RESOURCE DIVERSITY IN BELIZE AND ITS IMPLICATIONS FOR MODELS OF LOWLAND TRADE

Elizabeth Graham

The data presented here, by providing examples of resource diversity in Belize, add support to the current consensus that a basis indeed exists in the Maya Lowlands for placement of research emphasis on elucidating patterns of local or intercommunity exchange as a step toward understanding socioeconomic integration. The point also is made that any generalized model of exchange will fail to shed light on lowland integration unless patterns are defined for exchange that operated at the local or inter-community level. It is suggested that these patterns be sought against a backdrop of differential resource distribution.

The old habit, criticized by Covich (1978:155), of simplifying the lowland environment and ecological change has largely been broken, and it is the recognition of environmental diversity that has been the stimulus behind various approaches to field research (Ford 1981; Graham 1983; Hammond 1975; D. Rice 1978; D. Rice and P. Rice 1980, 1984; Siemens 1978; Turner 1978; Turner and Harrison 1983). Where larger questions such as the rise of civilization or the role of trade are considered, we are only beginning the process of building an understanding of lowland integration that is based on other than environmental simplification, and it is difficult to break away from the lowland environmental generalizations that have been conspicuous in past theories (Cowgill 1962:275; Flannery 1972a:407; Parsons and Price 1971:170–171; Rathje 1972; Sanders and Price 1968:129; Tourtellot and Sabloff 1972:126, 132). Our models and methods have been changing rapidly (e.g., Dillon 1977; Ford 1981; Fry 1980; Lee and Navarrete 1978; P. Rice 1978; Sanders 1977; Voorhies 1972, 1982) but the perception of the habitable lowlands as a single biome still occasionally surfaces as a concomitant of generalization (see Price 1982:729).

To a great extent the nature of any given characterization of the lowlands is largely a matter of scale (Blanton et al. 1981:173). That is, where cultural or evolutionary patterns are at issue, detail perforce is minimized and reliance is placed upon the generalization, more apparent than real, that lowland geography presented little in the way of barriers to integration, or that resource diversity played only a supporting role in acting as a stimulus to integration.

As Blanton et al. (1981:173) have noted, "When the scale of observation is changed, different patterns of environmental diversity emerge." In presenting the following resource data from Belize, I hope to illustrate that just such a change in the scale of observation brings environmental diversity to the fore as a factor to be considered in the prehistoric integration of Maya communities in the eastern lowlands. I suggest, furthermore, that generalizations formulated to illuminate the process of exchange in the Maya area must be aimed not at accounting for phenomena perceived in terms of dichotomies such as "differentiated vs. undifferentiated," "highlands vs. lowlands," or even "core vs. buffer," but at elucidating patterns of resource utilization on a restricted scale with a focus on intra and intercommunity exchange. What has been termed local trade is important not only in the reconstruction of localized exchange systems, but also ". . . in illuminating socioeconomic mechanisms important in the study of cultural process" (Arnold 1980:149).

Elizabeth Graham, Department of New World Archaeology, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario, Canada M5S 2C6

American Antiquity, 52(4), 1987, pp. 753–767.

In an attempt to emphasize the importance of studying environmental variability on the local level as a step toward generalizing about socioeconomic integration, I discuss areas I have studied in Belize in order to bring resource diversity to the fore as a factor to be considered in understanding lowland integration. I do not attempt to theorize about interregional integration, but it is my hope that the data on some aspects of resource diversity presented here will go a little way toward emphasizing the importance of understanding relationships between individual communities and the land around them before generalizing about interregional dependency or probable routes of trade.

RESOURCE DIVERSITY IN BELIZE

The importance of the differential distribution of resources in the Maya Lowlands is not now generally debated. Where local resource availability is not considered, inferences drawn from the supposed exotic nature of materials lose their basis in fact. The term "exotic" has been of some utility in discussions of trade patterns when used to refer to items or materials that any given community cannot obtain locally (Tourtellot and Sabloff 1972:126). However, the term seems sometimes to be given the meaning ascribed to "Functional" by Tourtellot and Sabloff (1972:128), as in the case of Cerros in northern Belize, where "exotics" include *Spondylus* shell, coral, pumice, and hematite (Freidel 1979:41–42). The first three of these items can be obtained along Belize's coast, and the last is common at least from the Belize Valley southward, although it may not be obtainable in Cerros's peninsular vicinity. It is clear in this case, and is a caveat for others, that the distance thought to have been traveled to obtain goods and materials needs to be reckoned more carefully in light of local and regional resource distribution in Belize.

Differentially Distributed Rock Types and Minerals

Some minerals that have been regarded as exotic to the lowlands are differentially distributed throughout central and southern Belize. Pyrite and hematite, for example, are distributed throughout the three major granitic intrusions: the Mountain Pine Ridge Batholith, the Cockscomb Batholith, and the Hummingbird granites (Shipley 1978) (Figure 1); but only pyrite, and not hematite, is common in the volcanics of the southern Maya Mountains (Druecker 1978:56, 58) (Figure 2). Pyrite occurs in highest concentrations in the argillites of the southwest Maya Mountains in the area of the Ceibo Chico-Chiquibul drainage (Thoreson 1978:2–5) (Figure 2). Sites in the area, such as Caracol, may well have exploited this resource for exchange as a raw material or crafted product. In addition to the minerals and various sorts of granites that characterize the batholiths, phyllites, quartzites, quartz conglomerates, schist, slate, and shale occur in diverse areas throughout the Maya Mountain formations.

It is critical to note, however, that the lowland Maya need not always have tapped rocks and minerals at their sources. At Quirigua, for example, obsidian seems to have been obtained from alluvial gravels along the Motagua River (Stross et al. 1983:334). The rivers and streams that drain the Maya Mountains to the north, south, east, and west carry boulders and their weathered products for various distances downstream. Therefore not only minerals but granites, slate, and other rocks used by the Maya in construction or for tool manufacture can be found along the lower reaches of waterways. This is a notable feature of both the Stann Creek and Toledo Districts, where the distance from the mountains to the sea is relatively short. However, even the inhabitants of the upper Belize Valley would not necessarily have had to journey to the Mountain Pine Ridge to find suitable materials for manos or metates, since these materials work their way downstream and can be found along the lower Macal and Mopan Rivers (Figure 3).

