

**MAYA LITHIC STUDIES:  
PAPERS FROM THE 1976 BELIZE FIELD SYMPOSIUM**



**Edited by**

**Thomas R. Hester  
and Norman Hammond**

**Special Report No. 4  
Center for Archaeological Research  
The University of Texas at San Antonio  
1976**



Center for Archaeological Research  
The University of Texas at San Antonio  
78285

Thomas R. Hester, Director

*Special Reports*

Publications dealing with the archaeology of Texas and Mesoamerica.

- No. 1 (1975) "Some Aspects of Late Prehistoric and Protohistoric Archaeology in Southern Texas" (By Thomas R. Hester and T. C. Hill, Jr.). (\$2.00 + .10 tax for Texas residents).
- No. 2 (1976). "The Texas Archaic: A Symposium" (Edited by Thomas R. Hester). (\$4.00 + .20 tax for Texas residents).
- No. 3 (1976) "Papers on Paleo-Indian Archaeology in Texas: I" (Papers by T. R. Hester and W. W. Birmingham). (\$3.00 + .15 tax for Texas residents).
- No. 4 (1976) "Maya Lithic Studies: Papers from the 1976 Belize Field Symposium" (Edited by Thomas R. Hester and Norman Hammond). (\$8.00 + .40 tax for Texas residents).



MAYA LITHIC STUDIES:  
PAPERS FROM THE 1976 BELIZE FIELD SYMPOSIUM

Edited by  
Thomas R. Hester  
and  
Norman Hammond

Special Report No. 4  
Center for Archaeological Research  
The University of Texas at San Antonio  
1976

The Center gratefully acknowledges the cooperation of the Department of Archaeology, Government of Belize (Joseph O. Palacio, Archaeological Commissioner) and the Centre for Latin American Studies, Cambridge University.

TABLE OF CONTENTS

	Page
Preface (Thomas R. Hester and Norman Hammond) . . . . .	v
Symposium Papers	
Islands of Lithic Knowledge Amid Seas of Ignorance in the Maya Area (Payson D. Sheets). . . . .	1
Belize Lithics: Forms and Functions (Thomas R. Hester) . . . . .	11
Belize Lithics: "Orange Peel" Flakes and Adze Manufacture (Harry J. Shafer). . . . .	21
Work in Progress at Colha, Belize, 1976 (Richard Wilk) . . . . .	35
Pre-Columbian Maya Development of Utilitarian Lithic Industries: The Broad Perspective from Yucatan (Irwin Rovner). . . . .	41
The Terminal Preclassic Lithic Industry of the Southeast Maya Highlands: A Component of the Protoclassic Site-Unit Intrusions in the Lowlands? (Payson D. Sheets) . . . . .	55
Maya Obsidian Trade in Southern Belize (Norman Hammond). . . . .	71
Long Distance Obsidian Trade: New Data from the Western Maya Periphery (Jay K. Johnson) . . . . .	83
Spatial Distribution of Flint and Obsidian Artifacts at Tikal, Guatemala (Hattula Moholy-Nagy) . . . . .	91
Some Sociological Observations on Obsidian Production at Kaminaljuyu, Guatemala (Joseph W. Michels) . . . . .	109
Arti-Fact or Fiction?: The Lithic Objects from Richmond Hill, Belize (Arlene V. Miller). . . . .	119
Contributed Papers	
An Obsidian Workshop at El Pozito, Northern Belize (Mary Neivens and David Libbey). . . . .	137
Notes on the Pre-Columbian Chert Industry of Northern Belize (John Andresen). . . . .	151
Metate Import in Northern Belize (Raymond Sidrys and John Andresen). . . . .	177





## PREFACE

As a result of intensified archaeological activity in northern Belize, and specifically the work of the joint British Museum-Cambridge University research project (directed by Norman Hammond), a variety of new data have been obtained on the prehistory of this region. Of the many sites that have been mapped, tested, or otherwise investigated in the past few years, one stands out as a major center of ancient Maya lithic technology. This is the site of Colha, located south of Orange Walk Town, along the highway between that town and Belize City. Personnel of the British Museum-Cambridge University Corozal Project began limited research at the site in 1973. As a result of efforts then and since, parts of this extensive site have been mapped, some stratigraphic tests have been made, and controlled surface sampling and lithic analysis have been initiated (the latter through the hard work of Richard Wilk). These investigations, although preliminary in nature, were sufficient to indicate that Colha had indeed been a significant center of stone tool production for the Maya, from Middle Preclassic through Postclassic times.

Conversations about the site, among Hammond, T. R. Hester, H. J. Shafer and R. Wilk during 1975, led to the formulation of plans to hold a "field symposium" in Belize, in which a number of persons interested in Mesoamerican lithic studies could be brought together. The purpose of the symposium was to be two-fold: (1) to make an on-site inspection of Colha, to view the chert-working loci and vast exposures of workshop debris, and (2) to present a series of papers, followed by extensive discussion, in which the status of lithic research in the region could be assessed.

Through the sponsorship of the Center for Archaeological Research at The University of Texas at San Antonio, the field symposium was held in Orange Walk Town, Belize during the period of April 16-20, 1976. The program was organized by Norman Hammond, a Faculty Associate of the Center, in collaboration with Thomas Hester, the Center's director. Formal sessions were held at the Hotel Nuevo Mi Amor, and we are grateful to the management (especially Sr. E. Urbina) for their assistance in providing a meeting room and appropriate refreshments. The participants included Don E. Crabtree, Norman Hammond, Thomas R. Hester, Jay K. Johnson, Joseph W. Michels, Arlene V. Miller, Hattula Moholy-Nagy, Harry J. Shafer, Payson D. Sheets and Richard Wilk; Irwin Rovner presented a paper *in absentia*. Each of the participants presented a formal paper, revised versions of which are published in this volume.\*

During the three days of the symposium, part of each day was occupied by the presentation of papers, while the remainder was spent in visits to archaeological sites in the vicinity. Greatest emphasis was placed on

---

\*Two papers dealing with Belize lithics have been submitted to the editors since the symposium. These contributions, by Ray Sidrys and John Andresen, are published here.

a full day inspection of the lithic workshops of Colha. While at the site, the symposium participants were able to examine a number of individual workshops and the wide variety of lithic debris exposed at these. Impromptu replicative experimentation utilizing nodules of the local chert exposed in a streambed was carried out by Crabtree, Sheets and Shafer. The participants also visited the ceremonial center of the site, and spent a good deal of time examining the extensive collection of stone tools belonging to John and Herbert Masson, the owners of the property on which Colha is situated. The Masson family was extremely gracious to the conference participants and we are very grateful for their hospitality, including a magnificent lunch.

Apart from the day spent at Colha, other sites visited during the conference included the Richmond Hill locality (about which the participants were collectively skeptical; see Miller's paper in this volume) and the Classic major center of El Pozito being excavated by the University of the Americas. An obsidian workshop had been discovered at El Pozito just prior to our visit and the materials from this workshop were examined. A paper has been written by Mary Neivens and David Libbey describing the workshop, and it is published in this volume. The Preclassic site of Cuello, being excavated by Hammond, was also visited, and lithics dating to 1000-2000 B.C. were examined.

The field symposium ended with a lengthy discussion of the status of Maya lithic studies, suggestions for a more unified approach and a more consistent terminology, and the identification of areas of knowledge, and similarly, areas of ignorance in the field of Maya lithics in terms of time, space, materials and technology. It was also agreed that the site of Colha deserved long-term, detailed research. Crabtree described the site as "one of the most important lithic sites in the world", and it was commonly felt by participants in the field symposium that research at this site would yield a wide variety of new insights into Maya lithic technology. A proposal for long-term research at Colha was being prepared at the time this volume went to press.

There are many to whom we are grateful for support and aid during and after the field symposium. We again thank Sr. Urbina of the Hotel Nuevo Mi Amor, and the Masson family, owners of the site of Colha. His Excellency the Governor of Belize, Mr. Richard Posnett, opened the conference and attended the session at Colha. Mr. Joseph Palacio, Archaeological Commissioner for the Government of Belize, provided the assistance of his office and welcomed participants. Belize Sugar Industries made available the swimming pool at Tower Hill, near Orange Walk Town, through the courtesy of Mr. F. J. C. Curtis, O.B.E. Norman Hammond's field crew at Cuello, with the generous aid of Harold B. Haley, provided the conference participants with a party on the last evening. Kathy McCauley, secretary for the Center for Archaeological Research, and Jeanette Burch, typist for the Center, helped in report preparation.

Persons attending the conference in addition to those participants listed above included: Evelyn Crabtree, Gabrielle Michels, Mary Neivens,

Juliette J. Cartwright, Peter R. A. Barron, Ginny Schneider, Harold B. Haley, Elizabeth Graham and Duncan Pring.

Thomas R. Hester  
The University of Texas at San Antonio

Norman Hammond  
Centre of Latin American Studies,  
Cambridge University, England

*As editors of this volume, and on behalf of the participants in the 1976 Belize field symposium, we respectfully dedicate this volume to Don E. Crabtree, in recognition of his outstanding contributions to the study of lithic technology.*



ISLANDS OF LITHIC KNOWLEDGE AMID SEAS OF  
IGNORANCE IN THE MAYA AREA

Payson D. Sheets

INTRODUCTION

The purpose of this paper is to provide a brief summary of lithic analyses in the Maya area, noting "islands of knowledge" amid "seas of ignorance". I shall use a geographic organization, beginning in the northern Maya lowlands and ending in the southern highlands. Length limitations eliminate many topics such as assessing what we know and need to know about trace element attribution studies and prehistoric trade, general technological analyses and Paleo-Indian research.

SURVEY OF MAYAN LITHIC STUDIES

This overview of what areas are well or poorly known in terms of chipped stone artifacts ("artifacts" includes implements and debitage) begins in the Yucatan Peninsula, continues southward into the Classic Maya core area, then shifts westward to the Isthmus of Tehuantepec. From there we can move eastward, examining lithic knowledge in the Maya highlands of Chiapas-Guatemala-El Salvador as well as along the adjoining Pacific piedmont and coast.

The Maya Lowlands

A small area of northern Yucatan is fairly well known in terms of lithics, extending from Mayapan to Chichen Itza, from the work of Proskouriakoff (1962) and Rovner (1974b). As the Dzibilchaltun monographs are published by the Middle American Research Institute over the next few years, our knowledge of chipped stone in this small area will increase further. But, this island of knowledge is surrounded by a vast sea of lithic ignorance extending to the south, east, and west. As we travel south the first locality with some information available on stone artifacts is Becan (Stoltman 1975; Rovner 1974a), and this information may be expected to increase as the Becan publications also become available from the Middle American Research Institute.

Both the Mexican states of Campeche and Quintana Roo are lithic *terra incognita*. Moving southward and passing over the border into Guatemala, we find the situation greatly improved. Piedras Negras (W. Coe 1959) and Altar de Sacrificios (Willey 1972), both along the Usumacinta River in the western Peten, are quite well described and thoroughly illustrated. The Seibal artifact analysis will be available soon (G. Willey, personal communication 1975) and it will contribute considerable new information on the south-central Peten area. Jay Johnson's analysis of Palenque chipped stone is now available (1976), contributing considerable valuable information to our understanding of lithics in the extreme western portion of the Maya realm.

The seminal studies of Uaxactun chipped stone (Ricketson and Ricketson 1937; Kidder 1947) are the major landmarks of published lithic information for the central Peten area. However, the first Tikal lithic analyses are now beginning to appear (Moholy-Nagy 1975; see also O. Puleston 1969 and Becker 1973). With the final publication of the Tikal series, the central Peten should be one of the best understood areas in southern Mesoamerica.

Yaxha, to the southeast of Tikal, should become better known, from the lithic technological standpoint, as the lithic analyses of Ray Sidrys and Jay Johnson continue (N. Hellmuth, personal communication 1975).

The area to the east of Yaxha, central and northern Belize, is becoming one of the better understood areas. Willey's lithic analysis of the Barton Ramie artifacts is thorough and well illustrated (Willey *et al.* 1965). Northern Belize has received considerable attention as of late, particularly because of the efforts of Norman Hammond, Dennis Puleston, and their associates. Puleston (1975) has mentioned the *possibility* of Richmond Hill being a Paleo-Indian site, but this must remain only a possibility until detailed excavations, analyses, and chronometric dating have been conducted. Further studies of the calibre of Arlene Miller's (1975; see also this volume) examination of the Richmond Hill lithics are needed at this yet-enigmatic location.

The work of N. Hammond and associates in northern Belize are beginning to yield a clearer picture of lithic patterning and variability as well as pointing out areas of critically-needed research. R. Wilk (1975) has performed a preliminary reconnaissance and analysis on the massive chert manufacturing center of Colha, and J. Andresen (n.d.; see also this volume) has contributed an overview manuscript of northern Belize chert implements. The small lithic collections from Lubaantun in southern Belize have recently been published by Hammond (1975), and the material from Elizabeth Graham's project in Stann Creek District, central coast of Belize, is being analyzed by R. Wilk.

The southern Peten and southern Belize-eastern Guatemalan areas are poorly known (see Joyce 1932 for an early description of "eccentric" lithics from this area), but Copan, in the southeastern Maya area, is relatively well understood from the work of Longyear (1948, 1952). The current Copan project, directed by G. Willey, should yield a considerable increase in lithic information. The same applies to the current project at nearby Quirigua, under the direction of W. Coe and R. Sharer.

#### Southern Maya Area

This summary of lithic reports in the southern Maya area begins with the Isthmus of Tehuantepec and continues eastward through Pacific and highland Chiapas, Guatemala, and El Salvador. These southern Mayan projects/reports tend to be smaller but more numerous and somewhat more evenly distributed across the landscape than those summarized above for the lowlands.

The work of Wallrath (1967) and Lee (1969) have contributed to lithic

knowledge of lowland Oaxaca (Isthmus of Tehuantepec) and lowland Chiapas respectively. MacNeish and Peterson (1962) encountered early Archaic lithics in the Santa Marta Cave near Tuxtla Gutierrez, and reported them extensively. Other than these three studies, little is known until we reach the Guatemalan frontier.

Just inside the Guatemalan border, along the Pacific coast, is the Ocos-La Victoria area subjected to the ecologic scrutiny of M. Coe and Flannery (1967). Some mention of lithic artifacts is made by them. J. Graham's and R. Heizer's current work at Abaj Takalik on the Pacific piedmont 50 km east of Ocos should yield at least Preclassic lithic materials. Bilbao, similarly situated but farther east, yielded chipped stone implements which Parsons (1969) described briefly.

In the highlands of Guatemala, Woodbury and Trik (1953) provide us with an extensive analysis of Zaculeu lithic artifacts. Kidder analyzed the artifacts of Zacualpa (1948) and Nebaj (Smith and Kidder 1951), two highland sites east of Zaculeu.

The central Guatemalan highlands are quite well known, based on the work of Kidder at Kaminaljuyu (Kidder, Jennings and Shook 1946; Shook and Kidder 1952) and from the recently completed fieldwork of Sanders and Michels (also see Michels' article, this volume). M. Coe and Flannery (1964) presented a valuable description of the El Chayal obsidian outcrop just northeast of Kaminaljuyu (but see Sheets 1975a and Michels 1975 for comments on their interpretations). M. Coe (1960) also describes a Paleo-Indian point from San Rafael, near Guatemala City.

Sidrys *et al.* (1976) recently visited a number of obsidian outcrops and their associated workshops in the Maya highlands. Their locational, descriptive, and analytic data are a contribution to our understanding of aboriginal quarrying and trade.

An extensive analysis of the chipped stone from Beleh (Chinautla Viejo) is contributed by Hester (1975) as a portion of L. Feldman's research. Brief analyses of small lithic samples collected by Feldman along the Motagua River and in the southernmost corner of Guatemala were performed by Sheets (1975b, 1975d, n.d.).

The massive obsidian outcrop of Ixtepeque and the associated processing site of Papalhuapa were described by Graham and Heizer (1968) and more recently by Sidrys *et al.* (1976).

The Chalchuapa area is fairly well understood, both at the site of Chalchuapa itself (Sheets 1974, 1975c) and at the rural Bustamante Site (Sheets 1972). Chalchuapa area core-blade technology recently was found to be representative, in most respects, of lithic technology in the central and western areas of El Salvador (Sheets 1976:29-32). The investigations of E. W. Andrews V at Quelepa, in eastern El Salvador, will extend our lithic understanding into a poorly known area. The Quelepa report will be published soon in the Middle American Research Institute series from Tulane (Andrews, personal

communication 1976). The area of northern El Salvador and all of Honduras except Copan is virtually *terra incognita* as far as lithics are concerned.

Mention should be made in this brief review of the Mayan lithic literature of other summaries which are available. Woodbury (1965) and W. Coe (1965), in their reviews of highland and lowland Maya artifacts, do give brief attention to lithics. In an earlier article W. Coe (1955) reviewed the pitfalls inherent in Paleo-Indian research in the Maya area. Contemporary researchers would do well to carefully consider this caveat. Also, I recently reviewed the Southern Mesoamerican-Central American lithic literature on a topical basis, noting shortcomings and lacunae (Sheets 1977). Finally, typological summaries are available in the comparison sections of the major site reports mentioned above. Particularly extensive typological summaries can be found in Kidder (1947), Willey (1972), Willey *et al.* (1965), Sheets (1974), and W. Coe (1959).

#### NEEDS FOR FUTURE RESEARCH

The needs for future research are numerous; in fact the needs are so vast and varied as to be discouraging, were it not for the fact that lithic analysis is rapidly becoming an integral component of Mesoamerican research programs.

From this survey we can see a number of geographic gaps where lithic knowledge is weak or nonexistent. The most striking are Campeche, Quintana Roo, and southern and eastern Chiapas in Mexico, the southern Peten and Alta Verapaz in Guatemala, southern Belize, and virtually all of Honduras.

Topically, I believe the most underdeveloped approach of Mayan lithic studies at present is function. This is not surprising, given the size and condition of most lithic samples, the number of variables intervening between implement abandonment and archaeological recovery, and the rigorous demands of a sophisticated functional analysis (cf. Ode11 1975).

Trace element analyses, which began in the 1960's, to attribute obsidian artifacts to sources, are contributing an important body of data which allow for reliable reconstruction of trade patterns. When combined with technological analyses yielding an understanding of what kind of exploitation and processing was occurring at what node along the manufacturing trajectory process, along with the changes which occurred through time, our knowledge of the processing and distribution of that valuable commodity will be greatly enhanced.



## REFERENCES CITED

- Andresen, J.
- n.d. The Prehistoric Chert Industry of Northern Belize. Paper presented at the annual meeting of the Society for American Archaeology, St. Louis.
- Becker, M.
- 1973 Archaeological Evidence for Occupational Specialization Among the Classic Period Maya at Tikal, Guatemala. *American Antiquity* 38:396-406.
- Coe, M.
- 1960 A Fluted Point from Highland Guatemala. *American Antiquity* 25:412-413.
- Coe, M. and K. Flannery
- 1964 The Precolumbian Obsidian Industry of El Chayal, Guatemala. *American Antiquity* 30:43-49.
- 1967 Early Cultures and Human Ecology in South Coastal Guatemala. *Smithsonian Contributions to Anthropology* 3.
- Coe, W.
- 1955 Early Man in the Maya Area. *American Antiquity* 20:271-273.
- 1959 Piedras Negras Archaeology: Artifacts, Caches, and Burials. *Museum Monographs*. University Museum, University of Pennsylvania.
- 1965 Artifacts of the Maya Lowlands. *Handbook of Middle American Indians* 3:594-602.
- Graham, J. and R. Heizer
- 1968 Notes on the Papalhuapa Site, Guatemala. *Contributions of the California Archaeological Research Facility* 5:101-125.
- Hammond, N.
- 1975 Lubaantun: A Classic Maya Realm. *Monographs of the Peabody Museum, Harvard University* 2.
- Hester, T. R.
- 1975 The Obsidian Industry of Beleh (Chinautla Viejo), Guatemala. *Actas, XLI Congreso Internacional de Americanistas* I:473-488.

- Johnson, J.
- 1976 Chipped Stone Artifacts from the Western Maya Periphery. University Microfilms, Ann Arbor.
- Joyce, T. A.
- 1932 The "Eccentric Flints" of Central America. *Journal of the Royal Anthropological Institute* 62:17-26.
- Kidder, A.
- 1947 The Artifacts of Uaxactun, Guatemala. *Carnegie Institute Washington, Publication* 576.
- 1948 The Artifacts of Zacualpa. In: Excavations at Zacualpa, Guatemala, by R. Wauchope. *Middle American Research Institute, Publication* 14.
- Kidder, A., J. Jennings, and E. Shook
- 1946 Excavations at Kaminaljuyu, Guatemala. *Carnegie Institute Washington, Publication* 561.
- Lee, T.
- 1969 The Artifacts of Chiapa de Corzo, Chiapas, Mexico. *Papers of New World Archaeological Foundation* 26.
- Longyear, J.
- 1948 A Sub-Pottery Deposit at Copan, Honduras. *American Antiquity* 13:248-249.
- 1952 Copan Ceramics. *Carnegie Institute Washington, Publication* 597.
- MacNeish, R. and F. Peterson
- 1962 The Santa Marta Rock Shelter, Ocozocoantla, Chiapas, Mexico. *Papers of the New World Archaeological Foundation* 14.
- Michels, J.
- 1975 El Chayal, Guatemala: A Chronological and Behavioral Reassessment. *American Antiquity* 40:103-106.
- Miller, A.
- 1975 A Study of Possible Explanations for Observed Damage on the Lithics from the Site of Richmond Hill, Belize. M.A. Thesis, Department of Anthropology, Washington State University, Pullman.

Moholy-Nagy, H.

- 1975 Obsidian at Tikal, Guatemala. *Actas, XLI Congreso Internacional de Americanistas* 1:511-518.

Ode11, G.

- 1975 Microwear in Perspective: A Sympathetic Response to Lawrence H. Keeley. *World Archaeology* 7:226-240.

Parsons, L.

- 1969 Bilbao, Guatemala, Vol. 2. *Milwaukee Public Museum, Publications in Anthropology* 12.

Proskouriakoff, T.

- 1962 The Artifacts of Mayapan. In Pollock *et al.* Mayapan, Yucatan, Mexico. *Carnegie Institute Washington, Publication* 619.

Puleston, D.

- 1975 Richmond Hill: A Probable Early Man Site in the Maya Lowlands. *Actas, XLI Congreso Internacional de Americanistas* 1:522-533.

Puleston, O.

- 1969 A Workshop Tool Kit from Tikal, Guatemala. Unpublished M.A. Thesis, University of Pennsylvania.

Ricketson, O. and E. Ricketson

- 1937 Uaxactun, Guatemala: Group E - 1926-31. *Carnegie Institute Washington, Publication* 477.

Rovner, I.

- 1974a Implications of the Lithic Analysis at Becan. *Middle American Research Institute Publication* 31:128-132.

- 1974b Evidence for a Secondary Obsidian Workshop at Mayapan, Yucatan. *Newsletter of Lithic Technology* 3:19-27.

Sheets, P.

- 1972 A Model of Mesoamerican Obsidian Technology Based on Pre-classic Workshop Debris in El Salvador. *Cerámica de Cultura Maya* 8:17-33.

- 1974 Differential Change Among the Precolumbian Artifacts of Chalchuapa, El Salvador. Ph.D. dissertation, University of Pennsylvania; University Microfilms, Ann Arbor. To be published by University of Pennsylvania Press, 1976, as Vol. II of *The Prehistory of Chalchuapa, El Salvador* (R. J. Sharer, ed.).
- 1975a A Reassessment of the Precolumbian Obsidian Industry of El Chayal, Guatemala. *American Antiquity* 40:98-103.
- 1975b The Obsidian (from the Terzuola site, Guatemala). In: L. Feldman, ed., *Jade Workers in the Motagua Valley. Museum Briefs, University of Missouri Museum* 17(7).
- 1975c Behavioral Analysis and the Structure of a Prehistoric Industry. *Current Anthropology* 16(3):369-391.
- 1975d A Study of a Few South Guatemalan Artifacts. In: L. Feldman, ed., *Papers on the Xinca of Eastern Guatemala. Museum Briefs, University of Missouri Museum* 19:17-24.
- 1976 Ilopango Volcano and the Maya Protoclassic. Report to NSF on the 1975 fieldwork. Manuscript in possession of the author.
- 1977 The Analysis of Chipped Stone Artifacts in Southern Mesoamerica: An Assessment. *Latin American Research Review* 12:(1), Spring 1977.
- n.d. The Obsidian Artifacts of Sabana Grande, Guatemala. *Museum Briefs, University of Missouri Museum*, in press.
- Shook, E. M. and A. V. Kidder
- 1952 Mound E-III-3, Kaminaljuyu, Guatemala. *Carnegie Institution of Washington, Contribution* 53.
- Sidrys, R., Jr. Andresen, and D. Marcucci
- 1976 Obsidian Sources in the Maya Area. *Journal of New World Archaeology* 1(5):1-13.
- Smith, A. L. and A. V. Kidder
- 1951 Excavations at Nebaj, Guatemala. *Carnegie Institution of Washington, Publication* 594.
- Stoltman, J.
- 1975 An Analysis of Chipped Stone Artifacts from Becan, Campeche, Mexico: A Case Study of the Value of Detailed Lithic Analyses in Complex Societies. Manuscript in possession of the author.

Wallrath, M.

- 1967 Excavations in the Tehuantepec Region, Mexico. *Transactions, American Philosophical Society* 57(2).

Wilk, R.

- 1975 Superficial Examination of Structure 100, Colha, 1975. In: N. Hammond, ed., *Archaeology in Northern Belize*. Centre of Latin American Studies, University of Cambridge.

Willey, G.

- 1972 The Artifacts of Altar de Sacrificios. *Papers of the Peabody Museum, Harvard University* 64(1).

Willey, G., W. Bullard, Jr., J. Glass, and J. C. Gifford

- 1965 Prehistoric Maya Settlements in the Belize Valley. *Papers of the Peabody Museum, Harvard University* 54.

Woodbury, R.

- 1965 Artifacts of the Guatemalan Highlands. *Handbook of Middle American Indians* 2(1):163-179.

Woodbury, R. and A. Trik

- 1953 *The Ruins of Zaculeu, Guatemala*. Byrd Press, Richmond, Va.



## BELIZE LITHICS: FORMS AND FUNCTIONS

Thomas R. Hester

## INTRODUCTION

In the symposium, this paper was designed to orient and stimulate the discussions regarding Belize chert industries. It was originally presented in two parts: (1) a commentary on the status of lithic studies in Belize; (2) a series of specific observations on a collection of chert artifacts from the site of Colha, as analyzed by H. J. Shafer. For the purposes of the symposium volume, Shafer's paper has been printed separately.

It should be emphasized at the outset that the author's background in Maya lithic studies is very limited, having been confined up to this point to the areas of trace element and technological analyses of Maya obsidian (cf. Hester 1972, 1975; Graham *et al.* 1972). However, I have worked extensively with chipped stone industries in North America, particularly in Texas and in the Great Basin area. Lithic research has greatly expanded over the past few years, and it is now standard practice for most North American archaeologists to devote considerable attention to lithics from their sites. Analyses include wear pattern studies designed to provide data on actual tool function, debitage analysis which permits a better perspective on the lithic manufacturing process, and the utilization of data derived from both functional and technological studies in an attempt to learn more about site function and intrasite behavioral patterns (a bibliography of such lithic research is presented by Hester and Heizer 1973).

