The Early Man Remains from Pikimachay Cave, Ayacucho Basin, Highland Peru

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INTRODUCTION

I am taking the liberty of not writing as general an article on early man in America as the others in this monograph. This article is a specific site description of our excavations in the earlier strata of the Pikimachay Cave in the Ayacucho Basin of Highland Peru (Figure 1). The reasons for my specificity are that some of our findings are extremely significant, and it may be a considerable length of time before all of our proposed six volumes on the archaeological investigations of Ayacucho, Peru, are published.

The purpose of this article is to remove these early archaeological remains from the realm of controversy; I hope to show that our artifacts are old and were found in good contexts. The article is written both descriptively and interpretively. The description encompasses: (1) a general background of both the stratigraphy of the cave and our excavation of it, (2) details of the stratigraphy of the south room where there were a number of occupations between 11,000 and 25,000 years ago, and (3) concise descriptions of each of the stratigraphic zones. The interpretive portion of the article discusses the 13 occupations which occur within the 7 earliest strata. Within these occupational zones are 26 activity areas which contain approximately 300 artifacts and 700 ecofacts. The occupations are classified by their cultural phases: Pacaicasa (23,000-14,000 B.C.), Ayacucho (14,000-11,000 B.C.), and Huanta (11,000-9,000 B.C.). I will briefly describe the kinds of artifacts that belong to each phase. The final portion of the article alludes to the relevance of these important materials to the issue of the initial peopling of the New World. I leave the discerning of the real implications of these materials to the reader and to the other authors of this volume.

Since the discovery of Pikimachay Cave led ultimately to the Ayacucho Archaeological-Botanical Project, let me tell you about this event. In our second stint to Peruvian exploration in 1967, Roger Ravines and I surveyed from Lima to Arroyo to Junín to Huanuco to Tarma to Huancayo to Huancavelica. The reconnaissance had been rather discouraging, because for two weeks we had been looking unsuccessfully for dry caves with preceramic remains. The best caves were near Junín and Huancayo, but the climate there was too wet for good preservation of plant remains. Huanuco had the right climate for good preservation, but we could find no caves that had preceramic remains. On July 17, we moved southward along the Mantaro River and drove into Huanta. I commented that, on the basis of the xerophytic vegetation, at last the climate seemed dry enough. I hoped that there were caves nearby.
The next morning we surveyed the hills south of Huanta on the road to Ayacucho. We noticed that the rather soft strata near the Mantaro River were being replaced by volcanic outcroppings which might have caves in or under them. After a number of stops, during which we searched the cliffs with our binoculars, we started downhill...
into a larger basin. Ravines commented that the Wari ruin and Ayacucho should be coming into sight soon.

The long hill we were descending had a number of bad hairpin curves in it, so I was paying attention to driving. In fact, I didn't look up until the road wound to the north away from the basin. When I looked up, there it was! Halfway up a large rounded hill full of ancient terraces was a huge dark cave, highlighted by the morning sun shining on the surrounding cliffs (Figure 2).

Figure 2. Pikimachay Cave as seen from downslope to the east.
This was it — a big cave in a xerophytic environment! I cannot remember now whether we stopped the car then and there to climb the half mile up to it, or whether we climbed up on the next day after we had settled into Ayacucho. However, I do remember climbing the terrace wall for the last slope before the cave. Ravines and I "went bananas" as we picked up 261 artifacts! The artifacts were all seemingly preceramic and included every kind of projectile point I had ever seen in Peru. Inside the huge cave we found three large rooms. In the south room, in a looter hole (number 1), there were three leaves, a nut, and a blade sticking out of stratified layers. In the central room, in the backfill of another hole (number 3), there were three corn cobs, four leaves, seven sticks, four chips, and a preceramic teardrop-shaped end scraper.

It was a great start. However, further investigations had to wait until we had finished the survey of other parts of the Andes: Arequipa, Callejón de Huaylas, Cajamarca, Jaén, and Bagua in northern Peru. By the end of August, we had decided that this huge cave in the dry environment was the best one we could find in Highland Peru. Our team expanded as we began to prepare for the big expedition. Roger Ravines went off with Augusto Cruzatt to look for other sites. Lucho Lumbreras and Antoinette Nelken-Terner joined us when we returned to Ayacucho.

A second visit to Pikimachay yielded 144 artifacts. In our 1-meter test pit in the central room adjacent to looter hole number 3, our trowel digging revealed nine superimposed strata; only the top five had ceramics. Although we found few artifacts in the preceramic strata, we obtained a good carbon sample from Zone F. We later received a determination of 1900 B.C. ± 120 years (14151) or 2404 B.C. in sidereal time.

These data, the date, and the results of our survey near Pikimachay, which netted about seven preceramic sites, were the bases for requesting funds for a major investigation in the valley. After a number of frustrating delays in 1969, the National Science Foundation provided grant No. 2446 to the R.S. Peabody Foundation, then under the direction of Dr. Frederick Johnson. As principal investigator, I could once again dig in Pikimachay. On June 11, 1969, Urve Linnemae, Augusto Cruzatt, and I received permission from the owner of the land, Ramón Calderón, to begin our work. That day, we climbed up to the cave, looked at the looter holes, and discussed our strategy. We noted in the profile of our test that there was neat stratigraphy from Zones A through F. Therefore, we set up a north-south grid line stake (0 to N14) in the back central room of the huge shelter.

It became readily apparent that two logistical problems would hinder our operations. It was a long and brutal walk up from the road to the cave carrying digging equipment. Also, the workmen who carried our tools from the road were terrified of entering the cave because of the Wamaní spirits inside. Consequently, the crew from Pacaicasa spent much of the next two weeks building a hairpin-turn road up the terraces to the cave. Augusto Cruzatt supervised this task while Urve Linnemae and I worked in the cave. Our only digger at first was Anicieto Quispe, my elder compadre, who was too old to care if he died or not (or who secretly thought el doctor's medicine and mana would protect him from the spirits). Then, since Viejito (Little Old One) didn't get sick or die, his brother Hipolito joined us, then a cousin, then a nephew, and so on.
This slow method of obtaining a field crew worked out quite advantageously. It gave me a chance to train each of our supervisors and workmen in archaeological digging techniques and methods. Those who could read and write were taught how to use the various instruments and tools involved in establishing our grid system, mapping-in artifacts, and drawing profiles. Most importantly, we taught them to stop and call for expert advice if they found something "good" or had any problems. (Oh! If only more of my archaeological colleagues and students would do the same.) (See Figure 3.)

**THE ECOLOGICAL BACKGROUND OF PIKIMACHAY**

Before we turn to the mundane and detailed aspects of the cave's earlier stratigraphy, let me tell you about the cave and its background. Pikimachay can be translated into its English equivalent: piki=flea, machay=cave. The cave is situated at 74°14'20" W. longitude and 13°3'30" S. latitude. It is 14 km north-northwest of the town of Ayacucho and is about 4.5 km west-northwest of the hamlet of Pacaicasa in the Department of Ayacucho in south-central highland Peru. The cave is at an elevation of about 2,850 m and is in the middle of the southern slope of a domelike hill in the center of our valley.

The shelter lies in a Thorn Forest Scrub ecozone. The climate is mild with an annual average temperature of about 12° C. There is rarely any frost even in the coldest dry-season night. Rainfall is between 500 and 800 mm a year; most of it occurs in the summer dry season from October to March. The basic characteristics of this ecozone are the climatic features and high elevation mentioned above, the underlying Mesozoic volcanic rocks, the chernozol soils, and the distinctive flora and fauna.

In trying to identify the vegetation that is and was indigenous to this ecozone, one must be aware that the terraces were possibly built in the Huarpá phase at the time of Christ. The present vegetation in front of the cave is mainly grass or savannah on the cleared terraces; however, the terrace edges and the unworked nearby slopes suggest what the unmodified vegetation might be. This lower montane zone seems to have a rather xerophytic vegetation. Moya and mesquite trees dominate over the cactuses such as fercrea, acacia, and mimosa. The pollen profile suggests that the present dominance of grass as well as opuntia and agave is a relatively recent introduction.

Pollen and soil samples from the cave as well as from surrounding soil zones suggest that even greater floral changes occurred in the distant past. The high acidity of soil samples from early zones suggests that the vegetation was more savannahlike with possibly a colder climate earlier than 23,000 years ago. Soil samples with pH ratings of 6.7 and 7, respectively, from the top of zone k and zone j (roughly 23,000 to 18,000 years ago) suggest a more woodlandlike form of flora. Zone i, which has an acidity of 8.15, and zone i, which has an acidity of 7.8, suggest a return to savannah-type vegetation. Zones h1 and h (acidity of 7.5 to 7.7) may indicate a swing back toward the more wooded form of flora.

In zone h we did find some pollen, and the congeries of the more dominant types are *Alnus, Gramineae*, Compositae, sedges, Sapindaceae, and *Salix*. The suggestion here is that during the period from 13,000 B.C. to 11,000 B.C., not only was the vegetation
Figure 3. South room before and after excavation.
more wooded, but it was similar to our present alder-filled Humid Woodlands ecozone at an elevation just slightly higher than that of Pikimachay. The final part of this early series comes from the overlying zone b (or "little h"). It is represented by an inadequate sample of pollen, mainly *Graminaceae*, but the soils are highly acidic, over 9, which suggests a savannah or *puna* vegetation.

