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The Kanam Rock Painting Site, Cambodia: Current Assessments

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Senior Guest Editor's Commentary

The Kanam rock art site is a rare site in a country whose archaeology has been overshadowed by the temples of Angkor. Presently, it remains the first fully-documented rock art site outside of the greater Angkor region. Its existence hints at the possibility of other rock art sites found in the Cardamom Mountains, and elsewhere in the country where relatively little research has been done. The documentation of the rock art and its surroundings is particularly welcome because of concerns stemming from the newly-built hydroelectric dam in the area and its knock-on effects to the local environment.

The depiction of elephants as the main feature of the rock art is equally fascinating. The interaction between elephants and humankind in Southeast Asia has not been fully explored in an archaeological perspective, but where it has, has been through rock art. Elephants, both in wild and domesticated settings, are found in rock art sites in Cambodia, Thailand, Laos, Myanmar, Malaysia and Indonesia. What is clear from the rock art is that elephants, no doubt due to their size and strength, captured the imagination of early humans even before they were domesticated in the region, even as the larger question of when elephants were domesticated in the region remains open.

Rock art remains to be a difficult class of archaeological material to study; they are not inherently portable and are often analysed ex-situ through photography which in turn leads to a focus on the just the images themselves. To that extent many rock art studies in the region has tended to come in the form of initial site impressions, sometimes as an addendum to a larger archaeological question, and their interpretations on what the images mean are speculative.

In this study, the authors have made a concerted effort to expand the study area beyond the motifs depicted, and more importantly to a number of externalities such as the landscape, other archaeological sites in the region and local knowledge. It most cases, rock art is divorced from the living memories of the extant local populations, and by extension such paintings is seen as an artefact of the distant past, whose meanings remain forever elusive. This study is thus rare amongst regional rock art research in that it uses ethnographic inquiry to understand the role of elephants and the larger socio-economic network of trade between the highlands and lowlands. We are still limited in methodologies to conduct direct dating of the rock art, but in the meantime the hypothesis that the site is related to the trade in forest products, including deer skin, is reasonable. In doing so, the authors have expanded the consideration of the rock art site from the imagery of the rock shelter to one that reflects a larger sphere of human activity in the past.

Senior Guest Editor's Bio

Noel Hidalgo Tan is Senior Specialist in Archaeology at the Southeast Asian Ministers of Education Organization Regional Centre for Archaeology and Fine Arts (SEAMEO SPAFA) based in Bangkok, Thailand where he carries out the broad mandate of promoting archaeology in the region. His main academic interest is the rock art of Southeast Asia and he has conducted fieldwork in Cambodia, Thailand, Myanmar, Laos and Malaysia. Since 2006, he has been running the Southeast Asian Archaeology Newsblog. Tan has also participated in excavations in Cambodia, Singapore and Australia and is currently working on documenting the newly-discovered wall paintings of Angkor Wat.

The Kanam Rock Painting Site, Cambodia: Current Assessments

Pursat Province, Cardamom Mountains, Cambodia

Abstract

Southeast Asia contains some of the world's earliest known art traditions. Recently tested sites indicate rock art in the form of cave paintings were produced as early as 35–40,000 years ago in Sulawesi, Indonesia (Aubert et al. 2014). These revised dates have significant implications for the region. Thus, it is clear that Southeast Asia contains widespread and longstanding traditions of cave/rock art emanating from the late Pleistocene and continuing to the present (Tan 2014; Taçon et al. 2014). These traditions have direct relevance to global discourse on the topic.

Nevertheless, relations among sites and the people who produced the art remain obscure and tenuous. Meanings and purposes are equally ambiguous. Many sites frequently depict animals and humans. Analyzed correctly, however, results reveal important insights about past cultures, practices, environment and ecology. Subsequently, this helps elucidate clues to assist a greater understanding several related topics, such as past industries and value-chain networks.

The recently researched Kanam Rock Art Site in the Cardamom Mountains, Cambodia depicts an abundance of medium to large-sized mammals with a reasonably clear emphasis on elephants, deer and humans (particularly elephant riders). The dates of the paintings and nature of site activities remain unknown. However, they may relate to elephant capture and training practices as well as deer hunting industries. Dates may extend as early as the Funan, Chenla and Angkor periods in the first millennium CE. Nevertheless, many indicators suggest a post-Angkor time frame of intensive use and/or creation and augmentation—particularly during the 15th–17th centuries when deerskins from Southeast Asia and Taiwan were in high demand, particularly driven by Japanese consumers.

The results of the research were recently presented at the IFRAO Conference held in Caceres, Spain (31 Aug–4 Sept 2015: "Symbols in the Landscape: Rock Art and its Context"). Fieldwork, methodology, results and implications of the 2015 research efforts will be discussed. Decorrelation Stretch (DStretch) image analysis (Tan 2014, Harmon pers comm; 2016 www.dstretch.com) aided considerably with re-analysis of original images. A methodological comparison of normative image analysis vis-à-vis DStretch analysis highlights the significant contributions of DStretch.

Key Words/Phrases: Cave Paintings, Cambodia, Cardamom Mountains, Decorrelation Stretch (DStretch) Analysis, Deer, Elephants, Elephant Riders, Historical Ecology, Rock Art

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1: Overview

The Kanam Rock Art Site was reinvestigated in 2015 in order to conduct a more systematic assessment of the site and paintings. Image analysis continued through 2015 and early 2016, recently adding Decorrelation Stretch (DStretch) image enhancement analysis (Tan 2014; Tan et al. 2014; Harmon pers comm; n.d.). This section, the overview, provides an expanded executive summary with key points—several in bulleted format—to benefit specific audiences. The remaining sections provide more detailed background, methodology and analysis coupled with a heavy visual complement of images. Some redundancy is inevitable. However, there are subtle differences and specific nuances stated during the course of discussions with colleagues (especially seminars presented in 2015 at ISEAS-Yusof Ishak Institute, Singapore) that deserve nuanced attention. The report is designed to focus on the Kanam Rock Art Site itself and the associated methodology of image analysis rather than provide a comparative overview of rock art sites in Mainland Southeast Asia. Thus, it is meant to be a more comprehensive monograph on the Kanam Site rather than a comparative exercise. For a thorough overview of Southeast Asian rock art sites, please refer to Tan (2014; see also Taçon et al. 2014). Future enhanced data recording, site dating, and comparative inter-site analysis will be valuable.

1.1: Project Goals

The primary goal was to re-address the 2011 unpublished report to include an on-site assessment, systematic data recording, and ethnographic interviews after identifying several previous research gaps. The following list provides specific details:

- Label and photo-document all paintings and features; arbitrary panels/zones were created to better organize the images.
- Systematically assess images to identify animals, tools, symbols, activities, scenes, environment, and ecology.
- Compare methodologies of normative image assessment with DStretch (Decorrelation Stretch) image analysis (note: this was added from December 2015 following initial analysis and report production at the recommendation of Dr. N. H. Tan).
- Conduct local interviews to include a former elephant catcher/trainer.
- Record traditions and beliefs associated with the site.
- Record additional physical and landscape features associated with the site.
- Survey the surrounding area for additional site and feature identification.
- Visually analyze artifacts recovered in the area (by local residents) to more accurately provide a cultural and temporal framework.
- Assess site conditions and preservation threats.

1.2: Site Names

- **Kanam Site:** current designation; also Kam Nam Site because of the proximity to Kam Nam Village.
- **Kanam Poeung Kamnou:** previous designation (also, Kam Nam Poeung Kamnou).
- **Neak Ta Beak Kandeng or Da Beak Kandeng:** local designation based on the associated "broken [elephant] bell" and *neak ta* legend(s).
- **Laang Komnou ("cave" and "painting"):** Heng et al. 2011:21.

1.3: Artwork Depicted, Cursory Analysis, and Basic Implications

Table 1 summarizes the assessment of art/picture classes (i.e., painting/image categories).

Table 1: Summary of image assessment

Basic Image Assessment (field observations plus minimally enhanced digital image assessment)						
Category	**Confident Classes (multiple criteria)**	**% Column Total**	**Speculative Classes (limited criteria)**	**% Column Total**	**Combined Classes**	**% Column Total**
Humans	7	6.6	2	4.8	9	6.1
Riders	17	16.0	8	19.0	25	16.9
Elephant	17	16.0	12	28.6	29	19.6
Deer	20	18.9	6	14.3	26	17.6
Buffalo	1	0.9	2	4.8	3	2.0
Mammal (unknown)	28	26.4	3	7.1	31	20.9
Plow	6	5.7	1	2.4	7	4.7
Unknown	10	9.4	8	19.0	18	12.2
Total	106	100.0	42	100.0	148	100.0
Decorrelation Stretch Analysis – DStretch-1 Analysis						
Category	**Confident Classes (multiple criteria)**	**% Column Total**	**Speculative Classes (limited criteria)**	**% Column Total**	**Combined Classes**	**% Column Total**
Humans	7*	5.0	15*	18.6	22	9.9
Riders	14	9.9	9	11.1	23	10.4
Elephant	10	7.1	22	27.2	32	14.4
Deer	37	26.2	32	39.5	69	31.1
Buffalo	0	0.0	1	1.2	1	0.5
Mammal (unknown)	51	36.2	0	0.0	51	23.0
Plow	0	0.0	2	2.5	2	0.9
Unknown	22	15.6	0	0.0	22	9.9
Total	141	100.0	81	100.0	222	100.0
* High speculation; round finger sized blobs possibly representing human heads. They are similar to riders' heads, but only have lines possibly representing bodies or no discernable lines at all)						
Decorrelation Stretch Analysis (some "human" classes rearranged to "unknown") – DStretch-2 Analysis						
Category	**Confident Classes (multiple criteria)**	**% Column Total**	**Speculative Classes (limited criteria)**	**% Column Total**	**Combined Classes**	**% Column Total**
Humans	2	1.5	5	5.8	7	3.2
Riders	14	10.3	9	10.5	23	10.4
Elephant	10	7.4	22	25.6	32	14.4
Deer	37	27.2	32	37.2	69	31.1
Buffalo	0	0.0	1	1.2	1	0.5
Mammal (unknown)	51	37.5	0	0	51	23.0
Plow	0	0.0	2	2.3	2	0.9
Unknown	22	16.2	15	17.4	37	16.7
Total	136	100.0	86	100.0	222	100.0

Paintings mainly occur on the upper ceiling, with only two elephant and rider panels painted on outward facing vertical walls. This would have likely required some form of elevated support for drawing. The purpose(s) of placement on the ceiling remains unknown, but may relate to a suitable location and surface (i.e., appropriate "canvas"), have a desired psychological effect, or have symbolic significance.

Images were likely painted with fingers. No indication for use of a brush or other tool is readily identifiable. No 'finger prints' are discernable. Images were painted in solid monochrome red. Ochre/hematite is suggested to be the base pigment ingredient, although this remains unconfirmed. Pigment composition remains unknown.

Eight panels/zones were arbitrarily designated for recording purposes and do not necessarily reflect intentional zoning by artists. 137 separate "paintings" and 148 distinct entities were identified (estimated) in the first analysis. Some paintings included multiple entities: mostly elephants with riders and deer clusters. Subsequent DStretch analysis resulted in identifying 222 entities. More critical panel examination and DStretch analysis aided identification of groups and clusters of animals; at least 3–5 fairly sizeable clusters where groups of animals were likely intentionally arranged by category and/or as a scene. Panels/zones 4–8 are complex; panel 6 being the most difficult to disentangle.

Fifty to sixty abstract lines were noted in the first analysis (curved and straight lines; not listed in Table 1); 275–300 abstract lines were noted with DStretch Analysis. Many lines may be part of animal paintings. The lines also may represent riggings for ox-carts or elephants, specific features, or tools (note: many traditional rice cutters, for example, also resemble the composite hooked, curved and straight line images; the Khmer *pkheak*—common composite bush knife—also has a long hooked handle). Unfortunately, there are no clear or specific morphological indicators. Several lines are likely part of earlier images that are faded, partially spalled and/or superimposed with subsequent pictograms. They remain ambiguous and enigmatic. Of particular interest, however, DStretch analysis highlights many curved arch-like or wave-like lines, a few concentric circles, many intersecting lines, and unknown straight lines. Some are comparatively large. The "arched" line is also apparent in some elephant and rider scenes. Further analysis is warranted as these may represent specialized gear, implements or something unique about particular riders.

Circles, balls, and spherical blobs were present. Some are thought to represent humans. Many remain ambiguous. A few may be implements held by individuals. For example, DStretch Analysis highlighted an unusual image originally thought to be a group of people represented by round blobs and lines (Panel 5, Image 5-2). The painting may actually depict people holding round objects on handles or sticks.

More than 25 cases (estimated) suggest images were partially superimposed in the original analysis. DStretch allowed the recognition of more prolific superimposition, including the possibility of animals depicted side-by-side.

Many animal paintings were inverted or occurred at oblique angles in relation to other paintings. This suggests multiple painting episodes. It also implies a disregard for forming complex scenes, although the re-analysis indicated clusters and possible scenes with multiple animals are indeed depicted. Some arguments suggesting that randomness and chaos were intentional are possible but are not currently supported.

Morphological redundancy and simplicity dominate style and technique. Almost all paintings are side profiles with all appendages represented (e.g., four legs on mammals, two ears, two horns/antlers, two tusks, two human arms, two human legs, etc.). Large

and medium-sized mammals represent the bulk of paintings. The occurrence of only one "stylistic tradition" or several traditions remains unknown. Simplicity and consistency of images suggest one or two "general traditions" are discernable at present. It is possible that only a few artists were responsible, although this is speculative and unlikely in the authors' opinions. Rather, several artists over a multi-generational time span are suggested.

Elephants (*Elephas maximus*), deer and humans (particularly elephant riders) account for almost all readily identifiable categories. Most antlers or horns are inward curving "halo-shaped" (almost circular). This complicates accurate interpretation as either wild cow/buffalo (e.g., *Bos* spp.: *kouprey—Bos sauveli*, *gaur—Bos gaurus*, *banteng—Bos javanicus; krabai/kerbau*—water buffalo—*Bubalis bubalis*) or deer (e.g., *Cervus* spp.; Eld's deer—*Cervus eldii*; sambar—*Cervus unicolor*; muntjac—*Muntiacus munjak*; hog deer—*Hyelaphus porcinus*; mouse deer—*Tragulus kanchil*). Many deer could be reinterpreted as wild cow or oxen pending analyst's preference. Indeed, the "halo-like" horns are seemingly more indicative of some *Bos* species. However, deer is argued as "more likely" given historic factors discussed below and the co-occurrence of other anatomical features more likely to represent deer (e.g., tails). Two elephants seem to have a penis depicted. This is potentially helpful for estimating possible gender preference for elephant use. One animal is filled with round dots; possibly spots. Three or more ovoid and tapered animals are unknown; possibly representing pigs (*Sus* spp; *Sus scrofa*) but this remains highly speculative.

Riders only occur on elephants. It is noteworthy that many of the riders are standing and several are carrying implements—silhouette images of both side profiles and frontal views. The seated riders are generally at the head of the elephant, facing forward. However, there is at least one clear depiction with the rider standing at the head of the elephant (possibly facing sideways or backwards). Elephant-rider ratios indicate elephants (foot to top of back) were perceived as approximately 1.5–2.5 times as tall as a standing person.

There are limited species and genera diversity represented. Most species, except humans, are wild and part of the normative forest ecosystem in the area; past and present. Some species may represent cats (civet, tiger), monkeys, pigs, dogs, goats, birds, snakes and other animals (mammals or otherwise) that are part of the normative Cardamom ecosystem. However, this was not evident with the first analysis and less evident in the DStretch analysis. Only one buffalo, however, was discerned with a moderate level of confidence. No mythical animals or supernatural beings (e.g., gods, demons) were depicted.

Contrary to original interpretations, few agricultural-related livestock (farm animals including chickens, pigs, dogs, etc.), few agricultural tools, and few agricultural scenes and images are represented with the exception of the possible apparatuses, ox-cart riggings, etc. which could also be interpreted as elephant implements (e.g., *angkus,* lassoes, capturing tools, snares and other tools). DStretch analysis indicates that only one depiction is possibly indicative of a plough. Paintings suggested to be plough riggings/apparatuses (curved and straight line combinations) were based on local interpretations. Although plausible, depictions could represent elephant hooks (*angkus*), other tools (a wide spectrum or Khmer style bush knives and cutting tools-e.g., *pkheak*), various riggings and apparatus/equipment parts (e.g., elephant gear, ox-carts), lassoes, snares, shields, weapons, possibly elephant catching harpoons, etc.

No depictions of recent historic or modern material culture are present that would assist temporal placement in a more recent context (e.g., the Gua Badak rock art site in Malaysia depicts motor cars, bicycles, guns, etc.; interestingly, there is an image of a

human riding an elephant and hunting scenes which may be of comparative value [Saidin and Taçon 2011]). It is noted, however, that these types of material culture (e.g., historically introduced foreign technologies) may not have been depicted even if present due to the nature of the possible very specific ritual use of the site, as well as the remoteness of the settlement area—not likely an area heavily exposed to early/colonial outside presence.

Brahmanistic, Buddhist, Angkorian, or traditional epic stories (e.g., Ramayana, Mahabharata) or related symbols, icons, scenes, and characters are absent (note: seminar comments suggest this may indicate pre-Brahmanistic/Indian influence and subsequently an earlier date for painting activities and site use). Inscriptions or writing are absent, except recent additions. Graffiti is not prevalent and the modern chalk additions by locals were intended to assist identification (discussed further below).

Elephants are not portrayed as highly adorned or armored (note: Dr. Tan has enhanced photos from other sites in Southeast Asia with image enhancement software which have revealed ropes, ornaments and other gear/adornments on elephant rock paintings; this is not evident at Kanam). Elephants in the depictions are neither associated with royalty as symbols of status and power, nor associated with mythical, religious or historic characters, scenes and stories as is often the case with many elephant representations elsewhere in Cambodia—e.g., Ganesh, Airwata, Ramayana, Mahabarata, Buddhism, Hinduism, royal battles scenes with Cham or Thai, etc. Likewise, humans and other animals are not portrayed as adorned or costumed with the exception of a few riders who may have headdresses (head gear), although head gear depictions are simple and ambiguous. Some, however, are holding implements and some may be associated with arched lines (purpose remains unknown).

1.4: Main Artifacts Recovered in the Area by Local Residents

An inventory of artifacts recovered by locals from the area was made. Some local residents displayed artifacts that were either heirlooms, or, recovered in the area from farming activities and other undertakings. Only a few residents were able to display artifacts, however, as many of the artifacts were non-portable (e.g., large glazed stoneware jars) and the team only had limited time to investigate. Residents indicated a wealth of additional artifacts we could inventory if we have more time for a future visit. The inventory is as follows:

- Angkorian brown glazed stoneware jar dating to around the 10th–14th centuries CE.
- Green glazed jarlet (possibly 16th century imported Chinese ware).
- 23 Bronze bangles of varying sizes and shapes. Most are simple, plain designs. Some are cabled and more highly stylized. Dates could range from the Mainland Southeast Asian Bronze and Iron Ages in the first few millennia BCE to Angkor and post-Angkor periods. Many appear typical of metal age burials, though residents did not indicate they were recovered from burial sites. Some may be large rings for riggings, animal use, etc.—difficult to determine.
- Two round pellets/balls (photographed but unexamined).
- One highly polished black stone axe/adze with use ware scars and flakes at the cutting edge.
- Note: all objects may have been in circulation for centuries. They are still in circulation today.

1.5: Additional Sites and Features in the Area

Two informally stacked stone mounds made of angular and semi-rounded boulders and cobbles were identified outside the site near the path/road approximately less than 100 meters away. The stone mounds are 2–3 meters in diameter; 1–1.5 meters high. The mounds are said to relate to a local legend (broken bell) and demark the site entrance. The stone mounds may not be contemporaneous with the rock paintings. They are speculated to significantly post-date the paintings (e.g., lack of significant biomass cover, plant growth, etc.). However, they are currently associated with the site and current rituals.

A cursory rapid foot survey (RFS) covered an approximate 1.0–1.5 km radius around the site. Although forested, ground visibility was adequate. No archaeological, anthropogenic or anthropomorphic features or sites were identified. Several rock outcrops including the larger outcropping at the site itself were quickly assessed. There are no indications of use, archaeological deposits or modifications. Other than the paintings and the two stone mounds, no clear archaeological deposits or features were evident at the site, in the site or adjacent to the site. No modifications to the site's natural stone/outcroppings were evident.

Fifteenth to seventeenth century jar (and wooden coffin) burial sites are located in the Cardamoms Mountains to the south (Beavan et al. 2015; Beavan et al. 2012). These sites utilized rock overhangs and shelves occurring in similar outcropping features as witnessed at Kanam. It is possible that the Kanam Site is contemporaneous. One hypothesis suggests that deer (meat, skins) and live elephant trade may have been part of a larger supply/value chain extending from the remote Cardamom hinterlands to networks within and beyond Southeast Asia (see Laver 2012; Hall pers comm). Jars (mostly from Mae Nam Noi Kiln sites, Singburi Province, Thailand) and artifacts from the jar burial sites clearly indicate exotic goods were imported to the hinterlands—likely in exchange for forest resources.

1.6: Historic Elephant Use (Respondent Feedback)

Local respondents indicated a strong history of elephant capture, training, use and supply to kings (post-Angkor) in the distant and recent past (confirmed by Ellul's 1970s ethnographic study; Ellul 1983). Elephant capture and trade was disrupted in the 1970s during the wars and Khmer Rouge regime. Many catchers, trainers and elephants fled to Thailand. Many elephants were abused and killed. The "industry" and tradition never returned.

A similar situation was noted at Chi Phat further south in the Cardamoms (the area known for 15th–17th century jar burials and coffins). An ethnic Chang (also, Chong) respondent in Areng Valley indicated that the people formerly captured, trained, traded and used elephants; performed similar rituals related to elephants; but the elephants disappeared during the Khmer Rouge regime—"no more elephants and elephant use after the Khmer Rouge".

Rituals are performed at the Kanam site twice yearly by religious leaders and local representatives. Primary occasions include: 1) Khmer New Year, and 2) Phchum Ben/ Ancestor Ceremony. People make offerings of food and incense to Neak Ta Beak Kandeng at the site. It is still viewed as a sacred/holy place to respect and make offerings for *neak ta* in order to demonstrate respect, gain favors and avoid misfortunes.

Limited discussion on deer hunting or traditional use was conducted (researchers were focused on elephant use at the time; re-engagement for deer capture and use interviews are highly recommended).

1.7: Oral History (Respondent Feedback)

A legend of the "broken bell and Neak Ta Beak Kandeng" is associated with the site and current rituals. The main theme of the story is as follows: A highlander (or highland people) were riding the elephant through the area. The elephant fell at the location. The elephant bell banged against the rocks. Either the bell broke or both the bell and the rocks broke (unclear). A man riding the elephant may have died in the incident (unclear). Nevertheless the rider became the *neak ta* (ancestor spirit) after his death. It is unclear if the elephant or elephant spirit was associated with or transformed into the *neak ta* spirit as well. Neak Ta Beak Kandeng refers to "broken bell" ancestor. No other special place names or legends were given to the area, although forest *neak ta* (generic and localized) are said to be present in the area—consistent with Khmer belief systems in general.

1.8: Ethnographic Interview(s) from Written Notes and Recordings

The following points are the opinions and statements of the respondents(s); not the author's interpretation. Informed consent protocols were followed. Respondents were pleased to provide information and personal details should other researchers be interested in follow-up inquiries.

Respondent: Mr. Prum Hoan, 76 years old.

Mr. Prum stated that Tamal is another man who used to catch elephants: "He is very good. He is a very good person. He is still alive and moved to Kravai/Kravaing District. He is 75. He lived here [Kanam area] when he was young." He also noted that Suey people [ethnic Khmer minority; several spellings] live in the area; confirmed by other respondents. Mr. Prum also knows of the Kuey people and their elephant traditions [the Kuey are an ethnic Khmer minority often associated with elephant mastery and ironworking; several spellings].

Mr. Prum emphasized that King Monivong had an administrator who could assign local riders to catch elephants for him. Sometimes they [the elephant capturers and trainers] would give the elephants to the king to gain prestige and honor. The person who assigned riders to catch elephants was Ta Maha(l) [possibly Tamal referred above, but unclear].

Mr. Prum decided to join the senior elephant catchers on his own accord when young. He observed and trained with the riders. After catching three elephants, he became a master. A ceremony necessarily follows after capturing the required amount of elephants. Curing the ceremony, Mr. Prum noted the new master rider has to eat rice mixed with the elephant feces. Mr. Prum captured and trained five elephants during his life. Others can catch up to 10–15 elephants in a lifetime. Elephants are captured and trained one at a time. At least three riders are needed to catch elephants. Women can ride elephants if there is a chair. However, women cannot (or do not) become riders/mahouts. Sometimes elephant

catchers would keep the well-behaved elephants. If elephants were not well behaved, they would be sold. Wild elephants are most dangerous, however.