An intensified concern with lithics as a source of behavioral information is beginning to penetrate into Mesoamerican archaeological research, a fact reflected by the nature of the papers published in this volume. The past seven or eight years have seen a greatly accelerated effort on the part of many Mesoamerican specialists to provide more anthropologically-meaningful analyses of lithic samples (cf. Sheets 1975a). In particular, there have been numerous studies devoted to trace element analysis of obsidian, and the resulting data have made available new information on the nature of obsidian dispersion in Mesoamerica (a recently published synthesis of such studies can be found in Stross *et al.* 1976).

Still, Mesoamerica lags far behind North America in the quality of lithic analysis that is being done. One can argue that the highly complex sites of Mesoamerica offer a wide range of data for analysis, whereas many North American sites often yield little else than chipped stone. This is certainly true; however, I would counter that the integration of data derived from lithic analysis with that obtained through studies of architecture, monuments, ceramics, long distance trade, intensive agriculture, and the like, will eventually permit a fuller and more complete picture of ancient Mesoamerican life-styles.

## LITHIC STUDIES IN BELIZE

Archaeological research in the Maya lowlands of Belize has tended to

neglect lithics and lithic studies. Early papers, like those of Franks (1877), Gray (1916) and Joyce (1932) were concerned with eccentrics or with individual specimens. This is a situation which has been considerably improved by the work of Willey and others in the Belize Valley (Willey *et al.* 1965), by N. Hammond's Corozal Project (particularly the work of R. Wilk at Colha; see this volume), and by the research of UCLA students in northern Belize (see the papers by Sidrys and Andresen in this volume).

An illustration of the paucity of information on chipped stone tools from the Maya lowlands is reflected in the scant five or six pages devoted to them in a synthesis of Maya lowland artifacts prepared by W. Coe (1965). As just stated above, more work has been done since then, but lithic studies in the lowland area remain in the embryonic stage.

A great deal more emphasis has been placed on the analysis of obsidian. Two major areas of research have been technological studies and trace element analysis. Work has been done by Rovner, Sheets, Michels, Moholy-Nagy, the author, and others. Concepts have been developed as to the process of obsidian tool production and distribution, the function of specific tool forms (cf. Hester 1975), the nature of activities at a site (Sheets 1975b; Michels 1975), and there has been particular success in defining and delimiting many of the significant obsidian sources in the Maya area (cf. Stross *et al.* 1976; Sidrys *et al.* 1976). Again, however, the area of Belize has not figured in most of this research (an exception is the work of Hammond 1972; see also this volume).

For the purposes of this symposium paper, it is perhaps most useful to restrict the discussion to implements fashioned from chert--the chipped stone artifacts of Belize and the adjacent Maya lowlands. Specifically, I would like to briefly examine (1) the problem of artifact description; (2) the need for functional analysis of lithic implements; (3) the need for studies of the lithic manufacturing process; (4) the necessity for intensive studies at sites specifically related to the lithic production process (also important in this regard is the relationship between the production site and the consumption/distribution of the products).

Early archaeological studies in Belize paid scant attention to lithic artifacts, although as I have previously noted, some exotic specimens were described and illustrated. There are, of course, a number of early reports which treat with stone implements in one fashion or another, but the general trend was to illustrate a few specimens and let it go with that (cf. Gann and Gann 1939; Ricketson 1929; Thompson 1939). In the report of Ricketson's (1929) research at Baking Pot, a number of eccentrically chipped chert artifacts are illustrated, along with large bifaces, discoid unifaces, and small bifaces that may be projectile points. None of these specimens was described in any detail.

The first really adequate descriptive studies of lowland Maya lithics came with the work of Kidder (1947) in his report on artifacts excavated some years earlier at Uaxactun. Kidder distinguished between artifacts of utilitarian and ceremonial functions. Within the utilitarian category,



further division was made on the basis of materials used in tool manufacture--"implements of white flint", "implements of dark flint", and "implements of obsidian". The implements of white flint consisted mainly of tools used in what he suggested were chopping, pecking, rubbing, perforating, and scraping functions, and these functional attributions were used in describing each form. The chopping tools were termed "general utility tools", with "standard" and other forms. Basic descriptive data and illustrations were provided. What I find significant about Kidder's treatment of the stone tools is his evident concern for substantive data related to function. He was not content to call a tool a "chopper" simply because it looked like what most archaeologists thought choppers ought to look like. Rather, he scrutinized the edges of these implements, as well as those of the other tool forms, for evidence of use-wear and for possible methods of prehension and/or hafting.

The descriptive categories set forth by Kidder in 1947 have generally been followed in studies published since that time. They have been elaborated upon and some new categories added; in particular, lengthy treatments of stone tools have been presented by Coe (1959, for Piedras Negras), Willey *et al.* (1965, for the Belize Valley), and Willey (1972, for the artifacts of Altar de Sacrificios).

By way of review, I want to very briefly examine those descriptive categories put forth by Willey *et al.* (1965) for the Belize Valley, confining these observations to what were termed "utilitarian implements of flint". Of the 524 specimens in this category, 6% were described as "knives or points", with stemmed, unstemmed, and notched variants; both bifacial and plano-convex examples were noted.

"Choppers or General Utility Tools" (following a classification originally proposed by Kidder) constituted 44% of the sample. These are large ovate bifaces, often bearing indications of wear on one end.

The rubric "chisel-like tools" was used to describe 6% of the assemblage, and includes "adzes or planes" (both bifacial and unifacial) "bifacial gouges", and "small bifacial chisels".

"Drills or punches" is a fourth category, representing 2% of the sample. Both "small" and "heavy" variants were reported.

"Scrapers" constituted 5% of the collection. These were subdivided into groups such as "triangular side-scrapers", "end and/or side scrapers" (with both large and small variants). "Prismatic end and side scrapers" were also described, and are made on blade-like chert flakes.

Other chipped stone tool categories include specimens which were either "choppers or cores" (19 of these showed wear evidence; 26 did not), a polyhedral chert core, unworked or slightly modified chert nodules, flake blades and flakes, rejects, and unidentifiable fragments.

In general, most of these categories evidence very good description, excellent illustrations, and contain comparative comments dealing with similar specimens elsewhere in the Maya area. There are no major criti-

cisms on my part as to the adequacy of the lithic descriptions; some categories, such as the flakes, are perhaps insufficiently treated, but the sample was small (and, to the authors' credit, they did carry out experiments in an effort to replicate the use-nicks observed on the flakes).

Thus, there are eight or nine major descriptive categories into which the Belize Valley lithics were sorted. Similar classifications were used earlier by Kidder, Coe and others, and in the subsequent Altar report by Willey (1972). All of these scholars seem to be talking about the same things when these various descriptive classifications are invoked. One could argue that these categories "communicate" well and that they have a respectable history of use among archaeologists working with lowland Maya artifactual remains.

Perhaps this is true, but it brings me to my second point. Do these descriptive terms have any substance, or do they reflect any sort of functional "reality"? Can these subjective terms be replaced by more meaningful labels reflecting the tool's actual use? Or, by the same token, can we provide better tests of the functional terms, such as "end and side scrapers", "chopper", etc., which currently exist in the literature?

The archaeologist now has available a series of research tools which would permit useful functional studies with Belize lithics. Paramount among these is wear pattern analysis, at both the macroscopic and microscopic levels. Such research can, and should, be combined with replicative experiments in which tool forms are used in certain tasks and the resulting wear patterns then observed and recorded for comparison with archaeological specimens.

Use-wear observations have already been made at the macroscopic level, beginning with the work of Kidder (1947) and amplified in the various publications of Willey (cf. Willey *et al.* 1965; Willey 1972). Wilk (n.d.a) has conducted microscopic wear pattern studies of artifacts from the site of Barton Ramie in Belize (see also Wilk's n.d.b, microwear research on the lithics of Seibal, Guatemala). The potential for functional analysis with Maya chert tools has already been demonstrated by similar studies with Maya obsidian industries. For example, at Beleh, Guatemala (Hester 1975), microscopic wear pattern studies revealed that thinned bifaces which might be called projectile points by some archaeologists actually functioned as cutting tools or knives. Similarly, in some Mexican obsidian assemblages, such as one I studied from Michoacan (Hester n.d.), there are unifacial implements which can be technologically classified as "end scrapers", but which wear analysis revealed to have been used on both the ends and sides, most probably used in a cutting, rather than in a scraping mode.

Practically all of the existing Belize lithic categories are ripe for functional analysis. The "general utility" bifaces, described by some as choppers or possibly hand-axes, often exhibit wear, either as battering on edges or as polish on or near working edges. Bullard (1965:53) uses the term "celt" for this tool form. He reports battering and use-polish on specimens from San Estevan in northern Belize. According to Bullard

the tool form is restricted to the Maya lowlands, and it is his belief that they were "primarily forest-clearing and wood-cutting tools" (probably hafted for such use). Bullard and Bullard (1965:28) present similar remarks. Significant samples of these tools need to be systematically studied for types and frequencies of wear patterns, and attempts should be made to replicate the wear evidence through controlled experimentation. The large, stemmed bifaces from Belize described by Willey *et al.* (1965) as "points or knives" should also undergo similar examination; a projectile point shape does not necessarily equate with function.

The so-called "chisels" or "gouges" show wear, but we have no concrete evidence as to their actual function. Specimens termed "scrapers" may well have served in that fashion, but wear pattern studies might lead to the establishment of useful subdivisions within this classification. Willey (1972), in his study of Altar de Sacrificios lithics, making the following observation about scrapers: "...they are not well reported, and it is possible that they have often been discarded as little more than odd flakes or scraps." (p. 178). He was referring to a particular unifacial form that has been noted at Barton Ramie, Tikal, Uaxactun, Piedras Negras, and other sites. However, terribly little has ever been written about this tool form.

Systematic functional research with Belize lithics would enable archaeologists to not only establish more realistic classifications, but to also use these meaningful categories in discussing the utilization of chert implements in Maya society. Such studies would be especially valuable in the interpretation of a production site like Colha. Wilk (1973) used both descriptive and morphological classifications in his studies of the lithics from that site, but repeatedly argued for wear pattern and functional research. Until such studies are done, it will be difficult to achieve the goals of explaining workshop activities, intra-site organization, and export mechanisms at the site.

A third area I have chosen for comment is the analysis of the lithic manufacturing process in Belize and lowland Maya chert industries. Here again, such studies have been carried out with obsidian assemblages, with the work done by Sheets (1972) serving as an excellent example. He has proposed a model which allows the archaeologist to evaluate obsidian specimens in terms of the sequence of manufacturing and use events--beginning with the quarrying phase, continuing through implement manufacture and utilization, and ending (usually) with the discard of the worn or broken tool.

No such model exists for the Belize chert industries (a post-symposium paper by Andresen presents a preliminary model; see this volume). In order to evaluate an industry or to develop a model to explicate it, one has to adequately sample and analyze flake debris, rejects, broken implements, etc., to record their provenience within a site, and, hopefully, to locate and study workshops and other functionally-specific areas within sites. In the past, flake debris has been consistently ignored at sites in Belize. Even those flakes used as tools have received rather cavalier treatment; e.g., Bullard's (1965:54) description of "worked flakes" at

San Estevan: "Irregular flakes showing use chipping on one or more edges were found sparingly in deposits of all periods." Willey (1972) notes that at Altar de Sacrificios, flakes were not saved except when they were found in caches (p. 180). He did report, however, that flakes were present in all parts of the site. At Barton Ramie, Belize, the "abundance of flint scrap and wastage" was reported, and an estimated 3000 specimens were tabulated but not analyzed. Willey *et al.* (1965:411) observed "... the presence of flint nodules in the house sites" and concluded that "these manufactures [of flint implements] were carried out at the Barton Ramie village" (*ibid.* 411). Obviously, the recovery and analysis of chert debris or debitage needs to be incorporated into future excavation projects. Some such studies have already been done. R. E. W. Adams (personal communication) informs me that James Stoltman has done a lithic debris analysis for the site of Becan in the Rio Bec area; Wilk (1973) has also provided cursory comments on lithic waste at Colha.

Similarly, tools broken during use, or those abandoned during the manufacturing process, need to be reported in order to establish the sequence of lithic tool utilization. Reports such as Barton Ramie (Willey *et al.* 1965) mention "uncompleted artifacts", but no descriptions are provided.

This brings me to a fourth and final point: we can perhaps best elucidate the lithic industries of Belize by beginning with the analysis of the production centers--the chert workshops. A number of such sites must be present in the Maya lowlands; for example, one workshop locality has been reported by Bullard (1960) near Santa Rosa on the Belize frontier. The participants in this field symposium will visit the site of Colha, where preliminary studies of a series of chert workshops has been initiated by R. Wilk (see this volume). To properly study a site as massive and as extensive as Colha will require a great deal of time, patience, and careful planning. Such an investment should be well worthwhile. The site has the potential to yield new and exciting data on the activities and organization of this major Maya chert-working center. Research at the site should also provide a better understanding of the manner through which the chert tools produced there were subsequently exported to Maya consumers.

#### REFERENCES CITED

Bullard, W. R., Jr.

1960 The Maya Settlement Pattern in Northeastern Peten, Guatemala. *American Antiquity* 25(3):355-372.

1965 Stratigraphic Excavations at San Estevan, Northern British Honduras. *Royal Ontario Museum, University of Toronto, Occasional Paper* 9.

Bullard, W. R., Jr., and M. R. Bullard

1965 Late Classic Finds at Baking Pot, British Honduras. *Royal Ontario Museum, University of Toronto, Occasional Paper* 8.

Coe, W. R.

- 1959 Piedras Negras Archaeology: Artifacts, Caches and Burials. *Museum Monographs, University of Pennsylvania*.
- 1965 Artifacts of the Maya Lowlands. *Handbook of Middle American Indians* 3(2):594-602.

Franks, Mr.

- 1877 Some Stone Implements from Honduras and Turks and Caicos Islands. *Journal of the Anthropological Institute of Great Britain and Ireland* 6:37-40.

Gann, T. and M. Gann

- 1939 Archeological Investigations in the Corozal District of British Honduras. *Bureau of American Ethnology, Bulletin* 123(7).

Graham, J. A., T. R. Hester and R. N. Jack

- 1972 Sources for the Obsidian at the Ruins of Seibal, Peten, Guatemala. *Contributions of the University of California Archaeological Research Facility* 16:111-115.

Gray, St. G.

- 1916 On a Chipped Flint Implement Found in British Honduras. *Man* 16:154-155.

Hammond, N.

- 1972 Obsidian Trade Routes in the Mayan Area. *Science* 178:1092-1093.

Hester, T. R.

- 1972 Notes on Large Blade Cores and Core-Blade Technology in Mesoamerica. *Contributions of the University of California Archaeological Research Facility* 14:95-105.
- 1975 The Obsidian Industry of Beleh (Chinautla Viejo), Guatemala. *Actas, XLI Congreso Internacional de Americanistas* 1:473-488.
- n.d. Preliminary Notes on the Technological Analysis of Obsidian Artifacts from Villa Morelos, Michoacan, Mexico. In: *Archaeological Studies of Mesoamerican Obsidian* (T. R. Hester, ed.). Ballena Press, Ramona, CA (in preparation).

Hester, T. R. and R. F. Heizer

- 1973 Bibliography of Archaeology I: Experiments, Lithic Technology and Petrography. *Addison-Wesley Modules in Anthropology* 29.

Joyce, T. A.

- 1932 The "Eccentric" Flints of Central America. *Journal of the Royal Anthropological Institute* 62:17-35.

Kidder, A. V.

- 1947 The Artifacts of Uaxactun, Guatemala. *Carnegie Institution of Washington, Publication* 567.

Michels, J. W.

- 1975 El Chayal, Guatemala: A Chronological and Behavioral Reassessment. *American Antiquity* 40(1):103-106.

Ricketson, O. G., Jr.

- 1929 Excavations at Baking Pot, British Honduras. *Carnegie Institution of Washington, Publication* 403.

Sheets, P. D.

- 1972 A Model of Mesoamerican Obsidian Technology Based on Pre-classic Workshop Debris in El Salvador. *Ceramica de Cultura Maya* 8:17-33.

- 1975a Behavioral Analysis and the Structure of a Prehistoric Industry. *Current Anthropology* 16(3):369-391.

- 1975b A Reassessment of the Precolumbian Obsidian Industry of El Chayal, Guatemala. *American Antiquity* 40(1):98-103.

Sidrys, R., J. Andresen, and D. Marcucci

- 1976 Obsidian Sources in the Maya Area. *Journal of New World Archaeology* 1(5):1-13.

Stross, F. H., T. R. Hester, R. N. Jack, and R. F. Heizer

- 1976 Chemical and Archaeological Studies of Mesoamerican Obsidians. In: *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives* (R. E. Taylor, ed.):240-258. Noyes Press, Park Ridge, New Jersey.

Thompson, J. E. S.

- 1939 Excavations at San Jose, British Honduras. *Carnegie Institution of Washington, Publication* 506.

Wilk, R.

- 1973 1973 Operations (Colha). In: *Centre of Latin American Studies, University of Cambridge, British Museum-Cambridge University Corozal Project* (N. Hammond, ed.):55-60.

- n.d.a Microscopic Analysis of Chipped Stone Tools from Barton Ramie, British Honduras. *Estudios Cultura Maya* 10: in press.
- n.d.b Microwear Analysis. Appendix in: Artifacts of Seibal, Guatemala (by G. R. Willey). *Papers of the Peabody Museum, Harvard University*: in press.

Willey, G. R.

- 1972 The Artifacts of Altar de Sacrificios. *Papers of the Peabody Museum, Harvard University* 64(1).

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, Harvard University* 54.





## BELIZE LITHICS: "ORANGE PEEL" FLAKES AND ADZE MANUFACTURE

Harry J. Shafer

## INTRODUCTION

The subject of my study is the technological analysis of a small sample (N=26) of chipped stone artifacts recovered from the surface of Structure 100 at Colha, Belize. The majority of the items are curious elongated, curved flakes exhibiting one unifacially retouched convex edge. Emphasis will be placed on describing the technology of production and exploring the functional implications of these flakes. These interesting artifacts have been described and termed "orange peels" by Wilk (1976:165-166). I will use the term "orange peel" flakes for the sake of continuity. In addition to the "orange peel" flakes, the sample contains five other artifacts which deserve special attention.

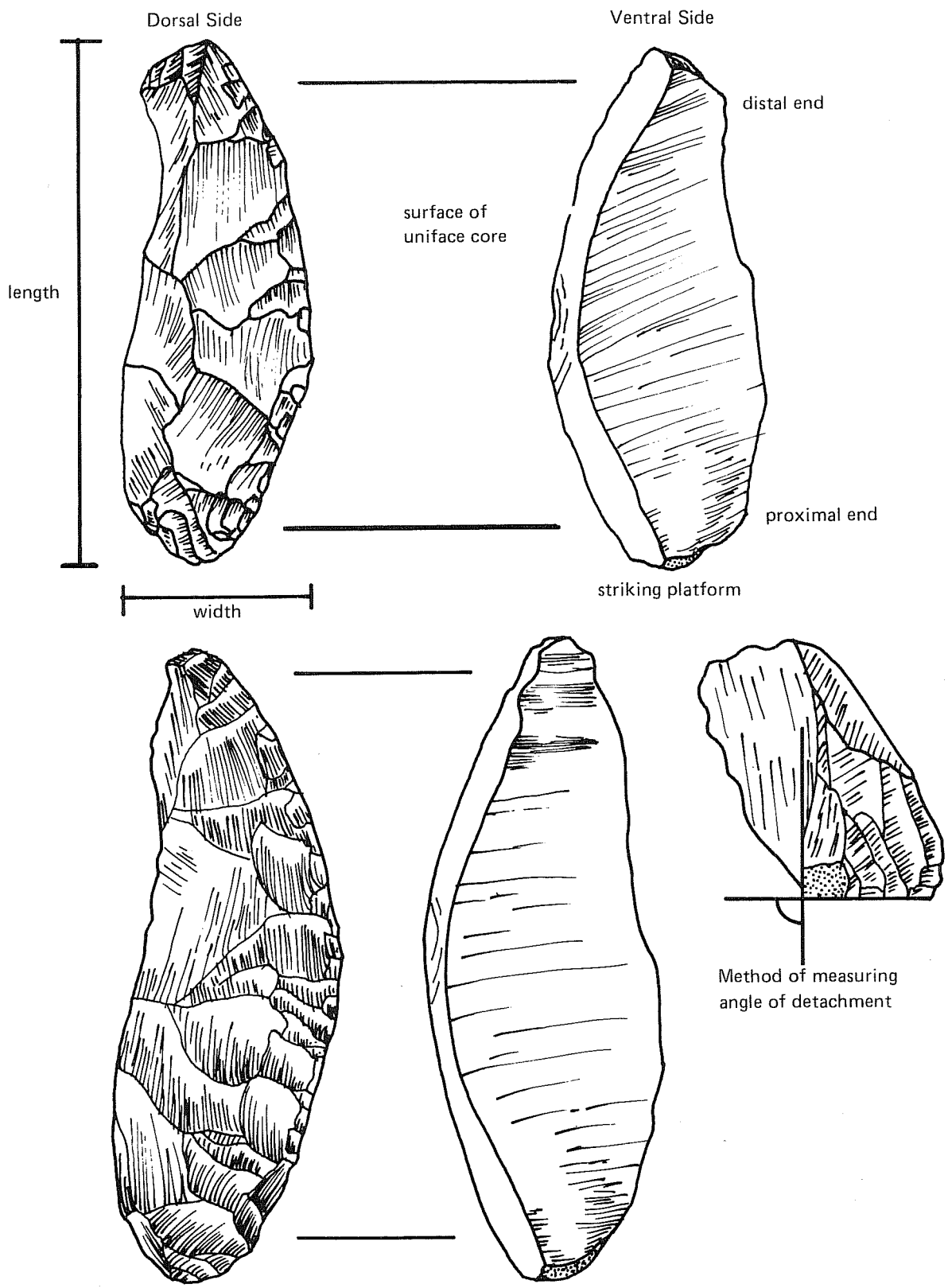
The major objectives of this brief study are (1) to provide a description of the sample; and (2) to provide a functional explanation of the "orange peel" artifacts. The descriptive work is accomplished by sorting the artifacts into morphological categories and providing a list of attributes used as sorting criteria. The second objective is accomplished by using the observed attributes of the "orange peel" flakes to hypothesize a reduction sequence which would explain the attribute patterns observed. This hypothesis was then tested in the field by searching for artifacts, at several debitage mounds at Colha, which could either have served as cores or which would otherwise provide clues to the purposes of the "orange peel" flakes. In essence, the hypothesis is that the "orange peel" flakes are the debitage resulting from edge rejuvenation of large unifacial adze-like utilitarian (and probably hafted) tools. This hypothesis, if confirmed, would explain the apparent abundance of the "orange peel" specimens and the near absence of cores from which they were derived, since the hypothesized cores or tools, once rejuvenated, would be carried back to the area where they were to be used. An alternative hypothesis proposed by both Wilk (1976) and Crabtree (personal communication), that the "orange peels" could themselves be specialized tools, will also be considered.

## THE SAMPLE

The artifacts were divided into two major categories: "orange peel" flakes and possible cores for "orange peel" flakes.

**"Orange Peel" Flakes (N=22)**

The sample of artifacts described under this heading was subdivided into four categories; three of these may have functional implications in that initial, secondary and tertiary uniface retouch steps appear to be represented. Measurements taken include the length of the retouch flake which would provide the maximum width of the core (Fig. 1). The width is calculated by measuring from the flat surface from which the retouch flakes along the worked edge were struck to the maximum width of the



Category 2 "orange peel" flakes illustrating method of orientation

Figure 1. Category 2 "orange peel" flakes illustrating method of orientation and measurement.

opposite edge (Fig. 1). This measurement will provide a minimum thickness of the core from which the "orange peel" flakes were derived. Edge angle measurements were made using a contact goniometer.

Category 1 (N=3; Fig. 2, top) Primary Removals: These are represented by three specimens; two of these exhibit all or significant portions of the bulb of force that resulted in the removal of the parent flake. Remnants of the weathered cortex surface are retained along the outer edge. However, much of this edge has been retouched, perhaps to establish a continuous ridge along the edge to direct the fracture path in order to insure a successful removal. Oriented with the bulbar end downward and with the original flake surface facing the viewer, the retouched edge is to the left on all three examples. Angles of the intersection of the ventral surface of the core and the flake facet are  $118^{\circ}$ ,  $120^{\circ}$  and  $121^{\circ}$ . One specimen appears to have been thermally altered (reddish hue at bulbar end), but since the specimen is a surface find the thermal alteration is likely due to slash and burn clearing of the mound (Wilk 1976: 153). Length: 10.4 cm, 11.6 cm, 10.2 cm; height: 3.7 cm, 3.7 cm, 3.3 cm.

Category 2 (N=14; Fig. 1): The largest group of "orange peel" flakes was removed from artifacts that could have been repeatedly retouched by step flaking along the wider and convex end. The presumed working edges of the tools prior to retouch are steeply trimmed by step flaking and the edges are evenly convex. The edges clearly show dulling. The possible wear is not the kind expected if the specimens were tools used against hard materials. It is possible that the dulling is due to abrasive retouch rather than constituting actual wear. With the bulb of force oriented downward and the parent flake surface facing the viewer, the retouched edge is on the left on 13 examples and on the right on one. Four appear to have been thermally altered (one at the bulbar end). Edge angles vary from  $85^{\circ}$ - $121^{\circ}$ . Dimensions: 7.0-12.4cm; height: 2.2-4.9 cm.

Category 3 (N=3; Fig. 2, lower): These are tertiary flakes in that they represent at least the second in a series of "orange peel" flakes from their respective cores. Two exhibit the characteristic step retouched edges since the previous "orange peel" removal. Both are quite thin, show the characteristic dulling observed on many category 2 examples, and are slightly burned. The third example is more complex in that a removal was attempted from one side but failed. The failure was partially corrected by another removal from the opposite side. Apparently still not satisfied, but now having a continuous outer edge to guide the fracture, a third and successful removal was struck from the striking platform where the original removal was attempted. Edge angles are  $170^{\circ}$ ,  $107^{\circ}$ , and  $106^{\circ}$ . Dimensions: 8.1 cm, 9.8 cm, 9.6 cm; height: 3.2 cm, 3.9 cm, and 5.0 cm.

