

ART. XXII.—*The Exploration of Samwel Cave*; by E. L. FURLONG.

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INTRODUCTION.

THE first active work in the exploration of caves in northern California was commenced in the summer of 1902. Though the presence of caves in the region was known for many years, yet no scientific work had been carried on in them. The excellent results derived from the exploration of Potter Creek Cave* stimulated exploration in this region for other caves. Of these the Samwel Cave† has furnished the most valuable results.

The cave investigations have been conducted under the auspices of the Department of Anthropology of the University of California. The exploration of Samwel Cave in 1905 was supported by a grant from the American Archaeological Institute.‡

The work has been carried on under the immediate direction of Professor J. C. Merriam, whom the writer desires to thank for material aid in the work of exploration and in the description of the cave fauna. Thanks are due Mr. Walter King and Mr. William Boynton for valuable service rendered in excavating and removing fossil remains under somewhat hazardous conditions.

History of Discovery.

The initial exploration of Samwel Cave in Shasta Co., California, for scientific purposes was carried on in the summer of 1903. An interesting legend, the scene of which was laid in Samwel cave and told by a Wintun Indian, led to its exploration. This story has a double value in making known an important cave, and in the verification of the legend, which now becomes an interesting piece of Wintun history. The Wintuns believe that caverns are of supernatural origin and have used them as places of magic. A courageous Indian, who had any important undertaking in view, such as a long

* The Exploration of the Potter Creek Cave; by Wm. J. Sinclair, Publ. Univ. Calif., North Amer. Arch. and Eth., vol. ii, No. 1.

† Prelim. Note on Expl. of Samwel Cave, Science, N. S., vol. xx, p. 53; E. L. Furlong.

‡ The above is submitted as a part of a report on investigations carried on under a grant from the American Archaeological Institute for cave explorations in California, under the direction of Professor F. W. Putnam.

hunting trip, or a war expedition, would hide himself in the cave for a certain period, fasting and meditating on the object desired. It was the belief that through this vigil they would obtain good luck and success.

Following is the version of the legend generally current among the Wintuns:—

Many years ago a woman of strong medicine told three Wintun maidens that this cave contained two pools of Sawame or magic water; and that if they bathed in these it would insure good luck and make their wishes come true. Acting on the old woman's advice, they entered the cave, lighting their way with pine torches. They found one pool of water in which they bathed, and then went in search of the second pool which contained the stronger Sawame. Following the instructions of the medicine woman, they climbed to the narrow entrance of a large chamber. Seeing no water here, they went hand in hand through this chamber and into the winding passages leading from it. In one of these they came to a large pit. One girl more curious and venturesome than the others went near the edge and looked down. Craning far over, her foot slipped and she fell over the edge. She would have fallen at once to the bottom but for the supporting hands of the other maidens. The overhanging wall at the edge of the pit was slippery and her efforts to regain the top were vain. The two girls above could with difficulty retain their footing and in their bewildered state did not have sufficient strength to lift her. At last, exhausted and slipping slowly toward the edge, they let go their hold and the unfortunate girl fell into the pit. They heard her strike, and then again far below a faint thud. They fled in fright from the cave and spread the news among their relatives and friends.

Some of the Indian braves went to the cave taking with them lengths of grass rope, which they knotted together and lowered into the pit. They seemed unable to touch the bottom with their rope and could do nothing. Hearing no sound below, after a time they left the place. They said the spirits had gotten the girl.

From this time on the cave was held in profound awe and was seldom if ever visited by the Indians. The white people who settled in the country soon after the event thought the tale was but an Indian myth and gave it little credence.

The first descent into the large chamber of the cave was made by Professor J. C. Merriam and the writer in August 1903, the other chambers having been investigated by our party a short time previous to this. The work commenced in 1903 has been continued during the past two summers.

Description of the Cave.

The Samwel cave is in the belt of Carboniferous limestone exposed along the lower portion of the McCloud river. It is situated about sixteen miles above the mouth and on the east bank of the river. The limestone ridge hollowed by the chambers is at the foot of a spur of Bollibokka Mountain.

