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Fresh Observations on Ancient Maya Ceramic/Textile Composites: Technological, Contextual and Conceptual Reconsiderations

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Abstract

In 1993, the Petexbatun Regional Cave Survey discovered a previously unknown composite material in the Cueva de los Quetzales, Petén, Guatemala. The composite material, consisting of layers of cotton fabric impregnated with ceramic slipping material, was analyzed by the Smithsonian Institution's Conservation Analytical Laboratory (now the Smithsonian Center for Materials Research and Education [SCMRE]). Recently, a micro-CT scan of one of the sherds has led the authors to question the established position that use of the composite technology was highly specialized and produced exclusively for the elite.

Keywords

Composite Material, Ceramic, Slip, Micro-CT Scan, Maya

1. Background

During the 1993 field season, the Petexbatun Regional Cave Survey conducted excavations in the Cueva de los Quetzales, a cavern running beneath the site of Las Pacayas located some 12.5 km south of the site of Dos Pilas, Petén, Guatemala (Brady & Rodas, 1994, 1995) (**Figure 1**). The site is situated on a low hill, some 20 - 25 m high, whose top was leveled for the construction of a small acropolis. The top of the natural hill was augmented by constructing retaining walls around the edges and filling and leveling behind them. The labor required was considerable. The site consists of two principal plazas, A and B, and eight structures, the tallest of which, Structure 4, is 5 m high (Escobedo et al., 1994). Investigation revealed five stuccoed floors that represent remodeling. Under the lowest floor, an almost complete bowl of Dos Arroyos Orange Polychrome was

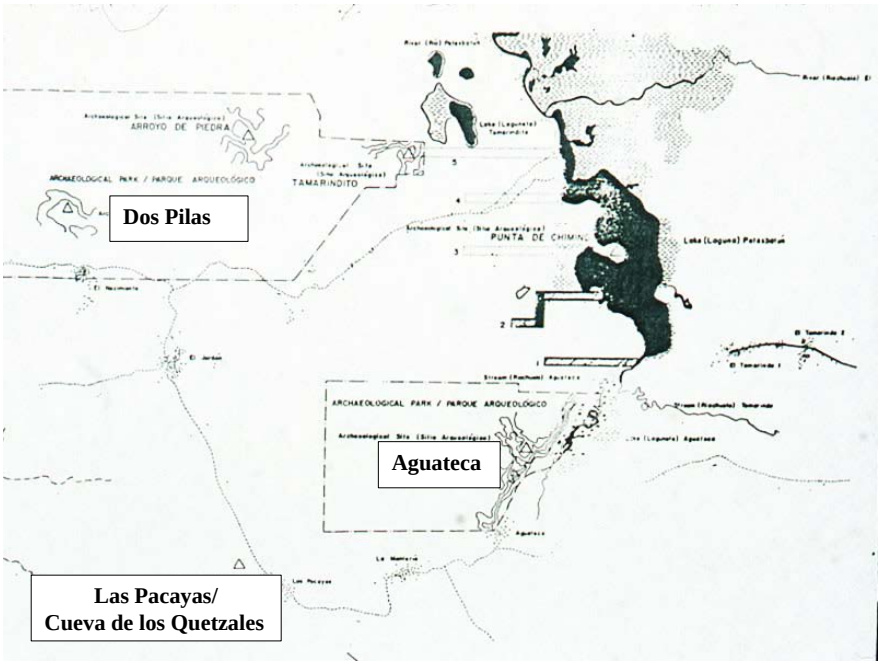


Figure 1. Map of the Petexbatun Region showing the location of Las Pacayas/Cueva de los Quetzales in relation to Dos Pilas and Aguateca.

recovered which provided an Early Classic [250 - 550 AD] date for the beginning of construction on Structure 4. Interestingly, the architecture, although small, was of finer quality than that of Dos Pilas.

In addition to an entrance at the base of the hill, the Cueva de los Quetzales has an opening in the roof of the principal chamber that was placed at the border of Plazas A and B (Figure 2). An altar appears to have been set up in front of the opening, but this is now wedged in the opening after an attempt was made to drop it into the cave. Beneath the opening, a conical mound at least 3 m deep formed from material dropped or washed in from above (Figure 3). During the 1993 field season, Irma Rodas directed the excavation of nine test units in the chamber with eight opened in this mound to determine the nature of the deposit (Brady & Rodas, 1994, 1995). The units were excavated in 10 cm levels and below one meter they encountered a large number of Late Preclassic [BC 400 - 250 AD] sherds.

