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Cave Hunting In The Sierra Of Peru

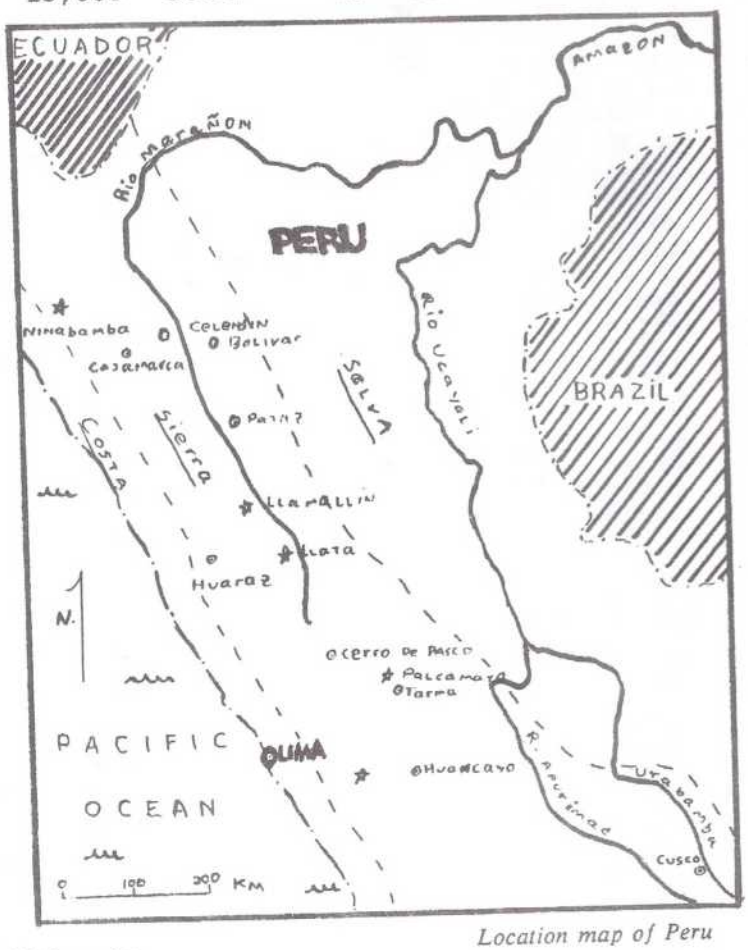
by James Miller

Peru, from a caver's point of view, is practically unexplored. During 1985, I did some initial research and spent two months in Peru doing reconnaissance for karst favorable for cave development. The results of that trip were published in Rocky Mountain Caving, Winter 1986, volume 3, number 1. Last summer, I spent four months in Peru between June and October to follow up my findings of 1985. The results are two new karsts with significant caves and many new ideas for further investigations.

Peru is divided into three distinct environments of remarkably different character, the Selva, the Sierra and the

Costa. The weather patterns in equatorial South America move from east to west. Moisture-laden air sweeps across the Amazon basin and up the eastern slope of the Andes, dropping substantial rain in the process. The Selva (jungle) prevails continuously from the Atlantic Ocean to the eastern slope of the cordillera up to elevations of 12,000 feet. The Selva is sparsely inhabited by diverse indiginous peoples and by colonists from other parts of Peru who come to farm cacao, fruit, timber and coca. The eastern cordillera rises to elevations of 13,000 feet with occasional higher peaks higher than 19,000 feet.

West of this area lies the dry central plateau. The Central Andes consist of the Puna Surface, a peneplane at an average elevation of 13,000 feet, deeply dissected by the headwaters of the Amazon River. To the south are the drainage basins of the Rio Apurimac, Rio Urabamba, and the Rio Mantero, which join to make the Rio Ucayali. From ten degrees south nearly to the Ecuadorian border runs the canyon of the Rio Maranon, cut through the central plateau, its valley as deep as 9,000 feet. The Rio Maranon and the Rio Ucayali join to form the Amazon River. Finally, west of the central plateaus rises the western cordillera to elevations exceeding 15,000 feet. In the world-famous Cordillera Blanca exist summits over 22,000 feet. The Andean region is known as the Sierra.



Location map of Peru

Here lives 60 per cent of Peru's population. It is the domain of the Quechua Indians, descendants of the Incas. From this area comes much of Peru's agricultural and mineral production. From the crest of the western ranges, the Andes drop rapidly to the Pacific coast.