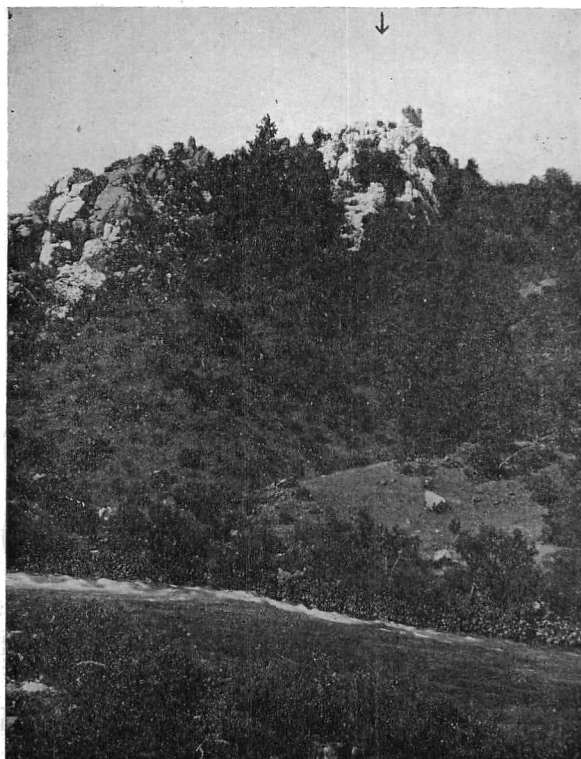


FIG. 1. Location of Samwel Cave. The main entrance is covered by a group of trees on the face of the highest limestone cliff, and below the arrow. The Quaternary entrance to the lower chamber (chamber II) is in the brushy canyon to the right and below. The elevations of the three lowest terraces are given by the grassy flat to the right across the river, by the small patch of open ground to the right above the lowest terrace, and by the highest point on the limestone.

A small canyon which lies to the south has been cut partly through the limestone at its lower portion and leaves a perpendicular limestone cliff as its northern boundary. From this canyon a small cavern penetrates the base of the cliff about

70 feet below, and considerably to the east of the main entrance of Samwel Cave. As this cavern is closely associated with chamber two, it will be discussed with the deposits in that chamber.

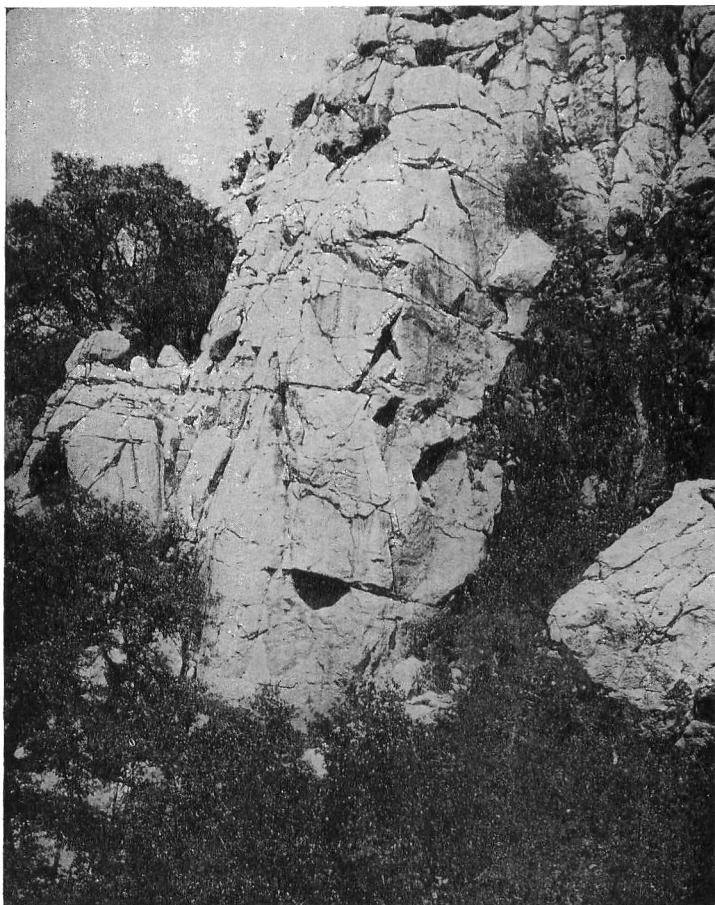


FIG. 2. View looking toward the cave from the canyon to the south. The existing entrance is behind the trees on a prominent rock shelf projecting to the left from the cliff. The Quaternary entrance to chamber two is behind and below the large fallen block to the right.