Mr. Prum stressed the Khmer Rouge sent elephant catchers to take the elephants during the 1970s. The Khmer Rouge 'took everything'. Some local people and elephants fled to Thailand. Now, nobody catches or owns elephants. Before the Khmer Rouge, most families had 1–2 elephants.

Mr. Prum emphasized that the lasso made of buffalo hide is the most sacred object with the most magic and rituals. There is no magic language [unlike the ethnic Bunong elephant catchers of Mondulkiri Province; note, may contrast with Ellul's accounts]. Elephant rituals for elephant capture and elephant birth (for the calf) are the same. The buffalo hide lasso/rope is the most important item.

A newly captured elephant will be tethered to a pole and fed for months until subdued. Naming entails offering names and sugar cane. When the elephant eats the sugar cane, the name will be accepted. If the elephant does not eat the sugar cane, the name is rejected and a new name is offered.

When female elephants are ovulating, they are free to go to forest to mate with wild elephants. They are also allowed to mate with village elephants [differing from other practices such as associated with the Bunong]. No ceremony or wedding is performed [again, differing from other traditions]. The elephant owners do not always know the fathering elephant.

Sick elephants are treated with a ritual. Fire [?] is burned at the body and tail to rid the elephant of bad spirits.

Elephant penis size is linked to predicted age. It the penis is long/big, the elephant will live to be 90–100 years old.

Note: The information contrasts rather sharply with Ellul's 1960s/70s (1983) ethnographic study of elephant capture in the Cardamoms, in which a great deal of ritual and taboo is associated with *hma* (hunters), *ganval* (assistants/apprentices), community members and others. Some of the information, however, such as the heavy emphasis on magic and ritual associated with the lassoes and involvement/relations with royalty, synchs well with Ellul's descriptions.

1.9: Key Interpretative Points and Additional Considerations

Trained elephants with riders are clearly depicted. This indicates a developed tradition of elephant capture, training and use—possibly also for trade, marketing or tribute. Some depictions may indicate scenes related to elephant capture and training. The images could act as instructional guides or visual enhancement during "ritual instruction". The context (perhaps distant from the settlement in a cultural liminal or wild location) coupled with the ceiling location may have added a necessary ritual and symbolic effect.

The two most prominent, complex and more highly skilled paintings are outward-facing. They include elephants and riders on two contiguous vertical rock faces at an approximately 90 degree angle. The intention, if any, is unknown but possibly meant for external viewing.

The nature of past ivory extraction and trade specific to the site area is unknown, but regionally indicated in historic references. Because evidence only indicates riders using elephants, elephants were not likely **exclusively** [emphasis added] hunted for ivory.

Rather, elephants were likely captured, trained and used for other purposes such as work/labor, transport, warfare, etc. Elephants may have related to prestige, status and status enhancement (e.g., evolving manifestations of leadership may have required possession, use and related symbolism of elephants—see Trautmann 2015).

On the other hand, deer product industries (particularly deer skin trade; e.g., the high demand by the Dutch, Chinese and ultimately Japanese in the post-Angkor period; Laver 2012; Hall pers comm) may have related to the prominent deer representations. It is possible that the deer interpretation is erroneous and animals may be buffalo, wild cow or a combination of *cervus* and *bos* species; possibly other medium to large mammals. Alternatively, but equally plausible, is a possibility that the horned animals do indeed represent buffalo/cow and elephant and buffalo are synched as a complimentary package (especially considering the importance of buffalo hide ropes and lassoes). The site may have been used for ritual activities and specialized ritual knowledge transfer (discussed further in the text vis-à-vis Ellul's ethnographic observations and interpretations of *tranam*). Combined factors from anatomical representations and historic evidence lean towards a more robust interpretation of deer, however.

Multiple episodes of site creation, use and types of paintings vis-à-vis local traditions, socio-economic changes, etc. may have occurred. It is also possible that the representations of deer and elephants may be separated by significant spans of time, for example. One hypothesis posits that elephant emphasis predated the deer emphasis: elephant emphasis was prevalent during the Funan to Angkorian periods. Influence from India may have promoted diffusion of elephant capture and use knowledge. Beyond functional reasons, elephants may have been critical in enhancing one's status during the evolution of leadership/kingship criteria and power representation. Deer became increasingly prevalent in the post-Angkor period due to a shift in economic demands and changes in extraction behaviors (e.g., a sizeable deer industry emerged).

A subsequent hypothesis suggests deer representation became prevalent as a means to emphasize importance and increase success rates of capture after deer populations may have drastically decreased due to overexploitation and deer capture became more difficult and less frequent (see Laver [2012:14–15] for comments on significant historic deer population impacts due to over extraction). Visual and [presumed] ritual emphasis may have been measures to enhance awareness, focus and increase "luck". Deer population decreases during heavy targeting periods such as witnessed in the 15th–17th centuries based on historical records (Laver 2012) likely correlated with capture rarity and/or difficulty, increased capture efforts (Laver 2012 also noted changes in capture techniques such as pitfalls and snares), and socially required "luck enhancement" investments. This may have increased the demand for representations, reinforcement of importance, and rituals. Perhaps it was even a stimulus for initial choices to include deer in the paintings and the invention of related rituals.

Elephant capture, training and use, as well as deer hunting, are high skill, dangerous and/or have low probability of success endeavors. Thus, it is not unexpected that they have special representation in a rare rock art forest context possibly associated with various beliefs, practices, rituals, magic, etc. to spiritually and socially mitigate potential negative consequences, enhance success, bring fortune and reinforce importance. Previous comments from 2015 seminars at ISEAS - Yusof Ishak Institute indicated scenes were characteristic of symbolism related to "man conquering nature; wild 'things' and 'forces'; and/or danger" (also suggesting a "power/control" statement). These possible

interpretations need further review and will likely remain difficult to fully support or refute, though remain plausible and intriguing.

Many of the line images (e.g., random or abstract lines; lines possibly representing tools, equipment, animals) may actually be connected to larger images. The space for observation and our focus on clearly depicted animal within the approximately 5–30 cm diameter range may have resulted in us occasionally "missing the larger picture".

Alternative explanations are innumerable. There is no need to speculate further for the purposes here. However, it is important to note that despite our desire to believe that there are functional and pragmatic motives and explanations, and if and when those fail to be evident, there must be ritual motives and explanations (arguably functional as well), and perhaps even entertainment explanations… it is quite possible that the artisan(s) were merely producing art for art's sake; simply because they wanted to for unknown personal reasons that have nothing to do with a "bigger picture" we want to link it to. Likewise, many of the images may be incomplete (i.e., partially finished) and several may be poor depictions of what they were intended to represent. Nevertheless, there is data in the images that allow us to determine something about their lives and environments.

1.10: Threats to Preservation

Threats to preservation include: spalling, insect nests and trails, plant growth, lichens, moss, salt, wind and water erosion, various natural chemical processes, fading, vandalism and recent white chalk/paintings overlaying the images. Local residents maintain and respect the site with minimal disturbance with the exception of the white chalk additions (meant to assist). The local residents or outsiders have not augmented, added or removed images to their knowledge.

Opportunities for oral history recording and analysis are quickly vanishing. It is a good opportunity for anthropologists to pursue further research; not just for documenting traditional culture, but to explore dynamics of change vis-à-vis major developmental impacts to the area as well as other socio-cultural, political and economic changes (e.g., communication, information access, nationalism, globalism, movement, new opportunities).

Lastly, the larger catchment areas and habitats are being affected by various development activities; particularly roads, dams and forest reduction. Archaeological sites are likely to be damaged or destroyed.

2: Background

In 2007, the Pursat Cultural Department officers reported the discovery of ancient paintings on rock walls and ceilings in caves, overhangs and other rock features located in remote areas of the Cardamom Mountains (Heng et al. 2011; Tep et al. 2011). The primary site of interest is located near Kam Nam (Kanam) Village; henceforth referred to as the Kanam Site for this report.[1] The red colored paintings were said to include various animals,

1 Thus far, Kanam is the only site in the immediate area to have received professional, albeit cursory, attention and validation as a rock art site. Paint samples were taken to Paris for chemical analysis at that time (Heng et al. 2011:27). However, the results are unknown and unavailable to the current authors.

humans, tools and other designs. Of particular prominence were the reported paintings of elephants, elephant riders, deer, cows, buffalo and ploughs.

Cambodian archaeologist, His Excellency Chuch Phoeurn, was one of the first to make the difficult trip in order to explore the finds, assess the research potential and advise on preservation. He was accompanied by a small team supported by several senior Cambodian officials promoting the pursuit of heritage exploration, documentation and protection. Subsequently, the site was visited and further assessed on only a few occasions by Mr. Heng Sophady, Mr. Tep Sokha, Dr. Nancy Beavan, and other researchers working in Cambodia (Heng et al. 2011; Tep et al. 2011).

Dr. Beavan and Tep Sokha have provided useful input into increased understanding of the Kanam Site as well as other archaeological sites in the Cardamoms (e.g., jar burials and coffins; Beavan et al. 2015; Beavan et al. 2012). Dr. Noel Hidalgo Tan (2014) analyzed recent Cambodian rock art discoveries at Phnom Kulen in Siem Reap. He subsequently included the 2007 Kanam discoveries in his thorough regional synthesis of rock, rock shelter, and cave art research throughout Southeast Asia (Tan 2014; see also Kusch 1986).

Ancient cave and rock art is widespread throughout the world. Most professionals and connoisseurs are familiar with ancient cave painting sites such as the famed Upper Paleolithic Lascaux Caves in France. Recently, Southeast Asian ancient rock art made global news with known sites in Sulawesi, Indonesia being reassessed and dated to as early as 40,000 years ago (Aubert et al. 2014). They are among the oldest in the world.[2] Prior to these recent announcements, however, few people were familiar with some of the earliest known sites closer to Southeast Asia, including Pleistocene sites in Australia which also rank among the oldest to date (Bednarik 2010; Flood 1997; Mulvaney & Kamminga 1999; see also AURANET-the Australian Rock Art Research Association).

Ancient and historic rock art and cave paintings are thought to occur sporadically throughout Southeast Asia. However, Tan (2014) notes a robust presence of rock art sites throughout the region. The sporadic distribution is partly a bias of reporting. Many sites are cursorily described as aspects of surveys and projects, or, components of sites. Cave art sites are rarely the center of research focus, especially at the scale of regional inter-site analysis.

Additionally, many findings are only locally reported in various languages rendering information searches difficult. Thus, many reports are not translated to English, French or other languages accessible to a more international research audience. They are infrequently disseminated beyond local departments, ministries and national borders. Most sites remain enigmatic, undated, under-researched, rarely systematically analyzed for inter-site comparison, and difficult to preserve and protect.

Dr. Noel Tan (2014) provides one of the most comprehensive overviews to date. He emphasizes there are over 600 known pictogram and petroglyph sites (approximately 1,500 sites when megalithic sites are included (Tan 2014:93) warranting the necessity for increased cave art research as a specific regional sub-field in its own right. When

2 Of interest, Sulawesi has always been separated from both the Sunda and Sahul continental land masses during the late Pleistocene. Land bridges from the Laurasian continent only reached Bali near Wallace's Line (biogeographic limit of Sunda and the beginning of Wallacea—between Bali and Lombok islands). Human settlement entailed systematic water crossings. Sufficiently tested and dated rock art includes hand stencils and babirusa (pig deer; Babyrusa babyrusa) among others.

fully operationalized, this will provide a more holistic and balanced archaeological understanding.

Religious and "epic story" rock art in Cambodia is relatively common—especially stone carvings (temple embellishments, bas reliefs, statuary, terraces, boulder carvings, rock face carvings, and others; see Figure 1). Paintings on rock are relatively rare. Rock art sites unrelated to Brahmanistic, Buddhist and related traditions typical of Funan to post-Angkor periods are also rare in Cambodia, especially in the Cardamom Mountain range (see Tan et al. 2014).[3] This may be indicative of limited attention and sampling, however.[4] Similar traditions—animal and human profile depictions in monochrome red paint—are noted in neighboring countries, although direct relationships as a unified cultural tradition are highly speculative.

Figure 1: Various depictions of elephants in Cambodian rock art traditions

Neighboring Thailand has over 200 documented rock art sites with monochrome red pictograms where Tan (2014) notes a stronger interest in rock art research which is more adequately supported. The Pha Taem Site in Ratchathani overlooks the Mekong River with images of elephants, humans and fish. Sawatsalee (1998) also emphasizes many paintings (specifically, Ban Rai Rockshelter) that "depict human relations to the landscape" (Tan 2014:75), a particularly relevant insight vis-à-vis the Kanam Site analysis because we are interested in ecological and economic implications as a major point of inquiry.

Current efforts with the Kanam Site include properly identifying and locating the site(s), preliminary documentation, and initial assessments of the conditions. Through cursory analysis, we hope to better place the temporal and ecological context of the site and people who crafted the paintings, as well as elucidate plausible explanations concerning

3 Tan et al. (2014) note post-Angkor paintings at Angkor Wat depicting daily life, a variety of animals such as elephants, and many other scenes. Most of the paintings are only visible through image enhancement.

4 Local informants claim other rock paintings are found in the Cardamoms, Phnom Kulen, the northeast mountains in Rattanikiri and in various limestone karst ranges in the south and northwest. Most remain unvalidated with the exception of several Phnom Kulen sites (Tan 2014).

the purpose, meaning and other cultural implications. This report covers the initial phase of preliminary documentation and heritage management planning. Further efforts will be made to seek support for additional survey, research, heritage management planning, as well as the implementation of protection, preservation and research related plans. It is expected that more sites exist. Thus, it is imperative that future plans include additional survey.

2.1: Survey Background

In 2011, a joint cooperative team consisting of Cambodian and foreign researchers visited the site with support from the Ministry of Culture and Fine Arts (MoCFA). The initial fieldwork was designed to survey, document and assess the area and paintings. The site was visited on 22 Feb 2011. The research group was led by Mr. Heng Sophady (MoCFA), Mr. Tep Sokha (RUFA-Royal university of Fine Arts, Cambodia), Ms Em Dany (RUFA), Mr. Sorn Chanthoeurn (RUFA), Dr. Fabrice Demeter, and residents/participants from Kravan district including Mr. Chhoem Ty, Lao Koem Moeurn, Prach Sarun Kun Thal, Kun Pros and Khun Rom.

Travel time consumed most of the single day survey. The actual site survey included a half-day assessment from late morning until afternoon. The site was expediently surveyed and photo-documented. There was insufficient time for an extensive area survey and data recording.

The recent visit included two days of survey, recording and assessment on-site from 20–21 January 2015. Dr. D. Kyle Latinis and Dr. P. Bion Griffin accompanied Mr. Tep Sokha and members from the local Ministry of Culture and Fine Arts.

Painted rock facings were organized into eight panels (arbitrarily assigned sections or zones). The panels were arbitrary and do not necessarily reflect any intended sections designated by the past artists. Drawings and drawing clusters were systematically numbered and recorded.

Local villagers were interviewed, with specific attention to: 1) current ritual use of the site; 2) traditional elephant-related practices in the area; 3) oral history related to the site and elephant use; 4) knowledge of historic and ancient features, sites and artifacts in the area; and 5) recommendations on heritage management from the local perspectives. Land use, demographics and changes in settlement, culture, ecology and land use were also discussed. Historic and ancient artifacts recovered (by locals) in the area were brought to the team and subsequently assessed.

Additionally, an expedient foot survey of the surrounding area (approximately 4 km^2) was also conducted around the rock art site.

2.2: Kanam Site Location

The site is located near Kanam Village, Kravan District, Pursat Province, Cambodia (see Figures 2–8); approximately 2 km South of the village. Kanam Village is remotely located within the Cardamom Mountain range. The site is difficult to access. Only part of the route is accessible by motorized ground vehicle.

- Site location according to 2015 GPS data:[5] 12° 10' 27.1" N, 103° 47' 10.1" E.
- Nearest sizeable village and agricultural field system:[6] 6 km 153° from site.
- Nearest Town: Kravan – 12° 21' 5.19" N 103° 46" 7.8" E; 20 km 355° from site.
- Nearest City: Pursat – 12° 31' 59.81" N, 103° 55' 0.00" E; 42 km 19° from site.

Figure 2: Mainland Southeast Asia and Cardamom mountains (Google Earth)

Kravan District Town is approximately 25 km from Pursat. Kanam Village is approximately 42 km from Kravan District Town along a well weathered road to include multiple water crossings. Normal and preferred transportation is by ox/buffalo-cart, foot or motorcycle. Approximately 50% or less of the families in the area own motorcycles.

Five small linear villages are passed before reaching Kanam Village from the Kravan District Town. Houses are placed along both sides of the road—one side being the upper river bank area. Whether or not this was the traditional and ancient settlement layout is unknown; although road construction often leads to settlement layout readjustment in linear roadside patterns.

The journey in the dry season includes travel by motorcycles along ox-cart paths to Kanam Village and hiking through bamboo thickets, forest, secondary growth from previously cleared plots, and both young and more mature woodlands through low hills. The proximate local villages along the road to Kanam include Veal Vong, Sach Pouk, Peam, Khsang, Prei Khmam and then Kanam Villages. Beyond Kanam Village are Ta Sai and Thma Keo Villages. The villages, as with Kanam, are located adjacent to the Kanam Stream/River which meanders through the broader valley area. The headwaters of the stream come from Ta Sai Village. The local name of the stream varies depending on the location.

5 The existing GPS data needs further validation. Inconsistencies were faced during field recording and map assessments.

6 This estimate is based on the GPS coordinates above and Google Earth image depictions.

Figure 3: Kanam rock art site and 15th–17th century jar burials; "JB" denotes jar burial sites

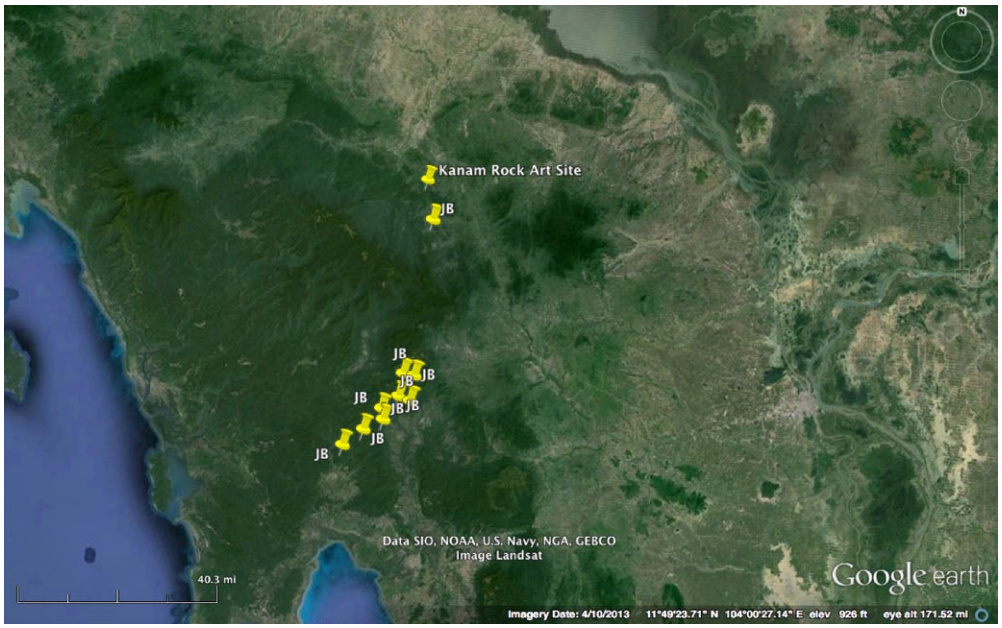


Figure 4: Kanam Site - Kravan Township - Pursat City

Note the forest cover, forest maturity and remoteness; also note the village-township-city network which then allows access to roads, rivers and the Tonle Sap Lake; also access to Siem Reap and Longvek areas (important during the post-Angkor periods). Internal mountain networks and networks to other valleys and areas extending all the way south to the coast and north and west to Thailand also exist.

Figure 5: Kanam Site – Forest Cover – Land Use – Local Drainage and Settlement

Figure 6: Kanam Site – Forest over – Drainage – Land use - Access route

Figure 7: Kanam Site profile; Projecting overhead slab with paintings and lower slab with red staining and spalling

Figure 8: Kanam Site oblique frontal view

3: Environment, People, Land and Resource Use

The Cardamom Mountains are subject to large-scale seasonal tropics monsoonal weather systems characteristic of Southeast Asia; although local topography and inland geography result in unique variability at both sub-regional and local scales. Nevertheless, adequate predictability and consistency occur. The dry season is frequently less than four

months in much of the Cardamom range with considerably more rainfall towards the coastal areas.

The mountain range is approximately 70 km NE–SW x 300 km NW–SE. They are among the highest mountains in Cambodia (highest peak: 1,813 m). Cooler average temperatures occur as altitude increases. Topographic, geologic, anthropogenic and orographic rainfall variability and other factors result in a more diverse set of micro-climates than occur in flat floodplain areas. Many larger drainage systems exist throughout the range; several of which are scheduled for hydroelectric dam construction—including one that was near operational at the time of 2015 fieldwork. The dam will impact settlement patterns and land-use dynamics in the area. It remains unknown how this will affect the Kanam Site and other sites in the area, or, if adequate heritage survey in inevitable flood zones has been conducted.

Wind and rain erosion are primary forces affecting the landscape, although human modifications are increasingly prominent (e.g., logging, forest clearance, flooding from dams, and agricultural development concessions (Figures 9–10). Some areas remain well sheltered while others are highly exposed. These are principal factors vis-à-vis concerns regarding Kanam rock art preservation.

Biodiversity is considerably high as the Cardamoms are one of the last large-scale frontiers in Mainland Southeast Asia. This is rapidly disappearing with increased development and resource exploitation. Several protected wildlife zones and parks exist. Several NGOs operate in the area, although few are permanently staffed.

Numerous large mammalian species include elephant, deer, wild cow/buffalo, pig, tiger, clouded leopard, gibbons, sun bear and several other species. Many are endangered. They are listed in various environmental reports and receive varying degrees of attention, protection and support. Total biodiversity is not fully known. New species are periodically identified through limited but useful ecological research endeavors. The range of extinct or "no longer present" animals in the Cardamoms is unknown, although some species such as rhinoceros may have more recently disappeared.

Elephants, buffalo, cow and deer are especially important in relation to the rock paintings described below. Pigs seem curiously absent among pictograms, although *Sus* spp is an important component of the ecology and subsistence/farming economies.

Threatened biological populations are decreasing with continued loss of habitat and over-targeting (see Daltry et al. 2015; Daltry et al. 2012). In fact, the elephant population has decreased in Cambodia from possibly hundreds of thousands[7] in Angkorian times to an estimated 300–600 in a 2001 report; half of which were said to be located in the Cardamoms (Schliesinger 2011: 176; Sukumar 2011; Trautmann 2015:2; Varma 2014).

7 Suryvarman II was said to control 200,000 elephants during the 12th century; elephants were still prolific in Chou Ta Kuan's descriptions during the late 13th century; and elephants were reasonably prolific in historic periods to include heavy use of "war elephants" as well as work-elephants until modern times. The early numbers may be exaggerated considering how much food, care and labor it would have taken to maintain, or, the possibility of such a large population vis-à-vis the availability of enough sustainable habitat. If the population were around one million people, every family would have an elephant. Interestingly, it was noted by Kanam villagers and other respondents that about every family in the area (Cardamom mountain area with presumably low population) indeed did have one or two elephants in the past. Nevertheless, it is noted that extremely rapid elephant population decline is a fact. Scriber (2014) notes 100,000 African elephants were killed by poachers in just three years.

Deer populations were likely reduced from hundreds of thousands (possibly millions) due to historic and modern "industrial scale" targeting (Laver 2012; for current population sampling and threats see also Daltry et al. 2012, especially Gray et al. 2012 for more specifics related to large mammals inclusive of several deer species). This will be examined further below. Although legally protected through various official policies, several species still remain under high threat. Policy enforcement is often lacking, although local awareness for protective measures are fairly robust. They know the consequences and many residents do try to minimize consumption.

Daltry and Traeholt (2003:104) note, "the indigenous wildlife communities are not entirely complete, however. Javan rhinos *Rhinoceros sondaicus*, have not been seen here for decades, although their name lives on in local place names, e.g., Chay Romeas ('Rhinoceros Rapids') near Chi Phat. Eld's deer *Cervus eldii*, and hog deer *Axis porcinus*, may also have gone. Interviewees in Chay Reap claimed there used to be literally hundreds of these rare deer in Trapeang Peang and other nearby wetlands, but they were all too easily shot by the 5,000 soldiers who were stationed near Chay Reap during the 1980s."

