

The Emergence of Shell Valuable Exchange in the New Guinea Highlands

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ABSTRACT Shell valuable exchange in the New Guinea Highlands has been a key interest in anthropology, providing insight into economics, aesthetics, and social stratification amongst banded communities. This paper describes how shell exchange at ethnographic present reflects deeper historical processes. We trace the origins and subsequent changes in shell use from the terminal Pleistocene to the Late Holocene at the site of Kiowa in Chimbu Province, Papua New Guinea. Zooarchaeological and technological analyses of Kiowa's shell artifacts indicates riverine mussel was procured locally from the terminal Pleistocene (9,500–10,000 years ago) and featured as a minor component in the diet into the recent precolonial period. In contrast, evidence for marine shell valuables only appears in the Late Holocene in the form of *Trochus* armbands and *Tegillarca granosa* and *Polymesoda* cf. *erosa* multifunctional tools. This challenges ideas that associate the gradual dispersal of marine shell into the highlands with the spread of agriculture around the Wahgi Valley at the start of the Holocene, and supports punctuated pulses of coastal contact. In doing so, we formulate a testable model for the development of shell exchange into the highlands, with implications for the emergence of stratification and the conduits between the interior and coast. [*shell valuables, trade and exchange, coastal contact, stratification, New Guinea Highlands*]

RESUMEN El intercambio valioso de conchas en la zona montañosa de la Nueva Guinea ha sido un interés clave en antropología, proveyendo conocimiento en la economía, la estética y la estratificación económica entre las comunidades congregadas. Este artículo describe cómo el intercambio de conchas en el presente etnográfico refleja procesos históricos más profundos. Trazamos los orígenes y los cambios subsecuentes en el uso de conchas desde el Pleistoceno terminal al Holoceno tardío en el sitio de Kiowa en la provincia de Chimbu, Papúa Nueva Guinea. Los análisis zooarqueológicos y tecnológicos de artefactos de conchas en Kiowa indican que el mejillón fluvial se obtuvo localmente desde el Pleistoceno terminal (9.500–10.000 años atrás) y se incluyó como un componente menor en la dieta en el período precolonial reciente. En contraste, la evidencia de objetos de valor de las conchas marinas sólo aparece en el Holoceno tardío en la forma de brazaletes de *Trochus* y herramientas multifuncionales de *Tegillarca granosa* y *Polymesoda* cf. *erosa*. Esto reta ideas que asocian la dispersión gradual de las conchas marinas en la zona montañosa con la expansión de la agricultura alrededor del Wahgi Valley al principio del Holoceno, y apoya pulsos intermitentes de contacto costero. De este modo, formulamos un modelo comprobable para el desarrollo del intercambio de conchas en la zona montañosa, con implicaciones para la emergencia de estratificación y los conductos entre el interior y la costa. [*objetos de valor de conchas, comercio e intercambio, contacto costero, estratificación, Zona montañosa de Nueva Guinea*]

When the Leahy Brothers first trekked into the deeply corrugated valley systems of the Central New Guinea Highlands in 1930, they were struck by the large marine shell valuables worn by communities who were thought to be isolated from the coast

(Leahy 1936). Since then, anthropologists have concerned themselves with tracing the networks and interrelationships that allowed these shells to work their way up into the interior of the island (e.g., Harding 1967; Hughes 1977; Sillitoe 1979). As such, the subject occupies an important place in the history and theoretical modeling of the discipline. Especially in relation to the economics and politics of exchange valuables. Archaeological anthropologists have also debated the timing, nature, and intensity of earlier forms of shell valuable exchange in the precolonial past (Swadling 1994; White 1972). The histories of these shell valuable exchanges are significant to anthropological understandings of trade and cultural history for two main reasons. Firstly, because the introduction of marine shells into the Highlands economy, even in small numbers, may have had important historical consequences in terms of the process and tempo of trade and exchange, along with the nature of social organization, leading to the highly sophisticated exchange networks and low-level stratification characteristic of the ethnographic period. Secondly, because marine shell is direct evidence for connectivity between the coast and the interior, it is a proxy to build interpretations about the movement and flow of goods, ideas, and perhaps people between the coast and the Highlands, with implications for the translocation of coastally adapted crops into montane environments starting in the Early Holocene, 10,000 years ago, and punctuations to Highlands economics around the Mid-Late Holocene.

Little is known about shell valuable exchange prior to the nineteenth century. Vial (1940) asserted that the number of shells entering the Highlands economy each year prior to European contact must have been small. However, it is not known what role these shell valuables played in Highlands society. Could shell objects have been even more important in the past for signifying prestige due to their rarity—as Vial (1940) further notes, the value of shells fell in the colonial period as stocks increased—or did they hold little more than personal value for adornment or as tools? We present one line of archaeological evidence for the development of shell use and exchange in the New Guinea Highlands, excavated from the rockshelter site of Kiowa in the Chimbu province (Figure 1). Although this assemblage is limited in number, it is highly informative, containing some of the only marine shell artifacts from a Highlands archaeological site. Using the Kiowa data, we ask: When did marine shells enter into the Highlands economies? Did the material become available at different times in different areas? And how did this inform social organization and exchange relationships? The evidence demonstrates that, although pearlescent riverine mussel was procured locally for subsistence since the terminal Pleistocene, there is no evidence for marine shell exchange at the site until the Late Holocene, from around 1,000 years ago. We posit that marine shell valuables were not a major component of the wider Highlands trade system until very recently and that the explanation for their importance is not exclusively linked to aesthetic values or to availability, but to unique, historically contingent mutations to power relationships and interaction networks that came to fruition in the last millennium. In doing so, we then build a tentative model for the origins and historical process of shell exchange around the Highlands, with implications for social organization and connections with the coast. This model stresses local variation as opposed to a singular evolutionary development. It also lends further support to the recent origins of incipient stratification in the Highlands in the form of “big-men.” As shell valuables have been used at various times and in many parts of the planet (Trubitt 2003), examining the variable histories of this material in New Guinea might be useful for informing broader anthropological concerns about changing trade and exchange within small-

scale communities, and about how the materials of this exchange inform stratification and social interrelationships.