Information concerning the second stages of vegetation comes not only from the cave itself, but from three dated buried soils with pollen from in front of the cave. The earliest of these soils has a C-14 date of 7116 B.C. ± 310 years (S604), and has pollen including *Alnus, Graminaceae, Podonaea, Melostomataceae, and Myrica*, which suggests a Humid Woodlands type of vegetation near the cave. The next horizon has a C-14 date of 5365 B.C. ± 120 years (S594).

The third stage of our sequence again comes from inside the cave, mainly from pollen from various strata of the central room trench. Pollen from zone F, carbon dated at 1900 B.C. ± 120 years (14154), includes much grass and *Cactaceae*, suggesting a slightly drier climate. Zone E, dating from 500 B.C. to A.D. 1000, had more arboreal pollen, suggesting a wetter climate. Zone D, dating from A.D. 1000 to A.D. 1500, again has pollen that suggests a drier climate. The later dry period after A.D. 1000 to the present is very much confirmed by four buried desert and regazol soil samples taken from the nearby Cachi River. The four samples have C-14 dates of A.D. 1490 ± 60 years (S597), A.D. 1530 ± 70 years (S606), A.D. 1610 ± 105 years (S597), and A.D. 1695 ± 45 years (S605).

The final paleo-ecological aspect of the ecozone is the faunal assemblages. The assemblages show changes, at least in the earlier phase, that tend to confirm the climatic changes suggested by the floral studies. The present Thorn Forest Scrub ecozone would typically have the white-tailed deer and some guanaco, but not vicuña or huemal deer. As mentioned by Wing, the fauna would be dominated by small animals and birds: e.g., the skunk (*Conepatus rex* and *Chuga*), fox (*Disicyon*), squirrel (*Lagidium*), guinea pig (*Cavia*), chinchilla (*Chinchilla peruviana*), wild cat (*Felis colocolo* and *Oreailurus*), various rodents (*Akodon* and *Phyllostis*), the tamarin bird (*Neboprotea*), doves (*Zenaida auriculata*), and frogs (*Bufo*). This assemblage seems to have been present in the region of Pikimachay for the last 11,000 years, since the Pleistocene era. Our inadequate sample cannot determine whether the proportions of these animals changed during this lengthy period. There are hints from zone b that many of the animals (with the exception of camelids and rodents) were absent in the ecozone between 11,000 and 13,000 years ago when the horse was still present. Although the evidence is meager, there is a possibility that the climate was colder and the environment was more grassy. The faunal assemblage would thus be in agreement with the pollen and soil data from zone b.

Better confirmation in the form of more faunal samples came from zone h, where 485 bones were uncovered. Of these, 161 were *Edentes*, sloth. There was probably a large variety of *Scelidotherium tarijensis*, but we also found a tooth of a smaller *Scelidotherium* and 13 bones of *Megatherium tarijensis*. While these bones might be taken as good evidence of a warmer climate and a more forested environment near the cave, one can find better proof from the 25 bones of deer, 13 bones of a wild puma, 5 of skunk, 2 of fox, 7 of chinchilla, and 27 of rodents. There were also 7 horse bones, 14
from camelids, 3 of a large carnivore, 3 bird bones, and 2 human bones. The assemblage from zone h1 was similar to, but smaller than, the assemblage from zones i and i1. It had only 35 bones.

Zones i and i1 had 42 and 35 bones, respectively. They differed from each other in most cases, although 14 and 11 sloth bones respectively were found in the two zones. In these lower two zones, there were high proportions of horse bones (9 of either Amerhippus or Equus andium), more big carnivore bones (4), and no bones of forest animals. This tends to confirm the hypothesis based on the analysis of the acidic soils that vegetation near the cave was probably more grassy between 15,000 and 18,000 years ago. A somewhat poorer confirmation comes from the underlying zone j. One could suggest that the area near the cave was more forested during zone j than in zones i and i1 because the soil samples from zone j are more acidic than those of zones i and i1. Moreover, of zone j’s five bones, four were sloth and one was deer. These bones certainly indicate a possible Woodlands faunal assemblage.

Thus, there is considerable evidence that the environment surrounding Pikimachay Cave has undergone considerable change during the last 25,000 years. Let us now examine the geological formation of the rock shelter itself before considering the occupation of it and our excavations.

The cave seems to have been formed by volcanic activity, probably in the Quaternary, during the last 60 million years. The basic volcanic action seemed to have occurred west of Pikimachay itself and seemed, in part, to have resulted in the formation of the large dome in which the east side of the cave is situated. The last two or three of the volcanic activities were the ones relevant to the cave. These activities were (1) a minor lava flow, a resultant deposition of volcanic ash, and volcanic detritus which formed the stratum that composed the floor and lower walls of the rock shelter; (2) a major lava flow which overrode the earlier, softer stratum to become the basalt roof of the cave; and (3) the erosion of some of the softer strata under the basalt flow, so that the south floor of the cave, with both the basalt deposits and overlying ash deposits, was worn away by both wind and water.

The basic floor plan of the cave until the end of the Pleistocene era was affected by the erosion of the softer strata. In the back center and north portion of the cave, mainly the more ashy layer was removed. The form was that of two interconnected rooms on a shelf. The shelf sloped sharply south and east to the basin in the southern and outer central section of the cave. At the end of the Pleistocene era, wind-blown soils and granular particles from the roof began to fill the south and central basin within the cave. Perhaps during this long period some of the outer lip of the roof of the cave came crashing down to form the rocky talus of the present cave. It might be added that in addition to the natural deposits in the south room, man and sloth were dropping their remains in the room.

Between 9,000 and 10,000 years ago, a catastrophic event occurred, possibly an earthquake or a series of earthquakes. A major portion of the north and central parts of the basalt roof fell. The central portion of the fall partially covered the earlier, relatively level deposits to the south. Concurrently, in the north, large chunks dropped onto the sloping area below the shelf into the ashy stratum, and some of the fall plowed south into the deposits in the south room. The earlier deposits of the south
room were completely covered. Three or four huge portions of the roof rested against the edge of the north and central portions of the shelf; two connected rooms had been formed. The three rooms received a few more minor deposits from man, and wind and water erosion. The final event seemed to have been mainly a camelid contribution; i.e., llama and alpaca dung.

When we arrived at the cave for our investigations, we found four varied rooms or areas (see Figure 4). The south room was at the lowest elevation. One entered the cave through it. It was roughly parabola-shaped. At the edge of the overhang of the room, it was about 27 m wide on its north-south axis, as it curved to the back and side cave wall or slope. It was only about 10 m wide and had an east-west maximum depth of about 15 m. There were a number of large rocks on the sloping floor as well as a small man-made terrace that helped as one climbed the 5 m from the lower room to the inner central room. The other part of the floor of the south room was more level, but there were at least five large boulders that stuck up from it as well as craterlike holes left by looters and other people. Right at the drip line at the east edge of the room was a small, roughly 20-cm high, man-made wall. Beyond it was the talus slope which was a mass of huge rocks sloping off to the more soily terrace some 5 m below.

Immediately north of the south room was the next area of the cave, mainly the outer central and south central part of the north portion. This was where the huge part of the rock roof had fallen. The level tops of the boulders were some 7 to 10 m above the floor of the south room, and 2 or 3 m above the floors of the inner central and north rooms. This area of huge rock fall was roughly 15 to 20 m north-south by 10 to 15 m east-west. It blended into the rugged 45° sloping talus in the north half of the cave, but many of the large blocks were well within the cave. Perhaps someday someone

![Figure 4. Contour map of Pikimachay Cave showing rockfall and rooms.](image)
with "real" earthmoving equipment can move the large boulders and find out if there are other early-man deposits beneath this undug portion of the cave.

We started our excavations and initial explorations in the interior of the cave, in the dark but cool central room (see Figure 5). It was situated in back (or east) of the rock fall, 5 m above the south floor. This elongated room was roughly 15 or 16 m long on a north-south axis. Its south end was the cave-floor slope, with boulders on it, which led to the south room. The north end was the highest portion of its slightly sloping floor. The floor had a light scatter of relatively small rocks from the roof. The west edge was composed of three blocks of roof fall. The blocks were about 11 m, 3 m, and 2 m long, respectively. The floor was generally level, with only two or three boulders and two looters' holes.

The north room was the smallest and was roughly triangular; the apex of the triangle was at the mouth of the cave, 5 or 6 m back from the drip line. The base of the triangle, in the interior of the cave and adjacent to the north end of the central interior room, was about 5 m wide. The room was 14 or 15 m long on an east-west axis. In this room also, the north and west edges and the east end comprised the steep sloping wall of the cave, and the southern portion was roof fall. Unlike the edge of the central room, the floor was littered not with a few huge boulders, but with a host of smaller ones of varying sizes and shapes. There were all sorts of nooks and crannies between the boulders. However, the general floor was relatively level and rock free.

All in all, it was a huge cave, some 52 to 60 m long on a north-south axis from its mouth. It had a maximum depth of over 20 to 25 m and a maximum height of from 18 to 25 m. It was the biggest and most complex cave I ever excavated.

Figure 5. Contour map of Pikimachay showing areas of excavation and good coordinates.
EXCAVATION AND STRATIGRAPHY

It seems appropriate to begin our description of our excavations and stratigraphy with the south end of the central room, because both of our initial tests in 1967 and our formal excavation in 1969 began here. In 1967, working from the north edge of the looter hole, I cleaned off a face and roughly numbered strata A through H, eight zones. In 1969, Urve Linnamae and I staked out the area in 1-m squares along the cardinal axis, established a numbering system, and further cleaned out the looter hole to make a 3-m, east-west profile from N2 to N2E3.

