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Rock art and long-distance prehistoric exchange behavior: a case study from Auwim, East Sepik, Papua New Guinea

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ABSTRACT: Since 1909, patrol officers, anthropologists, archaeologists, and others have identified evidence of a pre-contact trading network linking New Guinea with the Torres Strait. Current research in the Lower Sepik River Basin reported various ethnographic descriptions relating to cultural material objects stenciled on various rock art sites in Auwim, Upper Karawari-Arafundi region, East Sepik, Papua New Guinea (PNG). In addition to the rock art, the broader area has one of the most environmentally intact freshwater basins with lowland rainforests in Melanesia, and is famous for its architectural carvings and spirit houses. This paper reports new research that articulates local ethnographic knowledge about rock art with the art-work itself. The rock art panels contain a wide range of stencils primarily consisting of hands but also, importantly, several objects, one of which is the *kina*, gold-lip pearl (*Pinctada maxima*) shell. The *kina* shell stencils are, among other things, indicative of the remarkable distance over which the shells were traded and traditionally used. The Auwim case study is important because it is one of the relatively few sites across PNG for which we still have ethnography of rock art and therefore provides us with important insight into the past-present rock art practices, and concurrently notions of cultural continuity.

Keywords: Stencils, *kina* shell, *Pinctada maxima*, trade, D-stretch

Introduction

In Upper Karawari-Arafundi region, south of East Sepik in northeast New Guinea (Figure 1), exists a group of tropical rainforest inhabitants who have been called “progenitors of rock art” (Roscoe and Telban 2004, 93). This group has produced rock art for decades and is an important example of cultural continuity. Here rock art consists largely of hand stencils, but also contains material objects such as the *kina*, gold-lip or *Pinctada maxima* shell. This report presents the *kina* stencil, highlights its local significance, and the importance of their symbolism as part of a prehistoric trade network from the coast. We then apply the picture enhancement technique known as Decorrelation Stretch (D-stretch©) to rock art images to potentially uncover superimpositions or older *kina* shell stencils to observe their possible use over time.

The environmental and geomorphological characteristics of the southern end of the East Sepik area make it an ideal location to investigate rock art. The area receives around 3000-6000 mm of rainfall annually (Allen and Bourke 2009, 57, figure 1.5.2), which results in its limestone mountains having numerous small waterfalls that flow around 900-1000 m (Roscoe and Telban 2004) before feeding the Karawari and Arafundi Rivers, tributaries of the great Sepik River. The area contains one of the most environmentally intact freshwater basins in Papua New Guinea (PNG) and, as a result, the Sepik River’s upper region has been placed on

the UNESCO Tentative List as the “Upper Sepik River Basin”

(<https://whc.unesco.org/en/tentativelists/5065/>).

