Crab Supernova Rock Art: A Comprehensive, Critical, and Definitive Review

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Crab Supernova Rock Art: A Comprehensive, Critical and Definitive Review

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Abstract: "Star" and crescent combinations in rock art in the American Southwest were first interpreted in 1955 as eyewitness depictions of the 1054 AD supernova explosion that produced the Crab nebula. While the Crab nebula is visible only telescopically, the event that generated it was brilliant, and for a time only the Sun and Moon were brighter. Additional Crab supernova candidates in California and Southwest rock art were suggested 20 years later, and they included Chaco Canyon's Penasco Blanco pictograph panel, which became the poster child for Crab supernova rock art and is now called "Supernova" on signage at the site. By 1979, a list of 21 Crab supernova rock art sites was assembled, and the inventory has continued to expand more slowly since then. This critical review of the supernova interpretation of star/crescent rock art, the product of 35 years of fieldwork, required an independent re-examination of all of the primary sites in person. That enterprise has already demonstrated that the Tenabo, New Mexico, panel does not illustrate the Crab supernova and that the two Arizona sites on which the entire supernova rock art premise is based (White Mesa and "Navaho Canyon") are unlikely records of the event. This detailed evaluation of the primary proposed star/crescent images indicates none is a satisfactory portrayal of the striking 1054 AD supernova.

Keywords: American Southwest; Chaco Canyon; Crab nebula; pictograph; rock art; star/crescent; supernova

Introduction

Modern studies of archaeoastronomy in the American Southwest began in 1955 with the affiliation of two rock art panels in northern Arizona with the Crab supernova explosion in 1054 AD (Miller 1955a, 1955b). William C. Miller of Mount Wilson and Palomar

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Observatories suggested the combination of crescent and disc petroglyphs at a site he identified as "Navaho Canyon" and the intersection of a red circle with a red truncated crescent at White Mesa each plausibly represented the pairing of the waning crescent Moon and the brilliant exploding star as seen low in the east before dawn on 5th July, 1054 AD. The event had been observed and recorded by astronomers in China and Japan (Clark and Stephenson 1977) and also in the Middle East (Brecher *et al.* 1983), and Miller's interpretation of the rock art made supernova observers out of Ancestral Pueblo Indians in Arizona.

Although Miller's report captured the attention of astronomers, no one looked for additional examples of Southwest supernova rock art for two decades. In 1973, however, astronomer John C. Brandt and collaborators resurrected Miller's notion at the first large, formal meeting on archaeoastronomy in Pre-Columbian America, held in Mexico City (Brandt *et al.* 1975). They referenced Miller's two sites and described three more: two in northern California and one in Chaco Canyon, New Mexico. At the same conference, anthropologist Florence Hawley Ellis also considered the possibility of Crab supernova images in Southwest rock art in a lengthy review of cultural applications of astronomy among the Historic Pueblo Indians (Ellis 1975). Although Ellis did not dismiss the notion that prehistoric people in Chaco Canyon saw the Crab supernova and she mentioned a star/crescent petroglyph at Village of the Great Kivas, New Mexico, she argued these "supernova" sites more likely operated as Sun-watcher stations. She regarded the discs and circles in these rock-art sites as emblems of the Sun and supported her arguments with parallels in Historic Pueblo tradition.

Form alone cannot establish the astronomical identity of a stellar symbol, because multiple interpretations of star-like features remain possible. Also, we cannot distinguish an eyewitness representation of an actual event from symbolic use of the same celestial emblem without independent evidence of the context of the rock art's production. Most of the time, these ambiguities cannot be resolved.

Nonetheless, additional examples of star/crescent combinations were announced in 1975 at a symposium, "Native American Astronomy", held at Colgate University (Brandt and Williamson 1977; Mayer 1977). Brandt and Williamson reported their on-site examination of additional examples in New Mexico, including three at Village of the Great Kivas, a panel at Scholle (Tenabo) and a petroglyph boulder at San Cristobal. They also relied on other rock art researchers and cited independent reports of star/crescent rock art in Texas, Utah and Baja California, Mexico. Acknowledging the informed scepticism of Florence Hawley Ellis, they still concluded their circumstantial argument was strengthened by the discovery of more relevant sites. At the same meeting, Dorothy Mayer, an independent scholar, analysed 15 star/crescent emblems documented in literature on rock art in Nevada and California (Heizer and Baumhoff 1962; Heizer and Clewlow 1973). Believing the position and figural composition of adjacent images could establish the celestial setting of the star/crescent designs, she concluded that eight of the Great Basin images resemble the two Miller had originally showcased, and four of them, she judged, are reasonably read as Crab supernova rock art (Mayer 1977).

Brandt and Williamson soon amplified, consolidated and illustrated all of the available research on supernova rock art and assembled what is still the most comprehensive catalogue of star/crescent images (Brandt and Williamson 1979). Although physicist Seymour H. Koenig challenged the supernova interpretation in a thoughtful discussion of Pueblo ethnography (Koenig 1979), additional examples were announced through the following decades (e.g. Wellmann 1979; Mountjoy 1982; Fountain 2000; Olowin 2005). Since 1996, however, evidence that rules out or persuasively undermines the supernova explanation has emerged (Armitage *et al*. 2005; Krupp 2009; Krupp *et al.* 2010). In fact, it gradually became clear that no one had seen, in person, the two Arizona sites on which Miller had based his supernova conjecture in 1955, and that no one even knew where they were until 2008 (Krupp *et al.* 2010). These circumstances invite reconsideration of the premises on which the supernova interpretation is based and call for a rigorous reappraisal of all of the relevant examples.

Miller's later influence on popular astronomy and on archaeoastronomical research led to the inclusion of the paper that revived Miller's work (Brandt *et al*. 1975) in an anthology of fundamental research papers, *Foundations of Cultural Astronomy* (Aveni 2008). The impact of supernova rock art also earned a sceptical commentary in *Ancient Astronomy,* a contemporary encyclopaedic reference (Ruggles 2005). Supernova rock art has been energetically promoted in textbooks, popularisations and television programs (Brandt and Maran 1972; Pasachoff 1977; Eddy 1978; Sagan 1980; Patterson 1992; Aveni 1993; Krupp 1995), and is even signposted with the name "Supernova" at the Penasco Blanco pictograph overhang in Chaco Canyon National Historical Park. On-site inspection of the canonical sites promotes, however, a revised perspective on what has been an enduring and romantic theme in the study of ancient astronomy.

Miller thoughtfully and correctly regarded the identification of the two Arizona rock art panels with the 1054 AD supernova as tentative and speculative, but he did conclude the best explanation of the star/crescent combinations was eyewitness reports of the new, temporary and extraordinary star. Twelfth-century astronomical records from China and Japan of an event observed on the morning of 4th July, 1054 AD near the star zeta Tauri had been correlated with modern measurements of the expansion of the Crab nebula to confirm that a tattered, energetic and exotic cloud of interstellar gas is the remnant of the catastrophic explosion witnessed almost a thousand years ago (Duyvendak 1942; Needham 1959; Trimble 1968; Clark and Stephenson 1977).

According to Miller, circle/crescent combinations in Southwest rock art are rare, and he reasonably argued a crescent could represent the Moon. The pairing of the two symbols suggested two objects that appear near each other in the sky. Although the crescents face in different directions at White Mesa and Navaho Canyon, he dismissed the discrepancy as a common error of graphic transposition and concluded both panels depict the same event. He then considered various astronomical explanations for the design. He regarded a luminous object traveling between the Earth and the Moon as too improbable, and he thought conjunctions of planets with the crescent Moon too commonplace. Miller asserted: "To have merited special attention the event must have been exceedingly rare or highly spectacular, or both" (Miller 1955b, 4). That is, however, an assertion without evidence.

Novae, Miller thought, could command attention through brightness and rarity. Several historical novae and supernovae were bright enough to fulfil his requirements, but the 1054 AD supernova was the only one that occurred close to the time that the archaeological sites associated with the rock art were occupied and was accompanied by a crescent Moon. Excavations by archaeologist Robert C. Euler, at the Museum of Northern Arizona in Flagstaff, dated White Mesa at about 1070 AD and Navaho Canyon from 700 to 1300 AD. The 1006 AD supernova was a brighter event but appeared in the constellation Lupus the Wolf and far from the Moon. There is no credible association of the 1006 AD supernova with rock art in the Southwest.

When the Crab supernova ignited, it was six times brighter than Venus and one of the brightest stars ever recorded. Miller calculated the Crab supernova's circumstances for northern Arizona and determined the crescent Moon was evocatively just 2 degrees north of the extraordinary star on the morning of 5th July, 1054 AD. He concluded: "The rather stringent conditions for a favorable answer seem to be met and strongly suggest the possibility the two drawings actually depict the event of the apparition of the supernova" (Miller 1955b, 6) and asserted both sites "had an unobstructed view of the eastern sky" (Miller 1955b, 7).

Recent re-analysis of historical records and reconstruction of the Crab supernova light curve suggest the explosion may have first appeared in late April or early May in 1054 AD and would have then been visible in the evening sky (Collins *et al*. 1999; Fountain 2000). Despite the inconclusive but possible transformation of the narrative, the rock art can still be linked to the Crab event through a waxing crescent Moon. This fluidity of the astronomical constraints demonstrates, however, how generously forgiving the graphic evidence for supernova rock art is.

