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ANCIENT MAYA MOSAIC MIRRORS: FUNCTION, SYMBOLISM, AND MEANING

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Abstract

This paper examines the composite lithic artifacts of the ancient Maya commonly termed "mirrors." Typically flat, shiny objects with polished iron-ore polygons fitted in a mosaic pattern onto a slate backing, we assess these plaques for the technological, spatiotemporal, and functional contexts of their manufacture. Data from over 500 archaeological specimens, from dozens of Maya sites in Mexico, Guatemala, Belize and Honduras, were examined as part of this study. We also consider the iconography, epigraphy, and possible symbolism of these curious artifacts. Based on this analysis, we conclude that ancient Maya mosaic mirrors were employed in rituals, often by elite individuals, as both symbols of authority but also, importantly, as possible mystical devices for divinatory "scrying." They were highly valued, often beautifully made, reflective ceremonial objects whose possible use for prognostication in shamanic rites likely has great antiquity in Mesoamerica.

During the pre-Columbian era the Maya, as well as some other Mesoamerican societies, manufactured finely made, highly polished plaques, more commonly called "mirrors" due to their size and highly reflective surfaces (Ekholm 1973; Mason 1927). Some of the oldest mirrors known from Mesoamerica were made by the Olmec culture of Mexico in the Early Formative period (ca.1200–1000 B.C.) from a single, highly polished, often concave, piece of iron-ore (Carlson 1981; Cheetham 2006:45; Coe and Diehl 1980:243–244, Figure 251; Heizer and Gullberg 1981). Polished mirrors have been described as "enigmas" (Carlson 1981:131), "prestige" or "luxury" goods (Flannery 1968:79–110), indicators of high status (Brumfiel and Earle 1987:4; LeCount 1999:249), "power objects" (Saunders 2003:22), "elite markers" (Grove 1997:76), and as "essential accompaniments" to elite Classic Maya burials (Coe 1988:227–228; Healy et al. 2004a:234–235).

In contrast to the monolithic Olmec specimens, ancient Maya mirrors tended to be somewhat larger, composite artifacts—flat plaques usually composed of a slate backing with a shiny surface made of polished pyrite or hematite polygons assembled in a mosaic pattern (Kidder et al. 1946:126–133) (Figure 1). Despite some differences in mirror construction and materials, we suspect that these Maya objects served the same purpose as the much earlier Olmec specimens, and that this function was both political and, especially, ritual in nature.

Many of the Maya pyrite-encrusted plaques have drill holes in them, suggesting that they were once attached to another surface, such as clothing, or were mounted on wooden frames. Our research reveals that hundreds of archaeological specimens have been found at sites in the Maya subarea (southern Mexico, Guatemala, Belize, and the western portions of Honduras and El Salvador). Well preserved, whole specimens are relatively rare. Nonetheless, extant specimens do have a high degree of homogeneity in their design, raw materials, methods of manufacture, and final appearance. There is also considerable consistency in their archaeological contexts and associations. Surprisingly, there have been few detailed studies of these unusual products. Previous examinations have focused specifically on iconography and ethnohistory (Saunders 1988; Taube 1983, 1992).

In this paper, we review what these material objects look like, how the mosaic plaques were made, their archaeological occurrences, and their representation in ancient Maya art and hieroglyphic texts. Blending archaeological, artistic, epigraphic, and ethnohistoric information, we present suggestions for the function and meaning of ancient Maya iron-ore mirrors. We conclude that these well-made, composite, lithic reflectors were highly valued ceremonial artifacts used by their owners (almost always elite individuals) for religious divination and prognostication, based on age-old rites of scrying in attempts to make direct communicative contact with a spiritual Otherworld.

ANCIENT MAYA MIRRORS

Recently, Blainey (2007) described in detail the archaeological occurrence of over 500 mosaic mirrors found at 41 sites, in both the highlands and lowlands of the Maya subarea. Specimens were recorded for their size, raw materials, contexts, and age. Investigations have shown that iron-ore mosaic mirrors are relatively rare artifacts at most Lowland Maya sites, often with no more than one or two specimens found at a center. By contrast, several specific Highland Maya sites have produced large quantities of mirrors. Kaminaljuyu and Chama, for example, each have in excess of 35 recovered plaques, while over 200 mirrors were excavated from Nebaj early in the last century. Such concentration of these unusual artifacts suggests that the Highlands may have been important as a source of raw materials, as well as a production locale of

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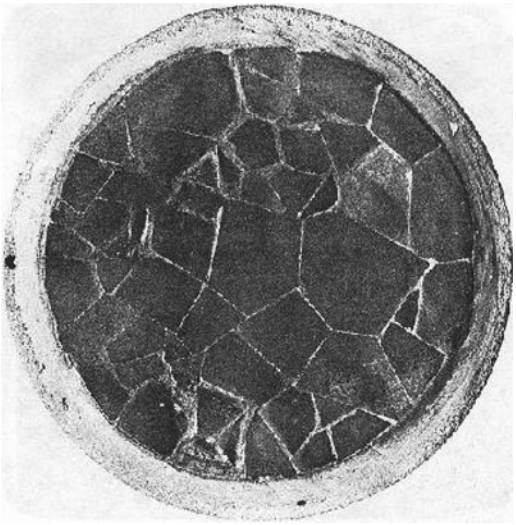


Figure 1. Round Maya mosaic mirror, pyrite with slate backing, from Kixpak, Guatemala (after Mason 1927:205; courtesy of Robert Sharer, University Museum, University of Pennsylvania, Philadelphia). Diameter 11.3 cm.

mirrors, for both local consumption and possibly interregional export and trade. While some archaeological specimens are whole, most are broken (probably intentionally) and recovered as fragments in elite Maya burials or ceremonial caches. The vast majority (n = 276, 97%) of Maya mirrors of known form are circular, flat disks, although the occasional mirror was oval or even square in shape (Figure 2a and 2b). Of 73 whole mirror backs with documented dimensions, diagonal measurements range from 5.6–29 cm, with an average of 15.1 cm; of these, 17 have a measured thickness ranging from 3–72 mm, with an average of 12.3 mm (Blainey 2007:Appendix A). Many whole specimens are almost perfectly round, suggesting the use of a compass-like device to provide precision in design.

Most of the known Maya mirrors (n = 113, 72%) have slate backings (sometimes also labelled shale, schist, or mudstone by archaeologists), although a small portion were made of sandstone, pottery, or possibly even shell. A few plaques appear to have once had wood, or wood and bone, basal frames around them, although such organic additions rarely survive the harsh tropical climate (Bullard and Bullard 1965:Figure 16). At least one Postclassic period specimen from Lamanai has an unusual pottery frame surrounding it (Figure 3).

While most Maya slate mirror backs are plain, a few are more ornate in design. A carved specimen from Kaminaljuyu, for example, has a complex volute decoration on the back reminiscent of designs from the Classic Veracruz culture of the Gulf Coast of Mexico (Kidder et al. 1946:Figure 14). Teotihuacan-style motifs, derived from highland central Mexico, are carved on the backs of several mirrors from Early Classic contexts at the site of Copan (Bell et al. 2004) (Figure 4). There are also slate mirror backs with Maya hieroglyphic texts carved on them, including specimens from Rio Azul (Adams 1999) and Topoxte (Figure 5) in Guatemala, the latter of which yields a phonetic spelling of the phrase *u-nen*. In Maya, *u* means "his," while *nen* probably means "shiny surface" or, more likely, "mirror" (Fialko 2000; Martin et al. 2004:46). Other examples of mirrors bearing glyphs have been found in Costa Rica, over 850 km to the south of the Maya heartland (Schmidt et al. 1998:628–629, Plates 433–434; Stone and Balser 1965), elucidations of which have yet to be published (Dennett and Blainey 2008; Mora-Marín 1996; Reents-Budet et al. 1995) (Figure 6).[1] Some Maya mirrors also show traces of stucco (lime plaster) coatings—likely once painted—or traces of cinnabar (red ochre) commonly associated with elite Maya burials (Bell et al. 2004). Clearly, these objects were valued highly, and were widely-exchanged works of art executed by very skilled Maya artisans.

Most of the mosaic iron-ore polygon pieces (n = 155, 81%) were made of pyrite (FeS_2), with a smaller proportion (n = 37, 19%) identified as hematite (Fe_2O_3), often crystalline hematite, glued to the backing with an unknown adhesive. The highly polished pyrite polygons, frequently with a brassy-golden color, provided the mirrors with their reflective (if fractured) surface. Over the centuries, due to moisture, pyrite polygons have often deteriorated to a rust-like accretion atop their backings. Consequently, it is far more common to find the slate backing of a mirror than the original polygons, although the outlines of the decomposed reflectors occasionally remain as ridged deposits of adhesive on the slate surface (e.g., at Piedras Negras; see Coe 1959).

PRODUCTION OF MAYA MOSAIC MIRRORS

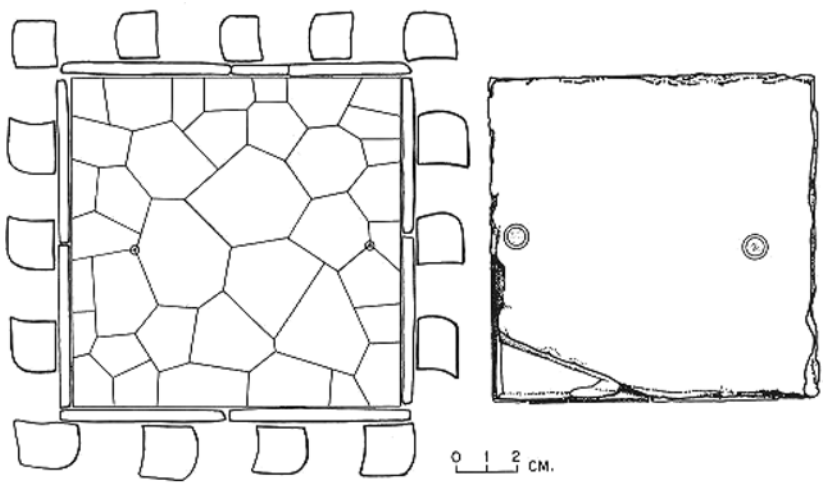
Given that the most common raw materials employed in Maya mirrors were slate and pyrite, the Guatemalan Highlands are a likely center for production, with completed plaques then being traded to the Lowlands (Willey 1972:142).[2] Healy and associates (1995) have identified two slate-producing zones in the Highlands of southern Guatemala: the Santa Rosa Group (near Zaculeu, Nebaj, and Utatlan) and the El Tambor Group (near San Augustin Acasaguastlan) (Figure 7). Blainey (2007:168–175) notes that significant raw iron-ore deposits (from which pyrite and hematite could have been extracted) also occur in southern Guatemala and neighbouring Honduras.