[FIGURE 1 ABOUT HERE]

The Anthropology of Exchange Valuables

All human groups have a propensity for ranking materials by “value” (Gregory 1982), also known as hierarchies of esteem (G. Clark 1986). Graeber (2001) argues the value of objects reflects commoditized labor and the proportion of total pooled work invested in that object. “Valuables” are then representations of specific action and motivate new forms of action, often in accordance with the characteristics associated with that object. For instance, objects that denote high status symbolize actions associated with achieving that status and encourage others to act in accordance with these characteristics. The locally peculiar ways of ranking different valuables may reflect resource scarcity or formal and informal measures of esteem within specific value networks operating within broader society (Gudeman 1986; cf. Graeber 2013). The exchange of valuable objects materializes social relationships (Thomas 1991, 7) and strengthens connections within these value networks.

Within hierarchies of esteem, often some of the most highly prized items are exotic, with restricted availability, and require exchange for procurement. Exotic exchange valuables, in particular, can be used to entice others into reciprocal relationships due to their rarity (Gosden 1989). For instance, in coastal Papua New Guinea, small and highly desirable objects like worked shell or obsidian would be added to bulk trades of practical objects, such as subsistence crops, to make the exchanges more appealing and to maintain reciprocal trade deals, essential for the survival of the trading groups (Harding 1967; Mager 1952, 128). The production (or not) of specific objects could also be deliberate, whereby different groups would focus on making specific, highly sought-after products to encourage and maintain exchange links. Thus, in archaeology, the presence of exotic goods, especially worked ornaments, is assumed to indicate some degree of social maneuvering due to their ability to manipulate and foster social relations.

As Hayden (1993, 1998) describes, these valuables produce the infrastructure of small-scale society, regulating both exchange relationships and social hierarchies. This is because these materials, as they flow into local economies, can be used to identify and enhance the status of particular individuals or social units. In practice, the contingencies of how something is displayed, and by whom, are paramount. Such valuables visually imply wealth, success, and, most importantly, differential power relationships. As the wearer or user visibly demonstrates success, others looking to that individual will attempt to imitate that success (G. Clark 1986). The use of these valuables also helps the owner to manipulate established power dynamics—for instance, in forming or maintaining friendships, promoting sexual selection, and controlling labor (Hayden 1998). Boone (1998) demonstrates that the labor costs involved in short-term display is outweighed by the potential benefits to social power and therefore improved fitness of successful individuals. This would encourage the gradual investment in display as other less-successful individuals are slowly drawn into the signaling game. These kinds of aggrandizing behaviors have been identified amongst ethnographic groups (e.g., Gould 1982) and developed into archaeological models by Clark and Blake (1994) and Hayden (1998), which posit that a small

percentage of personalities in a group who are ambitious and acquisitive of prestige valuables will have substantial influence in producing and controlling hierarchies within groups.

The production and exchange of these objects is only possible with surplus labor: work not scheduled for subsistence or survival activities (Hayden 1994), except when the production and exchange of goods is essential to acquiring food. Hayden (1994) shows that exchange valuables also mobilize and store surplus labor, in that they can be traded for direct labor costs or pent-up labor costs in other objects, plants, or animals. This includes the surplus labor of procuring raw materials, producing the things themselves, and distributing them around the landscape. This point is important because the emergence of exchange valuables in historical perspective might then be useful in teasing apart changes to surplus labor or food—and, in turn, the development of social stratification relating to the control of this surplus.

There are interregional commonalities in some of the materials deemed suitable to act as exchange valuables. The aesthetic quality of certain objects, such as polished stone and bone, obsidian, red ochre, and shells, perhaps appeals to a shared human propensity to collect lustrous, brightly colored, or visually striking things (Hayden 1998; Holdaway 1984; Taçon 1991). These qualities also lend these objects to public display (Schiffer 1992). So, too, do objects that visually impress the stored labor cost, such as highly ornamental carvings or finely crafted stone implements (Gell 1992). Marine shells, in particular, have been used as exchange valuables in many parts of the world from the Late Pleistocene through to today: in the Americas (Bradley 2013), Europe (Reese 1991), Asia (Bar-Yosef Mayer 2005), Africa (Bouzouggar et al. 2007), and Oceania (Balme and Morse 2006). In some instances, these shells could be used as currency in commodity exchanges, with their value increasing relative to their distance from the coast (Trubitt 2003). In Africa, Indian Ocean cowries were used as shell money in the slave trade during the sixteenth and seventeenth centuries (Gregory 1996), for instance. However, shells also had multiple symbolic and ritual functions and were not always alienated from trade partners or the broader social exchange network. Most famously in the Kula exchange network in the Massim of southeast Papua, shell objects would be carried vast distances on costly interisland expeditions to maintain delayed reciprocal obligations (Malinowski 1922; Munn 1992). The exchange valuables themselves would be inalienable from their previous owners and their life history, while the temporary owners of the objects would increase their social standing through successful exchanges.

Ethnographic Shell Valuable Exchange in the Highlands

At ethnographic contact in the 1930s, New Guinea Highlands economies similarly relied on delayed reciprocity, involving casual gifting and market trade, punctuated by important ceremonial exchanges that shifted objects over considerable distances from their place of manufacture (Brown 1961). Anthropologists have long noted the centrality of marine shell valuables in these exchanges (A. Strathern 1971). In some places, these shells took on a role similar to money, which helped to maintain the smooth transfer of more utilitarian goods, such as axes and pigs, between valley systems (Sillitoe 1978). As a currency, marine shells also helped men acquire status; by controlling and distributing material wealth, they become “big-men” within incipiently stratified extended kin groupings (A. Strathern 1969).

From the diverse assortment of shells found around the coast, only a select few were commonly imported into the Highlands and used in exchange (Figure 2). The most common included cowrie (*Cypraeidae* spp.) and dogwhelks (*Nassarius* spp.) for money and rings, and the most valuable were usually large pearl oyster (*Pinctada* spp.), volutes (*Volutidae* spp.), large white egg cowrie (*Ovula* spp.), and green turban shell (*Turbo marmoratus*) (Hughes 1977, 187). White-lipped and gold-lipped varieties of pearl oyster (*Pinctada maxima*) were the most significant material in *moka* and *tee* ceremonial exchange, which formed central activities in the production of big-men in the Western Highlands area. In these competitive gift ceremonies, large numbers of live pigs would be killed and distributed to other groups, with the expectation of delayed reciprocity of greater value in the form of shells, pigs, or other objects. In this network, gifts would travel along established linkages of clans and individuals, pooling together in semiregular ceremonies.

