Field Guide to Black Hills Land Snails FINAL REPORT

Submitted by: Tamara Anderson

December 2004

South Dakota Game, Fish & Parks funded the preparation and printing of a land snail field guide. This report summarizes the work completed in 2004.

Snails were collected in June 2004 from several locations in the Black Hills (see Table 1). These were identified using a microscope and standard snail taxonomic keys. Species not previously collected by the author were photographed for the field guide. Specimens will be deposited in the University of Colorado collection to ensure access by interested scientists.

Of special interest in this year's collections were specimens of *Vertigo paradoxa* (mystery vertigo) and *Pisidium* species (pea clam). *Vertigo paradoxa* was previously reported by Frest & Johannes and has been considered for sensitive species status by the Forest Service but does not currently hold that status. More work is needed to determine if the *Pisidium* samples represent rare species. *Pisidium* samples were sent out for identification, but were damaged during shipping and it is not known whether more collection will be necessary before definitive species identification can occur.

The layout for the field guide was completed by the University of Colorado Publications Office (see appendix) and has been submitted to the printer. When the printed copies are complete, 5 copies will be forwarded to the SD Game Fish & Parks. Several copies will be distributed to area professionals in the Forest Service, Wind Cave National Park, and Custer State Park that have expressed interest and/or supported various aspects of this project over the years. Additional copies will be available for purchase from the University of Colorado Museum.

Table 1. 2004 Snail Collection Sites

Site ID#	Site Description	UTM	UTM	Species Collected
Frest250	Spring north of road	0578400	4914677	Pisidium sp. Limax maximus Nesovitrea binneyana Vitrina alaskana Oreohelix sp.
4x	Picnic Area south of 85 by Dead Horse Gulch (just west of Frest #4)	0586531	4901877	Arion fasciatus Discus whitneyi Cionella lubrica Euconulus fulvus Vallonia gracilicosta Oreohelix sp.
14	Rattlesnake Canyon exclosure S of Rd 804	0570620	4908258	Cionella lubrica Discus whitneyi Vitrina alaskana Nesovitrea electrina Discus catskillensis
87	North of Trebor Draw off Rd 231	0590925	4889458	Oreohelix sp.
85	About 1 mile from Black Fox campground on Rd 233			Oreohelix
Black Fox Spring	Black Fox Spring botany area			Pisidium sp. Deroceras laeve Oreohelix sp. Discus whitneyi
P1	Further down road from spring	0590206	4887241	Oreohelix sp. Vallonia gracilicosta Catinella sp. Gastrocopta armifera
P2	From 190.1S go left on grass road, small cliffs	0591200	4886730	Oreohelix sp. Vertigo paradoxa Vitrina alaskana Catinella sp.
Castle Hughes Outcrop	5.0 miles down Rd 190 from the junction of 189/190	0592783	4886573	Oreohelix sp. present

Appendix: Field Guide

The following pages contain the layout for the field guide. The published version will be forwarded to SDGFP as soon as it becomes available.

Field Guide to Black Hills Land Snails

BY

TAMARA ANDERSON

Natural History Inventory
Publication Number 22
University of Colorado Museum

Table of Contents

Introduction 5
Where Land Snails Live 6
Biology of Land Snails 7
Ecology and Conservation of Land Snails 7
Identifying Land Snails and Slugs 7
Snail Species Descriptions
- *Carychium exiguum* 9
- *Cionella lubrica* 9
- *Columella columella alticola* 10
- *Columella simplex* 10
- *Discus catskillensis* 11
- *Discus shimeki* 11
- *Discus whitneyi* 12
- *Euconulus fulvus* 12
- *Gastrocopta armifera* 13
- *Gastrocopta holzingeri* 13
- *Gastrocopta pellucida* 14
- *Gastrocopta procera* 14
- *Hawaiia minuscula* 15
- *Nesovitrea binneyana* 15
- *Nesovitrea electrina* 16
- *Oreohelix cooperi* and other *Oreohelix* species 16
- *Punctum minutissimum* 17
- *Pupilla blandi* 17
- *Pupilla hebes* 18
- *Pupilla muscorum* 18
- *Pupoides albilabris* 19
- *Striatura milium* 19
- *Strobilops labyrinthica* 20
- *Vallonia gracilocosta* 20
- *Vallonia parvula* 21
- *Vallonia pulchella* 21
- Other *Vallonia* species 22
- *Vertigo arthuri* 22
- *Vertigo elatior* 23
- *Vertigo modesta modesta* 23
- *Vertigo paradoxa* 23
- *Vertigo tridentata* 24
- *Vitrina alaskana* 24
- *Zonitoides arboreus* 25
- *Zoogenetes harpa* 25
- Succineid Snails (*Catinella* and *Succinea* sp.) 26
- Slugs
  - *Arion fasciatus* 27
  - *Deroceras laeve* 27
  - *Limax maximus* 27

A Few Words about Aquatic Mollusks in the Black Hills 28
Table 1. Data Sources of Snail Species in the Black Hills 29
Acknowledgements 30
References Cited 30

Introduction

Land snails are a very diverse group of organisms that come in many shapes, colors, and sizes. Both cone-shaped and disc-shaped snails can be found in the Black Hills. Snails without shells, or slugs, can also be found in the local area. Bright yellow and green snails are common in tropical areas, but in the Black Hills most snail species are various shades of brown, tan, or white, with or without stripes. The world's largest known land snails are Giant African snails, which are larger than an adult human hand, but no species in the Black Hills reach that size. Snails in the area include some of the smallest known species that are smaller than your smallest fingernail.

