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# **Iconography, Science and Lightning Figures**

(2012/2022) revised version

Educational Purpose

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**Research Paper**

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# Iconography, Science and Lightning Figures

(2012/2022) revised version (see appendices page 10)

Albrecht Ploum

**Abstract.** *Some Australian Aboriginal figurative paintings in the Kimberley and the Northern Territory, known as 'lightning figures', show remarkable resemblance in morphology with strange atmospheric phenomena such as Red Sprites (upper-atmospheric optical phenomena associated with thunderstorms) that sometimes can be perceived with the naked eye in those parts of the continent. I argue that some ancient markings can be related in a consistent way to real perceived atmospheric phenomena.*

## Introduction: iconography in science

This paper is based on fundamental psychological, meteorological and anthropological research of specific global atmospheric phenomena such as Red Sprites that might have influenced indigenous rock art. There are remarkable resemblances between atmospheric phenomena and the morphology of some obsolete Australian Aboriginal figurative rock paintings in the Kimberley and the Northern Territory, known as 'Lightning Figures'. Red Sprites appear always together with thunderstorms but they totally differ from the common cloud to earth lightning. Although the hypothesis contains interpretational aspects, it should be clear that as long as interpretations are subject for falsification (open for conflicting arguments)<sup>1</sup> they still are part of a scientific approach<sup>2</sup>. In this paper an effort is made to test the null hypothesis (looking for conflicting arguments) that there is no relationship between Red Sprites and specific Australian rock art, known as 'Lightning Figures'. The statements to be tested are:

- The ability for rock-painters to observe the Red Sprite phenomena did not exist because such phenomena are too short-lived to be within the ability of the human eye.

- There is no climatological or geophysical opportunity for potential observation of the phenomena in question.
- There is no morphological resemblance between the lightning figures and the Red Sprite phenomena.
- There is no mythological relation with Red Sprites

Since there has been found empirical evidence (Dowden 1997), that under the right natural conditions Red Sprites indeed can be observed by the naked eye it became possible to test the other propositions through falsification.

## Australian Lightning Figures and other figures

There are many paintings in the Kimberley that Aborigines interpret as Lightning Figures or Lightnings (Figures 1a and 1b). According to Crawford (1977) they are associated with dry lightning and are usually smaller than Wanjin figures and are depicted in monochrome red, although in some cases they have small quantities of white or black pigment adhering to them. The paintings usually lack 'eyes', the 'head' is represented by a heavy encircling line, and the 'face' may be bisected. The 'headdress' is usually large and consists of radiating lines. The 'bodies' are coloured red, and little or no body decoration is now visible.

What kinds of realistic observation can be made in relation to the above lightning figures? Only in the last two decades (1990-2010) it has become possible to develop an idea of the possible natural phenomena by which the Lightning Figures could have been inspired. The phenomenon in question is called 'Red Sprite'.

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<sup>1</sup> According to Karl Popper, (e.g. 1959, 1963) and popularised in archaeology by Louis Binford (e.g. 1967) a theory is scientific if the population of potential falsifiers is not empty, in other words if basic statements can be formulated that make the theory testable.

<sup>2</sup> For example the theory that Australia was a part of Antarctica, once started with the remarkable speculation of form resemblance (that is similarity) of the coastlines of South America and western Africa. As long as no conflicting geological and paleontological data were found the development of a scientific explanation could take place.

