

15th century carnelian bead cargo of the Indian Ocean World: a conversation starter on collections-based research in the Asia-Pacific

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ABSTRACT

The topic of this abstract fits best within the Collections-based Research Session because existing museum collections of carnelian beads from two archaeological shipwreck sites were analyzed. The sites include different ship constructions located at the far ends, to the north and south, of the Philippines; and they carried comparable artefacts. Both the Pandanan (1460-1487 CE) and Santa Cruz (1488-1505 CE) shipwrecks carried cargoes of similar ceramics (i.e. Chinese Jingdezhen and Thai Maenam Noi) and black glass beads (i.e. west India soda alumina); yet these sites also carried dissimilar cargo in both the ceramics and glass beads. Both sites also carried disproportionate carnelian beads. The resources to conduct the work to study carnelian are the morphological analysis of measurement and descriptors, technological analysis of SEM and compositional analysis of LA-ICP-MS. My research questions ask what geographic patterns these analyses indicate of the carnelian beads: What is the source of the carnelian? Where were the bead workshops? What sailing routes did the carnelian move over to ultimately shipwreck off the Philippines? The expected results are that riverine systems that connected interior Indian carnelian were used to move raw material to west India bead workshops, via the Indian Ocean, Bay of Bengal into the Straits of Malacca to Southeast Asian entrepôt.

Keywords: Collections-based research, rigor, connectivities, shipwreck

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INTRODUCTION

In January 2023 I attended the Society for Historical Archaeology conference. This North American focused conference included a luncheon on Collections and Curation that invited practitioners of Collections-based Research. Wondering if I might be an oblivious participant, as someone who had recently completed a PhD dissertation on shipwreck beads collections stored in the National Museum of the Philippines, in the luncheon I found that there was a very clear definition of what collection-based research entailed for the North American Archaeologist/Curator, “using existing collections to pose and answer scholarly questions/it is a form of archaeological excavation in its own right. Searching through the contents of boxes and old catalogs found deep in repositories is a process full of discoveries/collections that can be generated over a period of decades by academic institutions, museums, volunteer organizations, and cultural resource management firms” ([King 2014](#)). This led me to think that if I was unaware of this definition then perhaps it is because it is not a concept in the Asia Pacific Region. I was curious to discuss with colleagues in the APConf 2023 of our ideas of collections-based research, including how might we like to define our own regional version, and I also wanted to

share what remained to published of my work on the NMPL collection of carnelian beads from two shipwrecks.

The topic of this paper fits best within this Session 23 on Collections-based Research because my case studies are museum collections of carnelian beads from two archaeological shipwreck sites in the Philippines. My research questions and methodologies are grounded in maritime archaeology, linguistics and museology. I wanted a space to explore what epistemologies I bring to collections-based research within a session of peers doing work on “collections”. My archaeology epistemology intersects with maritime-historical –indigenous-material science archaeology. Maritime archaeology in that my theoretical framework is the maritime cultural landscape, connecting artefacts and places across land and water. Historical archaeology in that I mostly work with objects made within the second millennia, with a slant of Art History in that I work across decades. Finally, built out of my exploration of linguistic methodologies to study cultural concepts and a human worldview, I am guided professionally by Indigenous-feminist archaeology. I use heart-centered practices: (1) show care for the living and the dead; (2) recognize we are all emotional and social as well as intellectual beings; (3) act upon our needs for responsible relationships with each other, with a range of communities, and with archaeological records, and; (4) emphasize rigor (Supernant, Baxter, Lyons, & Atalay 2020). Archaeometry contributes to the rigor of my answers to research questions on connectivities across large areas in short periods of time.