The purpose of this guide is to assist those interested in snails found in the Black Hills area (see Figure 1). The geological history and geography of this area have contributed to an environment that supports a diverse plant and animal community, including many snail species. All the snail species reported from this area are included in this guide. However, should you find a snail that does not appear to be one of the species described here, you are encouraged to contact the author or another malacologist (a scientist that studies snails and other mollusks). Because snails can exist in small patches of habitat, it is possible that additional, previously unreported species may be found.

Also, because every meter of the Black Hills has not been searched for snails, precise maps showing locations of each species are not included. Such maps are likely to become outdated quickly as more information becomes available. General statements of distributions and how common species are in the Black Hills are included where this information is known.

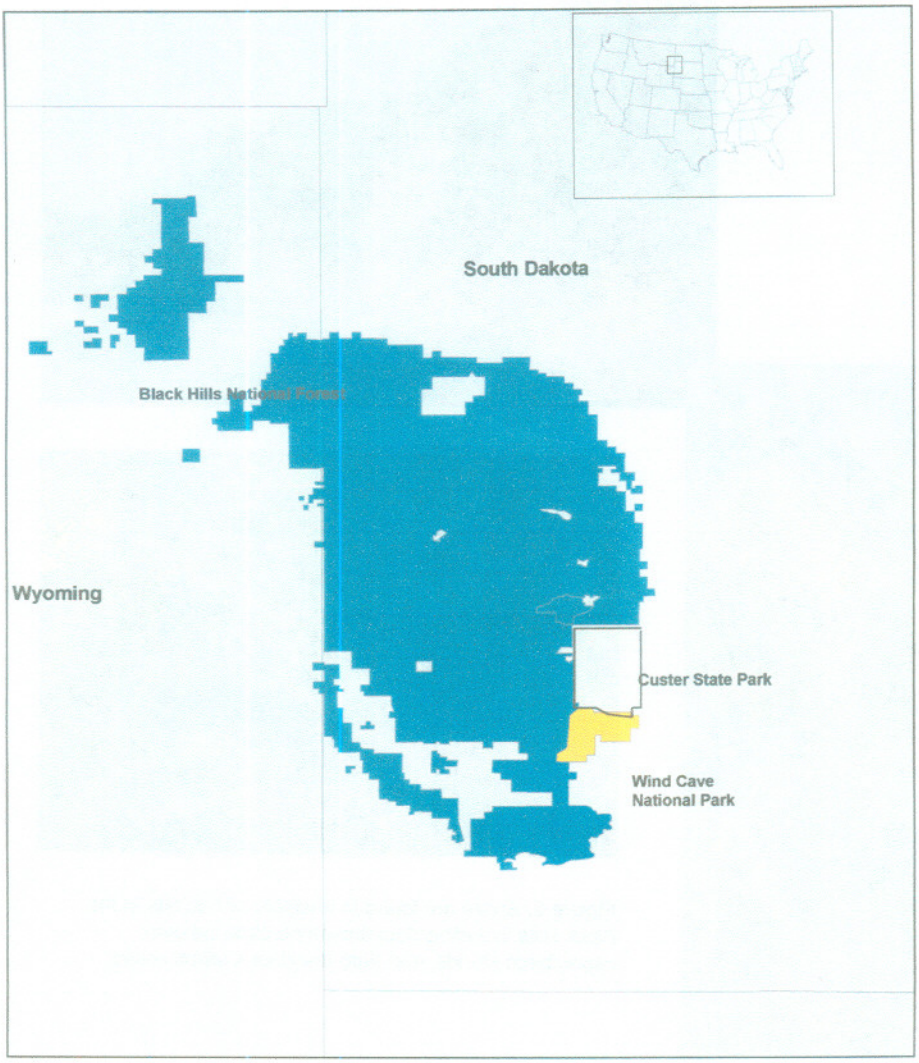

Figure 1. Map of the Black Hills area. The Black Hills National Forest, Custer State Park, and Wind Cave National Park are shown.

Where Land Snails Live

Worldwide, snails live everywhere from the treetops of tropical rainforests to rocky deserts. In the Black Hills, snails can be found in both grassland and forest habitats. During rainy weather, snails may be found crawling along on the surface of the ground or climbing up plants. When conditions become too dry, snails take refuge. Some species burrow underground. Other species crawl under rocks or logs or leaf litter.

Excellent snail habitat can be found in many areas of the Black Hills. Moist, shaded hillsides with small rocks and some vegetation covering the ground—especially if some deciduous leaves are present in the litter—commonly host several different species. Areas with aspen or birch trees mixed in with pine or spruce are favorable habitat. Moist cliffs of limestone also provide good habitat. Many shells can also be located on hills with deciduous shrubs, such as mountain mahogany. Unless conditions are extremely moist, snails in grassy areas are usually only seen by digging through the soil.

Not all snail species are found throughout the Black Hills. While some species can be found commonly in the area, others are found only rarely in small patches. The southern Black Hills are somewhat drier and have fewer deciduous trees, so not all species found in the northern reaches are found in the southern areas.