Though the rivers and creeks can be viewed as sources of raw materials in the lowlands, obviously not all materials were everywhere present in all rivers and streams. Some rivers, such as the Macal on the western flank of the mountains and the Swasey Branch on the east, drain areas of more diverse parent materials than do others (Wright et al. 1959) (Figures 2, 3). Slate and shale are abundant along the Sittee River and Big Creek (Figure 2). Along the waterways that drain the northern and eastern flanks of the mountains, hematite can be found in chunks in the sand or

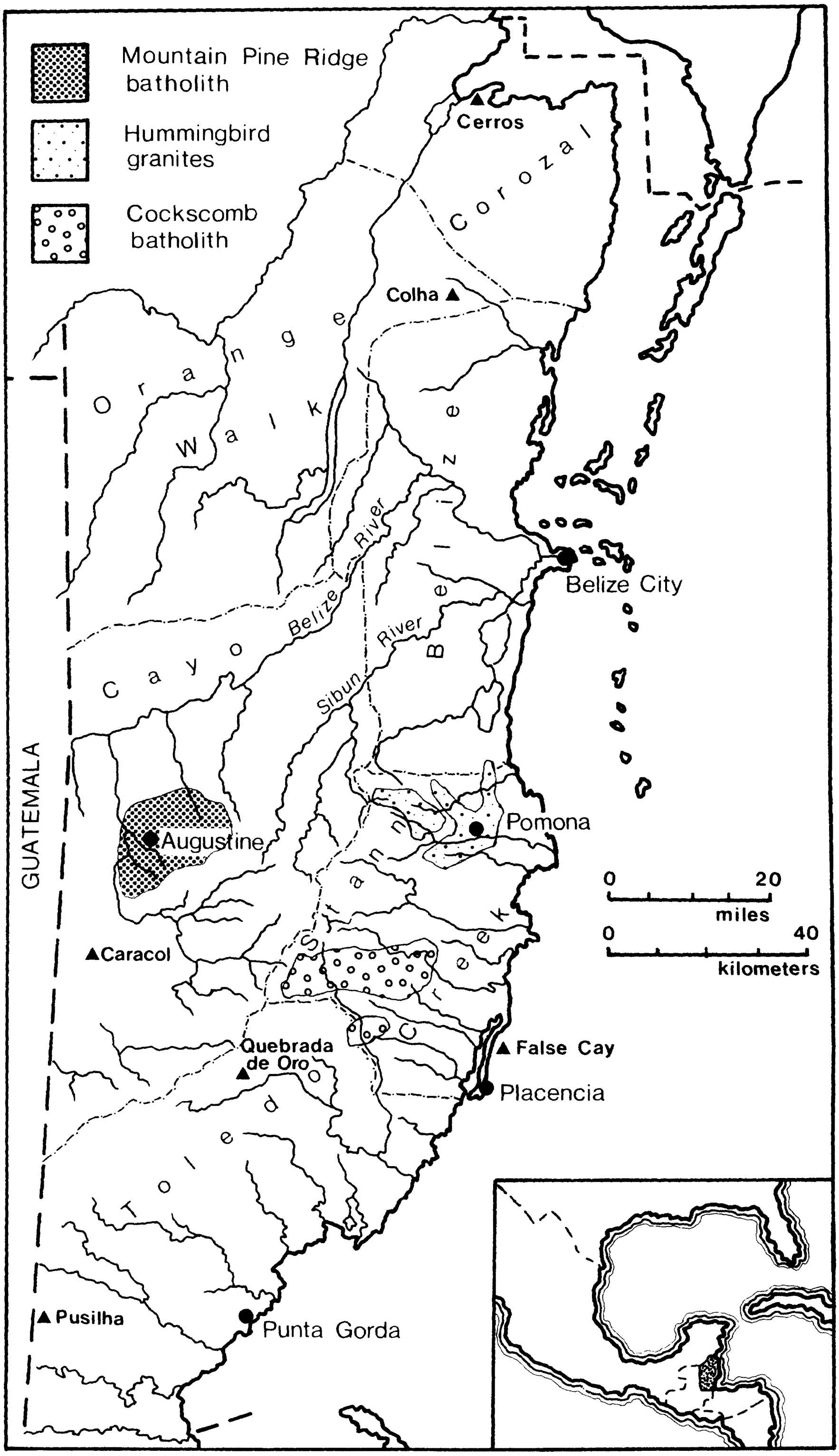

Figure 1. Map of Belize showing granitic intrusions and sites mentioned in text. (Adapted from Shipley 1978: Figure 2.)

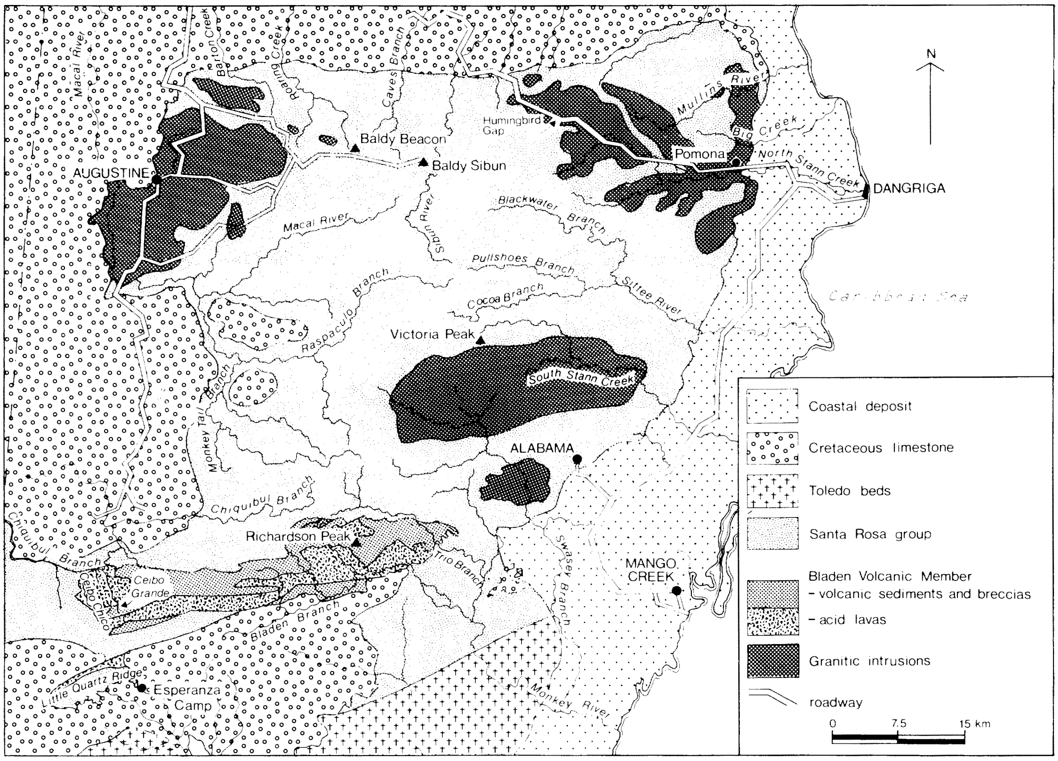

Figure 2. Geology of the Maya Mountains. (Adapted from Hall and Bateson 1972:Figure 1, and Dixon 1956 geological map of Southern British Honduras.)

embedded in the clays; however, iron minerals are particularly well developed along the numerous faults in southern Belize (Andrews-Jones, personal communication to Graham 1979) (Figure 3) and it is in these locations that we should look for possible larger-scale extraction of iron pigments for use in slip and paint production.

Granite is widely distributed in central and southern Belize, but different types of granite can be found at different locations. Not only can the three major granitic bodies be differentiated from each other by mineralogy and texture (Shipley 1976:11), but the batholiths themselves comprise different rock types (Shipley 1978), and common throughout the Maya Mountains are "smaller satellitic granitic bodies, each with its own distinctive texture and mineralogy" (Muncaster 1976:9). An entire thesis has been devoted primarily to the distinctive makeup of the Mountain Pine Ridge granites (Shipley 1978). At least four rock types make up the Hummingbird granites (Muncaster 1976:11), an area which extends from Mullins River to the North Stann Creek Valley (Figures 1, 2). Muscovite granites, with minor biotite components, outcrop in this area, whereas biotite granite, with minor muscovite, is distinctive of the Cockscomb Basin (Shipley 1978:38, 41). Except for a small outlier of muscovite granite porphyry to the southeast of the main body, the Mountain Pine Ridge Batholith lacks muscovite granite entirely (Shipley 1976:6, 1978:20–23).

