

elevata as being taken at New Bedford Harbor, but nowhere have I yet found it mentioned as being found attached to Synapta; and we, so far as I know, have never taken it except on Synapta. At the same time, one may dig a number of Synapta and not find *Montacuta*. If I were sent out to collect *Montacuta* I should certainly go where Synapta was common or abundant.

TWO NEW SPECIES OF MONADENIA FROM
NORTHERN CALIFORNIA

BY G. DALLAS HANNA AND ALLYN G. SMITH

Collections made during recent years have contained representatives of two species of *Monadenia* that cannot be identified with any of the known forms. The first is widely distributed in the northern part of California but the second is known only from Samwel Cave and Potter Creek Cave in Shasta County, where it was associated with numerous Pleistocene mammals in a state of preservation that shows the two groups were contemporaneous. The cave fauna was investigated several years ago by parties from the University of California and we are indebted to Messrs. E. L. Furlong and C. L. Camp for the privilege of describing the shells.

MONADENIA CHURCHI Hanna & Smith, n. sp. Plate 5, figs. 1-5; plate 6, fig. 8.

Shell medium sized, non-carinate, umbilicate; with a somewhat low spire; whorls $5\frac{1}{4}$, evenly rounded; outer lip slightly reflected; color pale brown, with a peripheral band of darker brown than the rest of the shell bounded above and below by light cream-colored bands, the upper about equal in width to the dark band, the lower a little wider; nuclear whorls $1\frac{1}{3}$, sculptured with densely set, wavy, somewhat elongated tubercles arranged roughly in spiral order; remaining whorls with sparse elongated tubercles, grouped principally in a protractive spiral order, more pronounced on the upper surface, becoming obsolete on the lower surface

and in the umbilicus. Extremely fine, wavy, axial sculpture is pronounced on the postnuclear whorls and is superimposed on the somewhat irregular, low, axial growth-ridges, but does not extend to the top of the tubercles. This sculpture gives the shell a moderately smooth, dull appearance when viewed without a lens.

Holotype: No. 5806 (Calif. Acad. Sci. Type Coll.), from 2.1 miles East of Payne's Creek Station, Tehama County, California; Allyn G. Smith collector, February 21, 1931; one paratype and 16 additional specimens were collected at the same place in a well-shaded lava rock-slide; these are No. 3729 of Mr. Smith's collection. Paratype: No. 5807 (C. A. S. Type Coll.), from "Deer Creek, Tehama County, California"; E. W. Gifford, collector, November 2, 1914.

The following material has been examined:

Lava rock-slide, 2.1 miles East of Payne's Creek Station, Tehama County, California; A. G. Smith, collector, Feb. 21, 1931; No. 3729 (A.G.S.); 18 adult and 10 young and broken specimens; six of the adults were living when found. Type lot.

Near Butte Creek, Tehama County, California, 22 miles East of Chico on the road to Butte Meadows; A. G. Smith, collector, Feb. 22, 1931; No. 3865 (A.G.S.); one immature specimen.

Deer Creek, Tehama County, California; E. W. Gifford, collector, Nov. 2, 1914; No. 20025 (C.A.S.); one specimen. Paratype.

Shasta County, California; J. A. Kusche, collector; No. 21908 (C.A.S.); one broken specimen.

Grass Valley Creek, Trinity County, California, 4 miles West of summit (county line) on the Redding-Weaverville highway; G. D. Hanna, collector, June, 1931; No. 25652 (C.A.S.); two broken adult specimens, one alive.

Cedar Creek, 6 miles East of Ingot, Shasta County, California; G. D. Hanna and J. L. Nicholson, collector, July, 1929; No. 24120 (C.A.S.); four badly weathered and broken shells.

Trinity Alps Camp, Stuart's Fork of the Trinity River, 12 miles Northeast of Weaverville, Trinity County, California; G. D. Hanna, collector, June, 1931; No. 25674 (C.A.S.); four dead specimens, three of which were broken.