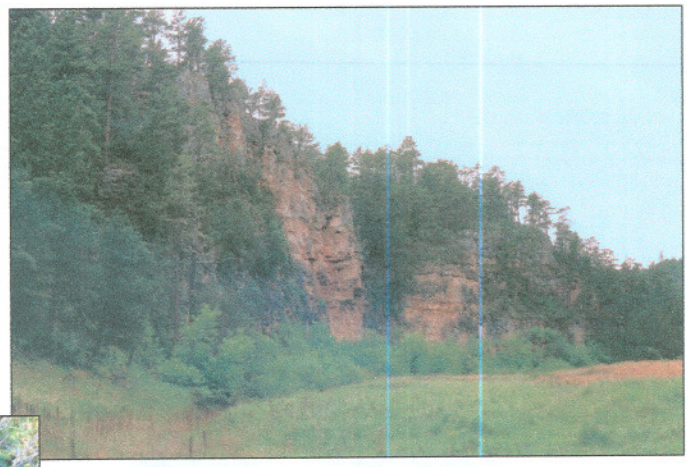

Figure 2. Snails are found in a variety of habitats in the Black Hills including (top) limestone cliffs, (above) aspen/birch stands, and (left) deciduous shrub areas.

Biology of Land Snails

Snails have fleshy bodies housed within hard shells made of calcium carbonate. As they mature, new shell material is laid down by an organ called the mantle. Only a portion of the snail body extends outside the shell, usually only the head with its sensory antenna and mouth, and the muscular foot on which the snail travels.

Most land snail species are hermaphrodites (meaning they have both male and female reproductive organs). Mating occurs when two individuals meet and exchange sperm. On rare occasions, snails may reproduce without a mate, in a process called self-fertilization. Breeding activity usually occurs only during a month or two of the summer. Most terrestrial snails lay their eggs in an egg sac, from which the juvenile snail emerges. A few species, including *Zoogenetes harpa* and *Oreohelix* species of the Black Hills, retain their eggs within their bodies and give birth to young snails (Pilsbry 1948).

After a juvenile period of growth and development, snails are reproductively mature. The time to maturity depends on the species and environmental conditions. Some *Vertigo* species can mature in as few as 30 days (Pokryszko 1990), while other snail species may take a year or more (Tompa 1984). The life span of snails also varies among species ranging from less than 2 years to 17 years (Heller 1990). One *Helix pomatia* individual in Europe is known to have lived for 35 years (Falkner 1990)!

Snails feed on a variety of foods. Most species eat plants or detritus. A few species are carnivores, feeding mostly on other snails. The Black Hills species have not been reported in the literature to be carnivorous, but their feeding habits have not been seriously studied. Snails also need minerals, especially calcium, which they obtain from rocks or soil, or other snail shells.

When habitat conditions are not favorable, such as during dry periods, snails become dormant in a process called aestivation. Snails can survive in this dormant state for many months.

Many excellent references are available for those interested in more details about the biology and anatomy of snails (see list at end of this guide). Much remains to be learned about individual snail species, so scientists continue to study these interesting creatures.

Ecology of Land Snails

Land snails play an important role in the ecosystem. By eating plant material in the litter layer, they keep detritus from accumulating. In some systems, they are important food sources for other organisms such as birds, small mammals, and reptiles.

Healthy land snail populations are dependent on vegetation, not only for food and shelter, but also to maintain the proper temperature and moisture levels in their habitat. Therefore, they are sensitive to changes in the vegetation in their environment. Activities that could potentially affect snail populations include fire, timber harvest, grazing, and changes in water flows that might affect soil moisture. Activities such as grazing, motor vehicle use, or excessive hiking at snail locations may also crush snails or compact soil. How snails might recover from damage to their environment is not understood.

There are several species of conservation interest in the Black Hills according to the Forest Service and the state of South Dakota. These species include: *Oreohelix cooperi*, *Vertigo arthuri*, and *Vertigo paradoxa*. More information on the conservation needs of these species can be found in species assessments prepared for the USDA Forest Service (www.fs.fed.us/r2/projects/scp/assessments).

Identifying Land Snails

Snails are mollusks that belong to the Class Gastropoda. The terrestrial snails described in this report breathe air and are all included in the Order Stylommatophora (except for *Carychium exiguum*, which is in Order Basommatophora [also called Order Archaeopulmonata]). What follows is a brief description and illustration of each of the species reported from the Black Hills. Each description begins with the scientific name in italics followed, in parentheses, by the name of the person who originally named the species and the year the species was originally described. Photos are of samples collected in the Black Hills unless otherwise noted.

The species descriptions are arranged in alphabetical order by scientific name. Scientific names are in Latin and consist of two words: the genus and species names. Rules govern what category a species is placed in and how a species is named. Mollusk taxonomy is a field of active research. Sometimes when more information is found, a species is moved to a different genus and the name must be changed accordingly. The scientific and common names used in this manual are according to Turgeon *et al.* (1998) unless otherwise noted.

The identifications and descriptions of the snail species are based on shape, color, size, and other aspects of the shells. In order to fully understand the descriptions, a few terms are defined below. A few species are difficult to identify based solely on their shells, and this is noted in their descriptions (see Succineid species).

