Ornaments as indicators of social changes and cultural practices in northeastern Taiwan before and after European colonial period

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Long-lasting indirect impacts on indigenous peoples in the periphery of colonial control are poorly understood, especially in East Asia. Trade ornaments from Kiwulan (1400-1900 AD) in northeastern Taiwan show the indirect impacts of European colonial activities on local societies. The diversity of ornaments was greater during the period of European presence compared to previous periods, and their spatial distribution was more clustered. This hints at increasing social inequality resulting from a colonial influence. Ornaments give insights into the increasing social inequality stimulated by European colonisation, and show the agency of indigenous people to incorporate ornaments into their social system.

# Introduction

The direct impacts of European colonialism on indigenous communities in East Asia were much less conspicuous than in island Southeast Asia and Oceania. Direct European colonial rule throughout East Asia was rare and limited, and the question of long-lasting indirect impacts on local indigenous communities remains largely unanswered. Understanding the indirect effects of colonialism are important for detecting colonial impacts on indigenous peoples in the periphery of colonial control (Trabert 2017). In many parts of the world, the introduction of foreign trade goods by colonial traders into local indigenous societies caused substantial transformations of indigenous economic, cultural, and socio-political systems (Dietler 2005; Dietler 1997; Junker 1993; Silliman 2005). Consumption patterns of foreign goods can give insights into negotiations between colonized and colonizer, and the resistance and accommodations of indigenous people through their daily cultural practices (Dietler 2015; Given 2004; Mullins 2011; Scaramelli & Scaramelli 2005; Silliman 2001; Torrence & Clarke 2000; Voss 2005). Northeastern Taiwan is an ideal context to study peripheral colonial influence because although there was a prominent Spanish and Dutch colonial presence in Taiwan, the northeastern region was isolated from intensive direct contact by the Xueshan Mountains.

This article describes ornaments excavated from the upper component of Kiwulan (1400 AD-1900 AD), the largest Iron Age settlement on the Yilan plain in northeastern Taiwan. The first recorded European presence in Yilan was a Spanish revenge attack on indigenous villages in 1632 (Borao 2001: 163). In 1647 the Dutch attacked villages and forced them to accept colonial rules and pay an annual tribute (Andrade 2007). According to Dutch census reports in 1650, Kiwulan was the largest indigenous settlement in the plain, with a population of 840 adults (Nakamura 1938: 12). Following defeat of Dutch by the Chinese general Koxinga in 1661-1662, the Dutch abandoned northern Taiwan. Direct contact with Han Chinese is indicated by Qing dynasty census reports mentioning Yilan villages in 1821 (Yao 1996).

One of the most commonly traded types of object in this region were personal ornaments such as glass and stone beads (Chen 2007; Li & Chiu 2014; National Musuem of Taiwan History 2005). Personal adornments in the archaeological record are useful as signal of an individual’s status (Joyce 2005; Scaramelli & Scaramelli 2005). For example, the consumption of stone beads in Southeast Asia during Iron Age is often associated with increasing social stratification or socio-political complexity (Bellina 2014; Carter 2016; Francis 2002; Theunissen *et al.* 2000; Kenoyer 2000). In this paper, we explore archaeological ornaments from Kiwulan spanning the pre-European contact period, the period of Spanish and Dutch presence, and the period of Chinese presence. We address the question of whether indirect colonial influences on the indigenous populations can be detected through the ornament assemblages.

# Ornaments in complex exchange network during the late Iron Age and early historical period

The island of Taiwan lies at the junction of mainland China, Southeast Asia, and Northeast Asia in the Pacific Ocean. The prehistory of Taiwan island could be roughly divided into three major periods, paleolithic (c. 27,000 BP- 5000BP), Neolithic (c. 6500- 2000BP), and Iron age (c. 2000- 400BP) with slightly regional differences in onset of each period and variations in style of artifacts and assemblages (Liu 2011; Chen 2017). It is generally accepted that Taiwan entered the historical period since the early 17th century due to the colonial presence of the Spanish and the Dutch who played an important role in keeping written records about Taiwan. The European colonial presence in Taiwan ended in 1662 when the Dutch were defeated by the kingdom of Tungning founded by Koxinga from China. Later in 1683, Taiwan was incorporated into the Qing dynasty in China and a large wave of Han Chinese migrated to Taiwan during the late 18th century. Because of natural harbors, northeast Taiwan was involved in a regional trade network through cross-culture interactions with Chinese merchants since the 14th century, and later the global trade network with the Europeans in the 17th century brought more trade goods circulated in Southeast Asia into Taiwan (Chen 2005; Liu & Wang 2017). Although on the peripheral location of the trade center, northeastern Taiwan- Yilan was connected to the trade networks via visits of other indigenous groups, Chinese merchants, and the Europeans via sea.

The European presence in northern Taiwan started with the Spanish who founded Fort San Salvador at Keelung in 1626, and Fort San Domingo in 1629 at Tamsui. They sent missionaries to local indigenous settlements in this region for religious purposes (Blussé & Everts 2000: 343) who left many records about the life of indigenous. Recording the trade beads, a report by a Dominican priest in 1632 mentioned that the Taparri, an indigenous tribe from northern Taiwan, exchanged carnelian beads with other indigenous groups. This form of exchange was widespread and even the Spanish soldiers learned to use carnelian beads as bargaining chips for gambling (Li & Wu 2006: 132–49). The use of beads as prestige goods is indicated by their role in bride price payments, and compensation to resolve disputes (Li & Wu 2006: 132–49). Other records mention that the female shamans (majuorbol) in the tribe would use carnelian beads as magical items in ritual practice for body healing (Borao 2009: 122–51). Records of an indigenous funeral process document the use of carnelian beads in ritual contexts, with more carnelian beads, pottery, and cloth placed into the graves of more influential people to indicate a family’s higher prestige (Li & Wu 2006: 153). These historical accounts indicate that carnelian beads were already treated as prestige goods in Yilan before the arrival of Europeans. In 1642, the Dutch Vereenigde Oostindische Compagnie (VOC) defeated the Spanish and took over their forts in northern Taiwan. They introduced a feudal system in an attempt to control the indigenous communities by asking indigenous leaders to attend an annual ceremony for demonstrating their loyalty and paying tributes (Andrade 2007, ch. 9; Kang 2016, ch. 4). The Dutch provided beads and other goods based on the demands of indigenous people to secure alliances in the annual ceremony or during travelling (Kang 2016, ch. 6). We might predict that the Dutch feudal system resulted in an increase in the amount and diversity of ornaments in northeastern indigenous communities during this period.

Chinese historical records from 1829, 1837, and 1852 during the Qing dynasty (1616-1911) contain some notes on the purposes of ornaments from Yilan, northeast Taiwan (Chen 1963: 228, 308; Ke 1993: 11, 126; Yao 1996: 77). According to those records, indigenous people in Yilan wore ornaments in ceremonial contexts to display their wealth and status. Among those ornaments, fish-shaped necklaces made of metal threads had high value due to their delicacy and the materials invested in production. These were usually possessed by wealthy people. Other people wore carnelian beads or glass beads on their head or neck to participate in ceremonies. In 1895, at the beginning of Japanese colonisation, an academic field survey for plains indigenous groups reported that golden necklaces were not used in Yilan at that time, but elderly people still used beads (Ino 1996: 227–32). In sum, we find multiple sources describing how ornaments represent high status or specialised social roles in indigenous communities in Yilan. Compared to the European period, there are fewer mentions of beads in the Chinese period and the descriptions are limited to clothing, but generally confirm the role of beads as status markers. However, we must recognize the inherent biases in historical records and the fragmented nature of texts generated by the writers (Galloway 2006). Inconsistent and incomplete descriptions from different written sources need to be compared and examined by studying the ornaments in archaeological contexts.

