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Earliest Hunters and Gatherers of South America

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Traditional syntheses of the archaeology of the late Pleistocene period in South America have focused primarily on the peopling of the continent by North American cultural groups and on identifying associations among regional sites. This focus has tended to ignore the widespread culture diversity of the period and the possible effects of different paleolandscapes on human migration and colonization, such as the presence of unglaciated tropical and temperate environments in the northern lowlands, the gateway to the interior. The earliest known cultural assemblages are characterized by various unifacial and bifacial lithic industries that may represent regional processes reminiscent of an Archaic lifeway. The major archaeological sites and associated artifact assemblages are examined in terms of regional and continental patterns of environmental and cultural change. Results suggest that the Pleistocene archaeological record of South America must be explained in its own terms and that the events and processes producing this record either occurred earlier than previously thought or are very different from those in North America.

KEY WORDS: human colonization; Pleistocene; hunter-gatherers; South America; lithic analysis; paleoecology; animal extinction; Andes; Amazonia.

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INTRODUCTION

The initial movement of people into the New World involved a dynamic process by which human populations successfully spread from one uninhabited region to another and grew both in size and cultural diversity. Much effort has been expended trying to devise conceptual and methodological means to determine the origin and divergence of late Pleistocene cultures in the Americas, often with limited and controversial results. Most debate has focused on dates of migration, on cultural continuity and discontinuity of certain traits, and on the quality and validity of early archaeological records (e.g., Haynes, 1969; Lynch, 1983, 1990b; Meltzer, 1989; Morlan, 1988; Dincauze, 1984; Greenberg *et al.*, 1986; Schobinger, 1988; Ardila and Politis, 1989; Dillehay and Meltzer, 1991). These issues have been extremely resistant to empirical resolution and to hemispherical and continental modeling.

Late Pleistocene research in South America began with the question of when the first Americans appeared (see Ameghino, 1880, 1915; Hrdlicka, 1912, 1918). When this problem was apparently resolved in the 1930s and 1940s by the research of Junius B. Bird (1938, 1969, 1983) in southern Patagonia, emphasis gradually shifted to questions of local sequences and cultural continuity (Willey, 1971), that is, whether the first South Americans were southerly Clovis (i.e., Paleoindian) big-game hunters (Lynch 1974, 1980; 1990b) or diversified pre-Clovis hunter-gatherers (Krieger, 1974; Bryan, 1973, 1978, 1986).

Today, the dispute over the origin of New World cultures has reached a high pitch. This is not the place to review the dialogue, but the issue is relevant to cultural chronology and diffusion and, especially, to the archaeological criteria employed to characterize the initial peopling of South America. Such criteria, borrowed uncritically from the North American Clovis horizon, include preference for fluted lanceolate projectile points and the hunting of "big-game" animals. The horizon approach has been advocated almost exclusively by Lynch (1974, 1983, pp. 96–108), who presumes that northern hemisphere big-game hunters, equipped with fluted points, passed through Panama and followed the high tundra-steppe down the spine of the Andes to reach the tip of South America early in the 11th millennium B.P.

This scenario presents problems. Although fluting is present in South America, Clovis projectile points have not yet been found further south than Costa Rica and possibly Panama. Furthermore, fluting in the south appears almost exclusively on stemmed points, not lanceolate forms, and dates as early as its counterpart in the north, leaving us to explain how the fluting technique appeared about the same time in both continents. It is also important that several apparently contemporaneous regional varieties of stemmed, stemless, and lanceolate points, as well as unifacial complexes, are radiocarbon dated as early as or earlier than flutes in South America. An alternative scenario is that humans reached South America earlier, bringing with them a different and less specialized pre-Clovis culture, and that the fluting technique spread later across an extant population (e.g., Rouse, 1976; Bryan, 1983, 1986; Mayer-Oakes, 1986). This view is also problematic because there still is no generally accepted record of pre-Clovis activity in North America, and there are no other apparent trait linkages besides fluting.

Admittedly, comparison of early archaeological records in both continents is difficult because of the paucity of information, the application of different research approaches, and the varying reliability of available dates. In addition, the wide variety of environments where sites are located suggests different paleoenvironmental sequences, different understandings of trait linkages, and different cultural interpretations (Bryan, 1973; Rouse, 1976; Lynch, 1974, 1983; Schobinger, 1988; Ardila and Politis, 1989). These problems are accentuated even more in South America, where archaeological research on late Pleistocene cultures is still in its infancy. In fact, it is probably our ignorance of the early archaeological record that has largely left us wide open for external causation and modeling. Yet, as local archaeological sequences have become better documented in recent years, there has been growing criticism, mainly by Latin American researchers (e.g., Ardila and Politis, 1989, pp. 35–40; Borrero, 1980), of the uncritical application of a Clovis-like model in the southern hemisphere. The current tendency among some researchers is to admit limited cultural continuity between the northern and the southern hemispheres at the time of initial human migration and to view technological and economic change and variation in South America more as a direct response to local natural and social environments. At present, we do not know how to model these changes, but cultural variation seems to have been a developed (and continuous) process that involved different modes of mobility, social and economic organization, and environmental parameters (Bryan, 1973), as evidenced by the presence of distinctive regional patterns by at least 11,000 to 10,500 B.P. It is possible that the greater variation in South America is associated with a time depth greater than 12,000 B.P. and/or with rates of culture change and development different from those for the Clovis horizon in North America.

Since so little is known about the archaeology of the earliest hunters and gatherers, all we propose to do in this paper is (1) to recognize the distinctive regional features and patterns of prehistoric cultures and their relations to various technological and environmental forms and (2) to speculate on the inferred meaning of these relations and forms. This paper does not pretend to provide a holistic review of the archaeological perspective of all sites and interpretations in South America, nor does it pretend to offer complete paleoenvironmental or chronological comprehensiveness.

RESEARCH PROBLEMS AND QUALITY OF DATA

There are several problems with the data that limit the depth of coverage of the early prehistory of South America. Interpretation difficulties arise from the small sample of sites available for study and the necessity of lumping together heterogeneous archaeological records to synthesize the early record. Ideally, we would like to describe all sites and to reconstruct and explain as many regional data sets and patterns as possible. We can compile about 95 known sites and site components, of which 35 to 40 have been partially excavated, and of these only 10 to 15 are considered to be firmly radiocarbon dated. It is impossible in this brief account, however, to enumerate all these localities. Nor is it necessary for the objectives of this paper; a few selected sites and site complexes reveal the general characteristics and patterns of the areas represented. Figure 1 shows the major sites discussed in the text.

Another problem is that little systematic research has been carried out in several areas, including the Orinoco and Amazon river basins, the Ecuadorian and northern Peruvian highlands, and the archipelagos of southern Chile. Little or no systematic work has been carried out in Bolivia (Arellano, 1987), Paraguay, and the Guyanas. Further, most of the sites covered in this paper have been found by isolated endeavors or accidents in heavily populated areas or in open environments, not by systematic survey. For the most part, these sites are those where a combination of favorable circumstances, chance preservation, and archaeological excavation give insightful information on chronology and cultural patterning. In combination, these limiting conditions have created a bias in the site data base: most localities are situated in arid or semiarid and open environments with optimal surface visibility and in soils that do not foster preservation of organic remains. Unfortunately, these conditions and the absence of remains other than bone and lithic debris have skewed the archaeological record toward hunting economies in open environments (Lynch, 1983, p. 91). Thus, little is known about early human utilization of plants in forest and savanna environments.

As for reconstructing activity areas, there are very few sites in which the excavated spaces are large enough to provide clues about intrasite variation and the overall artifact content. Similarly, estimates of tool type ratios (*sensu* Meltzer, 1988, p. 29) cannot be used reliably to compare artifact assemblage variability because very few detailed site reports are published and because there is no agreement on descriptive terms and minimum recording standards of artifact types. Such qualitative terms as large and small, and dense and sparse, often carry different meanings for different researchers. All of this means that we are still in the stage of recording associations among different types of ecological and artifactual materials at individual sites and attempting to recognize regular patterning among formal taxonomic units, particularly projectile points. Without

Fig. 1. Map showing the major sites discussed in the text. (1) Taima-Taima. (2) Río Pedregal, Cucuruchu. (3) El Abra, Tequendama, Tibitó. (4) Popayán. (5) El Inga. (6) Las Vegas. (7) Siches, Amotope, Talara. (8) Paiján. (9) Guitarrero Cave. (10) Lauricocha. (11) Telarmachay, Pachamachay, Uchumachay, Panalauca. (12) Pikimachay. (13) Ring Site. (14) Intihuasi Cave. (15) Gruta del Indio. (16) Agua de la Cueva. (17) Inca Cueva IV. (18) Huachichoana III. (19) Quebrada Seca 3. (20) Toca do Sitio do Meio, Toca do Boqueirâo da Pedra Furada. (21) Minas Gérais State. (22) Lapa Vermelha IV. (23) Gioás sites. (24) Itaborai sites. (25) Alice Boër. (26) Catalaense and Tangurupa complexes. (27) Cerro La China, Cerro El Sombrero, La Moderna, Arroyo Seco 2. (28) Los Toldos. (29) Fells Cave, Palli Aike, Cerro Sota. (30) Mylodon Cave, Cueva del Medio. (31) Tres Arroyos. (32–33) Various sites in northern Chile. (34) Quereo. (35) Tagua-Tagua. (36) Monte Verde. (37) El Ceibo. (38) Chobshi Cave. (39) Cubilán. (40) Asana. (41) Ubicui and Uruguai phase sites.

more detailed analysis and publication of lithic and other cultural materials, and more agreement on terms and definitions, we cannot identify larger assemblage patterns in a continental context. Nor can we divide the unifacial, bifacial, and fluted industries into subvarieties in order to study local events.

Another problem is fitting all aspects of the early archaeological record to preconceived notions of a focused Paleoindian hunting lifeway. As discussed earlier, the late glacial period in South America has become more generally recognized as a stage characterized by increasingly diverse and efficient adaptations to local environments and by the admixture of late Pleistocene and early Archaic technologies and life-styles. These include reduced mobility, a more diversified economy, and probably dwindling communication in some areas. For example, pre-10,000 B.P. early Archaic-like subsistence patterns have now been recognized in the arid Atacama region of northern Chile (Lynch, 1990b, pp. 12–15; Santoro and Núñez, 1987), the cool, temperate forest in southern Chile (Dillehay, 1981, 1984, 1989), the semitropical areas of northern Colombia (Ardila, 1987), the tropical coast of southwest Ecuador (Stothert, 1985), and the arid regions of eastern Brazil (e.g., Schmitz, 1987, pp. 55–62). Taking these patterns into consideration, the Paleoindian stage seems to have meaning only in a restricted cultural, geographical, and temporal sense, where the archaeological evidence shows the employment of symmetrical projectile points of bifacial manufacture to hunt big-game animals, primarily in open environments (e.g., Andean puna, grasslands of the Pampa and Patagonia) in terminal Pleistocene times. The mosaic pattern of Pleistocene and early Archaic-like cultures across the continent suggests that the former does not accurately and fully portray the full range of late Pleistocene societies in South America. Thus, to avoid possible confusion, we simply refer to the first Americans, late Pleistocene people, and early hunter-gatherers in this paper.

We also have decided not to emphasize the pre-Clovis debate and possible early chronology of people in South America. Some archaeologists (including one of the coauthors here—Beltrão) are convinced that humans were in the Americas prior to 40,000 B.P. (e.g., MacNeish, 1976; Beltrão, 1974a; Beltrão *et al.*, 1982; Guidon and Delibrias, 1985; de Lumley *et al.*, 1988). A few sites or site components, such as Toca da Esperanca and Pedra Furada in Brazil and Monte Verde in Chile, might date long before 12,000 B.P., but until the data from these localities are exhaustively and critically analyzed and published, we refrain from judging them here. Instead, we refer readers to several recent publications by South American specialists for discussion of these sites (Ardila and Politis, 1989; Lynch, 1983, 1990b, 1991; Núñez and Santoro, 1990; Dillehay and Collins, 1988, 1991; Bednarik, 1989; Delibrias and Guidon, 1986; Gruhn and Bryan, 1991). We focus primarily on localities radiocarbon dated between approximately 13,000–12,000 and 10,000 B.P. Included are a few localities dating to the 12th millennium or older that appear to have valid artifacts and geochronological contexts. These sites are Taima-Taima, El Abra, Tibitó, Tequendama, Monte Verde, and sites of the Ubicui and Itaparica phases. Although the glacial period ends around 10,000 B.P., several Pleistocene lithic traditions continue into the Holocene period.

Regarding absolute chronology, we cannot include a table of the radiometric assays for all late Pleistocene sites. Such a table would require a lengthy and detailed analysis and evaluation of the quality of dated material and of the meaning of each date, an effort that would surpass the objectives and space limitations of this paper. Instead, we provide the range of radiometric measurements published for sites, with more emphasis placed on the later side of the time scale.

Figure 1 shows the location of major sites discussed in the text, Figure 2 is a schematic reconstruction of the paleoenvironmental zones during the late Pleistocene period, and Table I presents the chronology of major projectile point types and unifacial assemblages in South America.

LATE PLEISTOCENE LANDSCAPES

Although the landscape and biotic composition of South America were different in late Pleistocene times, parts of the broader ecosystem may not have differed appreciably from the Holocene, with the exception of the presence of megafauna in the earlier period. From 14,000 to 10,000 B.P., the high intermontane valleys and plateaus of the Andean mountains, the western flanks of the Andes, from northern Peru to central Chile, and the arid regions of eastern and southern Brazil and most of Argentina and southern Chile were generally characterized by treeless landscapes, covered with grasslands, savannas, deserts, or tundra-steppes (Fig. 2). These landscapes probably facilitated the southward expansion and distribution of herbivorous animal species (Ochsenius, 1986; Bigarella *et al.*, 1984). Other parts of the continent were covered with parkland, savanna-woodland, and forests.

Although little paleoenvironmental or archaeological evidence is available from Central America, brief mention should be made of the coastlines and, particularly, the Pacific coastal plain in Panama, which has been considered as the possible point of entry into South America (Gruhn, 1988). Both the Pacific and the Caribbean plains were considerably wider and drier during the late glacial (ca. 14,000–12,000). Some areas were cooler and more open, with the temperate vegetational zones in the highlands as much as 1000 m lower than today (Ranere, 1977; Piperno *et al.*, 1990). Between approximately 11,500 and 10,500 B.P., a transition to the present-day temperature and environment occurred.