These various lots have the following measurements, in mm.

Number 3279 (A.G.S.), Payne's Creek.

Diam. 20.0	Alt. 11.3	Holotype	Diam. 18.3	Alt. 10.8
19.7	11.0	Paratype	18.3	9.7
18.6	10.4		20.8	11.5
18.3	10.5		20.0	11.1
19.2	11.1		20.3	11.5
19.4	10.6		18.0	9.7
17.8	10.8		19.6	10.8
19.5	11.2		19.7	10.7
18.7	10.4		19.1	10.5

No. 20025 (C.A.S.), Deer Creek, paratype.

23.5 13.6

No. 21908 (C.A.S.), Shasta County.

20.7 11.0

No. 25652 (C.A.S.), Grass Valley Creek.

21.9 14.0

No. 25674 (C.A.S.), Stuart's Fork, Trinity River.

22.6 13.5

20.3 11.6

20.7 11.4

The species has a fairly wide distribution in north-central California. It has been found chiefly in rock-slides but a few specimens were collected under forest debris in heavy shade. In the series examined the diameter ranges from 17.8 mm. to 23.5 mm.; the altitude ranges from 9.7 mm. to 14.0 mm.

In many living adult specimens the epidermis, apparently very thin, is badly eroded on the spire. As a result few mature shells in first class condition were found. The tubercles are usually elongate in a protractive spiral direction but do not have any regular arrangement otherwise. The tops of the tubercles are polished and do not bear hairs in most of the individuals examined, but in some of the specimens from Trinity County there is evidence of short blunt extensions of the epidermis in the umbilical region; these do not leave a pit or other mark on the tubercles when they are removed or absent. The shape of the tubercles is usually elongate spirally but this is subject to considerable variation even on the same specimen, some of them being round or pear-shaped.

The material at hand gives evidence of the existence of

several different races, each with minor variations that are not sufficiently pronounced to warrant describing them as subspecies. The paratype from Deer Creek is the largest and heaviest shell so far found. It differs from the type and from the others in the type lot by its larger size, somewhat lighter color, more reflected lip, and more thickly set tubercles, which are strong on the base and in the umbilicus as well as on the upper surface. Specimens from Trinity County are darker in color than those in the type lot and the tubercles are crowned sometimes with minute fin-shaped projections of the epidermis.

Specimens from the type lot have been placed in the collections of the United States National Museum, the Philadelphia Academy of Sciences, and in the private collections of S. S. Berry and E. P. and E. M. Chace. Named for Mr. Clifford C. Church, who has rendered able assistance on many field trips.

Notes on anatomy.—The individual that was dissected had started to form the outer lip of the shell but this was not complete; on account of this immaturity it is possible that the various organs had not reached their full size and proportions. The presence of the single unbranched mucous gland on the dart sac (Plate 6, fig. 8) proves conclusively that the species should be allied with the group *Monadenia*, as defined by Dr. Pilsbry.¹ He illustrated the genitalia of *fidelis*, the type of the genus² and we have investigated *infumata*, which agrees in all essential characters. Details differ among the several species as would be expected but none of them have the branched mucous gland, which seems to be characteristic of *Helminthoglypta*.

The mantle of *M. churchi* has a series of jet-black irregularly-shaped spots, sparsely arranged over the surface. The jaw has seven heavy ribs. There are 24 rows of teeth on each side of the central and the first laterals have a small cusp on the inner side.

To this time four species have been found to belong defi-

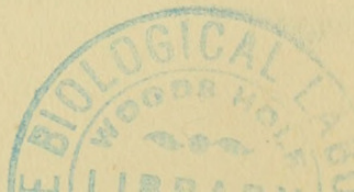
¹ Pilsbry, H. A., *Manual of Conch.*, ser. 2, vol. 9, 1895, p. 198.