The profile was trowelled off very carefully from the vertical face of the 1967 cleaning to the N2 axis. This task was accomplished mainly by Urve Linnamae, the supervisor, two students from the University of Huamange, U. Quispe and A. Cruzatt. Viejito and I screened the trowelled back-dirt. This was a training period; there was a great deal of discussion specifically of the stratigraphy, but also of the labelling of specimens, note taking, profile drawing, and methodology in general. Never again at Pikimachay were so many skilled personnel working together in one spot, squares E1, E2, N1E1, and N1E2. Never again was so little dirt being moved.

In terms of the stratigraphy, one result of our endeavors was that 13 superimposed zones were defined (see Figure 6). A brief description follows: Zone A was composed of loose ash and vegetal materials cemented together by dung. It not only capped the stratigraphy of the central room, but it was related to the top strata all over the cave as well. Zones B, C, and D extended over most of the central room; they were alternating layers of ash, preserved plant remains, and "Chanka" artifacts. They overlay a more complex set of ash layers which had ceramic remains. Zone E had a number of small subdivisions in it. Zones E1 and E2 extended over the southern portion of the central room. They overlay zone E3 which extended over most of the room. Zone E4 represented a rock-fall layer and capped zones E5, E5A, and E6. The latter three zones represented deposition in a pitlike depression in the center of the east room. Zones E5A and E6 cut through the late preceramic levels, zones F, G, and H. The late preceramic levels were confined to the south part of the central room; they overlay Piki cultural zones X, U, V; and W, which were in a depression in the central part of the room. Only floor X extended out of the depression in the north part of the room. It overlay both the floor of the cave, which was part of the huge fall, and zone g, which was present in all of the rooms.

The central room had good solid stratigraphy; there was a sequence of occupation by different groups who used different artifacts and ecofacts. Preservation was not quite what we had hoped for, but there were some plant remains and feces that told us something of the subsistence in late preceramic and ceramic times.

By July we had started a trench in the north room. In this room we also dug an initial square at N16E7, in order to see the depth of the deposits, and another square at N16E1, which we hoped might be the link between the strata of the central and north room trenches. Since the strata could not be correlated at that time, we numbered the north room strata in a new system which used Roman numerals (I to IX). Later, we found out that the strata did not connect (see Figure 7).

During the remainder of July and early August, Urve Linnamae directed the
Figure 6. Stratigraphy of the control room — top two profiles run south to north while bottom three are short west-east profiles.
Figure 7. Stratigraphy of the north room — top profile runs east to west while bottom three are north to south.
excavation of the central trench in a northerly direction, Cruzatt supervised the excavation of the north trench in an easterly direction. The large south room was left pretty much alone. It was full of huge boulders. Initial testing in June had determined that the stratigraphy was pretty much jumbled in between the large boulders. The room was at a lower elevation, so its stratigraphy could not connect with the other trenches. The south room was where we cooked and ate lunch, sorted tools, and placed our guards for the night.

Work in the north trench was not progressing well. The stratigraphy along the cave walls at both ends of the trench was jumbled. My two student supervisors were having some differences of opinion. To resolve these difficulties, I enlisted the help of Ulpiano Quispe, a student at the University of Huamanga, and took over the supervision of the digging at the north trench. I sent Cruzatt to finish our trenches in the general area of S7E16. I wanted him to go down to bedrock in the south room; this literally meant chopping through some of the huge boulders.

In case anyone gets the idea that I was somehow involved in "psychic archaeology," let me state that I did not expect Cruzatt to find anything except boulders on the original cave floor. The men broke up and removed one half-ton boulder, and pried apart another. Under the 1-to-2 layer of rocks, in a cleared area of soil, was the big surprise. There were excited workmen gibbering about "huesos de vacas gigantes." My first glance at a large humerus and rib convinced me that these were the bones of an enormous extinct animal, not of a giant cow.

That night Linnamae and I pawed through Romer's *Vertebrate Paleontology* (1966). We came to the conclusion that we had unearthed a giant sloth, probably a *Megatheriidae*. On the basis of dates from Crucent's digs, which unearthed sloth in Venezuela, I guessed that the bones might be 14,200 years old. Eventually, Dr. Hofsteder of the C.N.R.S. of France was to confirm our opinion, and the U.C.L.A. carbon-testing laboratory was to confirm our date.

Cruzatt showed me a couple of flakes, which he said came from the same soil stratum as the bones from below the rocks. Back in the south room, I began trawelling a small, 1-m section between and under the rocks. After about an hour, I had uncovered five or six more pieces of bone. I located one in direct association with a flake. This bone and flake were lying over a crude scraper plane. I no longer had any doubts about the association between the tools of man and the bones of sloth.

The final week of the field season was spent breaking up rocks so we could dig in the lower strata, especially zone h. We found more bones of extinct animals associated with more stone tools that we postulated to be of early-early man. Berger's C-14 date of 12,200 B.C. ± 180 years (UCLA 1464) confirmed this hypothesis. These finds certainly were a nice way to end our first season of digging in Pikimachay.

Since the major focus of the 1970 season was to be in the south room, I arranged for Wayne Wiersum to clear away the rocks down to zone h in the south room (Figures 8 and 9). He was to have cleaned off the big rock down to zone h. The area was to be staked out and a datum level determined. All this was to be done in time for us to begin work in the lower strata, zone h, when I returned after the rainy season in March of 1970. Unfortunately, Wayne was unable to do any of this because he was unjustifiably deported from Peru. Fortunately, my administrator, Gordon Haddon, was able to find a satisfactory substitute in Peter Jensen, a trained archaeologist who had been
Figure 8. Stratigraphy of the south room, east-west profiles.
Figure 9. Stratigraphy of the south room, south-north profiles.
running a tourist facility. Jensen and "Gato" Carillo, a student from the University of Huamanga, and our stalwart crew from Pacaicasa cleared most of the huge rocks out of the south room through zone g.

Then we were able to begin in earnest on the lower level, zone h. We excavated against the back wall of the cave and in the area where our tests had been the previous year. Every artifact and ecofact was plotted along its horizontal coordinates, and given a depth measurement. Each one was photographed in situ. Short profiles were drawn along each grid line (Figure 10).
As we progressed toward the mouth of the cave, a stratum under zone h began to appear. At that time, we referred to this layer as "zone h1;" then another zone, at first designated "zone h2," was later renamed "zone j." There seemed to be a possibility that there might be a number of zones under our 14,000-year-old stratum. We decided to put a 2-m-wide trench down to the cave floor from the back of the cave to near the mouth (E9) (see Figure 9). We would then have profile walls at S19 and S21 that could then be stripped off from a vertical face as we excavated along a north-south axis between E9 and E2 or E3.

Actually, we moved the trench south from E21 to the south wall of the cave before we got down to the real cave floor in our 2-m eastern-directed trench. We progressed in this manner largely because the zones under h increased in number (h1, i, i1, j, and k) and each increased in thickness as we headed east. Even more importantly, bones associated with artifacts appeared in all but the lower portion of zone k, just above the cave floor.

A large part of these excavations was carefully pecked out by Farmin Rivera and Idilio Santillana, two anthropology students from the University of Huamanga. It was slow and careful work; as the layers thickened, they also became harder. To prepare for in situ photographs, one literally had to chisel the dirt from the bones and/or artifacts. Since we did not want to damage the fossil bone, which was often softer than the surrounding dirt, the final extraction of some of the bones and artifacts was often performed at the laboratory in Ayacucho. After each bone and chunk of earth surrounding it was hauled from cave to town, it was cleaned with dental tools. This process was often cumbersome; much of it was done after Jensen and I left the dig in the hands of Carrillo in late May. However, the possibility of anything being intrusive into these cemented strata can be definitely ruled out.

The south portion of the trench was finished and the crew had begun moving by alternate squares into profiles to the north of S19 by the time I returned in July. During this final two-month stint we completed the excavation, in spite of interruptions caused by the Americanist Congress in Lima, and the distractions to my Latin male crew caused by the arrival of some miniskirted American students.

The central-room trench was now connected with the east end of the now completed north-room trench. In the south room the excavations were pushed north; the only new find was zone "little b" above zone h, which had a few artifacts in it (see Figure 10). Our final endeavor was at the edge of the cave and in the talus. Here, while some early artifacts appeared above the rock fall, little was dug or found below the rock fall. Future diggers who are more expert in rock breaking than we may check our findings by excavating further in the southeastern niche of our cave. I wish them every success!

This completes my description of the excavations of the stratigraphy of the rooms in Pikimachay. In terms of an overall sequence, the problem was how to correlate their stratigraphy, since only the rockfall, zone g, was common to the excavations of all three rooms. As far as the present paper is concerned, this is all that is necessary, for it indicates that zones b to k of the south room are earlier than any of the other strata. I might add that five carbon dates confirm this fact to a startling degree. Although zone k was undated, zone j had two dates done by different laboratories, in part on the same bone: 18,250 B.C. ± 1050 years (IS851), and 17,650 B.C. ± 1200 years (UCLA
Occupation 1 — Zone k, perhaps dating to 20,500 B.C. ± 2500 years, was a Pacaicasa occupation that occurred in three areas of the basin area in the south room.

Occupation 2 — Zone j, a Pacaicasa occupation, carbon-dating to 18,250 B.C. ± 1050 years, also occurred in the south room.

Occupation 3 — Zone i1, carbon dated at 14,100 B.C. ± 1200 years, is considered another brief Pacaicasa occupation, a sloth kill and butchering occupation in the south room.