2. Discovery of a New Clay/Fabric Composite Material

During the ensuing laboratory analysis, a sherd was noted because of its light weight and unusual rounded form. This led to the recovery of two additional sherds, one of which has a textile impress showing along an exposed break. The three sherds were brought to the Smithsonian Institution's Conservation Analytical Laboratory (now the Smithsonian Center for Materials Research and Education [SCMRE]) for analysis. It was concluded that the sherds represented a heretofore unreported composite material composed of multiple layers of fabric within a clay matrix (Kaplan, 1994). Their analysis suggests that plainly woven

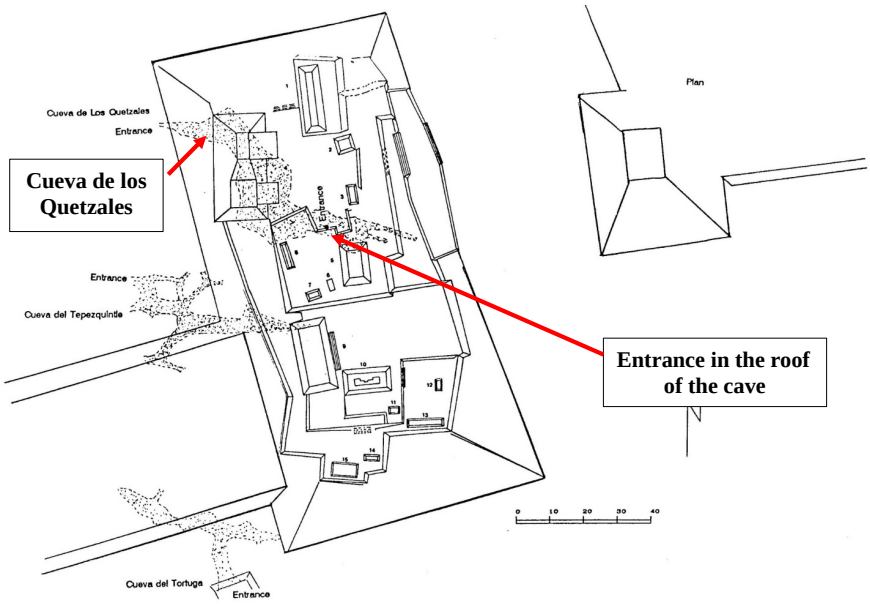


Figure 2. Map of Las Pacayas showing the location of the Cueva de los Quetzales.

Figure 3. View of the conical mound beneath the skylight opening to the Cueva de los Quetzales.

cotton fabric was dipped into a clay mixture similar to that of a slip and then laid on a mold with additional treated layers being added (Beaubien, 2001: p. 96). After drying, the composite ceramic could be heat hardened or fired.

3. The Recognition of Additional Sites Producing Composite Ceramics

From the start, the sample of composite ceramics has been miniscule. Five years after the Los Quetzales discoveries, composite materials were recovered from a second site in the ruins of a burned palace at Aguateca (Inomata et al., 2001: p. 294). The Aguateca examples were far more complete than the Los Quetzales finds including parts of two masks and a variety of other sherds. These have

provided the framework for the interpretation of the use of composite ceramics. Based on her work with the Los Quetzales and Aguateca composite ceramics, Harriet F. Beaubien applied for and received a grant from the Foundation for the Advancement of Mesoamerican Studies, Inc. to search ceramic collections in Guatemala for additional examples. Beaubien (2003, 2004b: pp. 643-644) succeeded in documenting composite ceramics in the collections from Arroyo de Piedra, Nacimiento, and Tamarindito in the Petexbatun region and found more sherds in the Aguateca collection. A figurine fragment from Piedras Negras was also reported to her.

