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Ecce Bufo: The Toad in Nature and in Olmec Iconography[1]

by Alison Bailey Kennedy

"MYSTERIOUS," "CRYPTIC," AND "ENIGMATIC": faced with the Olmec, archaeologists and art historians are forced to dip into the vocabulary of the hack writer. One hears of the Olmec "problem," "puzzle," or "riddle." Covarrubias, in fact, remarked that the average anthropologist, confronted with "the Olmec problem," treats it as he would a coiled rattlesnake. And yet it was probably Covarrubias, for all his insight and ardor, who perpetuated the arcanum that even today surrounds the Olmec. He speculated, in an era when speculation was decidedly out of vogue in American archaeological quarters, that the Olmec identified with the jaguar. Further, he proposed that the Olmec believed themselves descended from the union of a jaguar and a proto-Olmec woman—that the jaguar was their *nagual* or totemic animal and tutelary divinity. This pronouncement came at a time when there was a total theoretical vacuum, and it further commended itself by extending back in time one of the two cherished leitmotifs in Mesoamerican art. The idea that Mesoamerican iconography exhibited a rectilinear evolution was one of enormous appeal at a time when the various cultures were just beginning to be schematized. So it was that the were-jaguar with its cleft brow and toothless gums became entrenched in the literature. Coe

[1] This paper was presented at the XLIII International Congress of Americanists in Vancouver in August 1979 and was awarded the Charles Borden, Geoffrey Bushnell, and Juan Comas Prize for the best paper in art/intellectual history. Since it was first presented, several major contributions have appeared which should be noted. Coe's long-anticipated study on the archaeology of San Lorenzo Tenochtitlan (coauthor Richard Diehl, *In the Land of the Olmec*, 2 volumes, Austin: University of Texas Press, 1980) fills in many details and supplies a gratifying amount of data on the natural history of the region. Furst's article, "Jaguar Baby or Mother Toad," which I had read in an earlier draft, has been published in the Matthew Sterling memorial volume, *The Olmec and Their Neighbors* (Washington, D.C.: Dumbarton Oaks, 1981). I note that in the published version Furst draws on the more proximate cultures—Mayan, Izapan, Kaminaljuyu—in his pictorial documentation, rather than on the Mixtec and Hopi material that dominates the text. The down-pointed triangle or *quetchquemill* shape, upon which he lays great stress and which he relates to the female genitalia (uterine-U- or V-shaped vaginal opening), can also be related to the V-shape of the caudal region of the toad when its haunches are drawn up under it. This shape—highly stylized—is in fact repeated endlessly in Mezcala jade or serpentine toad effigies. *The Olmec and Their Neighbors* also includes Pohorilenko's article "The Olmec Style and Costa Rican Archaeology," with its discussion of the too-little-known examples of Olmec jade work from Costa Rica. Most relevant is the detailed description of the duck-tadpole of figure 50 (Pohorilenko had kindly furnished me with a drawing for the presentation of this paper in Vancouver).

Hamblin's article "The Magic Toads of Cozumel" has appeared in an abridged form in *Mexicon* 3(1), which highlights the hallucinogenic/ritual use of *Bufo marinus*.

Richard Evans Schultes has called my attention to his 1979 article "Ancient Gold Pectorals from Colombia: Mushroom Effigies?" (*Botanical Museum Leaflets* 27:5–6) and to the latest edition of his *Botany and Chemistry of the Hallucinogens* (Springfield: Thomas, 1980), both of which add to the growing awareness of the hallucinogenic significance of toads—an area which Peter Furst, perhaps more than anyone else, has pioneered.

George Zug's definitive monograph *The Marine Toad,* Bufo marinus: *A Natural History Resumé of Native Populations* was published by the Smithsonian Institution in 1979. A survey of the literature to date, it is enlarged by his own ecological field studies in Panama. Most relevant are the sections on the "food and feeding behavior" of these "sloppy and opportunistic feeders" and the "seasonal sexual activity patterns." (In a personal communication, Zug has cautioned me against imposing a single breeding peak on toads; most *marinus* populations exhibit two reproductive peaks, "early dry" and "late dry-early wet," and thus my attempt to identify the *cauac* months could be seen as "much ado about nothing." Lawrence Licht has also taken exception to my identification of *B. marinus* as a dry-season breeder, claiming that in Veracruz they breed in June and July, i.e., "early wet." Zug has further stated (personal communication and 1979:39) that ducks and wading birds do in fact eat the recently metamorphosed toadlets and juveniles of *B. marinus*. As for the artificial lagunas at San Lorenzo, "they couldn't have kept the *marinus* out if they had wanted" (personal communication).

The paper here published is an amplified version of the one delivered in Vancouver, with some supporting material added in the form of footnotes. There are a number of ideas in the paper which I am far from wedded to and things that I would say differently now, over two years later; but upon mature reflection I have decided to leave it essentially as it was. The presentation was accompanied by some 240 slides, half of which were taken by Lawrence Desmond, with whom I also had many fruitful discussions about matters Olmec. The photographs of live toads were kindly shot for me by Lloyd Gomez, staff photographer at the Steinhardt Aquarium at the California Academy of Sciences. Richard Lacer, staff amphibiologist, helped "milk" the paratoid glands so that the Ames mutagenicity test could be performed on the secretions by Bruce Ames of the Department of Biochemistry, University of California, Berkeley. (Results of the test were negative, but he evinced much curious and kindly interest.) Alexander T. Shulgin reviewed the biochemical arguments with me. John Graham of the University of California, Berkeley, showed friendly interest and gave me access to his Abaj Takalik material, replete with toad effigies. I have benefitted enormously from the prodigious spadework done by David Joralemon; he also kindly directed me to museums and private collections of Olmec material all over the country. It was he who first called my attention to the very intriguing "Transformation Figure" with a toad incised on its forehead at Princeton, illustrations of which I have appended here as figures 58 and 59. James Fox, Donald Hales, Susan Milbrath, and John Carlson, to mention but a few friends, all chimed in with help and suggestions. Special thanks are due to Marie Stephen of the University of British Columbia Press, who helped me with the eleventh-hour retyping of this text so that it could be submitted in the competition, and to Vivienne Thompson, Sino-Mayanist, who kindly typed the final draft and advised on phraseology.

gave it further currency in his books *The Jaguar's Children* (1965) and *America's First Civilization* (1968). It was finally canonized by the Dumbarton Oaks Conference: *The Cult of the Feline* (Benson 1972).

Somehow, no one had seriously undertaken to scrutinize the iconography with a view to identifying this so-called were-jaguar. Joralemon, in his meticulous study for Dumbarton Oaks (1971), anatomized the motifs and iconic representations of the Olmec: the flame brows, paw wings, crossed bands, and cleft elements. His sunderance and recombining of these iconic elements yielded ten "gods" where before there had been only one, but it did little to enlighten us as to the referential meaning of these elements. In "The Olmec Dragon" (1976) he cut the original inventory down to a mere three gods, but continued to insist on a pantheon composed of "biologically impossible" animals.

My own researches have convinced me that the typical attributes of the so-called were-jaguar are not, in fact, biologically impossible but are clear and diagnostic attributes of the toad. The cleft brow, for example, which Coe associated with the furrow in the crown of *some* mature male jaguars, is a clear and ever present feature in *all* members of the genus *Bufo* (figs. 1–3). In fact, in *Bufo marinus*, the giant toad of the Gulf Coast area, this cleft brow or intraorbital depression is further accentuated by the cranial crests (fig. 4)[2] which communicate with the powerful venom-secreting paratoid glands (figs. 5, 6). And these cranial supraorbital crests in *B. marinus* bear an uncanny resemblance to the Olmec flame brow (figs. 7–10).

FIG. 1. Male jaguar.

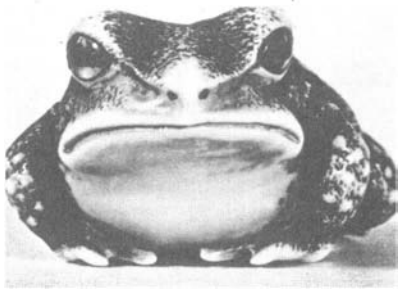
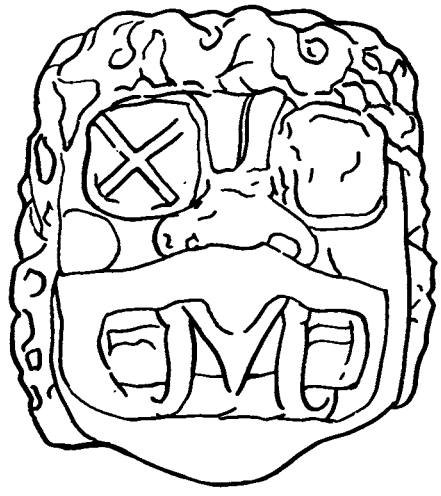


FIG. 2. *Bufo japonicus*, ivory netsuke in the Braun Collection, Tokyo (*Collectors' Netsuke* 1971:99, reprinted by permission of the publisher).

[2] In the interest of clarity, I have simplified its anatomy in the text. The crest can be broken down into various parts; according to Wright and Wright (1949:189), "The *canthus rostralis* is a prominent crest beginning ahead of and above the nostrils and ending at the anterior corner of the eye, where it forks into two ridges, a broad preorbital and a well-defined supraciliary crest which curves around the eye, sending off a broad supratympanic ridge to the paratoid and a very short postorbital." Viewed frontally these crests present a capital-M shape, a feature that turns out to be iconographically crucial when we come to the four-dots-and-bar motif. This capital-M shape turns up in almost naturalistic form on Monument 1 from Cerro de las Mesas. Here the center line of the canthus rostralis becomes the "egg tooth" and the preorbital crest (that curves down under the eye) becomes the fangs (see de la Fuente 1973:136).

The cleft brow has been tacitly regarded as "necessary and sufficient" to Olmec-style jade from the days of Covarrubias. This is an overstatement, clearly, but it is certainly focal, and its other associations must be explored. The cleft brow has recently been identified with fertility because of representations

FIG. 3. Incised basalt "mask" (knee pad?) from the Covarrubias collection (after Covarrubias 1957:80).



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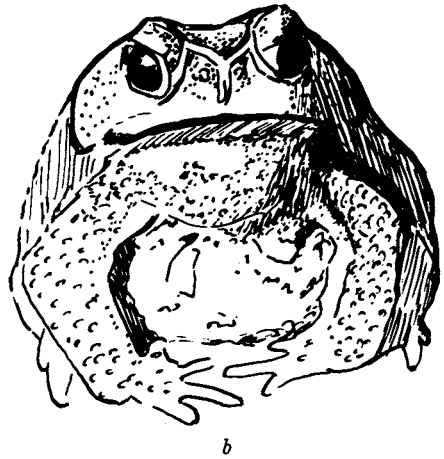

b

FIG. 4*a*, basalt head from Laguna de los Cerros featuring buccal mask with fangs and "egg tooth" (after de la Fuente 1973:136); *b*, *Bufo marinus* showing M-shaped canthus rostralis (after Breder 1946:pl. 42).

on Arroyo Pesquero celts of maize sprouting from it. Many of these celts have now been rejected as fakes, and I am inclined to think that such maize elements as do appear (without the corn-row pattern) represent the pineal gland. The cleft itself might also refer to the infant fontanelle, as Covarrubias (1947)

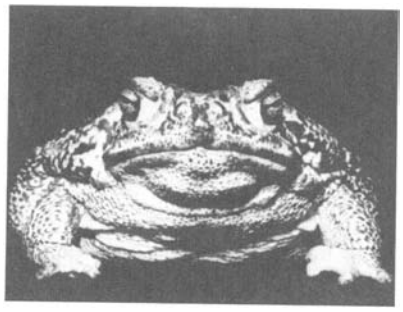

FIG. 5. Frontal view of *B. marinus* showing M-shaped canthus rostralis (photo by L. Gomez).

