analysts will be able to understand the complex interrelationships between minimum numbers and sample size in vertebrate faunal collections.

Acknowledgments. I thank Richard W. Casteel and Barbara Lawrence for critically reading earlier drafts of this paper. Sydney Anderson (American Museum of Natural History), C. O. Handley, Jr. (Smithsonian Institute), and J. Patton (Museum of Vertebrate Zoology, University of California) kindly allowed me access to skeletal collections under their care. Support provided by the National Science Foundation (GR-2846) and the Huber Fund of Kirkland College is gratefully acknowledged.

Chaplin, R. E.
1971 *The study of animal bones from archaeological sites*. Seminar Press, New York.
Daly, P.
1969 Approaches to faunal analysis in archaeology. *American Antiquity* 34:146-153.
Gejvall, N. -G.
1969 *Lerna, a pre-classical site in the Argoilid. Volume 1: the fauna*. American School of Classical Studies at Athens, Princeton.
Grayson, D. K.
1973 On the methodology of faunal analysis. *American Antiquity* 38:432-439.
1974 The Riverhaven No. 2 vertebrate fauna: some comments on methods in faunal analysis and on aspects of the subsistence potential of prehistoric New York. *Man in the Northeast* 2:23-39.
Guilday, J. E.
1963 Bone refuse from the Oakfield site, Genessee County, New York. *Pennsylvania Archaeologist* 33:12-15.
Guilday, J. E., P. W. Parmalee, and D. P. Tanner
1962 Aboriginal butchering techniques at the Eschelman site (36La12), Lancaster County, Pennsylvania. *Pennsylvania Archaeologist* 32:59-83.
Higham, C. F. W.
1968 Faunal sampling and economic prehistory. *Zeitung für Säugetierkunde* 33:297-305.
Payne, S.
1972 On the interpretation of bone samples from archaeological sites. In *Papers in economic prehistory*, edited by E. S. Higgs, pp. 65-82. Cambridge University Press, Cambridge.
Shotwell, J. A.
1955 An approach to the paleoecology of mammals. *Ecology* 36:327-337.
1958 Inter-community relationships in Hemphillian (mid-Pliocene) mammals. *Ecology* 39:271-282.
Thomas, D. H.
1969 Great Basin hunting patterns: a quantitative method for treating faunal remains. *American Antiquity* 34:392-401.
White, M. E.
1963 Settlement pattern change and the development of horticulture in the New York-Ontario area. *Pennsylvania Archaeologist* 33:1-12.

THE UTILIZATION OF *POMACEA* SNAILS AT TIKAL, GUATEMALA

HATTULA MOHOLY-NAGY

Pomacea flagellata *(Say), a large freshwater snail, was eaten by the ancient inhabitants of Tikal. Its shells appear in archaeological contexts datable to the entire circa 1500-year span of permanent occupation. Utilization was heaviest during the earliest and latest periods, a distributional pattern that seems directly related to population growth and decline. Comparison with the freshwater mussels and European land snails suggests that* Pomacea *snails were probably never more than a supplementary source of protein and calories. However, they could have been important in a marginal diet. Occasionally* Pomacea *were deposited in ceremonial contexts. They were most frequent during the later Early Classic period when they may have figured in a special votive complex.*

ARCHAEOLOGICAL EVIDENCE

Most of the mollusks found in archaeological context at Tikal were marine shells usually deposited in caches, burials, and deposits of a problematical nature (Table 1). However, a large number of freshwater shells also occurred, about two-thirds of them in redeposited and undisturbed occupation debris.

The most numerous freshwater mollusk was *Pomacea flagellata* (Say), a large, edible snail. About 588 were identified, of which 388 were complete or nearly so (Table 2). Only five were worked, i.e., perforated. Other freshwater shells included 238 mussel valves, nearly all incomplete, of which about 70 had been worked in some manner; 17 snails of the genus *Pachychilus* (Spanish: *jute*); and an unknown but small number of the waterhole snails, *Aplexa elata* (Gould) (e.g., Pearse et al. 1936:Pl. 1 and 2), apparently sometimes confused with the local land snail, *Euglandina sp.* Of the aquatic species, only *Pomacea* and

Table 1. Preliminary Counts of Unmodified and Scarcely-altered Shells and Fragments: by Source.

	General excavations	Special deposits	Total
Marine shells	187	2758+	2945+
Freshwater shells	636+	225+	861+
Land snails	240+	195+	435+
Unspecified	186+	1	187+
TOTAL	1249+	3179+	4428+

Aplexa occur in the immediate vicinity of Tikal today.