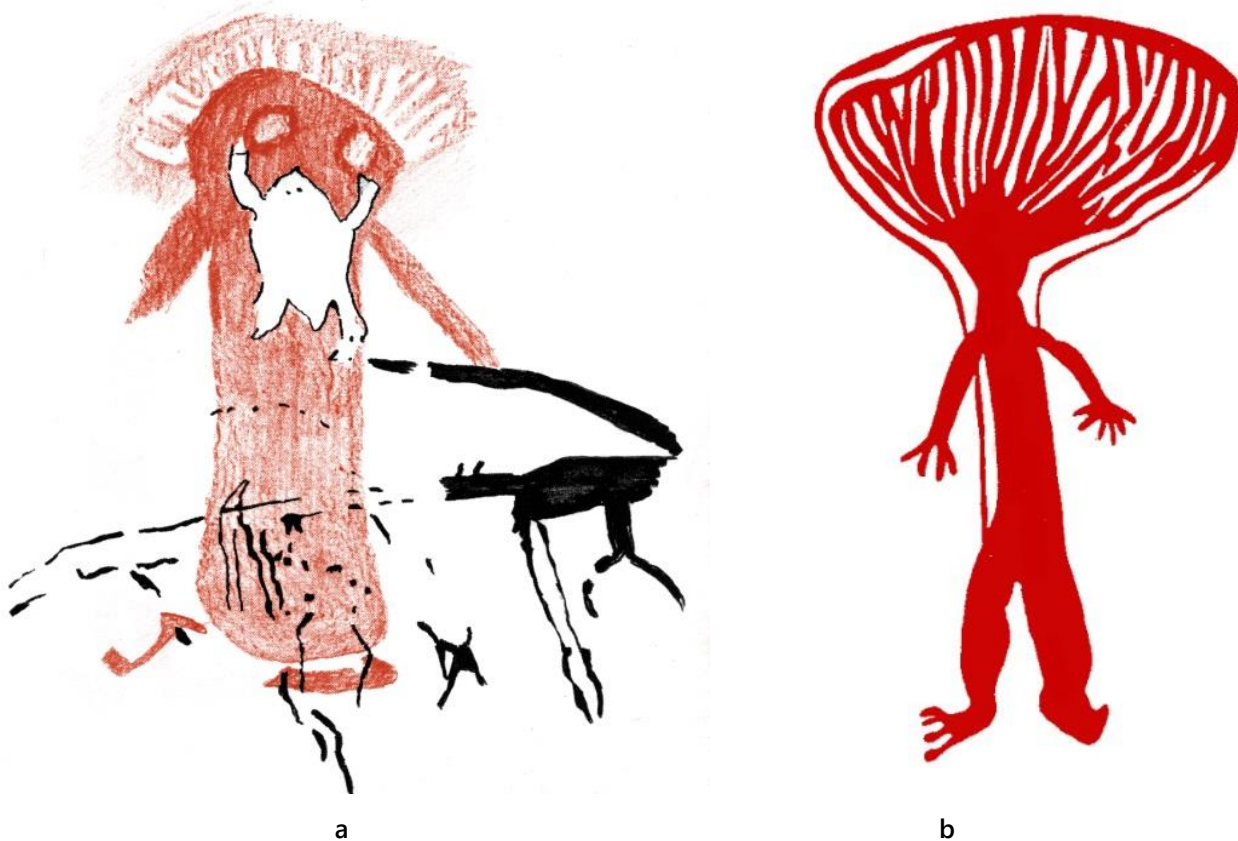


Figure 1: (a). Lightning Figure near Kununurra; figure is eroded red; black lines are more recent paintings in white ochre. The bottom group probably depicts a string of 'yams' (Crawford 1977:368); (b) Lightning Figure in red, Admiralty Gulf (Crawford 1977:369). Images reproduced with permission of AIATSIS

### Atmospheric phenomena: Red Sprites, Elves, Blue Jets and Gigantic Jets

Red Sprites (see figure 2 and 3) together with Elves, Blue Jets and Gigantic Jets belong to the category of upper atmospheric transient luminous events (TLE). Red Sprites have been documented recently using low-light-level television technology. The first images of a Sprite were accidentally obtained in 1989 (Franz et al. 1990). By 1990, about twenty images had been obtained from the space shuttle (Vaughan et al. 1992; Boeck et al. 1995). Since then, video sequences of many thousands of Sprites have been captured. These include measurements from the ground (Lyons 1994; Winckler 1995), and from aircraft (Sentman and Wescott 1993; Sentman et al. 1995). Sprites only happen above large, active thunderstorm systems, mostly in small groups. To see them requires visual access to the region above the storm, unobstructed by intervening clouds, and viewing against a dark stellar background. In most locations these conditions happen only rarely.

Elves<sup>3</sup>: Sometimes Sprites appear together with 'Elves'. Elves often appear as a dim, flattened, expanding glow around 200 to 400 km in diameter that lasts, typically, for just one millisecond. (not visible to the naked eye)

Blue Jets: Numerous images have also been obtained from aircraft of so-called 'Blue Jets' (Wescott et al. 1995), also a previously unrecorded form of optical activity above thunderstorms. Blue Jets appear to emerge directly from the tops of clouds and shoot *upward* in narrow cones through the stratosphere (circa 300 milliseconds, [ms]) and theoretically might be visible to the naked eye. Their upward speed has been measured to be about 100 kilometres per second.

Gigantic Jets: are Blue Jet related, but less frequent, more extended and longer lasting (>500 ms).(visible to the naked eye)

<sup>3</sup> 'Elves' is an acronym for Emissions of Light and Very Low Frequency Perturbations from Electromagnetic Pulse Sources; this term refers to the process by which the light is generated (the excitation of nitrogen molecules by electrons).



Figure 2: Burning-tree Sprite, 7 June 2001 (Goddard Space Flight Center 2005, source ISUAL Project, NCKU/NSPO, Taiwan. Image is pseudo-colour rendered)

It was a colour image of a Red Sprite that appeared as a 'burning tree', captured with a low-light-level camera in Taiwan (Figure 2), with features reminiscent of the two Lightning Figures reported from Admiralty Gulf and Near Kununnurra (Figure 1), which caught my attention.

Red Sprites characteristically take shapes of jellyfish, columns, fingers, paws, arrows, trees, insects and carrots. After gathering, over several years, many impressive (video) images of Red Sprites and Blue Jets, it became interesting to know whether not only the forms of Lightning Figures but also many stick-figures iconographically can be related to the Red Sprite phenomenon.