Miller expressed hope that more star/crescent imagery would be found, and that eventually occurred. Although Brandt and Williamson listed 21 "possible representations of the 1054 supernova" in their review (Brandt and Williamson 1979, S8, table 1), they had by then eliminated the San Cristobal petroglyphs. Executed in the well-documented Rio Grande Pueblo IV style, San Cristobal rock art is more than two centuries too late to qualify for 1054 AD supernova status. Brandt and Williamson also classified the Scholle (Tenabo) panel as late, but in the absence of archaeological dating, it remained in their list and continued to be showcased (Brandt and Scott 1989). In 1989, the number of supernova rock art sites was said to total 22, but no new list was assembled.

In 2005, radiocarbon dating of the pictographs in Fern Cave, in Lava Beds National Monument in northeast California, took that northern California star/crescent combination out of the supernova inventory. In 2009, Krupp demonstrated the Scholle (Tenabo) petroglyph illustrates a known celestial object and is not the supernova (Krupp 2009). Finally, after personal inspection in 2008 by Krupp and collaborators, the panels that inaugurated the entire supernova rock art movement were shown to be interpretively compromised (Krupp *et al.* 2010).

With four elemental supernova rock art sites compromised by discrepancies, reconsideration of the merits and liabilities of all of the alleged supernova depictions must drive the inquiry.

The sites include:

White Mesa (NA 5561)	Arizona
"Navaho Canyon" (Binne Etenni, NA 5653)	Arizona
"unknown location" near Flagstaff	Arizona
Fern Cave (Lava Beds National Monument)	California
Symbol Bridge (Lava Beds National Monument)	California
Ker 232	California
Iny 272	California
Lagomarsino (St-1)	Nevada
East Walker River (Ly-1)	Nevada
Ch-71	Nevada
Penasco Blanco ("Supernova," Chaco Canyon)	New Mexico
Scholle (Tenabo) (LA4092)	New Mexico
Village of the Great Kivas	New Mexico
San Cristobal Ranch	New Mexico
Breckenridge	Texas
Pleasant Creek (Capitol Reef National Monument)	Utah
Cueva Supernova, Arroyo del Parral	Baja California Sur, Mexico
Abo (Salinas Pueblo Missions National Monument)	New Mexico
La Pena Pintada	Jalisco, Mexico
Water Canyon (White Rock)	New Mexico
Cerro La Proveedora and Calera (Caborca)	Sonora, Mexico

White Mesa (NA 5561), Arizona

The ceramic evidence at the first proposed supernova rock art site suggests a post-1054 AD occupation, but later use, Miller argued, could have obliterated signs of an earlier presence. The pictograph is located deep within a cavernous open shelter eroded from a high spire of rock on the west end of White Mesa. Although the entrance is very large, there is no view of the eastern horizon inside the south-facing cave. Even outside the cave, the eastern horizon is high. The horn of the crescent is reversed from the orientation of waning crescent Moon, but advocates for the supernova interpretation explain wrong-way moons as common lapses in rendering an observed crescent. To represent the supernova, the circle's partial obstruction of the crescent also has to be viewed as the artist's response to the brilliance of the star. These assumptions diminish the objectivity of Miller's analysis and favour the supernova interpretation by defining the establishing criteria too loosely.

An eyewitness, of course, could portray the event from memory at a location from which the event could not be seen, but Miller identified his two Arizona rock art sites as places where the supernova could have been seen thanks to an "unobstructed view of the eastern sky", and he tallied that circumstance as evidence in favour of Crab supernova depiction in the rock art (Miller 1955b). Brandt and Williamson (1979) subsequently

emphasised the importance of a clear eastern horizon in the vicinity of the rock art in their milestone catalogue of supernova rock art candidates. Although a visible eastern horizon is not really a requirement, the alleged eastern horizon was used to argue the likelihood of the supernova interpretation.

On-site inspection of the pictograph added even more telling data. The bright red paint of the star/crescent pictograph is distinctive. It looks fresh in comparison to faded, and likely older, rock art on the shelter's back wall but is similar in colour and intensity to another pictograph on the east side of the shelter. That emblem resembles a Hopi shield or clan symbol, and the similarity of the two brighter pictographs, in colour and style, argue for an origin much more recent than the eleventh century. Alternative and likely explanations for the circle and truncated crescent include representation of the one-horn kachina, known in Hopi and Zuni ceremonialism, and a head with scalping knife. Both are encountered in Southern Tewa rock art.

Taken in full, the evidence at White Mesa, one of the two sites on which the supernova hypothesis is based, decertifies the pictograph's supernova standing (Krupp *et al.* 2010).

FIGURE 1. The "supernova" pictograph at White Mesa, Arizona, is much brighter than the recognisable Ancestral Pueblo rock art at the site and appears to be more recent than the eleventh century and the Crab supernova explosion. Although William C. Miller suggested the truncated crescent and circle may represent the waning Moon in the company of the Crab explosion on the morning of 5th July, 1054 AD, the emblem more likely depicts the one-horn kachina in Hopi and Zuni tradition (photograph by E. C. Krupp).

"Navaho Canyon" (Binne Etenni, NA 5653), Arizona

Miller's "Navaho Canyon" site was misnamed and is actually in a side canyon off Binne Etteni Canyon. Navajo Creek runs through the main canyon. Euler's archaeological work at the accompanying ruins confirmed occupation during the time of the supernova, but neither the side canyon nor the nearby portion of Binne Etteni Canyon offers a low eastern horizon. Although the supernova may have been seen on top of the canyon or elsewhere in the main canyon, the view at the vertical rock face on which the star/

crescent image was carved is greatly restricted by the side canyon's walls. The horn of the crescent is correctly oriented for a waning crescent Moon, and the style of the rock art is consistent with the era in which the supernova occurred.

The context of the Navaho Canyon petroglyph, however, makes interpretation far more problematic than the original reports suggest. The crescent and disc are part of a large, complex panel, which is one of many large, complex panels on the cliff face that flanks the north side of the tributary. The circle, or disc, that is supposed to be the supernova and the crescent are not prominent elements of the panel and are not conspicuous.

On-site inspection also revealed the disc, which is closely framed with the crescent in the only published photograph of the pair, is actually attached to another enigmatic element, and this figure has no obvious celestial character. Any interpretation of the disc must deal with it. The other nearby petroglyphs are similar in style and condition to the crescent and the disc and suggest all of the elements on the panel are actually part of a larger composition that restrains interpretation and discourages special treatment of the crescent and the disc.

Examination of the star/crescent rock art at "Navaho Canyon" burdened the rock art with unresolvable ambiguities and complications and greatly undermined the supernova interpretation of the two original "supernova" sites (Krupp *et al.* 2010).

FIGURE 2. William C. Miller's Crab supernova interpretation of a petroglyph in Binne Etenni, Arizona, is compromised by other carved elements that appear to be part of the same feature. These features were not shown in the original illustrations of the rock art and make it difficult to interpret the "star" disc and "Moon" crescent as eyewitness depictions of a celestial event (photograph and image enhancement by Robert Mark, inset drawing by Margaret Berrier).

Unknown location, vicinity of Flagstaff, Arizona

A photograph of the third example in the Brandt/Williamson list was supplied and discussed by physicist Seymour H. Koenig, who indicated it was extracted from a location 20 miles northwest of Flagstaff and now belongs to a private collection (Koenig 1979). The panel's numerous elements are executed in the same pecked style and include a correctly oriented crescent with a six-rayed disc, or "star", to the right. A set of concentric rings to the left of the crescent may be equated with the Sun, which followed the supernova and the waning crescent Moon into the eastern sky in July 1054 AD. Because the exact provenance of the rock art is unknown, nothing can be said about access to a clear eastern horizon.

Koenig provided an alternate and demonstrably more plausible interpretation of the petroglyph. He saw the three distinctive humps below the rings, crescent and rayed disc as an image of the San Francisco Peaks, the most prominent feature of the western horizon in the vicinity of Flagstaff. They are where the Hopi believe the Kachinas dwell after they leave the pueblos in summer. Other images on the panel include bird tracks, a bear paw, a lizard and a snake, all of which Koenig identified as Hopi clan symbols. A masked figure may be a Kachina impersonator, and a turtle may reference Kachina dance rattles. Koenig convincingly argued the entire panel was the work of one artist, and he suggested all of the figures, which are oriented toward the peaks, have something to do with an assembly of Hopi clans. The rayed disc, he argued, is reasonably guessed to be Venus.

Koenig's interpretation is more detailed and at least as persuasive as the supernova explanation of the scene. Neither can be proved, but a reasonable option dilutes the circumstantial case for the supernova.

FIGURE 3. Eastern sky: crescent Moon and supernova in Taurus as they appeared in western America, 5th July, 1054 AD, 2.5 hours before dawn. In Miller's interpretation, the star/crescent combinations in northern Arizona rock art mimicked the dawn configuration of the Crab supernova and the waning crescent Moon above the eastern horizon in the American Southwest (illustration by John A. Eddy, courtesy of E. C. Krupp).

Fern Cave, Lava Beds National Monument, California

The Fern Cave pictographs are drawn in charcoal on the west wall of a subterranean lava tube cave with no view of any horizon. The panel is very complicated and filled with unexplained images, and although the pictographs are numerous, their concentration and similarity in execution and style suggest they are related to each other. The "star" (a small circle) and the crescent are correctly oriented to each other but mystifyingly require the horizon to be to the left, rather than down, with respect to the wall in the cave. In that sense, the star/crescent is rotated 90 degrees from a normal ground-based view of the eastern horizon.