An alternative (or additional) source of raw materials for the mirrors occurs further north. Slate is found in abundance in parts of the Maya Mountains of central Belize and northern Guatemala, closer to many of the Central Maya Lowland sites from which mirrors have been recovered. Indeed, the earliest archaeological evidence for slate mirrors comes not from the highlands but from the Belize Valley. Awe (1992:302, Figure 91a) reports a fragmentary slate mirror back from Cahal Pech that dates to the Middle Formative period (ca. 600 B.C.). In addition, considerable evidence for ancient Maya working of slate, including a Late Classic period (A.D. 550–900) slate workshop, occurs nearby at Pacbitun on the edge of this slate-bearing zone of the Maya Mountains (Healy et al. 1995:343, 2004b:211).

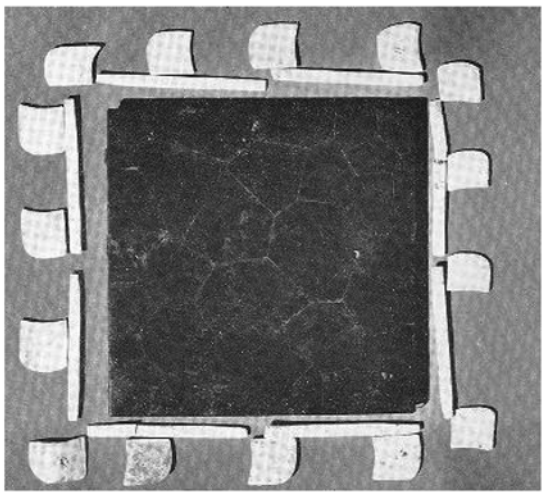
[1] David Mora-Marín has studied the two slate-backed disks (see Figure 6) from Costa Rica, and produced a detailed analysis of the epigraphy and style of these artifacts, both of which he dates to the Early Classic period. The occurrence of these Maya objects (and others) so far to the south raises interesting questions about cultural contacts and possible exchange between cultures of the two regions.

[2] Unquestionably, some of the largest quantities of Maya mirrors have been found at centers in the Guatemalan highlands, such as Nebaj, Chama, and Kaminaljuyu (approximately half of all known Maya mirrors derive from these three highland sites; 40% are from Nebaj alone).

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(a)



(b)

Figure 2. (a) Drawing (left, front view; right, back of plaque with drill holes) of an elaborate square Maya mosaic mirror, pyrite with slate, bone, and possibly wood, from Baking Pot, Belize (after Bullard and Bullard 1965:Figure 16; with permission of the Royal Ontario Museum © ROM). 10.8 × 10.8 cm (excluding bone frame). Thickness 0.9 cm; (b) Photograph of same (front view) (after Bullard and Bullard 1965:Plate XXI; with permission of the Royal Ontario Museum © ROM).

As such, there are several possible resource zones which may have provided materials in antiquity for the slate backings. In the absence of definitive geological testing, the exact source of the raw materials used for the mirrors found across the Maya Subarea remains unclear. It is possible that multiple mirror-manufacturing centers were in operation by the Classic period but, if so, these adhered closely to an almost formulaic template for mosaic mirror production.

SPECIALIZED TECHNOLOGY

Several early writers have commented on the time-consuming and painstaking craftsmanship involved in mirror production (Kidder et al. 1946; Smith and Kidder 1951:44). Figure 8 shows the carefully-layered construction of a typical Maya slate-backed pyrite mosaic mirror. Described as "masterpieces of the stoneworker's craft…the few undecayed…pieces of pyrite are so perfectly shaped and fitted that the joints are almost invisible, a result of long and careful grinding of each bit of pyrite" (Woodbury 1965:172).[3]

The fact that some mirrors have hieroglyphic texts carved on them, with many others found in either elite burials or ritual caches honoring monumental architecture, points to an aristocratic, if not royal, association for many of these objects. Based on what is presently known about ancient Maya society, it is likely that the mirrors were made by artisans with specialized knowledge and skills, and perhaps even royal lineage

[3] We have been alerted to the efforts of Dr. Emiliano Gallaga Murrieta (Director, Centro INAH, Chiapas; Museo Regional de Chiapas, Tuxtla Gutierrez) to reproduce, experimentally, one of these Maya mirrors, complete with pyrite mosaic pieces and stone backing, using only the tools and techniques that would have been available to the ancient Maya. So far, he has succeeded in making a respectable backing and one pyrite mosaic piece. He is currently researching the entire process of mirror manufacture and will publish his findings in the future.

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Figure 3. Round Maya mosaic mirror, pyrite with slate backing, enclosed within a ceramic ring frame, from BU N10-4/3, Lamanai, Belize (courtesy of David M. Pendergast). Diameter 10.5 cm (excluding ceramic frame).

(Reents-Budet 1994:36–71). There are indications of exceptional artists (and even schools of art) being closely affiliated with site rulers, and producing elite goods as craftsmen attached to royal Maya courts (Houston and Stuart 2001; Inomata 2001; Reents-Budet 1994:164–233).[4]

Given the amount of care and technology involved in their manufacture, each mosaic mirror was essentially a work of art. The exquisiteness of the mosaic mirrors led A.V. Kidder, a leading Mayanist of the early twentieth century, to state that: "Nothing produced in aboriginal America seems…to rival these plaques in the matter of skilled and meticulous craftsmanship…" (Kidder et al. 1946:131).

ARCHAEOLOGICAL CONTEXTS

The majority of the 175 mirrors with secure archaeological contexts and chronological detail were found in the highly ritualized contexts of either burials (n = 64, 37%) or caches (n = 46, 26%), with smaller numbers occurring in miscellaneous locations (caves, plaza deposits, storage pits, mound fill, surface finds, etc.) (Blainey 2007:201). Sites from nearly every region of the Maya subarea have produced evidence of mirrors. Furthermore, some of the most spectacular and lavish burials known from the Maya subarea include mosaic mirrors among their contents. These include elaborate burials of both elite males and females (Table 1).

Tozzer (1941:89, Note 376), citing descriptive text from a Contact-period Maya book, states that "mirrors may have been worn on the back or shoulder." From well preserved burial contexts, however, mirrors have been found lying near the head, chest, groin, lower back, and even at the feet of interred individuals (Figure 9). Occasionally, mirrors seem to have been placed on tomb floors at a distance from the body (Kidder et al. 1946:126). Mirrors—or what appear to be mirrors—are also depicted in some Maya art as objects that could be hand-held, often by servants or dwarfs, in front of Maya elite individuals, or mounted on stands.

Chronologically, Maya iron-ore mirrors have been found in contexts dating from the Middle Preclassic period (ca. 600 B.C.) until the close of the Late Postclassic period (ca. A.D. 1520). Based on current evidence, the majority of mirrors from the Maya Lowlands date to the Late Classic period (A.D. 600–900), while peak production and use in the Highlands was during the Early Classic period (A.D. 250–600).

THE ART, ICONOGRAPHY, AND EPIGRAPHY OF MAYA MIRRORS

Having discussed the appearance, manufacture, technology, and archaeological contexts for these elegant plaques, we turn to what we believe are representations of the use of mirrors in Classic Maya art, with observations on their role in Maya iconography, and to what appear to be epigraphic references to mirrors in Maya hieroglyphic writing. Fortunately, there are multiple artistic depictions on Maya ceramics which suggest the manner of mirror use. Ancient Maya polychrome, pictorial vases often reveal vivid depictions of elite Maya life (Reents-Budet 1994). Many of these portray the royal Maya palace as "an active locale—a stage—for the rhetorical and performative processes of governance" (Reents-Budet 2001: 225).

A key resource for painted representations of mirrors is Justin Kerr's online Maya Vase Database (Kerr 2006), an extensive collection of rollout photographs of these pictorial vases. A typology of Maya mirrors appearing on these painted polychromes from the Kerr database can be found in Blainey (2007:Appendix B). Here we highlight just a few of the specimens which depict mirrors in use.

Mirrors on Maya Polychrome Vases

K505. In this scene a monkey with a scribal headdress dances while looking into a mirror that he holds in his hand, juxtaposed with a dog-scribe staring blankly into the dark cavity of a large *olla* or jar lying on its side (Figure 10). Reents-Budet (1994:50) describes the "pictorial manipulation, pictorial composition, hieroglyphic writing and historical and religious knowledge" evident in the remarkable works of Maya painters, indicating that the master artist or *itz'at*[5] "was truly a savant, a literate person in command of Maya history, cosmology, and religious knowledge." In this way, the scene depicted on vase K505 suggests the elite artist's personal contemplation of light and dark, or life and death, such that the mirror in this scene represents a powerful symbol of life and light.

K530. The ritualized scene on this vase is described as: "4 toothless old deities prepare for a ceremony to (the Maya [supreme] god) *Itzamna*…2 will take enemas, 1 is inhaling drugs,

[4] Evidence of possible mirror production has been reported recently from the rapidly-abandoned Maya site of Aguateca (Aoyama 2007; Inomata et al. 2002:310–318). Excavations recovered over 300 pieces of mosaic pyrite mirror fragments on the floor of one room in Structure M8-4 (The House of Mirrors). This range structure, positioned adjacent to the royal Palace Group, appears to have been occupied by a high status courtier and his family during the Late Classic period.

[5] The embedding of glyphs throughout this discussion is aimed at underscoring the textual nature of the Maya script so that these glyphs, so often discussed in Mayanist literature, are presented as equal alongside our own alphabetic system. We thank Scott Johnson (Tulane University) who generated these embedded glyphs as "computerized vector graphics" (drawn using Open Office, adapted from Montgomery [2002a]) for granting permission to publish the results of his innovative technique herein.