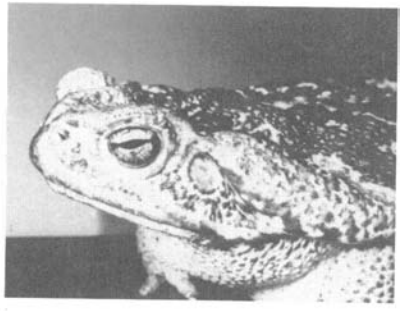

FIG. 6. Side views of *B. marinus* showing crest formation and paratoid glands (photos by L. Gomez).

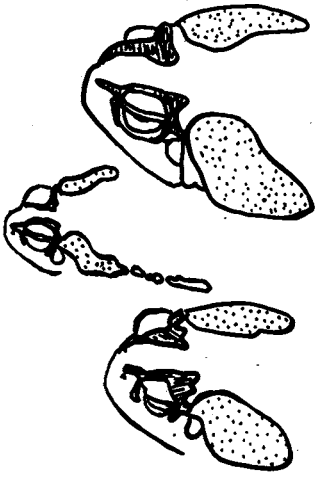

FIG. 7. Paratoid glands of three varieties of *B. marinus* (after Lutz 1971:432).

suggested, or to a trepanation hole—especially when seen in profile with a shaft leading to the "third eye" of a supernumerary profile face (fig. 11). However, even if the vegetal motif identification proves to hold up, the toad's associations with fertility and agriculture are certainly beyond question. *B. marinus* is a notoriously fecund creature, laying up to 35,000 eggs during its nuptial period. Additionally, it was doubtless used or recognized as a natural pest-control agent in agriculture, even as it is today throughout the Caribbean and Pacific areas.

The toad has many different guises in keeping with its amphibious nature. It appears as a fertility symbol, chthonic symbol, symbol of transformation, and psychopomp. Its representation among the Olmec and throughout Mesoamerican art is sometimes explicit and naturalistic but more often covert (especially in the case of the Olmec—see figure 12),[3] glorified or amalgamated with feline characteristics or *pars pro toto* symbolism: the hind legs, for example, the four-dots-and-bar motif, or the toothless gums.

One must first attune one's vision to perceive the essence of toadiness. There is something disconcertingly humanoid, almost foetal, about the toad. It recalls insistently that epoch of foetal life, the intrauterine environment, which is doubtless recorded on some level in our neural circuitry or phylogenetic memory. Indeed, Wassén (1934:629) records South American cosmology myths wherein toads were turned into men, the Arawaks of Surinam, "the first men at the earliest phase of the world." According to Seler (1923:696), the Mayan word for toad, *mutš* or *much*, is the same as for the female genitalia. Kelley (1976: 150), citing Barthel, suggests that T740 in the inscriptions, the up-ended frog's head, be read as *pok* or "be born." The head nethermost is of course the normal cephalic presentation in childbirth. The squatting or frog-leg posture has been identified by Pérez Ramirez (1960:18, 84) as the *postura del parto*, also known as the *postura india*—the normal position for childbirth

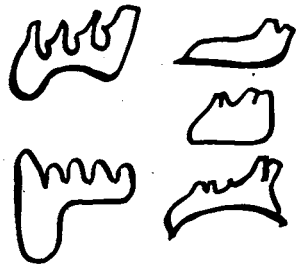

FIG. 8. "Flame eyebrows" (after Joralemon 1971:7).

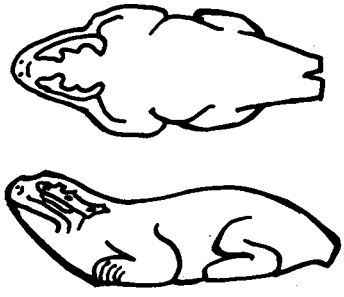

FIG. 9. Jade "jaguar" from the Brooklyn Museum, showing flame brows (after Joralemon 1971:36).

[3] Gillett Griffin showed me a piece of "covert symbolism" on a Xochipala stone vessel now in the Princeton Museum. The outer surface is incised with four diametrically opposed motifs, which, when the roll-outs were placed together, turned out to be halves of "frog" bodies. The spiral elements behind the shoulders (paratoids?) permit us to venture a toad identification (see Gay 1972*b*:49).

as represented at Monte Albán and recorded by ethnographers today in the Oaxaca area. But most telling is the fact that pharmacologically toad venom acts to increase contractions of the gravid uterus (Mann 1959:190). Toads must have been one of the more obstreperous items in the midwife's bag of tricks and a sovereign tool at the lying-in. This undoubtedly explains why toads have been associated with parturition in contexts as diverse as Egypt, China, and even Pennsylvania Dutch folk medicine.

But to return now to the Olmec heartland and the more pressing problems of iconography: What are the attributes that spell clearly, unequivocally, toadiness? How can one distinguish the toad from, say, the feline, or "hockers," or "zoömorphs"? This is a problem that besets all iconographers, but the Olmec constitute the most plaguesome test of the iconographer's intuition. Olmec art, especially the incised work on jade celts, masks, and canoes, is notoriously schematic and probably also, to make matters worse, polyvalent.

First, taking a frontal look at the toad, we have the V-cleft or intraorbital depression with its cranial crests, then the rather oblique and protuberant eyes, the two dots representing the nares, and the wide turned-down mouth (figs. 2–5). Sometimes also one finds the inverted forelimbs (on *yokes* and vases), a clear attribute of toadiness (figs. 13–15). Then we note the absence of the lower jaw or its deficient development, known medically as agnathia. This trait, so diagnostic of the toad, is often found in "earth-monster maws" (fig. 16).

Viewed from the side, the paratoid glands are quite conspicuous. On top of the shoulders, above and behind the eye and tympanum, they are generally represented as oval, liver, or boomerang-shaped tumefied structures (figs. 16, 17). In

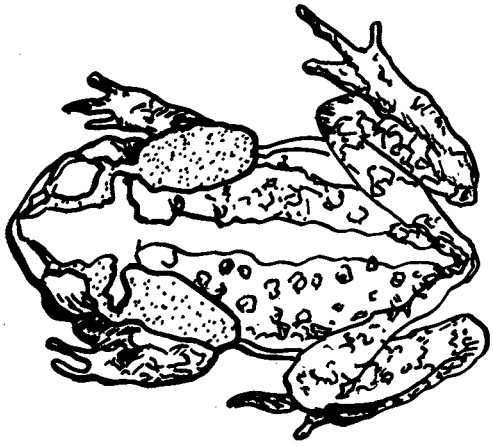

FIG. 10. *B. marinus*, showing "flame brow" paratoids (after Caras 1974:135).

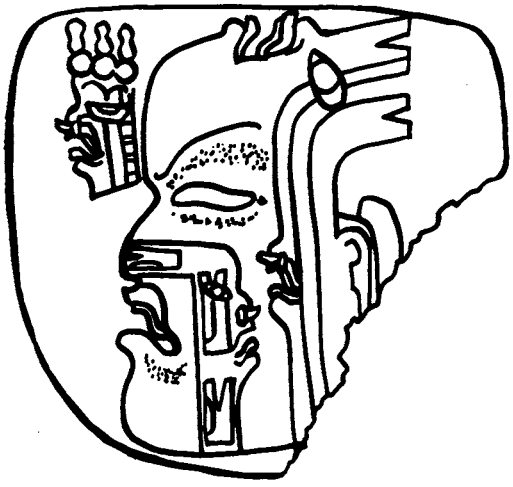

FIG. 11. Incised serpentine pectoral (after Covarrubias 1957:80) with "third eye."

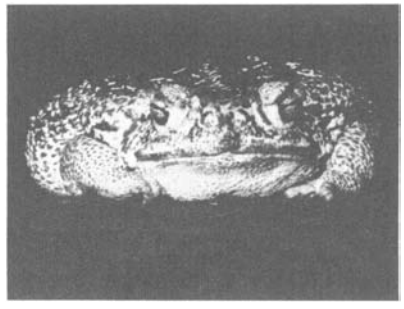

FIG. 13. Frontal view of *B. marinus* in crouching defensive posture, showing inverted forelimbs (photo by L. Gomez).

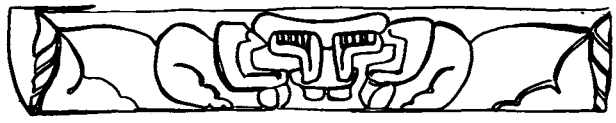

FIG. 14. Pottery bowl from Tabasco (after Joralemon 1971:36), showing toad with inverted forelimbs.

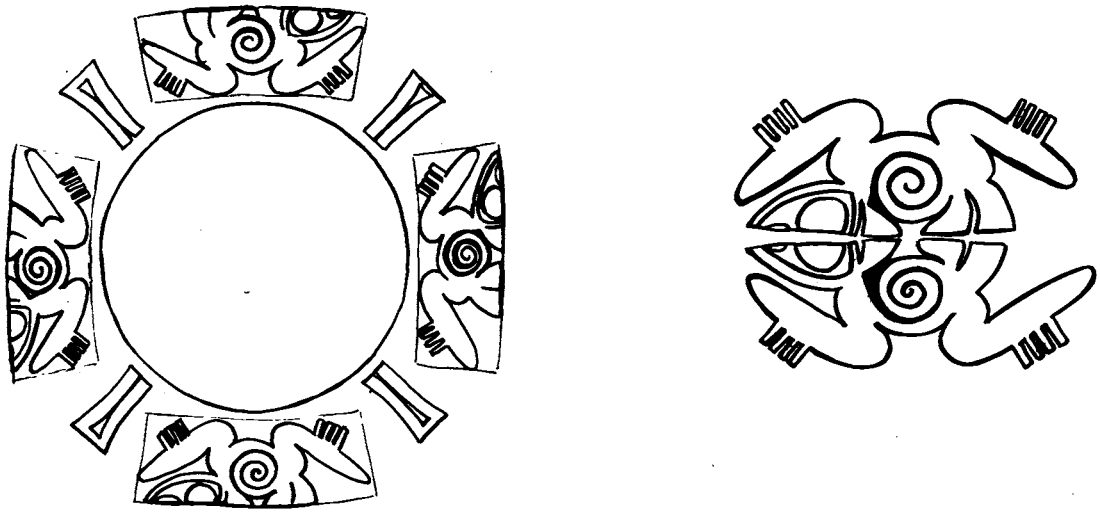

FIG. 12. "Covert" toad representations in composite design of Xochipala bowl (after Gay 1972*b*:49).

clay or sculptural representations, these pitted glands are delineated by punctation marks to represent the venom-secreting pores. These glands are clearly evident on Altar 2 at Izapa (fig. 18) and again on Stela 6, where they have been misidentified as a "cape" (fig. 19). The full-figure glyph of the *uo* frog on Stela D at Quirigua shows the three-dot *cauac* symbol on top of a clear and unambiguous liver-shaped paratoid gland placed just where it should be: on top of the shoulders (fig. 20).

Additional glands, almost as large and protuberant, can be found on the dorsal aspect of the tibia in *B. marinus* (fig. 21).

FIG. 15. "Frog coming out of his house," Tlingit chief's dancing blanket (Davis and Davis 1974:56; reprinted by permission of the publisher).