Category 4 (N=2) Fragments: One of these specimens is the distal end of an "orange peel". It would probably fit in the category 2 series had it been complete. It is broken at the proximal (bulbar) end by a thermal fracture. The second example is much more irregular in appearance than any other "orange peel" specimen. It, too, is the distal end,

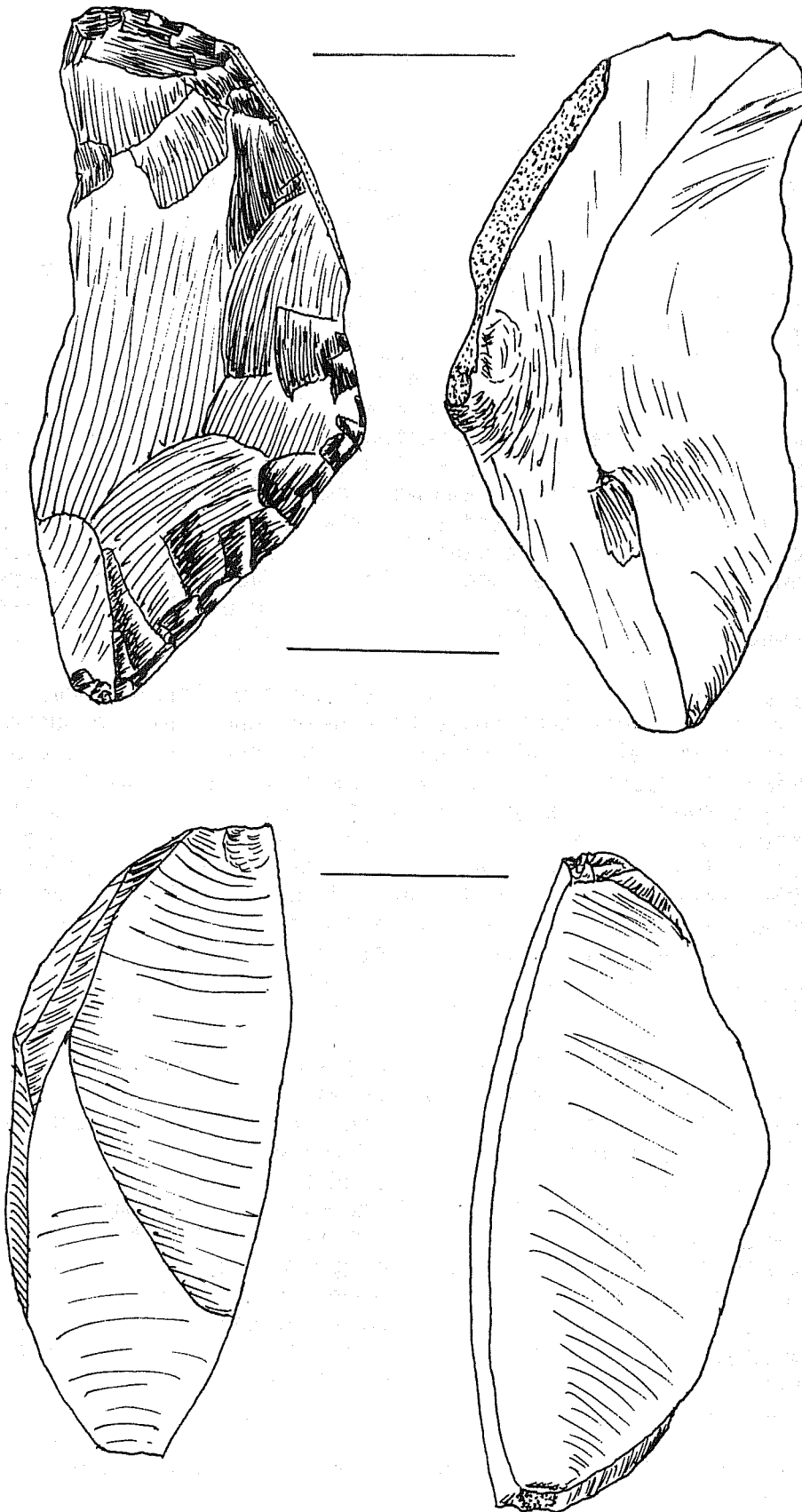


Figure 2. *Category 1 and Category 3 "orange peel" flakes. Upper, Category 1 flake (both faces); Lower, Category 3 flake (both faces).*

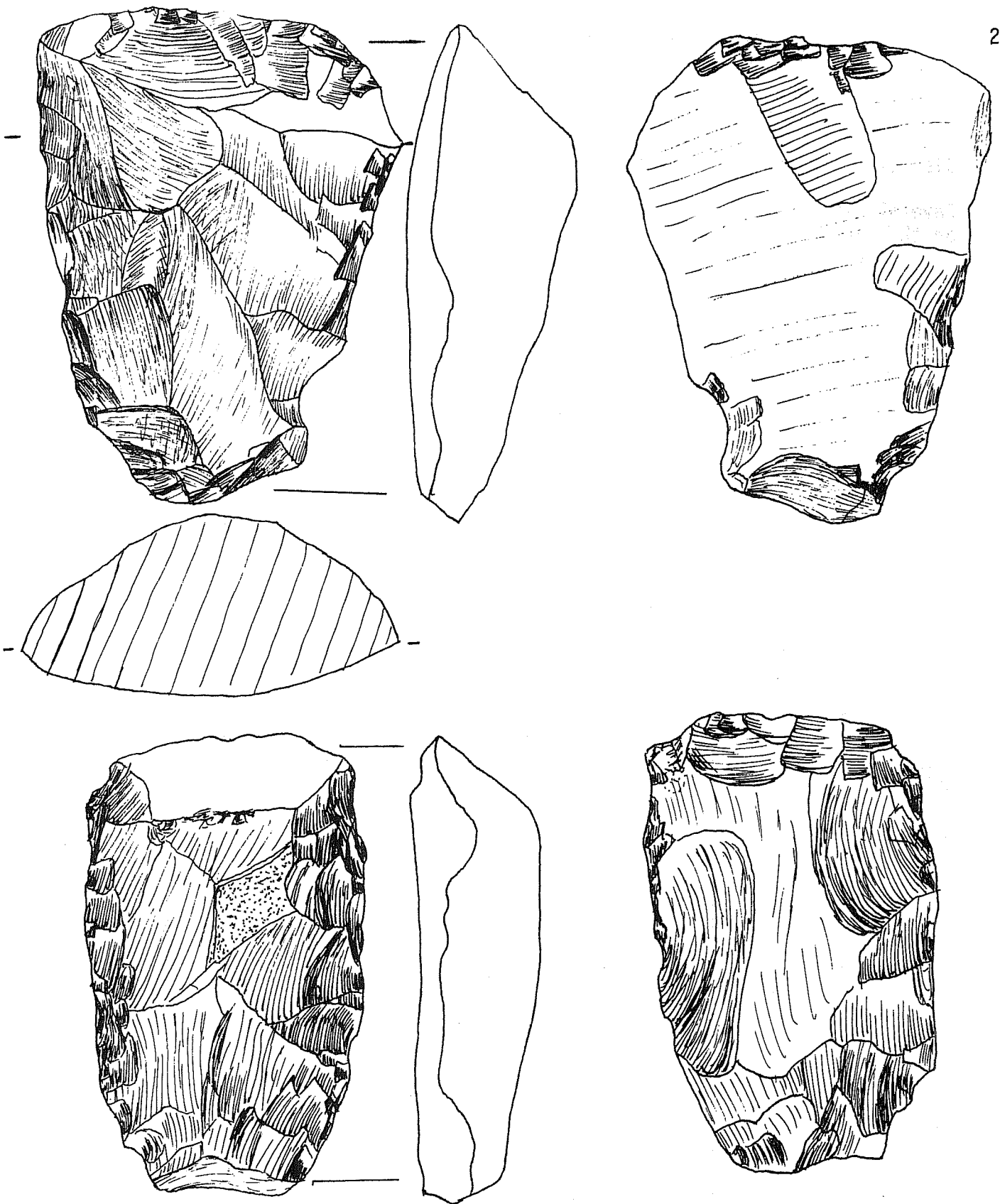


Figure 3. Possible cores for "orange peel" flakes. Adze-like tools exhibiting truncate retouch possibly resulting in "orange peel" flakes. Upper, specimen No. C72.17 (both faces, transverse and longitudinal sections shown); Lower, specimen No. C66.5 (both faces and longitudinal section shown).

having been snapped from the proximal end. Edge angles are  $98^{\circ}$  and  $119^{\circ}$ .

#### Discussion of the "Orange Peel" Flakes

Several general observations are worthy of comment. The striking platform on the flakes, for example, was prepared by extensively dulling and blunting one corner--with one exception, the same corner--of the parent core. This point of detachment was the upper right hand corner of the hypothesized adze-like plano-convex tool with the convex surface facing the viewer and the wider end oriented upward (see Fig. 4 C). It may have been necessary for the flintknapper to straighten the retouched or working edge of the core in order to insure a successful removal, but this cannot be demonstrated with certainty on category 2 specimens. I suspect, however, that was the reason for the unifacial retouch on the category 1 specimens.

Curiously, there are no obvious erailure scars (cf. Crabtree 1972:60) on the bulbar surfaces of any "orange peel" flakes. This, and the slight lipping effect observed at the striking platform area of several specimens, suggest to me that hardwood mallets may have been used in their removal.

Of the 22 specimens examined, the angle of removal--that angle created by the plane surface of the parent core and the facet created by the specimen's removal--varies from  $85^{\circ}$  to  $121^{\circ}$ . The expected complementary angle on the core resulting from the "orange peel" flake removal would vary from about  $60^{\circ}$  to  $105^{\circ}$ . Interestingly, this angle range does not differ significantly from that projected for the angle of the step retouched edge (i.e.,  $80^{\circ}$ - $100^{\circ}$ ). Assuming that these are rejuvenation flakes, the rounded, dulled and slightly smoothed retouched edge may have been more of a factor necessitating rejuvenation than an angle increase through retouch of the edge angle itself.

#### Possible Cores for "Orange Peel" Retouch

Wilk (1976:166; Fig. 9.28) describes and illustrates a specimen which he believes to be a possible core for "orange peel" flakes. This specimen was included in the shipment of artifacts to The University of Texas at San Antonio and eventually to Texas A & M University. The specimen is shown in Figure 5 A. Close examination revealed that the curvate fracture across the wider end thought by Wilk to be the scar from an "orange peel" flake removal was instead a thermal fracture. The wider end on this specimen was burned and the flint exhibits numerous internal fractures and some discoloration due to thermal potlidding. The specimen was much too thin at the wider end to have yielded an "orange peel" flake.

A search of the small sample of chipped stone artifacts accompanying the "orange peel" collection yielded four specimens of adze-like tools that appeared to have been retouched in a manner that would yield "orange peel"-like flakes. These specimens are described individually.

C72.17: This is a trapezoidal-shaped unifacially chipped tool made on a

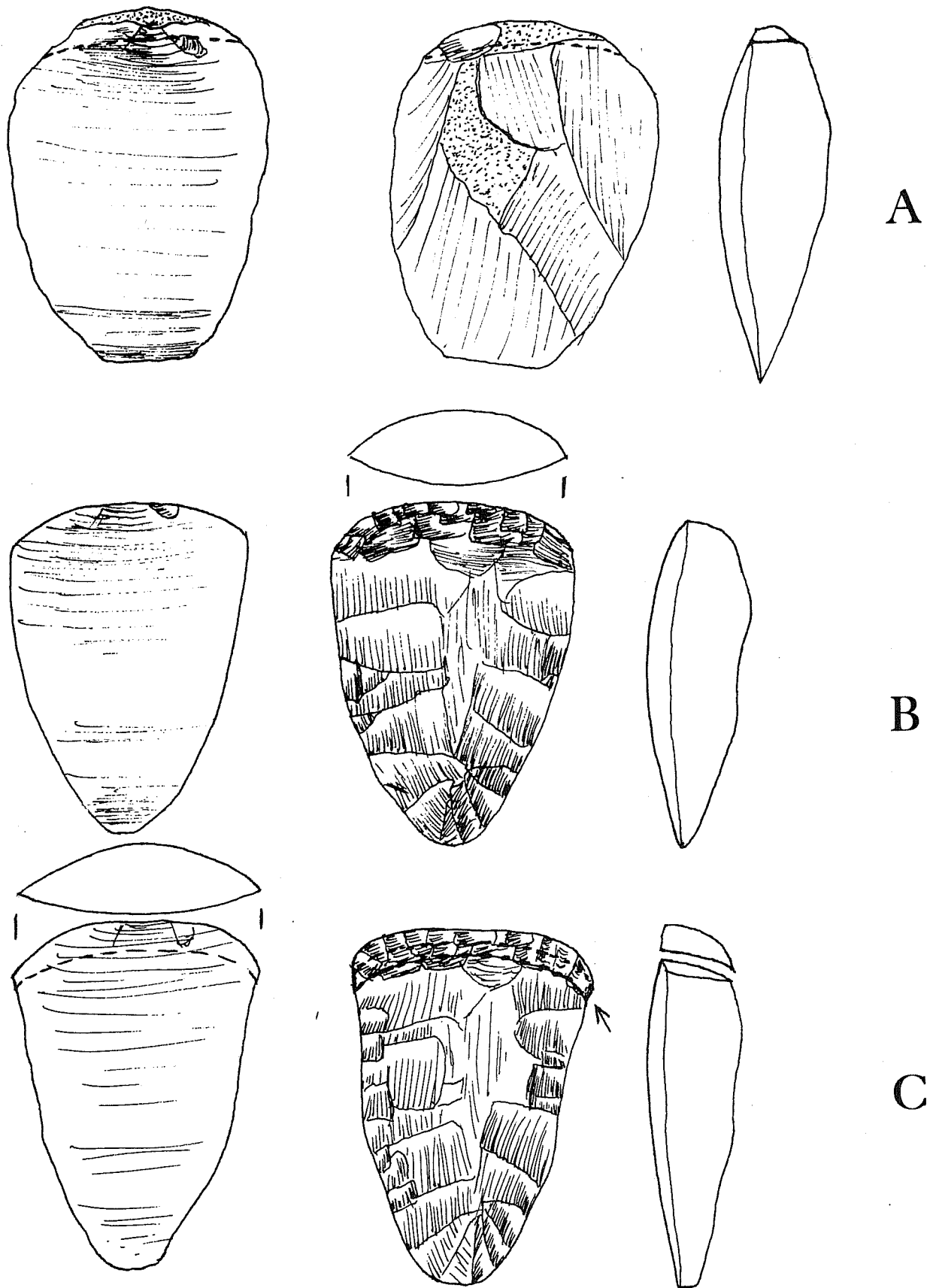


Figure 4. Hypothesized sequence for manufacture and retouch of adze-like tools illustrating how "orange peel" flakes may have been produced during the course of edge refurbishing.

large, thick flake (Fig. 3, top). It is described by Wilk (1976:168; Fig. 9.32) as an adze. The broader end exhibits traces of a single flake facet that removed the entire edge from corner to corner; edge angle created by this removal was  $71^{\circ}$ . The removal was struck from the right corner, the same corner which all but one of the "orange peel" were struck. The broader end has been mostly unifacially retouched with some minor bifacial retouching near the center on the ventral side. Dimensions: length, 9.2 cm; width, 7.1 cm; thickness, 3.4 cm.

Comments: The size of the tool and character of the wider end plus subsequent alteration of this end suggests strongly that the beveled edge was created by a single flake removal; the resulting flake would have all of the characteristics of an "orange peel".

C82.2: This is a narrow, triangular-shaped artifact made from a large, thick flake which was shaped mostly by unifacial chipping. It is described by Wilk (1976:168; Fig. 9.31) as a chisel. The wider end has been truncated by a single flake removal, again originating from the upper right corner (with the specimen oriented with the wider end up and the dorsal side of the parent flake facing the viewer). The angle created by the removal is  $77^{\circ}$ . The resulting edge is sharp and unretouched--and indeed appears to have been unmodified. The specimen may have been discarded subsequent to retouching. Length: 9.2 cm; maximum width: 4.4 cm; thickness: 2.9 cm.

C66.5: This specimen is a subrectangular biface (Fig. 3, lower). It appears to have been fashioned from a large thick flake although it is difficult to ascertain this. Cross section is approximately plano-convex. One end is slightly wider and exhibits traces of a single truncated retouch flake having been removed from this end. The angle created by this removal is impossible to measure but is estimated to have been about  $70^{\circ}$ . Retouching of this and other edges was done mostly from the ventral or planar side. The specimen had undergone quite extensive retouch from both sides subsequent to the truncation. Length: 8.9 cm; width: 5.2 cm; thickness: 2.5 cm.

Comment: The history of this particular specimen is clearly complex and later retouch and modification mask many of the earlier attributes. This factor should be taken into consideration in the search for possible cores of the "orange peel" flakes and signals the need to examine a sample of all the tool and debitage categories during the course of a technological analysis. The adze-like tools, whatever they were, may have been retouched in several ways during the time they were used. This specimen exhibits two possible ways: removing the entire edge with one stroke, resulting in an "orange peel" flake; and retouching the acute edge by removing flakes from the ventral (plane) side of the tool.

C80.4: This is another elongated thick plano-convex artifact that is mostly bifacially chipped. It appears to have been fashioned from a thick flake. The wider, thicker end exhibits several interesting flake removals. The first truncated the thicker end but created an irregular, recurved edge of approximately  $90^{\circ}$ . A possible attempt to straighten



this edge resulted in the removal of a blade-like flake from the opposite edge. This flake made most of the edge obtuse ( $115^{\circ}$ - $120^{\circ}$ ). Another flake struck from the dorsal side removed the striking platform of the second flake and may have destroyed any hope of recovering from previous mistakes. The dorsal surface exhibits a medial ridge created by the termination of flakes originating at each lateral edge. The highest point of the ridge near the presumed proximal end evidences scars resulting from battering. This battering is subsequent to the apparent retouch attempts previously described. The purpose of the battering is unknown, but again demonstrates the complexities of reconstructing the life history of these artifacts. Length: 9.9 cm; width: 5.5 cm; thickness: 3.3 cm.

#### Function of "Orange Peel" Flakes

Two hypotheses are proposed to explain the function of "orange peel" flakes. Hypothesis 1 is that the "orange peel" flakes were the by-products of edge rejuvenation of adze-like tools. This hypothesis was based on the author's experience with a strikingly similar (albeit smaller) pattern of uniface retouch debitage in west central Texas (Shafer 1970). The second hypothesis, proposed by Wilk, is that the "orange peel" flakes were specialized tools. These hypotheses are discussed in detail below.

The first hypothesis can best be presented by describing a reduction sequence for the "orange peel" flake cores based on the observations of various attributes in the sample. This sequence, illustrated in Figure 4, is as follows. A large, thick flake was selected (Fig. 4 A). The bulbar end was designated as the use end of the anticipated tool in order to take advantage of the curvature of the ventral flake surface due to the swollen bulb of force. The remainder of the flake was trimmed to an elongated triangular shape (Fig. 4 B). The bulbar end was either unifacially retouched to a steep, convex edge for use or the striking platform remnant was removed in one blow usually struck from the right corner of the wider end (ventral side up). This single removal created an "orange peel" flake containing traces of the striking platform and bulb of force on the trimmed edge (Fig. 4 C). As the adze tools were used and perhaps retouched through step flaking, eventually edge wear and perhaps resin accumulation along the step fractures necessitated refurbishing. The rounded edge may have become too stepped or obtuse for additional step retouch that in order to continue using the tools, complete removal of the edges was necessary. The process of removal was accomplished by roughening one corner of the tool in preparation of a striking platform and, using the retouched edge to guide the fracture path, removing the entire edge with one blow. The technique is essentially that of blade production modified to produce a new working edge with an angle of approximately  $60^{\circ}$ - $80^{\circ}$ . Critical to insure successful removal was achieving an even curvature of the retouched edge. This curvature was the surface or ridge that directed the fracture path.

Since the production and rejuvenation of the adze-like tools is one of reduction, mistakes can be expected at every step and exhausted examples should fossilize each critical step in the manufacturing sequence. Despite

the small sample, a model of virtually the entire sequence can be constructed. That the convex, retouched edge of the "orange peel" flakes originated from the bulbar end of large flakes is certain. Category 1 "orange peel" flakes may represent initial edge shaping for unifacial adze-like tools by removing the striking platform and creating a suitable working edge in a single removal. Category 2 flakes may represent the by-products of rejuvenating tools repaired or retouched by step flaking during the process of use. Two of the category 3 flakes may represent retouch debitage from tools that had previously been rejuvenated via the "orange peel" technique, retouched by stepped flaking, became dull through use, and retouched again by the "orange peel" technique. Three plano-convex adze-like tools exhibit traces of truncations across the wider end and the angle of this retouch conforms to the expected complementary angle of the "orange peel" flakes. Weighing the evidence in the small sample that agrees with the proposed reduction sequence of adze-like tools certainly provides a strong basis for the hypothesis that the "orange peel" flakes are uniface retouch debitage.

#### TESTING HYPOTHESIS 1

I anticipated having the opportunity to visit Colha and to examine several of the debitage mounds known to be present. The opportunity to collect selected artifacts from certain areas, however, was not anticipated and made possible a much more thorough analysis of the field collected sample. Collecting was indeed selective and most debitage specimens were collected from a bulldozed refuse mound southeast of Masson's house near the public road. The artifacts selected for collecting were those that represent either stages in adze manufacture or variations in "orange peel" flakes. Numerous examples of completed and exhausted adzes were seen in and near the ceremonial center and examples of these were collected. The initial intention was to use the artifacts as visual aids in the presentation of my paper on adze manufacture at the evening symposium at Orange Walk Town. The field collected sample caused me to rethink certain aspects of the adze manufacture and retouch sequence. In short, the original hypothesis was not altogether confirmed by the new data. Based on field examination of a massive quantity of debitage and a large sample of tools at Colha, I am currently of the opinion that the "orange peel" flakes are indeed debitage of adze manufacture but that the rejuvenation portion of the original hypothesis is in error. Figure 5 B-D illustrates three artifacts representing examples of steps in what I hypothesize the adze manufacturing sequence to be. In essence, this sequence can be described as follows:

1. A large flake was removed from a prepared core (Fig. 6 A). This flake was relatively thin in proportion to width and length and was longer (along the flake axis) than it was wide. A number of very large flakes which could have served as adze blanks were seen in several areas of Colha. One was collected and passed around at the symposium.

2. The striking platform of the large flake was retouched unilaterally to form an even convex edge and the lateral edges were trimmed to shape the specimen to a rough, triangular outline (Fig. 6 B).

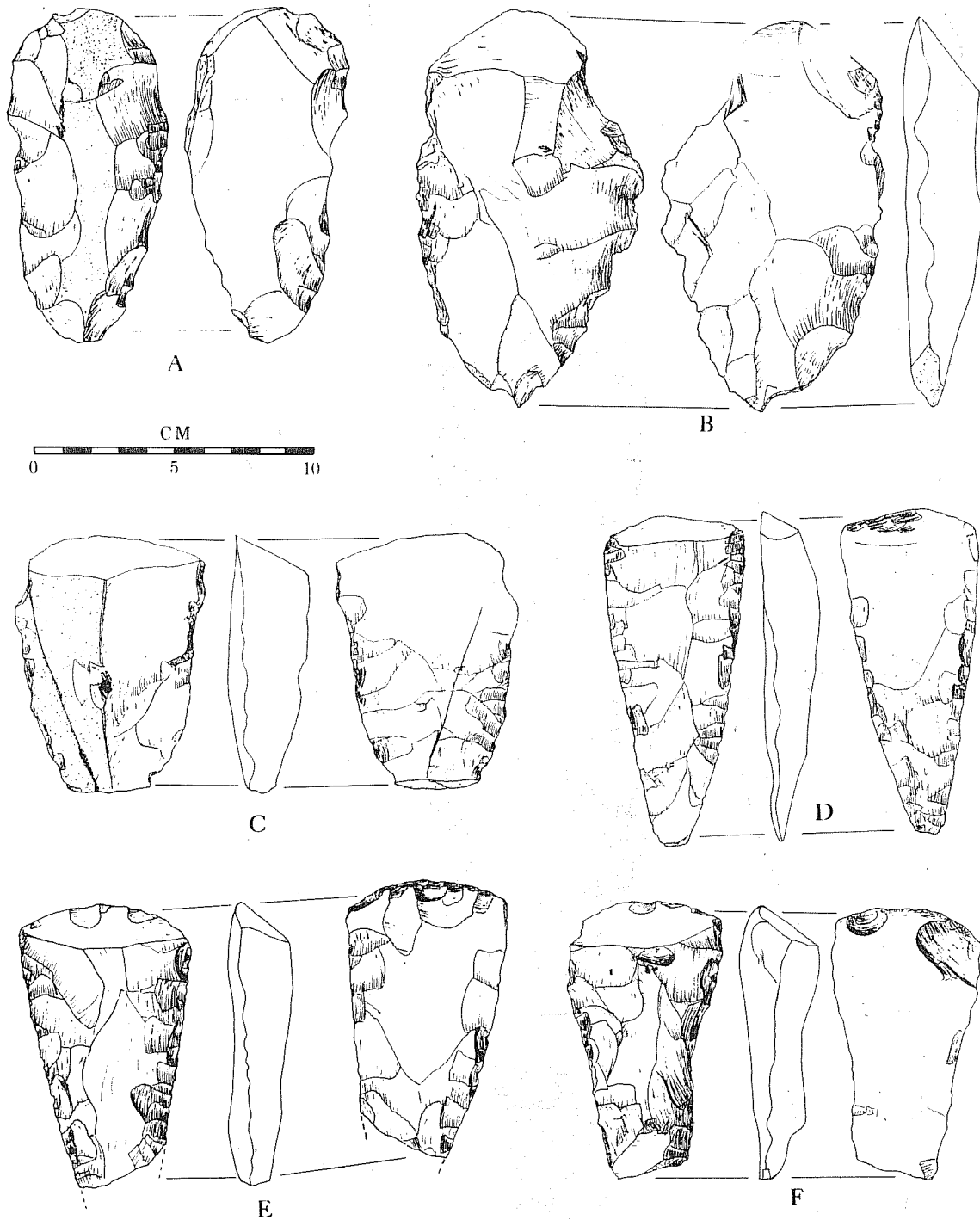


Figure 5. *Artifacts from Colha.* A, biface reported by Wilk as being possible "orange peel" core; B, rejected adze-preform after removal of "orange peel" flake; C, adze-preform; (B, C from bulldozed refuse mound); D-F, adzes collected from ceremonial center.

