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ARTICLES

Late Prehispanic Coquina Quarrying and Tomb Construction in Coastal Southern Peru

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ABSTRACT

We document the quarrying and source of coquina stone used in elite tomb construction at two late prehispanic sites in southern Peru. Excavations document tomb construction that includes coquina slabs for chamber walls, doorway lintel stones, and large slabs used to seal tomb openings. At the Inca site of Tacabua Tambo, we uncovered two massive coquina slabs covering the opening of an extended familial tomb. Smaller coquina blocks were used to create the burial chamber. At the Late Horizon and earlier fishing village of Pueblo Picata we document a tomb chamber for a single elite individual constructed of large coquina slabs. A short distance from the village area at Pueblo Picata is a marine terrace outcrop with extensive evidence of prehispanic quarrying. Macroscopic petrographic comparisons of geological samples from the marine terrace and a sample of the archaeological tomb contexts indicate that coquina at both sites derive primarily from the Picata quarry while one tomb slab is from an unknown locale. The study indicates that a significant labor investment was needed for the quarrying and transport of coquina slabs. Furthermore, the use of coquina exclusively for elite tomb construction at these sites, and not for domestic or administrative architecture, suggests a strong symbolic association between coquina and mortuary practices. Coquina quarries and coquina use

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in tombs have not been reported previously for this or other regions of the Central Andean coast.

Keywords coastal, South America, Andes, coquina quarrying, tombs, Inca

INTRODUCTION

In the second half of the fifteenth century Inca expansion into the coastal communities of southern Peru brought about political and social changes as well as innovations in site infrastructure and construction. Stone quarrying and masterful construction of monumental stone architecture were hallmarks of many ancient Central Andean cultures, particularly the Inca Empire. At highland inland locations abundant natural outcrops of igneous andesite and other rock sources were often the preferred material for construction (Janusek et al. 2013; Ogburn 2004; Protzen 1985, 1993, 2000). At low elevation coastal settings outcrops of igneous rock are less common; therefore, alternative sources of rock were often selected for construction projects. The provenance of stone used in ancient coastal construction projects provides insights into past labor practices and probable specialized economic activities. The use of preferred stone only for tomb construction, but not for domestic or administrative architecture, also provides insights into the symbolic association of raw materials with mortuary behavior during late prehispanic times.

Here we report on ancient quarrying of coquina blocks from an uplifted marine terrace on Punta Picata in far southern Peru. Coquina is a loosely cemented sedimentary rock composed of broken shell, coral, or other carbonate debris of marine origin. Evidence for prehispanic mining of the Punta Picata quarry comes from the coastal sites of Tacahuay Tambo and at the village settlement of Pueblo Picata. Coquina slabs from the quarry were used for the construction of tomb walls and to seal a tomb entrance. Both of the tombs with coquina rock architecture are associated with elite tombs (deFrance and Chacaltana 2011). A macroscopic petrographic analysis comparing samples from

the coquina quarry and the tomb slabs found at the two sites allowed us to source the majority of sampled tomb contexts to the Punta Picata coquina quarry. We were unable to identify the provenance of one large tomb closure slab; however, other coastal uplifted marine terraces along the southern Peruvian coast may be the source. Although the mining of many other materials (e.g., rocks, ores, minerals) has been documented for Andean sites (see Tripcevich and Vaughn 2013), coquina mining apparently has not been reported previously in the Central Andes.

Although we are unable to directly date the quarrying activities, the use of coquina slabs in tomb architecture is interpreted as a late prehispanic innovation that probably originated during the Late Horizon (ca. AD 1450–1532). The use of quarried coquina in tomb construction has not been reported previously for the immediate region despite extensive excavation of cemeteries dating to the earlier Late Intermediate Period (ca. AD 900–1450) (Lozada et al. 2009; Miranda and Umire 2007; Umire and Miranda 2001). Miranda and Umire (2007) report the occasional use of boulders and stones for walls and burial coverings in Late Intermediate Period tombs from a cemetery near Ilo, Peru, but none of the rocks are finished into slabs. In addition, coquina use in tombs is not reported for cemeteries located further south of Punta Picata along the coast of southern Peru or northern Chilean (Focacci 1980; Sutter 2005). Excavation of other Late Horizon sites along the southern Peruvian or northern Chile coastal plain might also contain evidence of coquina quarrying and its use in cemeteries. Coquina quarries are a poorly known aspect of ancient Andean economics. Their systematic analysis can help to further our understanding of probable labor specialization or ritual labor activities, and mortuary symbolism along the coastal plain.