One obvious implication of the foregoing example is that the raw material of manos or metates of muscovite granite can be traced specifically to sites in the area of the North Stann Creek Valley and Mullins River. Petrographic analyses of thin sections of four manos from Uaxactun revealed that their material is identical with quartz monzonite outcrops in Belize that occur on the north and south margins of the Mountain Pine Ridge, and in an area just southwest of Pomona, in the North Stann Creek Valley, where it outcrops mainly in stream beds (Shipley and Graham 1987). Another mano from Uaxactun and three from Seibal were found to be made of a coarse-grained

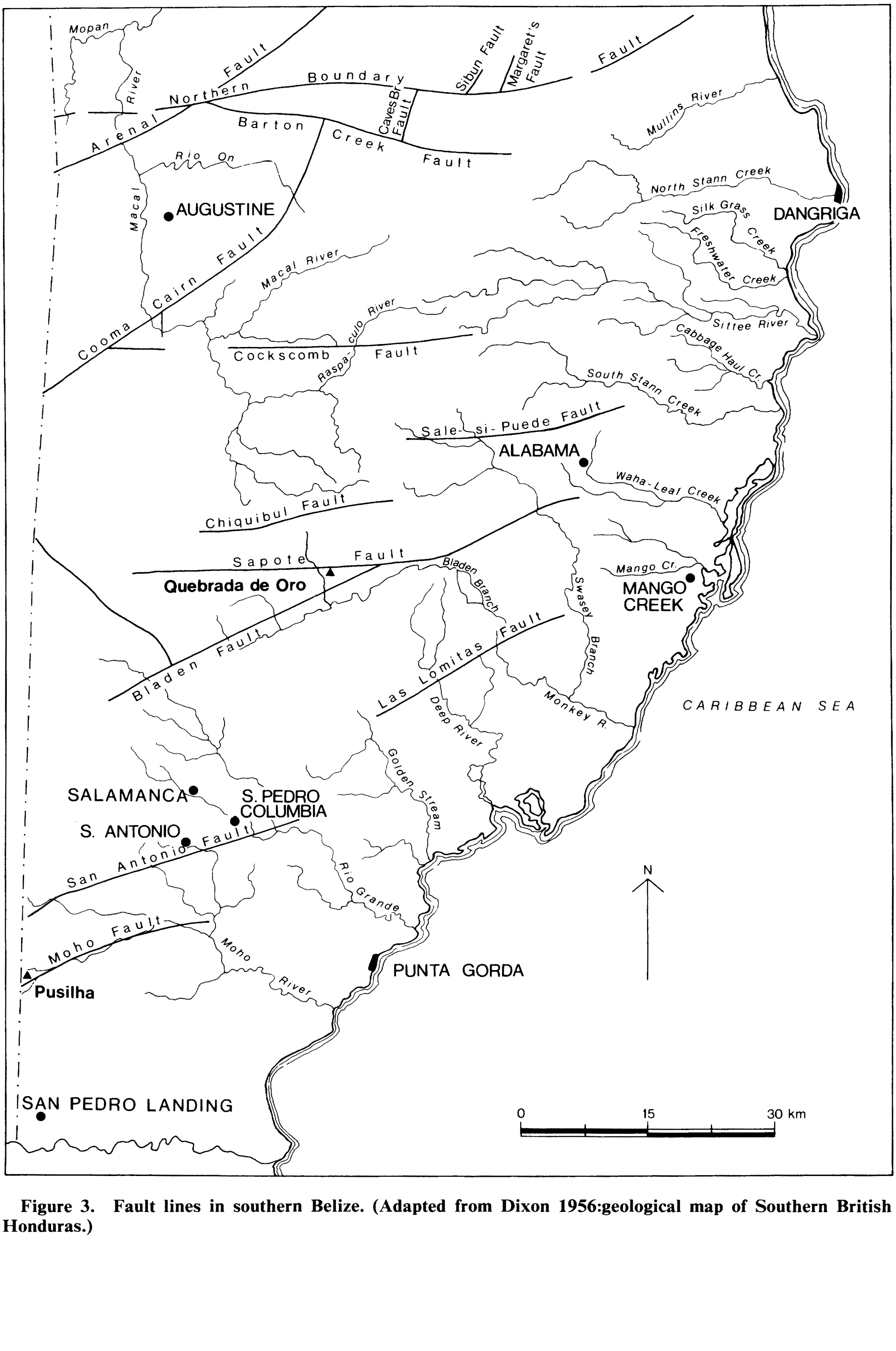

Figure 3. Fault lines in southern Belize. (Adapted from Dixon 1956:geological map of Southern British Honduras.)

granite that is found in the central portion of the Mountain Pine Ridge Batholith, mostly east of Augustine (Figure 2), an area drained by the branches of the Macal River.

The granites of Belize are important not just because they provided the raw material for tool manufacture. Of equal significance is the inference that, because clays weathered from the granites have distinctive properties and profiles, pottery made from the clays and any tempering material obtained are potentially traceable to their source areas (see Bishop 1980).

Because the Maya need not always have tapped rock types at their sources and probably acquired materials along creek and river beds, identification of a geologic source area necessitates inclusion of the rivers or creeks that drain the area, the sites that occur along the waterways, and the outcrop itself as a general "supply zone." In conjunction with other artifact data, petrographic analysis such as that carried out on the Seibal and Uaxactun material should permit recognition of communities that were part of particular distribution networks and help define the nature of trade among them.

Materials of More Restricted Distribution: Alabaster, Albite, Copper, Gold

Besides the various sorts of stone whose distribution as manufactured items may relate to routes to and from supply-zone communities, there are materials of more restricted distribution such as alabaster, albite, copper, and gold which, though they are reported from Belize, are not yet known to have been extracted in ancient times. Traces of copper and gold are not uncommon in many parts of southern Belize, but anomalies of any significance occur only in a few places.

Members of the Survey Department of the Belize government located and sampled an alabaster outcrop near the Salamanca base of the British Forces not far from Punta Gorda in the Toledo District, and provided samples to the Department of Archaeology in Belmopan. Another source was located in 1984; details are on record and samples are stored in the Ministry of Natural Resources, Office of the Petroleum Geologist, Belmopan. The ancient Maya apparently valued alabaster; carved alabaster rodents were recovered from Burial 195 at Tikal, and alabaster was found along with pearls, pottery, and Pacific shells at the same site in Burial 116 (Coe 1967:50, 33).

Albite is reported to be present in the biotite dacite flow that occurs near the southern bend of the Trio Branch of the Monkey River (Druecker 1978:26–28). The Trio Branch drains the Bladen Volcanic Series, which forms the southern range of the Maya Mountains (Figure 2). Albite also has been noted in deposits of metamorphosed volcanic rocks in the southwest Maya Mountains in the area of the Ceibo Chico-Chiquibul drainage basin (Thoreson 1978:2), and possible albite was observed in the Little Quartz Ridge (Shaffer 1976:4) (Figure 2). The geologists who reported these occurrences were conducting surveys geared to the location of economically useful minerals in Belize; as a result, albite and other economically uninteresting minerals were given only passing notice. However, Shaffer (personal communication to Graham 1976), who surveyed the Little Quartz Ridge, stated that the possible albite deposit he had encountered, which the demands of the survey prevented him from examining in detail, warranted reexamination and sampling in light of its potential as a "jade" source exploited by the ancient Maya.