Currently the ornaments found in northeastern Taiwan in the early historical period, including glass beads, stone beads, and metal ornaments, were considered as imported materials from other regions due to a lack of evidence of beadmaking waste, metalworking, or accessible local raw materials. The chemical composition analysis for glass beads shows high content of lead, coupled with the winding/folding technique, suggest a Chinese beadmaking tradition (Cheng 2008; Gan *et al.* 2006; Wang 2018). Although there is a wide variety of metal ornaments such as bells, bracelets, rings, and pendants, the common compositions of metal ornaments are brass and copper with a small number made from lead and tin that indicates multiple origins more likely from Southeast Asia (Chen 2011). There is no clear evidence showing the European origin of beads, however, a large amount of golden beads at Kiwulan might be introduced by the Spanish through economic activities because similar beads were found at Luzon, northern Philippines, a part of the trading route of the Spanish between 16-19th century (Wang & Liu 2007). Both archaeological evidence and historical records indicating northeastern Taiwan was involved in the regional network with East Asia in the late Iron age that Chinese merchants traded metal materials, clothes, and beads with local indigenous people in Taiwan for local resources and later incorporated into more international scale due to the arrival of the Europeans. The foreign stoneware jars frequently found in European shipwrecks were also commonly found from many sites in Taiwan that suggest a direct or indirect interaction. Despite the origin of some ornaments were traced to China, it is likely that a large amount of ornament found at the 17th century sites was an influence of the Europeans colonial and economic activities.

# Excavations at Kiwulan in northeastern Taiwan



Figure 1: Map showing the location of Kiwulan, and other places in northern Taiwan named in the text. Map data from naturalearthdata.com

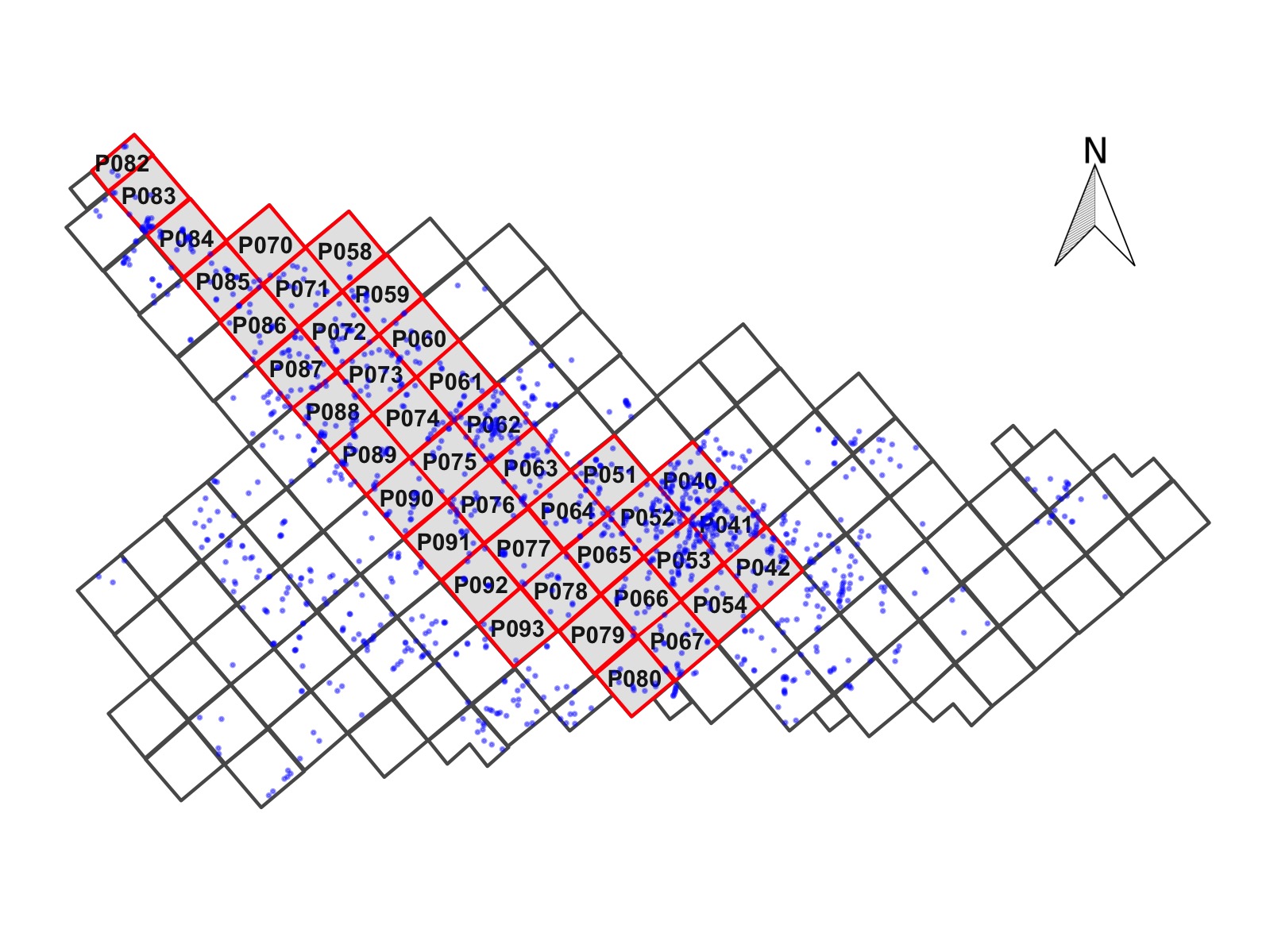


Figure 2: Map showing the largest section of excavation areas at Kiwulan, and the distribution of forty squares sampled in this paper presented in red with square ID number. Small dots represent the location of post-holes. Each square is 4 x 4 m

Kiwulan (Figure 1) was a rescue archaeology project that carried out from 2001 to 2004 in advance of water diversion project and construction of a road bridge. The excavation includes eight open area sections in total of 262 squares (4 m by 4 m) reaching 3,814 m2 (Chen 2007). The nearly 2 m thick archaeological deposits reveal a large amount of artefacts, burials, middens, post-holes, wooden pillars, and stone structures, all of which indicates it was a long-tern settlement. Based on the continuous deposition and the frequency of artifacts, the center of the site is the open area consisting of A and D sections, which is also the study area where our samples selected from. In the AD area, post-holes were found aligned in a north-south direction in some intervals with construction marks, which were interpreted as the remains of silt house structures. At the north margin of the dwelling place were burials that are mostly oriented in an east-west direction (Figure 2).

The chronology of Kiwulan can be divided into two phases represented by a upper component (1400-1900 AD, 600-100 BC) and a lower component (700-1200 AD, 1200-800 BC) separated by a sterile spanning 150 years according to . This chronology is based on the stratigraphy and a series of 32 radiocarbon dates previously published by Chen (2007). The relationship between upper component and lower component is still under debate and the sterile might result from dry weather according to pollen analyses (Lin 2015; Chiu 2004; Chen 2007). This paper focuses on the upper component covering a sequence spanning pre-European contact, European presence, and Chinese presence. Previous researches divided the upper component into six layers spanning from the 14th century to the 19th century with hundred year intervals according to the radiocarbon dates, excavation depth, consistency of contexts, and types of diagnostic porcelains such as blue and white porcelains (Hsieh 2009; Wang 2011). To answer our research question, we re-examined and assigned previous layers to a new chronology with three episodes of time: pre-European period, European period, and Chinese period to indicate the dominant foreign influence and cultural interaction for different time periods.

