Ancient Mesoamerica, **11** (2000), 91–98
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BEYOND MARITIME SYMBOLISM

Toxic marine objects from ritual contexts at Tikal

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Abstract

Tikal caches frequently contain a wide variety of marine materials such as shells, fish bones, and stingray spines (Coe 1990; Maxwell 1996). Beyond the possible use of stingray spines as bloodletters, however, little attention has been given to the role of these objects in ritual. Numerous caches contain the remains of toxic animals, including stingrays, porcupine fish, cone shells, and potentially toxic corals and sponges. Intriguingly, these objects are found in the greatest frequencies dating to the period from A.D. 562 to 695—known as the Tikal hiatus—beginning immediately following the defeat of Tikal by Caracol and ending with the ascension of Ruler A. It is proposed toxic marine objects were employed in rituals at Tikal and these rituals were most important during the hiatus period.

Marine materials are frequently encountered in ritual deposits at Tikal. The caches and problematic deposits of the North Acropolis (Coe 1990) and to a lesser extent Mundo Perdido (Laporte 1989; Laporte and Fialko 1987, 1995; Laporte et al. 1992; Laporte and Valdes 1993) contained a wealth of marine objects, including thousands of pieces of *Spondylus* shell, hundreds of stingray spines and fragments, and more than 80 different shell species, along with fish bones, coral and sponge fragments, and even pearls. Such a wealth of materials with an oceanic origin found in offerings at a landlocked Maya center strongly suggests a fascination with exotics, and with maritime symbolism. Yet a closer analysis of the types of objects present, and their spatial patterning through time suggests that more than just symbolism was occurring; many of the marine species used at Tikal were in fact highly toxic. Their presence in ritual contexts suggests that these materials functioned as much more than symbols of the sea, rather, they were probably utilized as a means of inflicting severe pain on the ritual participants. Further, increases in the frequency of occurrence of toxic marine objects in ritual contexts correlate with periods of heightened political activity, particularly the dynastic change of A.D. 379 (Culbert and Krejci 1995; Laporte and Fialko 1987), and the victory of Caracol over Tikal in A.D. 562 (Houston 1989). It seems possible toxic marine materials correlated with such periods of political transition and, by inference, were utilized in rituals at such times.

This study draws from published data from the North Acropolis, Great Plaza, and Temples I and II (Coe 1990), along with data from Mundo Perdido (Laporte 1989; Laporte and Fialko 1987, 1995; Laporte et al. 1992; Laporte and Valdes 1993), however, the data are most abundant for the North Acropolis, and therefore the emphasis of the discussion is on this section of Tikal. I begin with a discussion of the individual marine objects known to be toxic and the nature of their presence at this center, followed by a brief review of the political history of Tikal and its caches. Finally, a discussion of the co-occurrence of marine toxins and periods of significant change is presented, along with some possible scenarios for the use of these poisons.

TOXIC MARINE MATERIALS

Stingray Spines

Traditionally, stingray spines (properly known as stings) are thought to have functioned as bloodletters in ceremonial contexts (Chase 1989; Freidel et al. 1993; Schele and Freidel 1990; Schele and Miller 1986). Sharp points and serrated edges make spines prime candidates for inflicting puncture and/or laceration wounds, such as those associated with tongue or penis perforation. Schele and Freidel (1990:89) argued such perforation was a crucial component of bloodletting, which in turn was vital in providing sustenance for the gods, by opening a portal to the spirit realm or "Otherworld," and in inducing visions (see also Freidel et al. 1993; Furst 1976; Schele 1985). Indeed, Freidel et al. (1993:218) suggested Maya art depicts this portal ". . . erupting from the stingray spine itself." Thus, while the act of letting blood was important in and of itself, another aspect of this ritual behavior was permitting the individual to enter an altered state of consciousness, albeit not by toxin introduction in this case.

When defending itself in the wild, a stingray will inflict both laceration and puncture wounds, using a whip-like action of its tail to drive the spine into the victim. The teeth of the sting act as barbs. This makes removal of the spine difficult and frequently results in blood loss for the victim (Cunningham and Goetz 1996; Halstead 1980). Envenomation occurs during this process. Venom production occurs in the soft tissues found within the ventrolateral-glandular grooves of the sting, with additional venom secreted by the integumentary sheath (Cunningham and Goetz 1996:96) which attaches the sting to the body of the animal (Halstead 1980).

https://doi.org/10.1017/S0956536100111095 Published online by Cambridge University Press

Envenomation involves transfer of the poison from the ventrolateral-glandular grooves of the spine to the victim through the action of the teeth, either by allowing for exposure of the wound to the toxic area, or by passing the toxin into the wound. Venom-producing tissue remains within these grooves even after the integumentary sheath is worn away, and ". . . a perfectly clean-looking spine can still be venomous" (Halstead 1980:96).