4. Factors Contributing to the Lack of Recognition of Composite Ceramics

As a conservator, Beaubien (2003: p. 4; 2004a: p. 12) expressed interest in why the presence of composite ceramics had gone undetected in the archaeological record for so long. Naturally, much of her thinking focused on very legitimate factors of preservation. Composite ceramics appear to have been designed to produce a rigid ceramic which was at the same time lightweight because of its porosity. However, that porosity also made it more susceptible to degradation when exposed over time to acidic ground water, particularly since many of the composites may have been low fired. Low-fired artifacts would be unlikely to survive outside of a protective environment like a cave. Composite ceramics are also more brittle than ceramic and, therefore, more likely to be highly fragmented.

We are interested in the same question but approach it as archaeologists and so from the perspective of the ceramic analyst. It is instructive, therefore, to review the discovery at the Cueva de los Quetzales before the discipline was aware of the existence of composite ceramics. In the process of excavating an unstratified deposit such as the one in the cave, excavators pay little attention to individual sherds unless they are unusually complete or have an unusual form or decoration. Clearly the composite sherds did not qualify and additionally the deposit in Los Quetzales was producing hundreds of sherds of ceramic drums which were far more interesting. Thus, the sherds were collected, bagged, and transported to camp where they were washed by untrained workmen, a practice that Beaubien (2003: p. 17) called "potentially disastrous".

The first realistic opportunity to recognize the composite sherds for what they are would not occur in most cases until analysis in the laboratory. Even here, the Los Quetzales sherds do not jump out as anything special, resembling thousands of other unslipped or monochrome slipped sherds. Analysts being human pull out the interesting polychrome and fine past ceramics before treating the rest in a perfunctory fashion. Such a token look might not be enough to identify composite sherds. The discovery of the composite sherds at Los Quetzales occurred with the largest of the three because of its size and unusual curved form. It should be noted, however, that caves often yield large sherds because these are

low traffic areas while sherds from most contexts are smaller because of post depositional trampling. The Los Quetzales sherd was also noted as being unusually light, particularly in comparison with the other well-preserved ceramics recovered from the cave. Ceramics from surface contexts are often badly eroded and quite porous because acidic groundwater reacts with the calcite temper in the paste. Thus, the most easily recognizable diagnostics of composite sherds may not be present in material from most collections, so it is easy to appreciate why composites went unnoticed for a century. The good news is that, as Beaubien (2003) demonstrated, once one is aware of composites and knows what to look for, the material can be identified.

It is important, however, to keep in mind how little we know about this newly recognized technology. Because the SCMRE had already analyzed the Los Quetzales composite ceramics, the extraordinary discoveries at Aguateca were immediately identified as belonging in the same class. This in turn was the impetus for Beaubien's (2003) very important search for additional examples that focused on sites involved in the Petexbatun Regional Archaeological Project. She demonstrated that composite ceramics were the product of dedicated craft production (Beaubien 2004b: p. 646). Despite the fact that almost all the known examples of composite ceramics come from the Petexbatun area, we are hesitant to proclaim Aguateca to be the center of this technological innovation as Beaubien (2004a: p. 12) does. The fact that composite ceramics have been found at another major center (Tamarindito) and a host of smaller sites (Las Pacayas, Arroyo de Piedra, and Nacimiento) suggests that the production of composite ceramics was widely distributed in the Petexbatun region. The appearance of a figurine at Piedras Negras raises the possibility that the material may be found over at least the entire southern lowlands.

5. Some Technological Considerations

The SCMRE analysis was only able to observe the fabric pattern along breaks in sherds and areas where the surface was abraded. Beaubien states that most of the visible fabric pattern is simply an impression left in the clay matrix. In her experimental reconstructions of the fabrication process, she heated samples to temperatures between 350˚C to 1150˚C (Beaubien, 2001: p. 99). The fact that the Los Quetzales samples are impervious to water she says indicates that they had been heated above 600˚C and her experiments also indicated that fibers tended to burn away above 450˚C.

Composite ceramic masks found at Aguateca appear more highly fired than those of Los Quetzales and all traces of fabric in the Aguateca masks are missing but Beaubien (2001: p. 99) concedes that it is not clear if this occurred during production or as a result of the fire that destroyed the palace storeroom in which they were found. Beaubien's operating assumption is that, like lowland Maya ceramics, composite ceramics were fired to about 650˚C. Thus, she concludes "In contrast to the earlier stages of its manufacture, the fired product (both original and replica) cannot be considered a composite, since the textile component was

no longer present to contribute structural reinforcement. Ultimately the material's properties were a function of the surviving clay network" (Beaubien, 2001: p. 99). Beaubien (2004b: p. 642) calls them ceramic laminates.