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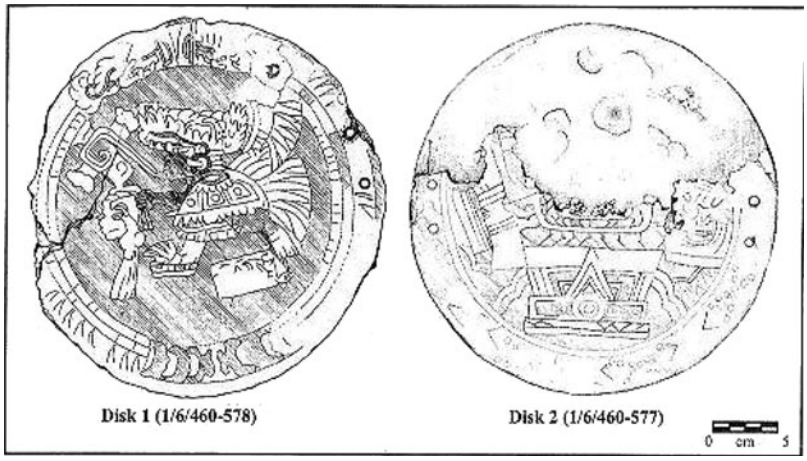


Figure 4. Drawings of round, carved, slate mirror backs from Margarita Tomb, Chamber 1, Copan, Honduras. Backs were both stuccoed and painted with Teotihucan-style designs (after Bell et al. 2004:140; courtesy of Robert J. Sharer and the University Museum, University of Pennsylvania, Philadelphia). Diameter ca. 21 cm. Drawings by Nelson Paredes.

and the last puts on makeup, all [to] the accompaniment…[of]… musicians" (Kerr 2006) (Figure 11). The one who is applying black paint to his face appears to be using a mirror, held by a female assistant, as a vanity aid. However, such practical use of mirrors is unlikely, as iron-ore mosaics would have produced a distorted, multiplied reflection of the onlooker. In contrast to the Western-centric interpretation of these Maya "mirrors" as serving a cosmetic function, it must be pointed out that the painting of the face in this scene, particularly the same black as the face of the mirror, more likely served a function of ritual metamorphosis associated with the mirror's dark surface: "The foregrounding of skin as a subject in some images makes clear that it was conceptualized as a bodily boundary, a site of conjunction of bodily identity, and a medium for transformation from one state to another" (Meskell and Joyce 2003:49). Mirrors may have been tools to facilitate this transformational process.

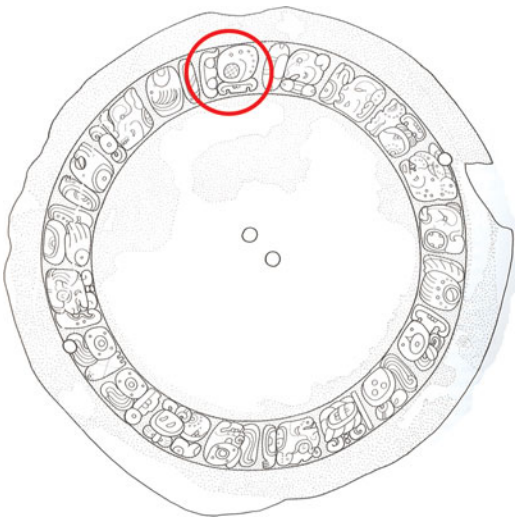


Figure 5. Drawing of round, carved, slate mirror with hieroglyphs from Topoxte, Guatemala, with circle highlighting phonetic glyph *u-nen*, meaning "his mirror" or "his shiny surface" (Fialko 2000).

K559. On the left of the rollout photograph (Figure 12), one sees "the Moon Goddess giving birth to the rabbit," while on the right there is Goddess O nursing the newborn rabbit (Kerr 2006). The rabbit, a Maya symbol of the moon, is shown falling onto (or in front of) a mirror situated directly where the cosmic World Tree grows (Miller and Taube 1993:127, 142; Schele and Miller 1986: 143–144). The scene depicts deities employing mirrors which are made, and also used, by the elite Maya, suggesting that mirrors were perceived as jointly used by gods and humans.

K2929. This painted image is very revealing in terms of the functions of ancient Maya iron-ore mirrors. It is important to note that ancient Maya iconography utilizes *synaesthesia* where "the modality of sight gleans signs that are intended to carry meaning, sound, and scent" (Houston and Taube 2000:263). In K2929 (Figure 13), the mirror partitions a human figure and an anthropomorphic rabbit. The latter character can be interpreted as a Maya *way*, or spiritual co-essence (Calvin 1997; Grube and Nahm 1994; Houston and Stuart 1989) with which the human figure is communicating *via* the mirror. In this scene, the mirror appears to act as a bridge between two normally divided worlds. This notion of the mirror as a possible communication device between the human realm and the spiritual Otherworld is strengthened by the fact that the *way* rabbit is emitting "speech scrolls" above and across the mirror towards the human figure (see Evans 2004:271; Houston et al. 2006:139; Houston and Taube 2000:275; Meskell and Joyce 2003:46).

K5764 & K7265. These two vases present scenes with the familiar palace setting, but with godly actors replacing the more customary mortal figures. Both scenes involve the supreme Maya god Itzamna, identifiable by his headdress with overhanging front tassel (Freidel et al. 1993:40; Miller and Taube 1993:100), interacting with animal spirits. In K5764, he sits before the Vulture deity connected with Maya kings (Schele and Miller 1986:325), who presents a bundle to the supreme deity (Figure 14). In K7265, Itzamna sits with a dog, an animal customarily associated with the Underworld in Mesoamerican belief systems (Reents-Budet 1994: 275; Evans 2004:215; see also K505) (Figure 15). A mirror is

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Figure 6. Photographs of round, carved slate mirror backs with hieroglyphics, from La Fortuna (left) and Nicoya (right), Costa Rica (Schmidt et al. 1998:629, Entries 433–434). Left, Diameter 17.0 cm, Thickness 2.0 cm; Right, Diameter 22.0 cm, Thickness 2.0 cm.

present in both scenes, suggesting that if deities also possess and use mirrors, that the surfaces of these Otherworld mirrors are merely the reverse side of the same mirrors used by rulers (and other elite individuals) in the human realm. Importantly, these two scenes seem to illustrate what the ancient Maya believed was taking place on *the other side* of their divinatory reflectors.

Curiously, mirrors do not seem to be depicted in Maya public art, such as on monuments (stelae and altars), or on architecture in public settings (Helmke et al. 1998:107).[6] To the best of our knowledge, no Maya inscribed monuments bear depictions of rulers holding mirrors or wearing mirrors on their elaborate regalia. Instead, representations of mirrors occur exclusively on what might be better termed "private," or personal works of art, such as ornate carved or painted pottery.

Maya Epigraphy and the "Reflective Surface Complex"

Recent advances in the translation of Maya hieroglyphs have permitted modern researchers to undertake cognitive archaeology, beginning to peer "into the minds of ancients" to understand their pre-Columbian worldview (Coe 1992; Flannery and Marcus 1996; Golden and Borgstede 2004:3; Houston 2000). In the following discussion, we parse out signs which some Maya epigraphers have construed as referring to mirrors, or at least symbols indicative of "shininess," and trace the wider distribution of these signs. This analysis will aid in the larger pursuit of insights into the functions of iron-ore mirrors within ancient Maya society, which increasingly point to their role in ritual scrying.

Glyph T24/T617. Originally assigned two different "T-numbers" in Thompson's (1962) *Catalog of Maya Hieroglyphs*, the elliptical Maya hieroglyph encapsulating one, two, or three curved bands appears as both a supplement to larger glyphic compositions (T24) and as a autonomous glyph with an independent meaning unto itself (T617). The glyph consists of curved bands either empty or crosshatched, and appears most frequently as an elemental component of a larger glyph whose meaning is not (so far) immediately related to mirrors. Nevertheless, the glyph is widely and consistently taken as the representation in Maya writing of a mirror (Montgomery 2002a:95; Schele and Miller 1983; Schele and Miller 1986:49), perhaps signified by the curved lines as shafts of reflected light. Recently, the glyph has been interpreted as symbolizing a "celt" or "reflective stone" (Macri and Looper 2003:273–275). The polyvalent nature of the Maya script, however, makes an assessment of this glyph's exact meaning difficult to pin down. This problem arises in the apparent use of T24/T617 by the Maya to indicate the notion of "shininess," where its occurrence can also denote, for example, volcanic glass (obsidian) blades (Schele and Miller 1986:176), shiny celts (Houston et al. 2006:72–73; Iannone 1993:238, 240), or even glossy shell "tinklers" (Kidder et al. 1946:145–148).

The significance of the T24/T617 glyph was discussed in an influential work by Schele and Miller (1983). Although the original interpretations put forward by the authors are now dated (Mary Miller, personal communication 2005), they nevertheless succeeded in conveying the iconographic prominence of the glyph. Building on their 1975 collaborations, Jeffrey Miller is credited as the originator of the interpretation that the glyph T24/T617 represents a mirror (Schele and Miller 1983:1).

Perhaps the most insightful passage in this publication concerns the linguistic concepts in the different dialects of the Mayan language family where the expressions *nen* or *lem* demonstrate significant ideational principles that inform the current discussion. In reviewing multiple dictionaries of Conquest-period and modern Mayan dialects, Schele and Miller (1983:12–14) identify multiple examples where the terms *nen* and *lem* function "as the root for (expressions such as) 'lightning,' 'gleam,' and 'shine.'" They discover that variants of *nen* and *lem* during the Contact period also refer to the concepts of "rulers and persons of importance as 'the reflection of the world'… 'succession in office'… 'to think,' 'to imagine,' 'to contemplate,' and 'to meditate.'" This linguistic data is complemented by the occurrence of a phonetic spelling for the same word (*nen*) as a carved glyph on a mirror from Topoxte, Guatemala (see Figure 5); here the full phrase is *u-nen*, meaning "his mirror" or "his shiny surface" (Fialko 2000). This semantic continuity, from pre-Columbian period hieroglyphs to Conquest-period linguistics, acts to fortify the current proposition that mirrors (shiny, gleaming artifacts) served to function within a broader ideological construct encompassing all reflective surfaces found in the natural and human-made worlds. This ancient Maya

[6] While some authors have interpreted instances of Glyph T24/T617 on public monuments as "mirrors" (Tate 1992), we think these are much more likely to be general indicators of "shininess" (Macri and Looper 2003:273–275), and probably represent a vast array of different reflective objects, such as seashells or polished stones.