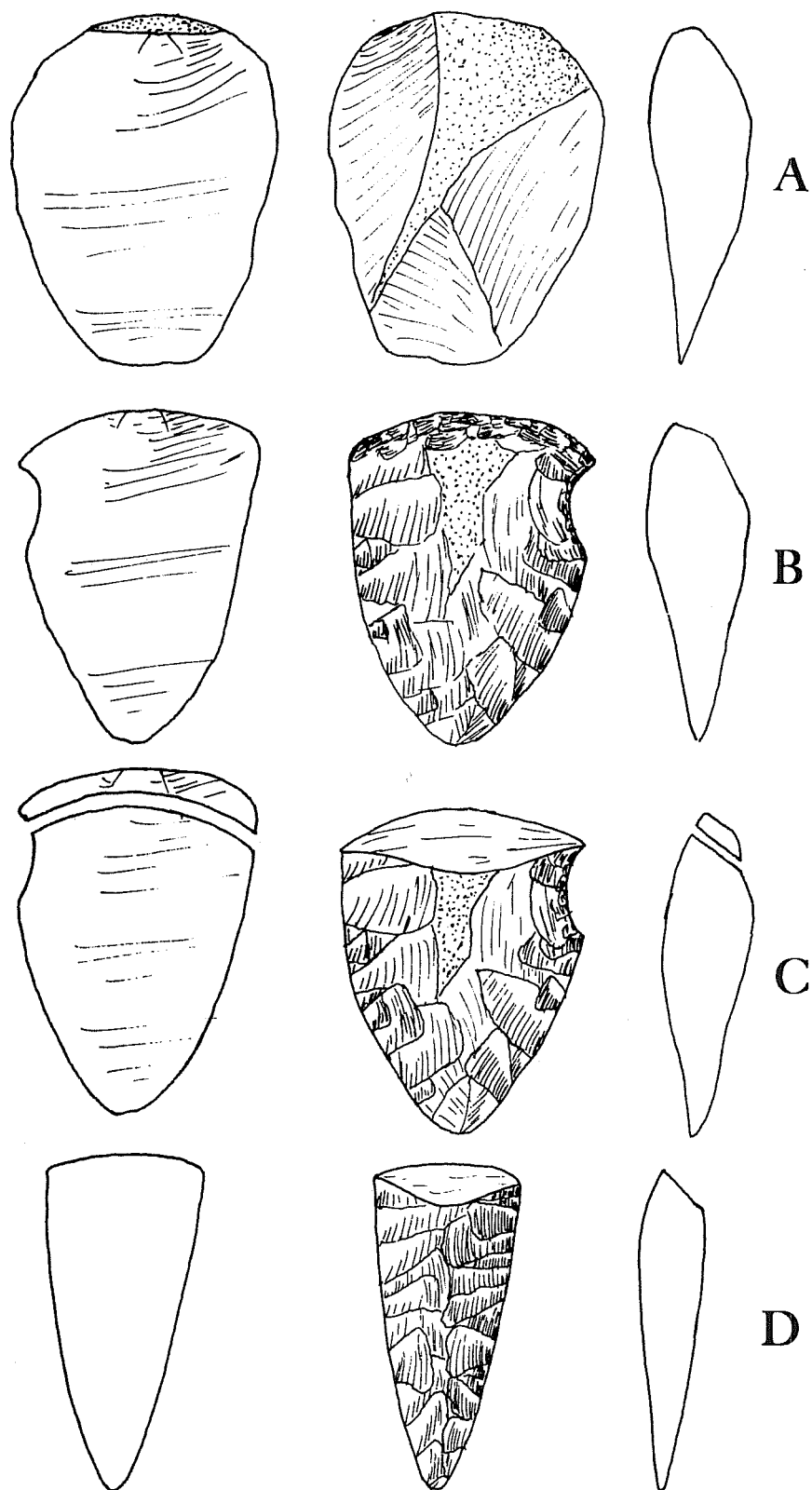


Figure 6. Revised hypothesis for the sequence of adze manufacture. "Orange peel" flakes are the result of creating the truncate bit on the adze preform.

3. A broad notch (Fig. 5 B; Fig. 6 B) was prepared in one edge near the wider end. Orienting the specimen with the dorsal side facing the viewer and with the wider end placed upward, this notch is usually located in the upper right-hand corner. A striking platform was prepared on the corner of the notch with the intersecting convex edge. The first (and if successful, the only) "orange peel" flake was then removed, possibly with a soft hammer (but a hammer with considerable mass nonetheless), for the purpose of creating the edge angle and bit of the adze (Fig. 6 C).

4. The adze preform was then bifaced and thinned to the desired size and form (Fig. 5 D, E; Fig. 6 D). Debitage from the thinning process would include biface thinning flakes and preform failures due to thinning errors. Mistakes during the removal of "orange peel" flakes also occurred (Fig. 5 C) and these are manifested on both the flakes and cores. It should be pointed out that "orange peel" flakes will always be longer than the adzes are wide, due to subsequent reduction of the adze preform through final shaping. The later retouch often masks or removes negative features of "orange peel" flake scars. This, plus the fact that I could not find tools large enough to serve as retouched tools, finally led me to favor the notion that the "orange peel" flakes were produced during the initial step of adze manufacture rather than being a product of adze bit rejuvenation as proposed in the first hypothesis. And my continued reference to the tools as adzes is based on an inspection of numerous tools found lying in and around the ceremonial center at Colha. I collected one of these tools which showed an especially good example of wear. This specimen is shown in Figure 5 F along with other examples of adzes and adze failures (Fig. 5 B-E).

#### TESTING HYPOTHESIS 2

The second hypothesis is that the "orange peel" flakes were some kind of specialized tool as Wilk first assumed. The patterned production of the flakes, their apparent abundance at Structure 100, plus the curious shape and combination of attributes would indeed create suspicion that they were specialized tools. Two observations by Wilk, however, tend to weigh heavily against this hypothesis. First, he noted that most "orange peel" flakes were complete whereas other tools were mostly fragmentary. Second, only one possible candidate for an "orange peel" flake core was observed by him and this specimen has since been rejected as a possible core. If the items were used as tools which resulted in the extensive step fracturing, their delicacy could doubtfully withstand prolonged wear without breaking. Second, the opposite edge is indeed sharp and is usually unaltered. Also, my observation that four plano-convex tools in the initial study collection were retouched in a manner that would create flakes similar to "orange peels" indicates that such items could result fortuitously through systematic and patterned retouch. In short, I reject the second hypothesis on several grounds, but mainly because their attributes are best explained by the reduction sequence model and because their common occurrence and complete condition are more likely due to the fact that much manufacturing activity was conducted at Structure 100 and the flakes are by-products of tool production activities of specialists. The seeming paucity of cores could be due to skill of the artisans or to the difficulty

in recognizing the cores. My own feeling is that by placing attention on the truncating technique, "orange peel" flake cores will become more apparent and more easily recognized.

The refined model of adze manufacture and "orange peel" flake production has been presented. The debitage at Colha is enormous in quantity and the lithic specialization includes a broad range of tools. One technique of adze bit formation has been described and is based on the inspection of debitage, failures and end products. Because we know so little of the Colha lithic technology at this time, it would be naive to claim that the "orange peel" question has been resolved. Indeed, a technique so expedient as the "orange peel" or truncating method would have been used to either prepare working edges or ends to other specialized tools as well as a technique for edge rejuvenation which we have not yet recognized. In short, the "orange peel" flake method is one specialized technique used by the Mayan flintknappers at Colha; undoubtedly there are others, but these will become clear only after an intensive analysis of debitage and tools is carried out.

#### REFERENCES CITED

Crabtree, D. E.

- 1972 An Introduction to Flintworking. *Occasional Papers of the Idaho State University Museum* 28.

Shafer, H. J.

- 1970 Notes on Uniface Retouch Technology. *American Antiquity* 35(4):480-487.

Wilk, R.

- 1976 Superficial Examination of Structure 100, Colha. In: *Archaeology in Northern Belize. British Museum-Cambridge University Corozal Project 1974-75 Interim Report:152-173.* Cambridge.

## WORK IN PROGRESS AT COLHA, BELIZE, 1976

Richard Wilk

Northern Belize is an area rich in archaeological resources, in which the Corozal Project has often found its efforts spread very thinly. The investigations at Colha have so far been managed as a small segment of the Corozal Project's general program in the Corozal and Orange Walk Districts, and thus the site has received much less attention than it deserves.

Colha is located on the farm of John and Herbert Masson, just north of the Orange Walk District's southern boundary (see Fig. 1). There is a minor ceremonial center, surrounded by many square kilometers (mostly unmapped and under forest cover) of house mounds and piles of chert artifacts and debitage which we have called workshops.

An effort was made this season to estimate the total area of the site by foot survey and the use of air photos. The eastern and western site boundaries are evident where the Northern Highway crosses them, but the other limits to the site are covered by thick bush, and are crossed only by a few trails. Along the highway the site stretches between 2.5 and 3 km; to the south dense mound concentrations are still encountered more than 1.5 km from the road, and may continue for more than another kilometer. To the north the site extends more than 2 km from the road and may continue to the edges of a large swamp, more than 3 km north of the road. A minimum site area is therefore  $8.75 \text{ km}^2$ ; extrapolating from the areas already mapped, in which mound densities average to about 460 per  $\text{km}^2$  (excluding the ceremonial center), the minimum number of structures present at the site is approximately 4,000.

It is worth pointing out that a density of 460 structures per  $\text{km}^2$  is more than double the figure of 197 structures per  $\text{km}^2$  given by Puleston for the combined residential areas of Tikal and Uaxactun (again excluding the ceremonial centers; Puleston 1974:308). On this basis alone, Colha is clearly an exceptional Maya site.

My first season at Colha was an all-too-short two weeks in the spring of 1973. Given the complexity and size of the site, an extensive survey program was ruled out, and excavations were limited to a single trench in a particularly enigmatic feature which turned out to be a chert-paved *sacbe* (reported in the Corozal Project 1973 interim report). The rest of my time was devoted to the intensive investigation of a single workshop mound, Structure 100 (Wilk 1976). Despite the problems of generalizing about other workshops on the basis of a single example, my work provided information on both technical problems of archaeology at Colha and the kinds of artifacts which were being produced at a single workshop.

Structure 100 was chosen because of accessibility and an apparent lack of any serious disturbance. I mapped all tools, took debitage samples, and attempted both distributional and technological analysis of the artifacts. Some of the artifacts have since been restudied by T. R. Hester and H. J. Shafer (see Shafer's paper in this volume) from a more strictly

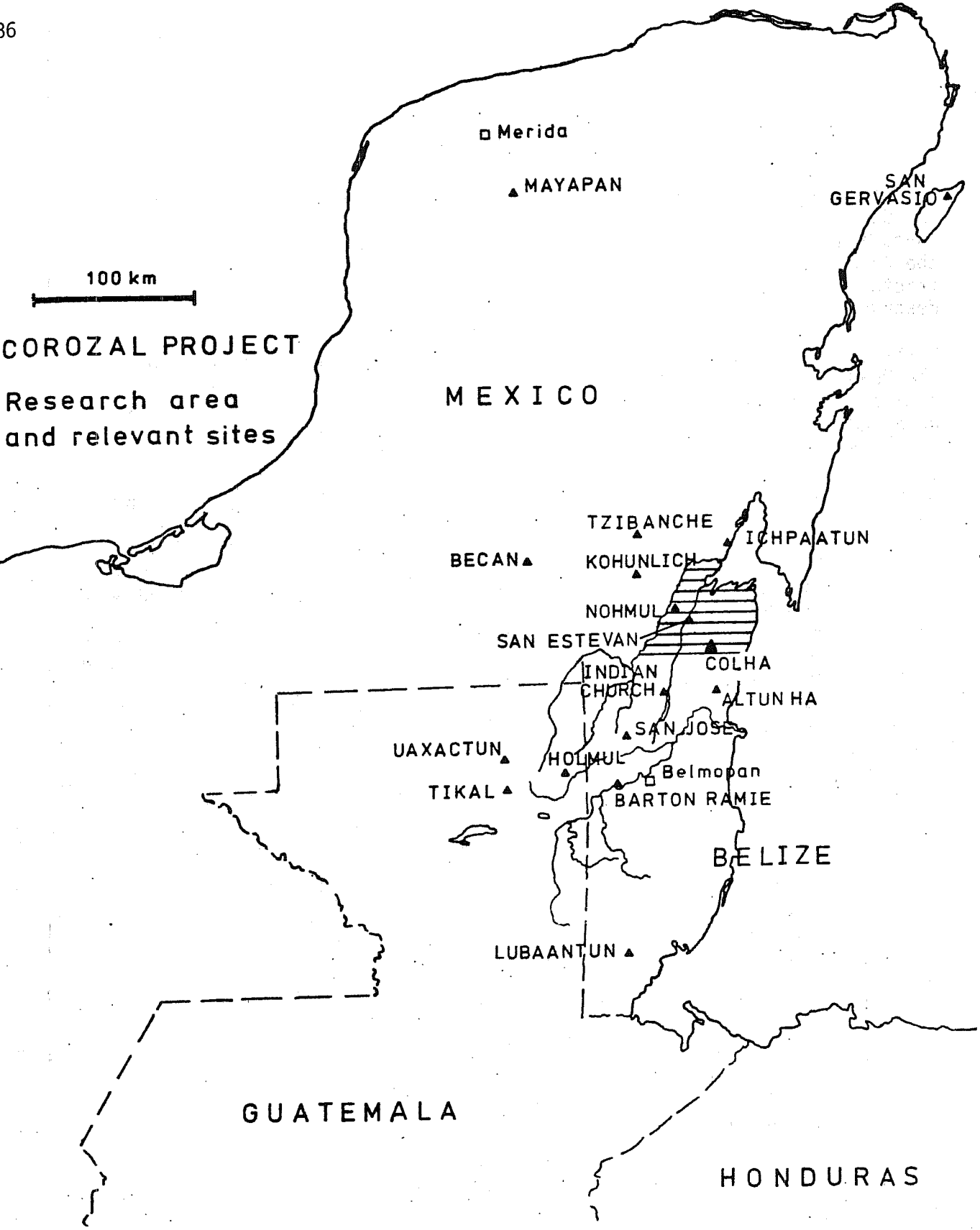


Figure 1. Location of Colha, Belize. The location of the site of Colha is shown in the shaded area of northern Belize.



technological point of view. Two very basic problems remain; delimiting the chronology of the workshops at the site, and determining the way in which production at Colha was organized.

Duncan Pring returned to Colha in 1975 and spent several weeks excavating within the ceremonial center. Though his work was mostly oriented towards ceramic chronology, several layers of workshop debris were excavated and sent back to England, to join the rest of the Corozal Project lithics, out of this investigator's present reach.

The ceramic sequence at Colha extends all the way from the Middle Preclassic to the Late Postclassic, some 2400 years (Pring 1976), though the excavated lithic debris dates to Late Classic and Postclassic times. Previous typological analysis of Colha material in the Masson collection has shown considerable similarities to the Postclassic lithics at Mayapan in Yucatan, and the Late Classic lithics from other sites in Belize, such as Nohmul, Barton Ramie and San Jose. An earlier dating for large scale lithic manufacture at Colha cannot be ruled out; the Corozal Project excavations in Early Preclassic levels at the site of Cuello turned up many artifacts which show similarities to Colha surface finds. In 1976, attention will be paid to ceramic remains from workshops, in an attempt to further clarify chronological problems, though excavation of workshops would be the ideal method.

The technical problems of excavating a deposit of solid artifacts and debitage are formidable. Hundreds or even thousands of kilograms of chert would have to be washed, sorted, counted and analyzed from just a single meter square test pit. Laboratory facilities on site would be an obvious necessity; specialized excavation and recording methods will also have to be developed.

Such an ambitious undertaking is beyond the limited available resources during 1976. The Masson family, with its characteristic generosity, has offered to provide accommodations and a pack horse for collecting artifacts; we will also have the Corozal Project survey and excavation equipment available. In addition, Texas A & M University has kindly provided funds for the shipping of artifacts back to the United States for analysis, under a permit provided by the Belizean government.

Given the vast size of the site, and our limited resources, a specific sampling strategy promises the largest possible information return. Though operations at Structure 100 disclosed a surprising variety of artifacts and production processes in a very small area, we have as yet no idea of the range of variability between workshops at the site. Are there patterns of organization at the site which are larger than the individual structure unit? This question has a wider relevance for Maya studies because it reflects upon the presently controversial nature of ancient Mayan social, political and economic organization? Various models are at hand which portray Classic Maya society as complex, hierarchical and based on specialized production and distribution of products, as opposed to the older theocratic state models which tended to stress religion and art at the expense of trade, politics and welfare. An important piece of ammunition in the hands of proponents of secular models is the increasing amount of evidence which suggests considerable

occupational specialization during the Late Classic, at least in the large ceremonial centers of the "core" zone. Marshall Becker's (ms.) work at Tikal has suggested to many that Classic centers had quite developed structures of complex craft specialization, perhaps on a clan basis, involved in a complex redistributive economy. Colha is not in the central Peten, nor is it a large ceremonial center; yet it seems to show the existence of *an entire site* with a single speciality-evidence that commercial structures existed at a much higher level than is presently accepted on the basis of intra-site evidence for specialization.

The tracing of the trade networks which distributed Colha artifacts will be a long and complex study. Neutron activation analysis of chert may be a necessity. But before the Colha workshops are fitted into a larger political and commercial network, we must have an accurate picture of how production *within* the site was organized; hopefully, this will be disclosed by distributional analysis.

Actual tactics in 1976 will be a variation of those used on Structure 100: extensive surface collection of artifacts and intensive localized sampling of debitage and debris. Operations will be limited to those mounds presently mapped which are clear of vegetation and have not been bulldozed by the Public Works Department. Two hundred fifty acres of land to the south of the creek have been cleared and burned this season, revealing several hundred new, unmapped mounds which we will not be able to get to in 1976.

Within our target population of 186 cleared, mapped structures (the ceremonial center has been excluded) there are enough gross morphological differences to allow stratification into three "types". First, there are earthen mounds which contain little flint debris or artifacts, much like the common house mounds at other sites in northern Belize. Then there is a large number (more than half the total) of mounds which consist mostly of flint nodules and limestone rubble, usually with a few artifacts scattered on the surface. The nature and function of these structures is still unknown, though it is unlikely that they are workshops considering the general lack of chipping debris or hammerstones. Finally is the group of structures, like Structure 100 (comprising about 13% of the total structures in the mapped area), which are largely covered with fine chipping debris, broken and discarded artifacts in all stages of manufacture, and large numbers of chert cores and nodules. Examination of bulldozer cuts and tree falls shows that these mounds are solid debris and artifacts rather than earthen platforms covered with sheet deposit. A variant of this kind of workshop is the eight large areas near the ceremonial center, where the artifacts and chipping debris are extensive, thin layers on the surface rather than piled up mounds. The fact that all three types of mound occur in close proximity to each other is a strong argument that the differences are due to more than differential erosion or preservation.

The first stage, just completed, involves the plotting of each type of mound on a master plan of the site, following intensive surface examination. Each stratum will now be random sampled; the sample size determined

by the limited amount of money available for shipping. Two by three meter squares will be laid out on each mound selected for sampling, and all artifacts enclosed, including preforms but excluding cores and debitage, will be collected. The location of the test squares will be determined by choosing the clearest and most easily collected area, rather than by any specifically randomized procedure.

One debitage sample will be taken from each mound from a 25 cm square located at random on the surface. This material is most important for efforts to reconstruct technological processes of tool production at each workshop.

Analysis will be carried out at the University of Arizona with the guidance of Dr. Arthur Jelinek. Artifacts will be sorted morphologically, as will the debitage, and the results will be coded for use with the University of Arizona CDC computer system, with the computer time provided by the Anthropology Department. Attention will be paid to the technological attributes of the artifacts and debitage in order to draw up more complete flow diagrams of the artifact reduction sequence than that proposed on the basis of the Structure 100 material (Wilk 1976: Fig. 9.34).

The general objective of the analysis of workshop artifacts is a set of statistics which describes the variability of the data in terms of indices of homogeneity and heterogeneity. A program for this has been developed at the University of Arizona, and has been used for the analysis of pottery distributions on Cozumel Island (Gordon Bronitsky, personal communication). There are three possible outcomes which would have clear implications for interpreting the productive organization of the site:

(1) High variability in the composition and output of workshop mounds with no significant clustering, a situation suggesting a large number of individual workshops conducting different operations or combinations of operations, with little central control or organization. An alternate explanation, verifiable only by excavation, would be that the surface remains sampled were mixed deposits from several phases, obscuring any meaningful variability.

(2) High variability between mounds with significant clustering, which I will call polytypism. The nature of the clusters would be the key to interpretation; they may have spatial correlates or temporal correlates, and will provide data for further stratification of the sample when test excavations become practical. If specific workshops tend to produce specific products or clusters of products, a degree of intra-site organization or control is implied. It is also hoped that significant clusters of artifact types will emerge, allowing the identification of tool kits and perhaps shedding light on the functions of some artifacts by association.

(3) A third outcome, that there is little variability between workshops, is very unlikely to occur. Preliminary observations show that there is a wealth of variation at the site.

Whatever the conclusions of the above analysis, it will provide a useful guide for further work at the site. A large, well-staffed program of mapping, geological survey, controlled surface sampling and excavation is the only way of approaching such a unique and important area. The work done in 1976 has been designed as a guide for this future research; it will provide the data necessary for coherent, large-scale work by allowing a further stratification of the mound population so that the test excavations will produce maximum data return. At the same time the program should produce data of more general interest to lithic specialists and Maya archaeologists.

#### ACKNOWLEDGEMENTS

I would like to acknowledge the interesting discussion of the field symposium participants, particularly for stimulating me to think more carefully about my work. I hope some of the members can return to Colha in the future to share the fascination of the site with me. Thanks are also due to the Masson family, protectors of the site, gifted "bush archaeologists" and providers of endless hospitality, as well as a good argument now and then.

#### REFERENCES CITED

Becker, M. J.

- ms.      Indications of Social Class Differences Based on the Archaeological Evidence for Occupational Specialization Among the Classic Maya at Tikal. Manuscript on file, Westchester State College.

Pring, D. R.

- 1976      Excavation Summaries, Colha, 1975. In: *Archaeology in Northern Belize. British Museum - Cambridge University Corozal Project 1974-1975 Interim Report:174-183.* Cambridge.

Puleston, D. E.

- 1974      Intersite Areas in the Vicinity of Tikal and Uaxactun. In: *Mesoamerican Archaeology, New Approaches* (N. Hammond, ed.): 303-313. University of Texas Press, Austin.

Wilk, R.

- 1976      Superficial Examination of Structure 100, Colha. In: *Archaeology in Northern Belize. British Museum - Cambridge University Corozal Project, 1974-75 Interim Report: 152-173.* Cambridge.

## PRE-COLUMBIAN MAYA DEVELOPMENT OF UTILITARIAN LITHIC INDUSTRIES:

## THE BROAD PERSPECTIVE FROM YUCATAN

Irwin Rovner

## INTRODUCTION

The major lithic assemblages used in this study were obtained from excavations conducted by the Middle American Research Institute, Tulane University, at the northern Yucatan site of Dzibilchaltun and at the central lowlands sites of Becan and Chicanna in the Rio Bec. In both cases lithic phase assemblages were defined providing a sequence extending from Preclassic through the Postclassic periods. Comparison of these sequences yielded some similarity in their patterns of development as well as several significant differences due in part to marked differences in locally available lithic resources. This condition is typical of the entire Maya lowlands; namely, that no particular locality possessed the full range of lithic resources to fill completely their basic utilitarian needs through time, much less their ceremonial requirements.

Dzibilchaltun on the north coast of Yucatan, was almost totally devoid of good quality local lithic resources. Usable chert is not present and even the limestone of the area is of such a coarse, porous quality that the residents of Dzibilchaltun also engaged in importing utilitarian limestone implements during much of their history. The most common chert at Dzibilchaltun is a hazy gray-brown. The abundance of this chert at nearby Mayapan suggests that the source for this material is relatively close, possibly in or near the Puuc Hills which could have also supplied a better quality limestone to Dzibilchaltun. The central and southern lowlands shared similar lithic resources, good quality limestone and a mediocre quality grayish-white chert common to wide areas of the Peten, Rio Bec and Belize. This chert was used for a variety of common biface core tools--celts, picks, choppers, etc.--found at sites in all three areas. Some moderately good quality chert cobbles were also available ranging in color from pinkish gray to yellowish brown. However, the high quality fine brown chert favored for Tepeu phase projectile points is rare to the point of essentially being absent in Yucatan, as are granite, basalt and obsidian. These resources were available variously from sources in Belize or the volcanic highland zones. In sum, lithic resource distribution clearly departs from the often-stated characterization of the Maya lowlands as "environmentally uniform". On the contrary, lithic resources which were basic to Maya economy and technology at the utilitarian level were quite diverse and divergent establishing many access gradients amenable to local industrial specialization, development of trade networks and competition for resources.

## INDUSTRIAL DEVELOPMENT OF THE LATE PRECLASSIC

The Dzibilchaltun and Rio Bec Preclassic assemblages like many other Maya

Preclassic lithic assemblages show three diagnostic characteristics: (1) they are overwhelmingly reliant on local resources; (2) show no significant development of short distance exchange networks to exploit lithic resource diversity; and (3) an inexplicable, but clearly evident, absence of stone projectile points. These features existed over a broad area as indicated by reports of various Early to Late Preclassic lithic assemblages from Chiapa de Corzo, Chiapas (Lee 1969); La Victoria (Coe 1961) and Salinas La Blanca (Coe and Flannery 1967), Guatemala; Uaxactun (Rickertson and Rickertson 1937) and Altar de Sacrificios (Willey 1972) in the Peten; and Barton Ramie (Willey *et al.* 1965) and San Jose (Thompson 1939) in Belize. At Kaminaljuyu Shook and Kidder (1952) are quite explicit in stating that their excavations in Preclassic Miraflores phase deposits failed to produce a single projectile point in spite of the presence of a clearly well-developed obsidian industry.

The Late Preclassic assemblage from the Rio Bec consists entirely of locally available material with the exception of a sparse presence of imported obsidian. Ground stone implements were also sparse, most probably a result of collection bias in the field, and are non-descript domestic implements. A substantial chert industry is represented by two general, related classes of implements--bifacial core tools, mostly celts, and a variety of simple, unifacially modified flake tools. These flake tools have been classed variously as simple retouched flakes, graters, beaks, denticulates, and notches. Both cortex (decortication) flakes and percussion trimming flakes, probably no more than the by-products of biface celt manufacture, were selected without any apparent preference. These flake implements show no morphological characteristics to distinguish them from similar implements commonly found in other lithic phase assemblages.

The biface celts, while showing clear and significant morphological variation through time, are present throughout the Rio Bec sequence. These celts, along with the associated flake tools, represent a basic local lithic industrial tradition which the Rio Bec shared with similar local industries to the south and east. Biface celts are rare in the Dzibilchaltun collections appearing late in the sequence suggesting that the function of the biface celt was ecologically related; i.e., useful in the tropical forest of the Rio Bec and Peten, but not in the scrubland-chaparral of the north coast. Morphological variation in biface celt assemblages through time show several potentially significant features. The Preclassic celt assemblages show the least standardization of quality of manufacturing technique, techniques employed and range of morphological variation. Poorly executed, thick and asymmetric celts are characteristic, indeed, possibly diagnostic of the Preclassic assemblage. If they were merely rejects, they should be expected to occur with celts and celt manufacturing debitage common in later phase assemblages. However, they are virtually absent in every phase assemblage of Tzakol 3-equivalent age and later. An informal test of this was conducted in survey collections from several sites in the Rio Bec area south of Becan showing high correlation with sites yielding Preclassic ceramics. Paradoxically, the technologically best celts also appear to be diagnostic of the Preclassic period as exemplified by large, elongate, symmetric celts which show a carefully

executed fully-polished bit end. The bit-polishing technique is absent in the Tzakol 3 and Tepeu equivalent phases, reappearing as an Early Postclassic feature of a morphologically unrelated, bevel-nosed biface celt, a diagnostic artifact. Morphological variation, showing a decided aversion to clustering, of the admittedly limited Preclassic celt sample is unequalled in later phases. In terms of Maya Classic development, it is surely not insignificant that free-ranging variation in manufacturing technique, size and form gives way to marked standardization by the end of the Early Classic period.