Hughes (1977, 184) points out that shell valuables are key material evidence for tracing the history of Highlands societies. J. Clark (1991, 310) therefore asked the important question: “Why were shells adopted for exchange in the first place?” For Clark, pearl oysters were not just “power tokens” but were sought after due to symbolic and aesthetic connections with the natural world and cycles of death and regeneration (see also M. Strathern 1981, 1984; Wagner 1978, 1986; Weiner 1988). Marilyn Strathern (1970) points out that the value of the shell was based on its style and visual excellence; the most prized shell valuables were those with a certain shape and sheen. In various places, shell valuables were protected against depreciation by this symbolic and aesthetic meaning (Breton 1999; Sillitoe 1979). For instance, amongst the Wodani of West Papua, cowrie (*Cypraea moneta*) were used both in mundane exchange for pigs, salt, and material culture, but were also seen as “immortal people” and essential to the reproduction and reconstitution of the clan in matrimonial and homicide compensation.

However, although these accounts offer vivid descriptions of the complex material lives of shells and people in the Highlands, it is not clear how much of what was observed during major ethnographic period from the 1950s through the 1970s is relatable to the precolonial past or, rather, was a result of colonial disruptions in the mid-twentieth century. Europeans substantially altered the nature of Highlands exchange and the value of shell objects by flooding the market in the 1930s and 1940s (Hughes 1978). Kiaps (colonial patrol officers) would distribute thousands of shells as money in exchange for pigs, crops, and labor, sidestepping many of the social rules regulating who handled shell valuables and how status ought to be acquired. As a result, instead of big-men regulating the flow of shell valuables, many “ordinary” men and women could acquire shells and prestige through wage labor. Hence, many of the observations by early ethnographers are almost certainly modern reconfigurations of precolonial exchange as the networks readjusted to this influx of prestige wealth, so they need to be understood from a historical perspective.

At initial European contact, marine shells were much rarer items (Bus 1951; Gitlow 1947). Healey (1990, 190), for instance, notes that before the 1920s, few if any marine shells reached the Kundagai, but that throughout the mid-twentieth century, cowries and dogwhelks, and later kina and green turban shells, came to replace customary dogtooth and seed necklaces as valuables. These shells reached the Jimi and Wahgi from the Simbai Valley, traveling up ancient trade routes. Similarly, amongst the Melpa, as shells became increasingly accessible, big-men utilized kina as a standard of exchange in order to devalue pigs in the prestige system. These shells could then be used as a durable and portable commodity for exchange, control, and

surplus. Thus, a once impermanent system of stratification was made more durable (Feil 1982).

Chimbu, the area in which Kiowa site lies, was the end point of many trade routes at ethnographic contact, and as such the Chimbu people highly valued shells for prestige and exchange due to their scarcity (Bergmann 1971; Brown 1961; 1972, 16; 1995, 21). However, unlike in the Wahgi Valley, shells did not come to dominate the economy as all-purpose currency, but were used in conjunction with other valuables, such as bird of paradise plumes and axes (Brown 1970). As valuables, shells were used as adornments on men's, women's and children's clothing (Bergmann 1971, v. II). When the 1933 Leahy expedition passed through the area, the Chimbu desire for shell valuables was so great that it caused conflicts between the locals and their visitors (Brown 1972, 26), as shells, in particular, along with axes, money, pigs, and feathers, could be used for bride prices by young men (31). Moreover, the *bugla gende* pig ceremony, similar to *moka* and *tee* ceremonies further west, involved material displays of wealth and power, with people wearing shell valuables and other finery as a matter of pride for the clan (50). These shells were therefore essential to maintaining and modifying power relationships between groups and individuals. As in other areas, kiaps in the 1930s and 1940s introduced copious shell valuables from the coast that flooded the local economy (57). Therefore, it is important to avoid projecting modern observations about shell exchange, and their behavioral and social implications, into the deep past.

[FIGURE 2 ABOUT HERE]

Archaeological Context

Along the coast of New Guinea and in the Bismarck Archipelago, shell artifact manufacture began in the Late Pleistocene (Summerhayes et al. 2017). Around the coast of New Ireland, shell modification is evident in Pleistocene contexts from the cave sites of Buang Merabak, Matenkupkum, Matenbek, and Balof Cave, and from Kilu Cave in the northern Solomons. From Manus, there is evidence for shell adze blades dating to terminal Pleistocene levels, while shell ornamentation, in the form of small beads, is found beginning at Matenbek from 10,000 to 8,000 years ago (for details, see Specht 2005; see also Barton and White 1993; Gorecki, Mabin, and Campbell 1991; O'Connor et al. 2011; Smith and Allen 1999; Summerhayes and Allen 1993). From the north coast of mainland New Guinea, few Pleistocene sites have been excavated and none contain evidence for shell artifact manufacture in the Late Pleistocene or Early-Mid-Holocene (see Gorecki, Mabin, and Campbell 1991; O'Connor et al. 2011). However, shell artifact manufacture increases exponentially from the Mid-Holocene occupation levels. This co-occurs with the appearance of Austronesian-speaking groups associated with Lapita pottery (Szabo 2010).

People have been in montane New Guinea for almost as long as they have occupied the coast, since 40,000 or 50,000 years ago (Summerhayes et al. 2010). Despite this, there is sparse archaeological evidence for marine shell in the Highlands, and the earliest examples only date to the Early Mid-Holocene at Kafiavana (White 1972, 93). Here, *Cypraea moneta* was found in Horizon VII, dated by association to between 6,000 and 10,000 years ago. A tentatively assigned marine gastropod was also found in Horizon IX, but it is unclear if this can be assigned a similar or earlier date. A small cowrie shell was also recovered from the lowest level of a test pit excavated by Cole at Kafiavana (Huff 2016a, 43), which has been suggested to be,

very tenuously by association with Peter White's excavations, around 10,000 years old (124). From the Mid-Holocene ($>4690\pm 170\text{BP}$) in Horizon IV, *C. moneta*, along with *Geloina spp.*, *Oliva sp.*, and *Nassarius sp.*, is present in more substantial numbers (White 1972, 93).