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Figure 7. Map of Maya subarea. Shaded areas in Guatemala and Belize indicate concentrated geological deposits of slate and iron ores suitable for mirror manufacture. Prepared by Paul F. Healy.

reflective surface complex continues to appear as one observes the occurrence of T24/T617 glyphs in epigraphic contexts conflated with other elements.

The correlation between surfaces that reflect light and the human eye that perceives them appears to have been a pivotal concept in the ancient Maya view of human being-in-the-world. This becomes apparent in the fact that the T24 phonetic version of the "mirror" glyph stands for the syllable *-il* or sometimes *-li*. It is matched by the morpheme *il* (Houston et al. 2006:139), represented by  or  meaning "to see," showing what appears to be the cross-section of an eyeball with lines of vision radiating out from the inner chamber. The passive version of this is *ilaj*, "was seen" , where the curled elements on the left side of the glyph provides an overt connection with the flared-out mirror-back seen in the painted pottery scenes discussed above (Montgomery 2002a:95–97). These examples suggest that the ancient Maya regarded the shiny surface of the eye as the human body's equivalent to a mirror; perhaps an acknowledgement of both entities as liminal thresholds partitioning separate realms. Even more, the T24 syllabic glyph was also used as a suffix to denote where something "exists as an inalienable part of something else…for example, (as) bark bears an inextricable relationship to the tree, and a door relates to its building….in such a way that a door by itself makes no sense" (Montgomery 2002b:147; see also Houston et al. 2006:66–67). As the notion of the T24/T617 glyph is explored in further examples below as indicative of a *reflective surface complex*, the totality of evidence pertaining to iron-ore mirrors is enhanced by an awareness of ancient forms of thought that only these visual and linguistic expressions can reveal.

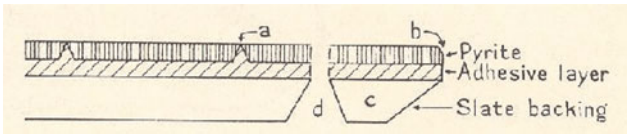


Figure 8. Drawing of a cross-section of an ancient Maya iron-ore mosaic mirror, revealing construction: (a) contact edges of polygonal pyrite plates bevelled for close surface fit; (b) pyrite plates forming periphery of incrustation probably had curving outer edge cut square, but with upper corner bevelled; (c) some slate backings are bevelled; and, (d) attachment holes drilled through the back in this image (after Kidder et al. 1946:Figure 52).

Some Incidences of T24/T617

Ch'ab (T712). This glyph, representing "an obsidian lancet," has a metaphorical polyvalence and is listed as signifying "'do penance, sacrifice'… 'to pierce with a lance,' 'lancing;' when used in parentage relationship statements it may have the meaning 'to create'" (Montgomery 2002a:72; see also Houston et al. 2006: 130–132). The connection of the shiny obsidian lancet to the "piercing" act in bloodletting rituals, a widespread pre-Columbian sacrificial practice, is suggestive of the *reflective surface complex* and breaches in the liminal skin that separates the inside and outside of the atoner's body. This aperture, created by the piercing act of bloodletting, turning a once fixed boundary into a permeable membrane, stands as a possible evocation for the social functions of iron-ore mirrors.

(T24/617:713a:130.116). Identified as a glyph marking a Maya lord's accession to the royal throne by Schele and Miller (1983), allegedly found only on inscriptions at the site of Palenque, it is synonymous with other "accession expressions" (Montgomery 2002b:169).[7] It consists of the phonetic elements in the Mayan language which would translate loosely as *k'al* ("bound/tied/wrapped") the mirror (Montgomery 2002a:145), suggesting a possible function of "suspension holes" found on most mirrors. If mirrors were official symbols of kingship, it is possible that this variant of the accession expression functioned much like the more common rite of *k'al sak hun* (bound/tied/wrapped the white headband), where a white "scarf…would be tied to the forehead" (Martin and Grube 2000:14). In fact, the *k'al sak hun* glyph also appears directly associated with the headband-tying ceremony on the Yaxchilan Hieroglyphic Stairway 3, on Quirigua Stela J (Houston et al. 2006:62), and on one of the incised mirror backs from Costa Rica (Schmidt et al. 1998:628–629).

Considering the pre-eminent status of the king as divinely-sanctioned mediator between the natural and supernatural realms (Martin and Grube 2000; Schele and Freidel 1990:65; Schele and Miller 1986; Sharer and Golden 2004:32), it is understandable that the glyph describing their acquisition of power illustrates their

[7] It is possible that this expression relates to the "mirror" or other shiny object depicted as part of the headdress of the Jester God scepter (see Schele and Miller 1986:53, Figure 43).

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Table 1. Examples of elite (royal) Maya burials with mosaic mirrors

Site (Country)	Grave	Gender	Reference
Altar de Sacrificios (Guatemala)	BU 128	Female	Smith 1972: Figure 49a
Altun Ha (Belize)	Burial B-4/7	Male	Pendergast 1969:18, Figures 10 and 35
Buenavista del Cayo (Belize)	Burial 88B-11	Male	Ball & Taschek 2001
Copan (Honduras)	Burial V-6	Male	Bell et al. 2004:155
	Burial 93-2	Female	Bell et al. 2004:139–141, Figure 8.5
Kaminaljuyu (Guatemala)	Tomb A-I	Male	Kidder et al. 1946
	Tomb A-III	Male	Kidder et al. 1946
	Tomb A-IV	Male	Kidder et al. 1946
	Tomb A-V	Male	Kidder et al. 1946
	Tomb B-II	Male	Kidder et al. 1946
	Tomb B-III	Male	Kidder et al. 1946
	Tomb B-V	Male	Kidder et al. 1946
	Tomb B-VI	Male	Kidder et al. 1946
Lamanai (Belize)	Burial N10-4/3	Male?	David M. Pendergast (Personal communication 2006)
Nebaj (Guatemala)	Tomb Mound 1	Male	Smith & Kidder 1951
	Tomb Mound 2	Male	Smith & Kidder 1951
Pacbitun (Belize)	Burial 1-9	Male	Healy et al. 2004a
Tikal (Guatemala)	Burial 8	Male	Coe 1990
	Burial 116	Male	Coe 1988:233; Trik 1963
	Burial 196	Male	Coe 1990
Zaculeu (Guatemala)	Burial 12-1	Female	Woodbury and Trik 1953:232–239
	Burial 13-23	Male?	Woodbury and Trik 1953:232–239

role as custodian of ritual objects with reflective surfaces. During the Classic period, Maya kings were both political leaders and priests. They not only oversaw military expeditions, and long-distance trade, but also the construction of major temple-pyramids, and the performance of complex rituals (some with mirrors) ordained by the cosmological order. Indeed, we suggest that rulers in ancient Maya society functioned at least partly, in their leadership roles, as a "supreme shaman," responsible for the well-being and security of their subjects (Blainey 2007; Sharer 1994:70).

If the accession to office made the new Maya ruler the foremost shaman of his polity, then the inclusion of the T24/T617 glyph in the Palenque accession glyph is plainly intended to convey the new king's responsibility for presiding over the liminal "portals of communication opened between the human and divine" (Freidel et al. 1993:317; see also Schele and Freidel 1990). The king had the tools and power to "see" beyond the mundane world occupied by humanity in the normal waking state of consciousness.

Mirror Maize-ball (T-86[24/617]). Much like the *K'an* sign for the "fourth day of the Maya *tzolk'in* calendar…probably represents a grain of maize" (Montgomery 2002a:147), the images of balls of maize dough are an example of how "the association of the mirror sign with maize is pervasive" (Taube 1989: 46–47). A plausible explanation for this pairing of mirrors and maize incorporates text about the origin of maize from the *Popol Vuh*, a sacred Maya book. Here, Seven Hunahpu, the father of the Hero Twins in this story, is reassembled and resurrected by his sons. Taking the form of the ancient Maya maize god, the Hero Twins "left him at the Place of Ball Game Sacrifice" (Tedlock 1996:141). Since, for the Maya, "the ballcourt was not only a

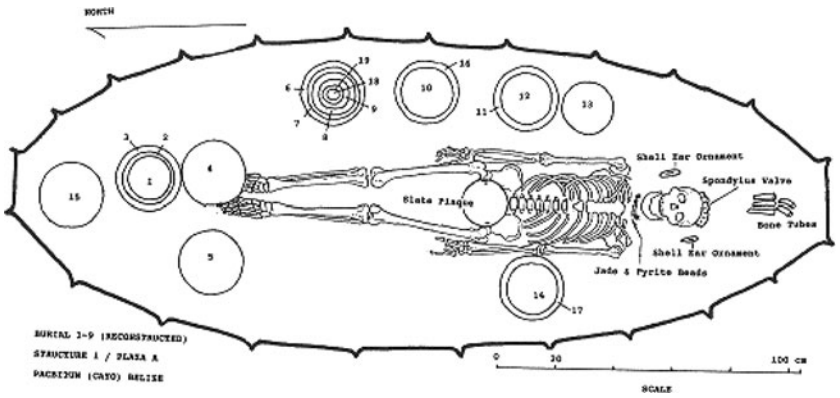


Figure 9. Plan of Burial 1-9, Pacbitun (Belize), a richly furnished, vaulted tomb, containing the remains of a tall adult male, lying extended, supine, with a complete slate plaque (pyrites eroded) placed over the pelvic area (after Healy et al. 2004a: Figure 14.1; courtesy of University of Florida Press, Gainesville, FL).

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Figure 10. Roll-out of Classic Maya polychrome vase K505 detailing possible use of a mirror (boxed in white) (from Kerr 2006; Photograph K505 © Justin Kerr).

place of sacrifice; it was an entry portal to the time and space of the last Creation" (Freidel et al. 1993:352), it appears that this initial portal between the human Middle realm and spiritual Underworld was associated with the emergent apotheosis of the Maize God. We see this notion illustrated clearly in painted images of the Maize God emerging from a cleft in the cosmic turtle's back, flanked by his Hero Twin sons, Hunahpu and Xbalanque (see Kerr Numbers 731 and 1892; Zender 2006:9). Thus, the affiliation of the mirror glyph with the glyph for maize provides yet another reasonable connection between reflective surfaces and liminal portals. Of course, it is also possible that the mirror glyph on maize represents the shiny surface of corn kernels.