The archaeological indicators of the start of the European influence at Kiwulan are the appearance of light grey glazed jars, known as “An-ping” jars in China and Taiwan, and large dark brown glazed stoneware jars that were introduced to Taiwan during the early 17th century. A large amount of light gray glazed jars were found on the Spanish shipwreck San Diego sinking in 1600 AD, which is believed to be the earliest evidence yet found (Hsieh 2009; Hsieh 1995). The origin of light gray glazed jars was thought from Southeast China and commonly found at sites in Taiwan that were associated with the European activities, such as Zeelandia fort site in Tainan (Wang & Liu 2007). Regarding large dark brown glazed stoneware jars, they might be made in Southeast Asia and are frequently found in European shipwrecks from this period for transporting water, wine or other fluids on the long voyages. The jar shapes found at Kiwulan are typical of those found elsewhere in VOC sites occupied during the 17th century (Berrocal *et al.* 2018: 917; Cort 2017: 282; Grave & McNiven 2013; Ketel 2011; Klose & Schrire 2018: 131). They might be directly imported to Kiwulan by the Europeans to Kiwulan or indirectly by Chinese merchants or other indigenous groups via the regional network in north Taiwan. Either way indicates that the Europeans played an important role in introducing foreign jars to Taiwan. Those jars were widely distributed across the site and served as indicators, together with the radiocarbon dates, to identify the excavation unites associated with the pre-European and the start of the European influence at Kiwulan. In addition to ornaments and stoneware jars, around 300 pieces of local made pipes and a few imported pipes were viewed as a custom introduced by the Europeans.

The archaeological signature of the Chinese period at Kiwulan is the large amount and diversity of Chinese porcelains in many forms such as bowls, plates, and cups. Other indicators include opium pipe-bowls and distinctive architectural bricks and tiles used by Chinese (Hsieh 2009). Chinese migrations to Yilan were also recorded in official Chinese records written in the early 19th century recording the first immigrant in 1768 (Chen 1963; Ke 1993).

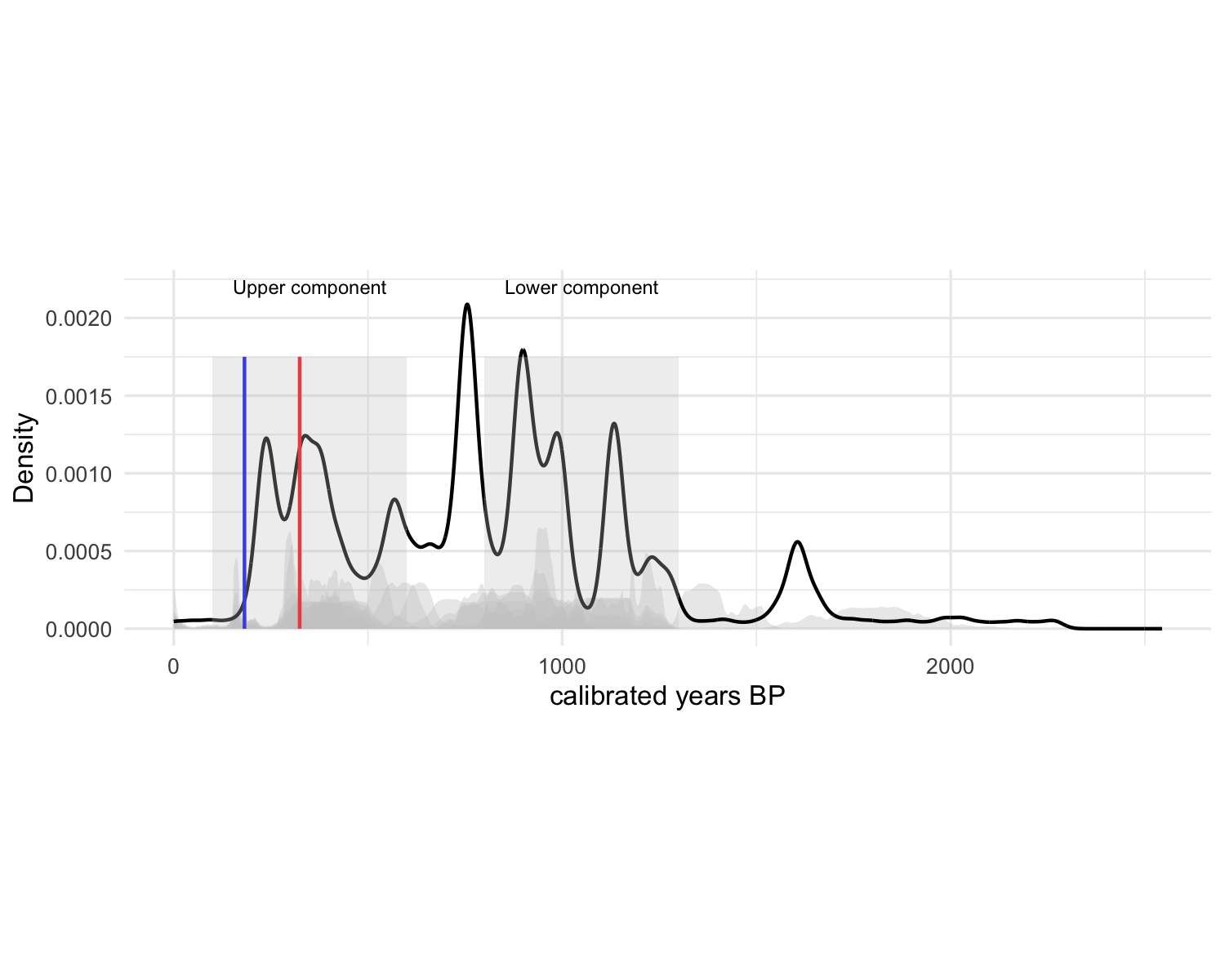


Figure 3: Summed probability distributions for dates from Kiwulan. The dark line represents the summed probabilities of all radiocarbon ages, and the grey lines in the background are the probabilities of individual ages. Grey rectangles indicate the approximate chronology of the major archaeological components of the deposit. Ages calibrated with the Bchron package (Parnell et al. 2008).

Table 1: Radiocarbon dates on charcoals from Kiwulan (Chen 2007). Calibrated using IntCal13 Atmospheric curve.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Period | Pit-Layer | Depth related to sea level (cm) | Date BP | Calibrated date (95% conf. level) | Details |
| NA | P028-L15 | -130 to -150 | 1050±40 | 898.95 - 1051 | NA |
| NA | P049-L11 | -20 to -30 | 340±30 | 314 - 483 | NA |
| NA | P041-L13 | -150 to -170 | 1240±30 | 1078 - 1262 | NA |
| NA | P052-L7 | 0 to -10 | <200yr | NA | NA |
| NA | P051-L17 | -36 to -56 | <200yr | NA | NA |
| NA | P041-L9 | -70 to -90 | 900±50 | 715 - 917 | NA |
| NA | P051-L19 | -70 to -90 | <200yr | NA | NA |
| NA | P041-L7 | -25 to -45 | 250±40 | 4 - 430 | NA |
| NA | M020-L9 L6 | -44 to -80 | 270±40 | 153 - 451 | NA |
| NA | H044-L12 | -30 to -70 | <200yr | NA | NA |
| NA | M009-L6 | 4 to -56 | 510±75 | 344 - 648.025 | NA |
| NA | P089-L11 | -50 to -70 | <200yr | NA | NA |
| NA | M030-L2 | -28 to -70 | 360±100 | 76 - 542 | NA |
| NA | P052-L16 | -110 to -130 | 310±100 | 17 - 510 | NA |
| NA | P248-L5 | -100 to -120 | 800±120 | 562 - 953 | NA |
| NA | M066-L5 | -100 to -120 | 1190±70 | 968 - 1266 | NA |
| NA | P154-L3 | 10 to -10 | 920±105 | 685 - 1052 | NA |
| NA | H193-L2 | 6 to -51 | 340±100 | 35 - 530 | NA |
| NA | P154-L14 | -180 to -190 | 1870±110 | 1566 - 2082 | NA |
| NA | H026-L5 | -120 to -160 | <200yr | NA | NA |
| NA | M095-L2 | 20 to -57 | <200yr | NA | NA |
| NA | H172-L4 | -10 to -110 | 280±70 | 12 - 484 | NA |
| NA | P162-L11 | -160 to -180 | 920±70 | 705 - 953 | NA |
| NA | P237-L4 | -70 to -90 | 1030±80 | 771.975 - 1153 | NA |
| NA | P144-L5 | -10 to -30 | 610±90 | 502 - 709 | NA |
| NA | P246-L8 | -160 to -180 | 1170±70 | 953 - 1255 | NA |
| NA | P154-L13 | -170 to -180 | 1080±90 | 800 - 1223 | NA |
| NA | P238-L10 | -130 to -150 | 1020±60 | 793 - 1055 | NA |
| NA | P144-L11 | -130 to -150 | 1480±70 | 1291 - 1526 | NA |