Both penetration by the stingray spine and envenomation are reported to be very painful (Cunningham and Goetz 1996:96–97). To the Maya, this may have had an important ritual function; Lowie (1954) mentioned self-mutilation was sometimes practiced by Plains Indians for vision inducement; Durkheim (1912) argued many religions use pain to rise above nature, thus gaining a certain mastery over it. Envenomation by a stingray generally produces a sharp shooting pain within 10 to 15 minutes (Cunningham and Goetz 1996:96). Halstead (1980:96) listed the symptoms of stingray wounds as the following: pain (sharp, shooting, spasmodic, or throbbing), a fall in blood pressure, vomiting, diarrhea, sweating, rapid heart beat, muscular paralysis, and even death. The area around the wound swells and goes through a sequence of color changes, beginning as an ashy color, later becoming cyanotic (blue), and then reddening. Halstead (1970:69) pointed out stingray venom has dramatic effects on the heart muscle, and beyond producing changes in heart rate and blood pressure, can precipitate a complete and irreversible cardiac standstill. Cunningham and Goetz (1996:97) noted severe secondary infections often occur in stingray wounds even if the wound is properly cleaned.

Stingray venom is most toxic in a live stingray, and when removed from the animal, it begins to lose its virulence. Halstead (1970:66) reported solutions of stingray venom (mixed with either distilled water or saline solution) began to ". . . lose their potency within a few days" when stored at a temperature of 5°C. Thus, if the stingray spine was brought to Tikal soon after the death of the stingray, there would be a chance that the spine would still contain potent venom at the time of ritual use. Even if the potency of the venom diminished, many less severe symptoms of stingray poisoning could have had ritual importance to the Maya and may have been augmented through other drugs.

It can be assumed stingrays were caught live, as these animals do not shed their stings other than during attack (Halstead 1980:93). Further, being cartilaginous and quick to decompose, the chances of finding a dead stingray on a beach in a tropical environment would be very low. Because of the likely procurement of live animals, the poison could be expected to be fresh during the earliest stages of the potential use of the spine in cultural contexts. It is unknown, however, whether fresh stings would be used in tongue or penis perforation. Both Halstead (1980) and Cunningham and Goetz (1996) noted stingray-spine wounds in the chest or neck area can result in death, perhaps as a function of the proximity of the toxin to the cardiovascular and central nervous systems. Reactions are less severe in wounds to the extremities, such as the ankle and foot, which suggests the toxins moved slowly through the bloodstream.

Manipulation of these objects by the Maya in bloodletting rites would have been remarkably similar to their natural function, resulting in very similar types of wounds and risks of envenomation. As already noted, stingray spines apparently continue to retain venom for some time after becoming detached from the animal. The act of perforating or lacerating with a reasonably fresh stingray spine in a ritual context would thus result in the poisoning of the individual.

The Tikal data. Although present in the North Acropolis problematic deposits as early as the Middle Preclassic (Coe 1990; Maxwell 1996), stingray spines do not appear in true caches, as opposed to problematic deposits, at Tikal until the Early Classic period (see Table 1). Early Classic deposits bearing stingray spines tend to be located in open areas, suggesting that large audiences could have been present for the placement of these deposits during public rituals. Intriguingly, stingray spines are absent from all deposits associated with stelae at Tikal (Maxwell 1996). This may indicate bloodletting with a stingray spine was not a common way of marking the passage of time as stelae usually have dates on them.

While stingray spines are a frequent component of Early Classic deposits, the most commonly encountered form is actually the bone imitation spine. Imitation spines are nearly twice as abundant as real spines, outnumbering the latter 58 to 33, and imitation spines are known from the same contexts as real spines. This may indicate stingray toxins were not widely used in rituals during the Early Classic, or it may reflect the value and scarcity of real spines.

Table 1. Stingray spines in Tikal caches[a]

Time Period	Number of Caches	Number of Problematic Deposits	Number of Spines[b]	Number of Imitation Spines[b]	Total Number of Deposits	Total Number of Spines[b]
Middle Preclassic	0	1	1	0	1	1
Late Preclassic	0	0	0	0	0	0
Early Classic (Interior Deposits)	0	1	0	1	0	1
Early Classic (Exterior Deposits)	16	1	33	58	17	91
Hiatus Period (Ik) (Interior Deposits)	16	8	267	105	24	372
Hiatus Period (Ik) (Exterior Deposits)	1	1	20	1	2	21
Late Classic (Imix) (Interior Deposits)	6	10	97	4	16	101
Late Classic (Imix) (Exterior Deposits)	3	0	66	0	3	66
Postclassic (Interior Deposits)	0	1	not quantified	0	1	not quantified
Postclassic (Exterior Deposits)	0	0	0	0	0	0
Totals	42	23	484	169	64	6531

[a]Data from Coe (1990) and Maxwell (1996).
[b]Whole and fragmentary specimens combined.

https://doi.org/10.1017/S0956536100111095 Published online by Cambridge University Press

Given the toxic potential of real spines, however, it is also possible bone copies were used in rituals to ensure the participant would not have to risk death or other severe injury.