In northwestern South America, the driest and coldest period was between approximately 21,000 and 14,000 B.P., when glaciers reached their maximum

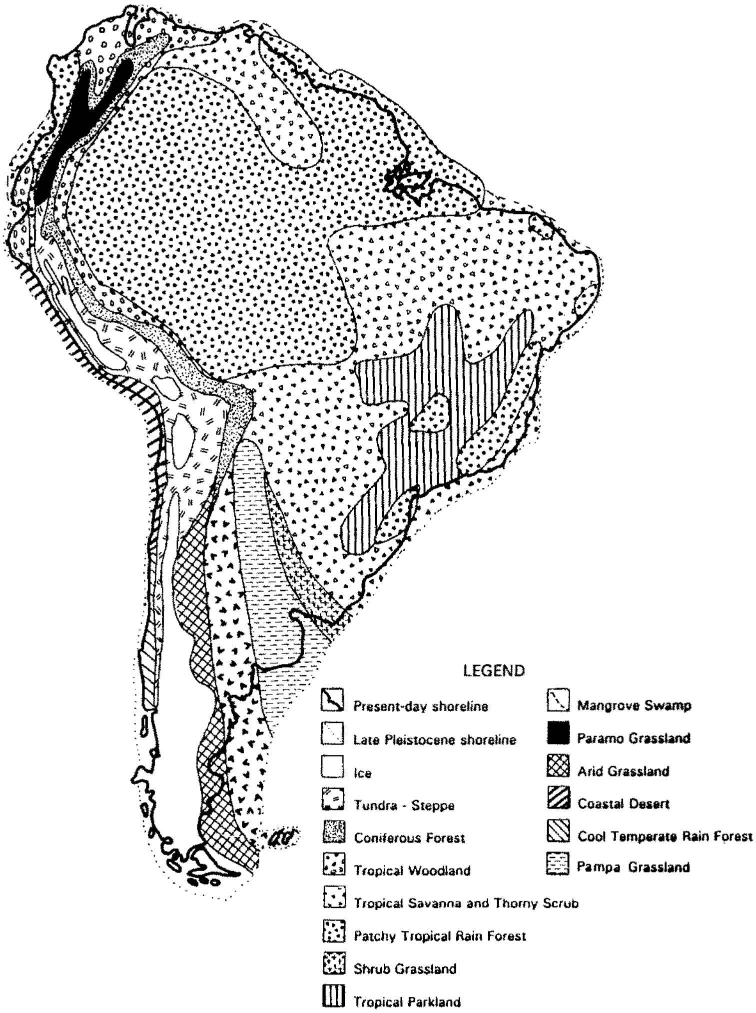
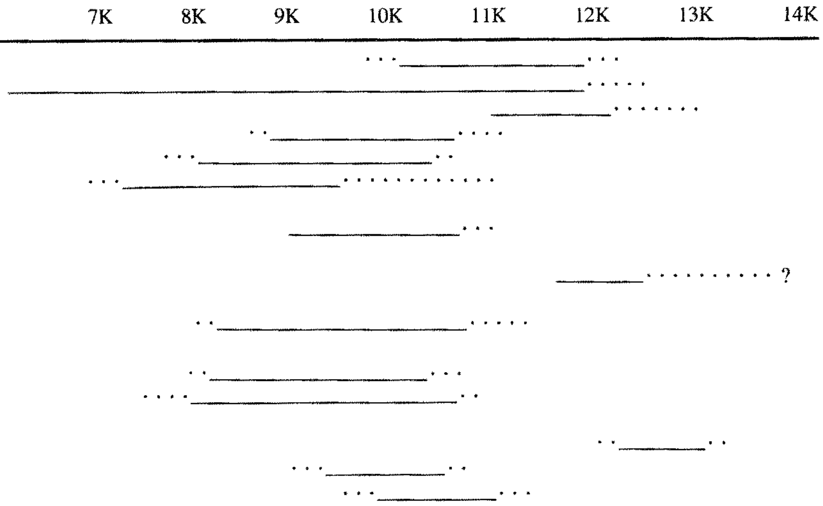


Fig. 2. Map showing a schematic reconstruction of paleoenvironmental zones during the late Pleistocene period, ca. 14,000–11,000 B.P.

extension. At the end of this period, the glaciers retreated and the high intermontane valleys in Colombia and northern Ecuador developed grasslands and *paramos* (prairie) (Van der Hammen and Correal, 1978; Van der Hammen, 1978, 1985, 1986a, pp. 248–250; Ardila, 1987). In the surrounding lowlands and hilly flanks of the Colombian Andes, patches of semitropical and tropical forests began to make contact with the savannas of the tropical *llanos* in Colombia and Venezuela. Between approximately 14,000 and 12,000 B.P., more

Table I. Projectile Point Types and Lithic Assemblages Dating to the Late Pleistocene and Early Holocene Periods

Country	Industry
Colombia	Tequendamiense
	Abriense
Venezuela	El Jobo
Ecuador	El Inga
Peru	Paijan
	North Coast Unifacial Complex
	Central Andean Highland Tradition[a]
Brazil	Flake Industry (Tropical Parklands)
	Itaparica Tradition (Unifacial Blade Industry)
Argentina	Toldense
Chile	Early Archaic Tradition (Northern Chile)
	Monte Verde
	Fell's Cave
Southern Cone	Fishtail Point



[a] Includes projectile point types and phases from Guitarrero, Laurichocha, Pikimachay, Panalauca, Pachamachay, and other highland valley or puna sites.

humid and warmer conditions prevailed, possibly reaching an "optimum" by 11,000 B.P. It was then apparently very cold until around 10,000 B.P., when the Andean forest developed extensively and large game animals became extinct (Van der Hammen, 1981, 1985, 1986c). Little is known of the late glacial period in the central and southern highlands of Ecuador and northern Peru. It is likely that the climatic and environmental episodes in these areas are similar to those described for Colombia and that glacial fluctuations in these regions were fairly synchronous events (Clapperton, 1983; Clapperton and Sugden, 1988).

Information on the eastern tropical lowlands is generally scarce. Changes in rainfall and temperature patterns suggest that the late Pleistocene was climatically and environmentally dynamic and different from the tropical forest setting of today, with grass savannas developing during cold periods and dense forests during warmer periods (Absy, 1979; Colinvaux, 1987; Whitmore and Prance, 1987). In the northern and eastern lowlands of Colombia and throughout most of Venezuela, there is some evidence of fossil sand dunes, suggesting dry, desert-like conditions throughout most of the late Pleistocene (Ochsenius, 1986). During the period from approximately 18,000 to 13,000 B.P., lower temperatures and increased aridity produced little vegetation, especially near the equator. In the southern Amazonia area of Brazil, recent studies (Colinvaux, 1987) of lake sediments show extensive savanna and savanna-woodland environments from approximately 22,000 to 14,000 B.P. and possibly earlier. In southern Brazil extensive patches of forests dominated the uplands, with dry steppes in the lowlands (Ab'Saber, 1977). In southeast Amazonia, the research of Absy and her colleagues (1991) has revealed several dry periods, one around 60,000 B.P., another shortly before 40,000 B.P., and a later one from 21,000 to 11,000 B.P. Ab'Saber (1977, 1980) suggested that by approximately 18,000 B.P. the climate of northeast Brazil was already semiarid, with a dry-steppe vegetation of *caatinga*-like tropical thorny shrub. With extensive arid regions in northeastern and southern Brazil in late Pleistocene times, it is likely that rainforests were patchy and confined largely to the lowlands in northwestern and western Colombia and to parts of the northern and eastern areas of the Brazilian lowlands.

In central Peru, the maximal glacial advance is estimated as between approximately 28,000 and 20,000 B.P., followed by a series of recessions and readvances. Some evidence suggests a glacial advance around 14,000 B.P. (Mercer, 1983b), with deglaciation probably occurring between 14,000 and 12,000 B.P., most likely around 12,000 B.P. (Birkeland *et al.*, 1989). A possible readvance occurred from about 11,500 to 11,000 B.P. (Brüggen, 1950; Paskoff, 1970; Mercer and Palacios, 1977). Pollen data from the central Andean Junin area at 4100 m, collected by Wright (1983, 1984) and his colleagues (Wright *et al.*, 1989; Hanson *et al.*, 1984; Seltzer, 1990), suggest a glacial advance between 12,000 and 11,000 B.P. and modern climatic conditions appearing sometime between 12,000 and 10,000 B.P.

Farther south, in the Atacama puna of northern Chile, there is evidence of a pluvial maximum around 14,000 B.P. and of higher lake stands between 12,500 and 11,000 B.P., which probably correspond to glacial retreat (Lynch, 1986). Pollen studies in this region suggest higher temperatures, associated with greater summer rainfall from 11,500 to perhaps 10,000 B.P.

Evidence of fossilized animal excrement (Phillipi, 1893) and coastal sand sheets suggest that desert-like conditions prevailed at lower altitudes in both coastal Peru and northern Chile for most of the late Pleistocene. Independent of land-based factors are the effects of El Niño, which may have brought rainfall to the Peruvian coast and marine bioturbation to northern Chile (e.g., Radtke, 1987; Rollins *et al.*, 1986). At these times, vegetation might have flourished and herbivorous animals (especially wild camelids) probably appeared (Craig, 1984).

In central Chile, most paleoenvironmental information is derived from the Laguna de Tagua-Tagua site, where the environment was characterized by a semiarid, broad woodland vegetation at the time of the last glacial maximum, 25,000–14,000 B.P. and earlier (43,000 and 34,000 B.P.). After 14,500 B.P., an overall increase in temperature and an interval of desiccation occurred, as evidenced by an increase in amaranths and chenopods (Heusser, 1983, 1990). Villagran and Varela (1990) have found pollen a few hundred kilometers to the north, which indicates wet conditions before 11,400 B.P.

The last glacial maximum in southern Chile was 25,000–14,000 B.P., preceded by a moderate interstadial that lasted from at least 43,000 to about 30,000 B.P. A cold, wet climate prevailed from 26,000 to 20,000 B.P. Recession from this stage was gradual, with the climate warming abruptly before 13,000 B.P. and rapid deglaciation taking place after this period (Mercer, 1976, 1983a, b; Ashworth and Hoganson, 1987; Dillehay, 1989). Villagran (1985) concludes from pollen evidence that the climate of Chiloé Island in the northern Chilean archipelago was already warm, in fact warmer than it is today, by 12,000 B.P.

Permanent glaciers and very cold and wet climatic conditions existed in extreme southern Chile and Argentina from approximately 18,000 to 12,000 B.P. (Mercer, 1976, 1983a; cf. Markgraf, 1987, 1989). After 12,000 B.P., glaciers receded and conditions ameliorated. Farther north in the Argentine Pampa, cool, wet conditions characterized most of the late Pleistocene until about 11,000 B.P., when a warming trend occurred (Markgraf, 1983; Fidalgo and Tonni, 1978; Tonni and Fidalgo, 1978; Politis, 1984b, pp. 46–57, 1985).

In sum, not all major regions of South America have been studied in terms of their paleoenvironments. Even in areas where studies have occurred, the data are difficult to evaluate. Despite the paucity of data, we can detect short, warm intervals during the last glaciation at approximately 60,000, 45,000, and 33,000 B.P. The coldest conditions occurred between 30,000 and 14,000 B.P. The climate was probably substantially drier and cooler over the unglaciated parts of the continent, including the coastal fringes along the Pacific shelf. As expected, the mountainous Andean region was more sensitive to glacial–interglacial fluctuations than the eastern lowlands, where subtropical or arid conditions predominated throughout. It also can be surmised that few areas were blocked from human habitation by glaciers. It is not yet known whether the *paramo* and grassland expansion was due largely to increased aridity or high temperature.

EXPLOITABLE RESOURCES

Lynch (1983, pp. 112–113) has presented a general survey of the principal animal species known from archaeological sites dating to the Pleistocene period. Most of our knowledge comes from western and southern South America. Among the major megafauna are mastodon (*Cuvieronius*), *Paleolama*, horse (*Hippidium* and *Equus*), ground sloth (*Mylodon* and *Megatherium*), glyptodon (giant armadillo), and deer.

The extinction of megafaunal species may be the result, in part, of hunting pressure in some areas, but as Politis and his colleagues (1989) note for the Argentine Pampa, the coincidence of extinction and a warming trend at the end of the Pleistocene is hard to overlook. It seems likely that environment played a significant part in the disappearance of a large number of species (Ochsenius, 1985; Van der Hammen, 1986a, b; Politis and Salemme, 1989; Politis *et al.*, 1989), perhaps corralling them into certain circumscribed zones, altering their breeding habits and demographic structure, and making them more predictable targets for human hunters. It is also possible that extinction of some species was delayed in some areas by the late development of aridity or other devastating conditions (Ochsenius, 1985; Politis *et al.*, 1989b) or by the "late arrival of hunters" (Lynch, 1990a, p. 213).

As for vegetal resources, several areas provided a wide range of plants, including tubers, rhizomes, nuts, berries, and soft leafy vegetables (see Lynch, 1983, pp. 133–136). The semitropical and deciduous forests and wet lowlands of Panama, Colombia, Venezuela, the eastern lowlands of Brazil and adjacent areas, certain areas of the Andes, and the cool temperate rainforest of southern Chile would have been suitable habitats for the continued development of broad-spectrum economies.

We must keep in mind that it was most likely the interaction between human populations and various plant communities in diverse semitropical and tropical environments that gradually set the scene for the domestication of a wide array of food crops possibly earlier than 8,000 B.P., as suggested by the presence of cultigens in the lower levels of Guitarrero Cave (Lynch, 1980) and at several early and middle Archaic sites scattered throughout the Andes and surrounding areas (Lathrap, 1970, 1973). Unfortunately, much of our understanding of this interaction depends upon the presence of organic remains in the archaeological record. Where preservation is good (e.g., Guitarrero Cave, Monte Verde, Huachichocana Cave, and some Itaparica Phase sites in eastern Brazil), plants have been recovered.

The evidence for climatic and environmental conditions during the late Pleistocene in various parts of the continent, as briefly indicated in this paper, suggests that most of the continent underwent a series of major changes with the most dramatic occurring in the Andean mountains. The extension and intensification of arid conditions that took place during the period of amelioration that followed deglaciation must have resulted in significant shifts and formations of different vegetational and faunal regimes. With changes in the distribution and composition of animal populations, people probably moved into new hunting grounds, such as the Andean *puna*, and into more productive plant zones, such as the eastern lowlands of Brazil.

REGIONAL ARCHAEOLOGICAL PATTERNS AND CULTURAL MEANING

Lowland Tropics and Savannas and Highland Paramo of the Northwest

The characteristic products of late Pleistocene lithic complexes in northwestern South America are unifacial tools and various forms of bifacially flaked points. For the period 12,000 to 10,500 B.P., there is considerable variation from site to site and from region to region, but complexes generally consist of flakes, scrapers, choppers, grinding stones, and infrequently, projectile points, most of which appear to date later than the unifacial tool complexes. There is also a simple bone industry, mainly restricted to awls.