### Pictorial views of Transient Luminous Events

Red Sprites are only barely detectable by the unaided human eye because of their short duration (10 to 200 ms) and low brightness, but in intensified television images obtained from the ground and from aircraft they appear as dazzlingly complex structures. Since there is discrepancy between images obtained from low light cameras and naked eye observations, it seems useful to show a scientific reconstruction of transient luminous events (TLE) related to lightning (Figure 3).

### Climatological or geophysical opportunity for potential observation of the Red Sprite phenomena

Could Red Sprites be seen in the Kimberley and in Arnhem land?

Climatologically, the Northern Territory is known for multiple Red Sprite observations. As early as 1997, Walter Lions and Russel A. Armstrong produced a world map of recorded Red Sprites distribution on which the Northern Territory was indicated as multiple Sprite observation area. (See UW Sprite Balloon Experiment 2002.).

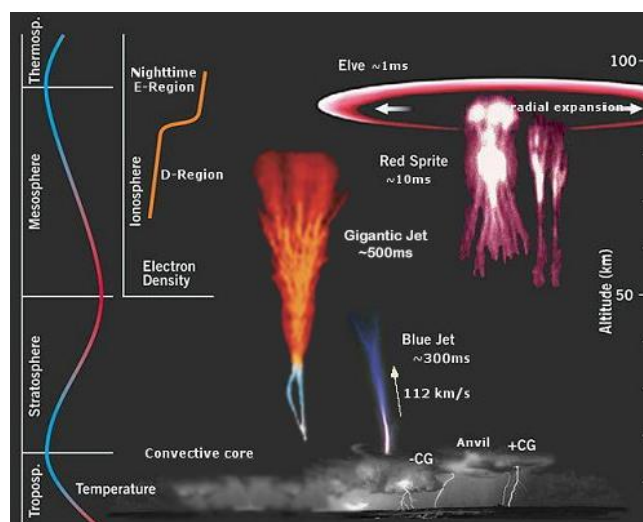


Figure 3: Pictorial view of Elves, Sprites and Blue Jets. (from Neubert 2003; image reprinted with permission of Neubert)

There are no reasons to assume that there were long-lasting climate changes in the latitude of the Kimberley and Arnhem Land regions during the late Holocene. They are regions of monsoons, of dry and wet periods, where, especially between seasons and during the wet, lightning and thunderstorms can be dramatic. The landscape contains high vantage points from which – and over great distances – the atmosphere above thunderstorms can be observed.

### The ability of rock-painters to observe the Red Sprite phenomena

It had been doubted that Red Sprites could be seen with the naked eye, but in 1997 unaided observation was reported by members of a team from the University of Otago researching near Darwin. The team leader, Professor Richard Dowden (1997), wrote that Red Sprites:

must have occurred above [the Northern Territory] every Wet season for millions of years. They rarely last more than a tenth of a second and are generally faint but some – certainly one and maybe up to nine of the 72 caught on video on Wednesday night – can be seen by the naked eye ... Such red sprites must surely have been seen by the Aboriginal peoples in the past, particularly before modern man polluted the night sky with artificial lighting. Is there an oral tradition of such sightings?

It was interesting to know if such a ghost-like fiery phenomenon with bizarre forms high in the sky, even on the threshold of visibility, was represented in Aboriginal cultures. However, the Otago researchers' attention was focused upon oral traditions and not on iconography.



There was still the question how a naked eye observation of the Burning-tree Sprite might look, and how to verify the true colours of the Lightning Figures of Admiralty Gulf and Kununurra. However, at that time it was more important to me to find out more about the naked eye observations of sprites.

We knew from traditional psychology that the time needed to build up a complete image for recognition of patterns is approximately 200 ms. Recent neurological experiments of responses of single neurons in the human temporal lobe showed that the threshold of conscious recognition lies around 33 ms (Quiaroga et al. 2008). This means that at this duration the subjects consciously perceived the images in only about half of the trials (threshold). Responses under 33ms are possible but are beyond the criteria for the absolute threshold. Positive responses under 33ms not only are conditioned by intensity and duration of the stimulus but also influenced by variables such as the subject's experience, background, motivation, expectation, cognitive processes and level of adaptation to the stimulus. The colour of red sprites can be neon-light red, blue, green and white. The majority of light emitted by Sprites ranges beyond 650 nanometres wavelength, for which the eye is not as sensitive. Visibility studies (Taylor 1980) showed that some Australian Aborigines possess significant heightened visual acuity, probably enhanced by needs of hunting and their great patience and the long period of their observations. What might be visible of red sprites by the naked eye can be derived from scientific measurements. According to Stenbaek-Nielsen and McHargh (2008:23):

The active phase of red sprites is very short, a few milliseconds, while the decay phase is much longer typically lasting 10 to 100 ms. Observations, made at 1000 fps [frames per second], show that small structures, which we called beads (dotted lines), would remain visible in some events for almost a full second.