The habitats of *Pomacea* snails, their archaeological contexts, spatial and chronological distribution, and possible nutritional value all contribute to inferences about their ancient utilization at Tikal.

HABITAT

Pomacea flagellata is common in the Petén and found in a variety of habitats: waterholes, swamps, arroyos, rivers, and lakes (Goodrich and van der Schalie 1937:35). By the summer of 1974, a few had established themselves in the new drinking-water cistern at Tikal. Two forms, subspecies, or varieties may be recognized: a smaller, thin-walled form, *P. flagellata* form *arata* (Crosse and Fischer) (Fig. 1, b-d; Fig. 2, d) and a larger, thicker-walled form, *P. flagellata* form *tristrami* (Crosse and Fischer) (Fig. 1, a) (A. Solem, personal communication 1974). The systematic importance of varieties in *Pomacea* is as yet unclear and it is possible that variations only indicate differences in habitat (A. Solem, personal communication 1974) or, as Goodrich and van der Schalie (1937:35) put it, "large forms will be in large bodies of water." Waterhole and swamp snails are of the *arata* form, while the *tristrami* form occurs in Lake Petén and vicinity, about 25 air-km south of Tikal. However, Goodrich and van der Schalie (1937:35) report that different forms sometimes occur together; for example, both *arata* and *tristrami* forms occur in Lake Petén (Fig. 1, a,c). At Tikal, *Pomacea* of the *arata* form are immediately available in its various waterholes and swamps and presumably also were in the past.

Both *arata* and *tristrami* snails were found in archaeological context at Tikal (Table 2). Of interest is the concentration of imported *tristrami* snails in Classic period special deposits.

CHRONOLOGICAL AND SPATIAL DISTRIBUTION

Most of the excavated *Pomacea* shells occurred in occupation debris reused as construction fill. A few were found in undisturbed midden deposits associated with range-type structures, small structures, and chultuns. Surface finds were rare. Such random occurrences are here designated as general excavations, and are distinguished from special deposits such as caches, burials, and problematical deposits (Table 2 and Fig. 3). The circumstance that an object was disposed of in a special manner indicates the possibility of a different function (Linton 1936:402-405).

Random occurrences are also more difficult to date than special deposits because they often include materials of different

Table 2. *Pomacea Flagellata:* Occurrence by Form ( ) = Shell Complete or Nearly So.

	General excavations	Special deposits	Total
Tristrami	16(2)	58(55)	74(57)
Arata	c.241(207)	c.42(32)	c.283(c.239)
Discarded	194(71)	37(21)	231(92)
Total	c.451(c.280)	c.137(108)	c.588(c.388)