The main entrance is on a Quaternary river terrace. The terrace is 355 ft. above the McCloud and 1505 ft. above sea level. It is broad and relatively low and gives access to a large open chamber. The cave as a whole is about 352 ft. long and

exhibits considerable beauty in the curious forms of its chambers and in the numerous stalagmite and stalactite growths contained in them. The entrance chamber is 73 ft. long and 50 ft. wide with an average height of 6 ft. At the extreme northeast end a small opening leads to a long series of lower chambers. Of the latter, the two most important will be designated as chambers one and two.

The lowest portion of the floor of chamber one is 24 ft. below its entrance. From a bench 4 ft. from the floor of the northwest corner a narrow, almost vertical shaft drops a distance of 16 ft. to a winding series of chambers below. The first of these contains the first pool of water referred to in the Indian legend.

About on a level with the entrance to chamber one and its extreme northeastern part, a narrow opening leads to a series of rooms running to chamber two. These have a general trend from south to north. The north chamber contains the chimney-like opening to the chamber below. From the floor of chamber two many small grottoes lead out in several directions. At the southeasterly side a low-arched grotto leads to a passage way which will be discussed later.

Character of the Deposits.

The principal deposits are in chambers one and two. The deposit in *chamber one* partly fills a small fissure-like grotto which leads off from this room. It extends into the chamber and fans out, covering a portion of the floor. This deposit is 29 ft. long, an average of 4 ft. wide and is 8 ft. deep in its thickest portion. The section is as follows :

Reddish clay	·1 to ·3 ft.
Stalagmite capping	·1 to ? ft.
Earth mixed with angular gravel	·3 to 1·6 ft.
Breccia	2· to ?
A floor of stalagmite	·1 to ·3 ft.
Earth grading into breccia	1·2 to 4·4 ft.

The deposit was evidently formed by earth and limestone fragments falling from the outside, through an aperture at the top of the grotto. There is now no sign of such an opening. However, earth can be seen on the fissure walls and projections till the walls meet at the top.

That there was an intermission of sufficient time for stalagmite to form before the completion of the deposit is shown by the presence of the false floor. Probably the aperture was choked for a time and later reopened. All of the material of the deposit evidently came in at one place, as it is as much in the form of a low cone as the fissure will allow. The apex

was near the middle of the fissure with its sides sloping to either end.



FIG. 3. A portion of the floor of chamber two, Samuel Cave, after the greater part of the fossil material had been removed. The type skull of *Euceratherium* was still in the stalagmite to the left of the undisturbed skeleton of the Indian woman.

The deposit in *chamber two* has greater surface area but is much shallower than that in chamber one. Its greatest length is 36 ft. from north to south and greatest width 18 ft. From north to south it is on an incline plane, the southern end being

5 ft. below the surface level at the north end. It is composed of thin beds, as follows:

Fine-grained reddish clay01 to	.4 ft.
Stalagmite capping1 "	.4 "
Mixed earth and gravel	1. "	2. "
Stalagmite05	"
Fine earth and gravel2	"

This shallow deposit was derived from material in the cave chamber, angular limestone gravel, stalagmite formed from dripping, and from very small streams of water carrying in material. The earth and clay were carried in by the water and possibly some part of it was tracked in by animals.

On the southeast side a grotto leading off from the chamber shows the sloping stalagmite-covered surface of a deposit that fills a large space between the outside, canyon entrance before referred to and chamber two. The deposit was tunneled through, thus making open communication between the surface and this chamber. The deposit is 56 ft. long, running approximately southeast by northwest; its greatest depth is 28 ft. Its surface in the canyon entrance is covered by blocks of limestone. The deposit in this portion of the cave has been intermittent in its deposition. Strata of mixed earth and gravel and of red earth occur. In about the middle of the beds, in vertical section, a thick flooring of stalagmite appears. It is thicker at places where there has been drip from the roof.

The material of this deposit was carried in by wash and slide from the entrance during the cutting of the canyon. It filled a former entrance of chamber two.

Method of Excavation.