The earliest known distinctive lithic types are the El Joboid tradition, the Tequendamiense, and the Abriense complexes. The El Jobo projectile point type is an early lanceolate form (Fig. 3) first defined by Cruxent (1967, 1970) at several terrace sites along the Río Pedregal in western Venezuela and later discovered in buried context with megafaunal remains at the Taima-Taima, Muaco, and Cucuruchu sites (Cruxent, 1967, 1970). The most convincing evidence of a direct association between El Jobo points and animal remains is at Taima-Taima, where the semiarticulated remains of mastodons were associated with fragmentary El Jobo points (Gruhn, 1979). One point fragment was recovered from the pubic cavity of one individual. Other lithics found at the site are flake tools, including scrapers, anvils, and "tools of expediency" (Cruxent, 1979, p. 79). The tightest cluster of associated radiocarbon dates at Taima-

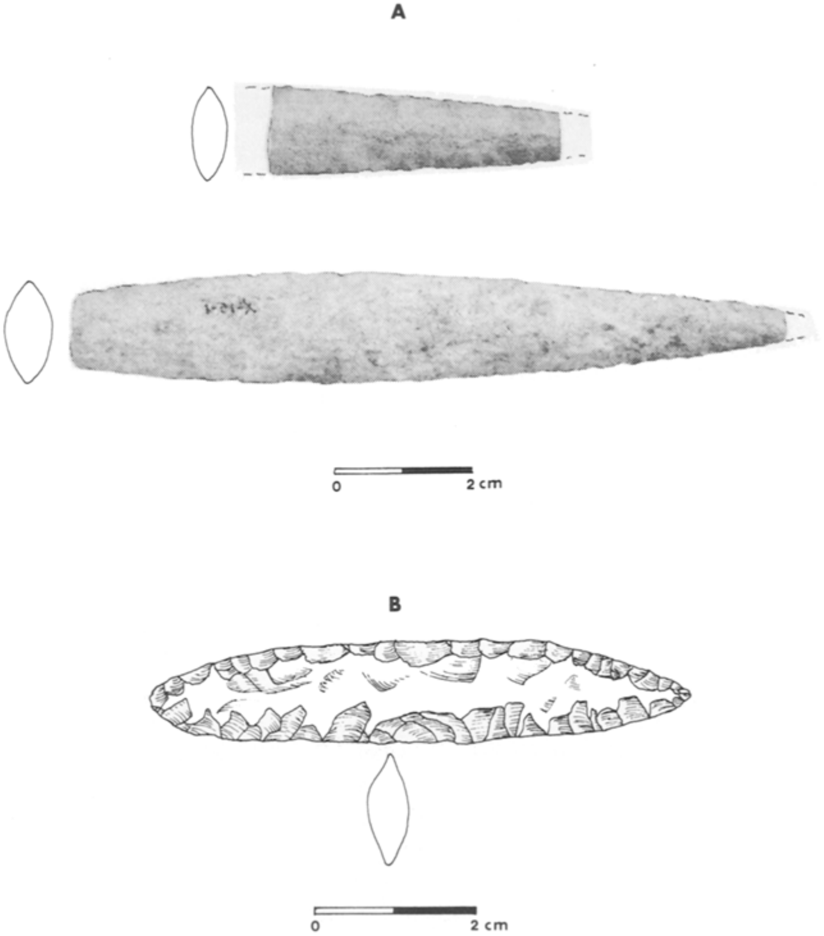


Fig. 3. (A) Monte Verde points; (B) El Jobo points. [B modified from Bryan (1983, Fig. 10.3).]

Taima suggests an age between 13,400 and 12,600 B.P. (Bryan and Gruhn, 1979, pp. 56–57). Cut marks, abrasions, and fractures are reported on several mastodon bones.

Although the context and age of the Taima-Taima site have been questioned (Lynch, 1974, p. 373, 1990a, p. 20), it seems certain that humans were at the water hole around 13,000 B.P., or shortly thereafter, when it was used by mastodons, and that people either killed or scavenged the animals there. The overlying strata, dated between 11,000 and 10,000 B.P., do not contain mastodon remains, suggesting that these animals had abandoned the area in favor of more humid areas to the south or that they had become extinct in the region. The bones of other species (e.g., *Equus*, *Glossotherium*, glyptodont) at the site do not show clear evidence of human exploitation.

One of the best-documented archaeological sequences of late Pleistocene cultural evidence is reported at several sites in the Plateau de Bogotá in the northern highlands of Colombia at approximately 2570-m elevation. Most of the artifacts from these sites have been assigned to the Tequendamiense tool complex or Abriense tool complex (Correal and Van der Hammen, 1977, p. 167; Correal, 1986; Ardila, 1987), the latter more commonly known as the edge-trimmed tool complex (Fig. 4) (Hurt *et al.*, 1977). Both complexes are characterized by small, amorphous chert flakes, small tools probably used to produce wood and bone tools. It is most likely that these complexes belong to a geographically wider unifacial culture that spans parts of the northern half of South America and includes the Itaparica complex of eastern Brazil, the later Las Vegas complex (10,000 B.P.) of southwest Ecuador, and possibly, unifacial complexes in northern Peru (Siches, Honda, Amotope). Both the Tequendamiense and the Abriense complexes are found in the deeper levels of the Tequendama rockshelters and correspond to the late glacial period of the Guantiva Interstadial and the El Abra Stadial (ca. 12,400 and 11,000 B.P.).

The Tequendama rockshelters contain well-documented stratigraphic and cultural sequences, with dates for culture-bearing deposits ranging from 1000 to 10,000 B.P. A series of preceramic occupation layers, each presumably indicative of temporary use episodes, is defined by variable lithic and bone material. The lithic tools include convex-plane (keeled) scrapers and a few blades of lidite, quartzite, liorite, or basalt. The lithic assemblage is associated with two workshops, two fire pits, and the bones of several modern species (deer, mouse, guinea pig, rabbit, armadillo). In addition to the technological differences between assemblages, Tequendamiense tools are made of exotic material possibly brought back from the Magdalena River, while the Abriense tools are of local materials.

The Abriense complex is a percussion-flake tool assemblage that lasted from late Pleistocene to European times. Diagnostic tool types are simple scrapers, knives, and spokeshaves with percussion-struck retouch along the edges, a tool group suggestive of woodworking. In the deeper levels of the El Abra site (C1/2 level) were recovered two choppers and some flakes that correspond to the Frequene Stadial, dated between approximately 21,000 and 14,000 B.P. These materials have led Van der Hammen (1985, p. 12) to suspect a possible earlier human presence.

Other Pleistocene sites possessing core and flake tools are Sueva and Tibitó. Sueva is associated with deer, guinea pig, and armadillo and is radiocarbon dated between 13,000 and 11,000 B.P. (Correal, 1981). Calcined and fragmented bones of mastodon, horse, and deer were recovered in association with

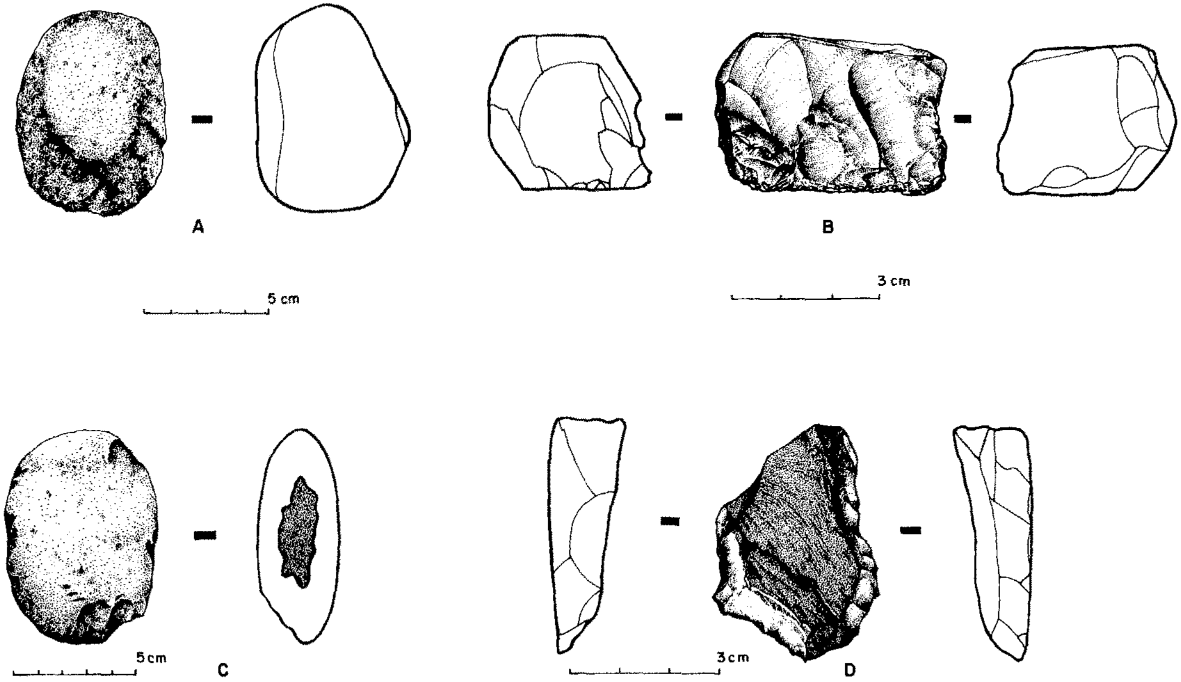


Fig. 4. Edge-trimmed flakes typical of the Tequendamiense and Abriense complexes (drawn by Julio Ariza).

discrete clusters of more than 120 cores and flake artifacts, dated to 11,740 ± 110 (Correal, 1981, p. 42), at the open-air site of Tibitó, located near El Abra.

It should be noted that since most of the Plateau de Bogotá sites have been excavated extensively, it is unlikely that sampling bias accounts for the absence of projectile points and bifacially thinned flakes. These lithic assemblages indeed appear to be unifacial in nature.

Other sites of the edge-trimmed tool complex are of the Las Vegas Phase, dating to terminal Pleistocene and early Holocene times (ca. 10,000 to 8000 B.P.), from the Santa Elena peninsula of coastal Ecuador (Stothert, 1985). The few pebble tools in the deepest levels of the Las Vegas site are possible precursors to the unifacial assemblage of the succeeding Las Vegas phase. This later phase is represented by an Archaic-like hunter-gatherer economy focused on small terrestrial animals and marine resources from coastal environments. Stothert believes that this phase has its roots in an early Tropical Forest tradition in northwestern South America. Both the pre-Las Vegas and the Las Vegas lithics are possibly related to unifacial complexes (e.g., Siches, Amotope, and Honda) of the north coast of Peru (Richardson, 1973).

Fluted fishtail points (Fig. 5, a–c) are found at eroded surface sites in Panama [Madden Lake site (Bird and Cooke, 1978)] and Venezuela (Ardila, 1987; Oliver and Alexander, 1989). Based on the radiocarbon age of these points at other sites in South America (see later discussion of Argentinean and Chilean sites), it is probable that they date later than the El Jobo points, probably after 11,000 B.P. More recently, several new point types have been defined at various localities in Colombia, primarily the Popoyán area (Bray, 1984; Illera and Gnecco, 1986; Ardila, 1986, 1987). One new type from Popoyán (Restrepo) has some similarities to the El Inga Broad-Stemmed and El Inga Shouldered lanceolate forms found farther south at the open-air site of El Inga in the northern highlands of Ecuador. This new type probably dates no earlier than 10,500 to 10,000 B.P.

Five different projectile point types have been reported from El Inga: Fell's Cave Stemmed, Paiján, El Inga Shouldered, El Inga Broad-Stemmed, and Ayampitín. The tools associated with these bifacial points are primarily unifacial blades and burins. With the exception of Paiján and Ayampitín, each type includes nonfluted and fluted forms. Based on the presence of these coeval point types, Mayer-Oakes (1986) has concluded that a developmental sequence occurred from nonfluted to basal-thinned points to fluted and pseudo-fluted points. He also has suggested that because El Inga Stemmed (Fig. 5, d and e) points predominate over lanceolate forms, the Ecuadorian fluting was invented independently of North American fluting. The chronology and stratigraphic sequence of the lithic types at El Inga, however, are not developed enough to support conclusively Mayer-Oakes's interpretations. The earliest radiocarbon dates for the fluted point at El Inga are around 9000 B.P., almost 1500 years later than

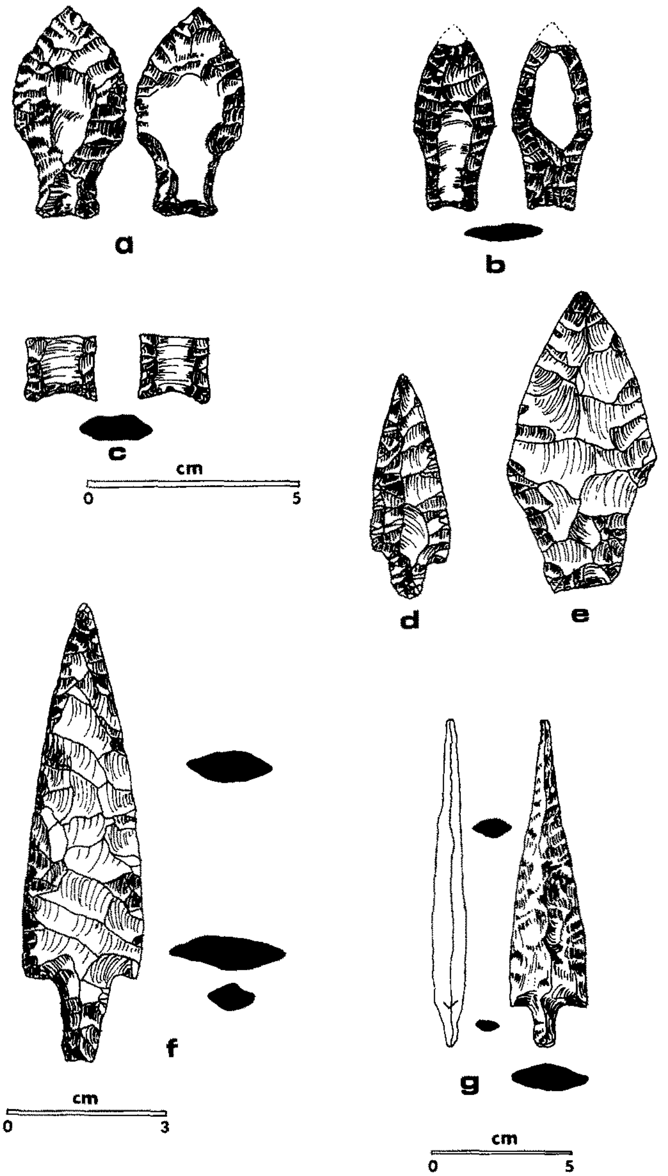


Fig. 5. (a) Obverse and reverse sides of two Magellan I-type projectile points from Fell's Cave (redrawn from Willey, 1971, p. 44; Emperaire *et al.*, 1963). (b, c) Magellan I or Fell's Cave fishtail-type points from El Inga, Ecuador (redrawn from Willey, 1971, p. 45). (d) Stemmed points from El Inga, Ecuador (redrawn from Willey, 1971, p. 46). (e) Paiján point from La Cumbre, Peru (redrawn from Ossa, 1978, Fig. 10). (f) Paiján point from Pampa de Fosíles, Peru (redrawn from Chauchat, 1988, p. 55).

those in southern Patagonia. A late date for the El Inga fluted point seems correct in the light of new data obtained from the nearby San José site. San José lacks bifacial projectile points and is dated by a series of obsidian hydration assays between approximately 11,000 and 10,000 B.P. (cited by Bryan, 1990).

Other than the El Inga and San José sites, little is known from the rest of the Ecuadorian highlands. Lynch's excavations at Chobshi Cave in the southern highlands, radiocarbon dated between 10,000 and 8000 B.P., have yielded disturbed deposits of bones of several modern animal species in association with early stemmed points (Lynch and Pollock, 1981). Farther south in the *paramo* of Cubilán, Temme (1982) has recovered leaf-shaped and tanged points dated around 10,500 B.P. ± 130 years. Salazar (1979, 1988) believes that Chobshi Cave represents a site typical of Willey's Andean Hunting-Gathering Tradition (Willey, 1971, p. 50) and that Cubilán was a quarry-campsite. Both Salazar (1988, p. 117) and Mayer-Oakes (1986, p. 211) postulate that the resources of the *paramo* and Andean slopes of Ecuador were utilized by hunter-gatherers as part of a wider network of mobility and exchange across multiple environmental zones.

Little is known about sites and lithic assemblages in the lowlands of Venezuela and eastern and western Colombia and Ecuador. Reichel-Dolmatoff (1986), Ardila (1985, 1987), Correal (1977), Oliver and Alexander (1989), and Jaimes (1990) have found several percussion-struck cores, scrapers, and unifacial tool assemblages and a few projectile points at surface sites along the lower Magdalena and Sinu rivers and at sites in the state of Lara, Venezuela, yet they have not been able to establish any secure relationship between megafaunal remains and tools. Virtually nothing is known of late Pleistocene cultures of the Orinoco and Amazon basins.