Copper anomalies have been reported in several areas of southern Belize. The most significant samples are from the Toledo District not far from Pusilha near San Pedro Landing (Figure 3), and at the confluence of a right bank tributary with the Sibun River not far from Baldy Sibun (Figure 2) on the northern flank of the Maya Mountains (Bateson and Hall 1970:12; Cole and Andrews-Jones 1978). None of the discoveries of the anomalies seems to have led to the location of mineralized veins with the potential for modern economic exploitation. It remains to be determined whether the ancient Maya could have exploited the copper in any form.

Surveys in Belize have yielded trace quantities of gold from the Mountain Pine Ridge, Mullins River, Esperanza, Punta Gorda, San Pedro Landing, the Macal River, Raspaculo Creek, tributaries of the Rio Grande, and the Chiquibul-Ceibo drainage (Bateson and Hall 1970:12; Cole and Andrews-Jones 1978) (Figures 1–3). Nuggets of gold at least 1 $cm^2 \times .5$ cm thick have been recovered from the Rio On (Duncan Derry, personal communication to D. Pendergast 1969) (Figure 3). Though reports seem to be unanimous in concluding that there is little potential for even a small mining industry for modern exploitation in Belize, it has been suggested (Bateson and Hall 1970:13) that mining of alluvial gold be undertaken by small-scale independent prospectors. Apparently small-scale mining from placer and vein gold deposits has been carried out in areas of western Belize near the Guatemalan border in modern times (Muncaster 1976:4). Therefore it is possible that the Maya exploited gold in Belize in ancient times, though there is no evidence that suggests knowledge of metallurgical techniques on their part. The possibility remains to be explored by detailed archaeologically-oriented investigations of the areas around sites such as Pusilha, Caracol, or Quebrada de Oro, which are situated in areas where gold anomalies have been reported.

Volcanic Ash and Pumice

Volcanic ash, which was used by the lowland Maya for pottery temper (Kidder 1937; Shepard 1939:251–257; Simmons and Brem 1979), has been classified most recently as an exotic from highland sources (Simmons and Brem 1979:85, 90). Simmons and Brem (1979:84–85) consider the possibility that sources of volcanic ash used by the Maya are present in Belize. However, their only sample of ash from Belize, derived from a lens in the Orange Walk District, can be seen in light of recent geological research to be too restricted for comparison. Ash deposits from southern Belize need to be sampled and examined before Belize can be ruled out as a source area for some types of volcanic ash temper.

Welded tuff is reported to lie south of the Mountain Pine Ridge Batholith (Shipley 1978:31) and layers of volcanic ash (ash-flow tuffs, air-flow tuffs, and tuffaceous sandstones) are abundant throughout the outcrop of the Bladen Volcanic Series (Bateson and Hall 1971; Druecker 1978; Hall and Bateson 1972) (Figure 2). This confirms Wilson's 1886 observation, noted by Shepard (1964:251) and Thompson (1970:142, fn 1), of the occurrence of ashy deposits along the Rio Trio (Trio Branch of the Monkey River) which drains the Bladen Volcanics. Ash beds also occur in the coastal sediments, particularly in the Punta Gorda region near San Pedro (Andrews-Jones, personal communication to Graham 1979). The presence of various types of volcanic ash deposits in Belize does not rule out highland-lowland long-distance trade; pottery of the northern lowlands may still prove to have been tempered with ash imported in bulk from the highlands, as proposed by Simmons and Brem (1979). However, the suggestion that foreign sources provided the ash for pottery from sites in the Peten and Belize (Simmons and Brem 1979:85) needs to be reassessed. Cross-cultural data presented by Arnold on distance to temper resources (1985:51–52, table 2.2) indicate that tempering material seldom comes from more than 6–9 km from a community, with the majority of communities obtaining temper at a distance of 1 km or less. Though access to the Caribbean probably facilitated transport in the lowlands, Arnold's data make it practicable to reconsider Belize as a possible source area for volcanic ash temper. Ford's (1985) study of volcanic ash tempering in ceramics of the Central Maya Lowlands is a major step in this direction.

Pumice, used by the prehistoric lowland Maya for fishing floats (Freidel 1978:250; Graham 1983: 701–702; McKillop 1984:figure 6) and perhaps also crushed for pottery temper, is exotic in the sense that it is not formed in the lowlands. However, it is abundant on the cays and in the mangrove swamps along the mainland coast of Belize, and it is used today to soften skin and scrub pots. Pumice is carried by rivers to the sea from areas of active vulcanism in the highlands of Guatemala. In particular, Thompson (1970:142) reports that pumice from highland tributaries is carried into the southern lowlands by the Usumacinta. It remains for analyses to be conducted to determine whether pumice was used by the Maya as tempering material.

Chert

Chert will not be discussed at length here, except to emphasize that it also is differentially distributed both in quality and quantity in Belize and elsewhere in the lowlands. For example, the Dzibilchaltun setting in northern Yucatan has been remarked upon for the lack of good-quality lithic resources (Rovner 1976:41), whereas the Peten has been characterized as "one big flint mine" (Rathje 1972:389). High-quality chert deposits in northern Belize (Shafer and Hester 1983) and exploitable chert in the northern part of the Toledo District (Hammond 1975:333) are set off as well from the Stann Creek District, where there is virtually no limestone and hence no chert. The character of the chert from sites in the Stann Creek District and the inferred techniques of tool manufacture suggest that the material did not originate in northern Belize (Graham 1983:94), and, therefore, that chert was imported into the region from the Toledo District to the south, or from the region west of the Hummingbird Gap where the Sibun, Caves Branch, and Belize rivers flow. Possible evidence for a southern route comes from False Cay, near Placencia in the southern part of the Stann Creek District (Figure 1). The large quantity of whole chert artifacts found here suggests that the cay was used as a transshipment point for chert (Graham 1983:167–169).

Rovner (1976:41) has stressed the importance of the variability in lithic resource distribution in the Maya Lowlands, not only in relation to chert industry specialization, but also for the role that the differential distribution of resources had in the development of trade networks. It is conceivable, in light of the data touched on above, that systems of organized exchange developed for obtaining access to chert not locally available. Even in communities where chert was available, exchange cannot be ruled out. Flaked stone artifacts from Dzibilchaltun, and to a minor extent from Colha (Figure 1), were fashioned from cherts that were both immediately accessible and exotic (Rovner 1976:41; Shafer and Hester 1983:531). Analysis of chert tool assemblages from the manufacturing center of Colha is helping to define the structure and pattern of chert artifact exchange among communities within the region of northern Belize (Shafer and Hester 1983:538). This level of community interaction also deserves more attention in examination of the role of exchange in interregional organization and information flow (Wright 1972).