(T-1030b:178). Among the ancient Maya assemblage of deities, it is the god K'awil that has the closest ties to mirrors and the *reflective surface complex*. First labelled "God K" in the Schellhas (1904) system of deity classification, and specifically referred to as GII at Palenque, this god "was identified with lightning, fire, and dynastic descent" (Miller and Taube 1993: 146–147). Distinctive features of God K include a zoomorphic/serpent face complemented by one serpent-headed foot, an anthropomorphic body, and a forehead mirror that is perforated by either a "flaming axe" (Schele and Mathews 1998:152), "a celt, a smoking celt, a smoking cigar, a smoking torch or a ceramic torch holder" (Schele and Miller 1986:49). He is also associated with conventional Maya symbols of kingship, such as the K'awil "Manikin Sceptre" and the Double-Headed Serpent Bar, suggesting that he is a deity associated with kingship and royal lineage (Clancy 1994; Freidel et al. 1993:195–196; Miller 1999; Schele and Freidel 1990:78, 414). The most revealing aspect garnered from artistic illustrations of K'awil is the fact that the mirror affixed to his forehead is penetrated by an instrument of which we can only see half, because the other half is presumably located on the other side of the mirror.

Segueing into the final aspect of "indirect" incidences of the mirrors, it is interesting to evoke Schele and Miller's (1983:12) allusion to the Motul (Maya) Dictionary where the phrase *nen* "describes the title holder as the 'mirror of the world' and 'the mirror of the pueblo' (or people)." This translation has been used to rationalize what have been interpreted as mirrors (T24/T617) worn on headdresses in the depiction of the kings of Yaxchilan (Tate 1992:103). The *nen* phrase in the Quiche (Maya) Dictionary is listed as "related to the Yucatec title as a term for 'succeed in office'" (Edmonson 1965:78; Vienna Dictionary 1972:99r). Considering these linguistic references relative to the iconographic and epigraphic evidence discussed above, as well as the ethnohistoric sources addressed below, the enigma of the T24/T617 glyph, and ancient Maya iron-ore mirrors in general, might be resolved by perceiving them from an emic standpoint.

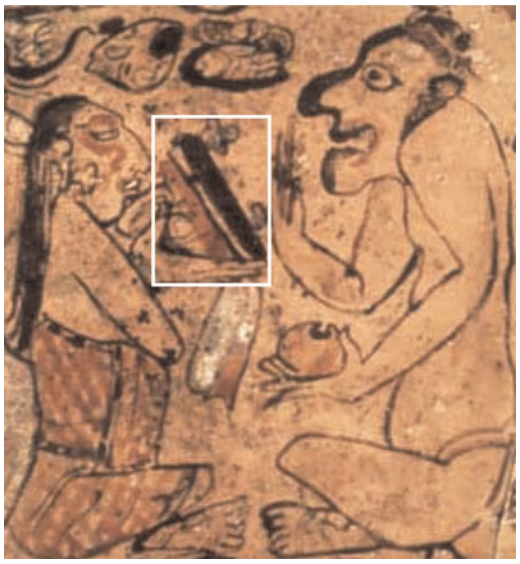


Figure 11. Roll-out of Classic Maya polychrome vase K530 detailing possible use of a mirror (boxed in white) (from Kerr 2006; Photograph K530 © Justin Kerr).

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Figure 12. Roll-out of Classic Maya polychrome vase K559 detailing possible use of a mirror (boxed in white) (from Kerr 2006; Photograph K559 © Justin Kerr).

SYMBOLISM OF THE MAYA MIRROR

Saunders (2003:17–18) suggests that indigenous cultures of Mesoamerica, like the Maya, appreciated the aesthetic of "brilliance." They were drawn to highly polished or shiny items as part of "…a worldview that saw light, dazzling colors, and shiny matter as indicating the presence of supernatural beings and essence." They placed a value on reflective objects as part of their traditional symbol system. Early Mesoamericans associated light with the Otherworldly realm "…inhabited by bright spirit beings who became visible to shamans, priests, and rulers in visions aglow with multicoloured light." For some Amerindians, then, "…all shiny matter, whether natural or artificial" was especially sacred, and infused with spirituality and cosmic power (Saunders 2003:36).

Polished jade was a highly symbolic, power-bestowing material worn by the elite of most Mesoamerican societies, representing important elements of nature: water, rain, fertility, young, green, growing maize—all elements vital to life (Saunders 2003:30–31). So too, polished, reflective, mosaic mirrors may have symbolized other crucial elements of nature: light, the sun, radiance, heat, the stars and, perhaps, fire—again, all components which were important (if not essential) to life (Taube 1992).

In the general absence of metals in the Classic Maya world, pyrite (or more rarely hematite) mosaic mirrors were one of the most effective pre-Columbian conveyors of light, sacredness, and brilliance (Saunders 2003:18–21). In this way, lithic mirrors, as ritual items, acted as a bridge between the heavenly world (and the sun) and the physical world of the earth. The "mystery" surrounding the reflective qualities of mirrors—and the restricted knowledge associated with the specialized manufacture of mirrors—likely enhanced their value and mystique, making them ideal objects within a political system formed around the divine status of royalty.

Pyrite mosaic polygons, with their glossy, golden sheen, may have been seen as cosmically liminal and, hence, powerful material. Perhaps having one's visage reflected in a pyrite mirror, even if in a multi-fractured image, was the equivalent to acquiring the power of this material. Given the contextual data (in cases for which there is uncompromised provenience), mirrors are overwhelmingly restricted to the upper echelon of ancient Maya society (Blainey 2007).

ETHNOHISTORIC AND ETHNOGRAPHIC VIEWS OF MAYA MIRRORS

Narrative accounts involving mirrors, written either by the Maya of the Conquest period or the Spanish who documented the foreign incursion, offer an enlightening analogue for the ancient Maya versions considered here. In outlining these literary references to mirrors, the following section is intended as a buttressing device, accentuating the more inert evidence for ancient mirrors with the descriptive accounts of once-living agents.



Figure 13. Roll-out of Classic Maya polychrome vase K2929 detailing possible use of a mirror (boxed in white) (from Kerr 2006; Photograph K2929 © Justin Kerr).

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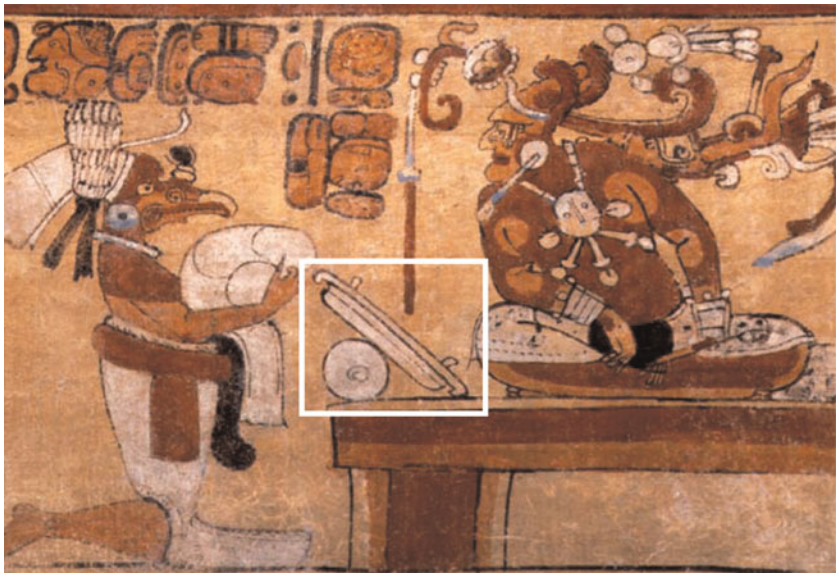


Figure 14. Roll-out of Classic Maya polychrome vase K5764 detailing possible use of a mirror (boxed in white) (from Kerr 2006, Photograph K5764 © Justin Kerr).

Bishop Diego de Landa wrote his *Relación de las Cosas de Yucatan* during a stint in Spain in the 1560s, between appointments as a Franciscan friar and Bishop of Merida (Barrus 1973:147; Tozzer 1941:vii). He mentions that "all the men use mirrors while the women had none; and to call each other cuckolds, they said that the wife had put the mirrors in the hair at the back of their heads" (Tozzer 1941:89). This reference may imply that mirrors, after the Spanish Conquest, were no longer considered elite, luxury items denoting prestige as they appear to have been during pre-Columbian times.

Whenever iron ore was not readily available it seems that the Maya resorted to other purveyors of reflective surfaces: "among many contact period Mesoamerican peoples, including the Yucatec Maya, Aztecs, and Tarascans, the reflective surfaces of bowls filled with water were also used for divination, and it is possible that this is an especially old tradition, perhaps even dating from before the manufacture of stone mirrors" (Miller and Taube 1993:114). Taube (1983:132, Figure 21) even identifies iconographically what have herein been considered elaborate mirror backs instead as mirrors submerged in bowls of water for "water-scrying."

Early writings about the Aztecs by the Spanish chronicler Diego Durán (1964:220–221) include a story about the coronation of the ruler Moctezuma II in which he is referred to and made analogous



Figure 15. Roll-out of Classic Maya polychrome vase K7265 detailing possible use of a mirror (boxed in black) (from Kerr 2006, Photograph K7265 © Justin Kerr).

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Figure 16. Round Maya mosaic mirror, pyrite with sandstone backing, from an elite tomb, Bonampak, Mexico (after Schmidt et al. 1998:569, Entry 203; ©Michel Zabé/AZA). Diameter 23.5 cm, Thickness 0.3 cm.

to "a mirror in which we will be reflected," "the torch which is to illuminate Mexico," and as "a mirror to look into." These statements match the meaning implied by the native portrayal of Maya rulers in ethnohistoric times as "the mirror of the people" (see also Schele and Miller 1983).

All this suggests that whatever conjuring rituals were being performed with mirrors were an expansion of a larger, more archaic religious tradition that has been referred to herein as the *reflective surface complex*. The ethnohistorically documented use of bowls of water indicates that the *reflective surface complex*, to the pre-Columbian Maya, may also have been a part of non-elite ceremonies as well, and not restricted to only the elite class.

The *Popol Vuh* has provided an incomparable gateway into pre-Columbian Maya thought (Tedlock 1996). Although it is widely confirmed that the first part of the *Popol Vuh* is based to a degree on post-Contact Christian influences, the text as a whole is considered by many to be "the most important single native-language text in all the New World" (Tedlock 1986:77).