In sum, the temporal and cultural linkages between the northwestern unifacial and projectile point traditions and the types of environments to which they were adapted are not well understood. The first pioneers probably had adapted to the characteristics of the semidry tropical lowlands during their movement through Central America (Ranere, 1977). If these people were in the northwest between 21,000 and 14,000 B.P., they would have experienced dry conditions in the lowlands and cold conditions in the highlands. Cooler, drier conditions occurred between 14,000 and 12,000 B.P., at about the time Tequendama, Tibitó, and other sites might have been initially occupied. After 12,000 B.P., once wetter, warmer conditions developed in the highlands, forest growth developed, and open areas and corridors for animal movement were probably reduced. During the latter part of the Guantiva Interstadial (ca. 11,000–10,000 B.P.), an increase in precipitation and temperature led to vegetation growth, more regionalized biotic regimes, and perhaps greater cultural diversity, as suggested by the admixture of the different unifacial and bifacial complexes in Colombia and Venezuela.

It is possible that the Tequendamiense and Abriense complexes are affiliated with a pattern of seasonal transhumance between the lowlands in the lower Magdalena River Valley and the Plateau de Bogotá in the highlands. Although there is no hard evidence to substantiate such a linkage, the deepest levels of the El Abra site contain choppers and plano-convex scrapers similar to those found from surface sites in the northern lowlands of Colombia and Venezuela (Oliver and Alexander, 1989; Correal, 1983, 1987; Van der Hammen, 1985).

Central and Eastern Tropical Forest, Savanna, and Parkland

Perhaps most significant in the Pleistocene record of Brazil is the evidence for the chronological sequence of a unifacial tool complex (Fig. 6) succeeded by a bifacial projectile point complex, a pattern, to date, known only in the

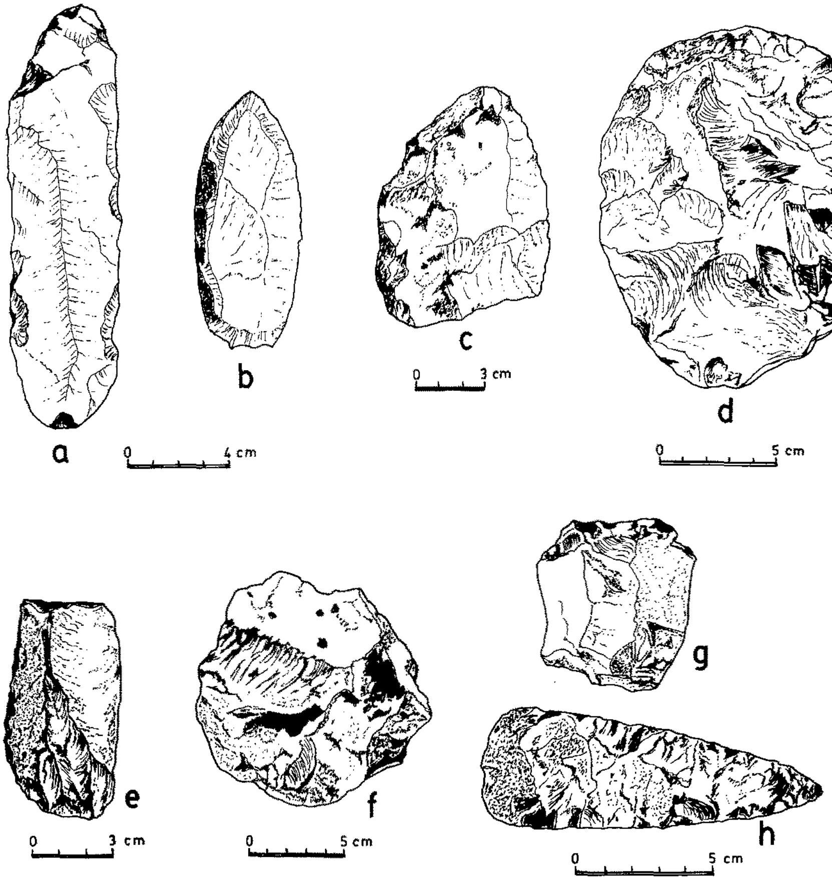


Fig. 6. Various unifacial stone tools from sites of the Itaparica Tradition.

highlands of Colombia and possibly at the Los Toldos and El Ceibo sites (Cardich *et al.*, 1987) in southern Argentina.

Since 1970, Guidon (1986; Guidon and Delibrias, 1986) and her colleagues (Parenti *et al.*, 1990) have been carrying out extensive research in the state of Piaui in northeastern Brazil. Excavations in several rockshelters, primarily Toca do Sitio do Meio and Toca do Boqueirão da Pedra Furada, have exposed a sequence of radiocarbon-dated deposits extending back to more than 40,000 B.P., associated with possible artifacts and hearths. Guidon has proposed a sequence of three early cultural phases: (1) ca. 35,000–14,000 B.P., associated with utilized but unretouched quartz and quartzite pebble tools and flakes; (2) ca. 14,000–11,000 B.P., associated with unifacially retouched "*limaces*" (slugs on thick blades), choppers, pebble hammerstones, and flakes of siltstone, quartz, or quartzite; and (3) ca. 10,000–7000 B.P., associated with large flakes, scrapers, and knives. Unfortunately, the preservation of organic remains is not very good at these sites and no bone or plant material has been recovered from the deeper levels. Guidon assumes that projectile points were made of bone, wood, or bamboo.

The validity of the proposed lithic sequence rests largely on the materials from Pedra Furada and, to a lesser extent, Toca do Sitio do Meio. The sequence is defined primarily by a series of intact layers containing varied frequencies and types of small flaked tools and small flaked pebbles, mostly of quartz, associated with the charcoal and ash features reported to be hearths. Since so little material has been published on these sites, it is difficult to evaluate the cultural reliability of the entire sequence and especially of the lithics and "hearth" features. The concern is whether the lithics are artifacts or simply quartz fragments that have fallen from the overhanging rockshelter wall and whether the "features" are natural. Although skepticism has been expressed about these sites (Lynch, 1990b; Schmitz, 1987) [see Bednarik (1989) and Bahn and Müller-Beck (1991) for a supportive view], some specimens of the early flake tool assemblage do seem to fit the technological parameters of the broader unifacial tool tradition of late Pleistocene and early Holocene age in Brazil. At present, we can only agree with Schmitz's (1987, p. 61) position that "although the reliability of these results remains to be established, they cannot be ignored."

Further possible evidence for an early association of megafauna and human artifacts comes from several cave sites in the Lagoa Santa area of Minas Gérais state (Prous, 1986b). Ground sloth remains from Lapa Vermelha IV rockshelter (Laming-Empéraire *et al.*, 1975; Laming-Empéraire, 1979; Prous, 1986a, p. 287, 1986b, pp. 176–177) are associated with charcoal radiocarbon dated between 10,200 B.P. ± 200 years and 8580 B.P. ± 200 years. The deeper levels of the rockshelter contain quartz cores and flakes stratigraphically dated between approximately 15,300 and as late as 6830 B.P. and, possibly, as early as 25,000 B.P. More securely dated are other caves in the region which contain cultural deposits with flakes, human bones, hearths, and other cultural features dated between 11,960 B.P. ± 250 years and 7900 B.P. One cave, the Gran Abrigo de Santana do Riacho (Prous, 1981, 1986a, pp. 292–295), contains quartz crystals and fragments of red ocher associated with a hearth dated at 11,960 B.P. ± 250 years. Another site, Lapa do Boquete (Prous, 1986a, pp. 289–291), is associated with unifacial tools dated around 11,000 B.P. ± 1000 years. It is reported that the basal cultural layers at the latter two sites were never exposed (Prous, 1986a).

Numerous rockshelters in the Goiás region also have yielded evidence of human occupation, with radiocarbon dates ranging from 14,000 to 9000 B.P. Although a few sites have pre-11,000 B.P. radiocarbon dates and possible flake tools in their basal deposits, the most reliable and best-defined occupation, referred to as the Paranaiba Phase (ca. 10,700–9000 B.P.) of the Itaparica Tradition, is associated with unifacially retouched artifacts or *limaces*. The overall lithic tool technology of this tradition often stresses the production of unretouched bladelets and core-reduced pieces (*pièces esquillées*, *outils écaillés*), with a marked absence of formal tools and the infrequent to rare occurrence of bifacial tools, including small stemmed points (Schmitz, 1987, p. 62). Most Itaparica sites are located in tropical parkland and are interpreted as temporary campsites, though a few quarry sites and more permanent base camps have been excavated. The rockshelter sites, in particular, often contain a wide variety of game animals, in addition to plant remains, including fruits and leafy vegetation. The presence of numerous smoothing and grinding stones and disk stones suggests plant or hide processing. The Paranaiba Phase is interpreted as a generalized hunting-gathering culture during a period of increased aridity and decreased precipitation.

Stratified deposits in the open-air, river terrace site of Alice Boër (Beltrão, 1974a, b; Bryan and Beltrão, 1978; Beltrão *et al.*, 1986; Hurt, 1986) in Sâo Paulo State have yielded cores, a flake uniface end scraper, and, in the deeper levels (Bed V), a thick, uniface end/side scraper made from a blade. Bed V is overlaid by a thin, culturally sterile Bed IV. A 2-m-thick cultural deposit (Bed III) overlies Bed IV and is characterized by unifacial, percussion-flaked cores and flake tools in its lower levels. The middle and upper levels of Bed III contain bifacial tools, including stemmed and lanceolate projectile points initially associated with a single radiocarbon date of 14,200 B.P. ± 1150 years. A more recent series of thermoluminescence and radiometric dates place the Bed III cultural deposits around 10,950 ± 1,000 B.P. If this radiocarbon assay is correct, earlier dates are suggested for the few lithics contained in Bed V.

Research at the Itaborai site by Beltrão and her associates (Beltrão, 1970; Beltrão and Sarcia, 1987) has produced edge-trimmed flake artifacts, retouched cores, and stemless projectiles estimated to date between approximately 12,000 and 9,000 B.P.

Recent research directed by Guidon (1989) along the lower Río Uruguay and by Miller (1976) along the upper Río Uruguay has located sites of early periods. In the latter area, the lower levels of the open-air site of Y-58 contained charcoal, flakes, and cores radiocarbon dated at about 11,500 ± 500. No bone or plant remains are preserved at these sites. A few fishtail points are known from surface contexts in Uruguay and the Río Claro region of Sâo Paulo (Beltrão, 1974a; Bosch *et al.*, 1980; Schobinger, 1973; Politis, 1987).

On the Brazilian side of the Río Uruguay, Miller (1987) has located 24 sites associated with the Ubicui and Uruguai phases and with open vegetation in the south. The Ubicui Phase is present at three open-air sites that contain both pressure- and percussion-flaked unifacial tools made of basalt and sandstone, in association with extinct megafauna (cf. *Glossotherium robustum*). This phase has only two radiocarbon dates, 12,690 B.P. ± 100 years and 12,770 B.P. ± 200 years, both on bone. The subsequent Uruguai Phase is defined at 21 sites and is characterized by bifacial stemmed projectile points, scrapers, lanceolate preforms, and bifaces. Eighteen radiocarbon dates place this phase between approximately 11,555 B.P. ± 230 years and 8585 B.P. ± 115 years, with most dates falling between 10,500 and 9500 B.P.

As a final note, three aspects of Brazilian archaeology require brief mention. First, a few archaeologists (Guidon, 1981; Beltrão and Andrade Lima, 1986) believe that rock-art hunting scenes at several sites in Piaui and Bahia states probably date to late Pleistocene times and that some of the depicted animals represent megafaunal species. Second, the remains of a female skeleton found in the Lapa Vermelha IV site (Lagoa Santa) at a depth of 11–13 m possibly dates from 11,960 to 10,700 B.P. (Prous, 1986a). Recent finds of skeletal remains at early sites in Bahia (Cartelle and Beltrão, 1985) and in Piaui (Guidon, personal communication, 1991) are under analysis. And third, eastern and southern Brazil probably contain the highest density of known late Pleistocene archaeological sites in South America. Despite the growing number of sites in these areas, archaeologists have not yet used differences in the occurrence and number of dated sites as a possible robust measure of the size and distribution of hunter-gatherer populations and of variations in resource productivity across different ecological zones, for what appears to be a widespread unifacial tradition beginning by at least 12,000 B.P.

Pampa and Patagonian Grasslands of the Southeast

Late Pleistocene human occupation in the southeast and deep south was located in the Pampa grasslands of Uruguay and eastern Argentina and in the Patagonian semiarid steppe of southern Argentina and Chile. Almost all occupation is reported from open-air sites in the Pampa and from caves and rockshelters in Patagonia.

Very few stratified sites are reported from the far northern end of the grasslands in Uruguay near the present-day Brazilian border. The chronological and cultural relationships between sites in these diverse environments are not well understood, but the sites do reveal some patterns and processes similar to those in southern Brazil and northeastern Argentina. On the basis of materials largely recovered from open-air surface sites, Taddei (1968, 1987) has proposed a sequence of Uruguayan lithic complexes, the earliest of which is Catalanense, estimated to date as early as 9000 B.P. This complex is characterized by large blades and large elongated flakes, with occasional bifacial tools. Another little-known complex is the Tangarupa complex of northwest Uruguay, associated with high terrace sites along rivers and with a wide variety of blade and flake tools, bifacial discoidal objects, and other flake varieties (Hurt, 1989). Although no Tangarupa sites have been dated by radiocarbon, site location and lithic type suggest a terminal Pleistocene age.

Information regarding human occupation on the Pampa grasslands of present-day Uruguay and northeastern and central Argentina is scarce, with the exception of the Tandilia and Interserrana areas. Hunting was primarily of guanaco; extinct horse, giant ground sloth, and glyptodont appear infrequently (Mengoni, 1986; Miotti, *et al.*, 1989; Politis and Salemme, 1989).

Arroyo Seco is a multicomponent open-air site (Fidalgo *et al.*, 1986; Politis *et al.*, 1987; Politis, 1989). The lower component is characterized by medium-sized flakes with unifacial marginal retouching (Fig. 6, a and b). The faunal assemblage of this level consists of guanaco and deer. Three radiocarbon dates on bones of extinct horse and giant ground sloth (Politis and Beukens, 1991) are 8890 B.P. ± 90 years, 8390 B.P. ± 240 years, and 7320 B.P. ± 50 years. Underlying this level is a stratum containing the remains of 20 human skeletons from different burial episodes, associated with radiocarbon dates ranging from 8980 B.P. ± 100 years to 6880 B.P. ± 90 years. More radiocarbon assays are required from Arroyo Seco to determine whether the later dates are correct and thus whether megafaunal species survived into early Holocene times. In combination, site stratigraphy, paleontological evidence, and lithics forms suggest that the present series of dates is unreliable.

La Moderna (Politis, 1984a, 1985; Politis and Olmo, 1986) is another multicomponent open-air site located in a gully bank, where the skeletal remains of glyptodont were found in direct association with flakes made of quartz, quartzite, and chert (Fig. 7, c). Two radiocarbon dates on glyptodont bones are 12,330 B.P. ± 370 years and 6550 B.P. ± 160 years. Since the cultural materials were excavated in late Pleistocene stratigraphic and paleontological contexts, Politis believes that the age of the deeper deposits is closer to the earlier date.