Clay Resources

Delineation of local, regional, and long-distance exchange of pottery has benefited from studies of clays and clay slips (e.g., Arnold and Bohor 1977; Beaudry 1984; Bishop 1980; Rands and Bishop 1980; P. Rice 1978, 1980; Sabloff et al. 1982; Shepard 1948). The pattern of clay resource distribution is too little known and too complex to be discussed fully here. However, in this context it is important to note that clay is differentially distributed in Belize as regards the properties it manifests as a raw material. For example, the clays that occur along the rivers and creeks that drain the eastern flank of the Maya Mountains are characterized by high percentages of kaolinite, whereas clays sampled north of the mountains along the lower reaches of the Sibun River contain high percentages of montmorillonite (Lefond and Roghani 1976:25, table 4, map Nos. 4-2, 4-3). Given the importance of factors of plasticity, shrinkage, color, and luster (Shepard 1956) there is a good basis for expecting that clay resources might have been exchanged among communities within a region.

White clay, which seems to have been an important constituent of the polychrome palette (R. Sonin, personal communication to Graham 1983), is a candidate for stimulus to intercommunity trade since its distribution is restricted, at least in southern Belize and probably elsewhere in the lowlands, as it is in the highlands (P. Rice 1978). White or white-firing clays with little or no iron-oxide staining occur in restricted areas along the Swasey Branch (Bateson and Hall 1970:13, 21–22), the Sittee River, and Big Creek. The Swasey clay was analyzed by mineralogists as a potential source of raw material for commercial pottery or other ceramic production, and it was noted as having ". . . significant plastic properties. Such clays . . . may be used for improving the workability of otherwise nonplastic or poorly plastic ceramic bodies" (Bateson and Hall 1970:22).

The geological data suggest that clays lacking iron-oxide staining would be most common along the creeks and rivers that drain the volcanics of the southern Maya Mountains. Though these white clays are more likely to have been exchanged widely as slip clays (see Arnold [1985:52–53, 60, table 2.3] for discussion of comparative distances to clays and resources), their plastic and other mineral properties may have influenced local pottery production sufficiently to enable the resultant vessels to be traced, if not to specific locations, at least to the general source area in southern Belize.

Experimentation has shown that clay obtained from Cabbage Haul Creek (Figure 3) can be refined to produce a lustrous slip (R. Sonin, personal communication to Graham 1983). According to Shepard (1956:122–125), some clays have the potential for achieving higher natural luster than others; surely this trait, too, is one to be considered in the reconstruction of possible patterns of intercommunity exchange of clay resources, particularly with regard to Classic gloss wares. Likewise, occurrence of well developed iron oxide minerals along the faults in southern Belize may well have led communities near the faults to take advantage of the resource and mine pigments for exchange.

In a study of modern ceramic variability and culture history in the Valley of Guatemala, Arnold (1978:48) points out that primary ceramic resources such as clays, tempers, and fuels tend to be locally derived, whereas secondary resources such as slips and paints are sometimes sought outside the local resource area. Guided by this insight, a productive line of investigation would include analysis to determine the mineral constituents of local clays within the area of a site under investigation—something which can be done without neutron activation—and experimentation to determine what the demand potential might be for slips, paints, or other clays that would augment the local repertoire of ceramic resources and would have served to stimulate intercommunity trade.

Resource Diversity: Summary

The foregoing data provide the kind of information that makes it possible to envision the range of trade ties that bound Maya communities together in Precolumbian times. The potential existed for the exchange of goods for both ceremonial and everyday household use, whether because of a differential lack of suitable raw materials (such as the absence of chert or the restricted distribution of mineral pigments), because of the local development of specialized manufacturing skills (such as Colha's chert industry), or, on another level, because of demands for goods that were status-linked or ritually significant, as in the acquisition of shells and stingray spines for other than dietary requirements (see Coe 1962:500).

Thompson (1970:146–156) and Voorhies (1982) have written about lowland forest products that were likely trade goods but, unfortunately, are perishable and not directly recoverable archaeologically. A closer look at lowland forests will reveal, as the closer look at other resources has done, that plants and trees are more differentially distributed than is generally assumed. Such distribution might have stimulated trade in the past not only in "compact" foodstuffs of the sort discussed by Voorhies (1982:table 1), such as seeds, resins, or dried plants, but also local trade in bulk foodstuffs. For example, ramon (*Brosimum alicastrum*) does not grow in the acid, lime-free soils east of the Maya Mountains; in contrast, craboo or nance (*Byrsonima crassifolia*) flourishes on the acid soils of the southern pine savannas (in Belize known as "pine ridge"). Differential quality also may have been significant, as in the case of cashews from trees on the "broken ridge" soils of areas in southern Belize (where broadleaf trees invade stands of pine [Graham 1983:37–40]) which are considered today to be superior to any from northern Belize.

It is clear that there is much yet to be known about the distribution of resources exploited by the ancient Maya. Though differential resource distribution was not the sole motivation for exchange, the scenario that emerges brings the lowlands into view as an area in which diversity is worthy of attention as a possible stimulus to trade. Once we agree that an assumption of resource diversity is a productive approach, however, we still are left with conceptual tools that need sharpening.

Many of the rather dull-edged tools are terminological. For example, in discussions of exchange, the word "region" requires clearer definition than it is sometimes given. It can have a primarily environmental connotation and serve to distinguish zones of resource production from zones of distribution, as in the case in which regions with jade and obsidian sources are distinguished from the areas in which these items were distributed (Hammond et al. 1977:39). The term "region" also can serve to encompass an area of production and distribution of particular items of exchange, such as ceramic vessels (Arnold 1980:148). Further, "region" can be used to distinguish a political territory (Marcus 1983:477, 1976). In the case of a political territory, use of the term "intraregional trade" refers to the exchange of items within a region defined primarily on the basis of archaeological and epigraphic rather than environmental evidence, as in the case of Palenque, where the ceremonial center and surrounding settlement cross-cut a range of environmental zones (Rands and Bishop 1980:20–22).

As long as the definition of "region" is explicit, use of the term to mean a political territory can have value in delineating spheres of interaction. Where environmental distinctions have potential as explanatory variables, it is even more critical to provide a definition of "region" in the context in which it is used. The "region" as a zone of resource production can cross-cut political boundaries, as in the case of the supply zone for muscovite granite, discussed above, which spans the settlement of two major river valleys. Similarly, the distribution of iron oxide minerals in Belize can be described as distinctive of a single region that includes the Maya Mountains and the rivers that drain it. Or, such a distribution can be described as cross-cutting the region of the Chiquibul limestone uplands as well as that of the eastern coastal plain.

Once a region is clearly defined, the use of terms such as "local" and "exotic" should be tailored to suit what is known about resources within the territory. In this approach, preconceived notions about the nature of highland/lowland resources or "core" vs. "buffer zone" conditions are not likely to bias inferences about the potential for exchange. Scrutiny of a limited territory also should stimulate reassessment of the utility of the local vs. long-distance trade dichotomy. The distances over which goods are seen to have been transported will be measured less in terms of mileage and more in terms of factors, both environmental and social, that affect accessibility, with emphasis on pinpointing nearby nodes of distribution networks in which the community or communities under study participated.

"Long-distance" is a term often applied to trade in materials, such as obsidian and jade, that are from zones of production believed to have been restricted in the degree to which the lowlands as a whole had access. The assumption made here is that access to obsidian or jade was everywhere perceived by the lowland Maya in terms of a great distance that separated highlands from lowlands. In some instances the distance was actually less than that involved in exchange of other materials. For example, the obsidian that reached Pusilha was carried over a shorter distance than was traversed in the transport of "Petkanche" polychromes, believed to have been manufactured in the Altun Ha area of northern Belize (Pendergast, personal communication 1985) to Dzibilchaltun (see Ball and Andrews 1975:232).