The sample of sherds, especially of those that have undergone technical analysis, is incredibly small so we have no realistic idea of the range of variation in heating temperatures used to produce composite ceramics. Our experience with the Los Quetzales material has led us to take a more cautious approach. As Beaubien notes, several of the Los Quetzales sherds appear to preserve actual fibers and produced Fourier Transform infrared spectra similar to those of cellulose (Beaubien, 2001: p. 95; Figures 5 & 6). As part of our continuing interest in this composite material, the authors conducted a micro-CT investigation of the largest of the Los Quetzales sherds using a Nikon XT H 225 system (**Figure 4**). The scan captures the woven pattern over the entirety of the sherd and at each layer within the sherd and shows what appears to be the actual presence of fibers. Stereomicroscopic images of the three sherds from Los Quetzales also show the preservation of fibers throughout.

The presence of fibers is a significant point because it has important implications for the nature of the finishing or firing of composite materials and presents something of a conundrum. The problem is that the results of the heating trials are simply experimental and may not closely mirror the conditions of pit firing in ancient times. It is also likely that the heat may have been more variable in ancient firing and the Los Quetzales sherd is thicker so that interior temperatures may have been lower. The presence of fibers in the Los Quetzales sherds does suggest that the original object may have been low fired. Given how little data are available on the technology, we feel that it would be helpful to examine another artifact that has not been previously discussed in the literature.

The Petexbatun Regional Cave Survey recovered a second unusual clay artifact from the Cueva de Río Murciélago in the form of a small jaguar head pendant (**Figure 5**). The pendant appeared to be ceramic until washed when it began to

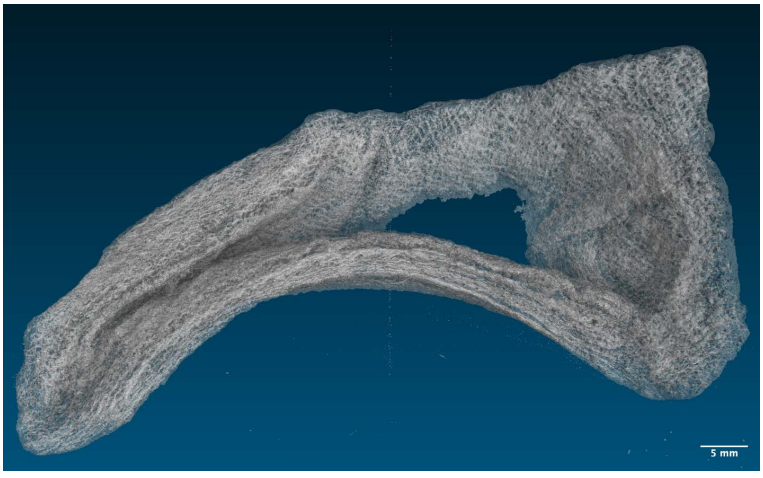


Figure 4. 3D rendering (partial) of CQ1-13-6 showing textile impression and multiple layers in cross-section.

Figure 5. A small jaguar pendent found in the Cueva de Río Murciélago, Dos Pilas was unfired or so low fired that it began to dissolve when washed.

fall apart. The piece was saved by immediately consolidating it in Acryloid B-72. The artifact had been, at best, heat hardened and had only survived because of the protection afforded by the cave environment. The pendant, as with the composite ceramics, suggests that hard firing of clay objects was only one option open to the Maya, although the failure to hard fire an object drastically reduced its survivability.