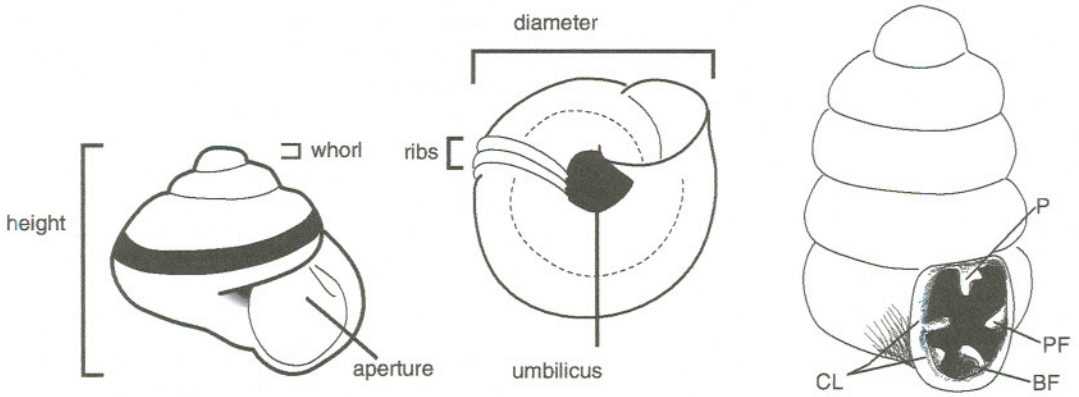

Figure 3. Diagram of snail shells illustrating parts important in identification. (Illustration by Leigh Anne McConnaughey)

Aperture: the opening in the shell; the body of the snail can be seen emerging from this opening in a living, active snail.

Diameter: measurement of the shell that is the largest distance perpendicular to the height.

Height: measurement of the shell that is the maximum distance from the top spire to the base of the shell

Lip: the edge of the aperture; in many shells this is thickened and/or reflected

Mantle: part of the snail that secretes the shell. In slugs it can be seen as a fleshy patch on the back of the body.

Ribs: raised projections on the shell that run perpendicular to the direction of the whorls; these can be regular, irregular, or non-existent, depending on the species.

Slug: a type of snail that does not have a shell.

Teeth: hard calcium projections within the aperture of the shell. The number and position of the teeth are used to define many species, especially the Pupillidae. The positions of the teeth are referred to as shown in the drawing where P = parietal lamella, CL = columellar lamellae, PF = palatial fold, and BF = basal fold. There may be multiple teeth on a side, as in the two columellar lamellae shown.

Umbilicus: an opening on the underside of the shell where the whorls of the shell can sometimes be seen. In some species the umbilicus is covered or absent so no whorls can be seen from the underside of the shell.

Whorls: the spiral layers of the shell found around a central axis. The snail lays down its shell as it grows, so the innermost whorls are the oldest. The number of whorls can help determine the identification of a species, as well as if a specimen is mature.

SNAIL SPECIES DESCRIPTIONS

Photos are of Black Hills specimens unless otherwised noted by an identification number from the University of Colorado Museum collection. The ruler in all of the photos shows millimeters.

Carychium exiguum (Say 1822), commonly called the obese thorn, due to the presence of a sharp parietal lamella and the diameter of last two whorls of the shell relative to the others. The shell is about 1.6-2.2 mm tall and 0.75 mm wide, and can be white or tan and has about 4.5 whorls. The smaller whorls are smooth, and the larger whorls have some striations. The lip is thickened. A small columellar lamella may appear as a thickening. Live specimens have eyes at the base of their tentacles, unlike the other species described in this book that all have their eyes at the ends of their tentacles. (Pilsbry 1948, Burch 1962)

Range: From Canada in the north south to Colorado, New Mexico, and Alabama (Burch 1962)

Local Distribution: A few rare occurrences in the Black Hills (Frest & Johannes 2002).

Habitat: Very moist areas, especially in leaf litter or logs (Burch 1962).

Taxonomy Notes: In the oldest references, may have occasionally been used interchangeably with *Carychium exile*, which is a separate species.

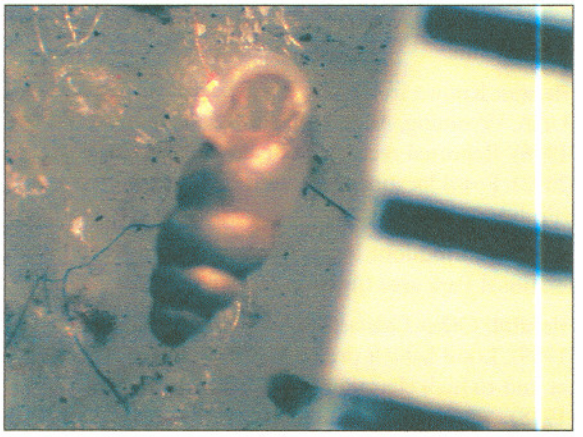

Figure 4. *Carychium exiguum* (UCM specimen #45482 from Missouri)

Cionella lubrica (Müller 1774) is also called the glossy pillar in reference to the shiny appearance of the shell. The shell is cone-shaped with no lip and no teeth. The specimens found at Wind Cave were approximately 3 mm tall with about 4 whorls (Anderson *in press*). These measurements are smaller than those listed in Pilsbry (1948) at 5 to 6.5 mm and 5.5 to 6 whorls.

Range: Almost all of North America. Burch (1962) found no records from Georgia, Florida, Texas, or California, but Roth & Sadeghian (2003) have now identified specimens from California. Also found in Europe. (Pilsbry 1948)

Local Distribution: Known from northern and central Black Hills (Frest & Johannes 2002, personal observation, see Table 1), as well as Wind Cave National Park and Custer State Park in the south (Anderson 2003, *in press*).