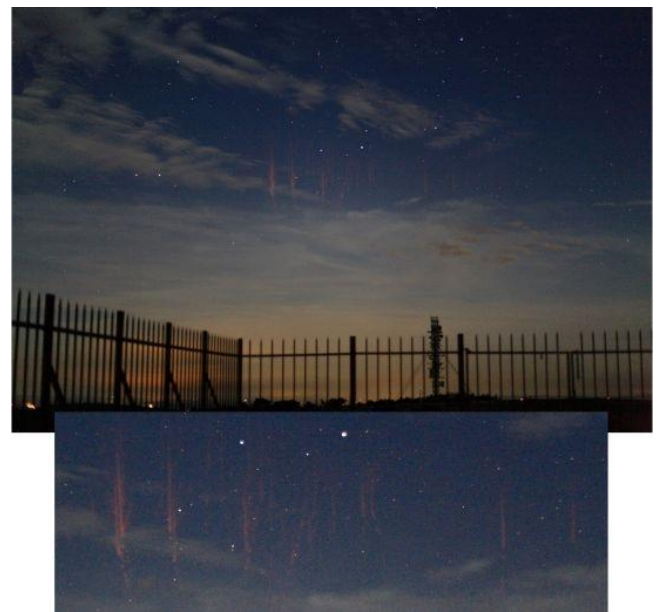
Oscar van der Velde, Red Sprite researcher at the Technical University of Catalonia (Spain) (personal communication 23 December 2010) confirms that the 'hairy' parts above and below the more intense middle part last only a few milliseconds (say 3 to 6 ms). The middle part lasts much longer, approximately 30 to 100 ms depending on the duration of extinction. The middle part of a Sprite as a whole, can last sometimes 200 ms or more in the case of a dancing Sprites where elements or several groups propagate horizontally. In tropical

latitudes, large Jets may last 100 to 500 ms, sufficient for perception by the naked eye.<sup>4</sup>

From this it can be concluded that the naked eyed typically cannot perceive the complete Red Sprite emission. Only parts or groups lasting more than approximately 30 ms can be recognised by the naked eye under good visibility conditions. The middle parts of the schematic image (figure 3) might be best observed by the unaided eye. Because of significant differences of acuity among different observer groups, at optimum conditions, even beyond conscious recognition threshold (<30 ms), a few more red sprite structures might be detected. At a subconscious level, durations of 3 to 10 ms might be registered; however the precise effect on image development is still debatable.

The above duration analyses might be illustrated by some (impressions) of sprite observations (video) ([http://sonotaco.com/sample/sprite/e\\_index.html](http://sonotaco.com/sample/sprite/e_index.html))

In September 2006, Van der Velde made a photograph of Red Sprites that also could be observed by the naked eye by a normal observer (Figure 4).



**Figure 4:** Colour photograph and simultaneous naked-eye observation of Red Sprites, 11 September 2006 (Camera settings: Canon EOS 5D, 50mm lens, f/1.8, 4 seconds, ISO 1600; photograph reproduced with permission of Oscar van der Velde)

Reasons why naked eye observations of Red Sprite are rarely reported has been discussed by members of a research group of the University of Alaska. (Heavner 2004). The observation rules from the research group are:

<sup>4</sup> Examples are at the EuroSprite blog at <eurosprite.blogspot.com> and at the 'Sprites Elves Blue Jets Lightnings' page of the Sonotaco.com website at <sonotaco.com/sample/sprite/e\_index.html>.





**a**  
**Figure 5:** (a) Sprites over thunderstorms in Kansas on 10 August 2000, observed in the mesosphere, with an altitude of 50 to 90 kilometres as a response to powerful lightning discharges from tropospheric thunderstorms. The true colour of sprites is 'pink-red'. The middle part, durations from 10 to 200 ms, credit: [www.WeatherVideoHD.TV](http://www.WeatherVideoHD.TV). (b) Red Sprites over Europe (Slovenia June 4-2017). Photo Martin Opek. (c) Red figure from Mitchell River Falls. The face is blank suggesting that it was painted originally in another colour; radiating from the 'head' are lines that terminate in red blobs, a feature reminiscent of the King Edward River 'bird' site Wanjina (Crawford 1977:367, reproduced with permission of AIATSIS)



**b**



**c**

- A clear view above a thunderstorm is required. This generally means the thunderstorm activity must be on the horizon. Additionally, there must be very little intervening cloud cover.
- Best viewing distance from the storm is 100-200 miles (200-300 km). At these distances sprites will subtend a vertical angular distance of 10-20 degrees. This is 2-4 times the separation of the pointer stars in the Big Dipper.
- For observing sprites, it must be completely dark. (i.e. no longer twilight)
- The eyes must be completely dark adapted. Use same criteria for this as for astronomical observing. If you can see the Milky Way, then it is probably dark enough and the eyes have adapted enough to see sprites.
- Fix your gaze on the space above an active thunderstorm. Do not be distracted by underlying lightning activity in the storm. Block out the lightning if necessary using a piece of dark paper in such a way as to still being able to view what is going on above the cloud.
- Sprites will be very brief flashes just on the edge of perceptibility. They occur too quickly to follow with the eyes, but their strange vertically

striated structure and dull red colour may be perceived.