At nearby Batari, however, shell is only present from around 3,000 years ago. Marine shell artifacts include two "round button-like objects" drilled through the center, one dentalium tube, and one unidentified rectangular piece with evidence for hand drilling and sawing (22). Riverine shell is also present from the Late Holocene in Horizon III, with increasing numbers leading into the last millennium, identified as *Hyridella guppyi aipiana*, Thiaridae and Neritidae. One freshwater Nerite from Horizon II, dating to anytime between about 800 and 3,500 years ago, had been perforated with a hole drilled in the back (19).

At Aibura, occupied 4,000 years ago, and later reoccupied 800 years ago, unworked marine shell only occurs from the recent reoccupation, alongside pottery and pig bone (White 1972). Marine species include *Trochus niloticus*, *Cypraea annulus*, *Ovula ovum*, *Nassarius thersites*, *Charonia tritonis*, *Oliva sp.*, and one unidentified piece, which could be *Cymatium* or *Murex*. Riverine mussel is present from Level 6, halfway down the deposit, with one shell being drilled. Shell is not reported at any other Eastern Highlands site; however, Cole (1996, 12) does mention some shell valuables were found dating to the "Tentika Phase," within the last few centuries, associated with the introduction of sweet potato (*Ipomoea batatas*) and perhaps new populations into the Eastern Highlands.

In the western area of the Highlands, estuarine bivalve species, *Polymesoda (Geloina) coaxans* and *Batissa violacea*, were imported from lagoons around the Sepik-Ramu inland sea to Ritamauda site in the Yuat Gorge of Enga Province around 3,500 years ago (Swadling and Anamiato 1989, 224). These artifacts were probably used as vegetal scrapers and prefigure the import of marine shells. *Cypraea annulus*, *Oliva carneola*, and *Nassarius spp.* occur at 3,000 to 3,500 years ago, while *P. maxima* first appears at 2,000 to 3,000 years ago (Swadling and Anamiato 1989, 225), probably traded from the south coast (Gorecki and Gillieson 1989). At the Rui Kumanga site in the Jimi Valley, one *Cypraea annulus* fragment dates to within the last 300 years (Gorecki and Gillieson 1989), and there is also evidence for shell artifacts at Tsak Pumakos Site III (TB82), in Stratum "n," but this remains undated (Kobayashi and Hayakawa 1971).

At Yuku rockshelter in the Lanim gorge near the junction of the Yuem and Lanim Rivers, one conus-shell nose ring was recovered from the surface of the site and two cowrie necklace fragments were found in Level 3, originally dated by association to at least the Mid-Holocene (Bulmer 1975, 30). Freshwater mussel and possible oyster were also found in Levels 2–3, dating to a similar time. Although recent radiometric dating brings the integrity of Yuku's stratigraphy into question (Denham 2016), it is likely that these shells derive from no earlier than the Mid-Holocene.

In Chimbu province, Nombe rockshelter lies only 2.5 kilometers southwest of Kiowa and was probably occupied concurrently by the same or similar groups. This site contained a range of marine shell in Stratum A, dating to the last 5,000 years, including cowrie (*C. annulus*), and fragments of pearl oyster (*P. maxima*) (Mountain 1991). In Stratum B dating from about 5,000 to 10,000 years ago, only very fragmentary pearl oyster was present, while there is no evidence for marine shell in Stratum C or D dating to the Pleistocene. Riverine mussels from the Hyriidae family

were also present from Stratum A–B (Mountain 1991, 4.10–4.12) and were abundant in local streams (White 1972, 19).

KIOWA

The final Highlands site with evidence for marine shell, and the subject of this paper, is Kiowa. The Kiowa (NAW) rockshelter site lies at 1,500 meters above sea level on Mt. Elimbari, about 20 meters away from a small tributary to the Mai River in Chimbu Province. It was excavated in 1960 by Susan Bulmer and dates from the terminal Pleistocene (c.12,000 years ago) with continued and perhaps seasonal occupation through to the Late Holocene (Bulmer 1964b, 1966). The deposit was excavated in five major areas to 4.6 meters deep, at which point large limestone boulders began to inhibit digging. The stratigraphy comprised interleaved orange clays and ashy soils (Figure 3), and radiocarbon dating on wood charcoal provides a robust chronology for change through time at the site (Denham 2016). Due to transport difficulties in the Highlands during the mid-twentieth century, only a selection of faunal material was retained for analysis. This included all cranial fragments, large postcranial bones, worked bone, eggshell, and marine/riverine shell, along with two bulk sample bags.

[FIGURE 3 ABOUT HERE]

Here, a lithic assemblage replete with local argillite raw material is thought to reflect increasing intensity of site use and landscape learning throughout the Holocene (Gaffney, Ford, and Summerhayes 2015a). Gradual changes in technological organization and raw material conservation, along with the introduction of quadrilateral stone axes and an increased utilization of fine-grain chert nodules, indicate increased activity in the local area through the Mid-Late Holocene (Bulmer 1964a, 2005; Gaffney, Ford, and Summerhayes 2015a). Recent isotopic analysis from the site's small mammal fauna suggests the local environment comprised substantial closed canopies even into the Late Holocene, unlike areas in the west where agricultural intensification is associated with major forest clearance at the start of the Holocene (Roberts et al. 2017). Zooarchaeological data from the site has only been reported summarily (Sutton et al. 2009), deriving from unpublished reports (Bulmer 1979), and a full faunal listing remains to be published. Nonetheless, the faunal assemblage is extensive and contains a number of small marsupial mammal species, thought to imply specialized bat hunting around the caves and rockshelters of Elimbari, supplemented by the hunting of cuscus, ringtail possum, macropods, bandicoot, and rodents around forests and grasslands.

