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Environmental History of an Early Spanish Settlement in the Visayas, Philippines: Excavations in the Parian District of Cebu City

Kasaysayang Pangkalikupan sa usa ka Karaang Puluy-anan Katsila sa Kabisay-an, Pilipinas: Mga Nakubkoban sa Distritong Parian, Lungsod sa Sugbu

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Abstract

The Jesuit House was built in 1730 on land reclaimed from the Tinago Marsh at the edge of the early Spanish settlement of Cebu City, Philippines, two centuries after it was first encountered by the Spanish explorer Magellan. As the city expanded from its core areas ca. 1565 around Fort San Pedro, Plaza Independencia, and the sites of Santo Nino Church and the Cebu Cathedral, waterways were drained and filled, and canals were dredged to extend the urban Spanish grid. Archaeological excavations at the Jesuit House and in the nearby Casa Gorordo Annex project document these changes in the urban landscape. Soil profiles throughout the downtown coastal plain in conjunction with chronostratigraphic data from the excavations demonstrate its submergence during the late Holocene high sea still-stand, followed by dissection by local drainages and the Guadalupe River. Relict channels and distinct interfluvial terraces are observed showing a migrating series of channels along the shoreline as well as a distinct escarpment at the back of the plain that marked the limits of marine intrusion during the high still-stand. Visayans and Spanish settlers selected higher ground for settlement in the interfluves and modified lowland areas such as the marshlands one of which became the Parian District of urban Cebu. Archaeological investigations at the Jesuit House and the Casa Gorordo Annex document the environmental history as well as the transition from native to colonial lifeways at the edge of Empire.

Ang Balay Hesuita natukod niadtong tuig 1730 pinaagi sa pagtambak og yuta sa Katunggan sa Tinago diha sa ngilit sa nag-unang nahimutangan sa mga Katsila sa Sugbu, Pilipinas, mga duha ka gatusan ka tuig human kini nakaplagan sa Katsilang manunuhid nga si Magallanes. Sa dihang nilapad ang lungsod, gibana-bana 1565, nga naglangkob sa Kotang San Pedro, Hawan Independencia, ug mga luna sa Simbahang Santo Nino ug Katedral sa Sugbu, ang mga katunggan gipahubas ug gitambaka'g yuta, ug ang mga kanal gihawas-asan aron sa pagpalugway sa gilapdon sa lungsuranong Katsila. Makita kining mga kausaban sa lungsod pinaagi sa mga nakubkuban sa mga arkeyologo sa Balay Hesuita ug sa Sumpay sa Balay Gorordo nga duol niini. Ang mga takilirang hulagway'ng yuta sa tibuok kabaybayunang patag sa maong lungsod, tali sa datos nga kronostratigrapiko nga nakuha pinaagi sa mga arkeyolohikong pangubkob nagapakita sa pagkalubog niini kaniadto sa kinatas-ang naabtan sa dagat sa panahon sa Holosino, gisundan kini sa pagtabas-tabas pinaagi sa mga gagmay'ng sapa ug sa Subang Guadalupe. Makita sa mga karaang giagian sa katubigan ug tataw'ng mga hinagdanan ang nagsunod-sunod nga mga agianan sa tubig subay sa baybayon ug ang mga tataw nga tagaytay sa likod sa patag nga maoy nagpaila kung asa taman niabot ang kadagatan sa panahon sa kintas-ang gihunungan niini kaniadto. Gipili sa mga lumolupyo nga Bisaya ug Katsila ang hataas nga mga lugar para ila kining puy-an taliwala sa mga dagayday ug ilang giusab ang mga basa nga mga lugar sa ubos niini, sama sa mga katunggan diin usa niini ang Ditritong Parian sa Sugbu. Ang mga pagtulun-ang arkeyologo sa Balay Hesuita ug sa Sumpay sa Balay Gorordo nagapakita sa kaagi sa kalikupan lakip na ang pag-usab gikan sa lumadnon ngadto sa kolonyal nga mga pamaagi sa kinabuhi diha sa ngilit sa Imperyo.

Keywords: environmental history, Cebu City, Philippines, early Spanish settlement, landscape archaeology | kaagi sa kalikupan, Dakbayan sa Sugbu, Pilipinas; mga naunang katilingbang Katsila; arkeoyolohiya sa kayutaan

Introduction

The Parian District was designated for early Chinese traders in the Cebu settlement by Spanish administrators (Figures 1 and 2). As in Manila, the *Sangleyes* or Chinese were encouraged to drain the wetlands at the northern edge of the urban settlement to build their own community,[1] and even early efforts led to an orderly and prosperous district that later boasted domiciles for many of the religious orders and illustrious families of the young city. Among these were the Jesuit House and the Casa Gorordo that are still preserved as heritage homes in the Parian.

The Jesuit House is an early Spanish period *balay na tisa* structure built in 1730 to house the Jesuit order in early Cebu (Mojares 2017:62), hence the name despite later residential occupation by the Borromeo and Sy families. The Parian Church and Plaza as well as other heritage homes such as the Yap-San Diego house contribute to a heritage neighborhood in Cebu City in the historic Parian district. The Sy family has been restoring the Jesuit House as one of the cornerstones of the heritage district. Along with historical museum displays the active restoration of *molave* posts was

[1] The Parian Marsh is depicted as early as 1742 on a map of the Port Area of Cebu (Figure 1). It appears as a salt-water inlet until a map in 1873 that depicts it as closed off from the sea. The marsh had already begun to shrink in extent from the late 1600s. By the late 1700s the "Parian estero" had started to silt up and was no longer navigable for commercial trade in the Parian District (Mojares 2017:32). It was apparently around 1590 that a Chinese settlement was established in Cebu, following the period of establishment of the Chinese Parian in Manila (see Fray Domingo, Bishop of the Philippines, "The Chinese and the Parian in Manila", from Blair and Robertson 1903, Vol. 7, p. 224. In Manila, the "sangleyes" or Chinese were relegated to the marshes on the border of the city where they reclaimed the marsh and built a Parian "on the firm ground where the four rows of buildings are located they have built their houses and streets" and instead of reeds covered their houses with tiles (Blair and Robertson 1903 Vol. 7 page 224). This was presumably originally in 1581 in Manila, followed soon after in 1590 in Cebu (Mojares 2017:29).

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archaeologically documented. The resulting artifact and stratigraphic discoveries contribute to knowledge of the period of contact with earlier Visayan habitation overlain by Spanish period native occupation, and finally by the Spanish Jesuits beginning in 1730 with the construction of the first Spanish period structure on the property.

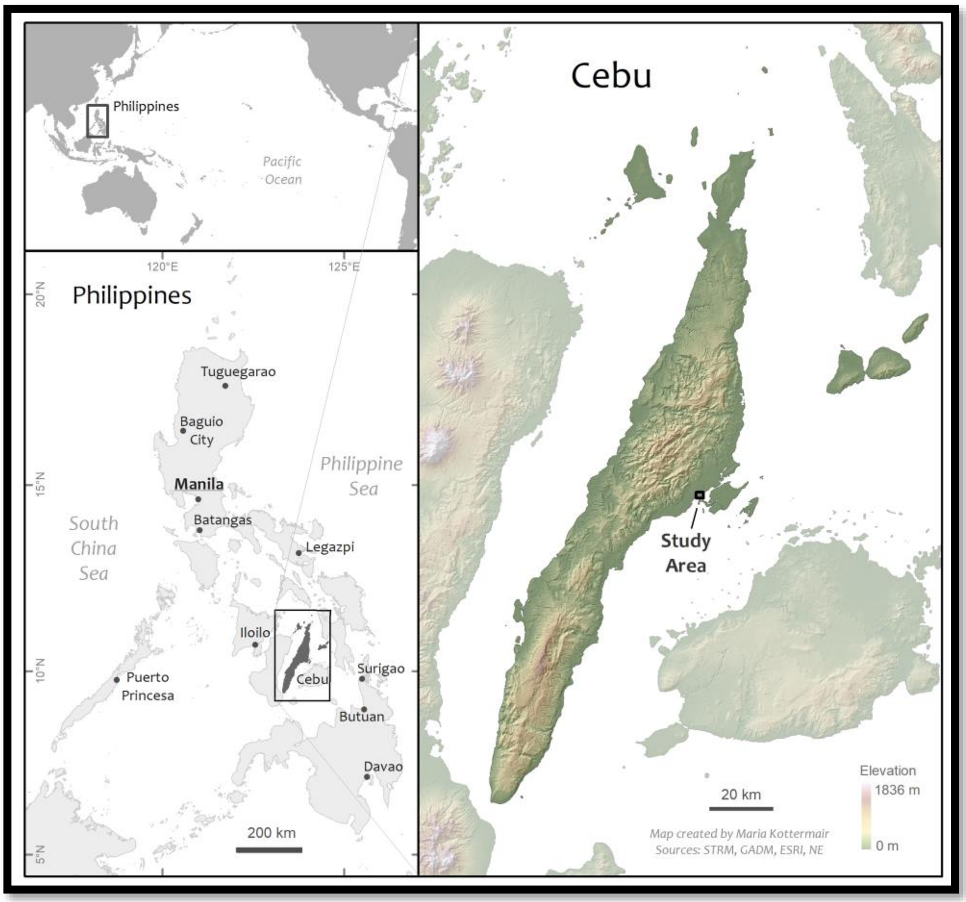
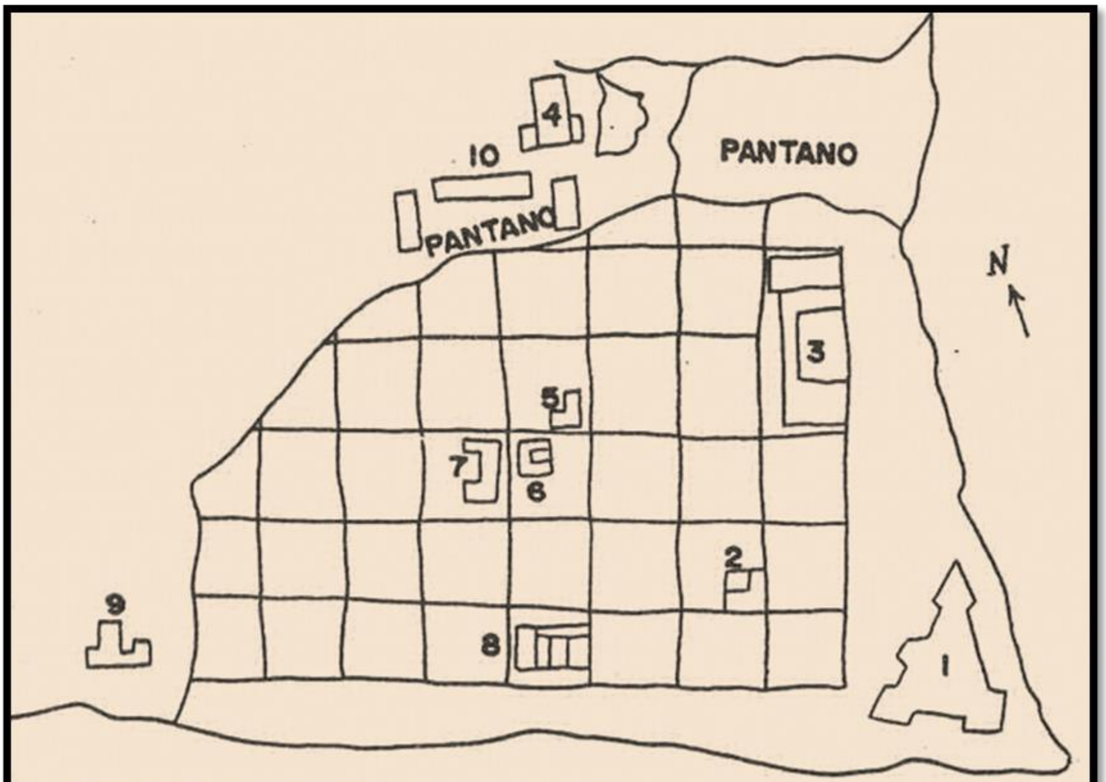


Fig. 1 Cebu City Locator Map. Source: Kottermair.

The Jesuit House was apparently built along the shoreline of an arm of the sea that was impounded in the late nineteenth century into a marsh that was subsequently reclaimed for the Parian District (Figures 3, 4). Across the marsh from the site of the Jesuit House the Casa Gorordo was built in the early nineteenth century on reclaimed land for residential use (Mojares 2017). Recent construction of an annex to the Casa Gorordo Museum led to the opportunity to monitor and collect environmental samples from the exposed stratigraphy. Unlike the Jesuit House, Casa Gorordo was in the middle of the marsh and produced very little in the way of archaeological materials suggesting that it was not built upon until the nineteenth century reclamation. The two adjacent sites contribute data toward modeling the evolution of the local landscape.



Map of the port area of Cebu ca. 1742, based on the MS. in Museo-Biblioteca de Ultramar in Madrid. Sites indicated are (1) Fuerza de San Pedro, (2) Quarteles y Casa Real, (3) Iglesia y Colegio de la Compañia de Jesus, (4) Iglesia S. Juan Bautista de Parian, (5) Casa de Cabildo, (6) Casas Episcopales, (7) Catedral, (8) Iglesia y Convento de Sto. Niño, (9) Iglesia y Convento de la Concepcion, and (10) Parian de los Sangleyes.

Fig. 2 Cebu port area in 1742 showing parian and marsh (*pantano*). Source: Blair and Robertson 1907 Vol. XLVII-1728-1759:115.

