THE ANALYSIS OF CHIPPED STONE ARTIFACTS IN SOUTHERN MESOAMERICA:

An Assessment*

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INTRODUCTION

Detailed analyses of ancient stone tools, or lithic analyses, were performed by archaeologists as early as the second half of the nineteenth century in Europe, the Near East, and North America. However, it was not until the past thirty years that lithic analysis became a standard part of prehistoric research in Mesoamerica. The reasons for this belated beginning involve the dominant humanities-art history orientation toward much of Mesoamerican archaeology prior to the 1960s; the extraordinary richness, complexity, and accessibility of other cultural components (particularly architecture, hieroglyphics, ceramics, and sculpture); and the lack of quantitative dating techniques. The paucity of reliable dating techniques until quite recently led archaeologists into elaborate attempts to date the past by using a variety of subjective ordering techniques. It is therefore not surprising that, prior to the last ten years, most Mesoamerican lithic analyses had as their major objective the isolation of chronologically significant classes. These were discovered and defined at both the typological and the attribute (or modal) level of classification.

Within the past decade a gradual shift can be detected away from this overwhelming concern for chronology toward analysis for other objectives. This is not to say that chronology is not important, but it is now recognized more as a means to other ends, not as an end in itself.

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For example, lithic analysts are now using physical science techniques such as X-ray fluorescence or neutron activation to identify the source areas of the obsidian used for making the bulk of Mesoamerican cutting, piercing, and scraping tools. These data allow scholars to reconstruct actual trade networks, to determine how much obsidian in what stage of manufacture was traded from a source to a village or city. Much of the politics and economics of the competitive Classic and Postclassic state involved access to obsidian, the "black gold" of ancient Mesoamerica. The continuing development of a wide variety of physical science dating techniques has lessened the need for subjective or statistical seriation, and the demand for "chronology for chronology's sake" has waned. Dating techniques such as radiocarbon, obsidian hydration, archaeomagnetism, and dendrochronology are widely used in Mesoamerica and related areas, while techniques such as superhydration, fission track, amino acid racemization, and thermoluminescence are becoming more common.

Turning their attention toward more social, cultural, and economic phenomena, analysts are reconstructing the lithic manufacturing and distributional systems of past civilizations. Questions of how specific tools were employed in assisting a culture to adapt to its environment are being answered by use-wear studies; and quantitative analyses, often computer-assisted, are more commonplace and more successful. Sophisticated sampling strategies are employed more often to assure against biases and to reduce the number of intensively studied artifacts while maintaining standards of representativeness. In short, what used to be one of the most conservative and underdeveloped domains of Mesoamerican archaeology is now becoming one of the most productive and exciting. We can look forward to more successful combinations of physical science techniques and social science objectives and theory with quantitative and qualitative analyses by Mesoamerican lithic analysts.

Southern Mesoamerica has not been particularly fertile ground for experimentation with new approaches in lithic analysis, at least not until very recently. It was Kidder's (1947) study of Uaxactun artifacts that began a tradition of lithic analysis in the Maya area, aspects of which are still with us almost thirty years later. During the past decade we have witnessed innovative lithic analyses which have involved debitage, trace elements (source-sample attribution), behavior and manufacturing structure, microwear, replication, culture change, and adaptation. The evaluations of the chipped stone sections of major site reports summarized in table 1 were largely done in a straightforward manner. As indicated, the length of each is simply the sum of its descriptive and illustrative pages. The illustrations were judged as good (+), fair (o), or poor (-) based on whether sufficiently didactic illustrations were presented to adequately portray the sample and the variation within it. The objectives of each report, whether implicit or explicit, were tabulated in order of importance. Four objectives were found to predominate: descriptive simplification (DS), chronology (Ch), function (F), and technology (T). These terms are used as defined by Sheets (1975c: 369–70). Finally, reports were evaluated on whether all frequencies of lithic artifacts were tabulated per taxon. It is a sad commentary on the state of the field to note that barely one-half (8/17) of the site reports tabulated the frequencies of recovered and analyzed lithics.