CASE STUDIES

The case studies under consideration are the shipwrecks Pandanan (1460-1487 CE) and Santa Cruz (1488-1505 CE). The first was a Vietnamese-Chinese barge located in south-west Philippines and the second a South China Sea Tradition open-ocean vessel located in north-west Philippines. Aside from the hull design and location, several differences exist between the cargoes. The Pandanan cargo included Chinese Longquan celadon, Jingdezhen and Guangdong with Burmese Twante, Vietnamese Chu Dau and Thai Si Satchanalai; High magnesium black glass beads morphologically identical to black west India soda alumina (in similarities); Small and long red west India soda alumina glass beads; three agates (one pendant, two rough cornerless cube/pentagon). The Santa Cruz cargo included Minyao Chinese, blue and white Cham and Go Sanh Cham wares, Sukhothai fish plates; Waxy yellow east India glass beads; Potash high potassium blue wound glass beads; 54-106 hexagonal prism carnelians/agates; 26-84 small lozenge carnelian/agates; one cornerless hexagon quartzite. Despite these differences the shipwrecks also carried three similar types of cargo: Chinese Jingdezhen and Thai Maenam Noi ceramics; black glass beads (i.e. west India soda alumina) (Craig 2021; Craig & Dussubieux 2022). I return to these details later as I consider context and connectivities across vast water bodies of the Indian Ocean and the seas in the Southeast Asia Region. This paper narrows into the discussion on the carnelian beads.

Carnelian beads

The range of carnelian/agate quantity comes from the inventory notes at the time of excavation and my morphology analysis results. The Pandanan excavation report included three agates. My morphological analysis recorded one pendant, and two rough cornerless cube/pentagon. The Santa Cruz inventory included 190 carnelians/agates beads. My morphological analysis recorded 54 hexagonal prisms and 26 small lozenge carnelian/agates.

RESOURCES

The resources available to conduct the work include the National Museum of the Philippines directors Jeremy Barns and Angel Baptiste, staff in the Archaeology Division Mary Jane Bolunia and Eusebio Dizon, staff in the Underwater Archaeology Division Clyde Jago-on and Bobby Orillaneda, and staff from the Records Section Nida Curvas. During fieldwork I appreciated the research assistance by Emil Bersamira and Bobby Orillaneda. The fieldwork was supported by the Social Science and Research Council of Canada MCRI, Society for Nautical Research, Brasenose College and Oxford University Meyerstein. The stone beads were exported for compositional analysis with Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), this details the elemental “recipe” (periodic table) of the stone to compare with known geological sources, by Laure Dussubieux (Chicago Field Museum, Elementary Analysis Laboratory) with funds from the National Science Foundation (BCS 1321731) and the Bruce and Barbara Trigger Award of the Anthropology Department McGill University; and statistical analysis and training supported by MITACS Research Training Award (2020). En route a fortuitous encounter with Dennys Frenez (Università di Bologna, Department of History and Cultures, Prehistory and Protohistory of Asia), Mark Kenoyer and Randall Law (University of Wisconsin–Madison, Department of Anthropology) with permission from NMPL colleagues, led to technical analysis of the bead bore putty impression samples at different magnifications (300X, 100X, 50X, 20X) with SEM- Hitachi 570 (University of Wisconsin–Madison, Laboratory of Experimental Archaeology). The technological analysis unanimously pointed to Indian craftsmanship where long faceted hexagonal beads are generally drilled with larger diameter diamond drills, and the smaller tabular lozenge shaped faceted beads are generally drilled with thinner diamond drills (Kenoyer pers. comm. 25 April 2017). Randall used statistical analysis with program SPSS [Table 1] using canonical discriminant analysis (CDA) to compare the Pandanan and Santa Cruz carnelian compositions to known agate sources (Carter & Dussubieux, 2016; Law et al., 2013).

Table 1 lists the Santa Cruz and Pandanan carnelian cargo average concentrations and standard deviations for the elements used in the statistical analysis with samples in parts per million (PPM) converted to log₁₀ values. These are compared to the four geologic sources Ratanpur, Mardak, Shahr-i-Sokhta and Ban Khao Mogul (reproduced/adapted from Carter and Dussubieux 2016:327, Table 3). When comparing these tables it is possible to see the difference between the elements and their ranges to notice how some line up but most are out of range. This indicates possible shared geography of source material but currently outside these locations. For example, with select elements the bead 1170E fits within the PPM range for Scandium (Sc) and Uranium (U) but not otherwise.