Earlier archaeological projects including the "*Houses Built on Stilts*" in the older, higher Spanish settlement area, attest to earlier Visayan village settlement (Hutterer 1973), and a systematic study of the early Cebu settlement by Masao Nishimura (1992) included collection of soil profiles and other environmental data that contribute to understanding of the evolution of the urban Cebu landscape. Jago-on documented stratigraphy at the Convento (Jago-on 2001), and de la Torre and Cuevas (2003) some of the earliest Plaza Independencia findings. Later comprehensive reporting was contributed by Mijares (2006) for ACECI and the National Museum. These excavations showed archaeological materials from within 1-2 meters of the ground surface with the greatest density in the late pre-Spanish and early Spanish period. In all the sites previously excavated there was at least one meter of variable fill from construction and demolition as well as street construction. The lower depths at the excavations, below ca. 1000 ACE, may have had human burials, but these were intrusive into silty alluvium that appears to have been deposited on river terraces in the early stages of the development of the coastal plain below the low hills of the Cebuan cordillera. The excavations at Jesuit House and Casa Gorordo supported these earlier chronological findings along with comparative data on coastal geomorphology and a broader sweep in both time and space across the coastal plain. We propose that this data collectively contributes to a narrative of coastal evolution from the mid-Holocene, ca. 6,000 ybp, through the natural transformation of an

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exposed coastal plain from lowering sea level, degradation and channel formation across the plain, and alluviation and in some higher and older interfluves emergence of stable landforms that were selected for settlement for the early Visayan Village as well as the Spanish *Urbis* that was built above its ruins.

Fig. 3 *Plano de Topografico de la Ciudad de Cebu* 1833. Source: National Archives of the Philippines 66/330.

Objectives of the Investigation

These projects were undertaken as separate and serendipitous activities. The Jesuit House followed an earlier restoration project that recovered high density Wan Li period Chinese ceramics as well as other materials mixed-up during construction excavation to provide a solid base for the post replacements. There was no effort to manage the excavation stratigraphically. However, the abundance of materials led to laying the groundwork for archaeological excavation during the restoration of the five remaining posts within the house. This project was undertaken as a class project the History majors at the University of San Carlos, and volunteers supporting the restoration project led by Mr. Jaime Sy, family of the property owners.

The project piqued the interest of the Ramon Aboitiz Foundation, Inc. which thereby contracted with the USC team to conduct monitoring and analysis of a construction project for the Casa Gorordo Annex to the RAFI museum. The monitoring of excavation for foundations recovered few archaeological materials, but a wealth of geoarchaeological materials that were used for radiocarbon dating and geomorphic interpretation of the marsh formation and its relation to the surrounding terrain, including that of the Jesuit House.

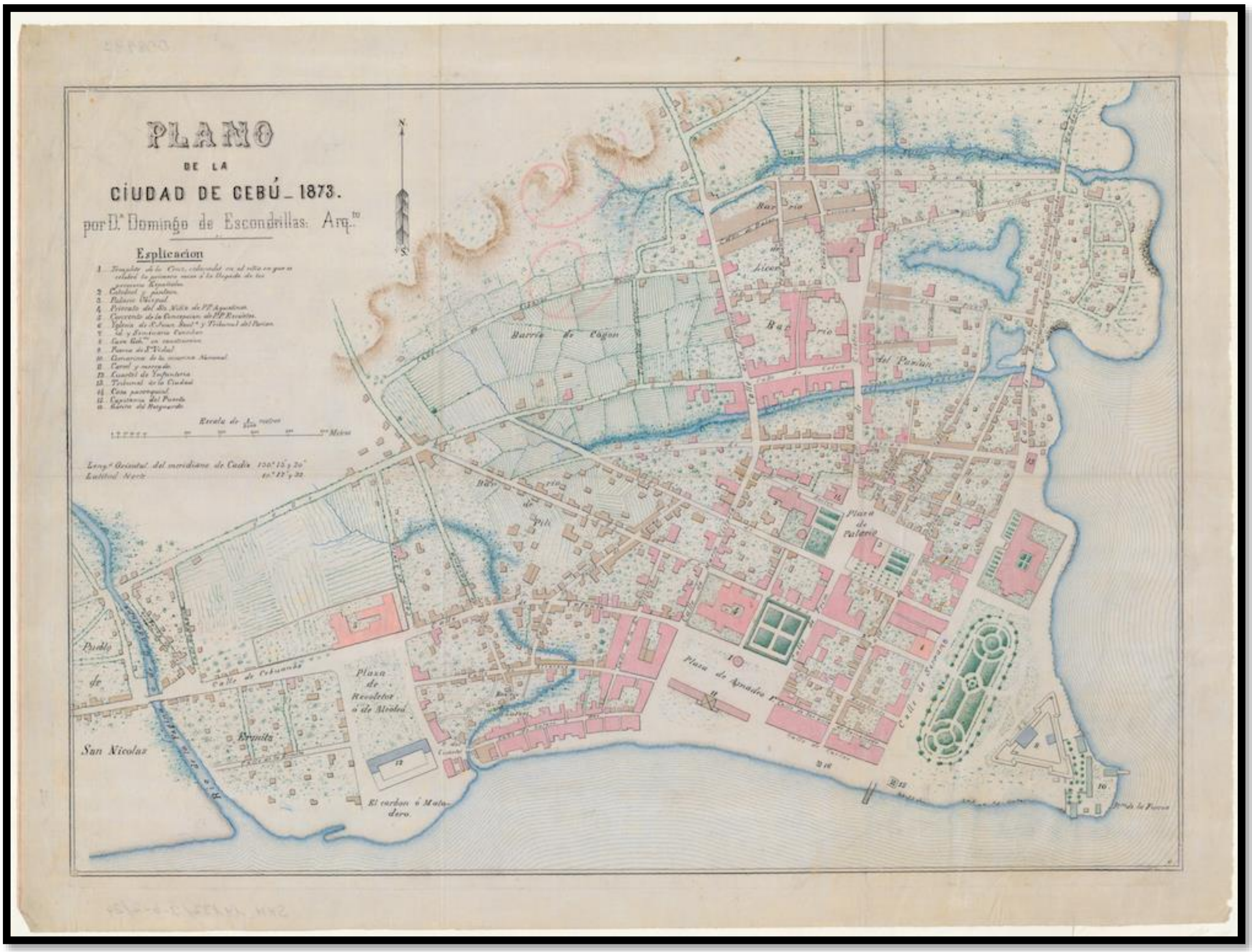

Fig. 4 *Plano de la Ciudad de Cebu por Dn. Domingo de Escondrillas*, 1873. Source: Ministro de Defensa, Cartoteca del Archivo General Militar de Madrid (Spain).

A nearby project, the Patria demolition and construction for office and residential units undertaken by the Diocese of Cebu and a private developer, provided support for archaeological impact analysis of the project. Initial observations has provided data for comparative landscape analysis and continuing monitoring is expected to produce additional radiocarbon dating results for our emerging model of evolution for the coastal plain.

Methods

The data from these projects as well as from previous work by Hutterer and Nishimura contributes to landscape interpretations of the natural as well as cultural landscapes of the downtown Cebu coastal plain. Fortunately, these earlier studies were detailed and systematic and contribute to the interpretation, with new data from our projects, of the evolution of the downtown Cebu coastal plain. Since this was by all accounts the area of greatest density Visayan settlement in the face of Spanish contact and was the later site for the development of the Spanish Urbis it is an important landscape to consider. What was appealing for settlement? How did change over time? What did it indicate about settlement histories and historic land use patterns?

These questions led us to document not only stratigraphy, archaeological materials, and features, but also a broad suite of materials for radiocarbon dating to cross-date environmental and cultural levels. We submitted wood, marine shell, charcoal, bulk soil, and annual seeds (coconut husk) to compensate for biases in the various materials such marine reservoir effects in the marine shell or contamination of charcoal from bioturbation. The resulting chronostratigraphy is a robust sampling with absolute and relative ages congruent throughout the levels in each site and also comparable across sites in the overall landscape. Excavation has been done by hand in 20 cm levels in the Jesuit House, by power shovel at the Casa Gorordo Annex, and by excavator at the Patria. All deposits were screened at the Jesuit House, while a sample was screened at the Casa Gorordo and the Patria. As construction continues at the Patria we will document very deep deposits including a 5 meter thick massive clay from 15-20 meters depth that will provide a glimpse at very early formation processes in the coastal plain, hopefully back to early mid-Holocene deposits, and possibly to a period where paleofauna and early human evidence might be found. Profiling, radiocarbon sampling, and plant microfossil analysis at all these deposits will ultimately provide data from a very broad time range, from 8,500 ybp to present in the downtown Cebu coastal plain landscape. Plant microfossils were prepared for analysis using the methods outlined in the work of Horrocks (2020).

Archaeological Excavations at Jesuit House and Casa Gorordo Annex

The archaeological recovery from the Jesuit House is a robust assemblage of artifacts and associated natural and ecological data from the changing urban landscape in downtown Cebu in the Early Modern Period. Renovations of the historic Jesuit House were initiated in the eastern portion of the structure in 2016 with repair of rotting *molave* house posts. The posts had rotted at ground level and two-meter square and two-meter deep pits were dug under the posts to build concrete supports for the posts that were truncated above the floor level. During this construction project an abundance of blue-on-white porcelain among other artifacts was recovered from the construction pits. The porcelain ceramics were identified by Prof. Li Jian'an, research fellow at the Institute of Cultural Relics and Archeology, Fujian Museum as late Ming Dynasty Wan Li period ca. 1572 to 1620 ACE with some earlier and later materials below and above the densest deposits or artifacts that were found about a meter below ground surface. These recoveries demonstrated the need for archaeological studies for subsequent restoration of the structure. In 2018 and early 2019 five more posts were renovated, this time in the northeastern portion of the structure, and archaeologists with the University of San Carlos conducted stratigraphic excavations for the sub-post deposits.

The results are the richest recoveries thus far from late pre-Spanish and early Spanish period archaeological deposits in the Visayas, containing significant faunal and landscape data. Along with the dense accumulation of Wan Li period porcelain one meter below ground surface, deeper and earlier deposits that pre-dated the construction of the house in 1730 as well as pre-Spanish occupation ca. 1565 were recovered that indicate that the site was on the edge of the marine intrusion shown in 1833 mapping and the Tinago Marsh ca. 1873. Below one-meter depth the soil is a dark, organic histosol with inclusive household trash and faunal remains, indicating that the site was wetland terrain associated with shoreline settlement. Wooden posts found intact and well-preserved in these marsh deposits appear to have been mostly contemporaneous and were aligned across the site suggesting that they were a continuous feature such as a fish corral or palisade at the edge of the marsh (Figures 5,6). The marsh was already shrinking and the Parian estero had ceased to flow from siltation in the 18th century (Mojares 2017:32). The 1730 Jesuit House was apparently built on reclaimed land at the edge of the marsh. Monitoring of the Casa Gorordo Annex construction site that was nearer to the center or far side of the marsh showed one meter of surface floors from probably late 19th and 20th century structures with over two meters of gleyed marsh deposits beneath and sparse artifact accumulation in the base of the marsh (Figure 7). Radiocarbon dating at Casa Gorordo annex demonstrates an early date for the wetland in the range 2640 ybp with rapid filling and by 560 CE a changing landscape; for the Jesuit House deeper 2 meter sediments were forming in the late pre-Spanish and early Spanish periods as a suite of dates from several materials confirm.

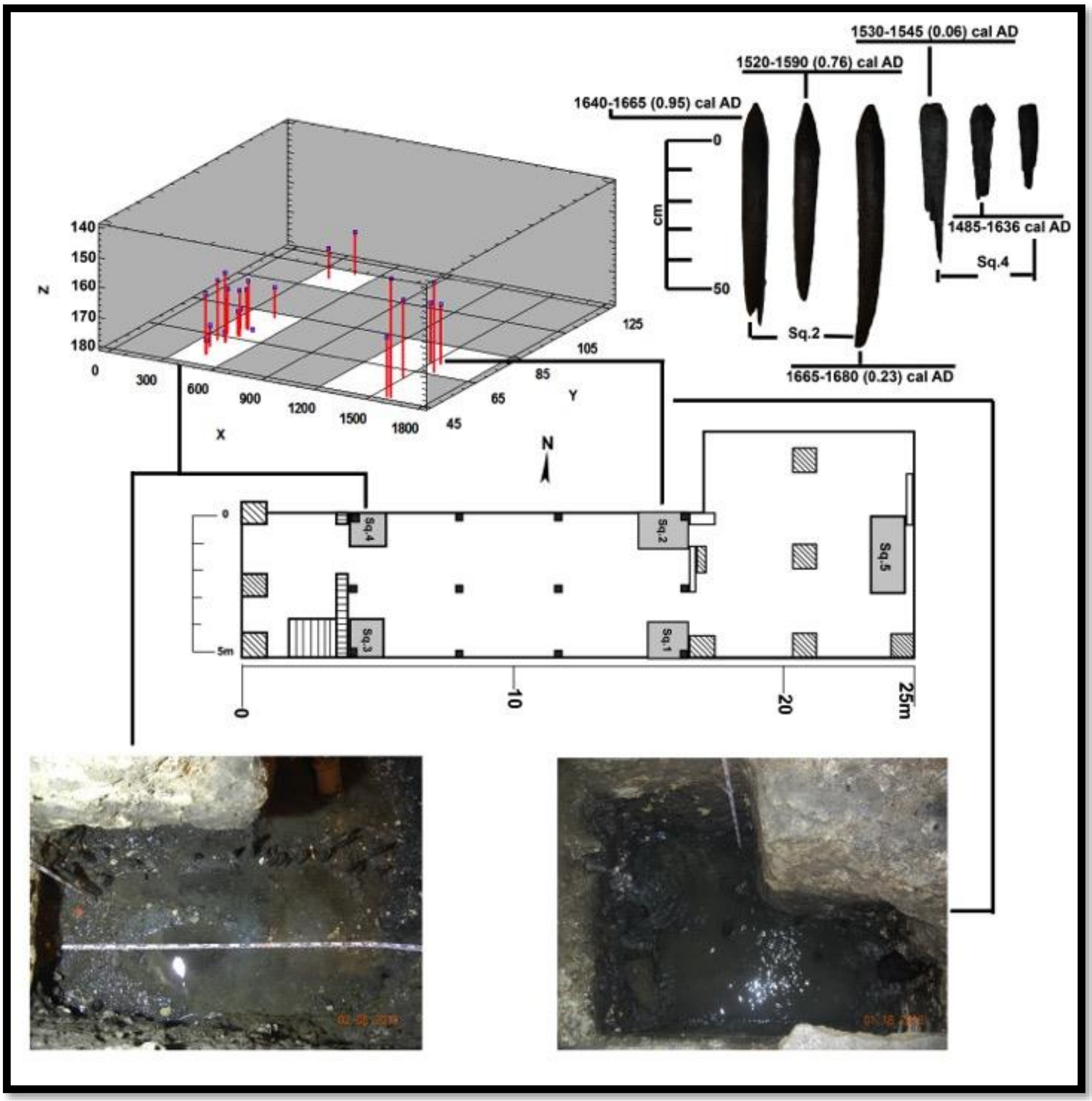

Fig. 5 Five post renovation units in Jesuit House, showing stakes recovered from pre-Jesuit House (1730) levels of marsh. Source: Tiauzon.