Brandt and Williamson asserted Fern Cave was in use in the eleventh century AD, but recent radiocarbon analysis of the charcoal pigment in two of the painted circles and in the crescent do not support that date. Radiocarbon calibration curves place the crescent between 1440 and 1670 AD and date the supernova circle between 1490 AD and the present (Armitage *et al.* 2005). A sample from a second circle, above the star/crescent pairing, falls in the range of 1020 to 1290 AD, with 1220 AD the most likely date. These results disqualify Fern Cave as Crab supernova rock art.

FIGURE 4. The star/crescent image in Fern Cave, at Lava Beds National Monument, is part of a very complex subterranean panel. Radiocarbon dating of a sample of the charcoal pigment indicates the rock art was painted several centuries after the Crab supernova (photograph by E. C. Krupp).

Symbol Bridge, Lava Beds National Monument, California

The pictographs on boulders at Symbol Bridge, a partially open lava tube, resemble the rock art in Fern Cave and are regarded to be related to it. If so, the established date from the Fern Cave paintings casts doubt on eleventh-century work at Symbol Bridge. The

boulder with the star/crescent combination is close to the entrance of the cave, on the floor of the collapsed lava tube, where there is no clear view of the eastern horizon.

The star and crescent at Symbol Bridge are painted on a tall boulder with many other black pictographs, including several of similar condition in a long vertical line that nearly spans the full height of the rock. The alleged supernova, at the top of this column of pictographs, is a cross just below an upturned crescent. There are, in fact, two more crescents on the same boulder face, and all are incorrectly oriented to the horizon, with horns up. The crescent associated with the supernova cross opens away from the star and is incorrectly oriented to it.

The star/crescent pictographs appear in style and in placement to be part of a larger, deliberate composition. Some kind of celestial meaning is evident in the other two wrong-way moons and in three rayed discs at the bottom. Their presence makes the astronomical connotations more complicated. Considering the star and crescent in isolation from the other celestial symbols arbitrarily edits the data and incorrectly favours the case for the supernova.

FIGURE 5. Multiple crescents, ambiguous orientation and a composition that includes several other elements complicate interpretation of the star (cross)/crescent imagery at Symbol Bridge in Lava Beds National Monument, in northeast California (photograph by E. C. Krupp).

Ker 232, California

The Ker 232 star/crescent painting was analysed by Dorothy Mayer (Mayer 1977, 1979) from a published drawing and not on-site. The red crescent looks like a banana and it opens correctly to the right, where a set of red concentric rings performs supernova duty below a smaller red dot. Mayer treated it as an example of Great Basin rock art, but it is, in fact, in Yokuts style. It is in Kern County, California, on the bank of Monetti Creek.

Mayer believed she could assess star/crescent sites by affiliating neighbouring rock art elements with known constellations and asterisms. She used these references to establish the location of the crescent Moon on the ecliptic and, in turn, to verify whether that position corresponded to Taurus the Bull, where the supernova occurred. She ruled out star/crescent pairings that did not meet this criterion or had no accompanying rock art to establish a position among known stars. Because the star and crescent at Ker 232 seemed to be isolated on the rock, Mayer ruled the image as indeterminate and did not treat it as a 1054 AD supernova image. No independent confirmation of Mayer's constellation symbols is possible, however.

Understanding the limitations of Mayer's approach, Brandt and Williamson included Ker 232 in their 1979 list after all, probably because it resembled in form the other examples they had assembled. They also stated the eastern horizon is visible from the site but descriptions of the panel do not provide any information on the setting. No date is established for it and any time between 1000 BC and 1500 AD is possible. Ker 232 can be viewed as a star/crescent combination, but it cannot favour the supernova interpretation over alternatives.

Iny 272

Mayer collected 15 crescent-and-circle figures from California and Nevada rock art, identified eight of them as supernova reports and dismissed the remaining seven. The alleged celestial configuration in the Great Basin curvilinear petroglyphs of Iny 272, she argued, can be established, and she concluded the orientation of the crescent, open to the left, illustrates the waxing crescent Moon near the western horizon and next to a bright object. She relied on a drawing of the petroglyphs and provided no information on the visibility of any horizon. The circle (star) and crescent are actually embedded in several other images, two of which almost look like another circle and distorted crescent, and there is nothing singular about the first crescent and star, which are not that obvious. Brandt and Williamson, however, treated them as the Crab supernova and Moon but provided no significant comment or justification beyond superficial resemblance to other star/crescent rock art.

In this case, independent investigators reached a different conclusion about the same site. This is a consequence of arbitrary judgement and insufficient data.

Lagomarsino (St-1), Nevada

Lagomarsino is a rich concentration of Great Basin Geometric-style petroglyphs on vertical cliff surfaces and boulders in western Nevada. No firm date is available for this

rock art, but some of it may be 4000 years old (Heizer and Baumhoff 1962). The cliff in this case faces south and the eastern horizon is reasonably accessible. The star is a dot, or disc, in contact with the lower horn of a respectable crescent if the crescent is viewed as a waning Moon. It is one of thousands of petroglyphs at the site and is accompanied by three other elements, including a kind of stick figure, without legs, in contact with the crescent's upper horn. Mayer decided it is not a supernova contender because she believed the adjacent petroglyphs represent the constellation Scorpius. Undeterred by that assertion, Brandt and Williamson kept it in the catalogue, but offered no explanation for the figure in contact with it. Its classification as a Crab supernova image is arbitrary.

East Walker River (Ly-1), Nevada

Brandt and Williamson listed three petroglyph panels at the East Walker River site on the eastern flank of the Sierra Nevada. The site has two large groups and several smaller groups of inscribed boulders that litter a ridge in the floodplain, and hundreds of rock art elements are present. The age of the carvings is unknown but likely to reach back thousands of years, as at Lagomarsino.

Mayer spotted crescents with circles in drawings and photographs of five of the boulders and, through dubious methodology, concluded two of them show the Crab supernova. Both crescents are properly oriented with respect to the circle on the lower horn. Without endorsing Mayer's system, Brandt and Williamson accepted the two images Mayer approved (Heizer and Baumhoff 1962, figs 88c, 90p) but also registered one that Mayer turned down (Heizer and Baumhoff 1962, fig. 90d). They did not comment on the remaining two East Walker River boulders, but it is likely they judged their star/crescent elements lacked clear definition.

All three of the listed petroglyph boulders carry acceptable images of a crescent accompanied by a circle, but nothing confines the art to the correct era. The relationship of these petroglyphs to the many other neighbouring petroglyphs, including those on the same small stones, is not addressed.

Ch-71, Nevada

Two more Great Basin Abstract petroglyphs (from a site in the Stillwater Range in northern Nevada) were evaluated by Mayer from drawings and photographs and accepted by her as Crab supernova rock art. The images, like those at the East Walker River site, are on faces of small boulders on the ground. In one case, the crescent opens toward a large disc to the right and a smaller disc is to the right of that. The other crescent has a rayed disc to the left and two dots below its lower horn. No specific date can be assigned to either carving. A view to the east is possible. Both boulders have several other petroglyphs that defy explanation and astronomical interpretation, although Mayer based her conclusion on her personalised assignment of constellations to the rest of the figures.

Like the other Nevada images, these rock art panels really were classified as supernova depictions because they resemble Miller's canonical figures.

Penasco Blanco ("Supernova", 29SJ427), Chaco Canyon National Historical Park, New Mexico

The star/crescent imagery painted on an overhang below the mesa on which the Penasco Blanco ruin stands is the most influential example of alleged Crab supernova rock art. Officially discovered in 1972 (Brandt *et al.* 1975), it was soon recognised as a particularly evocative panel of celestial symbols and moved the discussion into a landscape that also possesses a substantial inventory of prehistoric monumental architecture. Chaco Canyon emerged as a major complex of Ancestral Pueblo Great Houses, after centuries of earlier occupation, at the beginning of the tenth century AD, and remained active until the twelfth century, when the Chaco system was stressed by prolonged drought.

Facing the cliff wall and looking up at the Penasco Blanco overhang, a visitor sees, about 20 ft above the ground, an exquisitely drawn crescent. The "star" to its left has ten rays and the fingers of a painted handprint extend away from the cliff wall on the closed side of the crescent. All of the figures are deep brownish-red, and three concentric rings centred on a dot, painted in the same copper red, are high on the vertical wall just below the other figures. A more subtle feature that resembles a comet tail, first described by Reyman (1988), extends to the right from the rings. Others have since speculatively and anecdotally linked it with the 1066 AD appearance of comet Halley (Malville 2008). The view away from the cliff includes an eastern horizon that would have permitted the calculated 5th July, 1054 AD configuration to be seen. The size of the crescent pictograph is properly scaled to the angular distance of the supernova from the 5th July, 1054 AD waning Moon. The site's charm, accessibility and affiliation with a high civilisation that might be expected to support systematic astronomical observation favoured the Penasco Blanco site with attention. Carl Sagan included it in an episode of the widely viewed *Cosmos* Public Broadcasting System television series (Sagan 1980) and the National Park Service showcased it at the Chaco Canyon visitors' centre.