	8829 A	8829 B	8829 C	8829 D	8829 E										
B	23.31	23.15	41.12	6.61	24.42										
Ni	3.39	1.95	2.66	2.94	1.78										
Sb	1.16	0.48	1.16	0.66	1.19										
Sc	2.86	2.19	2.28	2.85	2.00										
U	0.06	0.02	0.02	0.02	0.05										

	1170 A	1170 B	1170 C	1170 D	1170 E										
B	10.51	33.41	15.45	24.89	16.08										
Ni	2.66	1.55	1.44	1.56	1.15										
Sb	1.00	3.78	0.28	2.11	0.88										
Sc	2.21	2.12	1.96	1.88	1.81										
U	0.35	0.09	0.01	0.02	0.01										

	1389 Ei	1389 Fi	1389 Gi	1389 Hi	1389 Mi	1389 Ni	1389 Oi	1389 Pi	1389 H	1389 I	1389 J	1389 K	1389 L	1389 M	1389 N
B	9.28	9.48	12.97	3.52	15.02	4.05	32.18	6.21	20.23	58.89	12.41	37.05	18.21	26.78	12.98
Ni	0.76	3.54	0.69	0.2	1.97	1.98	1.96	1.90	4.86	2.50	1.91	2.61	1.74	0.96	0.92
Sb	1.51	1.32	1.14	1.21	1.66	1.50	1.62	0.64	4.52	2.97	0.73	1.72	1.55	2.32	1.38
Sc	1.58	1.40	1.22	1.32	2.12	1.96	1.42	1.34	2.59	2.84	2.29	1.97	1.95	1.58	1.62
U	0.55	0.95	0.12	0.04	0.08	0.18	0.10	1.02	0.08	0.04	0.14	0.06	0.08	0.01	0.03

FRAMEWORK

My research questions ask what geographic patterns these compositional, morphological, technological analyses indicate of the carnelian beads: What is the source of the carnelian? Where were the bead workshops? What sailing routes did the carnelian move over to ultimately shipwreck off the Philippines? The results indicate the first two questions are well researched and relatively clear routes can be drawn, while the third question points to gaps in the literature.

RESULTS

The expected results are that riverine systems that connected interior Indian carnelian were used to move raw material to west India bead workshops, via the Indian Ocean, Bay of Bengal into the Straits of Malacca to Southeast Asian entrepôt.

My compositional results are that the Santa Cruz carnelian was sourced from an unknown location (Figure 1/TABLE 2), likely along the Deccan Traps of India (Carter & Dussubieux 2016). Perhaps there was some overlap with Ratanpur and Shahr-i-Sokhra but that's largely speculative (Figure 2). Technological analysis results of Indian craftsmanship adds details on the workshop location likelihood. The bead workshops near Ratanpur were in Limodara during the sixteenth century. The initial process of drying the stone and changing its colour by heating continued in Limodara (Dames 1918, 143; Lunde & Craig 2015, 22). Kenoyer, Vidale & Bhanet (1991, 45) show the location of agate bead production exclusively in Gujarat with raw materials from Ratanpur and Limodra, both situated along the Narmada River, flowing into the sea downstream of Broach (Lunde & Craig 2015, 27).