- Patience will be rewarded. If the right kind of storm is present and one's viewing geometry is favourable, then there is a greater likelihood of seeing a sprite than of seeing a shooting star or comet.

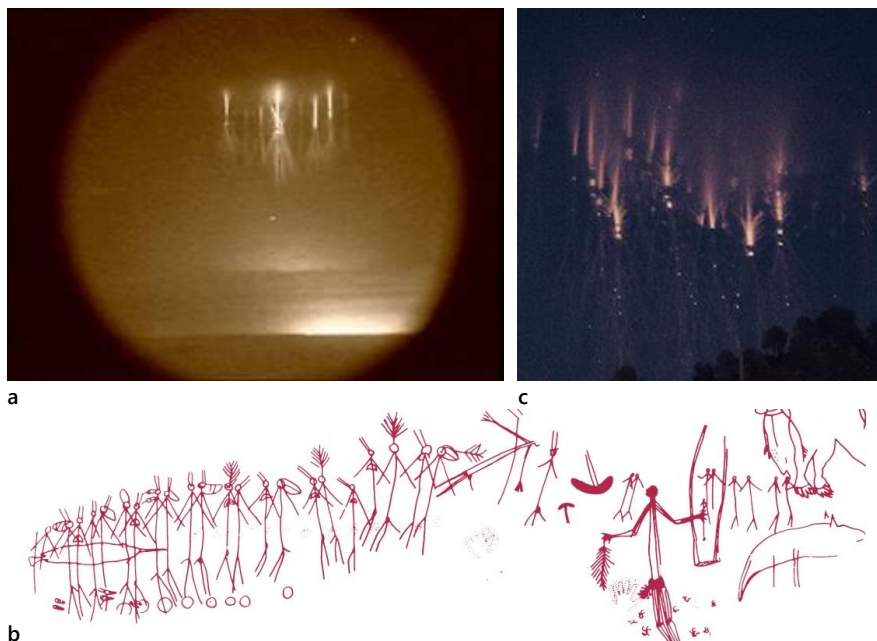
### Morphological resemblance between Lightning Figures and sprite phenomena

The Red Sprite structures below are compared with depictions of figures found in north-western Australian regions which are known for frequent Red Sprite lightning. The first examples (Figure 5a and 5b) are typical universal sprite structures (here observed in Kansas and Slovenia), compared with one of the known red blob figures (Figure 5c) at Mitchell River Falls and the King Edward River 'bird' site (Crawford 1977: 365, 367).

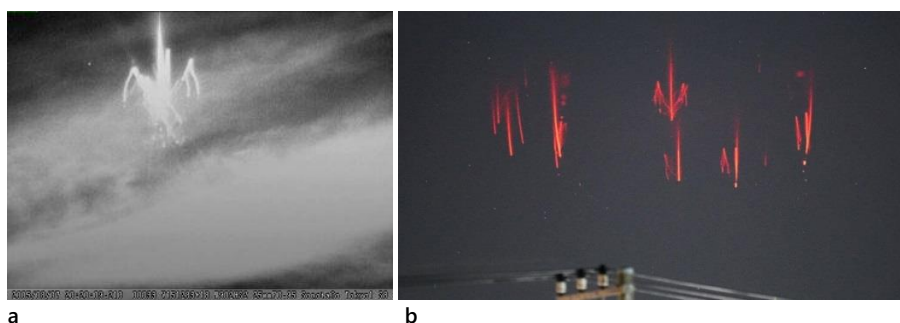
Figure 6a is an often observed image of Red Sprites propagating horizontally over large thunderstorm systems. In one of his early papers (1996) Walter Lyons termed them 'dancing sprites', which might also be the impression of the actions of the typical stick figure scenes of the Cadell River (Figure 6b) recorded by Brandl (1977).

The suggested fishbone hair dress of the figures are even much better present in the hairy parts ending with a dot of another typical red sprite display (Figure 6c). The above examples of Red Sprites should be totally or partly visible within a flash by the naked eye, because they fall within the conscious recognition threshold duration between 10 to 200ms.