Another assumption that underlies the use of the "long-distance" modifier is that distance "as the crow flies" had a greater effect on distribution patterns than did other factors such as ease of transport or social and economic value of the item of exchange (see Hodder [1978] for discussion of factors affecting distribution). In other cases, use of the term "long-distance trade" has been considered sufficient to explain the distribution or procurement of what are characterized collectively as "elite goods" or "prestigious resources" (Freidel 1979:48, 50; Sabloff 1977:71). Lastly, and perhaps in a subsumption of all the other assumptions, long-distance exchange is often treated as distinct from, as well as contrasted with, intraregional or interregional exchange (e.g., Marcus 1983:477).

Where aggregate distance alone is at issue, a contrast between long-distance and shorter-distance exchange is useful. However, where clarification of the mode of exchange (as in Renfrew 1975:41) is intended, one must recognize that implicit in such a contrast is a complex assumption that affects the way we conceptualize mechanisms of exchange: the distance over which an item is transported is linked to the operative modes by which it was exchanged. What seems to be implied is that mechanisms for local exchange (within or between defined territories) played no part in the transport or movement of materials over great distances, and/or that long-distance exchange involved complex modes of trade at the expense of or exclusion of modes that integrated communities within or between regions.

The fact that items were widely distributed over great distances and that communication associated with these items bridged great distances cannot be disputed, but it is not necessarily antithetical to the concept of intraregional or regional exchange. Mechanisms for local or intercommunity exchange may well have been responsible for the movement of goods in stages over what is ultimately assessed by us as a long distance. Exchange manifests itself in a variety of ways, and even though a society may evolve and develop more complex patterns of exchange (as defined by Renfrew [1975:41–43]) this does not mean that all other levels of exchange atrophy, or that they are not part of the framework of complex exchange.

To take a single example, we can now see that obsidian is proving to have been extensively distributed throughout all levels of Maya society (Rice et al. 1985:603) and was not particularly subject to procurement and distribution by elites, as has been suggested (Sidrys 1977). This phenomenon becomes explicable if we consider that mechanisms for obsidian distribution were very likely operating on more than one level and according to different modes of distribution (see, e.g., Charlton and Spence 1982:56, 59–60; Spence 1981:784). As Flannery (1972b:135) has observed in one discussion of trade: ". . . at each evolutionary step, a new institution for information processing is added—sodalities, trade partners, middle men, central places, and finally professional merchants. . . ." The key word here is "added." Whether one accepts this evolutionary sequence or not, it is surely more productive to envision trade in the Maya area as having functioned on a multiplicity of levels through time, and to focus our efforts on understanding the nature of all levels and how they were integrated, than to think solely in terms of procurement controls or absolute distances involved in the transport of materials.

Future Research

No grasp of the changing interaction of variables that served to integrate Maya trade will be achieved until more importance is attached to the levels of trade that reflect the unique way in which each community exploited the range of resources available to it. A site-specific problem orientation necessitates a focus on trade of this nature, but another productive approach would be to select a particular resource within a region, and map its distribution. Where regional surveys are planned, it might make sense to carry out resource surveys in advance of settlement surveys.

The limited resource survey presented here will, I hope, encourage the present trend in which resource diversity looms larger on the lowland horizon than had ever been reckoned in early theories that focused on lowland developments or on highland-lowland interaction. To begin to grasp what the bases of interregional integration might have been, and how such integration may have changed through time, it is essential to focus on relations that can be understood at the community level by employing a research strategy that keys the community into a network that reflects accessibility to mineral, soil, and plant resources. It is a caveat that the community cannot be understood in isolation from the region, but it also is true that we cannot fully apprehend developments on an interregional scale—nor will generalizations of this scale ever have long-lived utility—without better understanding of development and integration at the level of the community or site. This does not mean that trade models need to be limited by the boundaries of a community or region, but rather that the boundaries of models that seek to pattern trade or to account for culture change through trade must be defined by an understanding of the processes of exchange at the community or local level.

Acknowledgments. I would like to thank the Ministry of Natural Resources in Belize and the Anschutz Corporation for allowing me to have access to the mineral survey data from southern Belize during the time I served as the Archaeological Commissioner in Belmopan, from 1977 to 1979. I am especially indebted to Dr. R. Prasada Rao, Petroleum Geologist and Inspector of Mines, Ministry of Natural Resources, for his assistance in 1984 when I updated the geological findings; and I am grateful to Dr. Gordon R. Willey of the Peabody Museum, Harvard University, for giving me permission to sample the manos from Seibal and Uaxactun. I also would like to thank the Department of Archaeology in Belize for granting me a permit to carry out archaeological investigations in the Stann Creek District from 1975 to 1977. The Stann Creek excavations were funded by the Wenner-Gren Foundation for Anthropological Research, and by grants from the Sir Bartle Frere fund, Newnham College, and the Museum of Archaeology and Ethnology of Cambridge University, with support from the Royal Geographical Society, London.

I am grateful to Prudence Rice, Anthony Andrews, David Pendergast, Norman Hammond, and Dean Arnold for their valuable comments on earlier drafts of this manuscript. However, the content of the paper is entirely the responsibility of the author.

REFERENCES CITED

Arnold, D. E.

1978 Ceramic Variability, Environment and Culture History among the Pokom in the Valley of Guatemala. In *The Spatial Organization of Culture,* edited by I. Hodder, pp. 39–59. Gerald Duckworth, London.

1980 Localized Exchange: An Ethnoarchaeological Perspective. In *Models and Methods in Regional Exchange,* edited by R. E. Fry, pp. 147–150. SAA Papers No. 1. Society for American Archaeology, Washington, D.C.

1985 *Ceramic Theory and Cultural Process.* Cambridge University Press, Cambridge, England.