Consequently, the Penasco Blanco pictograph panel became the poster child of Crab supernova rock art despite its similarity to the images anthropologist Frank Cushing saw between 1879 and 1884 at a Zuni Sun-watching station or Sun shrine at Matsakya, not far east of Zuni Pueblo. Cushing enumerated the symbols on a stone pillar in a small "open tower": the face of the Sun, the sacred hand, the morning star and the new Moon (Cushing 1979 [1882–1883], 116). Another Southwest ethnographer, Matilda Coxe Stevenson, later published a picture of the "tower" and the illustrated stone slab in her Bureau of American Ethnology report on the Zuni (Stevenson 1904). Reyman (1988) discussed discrepancies in Cushing's report and tabulated differences with accounts by other historic ethnographers (Adolph Bandelier, Victor Mindeleff and Maltida Coxe Stevenson). Florence Hawley Ellis reported the remarkable parallel of the symbols (Ellis 1975) and regarded Penasco Blanco as a Sun-watching station. She also confirmed the four symbols are encountered in both Ancestral Pueblo and Historic Pueblo traditions and may be clan symbols. Although Brandt and Williamson accepted the possibility the Penasco Blanco pictographs mark a Sun-watching station, they argued that did not rule out an image of the Crab supernova as the Penasco Blanco morning star and added other purported Crab supernova rock art sites, like Fern Cave, could not possibly have functioned as solar observatories.

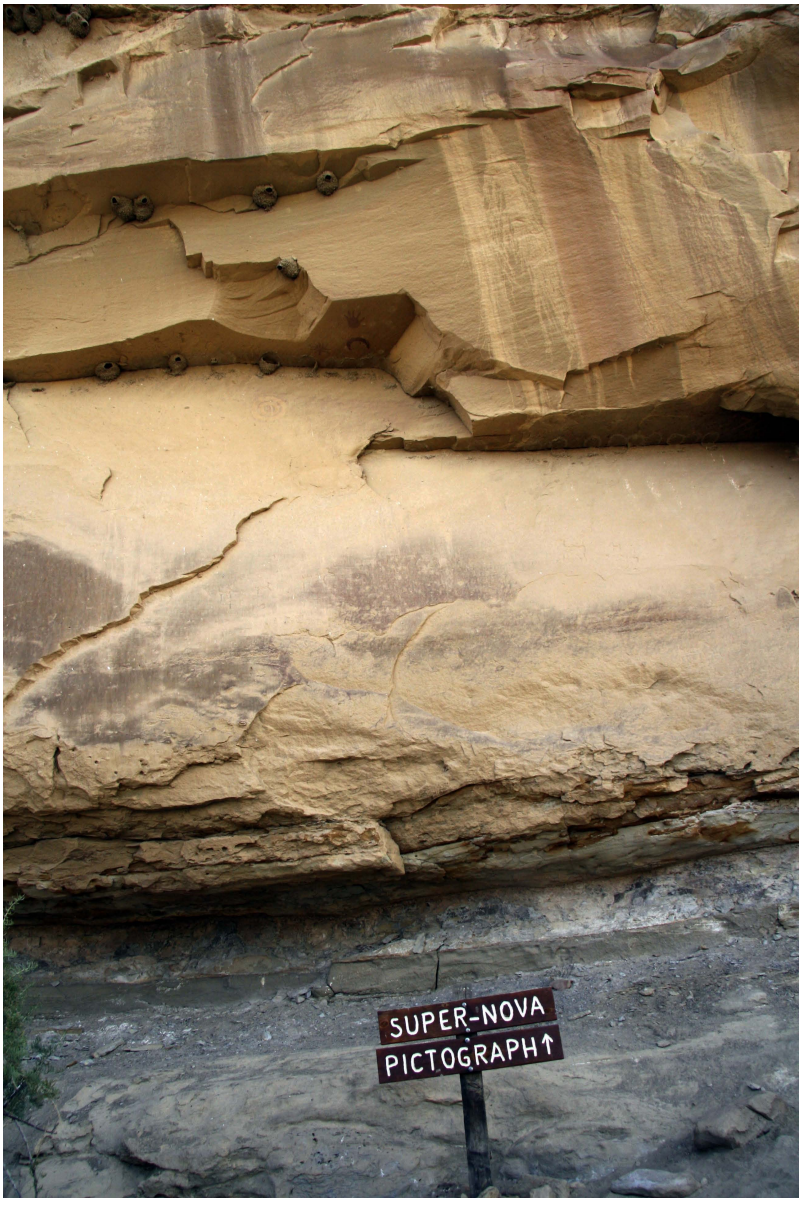

FIGURE 6. Wide public exposure of the Penasco Blanco pictograph panel intensified interest in the Crab supernova interpretation of star/crescent rock art. The National Park Service at Chaco Canyon National Historical Park, New Mexico, responded by naming the site "Super-nova" and putting up a sign for it (photograph by E. C. Krupp).

The Penasco Blanco pictographs have all of the circumstantial elements a supernova site requires. The image of the crescent Moon in conjunction with a bright star is correctly oriented. Although the eastern horizon is partially blocked by a low natural berm near the cliff wall, the rock art is no more than a few yards from a spot that provides access to

eastern sky. Finally, the nearby Penasco Blanco Great House was occupied at the time the Crab supernova occurred.

Jonathan Reyman, an anthropologist and archaeologist, provided, however, a disciplined and detailed commentary (Reyman 1988) on the Penasco Blanco site and concluded it is best understood as one of four prehistoric Sun shrines directionally placed around the Penasco Blanco great house. Other commentaries on the Penasco Blanco pictograph panel vary between supernova advocacy (Williamson 1984) and scepticism (Schaefer 2006; Fisher 2010). Notwithstanding alternative perspectives, the supernova interpretation of Penasco Blanco has endured. Publicity, the steady pilgrimage of Chaco Canyon visitors to the Penasco Blanco pictographs and the public popularity of the Crab supernova connection led the National Park Service to name the site "Super-nova" and signpost it accordingly.

Although "Super-nova" appears to resist scepticism, its pictographs are really the weak link in the argument. There is plenty of rock art in Chaco Canyon, and most of it, whether carved or painted, is Ancestral Pueblo. Most of it was probably produced between 500 and 1200 AD. The canyon also contains Navajo rock art, and the earliest Navajo petroglyphs were probably carved between 1750 and 1820 AD (Schaafsma 1992; Ambruster and Hull 2005). The styles of Ancestral Pueblo rock art and Navajo rock art are very distinct, and neither of them looks like the painting at Penasco Blanco. In a comprehensive survey of painted sites in Chaco Canyon National Historical Park, rock art specialist Pamela Baker described the Penasco Blanco site, outlined the history of its interpretation and documented additional painted elements on the overhang that have not been discussed (Baker 2009). Although the panel is tentatively classified as Ancestral Pueblo, it differs in appearance, execution, composition and content from other Chaco paintings. The arrangement of the three elements is more condensed and formal than other Chaco Canyon panels. The edges of the Penasco Blanco figures are sharp and clean. The execution of the figures is more exacting and refined. While handprints are present at other painted panels in the canyon, they do not have the same finesse as the hand at Penasco Blanco. Most of the other Chaco Canyon pictographs appear more faded and worn than Penasco Blanco. Anthropomorphs, quadrupeds and geometric figures are common, and other panels do not have the kind of formal, deliberate composition seen at Penasco Blanco.

Donna Yoder and Jane Kolber began a comprehensive assessment of all of the rock art in Chaco Canyon in 1996. Their preliminary report (Yoder and Kolber 2002; Kolber and Yoder 2002) emphasised the petroglyphs, which in content and disposition superficially resemble most Chaco Canyon pictographs. Although Kolber and Yoder added greatly to the inventory of Chaco Canyon petroglyphs and pictographs and found images "manufactured with great skill, complexity, and dexterity" (Kolber and Yoder 2002, 171), they did not indicate the presence of images similar in style and execution to the Penasco Blanco pictographs.

The handprint at Penasco Blanco is puzzling, but not because handprints are uncommon in Chaco Canyon. They are not. The handprint is puzzling because it is so prominent. The three elements of the panel – star, crescent and handprint – share a common scale, and no similar singular and simple arrangement is reported.

The similarity between Penasco Blanco and known Zuni imagery suggests the Penasco Blanco panel was painted well after the twelfth century. It seems conspicuously out of place in an inventory of Ancestral Pueblo rock art.

FIGURE 7. The "star" and crescent painted on the overhang below the Penasco Blanco ruin in Chaco Canyon provide a fetching Crab supernova image, and the panel is likely the best-known example of "supernova" rock art. In style, however, these pictographs differ dramatically from all known Ancestral Pueblo rock art in Chaco Canyon and bear little resemblance to eleventh-century Chaco rock art (photograph by E. C. Krupp).

Scholle (Tenabo, LA4092), New Mexico

Personal inspection of the Scholle (Tenabo) petroglyph panel in 2004 demonstrated that its downturned crescent in conjunction with a four-pointed star is not a representation

of the Crab supernova (Krupp 2009). The style of all of the rock art on the undated panel matches Rio Grande Pueblo and Pueblo IV rock art elsewhere in the area and is much later than the eleventh century. The star is equipped with a fanning tail that was ignored in earlier commentaries. The crescent and the star were highlighted with aluminium powder in the photograph that accompanied Brandt and Williamson's 1979 summary of supernova rock art, but the star's tail was not included in the enhancement. Polly Schaafsma, an expert on rock art in the American Southwest, has persuasively identified stars with tails, talons, faces, feathers, wings and weapons as armed celestial warriors and linked them with Venus as the morning star through relevant and explicit Pueblo ethnography. The morning star, in turn, is associated through conspicuous conjunctions with the waning crescent Moon (Schaafsma 1993, 2000, 2005).