The coastal area, known as the Costa, lies in the rain shadow of the Andes. In the capitol city of Lima, rain falls an average of once every ten years. Where rivers flow out of the Andes, sugar cane and cotton are grown. Elsewhere, the area is practically devoid of vegetation.

Southern hemisphere seasons are reverse from the north, although in the tropics there are few temperature variations. The Selva and the Sierra are dry between May and October, their summer. November through April brings much rain and is considered winter. By contrast, the coast is cool and foggy from April to November when it is called winter, while summer, hot and sunny, exists between December to March. Peruvian seasons are a bit confusing.

In 1985, I knew of only three cave localities in the Sierra of Peru. Geological mapping, where available, shows many terrains to be underlain by limestone. It is difficult to know where to begin looking fo rcaves in a comparatively unexplored region. Fortunately, there is good topographic coverage at a scale of 1:100,000. From these, I was able to pick out large scale topographic depressions developed over limestone formations. First, I visited the well known Palcamayo area which I described in my first article in RMC last winter. Then, I did three general traverses across the strike of the Cretaceous carbonate sequence in the Andes of central Peru, trying to understand relationships between the karst terrains and geology. I didn't find any new caves but I did obtain a great deal of data. Studying this over the winter, I was able to delineate several distinct linear zones of karsts.

My first goal upon arriving in Peru was to check out an area in weren Huanuco Province near the town of Llata where I had located two large drainage basins draining underground. The map shows the larger of the two basins to flow underground for one kilometer. The smaller basin disappears into a sink and reappears about three kilometers down stream sinking again with no indication of a resurgence. The national geological map of Peru shows the region to be underlain by the Pucara Group to upper Cretaceous sediments.

First, however, I spent some time in Lima researching geology, collecting maps and buying minerals. There I also met Marco Goldenberg and Orit Karni from Israel, who were touring Latin America by light aircraft. They were looking for something different to do in Peru, so I invited them to go check out the area near Llata. Also accompanying us was Carlos Morales Bermudez of Lima who is the only active caver in the Peruvian alpine group. Leaving Lima on July 2, we travelled for 23 hours by bus over the twisting roads so typical of the Andes, to arrive in Llata at 2:00 p.m. The following is edited from my diary.

July 3.

After buying a few supplies and having lunch, we had to go talk to the police. Then we packed our stuff three kilometers downstream to the point shown on the map to be the insurgence at 3,200 meters. I estimated the stream flow to be about 100 C.F.S. The stream entered a very deep and narrow gorge where it flows under large boulders in a series of drops. After some exploration, I was able to penetrate 150 feet into the canyon, where it looked like a belay would be advisable for further progress to cross over a 20 foot waterfall. It was getting dark so we set up camp upstream from the gorge.

July 4.

At 7:00, Marco and I took off to hike the trail above the gorge. Reaching the head of the canyon by yesterday's route didn't look too feasible. Therefore, we hiked to the top of the lip overlooking the insurgence and thence a short distance down the other side. The resurgence unfortunately is only 500 feet or less from the insurgence, the lower entrance being over 150 feet high and the bottom inaccessable. We talked to the people living on the bridge, who said that a very large cave is there but they had never entered, for it is infested with a demon. These people had a very nasty dog who took a strong dislike to Marco for some reason. We found three pits on the way back which probably open out into the wall of the gorge.

After returning to camp and breakfast, we decided to try to reach the upper entrance by way of the gorge. The scenery in this area is very beautiful and green. The four of us arrived at the drop which stopped us yesterday. Here, I belayed Marco across the top of the waterfall and up a short slippery scramble. From there, we could easily downclimb to stream level.

After a stretch of waist-deep water and a flat section, the stream turns and drops into an impressive entrance in a series of short falls. One ten-foot drop ended in a wall-to-wall pool. A nasty bypass there involved climbing a steep nettle-covered slope. Then we rigged our 100 foot rope down a short series of cliffs. At last, a short distance down stream we found a large pool at the entrance to the cave. The route beyond will require wetsuits. Making our way back, we cooked some dinner and at about 6:00, Carlos and I went to drop one of the pits above the gorge which was about 100 feet deep and very impressive. We landed on a steep dirt floor which dropped into the canyon. Upon returning, we had tea and talked till 9:30 of tomorrow's plan to go over the hill to the other insurgence at Irma Grande. "I hope it will be better. Less water, fewer nettles, and more cave. My hands and arms are still stinging from the nettles."