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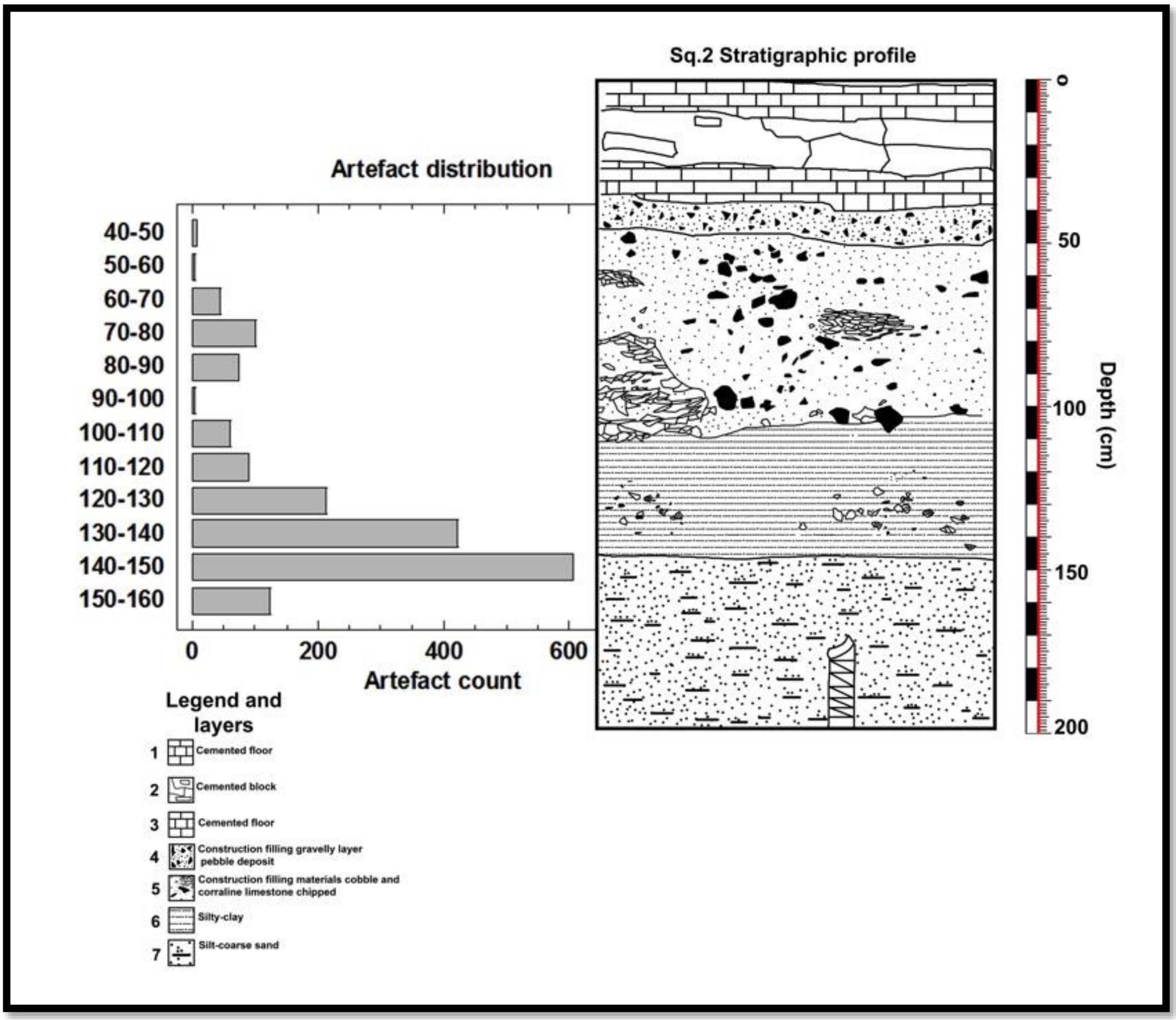

Fig. 6 Stratigraphy of deposits below ground level in unit 1 Jesuit House excavations showing greatest density of Wan Li pottery at 120-150 cm below ground surface. Source: Tiauzon.

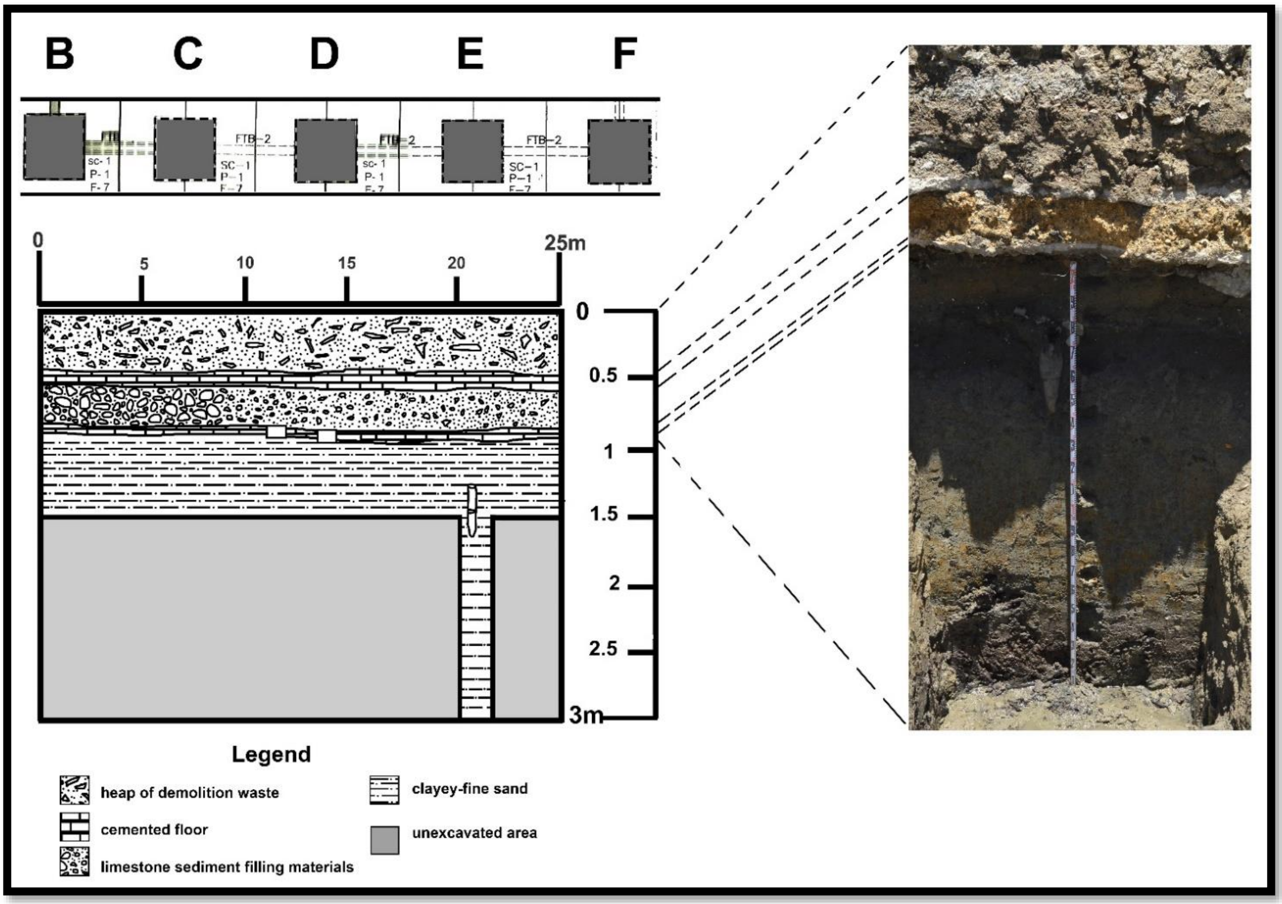

Fig. 7 Stratigraphy at Casa Gorordo monitoring project. Source: Tiauzon.

Radiocarbon Analysis

Seventeen radiocarbon samples were submitted to the University of California-Irvine Radiocarbon Laboratory from a variety of contexts and using a variety of materials to provide a baseline for dating results in Spanish contact period archaeological deposits at the Jesuit House and the Casa Gorordo Annex (Table 1). Four marine shell samples were submitted (two *Anadara* sp., one *Gafrarium* sp. and one *Crassostrea* sp.) in order to assess the age ranges relative to other sample types. The *Anadara* sp. from 105-110 cm in Unit 1 (1430-1655 cal. ACE) was comparable in age to the *Gafrarium* sp. in Unit 2 at 130-150 cm. (1405-1645 cal. ACE). An *Anadara* sp. from Unit 2 at 130-50 had an earlier age range (1290-1475 ca. ACE) but overlapped with the *Gafrarium* sp. from the same unit and depth. The laboratory found no published ΔR values for marine environments around Cebu, but determined the weighted mean for four samples from around the Philippines as 9±64 assuming marine upwelling as modest in the region. Pre-1950 specimens from the Biology Museum, University of San Carlos, will be submitted for modern comparative analysis. The *Crassostrea* sp. (oyster) was part of a cluster growing in the same context as wooden posts in Unit 2 and were submitted for dating to cross-date with the wooden posts (1453-1526 cal. ACE). The oysters were somewhat earlier than the mean ages of the wooden posts.

Six of the 18 wooden posts found in an alignment across the site were submitted for dating. The posts were all sharpened and driven into the marsh sediment as deep as 180-200 cm. The tops of the

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posts were uniformly truncated (rotted) at 140-160 cm, in same depth as the greatest density of Wan Li period ceramics. The age ranges of the six posts generally overlap with cal. ACE ages of 1640-1665 (95%), 1620-1645 (24%), 1665-1680 (23%), 1635-1665 (94%), 1485-1635, and 1599-1618 (18.56%), with some calibrated age ranges a century earlier. They appear to be associated with the era of the Wan Li ceramics, earlier than the construction of the Jesuit House (1730), and in the very earliest decades of the Spanish outpost in Cebu (Figure 8). The posts are no more than 10 cm in diameter and from points of the stakes to the rotted ends at what may have been the prior water line approximately 50-70 cm long.

A charcoal sample from Unit 1 at 80 cm depth was, as expected, quite young as it was recovered from fill materials over the Wan Li period deposits. This appears to have been associated with filling of the marsh for construction of the Jesuit House (1725-1815 (62%) but may have been a few decades earlier and still several decades younger than the Wan Li period (1572-1620). Charcoal from Unit 1 in the Jesuit House at 170-180 cm depth was 1444-1522 (71.2%) or somewhat later, but still within the early years of the Spanish settlement era (1575-1625 (24.2%). Coconut shell from Unit 2 190-200 cm in the Jesuit House was 1443-1491 (91.8%); bark from Unit 5 Jesuit House 200-210 cm in the range 987-1023 (95.4%). These dates show a long period of marsh deposition in the lowest 50 cm of the units from 1000 years ago to late pre-Spanish deposits in a distinct histosol of sandy clay below a massive 30 cm deposit of silty clay within which the Wan Li ceramics and supportive radiocarbon ages were deposited.

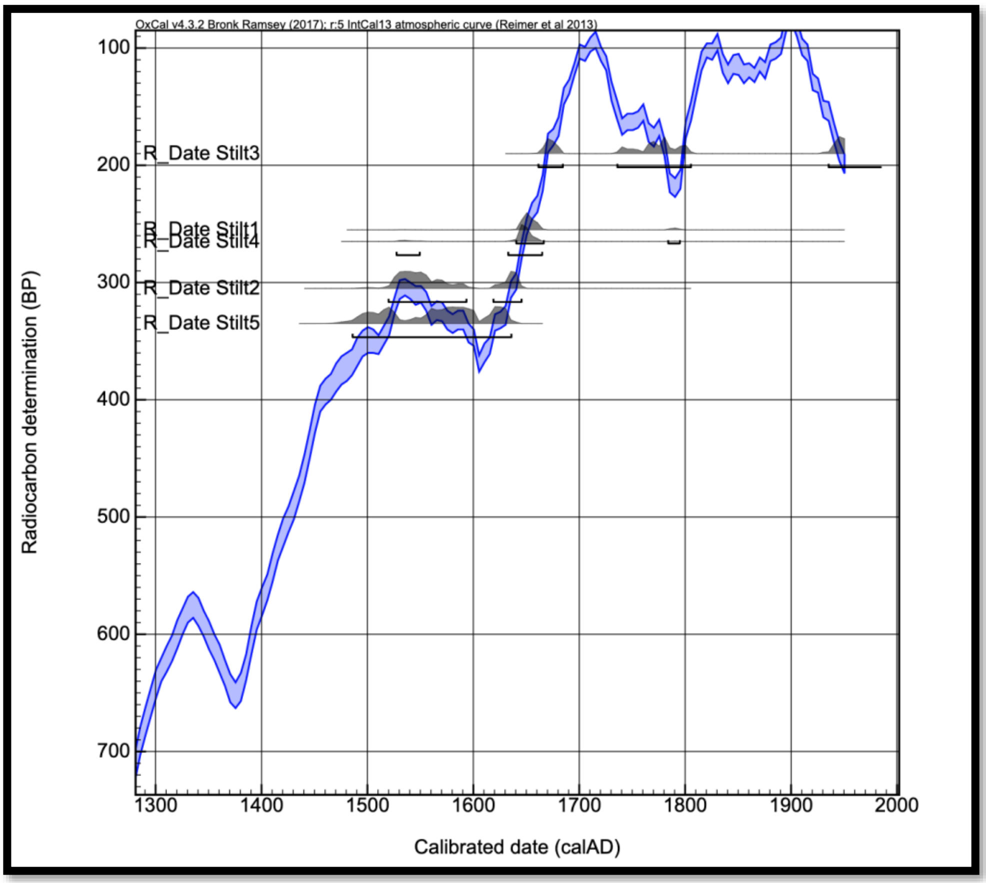

Fig. 8 Median age of wooden (stilt) posts below floor in Jesuit House. Source: UCIrvine Radiocarbon Laboratory.

