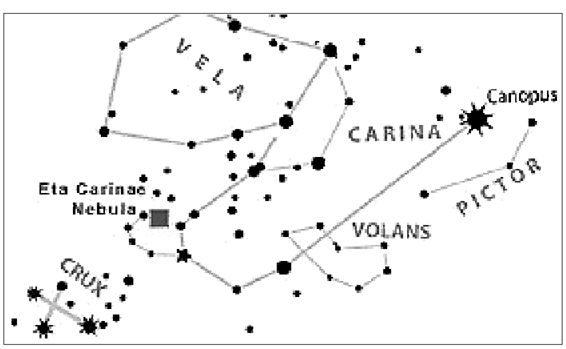

Figure 3. Sky map showing η Car to the right of the Southern Cross. *From the Chandra X-Ray Observatory web site.*

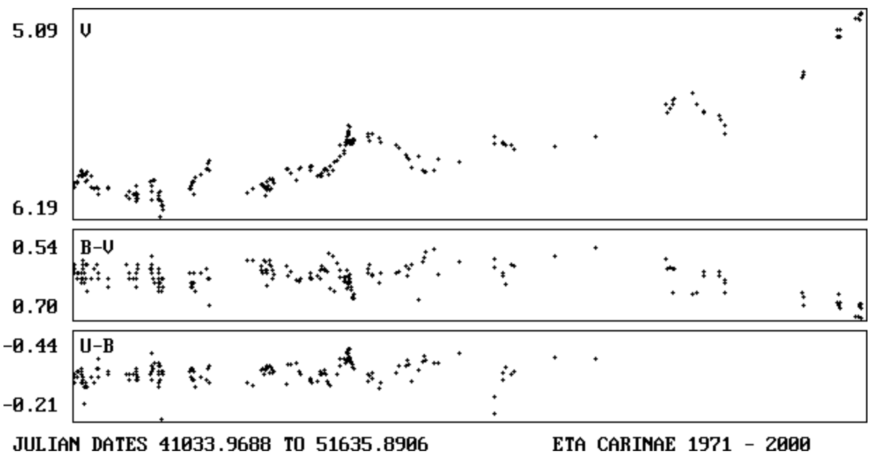

Figure 4. Graph of photoelectric photometry light curve of η Car for last 30 years. *Courtesy Stan Walker.*

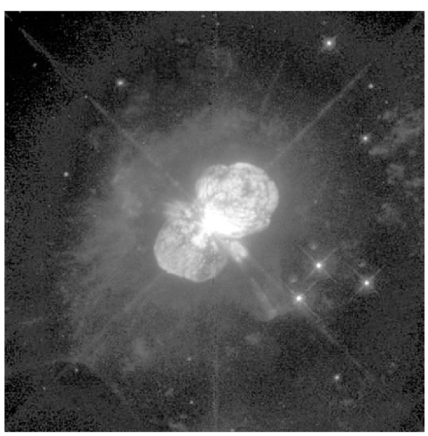

Figure 5. HST 1994 photo of η Car showing Homunculus and outer nebula. *Space Telescope Science Institute.*

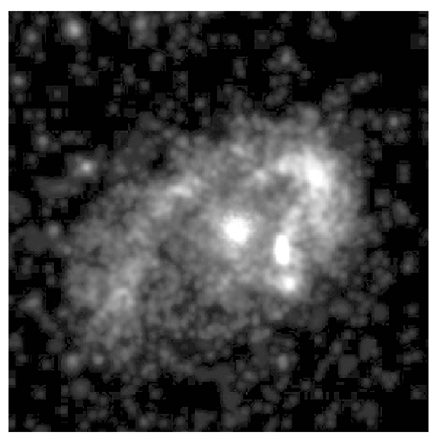

Figure 6. 1999 Chandra image of η Carinae, showing the Horseshoe-shaped outer nebula surrounding the Homunculus. *NASA/Chandra X-Ray Observatory.*

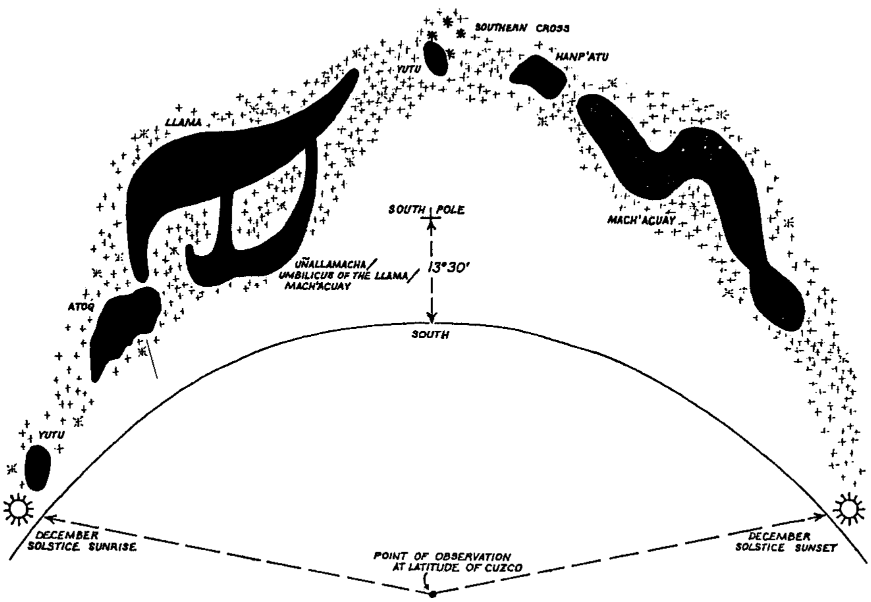

Figure 7. Illustration of "dark-nebula constellations" arrayed across the Milky Way, from Urton 1981a, p. 112, used by permission of the author.

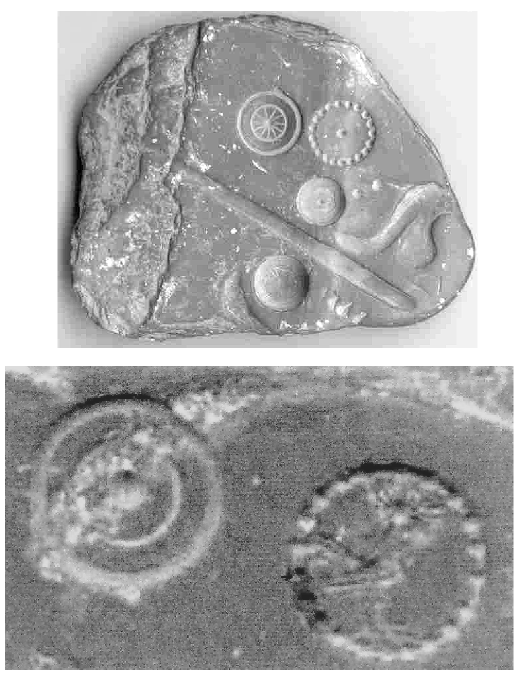

Figure 8. *Top,* Lake Titicaca circulos stone, 7.5 × 17cm, circa 1000 A.D., with possible depiction of η Carinae outburst. *Bottom,* Pajaro Stone, encircled bird with sunburst/starburst above head *(right circle)* and a circle within a circle *(left circle).* Circles are 1.5 cm diameter. Lake Titicaca, approximately 1000 AD. *Photos courtesy Bernardo Biados.*