As in the Potter Creek cave, the deposits were sectioned off in numbered squares of 4 ft. That of chamber one was first excavated. A cut was made in the deposit at the entrance to the fissure and carried through to the inner end. The fossil material was removed from benches a foot deep and each specimen labeled as to horizontal and vertical position. As the digging progressed, the waste material was thrown back to the hard floor in chamber one. It was necessary in working through the breccia to use powder and blast, though this was detrimental to the fossils contained in the breccia.

Previous to the opening of the outside passage way to the grotto in chamber two, a ladder 85 ft. long was necessary to gain access to its floor. For this purpose a rope ladder with wooden rounds was used. Two holes were drilled in the floor of the chamber above. In the holes drills were securely imbedded. Thimbles that were fastened in the free upper ends of the ladder were then dropped over the drills and tied

there. The ladder hung free from its upper fastenings to the floor below.

The deposit in chamber two was also sectioned off and the dirt removed section by section. Specimens were frequently cemented by stalagmite to the hard floor at the bottom of the deposit and had to be freed by the use of gads.

The discovery of specimens imbedded in the surface of a stalagmite-covered slope led to the excavation in the southeast grotto leading from chamber two. A low tunnel 20 ft. long was run through this deposit in a southeasterly direction. At the farther end a space 8 ft. high by 4 ft. wide was hollowed out. Falling blocks of stone and the danger of a sudden caving in of the loose dirt above made a discontinuance of the work at this place necessary.

With the object of ascertaining the distance of the tunnel workings from the canyon outside, Professor Merriam made a series of measurements with compass and a tape line from the far end of the tunnel to the top of chamber two and through the winding passages of the cave to the canyon grotto outside. These measurements indicated that the small cave at the base of the cliff in the canyon was but a few feet from the inner tunnel workings. Work was then commenced in the floor of the canyon cave. A shaft was sunk 4 ft. square by 10.5 ft. deep, at which depth a stalagmite floor was encountered. At this place a strong draught of air which made the candles flicker was noticed coming from a stratum of gravel in the cave. A drift 8 ft. long was run at right angles to the shaft in a northeasterly direction. As the drift progressed the draught had perceptibly increased and become so strong and cold as to make working uncomfortable. On continuing in the same direction an opening was made to a series of two sealed grottoes. The surface of the deposit slope formed the floor of these. Signals had been previously arranged so that a person knocking against the walls in the tunnel from chamber two would be understood if heard by those above. When excavation had reached the sealed grottoes, signals could be distinctly heard close by. In moving about the floor to locate the signals from chamber two, we suddenly heard a voice below warning us to move carefully or we should break through. It was found that a distance of only about one and one half feet intervened between the tunnel and the grotto above, and a moment's work with a shovel opened communication with the chamber below.

Fossil Remains.

The deposits in *chamber one* contained a relatively large quantity of material. Teeth and bones of extinct species were found on the surface. Many complete bones were taken

from the loose earth and gravel, also numerous teeth. Fragments and split bones were plentiful. The breccia layer was exceptionally rich in remains. Most of the specimens are in a fine state of preservation. Those on the surface had a coating of stalagmite of varying thickness. When the stalagmite was removed the bone was found to be white and fresh looking although it contained no organic matter. The specimens from the earth were more or less discolored though in good condition. The bones of young individuals in some cases were in a crumbling condition. In the gravel layers a thin incrustation of stalagmite covered the bones. Some old rodent burrows were dug into the upper layer of earth and in these recent rodent remains were numerous. The fragmentary material consisted principally of split pieces of narrow bones. The pieces were in most instances gnawed around their edges by rodents, the marks of the incisor teeth being distinct. Some fragments show long grooves and roughened places on the surface as if they had been crushed between the teeth of large carnivores.

The fossils in this deposit had access through the same opening as the earth and gravel and were deposited with it. That probably there were two distinct periods of deposition is shown by a slight difference in fauna in its top and bottom layers. In the lowest portion of the deposit ground-sloth (*Megalonyx*?) teeth occur, but they are absent in the top layers. So far there are 20 species recognized; of these 8, or 40 per cent, are extinct.

Following is a list of species from the fissure deposit:—

Ursus americanus Pallas.

Ursus, n. sp.

Vulpes, sp.

Putorius arizonensis Mearns.

Aplodontia major Merriam C. H.