Occupation 4 — Zone i of the south room was the final Pacaicasa occupation and was estimated as occurring between 12,750 B.C. and 13,750 B.C., or following the C-14 date, about 12,750 B.C. ± 1400 years. This was another brief horse and sloth kill and butchering occupation.

Occupations 5, 6, and possibly 7 — These (of zone h1) were a series of Ayacucho seasonal microband occupations of the south room between 14,000 B.C. and 12,200 B.C.

Occupations 8 possibly through 12 — These five zone h seasonal Ayacucho occupations in the south room may have occurred between 12,500 B.C. and 12,000 B.C.

Occupation 13 — Occurred in Zone b and was the final one of concern in this article. Zone g — The next major event in Pikimachay history was a horrendous roof fall between 9000 B.C. and 7000 B.C.

Occupation 14 — A small seasonal group of Jaywa hunters occupied the south room at the mouth of the cave at about 6900 B.C. ± 300 years. This occupation resulted in the laying down of zone f2 on top of the roof fall. Exactly in which season this occurred has not been determined.

Occupation 15 — Somewhat later, 5300 B.C. ± 300 years, a Piki seasonal microband occupation formed zone f1 at the mouth of the cave.

Occupation 16 — About half a millenium later, there was another seasonal microband Piki occupation on top of zone f1 and zone f. It was responsible for the deposition of a charcoal layer.
Zone e — Now another small roof fall occurred at the mouth of the south room and covered zones f and g. Toward the interior of the cave it blended into and became indistinguishable from zone g.

Occupation 17 — Perhaps, by now, the roof in the interior of the shelter was stabilized enough so that Piki micr bauds dared to live for a few brief weeks or more in the basinlike area of the central room. Zone W, dated at about 5800 B.C. to 4800 B.C., represented such an occupation.

Occupation 18 — Zone V, dating to about 5600 B.C. to 4600 B.C., may have been a similar occupation.

Occupation 19 — Zone U, at about 5800 B.C. to 3800 B.C., resembled the previous two occupations.

Occupation 20 — Zone k is similar to the previous three occupations. All of these were extremely brief, and there is the suggestion that they occurred during the spring of the year. The lack of projectile points suggests that the occupants were not groups of hunters.

Occupation 21 — Zone X, mainly a charcoal zone, covered a slightly larger area of the central room during Piki times, 5000 B.C. to 4000 B.C. The presence of quinoa seed suggests that the occupation occurred during the wet summer season and that it was by incipient agriculturalists.

Occupation 22 — The first Chihua occupation, zone VIII, dated at about 4000 B.C. to 3200 B.C., saw the movement of a small group into the north room. Plant remains again suggest a wet-season occupation.

Occupation 23 — Whether the next small Chihua occupation, zone VII, dated at about 3500 B.C. ± 400 years, occurred in the same season has not been determined.

Occupation 24 — Seemingly the next occupation of Cachi people occurred in the central room between 2500 B.C. and 2000 B.C. It resulted in the deposition of zone H. During what season this occurred could not be determined.

Occupation 25 — The following occupation in the north room, responsible for the deposition of the top of zone VI on top of a small roof fall, definitely seems to have been by wet-season Cachi farmers between 2700 B.C. and 1900 B.C.

Occupation 26 — Whether this occupation was separate from or contemporary with the people who deposited zone G in the central room could not be determined. We guess that it was not and estimate zone G to have been deposited by Cachi people between 2600 B.C. and 1800 B.C.

Occupation 27 — The final preceramic Cachi occupation deposition, zone F, occurred in the same central room at about 1900 B.C. ± 120 years, probably during the wet season. Whether they were visits by herders or brief occupations by farmers who planted on the slopes or terraces in front of the cave was difficult to determine, but this seems to have been the pattern that occurred throughout ceramic times.

Occupation 28 — This occupation was deposited in zone E6 in the central room between 700 B.C. and 400 B.C. Its sherds have been classified as being of the Kichkapta phase.

Occupation 29 — The Chupas phase was represented by zone V of the north room around 600 B.C. ± 300 years.

Occupation 30 — The deposits left in zone E5A in the central room between 300 B.C. and 200 B.C. were also of the Chupas phase.
Occupation 31 — Zone IV of the north room is the only Rancha occupation at about 400 B.C. ± 300 years.

Occupation 32 — One of the largest occupations of the Ayacucho Valley was during Huarpa times, and zone E5 in the central room may represent a visit by this group at about 250 B.C. ± 300 years.

Occupation 33 — Zone III in the north room was another sojourn by Huarpa people at 200 B.C. ± 300 years.

Occupation 34 — Zone II of the north room in the Cruz Pata phase may have occurred at about the time of Christ.

Occupation 35 — Zone E4 of the central room was representative of the same cultural group a century or so later.

Occupation 36 — Although the imperialistic Wari peoples lived mainly in the capital, the top layer, zone I of the north room, may represent a visit to the cave by them at A.D. 600 ± 400 years.

Occupation 37 — Zone E3, in the central room, is also a Wari deposition.

Occupation 38 — One occupation, depositing zone E1, is of Huamanga times.

Occupation 39 — Zone E in the central room also occurred during Huamanga times, perhaps at A.D. 800 ± 200 years and A.D. 1000 ± 200 years.

Occupations 40-42 — The next three occupations go in the general category of Chanka. All remains were left in the central room as zone D at roughly 1200 B.C. ± 200 years, zone C at 1500 B.C. ± 200 years, and zone B at 1400 B.C. ± 200 years.

Occupation 43 — The final occupation (or occupations) is almost impossible to determine and probably has occurred during the last four centuries since the Spanish conquest. Everywhere in the cave the occupation or occupations are represented by the capping layer of dung.

All in all, the sequences of culture found in this cave covered a remarkably long span of time. In fact, it gives the skeletal framework of the sequence of culture for the Ayacucho Valley and perhaps even for the central Andes.

INTERPRETATIONS OF THE EARLIEST OCCUPATIONS

Zone k (see Figure 11)

The first zone to be considered is zone k, the brownish-gray zone with a maximum thickness of 30 cm. This was the zone that filled the basin in the south room. Although we only excavated part of this oval-shaped zone, it seemed to have a maximum width of about 4m (north-south), and a maximum length of not more than 20m (east-west). The length was perhaps only about 16m on a flat surface, and 4 down the talus. Since artifacts, ecofacts, and broken rocks occurred only at the surface of this zone, one might have considered this area of about 40 to 45m² as both the ALS (absolute limit of scatter) and LMS (limit of most scatter), in Yellen's ethnographic classification (Yellen 1977:103).

No real feature or easily recognized floors were discerned, although in square S19E7, 12 rocks and a nearby side scraper and rock were all at the same depth. They were 4 cm below the surface of the stratum and literally formed a pavement like area with their flattened surfaces being roughly horizontal. Associated with these remains
in two adjacent squares in the northwest part of the zone, at approximately the same depth, we found 11 other rocks, 1 more side scraper, and 2 corelike scraper planes. We consider this area to be an activity area, number 3, or in Yellen’s classification, LNA (limit of nuclear area) 3. Exactly who used this area, or for what specific purpose, is difficult to determine. The artifacts suggest possibly butchering and/or woodworking activities.
To the southeast of LNA 3 was a large concentration of debris. It was at about the same depth in zone k, and was about 1 m wide and 3 to 4 m long (southwest-northeast). We called this activity area 2, or LNA 2. It had three possible butchering tools (SS50 and SS10) and flint chips or two chips and a chopper, which were associated with two sloth vertebrae and two bone fragments. In addition to these remains, there were 214 rocks at varying depths. Whether this was an area of the activities of an individual, family, or other group is difficult to determine, but the activity seems to have been butchering.

The third activity area, number 1, was a 2 × 2 meter region at the southwest corner of zone k. The kinds of artifacts found here seem to duplicate those of both the other nuclear areas. The artifacts were five tufa-slab spokeshaves, a worked flake, a tufa-flake chopper, two corelike scraper planes, and two chips. There were also 15 rocks. This could well have been the butchering and/or woodworking area of a (nuclear family?) group.

Its artifacts, as well as the ones from the other individuals, group, or groups, suggest that their material culture could be classified as belonging to the Pacaicasa phase. Zone j, dated at 20,200 and 19,600 years ago, had artifacts similar to those in its underlying zone k, suggesting that the occupation took place roughly 20,000 to 25,000 years ago. The limited number of artifacts and the remains of only a single sloth suggest that this occupation was of brief seasonal duration, possibly a kill site, where (at best) a microband was involved with butchering their kill.

Whether this interpretation of past lifeways is correct or not is difficult to determine, but there can be little doubt that man did occupy Pikimachay cave in this time period.

Zone j (see Figure 12)

Zone j was a dark reddish-gray stratum which reached a maximum thickness of 40 cm. It not only covered all of the underlying zone k, but extended westward beyond it in the basin of the south room. It reached a north-south maximum width of slightly more than 5 m, and an east-west length of close to 20 m (excluding the talus slope region). We estimate that zone j covered from 50 to 65 m² in its area of maximum scatter of artifacts and ecofacts (Yellen’s ALS).

Here, as in zone k, no features or floors were discernable, but there did seem to be three concentrations of artifacts, ecofacts, and rocks. As with the previously discussed zone, it was difficult to determine whether the three were occupied contemporaneously. However, datum depths on the 34 ecofacts and artifacts in the three areas showed that 26 of the depths of these were within 13 mm of each other, about 8 to 21 mm below the top of the surface of the zone. These depth readings suggested that the areas of concentration occurred at around the same time.