It is instructive to view the issue of preservation and survivability within the context of the Cueva de los Quetzales because it provides an underappreciated perspective on the issue. It was immediately noted that Los Quetzales resembled a number of other caves with chimney-like openings down which offerings had been dropped to form a midden at the base (Brady & Rodas, 1994, 1995). In fact, Thompson (1975: pp. xxxix-xli) pointed to these as exemplifying a major use of caves as places for the "Depositories of Ceremonially Discarded Utensils." Investigations since Thompson's time have shown this to be a variant on a larger pattern of intentional breakage associated with ritual. This was illustrated in the Cueva de Sangre at Dos Pilas where several hundred meters of the passage beyond the entrance were paved with ceramic vessels deliberately smashed in a muddy trench. The point for our discussion here is that from the start of production of ritual paraphernalia, the use-life was recognized as being very short. Thus, the lack of survivability caused by low firing would not have been an important concern to the Maya.

Beaubien (2001: p. 97) identifies the ceramic component in composite ceramics as a finely textured, well-levigated clay matrix suggestive of a slip. This is not what the micro-CT scan revealed. The images show many small, high-density objects within the clay suggesting that the matrix used in the production of the piece was not as fine as assumed. There may be several explanations for this. The matrix used for the Aguateca masks may well have used a finely ground matrix while the matrix used for other classes of objects was more variable. Our evi-

dence suggests that this is the case. Unfortunately, our data are still limited in this area. Interestingly, the scan also revealed what is likely a seed in the large sherd because of its hard shell and soft interior that was probably unintentionally incorporated into the matrix (Figure 6).

A careful consideration of the Los Quetzales sherds is informative in that it demonstrates that each belonged to a different type of vessel (Figure 7). The largest sherd (CQ1-13-6) is 76 mm × 34 mm across its greatest dimensions (Figure 8). Its greatest thickness, which occurs along a folded segment, is 9 mm while the thinnest section is 4.5 mm. Beaubien (2004b: p. 644) says, probably referring to this sherd, that it could well be imagined as representing facial features, implying that it could be part of a mask. We find this unlikely for several reasons. First, Beaubien (2001: p. 97) states that most of the composite sherds are between 1 - 2 mm thick, meaning that the Los Quetzales sherd is five times or more the thickness as the sherds belonging to masks. We feel this is significant and probably relates to the object having a different function than masks.

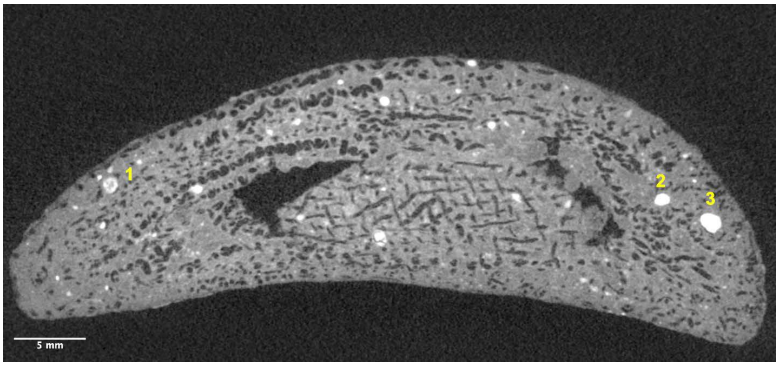


Figure 6. Slice from micro-CT of CQ1-13-6 showing inclusions of various sizes and densities throughout. Some of the largest inclusions measure 1.04 mm (1), 1.02 mm (2), and 1.42 mm (3). Some inclusions are biological objects such as seeds (1) while others are very dense and are likely small pebbles.

Figure 7. Photograph of the three Cueva de los Quetzales ceramic composite sherds.

Figure 8. Photo of the sherd from CQ1-13-6 showing the exterior surface (top) with a magnified image of the encircled area revealing exposed fibers.

Second, the sherd folds back on itself, making it difficult if not impossible to remove if it had been constructed on a mold. Finally, the interior surface is not smooth which one would expect if it had been pressed onto a mold. This suggests a different fabrication technique than has been considered thus far. Most people can picture a facecloth wrung out and allowed to dry so that it becomes stiff in this position. We propose that the fabric provided precisely this type of support in forming curving objects.