During the hiatus at Tikal (Ik ceramic period—A.D. 550–695), when Tikal may have been under the control of Caracol, the Early Classic pattern of stingray-spine distribution changes dramatically: the majority of spines are reported from deposits located inside rooms rather than in exterior public contexts (Coe 1990).[1] Another difference is real spines are now nearly three times as common as imitation ones. The frequency of imitation spines decreases from 61% to 27% of the collection, suggesting either bone copies were no longer readily accepted alternatives to the real object or envenomation was an increasingly important ritual behavior. Further, the majority of the assemblage during this period consists of fragmentary spines (86.8%); only 6 deposits contained whole spines, while 18 held fragments. If fragments were produced through ritual sacrifice of the artifact (see Walker 1995), then this was a routine practice during Late Classic (Ik) times.

Although the number of caches and problematic deposits increases slightly (from 55 to 57) following the hiatus[2] (Imix ceramic phase—A.D. 700–850), stingray spines become considerably less common with the combined real/imitation total decreasing by 57.3% (from 393 during the Ik ceramic phase, to only to 167 during the Imix phase). Imitation spines become almost nonexistent at this point, decreasing 96.2% from the period of hiatus at Tikal. This indicates ritual envenomation continued to be of some importance. The practice of intentionally breaking spines following their ritual use or "sacrificing" them (*sensu* Walker 1995) also continued, as nearly twice as many deposits (11) contain fragments as contain complete specimens (6). The percent of fragmentary specimens is almost identical to the preceding period, 85.9%; thus, the importance of this activity does not appear to have diminished. By the Postclassic period (after A.D. 850), stingray spines are virtually nonexistent in the North Acropolis area.

The presence of stingray spines in Tikal caches and problematic deposits from the Middle Preclassic through to the Postclassic period indicates these objects were of considerable ritual importance at this center. Further, the changes in spine frequency seem to correlate with known periods of political upheaval, with the greatest frequency of spines dating to the period when Tikal appears to have been under the proposed dominion of Caracol. The dramatic increase in the number of specimens at this time indicates their ritual use was more intense than during the preceding Early Classic period. Further, the switch from placing stingray spines primarily in exterior locations, where large audiences could have viewed the associated rituals, to interior locations—small rooms where audience size would be extremely limited—is suggestive of changes in rituals involving stingray spines, perhaps being banned in public contexts or taking on a secretive nature. It is even conceivable Caracol was somehow behind this increase, possibly introducing a new form of ritual behavior. The dramatic decline in frequency of imitation spines at this time suggests ritual envenomation became an important behavior—perhaps one associated with rituals designed to rid the Tikaleños of their Caracol overlords. The decline in the frequency of stingray spines during the Imix period, after Tikal had regained its independence, supports this idea and perhaps indicates such rituals no longer held the same importance.

Porcupine Fish

Porcupine fish are members of the Order *Tetraodontoidea*, which comprises fish that increase their size through swallowing quantities of water or air as a defense mechanism (known as puffer fish). Two species of porcupine fish, *Diodon holocanthus* and *D. hystrix* (Bohlke and Chaplin 1993) are found in the Caribbean. As the name suggests, porcupine fish are covered with sharp dermal spines. These spines would have made inviting implements for ritual bloodletting. It is worth noting, the flesh of these fish is highly toxic; in fact, puffer fish are among the most poisonous of all marine organisms (Halstead 1980:176) with a fatality rate of nearly 60% among people who consume the liver, gonads, or skin of the fish. Halstead (1980:177) describes puffer fish poisoning as follows:

> Puffer poisoning is characterized by paresthesias, a tingling sensation of the lips and tongue which gradually spreads to include the extremities and later develops into severe numbness involving the entire body. Gastrointestinal disturbances may or may not be present. Respiratory distress is a prominent part of the clinical picture, and the victim eventually becomes intensely cyanotic [the skin turns blue]. Petechial hemorrhages, blistering and severe scaling of the skin may develop. Ataxia [imperfect control of bodily functions], aphonia [loss of voice], dysphagia, muscular twitchings, tremors, incoordination, paralysis and convulsions are frequently present. The victim may become comatose, but in most instances remains conscious until shortly before death. If death occurs, it usually takes place within the first 24 hours.