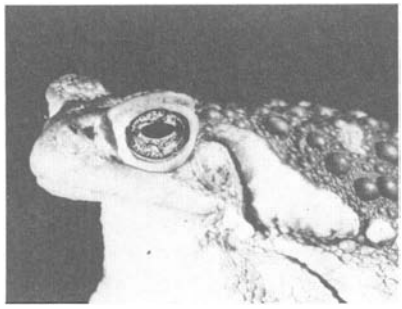

FIG. 16. Side view of *B. marinus ictericus*, showing the agnathia or opisthognathia typical of the toad (photo by L. Gomez).

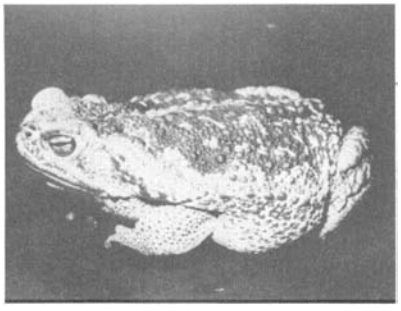

FIG. 17. Side view of *B. marinus* showing paratoid and tibial glands (photo by L. Gomez).

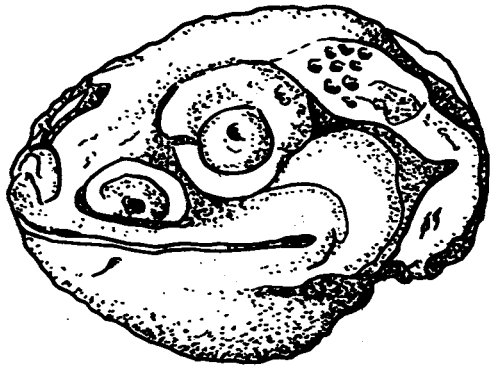

FIG. 18. Altar 2 at Izapa (after Norman 1976, pt. 2:242), showing toad paratoid glands.

The west side of zoömorph or "Monolithic Animal G" at Quirigua reveals both paratoid and tibial glands (fig. 22). It is obviously these four venom-producing glands plus the white line often found demarcating the spine of *B. marinus* that constitute the cryptic four-dots-and-bar motif whose meaning has heretofore eluded Olmec scholars. Above the four-dots-and-

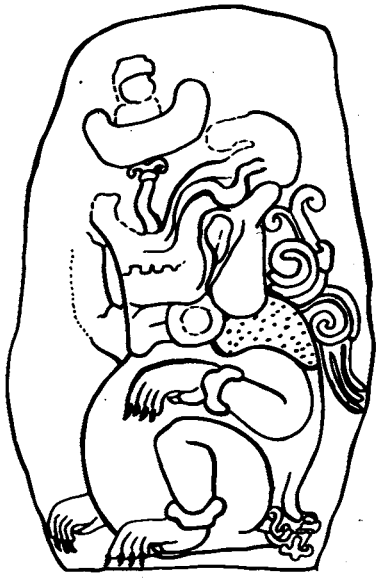

FIG. 19. Stela 6 at Izapa (after Norman 1976, pt. 1, pl. 12), showing toad paratoid glands.

FIG. 20. Stela D at Quirigua (Maudslay 1902: pl. 46), showing *cauac* symbol on top of typical paratoid gland.

FIG. 21. Dorsal view of *B. marinus* showing four glands—two paratoids and two tibials—and the light middorsal vertebral stripe (photo by L. Gomez).

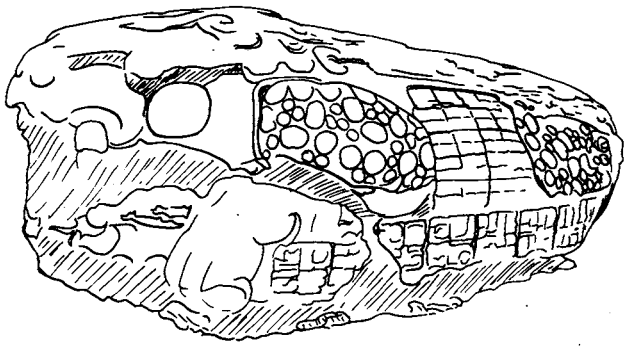

FIG. 22. "Monolithic Animal G" from Quirigua (after Maudslay 1902: pl. 42), with both paratoid and tibial glands.

FIG. 23. Four-dots-and-bar motif (after Joralemon 1971:33).

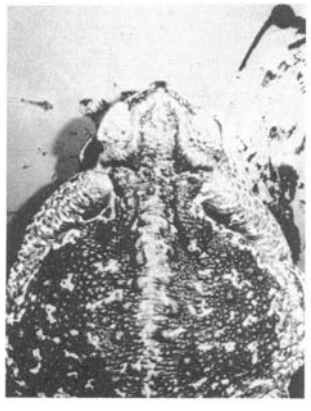

FIG. 24. Dorsal views of *B. mariqus* showing ogival crest and paratoids (photos by L. Gomez).

bar motif one usually finds an elongated M-shape or two smaller M-shapes that represent the cranial crest seen frontally (see n. 2). Alternatively, one sometimes finds an ogival or bell-shaped element which is the aspect of the cranial crest when viewed from above (figs. 23, 24). This element is clearly diagnostic of *B. marinus* and occurs on many of the stone yokes of Veracruz which have generally been saddled with a "feline" label (figs. 25, 26). Covarrubias (1957:181), however, recognized them as "frogs" and remarked on the resemblance of the crest ogee to the *oztotl* symbol for a mouth or cave (fig. 27).

This ogival or bell-shaped element evinces the Olmec genius for polyvalency. It represents not only the cranial crest but

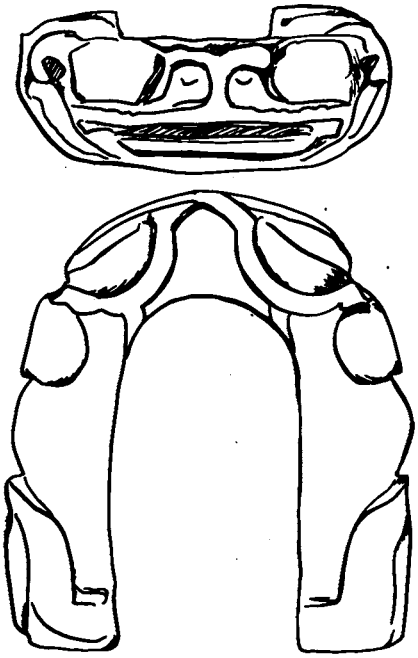

FIG. 25. Toad yoke from Veracruz area (after Holmes 1897:310).

FIG. 26. Toad yoke from Veracruz area in the Elayne Marquis Collection, San Francisco (photo courtesy of the owner).

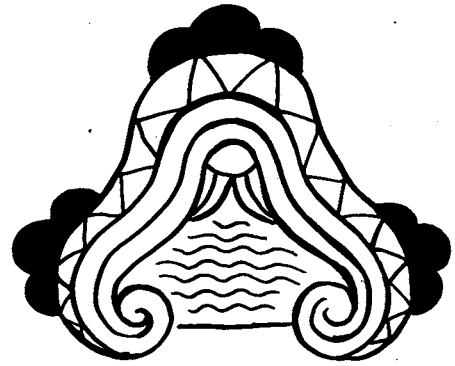

FIG. 27. The *oztotl*, symbol for a cave or entrance to the underworld (after Covarrubias 1957:182).

also the hind legs of the toad. Such toad-leg symbolism is found in Russian and Lithuanian grave markers denoting "transformation" or "renewal" (see Gimbutas 1958:32 and my figure 28). Lidded clay boxes from Monte Albán exhibit this element as a finial along with incised glyphs for water or reptile eyes; it is tempting to see these as apothecary jars (fig. 29). This same element is explicitly called "frog legs" (*kaeru-mata*) where it appears in traditional Japanese architecture (fig. 30). This symbol seems to function for the Olmec as kind of portmanteau incorporating the symbolism for the cranial crest, toad legs, and "jaguar mouth." An Olmec jade celt from the Smithsonian illustrates this magnificently. The "jaguar mouth" or toad-legs element is surmounted by an ogival element—an element that recalls forcibly the headdress on the goggle-eyed being on Relief 10 at Chalcacingo (Gay 1972*a*: 67). Is it a headdress atop a jaguar mouth, or is it a cranial crest astride toad legs (fig. 31)?

Toothless gums are another hallmark of Olmec art, appearing in the jade votive axes or in the ceramic "crying babies." The toad-leg symbolism is isomorphic with these toothless gums—even down to the urostyle or fused postsacral bones of the toad's "tail," which corresponds to the median gingival apex between the missing incisors of the toothless baby's gums (figs. 32, 33). Toads are, significantly enough, devoid of maxillary teeth, while frogs often have both maxillary and vomerine teeth. Interestingly, Wassén (1934:627) relates a Cuna Indian belief that if a baby who has not yet teethed should come into contact with a toad, the child will not teethe at all.[4] Certainly,

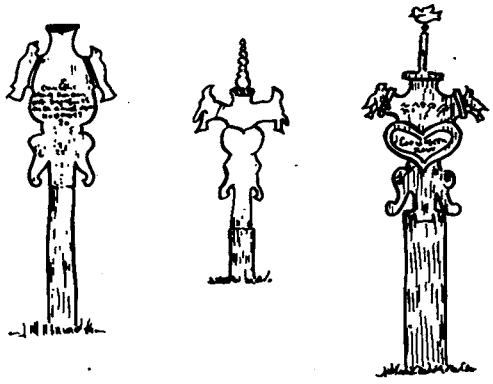

FIG. 28. Toad-leg motif on Lithuanian grave markers (after Gimbutas 1958:32).

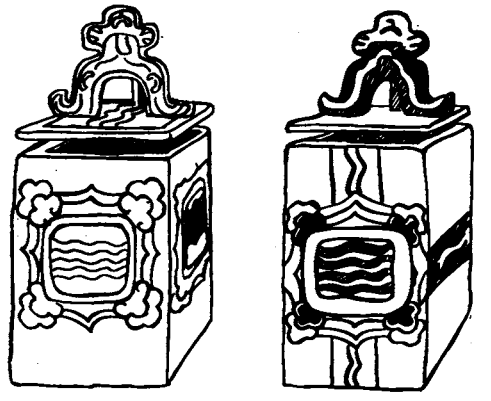

FIG. 29. "Toad-leg" finials on Monte Albán clay jars (after Bernal 1969:166).

FIG. 30. *Kaeru-mata* or frog-leg rafter supports (*ABC of Japanese art* 1937:46, pl. 58).

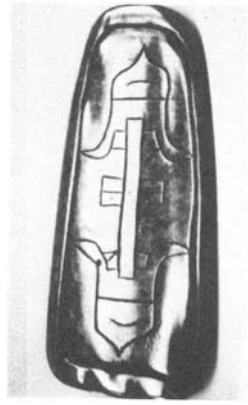

FIG. 31. Incised jadeite celt showing elements suggesting toad legs and cranial crest (Smithsonian cat. no. 364962; photo by L. Desmond).

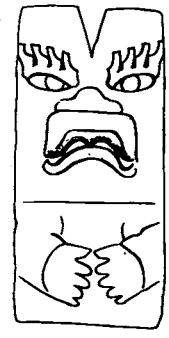

FIG. 32. Jadeite ceremonial celt (after Covarrubias 1957: pl. 16), showing characteristic toothless gums.