July 5.

We slowly broke camp this morning. A lady came by selling roasted meat and potatoes -- tasty. We got out of camp a little before 10:00. My pack felt very heavy as I climbed the steep path 1200 feet to a ridge. From the top the hike is quite easy and the view is lovely. A man told us of a tragedero (insurgence) up the hill from the village of Milpo. He thinks there is a large cave near Llata and another one overlooking the Rio Maranon. The trail traverses the upper slopes of the awesome 3,000 foot deep canyon of the Maranon.

On the way down a dog bit Carlos, who wants to take the dog's brains back to Lima. We think the dog's owner will discourage him.

There are rumored to be good ruins on the ridge overlooking the blind valley we are checking. The valley bottom is covered with deep dirt containing a few sinks. The bottom of the lower doline is disappointing. A seasonal stream course pours into a fissure that is maybe ten feet deep, bottomed by a sleasy pool but with no running water.

We asked a very nice lady, who lived up a little tributary canyon, if there was water about and she took us to one of several foul-smelling mud holes. She told us this is the clean water, which it is, comparatively. The woman is nearly blind from cataracts. We wanted to buy a chicken for dinner, but she told us that many of her chickens had died recently and she couldn't spare one. We settled for soy meat and noodles for dinner. Once we set up camp there, the lady's husband and three children came down to talk. They were quite amiable. He called this sink Sima Chica and the insurgence up valley Sima Grande. Tomorrow, we will check it out. He said it emerged at the level of the

Rio Maranon as many small springs.

July 6.

"Scooping day" in Peru. We struggled half-heartedly out of camp at 10:00. This morning I hit a dog hard with a rock, it was satisfying, yet a little embarrassing, as I didn't see its owner standing nearby. From her, we bought a quart of fresh cow milk.

We arrived at the insurgence and finally found a cave at an elevation of 11,400 feet. I rushed about looking at the tragedero and an upper dry entrance. People showed up from all around to see what we were up to. Everyone is so friendly here. It is a delight.

They told us that there used to be demons down there but a priest came and exorcised them. One man said he went in one night to practice the guitar and by the end of the night, the guitar was playing itself. One lady related the story from her grandmother's youth. Seven gringos (foreigners who talk funny) came to the valley and entered the cave where they discovered within a vast plain with lakes and grazing bulls. In the distance they could see beautiful women who were beckoning. Desirous of conversation, they walked towards them but, as they walked the women became further away. A door suddenly closed, trapping all but one who was bringing up the rear, who escaped to tell the story. We are the first gringos they have seen in this valley.

Armed with these stories, we decided to check out the cave. Orit decided to stay outside with the camp. I was rather impatient to get underground. I dropped down the insurgence about ten feet with a handline. The passage beyond was very wet and there was a scary waterfall, so we decided to use the upper entrance. The locals had fear on their faces as we entered.

A large entrance slopes down and then turns to the right. About 150 feet in, we came to a 30 foot drop into a large room. There is much dried, cracked mud on the floor and the walls are coated with dried mud. Across the room, a short mud chute leads to a 20 foot pitch. A short distance beyond, we came to a 60 foot drop into the stream canyon. A neat high lead takes off for 150 feet to another drop overlooking the stream. Here the cave changed in character from high big rooms and high dome pits to high stream canyon passage. We rigged the drop with the 100 foot rope and headed downstream past a series of rapids and pools through very classic vadose canyon passage. One waterfall on the left came from a passage too narrow to enter. After about 500 feet, the passage sumped. The river slowed and deepened and the roof dropped to water level. The water here is very cloudy. Plant roots grew at this deepest level, perhaps 300 feet from the surface.

Returning to the rope, we followed the upstream passage. The water was very deep, but fortunately by a series of chimney moves and traverses along the wall, we didn't get wet past the waist. After a short canal, the passage becomes smaller with a series of small drops and rapids -- a very clean, exciting cave. We quit after 200 feet at a steep water chute which I tried twice to get up before I quit. We were starting to get cold. We got out at 5:30. We estimated 1,000 feet of total passage with 270 feet of total depth. I think the cave's lowest level is at a local base level. It is about the same level as the sump at Sima Chica.

Tonight our friend Morino came down with boiled potatoes, which were wormy but delicious nonetheless. Morino thinks the water comes out at Morca, a village near the Rio Maranon. He told us he would show us some other entrances tomorrow.