Habitat: Moist areas with leaves or logs for cover (Pilsbry 1948, Beetle 1989)

Taxonomy Notes: Sometimes referred to as *Cochlicopa lubrica*, may also be the same as *Cochlicopa lubricella*. Referred to as the latter in Frest & Johannes (2002).

Figure 5. *Cionella lubrica*

Columella columella alticola (Ingersoll 1875) is a light brown, cylindrical shell measuring 1.5 to 3 mm tall with 5 to 7 whorls (Pilsbry 1948, Burch 1962). The shell has no teeth or ribs, although some wrinkles are present. *Columella columella* is commonly called the mellow column.

Range: Known from New Mexico, Arizona, Colorado, Utah, Wyoming, Alberta, and British Columbia (Pilsbry 1948). Reported recently in South Dakota (Jass *et al.* 2002). Fossil locations in Kansas, Iowa, and Illinois (Pilsbry 1948, Hubricht 1985).

Local Distribution: Reported from Wind Cave National Park area (Anderson *in press*)

Habitat: Other *Columella* species like aspen areas (Beetle 1989). Local habitat preferences unknown. Also found at mid-to high elevations from 7,500 to 9,000 ft (Pilsbry 1948).

Taxonomy Notes: Considered a full species, *Columella alticola*, in Pilsbry (1948), but reduced to subspecies in Hubricht (1985).

Figure 6. *Columella columella alticola*

Columella simplex (Gould 1841) is very similar to *C. columella alticola*, but is more tapered at the tip of the shell instead of being rounded and forming more of a cylinder. Eastern specimens measure from 1.8 to 2.2 mm tall and 1.1 mm in diameter (Pilsbry 1948).

Range: Maine west to Missouri and Oklahoma, south to Alabama and Mississippi (Hubricht 1985).

Local Distribution: Reported from the northwestern area of the Black Hills (Frest & Johannes 2002).

Habitat: Moist, wooded areas, aspen stands (Frest & Johannes 2002, Beetle 1989).

Taxonomy Notes: Sometimes considered as a race of *Columella edentula* (Pilsbry 1948). Hubricht (1985) indicates that the taxonomy for this species is confused and may represent multiple species.

Discus catskillensis (Pilsbry 1896) is referred to by the common name of angular disc. The shells are brown and measure about 5 mm in diameter. The lip is not reflected. Mature individuals have about 4 whorls. The whorls have distinct ribs. This species is very similar to *Discus whitneyi*, except the outer whorl is somewhat angled, instead of rounded. The umbilicus is also slightly larger in diameter. (Pilsbry 1948, Burch 1962)

Range: Maine west to South Dakota (Pilsbry 1948, Burch 1962). Recent specimens south to West Virginia, while fossil records exist as far south as Mississippi (Hubricht 1985).

Local Distribution: Reported from Wind Cave National Park and Custer State Park (Anderson 2003, *in press*). Also located in the Black Hills National Forest (Anderson unpublished data).

Habitat: Leaf litter, logs (Pilsbry 1948, Hubricht 1985).

Taxonomy Notes: Sometimes considered a subspecies and referred to as *Discus cronkhitei catskillensis*.

Figure 7. *Discus catskillensis*

Discus shimekii (Pilsbry 1890), also called the striate disc, has a brown to grayish shell that measures about 6 to 7 mm in diameter and 3 to 4 mm tall with 3.5 to 4.5 whorls. The ribs on the top of the shell are very prominent, but are very faint on the underside. The outermost whorl is rounded. The umbilicus is narrow—about one-fourth or slightly more of the diameter of the shell. (Pilsbry 1948)

Range: Canada south to New Mexico and Arizona, east to South Dakota, west to California. Only fossil locations are known from further east. (Pilsbry 1948)

Local Distribution: Spearfish Canyon (Pilsbry 1948) and other scattered locations in the central Black Hills (Frest & Johannes 2003).

Habitat: Moist limestone slopes with tree cover (Frest & Johannes 2003) and other damp places including canyons and riparian areas (Beetle 1989).

Taxonomy Notes: Turgeon *et al.* (1998) consider *D. shimeki* to be an incorrect spelling. *D. s. cockerelli* is sometimes considered a distinct subspecies (Pilsbry 1948).

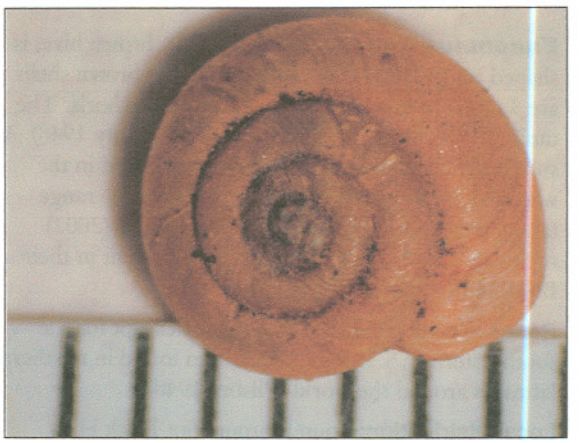

Figure 8. *Discus shimekii*. UCM specimen #8828 from White Mountain, Colorado

Discus whitneyi (Newcomb 1864), or the forest disc, is characterized by a brown or olive shell with distinct ribs. It has 3.5 to 4.5 whorls and normally ranges from 5 to 7 mm in diameter. (Pilsbry 1948, Burch 1962). Samples from Wind Cave National Park were slightly smaller and rarely exceeded 5 mm (Anderson *in press*). This species is very similar to *Discus catskillensis* except the outer whorl is rounded, not angular.