One of the most significant passages in the *Popol Vuh* describes the belief that there were inborn deficiencies to human vision, stemming from an alteration performed on the original human beings by the Maya Creator Gods. The origin of the role of Maya rulers as "mediators between 'mere' human beings and the divine" is explained in the *Popol Vuh* as the result of Maya gods being unhappy with the first lords' divine capacities, and their seeking "to correct it by chipping their eyes…and thereby having their vision and understanding restricted" (Hendrickson 1989:138):

> "They were *blinded as the face of a mirror is breathed upon*. Their vision flickered. Now it was only from close up that they could see what was there with any clarity.
>
> And such was the loss of the means of understanding along with the means of knowing everything, by the four humans. The root was implanted." (Tedlock 1996:148; emphasis added)

Based on pre-Columbian traditions of the Quiche Maya creation story, this passage asserts directly that human actions proceed according to the underlying ontological assumption that what appear as empty spaces were "not hollow or vacant, as we might understand them from an occidental perspective" (Houston and Taube 2000:281). Instead, human beings were created to witness only a fraction of a wider monistic reality, thus manifesting a superficial dualism between what could and could not be "seen" by the naked eye. Mirrors, used properly by shamans and kings, could help overcome this inherent deficiency and create a temporary channel between the human domain and the normally unseen Otherworld.

For the purposes of the current discussion, the intriguing point here involves the use of a mirror-face fogged by breath as an analogy for hindered vision (see Tedlock 1993:10). This connection with the eye and sight harmonizes with the iconographic and epigraphic evidence assessed above, which also supposes a connection between eyes, vision, and mirrors; this all heralds a strong probability that from an emic perspective, the ancient Maya can be said to have viewed a function of mirrors as comparable to that of eyes for the human agent. So, either iron-ore mirrors were used by elites as facilitators of their own vision, or the mirror itself was acting as an eye for something else that was looking out on the profane world from a spiritual Otherworld. Of course, there is the possibility that both the former and latter were functions of ancient Maya mirrors.

It is necessary for our review of iconographic, epigraphic, and Maya literary references to mirrors to be put into context relative to scholarly elaborations about the larger cosmological perspective of the ancient Maya. It may seem to some that "the obvious conclusion is that individual perceptions are largely unknowable in archaeology and this approach should be restricted to ethnographic studies in which such perceptions are accessible" (Earle and Preucel 1987:510). On the other hand, the last two decades have seen a series of credible interpretations of ancient cognition advance the notion that "particularistic approaches that equate prediction and explanation are no longer adequate to account for the diversity in the archaeological record" (Bruce Trigger, comment in Earle and Preucel 1987:523).

For many, the current era of Maya iconographic studies began with publication of *The Blood of Kings*:

> "For the Maya, the World was a complex and awesome place, alive with sacred power. This power was part of the landscape, of the fabric of space and time, of things both living and inanimate, and of the forces of nature—storms, wind, mist, smoke, rain, earth, sky and water. Sacred beings moved between the three levels of the cosmos: The Overworld which is the heavens, the Middleworld where humans live, and the Underworld or Xibalba, the source of disease and death. The king acted as a transformer through whom, in ritual acts, the unspeakable power of the supernatural passed into the lives of mortal men and their works. The person of the king was also sacred…*supernatural power was focused in the objects manipulated by the king, which seemed to accrue sacred energy through their use in ritual*." (Schele and Miller 1986: 301, emphasis added)

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Such a concise breakdown of the ancient Maya view of the universe establishes a credible reference point for readings of the material evidence, to be tested and refined over and over again, against an ever expanding iconographic and epigraphic record.

Several major works exploring ancient Maya art, architecture, and hieroglyphic texts emphasize how Maya artistic remains demonstrate a preoccupation with the opening of liminal portals to the Otherworld through shamanistic rituals (Freidel et al. 1993; Schele and Freidel 1990; Schele and Mathews 1998):

> "The sculptural record also demonstrates the shamanistic nature of Maya kingship, central to the Classic conception of the cosmos, by depicting the divine *ahau* (ruler) as a conductor of ritual…This ritual was most likely a public affirmation of his ability to open a portal to the supernatural realm." (Schele and Freidel 1990:87)

Although the term "supernatural" has its pitfalls when used to describe the ideologies of non-Western peoples, so long as the etic and emic definitions of the supernatural "are distinguished, the supernatural concept both clarifies a scientific position on a major source of religious behaviour and improves our ability to understand religious worldviews" (Lohmann 2003:176). The continued refinement of the archaeological techniques aimed at understanding ancient Maya cognition (i.e., how they conceived of the human condition) will likewise shed light on the significance of the political, economic, and ideological significance of iron-ore mirrors for the ancient Maya.

DISCUSSION

Although this type of mosaic, iron-ore mirror has been known for decades, there have been very few detailed discussions of their origin, manufacture, distribution, and dating, based on archaeological data. In this paper we also examined the possible varied uses and meanings of these Maya mirrors, based on iconography, epigraphy, and ethnohistory.

Some past studies of Maya mirrors have suggested that these curious, composite lithic artifacts were objects worn exclusively by rulers, as emblems of power and prestige (Coe 1988; Healy et al. 2004a). In this interpretive scenario, mirrors served the Maya elite as politico-religious badges of power and authority. Mirrors (like jade jewellery, eccentric chipped flints, or shells of the thorny oyster) were important symbolic objects which served as a talisman, reflectors or enhancers of power, in elite Maya political settings (Taube 1992).

Others have wondered if these plaques with a shiny, reflective surface actually functioned as mirrors (in the Western sense). Despite some polychrome vase representations that might superficially suggest this, ancient Maya iron-ore mirrors appear more likely to have been ritual items rather than simple aids to vanity (David M. Pendergast, personal communication 2006). Taube (1983:112–113), referring to pyrite encrusted mirrors of Mesoamerica as a group, argues that they "were not used for cosmetic purposes," or as looking glasses. We agree with this perspective.

An alternative interpretation for the role of Maya mirrors, and one not entirely contradictory from their use as emblems of power, was for meditative scrying, whereby the user gazed on the reflective surface of the mirror for purposes of divination (Bassie-Sweet 2008; Besterman 1965; Eliade 2004). Indeed, mirrors in pre-Columbian pictorial art are often seen to be associated with pools of liquid (water, or perhaps even liquid mercury) or water-filled bowls ("mirror bowls") that were studied for purposes of prognostication.[8] In this scenario, espoused herein, mirrors were linked historically to age-old shamanic rituals of divination. While Maya society had evolved a more complex, formalized priesthood and associated religious practices, rites of early shamanic scrying (and the tools to facilitate this) were passed down and continued through the Classic and Postclassic periods, providing the ancient Maya—literally—with a touchstone to their remarkable past. In this interpretation, ancient Maya iron-ore mirrors served in a ritualized, ceremonial context as valuable tools and religious icons to be gazed upon for divination (Blainey 2007).

While their possible use in divinatory scrying has been casually acknowledged in the literature on ancient Maya religion (Miller and Taube 1993:114), their wider social significance to the ancient Maya has, heretofore, largely been ignored. Thus, in forwarding the hypothesis that iron-ore mirrors represent a vital aspect of a larger *reflective surface complex*, our analysis ventures both to refine the ideological understanding of mirrors, while also locating their functions in ancient Maya politics and economics.

CONCLUSIONS

In sum, these ancient "mirrors" are relatively rare, brilliant, and often beautiful works of Maya lithic art (Figure 16). Because of this connection, they were considered valuable, high-status items that retained a religious (and we could argue "shamanic") function among the early Maya across a vast expanse of both time and space. Although the precise role of shamanism among the ancient Maya will likely remain a topic for debate, it is clear that the "polished, gleaming" qualities of iron-ore mirrors, being both "dark and light at once" (Joyce 2002:149), evoked the liminal connotations of its reflective surface. We believe that these affiliations with liminality, combined with their iconographic depiction as communicative devices, advocate an emic explanation of mirrors as instruments of shamanistic divination.

Just as their subjects might have been conjuring the portal to the Otherworld, opened by scrying with a bowl of water, the more sophisticated iron-ore mirrors wielded by the ancient Maya aristocracy summoned a grander, more regal, cosmic aperture. Shiny, iron-ore mirrors, as artistic masterpieces produced by skilled noble craftsman, embodied the power to breech the boundary between the human and spiritual realms in a permanent and portable form. Unlike water and eyes, polished pyrite mosaic mirrors authenticate their possessor as supreme mediator over the permeable membrane separating the two worlds, thus making this individual uniquely capable of communication across the cosmic divide incarnate in reflective surfaces.

[8] Glistening, shiny, liquid mercury, or "quicksilver," has been recorded from at least six different ancient Maya sites, in amounts ranging from 90 to over 600 g, and associated with ritual caches or elite burials containing jade, cinnabar, pearl, shell, bone, and ceramic remains (Austin 1994:Table 2). Though at least one of these caches dates to the Late Preclassic period, all other occurrences are from the Classic period (A.D. 250–900) (see Pendergast 1982).

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RESUMEN

En el presente trabajo de investigación, se examinan los utensilios compuestos líticos poco corrientes comúnmente denominados "espejos" en la literatura que se trata de los mayas antiguos. Típicamente objetos planos y relucientes con polígonos de mineral de hiero pulidos en un diseño mosaico sobre un dorso de pizarra, estas placas se evalúan aquí para determinar los contextos tecnológico, espacio-temporal y funcional de su fabricación. Se examinaron los datos sobre más de 500 especímenes arqueológicos de docenas de yacimientos mayas en México, Guatemala, Belice y Honduras como parte de esta investigación. También se consideraron la iconografía, la epigrafía y el simbolismo posible de estos artefactos curiosos. Basado en este análisis, los autores concluyen que los espejos mosaicos de los maya antiguos se empleaban en ritos, muchas veces por individuos de la clase élite o por personas reales, como símbolos de autoridad y también, lo que más importante, como instrumentos que tenían la posibilidad de utilizarse para la adivinación vidente. Servían como puentes, o sea conductos, hacia las deidades y el mundo celestial de los mayas. Los espejos mosaicos de mineral de hiero que tenían gran valor y que muchas veces eran fabricados maravillosamente, eran objetos ceremoniales reflectivos cuyo uso posible para hacer pronósticos en los ritos de los chamanes probablemente tiene gran antigüedad en Mesoamérica.