Fishtail points are found in secure stratigraphic contexts at a few multicomponent sites in the Cerro La China complex in the Tandilia area. Site 1, a small rockshelter, has yielded a scute of an extinct armadillo and a fragment of

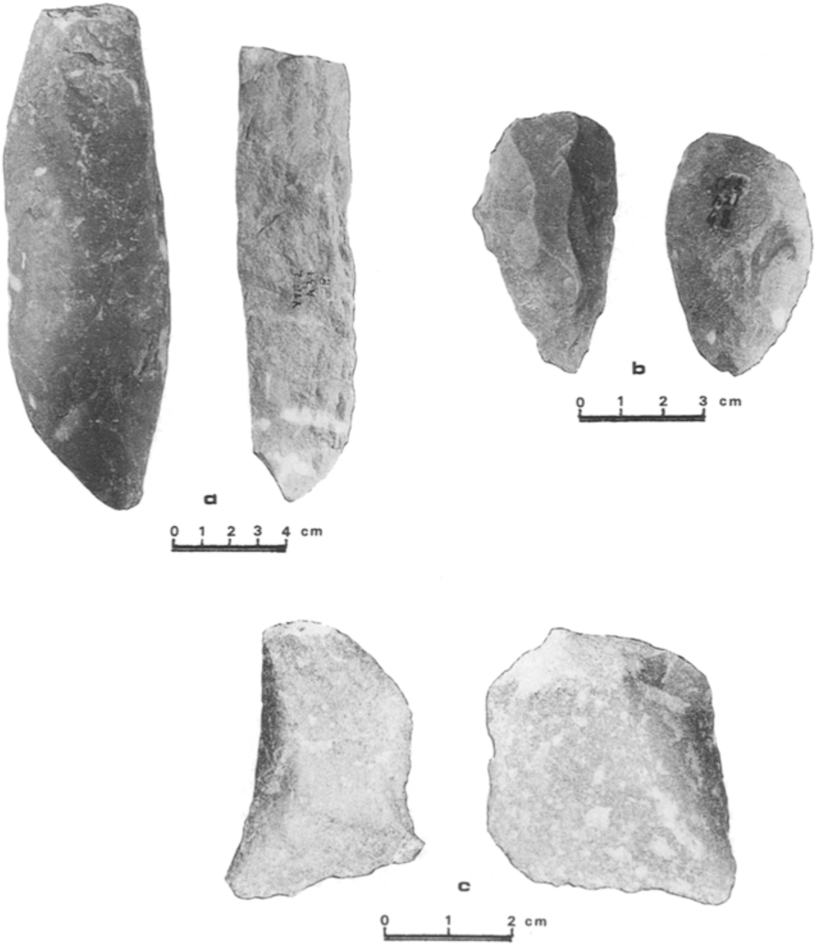


Fig. 7. (a, b) Modified flakes from the deeper level of Arroyo Seco, Argentina. (c) Edge-trimmed flakes from La Moderna.

a possible fishtail point from the lowest stratigraphic level (Flegenheimer, 1986, 1987), radiocarbon dated between 10,790 B.P. ± 120 years and 10,700 B.P. ± 300 years. Sites 2 and 3 are open-air localities associated with bifacial lithic complexes, including fishtail points Site 2, which is radiocarbon dated at 10,610 B.P. ± 180 years (Flegenheimer, 1986–1987). Located nearby is the Cerro El Sombrero site, which has yielded several surface and subsurface fishtail points. Although the buried contexts of the points has not yet been dated, they are probably contemporaneous with the Cerro La China fishtail points.

The earliest human record in Patagonia might be at Cave 3 (Level 11) of

Los Toldos in Argentina, where a lithic complex composed of thick, unifacial flakes with trimmed edges is associated with abundant guanaco bones and a few bones of extinct horse and extinct camelid (Cardich *et al.*, 1973; Cardich and Flegenheimer, 1978; Cardich, 1977). A single radiocarbon date places this deeper material around 12,600 B.P. ± 600 years. Overlying levels contain bifacial subtriangular projectile points associated with guanaco and other game, dated by radiometric means between 11,000 and 10,000 B.P. Although more radiocarbon dates are required before the deeper component can be accepted, this level underlies a Toldense cultural layer, defined by flake scrapers, subtriangular projectile points, and bifacial knives, dating between the 11th and the 9th millennia B.P. Other cave sites in the vicinity [El Ceibo, Cave 2 of Los Toldos (Cardich, 1987); Cueva de Los Manos, Alero Cardenas, Cueva Grande de Arroyo Feo (Gradin, 1980; Gradin *et al.*, 1979; Gradin *et al.*, 1987)] have also yielded Toldense lithic materials, some of which are in association with megafaunal species and are radiocarbon dated between 9500 and 7500 B.P. (Gradin *et al.*, 1987). Given the dates from these sites, it is likely that the deeper Level 11 at Los Toldos is between approximately 11,000 and 10,000 B.P.

In the southern Patagonian Magellan area, Junius Bird (1938, 1988) carried out his pioneering work at several famous cave sites. In the deepest level of Fell's Cave, radiocarbon dated between 11,000 B.P. ± 170 years and 10,080 B.P. ± 160 years, several fishtail points (Fig. 5, a) were associated with utilized flakes, cores, ground and pecked disks, and the bones of mylodon, horse, guanaco, birds, and other game. Hunters of the Fell's tradition also occupied Palli Aike cave, where fishtail points, polished disks, and the bones of horse and mylodon were dated to the ninth millennium B.P. In Palli Aike shelter near Fell's Cave, several human skeletons excavated by Bird possibly date to the ninth millennium. Cueva del Medio, located about 1 km from Mylodon Cave, contains an earlier cultural component, belonging to the Fell's I cultural tradition and associated with fishtail points and the bones of guanaco, extinct horse, mylodon, and cervids (Nami, 1987, 1989). Four radiocarbon dates from hearths in the deeper levels range between 12,390 B.P. ± 180 years and 9595 B.P. ± 115 years, placing the initial occupation of the cave sometime in the 11th or 10th millennium B.P.

Farther south on the island of Tierra del Fuego, more diversified hunter groups are revealed at Tres Arroyos, dated between approximately 10,420 B.P. ± 100 years and 10,280 B.P. ± 110 years. The bones of guanaco, fox, horse, camelid, birds, and rodents and a lithic assemblage made up of edge-trimmed flakes were recovered from the deeper deposits (Massone, 1983).

Until the early occupation at Los Toldos is better understood and dated, we cannot determine whether a marked qualitative change occurred in the lifeway of pioneer immigrants from the western or Chilean Andean side of Patagonia or whether new arrivals bearing fishtail points came from the Argentine north. In addition to the fishtail point, other diagnostic artifacts of this new way of life include scrapers, knives, coarse choppers, small flaked tools, and occasionally, polished discoidal (bola?) stones. Several varieties of extinct and modern animals were exploited, including mylodon, guanaco, horse, birds, fox, rodents, and rhea. Some evidence also exists for plant gathering, but this seems to have been secondary to hunting. Despite the paucity of evidence, it seems fairly certain that this way of life evolved later than the cultural changes described for the northern and central areas of South America and that it was associated with the development or adoption of the fishtail point sometime in the 11th millennium B.P., as evidenced at several cave sites in southern Patagonia, including Fell's Cave, Palli Aike, and Cueva del Medio.

During the 11th and 10th millennia B.P. and perhaps later, Pleistocene environmental conditions continued in most areas of the far south as deglaciation occurred. By the latter part of the 11th millennium, more elaborate lithic complexes appeared in association with a wide variety of fauna, both extinct and modern, suggesting increased adaptation to an ameliorating Patagonian environment. Unlike the arid grasslands along the western slopes and plains of Peru and northern Chile, where the extinction of megafauna might have occurred 1000 to 500 years earlier, mylodon and possibly horse were abundant until the 10th and 9th millennia B.P. During this period, postglacial climatic conditions developed, characterized by an increase in temperature and in rainfall (Markgraf, 1983), with an environment probably more suitable to the guanaco, which became the primary food source of the eastern and southern grasslands during the Holocene.

No evidence of horse and guanaco mass kills or jump sites has been reported for the open plains of South America. Where horse and guanaco have been found, there seems to be evidence of little exploitation of mylodon (Mengoni, 1986; Borrero, 1980; Politis and Salemme, 1989; Miotti *et al.*, 1989), perhaps because it was easier to kill the smaller game or because mylodon were scarce after 11,000 B.P.

In sum, until the lower component of the La Moderna site can be dated securely, there is little hard evidence to suggest that humans were on the Pampa grasslands before 11,000 B.P. If an earlier occupation existed, it is likely associated with geological contexts different from those where terminal Pleistocene and early Holocene sites are currently found. Alternatively, the absence of earlier habitation may indicate a very different pattern of resource use, possibly related to changing river courses and biotic regions and to increased aridity and the location of water sources prior to or during the initial deglaciation. Resources offered by the Atlantic coast and coastal lagoons also may have acted as a focus of human activity and as an early avenue to the southern tip of the continent.

Researching Atlantic coast areas might be impossible at present, for unlike the Pacific Coast, the very wide continental shelf, sometimes extending 100 km east, is under water.

Deserts, Grasslands, and Forests of the Central and Southern Andes

The archaeological data from the earliest sites reveal several different economic modes and tool complexes developed by regional populations dating at least to the 11th and 10th millennia B.P. Discussion of the data from this area is according to two major regions: (1) the coastal desert plains stretching from northern Peru to central Chile and the cool, temperate rainforest of south-central Chile and (2) the highland intermontane valleys and puna grasslands of Peru, Chile, and Argentina.

Coastal Lowlands. Richardson (1973, 1978) and Malpass (1983) have identified unifacial complexes (Amotape, Siches, Honda) possibly dating as early as 10,500 to 10,000 B.P. for the northern desert coastal plains of Peru. These complexes are generally characterized by a wide variety of pointed and beaked tools, denticulates, and flake forms. Sites associated with the Amotape complexes often are located around tar seeps (e.g., Talara), possibly suggesting a local environment of savanna-woodland or grassy savanna broken by gallery woodlands in river drainages. The complexes are very tentatively defined and are possibly linked to the late phase of the Tequendamiense and Abriense unifacial complexes of Colombia (El Abra) and coastal Ecuador (Las Vegas). Preliminary analyses point to lithic technologies, and presumably cultural lifeways, different from the highlands.

Farther south on the north-central coast of Peru is the Paiján complex, dated between 11,000–10,000 and 7000 B.P., which includes bifacial and unifacial tools, particularly long, slender points with short, contracting stems (Fig. 5, e and f) (Chauchat, 1975, p. 90, 1978, 1988; Uceda, 1986; Ossa, 1978). Paiján sites are confined to the desert and coastal foothills of the Andes and are associated with both maritime and inland resources. The presence of a Paiján complex in the coastal interior suggests seasonal rounds between closely juxtaposed areas or simultaneous exploitation of various resource zones.

The Paiján and unifacial complexes are considered coexisting but independent adaptations to similar environments and resources (Richardson, 1978, p. 280) or even distinct social groups (Malpass, 1983). However, there may be a greater technological linkage between them than the present data suggest and researchers admit.

Information on possible early maritime adaptations comes mainly from the Ring site (Sandweiss *et al.*, 1989) in southern Peru and from coastal sites in northern Chile (Llagostera, 1979). The preliminary data suggest an economic specialization in shellfish, fish, and terrestrial and marine mammals; a technology of composite bone-shell fish hooks and modified bone-shell artifacts; and a unifacial complex, possibly dating as early as 10,500 B.P. but more securely between 10,000 and 9000 B.P. Although the geochronological sequences of the basal deposits are not well dated and the claim for an early human presence must be substantiated, continued research at the Ring site may show that it is one of the first human occupations along the stabilized Pacific shoreline of southern Peru.

To date, no classic late Pleistocene sites (i.e., dating prior to 10,500 B.P. and associating human artifacts with extinct faunal remains) have been found in the northern desert of Chile, although transitional Pleistocene–Holocene locations are documented at a few sites dated between 11,000 and 8000 B.P. (Santoro, 1989). Perhaps the closest approximation to a late Pleistocene tradition is revealed at a series of caves and rockshelters (e.g., Patapatane, San Lorenzo, Tuina, Tojo-Tojone, Las Cuevas, Caru, Toquepala, Tulan) scattered across the high and low punas of northern Chile. These sites appear to represent an Andean Hunting Tradition (*sensu* Willey, 1971, pp. 44–60) characterized by a variety of projectile point styles and the remains of guanaco and other game (Santoro and Núñez, 1987).

Farther south are the sites of Quereo (Los Vilos) and Tagua-Tagua. Quereo, located on a bluff overlooking the Pacific Ocean, yielded a few crude stone flakes and possible simple tools associated with the bones of mastodon, extinct horse, deer, paleocamelid, and other animals. Fragments of marine shell and, possibly, whale and sea lion bones were also recovered (Núñez *et al.*, 1983, 1987). These materials were radiocarbon dated between 11,600 and 11,400 B.P. Lying below this component are traces of animal bones, including a crushed horse skull, and other remains that may bear minimal traces of human activities.

The best-documented site in central Chile is Tagua-Tagua, a kill-site (Montane, 1968; Núñez *et al.*, 1987). It is adjacent to a small freshwater lake and marsh, with grassland and scattered open woodland on the nearby hillsides. The shore of the lake was periodically visited by animals and by people who subsisted on a variety of game and, possibly, plants found along the shore of the lake and in the adjacent grasslands. Cultural remains at the site include a limited stone tool industry of flakes, hammerstones, flakers and cores, and a few miscellaneous bone tools. The bones of mastodon, horse, aquatic birds, camelid, and other extinct fauna were also recovered. Possible butchering and fracturing marks appear on some bones. Radiocarbon dates for this component range from 11,430 to 11,000 B.P.

Located approximately 900 km farther south is the site of Monte Verde in a cool, temperate forest. The site has revealed cultural materials radiocarbon dated between 13,200 and 12,500 B.P. (Dillehay, 1984, 1989). Additionally, equivocal older materials were recovered in deeper levels at the site (Dillehay and Collins, 1988). Several characteristics of the younger layer are worth noting.

Foundations of crude dwellings were excavated. A heterogeneous stone tool assemblage representing three technologies was recovered: (1) naturally fractured, edge-used flakes; (2) unifacially and bifacially edge-trimmed flake tools, including bifacially chipped projectile points (Fig. 3, a); and (3) pecked-ground bola and grinding stones. Also preserved are vegetal materials (i.e., seeds, pods, leaves, flowers, pollen, fruits, nuts, several species of medicinal plants) and wooden artifacts. Activity areas in the site contain a wide variety of resources procured from an extensive economic catchment area stretching from the coast to the highlands. Although the interpretation of the site has been questioned (Lynch, 1990b, 1991), there is clear evidence of a diversified economy and technology focused primarily on plant gathering before 12,000 B.P. (Dillehay and Collins, 1991).

Highland Valleys and Puna Grasslands. It is worth giving more detailed consideration to this region because it has been researched more than any area of South America. Located in the Callejón de Huaylas Valley (2500–3500 m) in north–central Peru is Guitarrero Cave, where Lynch (1980) has defined two early cultural complexes of the Central Andean Highland Tradition, dated from about 10,400 to 7500 B.P. The earlier Complex I is associated with faunal species typical of the Archaic period (e.g., deer, rodents, rabbits, tinamou bird, and other small game) and with three cultivated plants (pepper, lima beans, and quinoa). The younger Complex II is associated with the same and other animal species, various types of triangular, lanceolate, and contracting-stemmed points (Fig. 8), and perishable artifacts made of bone, wood, textiles, and plants. Although more than 30 radiocarbon dates have been obtained from the site, questions still remain about the integrity of the stratigraphy and about the cultural association and age of the cultigens (see Vescelius, 1981a, b; Bonavia, 1982, 1984; Lynch *et al.*, 1985). Even if the cultigens are younger, both the modern fauna and other plants from the deeper levels suggest an incipient Archaic lifeway beginning possibly in terminal Pleistocene to transitional Holocene times. If the early cultigens are indeed of late Pleistocene age and are of nonhighland origin, then we must consider the possibility of contemporaneous semisedentary to sedentary groups existing in lowland tropical environments.