Puffer fish poison, tetrodotoxin, acts on both the central and peripheral areas of the nervous system and results in respiratory failure and hypotension (low blood pressure) even if ingested in small doses. Intriguingly, tetrodotoxin is an important component of "recipe" used by Haitian Voodoo priests to create zombies, with the lowered metabolic rate of the victim used to simulate death (see Davis 1985). Zombies are placed into a near death state through a dose of tetrodotoxin, and then revived to become the "undead."

There is no firm evidence for the consumption of porcupine fish at Tikal, although unidentified fish vertebrae are often found in association with dermal spines. Still, the presence of porcupinefish remains in ritual contexts yields the possibility that tetrodotoxin may have been employed during certain ceremonies.

The Tikal data. Elements identified as porcupine-fish dermal spines from the North Acropolis (a single problematic deposit held 17 spines) date to the Early Classic period, at the earliest, and remain a rare inclusion throughout its occupation (see Table 2). During the hiatus period, however, those few deposits that yielded

[1] In another study of caches from Tikal and elsewhere (Maxwell 1996), I used the distinction between "interior" and "exterior" locations as a primary sorting characteristic in classifying the spatial characteristics of caches, based on the criteria of private (interior) versus public (exterior) space. I argue caches deposited in large, open areas (such as a plaza) were associated with rituals of a public nature, given that such a location could *potentially* allow for a large audience. Caches deposited in rooms, on the other hand, are evidence of "private" rituals, as Maya rooms could not accommodate large numbers of people. Thus, placement of a cache within a small area would effectively restrict access to a sacred space (Smith 1994). Given these very different audience potentials, locating caches in either interior or exterior locations appears to represent fundamentally different types of ritual behavior. Exploration of this dichotomy, along with the variability in spatial patterning of caches that contain toxic marine materials will be important directions for future research.

[2] This total excludes deposits from Mundo Perdido.

https://doi.org/10.1017/S0956536100111095 Published online by Cambridge University Press

Table 2. Porcupine fish remains from the Tikal North Acropolis[a]

Time Period	Number of Caches	Number of Problematic Deposits	Number of Dermal Spines	Number of Fish Vertebrae[b]	Total Number of Deposits	Total Number of Fish Remains[c]
Middle Preclassic	0	0	0	0	0	0
Late Preclassic	0	0	0	0	0	0
Early Classic (Interior Deposits)	0	1	17	0	1	17
Early Classic (Exterior Deposits)	0	0	0	0	0	0
Hiatus Period (Ik) (Interior Deposits)	3	3	245[d]	918	6	1163
Hiatus Period (Ik) (Exterior Deposits)	1	0	20	50	1	70
Late Classic (Imix) (Interior Deposits)	2	0	19	217	2	236
Late Classic (Imix) (Exterior Deposits)	0	0	0	0	0	0
Postclassic (Interior Deposits)	0	0	0	0	0	0
Postclassic (Exterior Deposits)	0	0	0	0	0	0
Totals	6	4	3013	1185	10	14861

[a]Data from Coe (1990) and Maxwell (1996).
[b]Vertebrae have not been identified, and may or may not be porcupine fish.
[c]Includes unidentified vertebrae.
[d]Minimal count; materials in Cache 190 are not quantified.

porcupine fish remains (7 total, 4 caches and 3 problematic deposits, as identified by Coe [1990]) held 265 spines, suggesting the presence and presumable use of several fish. As with stingray spines, the vast majority of these remains (6 of 7 deposits, 92.5% of all spines) came from interior deposits, indicative of private ritual. Unidentified fish vertebrae are found in four of these deposits, suggesting that whole fish were present at the time of the ritual and deposition, although how these animals were used in ceremonial context is unclear. The placement of porcupine-fish dermal spines in North Acropolis deposits occurred throughout the Imix ceramic period, although less frequently than in earlier periods. By the Postclassic period, they were no longer used.

The most intriguing aspect of the Tikal porcupine-fish dermal-spine assemblage is that the frequency of these remains is highest during the era following the defeat of Tikal by Caracol (A.D. 562–695) (Schele and Freidel 1990), when Tikal may have been under the control of Caracol. This was undoubtedly a time when the Tikal elites were undergoing severe social stress. The data indicate these individuals used poisonous fish in ritual contexts, although the nature of the ritual and the manner in which these animals were employed is unknown. Use of the dermal spines for bloodletting seems an obvious assumption; consumption to induce death or a near-death comatose state is another possibility.

Sponges (Phylum Porifera)

Marine sponges are occasionally identified in Tikal caches and problematic deposits (Coe 1990). Cunningham and Goetz (1996) noted contact with toxic sponge secretions can result in contact dermatitis (skin rash, swelling, redness, and itching); this condition is a potential hazard, not only from live sponges and those washed onto the beach after a storm, but also from dried sponges as their toxic condition may reappear when they become wet (Cunningham and Goetz 1996:11). While poor preservation precludes specific identifications of cached sponges, it is worth noting at least two species of poisonous sponge inhabit the Caribbean; thus, it is possible that some sponges encountered in caches are of the toxic variety.