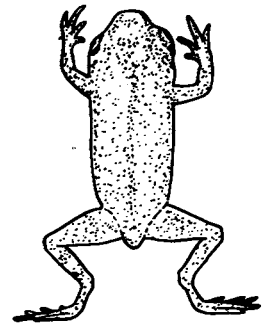

FIG. 33. *B. marinus* at metamorphosis, showing urostyle (after Breder 1946:396).

[4] Among the symptoms recorded by Avicenna of imbibing dried and pulverized toad in a drink is that "it often makes men toothless" (Leeser 1959:177).

whatever the significance of the toothless gums, we should not underestimate the observational powers of the Olmec.

The were-jaguar mouth may actually not be a feline snarl at all: it may be instead an expression of extreme disgust.[5] Darwin, in his classic *The Expression of the Emotions in Man and Animals* (1890:258), gives a lucid and detailed description of the disgust response. Even in infants the muscular response is unmistakable: the retraction of the upper lip so as to block the nares (and hence the sense of smell), the protrusion and eversion of the lower lip with the corners drawn down by the depressores anguli oris muscles, and, in extreme cases, the opening of the mouth and protrusion of the tongue so as to expel the contents of the mouth, "movements identical to those preparatory to the act of vomiting" (figs. 34, 35). In certain Olmec pieces, the expression seems to verge on rage. Here one finds a retraction of both lips, dilated nostrils, protuberant eyeballs, extreme distention of the veins in the forehead and neck, and (this we can only infer), a cyanosis or purpling of the face due to blockage of the venous return. This is the aspect presented by so many Asiatic demon figures and also by the berserks of Scandinavia. The symptom picture is identical to that produced by bufotenine (one constituent of toad venom) injected intravenously as reported by Fabing (1956:886; 1957:54). Fabing argued that this chemically induced sham-rage tallied perfectly with descriptions of the berserks of Norse legend from which we get our expression "going berserk"—meaning frenzied rage, reckless courage, and superhuman strength. He felt that the unidentified substance that the berserks ingested before going on their rampages was bufotenine because of the congruity in the symptom picture.[6] Clearly, whether the Olmec were representing disgust or rage, either emotion could be related without great strain to toads and *Bufo* intoxication.

Another feature which the Olmec doubtless observed and formalized was the toad tongue, or, as it became popularly known, the Chac tongue (fig. 36). The orthodox view is that this bifid lobular tongue represents that of a serpent. However, since it appears in composite monsters along with other raptorial characteristics, such as horns, fangs, and talons, this view seems unlikely; surely they were aware that the serpent tongue is primarily a sensory or olfactory organ. Toad tongues, however, are eminently raptorial. They have a dynamic shape determined by their complex muscular microanatomy. The attachment is at the front of the mouth to provide the greatest extension, and the powerful genioglossus basalis muscle flips out with a catapult-like action so that what was the dorsal surface in the mouth becomes the nether or ventral surface (fig. 37). The prey adheres to the sticky secretion produced by mucopolysaccharide glands on this surface. This "stickiness"

FIG. 34. Stone yoke from Dumbarton Oaks collection, showing facial features associated with disgust (after Bernal 1969: pl. 58).

FIG. 35. Early Gulf Coast celt showing disgust and toothless gums (after Museum für Völkerkunde 1965: pl. 5). Lower lip, when reversed, becomes "jaguar mouth" (toad legs).

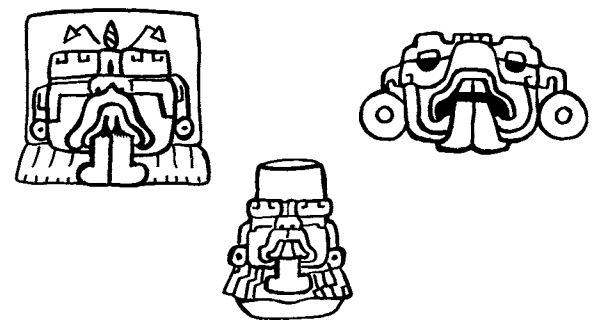

FIG. 36. Chac or Tlaloc tongues (after Covarrubias 1957:62).

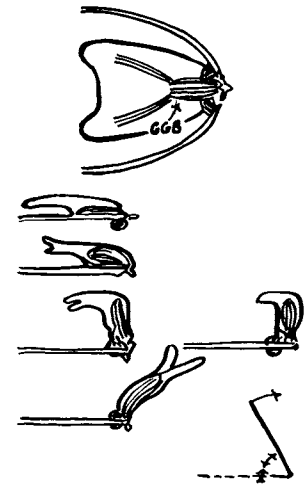

FIG. 37. Functional anatomy of frog and toad tongues (after Regal 1976:719).

[5] I am indebted to John Diamond, a behavioral kinesiologist, for calling my attention to this possibility.

[6] Unfortunately, he repeated the oft-made but erroneous assertion that bufotenine was the psychoactive principle in *Amanita muscaria;* this is now thought to be muscimole, formed by degradation of ibotenic acid (Brimblecombe and Pinder 1975:198; Schultes 1980:50).

may be represented in art by a cross-hatched pattern. If still more extension is required, additional muscle fascicles which extend into the alae of the tongue come into play. The shape of the tongue actually changes before one's eyes from a pyriform to a bifid lobular shape. This is readily observable, especially in the mature *B. marinus*, which is somewhat slower in its tongue action than a young *Bufo*. Deglutition, or swallowing, is accomplished by the eyelids' shutting and the eyeballs' descending through the vomerine palate where they aid in pushing the prey down the gullet. The end view of Structure 11 at Copan shows a heavy-lidded frog or toad in the act of swallowing (figs. 38, 39).

The shape of the shed toad skin was also probably observed and invested with symbolic meaning. It is a perfect geometric butterfly shape and may relate to concepts of transformation (fig. 40). In fact, what better symbol than the toad, going as it does from a larval vegetarian aquatic form to an adult carnivorous terrestrial form? And as a symbol of "renewal," the toad is preeminent. It sheds its skin as often as once a week in the young toad, or perhaps six times a year in the fully mature toad. The skin must be kept moist and vital, as it subserves the process of respiration in the toad, i.e., gases must be able to perfuse through it into the underlying vasculature. The toad's shedding of its skin was a readily observable phenomenon in the Olmec heartland, teeming as it is with *B. marinus*. And in shedding its skin it periodically reenacts the cosmic drama of transformation and renewal.

This butterfly-shaped skin may have been flayed by the Olmec along the same "fracture lines" or raphe that it naturally splits along in the toad—which is, moreover, the same way raccoons are known to "peel" a toad before eating it. The flayed toad skin may even—if I am not being too boldly conjectural—be the *fons et origo* of the whole Xipe-Totec tradition.[7] The "warty," mottled or maculated texture of some Xipe-Totec skins would appear to support this suggestion. It is tempting to speculate that this flayed toad skin may have been worn as an alveolar mask suspended from the nasal septum. All Olmec jade figurines that I have seen exhibit this perforated nasal septum, and yet we have no idea what was worn through it. The psychoactive skin and paratoid secretions would then be absorbed through the capillary bed of this "death mask" area of the midface directly to the brain.[8] A Mayan funerary vase in the St. Louis Museum shows a naturalistic butterfly-shaped mask worn in just this way. Wassén (1934:620) describes "nose cleaners" made from frog skin used

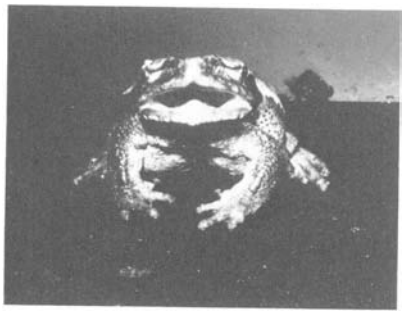

FIG. 38. *B. marinus* in the act of swallowing (photo by L. Gomez).

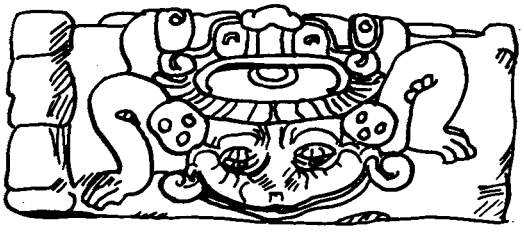

FIG. 39. Cauac toad swallowing: end view of "Oblong Altar," Structure 11 at Copan (after Maudslay 1902: pl. 114).

[7] Xipe-Totec is associated not only with "renewal," but also with skin diseases and their cure. Significantly, perhaps, toad skin secretions have been widely employed to cure skin disease. In Japan, *gama abura* (toad-oil) salesmen plied their trade at village festivals and in summer evening stalls. Accompanied by huge specimens of *gama* gazing balefully out at the buying public, they extolled the miraculous virtues of toad oil for skin conditions. This oil was scraped off toads that were roasted in earthware pots and then artfully packed in *hamaguri* (clam) shells (Joya 1960:68). Hudson (1939[1918]:158) describes the use of toad secretions to cure shingles, "a common and dangerous ailment" in the pampas region of Argentina. In this case, the curer wrote in pen and ink on the inflamed region "In the Name of the Father, Son, and Holy Ghost" and then, grasping a large toad, rubbed over the affected area. The toad, enraged at this treatment, exuded a "poisonous milky secretion" which Hudson claimed effected an absolute cure. The syncretic melding of Catholic and pagan elements is interesting here.

[8] For a full discussion of the vascular anatomy of this area with regard to hallucinogenic snuffs, see Holmstedt and Lindgren (in Efron 1967:339–73).

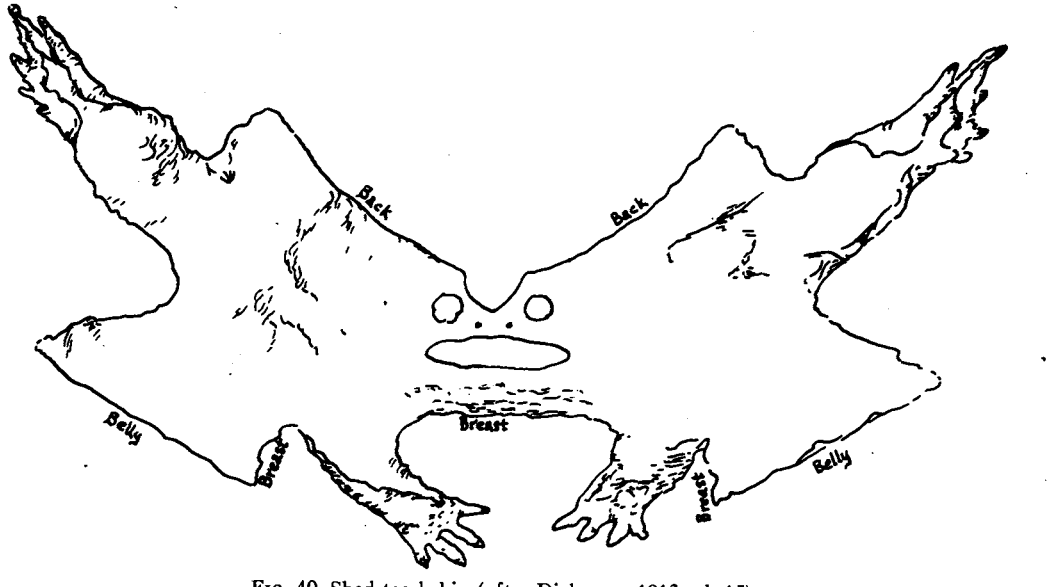

FIG. 40. Shed toad skin (after Dickerson 1913: pl. 15).

by the Patamona, Arecuna, and Macusi to secure good luck in hunting. The skins of the *pa* frog (small, yellow with black spots) and the *ambak* (small and brown) were pulled through the nose with a string of *iteh* bast (1934:620). It could plausibly be argued that the function of these "nose cleaners" was to increase the sensory acuity of the hunters.[9]

FIG. 41. Stela at Izapa (after Norman 1976, pt. 2:101).