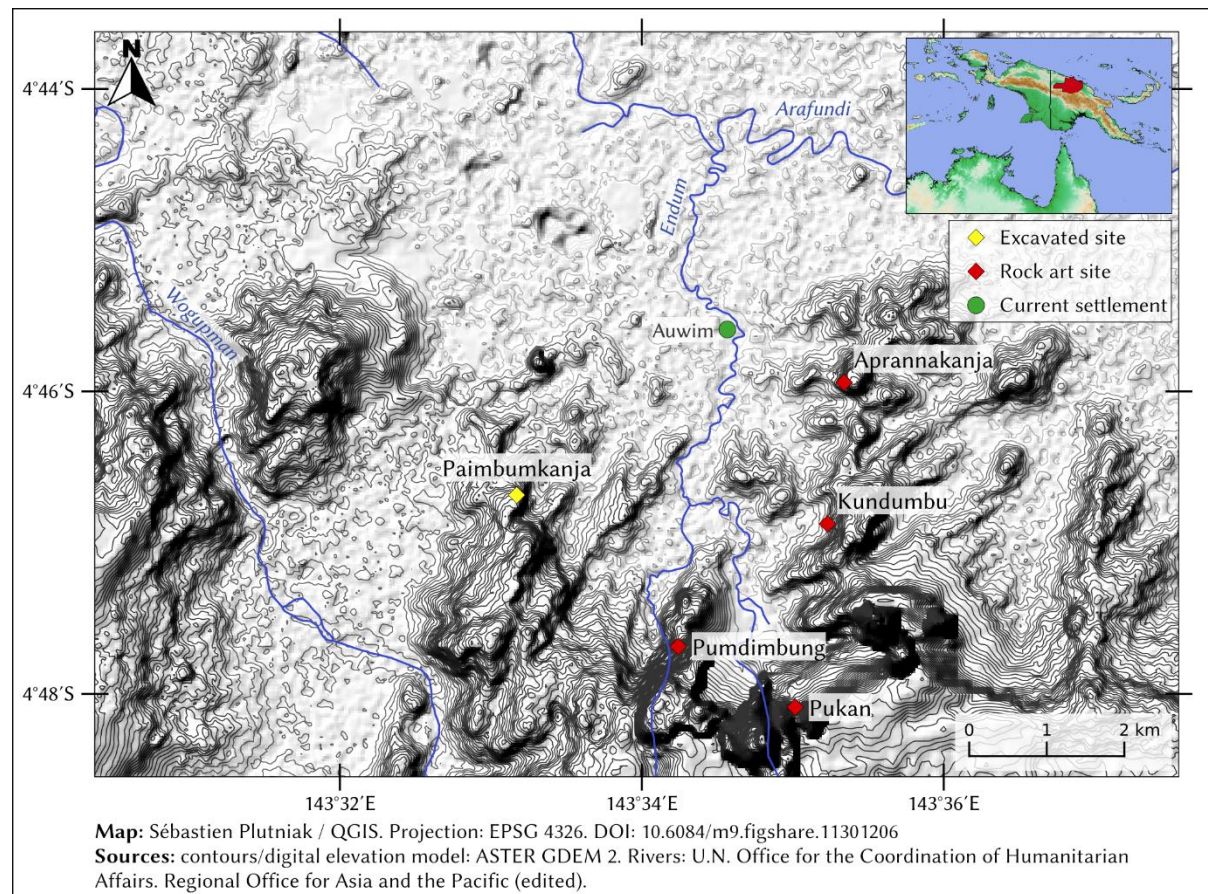


Figure 1. The Lower Sepik River Basin. Map also shows the location of rock art sites in Auwim, Upper Karawari-Arafundi region, East Sepik, Papua New Guinea. Map courtesy: S. Plutniak, Papuan Past Project, 2018, doi: <https://doi.org/10.6084/m9.figshare.11301206>.

The area is home to a population of more than 400,000 people and is one of the least economically developed areas in PNG (Allen and Bourke 2009, 29, table 1.1.1). It is also amongst the most linguistically diverse regions on earth where inhabitants speak more than 200 languages (Roscoe and Telban 2004, 93). Culturally, they are characterized for their architectural spirit houses, ceremonial music tradition, and art styles (<https://whc.unesco.org/en/tentativelists/5065/>). One of its most under-researched regions is Auwim village (also spelt Awim), in Upper Karawari-Arafundi (Figure 1). They are significant because of their “ethnographic distinction”, as they still practiced a hunter-gatherer lifestyle at European contact, which was seemingly rare for tropical forest peoples in east New Guinea (Roscoe and Telban 2004, 94).

Rock art in the Upper Karawari-Arafundi region

Research in the Upper Karawari-Arafundi region began with various scholars, beginning in 1959 with Forge and Buhler who were then followed by Haberland, Seyfarth, and Kaufmann (see Gabriel and Gorecki 2014, 11, 47). This early fieldwork primarily focused on recording the portable art and hooked figures of the region. Rock art remained unknown until it was reported in 1987 (Gorecki and Jones 1987a, 1987b, see also Gabriel and Gorecki 2014). The anthropologist Nancy Sullivan then led later expeditions beginning in 2005 (Edwards and Sullivan 2008) and others such as Borut Telban (Roscoe and Telban 2004).

Kina shell stencil in Auwim

In 1987, Gorecki and Jones (1987a, 1987b) reported about 20 rock art sites. Of these, they only visited 10, of which three, namely, Pundimbung (PNG National Museum and Art Gallery site code, CUN), Paigun (CUF) and Kalapul (CUL), were reported to contain 22 *kina* shell stencils (Gabriel and Gorecki 2014). These stencils have a distinctive crescent-shape that indicates their interpretation as *kina* shells. Actual shell ornaments (Figure 2A) are believed to have been traded from the Torres Strait and the Gulf of Papua (Gorecki and Jones 1987a, 3-4) in southern New Guinea. The *kina* shell ornament is perhaps traditionally made from the gold-lip pearl or *P. maxima* species and hung around the neck by a string (Gorecki and Jones 1987b, 3) (Figure 2B).