Resident human populations are low density and small. Local respondents indicated that ethnic Por and Sui Khmer minority people were more prevalent in the immediate survey area during the past. Currently, locals often identify themselves as Khmer, further qualifying identity with the place name of their village or settlement area in cases where their families are thought to have been indigenous (at least multi-generationally "local" in living memory). Linguistically, they are Khmer-speaking peoples related to more proximate inland and northern Khmer dialects. Few indigenous ethnic minorities remain and their population sizes are dwindling.

Most current residents are now ethnic Khmer, many having moved into the area in recent generations from various parts of Cambodia. Previously, many fled to Thailand during the Khmer Rouge regime and Vietnamese Occupation periods. Few Chinese and mixed Chinese are in the area, but are common in larger villages, nearby townships and urban areas. All residents are Buddhists, although traditional beliefs in *neak ta* and ancestral spirits are strongly incorporated into belief systems and practices. *Neak ta* beliefs are particularly influential.

Although the pre-modern ethnic settlement history is not well understood,[8] it is known that the Cardamoms were a significant resource zone for many exotic and commercial forest products in the earlier historic and prehistoric polities. The ancient and traditional industries related to extraction, processing, shipping, and management as well as the economic, social and trade networks that likely existed remain almost completely under-researched. It is highly plausible that various minority groups played significant roles in specialized industries and trade; much like the ethnic Kui (also spelled Kuay, Kuey, Kuy) have been specialists with iron manufacture, blacksmithing, and elephant capture/training since Angkorian times or earlier (Pryce et al. 2014). Local residents know of the Kui and their role as elephant catchers/trainers, but indicate the Kui are not part of the

8 Research has been conducted on the Cardamom skeletal remains from the Jar Burial sties (Beavan et al. 2014; Beavan et al. 2012), but this will not be detailed here. Some, however, are related to ecology, health and value/supply chain (e.g., questions can be posed regarding fish being imported and consumed, dietary deficiencies reflecting resource repertoire, diseases that are associated with certain ecosystems and so forth).

immediate social landscape; "they are located elsewhere in Cambodia…" Related past elephant capture and training practices, beliefs and "industry" vary significantly among other groups (e.g., the Bunong in Mondulkiri).

Currently, the main stream has its headwaters towards Ta Sai Village. River width varies but averages around 15–25 meters wide near the village areas. It floods in the wet season and is considerably dangerous and difficult to cross during that time. Medium and large lakes are absent in the immediate area, though some small lake-like and wetland-like areas occur towards the floodplains and mountain range peripheries. Small natural ponds are infrequent in the immediate area as well. Ponds around farmsteads are mostly artificial. The river is not heavily tapped for irrigation except in a few areas. Formal large-scale and well-designed canals and ditches do not occur, excepting a few locations. It is unknown if any ancient irrigation modifications were once built and used (e.g., chech dams, trapeang, canals and so forth).

The possible earlier existence of large-scale ancient water control features found elsewhere in mountainous or "upland" areas of Cambodia (e.g., Phnom Kulen and Koh Ker) to include canals, dykes, dams, reservoirs and irrigation systems are unknown. It is difficult to visually determine in the forested landscape at present. Remote sensing (e.g., LIDAR) and further ground survey may prove otherwise, as was the case at Phnom Kulen, Angkor, Preah Khan at Kampong Svay, Beng Mealea and Koh Ker. It is important to note the area has not been systematically surveyed and assessed to determine presence/absence of any ancient irrigation or water control systems (e.g., water capture, storage and distribution features such as canals, *baray* or *trapeang*—the traditional Khmer artificial water reservoirs) or other landscape features that are now defunct; to include ancient settlements and infrastructure, settlement patterns and landscape-scale impacts. Informal and/or pre-modern canals, if existing, are rarely used except for a few current rice growing strips.

Transport by river is limited. Rafts and small boats are used for crossing, local travel and fishing. Transport of goods, including lumber, to and from markets downstream (e.g., Kravan) is typically by ox-cart, motorcycle and occasional tractors and trucks where possible. Several water crossings are mandatory, including ferry crossings. Motorcycles are frequently used with difficulty. Trucks, tractors and cars have very limited ability to travel long distances in the area and are generally restricted to larger roads near Kravan.

3.1: Northern Cardamoms

The northern Cardamom regional ecology is best summarized in the following excerpt from Gene-Ecological Zonation of Cambodia report (DANIDA 2003:34):

> ***Geography***: The Northern Cardamom zone ranges across the leeward side of the Cardamom Mountains. The region is bordered to the North by the Tonle Sap Floodplain, and to the South the cloud-laden highlands of the Coastal Cardamom Ecozone. The eastern boundary is marked by the low alluvial plains of the Lower Mekong Floodplain Ecozone, where agricultural communities have removed all traces of its original woodlands. The Northern Cardamom Mountain Ecozone is slightly larger than the Coastal Cardamoms, covering around 12% of Cambodia's land surface.

> ***Determinant Environmental Factors***: The Northern Cardamom ecozone is distinguished from the Coastal Cardamoms on the basis of lower annual rainfall (800–1400 mm p.a.), and an extended dry season that often lasts for more than four months. A mixture of different soils can be found in this region, most notably Cretaceous sandstones. Nevertheless, a large granite outcrop dominates the highest and eastern-most reaches of the range (i.e., Mount Aural and environs). Like the coastal regions of the Cardamoms, the soils of the Northern Cardamoms are poor in retaining water and minerals.
>
> ***Plant and Vegetative Characteristics***: In response to drier climates and soils, the vegetation of the Northern Cardamoms is less robust and diverse than that of the coastal plains. Most forests are deciduous, and drop their foliage for over 4 months of the year. They produce timber trees of both primary and secondary quality, including species of *Anisoptera*, *Dipterocarpus*, *Ficus*, *Guttifera*, *Irvingia*, *Pahudia*, *Tetrameles*, and *Shorea* (Boyce, P., Eagnhourt K., & Sophal M, 2002 [sic])
>
> ***Priority Species***: *Afzelia xylocarpa* (Kurz) Craib., *Aquilaria crassna* Pierre, *Cananga latifolia* (Hook. F. & Thomson) Finet & Gagnep. (one source), *Dalbergia cochinchinense* Pierre (one source), *Dalbergia oliveri* Gamble (one source), *Diospyros bejaudii* Lecompte, *Diospyros cruenata* Thwaites (one source), *Dysoxylon loureiri* Pierre (one source), *Fagraea fragrans* Roxb. (one source), *Gardenia angkorensis* Pit., *Hopea helferi* (Dyer Brandis), *Pinus merkusii* Jungh et de Vries, *Pterocarpus macrocarpus* Kurz, *Shorea cochinchinense* Pierre (one source).

Older rock, granites, sandstones and a variety of complex mixed rock noted as "complex mixture" in the *Gene-Ecological Zonation of Cambodia* report (DANIDA 2003:27) are prevalent in the region—unlike the iron rich, reddish-brown, volcanic rock, basalt and soils such as found in the *terra rouge* hill regions of eastern Cambodia, or, the limestone karst areas found to the south near the coast and some other areas. Sandstones vary in color from gray (typical) to slightly reddish/pinkish and also a more buff color. The rock slabs on outcrops are worn from exposure to wind and rain. Rounded water worn boulders and cobbles are more typical near the valley drainage and river areas. Sandstone outcrops are typical on the many hilltops in the area.

In the more localized settlement area, the villages are ringed by larger mountains. Settlements and farm areas occur in the broader, lower and relatively flatter valley areas. Small worn rocky hills characterize the surrounding area. Evergreen and deciduous forest spread through much of the area. Local soils in the village and site areas are generally brown to buff in color; relatively sandy and rocky; and well drained. The soil throughout the Cardamoms is generally acidic and considered to have low agricultural potential except for flat alluvial flooded areas along drainages. Mixed agroforestry will likely have higher productive potential. Swidden plots are common and perhaps were standard and widespread in the past.

Villages are small with about 25–35 families per village. Kanam has 29 houses/families. All residents are farmers. Village histories and "founder" myths/legends were not known or described. Significant disruption in oral history traditions may have been a result of recent decades of conflict, strife and population movements. It should be noted, however, that some of the oral traditions suggest local people were descendants of the

Longvek people and period (post-Angkor); and, they were frequently at war with the Thai. Elephant catching, training, use, and trade was a tradition, but largely dissipated during the Khmer Rouge conflict; in some cases actively destroyed, with many residents and elephants fleeing to neighboring Thailand during that period.

Adequate agricultural areas are available for one paddy/wet-rice subsistence crop per year—usually harvested from late December to February. These plots are located behind houses and house gardens near the village on both sides of the river. Rice fields are usually amorphous in shape and are designed to take advantage of topography and a rain fed rice crop regimes. Rice and root crops are the main starch. Fruits, nuts, palm trees, bananas, bamboo, resins and forest products are important. The antiquity of wet-rice agriculture remains unknown. Given the nature of the Cardamoms vis-à-vis normative traditional mountain settlement by "hill tribes" throughout Mainland Southeast Asia, a fair amount of past swidden and "dry" (rain dependent) cultivation would be expected.

As indicated, the agriculturally managed environment also includes house gardens, fruit trees, *chamkar* (small plantations, plantation gardens and combination agricultural plots and plantation gardens generally located further from homes), and small scale agro-forestry or arboriculture areas—frequently referred to as *chamkar* as well. Coconut (*Cocos nucifera*) trees are common. However, the Khmer standard sugar palm (*Borassus flabellifar*)—prolific and definitive among floodplain Khmer landscapes—is neither currently prevalent nor heavily cultivated in Kanam Village. Some swidden agriculture may occur in various areas, but was neither noted during either survey, nor mentioned by respondents/residents.

Young woodland and bamboo characterize the uncultivated areas at present. It is unknown if thick stands of bamboo are natural or a result of past bamboo cultivation and promotion possibly due to more intensive use of bamboo in the past. Dipterocarps are prominent. The area was more heavily forested in the past. Larger tree stumps from logging are common throughout the area. Significant logging has occurred over the last 20 years. Secondary growth in various stages of forest succession is common. More mature forest areas occur within reasonable walking distances.

Hunting, fishing and capture/trapping of various mammals, reptiles, birds, amphibians, insects, etc. occur. Most animals are locally consumed as food or used for medicines. Animal and meat trade is not a significant industry among current residents. It is illegal or restricted to hunt most animals, including most existing species of deer. Bee honey is reportedly collected, but is not currently a large industry or a major trade commodity. Resin collection and processing are clearly evident, as is small-scale independent logging. Resin continues to play a small but important role in the economy. Resin, along with other forest products, may have had greater weight in past economies. Poaching has and does occur. However, 1) exactly what spectrum of wild forest products were/are targeted; 2) the extent, nature and impacts of extraction, processing, and management; and 3) the nature and mechanism of exchange to extra-local markets remain unknown. The Cardamoms host a considerable array of wild species, although the high biodiversity is rapidly diminishing due to habitat loss, urban and industrial agricultural/agroforestry encroachment, deforestation, mining, dam construction, poaching, and so forth (Figures 9 and 10).

Figure 9: Large-scale modern land modifications and clearance

Figure 10: Hydroelectric dam near Kravanh

The typical wooden houses are built on piles (wood), some significantly higher than others (often related to status/wealth). Houses are made of local wood and bamboo. Roofs are generally thatch with more residents increasingly using metal roofs. There is no school or religious structure (pagoda/monastery) in the immediate area of Kanam.

There is no electricity. Charged car batteries and generators are used. Wells are not used. The river/stream provides the water for bathing, washing, drinking and cooking. Large jars for rain water capture are less frequently used than originally expected. Common cylindrical metal tanks, however, are comparatively more abundant.

Many people (men and women) chew betel. Alcohol production (distilled rice wine) is common and most residents drink. Sugar or alcohol production from palms is not typical—contrasting with typical floodplain rice farmers in the Lower Mekong, Bassac and Tonle Sap areas to the east and south. This point may seem an odd ethnographic inclusion, but it is reminded that betel preparation containers and wine jars, for example, are important for archaeological and related historic, ritual and economic topics.

4: The Rock Painting Site

4.1: The Site and Its Surroundings

Only a single rock painting site has been identified, verified and documented in the area thus far (Figure 11). Only the Kanam Site has been visited for historic and archaeological rock art assessment to our knowledge. More painting and "cave" sites are reported to exist. However, there was confusion among respondents as to the nature of other sites and where they were located. Most descriptions were based on second-hand references. Several locals suggested the other sites are quite distant, and may have confused them with the jar burial and coffin sites. Descriptions also indicated some sites were possibly historic or purely natural.

Figure 11: Frontal view of the Kanam Site

Two amorphous, informally constructed, circular stone mounds (a few meters in diameter and 1–2 meters high) have been erected near the site (Figures 12a & 12b). They are adjacent to the path/road leading to the site. They consist of loosely piled stones with no formal facings. The mounds are said to be related to the site and serve as site markers. The antiquity of the mounds are unknown. However, they may have been more recently constructed (i.e., post-dating the paintings).

With the exception of the two piled stone mounds near the site, no other definitive sites or features were identified during the foot survey to the adjacent hillside and hill peak; up and down the path/road area; or in the adjacent drainage area down to the stream. The rapid foot/pedestrian survey (RFS) survey cursorily covered a 4 km^2 area. Additionally,

the pedestrian survey was opportunistic and only semi-systematic, thus having limited granularity and thoroughness. Several proximate rock features and outcrops were assessed.

The paintings occur on natural rock faces of the exposed natural rock outcropping formation at the top of a small hill, downslope from a much larger hill or low mountain; slightly upslope from the path/road (former drainage or terrace), and upslope from another drainage behind the site. The terrain is gradual with few instances of sharp faces or drops.

A former drainage area or terrace is now part of the existing road/path. It has large areas of exposed, flat, waterworn bedrock. The larger hill is mostly woodland with sporadic clearings from woodcutting activities. Rock outcrops are common. On the opposite side of the site, the slope drops significantly to the current drainage a few hundred meters away. Vegetation becomes much thicker and soil moisture increases as expected. The sandstone soils seem fairly well drained.

Figure 12: Stone mounds marking Kanam Site access

Note condition of boulders, cobbles, stacking, vegetation, etc

The rock outcrops consist of large rounded and angular blocks as well as plate-like blocks of exposed sandstone boulders. Many are naturally stacked in appearance (caused by natural fracturing and weathering). These natural outcrop features are characteristic of the landscape in general, especially on hilltops. Other rock outcrops, facings and overhangs are common in the immediate cluster of outcroppings, but none show signs of paintings, archaeological deposits or modification.

It cannot be ruled out that some stone features elsewhere in the Cardamoms may be megalithic structures. The possibility of hilltop megalithic "table" stones has been reported in parts of the Cardamoms (Latinis n.d.), but no formal investigation and validation has been conducted. The Kanam rock painting site is clearly not an anthropogenic megalithic structure. No indications of heavily worked stone are visible on the existing rock or around the site area.

It is reiterated that no other archaeological features or deposits were noted in or around the rock painting site with the exception of the two stone mounds. However, we would reasonably expect a few additional sites in the area, even if they are sporadic or intermittent in nature (e.g., processing stations, temporary or seasonal habitation, settlement sites, others). The artifacts showcased by the local villagers also support the likelihood of additional sites in the vicinity—perhaps related more to sedentary or semi-sedentary populations to include groups connected to larger trade networks and supply chains.

Despite some references to "cave site", the rock feature site itself is a sandstone rock outcrop and overhang rather than a deep cave or large rock shelter (not particularly large: approximately 5 m high, 5 m wide and 5–10 m in length depending on how it is measured). The ceiling contains almost all paintings and measures approximately 4 by 3–4 m—the approximate dimensions of the "roof".

The roof/ceiling is a laminar slab of rock about one meter thick. A primary site danger is possible roof/ceiling collapse.

The morphology and location of the outcrop have fortunately protected the paintings from intensive exposure. Most paintings occur on the underside of a very large slab that forms the ceiling of the overhang. This further protects the paintings from rain, direct sunlight, wind exposure and erosion.

A large, flat broken slab occurs at the lip of the overhang. Red staining occurs on the surface of this slab. It is reasonably plausible that this is an area where red paint was prepared. No clear evidence, however, supports this hypothesis at present. In other words, red staining is visibly evident, but staining as a result of paint preparation was not confirmed in the Jan 2015 assessment. It is possible the red staining may be natural or a result of the erosion from above. Further assessment is needed. It is clear, however, that no discernable anthropomorphic or zoomorphic drawings are evident on the slab.

4.2: Painting Locations

Paintings mainly occur on the upper ceiling. This would have required some support to draw. It is unknown if the ceiling placement was an intentional feature for specific reasons (e.g., enhancing ritual practices). The two most prominent outward facing paintings are elephants and riders occurring on two contiguous vertical rock faces at an approximately 90 degree angle (Panels 1 and 2). There may be an intentional reason, such as "outside" or outward facing display. Nonetheless, the location of these two paintings on vertical facings occur in a deeper niche-like area and are not ominously visible from a distance.

No paintings were noted on other walls, the table-like rock slab at the base and front of the site, or the exterior of the site. It is arguable that some paintings on certain locations (e.g., other vertical walls) may have completely eroded over time and are thus "invisible", but it would be expected that indicators would be present on at least some parts of panels (e.g., panel 6 has signs of partial erosion or degradation on a large section, but indications of paintings are still visible).

Panels 3–8 are complex. Panel 6 is arguably the most complex, eroded, covered in insect nests, and difficult to disentangle. Panels do not necessarily reflect artist or user intent, although it is possible that an unknown zoning system was used and equally possible further analysis may shed light on this topic.

4.3: Paint

Red ochre or a similar reddish paint or stain was likely used to draw the images. Hematite is often assumed for many sites as it is also found in many archaeological deposits, but the use of plant resin is a possibility.[9] Several specific types of rock are crushed and powdered in other parts of Cambodia to create red slips and paints for pottery; also used for glaze recipes (recent ethnographic interviews of potters in Siem Reap noted various rocks from Kulen and Kampong Chhnang are preferred for glaze, paint and slip recipes). Other additives such as oils, plant extracts, etc. are a possibility worth investigating. No paint samples were collected and analyzed during this phase of research, however.

It was suggested that a powder may have been prepared on the table-like rock slab at the lip of the overhang by crushing select rock and mixing with water. However, observations made during the site visit and data recording yielded no definitive evidence of paint preparation on the slab.

White chalk or powder was more recently used by local residents to highlight image morphology by outlining traces on several of the ancient paintings. Although semi-destructive, this was inadvertently done prior to the research team's arrival. Subsequent efforts were made to explain the potentially negative and possibly misleading effects. Evidence of carving, pecking, chipping or filing was not noted. Only the use of paint was evident. No inscriptions are noted in the immediate area.

4.4: Style and Technique

Paintings were likely drawn and filled with fingers. There is no indication that brushes or fine painting implements were used. Some of the antlers and other body parts are quite thin, however. This may indicate the use of a brush or similar implement. Most line widths, fill and blobs/balls suggest finger width. Identifying finger prints or finger strokes, however, is difficult.

Paint coats do not appear thick. Most appear to be single coats or applications. Some images are thin and highly faded. Many images appear to have been painted over. At least 25 cases of superimposition were noted during the normal image analysis, confirmed and accentuated with the DStretch analysis to include more cases of superimposition—many likely long after original images were highly faded and/or some spalling had occurred.

Images were consistently painted in monochrome red. Black, grays, whites, or other colors do not seem to occur. A few speculated black or brown images could be present, but it is difficult to determine. The white chalked images are recent overlays and outlines as noted above. The implications of red coloring are unknown except ethnographically. Red is often significant in many cultures (e.g., representing blood, danger, prosperity, magic… and so forth). Nevertheless, red may have simply been the most readily available pigment. Monochrome red is common to rock art sites throughout the Southeast Asian region.

Almost all paintings are side profiles and silhouettes with all appendages represented (e.g., four legs on mammals, two ears on deer, two horns on buffalo, full sets of antlers, two arms and two legs on humans, etc.). A few animals may be represented as oblique profiles, and a few humans may be represented as facing silhouettes.

9 Pigment analysis on Niah Cave paintings indicate paint was derived from local tree resin, contrary to original speculations of hematite (Tan 2014:89).

Morphological redundancy and simplicity are typical. Although distinct body parts on animals were prominent, for example, the actual paintings are not complex and intricate (i.e., somewhat stick-figure, silhouette, or simple shape figures). The decorrelation stretch (DStretch) analysis highlighted additional intricacies, mainly more complex and fine line antlers that were not evident in normal image analysis. Stylistic variability does not seem prominent with some variability in overall shape of animals (more prevalent in the deer clusters in Panel 6, for example). However, the simplicity of the representations may render subtle stylistic differences difficult to determine. It is possible that only a few artists were responsible for each episode, and separate artists may have followed an established pattern or template, although this is purely speculation.

As Table 1 indicates, up to and likely exceeding 222 separate "paintings" were identified (note above on approximated 75% accuracy of these overall counts). Up to 300 "lines" or abstract markings occur. Many straight, bisecting, curved and arched or wave-like lines appear to have been made to intentionally represent something. Some of these may have been drawn at larger scales than observers originally thought during field data collection and initial analysis. Many of the lines may have been part of animal paintings, tools or specific features, although there is no clear indication. Some may be natural colorations and striations of the parent rock. They remain enigmatic. A few unfilled circles were noted including an image of what looks like concentric circles with a solid monochrome circular center. A few lines may be black or white (unknown if natural or anthropogenic in some cases). The aforementioned tapered animals could be interpreted as pigs (or something other than deer, cow, elephant or human). One image had dots instead of solid fill—possibly representing spots.

5: Data Recording and Analysis

During the course of data recording, eight panels/zones in the natural facings were created to organize image clusters and simplify the process. Paintings were numbered according to panel or zone (Figures 13–17).[10] Attempts were made to isolate individual images and subsequently given a specific number. However, because many images were clustered, the cluster rather than the single image was given a number due to time constraints and/or inability to separate multiple images (too obscure or overlapping in some cases to isolate with confidence, especially given time, lighting and location constraints).[11]

Photographs, cursory drawings and notes were taken. Video recordings were also made. Many of the paintings were difficult to reach and photograph; some having better lighting than others. Simple digital cameras were used with no external artificial lighting. Camera flash was used on occasion with frequently poor results.

10 A note on scale(s): the red tape width for labels in all images and panels is approximately 1.5–1.75 cm depending on angle and image processing. An appropriate scale was unavailable during fieldwork, although basic measurements of images were collected. Statistics on image sizes have not been conducted thus far.

11 Future numbering should isolate individual images and even individual elements within single images. Capturing a complete high resolution pan image (photographic and/or drawing) was beyond the scope of data recording and analysis for the current project, but will assist future research and information dissemination.