Do–not–touch–me sponge (Neofibularia notangere). The do-not-touch-me sponge is found in coral reefs throughout the Gulf of Mexico and Caribbean. These animals range from the low-tide mark to water as deep as 150 feet (46 m) and are commonly associated with staghorn coral (*Acropora cervicornis*) and elkhorn coral (*A. palmata*) (Cunningham and Goetz 1996:11). Contact with the do-not-touch-me sponge is considered as a moderate to severe hazard and results in an immediate stinging sensation, while the affected area may experience numbness, swelling, severe burning, and blistering for several days (Cunningham and Goetz 1996:11).

Fire sponge (Tedania ignis). Fire sponge is also found throughout the Caribbean and Gulf of Mexico and is common in lagoons and shallow bays, ranging from the low-tide mark to 50 feet (15.24 m) below the surface. Human contact with fire sponge is considered a slight to moderate hazard. Contact results in a stinging sensation, which is followed by a rash similar to that caused by poison ivy. This can last for several days (Cunningham and Goetz 1996:13).

The Tikal data. Sponge is first reported to have been placed in deposits at Tikal in three Early Classic exterior deposits (Coe 1990). It has been found in 15 caches of the Ik ceramic phase (11 of these are from interior locations). By the Imix phase, the number of caches containing sponge decreased to only 4; all were exterior deposits.

The role of sponges in Tikal caches is unclear, however, several possibilities exist. Sponges may have been used for their absorbency, possibly in ceremonies involving transition and transformation, as sponges could have been used to make water or other liquids disappear and reappear. Sponges could also conceivably have been utilized to clean up after bloodletting, which may explain their inclusion in caches. Given the toxic nature of some species of sponges in the areas likely to have been supplying the materials used at Tikal, however, it is quite possible they were used as a component of rituals designed to induce pain.

CORALS (*PHYLUM CNIDARIA*)

Hard Corals (Class Anthozoa)

Corals are generally harmless to humans, although their rough structure can cause abrasions. Both fire corals and elkhorn corals, how-

https://doi.org/10.1017/S0956536100111095 Published online by Cambridge University Press

ever, are toxic to humans. They are found in the Caribbean, thus they were available for ritual use among the Maya.

Elkhorn coral (Acropora palmata). Colonies of elkhorn coral (and other species of *Acropora*, including staghorn coral) are common throughout the Caribbean and Gulf of Mexico and usually grow into tree-like structures. Contact with coral of this type is of only slight to moderate hazard to humans, most likely resulting in abrasions and deep cuts from contact with the sharp tips. Initial symptoms of contact include a stinging sensation, swelling, redness, and itching of the wound site. Abrasions and cuts may heal slowly and will frequently become infected if not cleaned properly (Cunningham and Goetz 1996:20).

Fire coral (Millepora complanata, M. alcicornis, and M. squarrosa). Two varieties of fire coral, branching and blade, are both dominant members of shallow reef communities, and they are common in the Caribbean. These inhabit a variety of depths, ranging from as little as 3 feet (1 m) below sea level to more than 30 feet (10 m) deep. Human contact with fire corals is considered a moderate to severe hazard:

> Contact with a live fire coral colony may cause a severe burning sensation. Skin may remain tender and inflamed for several days and blistering may occur in sensitive individuals. Fire coral stings are most severe on the sensitive body areas (i.e., inside of the arms and legs, torso, neck, and face) while envenomations to the calloused palms of the hands and soles of the feet may not even be felt [Cunningham and Goetz 1996:38].

Halstead (1980:59) noted the reaction to fire coral can range from a minor stinging sensation to a shooting, throbbing pain. Conceivably, this may have been used to release endorphins.

The Tikal data. Coral is reported (Coe 1990) to have been used first during the Early Classic, when it is present in nine exterior caches; seven of these contained unidentified branching corals, while single deposits yielded brain and gill coral (neither of which are toxic). Corals are reported (Coe 1990) from an additional seven caches that date to the hiatus period (all interior deposits). Contrary to the Early Classic pattern, however, only a single example of branching coral is present, with brain coral the most common form; a single piece of brain coral is also reported from a single exterior deposit dating to this period (Coe 1990). By the post-hiatus period, coral is an unusual cache inclusion, reported from only four deposits (equally divided between interior and exterior locales). Brain coral is present in both interior deposits and a single exterior cache, while branching corals are found in single interior and exterior deposits. Branching coral is reported from a single Postclassic exterior deposit (Coe 1990).