The *kina* shell stencil (Figure 2C) is a culturally significant item in Auwim, which is considered to be a ‘geo-symbol’, or a cultural marker of space and time. Gorecki and Jones (1987a, 3-4) reported that informants “were adamant that these items came from across the mountain ranges to the south.” In 2018, we were also informed that these pearl shell ornaments were once used for bride-price payment or exchange during marriage ceremonies and traded from the neighboring central highland in the Enga region to the south (Tsang 2018, 15). In this context, they are representative of women. For the nearby people of Wiru in the Southern Highlands, pearl shell ornaments are the “embodiment of all social and cosmological process, physical markers of the flow and movement of human substance mirroring the movement and reproduction of women and men”; however, the symbolism for its crescent form and associated symbolism is yet unknown (Clark 1991, as quoted in Ballard 1994, 132).

To the west, the *kina* shell drawings/paintings have been reported in rock art sites in the Western Highlands region (Swadling 1975, 13, 39; Gorecki and Dallas 1989, 249, 254). In

Auwim, the *kina* shell is still worn by dancers in farewell *singsings* as witnessed in June of 2018 (author's personal observation) (Figure 2B). To express ownership of a locality or remember individuals and events, human hand marks are produced, and specific cultural material objects are either stencilled on rock shelter walls or placed in caves and rock shelters. Local informants stated that given the high value still placed upon the *kina* shell, its stencils are more likely to be seen in rock shelters with art rather than actual ornaments as there is potential for theft (Tsang 2018, 15). In northern Australia, other important cultural material object stencils have recently been interpreted as inferring notions of memorization (Hayward et al. 2018). Furthermore, across Australia, pearl shell was traded over vast distances (e.g., Ackerman and Stanton 1994) and baler shell stencils were made at rock art sites far inland in parts of northern Queensland, Australia (e.g., Watchman and Hatte 1996).



Figure 2. A: An actual *kina* shell ornament. Photo courtesy: Juliana Fong, Queensland, Australia, 2020. B: A *kina* shell ornament worn by a small boy in Auwim, East Sepik Province in 2018. Photo: Roxanne Tsang. C: A similar *kina* shell stencil at Pundimbung rock art site. Photo courtesy: Papuan Past Project, 2018.

Trade connections of culturally valued objects between New Guinea and the Torres Strait have been reported ethnographically and archaeologically (e.g., see Haddon 1904, 43, 203, who provides an excellent ethnographic summary of *kina* [called Mai in Torres Strait]). In this context, these objects are considered highly sacred and frequently associated with important ceremonies brought by significant culture heroes. For archaeology, a minimum age (within the nineteenth century) is demonstrated by artifacts in museum collections (Moore 1984, e.g., #404). It is likely this represents broad shifts in ritual activities (including shell arrangements/ turtle shell masks) after 400 BP (David and Badulgal 2006; David et al. 2004). In addition, hand stencils are also found in Torres Strait, particularly good examples of which can be found on Badu Island and Pulu as well as on Somerset at the tip of Cape York in northern Queensland (Brady 2010, 226, 330). The two hand stencils found on Pulu Island were created in 2000 (Brady 2005, 527, 529; McNiven, David, and Brady 2002, 69; McNiven et al. 2002). In 1898, Haddon (1904, 4) photographed seven charcoal hand stencils, though these were gone by 2000 (Liam Brady, email to P.S.C. Taçon, March 27, 2020). In Auwim, a site called Apuranga was created during our fieldwork in 2018, which consists of hand, foot, and leaf stencils and handprints (Tsang 2018, 13).

New insights from the 2018 mission

In 2017-2019, our team of archaeologists, anthropologists, and bio-anthropologists have been working in the region as part of the broader Papuan Past Project, a collaboration between the University of Toulouse, France, and the University of Papua New Guinea with the goal of using genetic and archaeological methods to better understand settlement patterns in New Guinea (“Papuan Past Project,” accessed April 06, 2020, <http://papuanpast.hypotheses.org/>). Rock art research extended out of the archaeological component of the project and continues as part of one of the author’s (RT) PhD research.