Aplodontia near *major* Merriam C. H.

Aplodontia rufa Rafinesque.

Arctomys, sp.

Lepus auduboni Baird.

Thomomys, sp.

Thomomys monticola Allen.

Citellus douglasi Richardson.

Sciurus, sp.

Erethizon epixanthus Brandt.

Eucatherium collinum Sinclair and Furlong.

Haplocerus, sp.

Odocoileus, sp.

Equus occidentalis Leidy.

Elephas, sp. (tooth fragment)

Megalonyx, sp.

The area of deposit in *chamber two* when first viewed presented an interesting spectacle. Its surface was strewn with skulls and limb bones. Near the foot of the ladder lay a cougar skull. It was covered with stalagmite an inch thick but showed the outlines of skull perfectly. Imbedded in stalagmite, the limb bones of the same individual were lying near it. Near the middle section the skeleton of the unfortunate Indian woman was stretched on its side. The pelvic girdle and skull had a thin film of stalagmite crystals over them, and the remainder of the bones were covered by a soft black mould. Near the human skeleton lay the type specimen of *Euceratherium**. In the surface clay and lying loosely about were several raccoon skeletons. Porcupine and other rodent bones were plentiful. Mammal remains were abundant from the top of the deposit to the hard floor below. In the clay and on the stalagmite capping the fossil remains of several Myriopods were found, the exoskeletal structure and form being perfectly represented.

On some of the higher slopes in chamber two and in most of the grottoes there were a number of small skeletons. Of these, several were porcupines and raccoons. An almost complete porcupine skeleton with the bones lightly covered by stalagmite was found in one of the grottoes. In most instances the enveloping stalagmite tended to keep them in perfect condition. A marked feature of the specimens deposited at this place was the completeness of several skeletons and the unbroken condition of skulls and limb bones. For this reason the supposition of entrance through the opening 85 feet above would be improbable. The presence of entire skeletons of bear, cougar, *Preptoceras* and small carnivores led to the belief that the animals with the exception of the ungulates had free access to the cave at some previous time. The later work of excavating from the southeast grotto to the canyon cave proved the belief to be correct. From the slope in the grotto, where the tunnel was run, to within 8 feet of the surface at the outside entrance, scattered parts of individuals like the animals in the main deposit were found. The well-known hibernating habit of bears readily accounts for their presence in the chamber. At the present time hunters in that region make the rounds of the known caves where bears are in the habit of housing for the winter. It is not uncommon for cougars to use such places for a lair. It is not improbable that bears and cougars used chamber two when entrance was possible. It is true such animals do not care to go far from the light, but it would not have been necessary during the time the cave was inhabited. The deposit filling the old

* Furlong and Sinclair, Bull. Dept. Geol. Univ. Calif., vol. iii, p. 411.

entrance is of considerable extent and fills a large space that when clear would probably permit rays of light to penetrate to some of the deeper parts of the chamber.

That bears and cougars prey on ungulates and smaller mammals is well demonstrated in the present day, and the finding of large quantities of scattered and broken ungulate material, such as deer, *Euceratherium*, *Preptoceras* with many rodents, as rabbits and gophers, supports the view that they were brought in by carnivores. The large carnivore skeletons were found in several cases to be nearly complete and but little disturbed, and the supposition that the carnivores inhabited the cave and were in the habit of dragging their prey to the lair to feast on it at leisure, is probably correct.

Following is a list of the species represented in chamber two and in the deposit leading from the chamber. There are 21 species, of which 6, or 28·5 per cent, are extinct.

- Ursus*, n. sp.
- Ursus*, sp.
- Urocyon townsendi* Merriam C. H.
- Procyon* near *lotor* Linn.
- Felis* near *hippolestes* Merriam C. H.
- Mephitis occidentalis* Baird.
- Mustela*, sp.
- Aplodontia* near *major*.
- Erethizon epixanthus* Brandt.
- Lepus auduboni* Baird.
- Lepus*, sp.
- Microtus*, sp.
- Neotoma fuscipes* Baird.
- Neotoma*, sp.
- Sciurus*, sp.
- Citellus douglasi* Richardson.
- Euceratherium collinum* Sinclair and Furlong.
- Preptoceras sinclairi* Furlong.
- Odocoileus*, sp. (a)
- Odocoileus*, sp. (b)
- Megalonyx*, sp.