EARLY STUDIES

Kidder's seminal study of the artifacts of Pecos (1932) was to Southwestern lithic analysis as his study of Uaxactun artifacts to Mesoamerica: they set the standards for decades. Kidder is to be credited with isolating lithics as a viable realm of analysis within Maya studies. Previously lithics were described almost as an afterthought, as a residual category of troublesome items left over after the description and analysis of the splendors of architecture, sculpture, hieroglyphics, ceramics, and so forth, had been completed. Kidder did demonstrate in his Uaxactun monograph that significant cultural information was recorded in lithics. With that we must credit him, however we might disagree with some of his specific techniques and conclusions. The Pecos artifacts were sorted initially by the degree of flaking and secondarily on the resultant form. However, Kidder (1947:4) found that this procedure at Uaxactun would result in some very disparate objects being grouped in the same category, so he added the distinction of utilitarian versus ceremonial as a higher level sorting device. The Uaxactun classification, then, used the following criteria for sorting artifacts, in order: function, material, form, and occasionally the kind of chipping.

Kidder's decision to use the utilitarian-ceremonial distinction as inferred from context for the highest level taxonomic criterion has, in my opinion, plagued lithic analyses in southern Mesoamerica for the past three decades. Occasional artifacts are clearly ritual, such as the incised "eccentric" obsidian blade segments found in stela caches. Others are clearly utilitarian, such as the scrapers with extensive edge abrasion found in domestic midden contexts. However, a vast range of Maya implements derive from less than definitive contexts, creating a need for yet a third taxon of *indeterminate* artifacts. In retrospect we can see that Kidder was trying to combine too many objectives into the same taxono-

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mic scheme. One wishes that he had followed either his own excellent Pecos example or E. Ricketson's example of a preliminary analysis of Uaxactun artifacts (Ricketson and Ricketson 1937).

Significantly enough, Kidder did avoid this distinction in his later analyses of artifacts for Zacualpa, Kaminaljuyu, and Nebaj. The Zacualpa analysis (1948) is brief, concise, and straightforward. His description of largely Classic chipped stone from Kaminaljuyu (in Kidder, Jennings, and Shook 1946:135–40), as well as the Preclassic artifacts in Shook and Kidder (1952), is notable for its interest in the technology of core-blade manufacture. He discusses the sixteenth-century descriptions of prismatic blade production recorded by Torquemada and Motolinia, as translated by J. E. S. Thompson (but see Crabtree 1968, and then Fletcher 1970 and Feldman 1971 for discussion of translation difficulties). Motolinia's account is particularly interesting for its description of the rituals accompanying prismatic blade manufacture; these are detectable archaeologically (Sheets 1974). Kidder also describes the extraordinary sixty-one "flake sequins" (p. 138), which evidently were made by punching cones from the middle of Pachuca green prismatic blade segments and then retouching to circular shapes. Replication experimentation is sorely needed on this and related southern Mesoamerican lithic technology. The third site, Nebaj, did not receive Kidder's usual standard of analysis (Smith and Kidder 1951:50–51, fig. 88). He probably is incorrect in claiming pressure flaking for the large flint bifacially flaked specimen (p. 51), and his speculation about local versus foreign manufacture readily could have been resolved by examination of debitage.

Shook and Kidder's study (1952) of Mound E–III–3 at Kaminaljuyu focuses on the Late Preclassic Miraflores phase. Mound E–III–3 is a 20m high earth fill pyramid with two extraordinarily richly-stocked tombs. The complete lack of bifacially flaked projectile points and knives (p. 113) is substantiated by the total lack of bifacial implements or debitage during the entire Preclassic at Chalchuapa. A group of six blades of andesite were retouched after removal from the core and then cached in Tomb II.

It is an interesting sidelight to note that Teobart Maler (1901) encountered Lacandon Maya who were manufacturing and using chert arrowheads at the turn of the century. His description is sufficiently detailed to reconstruct the manufacturing sequence (pp. 36–38): The chert nodule, occasionally heat-treated, is prepared and then a deer-antler punch and mallet are used to detach flakes and blades. These blanks are retouched at the proximal end for hafting by using a fragment of an old iron knife. Hafting is achieved by insertion into the foreshaft and wrapping with cord covered with a black gum. The extraordinary

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aspect of this is that Maler's description matches almost exactly some chert-tipped arrows I have seen that were purchased from the Lacandon in 1974. The Lacandon are still knapping and hafting chert arrowheads, albeit for sale, and it is urgent that their manufacturing technology be studied and recorded as soon as possible.