In 2018, the community of Auwim had 29 households with an observed population between 200-300 (Bartole 2018, 63; Tsang 2018, 1). They speak both the local language ‘*Tape*’ and the PNG-wide *lingua franca* Tok Pisin (Bartole 2018, 63). Inhabitants of Auwim are thought to originate from two major clans (Wandukumbay and Mungkumbay), which is comprised of at least 20 sub-clans (Roscoe and Telban 2004, Tsang 2018, 1). The current population

largely depends on fishing, hunting, and collecting fruits and nuts. They fish in the nearby creeks and rivers, rarely hunt pigs except for special occasions, and frequently extract sago (Tsang 2018, 1). Sago (*Metroxylon sagu*/*Metroxylon salomonense*) remains the primary food source, combined with low-intensity taro gardens, banana (Hanson et al. 2001, 210), and breadfruit seed. Gardening is not common, perhaps because of “land constraints due to steep slopes, poor soils, high rainfall, and frequent cloud cover” (Hanson et al. 2001, 211, see map).

In this area we focused on *kina* shell stencils from Pundimbung and Pukan (PNG National Museum and Art Gallery site code, CUQ). Pundimbung was reported to contain eight *kina* shell stencils in 1987 (Gorecki and Jones 1987a, 10, 12) while Pukan was not visited by Gorecki and Jones. Both rock shelters are situated between about 300-400 m above sea level and are two hours walking distance from the campsite called Angarik which is two hours further south of Auwim village (Tsang 2018).

These sites are associated with sacred ritual and spirit-being stories, respectively. However, interestingly, both sites are similar in terms of their rock art motifs, rock shelter function (e.g., gendered space, with male and female sections), and their geographic location (steep cliff edges). They contain stencils and paintings of hands (e.g., right and left hand stencils, hand-and-arm stencils, left and right foot stencils, finger message stencils, bird foot stencils, bush knife stencils and handprints) and material objects (e.g., bone dagger, shell [baler, ring, disc, belt, rope] ornaments) (see Gorecki and Jones 1987a, 10, 1987b, 10; Gabriel and Gorecki 2014). Pundimbung contains about 580 rock art motifs (Gabriel and Gorecki 2014, 23, 25; Gorecki and Jones 1987a, 10, 1987b, 10). At Pukan, a preliminary count of motifs was not obtained in 2018 as a section had collapsed, but will be the subject of future investigation. Nevertheless, from the accessible chamber considered to be the male section, we identified both stencils and handprints. This section contains left- and right-hand stencils and handprints, finger message stencils, and various shell material object stencils (e.g., *kina*, nose septum, and Conidae shell shape-like stencil). Pundimbung and Pukan rock shelters also contain archaeological remains (e.g., animal and human bones, including cuscus and crocodile bones, pig skulls, and human tibia, femurs, and skulls) and other material objects (e.g., bone dagger, stone axe, bamboo flute, carved spear, doughnut-shaped stone, *purpur* [flower plants weaved on traditional grass skirts worn by females during cultural *singsings*] and *paspas* [arm band] (Gabriel and Gorecki 2014, 9, 10; Tsang 2018, 6-11) placed in the shelters. Some of these rock art motifs and archaeological remains placed in these rock

shelters are associated with stories relating to the individuals or clan members who produced them.

While in the field, superimposition was not visibly recognized in either shelter except for exfoliation in various parts. Faded motifs on exfoliated surfaces, smeared pigments, and new paintings produced on hollowed surfaces after exfoliation (Gabriel and Gorecki 2014, 13) were noted in 1987 by Gorecki and Jones for Pundimbung and in 2018 for Pukan as observed by our team. Concurring with Gorecki and Jones, we contend this suggests considerable age and continuity of the stencilling tradition at these sites. To better explore and support this notion, we applied D-stretch© on photographs taken in 2018 to reveal superimposition. D-stretch is a computer enhancement tool that is a plugin into ImageJ (a processing and analysis program) that helps rock art researchers to identify imageries that are invisible to the naked eye, usually referred to as superimposition and in instances where we are unable to date the art, this demonstrates a chronological sequence or painting episode.

In PNG, rock art sites have been reported to contain superimposition (e.g., Ballard 1988; Bulmer 1960; Gorecki and Jones 1987a, 7-8; Leask 1943; Swadling 1975, 13-14; White 1967; White 1972, 96; Williams 1931), but could be better sequenced and described with D-stretch©. While we understand that the use of image enhancement using D-stretch© and other computer enhancement techniques has been employed in rock art research for decades now (Brady 2006), it has not been widely used in PNG. The use of this technique has been reviewed and described (e.g., Brady 2006; Brady and Gunn 2012), tested at Torres Strait rock art sites, and is said to have worked effectively (David et al. 2001; McNiven, David, and Brayer 2000).