Tikal corals are never described as modified, suggesting that they were ritually important in and of themselves, and their ritual function is far from clear. It is possible they are simply offerings; it is also possible they were used as abrasive substances, possibly for bloodletting, or as a source of toxins. Alternatively these may have been used for their marine symbolism. It is intriguing that the potentially toxic specimens reported were found predominantly in Early Classic contexts—the exact opposite pattern to that seen for all other toxic materials. The reasons for this contrasting pattern are unknown.

Sea Urchins

Sea-urchin spines often inflict puncture wounds, which in turn result in envenomation and sometimes secondary bacterial infection. Cunningham and Goetz (1996:82) noted there is also a risk of envenomation by the pedicellariae which are the pincer-like jaws of the urchin that can bite into the skin.

The Tikal data. Sea urchin remains are reported from only a single Early Classic cache and these remains are not described (Coe 1990). The ritual function of sea urchins at Tikal is unclear. They may have been ornamental. Or they may have been utilized as a ceremonial foodstuff, as sea-urchin roe is today considered a delicacy by the Japanese. Further, sea urchins are covered with spines, making them prime candidates for use in bloodletting ceremonies; this, in turn, could have resulted in the envenomation of the individual doing the bloodletting. The rarity of urchin remains in caches, however, indicates this was not a frequent component of ritual at Tikal.

Cone Shells

Cone shells are renowned among shell collectors for their beauty; they are also very dangerous animals, producing deadly poisons (Halstead 1980:64–66). Poisoning occurs through puncture wounds inflicted by live animals. Typical symptoms include numbness and tingling, starting in the wound and progressing to encompass the entire body. The numbness and tingling are more severe around the mouth and lips. Severe reactions include coma and paralysis, and in some cases death.

The Tikal data. Cone shells are common in the Caribbean (Warmke and Abbott 1961). They are rarely found, however, in Tikal caches. Only three specimens are reported from Early Classic deposits (all exterior); a single specimen is reported from the hiatus period, and this comes from an interior cache (Coe 1990). The latest Tikal cone-shell deposit dates to the Imix period. Given the common nature of cone shells in the Caribbean area, the lack of these objects at Tikal is surprising and suggests if these animals were indeed utilized for their poisons, this occurred on a very rare basis.

A BRIEF HISTORY OF TIKAL POLITICS AND CACHES

Ritual activity seems to have been practiced in the North Acropolis during the Middle Preclassic period (Coe 1990). During this period there are few clear indications of offerings, and these tend toward little in the way of exotic or elaborately mode items, especially in comparison with what was to come in later periods. Mundo Perdido and the Plaza of the Seven Temples also were used for the placement of ritual offerings at this time, suggesting a widespread distribution of such activity at Tikal (Laporte 1989; Laporte and Valdes 1993).

Middle and Late Preclassic caches have been infrequently encountered and contain unspectacular materials; obsidian, chert, jade, shells, and other marine objects are rare commodities. Ceramics are found in caches, but in small numbers. Cache-content variety changed dramatically in the Early Classic period, probably because of the political events of the time (Maxwell 1996).

The key events of the Early Classic period are the Tikal-Uaxactun event of A.D. 378 and the dynastic change (Great Jaguar

https://doi.org/10.1017/S0956536100111095 Published online by Cambridge University Press

Paw to Curl Nose) of A.D. 379 (Culbert and Krejci 1995; Laporte and Fialko 1987). Great Jaguar Paw and his lineage focused their ritual attention on Mundo Perdido. Jones (1991) suggested the shift away from the North Acropolis to Mundo Perdido may indicate a break with the earlier rulers of Tikal. The reliance on the North Acropolis for placing ritual deposits appears directly related to these two events, which served to move the seat of the Tikal dynasty away from Mundo Perdido—where it was centered during the reign of Great Jaguar Paw—back to the North Acropolis. The return of the North Acropolis as the ritual core of Tikal seems to correspond with the dynastic change which occurred in A.D. 379, when Curl Nose replaced Great Jaguar Paw.

The time around A.D. 400 was important at Tikal and was marked by considerable architectural remodeling and construction in the North Acropolis and its immediate environs. The timing of this construction falls squarely within the reign of Curl Nose, who apparently took it upon himself to reestablish the North Acropolis as the primary center for ritual activity. Two important economic and ritual changes seem to accompany these events:

1. The use of exotic materials increases. Obsidian from both central Mexico and the Guatemalan highlands is reported from caches of this period; jade, presumably transported from the Motagua Valley, is also present, as are marine objects from both the Gulf of Mexico and the Pacific ocean (Coe 1990). Apparently the new dynasty had both an interest in and aptitude for long-distance trade and/or the development of tribute centers; Curl Nose and his successors were adept at acquiring exotic and valuable materials. Culbert and Krejci (1995:109–110) noted it is during this period major changes in royal burials occur, and these—like caches—become much richer in content than at any previous time.
2. The number of caches and problematic deposits increases dramatically (542% over the Late Preclassic frequency; 250% over the Preclassic, in general), suggesting changes in the pattern of ritual behavior from that employed by the Great Jaguar Paw dynasty. Rituals resulting in caches occurred more frequently, and these rituals either required or utilized a broader range of materials than Preclassic rituals. As Moholy-Nagy (1997) noted, it is during this time that craft-production debris, such as lithic debitage, began to appear in abundance in caches, also suggesting a change in ritual behavior from the Preclassic period.