Activity area 1 covered about 5 m² in the west portion of the zone. It contained two chipped cores and seven artifacts which belonged to five types. Three of the types, tufa-slab spokeshaves, flake choppers and crude corelike scraper planes occurred in the previous level and were interpreted as indicating butchering and/or woodworking activities. The two new types which occur in this zone, large utilized flakes and large, crude, denticulated scraper planes, tend to confirm such a reconstruction for this zone.
Activity area 2, in the southeast portion of the zone seems to represent a slightly different undertaking, even though two of the artifact types were shared between areas 1 and 2; that is, the flake choppers and small worked flakes. However, here there was also a different selection of debris: sloth bone, cut-and-polished sloth bone, double-edged spokeshaves and hammer-core choppers. This combination of artifacts and
ecofacts might indicate boneworking. Woodworking and/or butchering could also have occurred.

Area 3 in the northeast part of the zone had sidescrapers, sloth rib, deer femur, and some unidentified bone fragments. Activities similar to those in area 2 might have taken place in area 3.

The picture one obtains from zone j is similar to that of zone k. A small group at a kill site for a brief period of time was performing a limited number of activities. These activities probably were butchering, woodworking, and boneworking. The bone, some of which was worked when fresh, was dated by two different radiocarbon laboratories. UCLA's laboratory determination was 17,650 B.C. ± 3000 years (UCLA 1653A), while Isotopes laboratory, using a slightly different technique, got a confirming date of 18,250 B.C. ± 105 years (I5851). The deer bone and soil acidity indicated that vegetation near the cave may have been more forested than previously. The climate may have been more humid; perhaps it was some sort of glacial interstadial.

The almost complete duplication of the earlier types of artifacts by those from this zone indicates that we are dealing with the same cultural complex. It is the one we are calling Pacaicasa.

Zone 11 (see Figure 13)

Covering the eastern part of zone j was a hard, cemented reddish-brown layer called zone 11. Although we did not dig its east end, it seemed to have been only about 7 or 8 m long, and about 4 m (north-south). The total area was about 25 to 30 m². The zone filled most of the depression in the south room; it had a maximum thickness of about 30 cm.

The layer had no discernible features in it, and its activity areas were not well defined. An elongated area about 1×4 or 5 m was located in the southwest portion of the zone; we called this activity area 1. As with previously mentioned areas, this area seems to have been mainly concerned with butchering and/or woodworking. It had many artifact types in common with the other zones discussed above: slab spokeshaves, large utilized flakes, denticulates, small worked flakes, and three kinds of choppers — flake, slab cleaver, and core pebble. Associated with these 11 tools were a sloth metacarpal and phalange, three fragments of sloth teeth, two horse teeth, part of a horse femur, a rodent bone, four chopped up bones, and some rocks.

The other area, to the northeast of the first, was roughly square. It was about 2×2 m and had a northern and a southern concentration of debris; perhaps these concentrations were reasons for subdividing this area. This activity area 2 was less well defined, and had more bones and fewer artifacts than activity area 1. Butchering and/or woodworking may have occurred, as we found a hammer-core chopper, a flake chopper, a scraper plane, and a large crude denticulate. These were associated with a horse femur, cannon bone, and two jaw fragments, and a sloth jaw, three fragments of sloth scapula, three sloth vertebral pieces, a phalange and a portion of tibia. In addition to this assortment of bones was a polished and cut sloth rib and a scratched sloth long bone, which suggested that boneworking was done in activity area 2.

Again, the pattern was not dissimilar from that of zone j. Occupation was probably
brief and by a few people. Perhaps they came to the cave to kill and butcher animals such as a sloth. Perhaps, while they were there, they also killed a horse. Portions of the horse were brought back to the cave for butchering. The horse bones as well as the highly acidic soils suggested that the vegetation may have been more savannah-like than during the period of deposition of zone j. Also, the climate may have been drier.
and colder. One of the bones yielded a C-14 date of 14,100 B.C. ± 1200 years (UCLA 1653B). The artifact types again allow the complex to be classified as Pacaicasa.

Zone i (see Figure 14)

Zone i was roughly diamond-shaped, 5 to 6 m wide (north-south) and 10 to 12 m long (east-west). Neither the southern or eastern extremities of the zone were completely uncovered in our excavation, so our dimensions as well as our samples of tools were probably less than the total deposited. Zone i covered an area of between 50 to 60 m². This dark-brown stratum capped most of zone i, but in its eastern portion, it overlay zone j. It more or less filled the ever-lessening basin in the south room.

The zone was without features, but a piece of carbon did occur in activity area 2. Datum depths on artifacts and ecofacts indicate that most were in the middle deposit of the layer. Two pavementlike areas of rocks, bones, and artifacts which were about 10 cm thick occurred in squares S19E9 and S22E8. These seemingly belonged to two activity areas, numbers 3 and 2, respectively. Of the three areas in this zone, activity area 1, located to the west of 2 and 3, had the least closely spaced and most varied depths of its artifacts and ecofacts. In spite of these facts, I believe that at least two, if not all three, of the activity areas were contemporaneously deposited because the bones from areas 2 and 3 probably came from the same animal.

Activity area 1 was much like the activity areas of the previously discussed zones. Activities seemed to have centered around butchering, woodworking, and possibly flint knapping. The artifact types were even the same: crude scraper planes, slab spokeshaves, worked large and small flakes, large denticulates, hammer core choppers and pebble choppers. The other single flake and pieces of unidentified large animal bone further tended to confirm the opinion that butchering was being practiced. This group, similar to the previously mentioned ones, seems to have butchered their kill in the cave.

Activity area 2, located to the east of area 1, covered about the same amount of space — 4 to 6 m². Here was even better evidence that it was a kill site, for there were two fragments of projectile points in direct association with the bones of horse and sloth. Perhaps the sloth was killed in the cave den while the horse was killed outside. Some of its meatier long bones were then brought inside for butchering and preparation for consumption. Certainly, the flake chopper, pebble chopper, and large utilized flake could have been used for the latter tasks.

The third area, north of the second, seems to have covered only about 5 m². Again, sloth, horse, the bones of a carnivore, perhaps a big cat, and cut bone were found in association with a slab cleaver-chopper, a worked flake, and spokeshavelike tools. The indication was that butchering was performed. The bones of sloth and horse here seemed to be animals of about the same size as those of area 2. We guessed that there may have been two areas for butchering the same animals. We would like to point out that the presence of a third femur of a horse, as well as bones of a large cat, indicated that other animals were killed and butchered by the occupants of area 3. The burin, found in association with a cut sloth rib, a scratched and polished sloth rib, and two different fragments of polished and scratched long bones of large mammals, suggested that these people were also working bone.
In spite of the minor differences, the pattern of activities of zone i was much like that of the three previous occupations. The artifacts were similar too; therefore, zone i was classified as a Pacaicasa component. The acidity of the soil and the presence of horse bones suggests that the climate and vegetation of the cave was similar to that of zone i1, a dry savannah. The time of this seasonal microband occupation is more recent than zone i1, as indicated by the deposition of the strata. This fact is very neatly
confirmed by the C-14 determinations of 12,750 B.C. ± 1400 years (UCLA 1653C), about a millennium after zone I1. We suspect that this date may be too recent and would estimate the age of the zones to be 13,250 B.C. ± 1000 years.

Zone h1 (see Figures 15, 16, and 17)

Zone h1 capped all of the earlier strata in the east-west trench from S18 to S22 from the back of the cave to the overhang at about E10 or E11. This hard yellowish stratum also covered the basinlike area in the south room. Along the southern and most of the western peripheries, it lay on the cave floor. To the north, the stratum was close to, if not actually on, the cave floor. It was always the last layer uncovered in our excavations. Its limits were never accurately demarked where it extended east to the talus slope. Nevertheless, the zone covered a huge area, slightly greater than 114 m². It varied in thickness, averaging about 25 to 35 cm; in places, it reached a maximum thickness of 50 cm.

As might be expected, there were a number of noticeable clusters of artifacts and ecofacts. One activity area, number 6, was in the north apex of the triangular area and covered about 12 m². Much of it was defined by rocks and few artifacts (three cores and two flakes), ecofacts, and a rodent bone. It was much like area 5, which was a strip about 2 m wide and 4 to 7 m long just north of area 6. This length range is given because, except for a single side scraper, the whole eastern 3 to 4 m were defined by rocks. It must be pointed out, however, that in the 4-m square in the eastern end of the strip, 10 of the 14 artifacts, the 24 flakes and cores, and the 5 bone fragments occurred. In square S18E5, the debris was all lying horizontally, at about the same datum depth, forming an almost pavementlike structure.

The final concentrations were poorly defined. The area was a 10 m long strip, about 3 m wide, that ran across the southern portion of zone h1. It was obviously more than one activity area, so we began to make some square-by-square comparisons of its bones and artifacts. Almost immediately, it became apparent that the nine 1-m squares in the west had horse and rodent bones (as did areas 5 and 6), while the eastern end of the strip had camelid and carnivore bones, as well as many more artifacts that did not occur to the north or west. Thus, the western end became activity area 4 which connected with areas 5 and 6. Our study of the eastern end of the strip revealed three more discretely defined concentrations, which became areas 1, 2, and 3.

It might be restated that the debris of square S22E3 in activity area 1, and also that of S22E6 in activity area 3, was lying horizontally, at about the same depths, forming paved patches. It must be observed that these pavements were at different depths from those of activity area 5, and contained some different types of artifacts from the ones found in the other three activity areas.