July 7.

We made our coffee with milk today. after the sun had dried our clothes from yesterday's caving, we left with Morino and headed for a doline that we had noted yesterday. There are two sinks at an elevation of 12,000 feet. One is plugged with a landslide. The second has a fissure draining a seasonal stream bed. The fissure at first looked dismal. On further inspection, I located a good hole blowing a strong warm moist breeze. Morino called the sink Gompina.

Our guide said there were more impressive entrances up the hill, so we continued up, climbing to the rim of another large sink with several interconnecting entrances at the bottom. The sink is called Ogoucro. One passage leads to a crawl that seemed to be taking a weak breeze. I pushed about 100 feet of crawl and left it still going. Morino told us that the best was still up the hill. He said there is a pit so deep that one can't hear a rock hit the bottom.

We had to see that, so we climbed quite a distance to the ridge. The pit is just over the other side. The entrance is about 20 feet across and bells out to 60 feet in 120 feet. They call this pit Ashuac. I wasn't sure if I had enough rope. We rigged an anchor by chopping away dirt from around a large rock. The process used a great deal of rope and with our two ropes tied together, it barely touched the bottom. The edge is very clean. The pit is developed in a well crossbedded sandstone of the Goyllarisquizga Group closely

overlying the Pucara Formation.

It was a wild drop. I went down first. Marco followed and had a hard time crossing the knot. Carlos gave up and only descended as far as the knot. At the bottom, Marco found a skeleton with a skull that was deformed by binding the head of infants the way some ancient cultures did. We located ten remains total. The remaining skulls are normal. There are also two remains of some large animals and many dead birds. A breakdown hill in the center of the pit was covered with ferns with lovely spider webs built as a net over them.

The small crowd that gathered above knew nothing of the dead except for one cow robber who was escaping by night and who fell in, together with the cow. Morino knew of one other entrance and showed us a small blind valley draining into a short climbable pit. They called it Hueshcas Ukro. A lovely vadose passage takes off down dip. We explored about 450 feet of it with no end in sight. In the lower part was a tiny stream. Tomorrow we plan to explore it further. Carlos and I went to buy fresh vegetables for dinner. A great day of caving.

July 8.

The third straight day of good caving. Carlos and I invited Morino to accompany us into the cave. The three of us left camp at 9:00 and climbed quickly up. While we were waiting for Carlos, I took my 50 foot rope back to the pit we left yesterday and rigged it. It turned out to be easily climbable. I explored another 100 feet and came to a second, more difficult pit. I left the rope in place for Carlos and Morino, and went back to the entrance to see what they were up to. I found Carlos waiting there; Morino had run off, leaving his lamp running. It was a little puzzling.

Carlos and I headed in. After Carlos was down the first drop, I de-rigged and set it up at the second drop which is about 30 feet deep and also free climbable. From here the cave just dropped and dropped in high but narrow vadose passage. A third drop, about ten feet deep and very smooth, is the only drop that requires a rope. From here, the cave takes on a slightly different aspect. We moved away from the stream in passage that is very low and flat, which descends straight down dip and then opens into some big breakdown rooms. We explored one down until it became tight and briefly explored another room but didn't spend much time with it. Carlos was getting cold and was anxious to get out so we left it there. We kept track of distance and depth on the way out, estimating that we had explored about 1,200 feet of passage and 500 feet of depth. It's quite a deep cave for only having needed 15 feet of rope. Much of the passage is very tight and time consuming. The cave descends to below the level of the valley. I figure there could be as much as 300 feet more depth potential before reaching the water level.

It was overcast and rather windy when we got out. We ate a little and took some photographs before moving on to the hole that was blowing the warm steamy breeze. The entrance is lined with lovely ferns with humidity dripping off. I had to use the 100 foot rope to rig the entrance pit since the rig point is quite a distance away. Carlos was tired and didn't want to go in so I went alone. The drop is a two-level pit with a total depth of 30 feet. It lands in a shallow pool. At the bottom a nice canyon passage leads to a six foot climb over loose rock into more canyon. This brought me to a second pit about 20 feet deep. The way beyond looks like more big canyon. I was getting tired and didn't feel like going back out for the other rope so I only explored a total of 150 feet of passage. The cave has potential to be quite large. Carlos has to leave tomorrow and Marco and Orit want to move on. I feel bad having to leave such a nice lead. We returned to camp and to a dinner of lots of boiled potatoes and split pea soup with onions and carrots.