The Formative lithic assemblage at Dzibilchaltun is similar to the contemporary Rio Bec assemblage only in the general characteristic of local resource exploitation with the single significant exception of the sparse presence of obsidian. Unlike the Rio Bec assemblage, chert is poorly represented appearing mostly in the form of small flakes, few showing even simple deliberate retouch. There is hardly a chert implement worthy of the name represented. On the other hand, ground stone implements are well represented in the form of various limestone implements which probably functioned as smoothers and manos. Manos and metates of this period are primarily from poorly dressed, poor quality limestone. The manos are porous and often contain readily discernable marine shell inclusions. Manos are typically flat faced providing the basis for characteristically angular cross sections. Tapered cylindrical forms with round cross sections become dominant later in the sequence.

The presence of obsidian in both assemblages is similarly sparse but nonetheless significant. It indicates that the importation of material over long distances had developed prior to the development of more local interaction with immediate neighbors. A rounded prismatic blade platform is diagnostic of the few proximal fragments in both assemblages which appears to be related technologically to highland Mexico rather than highland Maya obsidian sources (Rovner 1975:101-110). The obsidian collections from throughout the sequences in the Rio Bec and at Dzibilchaltun fail to show any substantial on-site manufacture. Primary core production debitage is totally absent while a very small number of flakes, none of which show features which could conclusively characterize them as core platform rejuvenation debitage (Rovner 1974), are insufficient to demonstrate any significant level of local secondary industry production at either site at any time during their respective histories.

#### INDUSTRIAL DEVELOPMENT OF THE EARLY CLASSIC

In sharp contrast to the general expectation of dynamic development marking the Early Classic period at most sites including Becan, Dzibilchaltun undergoes a substantial decline in population and resident activity during its contemporary Early Period I phase. The lithic assemblage for this phase is correspondingly meagre and of little further concern unless particular importance is given to two individual artifacts; a fragment of barkbeater and a narrow, elongate chert biface pick vaguely suggesting affinities with the south (Belize?). There is also a change in the meagre obsidian sample from the Formative diagnostic rounded prismatic

blade platform to a style showing much less ablation of the platform edge prior to blade removal resulting in the retention of a small planar portion of the core platform on the proximal end of the blade. A similar change in blade platform style does occur synchronously in the Rio Bec obsidian sequence.

The Early Classic period in the Rio Bec is ushered in with an enormous flurry of dynamic growth at Becan.

At some time during the second or third century A.D....the Becan site was fortified by means of an enormous dry moat and parapet system...(Also) over 500 square meters of plaster flooring, four well preserved platform units, and one structure exceeding ten meters in height... With one exception, all of this activity was concentrated within the defensive perimeter. Major excavations at Chicanna produced no indications of Preclassic structural activity...(Ball 1973:375-376).

The nature of the lithic evidence does provide a perspective on at least some significant aspects of the activity at Becan, particularly the fortifications. There is not a single shred of *lithic* evidence to suggest antecedent local conditions in the Late Preclassic which would develop into as massive an undertaking as the Becan ditch and parapet. In the absence of any critical natural lithic resources there is no development of a specialized lithic industrial complex, no evidence of developing trade networks with neighboring regions and a total absence of lithic weaponry. Furthermore, the limited sample of locally produced lithic implements dating to the post-fortress construction phase is disproportionately static, showing a direct continuation of Preclassic traits even to the presence of an elongate, polished-bit biface celt.

The only substantial change in the lithic collection, and substantial in the extreme, is a proliferation of the only non-local feature of the Preclassic assemblage--obsidian prismatic blades, a long-distance import item. In spite of considerably more extensive excavations in Late Classic and Early Postclassic units, more than 26% of the total Rio Bec obsidian collection, including the material from Chicanna, was recovered in Tzakol 1-2 equivalent Early Classic contexts at Becan, within the fortified zone. The highest density of obsidian was obtained from a context apparently representing an elite ceremonial cache of Tzakol 1-2 date which was badly disturbed during Tzakol 3-equivalent period modification and reconstruction of the extant structure (Ball 1973:205). The obsidian collection from this context includes eight prismatic blades of Pachuca green obsidian, material of clear Teotihuacan origin. Several additional pieces of green obsidian were recovered from further excavations in the same vicinity (Stoltman 1975). This provides two important correlations; a continuation of the apparent highland Mexico origin of Preclassic phase obsidian as indicated by its technological features, and a second instance of cached green obsidian in the Maya lowlands dating well before the fifth century to match discoveries at Altun Ha by Pendergast (1971). The first appearance of projectile points occurs even later in the Early Classic. All but one are made of non-local material with the locally-made exception showing



an anomalous manufacturing technique of probable foreign origin.

With the sum total of changes in the Early Classic lithic assemblages attributed to foreign influence synchronous with and subsequent to the construction of the Becan fortifications, all the lithic evidence points to foreign influence motivating its construction. It is obviously tempting to see that motivation originating from either Teotihuacan itself or an intermediate group linked to Teotihuacan. However, the only reported architectural antecedents are apparently located at Los Naranjos, Honduras (Baudez 1971). A massive ditch and parapet construction dates to the Eden phase which extends from 200 B.C. to A.D. 400 wholly overlapping the suggested time range for the building of the Becan fortifications. Indeed, in terms of antecedents, there is a large, but simple, ditch fortification construction dating to the earlier Jaral phase at Los Naranjos. Given the development of the Protoclassic Usulután sphere it becomes tempting to see the Honduras and the Rio Bec fortifications as frontier outposts of that sphere. However, this contradicts not only the suggested Highland Mexican influence at Becan, but even more cogent ceramic data to argue against the presence of significant Usulután sphere influence.

...it is noteworthy that defensive measures seem to have been undertaken just at that time when intrusive elements were pushing their way westward and northward into the Maya lowlands. No true Protoclassic stage material was encountered at Becan, despite its proximity to Holmul (less than 140 kilometers away). Usulután types, present 125 kilometers south of Becan at Uaxactun and 290 kilometers northeast on the coast at Tancah, have been neither at Becan nor inland to its north... It is difficult to believe that the absence of intrusive Protoclassic ceramics from Becan and that center's second through third century growth are not casually inter-related (Ball 1973:375-376).

Furthermore, the large, triangular bodied, unifacially retouched "dagger" with wide shoulders and bifacially flaked stem, distributed from Chalchuapa, Honduras, to Chiapa de Corzo, Chiapas, to Belize and the Peten, is absent in the Rio Bec collections. The glaring discrepancy between the architectural relationships and the ceramic and lithic evidence clearly demands resolution.

The fourth and fifth centuries of the Early Classic period mark the first phase of major activity at Chicanna. The earliest manifestation of activity comes from a buried soil beneath the initial major architectural construction at Chicanna but is not necessarily related to that construction. The buried soil yielded a concentration of over 1000 pieces of local chert debitage. In spite of the relatively mediocre quality of the local chert, more than 15% of the debitage shows characteristics of a percussion blade technology while two chert cores in the sample appear to be blade core rejects. In addition 39 simple unifacially retouched implements, mostly beaks and gravers, were recovered, fully one-third of which were made on preforms classified as blades. There is no other significant incidence of chert blade production or selection of local chert blades as preforms for the manufacture of unifacially retouched implements anywhere

in the Rio Bec collections. It appears to be an intrusion of an alien technology into the Rio Bec near to, but outside, the fortified zone at Becan which was not incorporated into the subsequent chert industries either at Becan or at Chicanna. Although the retouched implements are superficially related to the flake beaks and graters typical of the traditional local chert industry, there is also a clear differentiation in average size and size range of the implements in this anomalous Chicanna industry. The 39 Chicanna flake and blade implements, of comparable size to each other, are distinctively smaller than their flake counterparts in the rest of the Rio Bec assemblage. Although this anomalous occurrence of chert blade tools in a restricted Early Classic context is not unique, Kidder (1947:6) illustrates 10 implements which appear to be beaks-on-blade from a single restricted Early Classic context at Uaxactun; the area of origin for this industry is not apparent. Inasmuch as the Rio Bec ceramics show minor changes in the fourth and fifth centuries with affinities to ceramics from Belize (Ball 1973), I am inclined to place the origin of this industry in that general area which also contains native resources of quality chert which would foster development of a local chert blade technology.

The appearance of projectile points during the Early Classic has several implications for developments in the Rio Bec. The small sample size, only eleven, and all from Becan itself, does not reflect the significance they represent. Ten are bifacially flaked, of which five are made of obsidian, one gray and four Pachuca green. All 10 are fragments or are badly broken. None were found in cache or ceremonial context; indeed, three of the four green obsidian points are in contexts directly associated with the fortifications. Ball (1973) notes the possibility of a fifth century "downfall" of the Becan fortress to Teotihuacan and/or highland Mexico-allied forces are a prelude to the final phase of the Early Classic which shows substantial Teotihuacan influence in the ceramic assemblage. He further notes (Ball 1973:380) the presence of large quantities of scattered human bone in most pure deposits of this period. To further confuse the issue of who was competing with whom, if anyone, for control of Becan during the fifth century, the eleventh Early Classic point is a small, unifacially retouched, stemmed point-on-blade made of local chert. The technological affinities are clearly to the anomalous alien chert blade industry at Chicanna, but the point, perhaps not surprisingly, was recovered from a context in association with the Becan fortifications. The permutations of possible explanations given the incomplete evidence strain the imagination.

#### INDUSTRIAL DEVELOPMENT OF THE LATE CLASSIC

The Late Classic period comparison of the Dzibilchaltun and Rio Bec lithic developments continues the general pattern of distinctly opposite trends, but in this instance representing a reversal of the Early Classic pattern. Following the apparent demise of widespread Teotihuacan influence in the Maya region, the Rio Bec underwent an initial retrenchment to a markedly localized development. Ceramic ties to the Peten disappear while distinctive Chenes-Rio Bec architectural and ceramic styles develop directly out of antecedent Early Classic forms (Ball 1973). Virtually all of the

indications of disparate foreign influences in the Early Classic lithic assemblages are either substantially diminished or disappear entirely. In sharp contrast, Dzibilchaltun rises out of its doldrums to the peak of its development socially, architecturally, etc., (Andrew IV 1965) with evidence of substantial interaction with neighboring and distant groups readily apparent in the lithic collection.

The absence of local chert resources at Dzibilchaltun appears to have precluded development of any local lithic industrial development at the site. The chert debitage of this period of maximum development shows no change from the Preclassic pattern, no chert nodules, reject cores, decoration flakes or large trimming flakes occur in the collections. Indeed, there is not even a substantial change in absolute quantity of small flake debitage recovered as compared to the Preclassic (Formative) collection. Considering the more extensive excavations in units of this later phase, which included substantial testing of house mounds as well as exploration of elite precincts, it might be suggested that even less lithic production activity took place at the site than even the rather meagre level indicated for the Formative. Obsidian importation is at its peak; imported fine quality limestone implements clearly predominate at the expense of implements of porous local material; and chert projectile points make their initial appearance in the sequence. The few diagnostic points are simple lanceolates or ovals. Stemmed points appear toward the close of this period while notched points are clearly a Postclassic-equivalent period occurrence. In addition a cache containing a pair of large, bifacial daggers (i.e., ceremonial knives), one made of fine brown chert and the other of gray obsidian, date to this period. Dzibilchaltun necessarily relied almost entirely on foreign industry and exchange to provide for all its utilitarian and relevant ceremonial lithic requirements.

With the subsidence of Early Classic foreign activity in the Rio Bec, a return to manifestation of local lithic industries and industrial traditions dominates the collections. In the Tepeu 1-equivalent phase, obsidian is imported at substantially diminished levels and is once again the only apparent utilitarian lithic import. Not one example of the ceremonial chert and obsidian eccentrics which typify the Late Classic in the Peten and Belize was found in the Rio Bec. Green obsidian does not again appear in this sequence. Local chert is used to manufacture bifacial projectile points for the first time; but, coincidentally with the points from Dzibilchaltun, only simple lanceolates are produced. The earliest possible date for stemmed points is the Tepeu 2-equivalent phase, but invariably in deposits mixed with later material. It is very likely that stemmed points do not appear in the Rio Bec until the Terminal Classic. Biface celt and unifacial flake tool manufacture is once again the most prominent feature of the lithic assemblage. Whereas there is little to distinguish the flake tools of this period from their counterparts in the Preclassic, clear distinction is evidenced in the celt collection. The polishing finish technique is absent; size clusters in the short-broad range; elongate celts are absent; and morphological types cluster in the rounded cordiform to oval zone. The apparent uniformity to size and form is further enhanced by the absence of crudely flaked, irregular celts and

suggests a development toward standardization, if not also occupational specialization, of the local chert manufacturing industry. Elaboration, as well as standardization, of the local lithic industry takes place. In addition to the biface points, the most prominent implement is the "domed smoother", a halved nodule of chert with decortication flake removals around the circumference. Apparently similar implements were named "Scraper, turtle-backed" by Kidder (1947) at Uaxactun. Because of the relatively crude nature of the implement, they may have been dismissed as discarded cores since they have not been reported at any other Maya sites. However, a broad distribution for them is indicated by their presence in quantity at the sites of Yagul and Mitla in Oaxaca (Hester and Heizer 1972) and given the name "scraper planes". As reported at Mitla, the most frequent context for the Rio Bec implements is constructional hearthing and rubble. Eight of the Rio Bec implements show clear evidence of stucco incrustation providing the suggestion of functional association which led to the selection of the term "domed smoother".

The developments in lithic industries during the Rio Bec Late Classic period contrast sharply with both the contemporary developments at Dzibilchaltun and its own previous Early Classic assemblage. The Rio Bec Maya apparently turned inward, intensifying and elaborating their traditional industrial activities reliant primarily on the exploitation of locally available resources.

#### INDUSTRIAL DEVELOPMENT OF THE TERMINAL CLASSIC

The Terminal Classic period in the Rio Bec is marked by essentially the same cultural collapse suffered by Maya Classic centers throughout the southern and central Lowlands. Manifestations of the local Rio Bec industries remain unchanged, a condition based on typological continuity which could mask significant change in the social and economic aspects of the local lithic industry. Manifestations of foreign lithic industries in the Rio Bec begin a superficially similar recapitulation of the character of the Early Classic period. The earliest of these is the appearance at both Becan and Chicanna of stemmed bifacial and stemmed unifacial points made of fine brown chert. They are typologically identical to points characterizing the previous Late Classic period in the Peten, in Belize, etc. This time discrepancy in their respective area appearances suggests at least two explanations: the Rio Bec again established interregional relationships with neighboring areas to the south; or, the Rio Bec began to receive migrations of people out of the culturally collapsing regions. Inasmuch as the Terminal Classic is a period of disintegration rather than growth, the latter hypothesis would seem the more reasonable of the two.

The high level of activity at Dzibilchaltun appears to have continued unabated, at least insofar as the level of lithic importation of obsidian, etc., is concerned. However, the absence of good stratigraphic separation of much of the lithic collection of this period from the previous makes valid quantitative comparisons difficult. To a significant degree the florescence of the Puuc centers south of Dzibilchaltun may have begun to divert the flow of imported items as a prelude to a second decline which is clearly manifested in the subsequent phase of the Dzibilchaltun

sequence. The development of the Puuc centers is not without its effects further south in the Rio Bec. Indeed, the Terminal Classic period at Becan is marked by the influx of material, both ceramic (Ball 1973) and lithic, from northern Yucatan. The diagnostic lithic element of this influx is a narrow, elongate biface point having narrow shoulders and a rounded stem. The distribution of this point suggests a specialized function or functional complex inasmuch as all but one of the 18 points of this type were recovered from the interior and exterior middens of a single structure, a multi-story pyramid (Structure IV), located inside the fortified zone at Becan. The single exception was recovered at the site of Xpuhil 2; none were found at Chicanna. The Becan middens which yielded the points also produced over 1,000 pieces of local chert debitage more than 800 of which were fire spalled, fire crazed, heat discolored or smoke hazed. Thermal damage was also common on the points themselves absolutely precluding the possibility of the technique of thermal treatment prior to flaking. The heat damage was so great in many instances that the stone would have been impossible to flake in any semblance of controlled fashion.

The narrow elongate point type was found in museum collections from the site of Uxmal in the Puuc Hills and Proskouriakoff (1965) illustrates examples, which also show heat damage, from the sites of Santa Cruz and Chacchob in northern Yucatan. A body fragment found at Dzibilchaltun which shows fire crazing may also belong to this type. However, the external relationships of this restricted lithic sub-assembly are not so simple. Donald Brockington (personal communication 1973) identified the point type as diagnostic of the Epiclassic period in Oaxaca. All these occurrences may be local manifestations of a broadly ranging sphere of interaction which Ball, using ceramic evidence, sees as part of a "continuous militaristic expansion on the part of the central highland-oriented, Gulf Coast Putun (Chontal) Maya" (Ball 1973:389). Following, as it does, on the heels of the appearance of points of Peten or Belize derivation, this parade of separate groups interacting with the local Rio Bec Maya poses a situation resembling the character of the Early Classic.

#### INDUSTRIAL DEVELOPMENT OF THE POSTCLASSIC

The character of the Postclassic assemblage in the Rio Bec continues the trend of the Terminal Classic period. Only one change occurs in the locally related industries, represented by the appearance of the elongated, bevel-nosed biface celt which also shows the employment of the polished bit technique. There are no other discernable changes in the typological configuration of the local lithic implement assemblage. In sharp contrast foreign elements continue their intrusions into the area, in several cases adding new and different materials suggestive of a broader area of interaction. In fact, we are faced with the paradox that the collapse and post-collapse periods provide the greatest variety of diverse lithic imports into the Rio Bec. Long distance exchange, a normally defining characteristic of the stage of peak civilization, appears to be rising as civilization is breaking down. Obsidian importation, while not reaching the levels of the Early Classic, does show a discernable increase over Late Classic levels, with the fully ground platform style dominating the

prismatic blade collection. Basalt manos and metates appear for the first and only time in the sequence. The 12 pieces recovered would not be as extraordinary a collection if it were not for the total absence of the material in any of the earlier periods. Three fragments of a single metate, made of a pink and gray granite, apparently from the quarry at Mountain Pine Ridge, Belize (Bullard and Bullard 1965), is the only granite artifact in the collection and dates not earlier than the Terminal Classic. Barkbeaters also appear in the collection. Projectile points show a tremendous variance in style and material. Local cherts, fine imported cherts and obsidian points are present in the collection. Types run the full range from simple lanceolates to stemmed to corner-notched, side-notched and expanded base varieties with both unifacial and bifacial points represented. Inexplicably, all the various notched point types diagnostic of the Postclassic appear at Chicanna, none from Becan. Given the earlier northern intrusion which avoided Chicanna, the exact relationship of these two sites to each other over time raises several unresolved questions. Large biface daggers occur in the Rio Bec collections for the first time, most made of fine brown chert. In earlier times, such a range of material might be interpreted as representing dynamic growth, far reaching economic and/or political alliances. Coming at a time of cultural disintegration, one can only wonder at the degree to which such activity might represent chaotic upheavals over broad areas.

Several of the elements characterizing the Postclassic at Becan appear at the same time at Dzibilchaltun. A variety of notched points appear, as do barkbeaters, obsidian prismatic blades with the fully ground platform, basalt, and fragments of the fine brown chert biface dagger. The "dogbone" mano and small, tripodal basalt metate (palette?) appear at Dzibilchaltun. Dzibilchaltun at this time, however, is also in eclipse, but in this case most probably due to the domination of the north coast by the Toltec influenced occupation at Chichen Itza. With the demise of Toltec influence, Mayapan grows to dominate the northern area with activity at Dzibilchaltun at a significant but subordinate level. The closest approximation to any local chert industry occurs at Dzibilchaltun. Nearly 100 small chert blades were recovered from structures showing strong Decadent period occupations. Although the blades, or bladelets, were probably produced from prepared cores, no examples of the latter were recovered. Nine marginally retouched, side-notched points-on-bladelet are diagnostic of the Decadent occupation at the site and, indeed, at several other Postclassic sites; including 15 found at Mayapan (Proskouriakoff 1965) and eight green prismatic blades were recovered variously from the surface of Decadent period shrines at Dzibilchaltun. The most substantial occurrence of green obsidian in the Lowlands dating to this period is the relatively large mortuary cache assemblage recovered from the burial mound at Atasta, Campeche (Ball and Rovner 1972). The arrival of the Spanish, of course, leaves the ultimate consequences of Aztec interaction with the Maya Lowlands solely to the imagination.

## REFERENCES CITED

Andrews IV, E. W.

- 1965 Archaeology and Prehistory in the Northern Maya Lowlands: An Introduction. In: *Handbook of Middle American Indians*, 2:228-330. University of Texas Press, Austin.

Ball, J. W.

- 1973 Ceramic Sequence at Becan, Campeche, Mexico. Ph.D. dissertation, University of Wisconsin.

Ball, J. W. and I. Rovner

- 1972 Protohistoric Putun Trade Patterns: Evidence from Two Graves at Atasta, Campeche. *Katunob* 8(2):40-46.

Baudez, C. F.

- 1971 Commentary on: Inventory of Some Pre-Classic Traits in the Highlands and Pacific Guatemala and Adjacent Areas. In: *Observations on the Emergence of Civilization in Mesoamerica*. (edited by R. F. Heizer, J. A. Graham and C. W. Clewlow, Jr.) *Contributions of the University of California Archaeological Research Facility* 11:78-84.

Bullard, W. R., Jr. and M. R. Bullard

- 1965 Late Classic Finds at Baking Pot, British Honduras. *Occasional Papers*. Royal Ontario Museum, Toronto.

Coe, M. D.

- 1961 La Victoria, an Early Site on the Pacific Coast of Guatemala. *Papers of the Peabody Museum, Harvard University* 53.

Coe, M. D. and K. V. Flannery

- 1967 Early Cultures and Human Ecology in South Coastal Guatemala. *Smithsonian Contributions to Anthropology* 3.

Hester, T. R. and R. F. Heizer

- 1973 Problems in the Functional Interpretation of Artifacts: Scraper Planes from Mitla and Yagul, Oaxaca. *Contributions of the University of California Archaeological Research Facility* 14:107-123.

Kidder, A. V.

- 1947 The Artifacts of Uaxactun, Guatemala. *Carnegie Institution of Washington Publication* 576.

Kidder, A. V., J. D. Jennings, and E. M. Shook

- 1946 Excavations at Kaminaljuyu, Guatemala. *Carnegie Institution of Washington Publication* 561.

Lee, T. A., Jr.

- 1969 The Artifacts of Chiapa de Corzo, Chiapas, Mexico. *Papers of the New World Archaeological Foundation* 26.

Pendergast, D. M.

- 1971 Evidence of Early Teotihuacan--Lowland Maya Contact at Altun Ha. *American Antiquity* 36(4):455-460.

Proskouriakoff, T.

- 1962 The Artifacts of Mayapan. *Carnegie Institution of Washington Publication* 619, Pt. 4.

Ricketson, O. G., Jr. and E. B. Ricketson

- 1937 Uaxactun, Guatemala, Group E; *Carnegie Institution of Washington Publication* 477.

Rovner, I.

- 1974 Evidence for a Secondary Obsidian Workshop at Mayapan, Yucatan. *Newsletter of Lithic Technology* 3(2):19-27.
- 1975 Lithic Sequences of the Maya Lowlands. Ph.D. dissertation, University of Wisconsin.

Shook, E. M. and A. V. Kidder

- 1952 Mound E-111-3, Kaminaljuyu, Guatemala. *Carnegie Institution of Washington Publication* 546.

Stoltman, J. B.

- 1975 An Analysis of Chipped Stone Artifacts From Becan, Campeche, Mexico: A Case Study of the Value of Detailed Lithic Analyses in Complex Societies. Unpublished manuscript.

Thompson, J. E. S.

- 1939 Excavations at San Jose, British Honduras. *Carnegie Institution of Washington Publication* 506.



Willey, G. R., W. R. Bullard, J. B. Glass, and J. C. Gifford .

1965 Prehistoric Maya Settlements in the Belize Valley. *Papers of the Peabody Museum, Harvard University* 54.

Willey, G. R.

1972 The Artifacts of Altar de Sacrificios. *Papers of the Peabody Museum, Harvard University* 61(1).



THE TERMINAL PRECLASSIC LITHIC INDUSTRY OF THE SOUTHEAST MAYA HIGHLANDS:  
A COMPONENT OF THE PROTOCLASSIC SITE -  
UNIT INTRUSIONS IN THE LOWLANDS?

Payson D. Sheets

INTRODUCTION

To date, the Protoclassic problem in the Maya lowlands has been discussed largely in terms of ceramic typology and dating (cf. Willey and Gifford 1961, Willey 1973, Willey, Culbert and Adams 1967, and others). It is the purpose of this paper to begin a broadening of our understanding of the Protoclassic phenomenon by investigating whether lithic artifacts might have been a component of a potential intrusion. The term lithic is used here in the broad sense to subsume both chipped and ground stone artifacts.

This paper is exploratory, for the detail, objectives, and standards of highland and lowland lithic analyses have varied considerably in 20th century Maya research. This variation, in many cases, is sufficient to obviate firm comparisons and conclusions, but at least at two sites where the Protoclassic seems to have been a sudden intrusion, Altar de Sacrificios and particularly Barton Ramie, lithic description and illustration are detailed enough to allow for meaningful comparison and some tentative conclusions. Fuller examination of the lithic component of the Protoclassic must await future detailed excavations and analyses. For these, this paper is intended to point out likely lithic components of the Protoclassic to be considered, and accepted, rejected, or modified as the evidence demands.

In a more general context, if the hypothesis were correct that the eruption of Volcan Ilopango in the southeast Maya highlands shortly after the time of Christ did create sufficient environmental modification over an extensive area occupied by peoples already making Protoclassic-style artifacts, then we would expect to see the following in areas to which people migrated:

1. Population increase
2. Acceleration of culture change
3. Intrusive elements of material culture
  - a. Ceramics
  - b. Lithics
  - c. Other (including architecture, sculptural styles, and additional artifact industries)

Willey *et al.* (1965:27, 565) encountered evidence for an approximate doubling of population at Barton Ramie, indicating that #1 above apparently occurred at least at one site receiving the Protoclassic ceramic intrusion. An acceleration of culture change at about this time (c. A.D. 200) has long been noted in the Maya area; it is partially responsible for archaeologists drawing a taxonomic boundary separating the Preclassic from the Classic at about that time. Ceramics (3a) were the earliest component of the phenomenon noted, and they still serve as the hallmarks for it. Lithic artifacts (3b) should be indicative of an intrusion, if an invasion actually occurred, but research is insufficient to thoroughly test this now. Little more than a framework for testing can be constructed at this point.