# The ornaments

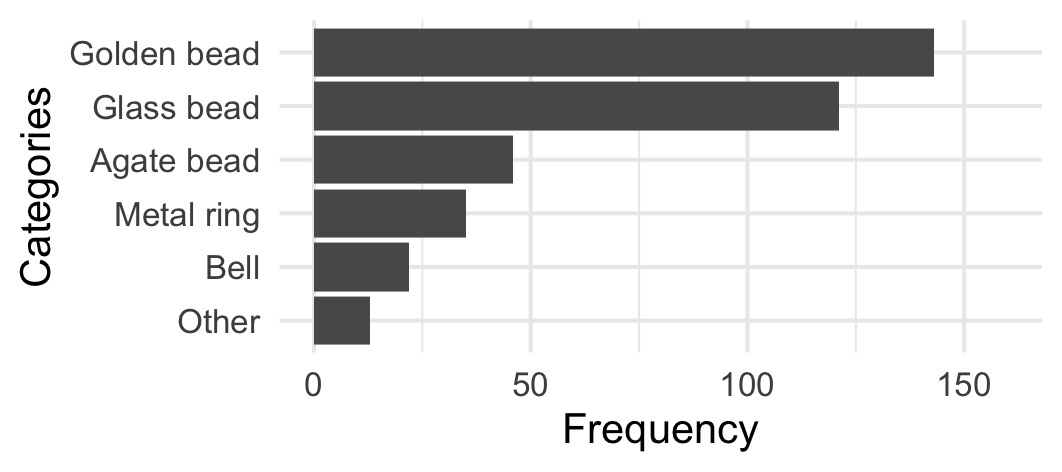


Figure 4: Frequency of the major class of ornaments at Kiwulan. Frequency represents artefact counts

Table 2: Ornament subtype at Kiwulan. The numbers represent artefact counts

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Categories | Type | Before European Contact | European Presence | Chinese Presence |
| Agate bead | hexagonal | 6 | 17 | 5 |
| Agate bead | waxy oval | 0 | 4 | 0 |
| Agate bead | small oval | 3 | 3 | 0 |
| Agate bead | globular | 0 | 1 | 0 |
| Agate bead | pentagonal | 0 | 1 | 0 |
| Agate bead | big oval | 0 | 0 | 1 |
| Agate bead | long bicone | 0 | 0 | 1 |
| Agate bead | octagonal | 0 | 0 | 1 |
| Bell | large | 3 | 8 | 3 |
| Bell | plain small | 0 | 4 | 1 |
| Bell | thin small | 0 | 1 | 1 |
| Glass bead | small (0.5-1 cm) | 60 | 37 | 1 |
| Glass bead | medium (1-2 cm) | 8 | 15 | 0 |
| Golden bead | NA | 48 | 93 | 2 |
| Metal ring | wide small | 1 | 9 | 1 |
| Metal ring | thin large | 4 | 5 | 2 |
| Metal ring | wide large | 0 | 5 | 0 |
| Metal ring | overlapped | 0 | 2 | 0 |
| Metal ring | braid | 0 | 1 | 0 |
| Metal ring | entwined | 1 | 1 | 0 |
| Metal ring | flat | 0 | 1 | 0 |
| Metal ring | large thick string | 0 | 1 | 0 |
| Metal ring | small thin string | 0 | 1 | 0 |



Figure 5: Subtypes of ornament in each major class. A: carnelian beads, B: bells, C: glass beads and golden beads, D: metal rings. Photographs are presented in the same order as those subtypes in the table but from left to right instead. The photographs of B, C, D classes were from original excavation report (Chen 2007).

Ornaments were found in different archaeological contexts including post-holes area, burials, and middens while digging and some small beads were collected through screens with 2 mm and 1.5 mm mesh. This study focuses on 406 ornaments from 40 sampling squares located at the dwelling place of Kiwulan, indicated by aliened post-holes with in-situ posts (Figure 2). They were sampled because those units were stratigraphically intact and undisturbed by modern construction activity, compared to excavation squares on the periphery of the site. There are 30 burials in the sampling area account for one third of the total number of burials at Kiwulan. Ornaments are commonly used as grave goods in burials, and the total number including different ornament classes is 3,173. The use of ornaments as body adornments in burials will be discussed to understand the function of ornaments, but not statistically analysed since the number of ornaments is highly affected by the presence of bead strands or patterned bands, which sometimes contains thousands of beads in an individual burial (Chen 2007). In addition to ornaments from the dwelling place and burial, there are 27 ornaments found in middens, which to some extent supports the argument that ornaments were treated as high-value items at Kiwulan based on a few finds in the midden contexts compared to high frequency in burial contexts. It is important to analyse the detailed distribution of ornaments from the dwelling place across different time periods as it can provide key information concerning social inequality indicated by uneven access to high-value items in relation to the foreign influences.

The ornaments found in the Figure 4 shows that the most common ornament are golden beads (n = 143), followed by glass beads (n = 121), carnelian beads (n = 46), metal rings (n = 35), and metal bells (n = 22, see also Figure 5). The variety of subtypes and their individual frequencies are summarized in Table 2. The criteria for classification of subtype is based on their dimensional attributes that are important to understand the variation in shapes. This might simplify the subtypes of glass beads when they are the same size and shape but in different color or texture. However, the variation would be considered and discussed separately. The ornaments found in the dwelling area were assumed as body adornments or a part of clothing in their daily life according to the use in burial contexts.

# Reproducibility and open source materials

To enable re-use of materials and improve reproducibility and transparency (Marwick 2017), the entire R code (R Core Team 2019) used for all the analysis and visualisations contained in this paper is included in <http://doi.org/10.17605/OSF.IO/R8YGA>. Also in this version-controlled compendium (Marwick *et al.* 2018) are the raw data for all the tests reported here. All of the figures, tables, and statistical test results presented here can be independently reproduced with the code and data in this repository. The code is released under the MIT license, the data as CC-0, and figures as CC-BY, to enable maximum re-use.