We never did see Morino again. There were no more visitors at all as a matter of fact. The next day when we walked out of the valley the area was absolutely deserted. At first they had been very curious and outgoing, but after we started going into and coming out of the caves, there was a distinct change in the attitude of the locals. They became very withdrawn.

I feel our coming to the valley was more than a casual event to the campesinos of the area. We were the first gringos they have seen in this valley and the first people to have entered the caves. They don't understand doing this sort of thing for sport. It is difficult to determine how important the caves and the myths surrounding the caves are in the lives of the campesinos. There are few people left in the world who still believe in myths. Should the myths be considered as part of the cave resource? It is a problem which I will consider in the future when working in areas that have had little previous impact from foreigners.

After our group split, I hiked down the Rio Maranon to look for the resurgence. I traversed along the river below spectacular cliffs of Pucara limestone. It was nice to be lower

(9,000 feet) for a short while. A warm campsite was enjoyable. I located the resurgence above the village of Morca at an elevation of 9,700 feet. It is 4.2 miles from Sima Grande. Three local men were curious about what I was doing and accompanied me to the resurgence. They told me it is the water that enters at Irma Grande. The entrance is 20 feet high and 30 feet across. The three men went with me into the entrance room but became afraid and went out. I continued into the cave. The cave becomes much smaller. A series of short climbs and stoopways leads to a large room about 60 feet across with a steep slope rising off to the left. The room has a high fissure ceiling running normal to the flow of the stream. At the far end the passage sumped and I found no way on. Air flow was weak and ambiguous. The total length of the cave is about 150 feet. They call the the cave Huari Uchko. The men told me that in the cave there is a large lake where a giant condor lives. I told them I hadn't gone in that far. They addressed me as engineer. From Morca, I returned to Llata where there was a persistant rumor of a cave in the cliffs of the canyon downstream from town. All I knew was that it is above a waterfall that emerges from a cliff of Cretaceous limestone. It was said to be very large and many people have never come out.

I located a squarish seven foot high entrance on a high ledge overlooking the canyon. There are quite a number of bones scattered around and it soon became apparent that they are human. The cave gets much visitation from locals. There is a fair amount of trash and incredible amounts of graffiti. I fired up my lamp and entered. The passage descends straight down dip and soon becomes a crawl. Even beyond one fairly tight spot there is copious graffiti. Small gypsum flowers grow profusely on the ceiling. The walls are constructed from stones.

The square passage opens back up and continues to drop. In this area I found numerous stalactites and flowstones covered by a black slippery substance. Then it turns abruptly right and the passage becomes a phreatic fissure. It is nicely decorated by the same type of black dripstone.

Shortly before doing a short climb-down, I thought I heard a noise coming from below. Upon reaching the bottom, the noise was distinct. It sounded like a mixture between heavy intermittant snoring and something heavy being drug around. The noise would come and go irregularly, I became timid and tiptoed forward until I was positive that it wasn't an over-active imagination. After listening for a minute, I decided I wasn't in the mood to deal with it and left.

About 300 feet of passage was explored with about 40 feet of depth. I checked the ledge to the end where there is a large Anasazi-type wall, finding along the way six other small caves with all sorts of skulls and bones. In addition there are minor amounts of thick pottery shards, bits of cloth, coconut shells and other small artifacts. None of these caves are longer than 50 feet and all of them had bones.

During the remaining time spent in the area, I collected geological notes for interpretation of aerial photography. The resulting map shows the area to be underlain by an asymetrical syncline with the western limb heavily folded by a probable overthrust as is typical in the Andes. In addition to the caves located in the Pucara Formation, there is potential for caves in the upper Cretacous formations which in this area are probably the Crisnejas, Jumasha, and Celendin Formations. From the photographs I located a number of sinks and possible pits developed on this terrain. That there is an underground plumbing system is obvious from the spring coming from the cliff downstream from Llata.

The blind valley of Irma Grande is associated with an old erosion surface that regionally lies at an average elevation of 12,000 feet. The plumbing system passes through a fault, downthrown to the west. It is possible that there might be phreatic passage developed above the water table that would provide an air connection through. Only further exploration will tell. If it does exist, there is 2000 feet of depth potential which could make it the deepest cave in South America.