In testing a lithic component of the migration-intrusion hypothesis it would be unreasonable, for a number of reasons, to expect wholesale importation of the southeast Maya highland material culture unchanged. A major one is ecologic. The majority of the inhabited area damaged by the tephra (ash flow and airfall ash) ranges from 500 to 1000 meters in elevation, and all of it is in the seasonal tropics, where over 90% of the precipitation is limited to the six-month rainy season. The Belize-Southwest Peten area which may have received many of the immigrants is closer to true tropical rainforest conditions with many evenly distributed convectional and orographic rains. The resultant highland vegetation in heavily inhabited areas is a deciduous to semi-deciduous broadleaf forest on a more nutriment-rich porous soil, while the lowlands are characterized by a tropical rainforest of broadleaf evergreen trees on a poorer soil. Material culture is a component of adaptation, and we should expect some significant adaptive adjustments to be made by the immigrants. Further, they did not arrive in an uninhabited area, but were immediately in contact with the lowland Maya and their indigenous lithic traditions. And, the specific lithic resources available shifted from an abundance of obsidian, andesite, and basalt to an abundance of chert, limestone, and to a lesser degree, quartzite.

Nevertheless, the sudden arrival of a large number of foreigners should be detectable in the archaeological record, given sufficient knowledge of their material culture prior to the move and detailed information of the material culture in the recipient area prior to, during, and after the purported immigration.

#### THE LOWLAND PROTOCLASSIC

Explaining the sudden arrival of Protoclassic artifacts into a number of sites in the eastern-southern Maya lowland area has been a recurrent problem for Mayanists for almost 70 years. The Problem was first recognized from Merwin's excavations at Holmul in 1910-11, where mammiform tetrapod vessels, Usulután decoration, spouted vessels, and pot stands were recognized as intrusive by Merwin and Vaillant (1932). They also noted the strong resemblance of artifacts from the southeast Maya highlands (El Salvador area). The following summary of literature on the Protoclassic in the highlands and lowlands is adapted from our report on 1975 research to the National Science Foundation.

Numerous other sites in the Maya lowlands have been found to have experienced a similar site unit intrusion sometime near the time of Christ. The artifacts have been known by a number of names, including Holmul I, Cimi, Matzanel, Salinas, Contutse, and Floral Park. The name Protoclassic may be used to subsume these similar materials. An excellent summary of the distribution of Protoclassic artifacts in southern Mesoamerica, particularly in the Maya lowlands, is that of Willey and Gifford (1961). They note the full occurrence of the Protoclassic at such sites as Barton Ramie, Holmul, Poptun, Mountain Cow, Nohmul (Douglas), Santa Rita, and Pomona. It has also been found at Altar de Sacrificios (Willey, Culbert, and Adams 1967:298; Willey 1973:34-39).

Sites with a few scattered Protoclassic artifacts, or lacking the evidence of a major, sudden infusion of the full Protoclassic are Uaxactun, Tikal, Finca Arevalo, Seibal, Chiapa de Corzo, Monte Alban, Kaminaljuyu, and southern Campeche. Willey and Gifford (1961:167) view the Protoclassic at Barton Ramie as an intrusion of a constellation of foreign characteristics into an indigenous technological and stylistic continuum. The intrusion does not break that continuum, and it is eventually absorbed into the general Early Classic culture.

Although the Protoclassic spread of artifacts might be explained by the opening of a new exchange or trade network, Willey and Gifford (1961:168, 1970) believe that a migration is the most likely explanation. They are uncertain of the source, mentioning northern Honduras, or, more likely, the Maya highlands. In retrospect, we can say that their suspicions may have been quite correct, and we may now be able to add the *reason* for the migration as well as the specific area of origin.

At Barton Ramie during the Floral Park Phase (the Protoclassic) a number of cultural and natural events occurred at approximately the same time, and they may have been interconnected. The dating of these events is not exceedingly precise; they occurred sometime between 100 B.C. and A.D. 300 (Willey *et al.* 1965:26-27). These changes (cf. p. 565) include at least a doubling of population as evidenced by a more than twofold increase in "house occupations", new ceramic characteristics interjected into the autochthonous continuum, barkbeaters, perforated potsherd discs (probably whorls), and apparently certain other artifacts. Among the ceramic changes, a new ceramic type appears, Aguacate Orange, which is so similar to sub-ash ceramics in El Salvador as to be indistinguishable by ceramicists working at Barton Ramie and Chalchuapa (Sharer and Gifford 1970). These cultural changes are accompanied by the virtual disappearance of fresh-water mussels and univalves from Barton Ramie. The acute sensitivity of aquatic species (animals and plants) to damage by tephra (Malde 1964) may be directly relevant here. In fact, if an ash fall radically diminished shellfish, fish, and related species in Belize, the same phenomenon should have occurred elsewhere. It may not be mere coincidence that the Ocos area of Pacific Guatemala-Chiapas, where the Preclassic occupation was heavily dependent on aquatic protein resources, was abandoned in the Early Classic, and then thoroughly reoccupied a few centuries later (Coe and Flannery 1967:84-91). At Bilbao, more inland on the

Guatemalan Pacific coastal plain, Parsons (1967:24) encountered a marked diminution of cultural materials in the Early Classic which may be indicative of a population decline, but not of an abandonment of the area. Because the Bilbao inhabitants apparently were not relying much on aquatic protein resources, I would expect their agricultural subsistence base to have been less sensitive to a tephra-induced perturbation than their Ocos neighbors. Bilbao is 140 km and Ocos is 215 km WNW of Ilopango.

The evidence of substantial flooding of the Belize River was encountered at Barton Ramie in the form of a sterile brown clay stratigraphically separating the Preclassic from later occupations and humic horizons:

We noted that mounds whose construction began in Preclassic Period times had their bases directly on or slightly into the (buried) black soil stratum, while mounds whose construction began at a later date had brown clay intervening between the mound base and the black soil" (Willey *et al.* 1965:31).

This flooding occurred at about the same time as the molluscs diminished and the Protoclassic cultural-demographic intrusion. Flooding is a common result of tephra damage to vegetation in the drainage basin of rivers, often exacerbated by the greatly increased rainfall.

From Tikal Project excavations during the past two decades it is clear that the roots of the Classic Maya florescence in the Peten are deeply embedded in the Peten Preclassic, therefore we cannot mechanistically derive the lowland Classic out of the highland Preclassic. However, it is likely that the sudden arrival of large numbers of people on the peripheries of the "core area" necessitated an intensification of social and political control mechanisms, thereby accelerating the rate of cultural development. The Protoclassic may have acted primarily as a catalyst instead of being a critical reagent in the emergence of the Classic Maya state and civilization.

The controversy over the nature of the Protoclassic continues among Mayanists working in the lowlands. Willey (1973) and Adams (1971) recently disagreed on the explanation for the large amounts of Protoclassic materials encountered during their excavations at Altar de Sacrificios of the Salinas Phase (A.D. 150-450). They both agree that the Salinas Phase was a time of rapid change in ceramics, trade, architecture, artifacts, and iconography. Adams explains this by an influx of population into Altar, accompanied by some violence and the invaders establishing themselves as the rulers, with the earlier resident population becoming the ruled. Willey (1973:38-39) had earlier favored the invasion explanation, but he now expresses some reservations by viewing the Protoclassic phenomenon as deriving out of "culture change benefiting by stimulation from foreign contacts."

Willey (1973:36) does note that the indigenous continuum of Altar utility wares was unbroken from the previous Plancha Phase through the Salinas Phase. The first "luxury ware" at Altar derives from the intrusive Protoclassic. If there were a Protoclassic invasion, then these two traditions

and their social functions can be used to trace the dynamics of ethnic interactions. Immigrant groups usually enter pre-existing non-egalitarian societies either on the lowest or the highest socio-economic level; rarely are they accepted by the inhabitants at precisely the same level. It would appear that the highland immigrants at Altar and Barton Ramie were socially (and probably politically and economically) dominant at least for the first few generations after the migration.

However, as Schwartz (1970:178) notes in discussing the developmental phases of postmigration cultures, the community ultimately may develop along lines quite different from those of either of the two separate groups. Although at Altar and Barton Ramie the intrusive socio-technic artifacts are initially dominant, the overall Maya lowland developmental continuum from the Late Formative into the Classic overwhelmed the Proto-classic cultural intrusion within a few generations. All the sites which may have received a significant site unit intrusion were, by the 5th century, fully within the Classic Maya realm.

The late facet of the Cantutse (Chicanel, or terminal Preclassic) Phase at Seibal contains many components of the Protoclassic complex, including mammiform tetrapod vessels, orange-slipped ceramics, and imitation "Usulután" types (Sabloff 1975:11, 231-232). The Protoclassic at Seibal apparently is analogous to Tikal; in both cases there is no evidence of a full site-unit intrusion and sudden population increase, but rather Protoclassic elements show up gradually and individually, by trade or imitation. Even though the earliest ritual construction at Seibal dates to the late facet of the Cantutse Phase, Seibal evidently experienced a marked population decline as well as a "cultural decline" (pp. 11-12), with "much of the site (being) abandoned to the jungle." As Sabloff summarizes: "There is no evidence of a separate Protoclassic complex such as the Salinas at Altar de Sacrificios or Floral Park at Barton Ramie. Nor is there evidence of an intrusion of new peoples such as Adams sees at Altar" (p. 232).

#### THE SOUTHEASTERN MAYA HIGHLANDS (EL SALVADOR AREA)

Numerous investigators over the past 50 years in the southeast Maya highlands (Fig. 1) have encountered Preclassic artifacts under a layer of volcanic ash. Lardé (1926) was the first to record this artifactual-stratigraphic relationship, followed shortly by Lothrop (1927). Two decades later more discoveries of comparable relationships began to be made by Dimick (1941:29), Boggs (in Longyear 1944; 1966), Porter (1955) and Longyear (1944:32) in central and eastern El Salvador.

Work of the Chalchuapa Archaeological Project, particularly in 1969 and 1970, documented the gradual development of the known elements of the Protoclassic complex, stratigraphically capped by the layer of volcanic ash (Sharer 1974), making possible the formulation of the hypothesis that explosive volcanism rendered uninhabitable a significant area of the southeast Maya highlands, and that a forced migration could be the explanation for the lowland Protoclassic intrusion. Prior to this research, a

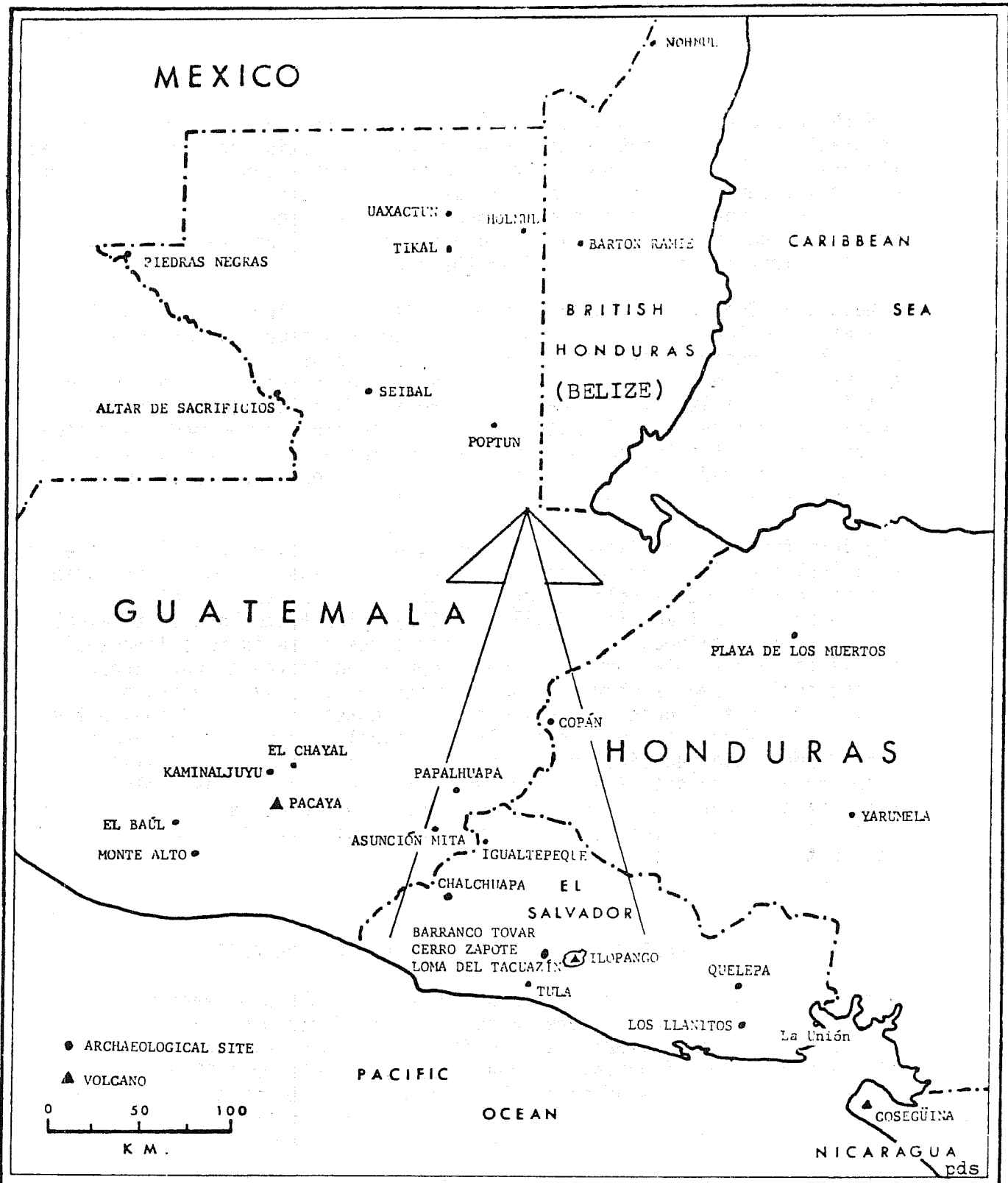


Figure 1. Map of sites in the southeast Maya highlands (El Salvador) devastated by the eruption, and sites in the Maya lowlands (N. Guatemala, Belize) affected by population movements.



major deficiency in our data derived from the fact that all the sub-ash artifact discoveries in the highlands were site-specific, and virtually all were without any geologic, let alone tephrochronologic, analysis. We had enticing fragments of data which might indicate a large scale natural disaster, but both a regional scope and a consistent, multi-disciplinary research strategy were lacking.

With these problems in mind, the 1975 research was directed toward determining if there was a relationship among these disparate finds of tephra overlying archaeological sites in the highlands. If the tephra deposits were in fact related, i.e. from the same eruption or series of eruptions, was the volcanologic event of sufficient magnitude to serve as a potential explanation, in the form of a migration, for the Proto-classic intrusion in the lowlands? According to the geologic analysis by Virginia Steen-McIntyre of the samples collected in June-July, 1975 the tephra shroud which blanketed the southeast Maya highlands is not a series of local, unrelated events separated in space and time, but a massive, complex eruption. As far as we presently know, this eruption occurred in three stages, two ashflows (*nuées ardentes* or glowing avalanches) followed by an airfall ash. The ashflows, consisting of incandescent clouds of pumice, ash, and gasses, rolled downhill and buried villages and forests in their paths as far as 45 km from their source. Shortly thereafter, perhaps hours to weeks, the airfall ash was deposited in a more uniform blanket over the countryside. Yet unpublished data from the German Geological Mission to El Salvador indicates Ilopango to be the source of these tephra, and our evidence is in accord (although not conclusive) with their source attribution.

In some areas the probability of human physical survival would have been slight. For example, the Cartografía site was a village suddenly buried by up to nine meters of hot ash flow material. Areas farther from the source which received less instantaneous destruction, but where the vegetation, soils and hydrography were severely altered by the acid ash, would be more likely source areas for human migrations.

I would estimate conservatively, based on present data, that the environmental impact of the tephra-fall was greater than the Preclassic Mayan technological capacity to adjust and continue their agricultural adaptation over at least 3000 km<sup>2</sup>. The density of settlement was high in the Late Preclassic, for the southeast Maya highlands had been settled by agriculturalists for over 1000 years preceding the eruption, and archaeological evidence indicates a steady population growth throughout the Preclassic. So, even if we use a minimal population density figure of 10 people per square kilometer, some 30,000 people would not have been able to continue living in the highlands.

## ARTIFACT DESCRIPTIONS AND COMPARISONS

### Chipped Stone

The reduction strategy for manufacture of obsidian implements in the Late Preclassic (c. 200 B.C. - A.D. 200) southeast Maya highlands is core-blade, involving a significant behavioral change from percussion to pressure midway

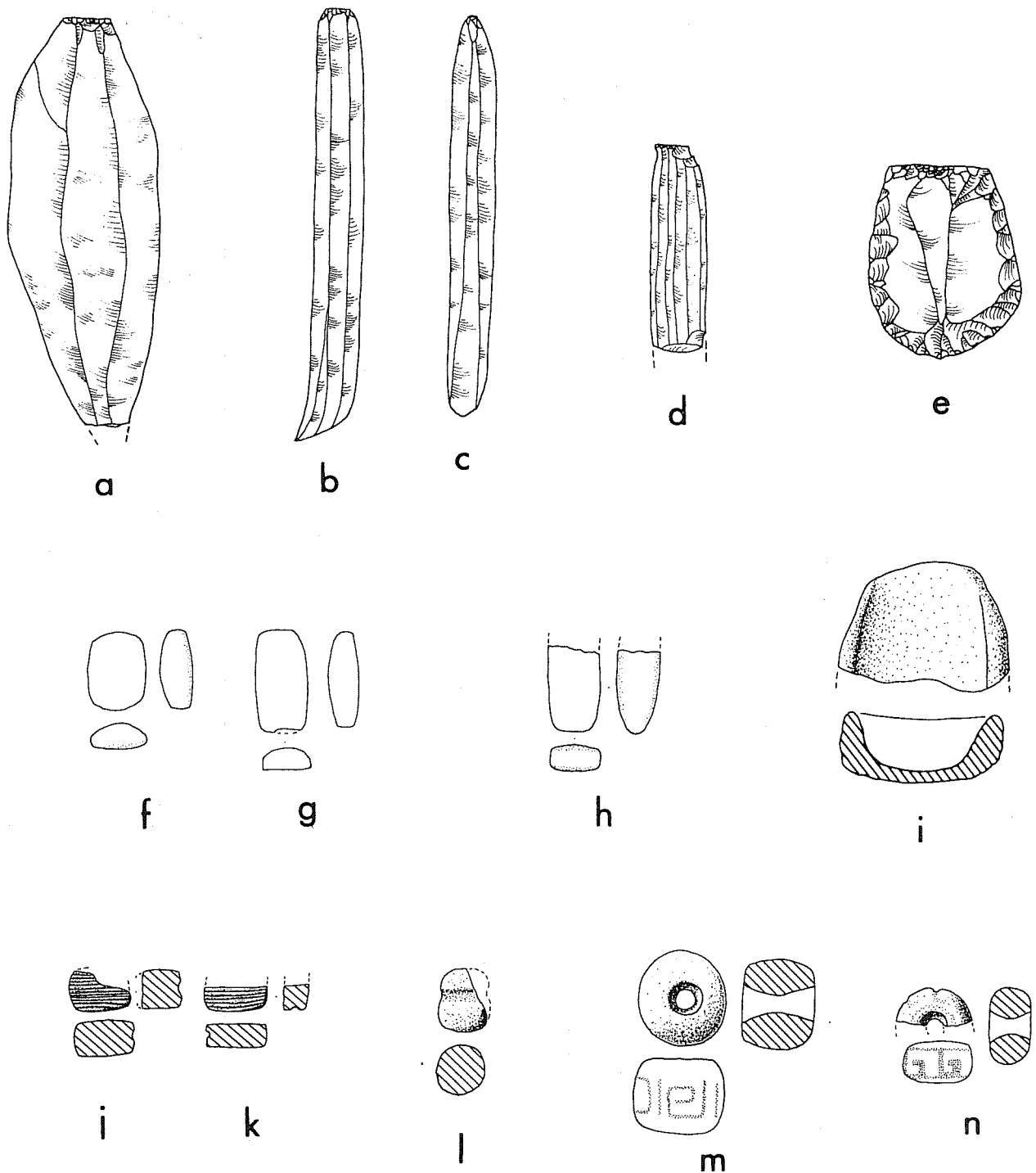


Figure 2. *Chalchuapa lithic artifacts: chipped stone and groundstone.* a, Macroblade (large blade); b, Late Preclassic prismatic blade (note "scraping" overhang removal); c, Early Preclassic prismatic blade (note flake-by-flake overhang removal, smaller platform); d, Polyhedral core; e, Scraper; f, g, Ovoid thin plano-convex manos; h, Elongate, oval to rectanguloid mano; i, Rounded back trough metate; j, k, Barkbeaters; l-n, Biconically perforated stone discs ("donut stones", ring-stones).  
Chipped stone (a-e) 1/2 scale; Groundstone (f-n) 1/10 scale.

in the process (Sheets 1972, 1974, 1975). The kinds of implements manufactured in the Late Preclassic involve prismatic blades, macroblades (large blades detached by percussion), scrapers, polyhedral cores, stemmed large blades, and occasionally other implements. Shook and Kidder's observation (1952: 113) of the paucity of bifacial manufacture in the highlands prior to the Classic has been substantiated by recent research (Sheets 1974:36). The following information about Chalchuapa and southeast Maya highland artifacts is drawn from Sheets (1974, 1975) unless otherwise noted.

The lack of bifacial flaking in obsidian also applied to some lowland Maya sites. Willey (1972:208 ff.) notes that bifacial flaking of obsidian does not begin at Altar de Sacrificios until the Late Classic. Willey (p. 212, 214) notes variation in platform preparation of polyhedral cores and prismatic blades but it is not temporally defined; so it is not possible to assess a potential core preparation component of the Protoclassic at that site.

A number of lines of evidence indicate a change in obsidian procurement and locus of manufacture in the highlands during the Late Preclassic. During the Early and Middle Preclassic the percentage of artifacts with cortex at Chalchuapa was consistently above 14%, and occasionally above 20%, indicating the importation of essentially unmodified obsidian cobbles into the site. Cortex percentages fall abruptly to 7% or less during the Late Preclassic through the Postclassic. This hypothesized shift toward preforming at or near the quarry is substantiated by the concomitant decline in the frequency of early preforming debitage at Chalchuapa. It appears likely that a more complex economic organization had emerged by this time, just prior to the Ilopango eruption. This evidently involved specialized preparation of the cores for transport, likely by a resident community of knappers at or near the quarry. This certainly was the case a few hundred years later, judging from the results of Graham and Heizer's (1968) brief study of Papalhuapa. With this change, consumption centers would have to trade for their obsidian in the form of prepared macrocores, instead of more directly obtaining their obsidian in raw nodule form.

Macroblades (Fig. 2a) were produced in large numbers by the Late Preclassic workshops in the highlands. The platform surface of most (usually over 60%) is the unmodified flat flake scar of the macrocore platform, but some are lightly striated on the platform surface. This is particularly true of the smaller, more regular macroblades. The platform overhangs were consistently and thoroughly removed by a heavy "scraping" action, likely with a stone, leaving a welter of tiny hinge and step fractures on the dorsal surface of the blade immediately below the platform. This contrasts with the Early Preclassic careful (flake-by-flake, with flakes generally terminating in feather edges) removal of the overhang, and it also contrasts with the minimal removal of the overhang, by scraping, in the Late Classic and Postclassic.

Similar macroblades abound at Papalhuapa (Graham and Heizer 1968:104), El Chayal (Coe and Flannery 1964:46), Copan (Longyear 1952), and other sites. I would not expect to find many macroblades in the Protoclassic materials in the lowlands, partly due to the increased scarcity/value of obsidian in the lowlands, but where they do occur, the above mentioned

chronologically sensitive technological indicators should be identifiable.

Because of their greater frequency in both highlands and lowlands, prismatic blades (Fig. 2b-c) should be of greater assistance to us than macroblades in assessing the nature of the Preclassic. The platform surfaces were consistently striated, and overhangs were rather thoroughly removed by the same scraping action described for macroblades. Platform dimensions of the Late Preclassic average 0.4 cm in length and 0.13 cm in width (measured from the dorsal to the ventral surface at the point of applied force, along the platform), but there is a rather large range of measurements. The percentage of prismatic blades to total chipped stone was surprisingly sensitive chronologically, beginning at ca. 5 - 10% in the Early Preclassic, rising to ca. 40% in the Late Preclassic, and continuing to increase to between 50 and 70% in the Postclassic. Longyear (1952:109) noted the same phenomenon, on a shorter time scale, at Copan. However, we cannot expect these frequencies to remain constant with a migration, largely because of intervening variables. We should expect the relative proportions of lithic implements to change rapidly as people changed their location of residence and their adaptation, while the way in which they made those artifacts should change more slowly. Technology, then, should be a more sensitive indicator of a migration-intrusion than the relative frequency of implement types. But, technology certainly would not remain static, particularly as extended contact is established between knappers of the highland and lowland traditions.

Stemmed large blades at Chalchuapa date to the Preclassic, particularly to the Middle Preclassic. They are large blades unifacially retouched (or, preferably, "laterally retouched") along the proximal margins (ventral or dorsal). These are often called "daggers" in the Mesoamerican archaeological literature. They have widespread distribution in Mesoamerica and areas of the Caribbean (W. Coe 1957). Of the numerous specimens from Barton Ramie, only one was from a datable context, and it was Early Classic (Willey *et al.* 1965:412, 422). That raises the possibility that these could be a component of the intrusion, for they are demonstrably earlier in the highlands. But, similar specimens were encountered in apparent Preclassic contexts at Uaxactun (Ricketson and Ricketson 1937:186-7). If other lowland specimens are found to date to the Preclassic, these "daggers" cannot be an intrusive component.

Scrapers (Fig. 2e) are another implement category manufactured from macroblade blanks, in this case by steep retouching of the distal and occasionally lateral margins of larger macroblades. All five types of scrapers from Chalchuapa were being manufactured during the Late Preclassic (Sheets 1974:78-84).

#### Groundstone

In very general terms, the groundstone industry reaches a relatively low ebb in manufacturing standards during the Late Preclassic in the southeast Maya highlands. The care shown in shaping manos and metates wanes throughout the Preclassic, but as legged metates begin to be made in the Classic, manufacture becomes more careful.

The most common mano at Chalchuapa, the "Ovoid, thin plano-convex" type (Fig. 2f,g) began in the Preclassic and extended throughout all time periods. Its counterpart at Barton Ramie, the "Rectangular-thin" type, dates to the Classic and perhaps to the Protoclassic Floral Park (Willey *et al.* 1965:459). The same applies to the Preclassic Chalchuapa "Cuboid" manos; they are comparable to the "Large-square" manos at Barton Ramie, and these latter date to the Classic (p. 457). Both are good candidates for inclusion in the Protoclassic intrusion.

The "Elongate, oval to rectanguloid" manos at Chalchuapa (Fig. 2h) date to the Middle Preclassic through the Postclassic. Comparable specimens at Barton Ramie may begin in the Preclassic (Willey *et al.* 1965:459). Even though the Barton Ramie specimens are somewhat wider, thicker, and shorter, the similarity and dating might be indicative of a direct relationship by the mechanism proposed here.

At Chalchuapa the "Rounded back trough metates" (Fig. 2i) begin in the Middle Preclassic, and evidently extend to the end of the Preclassic. This type in the lowlands is very common. It is called "Large metates" at Barton Ramie (Willey *et al.* 1965:453-454), where one unequivocally is dated to a context earlier than the Protoclassic. After the Protoclassic it is a common type, so we may have, in this case, not a standard case of intrusion of a previously unknown type. Rather, the increase in frequency of this already-established type may have as its explanation the arrival of numerous settlers who also valued it as a proper form for a metate. The same could apply to the "Elongate, oval to rectanguloid" manos above.