The sixth century A.D. was a turbulent time politically at Tikal and saw many rulers (all numbered, but only some named) come and go over a short span of time. This suggests considerable internal conflict. The continuing strife weakened Tikal both politically and with regard to military might. In A.D. 556, Caracol conducted a war against Tikal, and in A.D. 562 Caracol defeated Tikal (Schele and Freidel 1990), leading to a prolonged hiatus of monument construction.

Caches from this hiatus period reveal a mix of continuity and change from the Early Classic. The most dramatic change is the more common placement of caches in interior locations. Interior locations account for 69.1% of the hiatus-period deposits, compared to only 15.8% during the Early Classic period (Maxwell 1996). This change, combined with the lack of monuments from this period, indicates elite activities in the public sphere were curtailed dramatically. Perhaps rituals continued to be performed in private loci, thus explaining the preponderance of interior caches and problematic deposits.

Lithic artifacts, particularly simple forms such as flakes, cores, and debitage, decrease dramatically in frequency during the hiatus (see also Moholy-Nagy 1997). Although both obsidian and chert eccentrics continue to be encountered, their frequency—particularly those of obsidian—declines dramatically. Jade also declines in frequency and is rare throughout the remainder of occupation of Tikal. The only classes of jade artifacts encountered in any abundance during the hiatus period are mosaic elements and broken fragments. This may suggest a scarcity of jade at Tikal which possibly resulted from outside powers (i.e., Caracol) restricting access to this resource.

Another significant change relates to the use of marine materials in caches, where there is an increased frequency of non-shelled marine invertebrates such as coral, gorgonians, and sponge (Maxwell 1996). Remains dating to the hiatus period also yield the highest frequency of caches and problematic deposits that contain stingray spines. Bony fish were utilized to a greater extent than ever before, and those few identified fish remains—all porcupine fish—suggest their function was bloodletting or providing poisons which may have been used in rituals.

Little is known of the political history of Tikal during the hiatus period due to the lack of carved monuments; hence, it is unclear whether Caracol imposed a new ruler, or whether they simply sacked the city and left. Still, the change in caching activity (particularly the switch to interior locales) supports the former scenario. Further support comes from Burial 195, dating to either A.D. 593 or 613, which houses the remains of Animal Skull, who was the 22nd ruler of Tikal following Double Bird. As Jones (1991) noted, Animal Skull was not the son of Double Bird; his father's name glyph is not recognized as that of any member of the Tikal elite, and thus, the possibility exists that Animal Skull either came from Caracol or was put into power through the influence of this center (Jones 1991:117).

Although Ruler A appears to be a direct descendant from the hiatus rulers, his accession marked the time of re-emergence of Tikal from outside domination and the post-hiatus period (Imix ceramic phase). North Acropolis caches of this period are less elaborate and less spectacular in comparison with those of earlier times; while the familiar Early Classic materials—obsidian, chert, marine materials, jade—all continued to be used, but they are always found in low frequencies. Obsidian eccentrics became quite rare, although their chert counterparts remained common. The use of marine objects was much less common during the post-hiatus period than the Early Classic, and the use of stingray spines decreased considerably (Maxwell 1996).

These changes indicate that while Tikal experienced a resurgent period (reflected particularly in architecture and the erection of stelae), its elite lacked the kind of access to exotic goods present during the Early Classic period. Possibly trading partners, tribute centers, and access routes, which had previously been controlled by Tikal, had not been reacquired following the hiatus and period of external domination. It is also possible new rituals which required fewer exotic objects were performed, or rituals did not necessarily require the caching of objects upon completion. It appears, however, the North Acropolis was not a major center for ritual activity following the hiatus period (Maxwell 1996:351–352), which may explain the decrease in both presence and quantity of exotic materials in caches recovered from this area.