The next black-and-white photograph is a Sprite captured by SonotaCo in 2005 (Figure 7a). (see real time video [http://sonotaco.com/sample/sprite/e\\_index.html](http://sonotaco.com/sample/sprite/e_index.html)), supplemented with a colour photo of Red Sprites over Hiratsuka (Japan) 2021, McPott (Figure 7b). They are compared to painted images of figures, recorded by John Clegg at Upper Colo (Figure 8) and with the typical



**Figure 6:** (a) Sprites intensified by high-speed camera capable of recording more than 5000 frames per second at the Yucca Ridge Field Station in Fort Collins from July through August 2005 (credit: [www.WeatherVideoHD.TV](http://www.WeatherVideoHD.TV)); (b) Cadell River anthropomorphs and other designs (average height of figures at left 500 mm) (after Brandl 1977:228. Reproduction permitted by AIATSIS); (c) Colour photo of a Red Sprite, 8 October 2009, The sprite appeared instantaneously and had a duration of less than 40 ms (threshold naked eye recognition 30 ms). The camera had its internal filter removed and was sensitive to near-infrared light emitted by sprites. (Image reproduced with permission of Oscar van der Velde)



**Figure 7:** (a) Red Sprite. captured by SonotaCo 2005 (duration 10 to 100 ms) (reproduced with permission of SonotaCo) (b) (supplement): Red Sprites over Hiratsuka, Kanagawa Prefecture. Japan 12 November 2021, 3:55 a.m. (photo Smokey McPott)



**Figure 8** Upper Colo images (image size approximately two metres) (after J Clegg 1977:273 (the middle figure is accompanied by a later graffiti). Image reproduced with permission of AIATSIS

grasshopper structure of the lightning figures  
Namarrgon and his wife Barrginj depicted at the  
Nourlangie Rock site (Figure 9).

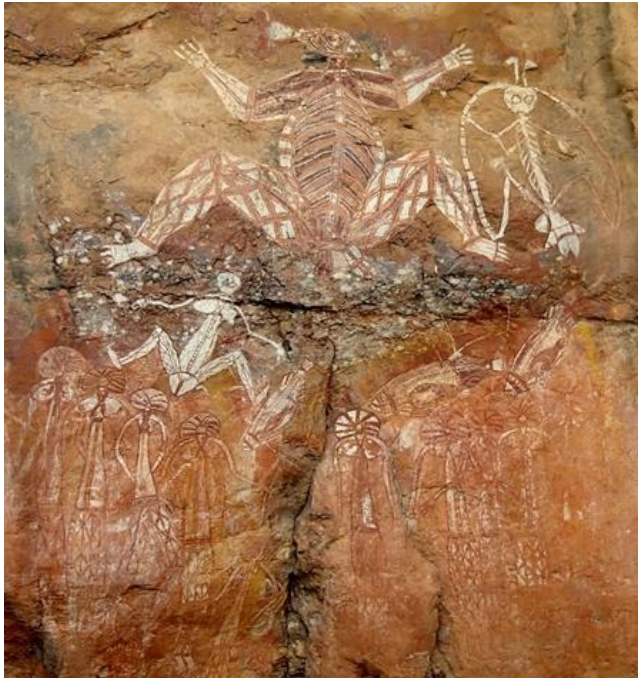


Figure 9. Creation Ancestors: middle: Namondjok; right: Lightning Man Namarrgon; bottom: his wife Barrginj (credit: Department of the Environment, Water, Heritage and the Arts, Canberra)

### Mythological relation with Sprites

Although these iconographical comparisons might at first glance appear speculative, there exist strong arguments that specific sprite structures (such as Figure 7a and Figure 7b), are central to the iconography of Aboriginal Lightning mythology. This statement can be elaborated by reference to the well-known text about the Nourlangie painting [Parks Australia n.d.]:

Namarrgon and his wife Barrginj

The Lightning Man rock art site (lower part of the Nourlangie Rock) shows several paintings of Creation Ancestors. An important one is Namondjok, of whom different clan groups tell different stories and who apparently now lives in the sky and can only be seen at night. Another important Creation ancestor is the Lightning Man Namarrgon who is still active today. He is responsible for the violent lightning storms that occur every wet season. He uses the axes on his head, elbows and feet to split the dark clouds and make lightning and thunder. The children of Namarrgon and his wife Barrginj are the Alyurr. They are associated with rare grasshoppers, with striking blue and orange colours, which are seen

just before the wet season when they come out and call to their father to bring the wet-season storms.

In this case the environmental factor is not at issue. The Lightning Man site is situated in a region that is known for its dazzling lightning of the Gudjew monsoon season (between January and March) where steep escarpments form ideal conditions for observation of transient luminous events such as Red Sprites, Elves, Blue Jets and Gigantic Jets.

The forms of the lightning man Namarrgon and his family show typical Red Sprite structure, as well, the description of activity above the thunderstorms is suggestive. Even the sprite structure seems to be related to the grasshopper anatomy and its colours.

Is this not what we are looking for? Aboriginal artists, with remarkable good vision and ability of natural observation observed on the edge of visibility the ghostlike phenomena above the thunderstorms that bring rain and fertility. Their mythology might be seen to be based on these observations

### Conclusion

This study has no pretension to be a new speculative interpretation of prehistoric art. It only shows that similarities in forms of some depictions might be considered as a form of *pareidolia* (the illusive perception of a pattern or meaning were it does not actually exist) and that such morphological similarities might be used to test a scientific hypothesis. One of the tasks of a scientist should be to find out under which conditions a phenomenon must be classified as *pareidolia*. Sometimes it might be extremely difficult and on rare occasions it might happen that subject and object (for aboriginals) are direct related. In this paper criteria for falsification are given.