Range: Common across northern North America. Labrador, Canada south to Maryland, west to California and Alaska, including upper elevations in Arizona and New Mexico (Pilsbry 1948, Hubricht 1985).

Local Distribution: Common in suitable areas throughout Black Hills (Frest & Johannes 2002, Anderson 2003, *in press*).

Habitat: Moist forest areas, roadsides, mossy areas, often associated with litter or limestone rocks (Pilsbry 1948, Hubricht 1985, Beetle 1989).

Taxonomy Notes: Also commonly called *Discus cronkhitei*, although Turgeon *et al.* (1998) concluded *whitneyi* had precedence as the proper name. Older references might also refer to the species as *Patula cronkhitei*.

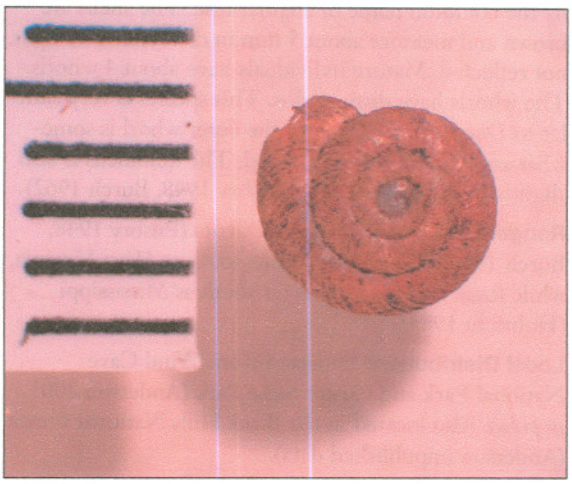

Figure 9. *Discus whitneyi*

Euconulus fulvus (Müller 1774), or brown hive, is shaped roughly like a bee-hive. The light brown shells are 3 to 3.5 mm in diameter with 4.5 to 6 whorls. The umbilicus is almost completely closed. (Pilsbry 1948). A subspecies, *Euconulus fulvus alaskensis*, is found in the west and has whorls on the smaller end of the range (about 4.5) (Pilsbry 1948). Frest & Johannes (2002) reported both *E. fulvus* and *E. fulvus alaskensis* in their Black Hills survey.

Range: Found across North America except for the southeastern U.S. (Burch 1962). Also found in northern latitudes around the world (Pilsbry 1948).

Local Distribution: Found throughout Black Hills (Frest & Johannes 2002, Anderson 2003, *in press*).

Habitat: Leaf litter or logs in moist locations, especially near springs and in mountains (Hubricht 1985, Beetle 1989).

Taxonomy Notes: Whether *E. f. alaskensis* represents a distinct subspecies is unclear.

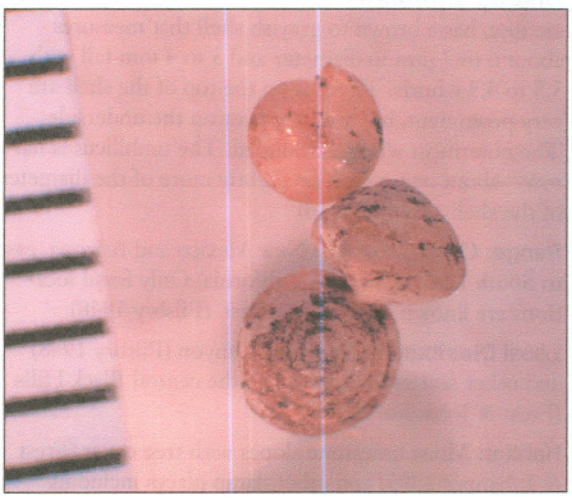

Figure 10. *Euconulus fulvus*

Gastrocopta armifera (Say, 1821) is commonly called the armed snaggletooth. These whitish shells are elongated, ranging from 3.3 to 4.6 mm in height and about 2 to 2.3 mm in diameter (Pilsbry 1948). Mature individuals have 6.5 to 7.5 whorls and slightly reflected lip (Burch 1962). The large teeth in the aperture include a complex (almost bi-lobed) parietal lamella, a wide columellar lamella, a low basal fold, and two palatal folds (Pilsbry 1948).

Range: This species is found across the eastern U.S. and Canada and extends west and south to Colorado and New Mexico (Pilsbry 1948).

Local Distribution: Scattered locations in the Black Hills, most concentrated towards the southern end of the Hills (Frest & Johannes 2002, Anderson 2003, *in press*).

Habitat: Found in open, dry habitats, especially near sandstone and limestone cliffs (Hubricht 1985, Beetle 1989).

Taxonomy Notes: In early literature, this species was called *Bifidaria armifera*.

Figure 11. *Gastrocopta armifera*

Gastrocopta holzingeri (Sterki 1889), the lambda snaggletooth, is white and elongated, measuring 1.5 to 1.8 mm in height and 0.8 to 0.9 mm in diameter. The shells have 5 whorls and distinct teeth. The teeth include a large, y-shaped parietal lamella, a columellar lamella that extends back into the aperture, one basal fold, and three palatal folds, the uppermost one very short. (Pilsbry 1948)

Range: Resides in the middle of the country from New York to Montana and south to Illinois, Kansas, and New Mexico (Pilsbry 1948).