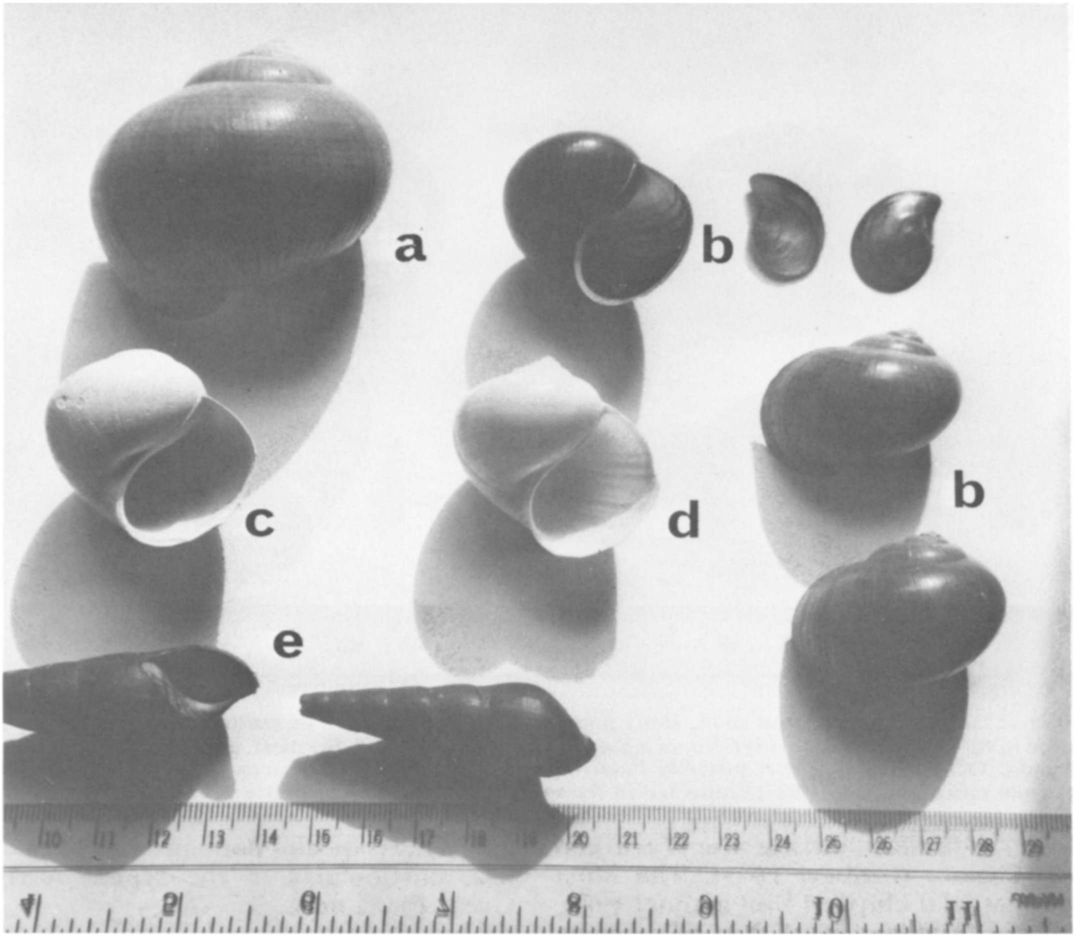

Fig. 1. (*a*) *Pomacea flagellata tristrami* (Crosse & Fischer), collected at Remate, Lake Peten-Itza, 1960; (*b*) *Pomacea flagellata arata* (Crosse & Fisher, collected at the Tikal Aguada, 1974; (*c*) *Pomacea flagellata arata* (Crosse & Fischer, collected with (*a*); (*d*) *Pomacea flagellata arata* (Crosse & Fischer), excavated at Tikal, 1963, lot 12P/124, Chuen Ceramic Complex; (*e*) *Pachychilus (Glyptomelania) largillierti (Philippi)*, one kind of *jute*, purchased in the Central Market, Guatelmala City, 1974–said to come from the vicinity of Puerto Barrios.

ages. Most of the *Pomacea* from general excavations came from somewhat mixed deposits and were dated according to the ceramic complex of the latest of the associated sherds.

The following ceramic complexes have been formulated for Tikal (cf. Willey et al. 967:Fig. 1): Eb, followed by Tzec (Middle Preclassic); Chuen, Cauac (Late Preclassic), and the Cimi Subcomplex of Cauac (Protoclassic); Manik (Early Classic); Ik (Middle Classic or early Late Classic), an Ik-Imix Transition of short duration, Imix (late Late Classic); Eznab (Terminal Classic). The time of use of Eznab ceramics coincided with the last permanent occupation of Tikal. The absolute dates for these complexes are still in a state of flux.

Disregarding for the moment the examples in special deposits because of their probable different function, *Pomacea* remains were most frequent during Tikal's earlier and later occupations. This is a very unusual distribution, the opposite of almost all categories of material culture. The volume of cultural deposits rose steadily from the Middle Preclassic (Eb) into the later Classic (Ik and Imix), followed by a radical,