The stenciled motifs at Auwim vary from distinctively clear to extremely faded. Most of the stencils have been made from ground ochre collected locally from the creek banks (Tsang 2018, 2). This is done by orally spraying paint over the hand or other material objects. To increase our ability to define or find the original form of faded paintings (McNiven et al. 2004, 231), photos were enhanced using D-stretch©, version 8.3 (color filters: yxx, yxx, labi and yre, respectively). D-stretch© was systematically applied to four photographs of both hand and *kina* stencils from Pundimbung and Pukan rock shelters (Figure 3). The use of D-stretch© revealed previously unrecognized hand stencils (see Figure 3A-B) and allowed us to differentiate the very recent phase of stencilling in terms of the clarity of images (e.g., Figure 3A and B) from an older phase, which is more faded (Figure 3C-H). In addition, the

enhancement of a photograph with a *kina* shell stencil revealed two more stencils that could not have been observed using the naked eye (compare Figure 3G to H). This is indirect superimposition as it is not directly placed over another, but rather spatially related and indicates an older phase of *kina* stencilling. Although we do not have direct dates for the stencils, we can conclude from the superimposition that the site had various and distinct painting episodes over time. This may indicate that the trade network goes back at least a few generations.

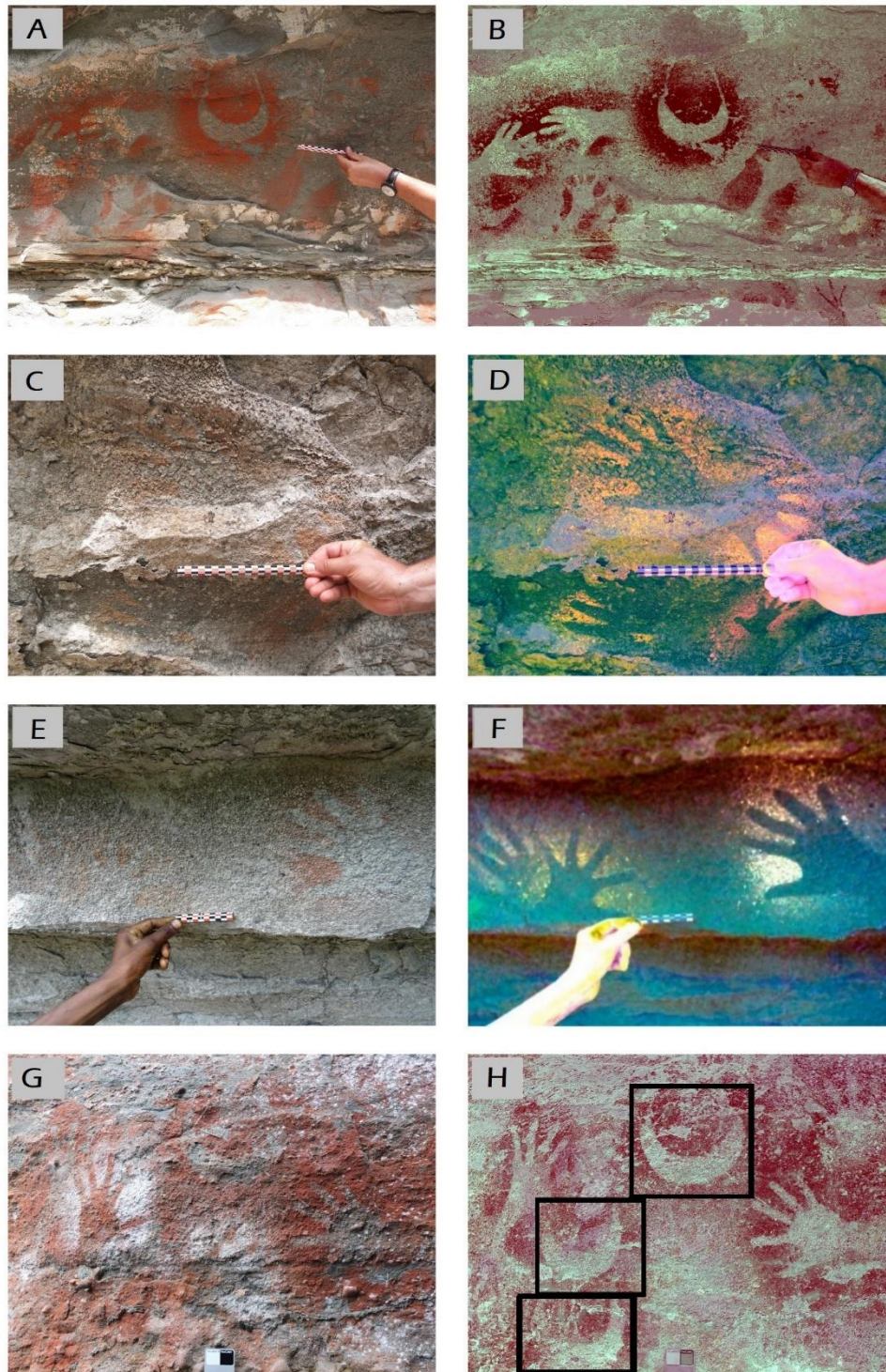


Figure 3. The results of using D-stretch© version 8.3 wherein color filters are in parenthesis for each image enhancement. A: Photograph before enhancement. B: After enhancement (yxx) two very distinctive *kina* shell stencils are revealed. C: A second panel at Pundimbung, photograph before enhancement. D: After enhancement (yxx) showing two hand stencils at the top and smaller hand stencils at the bottom. E: A third panel at Pundimbung, photograph before enhancement. F: After enhancement (labi), three hand stencils were clearly identified. G: At Pukan rock shelter, photograph before enhancement shows one visible *kina* shell stencil. H: After enhancement (yre), shows at least two more possible *kina* shell stencils. Original photographs courtesy of Papuan Past Project, 2018.

Discussion