The only other reported evidence for the use of coquina in coastal sites in the region comes from the Ring Site located ~29 km from the Punta Picata quarry. One level (J-2) at the Ring site contains fragments of coquina that have been interpreted as artificial fill to enlarge the shell ring. Although there are no radiocarbon dates from the level containing coquina, the upper levels of the Ring Site date to the Preceramic period between 2,100 yrs BP and $5,060 \pm 65$ yrs BP (Sandweiss et al. 1989:67). In contrast to the sites reported here, the use of coquina at the Ring Site for non-mortuary use suggests that these stone sources were in use before the area's Incan occupation and that future investigations may reveal further use of coastal quarries or other marine terrace outcrops.

MATERIALS

Geological Quarry Samples

Located approximately 35 km south of Ilo Peru, Punta Picata is a rocky headland measuring $\sim 7.5 \times 1.5$ km. (Figure 1). At the greatest projection of the headland into the Pacific Ocean is an uplifted marine terrace of unknown age (probably early Pleistocene, see Ortleib et al. 1996). The terrace is comprised of coquina, specifically grainstone ~1–3 meters thick (Figure 2). As a result of shoreline erosion, the terrace is preserved in four discontinuous sections measuring $\sim 160 \times 30$ m. This outcrop fines upward, the lower levels contain whole shells and gravel (~4 cm) while the upper levels consist of finely crushed shell and small

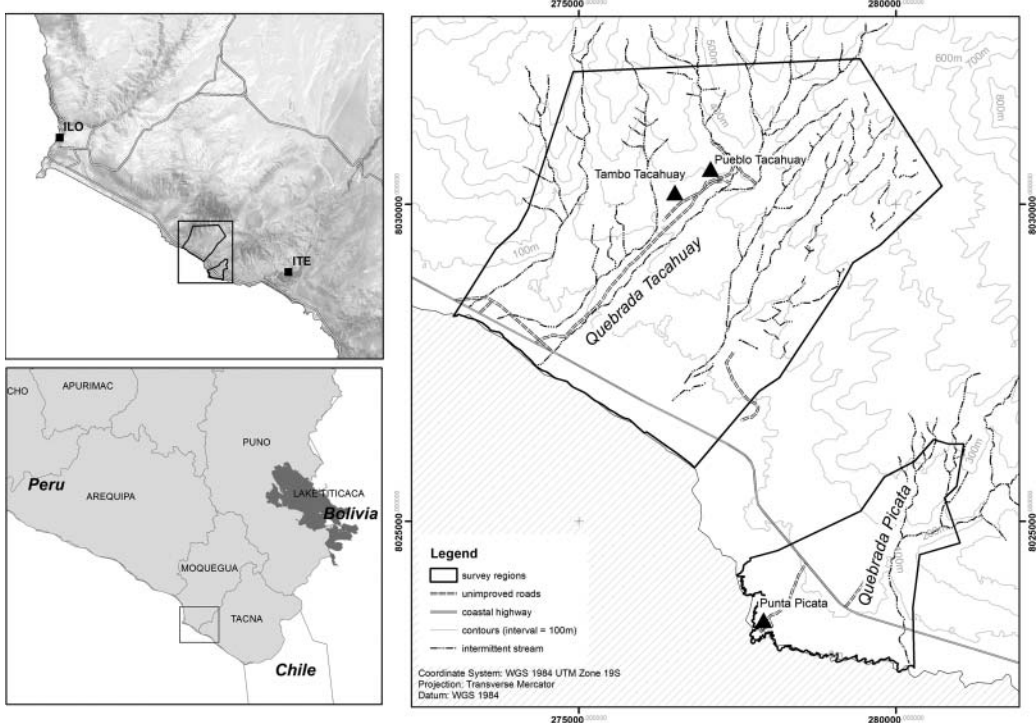


Figure 1. Location of Punta Picata and the archaeological sites of Tacahuay Tambo and Pueblo Picata in Southern Peru.