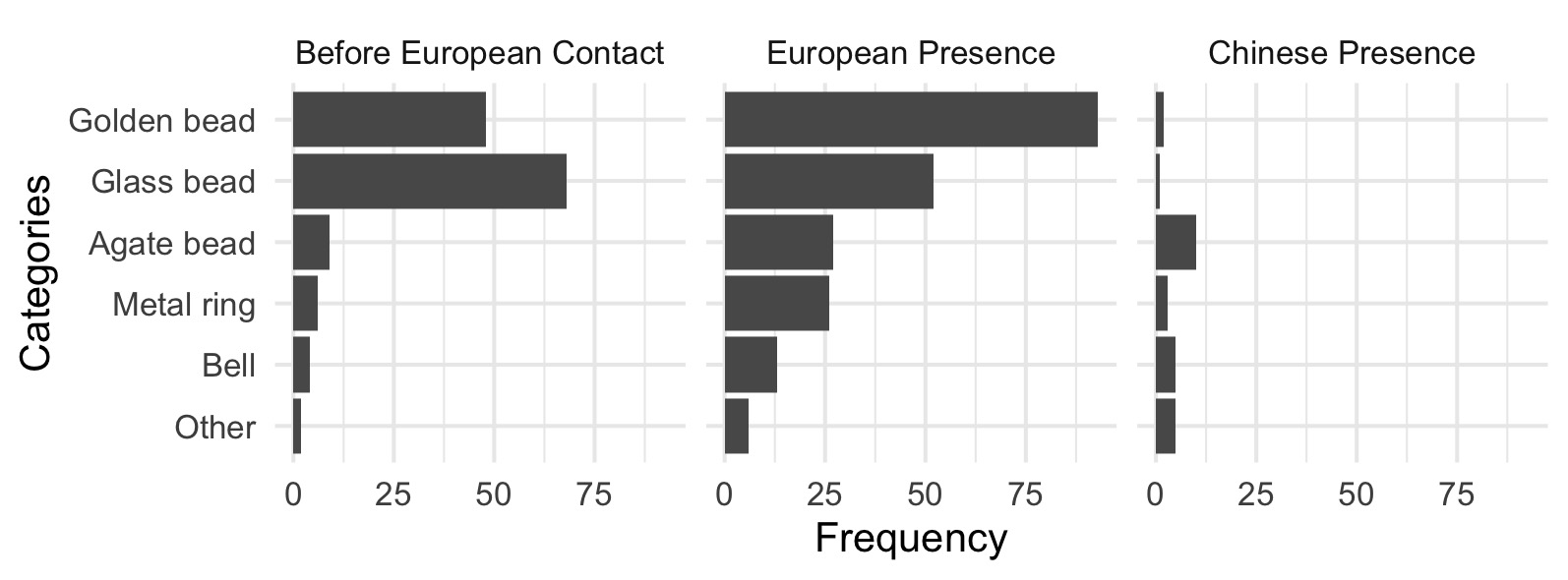


Figure 6: Frequency of the major ornament across different time periods.

# Results

## Changes in the frequencies of ornament types over time

Figure 6 shows the comparison of frequencies of the major classes of ornaments for different the time periods at Kiwulan. The difference in frequencies between the three time periods reflect significant differences in the use of ornaments (chi-square = 71.82, df = 8, p-value = ). Most ornament types were present before European contact. Ornament frequencies reached a peak during the European period and then dropped during the Chinese period, especially golden beads. This trend can be also seen on other ornaments including carnelian beads, metal rings, and bells. However, glass beads show a different pattern that indicates a higher frequency in the pre-European contact, and then a decrease in the European period and a further decrease in the Chinese period.

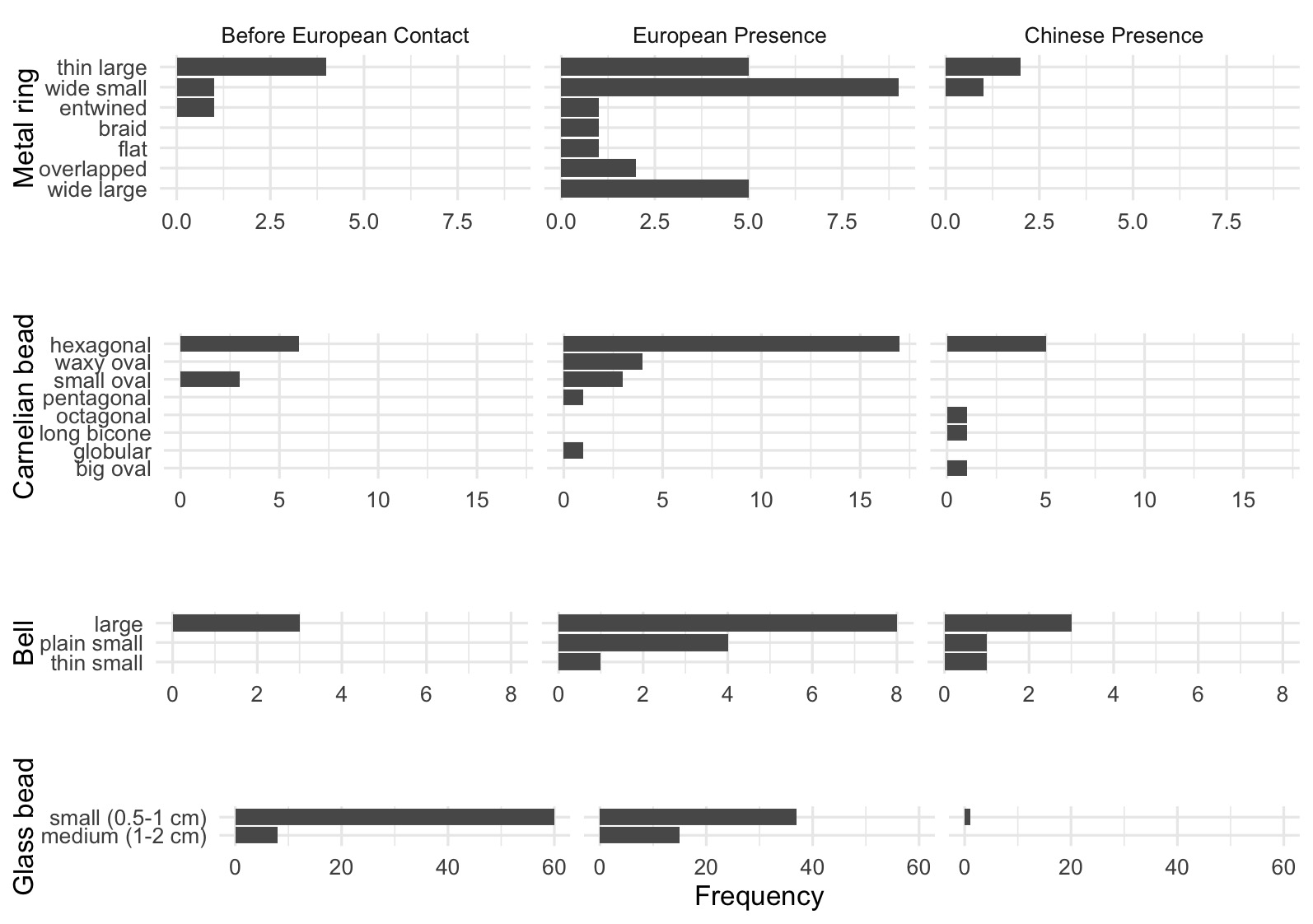


Figure 7: Frequency of ornament subtypes showing the changes in frequency across time periods for metal rings, carnelian beads, bells, and glass beads.

The distribution of frequencies for subtypes in each major class is presented in Figure 7. Spearman’s correlation test shows that there is no significant relationship between diversity of subtypes and sample size (S = 173.16, rho = 0.39, p = ). This indicates that the increases in diversity can be explained by the effects of culture interaction instead of the effects of sample size. Carnelian beads and metal rings have greater quantity and variety of shapes compared to copper bells and glass beads during the European period. The greater varieties for carnelian beads and metal rings might indicate multiple origins due to participation in large scale trade networks stimulated by the European presence. In contrast, copper bells have less variety typically >2 cm long with a wide variety of human faces as a motif. Although glass beads have less variety in size, small (0.5-1 cm) and medium (1-2 cm), they have a wide variety of colors or patterns mostly made by winding technique with high lead content in composition indicating possibly from China (Cheng 2008). Despite more researches needed to understand the specific source of ornaments, current researches suggest that glass beads and metal ornaments have similar technique and composition to those found in China (Chen 2011; Wang 2018). There seem to be no obvious changes in the sources of glass beads or metal ornaments at different periods in the upper component (1400-1900 AD). However, the glass beads found from the lower component (700-1200 AD) are mostly Indo-Pacific beads, widespread in Southeast Asian sites since 300 BC and declined in the early 2nd millennium (Wang 2018; Francis 2002). It indicates a different bead source more related to the exchange network in the South China Sea for the lower component.