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REFERENCES

Adams, Richard E.W.
1999 *Rio Azul: An Ancient Maya City*. University of Oklahoma Press, Norman.

Aoyama, Kazuo
2007 Elite Artists and Craft Producers in Classic Maya Society: Lithic Evidence from Aguateca, Guatemala. *Latin American Antiquity* 18:3–26.

Austin, Patricia A.
1994 *Mercury and the Ancient Maya*. Unpublished Master's thesis, Department of Anthropology, Trent University, Peterborough, ON.

Awe, Jaime J.
1992 *Dawn in the Land between the Rivers: Formative Occupation at Cahal Pech, Belize and its Implications for Preclassic Development in the Maya Lowlands*. Unpublished Ph.D. dissertation, Institute of Archaeology, University of London, London, UK.

Ball, Joseph W., and Jennifer T. Taschek
2001 Buenavista-Cahal Pech Court: A Multi-palace Royal Court from a Petty Lowland Maya Kingdom. In *Royal Courts of the Ancient Maya: Volume 2, Data and Case Studies*, edited by Takeshi Inomata and Stephen Houston, pp. 165–200. Westview Press, Boulder, CO.

Barrus, Ernest J.
1973 Religious Chroniclers and Historians: A Summary with Annotated Bibliography. In *Guide to Ethnohistorical Sources*, edited by Howard F. Cline, pp. 138–185. Handbook of Middle American Indians, Vol. 13, Robert Wauchope, general editor. University of Texas Press, Austin.

Bassie-Sweet, Karen
2008 *Maya Sacred Geography and the Creator Deities*. University of Oklahoma Press, Norman.

Bell, Ellen E., Robert J. Sharer, Loa P. Traxler, David W. Sedat, Christine W. Carrelli, and Lynn A. Grant
2004 Tombs and Burials in the Early Classic Acropolis at Copan. In *Understanding Early Classic Copan*, edited by Ellen E. Bell, Marcello A. Canuto, and Robert J. Sharer, pp. 131–157. Museum of Archaeology and Anthropology, University of Pennsylvania, Philadelphia.

Besterman, Theodore
1965 *Crystal Gazing: A Study in the History, Distribution, Theory and Practice of Scrying*. University Books, Hyde Park, NY.

Blainey, Marc G.
2007 *Surfaces and Beyond: The Political, Ideological and Economic Significance of Ancient Maya Iron-Ore Mirrors*. Unpublished Master's thesis, Department of Anthropology, Trent University, Peterborough, ON. Electronic document, http://www.wayeb.org/download/theses/blainey_2007.pdf.

Brumfiel, Elizabeth M., and Timothy K. Earle
1987 Specialization, Exchange, and Complex Societies: An Introduction. In *Specialization, Exchange, and Complex Societies*, edited by Elizabeth M. Brumfiel and Timothy K. Earle, pp. 1–9. Cambridge University Press, Cambridge.

Bullard, William R., Jr., and Mary Ricketson Bullard
1965 *Late Classic Finds at Baking Pot, British Honduras*. Occasional Paper in Art and Archaeology No. 8. Royal Ontario Museum, Toronto.

Calvin, Inga
1997 Where the *Wayob* Live: A Further Examination of Classic Maya Supernaturals. In *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases, Volume 5*, edited by Justin Kerr, pp. 868–883. Kerr Associates, New York.

Carlson, John B.
1981 The Olmec Concave Iron-ore Mirrors: The Aesthetics of a Lithic Technology and the Lord of the Mirror. In *The Olmec and Their Neighbors: Essays in Memory of Matthew W. Stirling*, edited by Elizabeth P. Benson, pp. 117–147. Dumbarton Oaks, Washington, DC.

Cheetham, David
2006 The Americas' First Colony? A Possible Olmec Outpost in Southern Mexico. *Archaeology* 59:42–46.

Clancy, Flora S.
1994 The Classic Maya Ceremonial Bar. *Anales del Instituto de Investigaciones Estéticas* 16(65):7–45.

Coe, Michael D.
1988 Ideology of the Maya Tomb. In *Maya Iconography*, edited by Elizabeth P. Benson and Gillett G. Griffin, pp. 222–235. Princeton University Press, Princeton, NJ.
1992 *Breaking the Maya Code*. Thames and Hudson, New York.

Coe, Michael D., and Richard A. Diehl
1980 *In the Land of the Olmec, Volume 1: The Archaeology of San Lorenzo Tenochtitlan*. University of Texas Press, Austin.

Coe, William R.
1959 *Piedras Negras Archaeology: Artifacts, Caches, and Burials*. University Museum Monograph No. 18. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia.
1990 *Excavations in the North Great Plaza, North Terrace and North Acropolis of Tikal*. University Museum, Tikal Report No. 14, Vol. 2.

https://doi.org/10.1017/S0956536111000241 Published online by Cambridge University Press

University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia.

Dennett, Carrie L., and Marc G. Blainey
2008 Reflecting on the Looking Glass: An Exploration of Ancient Maya Mirrors beyond the Southeast Periphery. Paper presented at the 41st Annual Meeting of the Canadian Archaeological Association, Peterborough, ON.

Durán, Diego
1964 *The Aztecs: A History of the Indies of New Spain*. Translated by Doris Heyden and Fernando Horcasitas. Orion Press, New York.

Earle, Timothy K., and Robert W. Preucel
1987 Archaeology and the Radical Critique. *Current Anthropology* 28: 501–538.

Edmonson, Munro
1965 *Quiche-English Dictionary*. Middle American Research Institute, Publication No. 30. Tulane University, New Orleans.

Ekholm, Gordon F.
1973 The Archaeological Significance of Mirrors in the New World. *Atti del XL Congresso Internazionale degli Americanisti, Roma-Genova, 1972*, Vol. 1:133–135. Casa Editrice Tilgher, Genova.

Eliade, Mircea
2004 *Shamanism: Archaic Techniques of Ecstasy*. Reprinted. Princeton, NJ.

Evans, Susan Toby
2004 *Ancient Mexico and Central America*. Thames and Hudson, New York.

Fialko, Vilma
2000 El espejo del Entierro 49: Morfología y texto jeroglífico. In *El Sitio Maya de Topoxté: Investigaciones en una isla del lago Yaxhá, Petén, Guatemala*, edited by Wolfgang W. Wurster, pp. 144–149. AVA-Materialien Band 57. Verlag Phillip von Zabern, Mainz am Rhein.

Flannery, Kent V.
1968 Olmec and the Valley of Oaxaca: A Model for Inter-regional Interaction in Formative Times. In *Dumbarton Oaks Conference on the Olmec: October 28th and 29th, 1967*, edited by Elizabeth P. Benson, pp. 79–117. Dumbarton Oaks, Washington, DC.

Flannery, Kent V., and Joyce Marcus
1996 Cognitive Archaeology. In *Contemporary Archaeology in Theory: A Reader*, edited by Robert W. Preucel and Ian Hodder, pp. 350–363. Wiley-Blackwell, Oxford.

Freidel, David, Linda Schele, and Joy Parker
1993 *Maya Cosmos: Three Thousand Years on the Shaman's Path*. HarperCollins, New York.

Golden, Charles W., and Greg Borgstede
2004 Continuities and Changes in Maya Archaeology: An Introduction. In *Continuities and Changes in Maya Archaeology: Perspectives at the Millennium*, edited by Charles W. Golden and Greg Borgstede, pp. 3–12. Routledge, New York.

Grove, David C.
1997 Olmec Archaeology: A Half-Century of Research and Its Accomplishments. *Journal of World Prehistory* 11:51–101.

Grube, Nikolai, and Werner Nahm
1994 A Census of Xibalba: A Complete Inventory of *Way* Characters on Maya Ceramics. In *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases, Vol. 4*, edited by Justin Kerr, pp. 686–715. Kerr Associates, New York.

Healy, Paul F., Jaime J. Awe, and Hermann Helmuth
2004a Defining Royal Maya Burials: A Case from Pacbitun. In *The Ancient Maya of the Belize Valley*, edited by James F. Garber, pp. 228–237. University Press of Florida, Gainesville.

Healy, Paul F., Jaime J. Awe, Gyles Iannone, and Cassandra Bill
1995 Pacbitun (Belize) and the Ancient Maya Use of Slate. *Antiquity* 69: 337–348.

Healy, Paul F., Bobbi Hohmann, and Terry G. Powis
2004b The Ancient Maya Center of Pacbitun. In *The Ancient Maya of the Belize Valley* edited by James F. Garber, pp. 207–227. University Press of Florida, Gainesville.

Heizer, Robert F., and Jonas E. Gullberg
1981 Concave Mirrors from the Site of La Venta, Tabasco: Their Occurrence, Mineralogy, Optical Description, and Function. In *The Olmecs and Their Neighbors: Essays in Memory of Matthew W. Stirling*, edited by Elizabeth P. Benson, pp. 109–116. Dumbarton Oaks, Washington, DC.

Helmke, Christophe G.B., Pierre Robert Colas, and Jaime J. Awe
1998 Comments on the Typology, Epigraphy, and Iconography of the Actun Tunichil Muknal Vase and the Belize Valley Modeled-Carved Vessels. In *The Western Belize Regional Cave Project: Report of the 1997 Field Season*, edited by Jaime J. Awe, pp. 93–140. Occasional Paper of the Department of Sociology and Anthropology No. 1. University of New Hampshire, Durham.

Hendrickson, Carol
1989 Twin Gods and Quiché Rulers: The Relations between Divine Power and Lordly Rule in the Popol Vuh. In *Word and Image in Maya Culture: Explorations in Language, Writing, and Representation*, edited by William F. Hanks and Don S. Rice, pp. 127–139. University of Utah Press, Salt Lake City.

Houston, Stephen D.
2000 Into the Minds of Ancients: Advances in Maya Glyph Studies. *Journal of World Prehistory* 14:121–201.

Houston, Stephen D., and David Stuart
1989 *The* Way *Glyph: Evidence for "Co-essences" among the Classic Maya*. Research Reports on Ancient Maya Writing No. 30. Center for Maya Research, Washington, DC.
2001 Peopling the Classic Maya Court. In *Royal Courts of the Ancient Maya, Volume 1: Theory, Comparison, and Synthesis*, edited by Takeshi Inomata and Stephen D. Houston, pp. 54–83. Westview Press, Boulder, CO.