Figure 13a: Placing panel or zone markers for data recording

Figure 13b: Placing panel or zone markers; Preliminary photo recording – side view

Figure 14a: Panels 5–8; Oblique view with labels

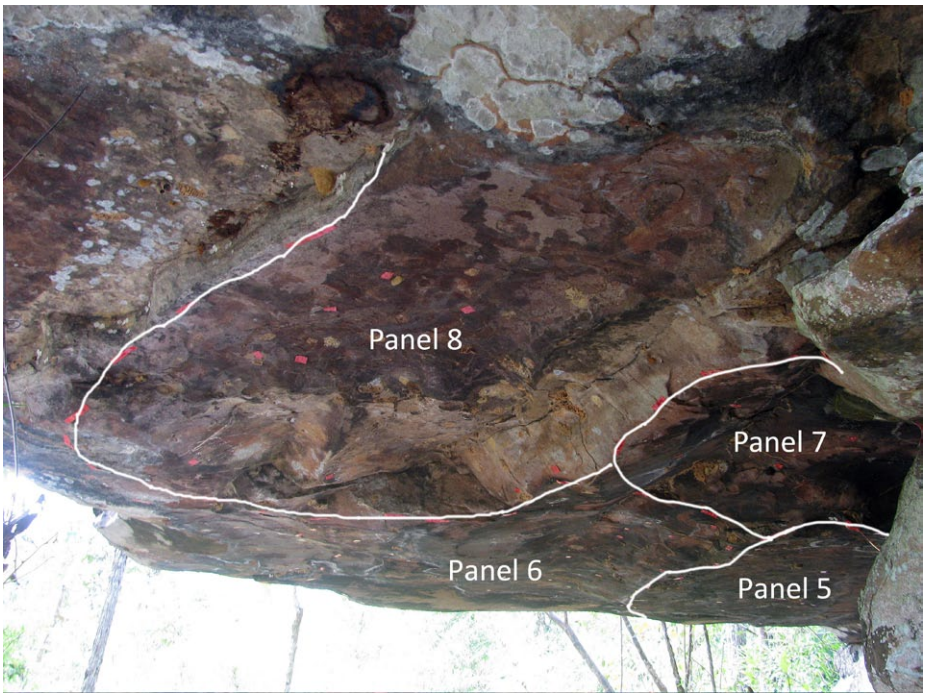


Figure 14b: Panels 5–8; Oblique view – DStrech image enhancement

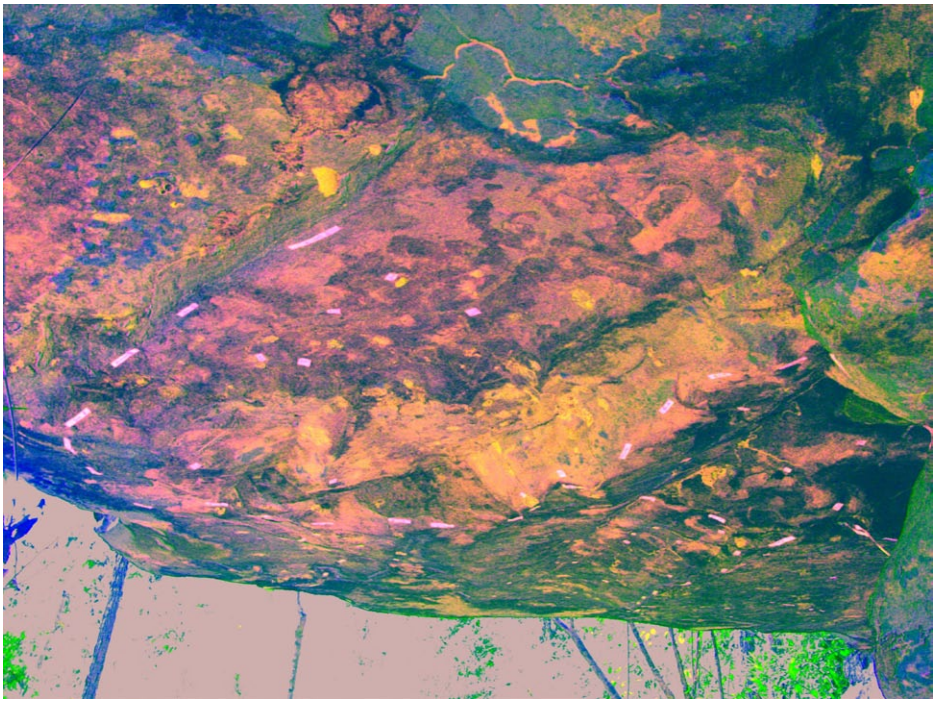


Figure 14c: Panels 1–5; Oblique view with labels

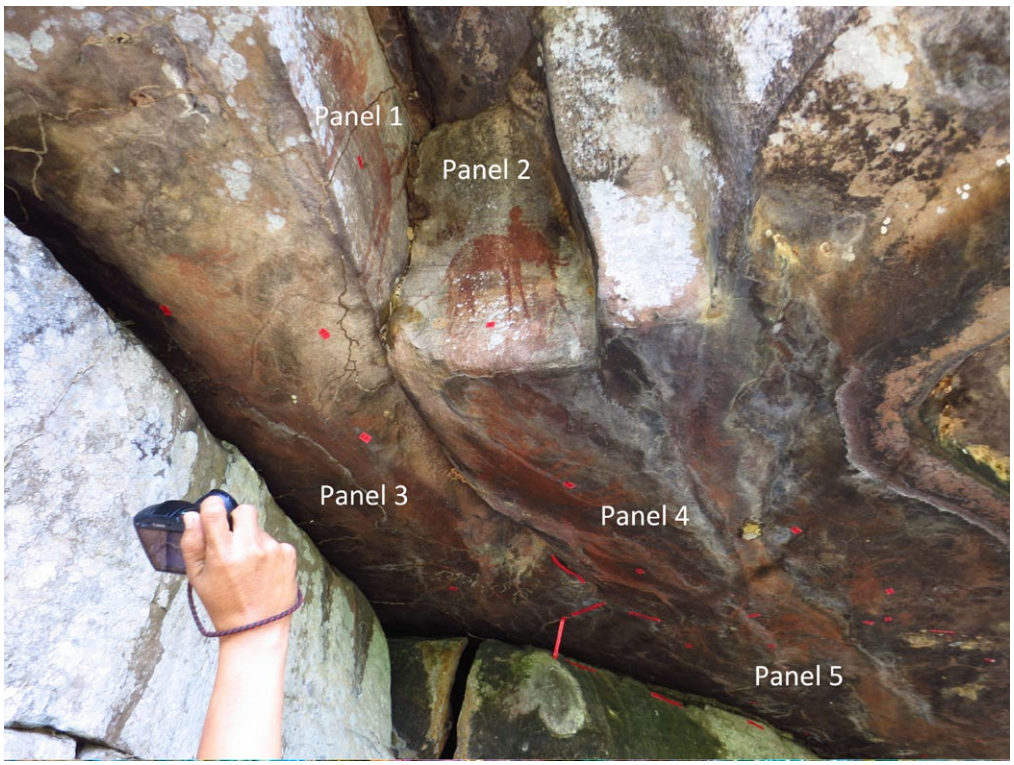


Figure 14d: Panels 1-5; Oblique view – DStretch image enhancement

Figure 15a: Various panel examples from Kanam

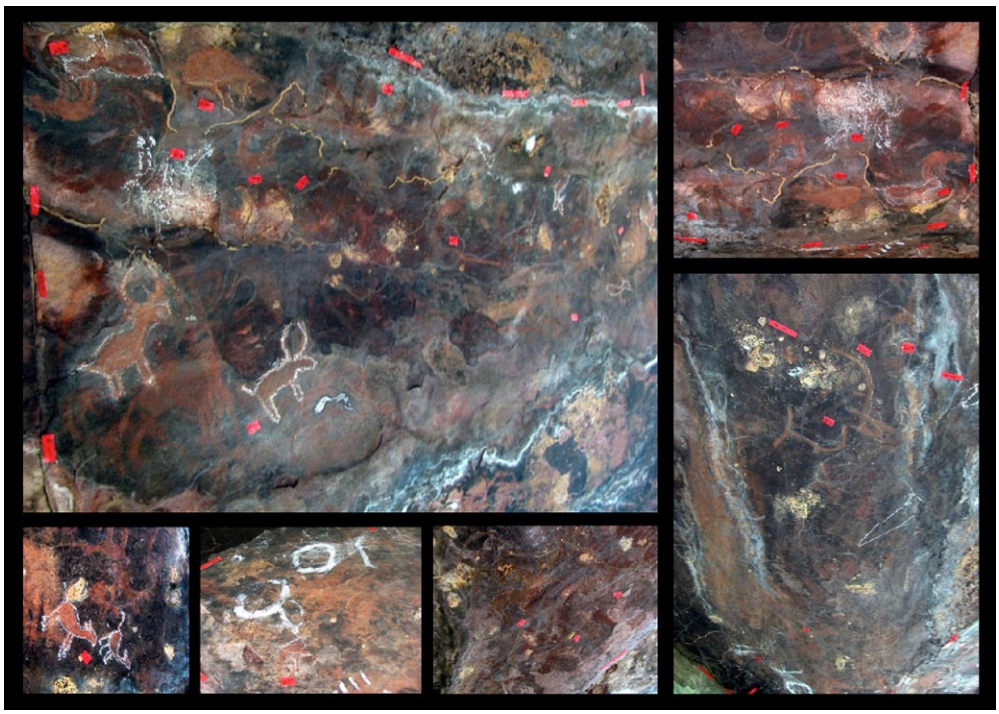
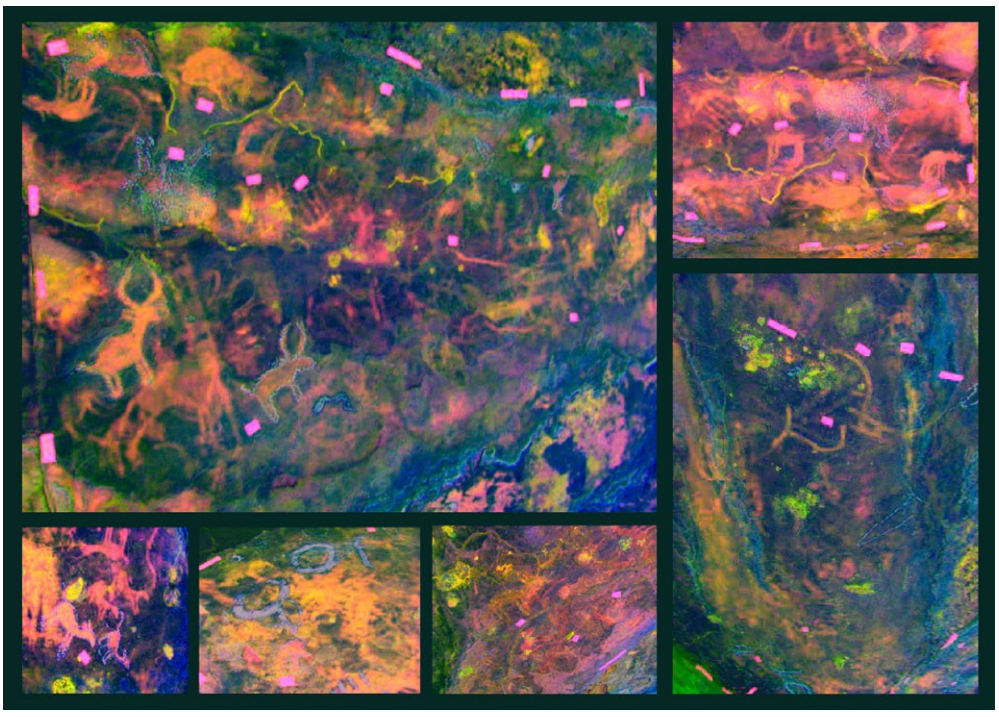


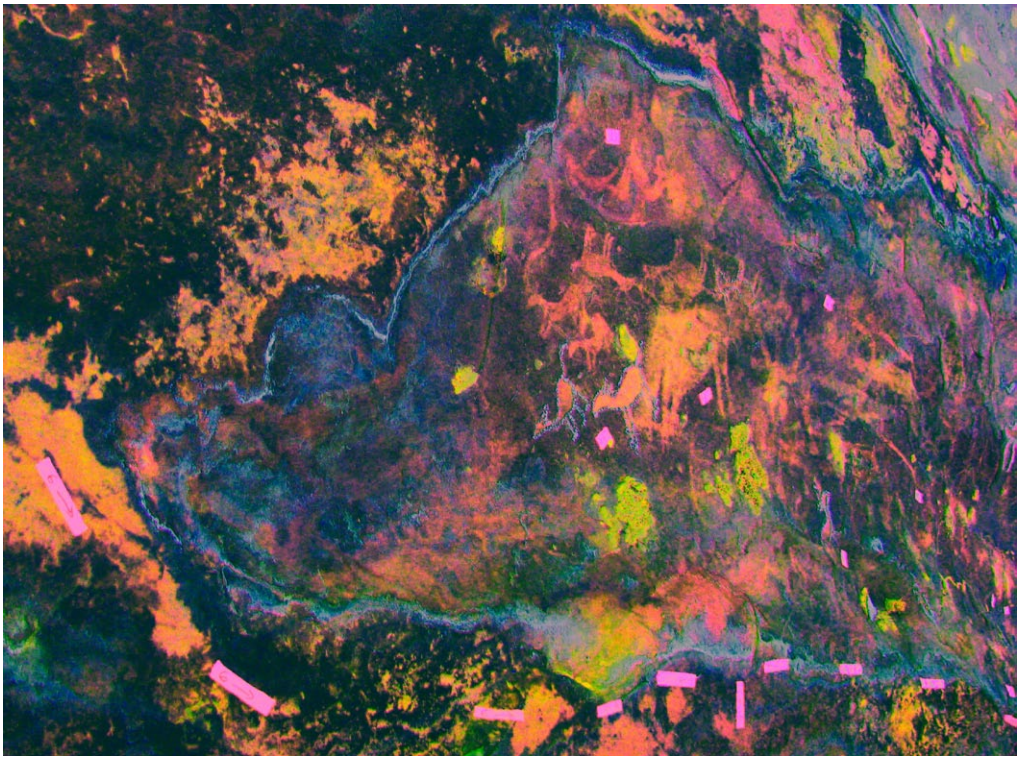
Figure 15b: Various Panel Examples from Kanam – Dstretch Image Enhancement



These images depict various arbitrary panels or zones for data recording. Note the conditions, seemingly random painting placements (although clusters are evident in DStretch analysis), superimpositioning of some images, white chalk from recent outlining attempts (generally incorrect tracings), and ambiguity in mammal identification. Note the abundance of deer and/or medium-sized mammals.

Figure 16a: Photo of panel 6 – Considerably complex (contrast heavily accentuated)

Figure 16b: Panel 6 from Figure 16a – Considerably complex – DStretch analysis YBL



Note multiple animal clusterings to right of image (especially deer); at least two clusters at oblique planes.

Figure 17a: – Closeup photo of panel 6

From Figure 16a; right side of upper image is left side of Figure 17b below. Note abundance of deer.

Figure 17b: Closeup photo of Panel 6

Note "superimpositioning" of deer and large mammal (possible elephant); planes of animal clusters at oblique angles.

5.1: Phase 1 – Paintings, Pictogram and Image Assessment

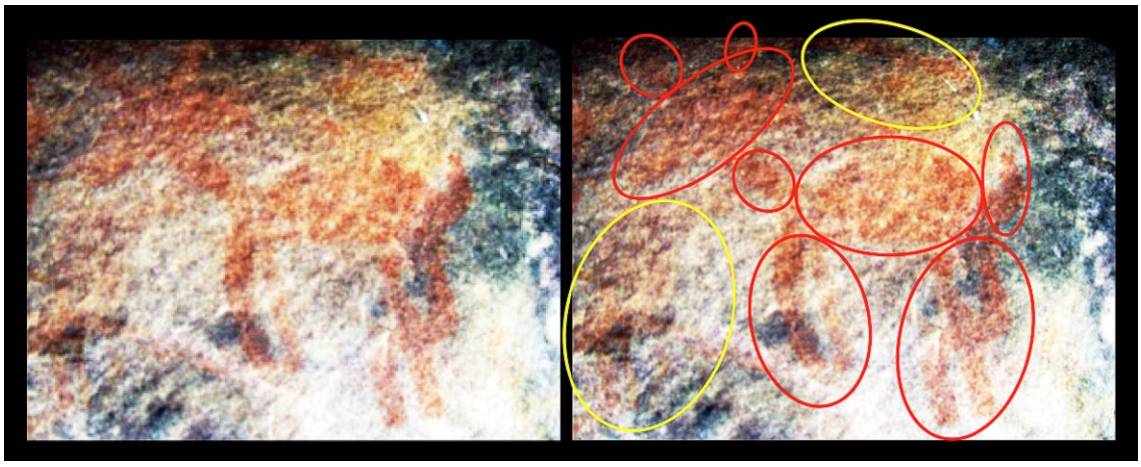
Most paintings include representations of animal and human figures as well as abstract lines, blobs and faded/clouded regions (likely multiple superimposed and eroding images). Size ranges from a few centimeters to dimensions as long as 30–50 cm.[12]

Some artisans may have used the topography on natural facings to accentuate certain features, yielding a more three-dimensional appearance to some images, although this technique is by no means robustly or definitely evident. Because most images are simple profile or silhouette depictions, three-dimensionality was not likely intended.

Original interpretations suggested a wide spectrum of species thought to represent elephants, water buffalo, cows, dogs, deer, pigs, and possibly birds, monkeys and a rabbit. This has since been refined to a more limited list of exclusively medium to large-sized mammals (Table 1). No reptilian, amphibian, insectivore or other major animal categories were noted. Likewise, no floral/plant, architectural, geological/natural landscapes (e.g., mountains, forest, streams, sky), anthropogenic landscapes (e.g., field systems, plantations), or astrological representations were identified.

Initial methodology for identification included designating criteria by dissecting distinct images into identifiable constituent anatomical parts and structures (e.g., body parts, locations, structures: legs, leg structures, leg positions, bodies, body structures, heads, head structures, head locations, horns, antlers, tusks, ears, trunks, mouths, tails, implements in hands, etc.; Figures 18 and 19). Comparative anatomical analysis was visually conducted from available animals in the area, publications, and website images (Figures 20–22). Very few paintings were 100% identifiable. Readily identifiable species were mostly elephants and humans. All photographed images were assessed with five iterations (one person) for comparative accuracy and consistency. Future analyses should include multiple assessors.

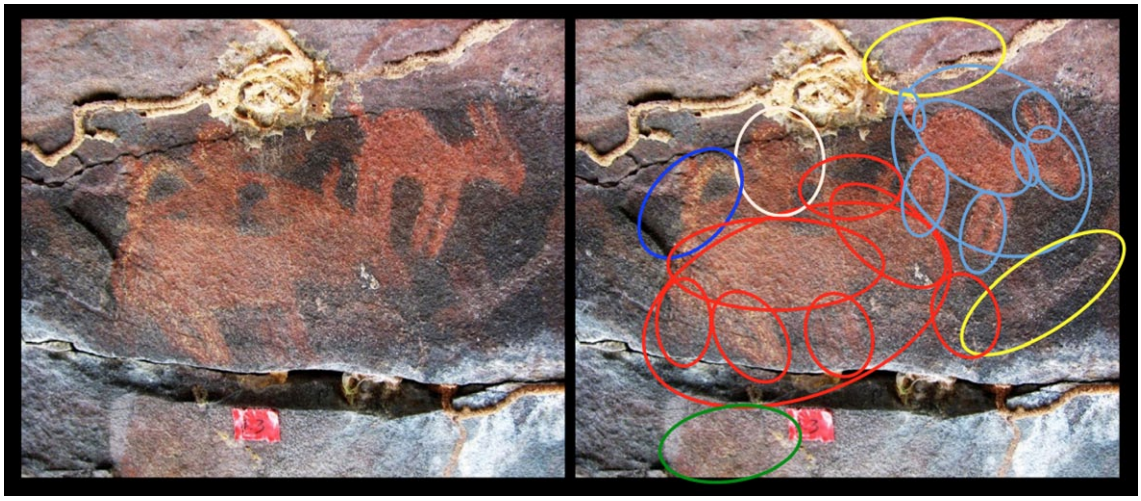
Figure 18: Breakdown by anatomical body parts for image separation and species identification



Example of breaking down images into constituent parts; different colors relate to images that are likely separate entities.

12 Most are intermediate (10–20 cm). Due to their amorphous nature, their location, total number, lack of appropriate equipment, and time constraints, exact measurements were not made. This is necessary for future research to include a color and metric measurement scale (that can adhere to the surface, or be properly placed without damaging the paintings).

Figure 19: Further breakdown of complex pictogram into separate entities and anatomical parts for improved identification

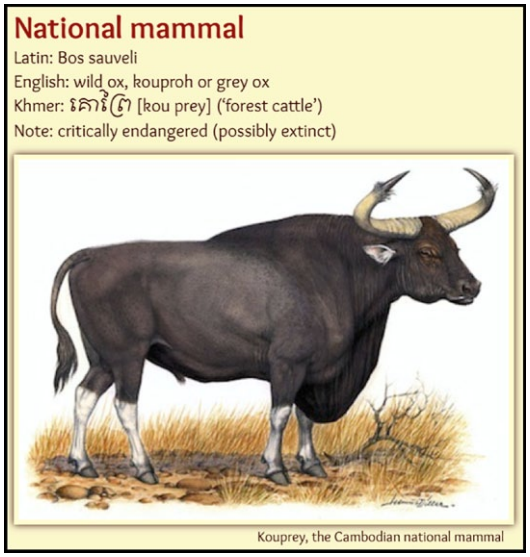


The process can become very complex, but useful. Analyzing constituent traits help build a more accurate assessment. Some traits are weighted more heavily (e.g., tails, ears, tusks or leg shapes may be more definitive than general body shape or head). This is an interesting image as it almost appears as if a person is handling or wrestling an animal. If fact, it is more likely a superimposed image or elephant with rider. There are indicators such as the arch-like implement or line that occur in other elephant and rider images, for example.

Table 1 and Figure 23 indicate "confident" classes or categories (approximately 50/60–100% accurate) and speculative classes (approximately 10–50/60% accurate; but sufficient criteria to speculate beyond "unidentified medium to large mammal"). It was also estimated that approximately 75–80% of the images were accurately identified as distinct entities, although not all images were identified. There may have been some overlap, repetition or missed/overlooked images and the likelihood of many superimposed images added to a notable degree of confusion and speculation. Additionally, one image cluster with vague and overlapped images could be interpreted multiple ways.

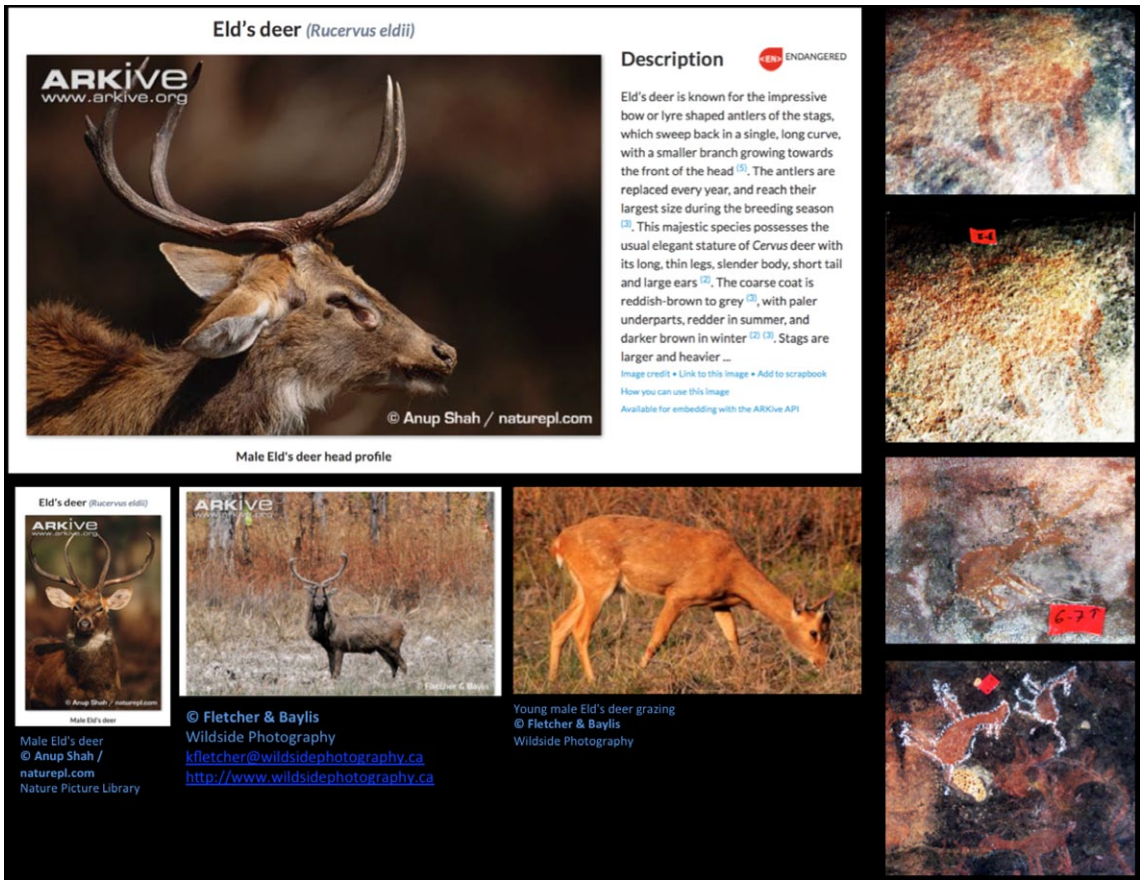
Figure 20: Comparative anatomy example 1 from seminar slide presentation

Figure 21: Comparative anatomy example 2 from seminar slide presentation



Kouprey image: Copyright: WWF/Helmut Diller on: cambodia.panda.org/projects_and_reports/endangered_species/mamammals/kouprey. Image with text from: www.rikitikitavi-kampot.com/environment/flora-faun/national-symbols-of-cambodia (WWW/Helmut Diller not cited in website)

Figure 22: Comparative anatomy example 3 from seminar slide presentation



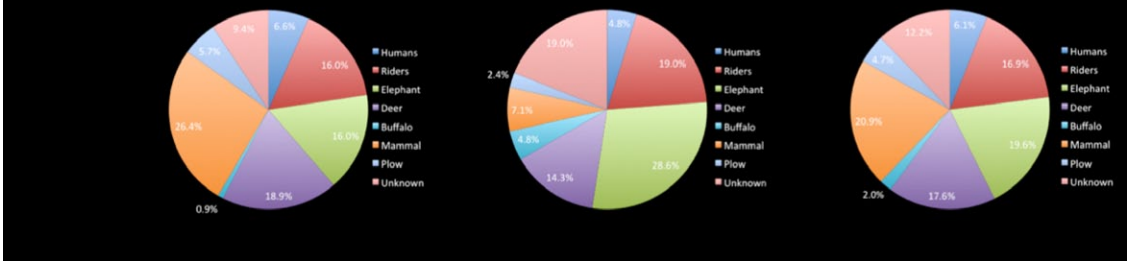
Adobe Photoshop enhancements proved useful (particularly brightness and contrast), but quality and size of the digital images were the main criteria for accurate image assessment. It is unfortunate that full panel shots were difficult to obtain, especially with consistent lighting. The complete assessment and description database is not provided here due to length.