Barkbeaters at Chalchuapa (Fig. 2j,k) extend chronologically from the Middle Preclassic through the Late Classic. They are rectangular in outline, and most are 3/4 grooved around the circumference. I suspect it is not by accident that virtually identical barkbeaters suddenly appear at Barton Ramie in the Protoclassic and continue through the Classic (Willey *et al.* 1965:469-471). A comparable dating distribution obtains at Altar de Sacrificios where a single well-dated specimen derived from a Late Preclassic context, and the type later (in the Late Classic) became much more common (Willey 1972:125-126).

Mauls (Fig. 2l) from another taxon which could be part of the Protoclassic. They date to the mid-Late Preclassic at Chalchuapa, and to the Classic or possibly as early as the Protoclassic at Barton Ramie (Willey *et al.* 1965:466).

Biconically perforated stones ("donut stones" or ring-stones) are encountered frequently at Chalchuapa (Fig. 2m,n); they date from the Middle Preclassic through the Postclassic. They are rare in most areas of the lowlands, but they occur surprisingly commonly at Altar de Sacrificios. They may begin as early as the Late Preclassic at Altar, but most date to the Late Classic (Willey 1972:135-136). There appears to be a good chance that these "donut stones" could be a Protoclassic component as well.

## CONCLUSIONS

As stated above, only tentative answers can be offered to the question, were lithic artifacts a component of the Protoclassic intrusions into lowland sites just after the time of Christ? Bifacial flaking in obsidian evidently postdates the Protoclassic in both highlands and lowlands, and therefore it cannot be an intrusive element of the complex under investigation. Stemmed large blades do antedate the eruption in the highlands, and most seem to date to Classic contexts in the lowlands, raising the possibility that they may be involved in a Protoclassic migration.

Two types of manos which were made and used at Chalchuapa prior to the eruption date to Classic and perhaps Protoclassic times as Barton Ramie. The same might obtain for rounded back trough metates, but this is less clear. A stronger case could be made for barkbeaters, at least as far as the Chalchuapa, Altar de Sacrificios, and Barton Ramie data indicate. Other groundstone candidates for inclusion in the Protoclassic intrusion are mauls and biconically perforated stones.

As lithic analyses become a more integral part of prehistoric Maya studies these artifact comparisons to determine the sources for technological or stylistic variables will be on a much more solid foundation. That will allow for detailed testing of ideas such as the migration-intrusion hypothesis offered by this paper.

## REFERENCES CITED

- Adams, R. E. W.
- 1971 The Ceramics of Altar de Sacrificios. *Papers of the Peabody Museum, Harvard University* 63(1).
- Coe, M. D. and K. V. Flannery
- 1964 The Pre-Columbian Obsidian Industry of El Chayal, Guatemala. *American Antiquity* 30:43-49.
- 1967 Early Cultures and Human Ecology in South Coastal Guatemala. *Smithsonian Contributions to Anthropology* 3.
- Coe, W. R.
- 1957 A Distinctive Artifact Common to Haiti and Central America. *American Antiquity* 22:280-282.
- Dimick, J. M.
- 1941 Salvador (notes on excavations at Campana San Andrés, El Salvador). *Carnegie Institution of Washington, Yearbook* 40:298-300.

Graham, J. and R. Heizer

- 1968 Notes on the Papalhuapa Site, Guatemala. *Contributions of the University of California Archaeological Research Facility* 5:101-125.

Lardé, Jorge

- 1926 Arqueología Cuzcatleca. Vestigios de una población pre-Mayica en el Valle de San Salvador, C. A., sepultados bajo una potente capa de productos volcánicos. *Revista de Ethnología, Arqueología, y Lingüística* 1:3 and 4. San Salvador.

Longyear, J. M. III

- 1944 Archaeological Investigations in El Salvador. *Memoirs of the Peabody Museum, Harvard University* 9(2).
- 1952 Copan Ceramics: A Study of Southeastern Maya Pottery. *Carnegie Institution of Washington, Publication* 597.
- 1966 Archaeological Survey of El Salvador. *Handbook of Middle American Indians* 4:132-156.

Lothrop, S. K.

- 1927 Pottery Types and Their Sequence in El Salvador. *Indian Notes and Monographs* 1(4):165-220. Museum of the American Indian, Heye Foundation, New York.

Malde, H.

- 1964 Ecologic Significance of Some Unfamiliar Geologic Processes. In: J. J. Hester and J. Schoenwetter (eds.) *The Reconstruction of Past Environments*. Fort Bugwin Research Center.

Merwin, R. E. and G. C. Vaillant

- 1932 The Ruins of Holmul, Guatemala. *Memoirs of the Peabody Museum, Harvard University* 3(2).

Parsons, L. A.

- 1967 Bilbao, Guatemala. *Milwaukee Public Museum, Publications in Anthropology* 11(1).

Porter, M. N.

- 1955 Material Preclásico de San Salvador. *Comunicaciones del Instituto Tropical de Investigaciones Científicas* 3/4:105-112. San Salvador.

Ricketson, O. and E. Ricketson

- 1937 Uaxactun, Guatemala: Group E, 1926-31. *Carnegie Institution of Washington, Publication 477.*

Sabloff, J. A.

- 1975 Excavations at Seibal, Department of Peten, Guatemala: Ceramics. *Memoirs of the Peabody Museum, Harvard University* 13(2).

Schwartz, D. W.

- 1970 The Postmigration Culture. A Base for Archaeological Inference. In: W. A. Longacre (ed.) *Reconstructing Prehistoric Pueblo Societies*: 178. University of New Mexico Press, Albuquerque.

Sharer, R. J.

- 1974 The Prehistory of the Southwestern Maya Periphery. *Current Anthropology* 15(2):165-187.

Sharer, R. J. and J. C. Gifford

- 1970 Preclassic Ceramics from Chalchuapa, El Salvador, and Their Relationships with the Maya Lowlands. *American Antiquity* 35:441-462.

Sheets, P. D.

- 1972 A Model of Mesoamerican Obsidian Technology Based on Preclassic Workshop Debris in El Salvador. *Cerámica de Cultura Maya* 8:17-33. Department of Anthropology, Temple University, Philadelphia.
- 1974 Differential Change Among the Precolumbian Artifacts of Chalchuapa, El Salvador. Ph.D. dissertation, University of Pennsylvania. University Microfilms, Ann Arbor.
- 1975 Behavioral Analysis and The Structure of a Prehistoric Industry. *Current Anthropology* 16(3):369-391.

Shook, E. M. and A. V. Kidder

- 1952 Mound E-III-3, Kaminaljuyu, Guatemala. *Carnegie Institution of Washington, Publication 596, Contribution 53.*

Wiley, G. R.

- 1972 The Artifacts of Altar de Sacrificios. *Papers of the Peabody Museum, Harvard University* 64(1).



- 1973 The Altar de Sacrificios Excavations: General Summary and Conclusions. *Papers of the Peabody Museum, Harvard University* 64(3).
- Willey, G. R., W. R. Bullard, J. B. Glass, and J. C. Gifford
- 1965 Prehistoric Settlements in the Belize Valley. *Papers of the Peabody Museum, Harvard University* 54.
- Willey, G. R., T. P. Culbert, and R. E. W. Adams (eds.)
- 1967 Maya Lowland Ceramics: A Report from the 1965 Guatemala City Conference. *American Antiquity* 32:289-315.
- Willey, G. R. and J. C. Gifford
- 1961 Pottery of the Holmul I Style from Barton Ramie, British Honduras. In: S. K. Lothrop (ed.) *Essays in Precolumbian Art and Archaeology*:152-170. Harvard University Press, Cambridge.



## MAYA OBSIDIAN TRADE IN SOUTHERN BELIZE

Norman Hammond

The study of Maya lithic artifacts embraces not only the morphological, technological and functional aspects of the subject, but also those of the sources, destinations and means of transmission of raw material, which can be at least as informative, albeit on different facets of Maya society. The sources of stone may be microlocal, as is most building stone and much chert, and the location of a site may be largely the result of available raw material (as at Colha); they may be local or regional, obtainable directly by a short journey beyond the bounds of the usual exploitation territory, or by exchange or redistribution within the realm ruled from a single major center; or they may be exotic, brought from a considerable distance beyond the boundaries of the realm. Within southern Belize a range of limestones, sandstones, siltstones, slates and cherts were microlocal to some sites, local to others within the realm of Lubaantun (Hammond 1975), and this realm seems to have possessed within its boundaries, areas of the metamorphic quartzites of the Maya Mountains as well. A number of types of stone were definitely exotic, however, including the small quantity of jade and large numbers of vesicular lava (basalt) metates, as well as polished stone axes. All of these came from various parts of the Guatemalan highlands to the south, from the Motagua valley on their northern margin or from further away. Obsidian falls into this latter class, of exotic stone from the more distant regions of the continental divide.

During excavations in 1970 at Lubaantun, 113 fragments of obsidian flake-blades were recovered from Late Classic levels (Hammond 1975:340-343); the same season a collection of surface obsidian was made from Wild Cane Cay, a small coral and mangrove island just off the coast, some 35 km east and north of Lubaantun (which lies 25 km inland). Test excavations on Wild Cane Cay in 1931 by Junius Bird (Hammond 1975:278-280; material unpublished in American Museum of Natural History, catalog 30.1/1474-1498) indicated a Late Classic into Early Postclassic sequence, and the presence of Tulum Red on the island suggests occupation or at least visitation into the 13th century A.D.

Initial analysis of one sample from each of the two sites, and four others from southern Belize, indicated that two obsidian sources were represented, Ixtepeque on the three island sites and El Chayal on the three mainland ones. This information was collated with analyses from a number of other Maya lowland sites, all again single or few samples, and a model for obsidian trade routes suggested by comparison with ethnohistoric and ethnographic data (Hammond 1972). This model was described by Jay Johnson at this symposium as being a speculation founded on wholly inadequate data --but one which seemed to be substantiated by subsequent analyses; its progenitor would reiterate that "the model presented is a skeletal one; it will be interesting to see if the flesh fits the bones". This paper adds a pound of flesh in the form of further analyses from Lubaantun and Wild Cane Cay, together with single analyses from Moho Cay and Frenchman's Cay; no dating estimates are available for these last two, although Late Classic ceramics have been found on the latter site.

The analyses were carried out (by F. Stross and F. Asaro) by improved techniques: the sensitivity and precision obtainable with neutron activation analysis make study of source homogeneity attractive, and both the El Chayal and Ixtepeque sources have been studied in some detail. The results of this work are summarized here as a basis for the artifact attributions.

The El Chayal samples were collected by Stross from road cuts at 23, 24 and 25 km northeast of Guatemala City; those from Ixtepeque are stored at the University of California at Berkeley Archaeological Research Facility, and had been analyzed using neutron activation by Stross, Bowman and Asaro (unpublished data) prior to this study. About 50 elements were searched for and over 30 observed; the 10 that best distinguish the two sources are shown in Figs. 1-3, and any one of them is adequate to distinguish between Ixtepeque and El Chayal obsidian.

As an example of the reproducibility of the measurements, for the 16 most precisely measured elements, it was found that the average root-mean-square deviation was 1.51% for 12 El Chayal source samples from the 24 and 25 km road cuts, and 1.57% for the four samples from the 23 km cut. With this precision it was found that there were very considerable differences in chemical composition between the obsidians from the 23 km and the 24+25 km cuts; the artifacts attributed to El Chayal match this latter source composition rather closely, although small differences were observed, the largest being of about 5% in scandium. These differences probably indicate that the artifacts came from a different part of the deposit than the source samples. A similar analytical division may be possible within the general Ixtepeque source area, where the volcano itself and the Agua Blanca source seem to have different levels of rubidium (Aspinall and Hammond, unpublished data on source samples collected by R. Sidrys; Sidrys, Andresen and Marcucci 1976); further samples are presently being analyzed to investigate this possibility.

In the present study 23 obsidian blade fragments from Wild Cane Cay were analyzed, 22 from Lubaantun and one each from Frenchman's Cay and Moho Cay nearby (not to be confused with Moho Cay off Belize City). Of the Wild Cane Cay sample 19 blades were assignable to the Ixtepeque source and four to El Chayal (82:18%). The two other cay samples were also assignable to Ixtepeque. Twenty-one of the 22 Lubaantun samples were assignable to El Chayal, and one to a third, unknown source; two blades from Ucareo, Michoacan, come from a source of very similar composition (Fig. 4).

These findings necessitate some changes in the model of Hammond (1972) as it applies to southern Belize: the model predicted that obsidian at the Lubaantun site should derive from both the Ixtepeque and the El Chayal sources, but none of the 22 samples comes from Ixtepeque, and the 95.5% representation of El Chayal obsidian indicates rather that the "cacao route" along the Maya Mountains and up into Alta Verapaz was probably functioning at this period (Hammond, in press). The analyses of obsidians from Palenque and Tikal reported at the symposium by Jay Johnson and Hattula Moholy-Nagy also indicate a preponderance of El Chayal material, and the

existence of the inland river-and-trail-based route network suggested for El Chayal by Hammond (1972) seems to be broadly substantiated, and the test expectations of the model fulfilled.

The Wild Cane Cay sample derived 82% from Ixtepeque and 18% from El Chayal, suggesting that the inland-riverine and coastal trade route networks linked up at this ideal natural harbor (Hammond 1975: Fig. 105c); its nodal function is confirmed by the quantities of exotic materials, including Plumbate and Tulum Red pottery, from the Pacific coast and Yucatan respectively, and jade and copper artifacts found on a site which is structurally unimpressive and physically tiny.

The pattern of obsidian source assignation at Wild Cane Cay is more akin to that predicted originally for Lubaantun: it would seem that the conjunction of trade routes lay not at the major ceremonial center and regional capital, but at a subsidiary location where the large coasting canoes and the smaller river craft could meet. Whether Wild Cane Cay operated as a "trading port" or as a "port-of-trade" in the Classic to Early Postclassic period, in the manner that Sabloff and Rathje (1975) have suggested for the larger island of Cozumel off the coast of Yucatan, is a problem that only further work on the site can elucidate.

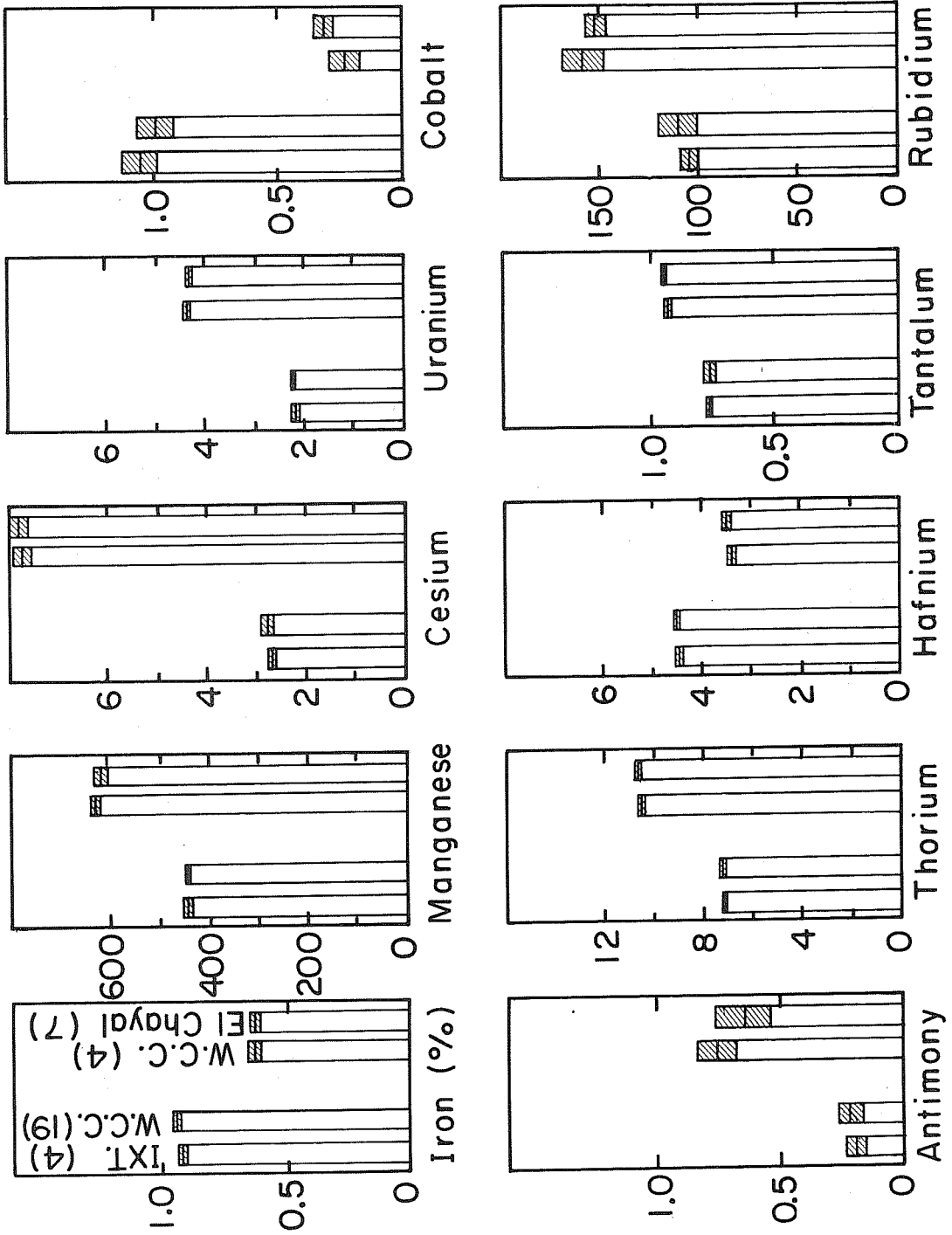
Even if this model cannot be applied to Maya east coast trade on evidence presently available, the data from a number of coastal sites suggests another, simpler, descriptive rather than analytical model which may be tested archaeologically. This model (Fig. 5) suggests the existence in the Classic period at least, and possibly both earlier and later, of a long-distance canoe route along the east coast of Yucatan, with major transshipment, chandling or other nodes at Cozumel and in the Bay of Honduras near or at Nito and the mouth of the Ulua. Both the existence of the route and the importance of these ports are attested for the 16th century, and they do form natural end-points to an east coast route, though linking to the extended routes round Yucatan to Xicalango in one direction and eastwards to Costa Rica and Panama in the other.

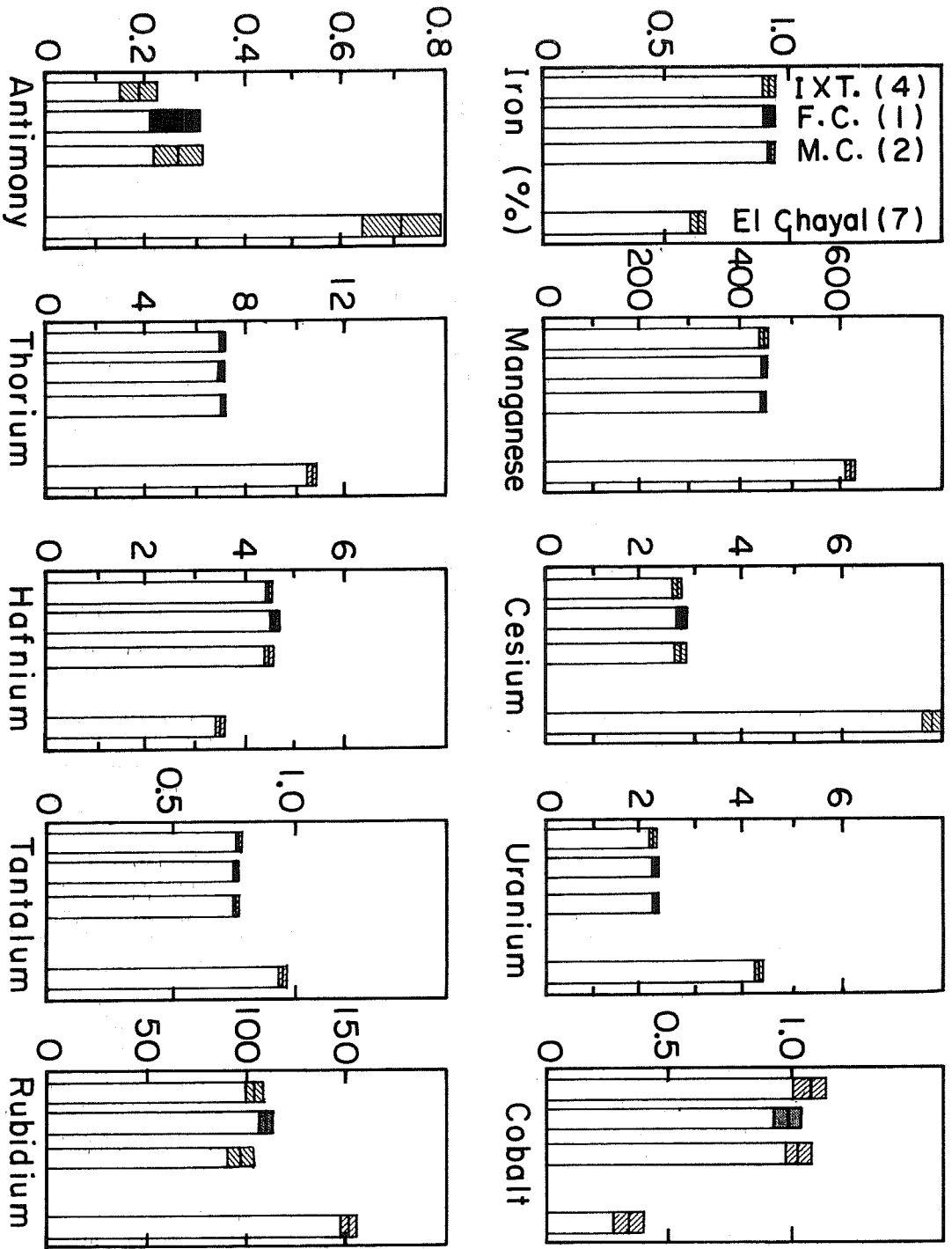
Between these end-points would have been a number of way-stations where the large coasting canoes would put in to off-load and take on goods from the mainland; such stations would habitually be on small islands off the coast, and from their small size and unsuitability for settlement on any substantial scale might well have functioned as *de facto* ports-of-trade, neutral ground with little other value. We would expect such a way-station to exist near the mouths of each of the major rivers emerging from the hinterland, and to be both small in size and unexpectedly prolific in artifact material, with a larger proportion of exotic goods than a similar small fishing settlement would be able to acquire. The way-station would in turn be reached by river canoe from the major settlements of the hinterland, which, like Lubaantun, often lay near the head of navigation where the river was fordable by overland trails and where goods would have to be offloaded to porters for any journey further inland. Some way-stations might be on the coastline itself, which was generally swampy and inaccessible overland; all that would be needed again would be landing facilities for both large and small canoes. One way-station might well

Figure 1. *Selected chemical abundances of obsidian from Wild Cane Cay, Ixtepeque and El Chayal.* All values are in parts-per-million except the iron abundance, which is in percent. The hatched areas show the root-mean-square deviation in the abundance values. The values in parentheses indicate the number of samples measured.

- 1st bar - Mean value and root-mean-square deviation for 4 source rocks from Ixtepeque volcano.
- 2nd bar - Same parameters as 1st bar for 19 obsidian artifacts from Wild Cane Cay.
- 3rd bar - Same parameters as 1st bar for 4 obsidian artifacts from Wild Cane Cay.
- 4th bar - Same parameters as 1st bar for 7 obsidian source rocks from a highway cut in the El Chayal deposit about 25 km NW at Guatemala City.

XBL7511-9501

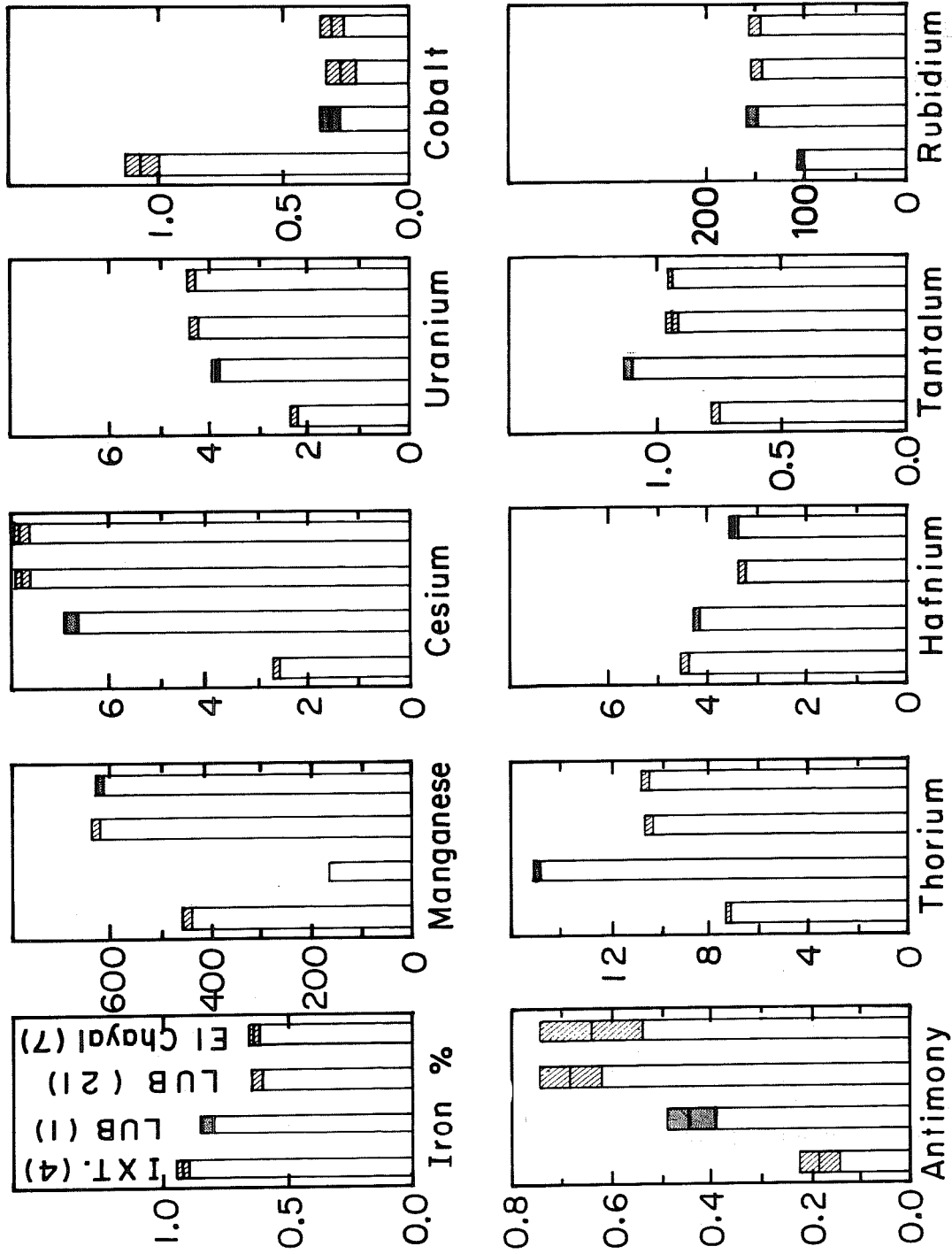




XBL 7511-9500

Figure 2. Selected chemical abundances of obsidian from Frenchman's Cay, Moho Cay, Ixtapaque and El Chayal. A11 values are in parts-per-million except the iron abundance, which is in percent. The hatched areas in bars 1, 3, and 4 represent the root-mean-square deviation in the abundances. The solid areas on the second bar show the error in a single measurement due to counting statistics. The values in parentheses indicate the number of samples measured. The data for the 1st and 4th bars are the same as in Figure 1.