Another informative site is Lauricocha Cave, located at 4000 m, near the source of the Amazon River, and dated around 10,000 B.P. (Cardich, 1964, 1983). The deeper deposits contain bifacial, lanceolate, subtriangular, and barbed points (Fig. 9, a). Faunal remains are of deer and camelidae. Tubers, roots, and fruit seeds are also found, as well as human skeletons, the latter dating to terminal Pleistocene to early Holocene times.

The most controversial early site in Peru is Pikimachay Cave, excavated by MacNeish and his colleagues (MacNeish, 1979; MacNeish *et al.*, 1980). Materials from the deeper levels of Paccaicasa Phase and Ayacucho Phase are of specific interest here. The Paccaicasa Phase is defined by bones of extinct

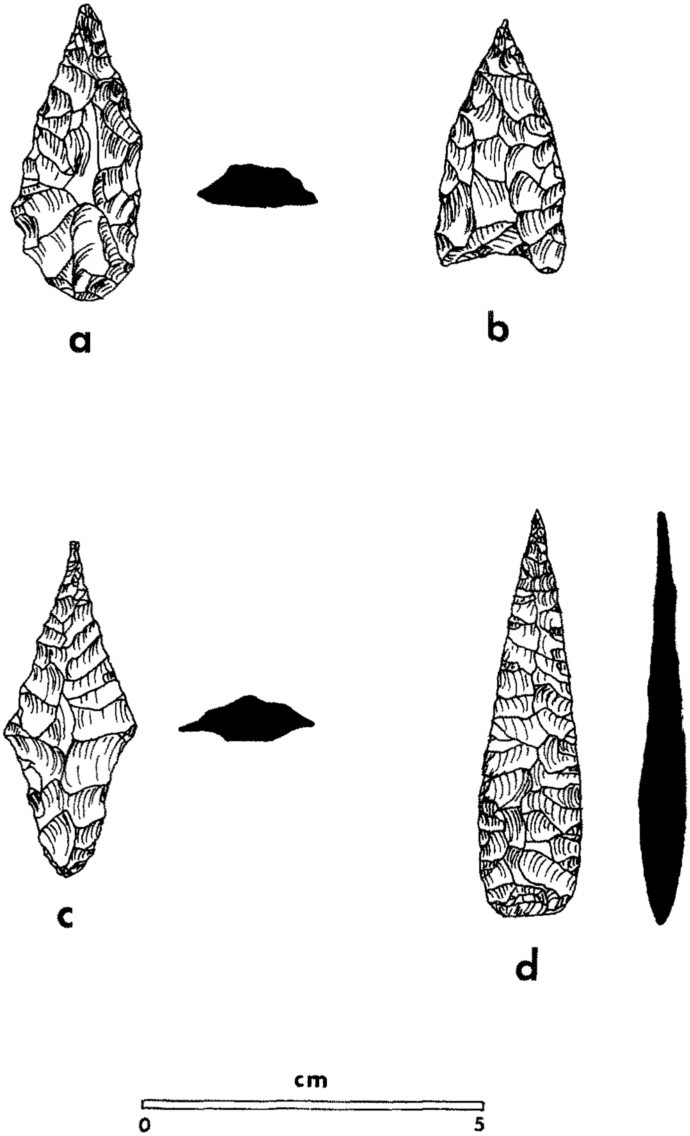


Fig. 8. Various stemmed and unstemmed points from the deeper levels of Guitarrero Cave, Peru.

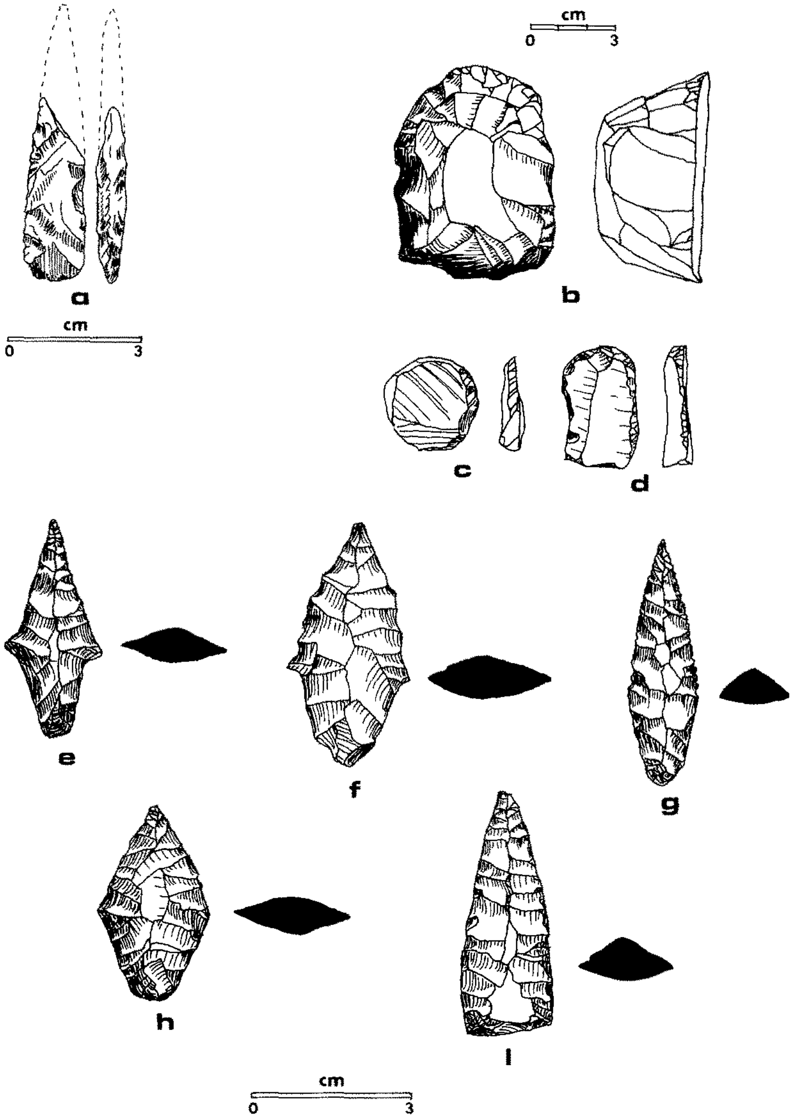


Fig. 9. (a) Lauricocha I projectile point (after Cardich, 1964; Willey, 1971, p. 48); (b-i) various unifaces and point types from Pachamachay Cave (Junin) that are typical tools of the early to middle Central Andean Preceramic Tradition (after Rick, 1980, p. 18): (b) straight-edge unifaces, (c, d) curved-edge unifaces, and (e-i) various unstemmed points.

animals and approximately 173 flakes or core fragments. Almost all of the lithics are made of the same "tufa" as the cave walls and show little convincing evidence of human modification. Radiocarbon dates on sloth bones date between approximately 20,200 and 15,000 B.P. The following Ayacucho Phase levels contain several hundred animal bones and stone debris, radiocarbon dated between approximately 15,000 and 13,000 B.P. Between about 13,000 and 11,000 B.P., a few stone and bone artifacts and animal bones are reported. Most archaeologists (Bate, 1985; Lynch, 1983; Rick, 1988; Dillehay, 1985) remain very uncertain as to whether the pre-11,500 B.P. context contains secure evidence of human activity. Until a more critical and comprehensive study of the deeper levels appears, it is difficult to include the Paccaicasa and Ayacucho levels in any scheme of late Pleistocene human prehistory.

In the Junin Puna areas of central Peru, a specialized vicuña hunting and plant exploitation pattern is documented around 10,500 B.P. at several cave sites located above 4000 m, including Telarmachay (Lavallee *et al.*, 1982), Pachamachay (Rick, 1980, 1983), and Uchcumachay (Kaulicke, 1980). Although a single radiocarbon date of 11,800 B.P. has been obtained from basal deposits at Pachamachay, no secure evidence of a pre-11,000 B.P. human presence exists in highland Peru. It is worth noting that only Pikimachay contains megafauna. The unifaces and projectile points recovered from these sites generally conform to types of the Central Andean Highland Tradition (Fig. 9, b–i).

A late arrival of hunters also occurred farther south in the high altitude Atacama desert and puna of northern Chile (Lynch, 1990a). Most projectile point forms from the late Pleistocene and early Holocene levels of valley and puna sites show a strong resemblance to subsequent early and middle Archaic forms found throughout the central and south-central Andes (Santoro and Núñez, 1987), also indicating a late human presence (see Figs. 8 and 9).

At Lauricocha and Telarmachay caves, the basal cultural deposits rest almost directly on glacial deposits, suggesting a human presence immediately after deglaciation, which, in the Junin area, probably dated sometime between 14,000 and 12,000 B.P. or perhaps between 11,000 and 10,000 B.P. (Wright, 1983, 1984). Further evidence of a late human arrival is at Panaulauca cave (Rick, 1980), where culturally sterile clays occurred underneath cultural deposits dated near 10,000 B.P. No evidence of a fluting tradition exists in the highlands, suggesting an absence or sampling bias. It is possible that the absence of fluted points and megafaunal species is correlated. Surface finds of mylodon and horse in the puna of northern Chile (Santaro and Chocama, 1982) suggest that these animals were extinct before the arrival of humans, that they never fully adapted to the puna, or that either humans avoided the puna or they were not present in the area until after 11,000 B.P.

The presence of megafauna and humans in the northern Andes between approximately 12,000 and 10,000 B.P., at relatively low elevations (below

2,500 m) and in relatively lush environments (e.g., Plateau de Bogotá), and the absence (or scarcity) of megafauna in the high central and south-central Andes after 11,000 B.P. might indicate that human activity in higher elevations was minimal until well after deglaciation. The same pattern is likely for southern Patagonia, where initial human habitation occurred after deglaciation.

Although today camelids and people live near glaciers in the highlands of central Peru (Wright, 1980), it is unlikely they did in late glacial times, unless during the warmer summer months. Surely, temperatures in the highlands were lower between 12,000 and 11,000 B.P. than today. It is also likely that periglacial zones in high altitudes had continuous or discontinuous permafrost. During this period, the lower limits of the permafrost might have been at approximately 3500 m, an elevation located below most puna cave sites and consistent with the estimated depression of snowlines through the region. Sometime after 12,000 to 11,000 B.P. during times of deglaciation, amelioration, and possibly megafaunal extinction, these were probably outwash plains, characterized by a drier and colder climate than now. It is unlikely that deglaciation led to the rapid retreat of ice sheets and to the immediate growth of biotic communities, because the retreat in the highlands might have been slower than in other areas.

The presence of early Archaic-like projectile points, dated no earlier than 11,000 to 10,500 B.P., and of Holocene animal species in the basal deposits of highland and puna caves also points to a late arrival of humans in the highlands. Also revealing is the absence of a Pleistocene "Paleoindian" lifeway (Lynch, 1983) characterized by symmetrical, lanceolate, bifacial projectile points and big-game hunting.

The current data suggest that the deeper cultural deposits in sites of this region cannot be considered accurate indications of the timing of human habitation in South America. Large-scale migration of people into the central and south-central Andean mountains probably occurred after or coincident with the reinvasion of plants and animals between approximately 11,000 and 10,500 B.P. It is likely that a similar situation occurred in the southern Andes and Patagonian area. If this scenario is correct, we should find the earliest human adaptation to central and southern mountain environments in caves and open-air sites at elevations lower than 2500 m.

On the other side of the Andes in northwest Argentina, evidence of human habitation of the arid puna and subpuna lands is from a few cave sites, most notably Inca Cueva 4, Huachichocana III, and Quebrada Seca 3. Although not located in the puna, the sites of Gruta del Indio and Agua de la Cueva provide limited information on early human adaptation to the south-central Andean foothills.

In the Jujuy puna is Inca Cueva 4, where the earliest evidence is from

Layer 2 (Aschero, 1979, 1987). Features, including hearths, storage pits, and prepared floors, are associated with several food and nonfood plant species and the bones of modern fauna, including rodents, cervids, and camelids (Yacobaccio, 1989). The lithic assemblage is characterized by stemless projectile points, end and side scrapers, and ground stone, all dated between 10,620 B.P. ± 140 years and 9230 B.P. ± 70 years. Another puna site, Quebrada Seca 3, also has produced evidence of early human habitation associated with local and exotic plant species, modern fauna, and thin, bifacial, leaf-shaped stone tools (Aschero *et al.*, 1988; D. Elkin, personal communication, 1991). These materials are dated much later, around 8700 B.P.

Excellent preservation of organic remains at Huachichocana Cave III (Fernández Distel, 1988) reveals edible plant species from several ecological zones. Coiled basketry and a wide variety of wooden artifacts, as well as the remains of camelids, deer, rodents, and birds, were excavated. These materials and triangular, lanceolate, and stemless projectile points, side and end scrapers, notches, unifacial denticulates with retouch, and utilized slate slabs, mostly of nonlocal material, were radiocarbon dated between 10,200 B.P. ± 480 years and 9620 B.P. ± 130 years.

Farther south, the Gruta del Indio (Semper and Lagiglia, 1962–1968) yielded sloth bones and dung associated with flakes and hearths radiocarbon dated between 10,350 B.P. ± 60 years and 8045 B.P. ± 55 years. It is not known, however, whether the animal remains are associated with a sloth living area or with human activity. Victor Duran's (personal communication, 1991) recent excavations at Agua de la Cueva near Mendoza have produced the remains of guanaco, side and end scrapers, retouched flakes, and two radiocarbon dates of 10,350 B.P. ± 220 years and 9840 B.P. ± 120 years.

In sum, there seems to be evidence of humans in the highlands and puna by 10,500 B.P., with a possible earlier presence between 12,000 and 11,000 B.P. If the older levels of Pikimachay and other sites (e.g., Pachamachay) turn out to be valid, the pattern of a few older remains may simply show a light human presence characterized by occasional treks by lower altitude groups into higher lands, possibly during the summer months or during periods of localized retreats of ice sheets during the initial withdrawal of ice.

A similar phenomenon may have occurred in the Argentine puna around 10,000 B.P., when there was an increase in human occupation and in different projectile point styles, both apparently associated with the increased exploitation of patchy resource zones. Yacobaccio (1989) associates these developments with two different but complementary resource strategies: a microregional pattern focused on local resources and a macroregional pattern centered on specific exotic goods. He also sees a strong relationship among the distributions of base camps, rock art sites, and resource territories.

ENTRY ROUTES AND THE HIGH AND LOW ROADS TO TIERRA DEL FUEGO

While the entry and spread of human populations in North America were strictly dictated by ice sheets, the distribution of glaciers in South America during the terminal Pleistocene had no major bearing on the passage of human populations into the continent and far less impact on their dispersion. In South America, glaciers were confined largely to the higher elevations in the Andean mountain chain and the high-latitude areas of the tip of the continent (Fig. 2). The only known physical and biological challenges to human entry into South America might have been the humidity or endemic disease load (Odom, 1959; Croll, 1983; Warren and Manmoud, 1984) of tropical areas in Central America and northern South America (e.g., Espinoza, 1982; Dillehay, 1991).