Original bias from locals, previous researchers, and current researchers (authors included) leaned towards identifying a diverse spectrum of animal species and genera (to include avian, reptilian, etc.); a large component of agricultural related species (e.g., domesticated buffalo and cows); and a sizeable representation of pigs—surprisingly absent unless misidentified (there are a few potential exceptions following the DStretch analysis). Thus, the results were unexpected and countered original interpretations.

Clearly identifiable animals include elephants, deer and humans (Table 1; Figures 23–29). A possible buffalo is present, though not a unanimous consensus. Many of the deer can be interpreted as wild cow or buffalo pending observer's preference. Antlers or horns are usually circular/semi-circular and "halo-like". These could be representative of wild cow, buffalo or deer species in the area. Tails, legs and bodies seem to be more indicative of deer, though by no means definitive. Nevertheless, the hypothesized greater spatial-temporal cultural and economic context suggests deer were a priority economic target if local residents were a significant supplier in the historic deer trade value chain.

Figure 23: Initial image assessment summary - classes, counts and percentages

Category	Confident Classes (multiple criteria)	%	Speculative Classes (limited criteria)	%	Combined	%
Humans	7	6.6%	2	4.8%	9	6.1%
Riders	17	16.0%	8	19.0%	25	16.9%
Elephant	17	16.0%	12	28.6%	29	19.6%
Deer	20	18.9%	6	14.3%	26	17.6%
Buffalo	1	0.9%	2	4.8%	3	2.0%
Mammal	28	26.4%	3	7.1%	31	20.9%
Plow	6	5.7%	1	2.4%	7	4.7%
Unknown	10	9.4%	8	19.0%	18	12.2%
Total	106	100.0%	42	100.0%	148	100.0%



Numerous mammals cannot be identified other than medium to large mammals. There are drawings of what appear to be plough riggings/apparatuses, but these images could also represent other tools or implements (e.g., elephant riggings, hooks [angkus] or other riding implements, spears, lassoes,[13] ropes, bush knives, rice cutters, etc.; Figures 30 & 31). Humans—mostly elephant riders—are clearly depicted with a few riders holding unidentifiable implements which do not appear to be battle or hunting related weapons such as spears, swords, bows or shields.

Some riders are standing, while others appear to be seated. The ratio of human height to elephant back height ranges from about 1.5 to 2.5; suggesting artisans may view elephants as about twice as tall as the average rider.

A few riders have what appear to be some form of head dressing or head gear (Panel 8, Image 8; Figures 27 and 32). Figures 32 through 39 showcase a spectrum of DStretch algorithms which exemplify a range of views for comparison (discussed below). These riders are also holding implements or gear. Two riders at the rear may be holding curved shield-like implements, each with a single end that is hooked or composite. Another standing rider at the elephant's head is holding an unidentified implement (perhaps angkus) with a transecting piece on one end in one hand and another straight stick-like implement in the other hand. The middle rider (standing) may be pulling a third rider with both arms, although the third may actually represent some form of equipment (not likely given the round spherical blob possibly representing a human head). This is perhaps the most mysterious picture, though seemingly easy to identify. It is noted that another unusual painting of possible people holding round objects in hands (Figure 33a–c; also further demonstrating use of DStretch image analysis) was originally thought to represent multiple humans. Some elephants depict multiple riders, others single riders, and others no riders.

Figure 24: Elephant with single rider panel/painting 2 (outward facing on vertical wall)

The rider is seated and facing forward. The staining in red at the base of the image may be a separate image. It was difficult to discern given the angle and height while doing field assessments. However, the photograph intimates a lower faded image (possibly an elephant). The horizontal lines at the lower left of the upper clearly visible elephant image (near its hind legs) may be another figure as well. Use of Decorrelation Stretch image enhance suggested up to three superimposed elephants (confidently two).

13 Buffalo hide lassoes are stated to have the most associated magic, ritual and importance. In this case, the buffalo, hides and sinews used for manufacturing lassoes are prioritized in ritual and magic, to include the manufacturing process. It is possible that the depictions are lassoes or compound tools with lassoes. Nevertheless, some images with the exceptionally long curved lines do appear more tool-like.

Figure 25: Elephant with 3 riders; panel/painting 1

Note: Two forward riders appear seated and facing forward. The third, rear-most rider is standing with possible tools/implements in either hand.

Figure 26: Elephants with riders on outward facing vertical panels (1 and 2)

Note the positions of the elephants are facing away from each other (Panels/Paintings 1 & 2). The meaning, if any, is unknown. Also, it should be emphasized that although the elephants and riders are the only two outward facing paintings on a vertical face, they occur within a niche-like area and are thus partially hidden from the exterior (and better protected from exposure to elements not conducive for preservation). It is unknown if the Panel/Painting 1 Elephant and Riders, like Panel 2, has additional faded or hidden paintings (further to the left). Lastly, if intentionally clustered with the elephants in Panel 4, this would represent a particularly interesting combination: vertical and horizontal panels (ceiling and walls) with multi-directional entities.

Figure 27: Elephant with multiple riders (complex multiple images; Panel-8, Painting 8-1)

The two forward riders towards the elephant's head are both standing and possibly wearing head gear, or headdresses. It could represent a hairstyle. The forward-most rider appears to be holding implements/tools and possibly facing sideways or backwards. The second rider almost appears to be pulling a third rider (likely with head and implement) or holding something towards the rear. A fourth rider is ambiguous, but likely given the ball-shaped head and similar implement. The rider may be mounting the elephant (appearance of climbing). The left section of the "scene", however, is perplexing and complicated. There are multiple entities; possibly overlaying animals. The lower left section of the image may contain a faded image of a deer superimposed by the painting of the elephant and riders. The full breakdown of this image(s) and realm of possible interpretations are considerable.

Figure 28: Elephant with penis and possible riders

The penis depiction is interesting. Are the others females? If so, we may be able to discern the possibility of sexual preference for elephant use and related ecological considerations as well. Gender bias towards captured elephants also may be important for both practical and cultural reasons as well. Also, considering the oral history of penis size and age longevity for elephants, it is possible an additional message was intended.

Figure 29: Elephant with rider and possible buffalo image

The rider, though speculative, may be standing. Also note the possible buffalo inverted at the base of the elephant. This was the only possible buffalo image that had a majority agreement among local observers. Not all authors agreed, however. Some remain skeptical, and may fall into the realm of unknown. In fact, what looks like a complete animal may actually be overlaying parts to other animals and abstract lines (a problem encountered frequently throughout the analysis; the spalling, insect trails, other surface alterations, natural colorations, and lighting can easily deceive). It may be the head of another animal, for example. Lastly, the three lines possibly representing the horns and head (a three-pronged pattern if viewed in a specific manner), was a pattern noted in two or three locations not necessarily related to clearly identifiable animals—in fact, they appear diamond shaped with a bisecting line, and one was thought to be the lower half of a human stick figure silhouette representation.

Figure 30: Possible plough or plough apparatus

Local respondents are fairly confident that these represent ploughs. Although a possibility, it is likely that these may represent other equipment related to elephant capture or use and equally possible something entirely different. The curious point about ploughing equipment is that the environment, topography and ecology are more amenable for swidden and hill rice agriculture, as remains the common practice—i.e., not ploughed field systems. Also, there are few "domesticated and agricultural" indicators in the entire make-up. Although elephant control/taming (not domestication) is emphasized, agriculture is not.

Figure 31a: Comparison of possible plough or Angkus with ethnographic examples

It is possible that the images relate to lassoes, traps, ox-cart riggings, gates, roads/paths, other animals, etc., or, something entirely different. With increased analysis, the authors became more skeptical of plough assignments to the images, especially given consideration of the more plausible economic and ecological context.

Figure 31b: Example of phkeak

5.2: Phase 2 - Decorrelation Stretch (DStretch) Analysis and Comparative Methodologies

Decorrelation Stretch (DStretch) analysis renders digital images through various algorithms to enhance subtle color differences (see Harmon http://www.dstretch.com). Different stock algorithms allow certain aspects of many images to be more clearly discernable. The plugin was originally designed for remote sensing (also used by NASA), although has significant contributions to rock art research further developed by Dr. Jon Harmon.

Figures 32–39 are used as an introduction to the Decorrelation Stretch (DStretch) analysis for Kanam. DStretch analysis was suggested by Dr. Noel H. Tan, who also provided an initial analysis of select images. Subsequently, software and instructional guidance were provided by Dr. Jon Harmon. The greatest use was not on this particular image per se, but the clustered and superimposed entities on several other panels.

Several depictions are superimposed. Many are difficult to discern with other image enhancement software. Some are barely discernable. Comparing different Kanam images from different DStretch stock algorithms resulted in better identification of more images. Images and panels were re-evaluated with approximately 10–20 different stock and manually adjusted algorithms. The original analysis took approximately 6–8 weeks. The DStretch analysis took approximately 2–3 weeks.

Table 1 lists the initial analysis at the top in which 148 entities were identified; 42 of them speculative. The DStretch analysis resulted in an additional 74 entities (total of 222); a 33% increase!

Two DStretch tables are presented in Table 1. The upper DStretch table (middle table in Table 1) includes a series of "round blobs" as potential human head representations. The logic of "human" class identification was similarity with elephant riders' heads and stick/line-like appendages. The second DStretch table (lowermost in Table 1) includes a re-evaluation of the possible human heads and moved most to the unknown category. Several other tables were created to assess possible gross variations in the statistical distributions of classes (not detailed here). Overall results are fairly consistent vis-à-vis priority questions pertaining to this particular preliminary research and methodological comparison.

Figure 32: Image 8-1 elephant and riders - DStretch LABI

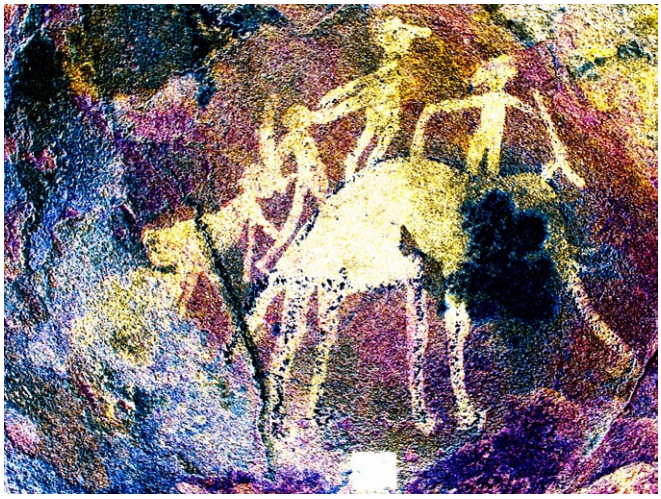


Figure 33a: Image 5-2; people holding objects

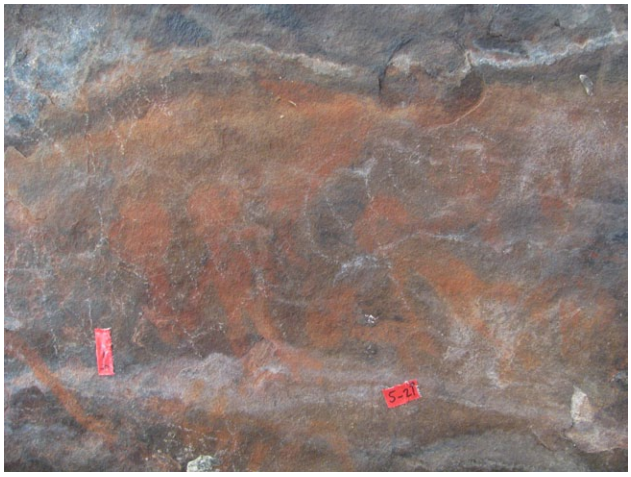
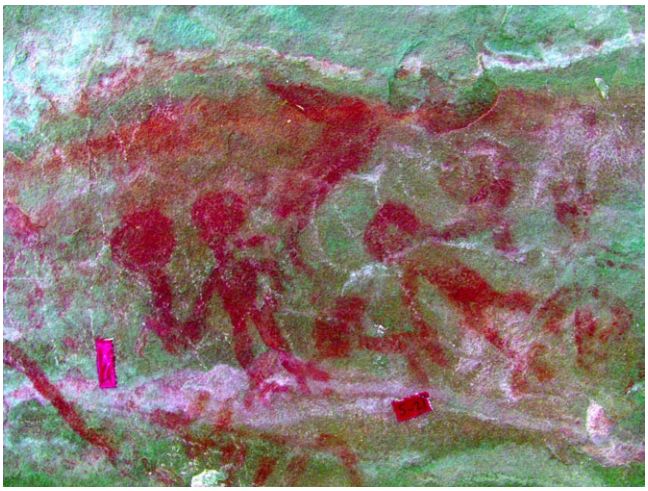


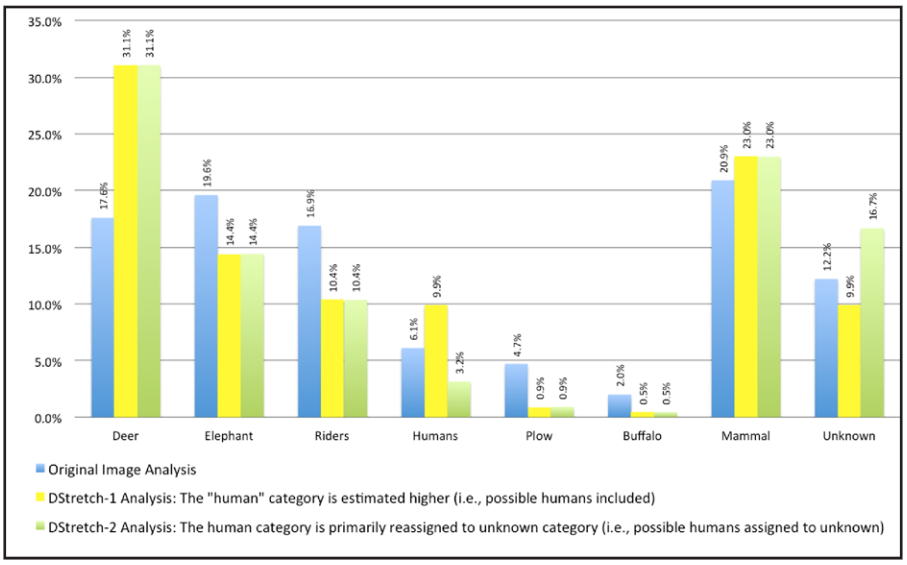
Figure 33b: Image 5-2; people holding objects – Dstretch LABI

Figure 33c: - Image 5-2 - people holding objects – Dstretch RGBO



The first visual analysis (Table 1; Figure 34) resulted in 28% speculative classes (72% confident). DStretch analysis resulted in 36% and 39% speculative classes respectively (64% and 61% confident); an 8–11% increase in speculative classes (8–11% decrease in confident classes). This may be considered somewhat marginal considering the overall recognition and identification of actual images present at the site is still liberally estimated to be around 75% (we are fairly confident many things were unrecognizable, missed or overlooked and not all panels images were 90–100% accurately recorded). Nonetheless, DStretch helped clarify many images while resulting in the addition of many more ambiguous entities.

Figure 34: Histogram of category percentages by analysis: normal visual analysis, DStretch-1 analysis, DStretch-2 analysis (humans adjusted)



The most striking increase in the DStretch analysis occurred among the deer category; changing from 17.6% to 31.1% (13.5%; total number from 26–69; most significant increase in the speculative category) (Note: some observers may quite acceptably argue several entities represent *Bos* spp). The total number of riders decreased slightly with the DStretch analysis (25 to 23) while the total number of elephants increased slightly (29–32).

Interestingly, the number of confidently identified elephant classes decreased with the DStretch analysis (17 to 10). Overall, elephant and rider percentages decreased by 5.2% and 6.5% respectively (expected with the increase in deer recognition). Medium to large-sized mammals increased 2.1%. Ploughs decreased to 0.9%. Unknown representations increased. Finally, 50–60 lines were noted in the first analysis (curved and straight lines; not listed in Table 1); 275–300 lines were noted with DStretch Analysis. Many may have been part of animal paintings, tools, riggings, or specific features. There are no clear or specific morphological indicators, however. Many are likely part of earlier images that are faded, partially spalled or overdrawn. They remain ambiguous and enigmatic, although curved arch-like or wave-like lines are frequent (some large and transect other images).[14]

14 It cannot be ruled out that some arch-like lines may represent yokes, shoulder poles for carrying goods, gates, paths, or even animals such as snakes; many explanations were offered.

Figure 35a: Panels 1 to 4 – normal view

Figure 35b: Panels 1 to 4 – DStretch LABI algorithm

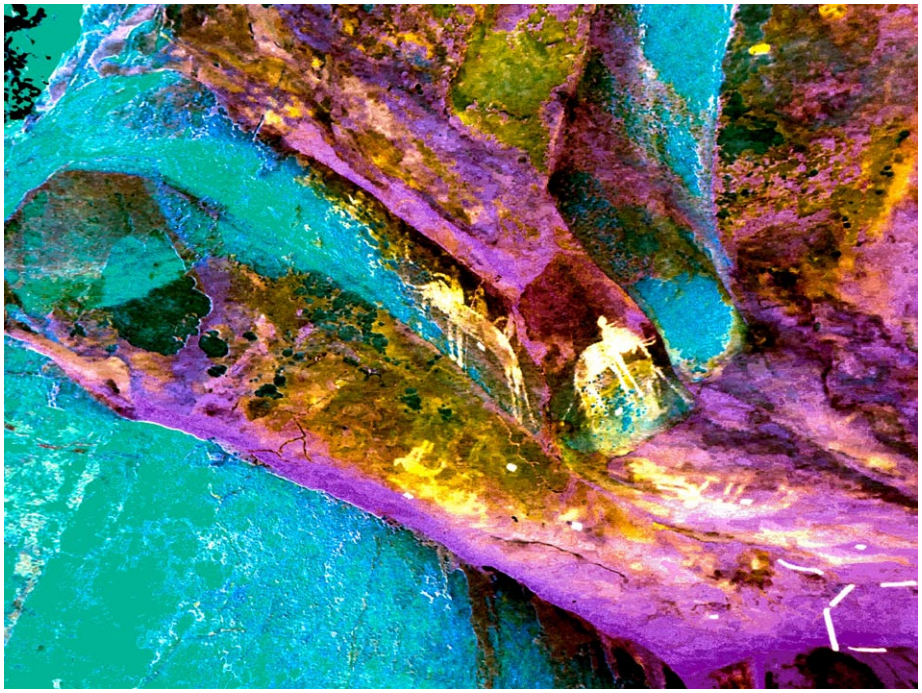


Figure 35c: Panels 1 to 4 – DStretch lBL algorithm

Figure 35d: Panels 1 to 4 – DStretch LBL algorithm

Note: The LBL algorithm allows slightly better ability to identify deer in panel 3 sections than IBL algorithm

Another positive result from the DStretch analysis was the identification of clusters, groups or scenes with multiple animals. Original interpretations suggested few clusters and no scenes. However, it appears there are distinct clusters of animals on the same horizontal plane and what appear to be intended panels or scenes in which clusters of animals are present. Panels 1, 2, and 4 clearly contain elephants and riders though on contiguous vertical and horizontal ceiling panels. Panel 3, for example, has what could be

interpreted as a cluster and possibly a herd or deer or cows (see Figures 35–38). Panel 6 also contains multiple animal clusters.