XBL 7512-9593

Figure 3. Selected chemical abundances of obsidian from Lubaantun, Ixtepeque and El Choyal. The representation is very similar to Figure 2.

serve a number of inland centers and a number of river routes: the model advanced suggests some half a dozen stations between Cozumel and the Bay of Honduras, summarized in Fig. 5:

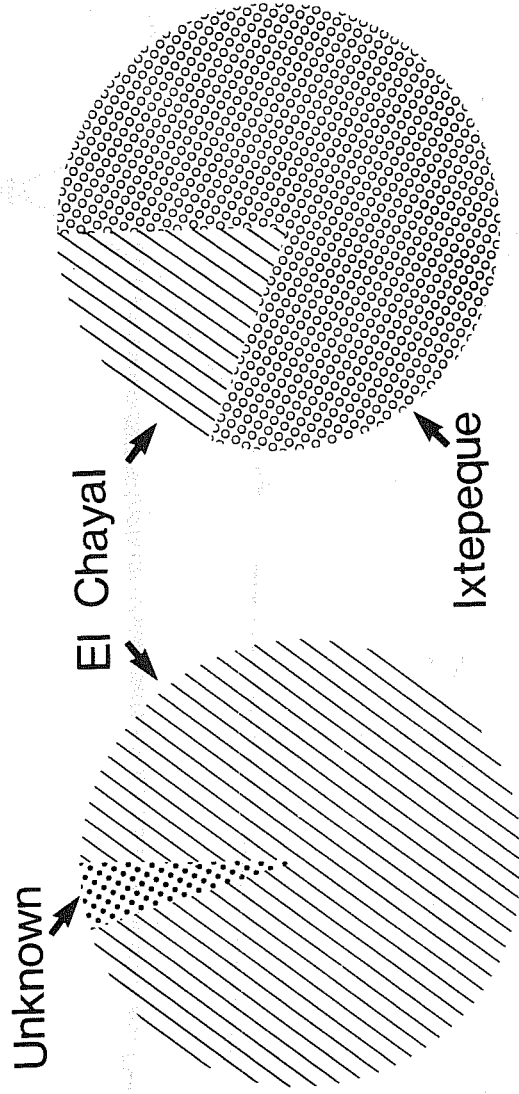
<u>Way-station</u>	<u>River served</u>	<u>Inland center</u>
Wild Cane Cay	Grande Golden Stream Deep River Monkey River	Lubaantun Nimli Punit unknown Quebrada de Oro
Tobacco Range or Kaka'lche	Mullins River Stann Creek Sittee River	unknown Pomona Kenda'l
Moho Cay	Belize River	Belize Valley generally
Marlowe Cay	-	Altun Ha Colha
Ambergris Cay	Rio Hondo Rio Nuevo  Arroyo de Ucum- Laguna de Bacalar	Nohmul, Ucum Aventura, San Estevan, Pozito Ucum, Tzibanche, Kohunlich
Tupak/Chacmool	-	Chichen Itza
Tancah	-	Coba

Many of these might be disputed: Ambergris Cay (from which Fine Orange and Plumbate pottery have been reported; M. D. Coe, personal communication, 1973) could be replaced by a site such as Santa Rita (which is, however, large, on the mainland proper, and apparently unutilized between the Protoclassic and Postclassic) or Cerro Maya (which seems however to be purely Pre-classic in date, reused as a Postclassic pilgrimage center). Neither Marlowe Cay nor Tancah fit the model in being transshipment points from sea-going to river canoes: they are transfers from canoe to porter. The journey from Tupak/Chacmool would only have been a short one across Ascension Bay and then overland, and perhaps a canoe-porter way-station exists within the bay, but the route from here to Chichen Itza is attested in the 16th century, however, improbable it may seem now. The model is, like its predecessor in *Science*, a speculative one: if it fares as well, its progenitor will be well pleased.

#### ACKNOWLEDGEMENTS

The obsidian analyses were carried out by F. Stross and F. Asaro at the Lawrence Berkeley Laboratory of the University of California at Berkeley; the excavations were sponsored by Cambridge, Harvard and Oxford Universities, the Wenner-Gren Foundation, and the British Museum.

Obsidian in southern Belize



Lubaantun ← 35 km → Wild Cane Cay

Late Classic → Post Classic

Figure 4. Obsidian source representation at Lubaantun and Wild Cane Cay. Space, time or covariance of both may be responsible for the contrasting patterns.

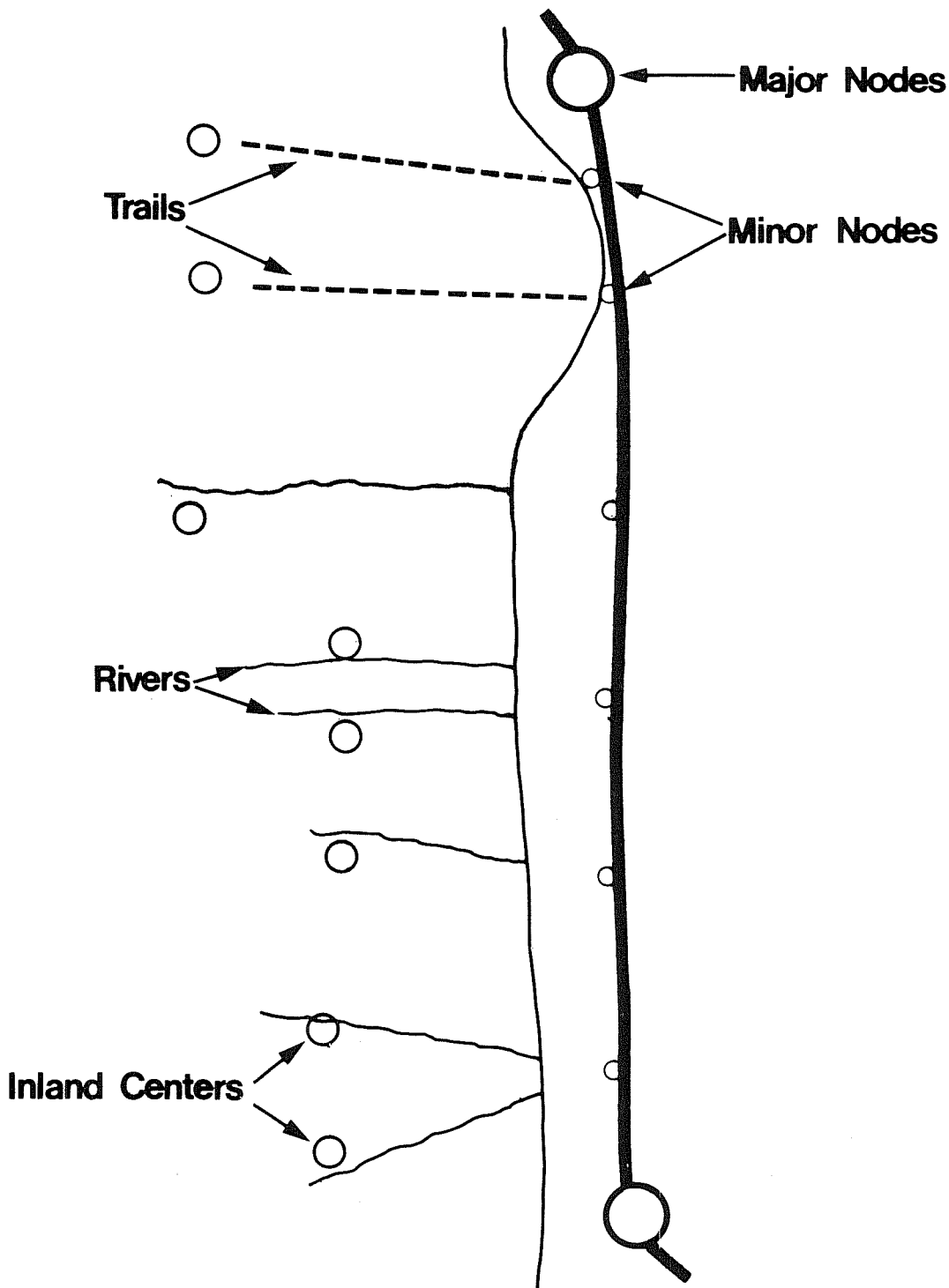


Figure 5. *Model for Maya east coast trade.* Transshipment from large seagoing canoes to smaller river canoes (in the south) or direct to foot-porters (in the north) would have occurred at minor nodes, which were either small offshore islands or coastal landfalls lacking productive hinterland.

## REFERENCES CITED

Hammond, N.

1972 Obsidian Trade Routes in the Mayan Area. *Science* 178:  
1092-1093.

1975 Lubaantun: A Classic Maya Realm. *Monographs of the Peabody  
Museum, Harvard University* 2.

in press An Overland Trade Route Between the Maya Highlands and  
Lowlands. In: *Mesoamerican Routes of Communication and  
Cultural Contact* (ed. by T. Lee and C. Navarrete), New  
World Archaeological Foundation, Provo.

Sabloff, J. A. and W. L. Rathje

1975 Changing Precolumbian Commercial Patterns. *Monographs of  
the Peabody Museum, Harvard University* 3.

Sidrys, R., J. Andresen, and D. Marcucci

1976 Obsidian Sources in the Maya Area. *Journal of New World  
Archaeology* 1(5):1-13.



## LONG DISTANCE OBSIDIAN TRADE:

## NEW DATA FROM THE WESTERN MAYA PERIPHERY

Jay K. Johnson

Obsidian trace element analysis constituted a major portion of a recently completed study<sup>1</sup> of chipped stone artifacts from 27 archaeological sites in the region surrounding the Classic Maya site of Palenque in southern Mexico (Fig. 1). Palenque's location on the western margin of the southern Maya lowlands, between that area and the highland Mexican obsidian sources, provides a ready gauge of the relative integration of long distance Maya trade in obsidian. In order to explore the possibilities of alternative trade routes a total of 173 specimens, constituting a 20% stratified random sample from all site collections in the study area, was subjected to X-ray fluorescence analysis.

In 1972 Hammond proposed a model for Maya obsidian trade based on the results of the trace element analysis of obsidian from 23 Classic Maya sites. Obsidian from these sites has been related to two major highland sources in Guatemala. Arguing from the geographical distribution of obsidians traced to these sources, topographic considerations, and ethno-historic data, Hammond (1972: Fig. 1) hypothesized two distinct trade routes. Obsidian from the El Chayal source near Guatemala City was traded down the Rio Chixoy to Altar de Sacrificios. From there it was traded up the Rio de la Pasion to Seibal and down the Usumacinta to Piedras Negras. Obsidian from the Ixtepeque source southeast of El Chayal was traded to Copan and thence down the Rio Montagua to the Gulf of Honduras. It was then distributed along the coast of the Yucatan Peninsula to sites in Belize and the northern Maya lowlands. Sites in the Peten received obsidian from both sources.

Unfortunately, the data base upon which Hammond built this reconstruction is quite small, consisting of 34 specimens from 23 sites (Stross *et al.* 1968: Table 2; Stross *et al.* 1971: Table 15.4). The largest single site sample is eight artifacts from Tikal. Most of the sites are represented by a single analyzed specimen. This problem of sample size was pointed out almost immediately by the publication of the analysis of 14 additional specimens from Seibal (Graham, Hester, and Jack 1972). Whereas Hammond was able to place Seibal in an exclusive El Chayal exchange network, these 14 specimens included obsidian from three other source areas in addition to El Chayal. The most damaging source allocation in terms of the Hammond model was the occurrence of an Ixtepeque obsidian at Seibal. This weakens the argument that the Chixoy, Pasion and Usumacinta drainages were completely dominated by the El Chayal source area trade.

Further modification of the Hammond model is necessitated by the discovery of a new obsidian source serving the Maya lowlands. Six of the obsidians analyzed from Seibal are probably from the San Martin Jilotepeque source area. Probable San Martin obsidian, also known as Aldea Chatalun (Graham, Hester, and Jack 1972:111), has been identified in the much

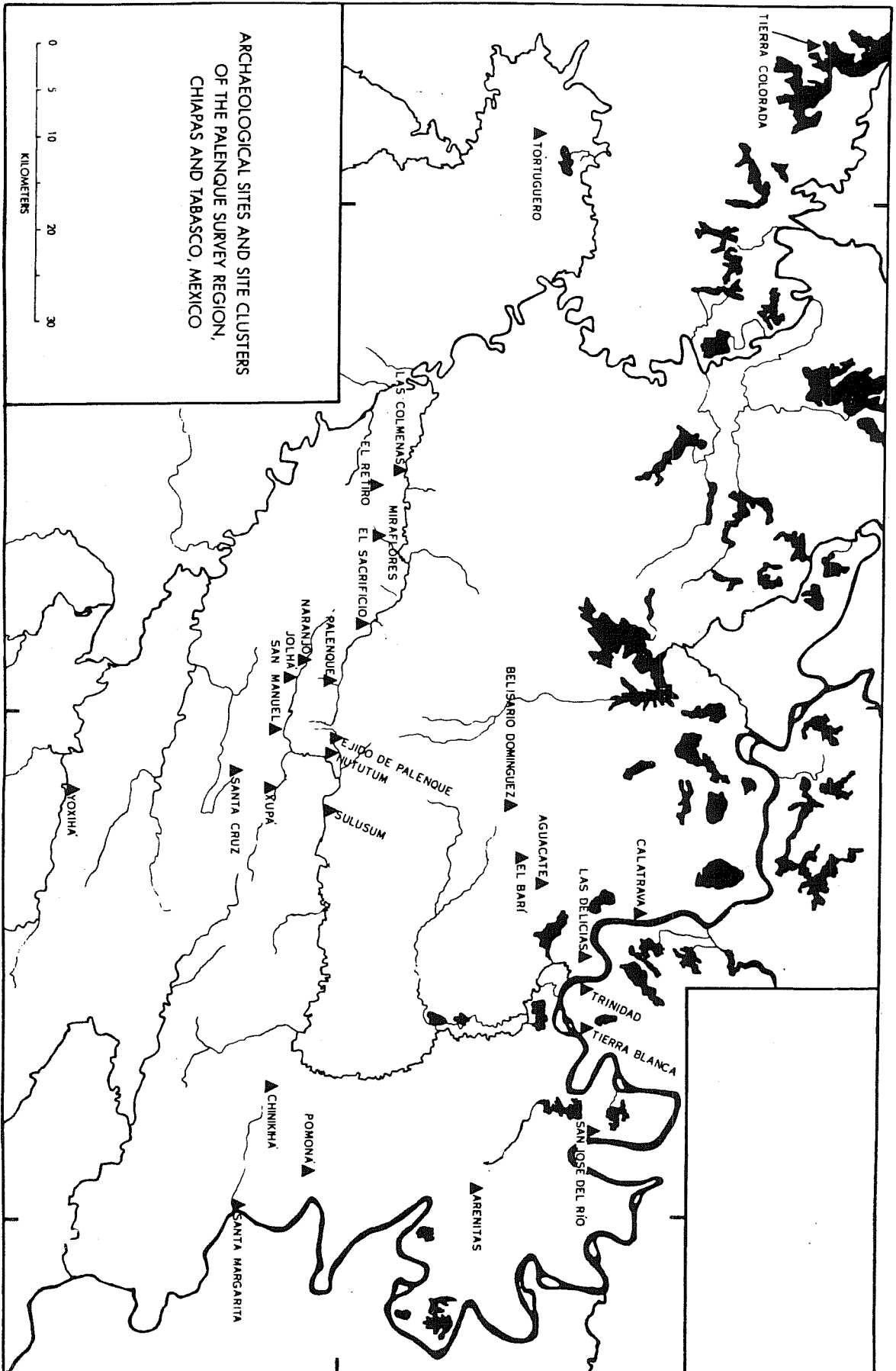


Figure 1. Location of sites in the Palenque region, southern Mexico.



enlarged sample recently reported for Tikal (Moholy-Nagy 1974: Table 1).

How does the Palenque region obsidian source data fit with the Hammond model? Hammond (1972:1093) concluded his discussion with a statement of test implications, "if the model is true, then obsidian from an Usumacinta Basin site, for example, Palenque, should come from El Chayal...." Prior to the beginning of the Palenque analysis an alternative hypothesis was built on the strength of Thompson's (1964:19) assessment of the importance of coastal Yucatan trade routes. If the rapids below Piedras Negras (Satterthwaite 1943:8-9) truncated the El Chayal-Chixoy-Usumacinta trade route, then the Palenque region may have been supplied by sea routes and obsidian from Ixtepeque should be found.

As it turns out, both expectations were fulfilled. While the majority of the Palenque region obsidian (94%) is from El Chayal, there are specimens from Ixtepeque as well as San Martin, possibly Zaragosa, and one piece of green obsidian (Table 1).

The green obsidian offers a useful key to understanding obsidian exchange in the Western Maya Periphery. The fact that it occurs exclusively at Yoxiha, on the southern limit of the survey area, suggests that rather than being traded directly from its probable Mexican source location, it may have been derived from a redistributive center in highland Guatemala, Kaminaljuyu perhaps. This is supported by the report of green obsidian from Piedras Negras (Coe 1959:13) and Tonina (Sheets 1975:7) and its reported absence at Comalcalco (Peniche Rivero 1973:156), a Maya center northwest of Palenque and even closer to the Pachuca source locality.

The occurrence of green obsidian at Yoxiha has been combined with the relative importance of San Martin source specimens at the site to hypothesize a second obsidian procurement system, independent from the Palenque system (Johnson n.d.). Assuming for the sake of discussion that this pattern could withstand more extensive sampling, the location of the Yoxiha trade sphere, inland from the Gulf coast, would seem to point to an overland route of trade. This would explain the inclusion of the San Martin Jilotepeque obsidian in a primarily El Chayal trade network. The San Martin source area is located west of El Chayal, between that source and Yoxiha.

If Palenque participated in a separate obsidian procurement system, it is characterized by the absence of green obsidian, the rarity of San Martin obsidian, and the unique occurrences of the Zaragosa and Ixtepeque obsidians. El Chayal is still the predominant source represented. The most straightforward model would have obsidian from the three Guatemalan sources and the redistributed green obsidian being traded down the Usumacinta toward Palenque. The lack of green obsidian and rarity of San Martin could then be attributed to a fall-off of the minority types. As obsidian was traded downstream, the rare types became less and less frequent until, in the case of the green obsidian, they fell out of the system entirely. However, if this were the case, we would expect to

find Ixtepeque obsidian at Yoxiha in greater abundance than at Palenque. In fact, Ixtepeque was not one of the source areas represented in the Yoxiha sample.

The Ixtepeque obsidian at Palenque seems to point to a coastal trade route. Ixtepeque as well as El Chayal obsidian could have been transported via the Rio Motagua to the Gulf of Honduras and from there around the Yucatan Peninsula and up the Usumacinta to Palenque. The fact that El Chayal and Ixtepeque were important sources at the Gulf coast site of San Lorenzo (Cobean *et al.* 1971: Table 2) points to the possibility of this sea route having considerable time depth. The only Guatemalan obsidian reported from the contemporaneous Veracruz site of La Venta (Jack, Hester, and Heizer 1972: Table 1) is San Martin. This weakens the argument somewhat.

More critical to the proposal that Palenque was participating in an exclusively coastal trade in obsidian is the source area composition of obsidian collections from the coast of Belize. In a recently completed analysis, Hammond (this volume) found El Chayal to be a minority source in this area with Ixtepeque predominating. This reversal of the relative importance of the two source areas points to the likelihood that El Chayal obsidian was not being traded around the Yucatan Peninsula and up the Usumacinta River to Palenque. Obsidian from this source probably reached the Western Periphery by means of an interior riverine route, traveling down the Chixoy and Usumacinta Rivers.

On the other hand, Ixtepeque obsidian has not been discovered in any of the collections from sites south of Palenque on the Usumacinta drainage. It is not until Seibal on the middle Pasion that it has been reported. Although the sample size is small, present evidence seems to indicate that while the majority of the Palenque area obsidian came from El Chayal via interior routes, the Ixtepeque obsidian came around or possibly across the Yucatan Peninsula to the Gulf coast and up the Usumacinta River.

Graham, Hester, and Jack (1972) found indications of a shift in the importance of the various obsidian sources through time in the sample from Seibal. Unfortunately, most of the non-El Chayal obsidians in the trace element sample from the Palenque region were not associated with sufficiently restricted ceramic assemblages to allow an assessment of temporal change in trade relationships.

The probable Zaragosa obsidian proved to be a partial exception. One of the four specimens came from a terminal Late Classic deposit. Associated ceramics include Early and Late Balunte types. A second probable Zaragosa obsidian was dated as generalized Late Classic, and the other two are unassigned as to period.

This in itself is not a particularly convincing pattern. However, all of the specimens which were designated as probable Zaragosa on the basis of their trace element composition proved to be a distinctive opaque black obsidian. Additionally, none of the obsidian allocated to the other source areas was visually similar. On the strength of these facts, the ceramic

associations of the eight unanalyzed black obsidians in the Palenque collection were examined. Two of these are Early and/or Late Balunte, two are Early Balunte, and the rest are either Late Classic or unassigned. Once again a terminal Late Classic time level is indicated.

The occurrence of these probable Zaragosa obsidians on a late time level at Palenque precedes only slightly their Bayal phase dating at Seibal (Graham, Hester, and Jack 1972:113). The Zaragosa source area is located in Puebla, and nearby sites in Veracruz, Cempoala, Quiahuitzlan and El Tajin, have shown a heavy dependence on this source (Jack, Hester, and Heizer 1972).

The use of the Zaragosa source at El Tajin has interesting implications. Ruz L. (1952:50,58) reports a complex of artifacts which may relate to this area which was recovered from superficial deposits in the Palace at Palenque. This complex includes votive axes, stone yokes and tecalli vessels. Ruz L. (1952:65) related these artifacts to a proposed Totonac invasion which led to the collapse of Palenque. Although succeeding years of research have not confirmed this hypothesis, these artifacts certainly indicate some sort of contact between Palenque and the coastal plain at the end of the Late Classic. The Zaragosa obsidian at Seibal takes on added interest in this light, for surface finds at that site include a votive axe (Willey *et al.* 1975:45).

#### NOTES

1. This paper is based on a portion of my dissertation research (Johnson 1976) which is one aspect of a comprehensive study of trade in the Palenque region. As such, I must express my debt to Robert L. Rands, director of my dissertation and the Palenque area research. Both he and Ronald L. Bishop have made useful suggestions in all stages of work which led to this paper. I would also like to thank Ray Sidrys for providing the Guatemalan source area obsidian samples used in the trace element analysis. The Department of Anthropology, Graduate School and Graduate Student Council at Southern Illinois University were generous in supplying the travel funds which allowed me to attend the Belize lithics conference.

TABLE I

The Distribution of Non-El Chayal Obsidian in  
Palenque Region Trace Element  
Analysis Sample

Site	Source Allocation			
	Ixtepeque	San Martin	Jilotepeque	Zaragosa*
Palenque % of site total	2 1.5%		1 0.8%	4 3%
Calatraba % of site total			1 50%	
Yoxiha % of site total			2 20%	

\*Allocation based on resemblance to published data; source samples from Zaragosa not available for reanalysis.

## REFERENCES CITED

- Cobean, R. H., M. D. Coe, E. A. Perry, Jr., K. K. Turekian, and D. P. Kharkar  
 1971 Obsidian Trade at San Lorenzo Tenochtitlan, Mexico. *Science* 174:666-671.
- Coe, W. R.  
 1959 Piedras Negras Archaeology: Artifacts, Caches, and Burials. *Museum Monographs*. The University Museum, Philadelphia.
- Graham, J. A., T. R. Hester, and R. N. Jack  
 1972 Sources for the Obsidian at the Ruins of Seibal, Peten, Guatemala. *Contributions of the University of California Archaeological Research Facility* 16:111-116.
- Hammond, N.  
 1972 Obsidian Trade Routes in the Maya Area. *Science* 178:1092-1094.
- Jack, R. N., T. R. Hester, and R. F. Heizer  
 1972 Geological Sources of Archaeological Obsidian from Sites in Northern and Central Veracruz, Mexico. *Contributions of the University of California Archaeological Research Facility* 16:117-122.
- Johnson, J. K.  
 1976 Chipped Stone Artifacts from the Western Maya Periphery. Dissertation, Southern Illinois University at Carbondale. University Microfilms, Ann Arbor.  
 n.d. Site Hierarchy in the Western Maya Periphery, a Correlation of Lithic Epigraphic, Architectural and Ceramic Data. In: *J. Charles Kelley Festschrift*, University Museum and Art Galleries, Southern Illinois University at Carbondale (in press).
- Moholy-Nagy, H.  
 1974 Obsidian at Tikal, Guatemala. *Actas del XLI Congreso Internacional de Americanistas* I:511-518.
- Peniche Rivero, C.  
 1973 *Comalcalco, Tabasco: Su Ceramica, Artefactos y Enterramientos*. M.A. Thesis, University of Yucatan, Merida.

Ruz L., A.

- 1952 Exploraciones en Palenque: 1951. *Anales del Instituto Nacional de Antropología e Historia* 5:47-65.

Satterthwaite, L.

- 1943 *Introduction, Piedras Negras Archaeology: Architecture, Part 1, No. 1.* University Museum, Philadelphia.

Sheets, P. D.

- 1975 New World Lithic Analysis Symposium: Southern Mesoamerica. Paper given at 40th Annual Meeting of the Society for American Archaeology, Dallas.

Stross, F. H., D. F. Stevenson, J. R. Weaver, and G. Wyld

- 1971 Analysis of American Obsidians by X-ray Fluorescence and Neutron Activation Analysis. In: *Science and Archaeology* (ed. by R. Brill):210-221. MIT Press, Cambridge.

Stross, F. H., J. R. Weaver, G. Wyld, R. F. Heizer, and J. A. Graham

- 1968 Analysis of American Obsidians by X-ray Fluorescence and Neutron Activation Analysis. *Contributions of the University of California Archaeological Research Facility* 5:59-79.

Thompson, J. E. S.

- 1964 Trade Relations Between the Maya Highlands and Lowlands. *Estudios de Cultura Maya* 4:13-49.

Willey, G. R., A. L. Smith, G. Tourtellot, III, and I. Graham

- 1975 Excavations at Seibal: Introduction: The Site and Its Setting. *Memoirs of the Peabody Museum of Archaeology and Ethnology, Harvard University* 13(1).