NUMBER 399 FEBRUARY 9, 1939

OCCASIONAL PAPERS OF THE MUSEUM OF ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN UNIVERSITY OF MICHIGAN PRESS

# *HENDERSONIA OCCULTA* (SAY) IN MICHIGAN; ITS DISTRIBUTION, ECOLOGY, AND GEOLOGICAL SIGNIFICANCE

BY HENRY VAN DER SCHALIE

DURING the course of a recent expedition[1] into the Upper Peninsula of Michigan for the purpose of collecting land shells, my wife and I were much surprised to find a colony of *Hendersonia occulta* (Say) on the banks of the Bark River, about five and one-half miles southeast of the town of Bark River, Delta County, Michigan. An examination of the previous distribution records reveals not only that this colony provides the first record of occurrence for this species in Michigan, but also that the Bark River station is the most northern locality from which it has ever been taken. This station is located well above forty-five degrees north latitude, whereas the nearest records of Holzinger, who collected *occulta* at Stockton and Winona, Minnesota, and Marston, who found it at Depere on the Fox River in Wisconsin, are below this line of latitude.

The distribution of *H. occulta* in the Bark River region proved to be decidedly sporadic. Though several stations were established within a radius of several miles around Bark River, not a single specimen of *occulta* was found. This observation

[1] The expedition was made possible by a grant from the Horace H. Rackham School of Graduate Studies.

is in agreement with the accounts of others who have commented on the extremely local distribution of the species. In order to provide a better picture of the distribution of *H. occulta* a small outline map has been prepared (Map 1). From the map we may note particularly (1) the unusual width of the range, (2) the wide separation of the colonies, and (3) the close association of each colony with some stream or lake. The latter observation has not been stressed in the past, and it is my belief that this omission has been unfortunate in view of the important role that *H. occulta* plays in the interpretation of Pleistocene geology. This matter will be discussed more fully later in the article.

The late Professor Shimek defined the ecology of *H. occulta* as follows (1904: 176):

> Invariably the specimens were found in rough, well-wooded territory, in loose leaf-mould, and under and among the fallen leaves, etc., which usually carpet the surface between the smaller plants which are characteristic of such shaded hillsides. In some of these localities the surface was also strewn with scattered fragments of limestone. The shells were invariably found on high grounds which were not subject to overflow.

No mention is made here of the fact that *H. occulta* usually inhabits an area in close proximity to a stream or other body of water. Furthermore, the statement is definitely made that this species is invariably found on high ground *not subject to overflow*. This, as will be indicated, was not true for the colony under consideration in this paper.

More recently Morrison (1929) reported *H. occulta* in southwestern Wisconsin where it was found along the banks of the Kickapoo River. According to the data given for the stations in his article it is clearly indicated that *occulta* was found on wooded slopes in the immediate vicinity of the stream. However, in the zone described as Station VI where there were smaller (p. 44) "ravines with no permanent streams in them," *H. occulta* was strikingly absent. Morrison mentioned the ecological preference of *occulta* but failed to notice that in its habitat it requires the proximity of the stream. Furthermore, his conclusion that *occulta* "is restricted to the region above

the high-water mark of the floodplains'' is not substantiated in the present report.

In the Bark River colony, specimens of *Hendersonia occulta* were found for the most part on the undersides of pieces of the smoother hardwood twigs and logs, which were abundantly scattered over the grass- and fern-covered alluvial soil of the area. The habitat was only partially cleared, and it was obviously used as a pasture. The vegetation consisted of a mixed stand of elm (*Ulmus americanus*), beech (*Fagus grandifolia*), and aspens, and there were numerous patches of ostrich fern (*Onoclea Struthiopteris*), a plant common on alluvial soils. *H. occulta* was found inhabiting both sides of the stream. The north bank proved to be rather marshy. Though no specimens of *occulta* were found in the marsh, they were taken from beneath twigs on the only slightly raised drier ground adjoining the marsh. That the habitat is subject to overflow during periods of high water was clearly evident from the masses of debris which were found deposited by the

TABLE I

SPECIES COLLECTED WITH *H. occulta* AT THE BARK RIVER STATION

| SPECIES | NUMBER OF SPECIMENS |
|---|---|
| *Polygyra albolabris maritima* Pilsbry | 4 |
| *Polygyra fraterna* (Say) | 2 |
| *Polygyra profunda* (Say) | 9 |
| *Strobilops labyrinthica virgo* (Pilsbry) | 7 |
| *Gastrocopta contracta* (Say) | 1 |
| *Vertigo ventricosa elatior* Sterki | 4 |
| *Cochlicopa lubrica* (Müller) | 1 |
| *Retinella binneyana* (Morse) | 6 |
| *Euconulus chersinus polygyratus* Pilsbry | 2 |
| *Zonitoides arboreus* (Say) | 30 |
| *Agriolimax campestris* (Say) | 3 |
| *Anguispira alternata* (Say) | 20 |
| *Gonyodiscus cronkhitei catskillensis* (Pilsbry) | 17 |
| *Helicodiscus parallelus* (Say) | 4 |
| *Columella edentula* (Draparnaud) | 1 |
| *Succinea avara* Say | 2 |
| *Succinea retusa* Lea | 2 |
| *Campeloma decisum* (Say) | (drift) 1 |

