



HUMAN SETTLEMENT OF CENTRAL AMERICA AND NORTHERNMOST SOUTH AMERICA (14,000–8000 BP)

Richard Cooke

Smithsonian Tropical Research Institute, Apdo 2072, Balboa, Panama

A human presence in Central America, Colombia and Venezuela (outside 'Amazonia') before the Late Glacial Stage ($\approx 14,000$ – $10,000$ BP) requires substantiation. In Venezuela, hunter-foragers who used elongate, thick bifacial projectile points preyed upon megamammals (e.g. gomphotheres) before the onset of a ($\approx 12,000$ – $11,000$ BP) warming stage, particularly visible in highland Colombia (Guantiva Interstadial). Some archaeologists argue for a distinct pre-12,000 BP population centered on the Sabana de Bogotá (Colombia, ≈ 2500 m). Their 'Abriense' stone tool kit lacked bifacial reduction, and continued to be used well into the Holocene. In Central America, no human cultural remains yet pre-date the widespread, but poorly documented 'Palaeoindian' horizon. This coincides chronologically with the $\approx 11,000$ – $10,000$ BP cold stage equivalent to the Younger Dryas (in Colombia, 'El Abra Stadial'). Makers of lanceolate ('Clovis') and stemmed ('Fish-Tail') fluted points, carefully trimmed scrapers, burins and perforators, 'Paleoindians' have also been identified in northwest South America. Palaeoenvironmental data suggest that they moved around in many different vegetation types. In general, these were unlike modern potential vegetation because temperatures and annual rainfall were still lower than those of today. Human material culture at the onset of the Holocene ($10,500 \pm 700$ BP depending on region) does not seem not to have changed as rapidly as climate and vegetation. But the disappearance of fluted projectile points and the Late Pleistocene megafauna may be causally related. Presently, it is difficult to distinguish widespread and short-lived diachronic changes in human culture, from culturally diverse populations living synchronously in different geographic areas. Some archaeologists argue that early Holocene forest expansion and foraging territory contraction were responsible for socioeconomic diversification and a gradual shift from mobile hunting and gathering to a more sylvan way of life. This emphasized the intensive collection and incipient domestication of forest products (e.g. palms and root crops), and the hunting of deer and rodents. © 1998 INQUA/Elsevier Science Ltd. All rights reserved

INTRODUCTION

This paper addresses the human settlement of Central America, Colombia and Venezuela (outside 'Amazonia') between ca. 14,000 and 8000 BP (Figs 1 and 2). A survey of the most relevant archaeological sites and artifacts is prefaced by vignettes of environmental changes inferred from palaeoecological studies.

ENVIRONMENTAL CHANGE: GENERAL OBSERVATIONS

The study region experienced a generally drier and colder (or cooler) climate during the Upper Pleniglacial (21,000–14,000 BP) (35–50% modern annual precipitation; atmospheric temperatures $8 \pm 1^\circ\text{C}$ below modern values depending on altitude (Leyden *et al.*, 1993; Markgraf, 1989)). Climate change during the Late Glacial Stage (henceforth LGS) (ca. 14,000–10,000 BP) continued to affect the vertical and horizontal zonation of vegetation in complex ways. Particularly relevant to archaeology is a warm-cold oscillation, which in time and inferred degree of temperature change is approximately equivalent to the warm-wet Bølling–Allerød and cold-dry Younger Dryas (YD) stages. The oscillation attains a high resolution in Colombia and Costa Rica above ca. 2000 m. It is less visible at lower elevations. The onset of the Holocene $10,500 \pm 700$ BP (seemingly rapid in spite of geographic dating inconsistencies) witnessed generally wetter and warmer conditions, although temperatures initially remained cooler than today. By 8500 ± 500 BP, altitudinal veg-

etation zones had moved close to their modern positions. All palaeoecological data from below 1000 m come from areas with strongly or moderately seasonal climates, where forests floristically similar to modern mesic formations quickly replaced other LGS vegetation types (i.e. temperate oak parkland, thorn-scrub, and herbaceous and wooded savanna). No palaeoecological data refer to areas where modern vegetation is lowland evergreen rainforest.

ENVIRONMENTAL VIGNETTES

The following vignettes refer to geographical zones in which the archaeological sites discussed in the text are situated.

Colombian Andean forests (2300/2500–3200/3500 m)

Rapidly accumulating evidence argues for the interhemispheric coupling of Pleistocene stadials and interstadials (Lowell *et al.*, 1995) and for a global YD (Denton and Hendy, 1994). Over 35 yr have passed since van der Hammen and González (1960) proposed that LGS climate change in the Cordillera Oriental approximated the Blytt-Sernander sequence. (For sake of convenience, the Guantiva Interstadial (ca. 12,000–11,000 BP) and El Abra Stadial (ca. 11,000–10,000 BP) of the Colombian Andes are employed henceforth as regional chronostages even though this is not formally correct for the South American lowlands or for Central America.)



FIG. 1. Central America (Huehuetenango: see Hayden, 1980).

The best evidence for Pleistocene–Holocene culture change comes from a high intermontane plain known as the Sabana de Bogotá (2500–2600 m). Maximum depression of Pleistocene glaciers (3200 m) occurred ca. 21,000 BP, before a human presence can be demonstrated. LGS vegetation varied between a cold-dry extreme of herbaceous páramo to a warm-wet extreme of Andean forest (*Alnus*, *Myrica*, *Symplocos*, locally *Quercus* and *Weinmannia*), with intermediate semi-open subpáramo dominated by Compositae. The last-named vegetation type probably existed near the El Abra and Tequendama rockshelters during the El Abra Stadial, when inferred local annual temperature was 4–6°C below modern values. Higher precipitation (i.e. during the Guantiva Interstadial (temperature 2°C lower than today) expanded marshes and small lakes in the basin of ‘Lake Bogotá’, which drained 30,000 BP. During the Early Holocene Andean forest again invaded the sabana to ca. 3000 m (van der Hammen and Correal Urrego, 1992; van der Hammen and Hooghiemstra, 1995).

Colombian Subandean forests (1200–2300 m)

Calima valley palynology suggests a gradual, but oscillating, LGS/Early Holocene withdrawal of *Quercus* as Andean forest moved upslope. This landscape

between ^{14}C core-section dates of 9590 ± 150 and 6680 ± 230 BP was heavily forested, but the boundary between Andean and Sub-Andean forest remained close to Sauzalito and El Recreo (see below) until the latter date (Herrera *et al.*, 1992).

The Magdalena lowlands (Colombia)

The middle Magdalena valley (altitude: 150–600 m, precipitation: 2500 mm/yr) was a focus for LGS and Early Holocene hunter-gatherers. All known sites appear to post-date the Guantiva Interstadial, during which there is geomorphological evidence for a locally moist climate. During very cold Late Pleniglacial or LGS Ciega Stadial (ca. 13,000–12,000 BP) times, an altitudinally continuous belt of open vegetation probably connected the lower valley with the eastern Cordillera (thereby facilitating hunter-gatherer mobility) (van der Hammen and Hooghiemstra, in press). During the less cold El Abra Stadial, lowland vegetation perhaps remained xeric and relatively open (López Castaño, 1993).

Lake Valencia, Venezuela

The coastal plateau where this lake is located (altitude: 1000 m, precipitation: 900 mm/yr) was adjacent



FIG. 2. Colombia and northern Venezuela.

to herbaceous grassland and/or dry thorn scrub 13,000–10,900/10,500 BP. Mesic forest, which encroached upon the watershed before the latter dates, became dominant 8300–7500 BP (Bradbury *et al.*, 1981; Leyden, 1985). The more arid Venezuelan coastal margin — where hunter-gatherers killed or scavenged extinct megamammals at springs — probably experienced desert-like conditions during much of the LGS.

The Central American highlands

The Cordillera de Talamanca (western Panama/eastern Costa Rica) and the Sierras Madre and de las Minas (Guatemala) rise to over 3000 m. Both ranges were glaciated during the Late Pleistocene, when tree line dropped 600–800 m (Horn, 1990; Hastenrath *vide* Schubert, 1988). Pollen evidence from the La Chonta

bog (Talamanca, altitude: 2310 m) suggests a YD-related cooling event 11,100–10,400 BP, with reduced rainfall and inferred annual temperatures 2–3°C lower than present values. Holocene conditions are evident by 9800 ± 120 BP (Islebe *et al.*, 1995).

The Central American lowlands

Palaeoecological records from Lakes Quexil and Salpetén (Guatemala) and Lake La Yeguada (Panama) suggest that LGS vegetation change was more unidirectional than above 2000 m, although floristic variability during the LGS may have been climate-induced (Bush *et al.*, 1992; Leyden *et al.*, 1993). Even so, LGS hunter-gatherers in Central America would have encountered vegetation taxonomically and areally different from today's potential formations, due to lowered

atmospheric temperatures ($5 \pm 1.5^\circ\text{C}$), and reduced and/or more seasonal precipitation (Piperno (1995) re-interprets proxy indicators of LGS aridity at La Yeguada; cf. Bush *et al.* (1992)). In the Guatemalan Petén, oak parkland replaced Late Pleniglacial xeric scrubland (Brenner 1993; Leyden *et al.*, 1993). In the Pacific foothills of Panama (altitude: 500–650 m), oak-*Ilex-magnolia* forests persisted until the onset of the Holocene, dated at La Yeguada to ca. 11,000 BP (Bush *et al.*, 1992). Piperno *et al.* (1991a) inferred from the La Yeguada and El Valle cores (Bush and Colinvaux, 1990) that the seasonally arid Pacific lowlands of Panama — and, by extrapolation, much of the Pacific slopes further north — were covered by thornscrub and herbaceous savannas, in places expanded oceanwards by still lowered sea levels. This open landscape would have extended through lowland Darién into Colombia. Data from fossil Monte Oscuro lake, Panama (altitude: 20 m, precipitation: 2000 mm/yr), substantiates their hypothesis. Here, a Pleistocene palaeosol, which probably formed under grassy thorn-scrub vegetation (with *Curatella* and *Arundinella*), is stratified beneath Early Holocene mesic forest (Piperno, 1995).

ARCHAEOLOGY

More than one Pre-‘Palaeoindian’ culture?

In North America, discussions about initial human colonization still revolve around the ‘Clovis’ culture. This first stage of the ‘Palaeoindian’ period is customarily associated with hunting medium- and large-sized animals — including extinct megaherbivores — in open landscapes. ‘Clovis’ tool kits are widespread virtually throughout the unglaciated (and some of the deglaciated parts) of this continent between ca. 11,200 and 10,600 BP (Meltzer, 1995).

A year after the first description of a ‘Clovis’ site, a different kind of stemmed (‘Fish-Tail’) fluted point was found in rock shelters in Chilean Patagonia alongside bones of extinct horses (*Onohippidium* [*Parahippus*]) and giant ground sloths (*Myodon*). If two University of Pittsburgh dates are ignored as outliers (cf. Borrero, 1995), the ‘Fish-Tail’ fluted point tradition in southernmost South America lasted from ca. 11,170 to 9920 BP (Bird, 1988; Politis, 1991; Table 1).

The view that a fluted point horizon derived from ‘Clovis’ is also the oldest human culture (Lynch, 1990), is not the majority opinion among archaeologists who work in South America (Bryan, 1991; Dillehay *et al.*, 1992; Gruhn and Bryan, 1991). There is now a general consensus that at least two culturally and adaptively distinct — and wholly or partially coeval — ‘populations’ or ‘traditions’ were present in this study area before the Palaeoindian horizon:

- (1) ‘Generalist’ hunter-foragers who moved around in small groups. Their stone tool kit lacks bifacial reduction, and consists of flakes and core tools made from chunks or water-worn nodules of siliceous materials. Working edges generally have

no retouch, but are sometimes trimmed (usually on one edge) by direct percussion (Fig. 3b). Woodworking is assumed to have been a dominant activity.

- (2) More ‘specialized’ hunters with extensive foraging ranges, who made bifacial projectile points and cutting tools, as well as unifaces sometimes retouched with controlled percussion flaking. Prey animals included extant taxa (i.e. deer) as well as extinct ones (i.e. gomphotheres, ground sloths, horses, and camelids).

Late Pleniglacial antecedents?

Correal Urrego (1993) reported flaked stone artifacts sealed under LGS volcanic ash and colluvium at Pubenza (Cundinamarca, Colombia), in the Magdalena river lowlands. These include an obsidian spent core and a chalcedony flake with a flat striking platform (Fig. 3a), associated with a dispersed wood charcoal date of $16,400 \pm 420$ BP. Faunal remains include mastodont, as well as ‘turtle, snails, crabs, mouse, and armadillo’.

Pre-Paleoindian predation on extinct fauna Colombia

^{14}C dates are pending for possibly early LGS sites at Totumo (Cundinamarca) and Las Piletas (Santander), which contain megafaunal remains, flakes, and cores. At Totumo, a circular feature containing *Haplomastodon* and sloth teeth from adults and juveniles recalls features from Tibitó in the Sabana de Bogotá (Correal Urrego, 1993).

Tibitó (altitude: 2600 m) is in the low dry montane forest zone of the Eastern Cordillera. In a 140 m² décapage, Correal Urrego (1981) identified human activities in association with extinct proboscideans (*Cuvieronius* and *Haplomastodon*) and horse (*Equus* (*Amerhippus*), MNI = 8), and extant deer (*Odocoileus*) and fox (*Cerdocyon*). Stratum 3A — a 0.2 m deep sandy loam — contained three features, in which burnt and unburnt horse and gomphothere bones were mixed with stone artifacts and chunks of limestone. The preponderance of teeth and ribs suggests *in situ* dismemberment and joint-removal (the animals could have been scavenged, but site geology does not suggest ponding). The single ^{14}C (bone) date of $11,740 \pm 110$ BP (Grn 9375) is concordant with the palynology. Stratum 3A’s inferred oak-alder wooded parkland is associated with the Guantiva Interstadial at this altitude. Overlying Stratum 3’s more herbaceous landscape correlates with the El Abra Stadial. Correal Urrego attributes all 156 stone artifacts to a flake-core tool tradition called ‘Abriense’ in Colombia (Correal Urrego *et al.*, 1966–69), except for a ‘finely retouched keeled’ scraper, which he attributes to the partially contemporaneous ‘Tequendamiense’ industry 62% are ‘used flakes’ and ‘core fragments’. 78% of the artifacts were found in Stratum 3A’s circular features.

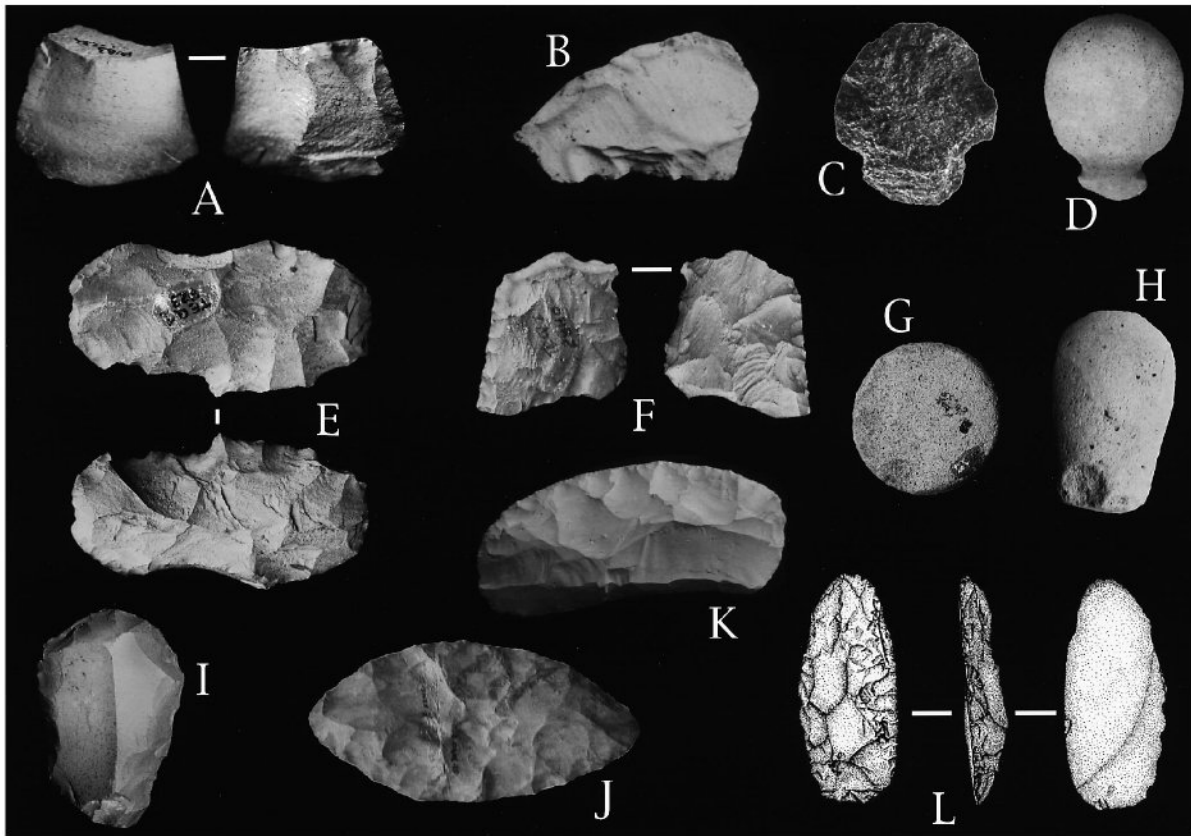


FIG. 3. Stone tools from Colombian sites (not to scale; size of each tool given below) (a) Pubenza, possibly Upper Pleniglacial (W: 35 mm; photo: R. Cooke, courtesy Instituto Colombiano de Antropología, (b) Totumo (Cundinamarca) (L: 50 mm; photo: R. Cooke, courtesy Instituto Colombiano de Antropología), (c) 'Hoe', Sauzalito (L: ca. 150 mm), (d) 'Hoe', El Recreo (L: ca. 145 mm; after Gnecco Valencia and Salgado López, 1989: Fig. 3, 1 and 3), (e) biface, Tequendama II (L: 62 mm, photo: R. Cooke, courtesy Instituto Colombiano de Antropología), (f) re-used bifacial point fragment, Tequendama II (L: 41 mm; photo: R. Cooke, courtesy Instituto Colombiano de Antropología), (g) discoidal stone, San Isidro (Diam: ca. 95 mm; photo: R. Cooke, courtesy C. Gnecco Valencia), (h) smoothed axe, San Isidro (L: ca. 130 mm; photo: R. Cooke, courtesy C. Gnecco Valencia), (i) end-scraper, Tequendama II (L: 46 mm; photo: R. Cooke, courtesy Instituto Colombiano de Antropología), (j) lanceolate biface, San Isidro (L: ca. 120 mm; photo: R. Cooke, courtesy C. Gnecco Valencia), (k) unifacial blade tool, La Palestina (Magdalena valley) (L: 105 mm; photo: R. Cooke, courtesy C. López Castaño), (l) unifacial scraper, Peñones de Bogotá (L: 92 mm).

Northern Venezuela

Correal Urrego did not find bifacial tools at Tibitó. At Monte Verde (southern Chile), however, two elongate lanceolate points were found in a 5–10 cm-thick layer stratified underneath peat dated to $11,760 \pm 470$ and $10,860 \pm 130$ BP. Culturally modified animal bone from the same context — including mastodont (*Cuvieronius*) and camelid (*Paleolama*) — was directly dated to $12,000 \pm 250$ and $11,990 \pm 200$ BP (Dillehay and Collins, 1991; Dillehay *et al.*, 1992; Fig. 3).

Long, thick, 'Joboid' lanceolate points are widespread in Venezuela (Fig. 5a; Ardila Calderón and Politis, 1989; Rouse and Cruxent, 1963). A 'Joboid' point mid-section was found within the obturator foramen of a juvenile *Haplomastodon* at Taima-Taima (Venezuela), an artesian spring just inland from the present-day beach (Bryan *et al.*, 1978). In the same stratum were glyptodontid, horse, mylontid sloth, ursid, and felid bones. Taima-Taima's excavation and conservation history (Gruhn and Bryan, 1984, p. 128; Cruxent, 1979, p. 77, *note*) have jeopardized objective interpretations (Morlan, 1988, pp. 35–36). The Monte

Verde finds, however, reaffirm this site's importance as a pre-Palaeoindian locality. Well-dated Early Holocene lanceolate points in the Andes (Lynch, 1980, pp. 186–191) do not invalidate a pre-'Clovis' date for the Monte Verde and Venezuelan 'Joboid' points. Since the latter differ technologically and morphologically from Early Holocene lanceolates, it is reasonable to assume that they were designed for different tasks. The dispatching of mortally wounded megamammals mired in muddy springs with lances tipped with long, thick, socketed bifaces, is not an intemperate inference. A 1σ range of 13,520 and 12,430 BP (13 dates) for the convoluted grey sand in which the gomphothere reposed at Taima-Taima (Bryan and Gruhn, 1979) suggests a pre- or early Guantiva Interstadial age. Palaeoenvironmental data are, however, inconclusive (Gruhn and Bryan, 1984). Conditions as, or more arid than today's, would have forced prey animals to congregate at perennial springs (Oschenius, 1979; cf. C.V. Haynes, 1991; G. Haynes, 1991). Recent geomorphological research and thermoluminescence dating also suggests that 'Joboid' sites pre-date 12,000 BP at the Piedra de Chispa site (Oliver and Alexander, 1990).

LGS 'Abriense' occupation of Sabana de Bogotá rockshelters

The 'Abriense' tool tradition was first identified at 'El Abra' — really three small shelters (2, 3, and 4) located in two parallel sandstone escarpments in the Sabana de Bogotá (altitude: 2570 m). The small 'Abriense' sample from LGS deposits comprises rough flakes and angular fragments of brown and black chert considered 'non-local' in reports, but, apparently, available in river terraces near the site (Hurt *et al.*, 1977, p. 14). Some flakes are pointed and blade-like. A few pieces with percussion retouch on one edge are described as scrapers, knives, and spokeshaves (Correal Urrego *et al.*, 1966–69; Hurt *et al.*, 1972, 1977).

Charcoal samples were collected at El Abra from arbitrary levels, which were then related to natural stratigraphy (Correal Urrego *et al.*, 1966–69: Fig. 5; Hurt *et al.*, 1997, p. 4). Summary articles (e.g. Correal Urrego, 1986; Reichel-Dalmatoff, 1992 (pp. 44–45)) attribute the LGS 'Abriense' *only* to the $12,400 \pm 160$ BP date. This is, in fact, the oldest of four dates obtained in most informative rockshelter (#2), within or at the upper boundary of deposition unit (DU) C₃, where the earliest formally described human occupation also occurs. The other dates are: $11,210 \pm 90$, $10,720 \pm 400$, and 8810 ± 420 BP. The charcoal for the 12,400 BP date was collected in arbitrary level 7, along with nine stone artifacts. A date of 9420 ± 110 BP was obtained in arbitrary level 8 underneath it. It was discarded by Correal Urrego *et al.* (1966–69, p. 16), because they feared rootlet contamination. The date is not mentioned in Hurt *et al.* (1997), van der Hammen's (1978) profiles or summaries of Colombian 14C dates (e.g. Botiva Contreras, n.d.; Uribe, 1990).

Pollen distribution inside the rockshelters is discontinuous. LGS and Early Holocene strata in shelter #2 lacked pollen. A Guantiva Interstadial age and environment were attributed to DU C₃ by stratigraphic cross-referencing with pollen cores taken in or near a gully in front of the shelter, and also from borings in the valley bottom (Schreve-Brinkman, 1978; van der Hammen, 1978: Fig. 27). The two dates accepted by the excavators for DU C₃ — 12,400 and 12,210 BP — are consistent with this palaeoenvironmental reconstruction. In DU C₄, above C₃, cross-referenced pollen data point to an El Abra Stadial sub-páramo vegetation. The 10,720 BP date collected at the junction of C₃ and C₄ is confirmatory of this age. DU D₁ accumulated above C₃ during the 10th millennium BP. In these earliest Holocene times, annual chert deposition in rockshelter #2 was considerably greater, and occupation either more regular or more intense than during the LGS (Hurt *et al.*, 1972, 1977, p. 6).

In sum, even though people appear to have occupied the El Abra shelters during the LGS, they went there sporadically or for very short periods of time. Inconsistencies among the cultural, chronometric, and palynological data warn against emphasizing a 13th

millennium BP origin for the 'Abriense' edge-trimmed tool 'tradition' at this particular locality.

Remarkably consistent radiometric dates, greater density of occupation debris, and clearer cultural features were recorded at the nearby Tequendama II rockshelter (altitude: 2570 m), where the 'Tequendamiense' lithic industry was first described (Correal Urrego and van der Hammen, 1977). There is no evidence for pre-LGS human activities. LGS cultural remains are concentrated in DU⁵, a 30 cm-thick humic, and slightly sandy soil, which has two sub-units. Scant 'simple flakes and a few artifacts' were found in DU 5a, but have not been described (Correal Urrego and van der Hammen, 1977) (pp. 34, 167). Immediately overlying level DU 5b contains shelter exfoliation debris, ash from hearths, and diminuted bone. It is anchored by three dates: $10,920 \pm 260$ BP (junction with underlying DU 5a), $10,730 \pm 105$ BP, and $10,460 \pm 130$ BP. Five charcoal samples from its boundary with DU 6, which represents the LGS/Holocene transition, overlap at 1σ (range: 10,300–9890 BP). DU 5b is indisputably of cultural origin and of El Abra Stadial age.

Correal Urrego and van der Hammen assigned DUs 5 and 6 to 'Occupation Zone I'. The 'Abriense' tool class in this zone appears better made, and morpho-technologically more uniform, than the small LGS 'Abriense' sample at El Abra. It is very similar to the earliest lithic sample from Nemocón IV (Correal Urrego, 1979). Only three bifacial tools were found (Correal Urrego and van der Hammen, 1977, p. 68). One appears to be a blade fragment of a thin chalcedony bifacial point, re-used on two edges (Fig. 3f). Its flaking pattern recalls that of an out-of-context point from Bahía Gloria (Fig. 5b: Correal Urrego and Pinto Nolla, 1983), and some of the thinner Central American 'Clovis'-like fluted points (e.g. Fig. 4c). The others are a thin quartzite foliate biface and a crude percussion-flaked waisted biface (Fig. 3e). A crude unifacial ovate scraper (limace), a large flake with semicircumferential retouch, and a stubby unifacial end-scraper (Fig. 3i) were also assigned to the 'Tequendamiense' industry. The latter recalls end-scrapers from the Los Tapiales 'Clovis'-like assemblage (Gruhn and Bryan, 1977). A similar tool was found at Tibitó (Correal Urrego, 1981; photo 13).

Four of these 'Tequendamiense' artifacts were found together — as though they had 'been forgotten by their owners'. Hence, they should be coeval (Correal Urrego and van der Hammen, 1977, p. 155). The unification of DUs 5 and 6 for analytical purposes implies that they may be as late as 9500 BP. The presence of pressure-flaking is doubtful (*contra* Correal Urrego and van der Hammen, 1977, p. 167). Only the re-used bifacial point fragment and the end-scraper seem 'carefully made'.

Several cooking, refuse disposal, and 'work' areas were identified at Tequendama II (van der Hammen 1977, pp. 156–160). In 'Occupation Zone I', mammal bones — including a few simple tools — were concentrated in one refuse feature. No extinct taxa were reported. The following rank-order of abundance can be

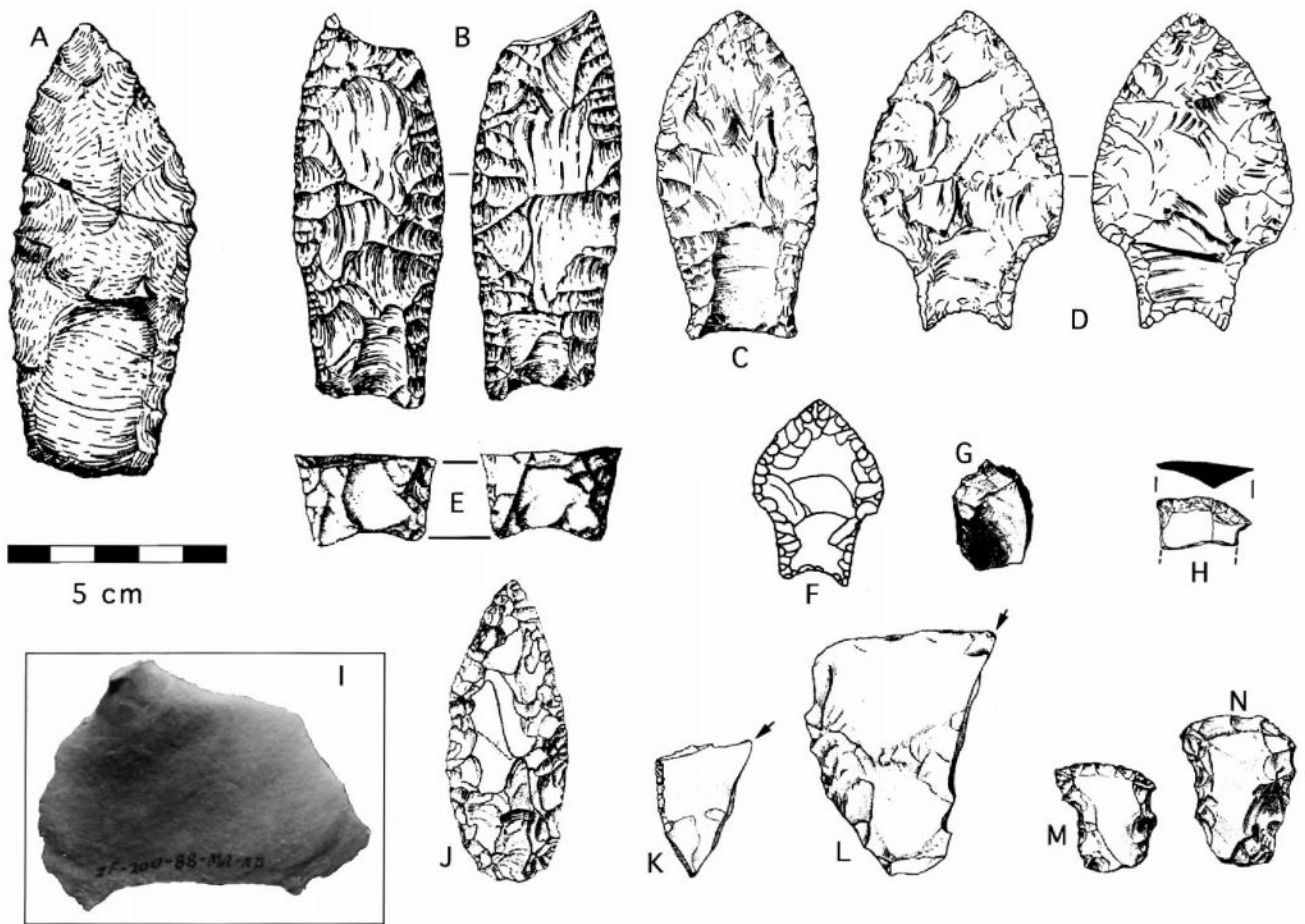


FIG. 4. Stone tools from Central American sites. (a) Fluted preform, Finca Guardiría, Costa Rica (Snarskis, 1979: Fig. 4b), (b) lanceolate 'Clovis' point, Ladyville, Belize (Kelly, 1993: Fig. 5a), (c) 'Waisted Clovis' point, Lake Madden, Panama (Bird and Cooke, 1977: Fig. 3c), (d) complete Fish-Tail point, Lake Madden, Panama (Bird and Cooke, 1977: Fig. 4e), (e) fluted point base, Los Tapiales, Guatemala (Gruhn *et al.*, 1977: Fig. 10a), (f) resharpened 'Fish Tail' fluted point, Lake Madden, Panama (Ranere and Cooke, 1995: Fig. 1.2d), (g) perforator on bifacial thinning flake, Los Tapiales, Guatemala (Gruhn *et al.*, 1977: Fig. 11e), (h) end-scraper with lateral spurs, La Mula-West, Panama (Ranere and Cooke, 1995: Fig. 1.1b), (i) bifacial thinning flake, Lake Madden, Panama (not to scale, max. width: 68 mm; photo M. Guerra), (j) unifacial tool, Los Tapiales, Guatemala (Gruhn and Bryan, 1977: Fig. 11a), (k, l) burins, Los Tapiales (Gruhn and Bryan, 1977: Fig. 11c and d).

inferred from one analyzed sub-sample: [1] white-tailed deer (*Odocoileus*), [2] rabbit (*Sylvilagus*), [3] cotton-rat (*Sigmodon*), [4] wild guinea-pig (*Cavia*), [5] armadillo (*Dasypus*), [6] brocket deer (*Mazama*), [7 =] tayra (*Eira*) and kinkajou (*Potos*). (Skunk [*Conepatus*] and opossum [*Didelphis*] abundance is unclear) (Correal Urrego and van der Hammen, 1977, pp. 48–50). Some taxa (e.g. *Potos*, *Eira*) are unlikely to have occurred in herbaceous sub-páramo. If Andean forest descended 300–600 m during the El Abra Stadial (Hooghiemstra and van der Hammen, 1993, pp. 258–259), hunters would have travelled a considerable distance to obtain these animals.

The Sueva rockshelter (altitude: 2690 m) also provides evidence for a quite intensive, but apparently short-lived human occupation. A 0.2–0.5 m dark black layer (DU 3), with a single $10,090 \pm 90$ BP date, contained > 5200 'Abriense' artifacts and > 300 animal bones of which 98% are white-tailed deer (*Odocoileus*). The only botanical information is a fragment of burnt forest bamboo (*Chusquea*). 46% of DU 3's lithics are

described as waste flakes, 6% as scrapers, and 2% cores and core fragments. There is no evidence for bifacial flaking. A primary flexed adult female was found buried in DU 3, associated with an offering (?) of 14 stone flakes, a 'side-scraper', and ochre and hematite fragments. It is the only possibly LGS human burial from the study area.

Underneath DU 3 at Sueva is a 0.1–0.6 m silty clay layer (DU 2). It has not been dated, but its pollen suggests a damp environment of alder forest intermixed with open herbaceous areas. It contained more than 1000 artifacts, and 170 animal bones (96% deer). Correal Urrego (1979) (p. 245) concludes that DU 2, which was in places sealed by sterile roof-fall, corresponds to the Guantiva Interstadial. However, the edaphological and cultural differences between this layer and DU 3 could also be due to varying occupation intensity. If the El Abra Stadial terminated in the northern Andes by 10,000 BP (van der Hammen and Hooghiemstra, in press), DU 2 and DU 3 may be transitional Pleistocene/Holocene, rather than LGS in age.

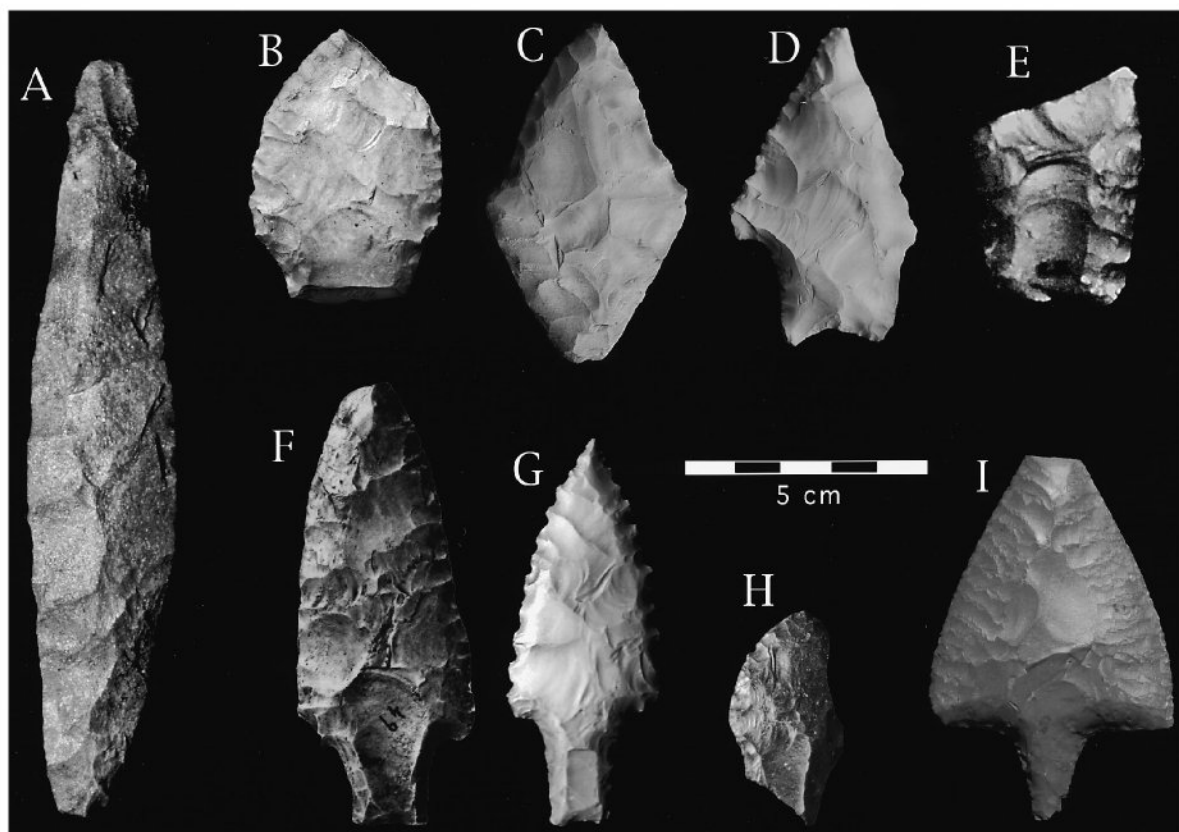


FIG. 5. Colombian and Venezuelan projectile points. (a) 'Joboid' point, Pedregal valley, Venezuela (Szabadick collection; photo: J. Oliver); (b) Cueva de los Murciélagos, Bahía Gloria (photo: J.B. Bird), (c) San Isidro, Cauca valley (photo: C. Gnecco Valencia), (d) San Isidro, Cauca valley (photo: C. Gnecco Valencia), (e) El Cayude, Paraguaná Peninsula, Venezuela (photo: J. Oliver), (f) Restrepo, Calima river, Colombia (L: 91 mm) (Reichel-Dalmatoff, 1986: Fig. 3), (g) Las Piletas, Santander (photo: R. Cooke, courtesy of G. Correal Urrego), (h) Estado de Falcón, Venezuela (photo: A. Jaymes), (i) Yondó, Magdalena river, Colombia (photo: R. Cooke, courtesy G. Correal Urrego).

Fluted points: morphology, technology, and time

I do not believe that 'fluting' was a 'minor technological tradition' (Gruhn and Bryan, 1977). It is a fundamental aspect of composite projectile technology, which involves both perishable and non-perishable parts (Bird, 1969; Frison, 1989). Fluting was not invented in the Old World. Wherever it was first developed and whichever direction its dispersal followed, allopatric convergent evolution in North and South America is unlikely.

In this study area, only the Los Tapiales lanceolate basal fragment (Fig. 4e) was found in ^{14}C -dated buried deposit. The complete point from Ladyville (Belize) (Fig. 4b (from Kelly, 1993: Fig. 5)) and one from Finca Guardiria (Ranere and Cooke, 1991: Fig. 6a) would probably satisfy Palaeoindian specialists' formal criteria for 'Clovis'. Some fluted points from El Cayude (Venezuela) (Fig. 5e; Oliver and Alexander, 1990; Ardila Calderón and Politis, 1989) probably belong in this group. Other complete points from (1) San Rafael (Guatemala), (2) Site G-164-A5 (Costa Rica) (Sheets, 1994), (3) Guanacaste (Costa Rica) (Bird and Cooke, 1978: Fig. 1b), (4) Finca Guardiria, and (5) Lake Madden (Panama) (Fig. 4c), are sub-medially re-

stricted, and have outflaring 'ears' at the base (often broken). Denominated 'waisted Clovis' (Ranere and Cooke, 1991), they recall regional Palaeoindian variants in the US, e.g. Florida 'Suwannee' and 'Simpson' points (cf. Dunbar, 1991: Figs 1c and 2b).

Five stemmed fluted points from Lake Madden (Panama) (Fig. 4d and f; Bird and Cooke 1977, 1978), and one from Finca Guardiria (Snarskis, 1979: Figs 2f and 3a), have the base-blade junction intact. Their dimensions are similar to those of Ecuadoran and southern South American 'Fish-Tails', but they have straight rather than outflaring 'ears'. Stems are but a fraction wider. This homogeneity alludes to a functional relationship between stem and blade width, and shaft circumference, upon which projectile penetration and strength is predicated (Bird, 1969; Politis, 1991) (p. 295). On both lanceolate and stemmed fluted points, the edges of basal sections are abraded to prevent them from cutting into the hafting medium.

'Restrepo' fluted points have been found only in Colombia, one in an (undated) lowland cave (Cueva de los Murciélagos, Bahía Gloria (Correal Urrego and Pinto Nolla, 1983)). They have a narrow base with a straight bottom edge, an elongate triangular blade, and a right-angled stem-blade junction. One has

prominent serrations. Basal bilateral fluting channels sometimes extend to the middle of the blade (Fig. 5f and g; Ardila Calderón, 1991: Fig. 4(2–4); Reichel-Dalmatoff, 1965: Fig. 8). One broad-stemmed point from La Elvira (type 2A) is fluted (Gnecco Valencia, 1994).

Fluted point morphology appears to correlate with two tool reduction processes. Lanceolate and, apparently, ‘Restrepo’ point manufacture, began with a bifacially prepared blank, which was then thinned by percussion flaking. Thinning flakes sometimes continue from edge to edge; mistakes make elongate ‘overshoot flakes’ (Ranere, 1992: Fig. 2j; Ranere and Cooke, 1995: Fig. 1.1e). The cross-sections of mid- (unfluted) sections are bi-convex.

Conversely, ‘Fish-Tail’ stemmed points, and the La Elvira stemmed example, are made from flake blanks that are not much thicker than the finished point. Thinning flakes ‘tend to broaden at their distal end and overlap each other in the center of the point’ (Ranere and Cooke, 1991, p. 239).

Three lithic samples point to the mutual exclusivity of the two reduction processes. At Los Tapiales, where biface-dressing is judged to have been a primary activity, lenticular platforms prepared by grinding or crushing occur, but ‘lips’ are rare. At La Mula West (Panama), perhaps an artifact refitting station, 67 biface fragments, scores of bifacial thinning flakes, and ‘overshoot’ flakes, and six fluted point fragments bear witness to the thick bifacial blank technology (Cooke and Ranere, 1992b; Ranere, 1992; Ranere and Cooke, 1995). On the other hand, abundant bifacial workshop debris from the Lake Madden (Westend) site — close to the reported fluted point find-sites (Bird and Cooke, 1977) — uniquely represents the large flake reduction tradition. Thinning flakes have tiny, abraded and lipped platforms. Many are triangular (Fig. 4i).

An alternative explanation for these differences is that they are related to raw material availability and workability, rather than a technology/time/culture interface. Fully 77% of Los Tapiales’ artifacts are basalt; almost all La Mula West’s are banded agate. These are perhaps inappropriate materials for taking off large thin flakes, unlike the fine Lake Madden chalcedonies or the La Elvira obsidian and glassy chert (Gnecco Valencia, 1994). Nevertheless, closer attention to the relationship between technology and morphology is encouraged in order to determine whether fluted point distributions exhibit an areal diachronic evolution (i.e. ‘Clovis’ and ‘Restrepo’ before ‘Fish-Tail’ and ‘La Elvira’ type 2A) or a regionally coeval distribution (i.e. different populations with contrasting tool manufacturing processes) (Dillehay *et al.*, 1992; Gnecco Valencia, 1994).

Gruhn and Bryan (1977, p. 244) believe that 10,700 BP is a ‘reasonable approximate estimate’ for ‘Clovis’ Los Tapiales and nearby La Piedra del Coyote (Guatemala). La Elvira (where only one point, in a sample of more than 100, was fluted) is assumed to be coeval with or slightly antecedent to nearby San Isidro (ca. 10,000–9500 BP) (Gnecco Valencia, 1994). Fluting

is absent at San Isidro, and also at San Juan de Bedout, La Palestina, and Naré in the lower Magdalena valley (1 σ range, four dates: 10,490–10,150 BP) (López Castaño, 1995a, b). These tenuous contextual data — in addition to radiometrically dated associations from outside this study area — suggest that fluting had everywhere disappeared by the beginning of the Holocene. Probably, its apogee occurred during the El Abra Stadial (Politis, 1991, p. 297).

Fluted points and life styles

No published fluted points have been associated with faunal or macrobotanical remains. Jaymes (*pers. comm.*, 1992), however, has found ‘Fish-Tail’ stemmed points associated with extinct megafauna in Falcón state (Venezuela) (Fig. 5h). Elsewhere, extinct mammals are nearly always present where fluted points accompany animal remains, e.g. mammoth (*Mammuthus primigenius*) in the southwestern United States, and horse, ground sloth, and glyptodontids in Argentina and Chile. If these taxa vanished before the end of the LGS (despite Politis *et al.*, 1987), their extinction and the disappearance of vertical basal fluting may not be coincidental. Nevertheless, the consensus opinion among archaeologists is that consuming extinct herbivores does not necessarily equate with hunting ‘specialization’. Opportunistic selection for the most abundant and/or easiest-to-hunt taxa in particular habitats, be they now extinct or extant, is a more likely scenario. Guanaco were important prey species for fluted-point users in Patagonia and the pampas; white-tailed deer probably were in this study area. At the same time, even if ‘Clovis’ weapons were not effective against adult mammoth (Frison, 1989) and even if underutilized megamammal carcasses were scavenged (Haynes, 1991), fluted points and the geographically uniform scrapers, perforators, and burins that accompany them all over the American continent (see Figs 3i, k, l and 4g, h, k–n) were not designed for scavenging!

If we adjudicate fluted point finds to the 11th millennium BP, we find their users in vegetation types that can be inferred from palaeoecological data as (1) páramo (highland Guatemala), (2) montane oak forests (drier in central Panama than Caribbean Costa Rica?), (3) seasonal lowland forest (Caribbean central Panama (Lake Gatún), Gulf of Urabá), (4) dry tropical forest, perhaps thorn-scrub and wooded savanna (central Panamanian lowlands, parts of Venezuela, Magdalena lowlands), (5) Andean oak forests (Cauca valley), and (6) semi-desert (Paraguaná Peninsula, Venezuela).

A sudden increase in particulate charcoal at Lake La Yeguada (Panama) after ca. 11,000 BP suggests that humans began to burn fires in oak-*Ilex*-magnolia forests at this time. Forest plant products and small animals were surely collected (Clausen *et al.*, 1979; Borrero, 1995; Lynch, 1983; Piperno *et al.*, 1991a). Nevertheless, while the plant resources of the above

habitats would have been diverse (requiring different foraging strategies and preparation technology), the trophic behavior of deer, sloth, horse, and mastodons did not restrict these taxa to specific vegetation types. All fluted point finds in the study area come from areas where seasonal water shortage (and animal aggregation behavior) was surely accentuated in YD-times. Lakes would have been primary foci for prey species.

If the search for dietarily (and probably cognitively) important prey species was one motivation for fluted-point users to habitually cross ecological boundaries, another was the desire for the best raw material for bifacial flaking. At tool manufacturing or repair sites (Los Tapias, La Mula-West, La Elvira) lithic raw materials were brought in from afar. The local rarity of good quality stone may explain why bifacial points, carefully trimmed scrapers, burins, and perforators are rare or absent in Sabana de Bogotá LGS (Correal Urrego and van der Hammen, 1977). Hence, the 'Abriense'-'Tequendamiense' dichotomy could reflect LGS hunter-gatherer behavior, rather than mutually exclusive tool traditions. Conversely, the large size of the Finca Guardiría workshop in Costa Rica (100,000 m²) is perhaps related to the abundance of good quality stone within the site's limits (Snarskis, 1979).

Holocene environmental change and human subsistence

A YD-related cooling episode was identified in the Costa Rican La Chonta bog between ca. 11,100 and 10,400 BP. In the Colombian Andes, the El Abra Stadial lasted from ca. 10,900–10,150 BP. At La Yeguada (Panama) the period 11,000–10,300 BP represents 'a major boundary in all the (palaeoecological) records' (Bush *et al.*, 1992, p. 259).

The La Yeguada lake core is the only one from the tropical lowlands where pre-8000 BP human activities are clearly visible in the pollen and phytolith record. The burning episode just mentioned was followed (10,500–8000 BP) by an increased abundance of grass and disturbance-indicator plants (Piperno *et al.*, 1990, 1991b). Archaeological evidence from three rock-shelters located between this lake and the Pacific coast (Corona, Carabalí, and Vampiros) substantiates (1) continued human presence after climatic amelioration, (2) wild plant food collection in seasonally dry forests, and (3) the use of a cultigen (arrowroot, *Maranta arundinacea*). Bifacial flaking debris in deposits dated between 10,400 \pm 450 and 8040 \pm 390 BP accompanies arrowroot microremains and edge-ground cobbles (for mashing the tubers?) (Cooke, 1993; Cooke and Ranere, 1992a). No bifacial point fragments were found in these excavations; but it is likely that lipped thinning flakes were removed from square-stemmed barbed points similar to surface-collected examples from the La Mula-Central quarry (Ranere and Cooke, 1995: Fig. 1.3). Surface-collected non-fluted

bifacial projectile points and turtle-backed scrapers (cf. Fig. 3(1)) from Costa Rica, Guatemala, and Belize probably include pre-8000 BP materials (Acuña Coto, 1983; Brown, 1980; Kelly, 1993).

Sound contextual information for the contemporaneity of unfluted bifacial tools made of cryptocrystalline stone, forest plant products, and their processing tools comes from San Isidro, in the valley of Popayán (altitude: 1800 m). Gnecco Valencia (1994) identifies this single component site, anchored to two dates (10,050 \pm 100 and 9530 \pm 100 BP), as a knapping station where hunter-foragers made artifacts and gathered mostly palm fruits (cf. *Acrocomia*), but also *Virola*, *Caryocar*, and *Persea* (bone was not recovered). Cobble grinding tools, smoothed discoidal stones (Fig. 3g), and a smoothed axe (Fig. 3h) were stratified with them. Projectile points include foliate, double-triangular, stemmed, and lanceolate types, all unfluted (Fig. 5c and d). Large bifaces (Fig. 3j), carefully prepared end-scrapers, and edge-trimmed unifacial tools are also present. Gnecco Valencia argues that San Isidro and La Elvira, which show clear cultural affiliations with adjacent parts of Ecuador (Bell, 1965; Mayer-Oakes, 1986), overlapped chronologically; hence, their divergent lithic traditions allude to coeval cultural heterogeneity. It remains to be seen whether this hypothesis is stronger than its obvious alternate (short-lived diachronic changes in widely distributed tool types).

Hunter-gatherer cultural diversity after ca. 10,500 BP has also been proposed by López Castaño for the middle Magdalena lowlands. Stone tools and flaking debris are widely distributed in an area where excellent cryptocrystalline stone abounds. Particularly widespread are unifacial ovate turtle-backed scrapers (e.g. Fig. 3(1)) and large flakes with carefully trimmed edges (e.g. Fig. 3k). The latter was found at the single-component La Palestina site associated with thinning flakes, flake scrapers, cores, and flaking debris (with two dates: 10,400 \pm 90 and 10,230 \pm 80 BP). Neither this site, nor coeval San Juan de Bedout (10,350 \pm 90 BP), provided stratified examples of the wide variety of stemmed and tanged points that were collected from the surface (López Castaño, 1995a, b; Oleoducto de Colombia, 1994).

López Castaño (1993, 1995a, b) infers from these data that (1) several late LGS/Early Holocene lithic traditions existed (some of these coeval), (2) hunter-gatherer groups with a post-Palaeoindian biface-scraper industry survived locally until 5000–3000 BP, and (3) an itinerant, savanna-adapted way-of-life persisted through the Early Holocene. Hunter-gatherer societies that used bifacial projectile points and emphasized deer and/or camelid hunting were present in the Ecuadoran and Peruvian Andes until well after 8000 BP (Rick, 1980; Lynch, 1980; Lynch and Pollock, 1981).

More excavations at single-component sites may, or may not, confirm the hypothesis of diachronically intensifying hunter-gatherer cultural diversity in Colombia (some undated points (e.g. Fig. 5i from

Yondó, Magdalena river) are clearly pressure-flaked, unlike other LGS examples that this author has handled). The utilization of Andean forest products, apparent at San Isidro, is substantiated for the Early Holocene in the Calima Valley. At Sauzalito (with two dates: 9670 ± 170 and 9600 ± 110 BP), a flaked laterally notched tool of igneous material (Fig. 3c) has been interpreted as a 'hoe'. At nearby El Recreo, a well-smoothed 'hoe' (Fig. 3d) was associated with three dates with a 1σ range of 8910–7690 BP. The wide distribution of these 'hoes' throughout the middle and upper Cauca valley (Salgado López, 1989), as well as their stratigraphic association with cobblestone grinders, and carbonized palm nuts and *Persea* pits, points towards a regional sylvan lifestyle at the Andean/Sub-Andean forest boundary. A single thinning flake at Sauzalito is the only evidence at these sites for the continuation of LGS bifacial reduction processes. The bifacial reduction of tools made of cryptocrystalline stone seems gradually to have petered out in the Early Holocene, as it did in central Panama (Ranere, 1992).

The record for human activities in the Sabana de Bogotá suggests continuing, generally more intensive, but still intermittent occupation of rockshelters used in the LGS, and the incorporation of higher elevations into the subsistence round. Structures have been identified at one open-site (Checua). Neusa II (altitude: 3350 m) was probably located at the upper limit of Andean forest when it was first occupied. The lithic industry from DU2 (8370 ± 90 BP) is 'Abriense' (tools are identified as 'scrapers' and 'knives'). DU 2A, immediately above D2 inside the shelter, contains anvils, grinding bases, and edge-ground cobbles similar to those reported from the Carabalí shelter in Panama (8040 ± 90 BP: Ranere and Cooke, 1995 (p. 13)). White-tailed and brocket deer (*Mazama*), armadillo, rodents, and bird were taken. (If correctly identified, the black-collared hawk (*Busarellus nigricollis*) was nonetheless probably not locally available) (Rivera Escobar, 1992).

Compositionally and artifactually the Early Holocene deposits at Tequendama and El Abra are similar. DU 7 at Tequendama II (estimated non-radiometric age: 9500–8500 BP) contains animal remains clustered around clay-lined hearths. By this time, the site was within Andean forest. 'Keeled' scrapers are present, but bifacial artifacts are not. Possible lithic innovations are hook-shaped flake 'perforators' and 'spokeshaves', the latter perhaps related to the increased importance of bone tools. Guinea-pig displaced the white-tailed deer as favorite preferred prey species, both here and at El Abra, where DU D (ca. 9400–7250 BP) is judged to be coeval with Tequendama DU 7 (Correal Urrego and van der Hammen, 1977; van der Hammen, 1978). Nemocón IV's varied fauna and sparse occupation debris allude to its use as a hunting camp ca. 9000–8000 BP. The predominance of white-tailed deer, and the presence of guinea-pigs, fox (*Urocyon*), peccaries (Tayassuidae), and howler monkey (*Alouatta*) sug-

gest either an ecotonal (forest/open country) location or a wide hunting range. Land-snails had been added to the sabana diet by this time (Correal Urrego, 1979).

The existence of open-air living sites in the sabana at the beginning of the Holocene is demonstrated by the Galindo and Checua sites. The earliest low-density occupation at Checua included post-holes and hearths associated with a lone date of 8200 ± 110 BP. Edge-ground cobbles and other pounding instruments allude to the plant food processing. This site and Nemocón 4 may have been used seasonally by the same cultural group (Groot de Mahecha, 1995).

CONCLUDING REMARKS

This review underlines some high-probability scenarios that can be inferred from the summarized data, some alternate scenarios whose resolution awaits better-quality data, and some areas of investigation whose encouragement would improve knowledge of the elected topic.

High probability scenarios:

- (1) A small and widely dispersed pre-El Abra Stadial (YD) human population.
- (2) The pre-El Abra Stadial (YD) consumption of extinct herbivores, including horse and gomphotheres, by cultural groups who made bifacial lanceolate points (probably socketed into wooden spears) and carefully trimmed scrapers.
- (3) More or less coincident with the YD and El Abra Stadial ($10,500 \pm 600$ BP), a widely distributed, culturally affiliated, and highly mobile ('Palaeoindian') population that customarily utilized basally fluted bifacial artifacts, blades, burins, flake perforators, and carefully trimmed end- and side-scrapers (often 'turtle-backed').
- (4) The use of different forest and open vegetation types throughout the LGS from sea level up to ca. 2500 m (except non-seasonal lowland rainforest).
- (5) At or soon after the LGS/Holocene boundary, widespread forest-dwelling settlements, whose inhabitants habitually collected forest plant products, some of which appear to have been under domestication by 8000 BP.

Alternative scenarios which cannot be confirmed by current data:

- (1) Humans were/were not present during the Upper Pleniglacial and did/did not use extinct Pleistocene mammals such as mastodons.
- (2) All pre-El Abra Stadial populations were/were not acquainted with bifacial reduction processes.
- (3) Pre-Holocene populations did/did not habitually collect wild plant foods.
- (4) The extinction of Pleistocene mammals did/did not coincide chronologically with the disappearance of fluted points.
- (5) Extant fauna, such as white-tailed deer, were/were not an important LGS hunting resource.

- (6) LGS and Early Holocene tool kits represent *either* short-lived, but areally distributed artifact types, *or* coeval assemblages belonging to different cultural groups with distinct subsistence orientations.
- (7) Hunter-gatherers using bifacial projectile points and large blade/flake scrapers did/did not survive after 8000 BP coevally with incipient cultivators.
- (8) Universal forest expansion and/or increased sedentism after climatic amelioration did/did not lead to the development of several economic systems strongly correlated with specific geographic regions and/or vegetation types (i.e. an 'Andean hunting tradition', 'a Central American premontane horticultural system').

Areas of study that should be promoted:

- (1) Trace-wear analysis (cf. Nieuwenhuis, 1994; Gnecco Valencia and Mohammed, 1994).
- (2) Studies of lithic waste materials (for identifying bifacial thinning and fluting flakes, and lithic reduction processes, especially where bifacial 'tools' have not been reported).
- (3) Excavation at buried single-component sites (to compensate for dating inconsistencies at continually occupied sites).
- (4) Archaeology and palaeoecology in evergreen (humid) rainforests.

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