Figure 36a: Panel 6 – DStretch LABI algorithm

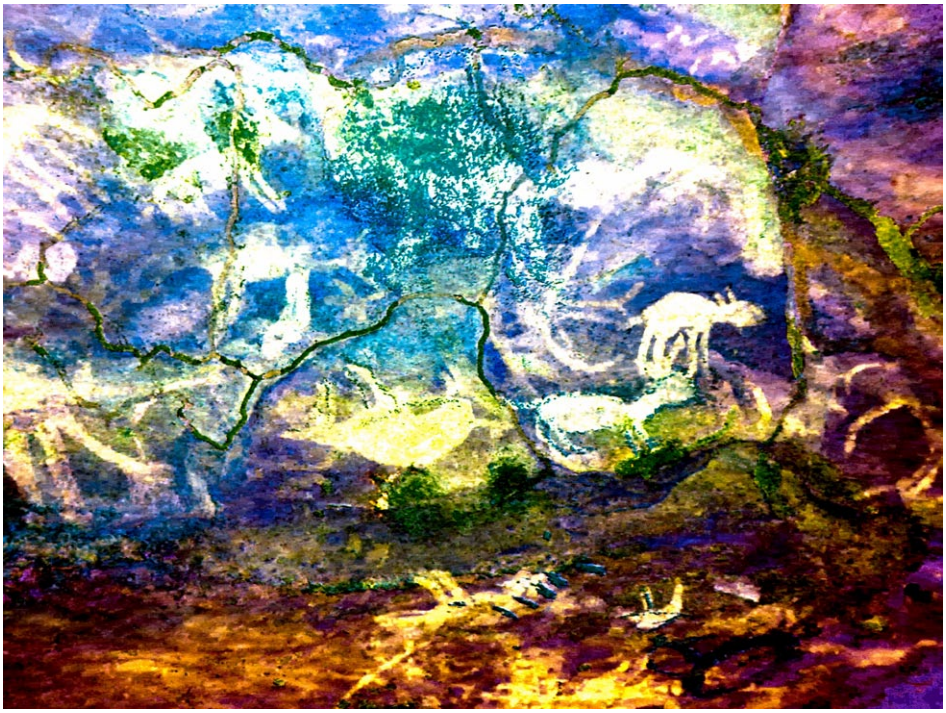


Figure 36b: Panel 6 – DStretch YBL algorithm

Figure 36c: Panel 6 – DStretch LYE algorithm

Figure 37a: Panel 6 – DStretch YBL algorithm

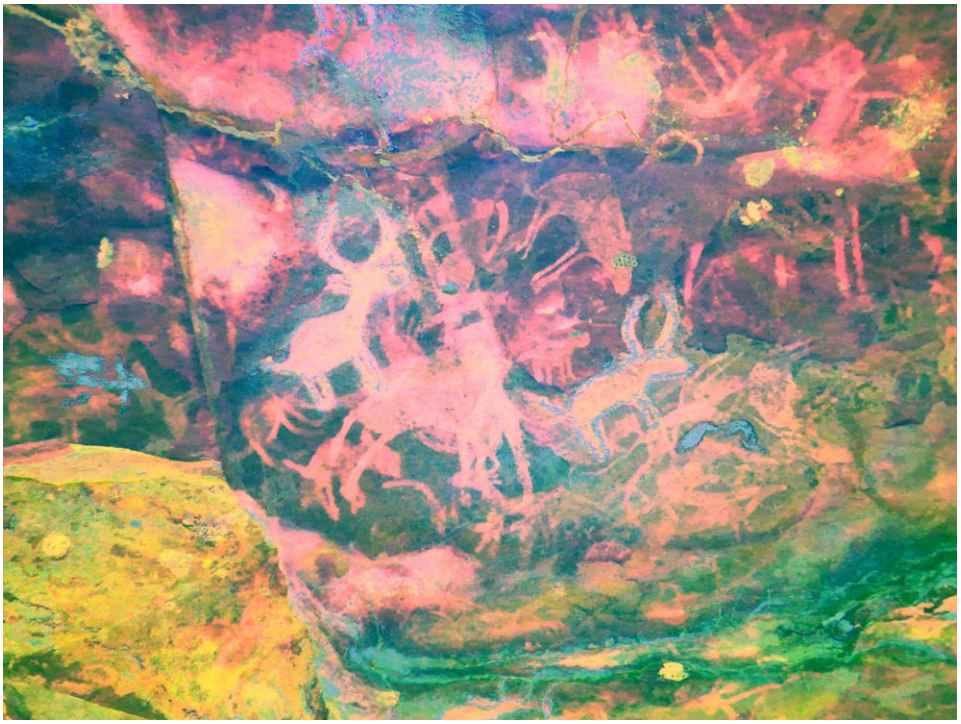


Figure 37b: Panel 6 – DStretch RGBO algorithm

Figure 37c: Panel 6 – DStretch LABI algorithm

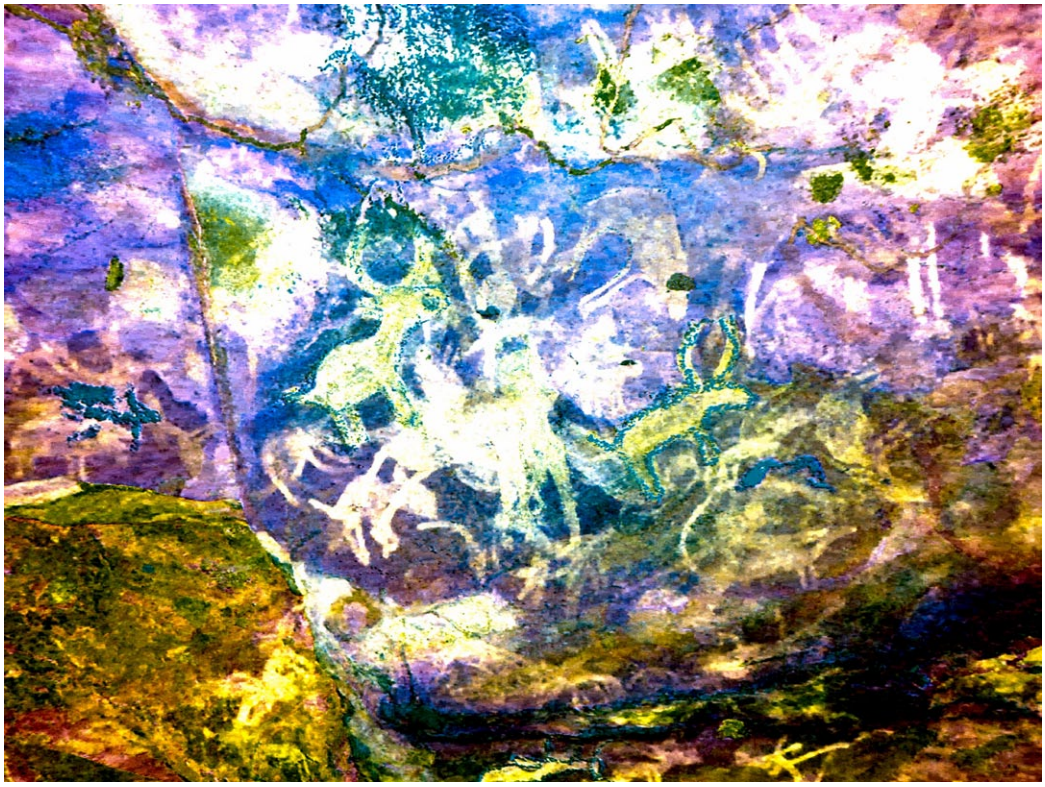
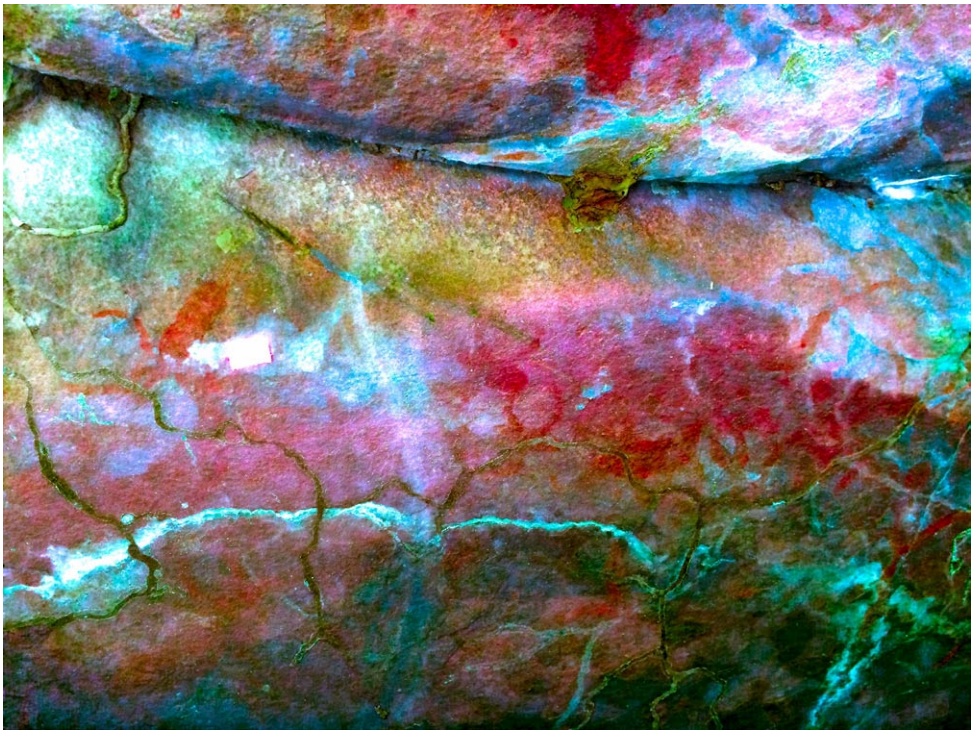


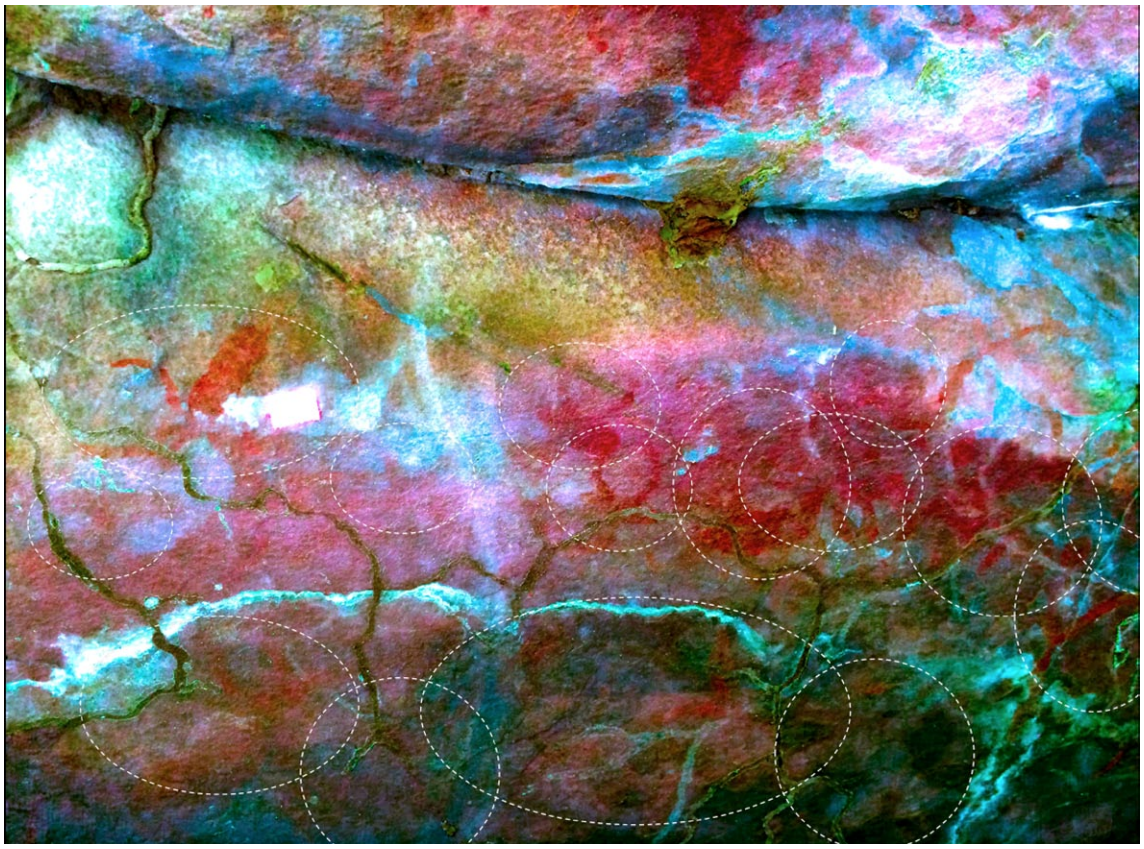
Figure 38a: Panel 3 – normal view

Figure 38b: Panel 3 - DStretch enhanced – adjusted algorithm



Three horizontal bands of animals can be more readily identified and discerned. The lowermost is inverted, faded and partially superimposed (possibly older). The uppermost is mixed and more random. The middle band consists of possible deer, mostly facing right on the same horizontal plane. Towards the right half, deer are faced left. Several more deer are located to the far right (not depicted in the image), and another cluster is located to the right of those. The scene almost appears to be herd-like. Furthermore, some of the images appear to be side-by-side.

Figure 38c: Panel 3 – DStretch enhanced – adjusted algorithm



Dashed circles highlight antlers/horns, heads, bodies, legs and other anatomical parts. Not all parts are highlighted in this image; these are merely some examples.

5.3: Other Species

A strong case for the dominance of deer, elephant and elephant rider (human) representations has been made. It is noted that the deer can also be interpreted as a variety of horned or antlered species. Other species are likely represented at Kanam as suggested by some of the "unknown" class of occurrences (Figures 39-1a through 39-4b). No mythical animals such as dragons, naga, garuda, gaja-sima, etc. were depicted.

Nevertheless, if many of the deer are interpreted as cow/bovine species, it still remains that a limited, focused, and deliberate set of animal representations are present. Painting a spectrum of diversity representing a repertoire of what is in the environment is not evident. Rather, the focus indicates specific activities (e.g., targeting behavior, totemic representation, focused ritual).

Initially, it was suggested that many depictions may represent domestic and wild buffalo, cow, ox, and possibly cats (civet cats to tigers), dogs, pigs, etc. These are also part of the Cardamom ecosystem. Only one buffalo, however, was discerned with a somewhat high level of confidence. Additionally, it is unknown whether it is a wild or domestic variety.

Goats were also suggested as were apes, monkeys, dogs, pigs, rabbits, snakes, birds and other animals, although their presence in the image repertoire are less likely than deer. Goats are also not listed in the biodiversity index of the Cardamoms (Daltry and Traeholt 2003), and if present, are possibly recent introductions. However, goats were

depicted at the Gua Tambun Site in Malaysia (Tan 2014:83) and their possible inclusion at Kanam cannot be summarily ruled out. Interestingly, horses were never mentioned as a possibility by locals or the research team. Chou Ta Kuan mentioned "chariots drawn by goats and horses…" for an Angkorian procession (see Schliesinger 2011:170 who also mentions ethnic minority goat sacrifice on occasion), thus indicating goats were possibly of high value as war beasts but evidence is thin.

It should be emphasized that various animal occurrences on many forms of art may relate to influences from Chinese zodiacs, popular pan-Asian epics, myths, and religious or semi-religious stories (e.g., Mahabharata, Ramayana). Chinese zodiac animals are prevalent in many modern and historic pagodas, for example. Ramayana and Mahabharata influences date back to early Indian religious and cultural influence. Related depictions of people, animals and supernatural beings (e.g., gods, demons, animals, etc.) are abundant at Angkor Wat and numerous other temples throughout Cambodia. Their present popularity may influence current local interpretations. Past popularity arguably could have influenced past artisans.

5.4: Superimposition, Random Placement and Clusters

Many entities are inverted or occur at oblique angles in relation to other paintings. Some areas are highly complex, superimposed, faded, blurred, etc. resulting in serious difficulties for analysis (almost comically appearing as psychedelic kaleidoscopic Rorschach tests in the DStretch analysis).

The superimposed, inverted and/or random placement suggest multiple painting episodes with little consideration of integrating a larger scene excepting a few cases such as deer and animal clusters where several animals were likely grouped; some possibly side-by-side. Groupings could exemplify herd scenes or capture scenes. In the cases of elephant clusters, it may represent coordinated multiple elephant capture, training, and/or use activities.

It could be argued that some of the seemingly chaotic placement was intentional, but the authors find this unlikely. As stated, the random placement of many images or image groups, the superimposition, "faded color" differences, and the angular differences of assumed planes for upright [posture, stance, i.e., standing] depiction suggest multiple periodic episodes of painting. It would be useful to determine which specific animals, if any, may have dominated later or earlier periods as this may assist answering various questions posited earlier; such as, the emergence of deer prominence at a period when deer targeting may have increased while deer populations may have been severely depleted from overexploitation (e.g., 15th–17th centuries CE), which consequentially may have correlated with increased perceived needs for investing into depiction, ritual and so forth.

Superimposition also implies there was no taboo related to painting over previous images; possibly suggesting that painting events may have been part of a limited duration event or "expectation" (e.g., preparation for a hunting or capture event; a rite of passage, protection or luck enhancing ritual; but not necessarily a generationally augmented, preserved and/or curated "history" or storyboard). Nevertheless, it remains unknown when painting events occurred or the duration of combined or distinct painting episodes. It is noted that the inception and duration of painting activities versus the duration of site use may vary significantly (e.g., the site is still used for ritual activities; and, activities likely vary considerably from original intent and over time).

Figure 39-1a: Complexities of image 6-10 - unknown animal or animals – normal view

Figure 39-1b: Complexities of image 6-10 - likely multiple animals – DStretch RGBO

Figure 39-1c: Complexities of image 6-10 - likely multiple animals – DStretch LABI

Figure 39-1d: Image 6-10 – DStretch YBL

Tracings highlight various lines possibly indicating overdrawn or side-by-side animals. Note, this is one of few images where similar tapered bodies and heads may indicate some other type of mammal cervus or bos, such as a possible pig (sus), pangolin, etc. (it remains unknown).

Figure 39-2a: Animal in chalk outline with unique lines at head – original image

Figure 39-2b: Animal in chalk outline with unique lines at Head – DStretch algorithm

The lines first appear to be antlers (thick and stylized), but may not be attached to the animal image, and may represent some other type of animal or unknown image

Figure 39-3: Possible animal with spots; DStretch RGBO

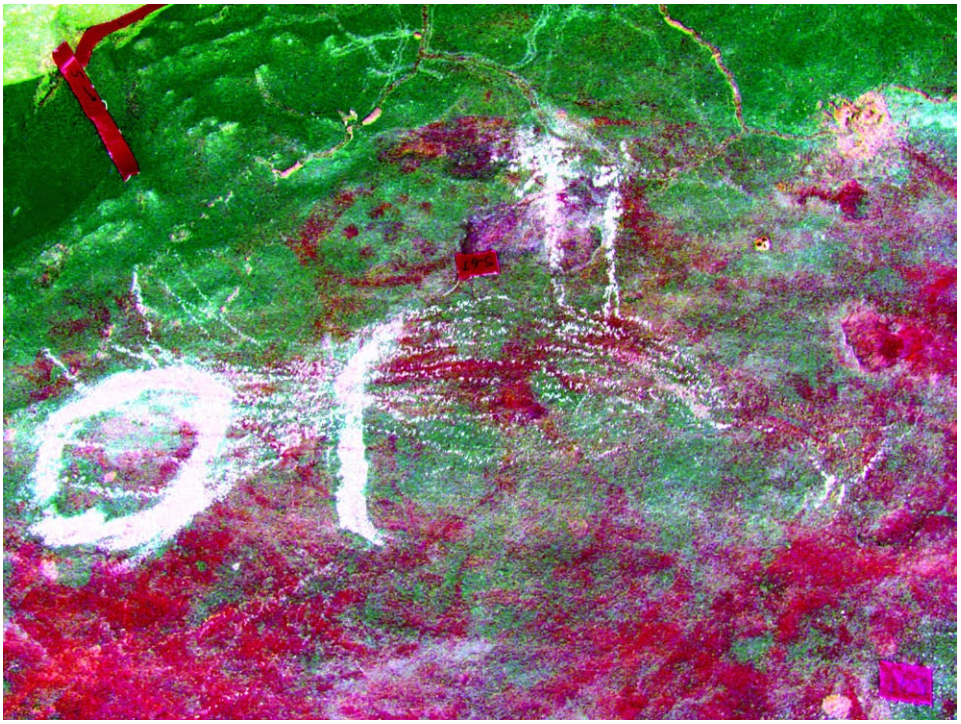
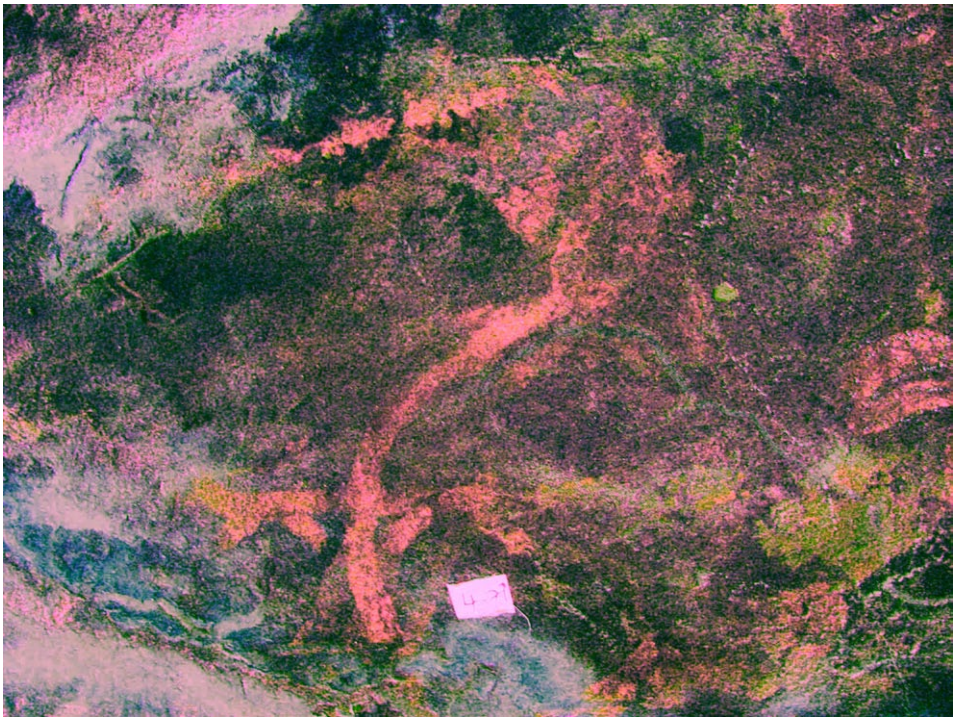


Figure 39-4a: Image 4-2 – Elephants and riders, abstract lines, curved arch with riders; DStretch YBL

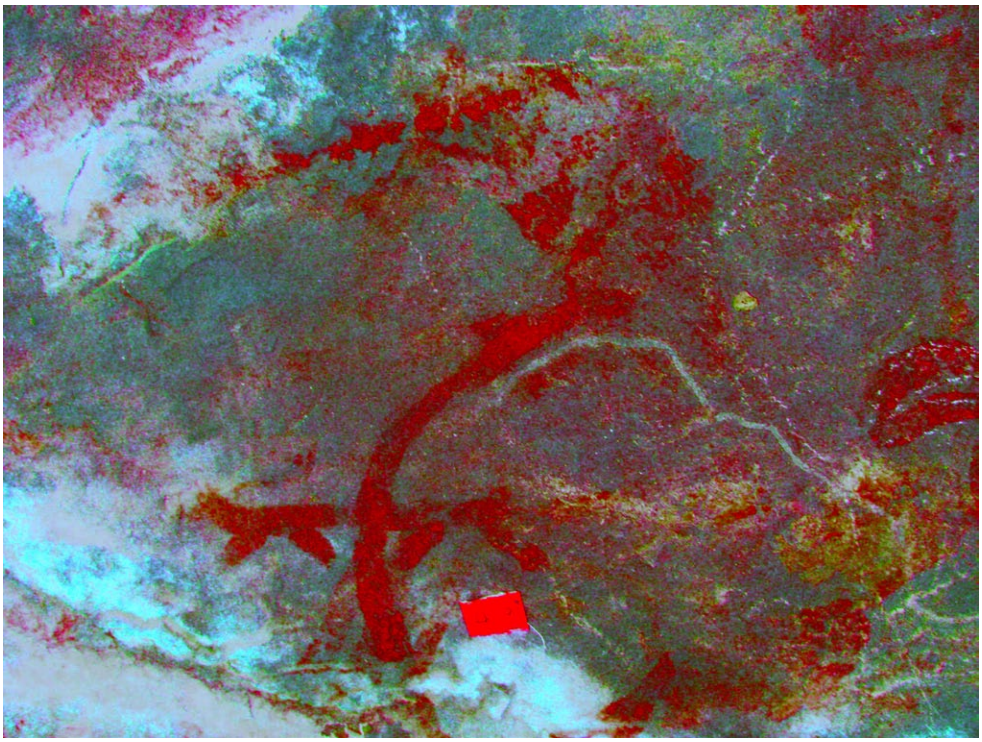
Note the arch-like line in center of elephant with possible middle rider. Also, the appendages on the front rider appear arch-like. This type of arched, bowed or curved line occurs in other cases. It remains ambiguous. Also note the many curved, arched, straight and transecting lines. These are common. Meaning is unknown. Some of these were thought to be ploughs. The three curved lines at the right appear to emanate from a single point at the back of the elephant to the right, but are not connected to the elephant on closer examination. Panel 4 is complex and the elephants may be part of a scene or cluster with panels 1 and 2. There are many superimposed images, but most remain obscure.

Figure 39-4b: Panel 4 Image 4-7 – Arched line, possible animal, straight and curved lines; DStretch YBG



This combination of lines is perplexing. The arch shape of the larger curved line in the middle of the picture is repeated elsewhere. Here, it seems to form a body of an animal at the top, but it could be an outline or overlain image. The curve towards the base transects a straight line with angled short lines extending downwards, like a saw-horse or table. Other curved lines to the right, superimposed paint and degraded areas make this section difficult to discern.

Figure 39-4c: Panel 4 Image 4-7 – Arched line, possible animal, straight and curved lines; DStretch YWE



5.5: Ecology, Targeting, Rituals and Magic

Large mammals represent the bulk of paintings. Humans (particularly elephant riders), elephants, and deer account for almost all specifically identifiable categories. Most unidentified mammals likely fall into these classes as well (percentages between confident and speculated classes are consistent). Thus, there are limited species and genera diversity represented, especially among the identifiable categories.

Most species excepting humans are wild and part of the normative forest ecosystem in the area, past and present. This is particularly important and unexpected from original considerations. Domesticated species were expected due to original interpretations that animals, scenes and tools were characterized as indicative of agricultural communities and practices. This may be true of the people who produced the images, but is not indicated in the paintings. Elephant riding (perhaps capture and/or use) is the most prominent discernable activity. Elephant capture is speculative, but reasonably plausible.

No hunting scenes or hunting implements are clearly depicted, unless many of the possible abstract implements are weapons. Some of the curved lines may represent snares and snaring. Clusters and herd-like scenes may relate to targeting. In any case, "spears, snares and lassoes" are not clearly depicted in relation to capturing animals. Thus, hunting and capture of deer is more speculative, but reasonably plausible.

Elephant capture, training, and use as well as deer hunting are high risk, high skill, unpredictable, difficult endeavors with low probabilities of success. This boosts their likelihood of being associated with important rituals, magic and rites of passage. The site itself may have been an important location for such activities.[15]

Thus, it is not unexpected that deer and elephant have special representation in a rare rock art forest context possibly associated with beliefs, practices, rituals, magic, etc. to: 1) spiritually and socially mitigate potentially negative consequences, 2) bring good fortune and protection from whatever force considered relevant (e.g., neak ta), and 3) reinforce importance. The paintings may have served as a visual instructional and educational aid (i.e., the ancient upland tribal predecessor of the all too familiar PowerPoint slide).

Considering the demand for deer may have increased exponentially from the Angkor to post-Angkor period (particularly as evidenced by the Japanese demand—see Section 8 below), tens of thousands if not hundreds of thousands of deer may have been targeted per year in the Cardamoms and proximate areas in Mainland Southeast Asia. This would have crippled populations. Habitat loss with urbanization and land clearance for agriculture is another prominent factor. Both deer and elephant populations decreased drastically and demand continued to increase. Capture would have been more difficult and investment into more ritual and magic would be expected.

5.6: Wild, Controlled, Domesticated and Agricultural Implications

Contrary to original interpretations, few agricultural-related livestock, tools, scenes and images are represented except the possible ploughing gear, riggings or related implements/

15 The abundance of deer may also relate to a deer cult unrelated to hunting or capture; possibly even related to totemic meanings, the importance of deer symbolism, or even important relations to epic stories such as the Ramayana, specific deities or entities, etc. It is unlikely, however, as we would expect different kinds of depictions, also with the other animals.

apparatuses. Paintings suggested to be plough riggings/apparatuses (curved and straight line combinations) were based on local interpretations. However, they could represent elephant hooks [*angkus*] or other tools.

One image indeed does appear plough-like. It cannot be ruled out that the curved lines and rectilinear lines could represent agricultural related gear, equipment and riggings such as ploughs, ox-carts, etc. No boats were noted, as would be expected due to the local topography, environment and ecology. Boats, however, are popular rock art drawings in the greater region.

Importantly, there is a prominence of a wild or non-domesticated ecology, yet familiar and controlled (i.e., elephants with riders; possible targeted animals, groups/herds of animals). This would be expected for tribal groups living in the upland Cardamoms during the speculated periods of site use. Swidden rice (slash and burn; shifting cultivation), house gardens and mixed forest cropping (arboriculture) were likely common practices, but are not depicted. Keeping significant herds or numbers of livestock (e.g., pastoralism) was not likely—not characteristic of most tropical forest economies, but not outside the realm of possibilities. If domesticated livestock were typical, it is speculated that each household has small numbers.