Local Distribution: Southern half of the Black Hills (Frest & Johannes 2002, Anderson 2003, *in press*).

Habitat: Shaded talus slopes (Hubricht 1985).

Taxonomy Notes: Over (1942) mistakenly refers to this species as *Bifidaria holzingeri*.

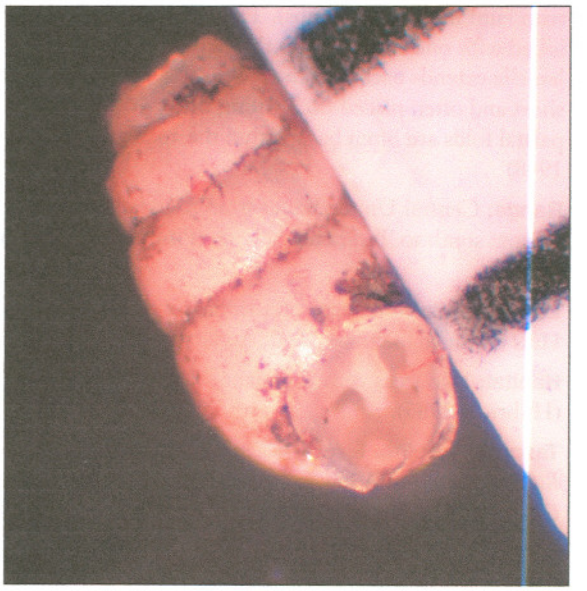

Figure 12. *Gastrocopta holzingeri*

Gastrocopta pellucida (Pfeiffer 1841), also called the slim snaggletooth, has an elongate, light tan shell. The shell diameter is very narrow, less than 1 mm. Height ranges from 1.7 to 2.6 mm with 5 to 5.5 whorls. The parietal lamellae is bi-lobed. The columellar lamella is quite prominent. The three folds may be strong or weak. (Pilsbry 1948, Burch 1962)

Range: In the east, the species ranges from New Jersey to Florida and extends all the way west to California (Burch 1962).

Local Distribution: Rare occurrences in Wind Cave National Park (Anderson *in press*).

Habitat: Dry, open woods (Hubricht 1985).

Taxonomy Notes: Earlier sources use the name *Bifidaria pellucida*.

Figure 13. *Gastrocopta pellucida*

Gastrocopta procera (Gould 1840), or wing snaggletooth, measures 2 to 3 mm in height with a diameter of 1 to 1.1 mm. The light brown shell has 5 to 6 whorls with faint lines (but not ribs). The parietal lamella is bi-lobed with one lobe tilted to the right. The columellar lamella extends back into the aperture. The basal fold is short and often placed back within the aperture. Two palatal folds are often back within the aperture. (Pilsbry 1948)

Range: Central United States from Maryland to South Dakota south to Texas and Arizona (Pilsbry 1948, Burch 1962).

Local Distribution: Rare occurrences in southern Black Hills (Frest & Johannes 2002, Anderson *in press*).

Habitat: Dry areas with abundant calcium sources (Hubricht 1985).

Taxonomy Notes: Over (1942) refers to this species as *Bifidaria pellucida*. A few subspecies have been proposed: *G. p. sterkiana* and *G. p. mcclungi*. Some elevate *G. p. sterkiana* to species level, *G. sterkiana* (Hubricht 1985), although Turgeon *et al.* (1998) regard the matter as unresolved.

Figure 14. *Gastrocopta procera*

Hawaiia minuscula (Binney 1941) is referred to by the common name, minute gem. The shells are very small, only 1.75 to 2.5 mm in diameter with 4 whorls. The shell is somewhat depressed with a height of only 0.75 to 1.2 mm. The top of the shell has some uneven striations, but the bottom is smooth. The umbilicus is fairly wide and all the whorls can be viewed from the underside. (Pilsbry 1946)

Range: Across the U.S. *except* a few mountainous states (Washington, Oregon, Idaho, Nevada, and Utah). Also occurs in the West Indies, Hawaii, Japan, and Great Britain. (Pilsbry 1946)

Local Distribution: Scattered locations in north and central Black Hills (Frest & Johannes 2002), also found at Wind Cave National Park and Custer State Park (Anderson 2003, *in press*).

Habitat: Open ground without leaf litter (Hubricht 1985).

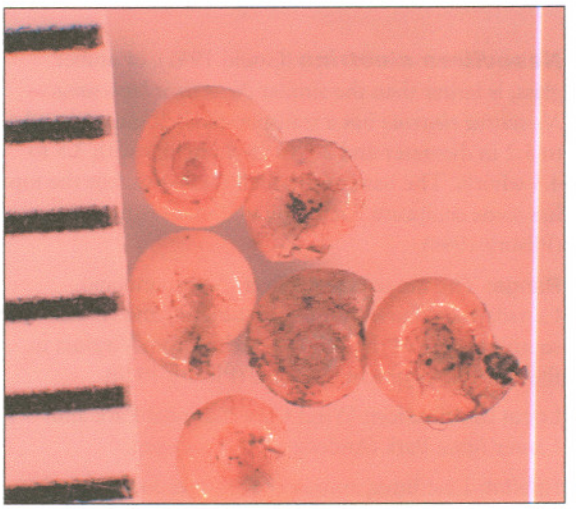

Figure 15. *Hawaiia minuscula*

Nesovitrea binneyana (Morse 1964) has the common name blue glass due to the color the tissue sometimes appears when viewed through the thin, colorless shell. The shell diameter normally ranges from 3.5 to 4.3 mm with 3.5 to 4 whorls. The umbilicus is narrow. (Pilsbry 1946)

Range: Ontario and Maine west to California. The southern boundary of the range is apparently from Ohio to Colorado. (Pilsbry 1946)

Local Distribution: Throughout Black Hills (Frest & Johannes 2002, Anderson 2003, *in press*).