Although they present no photographic illustrations, only line drawings, Woodbury and Trik's (1953) description of Zaculeu chipped stone is quite good. They follow Kidder (1947) in terminology ("flake-blade," for example) but they avoid his ceremonial-versus-utilitarian distinction as the highest level sorting criterion.

W. Coe's (1959) report on Piedras Negras artifacts is amply illustrated with thirty-seven pages of plates. Although he followed Kidder's distinction, he did note the difficulties therein: "For anyone preferring sources functionally cut and dried, the presence of four choppers in a probable sub-stela cache . . . is disconcerting" (p. 11). Similarly, Proskouriakoff (1962:356) observes that "the distinction between ritual and utilitarian forms" is not clear at Mayapan, but she proceeded to use the old dichotomy anyway for some of her categories. She does note (p. 355) that what is generally called flint in the Maya area is "perhaps more properly [called] chert." Virtually all of the core-blade technology in obsidian at Mayapan was conducted with what Proskouriakoff thought was cortex (p. 367), but what more probably is a heavily abraded, ground platform surface.

MacCurdy (1900) was the earliest Mesoamericanist to note the presence of radial fissures on prismatic blades and polyhedral cores. He even tried to explain these fissures in terms of what was known at the turn of the century about conchoidal fracture and tension-resistance. His analogy between these fissures and the marginal crevasses of a glacier may not be as far-fetched as it might initially appear.

As far as I am aware the earliest experiment in the controlled replication of Mesoamerican obsidian core-blade technology to test a particular idea was performed in the early 1930s by the French flint-knapper M. Leon Coutier (reported in Cabrol and Coutier 1932). Coutier became interested in Mesoamerican obsidian technology after reading the Torquemada and the Hernandez ethnohistoric descriptions of Aztec pressure-blade manufacture. These accounts *apparently* describe the seated knapper pressing the blades off of a foot-held core by using a three-cubit-long flaking staff. Testing the feasibility of this technique, Coutier found the staff to be far too long, and he found an abraded platform far superior to a slippery unabraded platform. Coutier's consideration of the possibility of using indirect percussion for blade manufacture deserves more analytic and replicative attention than it has received to date, even though few antler or hardwood punches have been recovered in Mesoamerican sites. Future replication of core-blade technology might also consider the possibility of *pulling* the pressure blades off rather than pressing; this could be performed in the described seated position with the implement mentioned by Hernandez and Torquemada.

RECENT EXCAVATIONS

Willey's analysis of Barton Ramie lithics (in Willey et al. 1965:410–51) follows and is plagued by Kidder's functional distinction. However, the Willey-style artifact analysis is notable for its wealth of descriptive and illustrative material. Also, despite the additional expense, illustrations are interpolated within the text instead of being relegated to a section in the back of the volume as is customary. The report on the artifacts of Altar de Sacrificios is within the same tradition (Willey 1972). A minor criticism is Willey's insistence on calling his nonobsidian material flint, when even his own lithic authority, Paul Hess, identified it as chert (Willey 1972:157). Flint is a cryptocrystalline silicate containing some hydrous silica, ranging from black through gray to brown, *and flint derives from a chalk matrix*. Chert, on the other hand, is found in modular form *in limestone* (Rosenfeld 1965). Chert is generally a coarser silicate with a more poorly developed conchoidal fracture. Fortunately Willey dropped the functional distinction of Kidder in the Altar report, but this concern occasionally manifests itself at a lower level (see p. 169 and fig. 149 for examples).