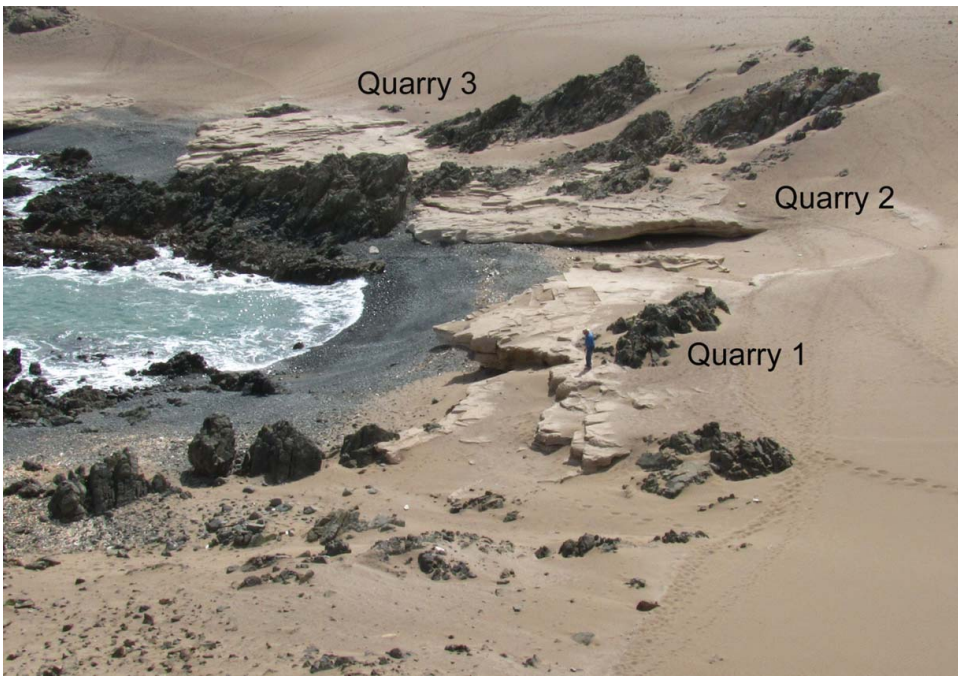


Figure 2. Overview of Punta Picata marine terrace outcrop (color figure available online).

pebbles (~4 mm) (Figure 3). This graded bedding is indicative of a unidirectional current with a waning flow (Bourgeois & Leithold 1984; LeRoux et al. 2006).

The terrace was heavily mined in the ancient and more recent past. The three easternmost outcrops contain extensive evidence of prehispanic non-mechanized mining. Extraction was achieved through broaching or channeling, a method in which a line of holes or a channel is drilled perpendicular to the cleavage plane of the rock and wedges and hammers are used to remove the stone. Mining evidence includes numerous pockmarks where large blocks of coquina were removed, precut stones on low pedestals readied for removal, and blocks that were broken probably during extraction (Figure 4). Some of the surfaces contain possible “marker’s marks” or symbols of unknown function (see Figure 4). The function of these marks is not known; they have not been reported previously for other mining sites in the Andes. Absent from the quarry

surface is debris from production (discarded blocks) and tools used for coquina mining. In contrast to the eastern outcrops, the westernmost quarry is characterized by highly regular pockmarks, possibly from pneumatic or other mechanical means of mining during more recent time periods. If prehispanic mining also occurred at the western exposure, it has been obscured by modern activity.

Coquina samples from the three eastern outcrops at the Punta Picata quarry were taken from the upper, middle, and lower stratum at each of the eastern exposures (Figure 5). A rock hammer was used to remove samples that measured approximately 5 cm × 5 cm. Efforts were made to collect examples that differed in visual composition from each exposure and stratum.

Archaeological Coquina Samples From Tomb Contexts

Tacahuay Tambo (17°48’S 71°06’W), located approximately 30 km southeast of



Figure 3. Upper, middle, and lower coquina strata at the Punta Picata marine terrace outcrop (color figure available online).

Ilo and roughly two and a half kilometers inland, is a Late Intermediate Period and Late Horizon village and Inca stone-masonry tambo/inn (see Figure 1) (Bar Esquivel 2010; Chacaltana Cortez 2010; Covey 2000, 2009; deFrance and Chacaltana 2011). Inca settlement of the region occurred late (~second half of the fifteenth century) and incorporated the local indigenous populations (Andean Late Intermediate period, Chiribaya or Late Horizon San Miguel/Gentilar cultures) into the empire. On the south coast of Peru the Late Intermediate Period Chiribaya ranged from approximately AD 1000 to 1500. In far southern Peru and northern Chile the San Miguel and Gentilar are successive phases with San Miguel ranging from ~AD 1000 to 1350 followed by Gentilar (AD 1350–1500) (Rivera 2008). Inca domination of the region is interpreted as indirect control, probably by Lupaqa overlords who origi-

nated in the Lake Titicaca basin (Covey 2009; deFrance and Chacaltana 2011).