Note:

I have not made references to earlier studies between prehistoric rock art and plasma physical phenomena. The first paper on this topic read was by the astrophysicist George L. Siscoe (Technology Review 1976) in which he related some prehistoric cave art to real observed meteorological phenomenon such as the aurora borealis.

Martinus Van Der Sluijs and Anthony Peratt (2010) related some characteristic rock art figures to the observation of a 'super aurora' that would have been observable by prehistoric peoples.

## REFERENCES

- BINFORD, Louis 1967 'Smudge Pits and Hide Smoking: The use of analogy in archaeological reasoning', *American Antiquity* 32:1-12.
- BOECK, William L., OH VAUGHAN, RJ BALKESLEE, B VONNEGUT, M BROOKS and J MCKUNE, 1995. Observations of lightning in the stratosphere. *Journal of Geophysical Research* 100:1465-75.
- BRANDL, Eric 1977. Human stick figures in rock art. In PJ Ucko (ed.), *Form in Indigenous Art: Schematization in the art of Aboriginal Australia and prehistoric Europe*. Australian Institute of Aboriginal Studies, Canberra pp. 220-242.
- CLEGG, John K 1977. A method of resolving problems which arise from style in art. In P.J. Ucko (ed.) *Form in Indigenous Art*. Australian Institute of Aboriginal Studies, Canberra. pp. 260-276.
- CRAWFORD, Ian M 1977. The relationship of Bradshaw and Wandjina art in north-west Kimberley. In P.J. Ucko (ed.) *Form in Indigenous Art: Schematization in the art of Aboriginal Australia and prehistoric Europe*. Australian Institute of Aboriginal Studies, Canberra pp. 368-369.
- DOWDEN, Richard L 1997. 'Huge jellyfish-shaped lights in the sky above Australia's Northern Territory'. Otago Space Physics Group, University of Otago <[www.physics.otago.ac.nz/space/darwin97/press\\_release.html](http://www.physics.otago.ac.nz/space/darwin97/press_release.html)> accessed 9 February 2011.
- FRANZ, Robert, CRL NEMZEK and LR WINCKLER. 1990. Television images of a large upward electrical discharge above a thunderstorm system. *Science* 249:48-51.
- HEAVNER, Matt J 2004 *Red Sprites and Blue Jets*. Geophysical Institute of the University of Alaska Fairbanks. <[elf.gi.alaska.edu](http://elf.gi.alaska.edu)> accessed 23 August 2010.
- LYONS, Walter A 1994. Characteristics of luminous structures in the stratosphere above thunderstorms as imaged by low-light video. *Geophysical Research Letters* 21:875.
- 1996 Sprite observations above the U.S. High Plains in relation to their parent thunderstorm systems. *Geophysical Research Letters* 101:29 641-29 652.
- NEUBERT, Torsten 2003 'On Sprites and Their Exotic Kin', *Science* 300:747-749.
- NGARJNO, UNGUDMAN, BANNGAL, NYAWARRA [Ngarinyin munnumburra] 2000 *Gwion Gwion: Dulwan Mamaa. Secret and sacred pathways of the Ngarinyin Aboriginal people of Australia*, edited by J Doring, Koenemann, Cologne.
- Parks Australia n.d. Nourlangie and Nanguluwur Art Sites, Kakadu National Park, Department of the Environment, Water, Heritage and the Arts, Canberra, <[www.environment.gov.au/parks/kakadu/visitor-activities/rock-art-nourlangie.html](http://www.environment.gov.au/parks/kakadu/visitor-activities/rock-art-nourlangie.html)> accessed 9 Februari 2011
- POPPER Karl 1959 *The logic of Scientific Discovery*. Hutchinson, London.
- 1963 *Conjectures and Refutations. The Growth of Scientific Knowledge*. Routledge and Kegan Paul, London.
- QUIAROGA, R Quian, Roy MUKAMEL, Eve A ISHAM, Rafael MALACH and Itzhak FRIED, (2008). Human single-neuron responses at the threshold of conscious recognition. *Proceedings of the National Academy of Sciences of the United States of America* 105(9):3599-604.
- SENTMAN, David D and Eugene M WESCOTT 1993. 'Video observations of upper atmospheric optical flashes recorded from an aircraft'. *Geophysical Research Letters* 20:2857.
- Eugene M WESCOTT, Dan L OSBORNE, Don L HAMPTON and Matt J HEAVNER 1995. Preliminary results from the Sprites94 aircraft campaign: 1. Red sprites *Geophysical Research Letters* 22(10): 1205-208. <[nova.stanford.edu/~vlf/IHY\\_Test/Tutorials/TLEs/Papers/Sentman1995.pdf](http://nova.stanford.edu/~vlf/IHY_Test/Tutorials/TLEs/Papers/Sentman1995.pdf)> accessed 27 May 2010.
- SISCOE, George I. 1976 'solar-terrestrial relations - Stone age to space age', *Technology review* 78:26-37.
- SONOTACO. 2005. A Sprite Captured By Ufocapturev2 At 7 August 2005, *SonotaCo* <[Sonotaco.Sub.jp/en/](http://Sonotaco.Sub.jp/en/)> accessed 9 February 2011.
- STENBAECK-NIELSEN, Hans and Matthew G McHARG 2008. 'High time-resolution sprite imaging: observations and implications'. *Journal of Physics D: Applied Physics* 41:234009.
- TAYLOR, Hugh R 1980. 'Prevalence and causes of blindness in Australian Aborigines'. *Medical Journal of Australia* 1(2):71-76.
- UW Sprite Balloon experiment 2002. 'Where are Sprites observed?', <[www.ess.washington.edu/Space/AtmosElec/sprite\\_info.html](http://www.ess.washington.edu/Space/AtmosElec/sprite_info.html)> accessed 12 October 2012.
- VAN DER SLUIJS, Marinus A and Anthony L Peratt 2010 'Astronomical petroglyphs: Searching for rockart evidence for an ancient super aurora', *Expedition* 52(2), <[penn.museum/documents/publications/expedition/PDFs/52-2/van%20der%20sluijs%20peratt.pdf](http://penn.museum/documents/publications/expedition/PDFs/52-2/van%20der%20sluijs%20peratt.pdf)> accessed 27 July 2012
- VAN DER VELDE, Oscar n.d. <<http://www.lightningwizard.com>> accessed 25 May 2011.
- VAUGHAN, Otha H Jr, Richard Blakeslee, William L Boeck, Bernard Vonnegut, Marx Brook and John Mckune Jr 1992 'A cloud-to-space lightning as recorded by the Space Shuttle payload-bay T-V camera', *Monthly Weather Review* 120:1459-61.
- WeatherVideoHD.TV n.d.a 'Classic Carrot Sprite', <[www.weathervideohd.tv/detail/4312/cumulonimbus-cloud-to-ground-cg-red-sprites-night-distant-storms-transient-luminous-event-tle-clouds-primary-types-lightning-sprites-jets-elves-sky-moods-atmospheric-optics-colors](http://www.weathervideohd.tv/detail/4312/cumulonimbus-cloud-to-ground-cg-red-sprites-night-distant-storms-transient-luminous-event-tle-clouds-primary-types-lightning-sprites-jets-elves-sky-moods-atmospheric-optics-colors)> accessed 21 September 2012.