Willey is to be credited for the abundance of photographic illustration in the Altar and Barton Ramie monographs, but the line drawings, as with many in Mesoamerican site reports, could stand improvement. Many drawings cannot be "read" for flake scar terminations or direction of applied force, making technological interpretation or comparison difficult if not impossible. For example, the illustration of the large stemmed bifaces from Barton Ramie (Willey et al. 1965: fig. 261b) lacks clear flake scar terminations, and indicates in two locations flakes having been removed by force applied not to the edge but to the inner face surface. This is highly unlikely. The monograph on the artifacts of Seibal is now largely complete (G. Willey personal communication Jan. 1975). The analysis will be similar to the Altar report and will focus on form, function (including a use-wear analysis by Richard Wilk), and manufacture. Trace element and "mineralogical" analyses to correlate artifacts with sources will also be included.

Coe and Flannery's (1967) innovative ecological research in the

Ocos area of Guatemala is an important contribution to paleo-anthropology, but as with so many Mesoamerican reports, chipped stone is analyzed in a few perfunctory paragraphs. The artifacts, without frequencies, are categorized as "obsidian chips," "obsidian flakes, re-touched," "prismatic blades, obsidian," and "blades with accidental burinlike blows?" Similarly, Lee Parson's (1969: 80–83, 231) study of Bilbao chipped stone artifacts is subordinated to architecture, ceramics, monuments, and other artifacts. The prismatic blade frequency is not recorded but only estimated at "several thousand" (p. 80). Might not artifacts of obsidian, a material that records so much of the economics, manufacturing, and use behavior of its owners, which are found in such high frequencies, deserve more analytic attention than this? Again, Lee's (1969) primary analytic efforts at Chiapa de Corzo were directed toward ceramic and groundstone artifacts, with the almost five hundred chipped stone artifacts being described and illustrated in only five pages. Lee does give accurate frequency tabulations for all categories.

In addition to his work at Villa Morelos (Michoacán), Oaxaca, and Tres Zapotes, all beyond the geographic scope of this paper, Tom Hester (1972, n.d.) has contributed significantly to our understanding of core-blade obsidian technology in Mesoamerica. His volume (as editor) of original and reprinted papers on Mesoamerican lithics should appear soon in the *Contributions of the University of California Archaeological Research Facility* series (Hester personal communication 1975). Hester (1973) also has contributed to our understanding of the reuse of polyhedral cores exhausted in the production of prismatic blades. The Classic Maya often rechipped blade cores into "eccentric" artifacts for ritual caching, which helps explain why there are so few obsidian cores at many Maya sites. This apparent lack of cores has led to the erroneous idea that the prismatic blades found in Maya sites were manufactured elsewhere and then traded into the lowland Maya centers. Hester, in his article, focuses upon a fragment of an exhausted polyhedral core which subsequently was used for a rubbing purpose, likely as a pottery smoothing tool.

The first analysis of obsidian implement manufacture and use and obsidian procurement at the site of Tikal has now appeared (Moholy-Nagy 1974). Among the interesting results are that 1.6 percent of the Tikal obsidian is green, which compares with 2 percent of Tonina and 0.2 percent of Chalchuapa prismatic blades (0.05 percent of all obsidian artifacts). All green obsidian traded for long distances in Mesoamerica evidently derives from Pacucha, southern Hidalgo. It is interesting to note that no gray obsidian from central Mexico was traded to Tikal; all gray obsidian analyzed to date derived from sources in the Guatemalan highlands. The fact that obsidian is found throughout Tikal, in elite as well as commoner habitation areas (p. 7), undermines Sidry's (1974) assertion that obsidian implement utilization was restricted to the Classic Maya elite.

A general description and synthesis of the Becan lithic analysis has recently been published by Rovner (1974a). I wish Rovner were correct in stating that "black-streaked obsidian probably originates in Guatemala, clear to milky-gray obsidian probably in central Mexico south of Mexico City," for this would obviate the need for detailed trace element analyses if sources could be characterized macroscopically. However, Ixtepeque, in southern Guatemala, yields obsidian varying from uniform light gray to a streaky black to a deep red mottled with black. Two of these varieties have been observed in a single nodule of Ixtepeque obsidian. On the positive side, Rovner's description of chert and green obisidian implements and their implications are significant contributions. Also, Rovner's (1974b) description of Mayapan lithics is a good example of the common lowland Mesoamerican obsidian technology involving the importation of prepared macrocores and maximization of material by the use of recovery and rejuvenation techniques. The "anomalous core with dome-shaped distal end" is the result of a yet-enigmatic rejuvenation procedure; similar specimens from southern Veracruz have been examined by Don Crabtree, Paul Katz, and myself. Replicative experimentation is sorely needed. Rovner (1975) has presented an intriguing overview of his lithic analyses of Becan and Dzibilchaltun lithics, put in the framework of two proposed trading spheres in the Maya lowlands. In addition to Rovner, Newell Wright (personal communication 1975) is conducting a lithic analysis of Becan artifacts. Wright, presently at the University of South Carolina at Conway, is focusing on a formal and functional analysis of lithic implements.