Further, the crescent Moon and the star are incorrectly configured at Tenabo and incorrectly oriented on the vertical face of the boulder for Crab supernova duty. The eastern horizon is completely obstructed by the natural foliage and walls of the small canyon in which the panel is located.

FIGURE 8. Tenabo's star/crescent combination is disqualified from Crab supernova duty by its explicit Rio Grande Pueblo and Pueblo IV style. The star has a fanning tail that was ignored in interpretive reports, and that tail identifies it as a representation of Venus as a warrior star. The site is near Scholle, New Mexico (photograph by E. C. Krupp).

Village of the Great Kivas, New Mexico

Three star/crescent petroglyphs appear on adjacent faces of rimrock above the Ancestral Pueblo ruins of Village of the Great Kivas, about 15 miles northeast of Zuni Pueblo. The eastern horizon is partially available from the rock art zone and was fully accessible from

lower ground where the Ancestral Pueblo structures were built. They include a great kiva, and their construction resembles what is encountered in Chaco Canyon. Archaeological excavation assigns them to the first part of the eleventh century AD, and they remained in use during the time of the Crab supernova. In the primary star/crescent image, the crescent horns are pointed down and the "star", an inscribed equal-armed cross above it, fails to replicate the configuration of the waning crescent Moon and the Crab supernova. The orientation of the crescent with respect to the ground makes it impossible to establish whether the crescent is intended to be read as waxing or waning, if either. Several other petroglyphs (including an undulating line that crosses above the star/crescent, turns downward to the left of it and drops to an image of an owl) are executed in the same style and seem to make the star/crescent image part of a larger composition. Although the panel faces east, most of the cliff faces south.

About 15 ft to the east of the primary star/crescent image, a south-facing panel and a west-facing panel form a corner of cliff face, and each wall of rock has a star and crescent. Both are more patinated than the petroglyphs on the primary face. The crescent on the south-facing wall opens upward, and the star, another cross, is incorrectly to the left and a little below the left horn.

The crescent on the adjacent wall opens downward and there is a four-pointed star below it, separated by a much greater distance from the crescent than in the other two examples. The star is distinctively different in form from the two crosses and looks newer than its neighbouring crescent. Although the orientation of the crescent to the ground is incorrect for the Crab supernova, a 90-degree counter-clockwise rotation allows a loose match.

Incorrect orientations and incorrect configurations were excused at Village of the Great Kivas, and Brandt and Williamson suggested the three different depictions might illustrate the progressive shift of the Moon with respect to the supernova on different mornings (Brandt and Williamson 1977). The evidence, however, cannot support that narrative. The three images cannot be combined into a consistent, readable, accurate and plausible sequence.

Physically close on the rimrock, the three examples of a star/crescent petroglyph at Village of the Great Kivas are completely different in the arrangement of the two key elements, a circumstance that invites doubt that all three represent the eyewitness records of the same specific event. Each could instead, easily and more reasonably, be interpreted as a different encounter of either crescent Moon with a bright planet or might, symbolically and generically, reference the Moon and the morning or evening star. The additional and seemingly related elements on the main panel certainly do not clarify the astronomical circumstances and actually add more unresolvable ambiguity. Florence Hawley Ellis thought the star/crescent images at Village of the Great Kivas more likely marked an ancient Sun-and-Moon-watching station (Ellis 1975).

San Cristobal Ranch, New Mexico

Although Brandt and Williamson discussed and included a photograph of a petroglyph of an encircled star, accompanied by a outlined crescent, on a large flat boulder at San

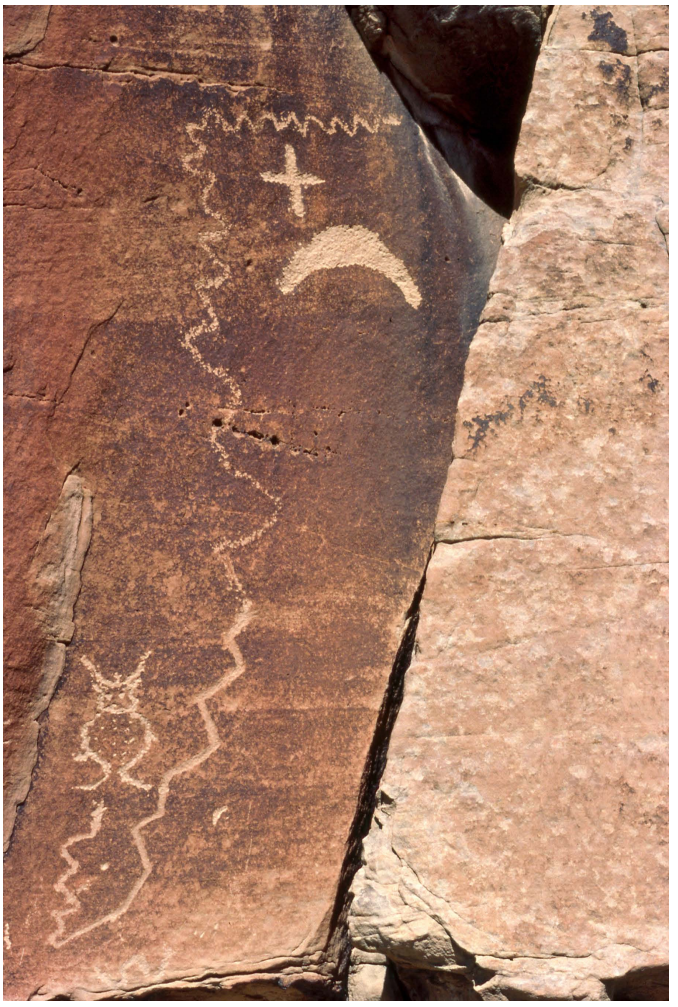

FIGURE 9. Several pairings of a star and crescent are carved onto the rimrock above Village of the Great Kivas, near Zuni Pueblo, New Mexico. The best-known of these orients the horns of the crescent toward the ground and incorrectly positions the star (cross). Adjacent petroglyphs of an owl and an undulating line are in the same style, appear to be associated with the cross and crescent, and complicate interpretation (photograph by E. C. Krupp).

Cristobal Ranch, they acknowledged the archaeological dating of the major Pueblo ruin nearby is too late (1380 AD) for the Crab supernova (Brandt and Williamson 1977). Another petroglyph on the same boulder places a small cross on the tip of one horn of a filled crescent and also qualifies as a star/crescent with the star on the wrong side, but it was not discussed. In fact, the second example at San Cristobal could equally qualify as a comet, but there is no more evidence for that than for the supernova. The "comet" was illustrated and evaluated later (Brandt and Williamson 1979), and by then the first star/crescent on the boulder was no longer mentioned.

Neither of the San Cristobal petroglyphs was accepted as Crab supernova rock art, because the style and adjacent petroglyphs clearly attribute them to the fourteenth century. They are similar in content, however, to the allegedly genuine supernova depictions and that suggests the other star/crescents easily could represent something besides the supernova. If the San Cristobal petroglyphs are something besides the Crab supernova and Moon, why not all of the others, too?

Breckenridge, Texas

Pictographs on the overhang of a shallow rock shelter a few miles southeast of Breckenridge, Texas, in the north-central part of the state, include a set of two loosely drawn red concentric rings to the left of a red-outline crescent that opens toward the rings (Kirkland and Newcomb 1967). The site was visited and recorded by Forrest and Lula Kirkland in 1937, and there is no indication anyone has examined the paintings since. Brandt and Williamson republished the Kirkland drawing of the panel and viewed the site favourably even though the celestial configuration is backwards and no physical or stylistic date can be assigned. The shelter faces east and overlooks a level valley that would have provided an appropriate horizon.

The concentric circles in the Breckenridge shelter could stand for the Sun, a planet, a star or something else altogether. Interpretation of this rock art as a Crab supernova emblem weakens further the parameters that constrain the argument and permits concentric rings to join crosses, circles, discs, four-pointed stars and multi-rayed stars and discs as permissible supernova iconography. As a consequence, almost anything that accompanies a crescent in rock art can be a supernova.

Pleasant Creek, Capitol Reef National Monument, Utah

In 1976, rock art expert Klaus F. Wellmann first described a star/crescent petroglyph on a south-facing sandstone cliff face at Pleasant Creek in Capitol Reef National Monument, Utah (Wellmann 1979). The San Rafael style of the petroglyphs and their geographic location affiliated them with the prehistoric Fremont culture, which is assigned to the period 1000–1200 AD (Schaafsma 1971) and the era in which the Crab supernova erupted. Wellmann recognised a celestial connotation in the two very well-executed crescents that accompany an equally well-carved set of concentric rings. One of the crescents is above the rings and opens upward. The other is to the right and opens to the right. Three anthropomorphic figures and a quadruped (bighorn sheep) may indicate how the panel should be viewed. If so, the crescent on the right does not comply with the Crab supernova configuration. In conjunction with the upper crescent, the rings are still out of place but not incorrectly oriented. Like the Breckenridge site, Capitol Reef expands the Crab supernova rock art inventory to concentric rings.