Trade in both shells and shell ornaments has long been a widespread tradition across the greater Sepik region. *P. maxima* are the largest species of the pearl oyster genus, *Pinctada*, and are prevalent throughout parts of the Indo-Pacific. The species can be yellow, gold-lipped, or silver-lipped in color and is characterized by its thick, large shell (20-30 cm in length) (Sims 1993, 2; Poutiers 1998, 186). They occasionally inhabit reef flats, but are more commonly found between the sublittoral zone at 10 m and the littoral zone at 60 m in depth (Poutiers 1998, 186). They are usually located in open shelf areas of continents and large islands and in clear, turbid water, usually in dense colonies (Poutiers 1998, 186; Sims 1993). Oyster pearl species are commonly found from Burma to the Solomon Islands and cultured for white pearls in northern Australia (Christensen 2016; Poutiers 1998; Shnukal 2018; Sims 1993), the Torres Strait since the 1860s (Swadling 2019, 18), and Southeast Asia. The gold-lip has also been cultured at various times in east New Guinea. The large-size is edible and said to be abundantly used for the pearl trade industry and has great economic importance in many areas (Poutiers 1998, 186).

Thus, the pearl shell crescents are likely manufactured from the *P. maxima* shell from the south PNG coast for two main reasons. First, the color of the species correlates with the ethnographic specimens as does the size of the shell (see Gabriel and Gorecki 2014, 9, figure 7). Second, Poutiers (1998) points out that the species prefers open waters between continents and large islands, such as is found to PNG's south, and one of the reasons it was cultured in northern Australia. Although *P. maxima* were culturally important along the south coast of PNG, they were culturally insignificant along the north coast as indicated by personal communication between locals from the north coast and Swadling and Anamiato (1989, 228) in 1984 and 1985, even though it can be found there.

Europeans produced machine-made pearls (Gorecki and Jones 1987a, 4) and imported them into the Highlands given their high demand and value in the 1930s (see Hughes 1977, 56; Swadling and Anamiato 1989, 230). However, it has been suggested that locals already had them before European incursion in 1930, which pre-dates the trade network and has been the source of interest by some anthropological archaeologists (Gaffney et al. 2018, 2). The use of the shell ornament in the central Highlands prior to European contact may have led to continuing trade into the foothills of East Sepik (McDowell 1989; Swadling 2010, 149) as the previously unrecognized, faded *kina* stencils in Auwim may suggest (Sullivan 2012).