The analysis of the thirty-seven thousand chipped stone artifacts from Chalchuapa, El Salvador, was based on the assumption that ancient manufacturing behavior was recorded on lithic implements and debitage, and that the analyst can interpret these attributes (Sheets 1974). Hence, the order of taxonomic criteria differs from most Mesoamerican lithic analyses, emphasizing the technology of manufacture first, and then secondarily considering chronology and other criteria. The theoretical basis and implications are discussed in a recent article (Sheets 1975c).

Jay Johnson, at Southern Illinois University, is involved in an analysis of the nonceramic artifacts of Palenque and thirty-three neighboring sites collected between 1951 and the present (personal communication 1975). The collection includes 992 obsidian artifacts, of which 855 are prismatic blades, and 108 chert artifacts. Johnson's technological analysis is yielding insights into lithic production; for example, he is able to use variation in lateral fissure location to reconstruct the sequence of blade removal from cores. He also is conducting a microscopic examination of wear patterns on obsidian and chert artifacts, and he is beginning a trace-element analysis of obsidian to investigate the aboriginal trade network. His dissertation has just become available (1976).

Sidrys (1974) conducted an ambitious analytic scheme to determine the structuring of the Classic Maya obsidian trade. His finding that the large regional centers, such as Tikal, have approximately five times the amount of obsidian per capita as the smaller sites is significant and appears to be justified by the data. However, his assertion that obsidian was an elite material is not supported by the voluminous data from Tikal (Moholy-Nagy 1974). More studies of this nature are needed, and surely will be forthcoming in the next few years.

According to Nicholas Hellmuth (personal communication 1975) the Yaxha obsidian is being studied by Ray Sidrys at UCLA, and the "flint" by Jay Johnson. The analysis of the Tonina (Chiapas) lithics by Claude Baudez (personal communication 1975) has been completed but has yet to be published. Baudez notes that about 2 percent of the obsidian is green, and that no green obsidian cores have yet been found. From these data he infers that green obsidian blades may have been imported into Tonina already manufactured. Although I doubt that many prismatic blades were traded readymade in Precolumbian Mesoamerica, this is at least a possibility with regard to the green obsidian, and should be examined closely in future research. Similarly at Chalchuapa we found green prismatic blades but no cores. However, the lack of green cores should be considered anomalous (indicative of trade of already-manufactured prismatic blades) only at sites where well over four hundred green prismatic blades and no cores have been recovered.

PALEO-INDIAN (EARLY MAN)

The attempt to find significant Paleo-Indian sites in Southern Mesoamerica that date to the Terminal Pleistocene has not been notable for its consistent successes. For example, Longyear (1948) excavated some chert and obsidian artifacts at Copán. These were associated with abundant charcoal and a probable hearth, located stratigraphically inferior to a deposit of river clay and Classic architecture and artifacts. Lacking extensive excavations and chronometric dating, it is unknown whether these lithics derived from an Early or Middle Preclassic workshop or from an earlier society. Insufficient description or illustration is presented to make meaningful stylistic or technological cross-ties with nearby well-dated materials.