² *Op. cit.*, pl. 59, fig. 81.

nitely to *Monadenia*. These are *fidelis*, *infumata*, *mormonum*, and *churchi*. In addition, the new species *troglo-dytes*, to be described later, probably belongs to the same group. Some others, especially those that belong to the large *mormonum* assemblage, are expected to fall into the genus also.

In order that a direct comparison may be made with a member of the genus *Helminthoglypta* a drawing of the genitalia of *H. cypreophila* (Newcomb) is furnished (Plate 6, fig. 9). The animal that was dissected for this last drawing came from 1 mile west of Columbia, Calaveras County, California, and was collected in 1930 by the writers. In extracting the soft parts from the shell the body was broken in two near the base of the mantle cavity and as a consequence the distal parts of the genital organs are missing. The anatomy presents some puzzling features. The penis system is elongated to such an extent that the retractor muscle is reduced in length to not over one millimeter, and serves merely as an attachment of the penis to the floor of the mantle cavity. Much farther back on the penis, the long flagellum is attached and the vas deferens is also attached at this latter point. The spermatic duct is very long, a flagellum-like branch being attached at about its lower third. In the animal dissected this duct was free. The spermatic duct was attached to the oviduct toward the lower end and this, in turn, was attached to the vagina near the opening to the exterior. The penis was attached at the same point. A large sac-like cloaca had the short dart-sac on the upper end and to this was attached the common duct of the two mucous glands. The glands themselves were large and spindle-shaped, and seemed to be filled with a yolk-like material. At the upper end of each gland a short tube led to a large irregularly-shaped pouch containing many folds. In one of the tubes were three small spherical bodies having the appearance of eggs. The essential details of *cypreophila* are therefore seen to agree with *Helminthoglypta* and not with *Monadenia*.

Incidentally it may be recorded that the necessary dissec-



tion for differentiating these two genera is quite simple and may be done under an ordinary dissecting microscope. It is necessary merely to ascertain whether the mucous gland is single or double, an operation that requires but a few minutes. It should be performed for more of the large California land snails.

MONADENIA TROGLODYTES Hanna & Smith, n. sp. Plate 5, figs. 6-8.

Shell light buff, medium size, widely umbilicate; spire greatly depressed; whorls $5\frac{1}{2}$ with moderately deep suture; the last whorl slightly depressed near the aperture; outer margin expanded very little, the basal margin somewhat more so; one narrow pale brown spiral band appears just above the periphery, which is bounded above and below by white bands that are slightly wider; surface without markings except growth lines; nucleus consisting of $1\frac{1}{2}$ whorls marked by radiating wavy riblets. Diameter 24.2; altitude 10.8 mm.

Holotype, No. 32394 (University of California, Dept. of Paleontology), from Samwel Cave, Shasta County, California; pleistocene. Paratype No. 5842 (Calif. Acad. Sci. Type Coll.), from the same locality.

The above is a description of the holotype, which, with the other specimens found, is in a semi-fossil state and completely denuded of the epidermis. Variation in size is shown by the series of measurements of specimens examined, which follows:

No.	Diam.	Alt.	No.	Diam.	Alt.
1008	24.2 mm.	10.8 mm.	1055	21.6 mm.	10.1 mm.
1008	22.5	10.6	1055	27.5	11.3
1008	26.2	12.0	1055	24.5	11.4
1008	25.0	11.7	1055	23.9	11.3
1008	24.1	11.5	1055	24.6	11.3
1008	23.8	10.5	1055	22.9	11.0
1008	26.3	13.0	1055	23.8	11.0
1008 ³	25.0	11.6	1055	24.8	11.3
1009	22.3	9.8	1055	26.2	12.3
1009	25.3	12.0	1055	24.9	11.1
1055	23.0	11.5	1055	24.6	11.3

³ Paratype, C.A.S.

No. 1008 (U.C.), Samwel Cave, Ch. 1, Sec. 2-5. No. 1009, Samwel Cave, in gravel slope filling grotto at South end. Ch. 2, Sec. 4. No. 1055, Potter Creek Cave. "Past kitchen."