The Kiowa Shell Artifacts

To describe change through time in the use of shells at the Kiowa site, taxonomic and technological analysis is presented here. The Kiowa shell assemblage is small (n=12) but uniquely informative in that it contains both modified and unmodified shell remains that span various stratigraphic levels from the terminal Pleistocene through to the Late Holocene (Table 1). For this paper, all pieces were identified using reference specimens at the University of Wollongong Zooarchaeology Laboratory and available literature following key features and general morphology. Traces of working and

modification were isolated with the assistance of a Dino-lite Edge AM4815ZT digital microscope. Interpretations were informed by the prior experience of KS as well as the results of previous experimental working. This expands and replaces summary information originally presented by the site excavator (Bulmer and Bulmer 1964).

[TABLE 1 ABOUT HERE]

A total of six freshwater mussel fragments from four individual valves were recovered from Kiowa (Figure 4). The fragments from Area EE represent the oldest molluscan remains found within the Kiowa sequence as Level 7 specimens are associated with a calibrated date of 9,500–10,000 cal. BP, and the Level 5 fragment is associated with a date of between 6,000–6,500 cal. BP at two sigma.

There are twenty-seven species of freshwater mussel found in Australasian (Australia, New Zealand, New Guinea, and Solomon Islands) waterways, most of which are in the family Hyriidae (Walker et al. 2001). This diversity is lower than other parts of the world and is probably influenced by both the aridity of Australia and the underrepresentation of New Guinea taxa (McMichael and Hiscock 1958, 382). Taxonomic identification of freshwater bivalves can be confused by phenotypic diversity (which results in plastic morphology) and other factors, such as water speed and substrate. While molecular approaches to taxonomy may overcome these issues, work in this domain is not very far advanced in the region (Walker et al. 2001). None of the fragments recovered from Kiowa contained the diagnostic hinge section of the valve, and as such firm species identification is extremely difficult. All fragments, however, appear to derive from the same species.

Freshwater mussel species associated with New Guinea collection localities identified in the large MUSSELP database include *Haasodonta fannyae*, *Hyridella guppyi*, *H. misoolensis*, *Microdonta anodontaeformis*, *Velesunio sentaniensis*, *V. wilsonii*, *Virgus beccarianus*, *Westralunio albertisi*, and *W. flyensis*. A number of species can be ruled out instantly based on general morphological features or geographical ranges that do not match (*H. faanyae*, *H. misoolensis*, *M. anodontaeformis*, *V. sentaniensis*, *V. beccarianus*, *V. wilsonii*, and *W. albertisi*). From the fragments present at Kiowa, morphological matches include *H. guppyi* and *W. flyensis*. Distributional data are insufficient to state whether either or both of these two species occur in the Central Highlands area of Papua New Guinea, although unpublished genus-level distributional maps from Art Bogan of the North Carolina Museum of Natural History indicate that *W. flyensis* is likely to occur in the area. This distribution seems to be confirmed by Walker, Jones, and Klunzinger (2014).

Although it is possible for freshwater mussel to be recycled for ornament manufacture, none of the fragments show signs of deliberate modification or working, and they have probably been introduced to the Kiowa deposits as food refuse rather than as formal artifacts. Similar freshwater mussel fragments have been identified in Early-Late Holocene deposits at Nombe (Mountain 1991), and at Aibura, Batari, and Kafiavana throughout the Holocene (White 1972). However, those specimens were only identified to the family level, Hyriidae, which is the only family that occurs in the region.

[FIGURE 4 ABOUT HERE]

The remaining five specimens were of marine or possibly estuarine origins. The only formal shell artifact in the Kiowa assemblage is a fragment of a large ring manufactured from *Tectus* (= *Trochus*) *niloticus* recovered from Level 2 in the South Extension (SE). The high placement in the sequence suggests a relatively recent date, probably around 200 BP and likely no earlier than 1,000 BP. Although not extensively ground, and having an outer perimeter that is virtually raw, microscopic examination makes clear that the ring was extensively used, as evidenced by rounding and polish of the surfaces (Figure 5). The ring is robust and has an estimated internal diameter of 7 centimeters.

[FIGURE 5 ABOUT HERE]

Two fragments of *Polymesoda* cf. *erosa* valves show clear signs of extensive use as unmodified tools (Figure 6). Both pieces have very rounded valve margins, extensive zones of polish at the margin, and numerous clear bands of striations running parallel to the margin set just back from the valve edge. The consistently parallel nature of the striations indicates that these tools were used in a knife-like back-and-forth action rather than in a scraping action. On the valve deriving from Level 2, East Extension (EE) (Figure 6b), the striations and most wear and polish are located on the inner valve surface. The specimen from Level 2 SE (Figure 6a) also displays extensive wear across the outer surface of the valve fragment. Much of the natural relief has been worn away and has been replaced by a high polish. This suggests that this latter artifact was also used in a burnishing-type manner where the outer surface of the valve was directly rubbed against a surface. The lack of faceting suggests that this surface was soft rather than resistant.

[FIGURE 6 ABOUT HERE]

The final two artifacts are manufactured from valves of *Tegillarca* (= *Anadara*) *granosa*. A small right valve, from Level 2, East Baulk (EB), displays clear and extensive wear across the elevated ribs of the whole valve surface (Figure 7a). This wear is slightly more pronounced toward the posterior. There is also wear at the ventral margin, with rounded wear in the central-anterior zone, and more faceted along the posterior zone. This suggests that different zones of the margin were used for different tasks. There is a hewn hole at the umbo, which shows use-wear from stringing. The second example from Level 2, SE, is broken in half with break surfaces being recent. The wear patterns on the body of the valve match the EB specimen, however, the wear is not as extensive and there is little detectable wear at the ventral margin. This specimen also has a hewn hole at the umbo with use-wear from stringing.

[FIGURE 7 ABOUT HERE]

DISCUSSION

Connections with the Coast

Recent archaeological studies in New Guinea have shifted away from unilinear narratives for social change, common to the whole Highlands region, and have emphasized instead the dynamic emergence of very different strands of practice in each part of the Highlands at different times (Denham 2016; Gaffney, Ford, and Summerhayes 2015a; Roberts et al. 2017). In this way, subregional variation was likely present in subsistence technology, mobility, and exchange networks. Although the evidence is fragmentary, we can use the Kiowa data to build on existing narratives that describe precolonial trade networks between the coast and the Highlands: their locations, directions, and timings. From this, we can later ask: Why did marine shells enter into the Highlands economies at all? Why did they take hold at different times? And what was the effect?