- WeatherVideoHD.TV n.d.b 'Classic C-Sprites', <[www.weathervideohd.tv/detail/4424/cumulonimbus-cloud-to-ground-cg-red-sprites-upward-lightning-clouds-primary-types-lightning-sprites-jets-elves](http://www.weathervideohd.tv/detail/4424/cumulonimbus-cloud-to-ground-cg-red-sprites-upward-lightning-clouds-primary-types-lightning-sprites-jets-elves)> accessed 21 September 2012.
- WESCOTT, Eugene M , David D SENTMANN, Dan L OSBORNE, Don L HAMPTON, and Matt J HEAVNER 1995. 'Preliminary results from the sprites94 aircraft campaign: 2. blue jets', *Geophysical Research Letter* 22(10): 1209-1212. <[www.gi.alaska.edu/~heavner/rs/bluejets.html](http://www.gi.alaska.edu/~heavner/rs/bluejets.html)> accessed 9 February 2011.
- WINCKLER, John R 1995 'Further observations of cloud-ionosphere electrical discharges above thunderstorms'. *Journal of Geophysical Research* 100(D7):14335-45.

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Drs. Albrecht Ploum: degree in psychology (Radboud University, Nijmegen, Netherlands). Fields of study: History of Science, History of art, Geomorphology, Biomorphology, Astronomy, Cosmology. Main work: *Mirror of the Universe* (1996, in German and Dutch). UNESCO library citation: true science. The aim of this book was to investigate some of the shapes shared by terrestrial biological and cosmic structures to try to determine whether resemblances are strictly coincidental or whether they are expressions of a more profound coherence among elements in the universe.  
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## Appendix A Illustrations

### Colour

Apart from the cover page, the illustrations in the research paper 'Iconography Science and Lightning Figures' were published in black/white, mainly because of the journal's publishing tradition. Unfortunately the lacking of (especially) the red colour, means missing an important element for imagining the colour relation between the Red Sprite phenomena and red rock paintings. In this revised supplement the colours used in models and rock paintings are more or less representative

### Style

Some important figures (5c) were extracted from a large panel (ca.7x3m) at Mitchell River Falls, Australia (Crawford 1977). The panel is very complicated because of aging and much overpainting. It shows some small anthropomorphic Wanjina figures associated with lightning figures, embedded and surrounded by many elegant streamlined beings which Crawford classified as *Gwion Style* figures. figures

