segments. In *Argeia,* therefore, the 'lames pleurales' are in two parts, an anterior and a posterior part, and it is not exact to refer to these thoracic processes, which arise from the posterior portion of the segments, as the 'lames pleurales' of the segments.

In conclusion, I wish to state that I am not more willing to accept the 'loi naturelle' than I was to accept the 'hypothèse' postulated by Giard and Bonnier until its confirmation has been maintained by facts. Professor Giard states that I have not carefully studied *Argeia pugettensis* coming from different hosts. I hope soon to give in greater detail the results of my researches on this form and on *Bopyroides hippolytes.*

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HARRIET RICHARDSON.

SPECIAL ARTICLES.

AN ACCOUNT OF THE PRELIMINARY EXCAVATIONS IN A RECENTLY EXPLORED QUATERNARY CAVE IN SHASTA COUNTY, CALIFORNIA.

IN the summer of 1902 the writer was commissioned by the department of anthropology of the University of California to search for Quaternary caves in the belt of Carboniferous limestone exposed along the lower portion of the McCloud River. The work of that year led to the exploration of the Potter Creek cave which has already been described in SCIENCE.*

* Wm. J. Sinclair, SCIENCE, N. S., Vol. XVII., No. 435, pp. 708–712, May 1, 1903.

During the summer of 1903 further explorations were carried on by the writer under the direction of Professor J. C. Merriam, in the hope that caves of somewhat later age might be discovered. As a result of this work cave deposits containing remains of Quaternary mammals have been found in several new localities. Of these, the cave containing the largest quantity of remains is so situated with relation to the topography of the region as to indicate that it is younger than the Potter Creek Cave. To this cavern the name Samwel cave has been given, owing to the presence in it of a pool known among the Wintun Indians as 'Samwel,' or spirit water. An Indian legend to the effect that a Wintun maiden had fallen into a very deep well in the cave while searching for water led to the most important discoveries made here.

The Samwel cave is situated on the east bank of the McCloud River and about sixteen miles above its mouth. The entrance is on a Quaternary river terrace. Measurements kindly furnished the writer by Mr. J. S. Diller, who visited the cave with him, show this terrace to be 355 feet above the McCloud River and 1,505 feet above sea level. The entrance is a large, low arched vestibule leading to a series of galleries which widen again to large chambers.

The first chamber is about twenty-five feet long. At the southeast end a vertical fissure about thirty feet high extends twenty feet into the wall. The top is arched over and the bottom is filled with a deposit of clay and stalagmite containing many bones. The highest point on this deposit is near the middle of the fissure. From this place it fans out, fills the farther end and slopes down to the floor of the main chamber where it spreads out. It has been excavated to the depth of four feet, and is seen to be composed of several strata. The whole is covered by a stalagmite capping varying considerably in thickness.

Many remains were taken from this deposit. They include limb bones, vertebrae, teeth, jaws and a large number of splintered bones. In the deposit on the floor of the chamber, near the entrance of the fissure, a dis-

tinctly chipped fragment of black lava was found six inches below the surface. Associated with it were splintered bones and remains of extinct mammals. It is possible that the flint may have fallen in from the surface or worked its way there through a small crevice in the floor, but before commencing excavation the floor had been cleared of all loose material and no crevices were observed. While not of the most conclusive character, the evidence seems to favor original association of the objects found. Bones of several extinct mammals were found cemented to the top of the stalagmite capping.

Following is a list of the species found here:

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.
Euceratherium sp.
Haplocerus sp.
Odocoileus sp.
Equus occidentalis Leidy.
Elephas sp. (tooth fragment).
Megalonyx sp.

The materials in the fissure deposit had access at some remote date through an opening in the roof. Of this no trace can now be seen, owing to stalactitic growth. Its source was indicated by streams of bones and earth found on projecting ledges and in pockets in the fissure walls.

On the sides of the chamber opposite the fissure several small openings lead to a lower series of galleries, in one of which a large pool of water winds among the rocks. At two places in the lower labyrinth of galleries there are deposits similar to that in chamber one and from these bones and teeth were taken. From the position of these deposits they appear to have entered through fissures leading from some other chamber or from the surface.

High on the south wall of chamber one and difficult of access is an entrance to a second and larger cavern. This has a high arched roof and several tunnel-like grottos lead from it. Through a crevice caused by a fault, a great quantity of earth, angular limestone fragments and gravel have partly filled this room.