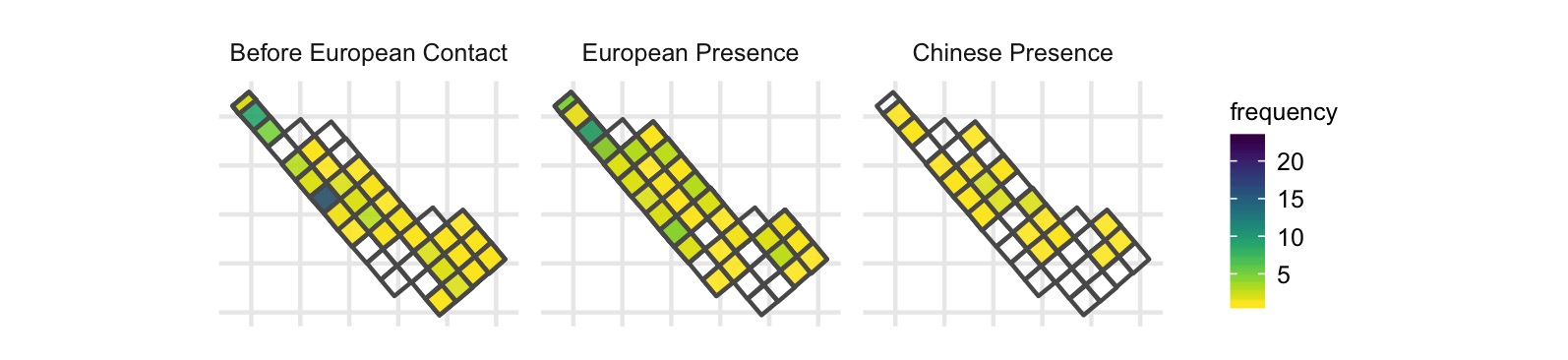


Figure 8: Spatial pattern of all class of ornament by time periods

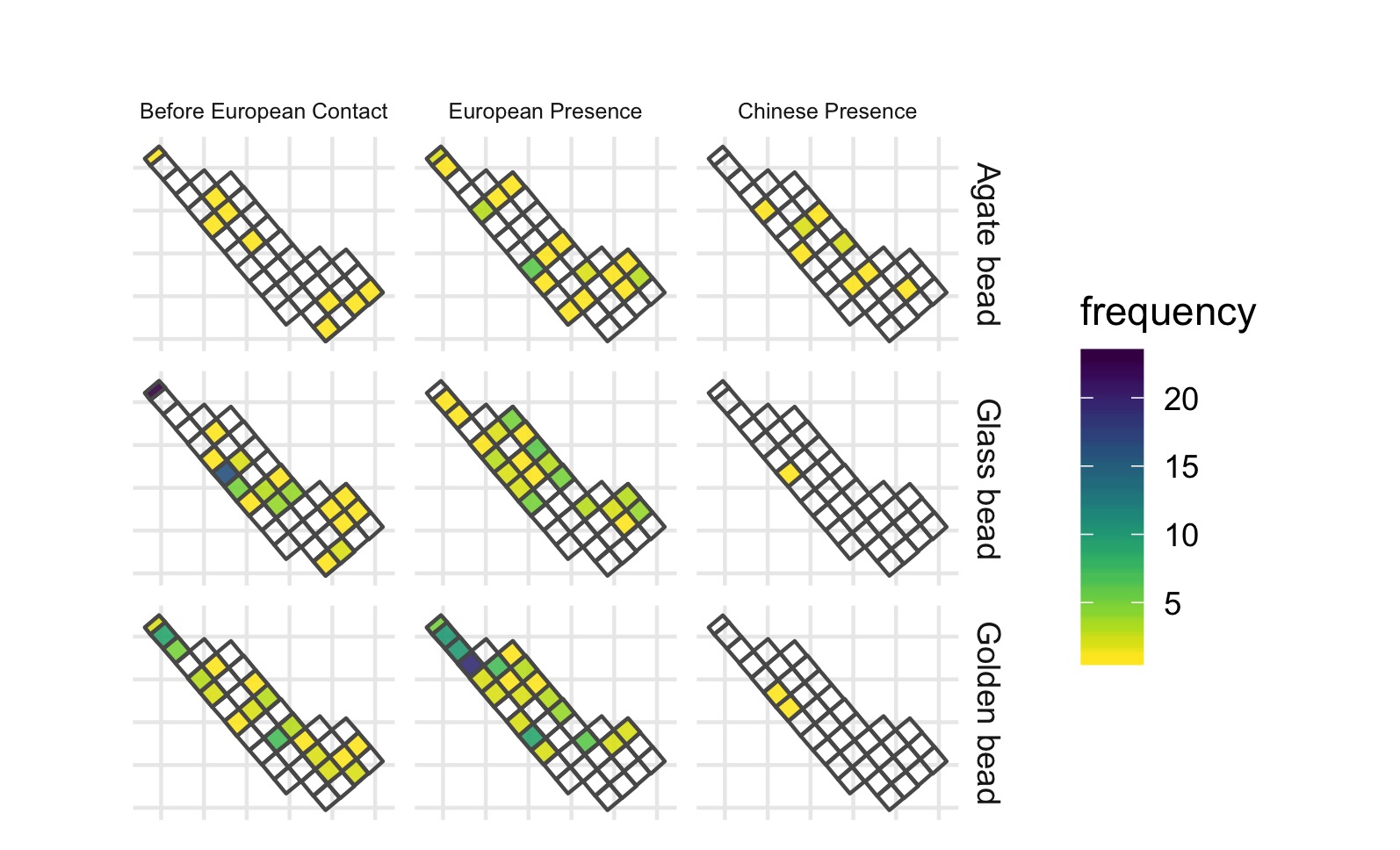


Figure 9: Spatial pattern for ornament class by time periods, only those types with more than 5 pieces are shown here

## Changes in patterns of the spatial distribution of ornament types

Figure 8 presents the spatial distribution of all ornaments from the research area for each time period. Before the European arrival, a greater amount of ornaments were found at the northern and middle parts of the research area. During the European period, ornaments were more widespread, with some clusters on the northern part. During the Chinese period the distribution is more even again. Figure 9 presents the distribution for the major ornament classes individually, some clusters across the area can be observed during the European period, such as golden beads and carnelian beads. However, there seems to be no clear consistent pattern across those different ornaments. Each class shows its own pattern where the squares with higher number of ornaments distributed separately and independently. For example, a cluster of golden beads was found at the northern part, while a cluster of carnelian beads was found in the middle part. In contrast, there are multiple clusters of metal rings that are distributed separately across the research area. Copper bells were usually found individually and appear randomly distributed across the area. In the Chinese period, both the amount and density of different classes of ornaments decreased.

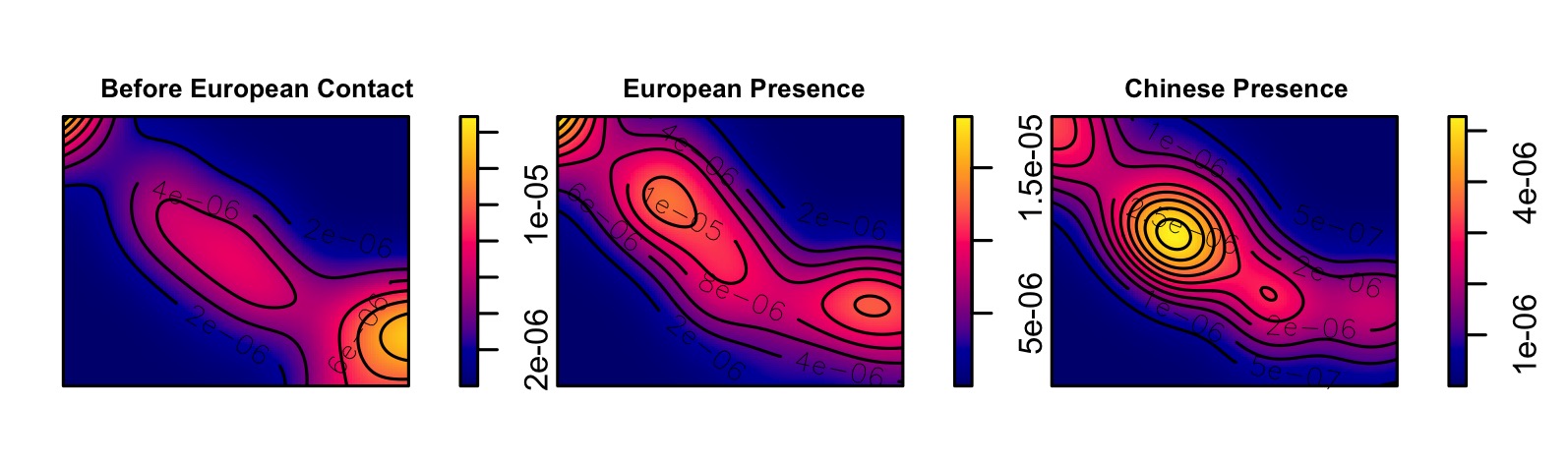


Figure 10: Kernel density map for ornaments by periods. Used the bandwidth based on Silverman (1986)’s rule of thumb.