DISCUSSION

There is no irrefutable evidence for the ritual use of marine toxins in ritual contexts at Tikal. The repeated presence of a wide variety of toxic marine objects in ritual deposits, however, suggests they were used in ceremonial contexts. Further, the most

https://doi.org/10.1017/S0956536100111095 Published online by Cambridge University Press

toxic species are typically found in their greatest numbers in deposits dating to a period in the history of Tikal when social control by an outside polity was a very real possibility. It is unclear whether Caracol actually imposed day-to-day control over the citizens of Tikal following the war of A.D. 562, however, it is clear this war resulted in a prolonged period of ill-fortune for Tikal. Changes in ritual assemblages are seen at this time: caches moved from primarily exterior locales where large audiences could view the ritual to interior locations where only a handful of people could be present; monument erection ceased leading to a gap in the historical sequence; access to materials such as jade and obsidian appears to have changed, as the frequency of these materials in caches and problematic deposits decreased dramatically (see Maxwell 1996), and these were replaced by higher numbers of toxic marine objects. These toxic marine objects may represent nothing more than a different pattern of ritual offerings, however, these too decrease in frequency following the hiatus, when Tikal again achieved a dominant political position in the Peten region. Thus, the highest frequency of toxic marine objects used in ritual contexts occurred during the hiatus period, a time when the Tikal elite likely experienced severe social stress. The covariation of these phenomena shows the ritual use of toxic marine animals at Tikal and suggests these were used for coping with such stresses; this may have included the ritual use of marine toxins, perhaps in combination with psychoreactive substances, as a component of behavior designed to achieve an altered state of consciousness.

Ritual use of marine objects as offerings was of considerable importance among the Maya, particularly at large inland centers such as Tikal. It appears likely not all marine objects functioned as devotional gifts to gods or rulers; the presence of a large number and variety of toxic marine materials is suggestive of the use of their toxins in ritual contexts (any deposit with evidence of ritual behavior, not just offerings). It seems unlikely—barring specific mention in a glyphic text—their actual use can ever be confirmed; yet it is probable, based on patterns of object appearance and their covariation with periods of political highs and lows, the Tikal elite did use toxic marine objects in rituals.

DIRECTIONS FOR FUTURE RESEARCH

Despite the patterns revealed in this study, it is apparent additional work is needed. Future research should minimally proceed along two lines: (1) A detailed study of the spatial patterning of toxic marine objects is needed for Tikal and other centers in the Maya lowlands. This is essential for determining whether this pattern is Tikal-specific, or can be recognized elsewhere. Such a study may also yield insight into the types of ritual behavior utilizing such objects, and thus the manner in which marine toxins were used. (2) Basic research into the properties of the marine toxins are needed to determine the specific reactions these will cause in humans. Halstead (1970) pointed out the poisons of only a handful of species of stingray have received any attention; it is essential we determine whether there are differences in the effects of the toxins of different species and how these effects diminish as the poison loses its virulence. Without such research, it will be impossible to do more than generalize about ritual behavior involving items such as stingray spines. Recognizing the ritual potential of these marine materials is an important first step in interpreting these deposits, but much work remains.

RESUMEN

Se presenta un estudio de organismos marítimos tóxicos de escondrijos y depósitos problemáticos (PD) del Acrópolis Norte, la Gran Plaza, los Templos I y II y Mundo Perdido en Tikal. Se encuentra con frecuencia en estos escondrijos una gran variedad de restos marítimos como conchas, huesos de pescado y espinas de manta raya (Coe 1990; Maxwell 1996). Sin embargo, poca atención se ha prestado al estudio de estos objetos como objetos rituales, fuera de la posibilidad del uso de espinas de manta raya en el autosacrificio.

Muchos escondrijos contienen los restos de animales tóxicos, incluyendo manta raya, pez globo, conchas cónicas y potencialmente tóxicos corales y esponjas. Por ejemplo, las toxinas producidas por la manta raya para defensa propia, no están concentradas en la carne del animal, si no en las cavidades de la espina. Por consiguiente, el veneno continuo existiendo en la espina del animal después de su muerte (Halstead 1980). Debido al hecho que espinas frescas de manta raya fueran usadas en contextos rituales, se presume que los participantes se envenenaban en el proceso. El proceso de autosacrificio, entonces, no solamente incluía la perforación del pene masculino o la lengua, pero también el envenenamiento del individuo.

Durante el período del "hiato Tikal" (562–695 d.C.), comenzando inmediatamente después de la derrota de Tikal por Caracol hasta la ascensión del soberano "A," la mayoría de estos restos marítimos aparecen en los cuartos interiores, de lo que se supone que en esta actividad no participaban una gran cantidad de gente. También durante este tiempo, se encuentra con más frecuencia espinas verdaderas de manta raya, en lugar de imitaciones. Este evidencia sugiere que la práctica del envenenamiento ritual llevaba más importancia durante el periodo del hiato. Evidencia de restos de pez globo apoya esta tendencia. Este estudio sugiere que el uso de objetos marítimos tóxicos en contextos rituales ocurre con más frecuencia durante el peor período político en Tikal. Se propone que esta práctica era utilizada por la élite de Tikal para sobrellevar la tensión causada por estar dominados por una cultura extranjera. La especifica manera del uso ritual no es cierta, pero es probable que estos venenos ayudaban a los participantes a entrar en un estado de realidad alterada.

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