In the Casa Gorordo deposits few artifacts were found, and none, arguably, in primary contexts. This appears to be a marsh deposit with distinctly gleyed deposits from 1.5 meters and lower in depth. Above that is a 50 cm deposit of sandy clay overlain by the top one meter below ground surface of successive house floors dating from the 20th century occupancy of the area. Samples were collected from the lowest levels exposed in the construction trench. A well-preserved wood sample from 240 cm below ground surface was 536-639 cal ACE (94%). Bulk sediment from 240-260 cm was 656-715 cal. ACE (79.3%) and 744-765 cal. ACE (16.1%); and the lowest specimen, charcoal, from 280-300 cm was 2458-2269 cal BCE 75.7%) and 2260-2207 cal BCE (19.7%). These three samples were split and were submitted for plant microfossil analysis to provide habitat data for the marsh ca. 1400 to 4500 years before present. During this period the marsh was probably a marine intrusion from the Mactan Strait and was apparently not associated with settlement in the immediate vicinity.

These radiocarbon ages contribute to the chronostratigraphy of the marsh from its earliest marine habitat to it use as a shoreline settlement with considerable accumulation of household debris of an area in transition from late pre-Spanish to early Spanish period settlement. The radiocarbon ages and the material culture correlate robustly to support the stratigraphic integrity of the deposits and both cultural and physical changes.

UCIAMS	**Unit/Site**	**Level**	**material**	**years BP**	**calAD/calBC**
204000	Unit 1/JH	105-110 cm	marine shell	805±15	1430-1655
204001	Unit 2/JH	130-150 cm	marine shell	975±15	1290-1475
204002	Unit 2/JH	130-150 cm	marine shell	835±15	1405-1645
204003	Unit 1/JH	80 cm	charcoal	155±15	1670-1695 (16%) 1725-1815 (62%) 1840-1946 (22%)
204004	Unit 2/JH	140-180 cm	wood post	255±15	1640-1665 (95%) 1785-1795 (5%)
204005	Unit 2/JH	140-180 cm	wood post	305±15	1520-1590 (76%) 1620-1645 (24%)
204006	Unit 2/JH	140-180 cm	wood post	190±15	1665-1680 (23%) 1735-1805 (57%) 1935-1950 (20%)
204007	Unit 4/JH	150-180 cm	wood post	265±15	1530-1545 (6%) 1635-1665 (94%)
204008	Unit 4/JH	150-180 cm	wood post	335±15	1485-1636
212580	Unit 5/JH	200-210 cm	wood	380±15	1449-1515 (76.8%) 1599-1618 (18.6%)
212581	Unit 5/JH	160-170	oyster shell	820±15	1453-1526 (95.4%)
212582	Unit 5/JH	200-210 cm	bark	1035±15	987 – 1023 (95.4%)
212602	Unit 1/JH	170-180 cm	charcoal	385±25	1444 – 1522 (71.2%) 1575-1625 (24.2%)
212583	Unit 2/JH	190-200 cm	coconut shell	400±15	1443 – 1491 (91.8%) 1602-1610 (3.6%)
212584	CG	240-250 cm	wood	1495±15	474 – 485 (1.4%) 536-639 (94.0%)
212585	CG	240-260 cm	soil	1320±20	656 – 715 (79.3%) 744-765 (16.1%)
212586	CG	280-300 cm	charcoal	3850±30	2458 – 2269 (75.7%) 2260-2207 (19.7%)

Table 1 Radiocarbon ages from Jesuit House and Casa Gorordo sites.

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The faunal assemblage recovered from the Jesuit House is from throughout this trajectory of settlement, with some significant findings in the late pre-Spanish period. Bones of *Gallus gallus* (submitted for DNA and AMS dating), *Sus* sp., *Canis familiaris*, and *Bubalus* sp., were all recovered from pre-Spanish levels of the excavation. The *Bubalus mindorensis* (?) (*tamaraw*) is the latest specimen recovered in Cebu of an extirpated species in the region. Unidentified materials including bird, cervid, and fish remains from all levels will be submitted for faunal analysis.

Archaeological Materials Recovery

Over 8,000 artifacts were recovered from the five excavated units at the Jesuit in two meters depth of deposits. The artifacts are diagnostic of distinct periods of settlement in the history downtown and provide excellent cross-dating resources that can serve as a baseline for other contexts in downtown Cebu. The bulk of artifacts were from a depth of about 1.2-1.5 meters below ground surface, where a very high density early Spanish period deposit was recovered from a silty clay deposit. The dominant diagnostic artifacts consisted of Wan Li period or Late Ming Dynasty ca. 1580-1640 (Figure 9). Within this zone were also stoneware sherds. A small sample of a dozen or so sherds of distinctive, hard-fired, stamped vessels were found in early Spanish deposits dating post 1600 ACE that may have been tradeware from Myanmar (personal communication, John Miksic 2019) (Figure 10). From 1.5 meters down in the deposits the artifact density declined but were clearly earlier, pre-Spanish artifacts such as the Lonquan celadon pottery from the 13th century Yuan dynasty. At that depth were also found significant faunal specimens including tamaraw (possibly the latest extant tamaraw remains from the central Philippines; they have been considered extirpated from Cebu), dog, chicken, pig, and a variety of fish and shellfish (Figures 11, 12). The radiocarbon chronology from a variety of different sample types corroborates the superposed character of the deposits through time, so we are reasonably confident that the archaeological materials below 1.5 meters were in a pre-Spanish context while the materials deposited from 1.5 upward were in the early Spanish or very late pre-Spanish period. The changing character of the deposits from sandy-gravelly below 1.5 meters, silty-clayey up to 1.2 meters below surface, and then overlain with construction materials from the Spanish period of development including the building of the Jesuit House up to the contemporary land surface all also mirrors the radiocarbon and artifact chronologies for the site. The transition from marine to silty marsh to reclaimed land fill over this period documents the trend noted in the scant literature on the Jesuit House. Detailed artifact and faunal analyses will be documented in a separate volume when completed.

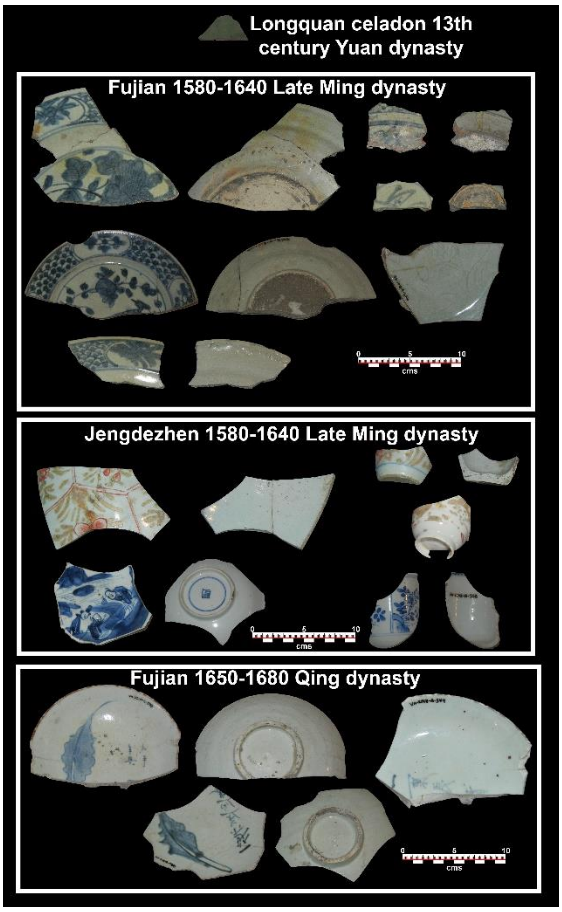

Fig. 9 Chinese porcelain ceramics recovered from Jesuit House. Fujian and Jindezhen sherds from Wan Li period, Late Ming Dynasty. Source: Tiauzon.

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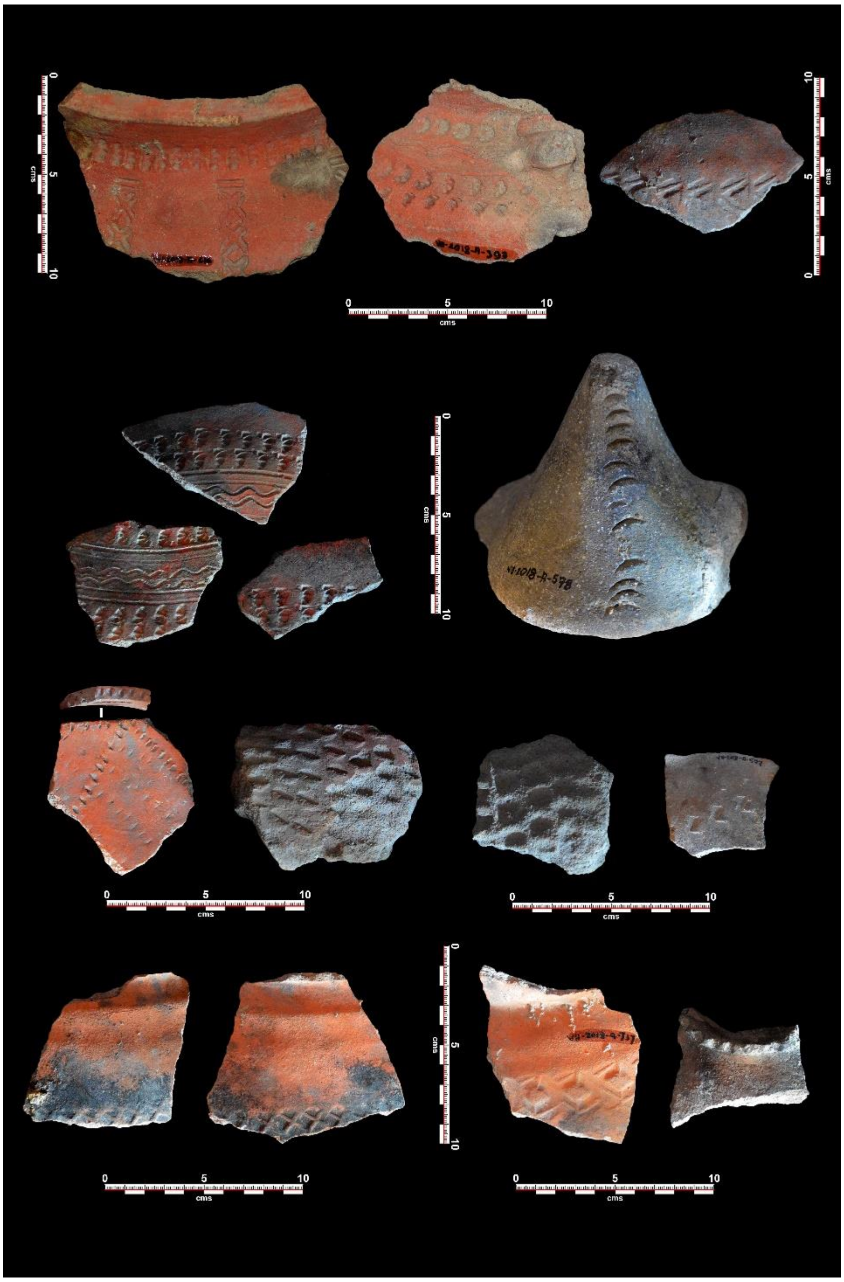

Fig. 10 Stamped and incised high-fired ceramics from 17th and 18th century deposits at Jesuit House, identified as tradeware from Myanmar (Miksic, personal communication). Source: Tiauzon.

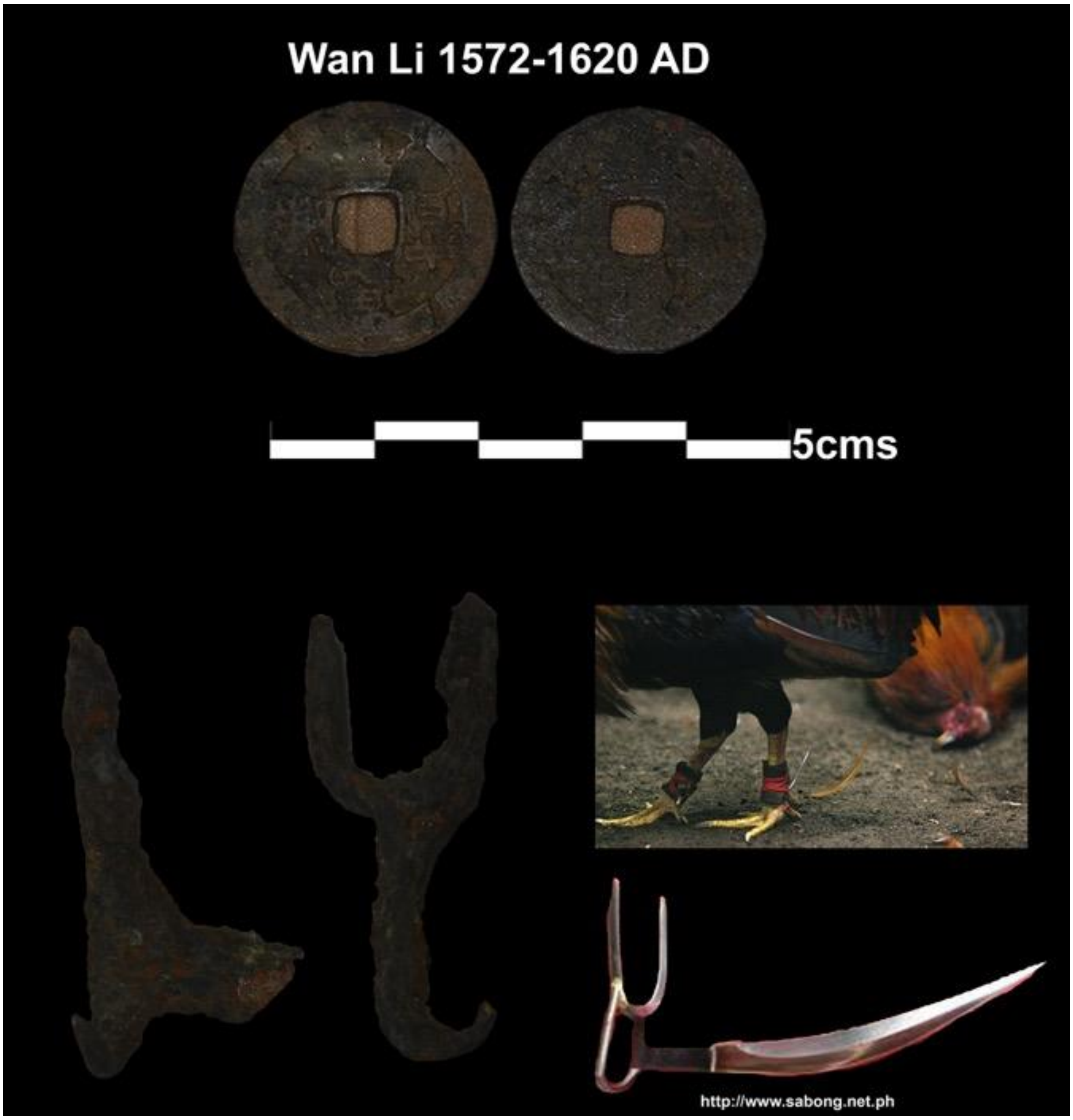

Fig. 11 Wan Li coin and cock-fighting *tari* or blade holder. The *tari* from late pre-Spanish deposits. Source: Tiauzon.