Preparatory to shedding its skin, the toad yawns extravagantly for a half hour or more. In fact, "yawning maws" in iconography might be reexamined in this light as portents or symbols of transformation. Then it repeatedly hunches up its back to loosen the outer, horny keratinized layer from the fresh young livery underneath. The skin splits up the back and under the ventral surface, and on the undersides of the limbs—not unlike a zipper opening up. The toad then gradually sucks this loosened integument into its mouth, the dangling "bifurcated" limb shreds being the last to pass into the corners of the mouth (Porter 1967:120).

Could the final phase of this small drama, with the four limb shreds disappearing into its maw, be the source of the "bifurcated fangs"—an element which has largely supported the feline interpretation of Olmec art? The orant figure in Izapan Stela 11 might now be construed as "the spirit of transformation" descending into or issuing out of a felinized toad, devouring its old self (the dangling limb shreds) while aspersing psychoactive toad venom from the shoulder areas in the form of cross-hatched volute elements (fig. 41). The toad can now be seen not only as a symbol of transformation, but also—perhaps a symbol for our age—of *recycling*.[10]

Toads in the act of spawning are popular subjects for treatment in Mesoamerican art. The male, usually half to three-quarters the size of the female, rides on her back clasping his nuptial pads into her fat little body in an attitude called amplexus. They maintain this posture for hours, days, or sometimes up to two weeks: the female may expire in the process. The male fertilizes the eggs as they issue forth in two long gelatinous strings from the oviducts via the cloaca (figs. 42, 43).

Frog spawn, by contrast, comes in amorphous grapelike clusters and may well be the symbol associated with the *cauac* monster which Thompson called the "grape cluster motif." Never one to ponder deeply on the anurans, Thompson refused to grant the Maya any particular awareness of toads (1974:160) and only grudgingly acknowledged, it would seem, the *uo* frogs as Chac helpers.[11] Yet the identity of the *cauac* monster,

[9] In this connection, one should note that *ch'an nao*, or toad brain, appears in the Chinese materia medica as a cure "for nightblindness and to clarify the vision" (Read 1971 [1941]:157).

Richard Spruce, in a note to *The Travels of Pedro de Cieza de León* (Markham 1864:341, 342), describes the Curucurus and Catauixis, now extinct Indians of the Purús River area, and their use of *paricá* (Humboldt's *Acacia niopo* of the genus *Anadenanthera*) both as a hallucinogenic snuff and as an enema. As a snuff, he compares its action to that of *Amanita muscaria;* as an enema, it acts as a purge and is said to "*clear the vision and render them more alert*" (italics mine). This is administered through an enema pipe made of the tarsus of the *tuyuyú* bird (*Mycteria americana*), first to themselves and then —curiously—to their hunting dogs. The "curucuru" epithet of these Indians, first mentioned by Acuña, is reported by Spruce to mean "spotted." Interestingly, "cururu" is also popularly used throughout South America for various subspecies of *B. marinus* (Lutz 1971: 440). (Doubling the first two syllables in Tupi commonly serves as an intensifier.) Lutz suggests that the word is imitative of the "liquid tremolo call" of the male *Bufo*. If in fact it does mean "spotted," it could just as plausibly refer to the "warty" mucosal or granular glands of *B. marinus*. The dart poison (a "sooty" mixture of ground roasted *niopo* seeds and toad venom, among other ingredients (Pagenstechen and Filko, cited in Abel and Macht 1911:1532) is smeared on the face—perhaps to prolong the effect of the enema during the hunt, although Spruce supposes it to be a badge of success in the hunt. The admixture of calcined toad skins, or paratoid secretions, to the *niopo* (*Piptadenia*) seeds might have served to potentiate its activity or, indeed, may have provided the bulk of the tryptamines to be potentiated by the betacarbolines (monoamine oxidase inhibitors) of *Anadenanthera peregrina*. This possibility is enhanced by Schultes's claim that the tree is rare to nonexistent in Amazonian Peru. In fact, its limited range suggests that the various equivalent terms used for snuff mixtures (*niopo, yopo, cohoba, paricá*) may have been used generically and that other plant species may have been involved (Schultes 1980:146). Certainly we should not neglect the ubiquitous toad when looking for possible snuff reagents or local substitutes.

It now appears that *B. marinus*—skin or secretion—may have been the key ingredient in wourali poison (curare) sought so indefatigably by Paul Fountain. In *The Great Mountains and Forests of South America* (1902) he devotes an entire chapter to arrow poisons—his attempts to "crack" the secret formula and his experiments on various animals. Although he managed to extract the formula from several *pee-a-men*—a "precious set of rogues" and the custodians of this highly guarded process—he refused, in an excess of 19th-century Rationalism, to add the *Capsicum* pods and the *bones and parts of certain reptiles*, as they were "clearly nothing more than charms." To his profound frustration, the poison would not work *even though it was compounded of several highly poisonous plants* (including *Strychnos toxifera*): apparently the poisons either volatilized or decomposed during the hours of preparation. Finally he decided that there was a *missing* ingredient which these mendacious rogues would not divulge to him; this ingredient, he arbitrarily decided, was bushmaster (*surukuku*) poison. He persisted in this view even though the effects of *surukuku* venom did not tally precisely with those of wourali and the snake venom caused a rapid decomposition of the flesh instead of the preservative action observed with wourali. Like so many 19th-century naturalists and travellers, he ignored the homely toad in favor of more spectacular local fauna. Recent research on the skin compounds of *B. marinus* (Flier et al. 1980:503) reveals the presence of ouabain-like substances corresponding to ouabain from the usual botanic sources (*Strophanthus gratus* or *S. kombe* or from *Acokanthera schimperi/Carissa schimperi* reported as an arrow poison in Africa). Thecardioactive effects are well established, but more important as a dart poison would be its muscle-relaxant effects on the respiratory center. Thus, in large dose, it would cause death by *asphyxiation*, a fact that tallies well with the reported action of wourali poison. Optimally a dart poison would have to operate in this way (i.e., as a super-muscle-relaxant inducing flaccid paralysis), for if a wounded animal moves more than a few yards in the jungle it is lost to the hunter. The prey is either unfindable in the dense vegetation or, in the case of howler monkeys—a prime target—inaccessible, as they hang by their tails from a topmost branch, where they go into rigor mortis (Patricia J. Lyon, personal communication). Whatever the precise action of ouabain, one can certainly predict rather pronounced bioactivity from a substance mediating basic ionic exchanges as it does in the skins of amphibians such as *Bufo*.

[10] A strangely similar creature is found at El Tajin (Pyramid of the Niches, Panel 1, and North Ball Court, Panel 3 [Kampen 1972]). Might this creature—or the "Tajin squat" (Kampen 1972:28)—be a dynastic convention, to denote descent through the female line?

[11] The *uo* frogs Thompson identifies (1970:258) as *Rhynophrynis dorsalis*. These burrowing frogs are small (ca. 2 in. from snout to vent), dark, with an orange or yellow stripe down the back and yellow spots on the sides. They are anatomically anomalous and have been placed in a family by themselves (Cochran 1961:95).

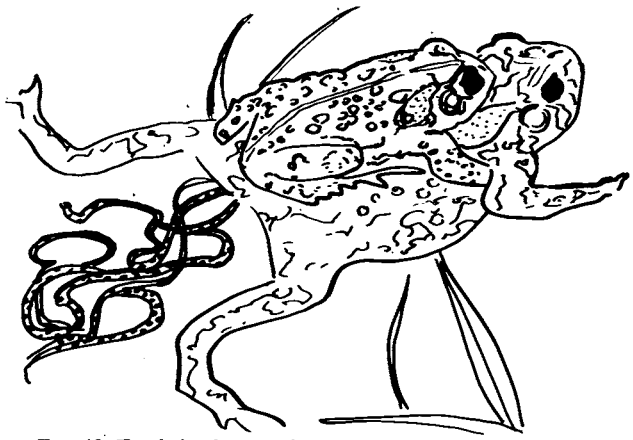

FIG. 42. Toads in the act of spawning (after Porter 1967:28).

FIG. 43. Izapan pot with toads spawning; note paratoids (from the Muldoon Elder Collection, San Francisco; photo courtesy of Donald Hales).

given its associations with caves, rain, fertility, the earth, and vegetation, together with its diagnostic grape cluster, should be luminously clear. Thompson adhered to his identification of the *cauac* monster as a sky dragon (1971:passim). Taylor (1978:79), however, correctly notes the tadpole-like vegetation associated with the "circle motifs"; frogs often attach their spawn protectively to floating vegetation.

According to Kelley (1976:150), there is no context in either the inscriptions or the codices in which the *cauac* symbol has the specific denotation of "rain." Marvin Cohodas has called my attention to the *cauac* sign or grape cluster found on the glyphs for the four dry-season months—*ch'en*, *yax*, *zac*, and *ceh*. This would appear to argue against a frog spawn identification and for a toad identification, as *B. marinus* is a dry-season breeder. James Fox, however, has pointed out that correcting the Mayan 365-day year to the true tropical year (365.2422 days) would push the so-called dry-season months or "*cauac* months" of the early colonial calendar well into the rainy season during the height of the Classic period. In fact, as the Mayan months rotate through the tropical year at a rate of slightly less than one day every four years, a correlation of the "*cauac* months" with any season must await clarification of the genesis point of the Mayan calendar. The Maya were probably aware of this difference but made no formal indication of it in the inscriptions, possibly to avoid disrupting the exquisite intermeshing of their calendrical cycles. Whatever their motives, it appears that the essential ambiguity of the *cauac* monster may reflect this shift through time of the Mayan calendar months (James Fox, personal communication).

Before frogs and toads mate they create an orchestral din in frenzied anticipation of their nuptial rites. The *uo* frogs' spawning coincides with the coming of the rainy season and is closely allied with Mayan fertility concepts. The resonant cones at Chichén Itzá, found in the Platform of Venus, are thought to be based on earlier stalactitic prototypes used in cave rituals. They may have constituted an elaborate chthonic organ designed to summon the Chacs through sympathetic mimicry of the *uo* frogs' nuptial chorus (Dennis Puleston, personal communication). In ancient China, stalactites were used to produce music for cave rituals; such stalactites were known metaphorically as "bell teats."[12] Natural stone drums found in caves were also used, presumably to summon rain. The Dong Son drums of Indochina often represent frogs spawning on the surface of the tympanum.

B. marinus, in contrast to the *uo* frog, is a dry-season breeder, spawning in the winter months in the Gulf Coast area. Its spawn comes in the typical long, gelatinous strings of the genus *Bufo*—specifically in a staggered double-row pattern clearly represented on a Mayan funerary vase (figs. 44, 45). Additionally, the initiated will now make out a coition scene in three of the six triangulated spaces of the vase. The intervening spaces show the grape-cluster motif which might suggest a dual reference to both frog and toad spawn.

The spawn of *B. marinus*, along with that of *B. valliceps* and *B. alvarius*, is thought to be toxic. Licht (1967) reported on the deaths of two Peruvian natives after the accidental ingestion of *Bufo* eggs—which he thought were probably *B. marinus*. This account inspired two further studies (Licht 1968, Wassersug 1971) on the palatability and toxicity of anuran eggs. Licht concluded that toxic components in the egg, its vitelline membrane, and possibly also the protective jelly coat discouraged predation at this early and highly vulnerable stage of development.