Swadling and Anamiato (1989, 228-230) among others (e.g., Gorecki and Jones 1987a; Swadling 1994) proposed that the *kina* shell ornament trade from the Torres Strait and Gulf of Papua was based on three main facets. First, in 1909, a German expedition into the middle Sepik region observed the use of the crescent-shaped *kina* shell ornament (Reche 1913, Plate XI, No.2). These ornaments did not come from the north coast of New Guinea as various personal communications in 1984 and 1985 with local informants from the north coast (Maprik and Yangoru) suggested an absence of cultural significance in their areas (Swadling and Anamiato 1989, 228). This contrasts with others in the middle-Sepik (Yatmul and Chambri) who said that the *kina* shell was the second most valuable shell in their areas (Gewertz 1983, 238, as quoted in Swadling and Anamiato 1989, 228). Second, McDowell (1983, 1989) confirms evidence of pearl shell ornaments being traded from the Highlands into the south Sepik region in 1932 (Swadling 2010, 149). Third, although in 1933 pearl shells were used in the central Highlands, they were broken and repaired. As such, Hughes (1977, 54-55, 57, 185) suggested that the “Ramu-Bismarck Fall and Asaro did not have any pearl shells” (Swadling and Anamiato 1989, 228). Hence, Swadling and Anamiato (1989, 228) concluded that it could not have been traded from the Madang coast. Swadling (1994, 141-142) also supported this notion by citing Landtman’s (1927) anthropological work in the Gulf of Papua (Landtman 1927, 40-41), which suggests the manufacture of trade shells by Torres Strait Islanders (Moore 1989, 44) and that these were exchanged with the Trans Fly and Papuan Gulf inhabitants. Similarly, Gorecki and Jones (1987a, 3) also identified one of the material objects stencilled in Auwim as the *kina* shell, made from the gold lipped pearl-shell as described previously. We concur with the notion of trade from the south coast into the Highlands region, further trade from the Highlands into the Sepik, and with Swadling and Anamiato’s (1989) identification of cut sliver fragments deriving from *P. maxima* species dating back to between 2000 to 3000 years ago (Gorecki and Gillieson 1989, 225).

While we accept that there is an issue with dating (Golson 2005, 472), the layers from which the fragments were recovered give a “range of two standard deviations of 3240-1820 cal BP which suggests that none of the shells was younger and thus is a reasonable age for the late-occurring pearl shells” (Bayliss-Smith, Golson and Hughes 2017, 322-323). The date gives us a probable maximum age for the oldest *kina* shell stencils at rock art sites. In other words, the *kina* shell stencils were probably made at various times within the past two millennia. In addition, our new results from D-stretch© revealed spatial-superimposition suggests to us that there may have indeed been several episodes of stencilling in the region that was

previously unrecognized. We argue that although the degree of fading does not always reflect or demonstrate age as opposed to taphonomic and/or weathering processes, exfoliation of surfaces and smeared pigment on fallen surfaces, as well as new motifs on hollow surfaces, suggests to us that there is indeed different stencilling episodes in Auwim. Subject matter and differences between the faded rock art, other superimpositions, and what appear to be more recent creations, is the subject of ongoing analysis and planned fieldwork in the future.

Conclusions

In this paper we have highlighted the importance of how rock art has allowed us to improve our understanding of culturally significant objects. It contributes to our ethnographic and archaeological knowledge on the trade, exchange, and connection between coastal/island and inland populace/societies. For instance, the *kina* shell ornament stencils support the notion of *kina* shell trade into inland east New Guinea from the south coast. Secondly, brief ethnographic reports in 2018 further confirm that this trade was from the south and revealed new *kina* shell stencils, hand stencils, handprints, and other material object stencils from the Pukan site, which had not been previously. Additionally, this emphasizes the cultural significance that *kina* shell objects still have in Auwim, as well as why they may have been stencilled in rock shelters. Finally, our first attempt to apply D-stretch© to photographs taken in 2018 from a PNG rock art site suggests that there were episodes of stencilling in the Auwim area of the East Sepik region and that the tradition may extend back far in time.

Kina shell stencils and hand stencils appear to have been made over a prolonged period. *Kina* shell and *kina* shell ornaments of high cultural value were traded and exchanged over long distances across topographically complex terrain and over many centuries. As our research demonstrates, rock art imagery, ethnography, and computer enhancement of rock art panels has allowed us to better understand this long-distance exchange behavior. Although the temporal duration for when these activities occurred is subject to further investigation, our research highlights the continuing importance of stencilled rock art across the broader Island Southeast Asia-Australia region where it was not only abundant, but done over a period of perhaps 40,000 years as evidence from Indonesia suggests (Aubert et al. 2014, 2018).

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