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Fig. 12 *Sus* sp. (above) and *Bubalus* sp. horn cores (below) from late pre-Spanish deposits at Jesuit House. Source: Tiauzon.

Plant Microfossil Analysis of Sediments at Casa Gorordo Annex

Three samples of sediment were analyzed for pollen, phytoliths, and starch residue to provide a record of past vegetation, environments, and human activity. The three samples, from depths of 240-260 cm, 260-280 cm and 280-300 cm, were collected from the exposed profile at Casa Gorordo Annex. The radiocarbon ages of the three samples were reported from samples at comparable depths as the samples submitted for microfossil analysis:

212584	CG	240-250 cm	wood	1495±15	474 – 485 (1.4%) 536-639 (94.0%)
212585	CG	240-260 cm	soil	1320±20	656 – 715 (79.3%) 744-765 (16.1%)
212586	CG	280-300 cm	charcoal	3850±30	2458 – 2269 (75.7%) 2260-2207 (19.7%)

The ages of the sediments within an otherwise massive gley suggest slowly accumulating deposition in the older lower zone dating from nearly 4400 years before present, overlain with more rapidly accumulating materials of wood and soil both around 500-600 ACE. The earlier deposit would have been during the period of the mid-Holocene high still stand with 1.8-2.0 meters higher sea level while the later two dates only 20 and 40 cm higher would have been after the last drawdown of sea level. This would have resulted in a much lower marine sea level in the area of the marsh and an expanded coastal plain draining into the marsh. The plant microfossils support this interpretation of the changing marine environment.

The plant microfossils show an initial local *Bruguiera*/*Rhizophora* mangrove environment, changing to a cf. *Neonauclea*/sedge riparian environment, coinciding with increased human impacts in the catchment. The microfossils also provide possible evidence for the cultivation of banana, rice and taro in the catchment.

Taphonomy Sources of the pollen in the Cebu samples comprise an atmospheric component (wind and rain) and an in-washed component (estuarine and tidal currents). For the latter, the sediment load of the associated water channel draining the catchment is likely a major contributor, with an unknown proportion comprising remobilised, older pollen. These same factors apply to the phytoliths and starch and associated plant material in the samples, except that the atmospheric component is presumably less because unlike many pollen types, this other material is not adapted for dispersal in air currents. The microfossils are thus derived from a combination of local and distal sources and could have large variations in age.

Pollen and spores The lowermost Cebu sample contained a very small amount of microscopic fragments of charcoal, while the overlying samples contained relatively very large amounts, reflecting increased vegetation clearance in the catchment by people. This landscape disturbance is further shown by an increase in grass (Poaceae) pollen in the overlying samples (Figure 13).

The pollen assemblage of the lowermost sample was dominated by *Bruguiera* and *Rhizophora*, indicating a largely mangrove local environment (Figure 13). Cf. *Acanthus* pollen increased in the overlying sample, at the expense of *Rhizophora* pollen. *Bruguiera* pollen then declined in the uppermost sample, with a coincident appearance of sedge (*Cyperaceae*) and cf. *Neonauclea* pollen. The latter recorded a very high percentage. These changes very strongly suggest a change from mangrove to riparian environments.

Phytoliths and other biosilicates The phytolith assemblages in the Cebu samples showed a major decline in tree and shrub phytoliths followed by an increase in grass phytoliths, particularly in the uppermost sample (Figure 14). This progression supports the pollen and microscopic charcoal evidence for increased human activity in the catchment. Palm (Arecaceae) phytoliths featured in moderate to large amounts in all samples, indicating significant palm presence in the catchment.

Phytoliths of possible cultigens identified include a small amount of banana (*Musa* sp.) phytoliths in the uppermost two samples (Figure 14). Wild bananas cannot be ruled out, however. Detailed descriptions and photomicrography of *Musa* phytoliths are given in the works of Mindzie et al. (2001) and Horrocks et al. (2009). Other biosilicates found in the samples comprise diatom tissue and sponge spicules, reflecting the aquatic nature of the sampled deposits (Figure 14).

Analysis of starch and other plant material Several types of starch and other microscopic plant material were identified in this study (Figures 14, 15). Clumps of mostly degraded cf. rice (*Oryza sativa*) starch were found in all three samples, and a relatively small amount of clumps of degraded cf. taro (*Colocasia esculenta*) starch was found in the middle sample (Figures 14, 15). Also, sheets of cells consistent with leaf epidermal tissue of taro were identified in the lowermost and middle samples. This cf. rice and cf. taro material could be from cultigens in the catchment. Wild rice (possibly including other rice species) and wild taro cannot be ruled out, however. Detailed descriptions and photomicrography of *Oryza sativa* and *Colocasia esculenta* starch, and *Colocasia esculenta* epidermal tissue are given in the works of Seidemann (1966), Horrocks and Barber (2005), Horrocks and Weisler (2006) and Horrocks et al. (2018).

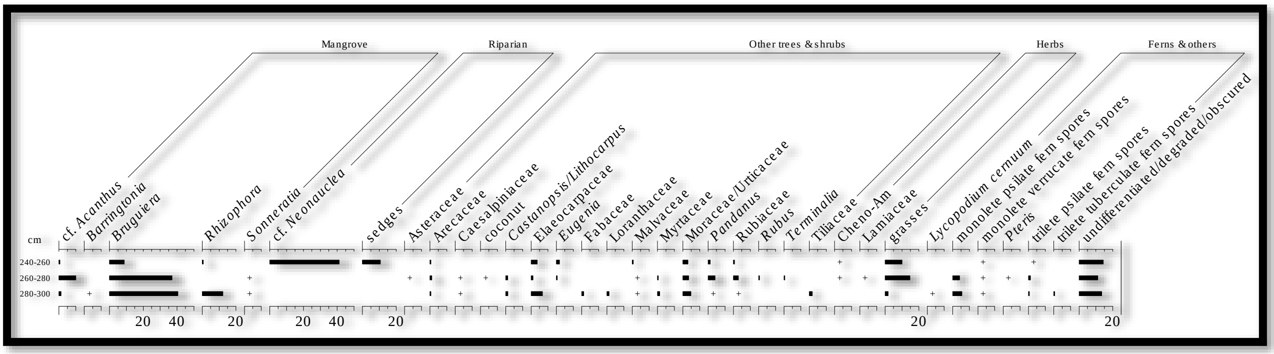

Fig. 13 Pollen percentage diagram from downtown Cebu, Philippines (at least 150 palynomorphs were counted per sample, + = found after count). Source: Horrocks.

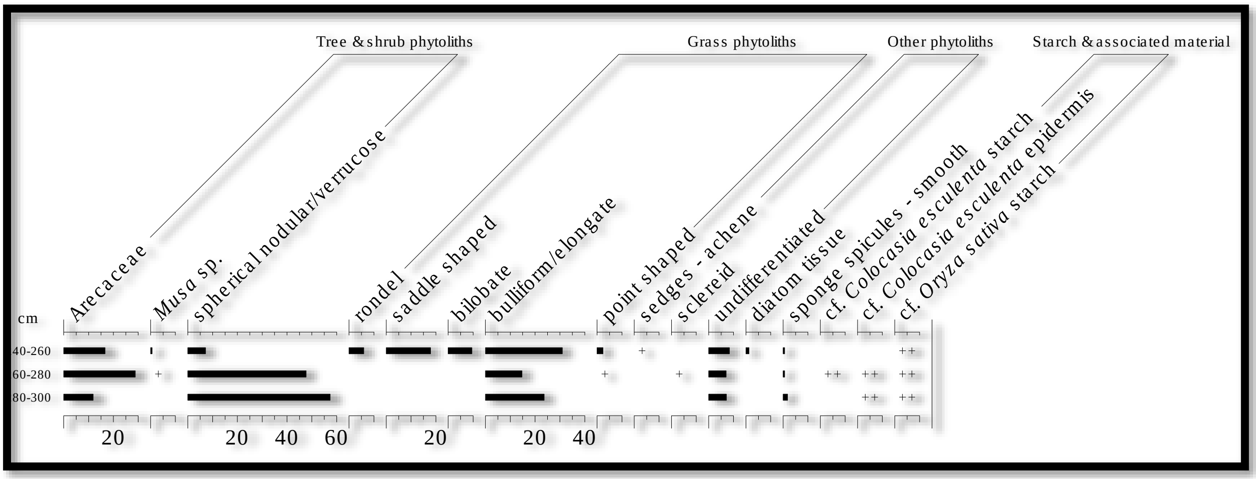

Fig. 14 Phytolith percentage and starch diagram from downtown Cebu, Philippines (at least 150 phytoliths were counted per sample, with other biosilicates, in this case diatoms and sponge spicules, not included in the counts from which the phytolith percentages were calculated; + = found after count; ++ = present). Source: Horrocks.

The identification of starch consistent with *Oryza sativa* and starch and leaf epidermis consistent with *Colocasia esculenta* from introduced or wild indigenous varieties could be significant (Figure 15). However, there is the possibility of mixing among stratigraphic levels with microscopic material. The taro starch was found in the middle deposit, and the taro epidermis was recovered from the lower two strata while the rice starch was found in all three. The lower two deposits have high frequencies of tree and shrub phytoliths and a high frequency of *Brugiera* mangrove pollen. The upper and latest deposit has a high frequency of *Neonauclea* pollen whereas there is none in the lower two deposits. This differentiates the latter from the upper deposit and suggests little vertical mixing. A large amount of charcoal was reported in the upper two deposits but not in the lower, again suggesting minimal mixing. These preliminary findings suggest that wild or domesticated rice and taro could have been growing in the catchment of the marsh as early as 4400 ybp.

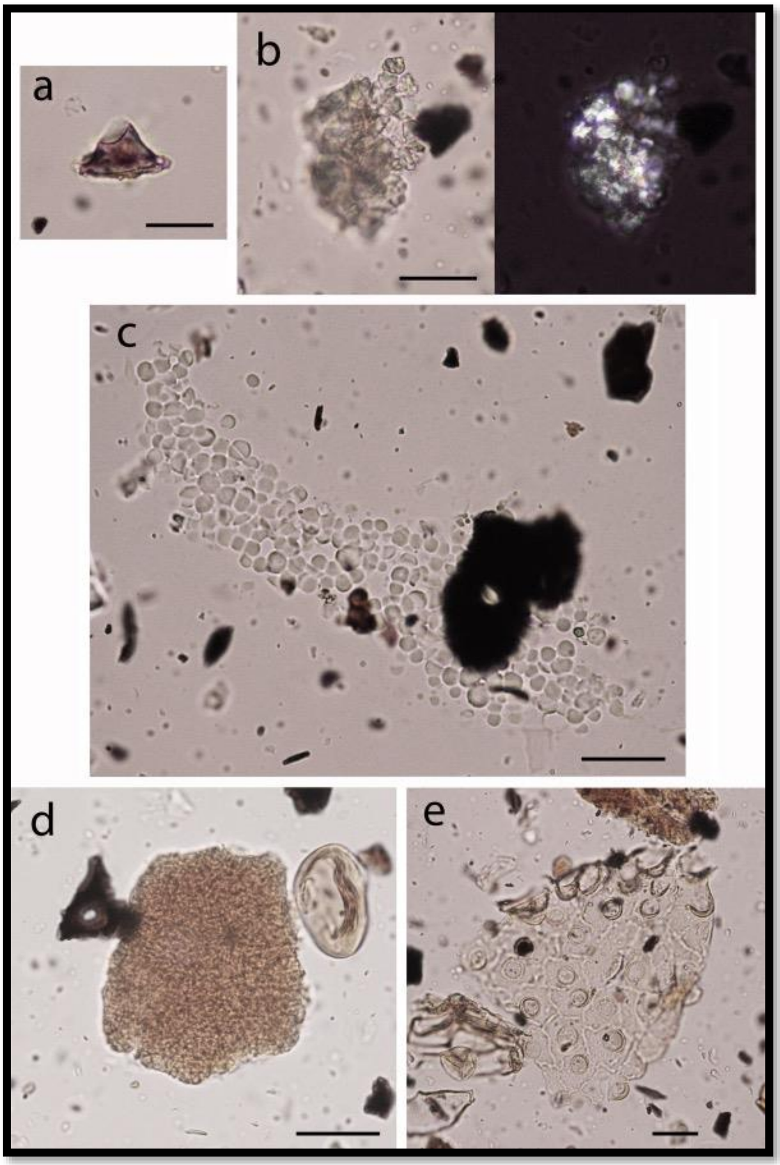

Fig. 15 Plant microfossils from downtown Cebu, Philippines. **a** mounted in Caedex, remainder in glycerol jelly; 600x; scale bars: 20 µm. **a** *Musa* sp. phytolith, showing characteristic raised crater. **b** Fragment of cf. *Oryza sativa* endosperm amyloplast, showing densely packed starch grains. As the fragment is 3-dimensional and has not been flattened under the cover slip, part of it is out of focus; the focal plane was selected to give the best image of individual grains (characteristically polyhedral angular) separating from the fragment, upper right. The fragment is also shown highly visible in cross-polarized light (black background). Maltese crosses are often not clearly visible on these small starch grains in dense groups when degraded and viewed in cross-polarized light; instead, groups can appear as highly visible bright masses. The central hilum, when visible, appears as a dark grey dot, which in this case can be seen in the three starch grains in a central row, and in some of the lower grains, in the cross-polarized image. **c** The cover slip here has been pressed down and moved sideways, flattening and smearing a cf. *Oryza sativa* amyloplast fragment, showing individual starch grains. **d** Remnant of cf. *Colocasia esculenta* corm amyloplast (next to a monolete psilate fern spore), showing characteristic high concentration (thousands) of densely packed tiny, angular starch grains. The grains are degraded, being discolored and having lost their Maltese cross. At mostly <4 µm, starch grains of this species (smaller than those of *Oryza sativa*) are near the limits of light microscopy so are best looked for in large groups. **e** Sheet of cf. *Colocasia esculenta* leaf epidermal cells, with cells showing characteristic papillae. Source: Horrocks.