The tadpoles of *B. marinus* apparently do not exhibit this degree of toxicity. Wassersug (1971) has reported on the palatability of eight species of dry-season tadpoles, including *B. marinus*, using eleven students in his 1970 University of California Tropical Biology class in Costa Rica. These students were somehow dragooned into acting as "mock predators" and were asked to rate tadpoles on a scale of 1 to 5 from "tastes good" to "God-awful/emetic." (It is possible that the rumoured hallucinogenicity of these tadpoles may have sparked their enthusiasm for the project.) They were requested to hold each

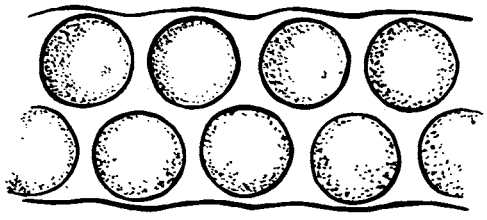

FIG. 44. Staggered double-row pattern of *B. marinus* spawn (after Breder 1946:395).

FIG. 45. Mayan pot, collection of Mildred Kaplan (drawing by Barbara Todd Kennedy from photo by L. Desmond).

[12] The "stalactitic milk" (water high in dissolved silica) which dripped from these limestone "bell teats" was used anciently in Taoist elixir chemistry and has survived into this century in rebirth rituals in caves on Fujiyama (Starr 1924:53,55). This recalls the "ritual use" of *zuhuy ha*, "virgin" or divine water, by Mayans in the hill caves of Yucatan or at Balankanche (Thompson 1970:183, 184).

tadpole in their mouths for 20 seconds without biting into it; then to bite into the tail and chew lightly for 20 seconds; and finally to bite "firmly and fully" into the body of the tadpole. They were not required to swallow the tadpole. The tadpole found least palatable, though not actually noxious, was *B. marinus*. The skin was found bitter and offensive and the body contents "gritty" in texture. However, there are numerous reports in Wassén (1934:614–17) of the use of anuran spawn, tadpoles, and frogs and toads as food, although not all species were deemed suitable. Some Indians admitted to eating frogs or toads; others would insult their neighbors by claiming that *they* ate frogs or toads. Hunn (1977:247) states that the *henken* or *B. marinus* is today considered inedible in the Tenejapan area but that the *pokok* or *B. bocourti* is consumed as a cure for malaria.

In southern China, frog and toad spawn were formerly gathered after rainstorms and were called "celestial chicken" (Williams 1932:397). Both Schafer (1977:131) and Freeman (1977:169) mention that the ancient northern Chinese were repelled by the thought of eating toads or frogs and considered the southerners barbarians for their disgusting predilection. Eberhard (1968:202–6) has, perhaps, the fullest treatment of toads, both as food and as the embodiment of *hun* soul-power.

The assumption in archaeological circles has always been that toads did not constitute a significant source of dietary protein. As Coe (1971:74) said of his *Bufo* osteological remains at San Lorenzo: "The toads are a puzzle as they cannot be skinned without an extremely dangerous poison getting into the meat. We are now looking into the possibility that the Olmecs used them for an hallucinogenic substance called bufotenine, which is one of the active ingredients." Since the Japanese manage to sate their craving for fugu fish (a puffer containing the infinitely more toxic tetrodotoxin in all of its viscera), this assumption may not be wholly warranted. Special techniques of evisceration are taught and diplomas awarded for fugu stew preparation in Japan. Charles Myers, curator of Herpetology at the Museum of Natural History in New York, has told me that toad bones are in fact often found in middens but that they are generally ignored or misidentified as avian remains.[13]

Coe's remark, however, in a popular article on the Olmec, is interesting because it is the first reference we have to his *Bufo* remains at San Lorenzo and their putative hallucinogenic activity. Upon closer querying, I found that these toad bones were found in "discrete pockets" and protected from decomposing in the highly acid soil by the subsequent laying down of clay floors which alkalinized the soil. These bones, Coe stressed, were nonarticulated bones, so they were clearly either dietary or ritual remains and not burrowing intrusive toads. There were also bones of ducks, snook (an edible fish), turtle, and man; but most remarkable, he felt, was the large sample of *B. marinus* remains.

The toad as a hallucinogenic agent has been explored by Dobkin de Rios (1974:147), who has proposed that the toad, mushroom, and water lily motifs in Mayan art were predicated on their psychotropic properties. Some commentators praised her insights and amplified them with their own field experiences, but several of the "Old Guard" chastised her for a vague, unsupported, and premature data base. One of the chief stumbling blocks was the fact that bufotenine, generally considered to be the psychoactive and hallucinatory constituent, does not, in the isolated, refined or synthetic form, cross the blood/brain barrier; suitable "processing," however, resulting in an increase in its lipid solubility, may enhance its transport. I shall return to this issue later in my discussion of the biochemistry of toad venom.

Furst has also dealt with the toad in several papers (1972, 1976), most recently in "Jaguar Baby or Toad Mother: A New Look at an Old Problem in Olmec Iconography" (1980). This latest—an omnium-gatherum of Mixtec and Aztec sources together with a dollop of toad ethology—provokes if it does not wholly convince. Certain of our ideas overlap and intersect, but he diverges widely when he sees the "were-jaguar" primarily as genetrix or earth-mother-toad and the cleft brow as a *sipapu* emergence hole or cosmic vagina. One relevant point that he did bring out in his first paper, "The Toad as Earth Mother . . . ," is the parity or equivalence that the toad seems to have with the Jaguar. This is an idea that seems irrational on first meeting but does turn up in many South American mythical tales. The toad woman can turn at will into a jaguar, or an Indian takes aim at a giant supernatural toad only to have it suddenly reappear as a jaguar (1972:38). We may infer that the feline attributes—claws and fangs—represent the toad in its higher octave as psychopomp or transformer of consciousness. The flame brow would accordingly represent the whole complex of paratoid glands, cranial crests, and the powerful transformative substance contained therein.

These glands are veritable chemical factories, elaborating and secreting at least 26 different venom constituents. Obviously this makes the secretion's mode of action exceedingly complex and impossible to characterize with any certainty. These compounds are all highly bioactive and react in numerous metabolic pathways. They can be basically broken down into (1) the cardioactive steroids commonly known as bufogenins and bufotoxins (conjugates of the bufogenins with suberylarginine); (2) the phenylethylamine bases, such as dopamine, adrenaline, and noradrenaline, all belonging to the class of catecholamines; and (3) the tryptamine bases and derivatives such as serotonin (a neuro-transmitting agent), cinobufagin (a cocaine-like substance, a powerful local anaesthetic), and bufotenin (the long-presumed hallucinogenic compound). Different species of the genus *Bufo* exhibit varying proportions of these venom constituents. It is in the tryptamine derivatives that the fabled hallucinogenic properties were thought to reside. Howard Fabing was the first to experiment with bufotenine as a hallucinogen back in the 1950s. His case for hallucinogenic activity was later disputed when other researchers were unable to substantiate his claims. It is now thought that bufotenine has no central-nervous-system activity and that its apparent effects are largely due to its pressor activity. However, its hallucinogenic effects may depend on the synergistic action of other venom constituents or on the activity of such substances as monoamine oxidase inhibitors occurring naturally with it in snuffs such as *Piptadenia*. Equally plausibly, roots or herbs providing such key enzyme inhibitors or potentiating agents might be mixed with it in tinctures, decoctions, or "menstruums," witches' brews in which toads were left to macerate for a month. Indeed, it is probably such "menstruums" that Shakespeare was alluding to when he wrote in *Macbeth:* "Toad, that under cold stone/Days and nights hast thirty-one/Swelter'd venom sleeping got,/Boil thou first i' the charmed pot." Thorndike's monumental *History of Magic and Experimental Science* (1923) is full of such recipes; a typical one, from Michael Scott, astrologer, augur, and alchemist at the court of Frederick II, reads: "Five toads are shut up in a vessel and made to drink the juices of various herbs with vinegar as the first step in the preparation of a marvelous elixir for the purposes of *transformation*" (p. 337). Thomas Gage, the Dominican friar who worked in the Pokomam Maya area of Guatemala in the 17th century, described the making of *chicha* consisting of water, honey or sugarcane, tobacco leaves, various roots "which they knew to be strong in operation," and, finally, a live toad. This mixture was sealed for a fortnight

[13] *Notaden bennetti*, a colorful leptodactylid of Australia, lacks paratoids but produces a yellow poisonous secretion from mucous glands throughout the dorsal skin. The Aborigines remove the poisonous skin of this tiny 1½-in. frog to get at the legs, which are considered a particularly choice bonne bouche. I have not been able to verify whether these tiny legs offer anything besides gustatory value (Cochran 1961:94).

or a month, "till all that they have put in be thoroughly steeped, the toad consumed, and the drink well strengthened" (Thompson 1970:120).

Hamblin (1979) recently reported on the remarkably large sample of amphibian specimens from Cozumel, 283 in all, of which 88% to 99% were *B. marinus* dating back to the late Postclassic. These were found in sealed burials and thought not to be intrusive. She described numerous other sites such as Kaminaljuyu, El Trapiche, Altar de Sacrificios, Seibal, and Mayapan which yielded *B. marinus* bones in burial contexts—in some cases actually in pottery vessels (figs. 46, 47). Such toads may have been steeped in *balche*, a liquor made from the crushed bark of the balche tree (*Lonchocarpus longistylus* of the Leguminosae) fermented with honey. The Leguminosae in general are rich in alkaloids and glucosides which might react with or potentiate the bufotenine. The possibilities are pungent indeed.

The final empiric evidence for the use of toads as hallucinogens appears in Knab's (n.d.) "Narcotic Use of Toad Toxins in Southern Veracruz." Knab has penetrated the arcana of several curanderos in the Veracruz area and details a recipe for the preparation of *B. marinus* paratoid glands which eliminates the most toxic compounds:

> Ten specimens of this toad are gathered, the paratoid glands are removed, and ground into a thick paste. To this paste is added lime and the ashes of a plant called "tamtwili" prepared by roasting the plant on a "comal." Water is then added to this mixture and it is boiled again until it no longer exudes "a certain bad odour." (This may be all night or longer.) To the mixture is then added a soured corn beer and the mixture is then filtered through coconut fibre. The resulting liquor is mixed with the masa, lime water from soaking corn, and 5 grains of sprouted maize which are ground with the masa. This mixture is then placed in the sun on several successive days during which it ferments slightly and evaporates. After this conglomeration is deemed ready, the remaining liquid is evaporated by setting the mixture near the fire in an open bowl until it is slightly scorched. The hardened mass that remains can be kept indefinitely. The hardened dough ("piedrecita") is kept in the forest far from human habitation. In previous times, small huts were especially built in which the drug was kept.

The symptom picture which Knab goes on to describe is distinctly unpleasant, consisting of chills, delirium, and tachycardia, and sounds more like a "life-crisis" initiation rite than a simple visionary experience—though it may partake of both. Clearly, in all these instances, whatever precise chemical processes have been employed, the overall design has been to detoxify certain venom constituents and to potentiate the bufotenine. The question next confronts us: how did the Olmec accomplish this ticklish bit of alchemy?