The site measures roughly 5 ha with settlement concentrated along the natural terraces south of the main quebrada channel. South of an area of agricultural terraces and overlooking former agricultural fields, Inca architecture consists of remnants of stone walls from five structures and enclosures. A presumed administrative structure (kallanka) is present as are smaller stone structures. The Inca co-opted and amplified the local agricultural system thus providing the economic impetus for settlement.

Excavations north of the kallanka uncovered a *chullpa*-style tomb that once had adobe walls. Commonly found in the south-central Andean highlands, *chullpas* are tomb towers usually constructed of stone and designed for periodic reentry. At Tacahuay the Inca apparently appropriated local ancestors



Figure 4. Evidence for coquina mining. Upper left: area of extensive mining; Upper right: marker's marks or extraction marks; Lower left: in situ block; Lower right: channel mark in coquina (color figure available online).

through the use of highland-style chullpas for burial. Excavation revealed that a portion of the adobe foundation and roof were intact, but the interior burial chamber was looted in the distant past. Broken ceramics are a combination of highland-style Inca-affiliated wares and local Gentilar pottery indicating a late construction (Bar Esquivel 2010). Although the interior of the tomb was looted via entry through the tomb vault or roof, the exterior was not disturbed. The undisturbed tomb opening (door) was capped by two massive upright coquina slabs (Figures 6 and 7; Table 1). Smaller coquina slabs were used to line the interior tomb chamber. Our excavations indicated that smaller coquina slabs were also used to support a small opening to the interior chamber of a second tomb. We sampled the two massive coquina slabs that capped the doorway of the first tomb

(Figure 8). These two stones indicate a significant labor investment to extract and transport them, particularly since there are no outcrops of coquina adjacent to the village and inn/tambo.

The second tomb is located at the Pueblo Picata (17°52'S 71°05'W) prehispanic fishing village (see Figure 1). The fishing village was established sometime in the Late Preceramic or early Formative period based on exposures of deep midden and radiocarbon dates. Late Horizon and Inca surface materials indicate the site was occupied through the fifteenth century. Ethnohistorical accounts indicate that a remnant population of specialized fisherfolk inhabited the site during the sixteenth century (Trelles Aréstegui 1991).