At the farthest end of one of the grottos is an oval pit-like opening, which seemed to correspond to the description of the well into which the Indian maiden fell. To explore this pit, holes were drilled in the hard floor of the grotto and into these steel pins were set for the support of a rope ladder. The well was found to widen towards the lower end and was really but the chimney of a large cavern. The skeleton of the Indian maiden lay immediately below the opening and over the greater part of the floor were strewn many bones of bear, cougar and a large extinct goat-like animal.*

The deposit on the floor of this chamber is an accumulation of mud, stalagmite and gravel. This has been excavated, in places, to a depth of four feet, and in that thickness shows six distinctly separated layers of clay, breccia and stalagmite.

Mammal remains were very abundant over the floor and through all the strata excavated. In many instances whole skeletons of carnivores and of rodents were found. There are many complete skulls and numerous dissociated limb bones. The stalagmite encrusting some of the specimens was from one to two inches thick, the bone below the covering being in a perfect state of preservation. Among the fragments are numerous split bones. Some specimens show scorings of rodents' teeth and others bear marks made by the gnawing of large carnivores.

Following is a provisional list of species from this chamber (No. II.):

Ursus n. sp.
Ursus sp.

* *Euceratherium collinum* Sinclair and Furlong. See *Univ. of Calif. Pub. Amer. Archeol. and Ethnog.*, Vol. 2, No. 1, p. 18.

Urocyon townsendi Merriam, C. H.
Procyon near *lotor* Linn.
Felis 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 & Furlong.
Euceratherium n. sp.
Odocoileus sp. (*a*).
Odocoileus sp. (*b*).
Megalonyx sp.

The majority of the remains discovered are those of large carnivora or of cave-inhabiting rodents. This would indicate that these animals have lived in the caves. Such evidence is supported by the fact that the remains of ungulates and other forms which would naturally fall prey to the carnivora are generally much scattered and broken, and in some instances show marks of carnivore teeth.

The position of the present entrance precludes the supposition that any animal could by means of it have gained entrance to this chamber. It is seventy-five feet above the cave floor with a straight drop from top to bottom. The approach to this chimney is through several difficult and tortuous galleries, a route which animals would not follow, as it is far from the light.

Under a portion of the overhanging wall at the southwest side of chamber two, a small fan of stalagmite-covered detrital matter sloping from the outside may mark a former entrance now entirely choked and sealed by the heavy stalagmite growth. It was possibly at this point that animals had access to the chamber, as there is now no outside entrance.

A full report on this investigation will appear later in the Publications of the University of California.

E. L. FURLONG.

UNIVERSITY OF CALIFORNIA,
April, 1904.

VITALITY OF PSEUDOMONAS CAMPESTRIS (PAM.) SMITH ON CABBAGE SEED.

BLACK rot of cabbage and cauliflower, caused by *Pseudomonas campestris* (Pam.) Smith, is a widespread and often destructive disease in the United States. The experience of farmers indicates that the disease may be transmitted by means of the seed; but plant pathologists have doubted this because it seemed impossible that the organism could retain its vitality for several months on dry seeds. *P. campestris* forms no spores. Moreover, Russell and Harding* found that when fresh bouillon cultures were dried at 29° C. on cover slips and kept in darkness 'an exposure of 45 hours invariably sufficed to destroy the vitality of the organisms.'

Recently the writers have investigated this subject and find that *P. campestris* may live on dry cabbage seed for at least ten months. A quantity of cabbage seed was wet with water into which a culture of *P. campestris* had been thoroughly stirred. The seed was then dried and stored in test-tubes in darkness. Some tubes were simply plugged with cotton, while others were plugged with cotton and then sealed with paraffin. Once a month the seeds were tested for the presence of living germs of *P. campestris*. This experiment is unfinished; but at the end of ten months some live germs were found (both in paraffined and in unparaffined tubes) and healthy cabbage plants inoculated with these germs showed the characteristic lesions of black rot in from one to three weeks.

The writers have also proved that germs of *P. campestris* actually do occur on cabbage seed. Four black-rot-infected seed-cabbage plants from Long Island were threshed separately and the seed rinsed in sterile water. Cultures of this water showed the presence of *P. campestris* on three lots of seed. The identity and pathogenicity of these cultures were proved by inoculations into plants. Other portions of the water were injected directly into plants and black rot produced in six out of twelve cases. On combining the re-

* Russell, H. L., and Harding, H. A., 'A Bacterial Rot of Cabbage and Allied Plants,' Wis. Agr. Exp. Sta. Bul. 65: 19.