## Point pattern analysis of ornament distribution

Point pattern analysis can assess whether the distribution of artefacts represents hotspots produced by non-random processes (Bevan & Lake 2016; Ducke 2015), such as concentrations of ornaments resulting from social inequality stimulated by a colonial presence. To prepare the ornament location data for point pattern analysis, we assigned each ornament to a random coordinate pair located in 4 x 4 m square it was recovered from (ornaments lack individual point provenance). The next step was to divide the ornaments into three time periods. All squares in the sampling area were occupied during all phases of habitation based on the continuous presence of archaeological materials across over the strata representing a time span of 600 years. Finally we computed the kernel densities for each time period for comparison. Kernel density estimations (KDE) compute the probability of the density of ornaments across space by creating a continuous, smooth density surface across space. Here we use KDE to visualize core areas of ornaments and surrounding neighbourhoods (Bonnier *et al.* 2019; Cortegoso *et al.* 2016). Density values of artefacts per square meter were calculated for each cell.

Figure 10 shows that there is one major core area during the pre-European period, multiple core areas during the European period, and a single core during the Chinese period. There are three consistent sub-regions with a core area that shifts over time. The distribution might indicate increase and decrease in the number of different social groups who possessed more ornaments. The multiple groups during the European period might reflect more unequal consumption of ornaments across the site, relative to other periods, or random patterns resulting from a bigger sample size. In addition, the generation of core areas might be biased due to small sample sizes, for example, a few ornaments found at one single square during the Chinese period could create an obvious hotspot. The proportion of ornaments is relative to the number of locally made pottery that shows the pattern of decline in the 19th century. Although the quantity of locally made pottery declines in the 19th century with an obvious growth of the imported Chinese porcelains, the general density of the total number of artifacts is consistent throughout all three phases. However, less locally made pottery and ornaments might relate to the indigenous population decline. Whether the observed clustering is random or non-random is crucial for the interpretation of intentional human activities.

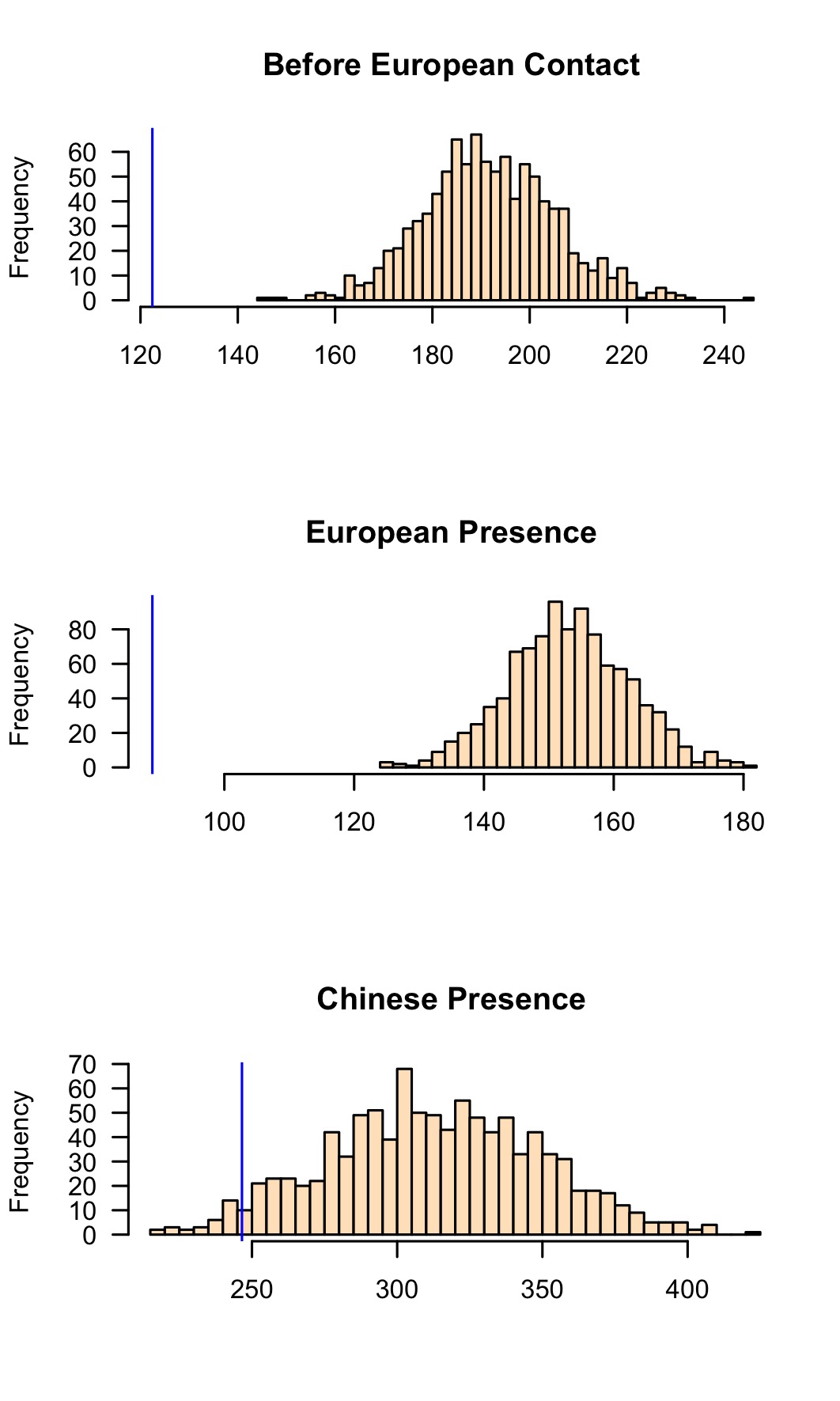


Figure 11: Histograms of simulated ANN values from 1000 simulations for three time periods. X values represent ANN expected value under a completely random process resulted from simulated pattern. Each sample distribution presents the null hypothesis with the blue line indicating the observed ANN value.

To test for randomness in spatial locations, we used a Monte Carlo method to simulate average nearest-neighbour distances (ANN). Figure 11 shows the observed ANN distances with the distributions of the ANN distances calculated on 1000 simulations of random ornament locations. The results show that 100% of the simulated values are much greater than our observed ANN value during the European period, which means the ornaments have non-randomly clustered distributions. A similar, but less extreme, result is also observed during the pre-European period. The observed distribution of ornaments is more similar to the random distributions during the Chinese period, with about one third of the simulated values are greater than our observed ANN value. This testing reveals that the clustered distributions of ornaments during the pre-European and European periods might reflect the presence of different social groups. Moreover, the clustering of ornaments during the European period is highly non-random, potentially indicating different degrees of access to foreign ornaments or a concentration of power to control the distribution of ornaments at Kiwulan.