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Landscape Evolution of the Coastal Plain of Cebu City

The Jesuit House and Casa Gorordo Annex projects provide data on the formation of the Tinago Marsh in the Parian District and its subsequent filling and construction history. This period extends from its appearance as a marine intrusion ca. 2200 BCE as documented in the Casa Gorordo Annex deposits, and the late pre-Spanish or native shoreline occupation during the period from ca. 1,000 ACE with more intense settlement evidence from the 14th century (Yuan ceramics recovered from lower levels) and especially dense artifact deposition during the Wan Li period of the Late Ming Dynasty, ca. 1572-1620 ACE. The marsh was filled ca. late 17th century as indicated by stratigraphic evidence of construction and coarse gravel above one meter in the units, and a radiocarbon age from within the fill at 80 cm depth with a probability that the charcoal is from that period (1670-1695 (16%) 1725-1815 (62%) 1840-1946 (22%)). Multiple radiocarbon samples of differing materials support that chronostratigraphy and provide excellent cross-dating of artifacts and environmental samples.

To assess how the formation of the marsh and the modern Parian landscape fits into the evolution of the late prehistoric and early Spanish period, a model is proposed that incorporates LiDAR imagery of downtown Cebu with soil probe data and mapping of relict channels of the Guadalupe River.

Hazards mapping for downtown Cebu (Figure 16) (Jubilo et al. 2019) was done using historical maps and field inspections. Relict channels of the Guadalupe River and the Parian Estero were found digitizing historical maps and georectifying them with current Google maps. In Figure 16 green channels depict still existing estuaries and violet marking; red show lost bodies of water; and violet indicates estuaries that have gone underground. Follow up with field inspections verified the digital discoveries. They also depict three areas of relict channels that provide documentation of prior locations of channels that were formed by avulsion into new channels. Onshore currents force river channels to migrated parallel to the current, in the case of Cebu forcefully to the north. As the mouth fills with sediment it eventually forces the river to form new channels that in turn break through in lower elevations to the sea. This migration strands sediments in interfluvial terraces that accumulate sediments during episodes of overbank flooding (Calhoun and Fletcher 1996; Woodroffe 2002). In time pedogenesis transforms land surfaces into soils with strong Bt horizonation. Younger terraces may exhibit incipient pedogenesis with a weakly developed A horizon of silty sediments but lacking formation of clay horizonation below (Hall and Peterson 2013). Dating of organic carbon in the soils could confirm the relative age of the sediments. That is currently underway as part of continuing studies in the downtown Cebu landscape. Bulk sediment as well as charcoal samples of the marsh deposits in the Casa Gorordo Annex, for example show that gleyed histosol deposits in the base of the construction impact at 2.8-3.0 meters below ground surface are 3850±30 ybp (cal.2458-2269 (75.7%) 2226-2207 (19.7%), with slow accumulation of sediments up to the level of 2.4-2.6 meters depth with considerably younger sediments cross-dating to 2700 years formation time for a 40 cm accumulation (474 – 485 cal. ACE (1.4%) 536-639 cal. ACE(94.0%) and 656 – 715 cal. ACE (79.3%) 744-765 cal. ACE (16.1%). This long period of rather minimal sedimentation challenges Nishimura's conclusion that pre-Spanish indigenous farmers were degrading upland terrain with destructive swidden farming practices (Nishimura 1992). Furthermore the model is not supported with data from the soil probe samples collected by Nishimura that in fact demonstrate modest sedimentation. Some of that in the period 2,000 ybp could be from denudation of the coastal plain be prograding shorelines from lowering sea level. The most significant contributions to sedimentation may have been from the Spanish colonizing of the landscape to fill channels and estuaries and marshes for urban reclamation projects such as the Parian.

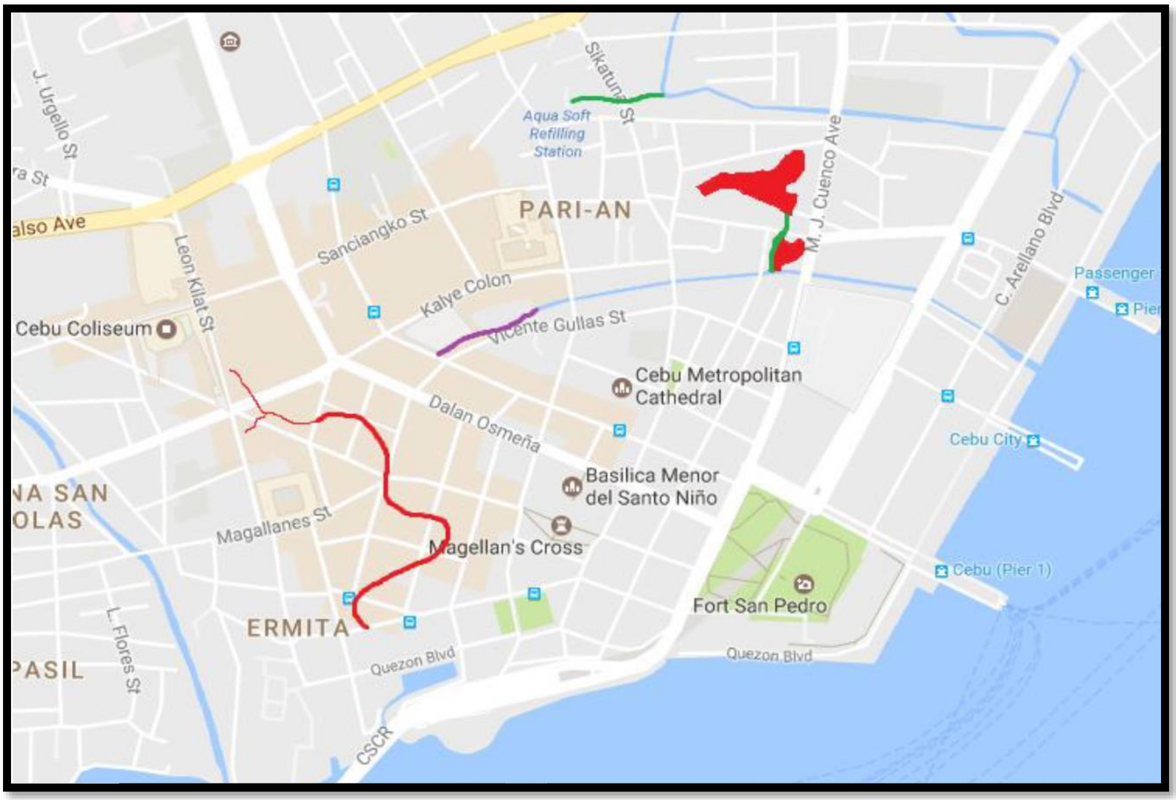

Fig. 16 Natural Hazards planning map for urban Cebu showing historical channels of the Guadalupe River. Note migration from west to east then reverting to western channel constrained by modern urban development. Source: Algodon and Soriano 2019:14 Figure 19.

Soil probes collected by Masao Nishimura during his PhD research in Cebu in the 1990s (Figure 17) contributed to a model where Nishimura argued that alluvial deposition on coastal terrain in downtown Cebu documented upland erosion brought about by intensive swidden farming by indigenous farmers in late pre-Spanish occupation of what is now Cebu City (1993). The probes show a relatively stable landscape in the area of the Basilica Menor del Santo Niño (samples 4 and 5) and also less so in the Plaza Independencia (samples 2 and 3, progressively less soil formation from east to west) and Cebu Cathedral areas (samples 6, 7, and 8). Note that these are all within interfluvial terrain between relict channels of the Guadalupe River. Areas to the west of that relatively deeper soil such as City Hall (Sample 1) have less soil development and in fact may have been in the active zone of the relict channel depicted in red in Figure 16. Areas to the east including even the sideyard of the Cebu Cathedral are much less developed, as is the buried incipient paleosol exposed under the Patria that is near the sideyard and closer to the modern shoreline (Figure 18). Fort San Pedro is on a sediment fan on the down current side of a relict channel that was eventually abandoned in favor of down current channels to the east (Figure 19).

The soil probe descriptions demonstrate that the highest and most stable landforms were selected by Spanish colonists for their permanent settlement and included the sites for the Fort San Pedro, the Plaza Independencia, the Basilica Menor de Santo Niño, and the Cebu Cathedral. To the west was lower and presumably flood-prone with weak soil development, and to the east successive channels had migrated parallel to the onshore current to form openings to the sea that were progressively downstream. These were abandoned in the modern city plan in favor of an older channel that was redeveloped more recently. The area of the Tinago Marsh drained the Lahug River from the north

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and west but may have also been a relict channel of the Guadalupe River as seen in Figure 16. In any case, soils in that area were very weakly developed (samples 8, 9, and 10) and Sample 11 at the Parian also has a very deep sandy substrate suggesting that it too was in a recent active channel. The marsh was still extant in 1873 (see Figure 5) and was still undrained. It was presumably shrinking in size by this time as urban development was infringing with filling such as that ordered by municipal authorities. In the early 1600's the Chinese community was given *carte blanche* to drain and fill the marsh for their parian district similar to the experience of the Chinese and the Parian in late 16th century Manila (Fray Domingo, *The Chinese and the Parian at Manila 1588-1591*, from Blair and Robertson 1907, vol. 7, p. 224); by the mid-19th century urban renewal of wetlands and draining of marshes was an active process funded by loans from the agriculture society (Agriculture in Filipinas 1858, 52:315 in Blair and Robertson 1907).

LiDAR imagery derived from LIPAD surveys (LiDAR Portal for Archiving and Distribution, Department of Science and Technology Philippines) was used to produce a bare earth model (Figure 20b) to predict sea level and shoreline terrain from the period of the mid- to late Holocene high sea still-stand expected for Cebu for the period roughly from 2,000 or 3,000 ybp to 6,000 ybp (Dickinson 2000, 2003, 2014; Maeda et al. 2004; Siringan et al. 2000; Peterson 2014, 2015). The yellow depicts coastal plain elevation of 3-4 meters above sea level up to the base of the escarpment above Del Rosario Street and below the Ramos Market in central Cebu City. The present land surface consists of at least one meter of post Spanish era urban fill as shown in Figures 6 from the Jesuit House, Figure 7 from the Casa Gorordo Annex, Figure 18 from the Patria, and also from Figure 1 from Hutterer's Magallanes Street excavations a few blocks to the south from the Parian and the Patria sites. The bare earth model removes structures down to the present street level that is about 2-3 meters above modern sea level. Original land surfaces during the Spanish era are one meter below present ground level; older surfaces from the era 2,000-3,000 ybp are expected to have been at a depth of an additional one meter depth as shown in Figure 7 from the Casa Gorordo Annex where the 600 cal. ACE samples were recovered, and from as much as three meters below modern ground surface in the era 2500-2700 ybp as indicated by radiocarbon age of charcoal from that level. These strata were from within the marsh, and were likely marine or brackish deposits within the marine embayment. These buried occupational surfaces suggest that the 3-4 meter elevation of the present ground surface would have been submerged by a 1.8-2.0 meter higher sea still-stand ca. 2,000 to 6,000 ybp. This elevation would have lapped at the base of the escarpment shown in the 1873 map of Cebu in the northwest of downtown, in the upper left of the figure and also depicted on the LiDAR imagery in the lower frame of Figure 19b.

An assumption of sea level analysis is that land surfaces were stable and not subject to uplift or subsidence. As Maeda et al. (2004) documented for various localities that effective change in sea level would be relative to those effects. Furthermore, they document multiple episodes of high sea still-stands with ages ranging from 4180 ybp to 7980 ybp in the localities measured in their 2003 study. Cebu is described as a tectonically active zone where the land surface would have been uplifting. However, in the far north, in San Remigio, subsidence was observed in archaeological deposits there. The variability has not been documented in the downtown Cebu City area, and measurements throughout Cebu appear to have been irregular but generally synchronous (Berdin et al. 2000; Siringan et al. 2000, Scholz 1986). Since the measurements of sea level change are based on observation of wave-cut notches obtaining a reliable estimate for Cebu City is difficult given the modification of shorelines by construction and by land reclamation. However, the combination of 1-2 meter development fill over the early Spanish land surface and even modest tectonic uplift suggests conformance of a shallow lagoon with a maximal shoreline elevation across the relatively flat coastal plain up to the base of the escarpment around del Rosario Street where the landscape becomes gradually higher in elevation toward the north and west. (escarpment depicted on LiDAR imagery) in Figure 19b.

A second assumption regarding sea level is that changes in elevation were gradual and progressive. However, Maeda et al. (2004) documents multiple wave-cut notches in coastal carbonate benches from mid- to late Holocene ages. Evidence from Guam of a 1960 ybp beach ramp 100 meters inland from the current shoreline along Tumon suggest a period of rapid downdraw ca. 2000 years ago, consistent with models developed by Dickinson (2000, 2003) and data from both Guam and Saipan (Peterson 2014). Elevations and periods of sea level still-stands were not consistent and uniform throughout the western Pacific and Island Southeast Asia, and may have been punctuated. Later still-stand impacts might in fact have

degraded evidence from earlier still-stands such as sandy shorelines or prior wave-cut notches in carbonate benches along the shore. It has been a dynamic process that nonetheless impacted the coastal plain of Cebu City and effected habitat as well as human settlement options.