The controlled "wild" ecology is an interesting perspective, and may support comments suggesting the images also functioned as a statement of "people controlling, conquering or having power over nature", particularly over large dangerous and difficult to capture and control animals.

5.7: Foreign Influence, Military/War, Status and Power Iconography

Brahmanistic, Buddhist, Angkorian or related symbols, icons, scenes, characters and similar imagery are absent. Inscriptions and writing are absent (except modern chalk writings and highlights). This has implications concerning "connectedness", extra-local network inclusion, and influence (or lack there of) as well as dating.

The communities may have been significantly autonomous and well outside heavy Brahmanistic, Buddhist and/or Funan, Chenla, Angkor, post-Angkor to modern influences. However, the people were likely very well connected to the economic supply chain; in fact, a source and essential component. This is certainly evident among the Jar Burial sites in the Cardamoms. Thus, they were almost certainly connected to information and influence networks as well; unless it was strictly business.

There is a possibility that the site pre-dates extra-regional influence and trade beginning in the first millennia BCE and CE (1,500–3,000 years ago), partially explaining the absence of world religion iconography. However, elephant capture, training and use may not significantly predate Funan and earlier overlapping Iron or Bronze Age periods. Assessment of presence, absence and abundance of elephant-use related artifacts (e.g., bells, riggings, chains, armor) in Bronze, Iron and later period sites may shed light on the antiquity of the industry.

Trautmann (2015) evokes a reasonable argument for elephant use, ownership/possession, and public display as correlating with evolving "prestige, status and legitimacy" needed by leaders as the nature of kingship was reinvented, expanded, and strengthened

from the Funan to Angkor periods—the period of influence from India.[16] Essentially, the argument posits that leaders who had elephants also had power and authority and vice-versa. Previous, non-elephant owning leaders may have been viewed as having "lesser" status and power by comparison. Elephant ownership would also help break the previous paradigm of leadership, power and authority criteria and definitions.

It remains unknown whether elephant ownership was directly related to military use and war; normative civil labor/work; prestige and power display (and legitimization); or combinations of all of these. No war scenes, parades or clearly identifiable work scenes are actually depicted.

The elephants themselves are not portrayed as highly adorned, highly armored, or highly equipped unlike many Angkorian and historic depictions. They are not "dressed" as a luxury item or a display of royalty, power, prestige, authority and status. Humans and other animals are not portrayed as adorned or costumed either, with the exception of a few riders possibly wearing head gear or headdresses (this also may have implications for site dating and cultural affiliation) and holding unknown implements (possibly angkus).

As stated, the elephants at Kanam do not at all appear to be involved in war scenes.[17] Depictions clearly demonstrate people riding trained elephants (some seated, some standing). It is reasonable to interpret the elephants and riders portraying capture, training and use scenes. However, representations of specific capturing, training and hunting activities, though highly plausible, are assumptions and remain speculative. The images also do not appear to represent other activities such as moving lumber or materials.

Thus, elephant paintings are neither clearly associated with royalty as symbols of status and power, nor associated with non-local mythical, religious or historic characters, scenes and stories as is often the case in many elephant representations elsewhere—e.g., Ganesh, Airwata, Ramayana, Mahabharata, Buddhism, Hinduism, royal battles scenes with Cham or Thai, etc. On the other hand, they are neither associated with labor, agricultural nor other domestic use scenes. Simply owning and using a trained elephant may have been a combination of status enhancing, utilitarian and commercial (a commodity to be exchanged). It remains unknown. Also unknown is who brought elephant capture and training to the communities, when, how and why—these underlying questions perhaps erroneously loaded with assumptions of diffusion. What remains fairly clear, however, it that foreign influence, military/war, status and power iconography are not depicted at Kanam.

16 It is reminded that "influence from India" does not imply a uni-directional dominant imposition of cultural, economic and socio-political evolution as is often packaged with older concepts and interpretations of Indianization—Indian interaction and influence stamped out the blueprint for complex polity development, technological and economic shifts, and hierarchical socio-political order with increasingly more powerful leadership. Rather, local agency was likely high. During periods of increased interaction with India from the Funan period onwards, selection of elements from various Indian ideologies, practices and material culture by local leaders and populations occurred (many of which were reformulated in accordance with local cultures), and complex polity development and increased semi-global long distance trade within complex networks were well underway prior to Indianization. This view is now more widely accepted.

17 Ethnographic interviews did not mention use of elephants for war; except the Khmer Rouge interest. The interviewees only mentioned supplying elephants to the king or his representatives.

6: Artifacts Recovered in the Area

Local residents have periodically recovered a wide variety of ancient artifacts from the area, although not from the Kanam Site per se. Most artifacts were recovered from farming and collecting activities, or, have been heirlooms (Figures 40–44). Respondents were quite open about reporting, describing and showing artifacts—happy to assist.

Figure 40: Angkorian brown glazed jar

Respondents described pottery and bronzes, but not statuary, bricks, architecture, etc. (probably due to absence rather than any respondent intent to hide or protect information as is more frequently the case in areas where looting is prominent). Respondents did not mention glass, agate or carnelian beads. Additionally, locals were not wearing strings of beads—often the case in areas such as Northwest Cambodia where burial sites are heavily looted and necklaces of beads are commonly worn. The respondents in the area who displayed the artifacts were not engaged in looting. Artifacts were heirlooms or recovered during farming activities. They did not know of any looting activities in the area.

Initial artifact summary from 2015 field notes:

> "Artifacts recovered around Kanam, however, vary significantly to include a highly polished stone axe/adze; numerous bronze bangles characteristic of the Bronze and Iron Ages (although many similar artifacts and designs occur through latter periods); a large Angkorian brown glazed stoneware jar; other bronze bowl fragments; a historic highly stylized bronze bowl—offering dish, incense dish, other—with a square metal

nut and round bolt at the base, and a few round pellets (ceramic, stone-? [not handled]). A green glazed Chinese or Thai jarlet probably dating to the 15th or later centuries CE was also recovered from the area and shown to the research crew. The occurrence of other Angkorian period pottery was indicated by respondents. No architectural, statuary or inscriptional remains were noted by respondents. Exact provenance of the artifacts recovered by locals is unknown, but respondents indicated they were obtained locally. The possibility of the original paintings being modern, however, is unlikely."

Figure 41: Chinese jarlet (possibly 16th century CE)

Figure 42a: Bangles, arm/leg-bands and large rings recovered in the area

Figure 42b: Thick, rectangular cross-sectioned bangles, arm/leg-bands and large rings with decorations

Figure 43: Pedestalled metal dish

The nearest known Angkorian or other large sites and architectural remains are possible foundations at Kravan and sites closer to Pursat. The Jar and coffin burials in the Cardamoms are 15th century CE onwards.

The artifact analysis is summarized as follows:

- Angkorian brown glazed stoneware jar dating to around the 10th–14th centuries CE.
- Green glazed jarlet[18] (Chinese; Zhangzhou kilns [?]; Fujian Province; 16th century CE).

18 Special thanks extended to Dr. Tai Yew Seng for comments after assessing the images. Dr. Tai also indicated that a comparable item was also recovered from the San Isidro shipwreck in the Philippines dated to the mid-16th century CE.

- Twenty-three Bronze bangles of varying sizes and shapes. Most are simple, plain designs. Some are cabled and more highly stylized. Some complete circles; some with narrow space between ends; some with wide space between ends; some thick and round; some flat [mostly cabled bangles]; some thin and round. Dates could range from the Mainland Southeast Asian Bronze and Iron Ages in the first few millennia BCE to Angkor and post-Angkor periods, although many appear typical of metal age burials. Some may be large rings for riggings, animal use, etc. It is difficult to determine. These artifacts may have been in circulation for centuries; they are still in circulation today.
- Two round pellets.
- One highly polished black stone axe/adze with use damage at the cutting edge (scars, dulling and flakes). The stone does not appear to be local. Use damage indicates a functional, utilitarian artifact rather than ritual or symbolic.
- More artifacts were reported and offered for assessment, but the field crew did not have time to review them as they were located in distant households. Local residents were very helpful and supportive of our interests.

Figure 44: Polished adze

The locally recovered artifacts allow a general time framework for settlement and resource use in the area (not the site) to be reasonably distilled. The artifacts span the Neolithic to Historic periods. This is consistent with settlement patterns in Mainland Southeast Asian hill and mountain regions.

Pre-Neolithic settlement is expected, but not likely in vast numbers and having a considerably smaller "ecological impact" footprint. Although a thin argument based on very poor sampling methodology, the solitary stone adze compared to 23 bronze bangles may be reflective of population increases, economic changes, and/or increased trade-network connectedness as well as frequency of interaction from the Bronze and Iron ages through the Funan to post-Angkor periods. The same can be said of the reported Angkorian jars (one was recorded, but several were mentioned).

The Cardamom Jar Burials clearly have an abundance of 15th–17th century material culture (of course, some items manufactured before then, but remained in circulation). The mid-16th century Chinese jarlet is interesting as it fits nicely in the proposed temporal speculations of site use and augmentation from the 15th–17th centuries CE vis-à-vis deer representations and possible deerskin trade.

Again, these are thin speculations. However, the important point is that the occurrence of these artifacts almost assuredly suggest additional sites in the area, and, Kanam likely fits within the timeframe.

7: Ethnography and History

7.1: Local Perceptions, Legends, Myths, Meanings and Rituals

Local people understand the Kanam Rock Art Site paintings are "old", but not specifically how old. They are simply "older than existing memory". The paintings are not associated with, or referenced to, any broadly known Cambodian temporal and cultural period (e.g., Angkorian, post-Angkorian, Colonial, etc.).

Locals refer to the site as **Neak Ta Beak Kandeng**. A legend of the "broken bell and Neak Ta Beak Kandeng" is associated with the site and current rituals. The main theme of the story is as follows: A highlander (or highland people) was riding an elephant through the area. The elephant fell at the location. The elephant bell banged against the rocks. Either the bell broke, or, both the bell and the rocks broke (unclear). The man riding the elephant may have died in the incident (unclear). Nevertheless, the rider became the *neak ta*—an ancestor spirit associated with the site. Or, a *neak ta* then became associated with the site (perhaps because of the incident). It is unclear if the elephant spirit may have been involved. Neak Ta Beak Kandeng refers to "broken bell" "ancestor". No other special place names or legends were given to the area, although forest *neak ta* (generic and localized) are said to be present in the region—consistent with Khmer belief systems in general.

The site was also designated **Kanam Poeung Kamnou**. Kanam refers to the village name. The older name is Tanam. This name refers to a concept (or ritual belief) of "not to do something; restricted, forbidden" (i.e., taboo). Poeung Kamnou refers to painting/painted cliff by the locals: hence, other names may include: "taboo cave; taboo paintings; or taboo cave paintings".

Locals continue to respect the site and the paintings. The site and paintings are associated with *neak ta* (various spirits with powers that can protect or harm). *Neak ta* have the capacity to help, assist, hinder or harm local people—possibly causing great fortune or mortal consequences. Some are more powerful than others. The power of Neak Ta Beak Kandeng is unknown. Locals did not inform on what the benefits or consequences were if Neak Ta Beak Kandeng was placated or disrespected respectively. However, many *neak ta* are mostly related to "protection from harm" if respected and placated properly. Some *neak ta* are more broadly associated with specific landscapes or ecology, such as forest, mountain, sea or even city.

Many locals do not feel especially connected to the Kanam Site *neak ta* spiritually in the sense of believing the *neak ta* are their direct ancestors and/or the *neak ta* share a formal religious commonality. They also do not view the *neak ta* as having been a creation by their own ancestors. The *neak ta* simply exist and are ancient. In other words, the site

is used as a *neak ta* shrine, but residents do not believe the paintings were necessarily produced as a ritually important phenomenon by their own ancestors. The paintings are not necessarily connected directly to the *neak ta*, but the area is. To recap, any *neak ta* is considered supernaturally empowered; though power levels, type of help, and type of harm vary. It is believed that lack of respect for any *neak ta* can result in misfortune.

Most locals believe that ancient people (not the *neak ta*) drew the paintings. They do not know which people (perhaps their ancestors, but not confirmed). They also do not know why they were drawn or what the intention was. Locals also believe that some paintings were casually drawn for no apparent purpose other than art expression. Some believe that a few paintings were recently created—likely referring to the people who outlined some of the paintings in white chalk/paint.

Nevertheless, consistent rituals are performed at the site twice yearly by religious leaders and local representatives. These occur during: 1) Khmer New Year, and 2) Ancestor Ceremony/Phchum Ben. People make offerings of food and incense to Neak Ta Beak Kandeng (at the site itself) specifically because it is viewed as a sacred place to respect and make offerings for *neak ta* in order to demonstrate respect, gain favors and avoid misfortunes. Local religious representatives occasionally visit the area and perform slightly more formal ceremonies and rituals. None of the current rituals can be positively associated with original practices. The antiquity of current rituals is also unknown.

Other respondents from previous site visits described the particular *neak ta* as "Pros Lok"; literally "bring back from the dead" or "reanimate/resurrect". Again, in the context of action and belief among the local residents it relates to honoring the artisans or other spirits that could be potentially dangerous or helpful.

7.2: Historic Elephant Use (Local Respondent Feedback)

This section is focused on historic elephant use from local memory rather than a summary of historic references. It is known from epigraphic, art historical, oral history, historic records, and some archaeological remains that elephant use was prevalent and vitally important from at least the early complex polities. Prolific use for work, war, ceremony and prestige were central, lasting well into the 20th century. The origin of capture and use almost assuredly derived from India (written in the Kotchalaksharanra, the gaja sutra). Capture made heavy use of snaring and other methods (mainly, the use of other elephants and riders—the *mela shikar* method; Schliesinger [2001:171]). Schliesinger (2001:171) describes:

> In Cambodia, the indigenous peoples' traditional method of catching wild elephants—especially of the ethnic Phnong and Brao—was to snare and lasso them with the help of specially trained hunting elephants (the mela-shikar method). Another method of capture in ancient Cambodia—probably used by the Khmer—was to drive a herd of elephants into a lake and shoot harpoons—attached to ropes—into their ears from boats.

The reference to harpoons and ropes is interesting, perhaps explaining some of the Kanam depictions. However, this was not mentioned in ethnographic interviews, not at all discernable in the rock art depiction, and the "lakes and boats" part of the equation is a poor match for the local environment.

Schliesinger continues to mention the Kuoy used to make their way to Battambang for elephant capturing campaigns; employing a spectrum of rituals, "forest spirit" language, shared rites and taboos. Nevertheless, he describes the training as basic and simple.

At a broader scale, various anthropological and environmental studies have covered elephant history and ecology in the region producing fairly extensive applied and academic discourse, particularly in response to the diminishing populations. With regret, it is not the purpose of this paper–to provide a full review. That stated, we do feel it is important to augment existing studies with extant informant feedback for other researchers.

Local respondents indicated a strong history of elephant capture, training, use and supply to kings (post-Angkor) in the distant and recent past. Elephant capture and trade was disrupted in the 1970s during the wars and Khmer Rouge regime. Many catchers, trainers and elephants fled to Thailand. The "industry" and tradition never returned.

A similar situation was noted at Chi Phat further south in the Cardamoms (the area known for 15th–17th century jar burials and coffins). An ethnic Chang respondent in Areng Valley indicated that the people used to engage in elephant capture, training and use; performed similar rituals related to elephants; but the elephants disappeared during the Khmer Rouge regime—"no more elephants and elephant use after the Khmer Rouge."

7.3: Ivory and Elephant Trade

The history of ivory trade specific to the area is unknown, but regionally indicated in many references (e.g., Tome Pires; in Cortesão 1944:112 [also 1990] specifically mentions that Cambodia has many elephants and elephant tusks [presumably as a trade product in the 16th century]; see also Chou Ta-Kuan [in Harris 2007:83] who resided in Angkor in the late 13th century). Nevertheless, because clear evidence indicates riders using elephants, it is not likely elephants were exclusively hunted for ivory. Elephant capture, training, trade and domestic use are more prevalent in local historic references and oral traditions.

Additionally, elephant (live) and ivory trade are prominent in historic records at the extra-local and inter-regional scales through the first and second millennia CE (e.g., various Chinese, Indian and Southeast Asian polities). A review and analysis of elephant trade is not presented here, although it remains critically important. Elephant trade was perhaps even more "sizeable" and intricate in many ways than the deer trade; possibly having different and potentially stronger impacts and implications. There may have been similarities in deer and elephant industries, networks, etc. at a very cursory level of analysis, but the nature of each "industry" may have been strikingly different, particularly with regard to elephant trace vis-à-vis prestige, power, status and different nuanced relations among local and extra-local communities, with local and extra-local rulers, royalty and so forth.

It is likely that there was sufficient local and extra-local demand for elephants and elephant products from the Cardamoms. Elephant capture and training are risky and highly dangerous endeavors. Investment into rituals, training, and knowledge dissemination is expected; minimally to bring success, safety, fortune and prestige. This may partially explain the occurrence of elephant and rider depictions at Kanam. Likewise, if elephant populations decreased with increased demand and capture over time, even more investment into rituals and related practices (e.g., artwork at Kanam) may have ensued.

7.4: Deer Trade

Of relevant economic and dating importance, however, is the high presence of deer in the Kanam Site paintings. Serendipitously, during the recent write-up of this paper, Dr. Kenneth Hall brought to our attention the high demand for deer skins in the early colonial period Asian trade networks, especially the demand coming from Japan.

In an article by Michael Laver (2012:13–16), the following key economic, trade network and ecological concerns are noted:

- "*… the trade in deerskins was second in value only to silk in the VOC's trade with Japan [a couple of decades in the 17th century; popular with Samurai and others for armor, undergarments, socks, skirts, bags and other goods]…*"
- "*The trade in Taiwanese deerskins is instructive in that it demonstrates how profitable even a niche item could be in early modern Japan…*"
- "*Deerskins were consistently one of the most valuable items imported into Japan. The number of skins arriving at Nagasaki reached hundreds of thousands, a remarkable number considering that skins were harvested by hunting rather than through raising deer.*"
- "*… in January 1625 Governor-General Peter de Carpentier reported to the Heeren Zeventien that Siam exported 250,000 deerskins per year… (Coolhaas 1960)…*"
- "*John Sheppard notes that in the seventeenth century, Taiwan was home to huge herds of deer (Sheppard 1993)… the natives had hunted the deer for centuries… the Dutch simply tapped into this system…*"
- "*With the arrival of the company, however, the hunting of deer [on Taiwan] shifted from a limited harvest to a full-scale industry: the skins were sold and shipped to Japan, while the meat was primarily sent to China on Chinese junks (Iwao Seiichi 1966).*"
- "*The following year [1643], the Chinese sent their ships to Cambodia whence they shipped 50,000 deerskins to Japan in three ships (Blusse and Vialle 2001).*"
- Deer populations in Taiwan declined drastically by the 18th century because of over-extraction [but did not hinder demand; Cambodian and Thai producers continued to supply].
- Some measures were taken to reduce overhunting and promote population sustainability; Khoo (2011) points out that habitat loss due to migration and conversion of habitats to farmsteads impacted deer populations [in Taiwan].

Additionally, Yamada Nagasama, a Japanese adventurer and privateer in the early 17th century, had established or strengthened a sizeable deerskin trade industry in Thailand for export to Japan (Ishii 2001). He was head of a district or settlement in Ayutthaya called Ban Yipun.

Two trends stand out of significant important: 1) high extra-local demand for deerskins (particularly from Japan), and 2) significant population decline of deer, particularly beginning with Taiwan in historic records and colonial activities (overexploitation and habitat loss). It is argued that the demand assured that communities in the Cardamoms were an integral source point of the value chain. Depleted deer populations in Taiwan and possibly political-economic tensions among traders likely resulted in greater demand from Thailand and Cambodia to include the Cardamom Mountain communities. Depleted

populations and decreasing capture rates in the Cardamoms may have subsequently required more investment into ritual, magic and luck—perhaps partially explaining the investment into the Kanam paintings.

7.5: Ethnographic Interview(s)

Dr. P. Bion Griffin is conducting comparative ethnographic and ethno-historic elephant research in Cambodia. A full report focusing on comparative ethnography is beyond the scope of this project. However, a brief summary is provided below. Further details will be made available soon. We provide the local ethnographic field data for this particular project because it interlaces with the archaeological project methodology, responsibilities and deliverables. Ethnographic data capture and reporting is essential for holistic understanding and preservation of the site to include the social as well as physical aspects;[19] falling into the category of critically important and non-renewable intangible heritage assets.

Figure 45: Mr. Prum, elephant master, with other respondents in background

We wish to sincerely acknowledge and thank the respondents and community for their feedback as well as hospitality. We hope that archiving the feedback in this report will allow them to further disseminate their knowledge, insights and opinions to other researchers as well as future generations. They were excited and supportive to have us record and publish their statements.

19 Extant social dimensions are frequently ignored in reporting. We urge readers to understand the inclusion, appreciate the value, and encourage other researchers to build the ethnographic and social databases in their future endeavors. Importantly, it is socially responsible research and allows further inclusion of local community involvement and partnership.

Figure 46: Local respondent discussing ecology and history

Several local respondents provided corroborative information on the oral history and current rituals. Interviews were semi-structured, informal, open ended and voluntary. Informed oral consent was obtained to include consenting to photographs and video recordings. Most respondents were senior community females and males. The context was very informal, open and somewhat focus-group based. The key respondent, Mr. Prum, was quickly identified as the only existing elephant catcher in the area. He graciously volunteered for video interviews. Others participated and reinforced the accuracy of his descriptions and analysis. No major contradictions were voiced regarding Mr. Prum's insights, although the respondents had no issues with candidness or disagreement. The main points are as follows:

7.5.1: Key Respondent Interview: Former Master Elephant Catcher and Trainer

- Mr. Prum Hoan; 76 years old; resident of the area; family is from the Cardamoms.
- Tamal is another man who used to catch elephants. He is a very good person. He is still alive and moved to Kravai/Kravaing District. He is 75. He lived here [Kanam area] when he was young.
- Suey people [ethnic Khmer minority] live in the area.
- King Monivong had an administrator who could assign local riders to catch elephants for him. Sometimes they would give the elephants to the king to gain prestige and honor. The person who assigned riders to catch elephants was Ta Maha(l).
- Mr. Prum [the respondent] decided to join the senior elephant catchers on his own accord. He observed and trained with the riders. After catching three elephants, he became a master. A ceremony necessarily followed in which the new master rider also has to eat rice mixed with the elephant feces.

- Mr. Prum captured and trained five elephants during his life. Others can catch up to 10–15 elephants in a lifetime. They are captured and trained one at a time.
- Sometimes they would keep the well-behaved elephants. If not well behaved, they would sell them. Before the Khmer Rouge regime, most families had 1–2 elephants.
- The Khmer Rouge sent elephant catchers to take the elephants. They took everything. Some locals and elephants fled to Thailand. Now, nobody catches or owns elephants.
- The lasso made of buffalo hide is the most sacred object with the most magic and rituals.
- There is no magic language (unlike the ethnic Bunong elephant catchers of Mondulkiri Province).
- Elephant rituals for elephant capture and elephant birth (for the calf) are the same. The buffalo hide lasso/rope is the most important item.
- Elephant capture is risky and there is high danger of being severely injured or killed. The tusks are particularly dangerous. They capture elephants in teams with other elephants. The buffalo hide lasso is the most important item in the capture. It must be strong (physically and magically). It often has magic (?) or magical power associated with it or imbued upon it.
- The captured elephant will be tethered to a pole for weeks or months until subdued.
- Naming entails offering names and sugar cane. When the elephant eats the sugar cane, the name will be accepted. If the elephant does not eat, a new name is offered.
- When females are ovulating, they are free to go to forest to mate with wild elephants. They are also allowed to mate with village elephants [differing from other practices such as associated with the Bunong]. No ceremony or wedding is performed [again, differing from other traditions]. The elephant owners do not always know the fathering elephant.
- Wild elephants are most dangerous.
- At least three riders[20] are needed to catch elephants (unclear if riding on one elephant or multiple elephants).
- Women can ride elephants if there is a chair. They cannot (or do not) become riders/mahouts.
- Elephant penis size is linked to predicted age; if long/big, the elephant will live to be 90–100 years old.
- Sick elephants are treated with a ritual. Fire (unclear if a fire or smoldering material) is burned at body and tail to rid the elephant of bad spirits.

7.6: Comparative Ethnographic Summary

Jean Ellul's 1970s ethnographic study in the area is particularly detailed and relevant (Ellul 1983). In fact, he studied the social and material culture of elephant capture and use in the immediate Kanam area of the Cardamoms (Srok Phnom Kravan [Druk bnam kravan]; particularly Leach). This included numerous respondent interviews covering detailed information on the customs, traditions, taboos, capture parties, masters and daily lives of

20 It is interesting that multiple riders on several of the paintings occurred. If multiple riders are necessary for elephant capture as opposed to normative work [maybe only one rider needed], then it may strengthen claims that elephant capture was depicted in the rock paintings.

the hunter-catchers, their assistants, and their interaction with other members in society; in normative village life contexts as well as during hunting and elephant use forays, events, rituals and so forth.