The densest area of occupation spans an area approximately 3.5 ha. Across the

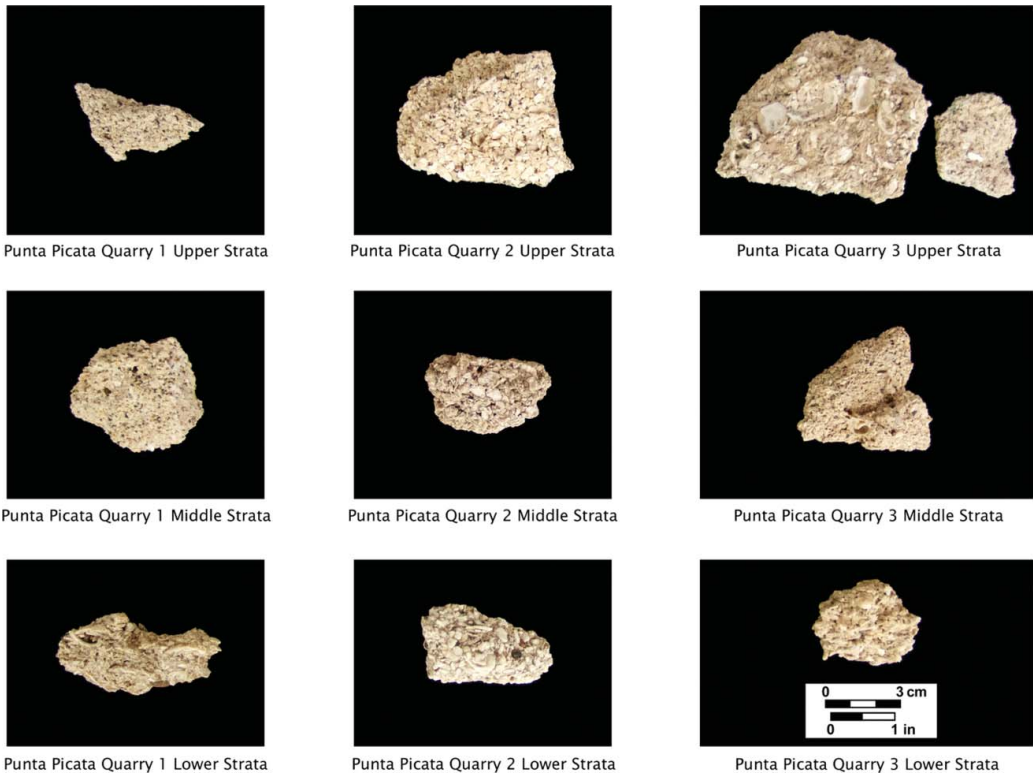


Figure 5. Modern coquina samples from the upper, middle, and lower strata at Punta Picata (color figure available online).

habitation area are several looted tombs. The surface of one looted tomb revealed walls composed of large coquina slabs (Figure 9). If a top slab was present, it had been removed during looting; however, the four walls of the tomb remained intact. A crew cleaned the loose fill of the tomb to expose the chamber. The tomb contained disarticulated human remains and Late Horizon style fragments of textiles. The walls of the tomb were mortarless, but overlapped on three sides to provide stability. We removed small samples of coquina rock from the east, west, and south walls of the tomb (see Figure 8; Table 1). The north wall, a large trapezoidal-shaped slab, did not overlap with any other walls and was deemed to be potentially unstable; therefore, we did not sample it. Visually, it was most similar to the east and west walls.

METHODS

To determine if the coquina used in tomb construction at Tacahuay Tambo and Pueblo Picata derived from the Picata quarry each archaeological sample was classified using the Folks and Dunham carbonate classification system. This classification system provides the baseline for macroscopic petrographic sample comparison. With this general lithologic determination in combination with observed stratigraphic relations, archaeological samples were correlated to quarry source. The mollusk species, which comprise the coquina, were unidentifiable because no whole specimens were present. Microscopic petrographic analyses were not necessary, because the quarry coquina samples contained little to no microscopic



Figure 6. Tacabuay Tambo tomb with coquina slabs covering exterior opening (color figure available online).



Figure 7. Detail of outer and inner coquina slabs at Tacabuay Tambo tomb. Left: outer slab, sample 1; Right: inner slab, sample 2 (color figure available online).

Table 1. Dimensions of coquina slabs, Tacahuay Tambo and Pueblo Picata tombs.

Tacahuay Tambo, Structure II, tomb

Outer tomb opening slab	Tacahuay sample #1, source unknown, not Punta Picata 98 cm × 75 cm
Inner tomb opening slab	Tacahuay sample #2, Punta Picata lower quarry stratum 77 cm × 64 cm

Pueblo Picata, tomb

West slab	Picata sample #3, lower quarry stratum top = 73 cm N-S bottom = 73 cm N-S depth = 112 cm
South slab	Picata sample #4, middle-upper quarry stratum top = 122 cm N-S bottom = 122 cm N-S depth = 86 cm
East slab	Picata sample #5, lower quarry stratum top = 81 cm N-S bottom = 81 cm N-S depth = 47 cm
North slab	No sample taken, slab was unstable top = 119 cm E-W bottom = 103 cm E-W depth = 73 cm

micrite. Furthermore, four of the five archaeological samples that had abundant cement present were clearly differentiated as described above. Future microscopic analysis of the one sample with copious amounts of micrite may be useful when a possible quarry source for this sample is located. Using this approach, four of the archaeological tomb slabs were sourced to natural quarry outcrops.