Houston, Stephen D., David Stuart, and Karl A. Taube
2006 *The Memory of Bones: Body, Being, and Experience among the Classic Maya*. University of Texas Press, Austin.

Houston, Stephen D., and Karl A. Taube
2000 An Archaeology of the Senses: Perception and Cultural Expression in Ancient Mesoamerica. *Cambridge Archaeological Journal* 10:261–294.

Iannone, Gyles
1993 *Ancient Maya Eccentric Lithics: A Contextual Analysis*. Master's thesis, Department of Anthropology, Trent University, Peterborough, ON. University Microfilms, Ann Arbor.

Inomata, Takeshi
2001 The Power and Ideology of Artistic Creation: Elite Craft Specialists in Classic Maya Society. *Current Anthropology* 42:321–333.

Inomata, Takeshi, Daniela Triadan, Erick Ponciano, Estela Pinto, Richard E. Terry, and Markus Eberl
2002 Domestic and Political Lives of Classic Maya Elites: The Excavation of Rapidly Abandoned Structures at Aguateca, Guatemala. *Latin American Antiquity* 13:305–330.

Joyce, Rosemary A.
2002 *The Languages of Archaeology*. Blackwell, Malden, MA.

Kerr, Justin
2006 *Maya Vase Database*. Foundation for the Advancement of Mesoamerican Studies, Inc. Electronic document, http://research.famsi.org/kerrmaya.html.

Kidder, Alfred V., Jesse D. Jennings, and Edward M. Shook
1946 *Excavations at Kaminaljuyu, Guatemala*. Carnegie Institution of Washington Publication No. 561, Washington, DC.

LeCount, Lisa
1999 Polychrome Pottery and Political Strategies in Late and Terminal Classic Lowland Maya Society. *Latin American Antiquity* 10:239–258.

Lohmann, Roger Ivan
2003 The Supernatural is Everywhere: Defining Qualities of Religion in Melanesia and Beyond. *Anthropological Forum* 13:175–185.

Macri, Martha J., and Matthew G. Looper
2003 *A New Catalog of Maya Hieroglyphs, Volume 1: The Classic Period Inscriptions*. University of Oklahoma Press, Norman.

Martin, Simon, Kathleen Berrin, and Mary Miller
2004 *Courtly Art of the Ancient Maya*. Thames and Hudson, London.

Martin, Simon, and Nikolai Grube
2000 *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*. Thames and Hudson, New York.

Mason, J. Alden
1927 Mirrors of Ancient America. *University of Pennsylvania Museum Journal* 18:201–209.

Meskell, Lynn M., and Rosemary A. Joyce
2003 *Embodied Lives: Figuring Ancient Maya and Egyptian Experience*. Routledge, New York.

Miller, Mary Ellen
1999 *Maya Art and Architecture*. Thames and Hudson, London.

https://doi.org/10.1017/S0956536111000241 Published online by Cambridge University Press

Miller, Mary Ellen, and Karl A. Taube
1993 *An Illustrated Dictionary of the Gods and Symbols of Ancient Mexico and the Maya*. Thames and Hudson, New York.
Montgomery, John
2002a *Dictionary of Maya Hieroglyphs*. Hippocrene Books, New York.
2002b *How to Read the Maya Hieroglyphs*. Hippocrene Books, New York.
Mora-Marín, David F.
1996 Resumen de estudio epigráfico de placas de jade incisas y discos de pizarra mayas encontrados en Costa Rica. Paper presented at the IX Simposio Anual de Arqueología y Etnología de Guatemala, Guatemala City.
Pendergast, David M.
1969 *Altun Ha, British Honduras (Belize): The Sun God's Tomb*. Occasional Paper in Art and Archaeology No. 19. Royal Ontario Museum, Toronto.
1982 Ancient Maya Mercury. *Science* 217:533–535.
Reents-Budet, Dorie
1994 *Painting the Maya Universe: Royal Ceramics of the Classic Period*. Duke University Press, Durham, NC.
2001 Classic Maya Concepts of the Royal Court: An Analysis of Renderings on Pictorial Ceramics. In *Royal Courts of the Ancient Maya, Volume 1: Theory, Comparison, and Synthesis*, edited by Takeshi Inomata and Stephen D. Houston, pp. 195–233. Westview Press, Boulder, CO.
Reents-Budet, Dorie, Virginia M. Fields, and David F. Mora-Marín
1995 Early Classic Maya Incised Jade Objects from Costa Rica. Manuscript on file, Duke University, Museum of Art, Durham, NC.
Saunders, Nicholas J.
1988 Anthropological Reflections on Archaeological Mirrors. In *Recent Studies in Pre-Columbian Archaeology*, edited by Nicholas J. Saunders and Olivier de Montmollin, pp. 1–39. BAR International Series 421. British Archaeological Reports, Oxford.
2003 Catching the Light: Technologies of Power and Enchantment in Pre-Columbian Goldworking. In *Gold and Power in Ancient Costa Rica, Panama, and Colombia: A Symposium at Dumbarton Oaks, 9 and 10 October 1999*, edited by Jeffrey Quilter and John Hoopes, pp. 15–47. Dumbarton Oaks, Washington, DC.
Schele, Linda, and David Freidel
1990 *A Forest of Kings: The Untold Story of the Ancient Maya*. William Morrow and Company, New York.
Schele, Linda, and Peter Mathews
1998 *The Code of Kings: The Language of Seven Sacred Maya Temples and Tombs*. Touchstone, New York.
Schele, Linda, and Jeffrey H. Miller
1983 *The Mirror, the Rabbit, and the Bundle: "Accession" Expressions from Classic Maya Inscriptions*. Studies in Pre-Columbian Art and Archaeology No. 25. Dumbarton Oaks, Washington, DC.
Schele, Linda, and Mary Ellen Miller
1986 *The Blood of Kings: Dynasty and Ritual in Maya Art*. Kimbell Art Museum, Fort Worth, TX.
Schellhas, Paul
1904 *Representations of Deities of the Maya Manuscripts*. Papers of the Peabody Museum of Archaeology and Ethnology, Vol. 4, No. 1, pp. 1–47. Harvard University, Cambridge, MA.
Schmidt, Peter, Mercedes de la Garza, and Enrique Nalda (editors)
1998 *Maya*. Rizzoli International Publications, New York.
Sharer, Robert J.
1994 *The Ancient Maya*. 5th ed. Stanford University Press, Stanford, CA.
Sharer, Robert J., and Charles W. Golden
2004 Kingship and Polity: Conceptualizing the Maya Body Politic. In *Continuities and Changes in Maya Archaeology: Perspectives at the Millennium*, edited by Charles W. Golden and Greg Borgstede, pp. 23–50. Routledge, New York.
Smith, A. Ledyard
1972 *Excavations at Altar de Sacrificios: Architecture, Settlement, Burials, and Caches*. Papers of the Peabody Museum of Archaeology and Ethnology, Vol. 62, No. 2. Harvard University, Cambridge, MA.
Smith, A. Ledyard, and Alfred V. Kidder
1951 *Excavations at Nebaj, Guatemala*. Carnegie Institution of Washington Publication No. 594, Washington, DC.
Stone, Doris Z., and Carlos Balser
1965 Incised Slate Disks from the Atlantic Watershed of Costa Rica. *American Antiquity* 30:310–328.
Tate, Carolyn E.
1992 *Yaxchilan: The Design of a Maya Ceremonial City*. University of Texas Press, Austin.
Taube, Karl A.
1983 The Teotihuacan Spider Woman. *Journal of Latin American Lore* 9:107–189.
1989 The Maize Tamale in Classic Maya Diet, Epigraphy, and Art. *American Antiquity* 51:31–51.
1992 The Iconography of Mirrors at Teotihuacan. In *Art, Ideology, and the City of Teotihuacan: A Symposium at Dumbarton Oaks, 8th and 9th October 1988*, edited by Janet C. Berlo, pp. 169–204. Dumbarton Oaks, Washington, DC.
Tedlock, Dennis
1986 Creation in the Popol Vuh: A Hermeneutical Approach. In *Symbol and Meaning beyond the Closed Community: Essays in Mesoamerican Ideas*, edited by Gary H. Gossen, pp. 77–82. Studies on Culture and Society, Vol. 1. Institute for Mesoamerican Studies, University at Albany, State University of New York, Albany.
1993 *Breath on the Mirror: Mythic Voices and Visions of the Living Maya*. University of New Mexico Press, Albuquerque.
1996 *Popol Vuh: The Mayan Book of the Dawn of Life*. Touchstone, New York.
Thompson, J. Eric S.
1962 *A Catalog of Maya Hieroglyphs*. University of Oklahoma Press, Norman.
Tozzer, Alfred M. (translator and editor)
1941 *Landa's Relación de las cosas de Yucatán*. Papers of the Peabody Museum of Archaeology and Ethnology, Vol. 18. Harvard University, Cambridge, MA.
Trik, Aubrey S.
1963 The Splendid Tomb of Temple I at Tikal, Guatemala. *Expedition* 6(1):2–18.
Vienna Dictionary
1972 Bocabulario de Mayathan: Das Worterbuch de yukatekische Mayasprache. *Bibliotheca Linguistical Americana I*. Akademische Druck- u.Verlagsanstalt, Graz.
Willey, Gordon R.
1972 *The Artifacts of Altar de Sacrificios*. Papers of the Peabody Museum of Archaeology and Ethnology, Vol. 64, No. 1. Harvard University, Cambridge, MA.
Woodbury, Richard B.
1965 Artifacts of the Guatemalan Highlands. In *Archaeology of Southern Mesoamerica, Part 1*, edited by Gordon R. Willey, pp. 163–180. Handbook of Middle American Indians, Vol. 2, Robert Wauchope, general editor. University of Texas Press, Austin.
Woodbury, Richard B., and Aubrey S. Trik
1953 *The Ruins of Zaculeu, Guatemala, Volumes 1–2*. William Byrd Press, Richmond, VA.
Zender, Marc
2006 Teasing the Turtle from its Shell: AHK and MAHK in Maya Writing. *The PARI Journal* 6(3):1–14.

https://doi.org/10.1017/S0956536111000241 Published online by Cambridge University Press