In the excavation of Samwel Cave the chambers were divided into sections and an accurate record was kept of exact locations and depths of the various specimens collected. (See report by Furlong referred to below.)

The diameter varies from 21.6 mm. to 27.5 mm., and the altitude from 9.8 mm. to 13.0 mm. This is exceptional uniformity for such a series of California land shells. All of the shells are greatly depressed, the most extreme specimen being almost planorboid.

Some of this series of shells were examined several years ago by one of us (G. D. H.) at the request of Mr. Eustace Furlong, when they were thought to belong to *M. mormonum* (Pfr.). Since then we have obtained abundant material of this species from Mormon Island, the type locality, and a comparison shows at once that the cave shells are decidedly different. The most noticeable characters of the latter are the greatly depressed spire and the wide umbilicus. In these respects *M. circumcarinata* (Stearns) is suggested although there is a complete absence of the strong ribs so characteristic of that form.

Locality Information.—An interesting account of the discovery and exploration of Samwel Cave has been given by E. L. Furlong.⁴ The cave is located in carboniferous limestone in Shasta County, California, along the East bank of the McCloud River, 16 miles above its mouth. Potter Creek Cave is in the same county and Wm. J. Sinclair has given an account of the exploration of it.⁵

In neither account is there a statement regarding the presence of land shells but Mr. Furlong has informed us verbally that in Samwel Cave there was no question but that the shells were in the same stratum with the bones. This of course is

⁴ Furlong, E. L., The Exploration of Samwel Cave. Am. Jour. Sci., ser. 4, vol. 22, 1906, pp. 235-247, 3 text figures.

⁵ Sinclair, Wm. J., The Exploration of the Potter Creek Cave. Univ. Calif. Publ. North Am. Arch. & Eth., vol. 2, No. 1.

borne out by the fact that the species is extinct. There is abundant evidence from mammalian remains that the caves were more or less freely accessible to animals from the outside during the long period of the Pleistocene.

EXPLANATION OF PLATES 5, AND 6

PLATE 5, Figs. 1, 2, 3. *Monadenia churchi* Hanna & Smith, n. sp. Holotype No. 5806 (C. A. S.) from 2.1 miles East of Payne's Creek Station, Tehama County, California. Diameter 20.0 mm.; altitude 11.3 mm.

Figs. 4, 5. *Monadenia churchi* Hanna & Smith, n. sp. Paratype. No. 5807 (C. A. S.) from Deer Creek, Tehama County, California. Apex and part of upper side of body whorl, enlarged about $\times 15$ to show details of sculpture. Diameter 23.5 mm., altitude 13.6 mm.

Figs. 6, 7, 8. *Monadenia troglodytes* Hanna & Smith, n. sp. Holotype No. 32394 (Univ. Calif. Dept. Paleo. Coll.) from Samwel Cave, Shasta County, California. Pleistocene. Diameter 24.2 mm., altitude 10.8 mm.

PLATE 6, Fig. 8. *Monadenia churchi* Hanna & Smith, n. sp. Genitalia of specimen from type lot, 2.1 miles East of Payne's Creek Station, Tehama County, California.

Fig. 9. *Helminthoglypta cypreophila* (Newcomb). Genitalia of specimen from 1 mile West of Columbia, Calaveras County, California.

TWO NEW LAND SHELLS FROM THE SOUTHERN APPALACHIANS

BY W. J. CLENCH AND A. F. ARCHER

The following report contains descriptions of the new land shells obtained during the past summer as well as a list of all the land mollusks collected at Mt. LeConte in the Great Smoky Mountains of Tennessee.

This field trip was made as part of a general survey of the southeastern states, first undertaken by the senior author under the auspices of the University of Michigan and since continued by the Museum of Comparative Zoology with financial aid from the University of Michigan, the Academy



Hanna, G D and Smith, A. G. 1933. "Two new species of Monadenia from northern California." *The Nautilus* 46, 79–86.

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