RESULTS

Comparisons of the quarry and archaeological samples indicate that four of the five tomb slabs can be correlated with the Punta Picata quarry (Figure 10). Of the archaeologi-

cal samples analyzed from the Pueblo Picata tomb walls, all three samples were mined from the Punta Picata quarry. Of the Pueblo Picata samples, the tomb west and east walls (samples #3 and 5) are from the lower stratum of the Punta Picata quarry, whereas the sample from the south tomb wall (sample #4) is from the middle-upper stratum of the quarry. Analysis of the samples from the large exterior tomb slabs from Tacahuay Tambo indicates that the inner slab (sample #2) is from a marine terrace of the same composition and maturity as the Punta Picata quarry terrace. This sample is coarse grained with some large clasts and was mined from the lower stratum of this marine terrace unit. In contrast, the outer slab (sample #1) is a different type of coquina. It is a biosparite with over 50% micrite matrix. The shells within this sample



Tacahuay Tambo Tomb Slab 1



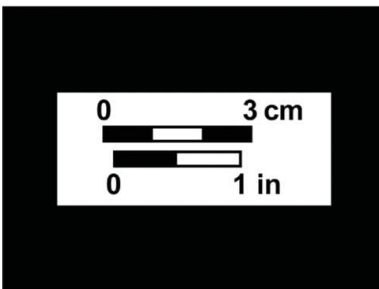
Punta Picata Tomb Slab Sample 3



Tacahuay Tambo Tomb Slab 2



Punta Picata Tomb Slab Sample 4



Punta Picata Tomb Slab Sample 5

Figure 8. *Archaeological samples of coquina from the Tacahuay Tambo tomb entry slabs and Pueblo Picata tomb walls (color figure available online).*

are large (~8 cm), and given the degree of micritization this sample is likely from a lagoonal evaporitic setting as has been identified by Ortlieb et al. (1996) on the Pampa del Palo, an extensive uplifted marine terrace located approximately 8 km west of Tacahuay Tambo.

The extent of the marine terrace unit at the Punta Picata Quarry is only 160 meters across, however this marine terrace unit may have other outcrops along the shore that have not yet been described. Work on the marine terraces at Pampa de Palo just 10 kilometers west of the mouth of Quebrada



Figure 9. Pueblo Picata tomb with coquina walls and samples 3, 4, and 5 (color figure available online).

Tacahuay found marine terrace units from six episodes of sea-level fluctuation (Ortlieb et al. 1996). Given the extensive distribution of marine terraces in this area it is not unreasonable to assume that the marine unit exposed at Punta Picata may be present elsewhere along the shoreline. However, several lines of evidence strongly suggest that the quarry at Picata was the source for four of the five samples. First, the Punta Picata quarry is only ~6.5 km south of Tacahuay Tambo and directly adjacent to the archaeological site of Pueblo Picata. Second, the Picata quarry has extensive evidence of pre-hispanic quarrying while mining of coquina rock has not been identified in any other area along the southern Peru coast despite archaeological survey of the region (Umire 1998). Third, with the exception of sample #1 from Tacahuay Tambo, the four other archaeological samples are indistinguishable from the Punta Picata quarry material. Therefore, in the absence of other quarrying ev-

idence, we can presume that the inhabitants of both sites quarried coquina from the Picata source and that people transported large stones to the inland location of the Tambo.

The large outer tomb slab at Tacahuay Tambo (sample #1) is of an unknown source of biosparite. Ortlieb et al. (1996) describe a similar rock type from their marine unit four that crops out around 20 m elevation at Pampa de Palo (~8–10 km west of Tacahuay). Tacahuay Tambo is ~2.5 km from the coast at an elevation of ~200 meters. While marine terraces from the Early Pleistocene are present at inland locations on the south coast in areas with similar geographic orientations (e.g., the marine terraces at Chala studied by Goy et al. 1992), the marine terraces in the Tacahuay drainage, if present, are overlain by thick alluvial fan deposits and are not likely to be exposed close to the site of Tacahuay Tambo.