## TABLE II

RECENT SPECIMENS OF *HENDERSONIA OCCULTA* REPORTED

| | LOCATION | COLLECTOR | YEAR |
|---|---|---|---|
| 1. | Sheboygan, Wisconsin (Lake Michigan) | I. A. Lapham | 1859 |
| 2. | Lexington, Virginia (James River drainage) | Prof. McDonald. | 1868 |
| 3. | Whitefish Bay, north of Milwaukee, Wisconsin | E. R. Leland | 1869 |
| 4. | Iowa City, Iowa (Iowa River drainage) | R. E. Call | 1882 |
| 5. | 6 miles north of Iowa City, Iowa (Iowa River drainage) | Pilsbry and Shimek | 1880 |
| 6. | Eldora, Hardin Co., Iowa (Iowa River drainage) | E. H. King | 1878 |
| 7. | South Pittsburg, Tennessee (Tennessee River) | R. E. Call | 1887 |
| 8. | Stockton and Winona, Minnesota (Mississippi River) | J. M. Holzinger | 1886 |
| 9. | 2 miles south of Depere, Wisconsin (Fox River); | G. T. Marston | 1886 |
| | also small creek, 3 miles east of Depere, Wisconsin | G. T. Marston | 1886 |
| 10. | Wildwood and Cayuga, Pennsylvania (Allegheny River) | S. H. Stupekoff | 1892 |
| 11. | Athens, Illinois (Sangamon River drainage) | H. A. Pilsbry | 1897 |
| 12. | Decorah, Iowa (Iowa River) | T. E. Savage | 1899 |
| 13. | Rowan Creek, Cade's Cover, Tennessee | J. H. Ferriss | 1900 |
| 14. | Pine Hollow Creek, DuBuque Co., Iowa | B. Shimek | 1901 |
| 15. | Little Turkey Creek, Clayton Co., Iowa | B. Shimek | 1901 |
| 16. | Kendallville, Winneshiek Co., Iowa | B. Shimek | 1901 |
| 17. | Plymouth Rock, Winneshiek Co., Iowa (same as 12) | B. Shimek | 1901 |
| 18. | Decorah, Winneshiek Co., Iowa (same as 12) | B. Shimek | 1901 |
| 19. | Fort Atkinson, Winneshiek Co., Iowa | B. Shimek | 1901 |
| 20. | Whitefish Bay, Wisconsin (same as No. 3) | G. H. Chadwick | 1902 |
| 21. | Kansas River, at Lawrence, Kansas | G. D. Hanna | 1908 |
| 22. | Floodplain Kickapoo River, near Trout Creek, Wisconsin | J. P. E. Morrison | 1928 |
| 23. | Wooded banks Red Cedar River, Vinton, Iowa | D. T. Jones | 1930 |
| 24. | Fort Madison, Lee Co., Iowa (Mississippi River) | T. Van Hyning | |
| 25. | Mount Mitchell, Yancey Co., North Carolina (Nolichucky drainage) | B. Walker | 1901 |
| 26. | Pigeon Roost, Roan Mountain, Mitchell Co., North Carolina | A. G. Wetherby | |
| 27. | St. Paul, Russell Co., Virginia | C. Goodrich | |
| 28. | Harriman, Roane Co., Tennessee (Emory River) | H. A. Pilsbry | |
| 29. | New Harmony, Posey Co., Indiana (Wabash River) | L. E. Daniels | |
| 30. | Vincennes, Knox Co., Indiana (Wabash River) | L. E. Daniels | 1904 |
| 31. | Mount Vernon, Posey Co., Indiana (Ohio River) | L. E. Daniels | 1904 |
| 32. | Banks Bark River, Delta Co., Michigan | H. and A. van der Schalie | 1938 |
| 33. | Natural Bridge, Rockbridge Co., Virginia (James River drainage) | M.C.Z. | |
| 34. | Near Reed Creek, 12 miles southwest of Pulaski, Wythe Co., Virginia (New River drainage) | M.C.Z. | |
| 35. | 4 miles east of Blackwater, Scott Co., Virginia (Clinch River drainage) | M.C.Z. | |


MAP 1. Distribution of colonies of *Hendersonia occulta*.

stream along its higher banks well above the region from which *occulta* was taken. Though a few specimens were found beneath twigs and logs in the grassy region close to the wooded zone, it was evident that this species showed a decided preference for the more heavily wooded portions of the habitat (Pl. I).