William Coe (1955:271–73) critically examined two earlier discoveries claimed to be Paleo-Indian, at Concepción in Campeche and in the Guatemalan Petén. Coe argues that even though these specific stone tools were relatively crude in manufacture and were not found in association with ceramics, that is not sufficient evidence to judge them as Preceramic. Rather, in terms of technology and style, they are duplicated by Classic Maya chert implements from various localities in the lowlands. It is likely that Coe's interpretation is correct, and that these sites represent isolated Preclassic or Classic lithics. MacNeish, in the search for continuous stratified deposits from Paleo-Indian through Postclassic containing evidence of plant domestication that eventually led him to Tehuacán, did conduct excavations of stratified cave sediments in western Chiapas (MacNeish and Peterson 1962). Judging from the cultural materials and radiocarbon dates, Paleo-Indian material is scarce, and most of the Preceramic material recovered is Archaic.

Dennis Puleston (1974) has been working since 1973 on an enigmatic lithic site in Belize called Richmond Hill. The site (or sites) is located in gently rolling terrain, and extends virtually continuously for at least 5 km (!). The chert tools are extremely crude and quite patinated. Excavations divulged a number of strata, at least one of which appears to be a prepared floor containing possible hearths. No ceramics, projectile points, or other Mesoamerican Neolithic diagnostics were associated. Further fieldwork is critical at this point to find unequivocal features and chronometric dating of features and artifacts. Arlene Miller of Washington State University is presently conducting a detailed microwear analysis of the Richmond Hill lithics (personal communication 1975). She reports some difficulty in achieving unanimity with other lithic specialists in discerning which of the specimens are artifactual and which were fractured by natural processes. She is considering edge damage units initially independently from other formal and functional characteristics. These data will be statistically analized to determine the nature and degree of clustering.

Another attempt at discovering and describing pre-Neolithic chipped stone artifacts in southern Mesoamerica is that of M. Coe and K. Flannery (1964). They collected obsidian artifacts from the massive El Chayal quarry-workshop near Guatemala City. Because they found no ceramics or prismatic blades, two hallmarks of the Mesoamerican Neolithic, and because the bifaces bore some stylistic resemblance to North American Archaic forms, they concluded their materials probably dated to the Archaic. However, new data from Chalchuapa (Sheets 1974, 1975) and from Kaminaljuyu and El Chayal (Michels 1975) indicate a date in the Late Classic and Postclassic.

Stone (1972:19–20) presents a useful summary of identified Paleo-Indian projectile points (and knives?) in Central America, including the obsidian Clovis Point from San Rafael (highland Guatemala—cf. M. Coe 1960) and Clovis Points from Costa Rica and Panama. The latter are found in the same area, Madden Lake, where Fish Tail Points have been found. Fish Tail Points are characteristic of Early Man in South America.

LOWER CENTRAL AMERICA

Lithic analysis in the Intermediate Area is most developed in Panama, largely due to the efforts of Anthony Ranere and Olga Linares. Summaries of the various seasons, including description and interpretation of lithic implements, are available (Linares and Ranere 1971; Linares, Sheets, and Rosenthal 1975) and the preparation and publication of the full report is progressing well. Other descriptions and illustrations of Panamanian Archaic (Preceramic) artifacts are presented by McGimsey (1956), and early ceramic or Formative lithics by Willey and McGimsey (1954), Linares (1968), and Ranere (1975).

Richard Magnus (personal communication 1975) has been conducting excavations along the Caribbean coast of Nicaragua and in the central (Chontales) portion of Nicaragua. He reports encountering much lithic debitage in both locations, and some "very elaborate projectile points and chipped stone tools" from the Chontales area. Andrea Gerstle, of the University of Colorado, is presently conducting a detailed technological and functional analysis of these central Nicaraguan lithics.

OTHER APPROACHES

Numerous articles have dealt, in whole or in part, with trace element analyses (X-ray fluorescence or neutron activation) of southern Mesoamerican source and site materials (Stevenson, Stross, and Heizer 1971; Graham, Hester, and Jack 1972; Stross et al. 1968; Jack and Heizer 1968; and Hester n.d.). Some considerations of trade routes and exchange systems based on these trace element analyses are now appearing (Hammond 1972; Sidrys 1974; Parsons and Price 1971). Two syntheses exist of artifacts (including lithics) from the Maya area, both published in the *Handbook of Middle American Indians*—that by W. Coe (1965) for the Maya lowlands and that by R. Woodbury (1965) for the Guatemalan highlands. In these, the coverage of chipped stone implements is relatively slight—approximately five and two pages, respectively. Two authors have recently concerned themselves with the topic of lithic occupational specialization in the Maya Classic (Adams 1970:497, and Becker 1973:398–99), but both reports are exceedingly brief. This is an area that needs considerable further research.