# Discussion

An indirect colonial influence is indicated at Kiwulan by a greater diversity of ornament types and materials during the European period. Northeastern Taiwan, Yilan, was involved in complex trading networks both in regional scale with other indigenous groups and Chinese merchants, and global scale with the European including the Dutch and the Spanish. The origin of ornaments might be multiple places mostly in Southeast Asia and introduced into northeastern Taiwan by Chinese merchants before 17th century. Later, the trade activities became more frequent and intense in the 17th century that might be related to the colonial involvement of the Europeans based on the similar styles of golden beads found in Luzon that was once the colony of the Spanish during this period. In addition to ornaments, stonewares at Kiwulan that were also found on a Spanish shipwreck and Southeast Asia in relation to the Dutch and the Spanish trading routes, and the tobacco use were also believed introduced to Kiwulan by the Europeans (Wang & Liu 2007; Chen 2007). The greater diversity and quantity of ornaments likely results from participation in large scale exchange networks that stimulated the circulation of different ornament classes. However, the frequency of overall ornaments and each subtype declines significantly during the Chinese period in the early 19th century. This may be due to a smaller scale of trading network, the overall decline of the indigenous population in Yilan, or adopting the practices of Han Chinese who did not use these kinds of beads in their dress. Since the end of the 18th century, many indigenous people moved southwards to Hualien due to population pressure caused by Han Chinese immigrants (Chen 2007). Although historical records indicate that trade ornaments were prestige goods in prehistoric northeastern Taiwan, the information might be biased that needs to be compared with archaeological evidence.

The archaeological contexts show that ornaments were rarely found in middens and mostly preserved well as body adornments in burial contexts serving as grave goods. This could reflect ornaments were viewed as valuable objects such as status indicators and their distribution across the dwelling area would help to understand the social relation reflected by people who possessed them, and the reaction of the society as a whole to the colonial presence in the 17th century. Spatial patterns of ornaments show that their distribution was clustered during the pre-European and European period. Testing for spatial patterns indicates that these clusters are non-random, and are most highly concentrated during the European period. The spatial clustering during the pre-European and the European period shows an increase in the use of ornaments in daily life at Kiwulan. It may indicate that a degree of social inequality based on uneven distribution was present before European contact and then it was reinforced and amplified during the European period. A further indicator of increasing social inequality is a burial dated to the 17th century that included 60 golden beads, well above the average of 2-3 pieces in the pre-European period (Chen 2007; Cheng 2008).

How might these results fit into a bigger picture of social change at periphery of colonial systems? We may get some insight into the general pathways that led to social inequality in northeastern Taiwan by considering how people have achieved and maintained power in a wide variety of societies (Drennan *et al.* 2010; Feinman 2000; Ames 2010; Bowles *et al.* 2010). For example, the corporate/network model proposed by Feinman (2000) expands traditional hierarchical complexity to provide a comparative basis for distinct strategies for power. In the network mode, inequality develops when individuals accumulate wealth through their individual networks and people use their wealth to attract factions, control resources, and monopolize trade networks. In contrast, the corporate mode stresses shared power across different groups and sectors, integrative ceremonies and rituals, and large cooperative labour tasks (Feinman 2000; Siegel 1999). This provides an interpretation that Yilan social organisation went from corporate mode before the European arrival, then transitioned to network mode during the European presence. The small number of ornaments, and less concentrated distribution during the pre-European period is consistent with shared power and wealth of the corporate mode. The long-distance trade network introduced by Europeans resulted in the appearance of a network mode due to competition among ambitious individuals for prestige, wealth, or power through collecting trade goods (Brumfiel 1994; Clark & Blake 1994). Because of the weak direct control from the European colonizers in northeastern Taiwan, local leaders may have had the flexibility to manipulate European colonial images, expand personal power, and monopolize the high-value trade goods (Kang 2012).

Another scenario could be that the increasing number and concentrated spatial pattern of ornaments indicate cultural resistance against the European intrusion by using them to show social identity and emphasize the local custom that had existed before European contact. Resistance could be presented in many forms. For example, Rubertone (2000) discussed a mid-17th century Narragansett Indian cemetery where a large amount of native-made shell beads supposed to be tributes for the European were found in the graves as an act of political resistance against the colonial demands. Similarly, the frequent presence of ornaments across the dwelling area during the European period suggests ornaments might be intentionally displayed in daily life to reinforce the original cultural tradition. During the Chinese period in the 19th century, the decreasing frequency and diversity of ornaments show a decline in the use and discard of ornaments at Kiwulan. This might reflect the smaller scale of exchange networks, with limited sources of ornaments, and limited opportunities for individuals to accumulate wealth, or indeigenous population decline. It is also possible that some ornaments were treated as heirlooms, such as carnelian beads and golden beads, that passed from one generation to the next. This might suggest that the ornaments found in the Chinese period were old items continuously used until then. Further analysis of the source for ornaments from different periods will be helpful to understand their origin and regional circulation.

# Conclusion

Examination of the indirect influence of colonialism can reveal how peripheral areas were influenced by colonial activities or involved in the colonial economy centred in the major European colonies (Trabert 2017). Kiwulan in northeastern Taiwan is an exceptional case study as an East Asian location that was relatively isolated and peripheral, and yet connected by regional and global trade networks. Kiwulan provides valuable insights into the discussion of indirect colonial influence on local societies living beyond the borders of direct European colonial occupation. The frequency and spatial distribution of body ornaments at Kiwulan present three distinct patterns during different dominant culture interaction periods. The greater amount and diversity of ornament types during the European period reflects an increasing use in ornaments in a colonial context. Before European contact, ornaments were traded into local indigenous societies via the regional exchagne network with Chinese merchants and viewed as prestige goods in local indigenous culture according to their distribution in the archaeological contexts. After the arrival of the Europeans, the exotic and powerful image carried by those ornaments may have intensified, further signalling wealth and privileged trading connections among the inhabitants of Kiwulan. These symbolic values may have stimulated more competition between aggrandizing individuals for prestige and wealth accumulation at Kiwulan, which might have resulted in an increase in social inequality. This might also indicate an act of intentional resistance to the intrusion of the Europeans by using more ornaments that is part of culture tradition.

We are still far from understanding the full variety of colonial impacts on peripheral indigenous communities. The origin of ornaments and how their sources changed over time would give more information to construct a clear picture of complex trade networks during this periods. By focusing on the distribution patterns in a settlement site, the Kiwulan ornaments suggest that foreign ornaments can be a proxy to detect indirect colonial influence on local indigenous populations. Ornaments give insights into the amplification of social inequality stimulated by European colonisation. It also shows the agency of indigenous people to incorporate ornaments into their social system and use them in their daily lives to display or intensify status differences. Future work could extend this approach to studies of other trade goods such as ceramics. We have introduced here the corporate/network model for understanding the dynamics of social inequality at Kiwulan, and future tests of this should include analysis of pottery production and standardisation, and mortuary practices.

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### Colophon

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#> P stringi 1.4.3 2019-03-12 [?]  
#> P stringr \* 1.4.0 2019-02-10 [?]  
#> tensor 1.5 2012-05-05 [2]  
#> testthat 2.2.1 2019-07-25 [2]  
#> P tibble \* 2.1.3 2019-06-06 [?]  
#> tidyr \* 1.0.0 2019-09-11 [1]  
#> P tidyselect 0.2.5 2018-10-11 [?]  
#> tidyverse \* 1.2.1 2017-11-14 [2]  
#> units 0.6-5 2019-10-08 [1]  
#> usethis 1.5.1 2019-07-04 [2]  
#> P vctrs 0.2.0 2019-07-05 [?]  
#> viridis \* 0.5.1 2018-03-29 [2]  
#> P viridisLite \* 0.3.0 2018-02-01 [?]  
#> P withr 2.1.2 2018-03-15 [?]  
#> xfun 0.11 2019-11-12 [2]  
#> xml2 1.2.2.9000 2019-11-09 [2]  
#> yaml 2.2.0 2018-07-25 [2]  
#> P zeallot 0.1.0 2018-01-28 [?]  
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#>   
#> [1] /Users/bmarwick/Desktop/kwl-ornaments/renv/library/R-3.6/x86\_64-apple-darwin15.6.0  
#> [2] /Library/Frameworks/R.framework/Versions/3.6/Resources/library  
#>   
#> P ── Loaded and on-disk path mismatch.

The current Git commit details are:

#> Local: master /Users/bmarwick/Desktop/kwl-ornaments  
#> Remote: master @ origin (https://github.com/LiYingWang/kwl-ornaments)  
#> Head: [5f70f66] 2019-12-10: merge conflict

Word count: 5675