Several species in Table I help to establish *Hendersonia occulta* as a form occupying a habitat found not far from streams or lakes. Chief among these species are *Vertigo ventricosa elatior, Columella edentula,* and *Cochlicopa lubrica.* The examination of data for the sixty-five stations established in the course of the land shell collecting in Gogebic and Delta counties proved that these three snails were found largely associated with such conditions. The presence of *Succinea retusa* and of the drift specimen of *Campeloma decisum* also clearly indicates that *occulta* occurs near an aquatic environment. Furthermore, several of the above species were credited by Shimek as common on timbered alluvial flats but uncommon in loess deposits (1913: 505):

> It is also noticeable that such species as *Zonitoides nitidus* and *Succinea retusa,* of low grounds, and *Helicodiscus parallelus, Vitrea hammonis, Bifidaria armifera, B. contracta, B. pentodon, Zonitoides arboreus,* and *Z. minusculus,* which are common on timbered alluvial flats and which occur so frequently in alluvium and modern river drift, are relatively rare in terrestrial deposits like loesses.

Shimek was aware that *Helicina occulta* and *Pomatiopsis lapidaria* had been classed by Call as belonging to the aquatic assemblages, for he stated (1931: 40) that "they have the operculum of our aquatic prosobranchs"; nevertheless he insisted that these species were not associated with aquatic conditions. I do not wish to raise the much-debated question as to whether or not *P. lapidaria* is an aquatic or a land shell. That problem is one to be settled by experimentation. I maintain, however, that the habitat of *lapidaria* is usually not far from water. *H. occulta* is ecologically similar to *lapidaria,* though it evidently inhabits a somewhat higher position above the water line. Unfortunately, life-history studies have not been carried out for either of these unusual operculate snails,

although the evidence at hand would indicate that the proximity of a body of water may prove essential in events involving the propagation of both species.

*Hendersonia occulta* is unique in both its distribution and ecology. Though most of the species of the *Helicina* group are tropical or subtropical in distribution, *occulta* ranges far north in the temperate zone (Map 1). Before the ecology and distribution of *occulta* were known, its presence in the loess was considered an indication that the climate during the time of loess deposition was warmer than at present. A better understanding of the distribution and ecology of the species gives no indication that the climate then was much different from that of the present. Moreover, *H. occulta* differs from most of the New World species of the *Helicina* group in the restriction of its distribution ecologically to the proximity of streams and lakes. In 1935 I collected five species of this group in Guatemala, and none of them followed the drainage patterns in its ecology and distribution; nor does the only other member of this group in the United States, *Oligyra orbiculata* (Say), follow the drainages in its distribution.

Since *H. occulta* has been considered a key fossil by Shimek and other Pleistocene geologists in their evaluation of conditions during the time of loess deposition, the factors of its ecology and distribution are significant geologically. Shimek, in this connection, stated (1904: 180):

> It does not therefore follow that all loess was deposited in woods, but the habits of *H. occulta*, and other species of like habits, which are associated with it in many loess deposits, indicate that such deposits were formed under forest conditions. Since many of these deposits are found in what is now open prairie, it follows that groves such as dot the eastern part of Iowa were formerly more generally distributed over the loess-bearing area.

This statement is based on an incomplete knowledge of the ecology of *H. occulta* and consequently is but partially true. The prairie areas where *occulta* is now found in loess deposits must not only have been forested, but they must also have been dissected by a stream or other body of water. I am of the

opinion that when this second condition is taken into consideration a far more accurate picture will be obtained of the conditions which must have existed at the time of loess deposition. The aeolian origin of the loess is not questioned here, but the fact is emphasized that where *H. occulta* is found the deposit must have formed near the banks of some river or lake.

SUMMARY

1. *Hendersonia occulta* is reported for the first time in Michigan. 2. The Bark River colony is the most northern hitherto reported. 3. *H. occulta* is confined to stream courses and lakes in its ecology and distribution. This distributional restriction may be connected with factors in its life history. 4. The present ecology and distribution of *occulta* are significant in the reconstruction of conditions during the time of loess deposition.

REFERENCES

BAKER, H. B.
1922 Notes on the Radula of the Helicinidae. Proc. Acad. Nat. Sci. Phila., 74: 29–67.

MORRISON, J. P. E.
1929 On the Occurrence of *Hendersonia* in Crawford County, Wisconsin. Nautilus, 43: 41–45.

SHIMEK, B.
1904 *Helicina occulta* Say. Proc. Davenport Acad. Sci., 9: 173–80.
1906 Additional Note on *Helicina occulta.* Journ. Geol., 13: 232–37.
1913 The Significance of Pleistocene Mollusks. Science (n.s.), 37: 501–9.
1931 Ecological Conditions During Loess-Deposition. Univ. Iowa Studies, 14: 38–54.

PLATE I

The habitat of *Hendersonia* (*Helicina*) *occulta* on the south bank of Bark River.