The report by Graham and Heizer (1968) on the Papalhuapa quarry-workshop is a contribution to the neglected subarea of early processing (early stages of reduction technology) of Mesoamerican lithics; it is unfortunate that they were not able to complete their planned term of fieldwork because of political unrest. One interpretation, based on their data, is that the Classic Maya established Papalhuapa as a means to control and exploit the Ixtepeque obsidian sometime near the middle of the Classic period in order to circumvent the Teotihuacán attempt at an obsidian monopoly (cf. Esperanza Kaminaljuyú).

CONCLUSIONS

The predominant objectives of early lithic analyses in southern Mesoamerica (beginning in the 1940s) were chronology and simplification of description and illustration by creating types of similar-appearing artifacts. However, lithic analysis was understandably far subordinated to the other more visually spectacular categories of architecture, sculpture, polychrome ceramics, and hieroglyphics. It is incumbent on Mesoamerican lithic analysts to demonstrate the wealth of cultural, social, and adaptive information that can be extracted from the past by lithic analysis. Fortunately, this demonstration has begun and we are witnessing a shift from a concern for typological-stylistic analyses to more focused studies of function, technology, and adaptation as lithic analysis becomes a productive research domain in its own right.

In the future, we can expect to see lithic analyses of improving descriptive and illustrative quality in site reports and in individual articles. Lithic analysts are broadening their techniques and emphases to include debitage, trace-element, microwear, and behavioral analyses. I would predict a considerable increase in focused studies regarding the application of innovative techniques to the study of social process and adaption. For example, trace-element analysis for attribution of archaeological samples to sources is beginning to be used for regional studies of trade. These must be intensified and broadened in scope to include also the loci of preforming and later stages of manufacture, occupational specialization, territoriality and the access or "ownership" of resource areas, politico-economic expansion and the formation of cartels, and the internal redistribution network of manufactured implements.

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Also needed is a standardization of terminology, not only at the typological level, but also in terms of petrography, attributes, and technology. Terminological standardization is essential for clear communication, and this has been achieved (or at least approximated) in other domains, such as ceramics, by holding conferences of specialists. The conference on Mayan lithics, held in Belize in April 1976 and chaired by Norman Hammond, is a significant first step toward conceptual and terminological standardization. The conference proceedings are available from the Center for Archaeological Research, University of Texas at San Antonio, in a volume edited by Tom Hester.

Urgently needed is an ethnoarchaeological study of contemporary Lacandon knappers and their apparent core-flake reduction strategy for the production of chert projectile points. Replication studies are necessary on various facets of aboriginal core-blade technology in obsidian in highlands and lowlands, as well as lowland chert technology.

In summary, even though lithic analysis traditionally has not been a major research domain in Mesoamerica, we are beginning to understand its potential in helping to discover what aboriginal peoples were doing, why they were doing it, and why they changed. With the emergence and increase of innovative approaches to lithic analysis being articulated with social and ecological pheomena, we can expect to witness lithic studies changing from a sidelight to playing an integral role in Mesoamerican prehistory.

TABLE 1 Lithic Analyses in Site Reports

Reference	*Site*	*Length*	*Illus.*	*Objectives*	*Frequencies?*
Coe 1959	Piedras Negras	59	+	DS, Ch	Yes
Coe and Flannery 1967	Ocós-Salinas La Blanca	3	–	DS, Ch	No
Kidder 1947	Uaxactun	38	+	DS, F	No
Kidder 1948	Zacualpa	5	+	DS,F	Yes
Kidder, Jennings, and Shook 1946	Kaminalijuyú	7	o	T, DS, Ch F	No
Lee 1969	Chiapa de Corzo	5	o	DS, Ch	Yes
Longyear 1952	Copán	5	o	DS, Ch	No
MacNeish and Peterson 1962	Santa Marta	9	o	Ch, DS, T	Yes
Parsons 1969	Bilbao	4	–	DS, Ch	No
Proskouriakoff 1962	Mayapan	29	+	DS, Ch	Yes
Ricketson 1937	Uaxactun	13	o	DS, T	No
Sheets 1974	Chalchuapa	78	+	T, Ch, DS, F	Yes
Smith and Kidder 1951	Nebaj	3	o	DS	No
Wallrath 1967	Tehuantepec	6	–	Ch, DS	No
Willey 1972	Altar de Sacrificios	63	+	DS, Ch, F	Yes
Willey et al. 1965	Barton Ramie	41	+	DS, Ch, F	Yes
Woodbury and Trik 1953	Zaculeu	6	o	DS, Ch, T, F	Yes