The question was now one of interpretation of the activity areas. The varying depths of the artifacts, differing concentrations of artifacts and differing kinds of bones in the various activity areas suggested that these represented different occupations. On the assumption that it is likely that the bones of a single animal will get scattered over all activity areas during one occupation (as occurred in Yellen's 'Kung ethnographic data), it appeared that we might have two occupations represented. People of both
occupations seemed to have killed sloth, but activity areas 4, 5 and 6 also seemed to have horse and rodent bones. Activity areas 1 and 2 do not have these kinds of bones but do have camelid and carnivore bones, which suggested that areas 1 and 2 were not contemporaneous with areas 4, 5, and 6. Activity area 3, adjacent to 1 at a similar depth, was also classified as a part of the same occupation. Of course, it could have been a separate one.

Figure 15. Floor plot of occupation of the southern part of zone hi showing its artifacts and ecofacts in their activity areas.
The northern area, including areas 4, 5, and 6, was called occupation 2 because its artifacts and debris were generally found less deep than the debris in the south areas 1, 2, and 3, which was called occupation 1. It might be added that the rodent bones in occupation 2 suggested that it may have been active in the wet season. This, as with all seasonality data for such early occupations, was not convincing. However, the bone data suggested that both occupations were for limited periods of a season or less, by a limited number of people; that is, microbands.

Figure 16. Floor plot of occupation 2 on the northern part of zone h1 showing its artifacts and ecofacts in their activity areas.
Let us now speculate about what activities may have occurred during these two hypothetical seasonal microband occupations. Occupation 1 seems to have had three activity areas. The first of these, number 1, which was located against the west wall of the cave, had the most debris in it. Sloth, deer, camelid, and carnivore bones were in association with a projectile point; this suggested that the people were hunters. These eight bones, plus four more chopped up ones, were in association with two worked flakes, four slab spokeshaves, and a core pebble chopper. The latter two types have percussive wear on them, which suggests that butchering was done in this area. The three denticulates, four spokeshaves, and two scraper planes could also have been used in butchering, in addition to working wood and bone.
Other activities were more difficult to discern. The seven flakes and two cores suggested that some flint knapping was done. The association of these flakes and cores with scraper planes and denticulates, which could also have served as cores, choppers, or hammers, tends to support the assumption that flint knapping occurred.

Activity area 2 had some evidence for flint knapping, as did area 3. Both areas had cores, flakes, and core pebble choppers. In addition, area 3 had a hammer core chopper. The last two types of tools could have also been used for butchering and perhaps woodworking. Both tool types were associated with other tools that might have been used for butchering or woodworking. In area 3 there were five large denticulates and four large utilized flakes. In area 2 there were four large utilized flakes, a pebble side-scaper, a split-pebble scraper-plane, and a camelid bone.

The other occupation may have occurred later in time than the one just discussed. It was represented by three activity areas in the north end of the cave. The specific type of rodent bones found in areas 4 and 6 suggested that this occupation may have occurred in the wet season. The presence of sloth and horse bones in areas 4 and 5, and of rodent bones in areas 4 and 6, suggests that the areas were contemporaneously utilized and that a major activity in each area was butchering.

The projectile-point fragments found in area 6, as well as the large mammal bones of areas 4 and 5, indicate that hunting occurred.

In area 6 there was little evidence for butchering, but the seven flakes, three cores, two core pebble choppers, large denticulate, and slab spokeshave may indicate flint working; there was also considerable evidence for flint knapping in areas 4 and 5. The types of artifacts found in both areas were quite similar; there were core pebble choppers, tufa scraper planes and/or cores found in direct association with numerous cores and flakes. The materials of these artifacts were not native to the cave. In areas 4 and 5 the composition of tool types for butchering, woodworking, or other activities differed slightly. The debris that both areas share were slab spokeshaves, large denticulates, cleaver choppers, large utilized flakes, and sloth and horse bones. Area 4 had a double-edged spokeshave, a small worked flake, and a split-pebble scraper plane. Area 5 had a pebble side-scaper, and two flake spokeshaves. The significance of these differences in types has not been determined.

In spite of the differences in the three activity areas of each of the two occupations, the occupations seem extremely similar and may be classified as being of the Ayacucho phase. Although we have no dates on this zone, the radiocarbon determinations on bones from just above and just below the zone suggest that zone 1 was deposited at about 13,000 B.C. ± 1000 years.

Zone 1 (see Figures 18-20)

Zone 1 was the most extensive stratum below the rock fall; it contained the greatest number of artifacts and ecofacts found in any level we excavated at Pikimachay. Zone 1 was a reddish-orange stratum which varied in width from 5 to 10 cm along the cave wall to greater than 30 cm near the mouth of the cave. Datum depths from artifacts and ecofacts in the northern and eastern squares covered a wide range, and the artifacts and ecofacts formed pavementlike lenses only in a few spots in the southeastern part of the zone.
Figure 18. Floor plot of occupations on the southern part of zone h showing its artifacts and ecofacts in activity areas 1, 2, and 6.

One cluster of debris which formed a floorlike lens was in a (southeastern) area about 3 m in diameter, in which the stratum was only 5 to 10 cm thick and rested on the original cave floor in many places (Figure 18). We designated the cluster an activity area, and because its pavement of bones and tools was nearer to the bottom of the zone and cave than were the other areas, we labelled the cluster "activity area 1." We
considered the area to represent a different occupation from the others in the zone because of its distinctive assemblage of animal bones. Large sloth, cameldid, deer, and skunk were represented, while horse, puma, large cat, rodent, and small sloth (*Megatheriidae*) were not.

We suspected that the occupation represented a sloth kill which occurred in the cave, although we found no projectile points. The indication that there were no fewer
than three sloths came from the faunal evidence; there were three humeri, three femurs, and four fragments of vertebrae from at least three different-sized sloths. In addition to butchering and subsisting on sloth, the occupants of the cave may also have hunted and killed deer, camelid, and skunk outside the cave. Since only the long bones of these animals are present, it would seem that the animals were killed and butchered elsewhere and only the meatier anatomical portions (the limbs) were brought back to
the cave for consumption. The butchering tools, perhaps, were the large and small flake side-scrapers or knives, the pebble side-scaper or knife, the flakes, and the scraper plane. Further evidence that butchering occurred in activity area 1 were the two pieces of cut bone (H31) and the 54 unidentified bone fragments.

The scraper-plane, of course, could have been used for scraping skins, but its association with two kinds of spokeshaves and denticulates suggested that it was used in woodworking. Woodworking seemed to have been the other main activity of this occupation. We suggest that the occupation consisted of one or two microbands for less than one indeterminate season in the general period from 12,000 to 12,500 B.C.

The second concentration of artifacts and ecofacts, activity area 2, was found just south of activity area 1, also along the wall of the cave (Figure 18). There were a couple of lenses of bone in the area, and because they were higher in the stratum than the lens of area 1, we consider area 2 to be representative of the activities of a later occupation. The varying faunal assemblages confirm the interpretation that temporally separated groups were responsible for the different concentrations of artifacts and ecofacts. In activity area 2, bones of animals similar to those found in area 1 occurred, such as large sloth, deer, camelid, and skunk; there were also bones of horse, puma, large cat, and a small sloth (*Scelidotherium*). The latter bones, as well as the lack of camelid bones, made area 2 distinct from the other concentrations of this stratum.

Area 2 resembled area 1 in that it seemed to represent a sloth kill site. The major activity was butchering; the butchering tools were large and small flake side-scrapers or knives, pebble side-scrapers or knives, and choppers or cleavers. In area 2 we found a fragment of a unifacial projectile point, possibly a point used to kill animals within or outside the cave. As in area 1, deer, puma, skunk, and big cat were mainly represented by limb bones; the suggestion again was that these animals were killed and butchered elsewhere, and only a few remains were brought to the cave.

As in area 1, there was evidence in area 2 for woodworking and/or skin scraping from the spokeshaves and two kinds of denticulates. Unlike area 1, there was ample evidence for bone working in the burin, the worked-and-polished sloth rib, cut-and-scratched sloth rib, and cut bones of some animal smaller than sloth. At least nine flakes, the core hammer, and the denticulates that could also have served as cores, suggest flint knapping.

It would seem that these people occupied the span between 12,500 B.C. and 12,000 B.C. The size of the activity area suggests the occupants comprised a microband; estimates of meat from the bones of the animals suggest that the microband could not have subsisted for more than a season in the cave. The small group had come to kill sloths in the cave. They stayed to butcher and eat the sloths and other animals. They also did a little woodworking, bone working, possible skin scraping, and flint knapping before they left.

Let us now turn to the next major concentration of artifacts in the center of the cave (Figure 19). There was a 3 to 4 m concentration of artifacts and ecofacts spread across the center of the cave from east to west. The concentration was about 10 m long. There were some reasons for subdividing the strip into three divisions even though the clusters of artifacts and ecofacts were not well separated. First, in the east was an oval of 9 m² with a scatter of artifacts and ecofacts that were found at roughly the same datum
depth, ranging from 7 to 13 cm. The oval contrasted with a central, better defined second cluster that was roughly 3 m wide, east and west, and 4 to 5 m long, north and south. In this cluster, the artifacts and ecofacts covered a greater depth range, up to 55 cm. Finally, the west 9 m² of the strip had fewer artifacts than other portions of the strip, but most of them occurred at about the same datum depth as one small pavementlike area of ecofacts and artifacts in S19E8.