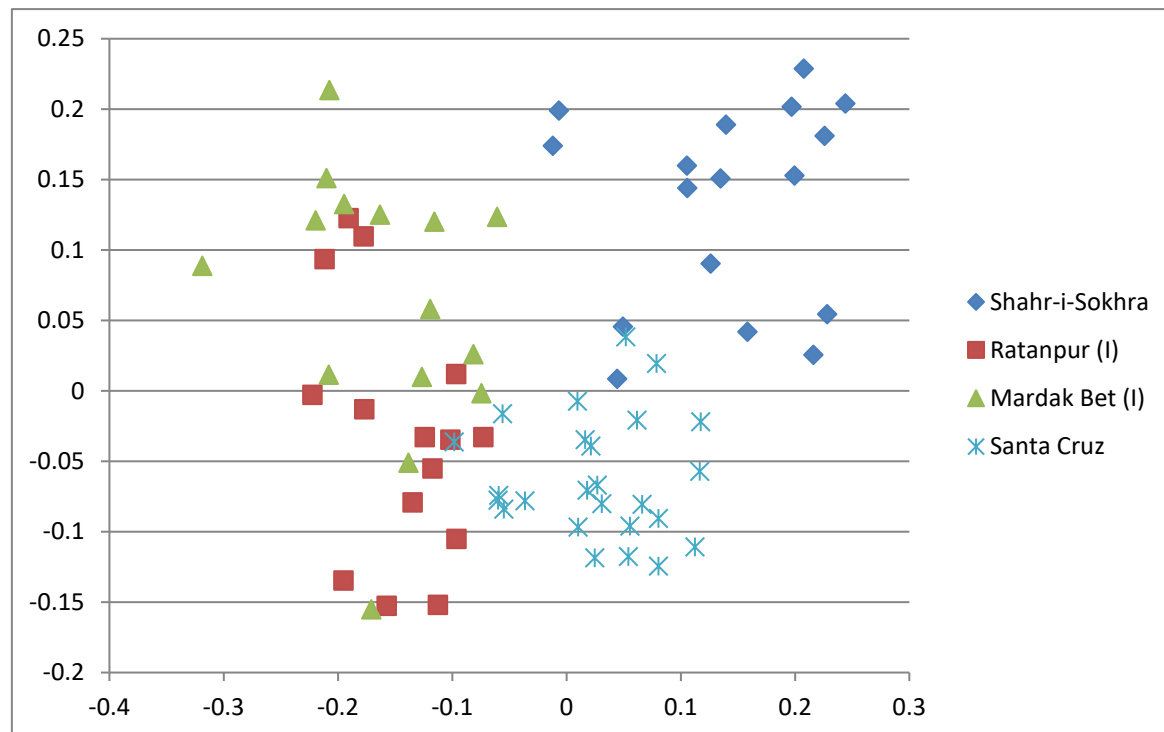


Table 2 Agate/Carnelian artefacts analyzed in this study and their primary predicted group memberships (PGM) from Canonical Discriminant Analysis (CDA). CDA assumes that all groups (sources) are present in the dataset when generating PGMs. That is, it will provide an assignment even if the true source is not present because data is expected to anchor to centroids.

Site name and dates	Database ID	Agate/Carnelian	Predicted Group Membership
Santa Cruz 1488-1505 CE	8829_D	Agate	Ratanpur (RTP), India
	8829_B	Agate	Ratanpur (RTP), India
	1170_C	Agate	Ratanpur (RTP), India
	8829_A	Agate	Ratanpur (RTP), India
	8829_C	Agate	Ratanpur (RTP), India
	8829_E	Agate	Ratanpur (RTP), India
	1170_E	Agate	Ratanpur (RTP), India
	1170_A	Agate	Mardak Bet (MB), India
	1170_B	Agate	Shahr-i-Sokhta (SiS), Iran
	1170_D	Agate	Ratanpur (RTP), India
	11389_Mi	Carnelian	Mardak Bet (MB), India
	11389_Ni	Agate	Mardak Bet (MB), India
	11389_Oi	Carnelian	Mardak Bet (MB), India
	11389_Pi	Agate	Shahr-i-Sokhta (SiS), Iran
	11389_Ei	Carnelian	Shahr-i-Sokhta (SiS), Iran
	11389_Fi	Carnelian	Ban Khao Mogul (BKM), Thailand
	11389_Gi	Carnelian	Mardak Bet (MB), India
	11389_Hi	Carnelian	Ratanpur (RTP), India
	11389_Ii	Agate	Ratanpur (RTP), India
	11389_Ji	Carnelian	Mardak Bet (MB), India
	11389_Ki	Carnelian	Mardak Bet (MB), India
	11389_Li	Agate	Ratanpur (RTP), India
	11389_Ai	Carnelian	Mardak Bet (MB), India
	11389_Bi	Carnelian	Ratanpur (RTP), India
	11389_Ci	Carnelian	Ratanpur (RTP), India
	11389_Di	Agate	Ratanpur (RTP), India
	11389_Qi	Agate	Ratanpur (RTP), India
	11389_I	Carnelian	Ratanpur (RTP), India
	11389_J	Carnelian	Ratanpur (RTP), India
	11389_K	Carnelian	Ratanpur (RTP), India
	11389_H	Carnelian	Ratanpur (RTP), India
	11389_L	Carnelian	Ratanpur (RTP), India
	11389_M	Carnelian	Ratanpur (RTP), India
	11389_N	Carnelian	Ratanpur (RTP), India
Pandanan 1460-1487 CE	3043_A	Agate	Ratanpur (RTP), India
	3043_B	Agate	Ratanpur (RTP), India
	1087_F	Agate	Ratanpur (RTP), India