Discussion

The changing landscape of the Cebu City coastal plain was constrained by both natural and human processes. Rising sea level from the late full-glacial period ca. 22,000 ybp was about 130 meters below present sea level at its lowest point. Over the next 10,000 years sea level rose rapidly, then paused or possibly retreated during the Upper Dryas cold period about 12,000 ybp. Then it rose again until 6,000 or 7,000 years ago it rose higher than modern sea level by ranging from 1.5 meters 6.36 ky up to 2.3, 2.6, or 3.0 meters above modern sea level in undated periods. This demonstrates the variability, the punctuated character of the sea level still-stands, and that is not progressive or even unidirectional. The periods of relatively recent sea level progradation is not well dated in Cebu, but if consistent with models for the western Pacific may have been in stages of a meter each about 3,000 and 2,000 ybp (Berdin et al. 2000; Siringan 2000 et al.; Peterson 2005, 2014, 2015). The submergence of the present coastal plain that makes up Cebu City from the escarpment seaward was likely complete until at least that period when it was exposed by progradation of the shoreline from lowering sea level. During the period of initial exposure it would have been denuded and subject to degradation. Sinuous channels of the Guadalupe and Lahug Rivers would have migrated across the plain seeking the lowest elevations.

Microfossil analysis supports this model of a slowly accumulating marsh gley with a primarily *Rhizophora*/*Bruguiera* mangrove habitat changing to a more rapidly accumulating deposit ca. 500-600 ACE concurrent with the downdraw of the mid-Holocene high sea stand and the exposure of the coastal plain and transition to a sedge and *Neonauclea* riparian habitat. While still largely marine as it was open to the sea, the marsh may have been more brackish during this later period before it was enclosed in the late 19th century. The phytolith spectra show a decline in tree and shrub phytoliths and an increase in grass phytoliths, strongly suggesting increased human impact in the catchment. The upper two samples also include a small amount of banana remains. Other residues include those of cf. rice in all samples and cf. taro in the lower two samples. These remains support an interpretation of riverine or freshwater subsistence farming upslope from the marsh, possibly including swidden farming of rice. No wet-rice farming was found in Cebu during early Spanish contact.

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Scars of these relict channels are preserved in several localities as depicted in the accompanying figures (Figure 20a). In stable interfluvial terraces between active channels sediments accumulated and in the area from Fort San Pedro to Santo Nino and Cebu Cathedral the land surface was stable for sufficient time for pedogenesis mature into well-developed soils as documented by sediment descriptions in Nishimura’s soil probes as well as by the selection of this terrain for both pre-Spanish as well as Spanish settlement. The Visayan households and burials in Hutterer’s excavation were in three Horizons, the earliest dating to Iron Age with no Asian export ceramics, first millennium ACE; Horizon II had early Porcelain Age ceramics including Sung and Yuan dating to 9th to 13th century ACE; Horizon III had Sawankhalok and late Ming ceramics late 14th and 15th century ACE. These burials appeared from two meters below surface to one meter below surface, and were then covered by one meter of Spanish era and later road surface and modern construction fill. The Spanish era features were built from the late 16th century in this stratum (Hutterer 1973). The earliest first millennium occupation and burial emplacement might have been soon after the landscape was emergent from higher sea level ca. 2,000 ybp.

The area to the east such as the Patria site appears to be a young alluvial soil with incipient pedogenesis, with possible settlement in the late pre-Spanish period but built upon in the early 1800s for the Residencia of the Cebu Cathedral. Further to the east and to the north the Tinago embayment was gradually reclaimed first from a marine embayment to a freshwater marsh and finally reclaimed urban land ca. 1730 at the Jesuit House and later in 1820 for the Casa Gorordo house. Prior to that however the latter was within the marsh pool while the Jesuit House appears to have been at the shoreline and may have been a stilt-house residence at the edge of a fish corral or lined containment feature dating from possibly as early as 1000 ACE up to its principal occupation in the late 14th to late 17th centuries coeval with significant Chinese trading of porcelain and stonewares. This before its reclamation and conversion into the Jesuit House in 1730 that has occupied the site until today.

The relict channels and interfluvial terraces do not document periods of severe upland degradation or mass wasting of upland terrain. Rather sediments appear to have built up gradually from stable pedogenesis during the first millennium ACE. Sediment deposited during this period could have come from the recently denuded coastal plain and not from upland swidden farming. By the late pre-Spanish period landscapes appear to have been stable. The Tinago Marsh shows very gradual and modest sedimentation from 2600 BCE up until 600 ACE and above that to its final reclamation in the early 20th century. The sediment history of Cebu City does not support a model of increasing degradation of upland swidden plots; rather it demonstrates the rapid urbanization following the Spanish occupation of the landscape.

This increasingly urban landscape participated in the emergence of regional and Asian trade networks throughout the 9th to 10th centuries onward, but natives maintained a core indigenous land use and *habitus* at least after the first centuries of Spanish colonization. Recovery of chicken bone and cock-fighting *tari* from the late pre-Spanish levels of the Jesuit House document a cultural practice that continues into the present. Traditional fishing practices and foodways have persisted until now, and land use patterns and housing can still be found especially in rural areas of the Visayas. The overlay of an urban landscape on cultural as well as natural environmental landscapes has sealed much of the past but there is still a resilient core of native lifeways that persists it least as relict landscapes.

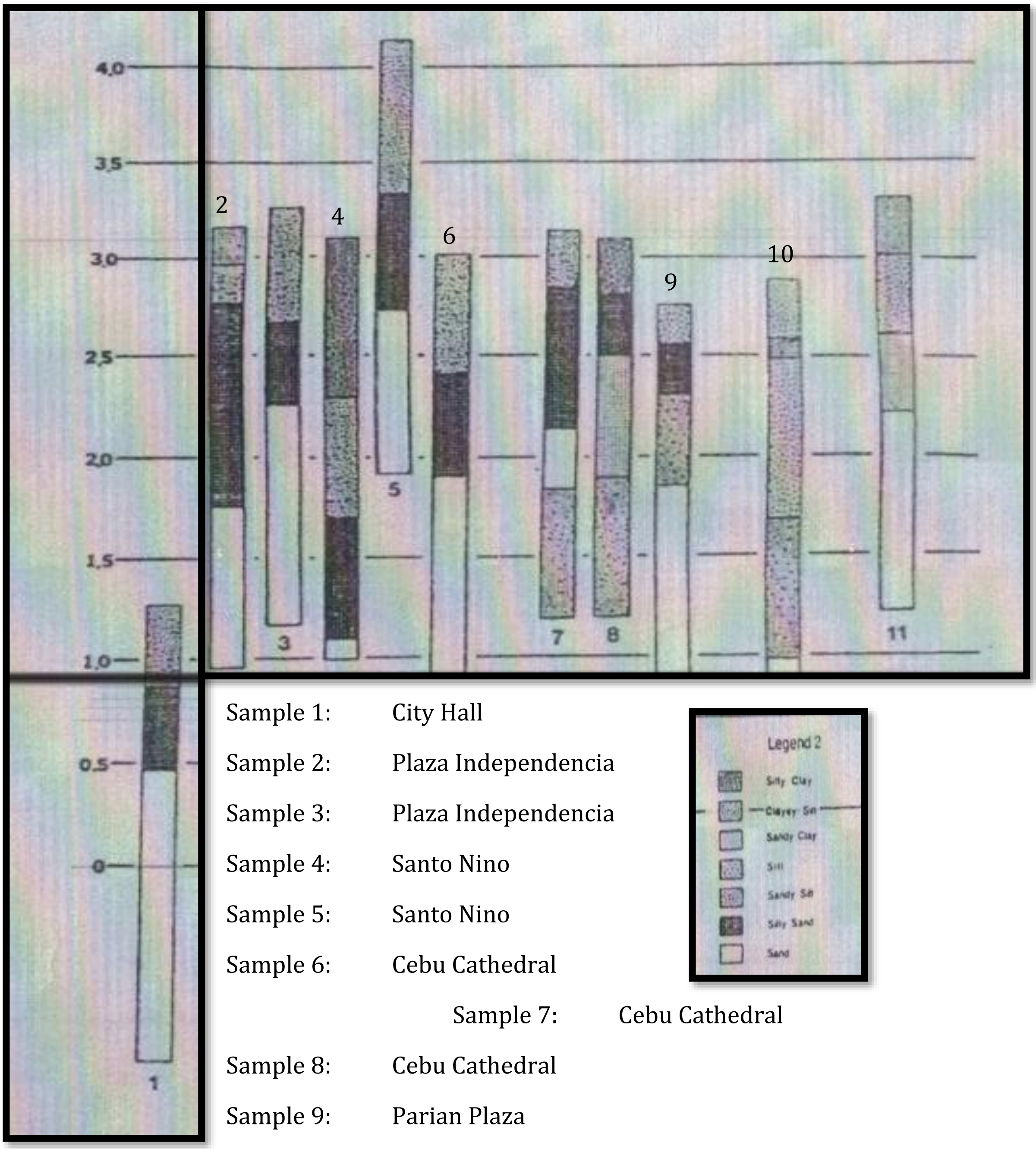

Fig. 17 Soil profiles from Cebu City and analysis, adapted from Nishimura (1993). Source: Tiauzon.

Fig. 18 Stratigraphy at Patria construction site showing 1950s era concrete floor, rubble from early 19th century Residencia and incipient paleosol from early Spanish period (16th-early 18th century) land surface. Source: Peterson.

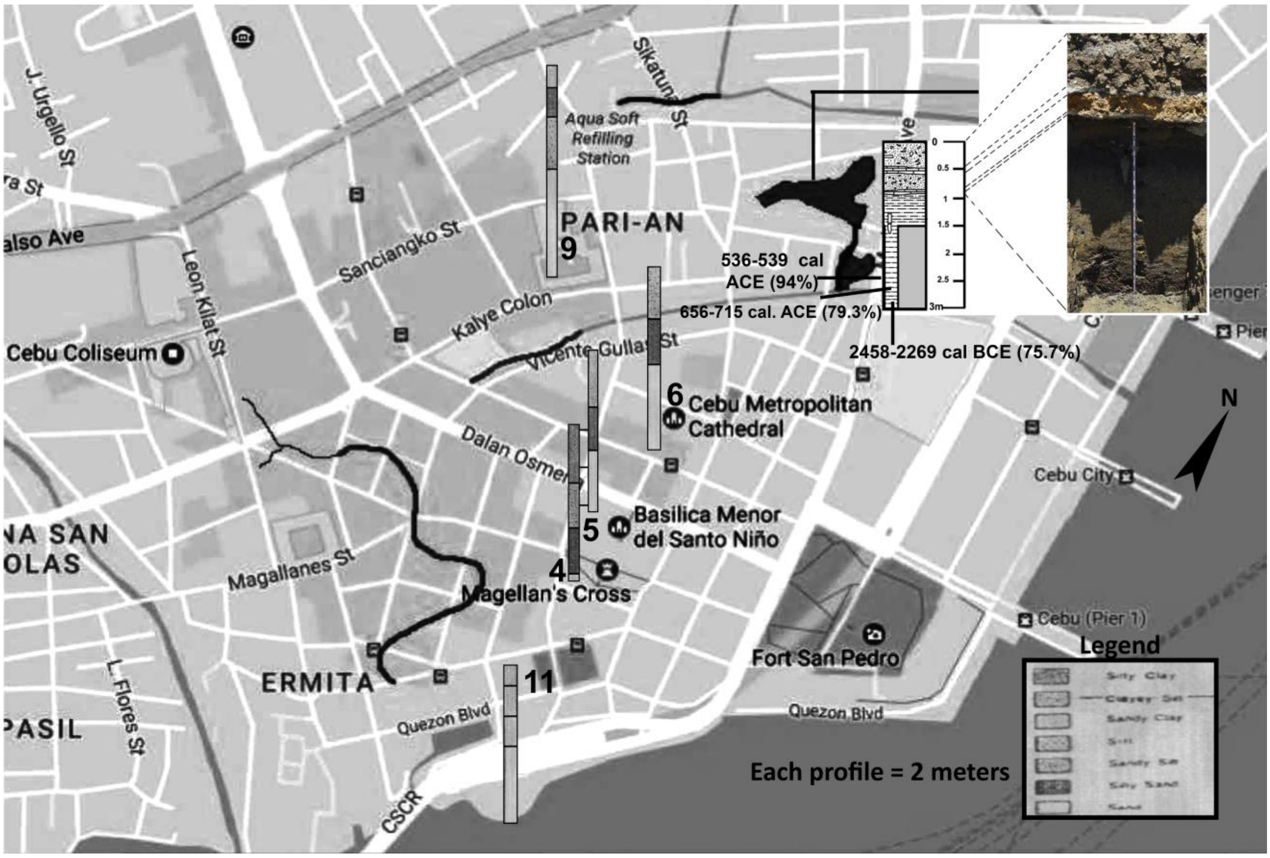

Fig. 19 Stratigraphic columns across Cebu City showing relation of areas of greater soil development in older, higher interfluves. The numbers are roughly in the location of the profile cores. Profile numbers refer to profiles in Figure 17. Profile 11. City Hall, young soil in recent channel deposits; Profiles 4,5. Santo Nino, older soil on higher terrain in older interfluve; Profile 6. Cebu Cathedral, younger soil in more recent interfluve; Profile 9. Parian Church, younger soil in more recent interfluve; Casa Gorordo in marsh showing gley depoists with very old 2400 years old radiocarbon age overlain by 1500 years old radiocarbon age showing transition from marine marsh to disturbance and infilling of marsh in higher sediments. Source: Base figure adapted from Algodon and Soriano 2019:14 Figure 19.