A smaller sherd (CQ1-11-8) measures 53 mm × 41 mm across its greatest dimensions, with a maximum thickness of 6 mm and a minimum thickness of 4.8 mm (Figure 9). The exterior surface appears to be burnt while the reverse side is unburned with an orangish unslipped finish. A straight sided, circular hole, 7 mm in diameter, possibly for suspension, was punched in it before heating or firing. A number of fibers, some burnt, are still preserved on the exterior surface while a fabric pattern is discernable under raking light on the interior surface. This sherd appears to belong to a round object or vessel because of a 26.7 mm segment of an edge still being present which allowed for a reconstructed diameter of approximately 140 mm. The remaining portion of the side wall is only 9.9 mm high.

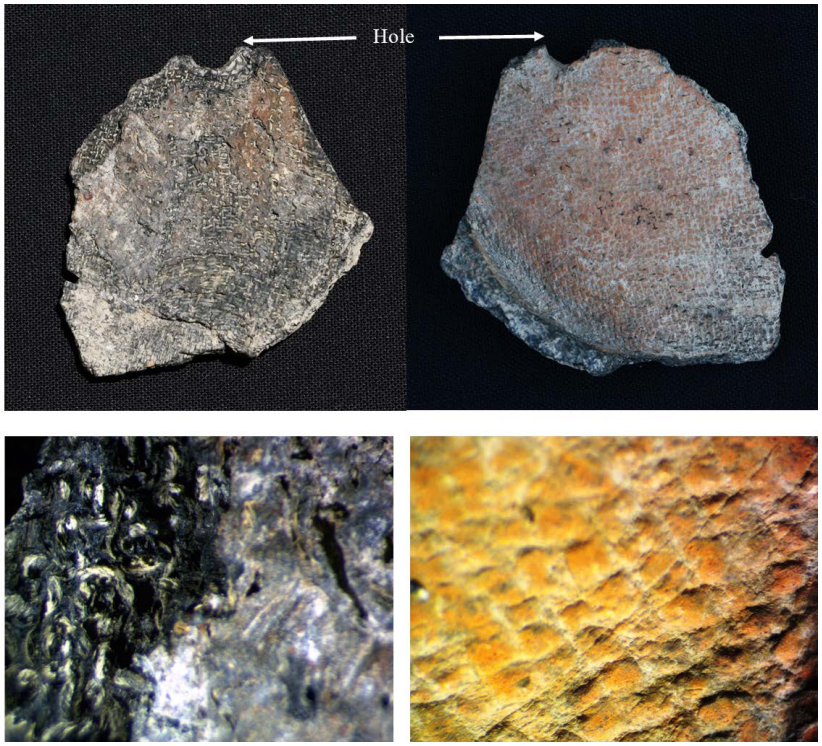


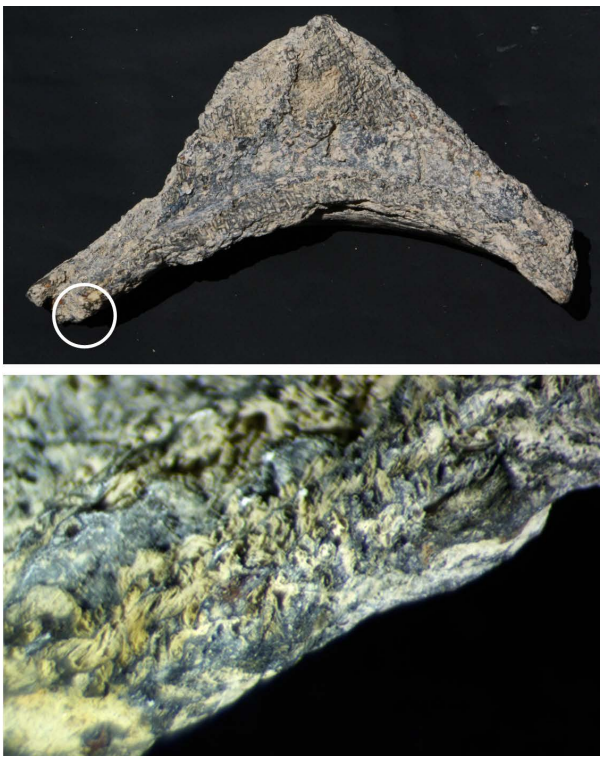
Figure 9. Photo of sherd (CQ1-11-8) showing: (left) the exterior surface and (right) the interior surface with their respective magnified surfaces showing the presence of fibers.