Despite being a small assemblage, the shell from Kiowa is both diverse and informative. Freshwater mussel remains are seemingly local and likely represent a minor component of the diet since the terminal Pleistocene and into the ethnographic period (see Bulmer and Bulmer 1964, 51). The modified artifacts, on the other hand, are constructed from marine and estuarine shell and have traveled considerable distances from their original source. From Kiowa, the nearest coastline is about one hundred kilometers away, as the crow flies, and much further when the sheer topography is considered. Given that these raw materials are difficult to replenish, it is not surprising that the wear traces are distinct and often heavy, implying an extended use-life. It is also not surprising that one of the *Tegillarca granosa* and one of the *Polymesoda* cf. *erosa* tools have contrasting wear patterns, indicating the artifacts were used for different purposes, either concurrently or at different points in time. The multifunctional use of the *Polymesoda* cf. *erosa* shells as prestige goods, as well as *ad hoc* practical tools, is consistent with how people were using other materials in the Highlands. This includes stone axes that could be used as practical tools or exchange valuables, and flaked lithics, which tended to be used in an expedient and multipurpose manner. *T. niloticus* rings are a stalwart formal artifact of the New Guinea cultural sequence, and as such are nondiagnostic with regards to time period. Typologically, these resemble rings used for nose ornaments by modern Chimbu and Eastern Highlands groups; however, there is no evidence to demonstrate technological continuity. Nevertheless, the presence of marine shell ornaments and tools demonstrates new contacts with the coast, whether direct or indirect, sometime in the last millennium before present.

This assemblage composition is very similar to the marine shell component at Nombe, further up the slopes of Mt. Elimbari. However, the finer-resolution dating of the Kiowa sequence allows us to tease apart changes throughout the Holocene. At Nombe, M. J. Mountain (1991) found freshwater mussel relating to subsistence from the Late Pleistocene through to the Late Holocene. However, diagnostic evidence for marine shell only appears in the Mid-Late Holocene in the form of *P. maxima* and *C. annulus*. During Peter White's (1972) initial excavations, he only identified three marine shell fragments from the Upper Horizon, including two yellow olive shells (*Oliva carneola*) and one *C. annulus*, alongside freshwater mussel. These species are different from the marine component at Kiowa, but the small sample size makes meaningful comparisons difficult.

Further east, at Batari and Kafiavana, the marine shell component also increases in the Late Holocene. The Kafiavana sequence is particularly interesting, as there seems to be a series of pulses of shell entering the area (Figure 8): one in the Early Holocene (although this evidence is not replicated at other Highlands sites), and another starting in the Mid-Holocene, becoming increasingly important in the Late

Holocene. The dating of Kafiavana is not thorough enough to distinguish exactly when this second pulse began, but it may have been before 4690±170BP (ANU-42, base of Horizon II).

[FIGURE 8 ABOUT HERE]

Other material lines of evidence can help to clarify the timing and nature of these coastal connections. During the ethnographic period, shells moved through a number of trade corridors following major river catchments from the coast to the interior (Hughes 1977). This included the Yuat, Markham, Kikori, and Ramu Rivers. It is likely that precolonial shell exchange centered along these trade routes, too, as other exotic artifacts moved into the Highlands along similar conduits. The Sepik-Ramu Inland Sea present in the Mid-Late Holocene would have also expedited exchanges between the north coast and the mountains (Swadling and Hide 2005). Obsidian, for instance, excavated in the Eastern Highlands predominantly derived from Talasea on New Britain in the Bismarck Archipelago, although one piece came from Fergusson Island in the Massim (Watson 1986). Another piece of obsidian from the Kaironk Valley, near Wañelek, with insecure provenience, also derives from Fergusson (Gaffney, Ford, and Summerhayes 2016). This material, not naturally present in the Highlands, probably entered through the Markham, linking to the Tami exchange networks on the coast, or up the Sepik-Yuat, passed down the line through the Sio, Siassi, and Madang trade networks.

In the Bismarck Archipelago, expertly produced obsidian-stemmed artifacts were distributed around northeast New Guinea from the Mid-Holocene (Torrence et al. 2009). Torrence (2004) has previously argued that these objects took on a similar role around the coast as shells and axes did in the Highlands, being scarce objects with restricted procurement zones, transported around the landscape as mediators of exchange. Moreover, like shells in the Highlands, their value was established by the excellence of their making. Rath and Torrence (2003) suggest this value was also manifest because they represented extensive social network management in the processes of procurement, production, and distribution, which involved a number of groups working within a common value network. Ethnographic observations of exchange on the coast and in the Highlands have noted that small, highly desirable objects would be added to bulk trades of subsistence crops to make the exchanges more appealing (Harding 1967; Mager 1952, 128). Although no obsidian-stemmed artifacts have been found in the Highlands, typologically similar slate-tanged tools occur at Wañelek in the fringe Highlands zone by the Late Holocene (Bulmer 1991). Swadling (2005) argues that connections with the coast were forming by the Mid-Holocene, especially around the Huon Gulf and Sepik-Ramu Inland Sea, revolving around pestles and mortars, bird plumes, and other valuables.

Pottery produced on the coast and foothills also reached Wañelek by at least 3,000 years ago (Gaffney et al. 2015b), and in the Eastern Highlands, pottery may have been imported since about 3,000 years ago (Huff 2016b). This occurs at the same time that marine shell is found in the Yuat and may indicate a separate pulse of connectivity, associated with Austronesian-speaking groups arriving for the first time around the Sepik-Ramu inland sea (Summerhayes 2017). However, at Kiowa the only evidence for pottery comes in the form of three sherds at the top of Level 2, probably dating to very recent times, just prior to site abandonment. Some of this pottery was

produced using the coiling method, and the nearest probable sources lie in the Eastern Highlands or in foothill zones around Madang (Gaffney, Ford, and Summerhayes 2016).

Coastal crops were also introduced into the Highlands at the start of the Holocene, as prior to this the interior was too cold to sustain growth (Haberle et al. 2012). The first evidence of marine shell at Kafiavana in the Early Holocene broadly coincides with the first introductions of coastally adapted crops appearing in the Western Highlands at Kuk (Fullagar et al. 2006). Perhaps there was a brief pulse of exchange between the coast and the Highlands at this time, coinciding with ameliorating climatic conditions that allowed year-round occupation. Alternatively, the shell from Kafiavana may even represent coastal people hunting and gathering at higher altitudes, practicing seasonal logistical mobility, with direct access to the sea in the terminal Pleistocene (see Gaffney, Ford, and Summerhayes 2015a, Fig. 17).