Wellman did not endorse a supernova interpretation of the Capitol Reef rock art but instead emphasised uncertainties and alternative explanations. In a very brief, but effective, note, Wellmann quoted anthropologist Franz Boas, who advised caution in symbol interpretation (Wellmann 1979). Boas warned that

> the same form may be given different meanings, that the form is constant, the interpretation variable, not only tribally but individually. It can be shown that this tendency is not by any means confined to art, but that it is present also in mythology and ceremonialism, that in these also the outer form remains, while the accompanying interpretations are widely different. (Boas 1951, 128)

Even more problematic, the Capitol Reef panel has three more crescents, which are cropped out of published photographs of the panel. Two of them, to the left and a little below the rings, are thin and open upward. The third is just above and to the left of the upper crescent. It opens to the right and its lower horn almost touches the left horn of the crescent next to it. The panel has altogether too many moons for one dubious supernova. It also has another double circle with no crescent for company.

FIGURE 10. Capitol Reef's Crab supernova candidate turns a set of concentric rings into a star and links them with one of the two carved crescents at Pleasant Creek, Capitol Reef National Monument, Utah (photograph by George Stoll).

Cueva Supernova, Arroyo del Parral, Sierra de San Francisco, Baja California, Mexico

The Crab supernova's growing notoriety in rock art caught the attention of Harry Crosby, a pioneering expert on the prehistoric rock art in the Sierra de San Francisco, in the centre of Mexico's Baja Peninsula. In 1971, Crosby noticed a rayed disc painted in red on the ceiling of a shallow and relatively small rock art shelter in the middle of the drainage and mule trail that runs south through Arroyo del Parral from Serpiente Cave (Crosby 1975). The disc has perhaps 18 discernible rays and is a more persuasive Sun symbol than star, but it is tangent to a painted red oval. The oval is nearly circular and half filled with pigment, like a quarter Moon. When Crosby encountered the Crab supernova work of

Brandt and Williamson and others, he supposed the Parral pictograph might represent the same event. In subsequent publications, he named the shelter Cueva Supernova.

The singularity of the Parral rayed disc in all of Great Mural rock art prompted Brandt and Williamson to argue it portrayed a singular event and not some routine celestial conjunction, but a truly remarkable celestial event could have just as easily persuaded many eyewitnesses to record it permanently. Adopting one line of reasoning here over the other reflects an unjustified bias for the conclusion.

A Crab explosion interpretation of the Baja pictograph also plays fast and loose with the supernova Moon, which is not shown as a crescent, were the bisected oval even intended to be the Moon. The actual phase of this "Moon" received no comment in Brandt and Williamson's 1979 survey.

Personal inspection of Cueva Supernova in 1999 confirmed the ceiling of the shelter is covered with a great deal of imagery. The "star/crescent" pictograph is small compared with everything else painted there and is difficult to spot. There is also a rayed disc, without any adjacent "crescent", carved into the rock in the shelter. No date is available for the site, and a considerable range of time is assigned to Great Mural rock art. The shelter is at the bottom of a deep and rather narrow canyon and faces west. From the floor of the arroyo only a fraction of the sky is visible, and the distant horizons are completely inaccessible. A supernova witness would have had to have been high up on the mesa, far from the shelter in distance and time. Like Penasco Blanco, this site in name now honours the Crab explosion, but the meaning of its celestial rock art is completely unresolved.

FIGURE 11. As Crab supernova rock art became fashionable, candidates were identified beyond the American Southwest. A red rayed disc and a half-filled oval on the ceiling of a shallow rock shelter in the Arroyo del Parral, Sierra de San Francisco, Baja California Sur, Mexico, prompted designation of the site as "Supernova Cave". The substitution of an oval for a crescent is only one of the site's supernova liabilities (photograph by E. C. Krupp).

Abo, Salinas Pueblo Missions National Monument, Abo Unit, New Mexico

Rock art in the vicinity of the Abo pueblo and mission ruins includes a star/crescent combination that was first published in the first systematic modern survey of archaeo-astronomy (Krupp 1978), in a chapter by solar astronomer John A. Eddy (Eddy 1978). Six drawings of Crab supernova sites (Penasco Blanco, White Mesa, Navaho Canyon, Fern Cave, Symbol Bridge and Abo) illustrated Eddy's careful section on "Possible Records of the Crab Supernova", but the Abo panel, shown as a crescent arcing over a four-pointed star with a central circle, was not included in any other report.

Although the relationship of the crescent to the star is arguably acceptable, a personal inspection of the Abo site excluded it from supernova stature. The star and crescent petroglyphs are on a vertical side of a boulder near the top of and at the south end of a low mesa. The petroglyphs face southwest and a short walk from them to the east of the mesa will provide an adequate eastern horizon. In style, however, the Abo panel matches the Tenabo petroglyphs and other rock art in the Rio Grande Pueblo and Pueblo IV style.

The Abo panel is also much more complex than shown in the published vignette. Two figures are positioned just below the star, and there are two more stars, one of which is much larger than the star under the crescent. A couple of snake petroglyphs also slither down the rock. The circle inside the alleged supernova star is a dark disc which represents the face of the Venus/morning star warrior found throughout the Rio Grande region of central New Mexico. The celestial meaning of the stars at Abo is understood, and the petroglyphs are three centuries too late for the supernova (Krupp 2009).

La Peña Pintada, Jalisco, Mexico

Far less well-known than most proposed Crab supernova rock art sites, the La Peña Pintada rock shelter above the Tomatlan River in Jalisco, Mexico, includes a crescent, with a dot painted on the "upper horn", among a couple dozen elements on the interior ceiling (Mountjoy 1982). The site was not known to Brandt and Williamson at the time they assembled their 1979 review and is, therefore, not included in their inventory.

The shelter is shallow, and the back wall is blanketed with hundreds of pictographs. By comparison, the ceiling is almost empty. The site is in Huichol and Cora territory, but the date is uncertain. The rock art and the shelter are assigned to the period 900–1500 AD, which bookends the 1054 AD date of the Crab supernova but does not pinpoint it. From the top of the shelter the view is relatively unobstructed and includes an eastern horizon.

Mountjoy attempted to interpret the pictographs through ethnographic analogy with the Huichol. The Crab supernova rock art literature led him to dedicate special interest to what he regarded as a crescent/dot combination. The solidly coloured pictograph could be interpreted as a kind of hook with a knob at one end or even as a sinuous snake with a round head. Mountjoy's celestial interpretation was reinforced by the picto-

FIGURE 12. A star and crescent near Abo Pueblo, Salinas Missions National Monument, New Mexico, shares the late Rio Grande Pueblo style encountered at Tenabo. The star's dark face signals it as the Venus war star and not the Crab supernova (photograph by E. C. Krupp).

graph's placement on the ceiling of the overhang, possibly a stand-in for the sky, and Mountjoy also suggested the main stick figure, in the middle of the ceiling and next to the star/crescent pictograph, was intended to represent Orion. He additionally explored other possible astronomical identities for ceiling pictographs, but without a disciplined methodology and independent iconographic confirmation, Mountjoy's astronomical remarks lead to no conclusion.

If the back edge of the ceiling is intended to represent the eastern horizon, the crescent is correctly oriented, but the star (dot) is in the wrong place on the top horn of the crescent. If the lip of the ceiling is supposed to be the horizon, the crescent is backwards, but the star's position is acceptable. The crescent and dot may, in fact, be celestial symbols, but the degrees of interpretive freedom are again too forgiving to assign the crescent and dot to the Moon and the Crab supernova or to any particular astronomical configuration.

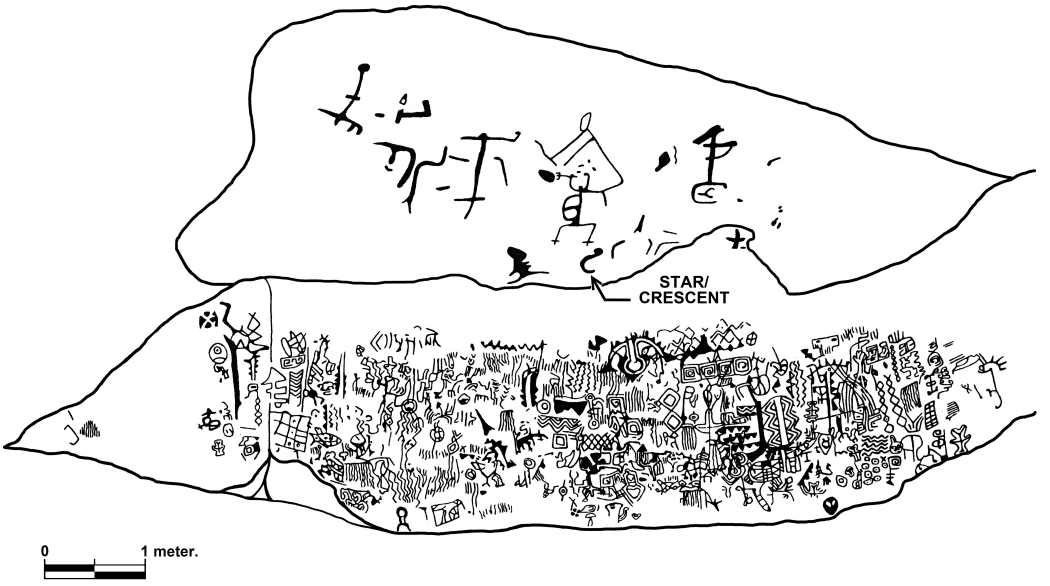

FIGURE 13. La Peña Pintada, in Jalisco, Mexico, shelters hundreds of pictographs on the wall and ceiling, and the "supernova" dot and lunar crescent on the ceiling are almost overwhelmed by all of the other paintings (illustration by Robert Smith for the Griffith Observatory, after Mountjoy 1982).