The clue to this lies in Olmec art—especially the jade work. Not everything they represent is toads and jaguars. There are tadpoles, too: the jade "spoons" which Pohorilenko (1972:32) has called *atepocates*. They generally have a shallow depression, sometimes with a pinpoint hole (figs. 47–49). They may have served as dehydration vessels or separatory vessels, used to fraction off the various venom constituents. (The Chinese, it is known, dehydrated the *ch'an su* or toad venom and made boluses out of it [see Chen and Jensen 1929]. A separatory vessel might have been used to dissociate the oil- and water-soluble components.) Some are glorified tadpoles which I call "dragon tadpoles"—tadpoles with crests, bifurcated fangs, and avian characteristics. One gloriously enlightening example, now in a Costa Rican museum, is illustrated by Pohorilenko: a tadpole spoon which turned upside down becomes a duck head with a duck bill (fig. 50). Do ducks eat tadpoles? Both duck heads and duck-bill masks are a recurrent Olmec theme. They represent ducks repeatedly in ceramic, clay, and basalt sculpture. Particularly appealing are the many duck-effigy vessels from Las Bocas, which Coe (1965:13) identified as the Northern shoveller, *Spatula clypeata*. There is the famous Tuxtla statuette of a shaman or priest figure wearing a feathered cloak and duck-bill mask (fig. 51). There are two monumental sculptures with duck-bill masks at La Venta and a third at Cerro de Mesas, and there are small portable jade or serpentine pendants of human faces with duck-bill masks (fig. 52). Yet the precise meaning of this "duck mania" seems to have escaped scholarly attention. My original theory was that shamans might engarb themselves in full duck panoply to confer some sort of "sympa-

FIG. 46. Mayan toad vessels, Late Classic (*top*) and Early Classic (*bottom*) (from Robicsek 1978:55; reprinted by permission of the publisher).

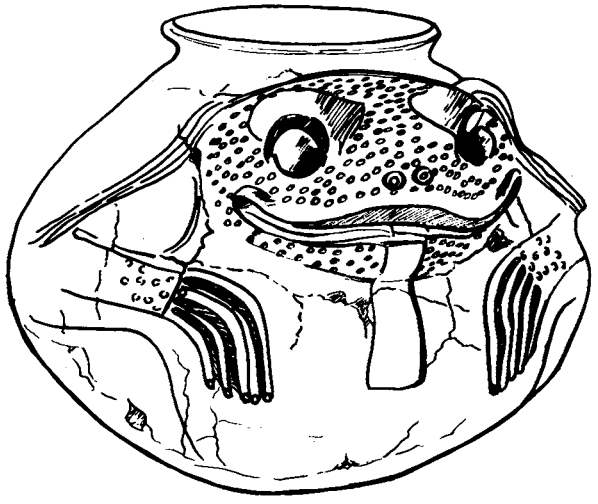

FIG. 47. Monumental toad effigy jar, Gulf Coast A.D. 1–200(?) (after Parsons 1980:159).

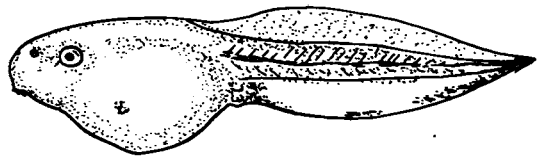

FIG. 48. Mature *B. marinus* tadpole (after Breder 1946:395).

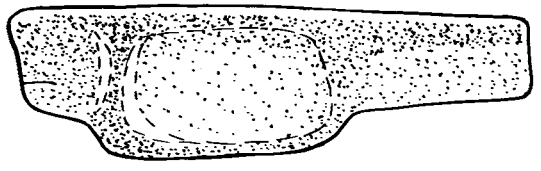

FIG. 49. Olmec jade spoon, tail broken (after Pohorilenko 1972:59).

thetic immunity." The mask and winged costume would at the same time protect them from venom spatters as they stood at their toad altars lancing the paratoid glands and pressing out the contents preparatory to further "processing." This interpretation rested on the premise that ducks could eat toads and tadpoles with impunity. The amphibiologists I approached on this were less than encouraging: merely mouthing a *B. marinus* can kill a full-grown dog, they chorused. But none of them really knew about ducks. Finally, I was referred to David McKelvey, the head aviculturist at the San Antonio Zoo.

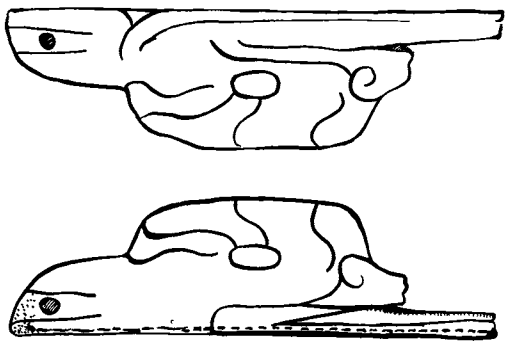

FIG. 50. Duck-head *atepocate* (after drawing supplied by A. Pohorilenko from a piece in the Museo del Instituto Nacional de Seguros, San José).

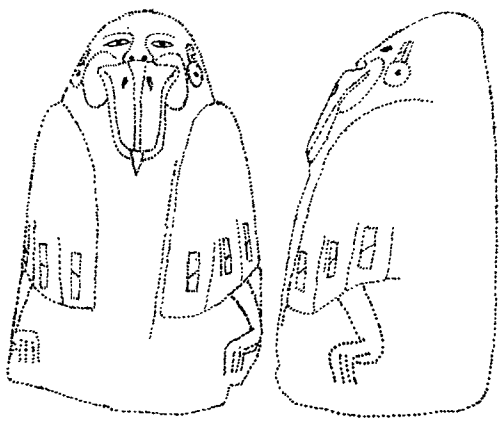

FIG. 51. The Tuxtla statuette, with figure in duck-bill mask (after Holmes 1907: pl. 34 and 40).

FIG. 52. Duck-bill mask pendant, Jay Leff collection (drawing by Barbara Todd Kennedy from photo by L. Desmond).

McKelvey stated that birds in general, and ducks in particular, have unusually efficient livers (the liver being the chief organ of detoxification). Field accounts of the duck's natural diet being sketchy, there was only one way to establish this. Thus it was that 15 young *Bufos* with well-developed paratoids were experimentally sacrificed by casting them into the duck pond at the San Antonio Zoo. This pond had numerous varieties of ducks, including *Anas diazi* and *A. platyrhynchos*. *A. diazi* is the nonmigratory Mexican duck, and *A. platyrhynchos* is the mallard that formerly wintered over on the Gulf Coast area at the precise time that *B. marinus* is spawning. (Its migratory habits have altered radically in the last century; it is now virtually unknown in Central Mexico [Leopold 1959: 168].)

These ducks were what one might call "toad-naive" ducks—born and bred in the San Antonio Zoo—and had never, to McKelvey's knowledge, encountered a toad. They had an ample supply of duck chow ad libitum, and yet they pursued these young toads with avidity, even sparring with one another for the tender morsels. They showed every evidence of instinctual behaviour: they immediately began to "process" the toads, turning them around and around in their bills as they swam through the water, evidently pressing out most of the paratoid secretion. (The skunk is known to flip toads over on their backs and press out most of the secretion before eating them.) The duck's bill is, of course, admirably adapted to such a task, as it has neither nerve endings to react to the cinobufagin nor blood vessels to absorb the venom. It is this cinobufagin, with its powerful local anaesthetic action (90 times as strong as cocaine), that is the toad's first line of defense against predators. The mammalian mouth is both highly vascular and highly innervated; most predators, upon seizing a toad in the mouth, will drop it like the proverbial hot potato. The behavior of the ducks, however, was singular and apparently wholly instinctive. Each of the toads was swallowed head first, and, as they were somewhat large, the ducks swam around for some time with the hind legs of the toads dangling out of their bills before succeeding in swallowing them (fig. 53).

Suddenly all the unusual features of the San Lorenzo site which Coe excavated came into sharp focus: the elaborate "water control" system, consisting of 300 tons of U-shaped trough stones and their covers in 550 feet of "main line" and 98 feet of laterals. This system represents a prodigious amount of lithic work and engineering. Coe is reasonably sure, too, that a mirror image system lies on the southeast side of the site. At one end of this "main line" lay a rain god or "were-jaguar" sculpture; at the other end, an enormous stone receptacle (Monument 9) in the shape of a duck (fig. 54). This was thought to be some kind of cistern, as a trough-stone fit perfectly into a U-shaped opening in one side. This system seemed to feed or to drain the 20 "lagunas" on the ceremonial plateau. The purpose of these artificial lagunas—too small and shallow for effective bathing—could only be put down to "ritual use," the final resort of the confounded. An irresistible hypothesis now springs forth: these lagunas and their elaborate hydraulic system were designed as a complete "*Bufo*-culture station"—to provide spawning grounds for toads and maintain ducks to feed upon them. The ducks might be presumed to build up tissue concentrations of hallucinogenic compounds or psychoactive metabolic conversion products. They could have served as bio-processors or bio-mediators of the toad venom, rendering it both more potent and less toxic, by converting it into certain metabolites in their livers. The flesh might then have been utilized as a psychotropic delicacy for religious feasts or bacchanals. Obviously, to test this hypothesis fully would require feeding toads to ducks over a period of time and then performing a bioassay on the various tissues and organs.

Still, there is another kind of supporting evidence available. It is clear that other cultures have been much more observant

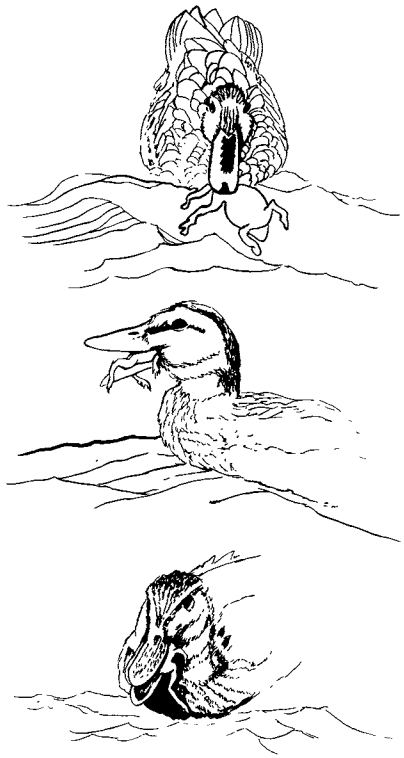

FIG. 53. Ducks eating toads (drawings by Barbara Todd Kennedy from photos by L. Desmond).

of food chain and predator-prey relationships than we and that such knowledge has been encoded in folktales and in dietary laws and proscriptions (see, for example, figure 55). Many dietary systems are actually broken down into such categories as "hot" or "cold" depending on the nature of the food or prey that animal ingests. Such peoples may be acutely aware of the nutritive properties of a given animal deriving from its choice of food.

The *cañanes* lizards in Peru, for example, as recorded by Helms (1977), are reputed to be aphrodisiac. This property is said to reside in their choice of food: the immature fruit of the algarroba or carob tree (*Prosopis juliflora*). This tree belongs to the Leguminosae, noted, as we have seen, for its high alkaloid and/or glucoside content. The Indians do not eat the fruit itself, as it is either indigestible or toxic at that stage, but they rely on the *cañanes* lizard to bio-process the active constituents for them.

Another suggestive example is Wasson's (1968) account of the reindeer and the fly-agaric complex of Siberia. He cites numerous authorities on the almost symbiotic relationship between the Koryak, Yukagir, and other Siberian tribes and their reindeer. Man and deer share a predilection for the fly-agaric mushroom and for each other's urine, in which the psychotropic metabolites are concentrated in less toxic form. Further, it is said that if they encounter an intoxicated reindeer, they bind its legs until the mushroom has lost its effect. Thereupon, they kill the animal and eat its flesh, from which "everyone becomes intoxicated as if they had eaten the actual fly-agaric" (p. 250).