The third sherd (CQ1-13-6) although fragmentary, measuring 71 mm × 28 mm across its greatest dimensions and 6 mm thick, has a recognizable form. It belongs to a coarsely finished, black unslipped bowl with outflaring sides and what appears to be a convex interior. Incised lines are discernable where the sides meet the base. The sherd sits on a ring base with the exterior wall exhibiting a black slip. Preserved fibers were observed on both the internal and external surfaces (**Figure 10**). A similar bowl from Las Cuevas, Belize was illustrated by Digby (1958: Fig.3) and Naj Tunich, Guatemala produced a number of examples (Brady, 1989: pp. 214, 216, Fig. 5.16). Borhegyi (1959) proposed that they were used with three-pronged incense burners.

6. The Social Context of Composite Ceramic Production

We are also cautious in our approach to the function of composite ceramics and their place within the fabric of ancient Maya society. We know that composites produce a rigid but light-weight material with the fabric providing the strength and flexibility during the forming process to permit the production of unusual and diverse shapes. The Aguateca masks provide a striking example of one application of composite technology. These, however, are the only examples that provide a clear indication of form and function, and as such have dominated the thinking about the nature of composite ceramics. As archaeologists and ceramic analysts, we are uneasy that there has not been more attention to the sherd inventory. A number of sherds were plainly not masks but rather appear to belong

(a)



(b)

Figure 10. (a) Side view of the smaller sherd from CQ1-13-6 sitting on its ring-base (top) and a magnified view showing fibers present along the break (bottom); (b) Photo of the smaller sherd from CQ1-13-6, showing the interior of the vessel (top). Magnified view of the encircled area showing fibers along a break (bottom).

to some type of vessel. The greater the number of forms produced should be directly related to the number of functions and this in turn has implications for the scale of production. At this stage, we clearly have only the most rudimentary understanding of how this technology was used.

We are uncomfortable, however, with the interpretation of composite ceramics as being "highly restricted or specialized in its use" (Beaubien, 2004a: p. 12). The justification for this position is that "the majority of fragments were found in high status contexts" but since the majority of excavations occurred in high status contexts the association was predictable and does not prove the point. No search of nonelite contexts has been conducted, so the distribution of composites within society must be considered an open question. Here once again we feel the interpretation of the technology has relied too heavily on the spectacular Aguateca finds within a severely limited data set. The interpretation, if accepted, could be detrimental to our understanding if it limits the parameters of future investigation.

The Los Quetzales examples raise some interesting conceptual questions on this issue. It should not be thought that the breakage that produced the Los Quetzales deposit is a feature specific to cave ritual. The placement of the opening to the cave at the intersection of the two principal plazas at Las Pacayas/Los Quetzales marks this as elite space, but it must be emphasized that the material recovered from within the cave consists of objects used in rituals performed in the plazas. In this respect, the Los Quetzales material fits well with the utilization that Beaubien (2001: p. 8; 2004a: p. 12) proposes for the masks from Aguateca. In fact, the two sites share other elements of their assemblages. Among the elite items found in the same room that produced the masks at Aguateca were three small ceramic drums and Inomata et al. (2010) devote a chapter to drums in their report. Las Pacayas produced an even larger assemblage with over 300 sherds belonging to drums. We return to the Los Quetzales context because we see an implicit assumption with elite association that the material must have been considered precious and with a restricted distribution because of cost. At Aguateca these items were kept in the king's storeroom, but at Las Pacayas both composite ceramics and ceramic drums appear to have been casually destroyed at the conclusion of each ritual. So, were these objects precious? They may have been, but we have no data on this point. At Dos Pilas, we have evidence of large quantities of wealth and imported items being deposited in caves as part of rituals (Brady, 2005). We also see significant expenditures being made for ritual by the elites of Tipan Chen Uitz, Belize who arranged for the capture and transport alive of four large, blue/green parrot fish some 50 km inland for sacrifice at Midnight Terror Cave (Brady et al., 2019). So, it is possible that items like composite ceramics and ceramic drums were costly. The destruction of such items after only a single use would be the type of display of conspicuous consumption consistent with Inomata's (2006) idea of the Maya as a theater state. Our point is that the jury is still out on this issue.