Ellul mentions two types of *hma* (elephant hunters/masters); the *ham thai* (appointed by the king) and the *hma mon* (ancestral, inherited). Hma Thav is part of the origin myth. *Ganval* are assistants, aides or apprentices. Ellul discussed the Hma Thav as well as Kui and other ethnic groups (1983:12–15); possibly indicating separate traditions in the larger region perhaps related to differences among major ethno-linguistic groups such as the Austronesians, Mon-Khmer and Thai.

Ellul notes that *tranam* is a vitally important concept equating to ritualized rules, taboos, and knowledge. Tranam could also indicate ritually charged state [of being] and/or a context for capturing elephants. Importantly, this also includes teaching and training elephant capture. In other words, a *tranam* physical, social, spiritual and mental context and "state" [of being] is required. This includes special language, behaviors, and rules that were not normative yet had a coherent logic (many words including *tranam* derived from words that probably relate to caution, danger, taboo, and the likes). A detailed analysis of the breadth of the *tranam* concept and implication, however, is not the purpose here and will be discussed separately in forthcoming analyses.

Importantly, however, instruction and training of apprentices could not be conducted on hunts. That is, training, teaching and knowledge dissemination were activities specifically separated from actual hunts; physically and socially. [Note: this is a sensible practice as training beginners or novices during actual hunts significantly increases risks for all participants; that is, it is best to train separately.] Interestingly, training and knowledge dissemination occurred in areas at the juncture of domestic and wild physical, social and spiritual contexts (e.g., the edge of the forest or edge of cultivated space). Again, there is a large corpus of anthropological literature on domestic, liminal and wild contexts and the implications that will not be reviewed here. With regard to the Kanam Site, it is perhaps not coincidental that the site is located in a seemingly similar non-domesticated, forested and seemingly transitional context. It would be convenient to place the Kanam Site in this explanatory paradigm. Nevertheless, assuming that the current "wild/forest" context was the same as the past is unwarranted. For all we know, the area may have been heavily cultivated or far less disturbed than what we see at present. The important point is that the teaching of *tranam* could only be conducted in certain contexts under certain conditions. It is unclear if this also means teaching *tranam* (special rules) in a "*tranam*" state (special mental, spiritual, and/or physical condition, such as a trance-like state, for example); *tranam* equals the codes/rules/knowledge, and, *tranam* also equals a supernatural or ritually charged state.

The consecration of lassoes is specifically mentioned (Ellul 1983:5, 7, 15)—the lasso, ropes and tethers made of buffalo hide being particularly important to Mr. Prum's accounts as well. Ellul also details the many different methods of capture: pits/pitfalls; surrounding/encirclement; harpooning in wet/inundated areas; driving into enclosures (i.e., walled); chasing and others. Lassoing is important to many of these. Strong ropes, tethers and roped gear are critically important.

Ellul further discusses ecology, a topic which has importance to the current research. He describes local classifications of several forest types based on maturity, dominant types of vegetation, topography, cultivated/uncultivated and/or cleared status, etc. This is typical of many indigenous classification frameworks and alludes to the type of habitats.

Thus, the expected animal populations can be deduced, the nature of the ecosystem, and aspects of systemic and chronic types and intensities of habitat disturbance, degradation, management or enhancement. Some of the location names are based on morphology of topography and several relate to particular animals (e.g., crocodile, tiger, serpent, etc.—some possibly totemic; Ellul 1983:8). Lastly, toponyms sometimes give clues as to the nature of animal populations, resources and eco-systems as well.

Ellul notes that certain ecosystems were preferred for hunting/capture (e.g., eastern windward side; areas with open fields/grass; certain valleys). Groups of 30 or more people (3–5 camps) would form 12–15 teams to go off for 3–4 weeks to capture elephants in certain areas (Ellul 1983: 8). He mentions one master per 60 people; a village has 25–30 houses and a few hundred people; generally equating to four masters (*hma*) and four apprentices (*ganval*) per village; and some other metrical information. Based on respondent feedback, Ellul indicates that there were 87 hunting elephants; 50 elephants were used for haulage and transport (wood, etc.); 12 wild elephants per year were captured, and there were more wild elephants in past. He indicates there were approximately 50 *hma* and 50 *ganval* in Pursat in 1968; 300 hunters and assistants in total to include "lineages" in Koh Kong and Kampong Speu further south in 1960s.

Although a full review of Ellul (1983) and the implications for understanding the rock art site is not possible here, it is important to note that the site may indeed have functioned similar to a ritualized information and skills dissemination that is locale specific to elephant and animal capture. We now wish to provide some comparative ethnographic comments on other extant ethnic groups in Cambodia still practicing elephant capture, training and use; particularly the Bunong, a groups researched thoroughly in recent years by Dr. Griffin.

The Bunong, also commonly known as Phnong by the Khmer, live throughout Mondol Kiri Province and into adjacent territories. They are related to the Munong of adjacent Vietnam, although interactions are illegal now. They boast the largest collection of remaining *domrei srok*, or village elephants, still extant in Cambodia. Mondol Kiri also holds many of the few remaining wild elephants.

Bunong were in previous generations of elephant catchers (Griffin 2009–2010), as were the Sui and Kui (or Kuay) of western Cambodia (Ellul 1983). They do not, however, share all the customs and beliefs of the other tribal groups. While Bunong still own and work with elephants, unlike the Sui and Kui, they no longer have the personnel in the form of rigorous men nor the ritual knowledge to appropriately undertake elephant capture (Giles 1929). Some Sui and Kui are, in fact, still elephant owners, but they now reside in Thailand, having fled the Khmer Rouge in the 1970s. They took their elephants with them (Cuasay 2002).

The technology and tactics of wild elephant capture do not differ markedly among Cambodian elephant people. Groups of Bunong men driving and riding on tamed elephants seek wild elephants among the hills and deciduous forests of the Annamite chain. The tame elephants help corner and constrain selected wild prey, especially immature yet partially grown specimens (no calves).

Buffalo hide lassos are key in the capture. Once caught on a leg or even neck, the rope should be tied to a tree. The ropes are both materially and psychically strong and unbreakable even for a thrashing elephant. The ridden elephants surround and constrain the captive while further ropes are fastened on legs. Thus held, the captive is nudged, pushed and hauled home to begin the process of breaking, or taming. Training follows

a taming routine that can last months and even result in the death of a strongly resistant animal.

The Bunong differ from the Sui and Kui in the details of their beliefs about the social and spiritual nature of elephants. Among the Bunong, elephants have traditionally enjoyed a near religious and certainly spiritual status. Unlike the Sui, Bunong in the past replenished their stock only through capture or purchase. Breeding, even inadvertent insemination, is still anathema. In other words, elephant babies are unwanted and can be an unmitigated disaster.

Should a female become pregnant, a costly wedding must follow. The mother and calf will eventually be expelled from the village, taking up residence and work in another village. Should this not occur, illness and misfortune are said to follow in the village.

Elephants in a village also function as indicators of peoples' adherence to proper behavior. A sick elephant is, Bunong say, sick because some villagers' misbehavior. Transgression of sexual mores is often diagnosed. Guilty parties are sought, perhaps punished, or reformed, and the elephant should get well. At the same time folk remedies are applied. Given that the Bunong world is full of spirits and invisible influences, the elephant may or may not fully recover.

Today, Bunong elephants are over worked, sometimes poorly fed and watered, and often handled by several owners or drivers. The result is that the elephant's needs are neglected. Modern medicines, such as antibiotics, are often rejected by the owners who prefer to rely on folk medicine and on assessment of villagers' behavior. The pressure to have elephants up and about, carrying tourists and hauling goods increases the decline in health and rigor.

8: Site Dating and Supply/Value Chain Discussion

The age and purpose of the paintings remain unknown. These variables are currently difficult to estimate. However, the possible representation of a few domesticated animals (very few), semi-trained animals used frequently by humans (specifically, elephants), and the possibility of agricultural tools and implements do not support speculations the paintings predate the Neolithic period in Southeast Asia. That is, the drawings/paintings are likely younger than 5,000 BP. In fact, it would be wholly unexpected if they predated the Bronze and Iron Ages or even the Funan Period. Thus, the paintings are probably no older than 2,000–2,500 years; even a metal age date would be surprising.

It is possible that some paintings were drawn quite early while the site and paintings were periodically augmented and modified throughout a long time span (e.g., 5,000–20,000 years), rather than created in a single event, or, augmented periodically over a shorter interval of time (e.g., 2–3 centuries; at most, 2–3 millennia). Given the overall consistency and content, the rock paintings appear to have belonged to a single local tradition, albeit long enough to superimpose paintings and remain in consistent but intermittent use—perhaps a few centuries or longer. There may be two or more traditions represented, however (e.g., the elephant and deer are separated temporally and/

or ritually.)[21] Some additions or modifications may be relatively recent as indicated by the some of the white outlines added to several paintings.

The lack of anything definitive of the Funan, Chenla, Angkorian, post-Angkorian, Colonial or Modern periods as well as the absence of any Buddhist or Brahmanistic indicators, however, could suggest something "earlier than Angkor". Nevertheless, the absence could just as easily justify a more recent post-Angkor date and/or the communities were well outside the immediate sphere of influence, possibly due to geographic and cultural remoteness—not uncommon with remote mountainous ethnic groups. Additionally, a new religious belief system replacing traditional belief systems was likely a moot issue, or, did not offer sufficient advantages or significant strength to replace traditional beliefs and practices.

It is heavily stressed, however, this does not imply they were isolated from supply and value chains. In fact, the demand for exotic forest resources likely ensured their high economic integration but loose control along those lines. For example, the ethnographic interviews intimated it was not their duty to supply elephants to the King, especially under coercion, force or threat. Rather, in addition to having a sense of loyalty, they increased their prestige by choosing to participate. Of note, they also did not mention competition with other villages or suppliers, and, also did not mention other sources of demand.

Artifacts in the area ranges from a stone axe to a highly stylized colonial metal dish, numerous bronze bangles indicative of the metal ages, and Angkorian period glazed stonewares (local and foreign). Many of these artifacts could have been in circulation for centuries. It is reminded that they are still in circulation today.

Jar burial and coffin burial sites in the Cardamoms generally date to post-Angkor periods (i.e., 15th–17th centuries CE with a well-dated sequence; Beavan et al. 2012; Beavan et al. 2015). The context and type of site choice (forested rock outcroppings) are similar. It is reasonable to hypothesize that a contemporaneous time range applies. However, the fact that both the Jar Burial Sites and Kanam Site are somewhat proximate, share a similar ecology, and utilize rock outcroppings still remains a very weak association for assuming contemporary site development and use.

The history deerskin trade mentioned in earlier sections is particularly relevant. A parsimonious and logical explanation of the Kanam deer paintings would revolve around the post-Angkor to colonial period deerskin trade. Deer and elephant were highly valuable resources. They are difficult and/or dangerous to obtain. The Kanam Site may have been a critical locus for rituals relating to protection, good fortune, traditions related to deer hunting and elephant capture, and activities (perhaps rites of passage) associated with related training and mastery. With heavily decreased deer population yet continued demand, it is likely more investment into anything bringing success and fortune (e.g., ritual) would be expected. Nevertheless, no other indicators are yet available to support or refute this hypothesis; either the hypothesized activities or the time frame.

The important point is that the Cardamoms were a source for exotic hinterland goods in semi-global supply chains, noted in historic documents. Deer were in high

21 It is possible the elephant tradition predates or postdates the deer, other drawing, etc. traditions. It is also possible that two sets of activities by different interest groups (perhaps even different communities) occurred simultaneously that explains the differences in drawing clusters and species/activities represented. These speculations are indeterminate at present.

demand (see also foreign goods coming into the Cardamoms during that period are clearly evident by artifacts in the Jar Burial sites, including the stoneware jars themselves. The supply chains were robust enough for relatively high volume and consistent trade to occur. Dr. Beavan also postulates involvement in larger trade networks and supply chains, perhaps akin to hinterland to coastal port dendritic drainage system models suggested by Bronson (1977).

Does the Kanam Site fall into this network? Elephants were clearly captured, trained and used. It is likely that elephants not only played a role in extracting forest resources, but were a significant forest export commodity themselves—certainly within mainland Southeast Asia, but possibly through port cities to more distant locations. Ethnographic evidence may not extend beyond recent decades and a century or two at best, and may not be sufficient enough to disentangle the destinations for more remote ends of the supply chains, but the data indicate a tradition existed of supplying Cambodian Kings with elephants; i.e., they were significant part (indeed an important source) of a larger value/supply chain network.

Earlier, it was mentioned that the elephant and deer depictions may not be contemporaneous. This is possible. It may be hypothesized that elephant pictograms occurred first or vice-versa. For example, elephant capture may have been prevalent during the Funan to Angkor periods, while deer capture eclipsed the economic targeting of elephants in the 15th–17th centuries due to growing demands and the ability for Cardamom residents to gain more wealth and prestige (possibly dealing through different networks with the decline of traditional Angkorian urban centers in Siem Reap; or, alternatively, more directly with royalty due to the shift from Siem Reap to Longvek). Quite possibly, resurgences of elephant targeting and/or deer targeting occurred periodically. The depictions of animals at Kanam may reflect varying trends. However, it could be argued the depictions were responses to population declines and local needs rather than the onset of increased extra-local demands. Thus, several hypotheses can be generated. Unfortunately, we are not at the stage to answer these.

It would be useful to find and analyze archaeological deposits, artifacts and ecofacts directly related to the Kanam Site. However, even if food remains, for example, were recovered and interpreted as offerings, it does not necessarily indicate ritual use for deer hunting or elephant capture. Recovering deer bones in abundance, on the other hand, may indicate a processing station. If thousands of deer were being extracted, we would expect sizeable processing sites for meat and hide preparation.

In addition, although finding datable material in buried deposits at Kanam may appear useful, it is reminded that drawing a link between paintings in a rockshelter/cave and material culture, other remains such as ecofacts, and/or anthropogenic deposits in an archaeological deposit inside a the same rockshelter/cave is not necessarily a strong link. In many cases, they are not linked at all.

On the positive side, the existence of related archaeological deposits and remains in the vicinity, and perhaps somewhere adjacent to or within the site is possible. The rock slabs, debris and deposits in and around the site may be covering or have assisted the accumulation of such deposits and remains. Downslope depressions which may have also captured eroding or washed away remains may be helpful as well.

Regardless of various "ways forward" for further archaeological research, we recommend dating the paintings themselves as a first step (perhaps possible with small paint samples). Further data recording and analysis of the paintings are equally

in order. Systematic survey of the area coupled with local assistance and ethnographic interviewing is highly recommended. The Kanam Site has fortunately been considered in larger scale regional analyses (Tan 2014). Continuing with the local to regional scale inter-site comparisons will prove highly valuable and address a wide spectrum of research interests. In all subsequent steps, however, a preservation plan must be prioritized. The documentation and report provided here is meant to be an initial measure for further conservation and protection efforts.

9: Preservation Threats

Threats to preservation include: spalling, insect nests and trails, plant growth, lichens, moss, salt, wind and water erosion, various natural chemical processes, fading, vandalism and recent white chalk/paintings overlaying the images. Roof collapse is possible, especially given the weight and laminar structure of the rock. Local residents maintain and respect the site with minimal disturbance, excepting the white chalk additions (meant to assist). The local residents or outsiders have not augmented, added or removed images to their knowledge.

Opportunities for oral history recording and analysis are quickly vanishing. Preserving related oral histories is an aspect that is often overlooked. The intangible cultural and social aspects are equally important. Efforts should be made to record what little likely remains.

Additionally, the larger catchment areas and habitats are being affected by various development activities. Sites may be damaged or destroyed.

10: Conclusion

The Kanam rock art site offers a unique and rich data set for assessing past activities and local ecology. The 222 images recognized thus far have a distinctly focused group of representations (Table 1; Figure 34). Most prominent and almost exclusively are elephants, deer and elephant riders. These animals, including humans, are typical of the Cardamom ecosystem, past and present.

Many ambiguous images may relate to other animals, implements, tools or undecipherable abstract pictures. Many images are superimposed and randomly placed on different planes, suggesting periodic, repeated activities. Some, however, occur in clusters possibly to represent scenes, herds or coordinated activities (e.g., elephant capture with other elephants and a team of riders).

As stated, the limited repertoire appears focused and deliberate to serve particular purposes. It is argued that at least two dominant activities, perhaps industries, are represented. The first applies to elephant capture, training and use. The second relates to deer targeting. Both of these industries were likely linked to sub-regional, regional and extra-regional value and supply chains.

The Cardamoms were a source for exotic resources to extra-local markets. Likewise, the Cardamoms were a destination for "exotic" resources from afar. It cannot be discounted that the currency in demand by Cardamom residents in the exchange networks also included immaterial returns such as prestige, status, recognition and inclusiveness/connectedness as well as exotic or non-locally produced material goods such as ceramics, beads, metals, textiles, etc. and possibly non-local staples and consumables (e.g., salt, fish,

various cereals…). With the available historic data and some of the archaeological data in proxy sites such as the Jar Burial Sites, we can fill in some gaps regarding "what was coming in" and "what was going out". However, the Kanam Site remains unique. It is one of a kind in the area. A hard connection to the Jar Burial sites, contemporaneity and socio-economic connectedness with them is currently missing. Nevertheless, a fair amount of data and deduction helps narrow the realm of possibilities vis-à-vis useful modeling.

Because of: 1) the extra-regional large-scale demand for deer in the post-Angkor colonial period for markets in Japan noted in historic records; 2) the possible relationship with the well-dated 15th–17th CE century Jar Burial sites; and 3) the nature of the artifacts recovered in the area, we argue a 15th–17th century CE period for the deer depictions. Elephant depictions may have a broader temporal range from the Funan to post-Angkor periods, but, like the deer depictions, are possibly more related to the post-Angkor through modern periods.

Interestingly, the nature of each industry may have been quite different. For example, the deer industry may have been purely functional (local food, medicine) and commercial (skins, food, medicine, other products). The nature of the value chain, exchange partners and exchange practices may have been quite different as well—i.e., more business oriented.

On the other hand, the elephant industry may have been functional (work, labor), commercial (exchange: live elephants and ivory), and social (prestige, status, tribute, reaffirming prominent relations, etc.). On the premise that both industries were not merely for local use and consumption, the network and value chain for elephants may have been far more intricate with many different social implications and "types" of demands than the deer industry. The social nature of exchange partnerships or tribute relations may have been vastly different.

It is speculated that the purpose and use of the paintings and the site may have been ritual—unfortunately an archaeological cliché for "unable to determine any specific function". The investment into ritual and magic related activities would be expected for dangerous and difficult endeavors, however—a strong point that cannot be ignored or dismissed.

We further speculate that decrease in populations would have required more investment in ritual and magic to enhance capture success, at least psychologically. The Kanam venue may have been used for preparation, teaching and training as well—the pre-modern equivalent of the PowerPoint presentation. It would be intriguing to further research the nature of value-chain social relations in both the deer and elephant industries, but data will be difficult to find.

Another possibility worth considering is that the industries may have been dominated by specific ethnic "hill tribe" groups. Various ethnic groups (e.g., Kuay, Bunong, Brao) are associated with elephant use and training as a dominant mode of production and identity marker (Diffloth 2011; Schliesinger 2011). It is also their ecological and economic niche. Pryce et al. (2014), for example, postulate that iron-working communities of Kuay (known ethnographically and historically) were also linked to ancient iron-smiths. The Kuay perhaps dominated the traditional industries from the Angkorian era to relatively modern times through strong continuous "techno-cultural transmission" linkages. Further ethno-historic research may shed light on the elephant catchers and deer hunters of the Cardamoms.

Returning to the data at hand, what do the images portray about the ecology beyond a Mainland Southeast Asian mountain environment with plenty of elephant and

deer (and presumably forest), though rapidly disappearing? Are the images a testament of controlling nature, changing the ecosystems, a harmonious symbiotic relationship within the ecosystem as interlaced members (perhaps even an "actor with agency" to maintain balance), a response to depleted animal resources in the ecosystem due to economic demands, obligations, over-extraction and possibly habitat loss? One or more of these explanations are plausible but data is limited, perhaps mismatched to these questions, and the hypotheses are subsequently difficult to strongly support.

It is known that deer populations were heavily targeted in Southeast Asia during the 15th–17th centuries, which almost assuredly included the Cardamoms. Subsequently populations were heavily depleted. This also accords with historic records (at least in Taiwan). Currently, most species of deer are at various levels of threat based on the respective endangered species lists; many on a trajectory towards extinction rather than recovery. Though targeting has diminished, habitat loss is increasing.

Habitat loss is an important criteria for sustainable populations. The Cardamoms are comparatively large, but not infinite. Khoo (2011) has a strong argument for habitat loss as a driving factor for population decline. Human in-migration and "forest-to-farmland" conversion with increased wood extraction (fuel and construction) is a significant cumulative force of environmental change, ecological shift and habitat loss. Was habitat loss also a critical factor during the Funan, Chenla, Angkor and post-Angkor periods with increases in human populations, 2,000 years of exponential urbanization and massive construction, and a heavy demand for agricultural lands and wood resources (construction and fuel)? This is an interesting question.

The deer targeting, if within a "business is business" paradigm, probably faced a relentless targeting effort. The more, the better. As for elephant populations, another ecological narrative might exist: humans may have effectively supported and cultivated sustainable populations. Although "politically correct" sounding (and it is reminded that poaching has been and still is a substantial problem), this may be an objective truth. It is reminded that the ethnographic interviews suggested every family had one or two elephants. Common practice is to nurture and take care of the animals, including provision of medicine and magic when sick or injured. From an economic standpoint, the loss of a cow is hard enough on a family's assets; but the loss of a much bigger investment, an elephant, may be exponentially more critical. Furthermore, although ivory trade likely impacted populations, there is no indication of massive hunting for ivory. The elephant-human relations depicted at Kanam are elephant-rider, not hunter-hunted.

Nonetheless, heavy external demand, habitat loss and war (modern/Khmer Rouge and arguably ancient conflicts and warfare) have taken their toll. Populations have moved from thousands or tens of thousands to less than a few hundred. Other socio-cultural factors and conflicting policies come into play as well (as with the Bunong case), another research topic in itself.

Returning to the purpose of the discussion, it is without question that further comparison with historic and ethnographic cases is warranted for increased understanding and better modeling. It cannot be determined whether elephants were used locally in the distant past and/or if they indeed may have been trained and traded (e.g., trained and traded to the kingdom centers in ancient Cambodia or neighboring areas). However, informants recalled that elephant use was prevalent around 50 years ago (i.e., before the modern conflict period in the 1960s–1990s) and elephants were given to the King and

his representatives. It is known that elephants were a high valued forest commodity. It is undeniable the local communities were the source for a much larger supply chain network.

It is noted that questions emerged as to which was the priority: deer or elephants? Deer are most highly represented in numbers, although this does not necessarily indicate a hierarchy of preference or importance. We did prioritize the elephant as a more important variable at the onset of research, however. The importance of deer emerged as a surprise. All we can surmise at present is that the deerskin trade was likely an equally important aspect of the local economy and culture. As stated, we only know deerskin demand was particularly prominent in the post-Angkor period (clearly evident in the 17th century) and Cambodia was a prominent supplier along with Thailand to supplement the diminishing Taiwan supply. This does not tell us when Cambodia became a major supplier, but it helps estimate a historic as well as a socio-economic context—a critically important source of commodities and integral part of the supply/value chain.

In summary, the Kanam Site reflects a focus on deer, elephants, and riders. By extension, this highlights two prominent industries and ecologies involving their centrality. By comparison, the Cardamom Jar Burial Sites clearly fall into the 15th–17th centuries CE and occur within the same forest hinterland and economic environment—a source of exotic resources for trade networks that were nebulous, complex and semi-global at concentrically larger geographic, social and economic scales. The Kanam Site may be contemporaneous. It is our opinion that it reflects significant inclusion in the value chain with a number of implications. There remains considerable research potential that should be operationalized as soon as possible.

Thus, what is the future? The Kanam Site is currently used for *neak ta* offerings and is thus ritually and culturally important for local residents. That alone warrants protection measures. The Ministry of Culture and Fine Arts has made solid efforts through their visits, documentation and encouragement for further research and protection plans.

As Kanam is a unique site (currently, an unusual rock art site, and one of a kind in the Cardamom area), it deserves special attention. Due to its rarity, it is very important for regional and global cultural heritage. The preservation condition is fair, but the paintings are not protected. It is not likely the site will be vandalized or looted (there were no other noticeable archaeological remains during the brief survey), but protection measures should be taken. Spalling, fading, erosion and degradation are evident. The site should be revisited for potential dating assessment and preparation of a report for UNESCO and others to consider further for recognition as an important historical and cultural heritage site thereby stimulating further action. This report is a preliminary step.

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Team photo, January 2015