I returned to Lima in late July. My plans were to go to northern Peru for a reconnaissance in the Department of Amazonas. While in Lima, I met Kieth Alpaugh who was planning to kayack the Amazon River. He had some time to fill so I mentioned an area west of Huancayo that looked as if it might have caves. He said he might check it.

When I returned from Amazonas in late August I learned that Kieth had made a trip to the area and located a number of very deep pits. He returned to Lima and talked Crag Jones, an English climber, into going with him to drop a few of them. Together, they dropped three pits. He said the deepest was 400 feet. They had done the drop with three climbing ropes tied together. I spent early September in the jungle and in late September I went to Huancayo to see what Kieth had found. From Huancayo, I travelled to the little town of Chaucha by bus and hiked a little over a mile to a campsite at 15,000 feet. Here an

anticline exposes the Condorsinga Formation of Jurassic age. Here are some excerpts from my diary.

September 28.

I left camp at 7:30 and climbed the ridge at the northern end of the anticline and continued up a little peak on the ridge to about 16,000 feet. Below and to the west, two pits could be seen. I descended to check them, but found them to be filled. Circling the peaks to the south, I went to an area where Kieth had indicated a pit on the map and located a pit about three seconds deep at an elevation of about 15,600 feet. I don't know if it is the same one that Kieth had located. It's difficult to see very far here as there are numerous limestone ridges everywhere. On the way down I checked a little seasonal insurgence which was plugged. I returned to camp about 2:00 very tired and a little discouraged. The rest of the day was spent reading and resting.

September 29.

I left camp about 10:00, tired and uninspired. Arriving at the pit located yesterday, I rigged around a protrusion of limestone with my 50 foot rope and dropped my 250 foot piece down the pit. It is a lovely vadose pit, very clean with numerous calcite veinlets in the walls. The pit is 150 feet deep with no passage. I derigged and descended by a different route than yesterday. There is a large sink to the south and on the lip of the sink there is another pit. A passage trending off to the west could be seen. I rested and collected my ambition a while and then dropped it. At the bottom, a passage slopes down for about 20 feet and then ends in breakdown. The pit is about 100 feet deep. I wandered back to camp and rested for the remainder of the day.

September 30.

Today I moved camp down valley about two miles to a lake. It was snowing off and on. I was tired and didn't leave the tent until 1:00 during a lull of the snow storm to check an obvious lead overlooking one of the large sinks. It was a disappointment. Traversing to the south, I located several short pits on the way. One of these is a large pit on a ridge at an elevation of about 15,200 feet. Tomorrow I will check it.

October 1.

Today was a gorgeous cloudless day. I got an early start but was quite tired. I rigged the pit found yesterday and dropped down. It is about 140 feet deep. The only good point to tie off had a horrible line inside a corner. The pit has fissure passage going off in both directions. To the south it ends quickly in breakdown. At the lower end there is a tiny human skull; a dead baby I guess. The other direction sloped down to a ten foot chimney that is very tight. I dropped the end of the rope down and fired up my lamp. It was leaking from the bottom and would periodically catch on fire. then I got stuck trying to get down. I ended up leaving it and climbed out and rested a long time. Taking my rope, I hiked south to the point Kieth plotted the deepest pit. On the way, I met a woman who had met Kieth and Crag when they had visited the area. The area is very rich in short pits and solution features. I located two pits that are an estimated 150 feet deep. Dropping my vertical gear, I headed back to camp. On the way, I met the lady's husband, Porfirio. He told me tomorrow he whould show me a very deep pit on the next hill to the south. Porfirio is very interested in photography and wants to buy my camera.

October 2.

It was overcast and snowing today. I met Porfirio at 9:00. He fed me mutton and pancakes. It was a nice change from cold oats (my stove had broken a month earlier and I was on cold food). We climbed to the top of the hill and found the pit only 100 yards from the summit at an elevation of 15,500 feet. It is within 30 feet of the crest of the ridge and is only about 90 feet deep. There is a small fissure passage extending downwards which didn't look very encouraging and I didn't push it. We descended to the deep pit that Kieth and Crag had dropped. It was snowing hard for awhile.