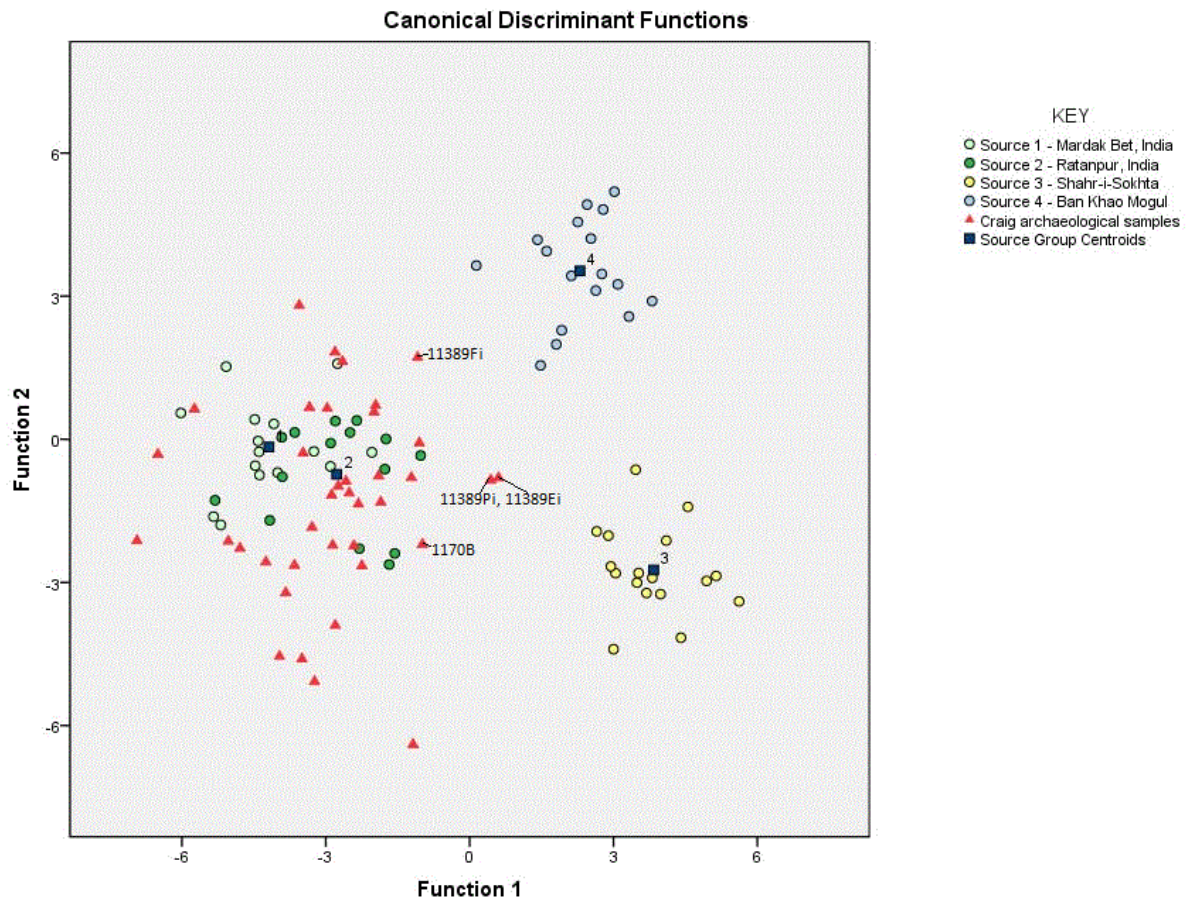


Figure 2 A biplot of the agate/carnelian geologic sources with the agate/carnelian artifacts plotted by their first two discriminant functions. The four labeled artifacts are outliers from those that have either a primary or secondary PGM assignment. All four were predicted to belong to one Indian source. Of those four, one had a PGM in the Thai source and three had PGMs in the Iran source.

The importance of ports in the transport system is significant because the Gujarat area was strategically placed along the main shipping route. Early 16th century records by Ludovico di Varthema (travelled from 1503 to 1508), mentions the agate/carnelian trade of Cambay and the wide web of foreign markets, reached by ‘Mohammedan sea-faring traders’ along the Red Sea, East Coast of Africa, the Mediterranean and the Far East (Arkell 1936, 299). For the carnelian/agate source Shahr-i-Sokhra the port of Hormuz was likely. During the years 1325-1622 CE, the bulk of the India trade passed through Hormuz, and continued to do so even after the Portuguese took the city in 1514 CE (Lunde & Craig 2015, 26). Hormuz had a significant advantage over Aden, its main rival. “Ships out of Hormuz could sail to Gujarat almost all the year round, hugging the coasts of Makran and Sind, while Yemeni and Red Sea ships were completely dependent on the monsoon system, with narrow windows of opportunity for safely crossing the Indian Ocean.” (Lunde & Craig 2015, 26).

Contemporary to the dates of the shipwrecks Pandanan and Santa Cruz, the port Rander (destroyed by Portuguese in 1530 CE) was described by Duarte Barbosa in 1514 CE as trading with Malacca, Bengal, Tenasserim, and Pegu. Prior to the silting of the estuary to Rander in the 16th century, stone beads were shipped out of Cambay by Portuguese and Gujarati merchants along with glass beads from Broach. The importance of Bharuch from the turn of the millennium through the 18th century, located 25 nautical miles from the sea on the north bank of the Narmada River (Maqbul Ahmad 1960, 58; Lunde & Craig 2015, 24), indicates the heavy riverine traffic of the Narmada River. Narmada River to Limodara and