What then is our reluctance to accept a restricted, elite use of composite ce-

ramics? In a word, it is too simplistic in that it embraces the common archaeological dichotomy of elite vs. commoner as reflecting wealthy vs. poor. In a previous study of ritual economy at Dos Pilas, it was shown that high percentages of a number of artifact categories, especially those associated with imported materials and specialty production, were expended on cave ritual (Brady, 2005). That study was heavily influenced by Wolf's (1966) observations of living peasant societies because those are grounded in actual human behavior. Wolf notes that peasant production is aimed at three areas, the "ritual fund" being the focus of our discussion here. While the nature of the expenditures may differ between elite and commoner, Wolf's underlying point is that the non-elite had expendable resources for ritual.

It is here that our concern for an excessive focus on the Aguateca masks comes into play because we are not suggesting for a moment that the non-elite would be commissioning composite deity masks. They would have had no use for such objects. Rather, if a composite figure (for instance the Piedras Negras figurine) or a vessel were considered to be appropriate or necessary there would have been resources available to acquire it. It is for that reason we expressed our interest in the sherds that may not belong to spectacular objects. While the spectacular objects attract our attention, it may be the more pedestrian production that, because of numbers, actually sustained the craft.

Furthermore, there is an implicit assumption that this was a highly specialized form of craft production. Although Beaubien acknowledges that all of the elements for the production of composite ceramics were available to the non-elite, the implications were never explored. There is no shortage of figurines that depict ancient Maya women weaving in the same manner that they do today. Thus, all of the raw materials were in the hands of specialists with an intimate knowledge of ceramic technology so we shouldn't assume it is a specialist-only craft. Our position simply assumes that the knowledge of composite ceramic production was widely diffused in Maya society which seems to us to be more logical than the view that it could be kept highly restricted.

7. Conclusion

This article recenters the discussion of composite ceramic pottery production in the Maya lowlands by stressing the very superficial nature of our knowledge based upon a limited sample of identified sherds from a handful of sites. Our discussion of the first discovery of composite ceramics at the Cueva de los Quetzales argues that the failure of a century of ceramic analysis to report the existence of the composite technology is, given the circumstances, not only understandable but not even particularly surprising. Composite sherds resemble other ceramic sherds and most on cursory inspection do not appear to warrant a closer look. As ceramic analysts ourselves this is a telling point when one may have tens of thousands of sherds to analyze. It should also be noted that the distinguishing characteristics of composite sherds, light weight and unusual forms, are

not as apparent in contexts of high traffic and poor preservation.

We have also proposed based on the presence of fibers surviving within the Los Quetzales sherds that heating or firing of composite ceramics may have been quite variable with a significant percentage being low fired. We illustrated this by presenting a clay jaguar head pendant that was so low fired that it was not impervious to water. Such objects would generally not survive to be found by archaeologists.

We also expressed our concern that the Aguateca sherds have played too great a role in the interpretation of our very limited data set. Aguateca has been proposed as the center for this new technology simply because it has produced more sherds than any other site. That number is, however, so small that another project could easily displace Aguacteca with a single significant find. Given that situation, it seems advisable to withhold our judgement until we have more information. The same criticism can be made about the forms produced using composite technology because the two Aquateca masks are the only cases where we have an idea of form. Our knowledge of form is clearly our weakest area (Beaubien, 2004b: pp. 645-646).

Because of Maya archaeology's pattern of excavating primarily in the site core, the composite ceramics have been recovered exclusively from elite contexts and since the two composite items for which we have forms, the Aguateca masks, are clearly elite artifacts, composite technology has been interpreted as being produced exclusively for elite needs. We are simply not prepared to embrace such a leap beyond the meager data. The position becomes even less tenable if, as we propose, all Maya ceramists could have been producing composite ceramics. We have adopted the position that there may have been substantial composite ceramic production, while recognizing that items not hard fired would not survive. The challenge for the field is to investigate non-elite spaces in search of evidence of composite ceramic use.

Given our very limited sample of composite ceramics, we have attempted to throw as wide a net as possible in our interpretations of the material so as not to exclude any possible avenues of investigation. We are impressed with the need to move deliberately out of a sense that a technology that was able to elude our notice for a century may still not be ready to yield all of its secrets.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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