Habitat: Among leaf litter, near creeks, under limestone rocks (Hubricht 1985, Beetle 1989).

Taxonomy Notes: Many sources use an older name, *Retinella binneyana*.

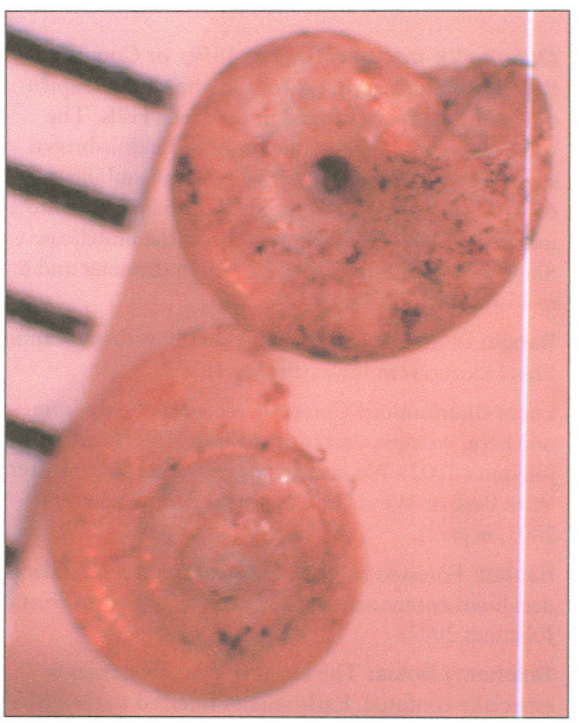

Figure 16. *Nesovitrea binneyana*

Nesovitrea electrina (Gould 1941), or amber glass, is larger than the similar *Nesovitrea binneyana*. *Nesovitrea electrina* has a transparent shell measuring 4.6 to 5.2 in diameter and 2.5 to 2.8 in height with 3.5 to 4.5 whorls. The base of the shell is smooth, but the top has some sculpture lines. The umbilicus is narrow. (Pilsbry 1946)

Range: The range extends from Newfoundland, Canada and Maine west to Washington and Alaska. The southern edge of the range stretches from Virginia in the east to Arizona in the west. (Pilsbry 1946)

Local Distribution: Wind Cave National Park and Custer State Park (Anderson 2003, *in press*).

Habitat: Leaf litter, among sedges, meadows, along creeks or other moist areas (Hubricht 1985, Beetle 1989).

Taxonomy Notes: Sources using an older genus name refer to the species as *Retinella electrina*.

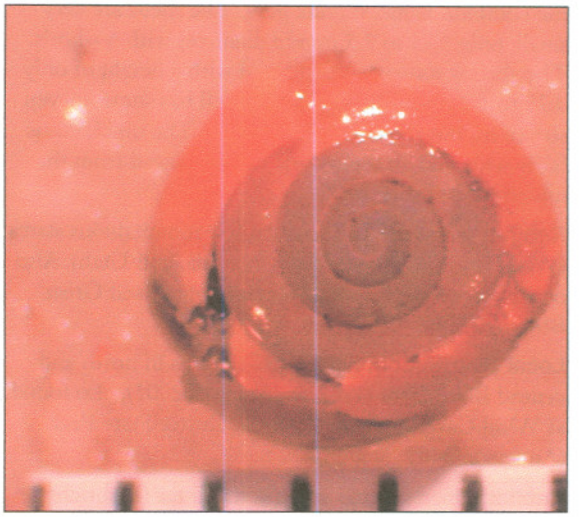

Figure 17. *Nesovitrea electrina*

Oreohelix cooperi (Binney 1859), or Cooper's Rocky Mountain snail, is probably the most conspicuous land snail species found in the Black Hills. The white shells usually have one or more reddish-brown stripes on the rounded outer whorl. The umbilicus is one-fifth the diameter of the shell. The lip of mature individuals is reflected where it meets the umbilicus. Shells vary in size from 9 to 22 mm in diameter and 6 to 17 mm tall. (Pilsbry 1939)

Range: Black Hills and possibly one Canadian location. Fossil locations in Iowa. (Pilsbry 1939)

Local Distribution: Currently recognized only from northern, western, and central Black Hills (Frest & Johannes 2002). No occurrences reported from Custer State Park or Wind Cave National Park (Anderson 2003, *in press*).

Habitat: Forested habitats, especially with a secondary deciduous component present, and talus slopes (Frest & Johannes 2002).

Taxonomy Notes: The taxonomy of this species is especially confused. Early studies referred to the genus as *Helix* or *Patula*. At one point, a different *Oreohelix* species, now called *Oreohelix subrudis*, was called *Oreohelix cooperi*. *Oreohelix cooperi* has also been classified as a subspecies of *Oreohelix strigosa* (*Oreohelix strigosa cooperi*). