EARLY MAN IN THE ANDES

Stone tools in highland Peru indicate that men lived there 22,000 years ago, almost twice the old estimate. They also imply that the first cultural traditions of the New World had their roots in Asia

by Richard S. MacNeish

Recent archaeological discoveries in the highlands of Peru have extended the prehistory of the New World in two significant respects. First, the finds themselves indicate that we must push back the date of man's earliest known appearance in South America from the currently accepted estimate of around 12,000 B.C. to perhaps as much as 20,000 B.C. Second and even more important is the implication, in the nature of the very early Andean hunting cultures now brought to light, that these cultures reflect Old World origins of even greater antiquity. If this is so, man may have first arrived in the Western Hemisphere between 40,000 and 100,000 years ago. The discoveries and the conclusions they suggest seem important enough to warrant this preliminary report in spite of the hazard that it may prove to be premature.

The new findings were made in 1969 and 1970 near Ayacucho, a town in the Peruvian province of the same name. All the sites lie within a mountain-ringed valley, most of it 6,500 feet above sea level, located some 200 miles southeast of Lima [*see top illustration on page 39*]. The valley is rich in prehistoric remains (we noted some 500 sites during our preliminary survey) and archaeological investigations have been conducted there since the 1930's. For me and my associates in the Ayacucho Archaeological-Botanical Project, however, the valley was interesting for other reasons as well.

A number of us had already been involved in a joint archaeological-botanical investigation at Tehuacán in the highlands of Mexico under the sponsorship of the Robert S. Peabody Foundation for Archaeology. Our prime target was early botanical evidence of the origin and development of agriculture in the area. This we sought by archaeological methods, while simultaneously recording the relation between agricultural advances and the material evidence of developing village life (and ultimately urban life) in Mexico before the Spanish conquest. By the time our fieldwork at Tehuacán had been completed in the mid-1960's we had gained some understanding of the changes that had come about in highland Mesoamerica between its initial occupation by preagricultural hunters and gatherers around 10,000 B.C. and the rise of pre-Columbian civilization [see "The Origins of New World Civilization," by Richard S. MacNeish; SCIENTIFIC AMERICAN, November, 1964].

There was, however, at least one other major New World center that had been the site of a similar development from hunting bands to farmers and city folk. This is western South America. Its inhabitants had cultivated some plants that were unknown to the farmers of Mesoamerica, and they had domesticated animals that were similarly unique to the region. Mesoamerica certainly interacted with South America, but the earliest stages of this second regional development apparently took place in isolation. It seemed logical that the record of these isolated advances might provide the foundation for functional comparisons with the Tehuacán results and perhaps lead us to some generalizations about the rise of civilization in the New World.

This was the objective that brought several veterans of the Tehuacán investigation, myself included, to Peru. The work was again sponsored by the Peabody Foundation, where I now serve as director. Reconnaissance of a number of highland areas led us to select the Ayacucho valley as the scene of our investigations. Our decision was based primarily on ecological grounds: within a radius of 15 miles the varied highland environment includes areas of subtropical desert, thorn-forest grassland, dry thorn forest, humid scrub forest and subarctic tundra [*see bottom illustration on page 39*]. It is the consensus among botanists who have studied the question that many of the plants first domesticated in western South America were indigenous to the highlands and that their domestication had probably taken place in Peru. The Peruvian ecologist J. A. Tosi had concluded that the most probable locale for the event would be a highland valley that included a wide range of environments. An additional consideration was that the area where we worked should contain caves that could have served as shelters in the past and thus might prove to be the repositories of animal and plant remains. The Ayacucho valley met both requirements.

Two caves in the valley have in fact turned out to be particularly rich repositories. One of them, located about eight miles north of the town of Ayacucho, is known locally as Pikimachay, or Flea Cave. It lies some 9,000 feet above sea level on the eastern slope of a hill composed of volcanic rock; the mouth of the cave is 40 feet high in places and 175 feet wide, and the distance from the

DEEP CUT through part of an open-air archaeological site at Puente in highland Peru is seen in the photograph on the opposite page. The record preserved in the successive strata at Puente extends from the first appearance of pottery in the 16th century B.C. to about 7000 B.C., when the Andes were inhabited by hunters specializing in the pursuit of big game.

FLEA CAVE, the site that contains the oldest evidence of man's presence thus far unearthed in South America, lies at an altitude of 9,000 feet in an area of intermingled thorn forest and grassland. The mouth of the cave (*center*) is 175 feet wide and 40 feet high.

PEPPER CAVE, the other major cave site in the Ayacucho area, lies at an altitude of 11,000 feet on a hill where humid scrub forest gives way to upland tundra vegetation. The lowest strata excavated at Pepper Cave are evidently the product of local glacial outwashes.

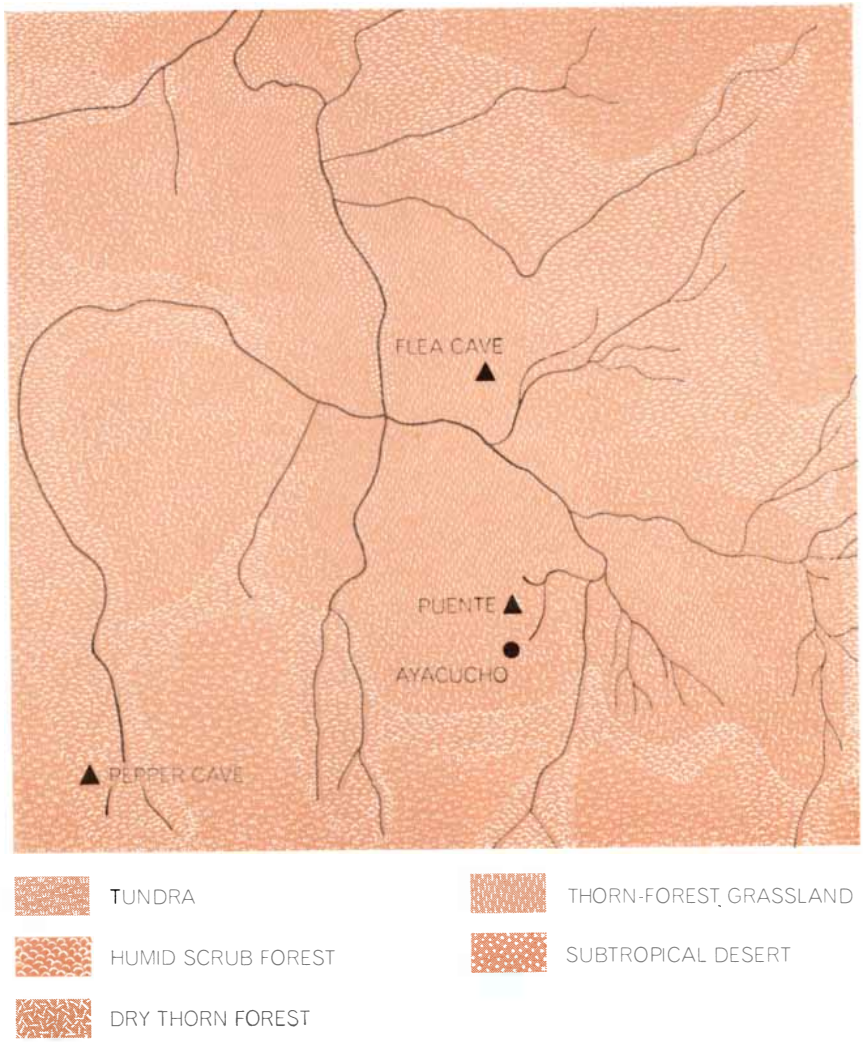
front of the cave to the deepest point inside it is 80 feet. Rocks that have fallen from the roof occupy the northern third of the interior of the cave and form a pile that reaches a height of 20 feet. In 1969 Flea Cave yielded the single most dramatic discovery of the season. During our last week of excavation a test trench, dug to a depth of six feet near the south end of the cave, revealed stone tools in association with bones of an extinct ground sloth of the same family as the fossil North American sloth *Megatherium*. One of the bones, a humerus, has been shown by carbon-14 analysis to be 14,150 (±180) years old.

The other notable cave site, some 11 miles east of the town of Ayacucho, is known locally as Jayamachay, or Pepper Cave. Although Pepper Cave is as high and nearly as wide as Flea Cave, it is only 15 feet deep. Excavations were made at Pepper Cave with rewarding results in both the 1969 and the 1970 seasons. Because the significance of the findings at this site arises largely from a comparison of the material from both caves, I shall first describe the strata at Flea Cave.

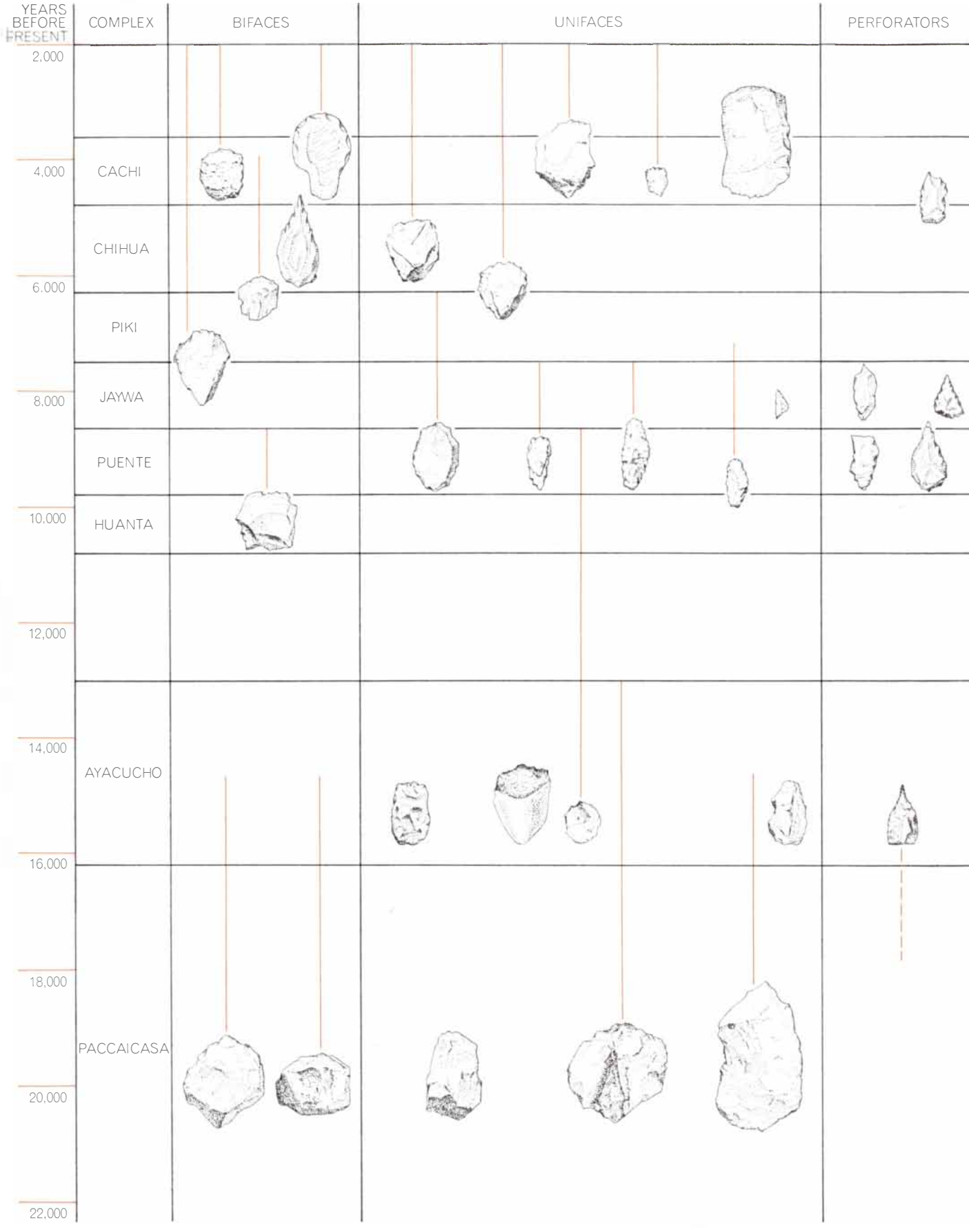
AYACUCHO VALLEY, between Lima and Cuzco, is undergoing joint botanical and archaeological investigation that will allow comparisons with a study of Tehuacán, in Mexico. The Robert S. Peabody Foundation for Archaeology is the sponsor of both studies.

What has been revealed in general by our work at all the cave and open-air sites in the Ayacucho valley (a total of 12 excavations) is a series of remains representative of successive cultures in an unbroken sequence that spans the millenniums from 20,000 B.C. to A.D. 1500. The archaeological sequence documents man's progression from an early hunter to an incipient agriculturist to a village farmer and finally to the role of a subject of imperial rule. The material of the most significance to the present discussion, however, is contained in the strata representing the earliest phases of this long prehistoric record. These strata have yielded a succession of stone-tool types that began some 20,000 years ago and continued until about 10,500 years ago. The earliest part of the record is found in the lowest levels at Flea Cave.

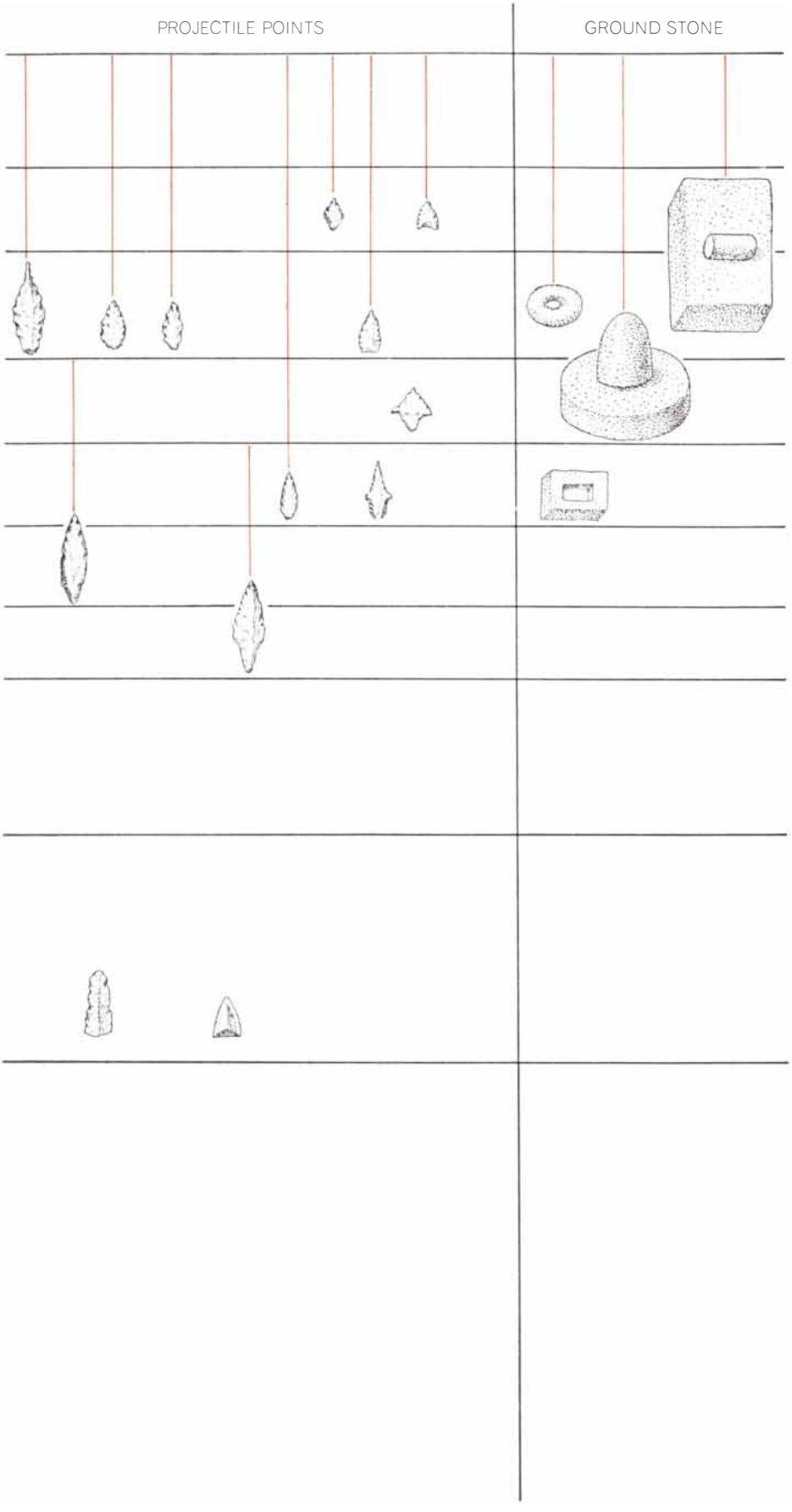
The oldest stratified deposit in the cave lies in a basin-like hollow in the lava flow that forms the cave floor. The stratum lies just above the bedrock of the basin. Labeled Zone k, the stratum consists of soils, transported into the cave by natural means, that are mixed with disintegrated volcanic tuffs from the rocks of the cave itself. Zone k is eight inches deep. Just before the deposition of the stratum ended, some animal vertebrae and a rib bone (possibly from an extinct ground sloth) were deposited in it. So were four crude tools fashioned from



MAJOR SITES in the Ayacucho valley include Puente, near the town of Ayacucho, Flea Cave, a few miles north of Puente, and Pepper Cave, a few miles southwest. The existence of five distinct zones of vegetation in the valley (*key*) was a factor in its selection for study.



KINDS OF TOOLS discovered at 12 excavations in the Ayacucho valley appear in this chart in association with the complex (*names at left*) that first includes them. No complex more recent than the Puente, some 9,000 years old, is relevant to man's earliest arrival



in Peru. The first crude tools (*bottom*) are reminiscent of chopping tools found in Asia. In the next complex projectile points first appear; some were made out of bone (*far right*).

volcanic tuff and a few flakes that had been struck from tools. One of the flakes is of a green stone that could only have come from outside the cave.

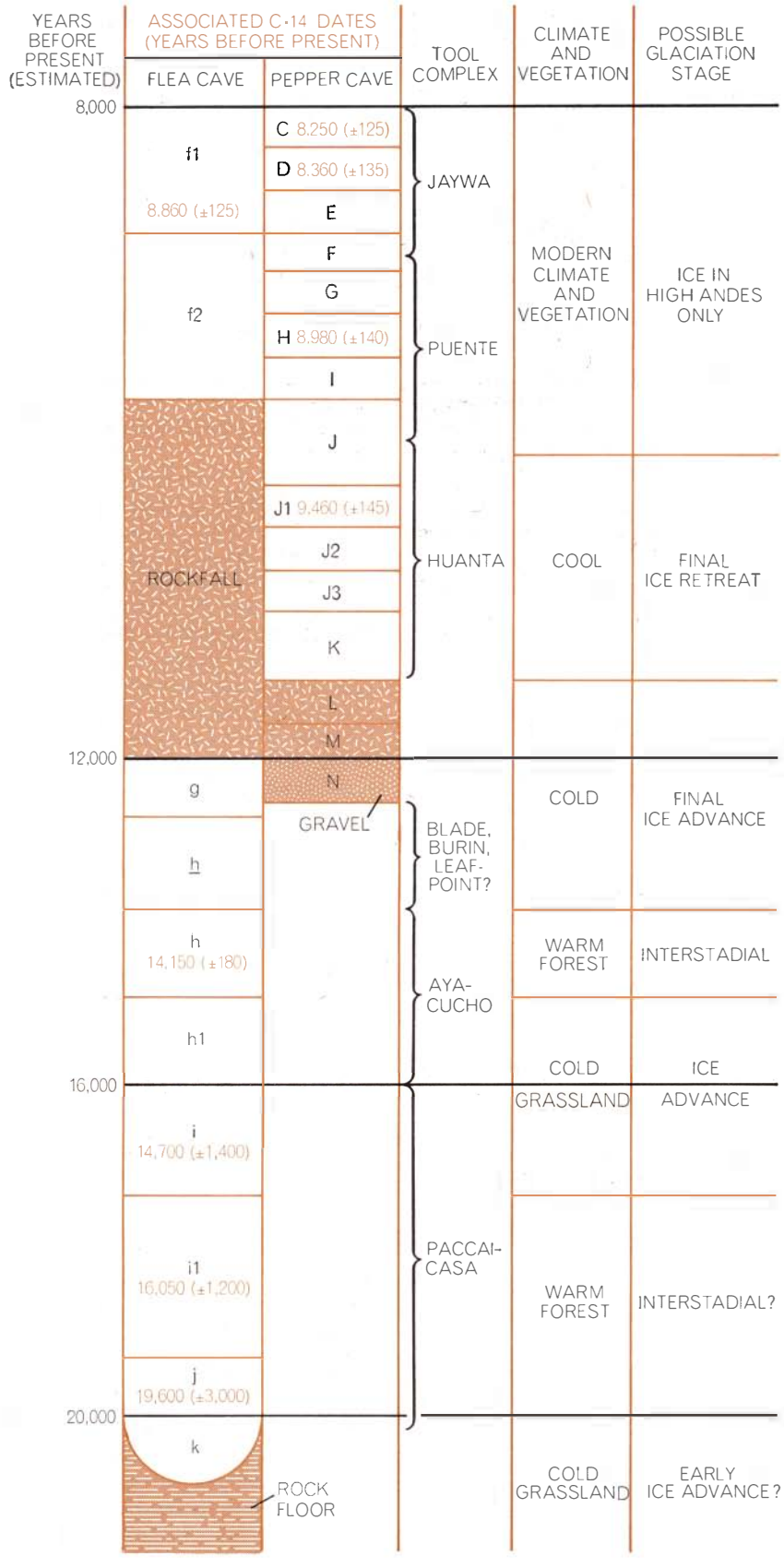
The soils in Zone k are neutral in terms of acidity, which suggests that the vegetation outside the cave when the soils were formed was of the grassland variety, in contrast to the dry thorn-forest vegetation found today. The period of deposition that formed Zone k may have begun more than 23,000 years ago. It remains to be seen whether the climate at that time, as indicated by the neutral acidity of the soil, can be exactly correlated with any of the several known glacial fluctuations in the neighboring Andes.

Three later strata, all containing the bones of extinct animals and additional stone implements, overlie Zone k. They are labeled, in ascending order, zones j, i1 and i. Zone j is a brown soil deposit 12 inches thick. In various parts of this stratum we unearthed three vertebrae and two rib fragments of an extinct ground sloth and the leg bone of a smaller mammal, perhaps an ancestral species of horse or camel. Zone j yielded 14 stone tools; like those in Zone k, they are crudely made from volcanic tuff. There are in addition some 40 stone flakes, evidently the waste from toolmaking. Carbon-14 analysis of one of the ground-sloth vertebrae shows it to be 19,600 (±3,000) years old.

Zone i1, above Zone j, is a deposit of a more orange-colored soil; it is 15 inches thick, and it contains tools and both fossilized and burned animal bone. Carbon-14 analysis of one of the bones, a fragment of sloth scapula, indicates that it is 16,050 (±1,200) years old. The soils of zones j and i1 are both quite acid, suggesting that they were formed when the climate was less arid and the vegetation outside Flea Cave included forest cover.

The uppermost of the four strata, Zone i, consists of 18 inches of a slightly browner soil. The soil approaches that of Zone k in neutral acidity, suggesting a return to drier climatic conditions. Distributed through the deposit are crude stone artifacts, waste flakes and the bones of sloth and horse. Carbon-14 analysis of one of the bones shows it to be 14,700 (±1,400) years old.

The stone tools from all four of the lowest Flea Cave strata are much alike. There are 50 of them in all, uniformly large and crude in workmanship. The tool types include sidescrapers, choppers, cleavers, "spokeshaves" and denticulate (sawtoothed) forms. Most of



SEQUENCE OF STRATA at the major Ayacucho cave sites is correlated in this chart with the five earliest tool complexes that have been identified thus far. Carbon-14 determinations of the age of certain strata are shown in relation to estimates of the overall temporal sequence. The climate and vegetation are linked to probable stages of glaciation.

them were made from volcanic tuff, which does not flake well, and it takes a skilled eye to distinguish many of them from unworked tuff detached from the cave walls by natural processes. A few of the tools, however, were made from other materials, such as rounded pebbles and pieces of basalt, that were collected outside the cave and carried back to be fashioned into implements. The tools in these four levels represent the earliest assemblage of tools, or tool complex, unearthed so far at a stratified site anywhere in South America. We call it the Paccaicasa complex, after a nearby village. The men who fashioned its distinctive tools occupied the Ayacucho valley from as much as 22,000 years ago to about 13,000 years ago.

The strata at Flea Cave that contain the Paccaicasa complex were excavated during the 1970 season. The previous year we thought we had already reached bedrock when we reached the top of the stratum just above Zone i: it was a very hard, yellowish layer of soil that included numerous small flakes of volcanic tuff. With the season nearly at an end we proceeded no farther. The yellow layer, now known as Zone h1, actually turned out to lie just above bedrock over an area of some 150 square yards of cave floor except for the natural basin near the south end of the cave. Digging into this stratum with some difficulty at the start of the 1970 season, we found that its 20-inch depth contained not only the bones of sloth, horse and possibly saber-toothed tiger but also numerous flakes of waste stone and some 70 tools, most of them quite different from the crude tuff artifacts of the strata below. A few tools of the older kind were present in Zone h1, but the majority are made from such materials as basalt, chalcedony, chert and pebbles of quartzite.

The use of new tool materials is also characteristic of Zone h, a 12-inch stratum of softer, light orange soil that overlies Zone h1. Here, however, the animal remains include many not found in the older strata. A kind of ancestral camel appears to be represented in addition to the sloth and the horse. There are also the remains of the puma, the hog-nosed skunk, an extinct species of deer and several unidentified species, possibly including the mastodon. This larger faunal assemblage suggests a return of the countryside around Flea Cave to forest cover. Indeed, the soil of Zone h is strongly acid, unlike the neutral soils of Zone i and Zone h1.

The tools in Zone h are abundant; in addition to more than 1,000 fragments of waste stone there are some 250 fin-

LIMB BONE of an extinct ground sloth (*center*) was found at Flea Cave in a stratum that also contained stone and bone tools representative of the Ayacucho complex. Carbon-14 analysis of the bone shows that the stratum was deposited at least 14,000 years ago.

ished artifacts. Some of these artifacts are in the "core" tradition of tool manufacture: they were made by removing flakes from a stone to produce the desired shape. Among them are both the choppers and spokeshaves typical of the lower strata and new varieties of tool such as split-pebble scrapers and fluted wedges. The core tools are outnumbered, however, by tools consisting of flakes: burins, gravers, sidescrapers, flake spokeshaves, denticulate flakes and unifacial projectile points (points flaked only on one side). The unifacial points are the oldest projectile points found at Ayacucho.

At this stage the inhabitants of Flea Cave were also fashioning tools out of bone: triangular projectile points, polishers, punches made out of antler and "fleshers" formed out of rib bones. There is even one polished animal toe bone that may have been an ornament.

Zone h is the rich stratum that yielded the 14,000-year-old sloth humerus in 1969. The change in tool materials apparent in Zone h1 and the proliferation of new tool types in Zone h suggest that at Flea Cave a second tool complex had taken the place of the earlier Paccaicasa complex. We have named the distinctive assemblage from these two strata the Ayacucho complex.

The stratum immediately overlying Zone h is found in only a few parts of the excavation. It consists of a fine, powdery yellow soil that is neutral in acidity. This sparse formation, labeled Zone *h*, has so far yielded only three stone artifacts: a blade, a sidescraper and a large denticulate scraper. The lack of soil acidity suggests that the interval represented by Zone *h* was characterized by dry grassland vegetation. Further investigation may yield enough artifacts to indicate whether or not the stratum contains a distinctive tool complex suited to the changed environment. For the time being we know too little about Zone *h* to come to any conclusions.

For the purposes of this discussion the Flea Cave story ends here. Above Zone *h* at the time our work began was a three-foot layer of fallen rock, including some individual stones that weighed more than three tons. This rock was apparently associated with the much heavier fall in the northern half of the cave. A small stratum above the rock debris, labeled Zone f1, contained charcoal, the bones of modern deer and llamas, and a few well-made bifacial tools (stone tools flaked on both sides). These tools closely resemble tools of known age at Puente, an open-air site near Ayacucho where only the remains of modern animals have been found. On this basis one can conclude that the time of the rockfall at Flea Cave was no later than 10,000 years ago. It is worth mentioning that before any of the strata below the rock layer could be excavated, the rocks had to be broken up by pickax and carried out of the cave. The three-foot rock stratum was labeled Zone g.

The strata that tell the rest of our story are in a deep deposit in the southeast corner of Pepper Cave. Situated at an altitude of nearly 11,000 feet, this cave is surrounded today by humid scrub forest. It is adjacent to a tributary of the Cachi River, whose bed lies 150 feet below the level of the cave. The bottom stratum of the deep deposit at Pepper Cave consists of stratified sands and gravels close to the top of a high water-built terrace. This fluvial deposit is labeled Zone N. It is overlain by a three-foot layer of rocks that have fallen from the roof of the cave, mixed with stratified sands that indicate a continuation of fluvial terrace building. The mixed stratum comprises zones M and L. Preliminary geological studies suggest that the terrace was formed by outwash from the final advance of the Andean glaciers. There is no evidence of human activity in the three lowest strata at Pepper Cave.

Overlying these sterile layers is a 28-inch stratum of windblown sand and disintegrated volcanic tuff that has been labeled Zone K. Artifacts were found in the upper four inches of the deposit, and a few were also unearthed in one reddish area near the bottom of it. The artifacts represent a new complex of tools that was also found in the next three strata:

floors of human habitation that are labeled in ascending order zones J3, J2 and J1. No animal remains have been recovered from Zone K, but the three J zones contain the bones of horses, of extinct species of deer and possibly of llamas.

The characteristic artifacts of the new tool complex, which we have named Huanta after another town in the valley, include bifacially flaked projectile points with a "fishtail" base, gravers, burins, blades, half-moon-shaped sidescrapers and teardrop-shaped end scrapers. A carbon-14 analysis of one of the animal bones from the uppermost stratum, Zone J1, indicates that the Huanta complex flourished until about 9,500 years ago.

The five strata overlying the Huanta complex at Pepper Cave, like the single layer above the rockfall at Flea Cave, hold remains typical of the Puente complex. These strata have been designated zones J through F. One stratum near the middle, Zone H, is shown by a carbon-14 analysis of charcoal to have been laid down about 9,000 years ago. This date is in good agreement with the known age of material excavated at the Puente site. The contents of the strata above the Puente complex zones at Pepper Cave (zones E through A), like the contents of zones f1 through a at Flea Cave, will not concern us here.

Having reviewed the facts revealed at Ayacucho, let us consider their broader implications. What follows is not only interpretive but also somewhat speculative; it goes well beyond the direct evidence now at our disposal. Stating the implications straightforwardly, however, may serve two useful purposes. First, in doing so we are in effect putting forward hypotheses to be proved or disproved by future findings. Second, in being explicit we help to define the problems that remain to be solved.

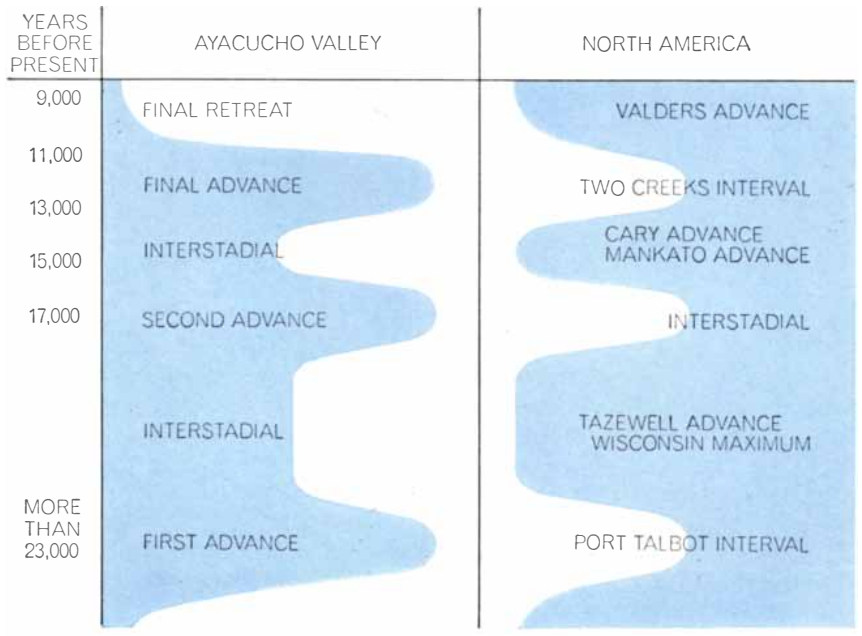
Let us first consider the implications of our evidence concerning changes in vegetation and climate. Remains of the Puente complex overlie the sequences of earlier strata at both caves: they are on top of the material of uncertain character at Flea Cave and on top of the Huanta complex at Pepper Cave. To judge from carbon-14 measurements, the earliest appearance of the Puente complex, with its advanced tools and remains of modern animal species, may have been around 9,700 years ago. At about that time, then, the association of early man and extinct animals in this highland area evidently came to an end.

We have not yet completed the soil studies and the analyses of pollens in the soil that will add many details to the record of climate and vegetation. For the time being, however, I tentatively propose that the last of the pre-Puente strata at Flea Cave (Zone *h*) and the sterile zones N through L at Pepper Cave coincide with the last Andean glacial advance. Zone h at Flea Cave, with its acid soil and remains of forest animals, appears to represent an earlier "interstadial" period in the glacial record—a breathing spell rather than a full-scale retreat. Zones h1 and i, below Zone h, are characterized by the remains of different animals and by soil of neutral acidity, suggesting a colder climate and a glacial advance. Evidence from the still earlier zones i1 and j suggests a second interstadial period of relative warmth. Zone k, the lowest in the Flea Cave excavation, apparently represents another period of advancing ice. If the Ayacucho evidence holds true for Andean glacial activity in general, the South American glacial advances and retreats do not coincide with those of the Wisconsin glaciation in North America [*see illustration on this page*]. This apparent lack of correlation presents interesting problems. If glaciation is caused by worldwide climatic change, why are the South American oscillations so unlike the North American ones? If, on the other hand, widespread climatic change is not the cause of glaciation, what is? The precise sequence of Andean glacial advances and retreats obviously calls for further study.

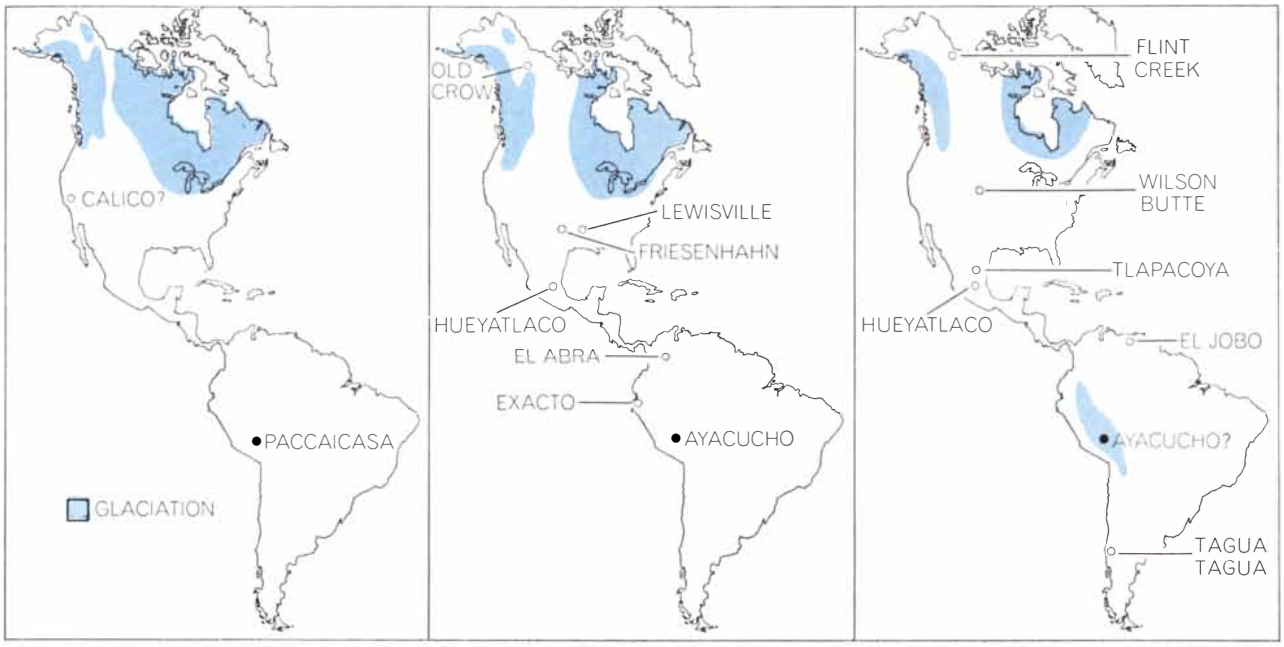
What are the implications of the Ayacucho findings with respect to early man, not only in South America but also elsewhere in the New World? The results of local studies of the earliest phases of prehistory in South America are all too seldom published, so that the comments that follow are particularly speculative. Having warned the reader, let me suggest that the Paccaicasa complex in the Peruvian central highlands may well represent the earliest stage of man's appearance in South America.

To generalize from Ayacucho material, this earliest stage seems to be characterized by a tool assemblage consisting of large corelike choppers, large sidescrapers and spokeshaves and heavy denticulate implements. This I shall call the Core Tool Tradition; it is certainly represented by the Paccaicasa assemblage in South America and may just possibly be represented in North America by the controversial finds at the Calico site in the Mojave Desert north of Barstow, Calif. In South America the Core Tool Tradition appears to have flourished from about 25,000 years ago to 15,000 years ago.

Man's next stage in South America I call the Flake and Bone Tool Tradition. The only adequate definition of this tradition so far is found in the Ayacucho tool complex. That complex is characterized by a reduction in the proportion of core tools and a sudden abundance of tools made out of flakes: projectile points, knives, sidescrapers, gravers, burins, spokeshaves and denticulate tools.



PHASE REVERSAL with respect to the glacial advances and retreats in the Northern Hemisphere during the final period of Pleistocene glaciation appears to characterize the record of fluctuations preserved at Ayacucho. The graph compares estimated Andean advances, retreats and interstadial phases with the phases of the Wisconsin glaciation.



THREE TRADITIONS in New World prehistory are the Core Tool Tradition (*left*), the Flake and Bone Tool Tradition (*center*) and the Blade, Burin and Leaf-Point Tradition (*right*). The age of each tradition in North America, in cases where the age of a representative site is known, is substantially greater than it is in South America, suggesting that they stem from earlier Old World roots.

An important element in the tradition is the presence of bone implements, including projectile points, awls and scrapers. The Flake and Bone Tool Tradition apparently flourished from about 15,000 years ago to 13,000 or 12,000 years ago. Elsewhere in South America, although the evidence is scanty, the tradition may be reflected in surface finds attributed to the Exacto complex of coastal Ecuador and in flake tools from the El Abra cave site in highland Colombia; the El Abra material is estimated to be 12,500 years old. Some of the rare worked flakes from the Chivateros "red zone" of coastal central Peru may also represent this tradition [see "Early Man in South America," by Edward P. Lanning and Thomas C. Patterson; SCIENTIFIC AMERICAN, November, 1967]. Not all the North American sites that may be representative of the tradition are adequately dated. Where dates are available, however, they are from 10,000 to more than 20,000 years earlier than their South American counterparts.

The third South American stage I call the Blade, Burin and Leaf-Point Tradition. At present it is very poorly represented at our highland sites, consisting only of the three artifacts from Zone *h* at Flea Cave. The tradition is far better defined, however, in the El Jobo phase of Venezuela, where double-ended points, blades, burins and corelike scrapers have been unearthed in association with the bones of extinct animals. The El Jobo phase is not adequately dated, but estimates suggest that its tool industry flourished roughly between 10,000 and 14,000 years ago. A small amount of material found at Laguna de Tagua Tagua in central Chile may also belong to this third tradition; carbon-14 analysis indicates that the Chilean material is about 11,300 years old. The precise duration of the Blade, Burin and Leaf-Point Tradition is not yet known. My guess is that it flourished from 13,000 or 12,000 years ago until 11,000 or 10,000 years ago. Like the preceding tradition, it is represented at sites in North America that, where age estimates exist, appear to be somewhat older.

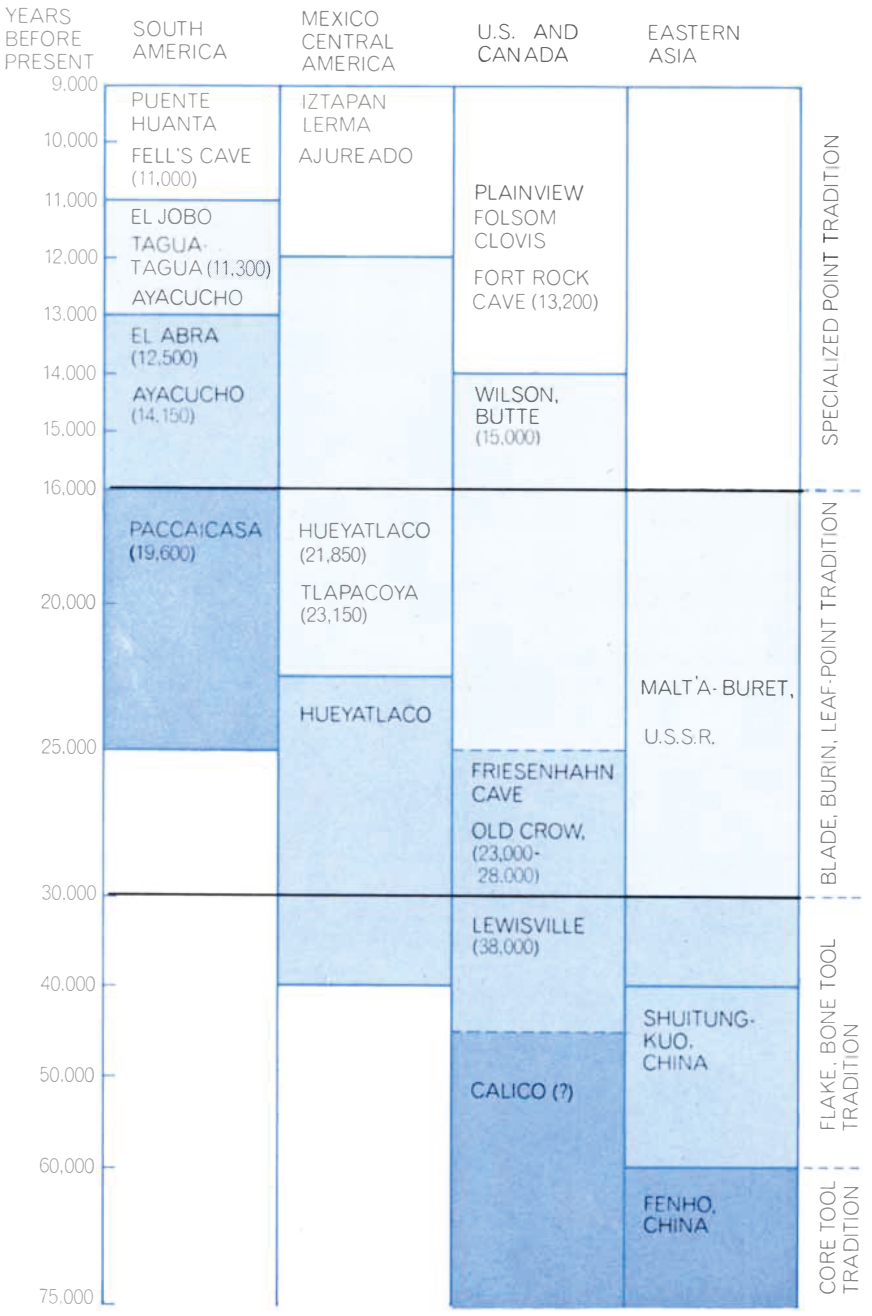
Seen from the perspective of the Ayacucho valley, early man's final stage in South America, which I call the Specialized Bifacial Point Tradition, appears to have flourished from 11,000 or 10,000 years ago to 9,000 or 8,000 years ago. At Ayacucho the tradition is defined in the Huanta complex at Pepper Cave and in the later Puente complex there and elsewhere in the valley. It is characterized by bifacially flaked projectile points that evidently represent a specialization for big-game hunting. The tradition's other characteristic implements include specialized end scrapers and knives suited to skinning and butchering. Elsewhere in South America the tradition is represented at Fell's Cave in southern Chile, where a number of carbon-14 determinations suggest ages clustering around 11,000 years ago. Other artifacts probably in this tradition are those from a stratum overlying the red zone at Chivateros (which are evidently some 10,000 years old), from Toquepala Cave in southernmost Peru (which are about 9,500 years old) and from a number of other South American sites. Sites representative of the Specialized Bifacial Point Tradition in North America are almost too numerous to mention.

What might these four postulated traditions signify concerning man's arrival in the New World from Asia? Considering first the latest tradition—the Specialized Bifacial Point Tradition—we find a bewildering variety of complexes throughout North America at about the time when the late Paleo-Indian stage ends and the Archaic Indian stage begins. Nearly all the complexes have something in common, however: a specialization in bifacially flaked projectile points of extraordinary workmanship. I suggest that these specialized point industries all belong to a single tradition, that for the most part they represent local New World developments and that there is little use in trying to trace them to some ancestral assemblage on the far side of the Bering Strait. Carbon-14 analysis of charcoal from Fort Rock Cave in Oregon indicates that the earliest known specialized projectile points in the New World are some 13,200 years old. On the basis of this finding I pro-

pose that the Specialized Bifacial Point Tradition originated in the New World, beginning about 14,000 years ago in North America, and reached South America 3,000 to 4,000 years later.

North American artifacts related to the preceding tradition—the Blade, Burin and Leaf-Point Tradition—in South America include material from Tlapacoya and Hueyatlaco in Mexico, respectively some 23,000 and 22,000 years old, and material at least 15,000 years old from the lower levels of Wilson Butte Cave in Idaho. Some artifacts of the Cordilleran tradition in Canada and Alaska may also be related to the South American tradition. Again there apparently is a lag in cultural transmission from north to south that at its longest approaches 10,000 years. If there was a similar lag in transmission from Asia to North America, it is possible that the Blade, Burin and Leaf-Point Tradition originated with the Malt'a and Buret tool industries of the Lake Baikal region in eastern Siberia, which are between 15,000 and 30,000 years old.

As for the still older Flake and Bone Tool Tradition, adequately dated North American parallels are more difficult to find. Artifacts from Friesenhahn Cave in central Texas and some of the oldest material at Hueyatlaco show similarities to tools in the Ayacucho complex, but in spite of hints that these North American sites are very old the finds cannot be exactly dated. There are bone tools from a site near Old Crow in the Canadian Yukon that carbon-14 analysis shows to be from 23,000 to 28,000 years old. It is my guess that the Yukon artifacts belong to the Flake and Bone Tool Tradition, but many more arctic finds of the same kind are needed to change this guess into a strong presumption. A few flake tools from the site at Lewisville, Tex., may also be representative of the Ayacucho complex. Their estimated age of 38,000 years is appropriate. Figuring backward from the time the tradition appears to have arrived in South America, it would have flourished in North America between 25,000 and 40,000 years ago. Is it not possible that the Flake and Bone Tool Tradition is also an import from Asia? Perhaps it came from some Old World source such as the Shuitungkuo complex of northern China, reportedly between 40,000 and 60,000 years old.



OLD WORLD SOURCES of the three earliest prehistoric traditions in the New World are suggested in this chart. A fourth and more recent tradition, marked by the presence of finely made projectile points for big-game hunting, seems to have been indigenous rather than an Old World import. Although much work will be required to establish the validity of all three proposed relationships, the foremost weakness in the hypothesis at present is a lack in the Northern Hemisphere of well-dated examples of the core-tool tradition.

We now come to the most difficult question, which concerns the oldest of the four traditions: the Core Tool Tradition. I wonder if any of my more conservative colleagues would care to venture the flat statement that no Core Tool Tradition parallel to the one in the Paccaicasa strata at Flea Cave will ever be unearthed in North America? If it is found, is it not likely that it will be from 40,000 to as much as 100,000 years old? To me it seems entirely possible that such a core-tool tradition in the New World, although one can only guess at it today, could be derived from the chopper and chopping-tool tradition of Asia, which is well over 50,000 years old. (An example of such a tradition is the Fenho industry of China.) I find there is much reason to believe that three of the four oldest cultural traditions in the New World can be derived from specific Old World predecessors. That seems to be the most significant implication of our findings at Ayacucho. However much this conclusion may be modified by future work, one thing is certain: our knowledge of early man in the New World is in its infancy. An almost untouched province of archaeology awaits exploration.