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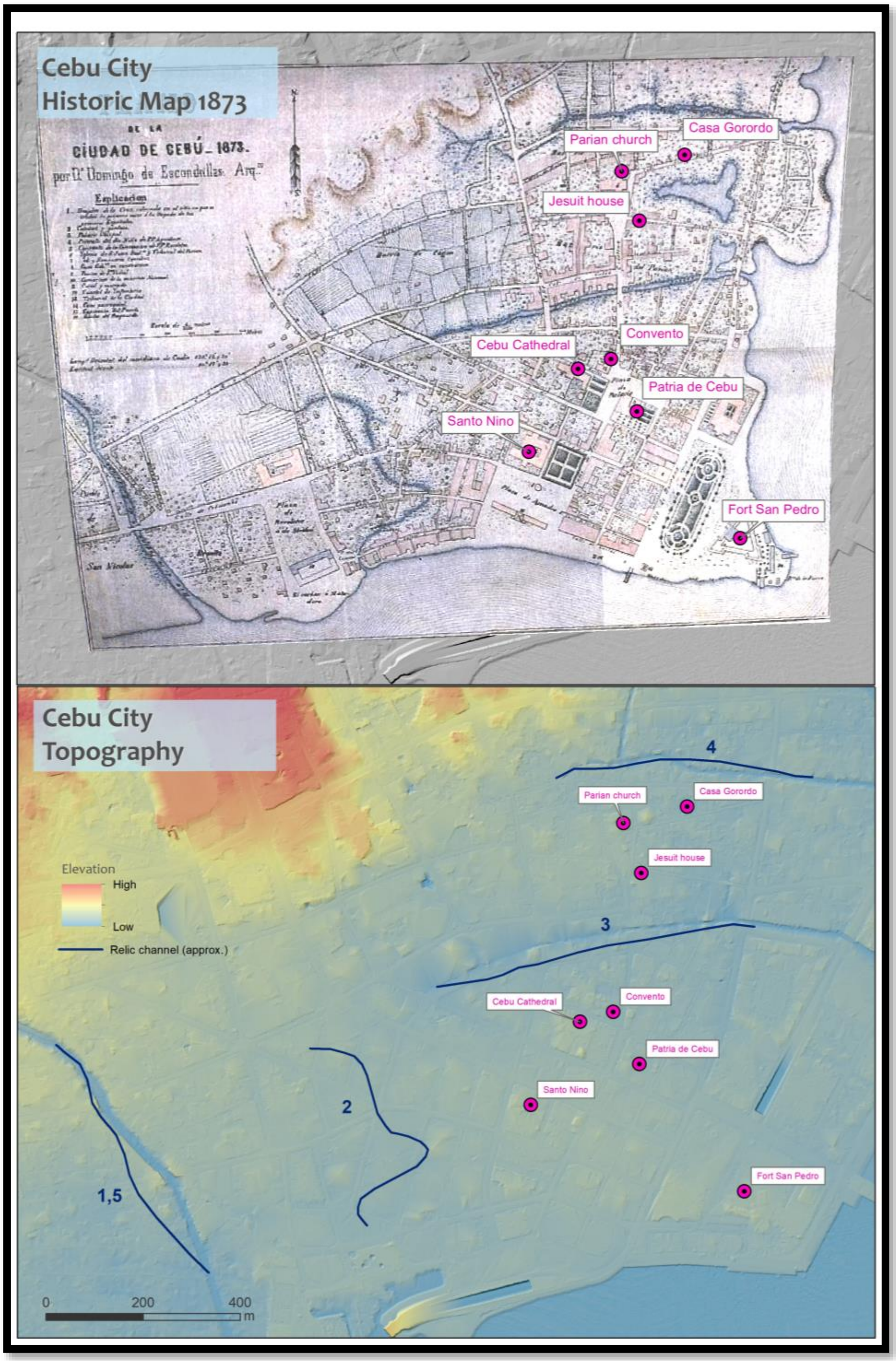

Fig. 20a, b 1873 map of Cebu City contrasted with bare earth model from LiDAR image of same area. The escarpment in upper left is limit of 2,000-6,000 ybp high sea level still-stand; yellow area is 2 meters elevation above present sea level. Blue areas are drainages and the entrances to the Plaza Independencia underpass. Channels are numbered 1-4 as they avulsed to the east, then 5 in original channel and in current location. b. Source: LiPAD, Phil. LiDAR Program, University of the Philippines and Kottermair.

Conclusions

Chronostratigraphic studies of the excavations demonstrate earlier and longer-term late-Holocene environmental change from a higher sea level embayment to a brackish then freshwater habitat in the Tinago Marsh as sea level prograded to modern elevations 2,000-3,000 years ago. Lowering sea level contributed to channel avulsion and formation of relict channels of the Guadalupe River that migrated eastward parallel to the current onshore current. Fort San Pedro and the early church and municipal buildings were built on an interfluve of these relict channels that formed a long point bar of sediments from the dissected coastal plain upstream. Alluvium in the interfluve landform was older and higher and developed into stable soils as shown in profiles collected by Nishimura (1990) from Santo Nino and the eastern Plaza Independencia, but were younger and less developed in the eastward interfluves such where the Cebu Cathedral was built later. An incipient paleosol underlay the alluvium where the *Residencia* and later the *Patria* were built, ca. early 1800s and 1954 respectively, even further to the east from the areas of deepest soil formation.

Visayans adapted to the changing habitat of the Tinago wetland and marsh at the northeastern part of the coastal plain with structures that were possibly house supports or fish corrals. Much later the freshwater marsh was by the early Chinese merchant community who in turn extended the urban grid into what would become the Parian District of Cebu City. The course of landscape change was driven by the two processes of sea level rise and fall and municipal development that has obscured evidence of this physical landscape evolution as well as of changing adaptation from native to urban settlement in the landscape until exposed through comparative and systematic interdisciplinary archaeological studies.

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References

Algodon, MR and Soriano, M (2019) Project Lost Waterways: Clues from Digitized historical Maps of Manila and other Philippines Cities. Report for Cartography of Old Informs the New (COIN). Quezon City: National Institute of Physics, University of the Philippines Diliman.

Berdin, RD, Siringan, FP, Maeda, Y and Nakamura, T (2000) A multiple-method approach in establishing relative sea level and paleoenvironmental changes in SW Bohol, Philippines. In*:* N Mimura & H Yokoki (eds.) *Global Change and Asia Pacific Coasts: Proceedings of the APN/SURVAS/LOICZ Joint Conference on Coastal Impacts of Climate Change and Adaptation in the Asia-Pacific Region, Nov. 14–16.* Kobe: Asia-Pacific Network for Global Change, 57.

Blair, EH and Robertson, JA (eds.) (1907) *The Philippine Islands, 1493-1898.* Cleveland, Ohio: The Arther H. Clark Company.

Calhoun, RS and Fletcher, CH (1996) Late Holocene Coastal Plain Stratigraphy and Sea-Level History at Hanalei, Kauai, Hawaiian Islands. *Quaternary Research*, 45(1)**:** 47-58.

de La Torre, AA and Cuevas, NT (2003) Glimpse of the Sugbanun Past. *Proceedings of the Society of Philippine Archaeologists*, 1**:** 110-114.

Dickinson, WR (2000) Hydro-Isostatic and Teconic Influences on Emergent Holocene Paleoshorelines in the Mariana Islands, Western Pacific Islands. *Journal of Coastal Research*, 16(3)**:** 735-746.

Dickinson, WR (2003) Impact of mid-Holocene hydro-isostatic highstand in regional sea level on habitability of islands in Pacific Oceania. *Journal of Coastal Research*, 19**:** 489-502.

Dickinson, WR (2014) Beach Ridges as Favored Locales for Human Settlement on Pacific Islands. *Geoarcheology*, 29(3)**:** 249-267.

Escondrillas, Dn. Domingo de (1873) *Plano de la Ciudad de Cebu por Dn. Domingo de Escondrillas*, [Plan of the City of Cegu by Don. Domingo de Escondrillas] Madrid: Ministro de Defensa. Cartoteca del Archivo General Militar de Madrid.

Hall, SA and Peterson, JA (2013) Floodplain construction of the Rio Grande at El Paso Texas: Response to Holocene climate change. *Quaternary Science Reviews*, 65**:** 102-119.

Horrocks, M (2020) Recovering plant microfossils from archaeological and other paleoenvironmental deposits: A practical guide developed from Pacific Region experience. *Asian Perspectives*, 59**:** 186-208.

Horrocks, M, Acabado, S and Peterson, J (2018) Plant Microfossil Results from Old Kiyyangan Village: Looking for the Introduction and Expansion of Wet-field Rice (Oryza sativa) Cultivation in the Ifugao Rice Terraces, Philippine Cordilleras. *Asian Perspectives*, 57(1)**:** 159-176.

Horrocks, M and Barber, I (2005) Microfossils of introduced starch cultigens from an early wetland ditch in New Zealand. *Archaeology in Oceania*, 40**:** 106-114.

Horrocks, M, Bedford, S and Spriggs, M (2009) A short note on banana (Musa) phytoliths in Lapita, immediately post-Lapita and modern period archaeological deposits from Vanuatu. *Journal of Archaeological Science*, 36**:** 2048-2054.

Horrocks, M and Weisler, MI (2006) A short note on starch and xylem of Colocasia esculenta (taro) in archaeological deposits from Pitcairn Island, southeast Polynesia. *Journal of Archaeological Science*, 33**:** 1189-1193.

Hutterer, K (1973) *An Archaeological Picture of a Pre-Spanish Cebuano Community*. San Carlos Publications Series A: Humanities Number Nine. Cebu City: University of San Carlos.

Jago-On, SCB (2001) Field Report on the Archaeological Excavation at Old Convent Site, Cebu City. [Unpublished work].

Jubilo, KGA, Algodon, MRL, Torres, EMA, Abraham, ZDP, Ide-Ektessabi, A and Soriano, MN (2019) Lost Waterways: Clues from Digitized Historical Maps of Manila and other Philippines Cities. Report for Cartography of Old Informs the New (COIN) Project. Technical Report. Quezon City: National Institute of Physics, University of the Philippines Diliman.

Maeda, Y, Siringan, F, Omura, A, Berdin, R, Hosono, Y, Atsumi, S and Nakamura, T (2004) Higher-than-present Holocene mean sea levels in Ilocos, Palawan and Samar, Philippines. *Quaternary International*, 115-116**:** 15-26.

Mijares, A (2006) National Museum – ACECI Excavation of Plaza Independencia [Unpublished work]. Manila.

Mindzie, CM, Doutrelepont, H, Vrydaghs, L, Swennen, L, Swennen, RJ, Beeckman, H, De Langhe, E and De Maret, P (2001) First archaeological evidence of banana cultivation in central Africa during the third millennium before present. *Vegetation History and Archaeobotany*, 10**:** 1-6.

Mojares, RB (2017) *Casa Gorordo in Cebu: Urban Residence in a Philippine Province 1860-1920*. Cebu City: Ramon Aboitiz Foundation Inc.

National Archives of the Philippines (1873) Plano Topografico de la Ciudad de Cebu 1833, Año de 1833-1849, Que contiene la representacion del Sr. Obispo de Zebu sobre que se lleve de efecto la reunion del parian y lutaos a la Catedral – acompaña el plano de la Ciudad de Cebu [Topographical Plan of the City of Cebu 1833, 1833-1849 that contains a representation by the Bishop of Cebu to bring about the merger of the parian and Lutaos to the Cathedral, accompanying a map of the City of Cebu]. Spanish Documents Section 66/330.

Nishimura, M (1992) Long-Distance Trade and the Development of Complex Societies in the Prehistory of the Central Philippines: The Cebu Central Settlement Case. PhD thesis, University of Michigan, Ann Arbor.

Peterson, JA (2005) Holocene landscapes of Waimānalo Bay: Archaeological investigations at Bellows Beach,O‘ahu, Hawai‘i. *Hawaiian Archaeology*, 10**:** 47-69.

Peterson, JA (2014) Landscape evolution in Cebu, Central Philippines: the impact of sea level, social history, and tectonism on archaeological landscapes. *Asian Perspectives, special volume on Landscape Archaeology in Southeast Asia*, 52(2)**:** 190-212.

Peterson, JA (2015) Pacific Islands on the Brink of Submergence. Rising Seas in an Age of Climate Changes. In: WJH Willems & HPJV Schaik (eds.) *Water Heritage: Material, Conceptual and Spiritual Connections.* Leiden: Sidestone Press, 121-140.

Peterson, JA (2019) A Research Guide to Archeology in the Visayas, with Special Attention to Cebu. Philippine Quarterly of Culture and Society. In Press.

Scholz, J (1986) Sea-level data from the fringing reefs and barrier reefs of Cebu (Philippines). *The Philippine Scientist,* 23**:** 50–57.

Seidemann, J (1966) *Stärke-atlas.* Berlin: Paul Parey.

Siringan, FP, Maeda, Y, Rodolfo, KS and Omura, A (2000) Short-term and long-term changes of sea level in the Philippine Islands. In: N Mimura & H Yokoki (eds.) *Global Change and Asia Pacific Coasts: Proceedings of the APN/SURVAS/LOICZ Joint Conference on Coastal Impacts of Climate Change and Adaptation in the Asia-Pacific Region, Nov. 14–16.* Kobe: Asia Pacific Network for Global Change, 58.

Woodroffe, CD (2002) *Coasts: Form, Process and Evolution.* Cambridge: Cambridge University Press.

Glossary

Bioturbation	The disturbance of sedimentary deposits by living organisms (Oxford Languages)
Chronostratigraphy	the branch of geology concerned with establishing the absolute ages of strata (Oxford Languages).
Early modern period	corresponding to European history from the end of the Middle Ages ca. late 1400s to the late 18th century, period of European colonization in Island Southeast Asia
Georectifying	referencing an image such as an aerial photograph to a spatial grid such as a map coordinate system
Gley	a sticky waterlogged soil lacking in oxygen, typically gray to blue in color (Oxford Languages).
Histosol	a soil of an order comprising peaty soils, with a deep surface layer of purely organic material Oxford Languages).
Interfluve	a region between the valleys of adjacent watercourses, especially in a dissected upland. (Oxford Languages).
Lithologically	description of a rock or stratum according to its physical characteristics such as color, composition, grain size, and texture.
Plant microfossils	microscopic remains of pollen, phytoliths, and starch residues, among other tissues, recovered in order to evaluate paleoenvironments.
Pedogenesis	process of soil formation.
Relict channels	When the flow of a river changes to a new channel the old channel is considered relict.

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