Arnold, D. E., and B. F. Bohor
1977 An Ancient Clay Mine at Yo' K'at, Yucatan. *American Antiquity* 42:575-582.
Ball, J. W., and E. W. Andrews V
1975 The Polychrome Pottery of Dzibilchaltun, Yucatan, Mexico: Typology and Archaeological Context. In *Archaeological Investigations on the Yucatan Peninsula,* pp. 227-247. Middle American Research Institute Publication 31. Tulane University, New Orleans.
Bateson, J. H., and I. H. S. Hall
1970 *Reconnaissance Geochemical and Geological Investigation of the Maya Mountains of Southern British Honduras.* Report No. 16. Institute of Geological Sciences, Overseas Division, London.
1971 Revised Geologic Nomenclature for Pre-Cretaceous Rocks of British Honduras. *American Association of Petroleum Geologists Bulletin* 55:529-530.
Beaudry, M. P.
1984 *Ceramic Production and Distribution in the Southeastern Maya Periphery: Late Classic Painted Serving Vessels.* BAR International Series 203, British Archaeological Reports, Oxford, England.
Bishop, R. L.
1980 Aspects of Ceramic Compositional Modeling. In *Models and Methods in Regional Exchange,* edited by R. E. Fry, pp. 47-65. SAA Papers No. 1. Society for American Archaeology, Washington, D.C.
Blanton, R. E., S. A. Kowalewski, G. Feinman, and J. Appel
1981 *Ancient Mesoamerica: A Comparison of Change in Three Regions.* Cambridge University Press, Cambridge, England.
Charlton, T., and M. W. Spence
1982 Obsidian Exploitation and Civilization in the Basin of Mexico. *Anthropology* 6(1, 2):7-86. State University of New York at Stony Brook.
Coe, W. R.
1962 A Summary of Excavation and Research at Tikal, Guatemala, 1956-1961. *American Antiquity* 27: 479-507.
1967 *Tikal-A Handbook of the Ancient Maya Ruins.* The University Museum, University of Pennsylvania, Philadelphia.
Cole, G. L., and D. A. Andrews-Jones
1978 *Economic Evaluation of the Mineral Potential of Belize: An Overview of the Anschutz Mining Corporation Exploration Program in Belize, 1975-1977.* Anchutz Mining Corporation. Third Annual Report, February 1978. Submitted to the Government of Belize. Report on file, Office of the Petroleum Geologist and Inspector of Mines, Ministry of Natural Resources, Belmopan, Belize.
Covich, A. P.
1978 A Reassessment of Ecological Stability in the Maya Area: Evidence from Lake Studies of Early Agricultural Impacts on Biotic Communities. In *Pre-Hispanic Maya Agriculture,* edited by P. D. Harrison and B. L. Turner II, pp. 145-155. University of New Mexico Press, Albuquerque.
Cowgill, U. M.
1962 An Agricultural Study of the Southern Maya Lowlands. *American Anthropologist* 64:273-286.
Dillon, B. D.
1977 *Salinas de los Nueve Cerros, Guatemala: Preliminary Archaeological Investigations.* Studies in Mesoamerican Art, Archaeology and Ethnohistory No. 2. Ballena Press, Socorro, New Mexico.
Dixon, C. G.
1956 *Geology of Southern British Honduras.* Report of the Geological Survey, 1950-1956. Submitted to the Survey Department, Government of British Honduras (Belize).
Druecker, M. D.
1978 *The Geology of the Bladen Volcanic Series, Southern Maya Mountains, Belize, Central America.* Unpublished Master's thesis, Department of Geology, Colorado School of Mines, Golden.
Flannery, K. V.
1972a The Cultural Evolution of Civilizations. *Annual Review of Ecology and Systematics* 3:399-426.
1972b Evolutionary Trends in Social Exchange and Interaction. In *Social Exchange and Interaction,* edited by E. N. Wilmsen, pp. 129-135. Anthropological Papers No. 46. Museum of Anthropology, University of Michigan, Ann Arbor.
Ford, A.
1981 *Conditions for the Evolution of Complex Societies: The Development of the Central Lowland Maya.* Ph.D. dissertation, University of California at Santa Barbara. University Microfilms, Ann Arbor, Michigan.
1985 The Significance of Volcanic Ash Tempering in the Ceramics of the Central Maya Lowlands. Paper presented at the 1985 Maya Ceramic Conference, Washington, D.C.
Fry, R. E. (editor)
1980 *Models and Methods in Regional Exchange.* SAA Papers No. 1. Society for American Archaeology, Washington, D.C.
Freidel, D. A.
1978 Maritime Adaptation and the Rise of Maya Civilization: The View from Cerros, Belize. In *Prehistoric Coastal Adaptations,* edited by B. Stark and B. Voorhies, pp. 239-265. Academic Press, New York.

1979 Culture Areas and Interaction Spheres: Contrasting Approaches to the Emergence of Civilization in the Maya Lowlands. *American Antiquity* 44:36–54.
Graham, E.
1983 *The Highlands of the Lowlands: Environment and Archaeology in the Stann Creek District, Belize, Central America.* Ph.D. dissertation, University of Cambridge, England. University Microfilms, Ann Arbor, Michigan.
Hall, I. H. S., and J. H. Bateson
1972 Late Paleozoic Lavas in Maya Mountains, British Honduras and Their Possible Regional Significance. *American Association of Petroleum Geologists Bulletin* 56:950–956.
Hammond, N.
1975 *Lubaantun: A Classic Maya Realm.* Monographs of the Peabody Museum of Archaeology and Ethnology No. 2. Harvard University, Cambridge, Massachusetts.
Hammond, N., A. Aspinall, S. Feather, J. Hazelden, T. Gazard, and S. Agrell
1977 Maya Jade: Source Location and Analysis. In *Exchange Systems in Prehistory,* edited by T. K. Earle and J. E. Ericson, pp. 35–67. Academic Press, New York.
Hodder, I.
1978 Some Effects of Distance on Patterns of Human Interaction. In *Spatial Organization of Culture,* edited by I. Hodder, pp. 155–178. Gerald Duckworth, London.
Kidder, A. V.
1937 Ceramic Technology—Anna O. Shepard. In The Reports on the Investigations of the Division of Historical Research, pp. 144–145. *Carnegie Institution of Washington Year Book* 36. Washington, D.C.
Lee, T. A., Jr., and C. Navarrete (editors)
1978 *Mesoamerican Communication Routes and Cultural Contacts.* Papers of the New World Archaeological Foundation No. 40. Brigham Young University, Provo, Utah.
Lefond, S. J., and F. Roghani
1976 *Belize Industrial Mineral Survey, Summer Field Season, 1976.* Anschutz Mining Corporation. Submitted to the Government of Belize. Report on file, Office of the Petroleum Geologist and Inspector of Mines, Ministry of Natural Resources, Belmopan, Belize.
Marcus, J.
1976 *Emblem and State in the Classic Maya Lowlands: An Epigraphic Approach to Territorial Organization.* Dumbarton Oaks, Washington, D.C.
1983 Lowland Maya Archaeology at the Crossroads. *American Antiquity* 48:454–488.
McKillop, H.
1984 Prehistoric Maya Reliance on Marine Resources: Analysis of a Midden from Moho Cay, Belize. *Journal of Field Archaeology* 11:24–35.
Muncaster, N.
1976 *Mineral Reconnaissance of Granites in the Maya Mountains, Belize, Central America—February, April, May, 1976.* Anschutz Mining Corporation. Submitted to the Government of Belize. Report on file, Office of the Petroleum Geologist and Inspector of Mines, Ministry of Natural Resources, Belmopan, Belize.
Parsons, L. A., and B. J. Price
1971 Mesoamerican Trade and Its Role in the Emergence of Civilization. In *Observations on the Emergence of Civilization in Mesoamerica,* edited by R. F. Heizer and J. A. Graham, pp. 169–195. Contributions of the University of California Archaeological Research Facility No. 11. Department of Anthropology, Berkeley.
Price, B.
1982 Cultural Materialism: A Theoretical Review. *American Antiquity* 47:709–741.
Rands, R. L., and R. L. Bishop
1980 Resource Procurement Zones and Patterns of Ceramic Exchange in the Palenque Region, Mexico. In *Models and Methods in Regional Exchange,* edited by R. E. Fry, pp. 19–46. SAA Papers No. 1. Society for American Archaeology, Washington, D.C.
Rathje, W. L.
1972 Praise the Gods and Pass the Metates: A Hypothesis of the Development of Lowland Rainforest Civilizations in Middle America. In *Contemporary Archaeology,* edited by M. P. Leone, pp. 365–392. Southern Illinois University Press, Carbondale.
Renfrew, C.
1975 Trade as Action at a Distance: Questions of Integration and Communication. In *Ancient Civilization and Trade,* edited by C. Renfrew, pp. 3–59. University of New Mexico Press, Albuquerque.
Rice, D. S.
1978 Population Growth and Subsistence Alternatives in a Tropical Lacustrine Environment. In *Pre-Hispanic Maya Agriculture,* edited by P. D. Harrison and B. L. Turner II, pp. 35–61. University of New Mexico Press, Albuquerque.
Rice, D. S., and P. M. Rice
1980 The Northeast Peten Revisited. *American Antiquity* 45:432–454.
1984 Lessons from the Maya. *Latin American Research Review* 19(3):7–34.