Considerable discussion has focused on the possibility of people migrating south of North America along the Pacific coastline (Fladmark, 1979; Gruhn, 1988). Unfortunately, little is known of the paleoecology and archaeology of late Pleistocene northern maritime environments in South America, making it difficult to project an early pattern of adaptation. Upon leaving the relatively narrow Isthmus of Panama, hunter-gatherers would have expanded along the Pacific and Atlantic coastal shelves and/or into the interior lowlands of Colombia and Venezuela. If the coastlines were exploited by the first South Americans, it is possible that they were generalized collectors, who subsisted on shellfish supplemented by coastal fishing and probably interior hunting.

Human populations traversing the lowlands in the northwest corner of the continent would have coped with a variety of habitats, including some comparable to present-day open swamps, savannas, parklands, and tropical forests. Although most studies focus on the big-game hunting potential of these habitats, the incentive to enter mangrove swamps, coastal estuaries, and forests may have been greater (Ardila, 1985), given the likely presence of both rich game and rich vegetal resources. Once migrants adapted to a wide array of habitats in northern Colombia and Venezuela, some population segments likely developed Archaic-like ways of life, multiplying their subsistence patterns and technologies, while others, as they moved farther south and east into open savannas and grasslands, perhaps with more abundant game, followed a big-game hunting life. In either case, diverse lowland and highland environments in Colombia and Venezuela and changes in climate and in the character of the faunal and floral communities most likely would have forced upon these immigrants a reliance on multiple plant and animal resources. Given the diverse environments of this region, it should not be surprising to find evidence of pronounced cultural diversity, including an Archaic economic lifeway, at an early time in northwest South America and slightly later in more southerly and easterly latitudes.

An alternative viewpoint is presented by Lynch (1971, p. 86, 1983), who favors the spine of the Andean mountains, with its open and rather uniform and altitudinally influenced environmental zones, as the route of rapid north to south penetration of the continent, sometime around 11,000 B.P. If the first South Americans entered the highlands, they probably followed the Magdalena, Cauca, and Sinu river valleys that lead into the lower intermontane valleys of Colombia. Whatever progress the first human groups may have made, glaciation would not have affected their movement in this area, unless they initially migrated into higher lands where the glaciers had reached their maximum extension between approximately 21,000 and 14,000 years ago. The incentive to follow the high Andean road south of Colombia was probably minimal, however, until 11,000 to 10,000 B.P., when only patchy glaciers remained at higher altitudes (ca. above 4,500 m) in Ecuador and central Peru and when game resources probably expanded from lower elevations as a result of ameliorating conditions. Remains of both extinct and modern faunal species (vicuña, deer) at several highland and puna sites dated to this period provide evidence of the expansion of game. Movement via the Andean road to Tierra del Fuego, on the other hand, may have been blocked by permanent glaciers on the Chilean side of the southern Andes. This area could have been reached by taking a Pacific route or an easterly lowland path through Argentina.

Once pioneer groups had penetrated the continent, higher-elevation zones in parts of the Andean mountain chain (especially in the far south where permanent glaciers existed) still may have been physical barriers to migration and culture contact, with the populations residing farther east and west having little or no interaction with each other. At this time, such environments may have limited the abundance of animal species and inhibited prolonged residence by human populations in any one area. The frequent movement by discrete populations within recognizable and predictable temperate and lowland environments might have produced some of the variation in regional lithic styles dated between 12,000 (or possibly earlier) and 10,000 B.P. in northwest South America. It is also likely that, for one reason or another, some environments were avoided altogether and therefore contain little or no evidence of late Pleistocene human populations.

For instance, some extremely arid and cold environments were possibly uninhabited or sparsely occupied in late glacial times. The low archaeological visibility of sites in the Pacific desert areas, for instance, and the tropics of Brazil may be a feature of low or no population or of sampling bias. Butzer (1991, p. 151) has remarked that the low visibility of pre-Clovis sites in the New World may reflect low population densities, especially during the initial period of human migration. In Africa, Butzer (1988) and Harpending and Davis (1977) have suggested that topographic factors, environmental diversity, and resource abundance and predictability are the primary variables determining long-term, large-scale human populations there. In South America, the grassy savannas, forested areas, and mountain slope ecotones may have been preferred areas of habitation, with humans being less successful in other environments, such as deserts and high puna lands, until terminal Pleistocene times, after deglaciation. It also is likely that some populations retreated or altogether disappeared from some areas of low resource productivity, particularly during drought, or that some populations, such as those utilizing the fishtail point, took advantage of changes in the late Pleistocene environment and in resource distribution to spread rapidly.

The reconstruction of the paleoenvironment of South America suggests that the variety of ecological niches after 11,000 B.P. surpassed that of earlier periods. After the retreat of the glaciers, new resources and water sources and rising sea levels probably promoted migration of both animals and humans toward the south of the continent, especially toward the eastern and southern grasslands of the southern cone. This time would have been favorable for long-distance migration and for the establishment or renewal of contacts between neighboring regions on both sides of the Andes. Such contacts would explain the widely scattered and seemingly rapid distribution of fluting, possibly as early as 11,000 B.P. but more likely between 10,500 and 10,000 B.P. These events also seem to correspond broadly with the development of specialized hunting groups in deglaciated areas, especially Patagonia, where increased humidity and a temperate climate between 11,000 and 10,000 B.P. favored an increased human population and, possibly, an ''exploratory'' or colonizing phase spurred by hunting (Borrero, 1989).

THE MONOLITHIC APPROACH: FORERUNNERS, FLUTES, AND LINKAGES

The few known lithic complexes in South America suggest the existence in Colombia and Venezuela of a cultural tradition differing widely from that of Patagonia in the south. These complexes are important, although they do not constitute a continuous cultural sequence and a ''horizon'' concept comparable to the North American Clovis horizon. Instead, there are several apparently contemporary complexes, each possibly representing a different adaptation, only occasionally overlapping geographically with other complexes (Bryan, 1986). These are the Colombian Tequendamiense and Abriense complexes, El Jobo, and the Itaparica complex for the 12,000 and 11,000 B.P. period and the fishtail, Paiján, and myriad of projectile point types of the Central Andean highlands (see Rick, 1980; Lynch, 1980; Cardich, 1964) for the 11,000–10,000 B.P. period. In addition to the lithic complexes, other less known or less diagnostic unifacial and bifacial assemblages have been recognized throughout the continent.

If cultural diversity in the late Pleistocene is indicated by the series of projectile point styles and stone tool complexes (Bryan, 1973), then it is clear that culture has not diversified everywhere at the same rate. It seems that there have been core areas of diversity. Everything, at present, points to northwest South America, especially the northern rim of Colombia and Venezuela, as the core area of stylistic diversity at the beginning of human occupation. The widest variety of diagnostic bifacial and nondiagnostic unifacial tool types is found there, and so are some of the earliest sites. The earliest known bifacially chipped stone points appear to be El Jobo [which might have a southern affiliate in the Monte Verde points (Dillehay, 1989, p. 11)]. After deglaciation in the Andes and amelioration in the lowlands, core areas probably developed farther south in the open environments (e.g., Andean puna and the grasslands of the southern cone).

The earliest known sites with unifacial stone tools are Tibito, El Abra, and Tequendama (ca. 13,500–11,000 B.P.) of the Plateau de Bogotá in Colombia and sites of the Itaparica Tradition (ca. 12,000–10,500 B.P.) in Brazil. Aspects of the Monte Verde edge-trimmed and edge-used flake assemblage (ca. 13,200–12,400 B.P.) could also be included here. Other late Pleistocene unifacial complexes, dated around 10,000 B.P. or shortly thereafter, have been reported in southwest Ecuador, northwest Peru, northeast Brazil, and the Argentine Pampa. Not surprisingly, the stoneworking techniques at all of these sites are generally unsophisticated and the range of tool types is limited. There are numerous irregular flakes and various heavier tools made from cores.

The degree of typological variation in the South American projectile point assemblages between 13,000 and 11,000 B.P. and between 11,000 and 10,000 B.P. is, as yet, unmatched in the rest of the Americas [with the possible exception of stemmed and fluted point types in the western United States (D. Stanford, personal communication, 1990; Bryan, 1988)]. Those types dating to the 12th millennium or earlier are Taima-Taima, Monte Verde, Tequendama, and possibly the Itaparica unifacial complex of eastern Brazil. The later assemblages are the fishtail point [and its varieties (see Mayer-Oakes, 1986)], the unstemmed subtriangular types of the central Andean highlands (Rick, 1980; Cardich, 1964; Lynch, 1980), the subtriangular Toldense points, and the Uruguai assemblage of southern Brazil and Uruguay. It is not known whether this lithic diversity is the result of (1) increasing population densities leading to the development of social boundaries, which might have enhanced regional differences, or (2) reduced mobility and isolation due to local environments and, possibly, a subsequent rapid culture change. No clear answer is yet available, making it difficult to associate lithic style diversity with social or demographic processes.

This issue would be easier to understand if we could demonstrate that (1) environmental change and/or social conditions stimulated the advent of new lithic styles or (2) that they coincided with greater hunting success, allowing larger animals, such as mastodon and ground sloth, to be procured and butchered. Since the remains of modern faunal species are found with both unifacial and projectile point assemblages at Pleistocene sites in Colombia, Brazil, Chile, and Argentina, it is not known whether different assemblages represent seasonally different activities or environmentally different situations or whether they are the products of different groups of people migrating into South America at different times. An explanation for these differences may be simpler than we assume. For instance, they may be different technological expressions of local food procurement strategies. If this is the case, we could expect groups to exploit localized, nonmigratory resources. The fixed territorial behavior of vicuna, guanaco, and horse partially meets this requirement.

In attempting to interpret the bifacial and unifacial complexes of South America, it is conceivable, though unlikely, that some sites (e.g., Tequendama, El Abra, Itaparica, Arroyo Seco) or site components (e.g., Level 11 at Los Toldos) that lack projectile points reflect specialized task groups that utilized bifacial tools only in certain environments. In parts of Colombia, eastern Brazil, and northern Peru, unifacial and bifacial complexes coexisted. In Colombia and Brazil, the current data suggest that projectile points are later than unifacial complexes. Despite these data, South American archaeology has not yet demonstrated convincingly that unifacial complexes constitute the first stone tool kit. Nor is there secure evidence to suggest a simple evolutionary sequence from unifacial tools to projectile points.

An issue of growing significance in the study of the peopling of South America is the postulated Clovis typological link between North America and South America, as suggested through the fluted-stemmed fishtail points and wide-stemmed projectile points (Lynch, 1974, 1983) and, to a less reliable extent, through edge grinding on lanceolate points, various scraper types, and blade technology. The basic assumption is that since North American and South American cultures share fluting, they must also have other similar traits and are therefore related genetically. Such an analogy is weak because the sharing of a trait may be fortuitous or accidental. The important issue here is whether there was (1) a migration of Clovis people, (2) a diffusion of Clovis traits, or (3) a coeval invention of fluting on both continents. The first, which has been uncritically accepted and never adequately tested archaeologically, explains only an 11,000 to 10,000 B.P. presence of humans in South America. The latter two permit an earlier population, with traits moving across extant populations.

A separate fluted technology in South America sometime around or after 11,000 B.P. is a distinct possibility that should be considered as a working hypothesis. Some archaeologists find it easier to accept a model in which an extant South American population, somewhere in Ecuador or the southern cone (Borrero, 1980; Bryan, 1986; Mayer-Oakes, 1986; Politis, 1987) around 11,000 B.P. or thereafter, developed fluted points and bifacial stemmed projectile points, which then diffused throughout existing populations in South America. Others

(Lynch, 1983, 1990b; Schobinger, 1988; Martin, 1973) advocate a North American "Paleoindian" population rapidly traversing the southern hemisphere after 11,000 B.P. Archaeologically, such a north-to-south "blitzkrieg" movement would be an unprecedented rate of human migration with a technological trait that apparently faded out relatively soon thereafter (ca. 10,500 to 10,000 B.P.?). Most important, however, is evidence of regional stone tool complexes (El Jobo, Tequendamiense, Abriense, and the Itaparica Phase sites) that are earlier than or contemporary with fluting, which suggests its diffusion across an extant population rather than migration. Further, the timing of the appearance and spread of fluting seems to coincide with deglaciation and, in some areas, postglacial aridity and animal extinction. Future research may show that fluted point-bearing groups were the *coup de grâce* exterminators of some megafaunal species.

From this, the question becomes whether the shared fluting trait in North America and South America is the result of technological convergence or diffusion. While this is a very basic question about typology, culture contact, and technological development, difficulties arise on at least two levels. First, it is not obvious what features of the late Pleistocene society that share this trait should be expected to converge. The second difficulty is one of morphological evolution (or revolution). Fluting in North America is on a lanceolate point, and in South America it appears on an expanded stemmed point. Another problem is the absence of earlier lithic forms that may be ancestral to both point types. If stemmed points are slightly earlier in South America, as they might be, why not postulate a backward migration of stemmed point cultures into North America between 11,000 and 10,000 B.P.? In short, it is possible that independent invention and convergence occurred, perhaps as a result of "shared similar morphological and technological concepts" (Politis, 1987, p. 7) in both North America and South America. If not, diffusion likely occurred (either from north to south, from south to north, or both).

Besides the problems of chronology and diffusion, there are typological problems with fluting. There is as yet no yardstick by which to gauge the differences between the two American fluting traditions other than fluting itself, and here there are problems. For example, there is little or no consensus as to what constitutes Clovis, Clovis-like, waisted and eared Clovis, fishtail, basal thinning on fishtail, and unmodified fishtail points. Compounding this problem is the absence of fluting on many fishtail points and its presence on other point types [e.g., see Seguel and Campana (1975) for possible fluting on lanceolate forms from the Nochaco site in southern Chile]. Nor is there serious concern over the predominance of fluting on stemmed points (normally an Archaic form) instead of on lanceolate point forms. Another problem is the distinction between fluting and basal thinning. Many fishtail and lanceolate points exhibit shallow longitudinal flakes struck from the base that have been mistaken for fluted channel flakes (see Lynch, 1983, Fig. 3.5, bottom right projectile point from Pilmaiquen). Even though there is some similarity between fluting on Clovis and fluting on fishtail points, there are major technological and morphological differences. The hallmark traits of the Clovis points are the removal of fluted channel flakes (almost always on both faces) and deep parallel flake scars that transversely cross the body. Only a minority of the fishtail points exhibits fluting, and then rarely on both sides. The fishtail point, on the other hand, is characterized mainly by the shape of the stem and rounded shoulders (Politis, 1987, p. 7). In the absence of other cultural traits to link fluted (or basally thinned) points to sites throughout the western hemisphere, we must be much more cautious in building a model of human migration to link North America and South America.