on to Bharuch/ Broach on southeast of Cambay's estuary and Tapi River to Rander share a baseflow source in the Deccan Plateau grabens (Vanderkluyzen et al. 2011). This is to say the mineral content of the geology is similar (Das, Krishnaswami & Kumar 2006).

CONCLUSION

In conclusion, presumably stone beads exported via Broach were along the river systems or in the saltwater on shallow lightering-craft. The archaeological and historical text evidence together indicates that bead production and port location were inextricably linked in Gujarat (Lunde & Craig 2015, 27). However, large gaps in the literature still remain for the story on how carnelian beads may have moved through the Bay of Bengal into the Straits of Malacca to Southeast Asian entrepôt.

Returning to my *raison d'être* of creating this session for discussion in our APConf 2023, on ideas of collections-based research, including how we might like to define a version in the Asia Pacific region. I consider the beads and Rey Santiago as I go into this question. Rey was my bead mentor. He curated the records and objects of bead collections in the NMPL, cultivated methodology of their study, (and the part that hooked me onto these small finds) extrapolated the stories of each bead from water and land. With these intangible and tangible inputs to my collections-based research, I propose that we, "pose and answer scholarly questions/it is a form of archaeological excavation in its own right. Searching [with mentors/ghosts/spirits/colleagues] through the contents of boxes and old catalogs found deep in repositories is a process full of discoveries[/magic/kinship-making/affirming that include] collections that can be generated over a period of decades by academic institutions, museums, volunteer organizations, and cultural resource management firms [so as to gather stories and storytell]" ([King 2014](#); Supernant 2020; Supernant, Beisaw, Garrison, & Surface-Evans 2020).

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