Rice, P. M.
1978 Ceramic Continuity and Change in the Valley of Guatemala. In *The Ceramics of Kaminaljuyu, Guatemala,* edited by R. K. Wetherington, pp. 401–510. Monograph Series on Kaminaljuyu. Pennsylvania State University Press, University Park.
1980 Peten Postclassic Pottery Production and Exchange: A View from Macanche. In *Models and Methods in Regional Exchange,* edited by R. E. Fry, pp. 67–82. SAA Papers No. 1. Society for American Archaeology, Washington, D.C.

Rice, P. M., H. V. Michel, F. Asaro, and F. Stross
1985 Provenience Analysis of Obsidians from the Central Peten Lakes Region, Guatemala. *American Antiquity* 50:591–604.

Rovner, I.
1976 Pre-Columbian Maya Development of Utilitarian Lithic Industries: The Broad Perspective from Yucatan. In *Maya Lithic Studies: Papers from the 1976 Belize Field Symposium,* edited by T. R. Hester and N. Hammond, pp. 41–53. Special Report No. 4. Center for Archaeological Research, University of Texas at San Antonio.

Sabloff, J. A.
1977 Old Myths, New Myths: The Role of Sea Traders in the Development of Ancient Maya Civilization. In *The Sea in the Precolumbian World,* edited by E. Benson, pp. 67–95. Dumbarton Oaks, Washington, D.C.

Sabloff, J. A., R. L. Bishop, G. Harbottle, R. L. Rands, and E. V. Sayre
1982 Analyses of Fine Paste Ceramics. In *Excavations at Seibal,* edited by G. R. Willey, pp. 265–343. Memoirs of the Peabody Museum of Archaeology and Ethnology 15(2). Harvard University, Cambridge, Massachusetts.

Sanders, W. T.
1977 Environmental Heterogeneity and the Evolution of Lowland Maya Civilization. In *The Origins of Maya Civilization,* edited by R. E. W. Adams, pp. 287–298. University of New Mexico Press, Albuquerque.

Sanders, W. T., and B. Price
1968 *Mesoamerica: The Evolution of a Civilization.* Random House, New York.

Shafer, H. J., and T. R. Hester
1983 Ancient Maya Chert Workshops in Northern Belize, Central America. *American Antiquity* 48:519–543.

Shaffer, M. E.
1976 *Final Report.* Anschutz Mining Corporation. Submitted to the Government of Belize. Report on file, Office of the Petroleum Geologist and Inspector of Mines, Ministry of Natural Resources, Belmopan, Belize.

Shepard, A. O.
1939 Technological Notes on the Pottery of San Jose. In *Excavations at San Jose, British Honduras,* by J. E. S. Thompson, pp. 251–277. Carnegie Institution of Washington Publication 506. Washington, D.C.
1948 *Plumbate: A Mesoamerican Trade Ware.* Carnegie Institution of Washington Publication 573. Washington, D.C.
1956 *Ceramics for the Archaeologist.* Carnegie Institution of Washington Publication 609. Washington, D.C.
1964 Ceramic Development of the Lowland and Highland Maya. *Thirty-fifth International Congress of Americanists 1:249–262.*

Shipley, W. E. III
1976 *The Granites of Belize: Comparative Study.* Anschutz Mining Corporation. Submitted to the Government of Belize. Report on file, Office of the Petroleum Geologist and Inspector of Mines, Ministry of Natural Resources, Belmopan, Belize.
1978 *Geology, Petrology, and Geochemistry of the Mountain Pine Ridge Batholith, Belize, Central America.* Unpublished Master's thesis, Department of Geology, Colorado School of Mines, Golden.

Shipley, W. E. II, and E. Graham
1987 Petrographic Analysis and Preliminary Source Identification of Selected Stone Artifacts from the Maya Sites of Seibal and Uaxactun, Guatemala. *The Journal of Archaeological Science* 14:367–383.

Sidrys, R.
1977 Mass-Distance Measures for the Maya Obsidian Trade. In *Exchange Systems in Prehistory,* edited by T. K. Earle and J. E. Ericson, pp. 91–108. Academic Press, New York.

Siemens, A. H.
1978 Karst and the Pre-Hispanic Maya in the Southern Lowlands. In *Pre-Hispanic Maya Agriculture,* edited by P. D. Harrison and B. L. Turner II, pp. 117–143. University of New Mexico Press, Albuquerque.

Simmons, M. P., and G. F. Brem
1979 The Analysis and Distribution of Volcanic Ash-Tempered Pottery in the Lowland Maya Area. *American Antiquity* 44:79–91.

Spence, M. W.
1981 Obsidian Production and the State in Teotihuacan. *American Antiquity* 46:769–788.

Stross, F. H., P. D. Sheets, F. Asaro, and H. Michel
1983 Precise Characterization of Guatemalan Obsidian Sources, and Source Determination of Artifacts from Quirigua. *American Antiquity* 48:323–346.
Thompson, J. E. S.
1970 *Maya History and Religion.* University of Oklahoma Press, Norman.
Thoreson, R. F.
1978 *A Preliminary Report on the Alteration and Mineralization of the Southwest Maya Mountains, Belize, Central America.* Anschutz Mining Corporation. Submitted to the Government of Belize. Report on file, Office of the Petroleum Geologist and Inspector of Mines, Ministry of Natural Resources, Belmopan, Belize.
Tourtellot, G., and J. A. Sabloff
1972 Exchange Systems Among the Ancient Maya. *American Antiquity* 37:126–135.
Turner, B. L. II
1978 Ancient Agricultural Land Use in the Central Maya Lowlands. In *Pre-Hispanic Maya Agriculture,* edited by P. D. Harrison and B. L. Turner II, pp. 163–183. University of Texas Press, Austin.
Turner, B. L. II, and P. D. Harrison (editors)
1983 *Pulltrouser Swamp Ancient Maya Habitat, Agriculture, and Settlement in Northern Belize.* University of Texas Press, Austin.
Voorhies, B.
1972 Settlement Patterns in Two Regions of the Southern Maya Lowlands. *American Antiquity* 37:115–126.
1982 An Ecological Model of the Early Maya of the Central Lowlands. In *Maya Subsistence,* edited by K. V. Flannery, pp. 65–95. Academic Press, New York.
Wright, A. C. S., D. H. Romney, R. H. Arbuckle, and V. E. Vial
1959 *Land in British Honduras, Report of the British Honduras Land Use Survey Team,* edited by D. H. Romney. Colonial Research Publications No. 24. Her Majesty's Stationery Office, London.
Wright, H. T.
1972 A Consideration of Interregional Exchange in Greater Mesopotamia: 4000–3000 B.C. In *Social Exchange and Interaction,* edited by E. N. Wilmsen, pp. 95–105. Anthropological Papers 46. Museum of Anthropology, University of Michigan, Ann Arbor.