We divided our strip from east to west into activity areas 3, 4, and 5; however, the boundaries of each were indistinct. Comparisons of animal bones from the three areas showed a wide range, which included sloth, deer, horse, camelid, puma, and rodent with skunk and Megatherium sloth occurring in two of them (3 and 5), but no big cat in any of them. The faunal remains suggested that these three areas are representative of a single occupation, number 3. The whole strip might be considered to be a single huge activity area, but I separated the strip on the basis that the tools used in the three main activities — (1) butchering and/or hunting, (2) boneworking, and (3) woodworking and/or skin scraping — were slightly different in the three areas.

Since one of the bones from activity area 3 was C-14 dated at 12,200 B.C. ± 150 years, this was taken as the date of the occupation. However, considering that the occupation may have been by as many as three microbands (each producing one of activity areas 3, 4, and 5) and that the faunal remains in the three activity areas may well represent the same animals, the length of the occupation could not have been long. We are again dealing with a seasonal microband occupation, albeit a large microband.

In all of the activity areas of this occupation, the bones of large animals found in association with bone projectile points presented good evidence that the occupants of the cave at that time were hunting. In addition, activity area 4 had six unifacial stone projectile points, and activity area 5 had one unifacial stone projectile point. As in the areas discussed previously, the anatomical variety of sloth bones suggests that the sloths were killed within the cave; the predominance of limb bones of the other (smaller) animals such as deer, horse, camelid, and puma suggests that these animals were killed and butchered elsewhere, and mainly their limb bones with adhering meat were brought back to the cave.

The many bone fragments, as well as cut and scratched bones in all three areas, suggest that a major activity was butchering. The butchering tools differed slightly in each area. In area 5, there was a small utilized flake, a pebble side-scaper, and a hammer core chopper. In area 4, there were large and small utilized flakes, pebble side-scrapers, and core pebble choppers. Area 3 had two small utilized flakes, four pebble side-scrapers or knives, a core pebble chopper, and a cleaver chopper.

All three areas showed evidence of bone working activity in the form of burins. Area 4 had a fluted core that could have served as a burin. All three areas also had cut and worked bones and scratched sloth-ribs (H28), and bone projectile points. Area 4 also had an antler punch and a sloth rib-flesher.

Wood and/or skin working seems to have been another activity in all three areas. Tools that occurred in all areas included small-edged spokeshaves (SS50) and denticulates (SS52, SS53). Areas 3 and 4 also had flake spokeshaves, while area 5 had a scraper plane. Unlike area 2, there was little evidence for flint knapping. A feature unique to
this zone occurred in area 5; it was a circle of rocks associated with reddish soil. Perhaps the reddish soil was caused by burning, and the rocks were surrounding a hearth, but definite proof is lacking. There were no associated charcoal or burned bones, and the reddish soil was not analyzed.

The difficulties in interpreting the feature in area 5 hold true also for our reconstruction of the two final vague concentrations of artifacts and ecofacts in zone h. One concentration is more or less in the southeastern section of the cave, roughly between area 2 and areas 4 and 5. This poorly represented patch, arbitrarily called "activity area 6," is about 5 m long, east and west, and between 2 and 3 m wide, north and south. Whether this is a separate area or not is open to question; the objects in this space varied in depth and there were no pavementlike areas. The faunal remains resemble those of occupation 3, and not those of occupations 1 and 2, because there were a wide variety of animal bones represented. There were bones of sloth, deer, horse, camelid, puma, and rodent, but no skunk.

The activities represented are similar to those in the activity area of occupation 2, but area 5 lacks projectile points. There is, however, good evidence for butchering, not only from the many bone fragments and the cut-and-scratched bone, but also from the large and small flake side-scrapers or knives, pebble core choppers, pebble side-scrapers, and slab cleaver chopper. The assemblage resembled that of activity area 2. Also similar to occupation 2 was evidence of boneworking, in the form of burins, a cut horse phalanXG, and cut-and-scratched bones. Evidence of woodworking and/or skin scraping in the form of small-edged spokeshaves, large denticulates, and a split-pebble scraper plane.

Again, the relatively small area and small amount of food represented by the animal bones suggested a seasonal microband occupation of the Ayacucho phase, roughly from 12,500 B.C. to 12,000 B.C. Whether area 6 represented a separate occupation, number 4, or was merely some sort of extension of occupation 3, cannot be definitively determined, although I suspect the latter.

Of an equally indeterminate status was a small patch of artifacts in the north end of the zone, called activity area 7. Area 7 also could have been some sort of dumping area of occupation 3; however, the presence of only sloth, camelid, and rodent bones, and not of the wide variety of animals represented in areas 3, 4, and 5, suggests that area 7 may have represented a separate occupation, number 4 or 5. As in area 6, artifacts and ecofacts ranged over many datum depths, which suggests a dumping area rather than an occupation, as does the limited number of activities represented.

The chopper and small worked flakes may have represented butchering. The worked sloth metapodial might have represented bone working. The denticulates, three scraper planes, and flakes could be considered evidence for woodworking and/or skin scraping, and/or flint knapping. These artifacts and ecofacts also could be more widely discarded tools from occupation 3. Whatever behaviors this area represented were probably done by a small group during a brief sojourn in the period roughly between 12,500 and 12,000 B.C.

In summary, zone h produced evidence of three, and perhaps as many as five, separate seasonal microband occupations that took place between 12,350 B.C. and 12,050 B.C., as evidenced by one radiocarbon determination. Activities were rela-
tively limited, but there are suggestions that the occupants hunted, butchered the kills, worked the bone of the kills, perhaps worked on the skins of the kills, worked wood, and knapped flint. The numerous artifacts (169) and ecofacts (481 bones) have been classified as being of the Ayacucho phase, as were those of the previous zone, zone h1.

Zone h or "little h"

Zone b (or "little b") overlay zone h in the north end of the excavation in the south room. It was a relatively soft reddish-brown layer, only about 20 cm thick at its north end, and spreading out about 7 m to the south. It was about as wide at its north end as it was long, making it roughly triangular, and covering from 22 to 28 m². The shape, thickness, and general softness indicated that probably most of the zone was plowed off in its south end when the rock fall of zone g slid across it. Therefore, we do not know how many occupations or activity areas it originally had; all we have was the poor representation of an occupation. There were only 7 artifacts, and 7 identifiable bones of the 15 found, but there were also 19 cores, 47 chips, and 66 rocks. Probably many of the artifacts and ecofacts from the lower part of the rock-fall zone h1 originally came from the occupation of zone b, but there is no way of proving it.

In spite of the limited evidence, we have hints of activities that may have occurred during the period of zone b, which pollen indicates had a colder climate, with more grasses than in earlier times. Unlike any of the earlier occupations, this one, whose people are classified as Huanta, saw flint knapping as an important activity. Further, the narrow striking platforms of the flakes with prominent ventral lips suggested that much of the percussion was not done with a hard hammer as in previous horizons. The narrow platform at less acute angles than previously suggests that the knappers had better control of their knapping. The presence of a blade and the bifacial projectile point with its pressure-retouched edges further emphasized that a new kind of more skillful flint knapping was being undertaken. As in zone h, with its Ayacucho culture, many of the worked materials were from outside the cave, and again, the occurrence of three flakes of Huancavelica obsidian indicated new kinds of wider importations of raw materials for flint knapping.

Other activities were not so prominently evinced, but an Andean bipoint projectile point in conjunction with horse and camelid bones shows that hunting occurred. Unlike previous occupations, hunting seems to have been outside of the cave; the cave was no longer a sloth-kill site. The horse and camelid bones suggested that the hunting was some sort of specialized herd-hunting, but more evidence is needed from open kill sites before we can understand exactly what sort of herd-hunting occurred.

There was a suggestion of butchering from the animal-bone fragments in conjunction with the various scrapers and blades. The lack of bones from skulls or torsos suggests that much of the butchering was done outside the cave, with the limb bones and adhering meat brought to the cave for final food preparation. The Huanta butchering pattern was very different from that of the previous cultural phase, and it is worth noting that there was no longer any evidence of a prominent woodworking industry.

The evidence for other possible activities is extremely slim, but the blade and
scraper-plane in conjunction with the bones of animals with hides indicated some skin working. The denticulated scraper-plane could have been used on wood.

There was no evidence that the size of the group was larger than a microband, and the amount of meat as represented by the bones of animals could not have lasted longer than part of a season. Our limited tool types suggested that we had a new culture called Huanta. The date of the previous Ayacucho culture and the later Puente culture indicates that the Huanta phase occurred between 11,000 B.C. and 9,000 B.C.

Not too long after the occupation, the roof of the cave fell and covered zone b. Although zone f2, dated at about 6900 B.C., overlapped the zone of rock fall, zone g, the roof fall terminated our early man occupations of Pikimachay Cave. By early man, I mean man associated or contemporaneous with the now-extinct animals of the Pleistocene. Having described the actual early occupations, let us now look more closely at our cultural classification of these earliest remains.

CONCLUSIONS

In the last few pages we have given the stratigraphic evidence about our sequence of layers below the rock fall of the south room of Pikimachay Cave. This stratigraphy from zones k to b has been confirmed in part by five radiocarbon determinations, the earliest two of which were done by two different laboratories using slightly different measuring techniques, but still giving statistically the same results. No matter what one may think of our attempt at correlating the paleoecological data in terms of geological time, or of our estimates of non-carbon-dated layers, there is no chance that the stratigraphy of our seven layers is invalid. The error of our temporal estimate must fall within the one-sigma range (that is, it could only be wrong once in twenty chances).