I rested and took a long time to rig the pit. It was wild doing a long drop. Part way down, Portirio's little son threw in a rock which shook me up a bit. I was really clumsy crossing the knot. The pit is about 330 feet deep. From the bottom, he entrance looks like the sole of a shoe. The snow on the bottom looks like a foot print. The bottom is bleak and gloomy. There are no leads. It took me 20 minutes to climb out. I was really tired at the top. Porfirio pulled the rope out for me. We went to his house where he fed me cinnamin tea and pancakes. It snowed all the way back to the tent. I was quite chilled upon arriving and felt feverish. I'm really run down and plan to leave tomorrow.

I returned to Huancayo the next day. Daily attacks of chills and fever began, which turned out to be Malaria contracted during my time in the jungle. I left Peru on the tenth of October.

I have been able to generate a geological map of the Chaucha area from

aerial photographs. The pits are developed on a simple anticline. The west limb is steeply dipping to vertical and the east limb dips between ten and 30 degrees. Kieth and Crag dropped one pit near an insurgence low on the west limb of the anticline. They estimated it to drop 400 feet in a series of three drops. They ran out of rope and said it is still going down. Practically all the rest of the pits are on the eastern limb. From the aerial photographs, I plotted about 100 pits on the anticline. These range in altitude from 14,600 feet to 15,800 feet. There is no preferential elevation in the distribution of the pits. Some pits show a linear distribution. Local base level is about 14,300 feet. These are the only caves I know of in the Andes not associated with an active vadose system. I'm still a little puzzled about their origins. They are the highest caves that I'm aware of in the world. It was disappointing not to find horizontal cave development, but only a small fraction of the total number of pits were checked. Hopefully, further work in the area will result in a larger cave.

I now have two specific project areas that warrant surveying and further study. In addition, I am getting a feel for what geological settings are favorable for further reconnaissance exploration.

Of southern Peru and the Permian age formations that dominate the limestone there I know almost nothing. The Ayacucho area looks very promising for caves, but at present it is a hot-bed of terrorism and the government might discourage underground activities there. The terrains underlain by Pucara age limestones on the eastern slope of the Andes lack map and aerial photograph coverage. The country is covered by jungle and is very difficult to travel through. North of Huancayo near the town of Tarma lies the Palcamayo district with its vadose caves developed in the Triassic age Chambara Formation (I described these caves in my previous article).

The area I know best is the belt of upper Cretaceous limestones in the north central Sierra of Peru. Developed on this belt is a distinct zone of karst districts. I have defined this zone by the distribution of depressions visible on the 1:100,000 scale topographic maps. It is very rough definition. The belt runs from Lake Lauricocha east of Cerro De Pasco north past Banos and La Union to beyond Llamellin. The Llate area is off the belt to the northeast of La Union. I also described an enticing karst near Llamellin that I briefly investigated in 1985 in last year's article. North of Llamellin the central plateau is nearly eroded away and there are no karsts.

On strike to the north, at the latitude of Pataz, a second zone of karst runs north past Celendin and terminates near the town of Cutervo. There are caves known in the areas of Cajamarca, Celendin and Cutervo developed in the Jumasha Formation equivalents. To the west near the town of Ninabamba lies the cave of Uchkupisjo and several other caves associated with a large underground plumbing system. This system is also developed in a Jumasha equivalent. It was explored and surveyed in 1984 by an expedition from Imperial College in England.

The karsts of the Andes seem to be associated with elevated old erosion surfaces. There is a higher frequency of karst features in areas where the strata is least deformed. The larger caves developed within the karsts are primarily vadose in nature and are developed between these surfaces.

This winter, I plan to study relationships between the karsts and paleoerosion surfaces in an effort to determine favorable localities for future projects. With such an approach, there is a risk of missing large caves. If people had only looked in areas of obvious karst for caves, both the Palcamayo and Ninabamba districts would never have been found. Nonetheless, karst is a logical place to look for caves.

I am planning another trip possibly as early as summer 1987 to survey what I've found and to do another reconnaissance project. I'm looking for strong motivated cavers to accompany me. I have accumulated a substantial collection of references, maps and notes and will be glad to share this information with any interested individuals. I would welcome any comments or criticisms of this article.

Connection Fever At The Cave of the Winds

by Richard Rhinehart
Editor

In the recent years of caver-sponsored digging at the Cave of the Winds, connections between passages have been a very rare occurrence. Other than last year's historic connection between Cliffhanger Cave and the Cave of the Winds (which established the first new entrance to the cave in nearly a century) and the 1982 connection between the Bridal Chamber dig and Cokebottle Crawl, no other dig project had yet resulted in a connection. Until this year, that is.