Age of Samuel Cave Fauna.

The Samuel fauna through its percentage (over 30 per cent) of extinct species, and its typical Quaternary species, as the ground-sloth, *Equus occidentalis*, *Teonoma spelæa*? *Ursus* n. sp., *Elephas*, *Euceratherium* and *Preptoceras*, establishes its age as Quaternary.

A comparison of the species from chamber one and chamber two shows a greater percentage of extinct species from the former. That the remains may have had entrance to chamber one many years before it was possible for chamber two to be

used by animals or for their remains to reach it, is shown by the relative positions of the two entrances. Though the former entrance to the fissure in chamber one is closely sealed, its outer opening could only be from the top of the cliff the cave is in. The entrance to chamber two from the canyon bed is a hundred or more feet below the point where the fissure entrance was probably located. The additional time required for cutting of the canyon to the depth of the lower entrance would be considerable.

The foregoing reasons, viz: the faunal difference and the probably greater age of the entrance to chamber one, tend to show that the fissure deposit is older than the deposit in chamber two.

While the faunas of Potter Creek Cave and Samwel Cave are both Quaternary and are closely allied, there are some differences that suggest difference in age. *Preptoceras* and the Porcupines are present in Samwel Cave and absent from Potter Creek Cave. *Arctotherium*, *Camelus*, and *Mastodon* are present in Potter Creek Cave and absent from Samwel Cave. These faunal differences are probably to be correlated with a difference in the physiographic relations of the Samwel Cave and indicate that it is of somewhat later origin than the Potter Creek cave. In support of this hypothesis, the river terraces of the McCloud canyon offer some evidence.

On both sides of the McCloud canyon at Samwel Cave several distinct terraces are visible. Across the McCloud, south of Bollibokka, well-defined terraces are cut in Hirtz Mt.; the lowest of these is 27 feet above the river. Above the latter, approximately 150 feet higher, is a smaller terrace. Between this and a terrace approximately 300 feet higher several small benches occur. The 177 ft. terrace corresponds to a level but a short distance below the canyon cave entrance. The 300 ft. terrace is on a level with the top of the cliff over the main entrance to the cave. One of the small benches between the 177 and 477 ft. terraces corresponds to the level of the main entrance itself. It is probable that when the McCloud river flowed at a level 477 ft. higher than its present height opposite the cave, and when making the terraces at that height on Hirtz Mountain, the cave was being partly carved out by solution and subterranean water flow. During subsequent river cutting to the terrace in front of the upper cave entrance, the large chambers were formed. The time represented by the cutting between this last terrace and the one just below the canyon entrance was the period when mammals inhabited portions of the cave and the deposit in chamber one was formed. During the latter part of this period chamber two was opened and occupied. When the river cut to a still lower level and the

canyon on which the lower cave entrance opens was deepened, the lower entrance was gradually filled.

The terrace 477 ft. above the river on Hirtz mountain corresponds to the level of the top of the cliff over the Samwel Cave and probably represents also the present elevation of an early terrace stage mentioned by Dr. Sinclair.* It is 240 ft. above the river level at Baird and is represented by gravel-strewn terraces at that height. This being the case, considerable time must have elapsed after the opening of Potter Creek Cave, which opened at the 800 ft. level and prior to the opening of the Samwel Cave.

Possible Quaternary Artifacts.

In the course of excavation numerous split bones were encountered. Most of these have many marks made by rodents and large carnivore teeth. Some have been gnawed around their entire edge. Split bones were also found that have polished surfaces like some of those described by Sinclair from the Potter Creek Cave.

A piece of chipped lava was removed with some bones a few inches below the surface in the deposit in chamber one. It was found after the firing of a blast and may have fallen in from the surface, though its being covered by a film of stalagmite may support the belief that it was in place.

A chipped obsidian was removed from a bucket of earth and gravel hoisted from a depth of several feet while sinking the shaft through the deposit filling the lower entrance to chamber two.

The description and discussion of the archæological value of these specimens by Professor F. W. Putnam is in press at the time of writing this report.

University of California, May, 1906.

* Univ. Calif. Publ. Am. Arch. and Eth., vol. ii, No. 1, p. 24.