David McKelvey spent three years on Mauritius studying the pink pigeon (*Columba meyeri*), regarded as an endangered species. His findings suggest another instance of bio-processing. He claims that the pink pigeon evolved with no known predators and in intimate association with three different hallucinogenic plants: *fandamon* (Creole patois for *Aphloiea*), *fangam* (*Styllingia*, a euphorb), and a species of lantana. The birds feed on the berries of these plants and become intoxicated, and their flesh when eaten is hallucinogenic. The birds become totally incapacitated and loll about on the ground in a stuporous state. Obviously they were highly vulnerable to attack when the British introduced the mongoose into Mauritius, and their numbers were decimated. McKelvey believes that the birds have perhaps a physiological requirement for these berries; they cannot be kept in captivity, and certainly will not flourish, without their "drug of choice" (personal communication).

Marlene Dobkin de Rios has related to me a final example, the *borracho* (or "drunken") fish found off the coast of Peru near Trujillo. This fish is reported to feed on toxic algae and to convert these into psychoactive metabolites. The flesh of this fish is highly hallucinogenic, according to her informants' reports (personal communication).

That such reports are not merely folkloristic—that bioactive substances do accumulate in the flesh of predators—is attested to by the incidence of turtle poisoning. The *Chelonia* produce no venom of any sort, and yet there are reports of turtle poisoning from eating the eastern box turtle of the United States or the sea turtle of the Western Pacific. Boys (1959:12) remarks: "Their poisonous properties are derived solely from their food. If they have eaten certain foods poisonous to humans (but not to turtles), the poison may be dispersed for a time in all bodily tissues, including the muscles that

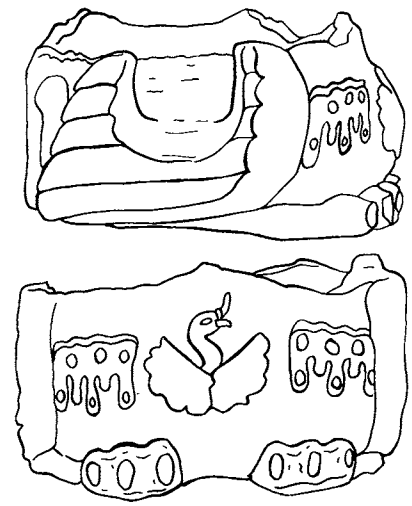

FIG. 54. "Duck cistern," Monument 9 at San Lorenzo (after de la Fuente 1973:189).

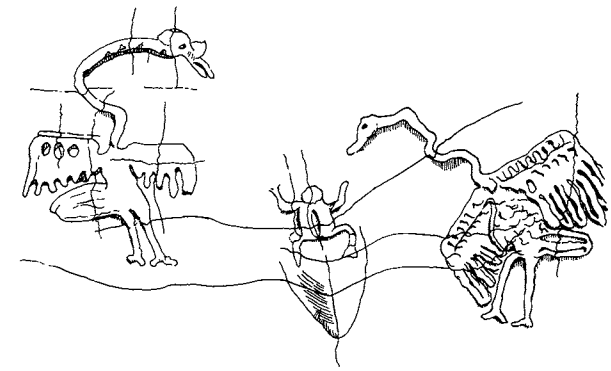

FIG. 55. Animals associated with rain cult, shown in bas-relief on the interior wall of an underground cistern at Uxmal (after drawing by Dunster in Barrera Rubio 1978).

humans eat. Thus, humans eating the poisonous tissues are themselves poisoned, not from the turtle itself but from the food eaten by the turtle." The symptom picture sounds like indolic poisoning and is thought to derive from certain toxic algae, in the case of the sea turtle, or from *Amanita* mushrooms in the case of the box turtles.

Quails, alone among the common game birds, have been known to cause severe poisoning. The Bible provides the first graphic description of what must have been fairly acute poisoning, as the Israelites were stricken "while the flesh was yet between their teeth" (Numbers 11:32–34). Reports of the toxicity of quail flesh proceed from Classical times down to the present day. Aristotle, in his work *On Plants*, observed, "some fruits are unfit for us to eat, but fit for others, like the henbane and hellebore *which are poisonous to man, but good food for quails*" (italics mine). Lucretius, Pliny, Galen, Avicenna, and Maimonides all by turns refer to the toxic effects of eating quail, which they attribute variously to the hellebore, henbane, or hemlock seed "which is the nourishment of the quail" (Maimonides, quoted in Darby, Ghacioungui, and Grivetti 1977:314). In Trimalchio's Rome, quail were thought to cause the falling sickness (epilepsy) and were banished from Roman tables. Recently, this classic problem in toxicology has been the subject of fresh scrutiny and some novel experimentation. One researcher demonstrated that hemlock seed was practically harmless to quail but would—and did—kill dogs when fed to them in the form of hemlock-fattened quail. Most investigators seem to agree that the coniine alkaloids accumulating in the flesh account for the toxicity (van Veen 1973:465).

Interestingly, and to bring us round full circle, one finds quails closely associated with toads in ancient China. Small toads, in fact, are said to metamorphose into quail after eating bitter gourds (*Citrullus colocynthus*) (Read 1977 [1932]:45). Once again we find the same plexus of associations: alchemy (transformation or fermentation), the toad, and a bitter, poisonous, gall-like substance that one finds in variant forms throughout South America with *B. marinus*, bitter manioc (*Manihot utilissima*), and *casiri* (Karen Hissink, cited in Furst 1972:38, 39). Coincidentally, researchers Weiland and Alles characterized bufotalin and bufotoxin as "allied to the bile acids" (bitter and gall-like) (Gimlette 1971 [1929]:138).

These numerous examples help us to formulate a model for animals utilized as bio-mediators or bio-potentiators. A bio-mediator, then, is an animal that refines, detoxifies, converts, or bio-concentrates substances which, in their natural state, are too toxic, indigestible, unpalatable, or simply of too low a concentration to be eaten directly. I think we should begin to analyze neotropical food-chain relationships and look for possible clues in myths and folktales. There is probably a wealth of data wholly untapped.

The whole complex of bird-man shamanism might be fruitfully reexamined. It is generally held that the link between shamanism and bird symbolism is through the nexus of "celestial flight" or ecstatic trance states and spirit travels. The birds usually emblematic of shamanic flight are the hawk and eagle, the wild gander and duck, the crane, ibis, owl, and raven. It is certainly suggestive that these birds are the very birds that are known to eat toads. Among the Tungus, according to Eliade (1964:149), two kinds of shaman costumes predominate: one in the form of a reindeer (whose meaning Wasson has certainly clarified), the other in the form of a duck. La Barre (1970:176) sees a dichotomy between the two: the bird costume used for shamanizing to the upper world (weather, cosmic forces, and disease) and the reindeer costume for shamanizing to the lower world (ancestors, the dead, and fertility). Campbell (1951:168) states that the shamanic birds of various Palaeolithic sites in Siberia were ducks and water birds, wild geese and ganders. Certainly eagles or even cranes would have been a more apt and glamorous symbol of shamanic flight.

Bird-men carved in jade turn up not only among the Olmec, but also in the jades of Costa Rica and early China. The bird-man of the Shang slowly metamorphoses by the Han Dynasty into the Taoist Immortal, the beak becoming his beard and the feathered cloak his robe. Schafer (1963:112) discusses at length the feathered garments worn as late as the T'ang by Taoist adepts and would-be genies. There were Taoist legends of "feathered men" and *hsien* who sprouted feathers after faithfully following a naturist diet of jujubes, pollen, pine nuts, polypores, hemp seeds, and raw meat (no doubt an admirably well-balanced diet for a bird) (Lévi 1979). Such legends preserve intact archaic shamanistic traditions and hint at an earlier repertoire of ecstatic techniques going back to some animistic *Ur*-stratum of religion. It is wholly possible that this lore had, by the Han Dynasty, gone underground or even into total eclipse, with only vestiges—such as the feathered cloaks—left to betray its original meaning.

Cranes have been hallowed immemorially in China as symbols of immortality and as the "aerial coursers of the Immortals." Invariably, cranes accompany Fukurokuju, in Japan, or his Chinese prototype, Shou Lao, gods of longevity and immortality (fig. 56). Curiously enough, these two deities exhibit the same bizarre cranial deformation (known as oxycephaly or tower-headedness) that we find in the Olmec priest group (Offering 4) from La Venta (fig. 57). But were these birds their alter egos or familiars, their mentors or convoys? Or was the identification more complete still: did they actually eat crane meat in order to ascend to the empyreal realms or the "Isles of the Blest"?

The toad, of course, was a stock familiar: the *gama sennins* (or toad-wizard/hermits) of Japan were said to have learned

FIG. 56. Shou Lao, god of longevity, showing characteristic oxycephaly (Verwey 1922:facing p. 49).

FIG. 57. Small jade maskoid of oxycephalic Olmec priest wearing parabolic magic mirror (Cleveland Museum cat. no. 67. 154; photo by L. Desmond).

their uncanny art and supernatural powers from their toads. *Tsuru sennins* were crane-wizards who are generally represented holding a half-gnawed crane leg and grimacing with bulging eyes and a manic ferocity. This recalls both the berserks of Norse legend and Palaeo-Asiatic traditions of initiatory survival retreats by would-be shamans who repaired to the mountains and lived on raw birds and animals. Cranes, it is said (Joya 1960:166), were formerly much valued for their meat, although "it did not taste good." Today, of course, the crane is highly revered and taboo as food; such cases, though, are not unusual for the hallucinogens or sacraments of an earlier dispensation.

The Olmec, of course, lack the explicitly literary tradition of China. We must perforce fall back on the monuments, basreliefs, jade carvings, and earthworks. Yet even an effigy mound may provide us with suggestive evidence. The site of San Lorenzo, for example, consists of a ceremonial plateau area in the shape of a gigantic effigy bird flying eastward, with its wing feathers forming the artificial ridges on the north and south and its tail trailing to the west (Coe 1971:67). A migratory duck, perhaps?

All this obviously requires some hard data before it can be elevated out of the realm of wild conjecture. But these points we can assert with some confidence: the Olmec were acute observers of their natural environment and fully exploited the riverine resources of their heartland. And, of course, the toad was a conspicuous and ever present feature of that environment.

Pride of place in the Olmec pantheon is still a moot issue. I certainly have no intention of supplanting the were-jaguar with the were-toad. Obviously, many creatures are composite, and clearly the zoological attributes are intended to convey certain symbolic forces. Such symbolism may have acquired in time an exclusively totemic or dynastic meaning, especially in the art forms of the elite. However, its original meaning would be preserved in folk traditions—most accessibly in the "animal medicines" of the materia medica which continue to this day. Such animal medicines could be compared fruitfully with their Arabic, Indian, and Chinese counterparts, for which we have relatively luxuriant documentation. The *axaloll* or salamander, the cochineal, and the tapir are all invested with iconic meaning and loom large in the medical/prototechnical traditions in both East and West. As iconographers we can enlarge our understanding of the full range of iconic import by turning our overcivilized attention to the faunal realm for a closer and—dare I say it?—more scientific, less "art-historical," look.

FIG. 58. Stone figure in Princeton University Art Museum identified as "shaman in transformation pose; Olmec ca. 800 B.C." The placard in the exhibition case continues: "The shaman is shown under the effect of an hallucinogenic drug derived from the glands of a particular species of frog. An image of the frog is incised in the forehead of the priest who is anticipating the transformation that will be induced by the drug" (photo by Donald Hales).

FIG. 59. Close-up of incised toad on forehead of shaman of figure 58 (photo by Donald Hales).

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