In sum, several points are worth noting. First, the late Pleistocene period shows a remarkable spread of diverse unifacial and bifacial lithic (particularly projectile point) styles between at least 11,000 and 10,000 B.P., and very likely as early as 13,000–12,000 B.P. Second, as it now stands, the record can be logically interpreted to favor several alternative explanations of technological and economic diversity in South America. Early technological diversity in South America appears to be the product of more or less constant interaction among a number of factors, including the kinds of resources available in different areas, the regional variability of stones suitable for flaking, and the size of human groups occupying a given area. In North America, various projectile point and lithic assemblages developed after megafaunal extinction at about 10,000 to 10,500 B.P. In South America, late Pleistocene human populations in the puna and highlands of the central and south-central Andes and those along the Pacific coast apparently did not hunt megafauna, or hunted or scavenged them only as secondary resources, which implies an early entry into the Archaic lifeway and the development of diverse economies and technologies. Third, what makes the fluting in South America interesting is not so much the possible linkage to North America, or its age, but its appearance on stemmed points and its diffusion, in the absence of other continental styles, either after or contemporaneous with other lithic complexes. If the trait represents a north-to-south migration, it must indeed have been derived from the Clovis culture in North America and must be explained by an extremely rapid southward migration. But even here we must explain why it first appeared on a stemmed point in South America. Until a secure north-to-south migratory linkage is established between the two continents, it is just as likely that South Americans with flutes and stemmed points migrated north.

Finally, it is the proliferation of lithic assemblages by at least 11,000 to 10,500 B.P., in combination with the absence of megafauna and the development of generalized Archaic-like economies in parts of eastern Brazil and the central and south-central Andes, that allows us to postulate distinctive regional economies and stylistic designations to lithic assemblages. Before we try to apply specific sociocultural designations to various lithic assemblages, we must attempt to fit both unifacial and bifacial technological strategies to a wide range of economic adjustments in different environments.

ECONOMICALLY DIFFERENTIATED POPULATIONS: POSSIBILITIES AND IMPLICATIONS

At the core of many of these morphological differences in the lithic assemblages of late Pleistocene cultures in South America are, in essence, different economic and broader cultural activities that emerge from the archaeological evidence. In spite of the obvious data recovery and sampling problems in many regions, there is enough evidence to suggest a wide range of differential emphases on plant and animal resources, as demonstrated at several sites, e.g., Tequendama, El Abra, Monte Verde, sites of the Itaparica Phase, and Guitarrero Cave. This is a pattern that is alluded to by several investigators (Bryan, 1973; Lynch, 1983; Ardila and Politis, 1989) but might have been brought out more explicitly.

If we are to understand these differences and the cultural contributions made by the first South Americans, we must leap over the taxonomy of formal lithic types and consider the subsistence–settlement dimension of founding human populations, as well as the causes and processes of cultural innovation, diffusion, and change. The fundamental problem with diverse lithic types is that we do not know the relationships among technology, environment, and subsistence patterns. Our guess is that these types primarily represent small, perhaps short-lived regional adaptations, as well as attempts by migrant population segments to adapt a particular lithic technology to diverse environments and resources (Bamforth, 1990) rather than to adapt a specific set of resources (e.g., mastodon, guanaco, and tuberous plants) to technology. If so, developments such as fluting and the stemmed fishtail point may be nothing more than hafting features developed to bring the technology into line with highly mobile and opportunistic hunting in a variety of deglaciated habitats, experiencing a moderate to rapid influx of various animal and human populations during a heightened period of aridity.

In attempting to relate diverse lithic complexes to other cultural dimensions, we know that we cannot make direct correlations between projectile point styles, economic modes, and human population territories (Weissner, 1983). Nevertheless, as more evidence is accumulated, we see emerging a mosaic of lithic ‘‘style zones’’ (Price, 1991), which must reflect certain aspects of regional socioeconomic organization and the interaction of early human societies through time. There is mounting evidence to suggest that regional economies developed in Colombia, Venezuela, and eastern Brazil, where populations adapted to a wide variety of forest, savanna, or parkland environments and possessed unifacial and/or bifacial complexes. Societies in the Andean highlands and in the arid lowlands of Peru, Argentina, and parts of Chile were possibly more species-specific and habitat-specific, hunting vicuna, guanaco, horse, or ground sloth in more open areas.

It is not known whether these kinds of differences may have been due to the different availability of food resources, to human population drift, or to slow or rapid technological change. The fact that regional diversity existed by at least 11,000 to 10,500 B.P. may suggest a greater time depth and density of human population or more rapid rates of culture change. Although the demographic characteristics of these processes are not understood, it is our impression that pioneer groups must have had low rates of population growth and high to moderate rates of culture change, especially during the period of initial migration into and exploration of the continent. We do not consider, however, population pressure as a potentially important cause of rapid movement, as Kelly and Todd (1988) have postulated for Clovis populations in North America. As for rates of culture change, the initiation of plant and animal domestication, and related culture change (see Quilter, 1991, pp. 395–400) in parts of South America, possibly as early as 8000 to 7000 B.P., suggests that much more than hunting was practiced in late glacial times and that some cultural processes were operating very differently from those in North America. For instance, it is probable that the Andean mode of economic "complementarity" of resources from multiple environmental zones probably had its beginnings in terminal Pleistocene times (cf. Lynch 1988), when river systems became much more stabilized and groups established more regular patterns of resource use, transhumance, and perhaps territoriality in river basins. Prior to deglaciation, pioneer groups probably utilized river drainages much like other features of the landscape.

If we accept for the moment a human presence in the southern hemisphere before or during deglaciation (ca. 14,000–12,000 B.P.), there surely would have been greater pressure placed on pioneer (or later) groups to adapt to dynamic climatic conditions, and to rapidly changing environments, especially river systems and woodlands. Recent studies in Quaternary paleoecology reveal that while most woodlands afforded people with many subsistence options, they were generally unpredictable and impermanent vegetational zones through time (Colinvaux, 1987; Webb and Marshall, 1988). Both temperate and tropical forests are known to have been subjected to numerous disruptive episodes of aridity of varying durations, intensities, and geographical extents throughout the Pleistocene period. Repeated human occupation and readaptation to these environments might have led to more economic and technological diversity at regional levels. It also might have led to more rapid movement through those parts, with more long-term occupation occurring in open environments. Such patterns might suggest a strong correlation between accelerated culture change and rapidly changing deglaciated environments.

If we assume that the array of potential food resources in changing environments constrained possible subsistence modes and technological forms, this constraint was likely to have been least where the diversity of potential resources was greatest. In relatively homogeneous environments of low resource diversity and possibly high predictability, such as the puna of Peru and Chile, the savannas of Venezuela and Brazil, and the grasslands of Argentina, the distribution of animal herds would have been patchy in time and space. Here, founding populations probably had little choice but to opt for the procurement of fewer food resources in relatively larger quantities. In high-diversity environments, such as tropical and temperate forests, that contain a relatively small to moderate number of individuals per species and show moderate predictability, a different pattern of resource exploitation would have been manifested. People would have consumed small to moderate portions of multiple foods. Populations like those at Monte Verde in southern Chile and in the woodlands and parklands of eastern Brazil apparently responded to these environments as though they were relatively heterogeneous in resource structure, procuring small quantities of a wide diversity of food resources and manufacturing a more generalized, expedient technology comprised primarily of unifacial stone tools.

Irrespective of environmental and resource considerations, late Pleistocene cultural developments appear not to have been homogeneous; as population segments migrated from area to area or became regionalized, they apparently no longer shared the economic and sociocultural forms of pioneer immigrants. Small pioneer populations situated on the frontiers of uninhabited areas in places such as the eastern lowlands of Colombia, Venezuela, and Brazil or in the Andean highlands must have been affected by environmental and social changes in a different manner from subsequent populations. The same can be said for population segments either in isolation or in contact with neighboring groups. Social isolation, marginality, or interaction must have created new (and probably pluralistic) cultural forms and the replacement of one culture by another. Biological divergence following spatial isolation is well documented, and there is no reason to doubt that the same process occurred culturally. Differences in the diversity of lithic assemblages at sites like El Inga and Fell's Cave, characterized by a wide variety of possibly contemporaneous projectile points, and Monte Verde and Los Toldos, characterized by a relatively narrow range of lithic types, might reflect different degrees of cultural isolation or contact among populations.

It also is likely that populations were grouping at different levels of economic organization and perhaps even partitioning resources of given environmental types and engaging in both local and nonlocal exchange networks, though no widespread exotic trade items (like Alibates and other raw material types in North America) have been recognized in South America. Exploitation areas of raw lithic materials seem to be small in South America; most sources are found within a 100-km radius. Transhumance and/or exchange across closely juxtaposed lowland and highland zones is suggested at several puna-based cave sites in northern Chile (Santoro, 1989; Santoro and Núñez, 1987) that contain local and nonlocal stone and other raw material. The only current evidence to suggest long-distance movement of people and/or sharing of ideas is the occurrence of fishtail points in limited areas on both sides of the continent.

Much more information is required about human migration through the tropical and subtropical environments of Central America and northwestern Colombia before we can model socioeconomic adaptation to the interior environments. Multiple highland and lowland migration routes were probably followed into the interior, where distinct regional populations began to employ different hunting-gathering strategies. If the initial migrants passed through as quickly as Martin and Lynch have postulated, long-term localized adaptations must have been few. Rapid movement would have been spurred by seasonality and resource diversity or by the near-exclusive use of mobile animals as food staples. On the other hand, if groups stopped to pattern their procurement after a particular environment itself, it probably led to stylized local adaptations, as perhaps revealed at the Tequendama, Taima-Taima, and Monte Verde sites. The presence of localized styles in these areas suggests the latter pattern for the initial occupation of the continent before or during deglaciation (perhaps the 12th millennium B.P. or earlier) and the former pattern for later colonization by subsequent generations during or after deglaciation (perhaps after the 12th millennium B.P.). The distributions of fishtail points and, possibly, the unifacial complexes of the 10th and 11th millennia B.P. suggest either trait diffusion across extant populations or extremely rapid migration of a single population.

Once human populations initially penetrated the continent, those living in the eastern lowlands of Brazil probably developed a highly diversified gathering-hunting economy, as suggested by the presence of unifacial-bifacial tool complexes, the exploitation of both large and small animals and various plant species, and the absence (or low frequency) of Pleistocene big-game species in sites. It was probably a mobile hunting-focused segment of the Brazilian population that first colonized the Pampa and Patagonian regions farther south and became generalized hunters exploiting giant armadillo, ground sloth, horse, guanaco, and other animals. A Pacific gathering-hunting population probably followed the foothills and river valleys of the western Andes, gradually adapting to the north-to-south trending arid plains of western Peru and Chile and eventually reaching the archipelago near Monte Verde. Some segments of the Pacific group probably developed into generalized or specialized hunters in semiopen to open environments, while others continued to practice a broad spectrum economy in more closed areas. The first generalized hunters of the northern highlands probably moved down the spine of the Andes, occasionally moving into lower elevations until they reached the higher, colder, and drier lands of central Peru and northern Chile, where they became specialized camelid hunters. Others probably migrated downslope into lower environments, practicing various economic strategies. Colonization of the highlands was also probably achieved by diversified lowlanders who ascended the slopes from both the eastern and the western sides of the Andes. Finally, coastally adapted groups circumscribing the continent probably had a mixed maritime economy, supplemented by interior food sources.

Although many hard data are required before this broadly sketched pattern of diverse economic strategies can be accepted and elaborated theoretically, it provides possibilities for archaeological testing and modeling. An initial step in this direction is to carry out more systematic geological and archaeological survey in the river valleys and plateaus of northwestern Colombia, along the eastern and western slopes of the Andes, on the offshore islands of the Pacific and Atlantic coasts, and in many interior areas. We also must adopt new interdisciplinary research strategies to find hard-to-detect sites, for instance, those buried in deep floodplain deposits or in degraded and collapsed rockshelters (Collins, 1991; Laville, 1964, 1975; Laville *et al.*, 1980). Once new and different sites are investigated, greater regional variation will be realized (Price, 1991).

PROBLEMS AND FUTURE AGENDAS

There is much to be done before South American specialists achieve a depth and breadth of understanding of the peopling of South America equivalent to that of North America, Africa, and Europe (see Price, 1991; Dillehay and Meltzer, 1991). While we need to maintain an interest in the evolution of technological and economic adaptations, we must carry out more settlement pattern studies and, above all, publish more detailed data. We must also examine early human demographic organization and concentrate on broader demographic processes (Dillehay and Meltzer, 1991). Though several past research projects (e.g., Correal, 1977; Miller, 1987) have undertaken settlement pattern studies, there remains a strong focus on the discovery and excavation of single sites rather than the elucidation of site complexes and regional patterns. Moreover, if we are to gain broader insights into these and other problems, more research needs to be carried out in little-known areas, including the Darien Isthmus of Panama, the entry point into South America. To resolve these problems, we need to search in new places (e.g., coastlines, offshore islands, wetlands, forests) for new and different types of sites.

Another important aspect of the Pleistocene archaeological record of the Americas continues to elude us—human skeletal remains. Some controversy about the peopling of the Americas might be resolved if we paid more attention to the search for these remains (Dillehay, 1991). The fact that human skeletal material is rarely, if ever, found reflects a probable high degree of mobility of late Pleistocene populations, with burials most likely placed in expedient graves along trails or in other difficult-to-find places. If we are to learn more about the biological and cultural makeup of the people themselves, we need to make a greater effort to locate human skeletons.

South Americanists and others also must take urgent advantage of the presence of a wide variety of unacculturated to minimally acculturated ethnographic hunter-gatherer groups on the continent to carry out more ethnoarchaeological research on the technological, economic, and social dimensions of site formation processes, for comparison with late Pleistocene localities. If used cautiously, this line of inquiry has much to offer, though there are inevitably certain predictable limitations.

Finally, much more caution needs to be taken in the interpretation of early archaeological records. South American specialists have been attentive to the geological and cultural processes that create sites, but they have not considered adequately nonbehavioral site formational processes. Site and regional models of technological and economic interpretations have tended to accommodate the existing data. We cannot continue to use uncritically the contents of particular cultural layers or sites, without consideration of the effects of natural processes such as cryoturbation, solifluction, and others on data.

CONCLUSION

In this paper, we paid most attention to patterns of cultural diversity that seem to be general in the late Pleistocene archaeological record of South America. Despite the paucity of evidence, we have attempted to examine lithic technology and subsistence and settlement differences within and between regions and interpreted them in a way that best fits the current South American data. Observation of different technological and economic patterns can be tentatively modeled and explained in any number of ways. The evidence suggests that diversified economies, probably more focused on hunting in some areas, were developed in the late Pleistocene by at least 11,000 B.P. These economies emerged primarily with technological developments often thought of as early Archaic in nature. As to what might have motivated such developments before the late glacial aridity or final Pleistocene extinction on the continent, we can only suggest that more research is needed.

Previous expectations of early cultural uniformity (i.e., Clovis horizon) and growth of unvarying life-styles (Lynch, 1974, 1983, 1990b) need to be replaced by a model that accounts for this diversity. In considering the longer-term and wider-spaced processes of culture change and diversity in particular regions, we must relocate analysis of the early peopling of South America within a larger system of interaction among differentiated populations and focus on the dynamics of culture change within different environments. Central to an understanding of these processes is chronology and the entry date of the first Americans. But perhaps in the end there is no way to resolve the issue of the timing of the first Americans without a detailed reconstruction, via local and hemispherical archaeological records, of the developments that gave birth to local manifestations. We can also see the weaknesses in both hemispherical and local temporal and conceptual frameworks that hamper the interpretation of our evidence, and we are overwhelmed by the enormity of the task of making better sense out of existing data. Again, our best hope in this regard is the availability of new evidence, collected and interpreted with an awareness of these problems and requirements.

If there truly are different populations and cultural styles in different South American environments before 12,000 B.P., the archaeological record, by its large scale and its time depth, will give us entry into a Pleistocene world very different from the big-game hunting Clovis horizon documented for parts of North America. Surely, as more data are gathered and much more variety of knowledge is added, we will be solaced by the prospects for new interpretations.

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