In or on the seven layers, there were 283 artifacts, 47 pieces of worked bone, 118 flakes, 41 cores, 361 identifiable bones of 18 different kinds of animals, and 270 unidentifiable bone fragments concentrated in 25 nonrandom clusters, some of which were at exactly the same depth. It is highly likely that these concentrations were the work of man. Further, not only are the bones represented not a random sample, but their concentration in clusters is no accident, and, what is more, 40 of them have been worked by man and 7 are unmistakably artifacts. However, if this is not enough evidence for the doubters, there were 118 chips, 41 cores, and 283 chipped stone artifacts in these nonrandom clusters associated with the ecofacts, as well as the one thousand or so rocks and a possible fireplace. Of these rocks, 1 from zone k, 2 from zone j, 3 from east of zone i1 and i, 32 from zone h1, 86 from zone h, and all 6 from zone b are of lithic materials foreign to the cave. There is no way these rocks could have gotten into the nonrandom concentrations in the seven solidly stratified layers except by the hand of man.

Some doubts have been expressed that the 283 stones are artifacts. Carl Phagan, Ruthann Knudson, and Antoinette Nelken-Terner, all lithic experts who worked with these materials, had no doubts that all were tools. Don Crabtree, who saw about 30 items from all layers, was of the same opinion. In this article, I do not have the space to describe each type — this is being done in a forthcoming volume (MacNeish et al
Figure 21. Pacaicasa artifacts: (1) hammer core chopper (B20) from zone j; (2) hammer core chopper (B20) from zone i; (3) small flat worked flake (SS10) from zone i; (4) tufa scraper plane (ES23a) from zone k; (5) Ayacucho burin (SS58) from zone i; (6) tufa slab spokeshave (SS50) from zone j; (7) double edge tufa spokeshave (SS51) from zone j; (8) double edge tufa spokeshave (SS51) from zone k; (9) large denticulate (SS52) from zone j.
1979) — but there are three figures in this article illustrating the most diagnostic types from the six earlier layers, so you can judge for yourself.

Whether our interpretations of how these tools were used in the various activity areas are correct or not is another matter. There is considerable room for argument, and better techniques of lithic analysis may lead to other conclusions. I wish future investigators the best of luck and Godspeed!

Our classification into three sequential complexes is also a matter of interpretation of a very limited sample and may be questioned. I hope future research will improve or even supplant our classification. All I can do at present is to work with what I found in good stratigraphic context. When one compares the assemblages of the seven zones, the materials seem to fall into three general groups. The first group has been classified as the Huanta complex. The limited sample from zone $b$ has distinctive tools, a fragment of a blade and a bifacial projectile point. The second group, the Ayacucho phase, encompasses the materials of zones $h$ and $h1$. Forty-six percent of the artifacts are relatively thin bifaces, 16% are bone tools or worked bone, and only about 42% are large crude bifaces. The third group, the Pacaicasa phase, is composed of the materials from zones i-k, which have about 75% crude core tools, including 30% choppers and only about 25% thin unifaces.

The first of these has too small a sample to be statistically significant, and one cannot but suspect that many of the tools, particularly the ones not found in later phases and ones from zone $g$, also belong to this assemblage. We might, however, note that in a factor analysis, all types from all zones show that the blades and the point factor-out as a small distinctive assemblage but, again, it is difficult to determine. Tentatively, we accept the materials from this zone $b$ as representing a distinctive complex, Huanta, a sort of hypothetical phase to be tested or confirmed by more adequate samples of tools from a series of better documented excavated components.

The earlier, very different materials which, for the most part, have relatively small samples of tools from their respective activity areas are in the first four stratified zones. In terms of our initial large factor analysis of types, type B21, confined to zones $k$ to i, was a separate group, suggesting that these zones belonged to a distinctive cultural manifestation. Other types, mainly bone and unifacial points that occurred in zones $h$ and $h1$, factored out and suggested that there was a second cultural manifestation in these zones. Also, chi-square analysis among zones $k$, $j$, $i1$, and $i$ show that their various distribution of types was probably due to chance and not to significant cultural factors. The same is true when one compares the types of $h$ and $h1$. However, when one compares the types of $h$ or $h1$ with any of those from $k$ through $i$, these do appear to be significantly different, and the difference seems unlikely to be due to either chance or poor samples. Thus, there seem to be two different cultural complexes in these two groups of zones. The one from $h$ and $h1$ has been named Ayacucho and the other from i-k has been named Pacaicasa. It must be added, however, that the majority of the types of Pacaicasa and Ayacucho have great similarity, suggesting there is considerable cultural continuity between the two. Further, it should be noted that the activities of zones $k$, $j$, $i1$, and $i$ were, in the main, monotonously butchering, possibly woodworking, and flint knapping. Those of zones $h$ and $b$ gave much more evidence of the latter as well as substantial amounts of bone working and possibly skin preparation. Such
Figure 22. Ayacucho artifacts: (1) core pebble choppers (B2) from zone h; (2) core pebble chopper (B2) from zone h; (3) slab cleaver chopper (B22) from zone h; (4) split pebble scraper plane (ES40) from zone h1; (5) large denticulate (SS53) from zone h1; (6) large denticulate (DD53) from zone h; (7) large denticulate (SS53) from zone h; (8) large denticulate (SS52) from zone h1; (9) pebble sidescraper (SS55) from zone h.
Figure 23. Ayacucho artifacts: (1) Ayacucho unifacial point (PP1) from zone h; (2) Ayacucho unifacial point (PP1) from zone h; (3) Ayacucho unifacial point (PP1) from zone h; (4) bone projectile point (H1) from zone h; (5) bone projectile point (H1) from zone h; (6) cut horse phalange (H4) from zone h; (7) sloth-rib flesher (H3) from zone h; (8) antler punch (H2) from zone h; (9) Ayacucho burin (SS58) from zone h; (10) Ayacucho burin (SS58) from zone h; (11) Ayacucho burin (SS58) from zone h; (12) fluted wedge (SS57) from zone h; (13) tufa slab spokeshave (SS50) from zone h; (14) pebble side-scaper (SS56) from zone h; (15) pebble side-scaper (SS55) from zone h.
variations would further make the two complexes appear more different. They seem to be, at least tentatively, two separate complexes, subject to redefinition when more data become available.

While our classification of these materials leaves much to be desired, and our interpretations of the activities that might have occurred in the 25 clusters of artifacts in the seven strata is open to question, any attempt to relate these three ill-defined complexes to other equally poorly defined early assemblages in the New World is, at best, speculation, as is any statement about migrations, routes, or Asiatic sources for these Peruvian complexes. I have made such speculations earlier (MacNeish 1976), but here I will stick to the “facts” as I found and saw them, and I would summarize the findings as follows.

The first occupation of the south part of the cave occurred in a shallow basin on top of zone k. We guess it happened roughly 20,000 to 25,000 years ago, and the first inhabitants were probably a small group who stayed but a brief time. During their short sojourn, these early sloth hunters did some flint knapping, butchering, and/or woodworking. Their meager tool assemblage suggests they belonged to the Pacaicasa culture, as did those who laid down the tools in zone j on top of zone k. This may have occurred a considerable time after this first occupation, for there is evidence that the vegetation around the cave was more wooded at this period, roughly 18,250 B.C. ± 1050 years. A considerable time later, at about 14,100 B.C. ± 1200 years, a small band, having the same material culture, occupied two spots on top of zone i, and still later, at about 12,750 B.C. ± 1400 years, three spots on top of zone i were inhabited for brief periods by these early Pacaicasa hunters. Activities were still mainly flint knapping, bone working, butchering, and/or woodworking. This early complex is very poorly defined; its relationship to other early chopper-core groups is not well understood; and the clusters of ecofacts and artifacts on each zone may be interpreted differently from the way I have done it. The fact remains, however, that man’s tools are definitely associated with bones of extinct animals in the general period from 25,000 to 13,000 B.C.

The evidence for early early man in our Peruvian excavation is even clearer in the overlying layers, zones h1 and h. Here, we uncovered larger numbers of tools, mainly unifacial; but some were distinctive types, made from bone, that we believe compose a complex called Ayacucho, which has been radiocarbon dated as between 13,000 B.C. and 11,000 B.C. In each of these soil zones, perhaps deposited when there was a more wooded vegetation near the cave, there was a series of clusters of artifacts and ecofacts that we believe were activity areas of between 6 and 11 different seasonal occupations by small groups. Whether this culture complex was related to other early ones in America with unifacial and bone tools remains to be seen. Better interpretations of his ancient activities may be forthcoming, but there should be no doubt that a large number of tools were made by man from stone and from the bones of the extinct animals killed in Pikimachay Cave about the period of the radiocarbon determination of 12,200 B.C. ± 180 years.

Our information on tools from the overlying zone h is even poorer and the relationships almost unknown, but again, the fact remains that blades and leaf-shaped
bifacial points and other tools were used by man in Pikimachay Cave from roughly 11,000 B.C. to 9,000 B.C.

These tools of Pikimachay Cave were found in good stratigraphic contexts that date from more than 21,000 to 25,000 years ago. As Alex Krieger will gladly tell you, I was a nonbeliever of this same sort of evidence when he presented it in 1964 in his "Early Man in the New World" article (Krieger 1964). Now my own excavations of Pikimachay Cave have proved to me that such pre-10,000 B.C., and pre-20,000 B.C. remains of man do exist. I hope this article will show that the evidence (or at least mine in Pikimachay) for early early man is extremely reliable. The proof will not go away, so we had better learn to live with it and start attempting to interpret the evidence in some sort of rational manner, rather than trying to ignore it or ridicule it out of existence.

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