Water Canyon, White Rock, New Mexico

The Crab supernova rock art quest continued to collect new star/crescent partnerships, and John Fountain added several, without detailed commentary, from New Mexico, Arizona, Nevada, California, and Sonora, Mexico, in a paper presented at the annual San Diego Rock Art Conference (Fountain 2000). One of these, a petroglyph panel in Water Canyon, near White Rock, New Mexico, had been examined more thoroughly at the 1996 Fifth Oxford International Conference on Archaeoastronomy in Santa Fe by Ronald Olowin, who argued on behalf of Crab supernova recognition for a set of two concentric rings in contact with the lower horn of a left-facing (and incorrect) crescent. Other close elements include a circle trailing four lines of dots to the left, possibly representing a comet (Olowin 2005). Olowin also proposed a line of three dots below the concentric rings may indicate the Belt of Orion and help place the image in the neighbourhood of Taurus the Bull where the Crab supernova was seen.

White Rock is in Tewa territory, and most of the rock art is classified as the Northern Tewa Province of the Rio Grande Style (Lilienthal and Hoard 1995). It is not believed the Pajarito Plateau around White Rock was permanently inhabited before 1150 AD, and the petroglyphs may not be as old as the Crab supernova. Nonetheless, Olowin examined a full range of astronomical events for the period 500–1500 AD and dismissed conjunctions of the Moon with bright planets, even just with Venus, as too frequent to be engraved in stone. In the end, he favoured the Crab supernova explanation of the panel and assigned the "comet" to a different event at a different time.

Interpretation of White Rock as the supernova again makes a pair of concentric rings perform as the exploding star. The panel is on a vertical face of rock well below the rim of the canyon but above the talus. From this position in the canyon, a clear view of the east horizon is not at hand. Unexplained adjacent petroglyphs, an inadequate vista, ambiguous iconography and likely too-recent production all imply the White Rock petroglyph panel owes no more to the Crab supernova than to other astronomical interpretations.

FIGURE 14. The Water Canyon "supernova" panel and the rest of the petroglyphs at White Rock, New Mexico, are persuasively thought to be no older than the twelfth century, and so the concentric rings and crescent are relieved of their Crab supernova responsibilities (photograph by E. C. Krupp).

Cerros La Proveedora and Calera, Caborca, Sonora Mexico

Nearly 6000 petroglyphs on Cerro La Proveedora and Cerro Calera, in northern Sonora, near the town of Caborca, have been documented, and a complete survey of them

(Ballereau 1987) catalogued dozens of crescents, rayed discs and other symbols that could represent celestial objects. The Caborca rock art has been assigned through its archaeological setting to the prehistoric Trincheras culture, which occupied the area between 800 and 1100 AD. Trincheras pottery and rock art have affinities with prehistoric southern Arizona's Hohokam pottery and rock art in the period 900–1100 AD.

Dominique Ballereau, an astronomer, subsequently analysed the ostensibly celestial emblems of Caborca in more detail (Ballereau 1991). He illustrated three "star/crescent" combinations but declined to recognise four more, despite their inclusion in his pictorial catalogue. The "crescent" in one of Ballereau's identified pairs may actually be a stylised, bowlegged anthropomorphic figure. The horns of four of the other six crescents point up. One crescent opens to the right. The sixth crescent's horns point down. Unaccompanied crescents elsewhere on the two hills open up or down. The "star" is above and to the right of three of the crescents and below and to the left of two. In one pair, the "star" (a large filled disc) is directly to the left. The "stars" vary in appearance. Two are filled discs. Two are dots. One is a rayed circle with a smaller central circle, and the last is a circle with a central dot. The panels are on the eastern flanks of the hills and have reasonable access to the eastern horizon, whether or not the boulders on which they are carved face east.

Ballereau (1991, 541) mentioned the Crab supernova interpretation of "star/crescent" rock art but did not advocate that explanation. Although the 1054 AD supernova occurred during the period of Trincheras rock art, incorrect and inconsistent configurations of the Moon and of its position with respect to the "star" in multiple depictions weaken any affiliation of Caborca rock art with the 1054 AD event.

Star-crossed Supernova Rock Art: Conclusion

Most of those who have explored rock art's potential for eyewitness depictions of the Crab supernova of 1054 AD have correctly observed that the case for supernova rock art remains unproven, but they still often infer the supernova interpretation is reasonable and, in some cases, perhaps the most likely explanation of the star/crescent combinations. In fact, the criteria for evaluating these images are not tightly defined, and most sites do not comply with the fundamental principles Miller outlined in 1955. Minimal similarity in form has turned one crescent after another into a Crab supernova Moon in a marathon of wishful thinking.

Rock art specialist Ken Hedges outlined the problem in 1983 at the Northridge Conference on Archaeoastronomy: "In general, the crescent-and-star motifs are a mixed lot, sometimes selected out of a busy panel which includes additional circles and other motifs […]. There is no way to quantify and statistically test for validity in this type of interpretation of subjective and circumstantial evidence" (Hedges 1985, 26).

All of the sites discussed here are ambiguous, and the supernova interpretation of several of them is fatally flawed. The best-known sites, including the two Arizona panels that inaugurated this theme in rock art and ancient astronomy, are problematically burdened with evidence that actually contradicts the supernova notion. These rock art supernova studies, however, have been driven by a romantic desire to understand the

FIGURE 15. At least six plausible star/crescent petroglyphs populate the rich petroglyph slopes of Cerro La Proveedora and Cerro Calera, near Caborca, about a hundred miles south of the US border, in northern Sonora, Mexico. Although the "star" (circle with central dot) in this example is correctly placed to the right of the crescent Moon, the crescent is upside-down. Alternatively, viewed from above, the crescent's orientation would be more accurate, but the star would be on the wrong side of the Moon (photograph by E. C. Krupp).

elusive and the ambiguous past with help from the sky. The catalogue of supernova rock art has fed itself new prospects and, taken cumulatively and uncritically, these places seem to endorse a shared celestial meaning (Krupp 2006). Examined one at a time, without interpretive latitude, each one's grip on the Crab supernova explodes.

References

Ambruster, C. W. and T. Hull, 2005. "Evidence for Early Navajo Horizon Astronomy in Chaco Canyon". In *Current Studies in Archaeoastronomy: Conversations across Time and Space. Selected Papers from the Fifth Oxford International Conference at Santa Fe, 1996*, edited by J. W. Fountain and R. M. Sinclair, 205–220. Durham, NC: Carolina Academic Press.

Armitage, R. A., M. Hyman, M. W. Rowe, J. R. Southon and C. Barat, 2005. "Fern Cave Rock Paintings at Lava Beds National Monument, California: Not the AD 1054 Supernova". In *Current Studies in Archaeoastronomy: Conversations Across Time and Space. Selected Papers from the Fifth Oxford International Conference at Santa Fe, 1996*, edited by J. W. Fountain and Rolf M. Sinclair, 121–131. Durham, NC: Carolina Academic Press.

Aveni, A. F., 1993. *Ancient Astronomers*. Montreal: St. Remy Press / Washington, DC: Smithsonian Books.

Aveni, A. F. (ed.), 2008. *Foundations of New World Cultural Astronomy*. Boulder: University Press of Colorado.

Baker, P., 2009. "Painted Sites of the Ancestral Puebloans in Chaco Canyon National Historical Park, New Mexico". In *American Indian Rock Art*, vol. 35, edited by J. D. Keyser, D. Kaiser, G. Poetschat and M. W. Taylor, 13–25. Tucson, AZ: American Rock Art Research Association.

Ballereau, D., 1987. "A Complete Survey of Petroglyphs from Cerros La Proveedora and Calera, Sonora". In *Rock Art Papers*, vol. 5, edited by K. Hedges, 95–112. San Diego Museum Papers 23. San Diego, CA: San Diego Museum of Man.

Ballereau, D., 1991. "Lunas Crecientes, Soles y Estrellas en los Grabados Rupestres de los Cerros La Proveedora y Calera (Sonora, Mexico)". In *Arqueoastronomía y Etnoastronomía en Mesoamérica*, edited by J. Broda, S. Iwaniszewski and L. Maupomé, 537–544. Mexico City: Universidad Nacional Autónoma de México.

Boas, F., 1951. *Primitive Art*. Irvington-on-Hudson, NY: Capitol Publishing Co.

Brandt, J. C. and S. P. Maran, 1972. *New Horizons in Astronomy*. San Francisco: W. H. Freeman and Company.

Brandt, J. C., S. P. Maran, R. A. Williamson, R. S. Harrington, C. Cochran, M. Kennedy, W. J. Kennedy and V. D. Chamberlain, 1975. "Possible Rock Art Records of the Crab Nebula Supernova in the Western United States". In *Archaeoastronomy in Pre-Columbian America*, edited by A. F. Aveni, 45–58. Austin: University of Texas Press.

Brandt, J. C. and J. Scott, 1989. "Indian Rock Art Discovery Adds to Supernova Mystery". *News, University of Colorado at Boulder*, press release.

Brandt, J. C. and R. A. Williamson, 1977. "Rock Art Representations of the AD 1054 Supernova: A Progress Report". In *Native American Astronomy*, edited by A. F. Aveni, 171–177. Austin: University of Texas Press.