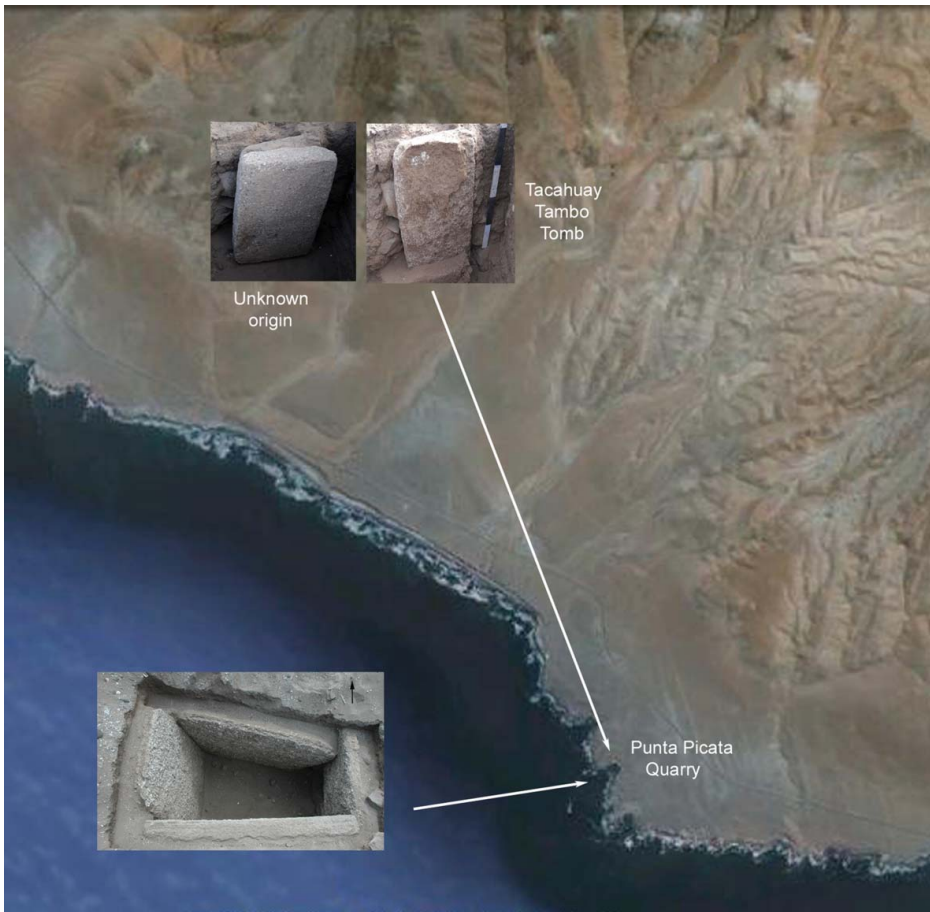


Figure 10. Correlation of quarry coquina with tomb slabs from Tacahuay Tambo and Pueblo Picata (color figure available online).

DISCUSSION AND SUMMARY

The ancient mining of the Punta Picata quarry for tomb slabs is evident at the quarry today. The population of Pueblo Picata was clearly exploiting this resource for their own burial practices. Sample #2 at Tacahuay Tambo suggests that inland populations probably used this coastal quarry as well, while sample #1, from Tacahuay Tambo indicates that other quarrying sites along the coast were also mined.

The quarrying of coquina required a substantial and specialized labor force for the extraction and transport of the stone. In

comparison to other types of rock found on the coastal plain or in the coastal mountain range, coquina is relatively easy to extract. Large uniform pieces could be extracted. Despite the relative ease of procurement, skill in coquina removal and its use in tomb construction indicate a body of craftspeople and overseers to coordinate labor activities. Excavations completed thus far suggest that coquina slabs were used only in the tombs of elite members of society, particularly at Tacahuay Tambo where the tomb is located in the center of the Inca administrative center of the site. The size and location of the tomb at the tambo suggest that various

family members were interred through time. The presence of two slabs with distinct provenance covering the tomb entry supports the proposition that interments took place over time and that those buried there were able to appropriate the labor needed for mining, finishing, and transport of large stone pieces. Although we were able to document that the Picata quarry was mined in the prehispanic past, we have little information on labor organization and management. Also, we do not have any direct evidence for extraction methods, such as tools or materials used for overland transport.

In addition to its ease of extraction and durability, the inhabitants of both sites appear to have created a symbolical association between coquina and the afterlife. The exclusive use of coquina for tomb construction during the Late Horizon/Inca Period, but not in mundane domestic architecture or in the presumably administrative buildings present at Tacahuay Tambo, suggests that coquina as a raw material was deemed appropriate for use in mortuary architecture for reasons beyond its practicality. A larger comparative sample of sites with coquina tomb structural elements is needed to understand this practice.

Future excavation of the quarry itself as well as other sites along the coast might provide further insights into this aspect of coastal life and its symbolic significance during the Andean Late Horizon. Additional sampling of archaeological coquina elsewhere along the far southern Peruvian coast and comparisons with the deposits from other uplifted terraces will help to expand our understanding of ancient Andean coastal sedimentary deposit mining and its cultural significance. This study has added to our knowledge of raw materials mined in the ancient Andean past through a study of the seemingly unique practice of using coquina for tomb construction at two late prehispanic sites on the southern Peruvian littoral.

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