Domesticated or feral animals also moved into the Highlands from lower altitudes. Although pig (*Sus scrofa*) is argued to be present in terminal Pleistocene levels at Kiowa (Bulmer and Bulmer 1964), these bones and teeth remain undated. Claims that pig existed at other Highlands sites in the Early Holocene, such as Kafiavana, have been disproven (Hedges et al. 1995). The introduction of pigs is important, as Feil (1982) argues that shells were brought in to devalue pigs in exchange ceremonies, suggesting both introductions were very recent. Regardless of the initial date of introduction, Highlands pig has probably only been of widespread importance for the last few centuries with the introduction of sweet potato (*Ipomoea batatas*) to higher altitudes, allowing more intensive feeding and rearing. As Bayliss-Smith, Golson, and Hughes (2017, 323) note, it is possible that some shells, particularly sickle-shaped pearl-oyster breast ornaments, were imported from the Papuan Gulf and Torres Strait, following the route that sweet potato and also tobacco originally took in dispersing into higher altitudes. At the same time, stone axes filtered down from the Highlands to the south coast (Rhoads and Mackenzie 1991). Alternatively, and perhaps more likely, these gold-lipped oyster shells may have entered the interior blocks through hinterland middlemen groups around the Huon Peninsula. Harding (1967) notes that these shells were mass-produced in the Arawe Islands and collected by Siassi traders who transported them across the Vitiaz Strait into mainland networks. The precolonial antecedents of this exchange date no earlier than about 1,500 to 2,000 years ago, with intensive trade only starting within the last few hundred years (Gaffney et al. 2017; Lilley 1988). Thus, the final precolonial pulse of shell exchange into the Highlands, and to sites like Kiowa, may be linked to expansions to Highlands exchange networks during the “Ipomoean Revolution,” along with the intensification of coastal trading in the last millennia. This idea is now picked up further in the final section, where we think in an exploratory manner about the impetus for the emergence of the shell trade and its implications for social organization.

The Emergence of the Highlands Shell Trade

Because people had access to nacreous/lustrous materials since the Pleistocene in the form of freshwater mussels, and there is evidence for ornamentation of these materials at Aibura and Batari, it is possible that this material was used as a precursor to marine shell. But why then did the marine shell trade emerge in the Highlands at all, and why only in the Late Holocene at Kiowa? Importing shells from the coast would have been a costly ongoing exercise and indicates that the objects were at all times valued. There

must have been sufficient demand for them to be traded into the interior blocks in the first place, even if they were *ad hoc* collections made during trading forays down river conduits, but without much mass bargaining power.

The specific context of the Highlands sociopolitical economy in the Late Holocene is here crucial. Burton's (1984) work on the stone ax trade indicates that Highlands exchange systems were expanding through the Late Holocene, 2,500 to 1,500 years ago, as polished axes from a limited number of quarrying areas were distributed and redistributed across large distances through a series of intermediary groups. Burton (1984, 248) suggests this coincides with major alterations to irrigation practices at Kuk (Phase 4; see Golson 1977), however, it remains unclear if this change was predominately internal or related to connections with Austronesian-speaking coastal groups around the north coast at around 3,000 years ago. As trade expanded in the Late Holocene, perhaps it slowly became necessary for some material to regulate the complexities of exchange and "value" across larger spaces and between different value networks. One of these items was the ceremonial ax, and another was marine shell. As such, shells came to replace a variety of localized organic currencies, being used as a more standard measure of wealth and prestige across the Highlands because they came from an outside source and could not be manufactured and controlled by any one group.

When networks between the coast and Highlands opened up, perhaps associated with the rise of long-distance ax trade and the dispersal of new agricultural practices, shells became more accessible. As Clark (1991) describes, these shells may have initially held symbolic and aesthetic value, without necessarily being acquired in excess to cement power relationships. However, because similar lustrous riverine shells have been available since the Late Pleistocene, both aesthetic and economic factors need to be considered relative to the specific historical changes taking place in the last millennium. Moreover, local and subregional variation need to be considered. Because Kiowa is toward the end of the line in the trade network for marine shells, being further away from major river conduits compared with Kafiavana or Ritamauda, it implies the arterial networks linking most of the Highlands groups to the coast had not fully formed until the last millennium before present. This period was also a time of population increases, group migrations, and a filling up of the landscape (Brown and Podolefsky 1976; Feil 1987; Golson and Gardner 1990). For instance, shell exchange between the Simbai Valley in the Madang Highlands and the Wahgi at ethnographic contact was predominantly through short-distance, kin-based exchange (Clarke 1971), but prior to this it may have involved longer-distance explicit trading between socially disparate groups. The same demographic changes may have occurred around Kiowa, finally linking its people to major shell networks.

As Bayliss-Smith, Golson, and Hughes (2017) have recently noted, although it is possible that the sweet potato and other materials flowed into the Highlands through established shell routes, there is no evidence for an unbroken shell trade with the Highlands of any antiquity. In fact, as mentioned above for Kafiavana, there seems to have been a number of short pulses of exchange. The correspondence between the coast and Highlands did not need to be sustained for any long period to have dramatic influences, and interactions of less than a century could allow for major shifts to production, exchange, and power relationships. Although these pulses seem to have been felt in the Eastern Highlands, perhaps as early as the start of the Holocene, and in the fringe Madang Highlands around 3,000 years ago, at most Highlands sites there is no evidence for shell valuables until a major pulse within the last 1,000 years, leading up to ethnographic observations, at which point trade was

again dramatically reconfigured by the imposition of capitalist power relationships. In this way, shell artifacts in the Highlands archaeological record should not be seen as part of one extended evolutionary development, but rather as the result of stop-and-start interactions with the coast and asymmetrical connectivities between Highlands groups. The esteem of these objects may have been acknowledged within specific subregional value networks, but did not signify prestige across all Highlands groups until much later.