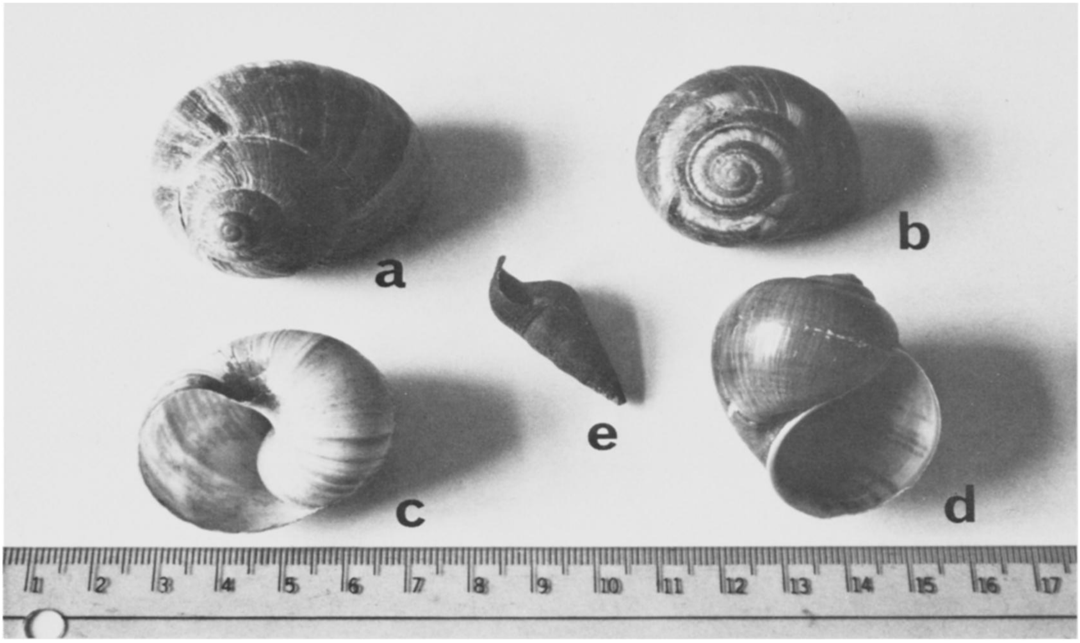

Fig. 2. (*a-c*) European land snail, *Helix pomatia* Linne, purchased in Zurich, 1975, commercially raised in the Alsace, France; (*d*) *Pomacea flagellata arata* (Crosse & Fischer), collected from the Tikal Aguada, 1974; (*e*) a small *jute*, possibly *Pachychilus (Glytomelania) obeliscus* (Reeve) (D. Cawthon, personal communication 1977), collected in the Orange Walk District, Belize, 1976.

site-wide reduction during the Terminal Classic (Eznab) (Culbert 1973). The most common bifacial chipped flint artifact type, the chopper (Kidder 1947:5, Fig. 61), can be taken as an example of a typical distribution through time. Choppers and chopper fragments steadily increased in number until the Late Classic and then sharply declined. In the absence, at this stage of research, of a better standard of comparison, choppers from general excavations in architectural groups producing freshwater shell are shown with *Pomacea* on Fig. 3, in order to point up the anomalous temporal distribution of *Pomacea* and its greater relative importance during the time of the Eb and Eznab complexes.

Spatial distribution of *Pomacea* closely followed chronological occurrence, particularly in the case of general excavations. Proveniences producing the most Preclassic or Terminal Classic materials produced the most *Pomacea* shells, regardless of type of architectural group. *Pomacea* occurred most frequently in special deposits at those loci where special deposits were concentrated, particularly in the North Acropolis-Great Plaza area.

SPECIAL DEPOSITS AND ANCIENT UTILIZATION

Generally freshwater shells were uncommon in special deposits (Table 1). *Pomacea* snails were occasionally offered from Chuen into Imix times, and were found in two burials of probable Eznab Ceramic complex date (Table 3). They were most frequently deposited in burials and burial-like problematical deposits. They never occurred in the presumably "lower-class" burials associated with Smaller Structure Groups (Moholy-Nagy 1976), which did noy include shells of any kind.

The only time *Pomacea* was of an importance in special deposits was during the Early Classic period, when it apparent ly figured in a short-lived votive complex The reasons for this increased ritual use are at present unclear and will have to de sought in a general conside ation of cere

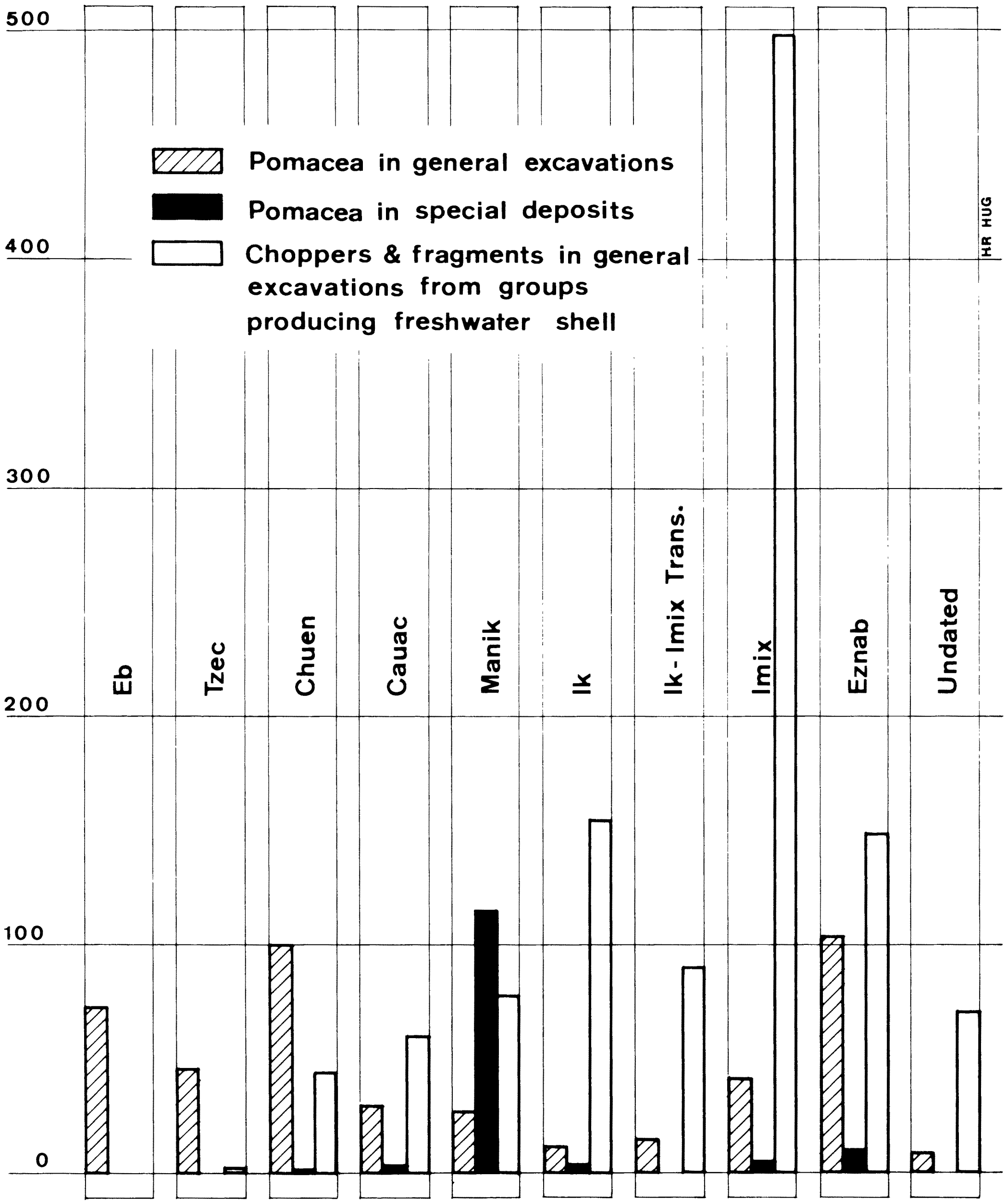

Fig. 3. Association of *Pomacea* snails and flint choppers with ceramic complexes (latest ceramics present).

monial activities during the Early Classic. At least five of the 12 Early Classic special deposits including *Pomacea* snails also included the remains of crocodile and turtle (Structure Caches 86, 120, 140, elite Burial 10, burial-like Problematical Deposit 22). A sixth deposit, burial-like Problematical Deposit 74, included turtle remains and a bone pendant in the shape of a crocodile head. Identification of animal bones from Tikal is still in progress, and it may be that this association of *Pomacea,* crocodile, and turtle occurred more frequently. At the moment it seems restricted to the time of the Middle and Late Manik ceramic complexes.

Table 3. *Pomacea* Snails in Special Deposits.
( )-number of occurrences

		Chuen (1)	Cauac-Cimi (1)	Early Classic (12)	Early Cl/Middle Cl (2)	Middle Classic (2)	Late Classic (1)	Imix (4)	Eznab? (2)	TOTAL (25)
Monument caches	(0)	-	-	-	-	-	-	-	-	-
Structure caches	(5)	-	-	90	-	1	-	-	-	91
Burials:										
elite	(3)	1	3	9	-	-	-	-	-	13
other	(9)	-	-	6	-	-	1	4	10	21
Probl. Dep:										
burial-like	(4)	-	-	8	-	-	-	-	-	8
Probl. Dep:										
other	(4)	-	-	1	2	1	-	-	-	4
Total	(25)	1	3	114	2	2	1	4	10	137

Although marine shells also occurred in all of these six deposits, the *Pomacea* may have been grouped with the turtles and crocodiles to form a kind of freshwater-animal votive complex, comparable to Andrews' "cult of the sea" (Andrews 1969:53). The identifiable turtles were all *Dermatemys mawii* Gray (L. C. Stuart, personal communication 1968), a species inhabiting clear streams and lakes and unknown in the Tikal-Uaxactun area today (Stuart 1958:19). The crocodiles, *Crocodylus sp.*, were not identifiable to species and could be lake or river animals (L. C. Stuart, personal communication 1968). The significance of this complex may have been that all of its components were edible.

Fifty-six, or a little over three-fourths of the *tristrami* form of *Pomacea* identified at Tikal (Table 2), occurred in Early Classic special deposits. Thirty others were of the *arata* form, some of which may have been imported, and 28 were not identified. The high proportion of definitely imported snails could be interpreted as another manifestation of the importance of exotic materials in ceremonial contexts. It probably also indicates a scarcity of local snails.

The association of *Pomacea* with two other edible freshwater animals in some Early Classic special deposits reinforces the impression gained from their distribution in general excavations. The large number of shells recovered, particularly in relation to those of local land snails, their often clustered occurrence, unmodified condition, and the circumstance that their distribution shows a chronological rather than spatial pattern, all indicate a primary utilization as food.

POMACEA AS AN ANCIENT FOOD SOURCE

This section is somewhat speculative because it was not possible to locate any nutritional analyses of *Pomacea*. However, the *arata* form is very similar in size and shape to the land snail, *Helix pomatia* Linné, eaten in Europe today (Fig. 2, a-c). Table 4 lists food values for *Helix*, two species of freshwater mussels from eastern North America, and some vertebrates also found in the Lowland Maya area.

All of the shellfish are very low in calories and protein compared to the vertebrates, but *Helix* contains considerably more protein than the mussels. The usual main course is 12 *Helix* snails or about 85 grams of meat. This provides 63.7 calories and 12.7 grams of protein, but the snails are traditionally prepared with butter (e.g., Rombauer and Becker 1951:257) and served with bread or toast. An experiment with an

Table 4. Food Values per 100 Grams

	k calories	protein (grams)	fat (grams)	carbohydrates (grams)	Reference
Land snails:					
Helix pomatia	75	15.0	0.8	2.0	Biopress n.d.: 11
Freshwater mussels:					
Proptera alata	77	9.5	0.8	7.8	Parmalee & Klippel 1974:431
Actinonaias Carinata	58	7.8	0.7	4.5	Parmalee & Klippel 1974:431
Deer:					
Odocoileus sp.	126	21.0	4.0	0	Parmalee & Klippel 1974:431
Venison, semi-dried salted	142	31.4	0.9	0	Woot-Tsuen 1961:79
Venison, roasted	146	29.5	2.2	0	Woot-Tsuen 1961:79
Turkey, medium fat	268	20.1	20.2	0	Woot-Tsuen 1961:79
Alligator, semi-dried	232	45.6	4.2	0	Woot-Tsuen 1961:72
Turtle, roasted	89	19.8	0.5	0	Woot-Tsuen 1961:86

Iranian species demonstrated that the snails were also "quite tasty" when boiled 15 minutes in their shells and eaten hot without salt or other seasoning (Reed 1962).

In the Lake Petén area today, some people eat *Pomacea* (local name: *tote*) and other aquatic snails with enthusiasm. Land snails, on the other hand, are not only considered inedible (cf. Andrews 1969:34) but also *masamora*, capable of producing a skin rash. *Pomacea* snails can be removed from the shell with a knife while still alive and are boiled in a stew, sometimes with a few of the shells to add flavor and calcium (N. Tesucum, personal communication 1974). *Pomacea* shells from archaeological context rarely show any modifications that could be attributed to preparation or cooking.

Archaeological and ethnographic data indicate that the ancient inhabitants of Tikal utilized *Pomacea flagellata* as food. However, the low caloric and protein content of *Helix pomatia* and the two species of freshwater mussel when compared to the number of *Pomacea* shells and fragments recovered from Tikal, suggest that *Pomacea* was not a staple food and probably only a supplementary source of protein.

For example, the largest single concentration of *Pomacea* shells from Tikal consisted of some 70 of the *arata* form associated with a deposit of Eb Complex pottery (lot 12P/151). If the caloric and protein content of *Pomacea flagellata arata* are considered to be the same as those of *Helix pomatia*, then the 70 snails would have provided about 490 grams of meat, 367.5 calories, and 73.5 grams of protein. This is not much if one accepts the daily, adult allowances recommended by the World Health Organization of 2200-3000 calories and 30-40 grams of protein (Scrimshaw and Young 1976:60). The difficulties of providing from mollusks the daily nutritional requirements of even a nuclear family have been pointed out by Meighan (1969:420) and Parmalee and Klippel (1974:432). On the other hand, even the few grams of protein provided by *Pomacea* snails could have been an important supplement to people living on a marginal diet (O. Stavrakis Puleston, personal communication 1976). This would have been of particular importance if the diet consisted mainly of plant foods (Cook 1946:52).

COMPARATIVE DATA AND CHRONOLOGICAL FLUCTUATIONS

Unfortunately there are few comparative data on the occurrence of freshwater mollusks at other Maya sites. Until recently, investigators concentrated their attention on marine shells and tended to ignore freshwater or land mollusks. The situation is exemplified in the emphasis on marine shells in Andrews' (1969) important synthesis of the archaeological evidence of mollusks in the Maya Lowlands. His annotated list of freshwater species (Andrews 1969:32-33) omits some sites where freshwater mollusks occurred, undoubtedly because of inadequate reporting by the excavators. At Copan, Honduras, for example, Longyear reported quantities of "hute" shells from Archaic (Preclassic) refuse and noticeably less from later contexts (Longyear 1952:16-17). No counts are given and the shells are not identified or illustrated. Thompson (1939:180-181) noted "many freshwater and land shells," including *jutes*, in the excavations at San José, now Belize. But, as he believed they were not deposited by man, they are not identified or illustrated, nor are any counts or contexts given. Finally, it would have been of particular interest to know if freshwater mollusks occurred in any quantity in the earliest deposits beneath the plaza of Group E at Tikal's neighboring site of Uaxactun. E. B. Ricketson mentions *Pachychilus*, *Pomacea flagellata*, and a pearly freshwater mussel (in order of occurrence) from Group E as a whole, but no counts or proveniences are reported (Ricketson and Ricketson 1937:199). The fact that *Pachychilus*, a nonlocal genus, outnumbered *Pomacea*, a local one, is of great interest.

The usefulness of more complete reporting is shown by Willey's data on freshwater mollusks from Barton Ramie, Belize (Willey et al. 1965:525-528). The pattern of use was similar to Tikal's in that it was heaviest during the Preclassic Period and declined sharply thereafter. Mussels were most common, with *jutes* next. Unlike Tikal, there was apparently no increase in use during the latter part of the Spanish Lookout phase, which corresponds to the time of the Eznab ceramic complex at Tikal (Willey et al. 1965:Fig. 3). The heavy utilization of freshwater mollusks in Preclassic times would tend to support a hypothesis advanced by Puleston and Puleston (1971). They suggested that the Maya Lowlands were colonized by peoples who possessed a river-oriented subsistence system and obtained their animal protein from fish, turtles, and mollusks.

Four possible causes for the marked chronological fluctuations in the use of *Pomacea* at Tikal readily come to mind: natural or manmade alteration of the environment, changes in dietary habits, and overexploitation by the human population. However, the circumstance that *Pomacea* are present to some extent throughout the entire occupation of Tikal (Fig. 3) would seem to rule out culturally-determined changes in eating habits. That *Pomacea* began to increase in quantity during the final period of occupation would seem to rule out any naturally-caused changes in the environment.

The decline in use of *Pomacea* seems related to the growth of the human population. Archaeological evidence indicates a population increase from the earliest settlement on, which reached a peak during the early Late Classic or Middle Classic (Ik ceramic complex) and remained constant for approximately 2 centuries or well into the time of the Imix ceramic complex (Haviland 1970:192). The local snails may have been overexploited by the growing population, an explanation also suggested for Barton Ramie (Willey et al. 1965:528). Toward the end of Imix times, Tikal's population began to decline. During the time of the Eznab ceramic complex, it may have been reduced by as much as 90% from its peak (Culbert 1973:70). By that time pressure on the local *Pomacea* snails may have eased to the point where they could be gathered in larger numbers. The circumstance that the use of freshwater mollusks did not increase at Barton Ramie during the Terminal Classic there seems due to the fact that the population did not decline (Willey et al. 1965:568). The available data do not exclude the possibility of detrimental manmade changes in the environment that might have affected the life-cycle of *Pomacea*. Such changes might include the dredging and reshaping of waterholes for use as reservoirs, erosion in built-up areas, draining of swamps, or laying out ridged-field systems (L. H. Feldman, personal communication 1976; Dahlin 1976:94-110; Willey et al. 1965:528). However, the considerable adaptive ability of *Pomacea*, which seems to do well almost anywhere in the Petén (Goodrich and van der Schalie 1937:35), suggests that overexploitation would have been a more important factor.

Acknowledgments. I thank Joann Andrews, Lawrence H. Feldman, Norman Hammond, Mary Pohl, Dennis E. Puleston, Olga Stavrakis Puleston, and Norberto Tesucum Cunul for information, comments, and suggestions. Figures 2 and 3 are by Hans-Ruedi Hug.

Andrews IV, E. W.
1969 The archaeological use and distribution of mollusca in the Maya Lowlands. *Middle American Research Institute, Tulane University, Publication* 34.

Biopress
n.d. *Kalorien und Nähwert-Tabelle.* Biopress, Zürich.

Cook, S. F.
1946 A reconsideration of shellmounds with respect to population and nutrition. *American Antiquity* 12:50-53.

Culbert, T. P.
1973 The Maya downfall at Tikal. In *The Classic Maya collapse,* edited by T. P. Culbert, pp. 63-92. University of New Mexico Press, Albuquerque.

Dahlin, B. H.
1976 An anthropologist looks at the pyramids: a Late Classic revitalization movement at Tikal, Guatemala. Ph.D. thesis in Anthropology, Temple University.

Goodrich, C., and H. van der Schalie
1937 Mollusca of Petén and north Alta Vera Paz, Guatemala. *University of Michigan, Museum of Zoology, Misc. Publication* 34.

Haviland, W. A.
1970 Tikal, Guatemala and Mesoamerican urbanism. *World Archaeology* 2:186-98.

Kidder, A. V.
1947 The artifacts of Uaxactun, Guatemala. *Carnegie Institution of Washington, Publication* 576.

Linton, R.
1936 *The study of man.* Appleton-Century-Crofts, Inc., New York.

Longyear, J. M.
1952 Copan ceramics: a study of southeastern Maya pottery. *Carnegie Institution of Washington, Publication* 597.

Meighan, C. E.
1969 Molluscs as food remains in archaeological sites. In *Science in archaeology,* edited by D. Brothwell and E. Higgs, revised edition, pp. 415-22. Thames & Hudson, London.

Moholy-Nagy, H.
1976 Spatial distribution of flint and obsidian artifacts at Tikal, Guatemala. In Maya lithic studies, edited by T. R. Hester and N. Hammond, pp. 91-108. *Center for Archaeological Research, University of Texas at San Antonio, Special Report* 4.

Parmalee, P. W., and W. E. Klippel
1974 Freshwater mussels as a prehistoric food resource. *American Antiquity* 39:421-34.

Pearse, A. S., E. P. Creaser, F. G. Hale and collaborators
1936 The cenotes of Yucatan: Zoological and hydrographic survey. *Carnegie Institution of Washington, Publication* 457.

Puleston, D. E., and O. S. Puleston
1971 An ecological approach to the origins of Maya civilization. *Archaeology* 24:330-37.

Reed, C. A.
1962 Snails on a Persian hillside. *Postilla, Yale Peabody Museum of Natural History,* No. 66.

Ricketson, O. G., and E. B. Ricketson
1937 Uaxactun, Guatemala: Group E—1926-1931. *Carnegie Institution of Washington, Publication* 477.

Rombauer, I. S., and M. R. Becker
1951 The joy of cooking. Bobbs-Merrill, Indianapolis.

Scrimshaw, N. S., and V. R. Young
1976 The requirements of human nutrition. *Scientific American* 235:50-64.

Stuart, L. C.
1958 A study of the herptofauna of the Uaxactun-Tikal area of northern El Petén, Guatemala. *University of Michigan, Contributions from the Laboratory of Vertebrate Biology,* No. 75.

Thompson, J. E. S.
1939 Excavations at San José, British Honduras. *Carnegie Institution of Washington, Publication* 506.

Willey, G. R., W. R. Bullard, Jr., J. B. Glass, and J. C. Gifford
1965 Prehistoric Maya settlements in the Belize valley. *Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University,* Vol. 54.

Willey, G. R., T. P. Culbert, and R. E. W. Adams
1967 Maya Lowland ceramics: a report from the 1965 Guatemala City conference. *American Antiquity* 32:289-315.

Woot-Tsuen, Wu Leung (ed.)
1961 *Food composition table for use in Latin America.* The Institute of Nutrition for Central America and Panama (INCAP) and the Interdepartmental Committee on Nutrition for National Defense, National Institutes of Health, Bethesda.

TECALI VESSEL MANUFACTURING DEBRIS AT TOLLAN, MEXICO

Richard A. Diehl
Edward G. Stroh, Jr.

The evidence for the production of tecali (travertine) vessels at Tollan, Hidalgo, Mexico is examined and some possible secondary uses for the resultant waste materials are considered. An attempt is also made to show how artifact reuse can confuse the archaeological record, possibly leading to false conclusions.