KEY: DS = Descriptive simplification, Ch = Chronology, F = Function, T = Technology

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TABLE 2: Articles and Manuscripts

Reference	*Site or Area*	*Comments*
Andrews and Rovner 1973	Yucatan	Tool kits from two masons' caches in N. Yucatan
Barnes 1947	Mesoam.	Obsidian core-blade technology
Cabrol and Coutier 1932	Mesoam.	Technological analysis and replication
W. Coe 1955	Maya	Critique of Paleo-Indian evidence in Maya area
W. Coe 1957	Cent. Am.	Stemmed macroblade dates and distribution
Crabtree 1968	Mesoam.	Description of core-blade manufacturing technology
Feldman 1971	Mesoam.	Critique of Fletcher (1970) and Crabtree (1968)
Feldman 1973	Mesoam.	Ethnohistoric data on aboriginal lithics
Fletcher 1970	Mesoam.	Critique of ethnohistory of Crabtree (1968)
Graham and Heizer 1968	Papalhuapa	Quarry-workshop of Ixtepeque obsidian, Mid-late Classic period
Graham et al. 1972	Seibal	Sources of obsidian used at Seibal
Hammond 1972	S. Mesoam.	Obsidian trade patterns
Hester n.d.	Beleh, Guatemala	Analysis of Postclassic implements
Hester 1972	S. Mesoam.	Macrocores and core-blade technology
Hester 1973	Mesoam.	Exhausted polyhedral core reuse
Jack and Heizer 1968	S. Mesoam.	Source-sample attributions
Linares 1968	Chiriquí	Culture history of W. Panama
Linares and Ranere 1971	Panama	Lithics and adaptation to tropical rainforest
Longyear 1948	Copán	Lithic workshop, probably Preclassic, possibly earlier

Table 2 (con't)

Reference	*Site or Area*	*Comments*
Linares, Sheets, and Rosenthal 1975	Panama	Lithics and adaptation to highland microenvironments
McGimsey 1956	Cerro Mangote	Archaic lithics on Panama Pacific coast
MacCurdy 1900	Mesoam. (N)	Early technological analysis of obsidian core-blade technology
Maler 1901	Lacandon	Lacandon Indians making chert arrowheads
Moholy-Nagy 1974	Tikal	Preliminary analysis of 28,000 obsidian artifacts
Puleston 1974	Richmond Hill (Belize)	Possible Early Man site, curious stratigraphy
Ranere 1975	Panama	Technology and function of preceramic lithics
Rovner 1947a	Becan	Summary of lithic analysis at Becan
Rovner 1947b	Mayapan	Later stages of obsidian core-blade technology
Rovner 1975	S. Mesoam.	Two competing lowland trade spheres proposed
Sheets 1972, 1973	Chalchuapa	A model of core-blade manufacturing technology
Sheets 1975b	Xinca (Guatemala)	Lithic analysis of Xinca sites, Southeast Guatemala
Sheets 1976	Sabana Grande (Guatemala)	Analysis of Late Classic and Post-classic obsidian artifacts
Sidrys 1975	Maya	Obsidian trade of the Classic Maya
Stevenson et al. 1971	S. Mesoam.	Source-sample attributions
Stross et al. 1968	Maya +	Source-sample attributions for miscellaneous Mesoam and No. Am. sites
Willey and McGimsey 1954	Monagrillo	Early Formative on Panama Pacific coast

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