Within the last millennium, marine shells probably also enabled men to acquire status by controlling and distributing material wealth, thereby becoming “big-men” within incipiently stratified extended kin groupings (A. Strathern 1969). By acquiring objects of permanence that could be collected and pooled, and which held aesthetic and symbolic appeal over larger areas due to their exotic nature, individuals were able to materialize and maintain their prestige within the community. As Golson and Gardner (1990) note, this may be inextricably linked to the Ipomoean Revolution. Because sweet potato gardens could be grown to maintain pigs across larger areas, it democratized prestige acquisition through pigs. Previously, surplus root crops for pig rearing may have been afforded only to a limited number of groups with access to wetlands, like in the Wahgi (Bayliss-Smith, Golson, and Hughes 2017, 318). This ties into a broader Highlands reconfiguration of land use and subsistence, where many areas remained hubs of hunting and collecting until very recently, despite early wetland agricultural systems in some key places (see Gaffney, Ford, and Summerhayes 2015a; Roberts et al. 2017). Bayliss-Smith, Golson, and Hughes (2017) suggest that in response to this democratization, big-men turned their sights to acquiring lasting and relatively scarce marine shell valuables as mediums of exchange and representations of power and prestige and as a visual display of unequal access to resources. A similar string of events occurred when shell valuables flooded the market in the twentieth century and many big-men turned to rare “Western” objects to represent esteem. Importantly, also, in a time of social flux and substantial warfare and migration, shell valuables were portable and maintained prestige even when transported over large distances.

In sum, our study lends further support to the recent origins of incipient stratification in the Highlands (or, at least, that the specific process of social stratification observed in ethnographic accounts has recent origins). Some authors suggest that big-men are a purely postcolonial phenomenon (Chowning 1979; Friedman 1982; Liep 1996). Although others, such as Andrew Strathern (1987), lend weight to it being part of a longer process associated with the introduction of sweet potato (in support of Golson), but not necessarily dependant on wetland field systems. However, we argue that the origins may indeed be precolonial, but they are not necessarily older than the Late Holocene. This has implications for analogical studies elsewhere in the world. As Spriggs (2008) points out, there is a tendency to invoke ethnographic case studies—especially of Melanesian big-men societies—in reconstructions of archaeological exchange systems, such as the Neolithic ax trade in Europe. These “big-men” stem primarily from Sahlins’s (1972) deliberately idealized typology of social organization. Many of these reconstructions fail to acknowledge the archaeology of the region, which often suggests that the present is no good analogy for the deep past (Spriggs 2008). The evidence from the Kiowa shell assemblage suggests we cannot look at the nature of exchange in the past as flat. Rather, it seems to have been dynamic and changing, punctuated by stops and starts, which probably resulted in dynamic exchange networks and changing modes of social stratification, practiced in different parts of the Highlands at different times.

CONCLUSION

Less than a hundred years ago, European explorers could only conjecture at the possibility of people living in the New Guinea Highlands, let alone at the expansive, dendritic material culture networks that connected these groups to lowland, coastal, and island populations. This study, working from the small but informative marine and riverine shell assemblage from Kiowa rockshelter, has shown that around Chimbu in the deep interior, many of these networks were beginning to take form only in the Late Holocene period, but certainly prior to European contact. Contrary to statements made elsewhere in the Highlands, there is no evidence at Kiowa for coastal connections at a similar time to early agricultural innovations at the site of Kuk Swamp in the Early Holocene. Instead, marine shells seem to have only been introduced to the area in the Late Holocene, with increasing economic importance leading up to ethnographic contact. This suggests that in Chimbu, the extensive trade networks linking the Highlands to the coast were not fully formed until the last 1,000 years, intertwined with dramatic changes to production and distribution associated with population increases, the expansion of the ax trade, the introduction of sweet potato, and the rearing of pigs as prestige goods. This paper's primary contribution lies in (1) challenging monolithic narratives for the emergence of Highlands shell exchange, (2) adding historical perspective to shell exchange as a dynamic and emergent process, and (3) lending further archaeological support to the recent phenomenon of big-man societies. These points may prove useful in situating valuable exchange amongst small-scale societies in ethnographic and archaeological contexts in Melanesia generally and in other parts of the world.

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NOTES

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FIGURE CAPTIONS

Figure 1. New Guinea in the Western Pacific region, along with places mentioned in text, and major trade routes from the coast to the Highlands (Illustration: Dylan Gaffney 2017).

Figure 2. Top and bottom left: ethnographic shell valuables being worn in the Kaironk Valley, Madang Highlands (Photographs: Susan Bulmer 1972, Bulmer Collection, University of Otago). Top and bottom right: shell valuables in Tsembaga, Maring area, Jiwaka Province (Photographs: Roy A. Rappaport 1963, UC San Diego digital archive).

Figure 3. The excavation units and stratigraphy at Kiowa rockshelter (from Roberts et al. 2017; adapted from Bulmer 1966).

Figure 4. Freshwater mussel fragments recovered from Kiowa: (a) EE layer 5, (b) EE layer 7, (c) TR1 layer 2, and (d) TR layer 2 (Photographs: Kat Szabo and Brent Koppel 2017).

Figure 5. *Tectus niloticus* ring fragment. Inset of wear and polish magnified 20x (Photographs: Kat Szabo and Brent Koppel 2017).

Figure 6: Unmodified *Polymesoda* cf. *erosa* valves used as expedient tools: (a) Area SE Layer 2 tool with close-up of striations and polish at 43x magnification, and (b) Area EE layer 2B tool with close-up of striations and polish at 40x magnification (Photographs: Kat Szabo and Brent Koppel 2017).

Figure 7. *Tegillarca granosa* shell tools: (a) Area EB layer 2 utilized valve and inset showing abrasion and polish on high-relief areas magnified 20x, and (b) Area SE

layer 2 utilized valve with inset of abrasion on high-relief areas magnified 25x (Photographs: Kat Szabo and Brent Koppel 2017).

Figure 8. Infographic showing increases to marine shell in key Highlands deposits through the Holocene. Kiowa, Kafiavana, and Batari are shown in Minimum Number of Individuals (MNI), while Nombe shows grams per liter of deposit, including both freshwater and marine shell (more detailed information is not available) (Illustration: Dylan Gaffney 2017).