Brandt, J. C. and R. A. Williamson, 1979. "The 1054 Supernova and Native American Rock Art". *Archaeoastronomy* (Supplement to the *Journal for the History of Astronomy*) 1: S1–S38.

Brecher, K., R. A. Fesen, S. P. Maran and J. C. Brandt, 1983. "Ancient Records and the Crab Nebula Supernova". *The Observatory* 103: 106–113.

Clark, D. H. and F. R. Stephenson, 1977. *The Historical Supernovae*. Oxford: Pergamon Press.

Collins, G. W., W. P. Claspy and J. C. Martin, 1999. "A Reinterpretation of Historical References to the Supernova of AD 1054". *Publications of the Astronomical Society of the Pacific* 111: 871–880. http://dx.doi.org/10.1086/316401

Crosby, H. W., 1975. *The Cave Paintings of Baja California*. San Diego, CA: Copley Books.

Cushing, F. H. 1979 [1882-1883] "My Advenures in Zuñi". In *Zuñi: Selected Writings of Frank Hamilton Cushing*, 46–134. J. Green, ed. Lincoln: University of Nebraska Press.

Duyvendak, J., 1942. "Further Data Bearing on the Identification of the Crab Nebula with the Supernova of 1054 AD. Part I: The Ancient Oriental Chronicles". *Publications of the Astronomical Society of the Pacific* 54: 91–94. http://dx.doi.org/10.1086/125409

Eddy, J. A., 1978. "Archaeoastronomy in North America: Cliffs, Mounds, and Medicine Wheels". In *In Search of Ancient Astronomies*, edited by E. C. Krupp, 133–163. Garden City, NY: Doubleday.

Ellis, F. H., 1975. "A Thousand Years of the Pueblo Sun-Moon-Star Calendar". In *Archaeoastronomy in Pre-Columbian America*, edited by A. Aveni, 59–87. Austin: University of Texas Press.

Fisher, V. B., 2010. "Classic Object Lessons in Southwestern Archaeoastronomy". *Archaeoastronomy* 33: 27–34.
Fountain, J., 2000. "New Perspectives on the Crab Supernova in Rock Art". In *Rock Art Papers,* vol. 15, edited by K. Hedges, 91–97. San Diego, CA: San Diego Museum of Man.
Hedges, K., 1985. "Methodology and Validity in California Archaeoastronomy". In *Earth and Sky: Papers from the Northridge Conference on Archaeoastronomy*, edited by A. Benson and T. Hoskinson, 25–39. Thousand Oaks, CA: Slo'w Press.
Heizer, R. F. and M. A. Baumhoff, 1962. *Prehistoric Rock Art of Nevada and Eastern California*. Berkeley: University of California Press.
Heizer, R. F. and C. W. Clewlow Jr., 1973. *Prehistoric Rock Art of California*. Ramona, CA: Ballena Press.
Kirkland, F. J. and W. W. Newcomb Jr., 1967. *The Rock Art of the Texas Indians*. Austin: University of Texas Press.
Koenig, S. H., 1979. "Stars, Crescents, and Supernovae in Southwestern Indian Art". *Archaeoastronomy* (Supplement to the *Journal for the History of Astronomy*) 1: S39–S50.
Kolber, J. and D. Yoder, 2002. "The Great Anasazi Rock Art of Chaco Canyon: Possible and Probable Implications". In *American Indian Rock Art*, vol. 28, edited by A. Woody, 169–179. Tucson, AZ: American Rock Art Research Association.
Krupp, E. C. (ed.), 1978. *In Search of Ancient Astronomies*. Garden City, NY: Doubleday.
Krupp, E. C., 1995. "Engraved in Stone". *Sky & Telescope* 89 (4): 60–61.
Krupp, E. C., 2006. "Archaeoastronomy Unplugged: Eliminating the Fuzz Tone from Rock Art Astronomy". In *American Indian Rock Art*, vol. 21, edited by P. Whitehead, 353–369. International Rock Art Congress 1994, vol. 3. Phoenix, AZ: ARARA Publications.
Krupp, E. C., 2009. "Rock Star". In *American Indian Rock Art*, vol. 35, edited by J. D. Keyser, D. Kaiser, G. Poetschat and M. W. Taylor, 79–89. Tucson, AZ: American Rock Art Research Association.
Krupp, E. C., E. Billo and R. Mark, 2010. "Star Trek: Recovery and Review of the First Alleged Supernova Rock Art". *Archaeoastronomy: The Journal of Astronomy in Culture* 23: 35–43.
Lilienthal, B. and D. Hoard., 1995. *The Petroglyphs of Los Alamos: Sentinels on Stone*. Los Alamos, NM: Los Alamos Historical Society.
Malville, J. M., 2008. *Guide to Prehistoric Astronomy in the Southwest*. Boulder, CO: Johnson Books.
Mayer, D., 1977. "An Examination of Miller's Hypothesis". In *Native American Astronomy*, edited by A. F. Aveni, 180–201. Austin: University of Texas Press.
Mayer, D., 1979. "Miller's Hypothesis: Some California and Nevada Evidence". *Archaeoastronomy* (Supplement to the *Journal for the History of Astronomy*) 1: S51–S74.
Miller, W. C., 1955a. "Two Possible Astronomical Pictographs Found in Northern Arizona". *Plateau* 27 (4): 6–13.
Miller, W. C., 1955b. "Two Prehistoric Drawings of Possible Astronomical Significance". *Astronomical Society of the Pacific Leaflet* 314: 1–8.
Mountjoy, J. B., 1982. "An Interpretation of the Pictographs at La Pena Pintada, Jalisco, Mexico". *American Antiquity* 47 (1): 110–126. http://dx.doi.org/10.2307/280057
Needham, J., 1959. *Science and Civilisation in China*, vol. 3: *Mathematics and the Sciences of the Heavens and the Earth*. Cambridge: Cambridge University Press.
Olowin, R. P., 2005. "A Petroglyph Panel of Astronomical Significance". In *Current Studies in Archaeoastronomy: Conversations Across Time and Space. Selected Papers from the Fifth Oxford International Conference at Santa Fe, 1996*, edited by J. W. Fountain and R. M. Sinclair, 181–189. Durham, NC: Carolina Academic Press.
Pasachoff, J. M., 1977. *Contemporary Astronomy*. Philadelphia: W. B. Saunders.
Patterson, A., 1992. *A Field Guide to Rock Art Symbols of the Greater Southwest*. Boulder, CO: Johnson Books.
Reyman, J., 1988. "Site 29SJ427, Chaco Canyon, NM: Review and Re-evaluation". In *Reflections: Papers on Southwestern Culture History in Honor of Charles H. Lange*, edited by A. Poore, 213–226. Papers of the Archaeological Society of New Mexico 14. Santa Fe, NM: Ancient City Press.
Ruggles, C., 2005. *Ancient Astronomy: An Encyclopedia of Cosmologies and Myth*. Santa Barbara, CA: ABC-CLIO.
Sagan, C., 1980. *Cosmos*. New York: Random House.

Schaafsma, P., 1971. *The Rock Art of Utah*. Cambridge, MA: Peabody Museum of Archaeology and Ethnology.

Schaafsma, P., 1992. *Rock Art in New Mexico*. Santa Fe: Museum of New Mexico Press.

Schaafsma, P., 1993. "Imagery and Magic: Petroglyphs at Comanche Gap, Galisteo Basin, New Mexico". In *Archaeology, Art, & Anthropology: Papers in Honor of J. J. Brody*, edited by M. Duran and D. Kirkpatrick, 157–174. Albuquerque: Archaeological Society of New Mexico.

Schaafsma, P., 2000. *Warrior, Shield, and Star: Imagery and Ideology of Pueblo Warfare*. Santa Fe, NM: Western Edge Press.

Schaafsma, P., 2005. "Feathered Stars and Scalps in Pueblo IV". In *Current Studies in Archaeoastronomy: Conversations Across Time and Space. Selected Papers from the Fifth Oxford International Conference at Santa Fe, 1996*, edited by J. W. Fountain and R. M. Sinclair, 191–204. Durham, NC: Carolina Academic Press.

Schaefer, B. E., 2006. "Case Studies of Three of the Most Famous Claimed Archaeoastronomical Alignments in North America". In *Viewing the Sky through Past and Present Cultures*, edited by T. W. Bostwick and B. Bates, 27–56. Phoenix, AZ: City of Phoenix.

Stevenson, M. C., 1904. *The Zuni Indians: Their Mythology, Esoteric Societies, and Ceremonies 1901–1902*. Twenty-Third Annual Report of the Bureau of American Ethnology. Washington, DC: Government Printing Office.

Trimble, V., 1968. "Motions and Structure of the Filamentary Envelope of the Crab Nebula". *Publications of the Astronomical Society of the Pacific* 73 (7): 535–547. http://dx.doi.org/10.1086/110658

Wellmann, K. F., 1979. "Further Remark on an Astronomical Petroglyph in Capitol Reef National Park Utah". *Archaeoastronomy* (Supplement to the *Journal for the History of Astronomy*) 1: S75–S77.

Williamson, R. A., 1984. *Living the Sky*. Boston, MA: Houghton Mifflin Company.

Yoder, D. and J. Kolber, 2002. "The Anasazi Rock Art of Chaco Canyon: A Preliminary Report of the Findings". In *American Indian Rock Art*, vol. 28, edited by A. Woody, 161–168. Tucson, AZ: American Rock Art Research Association.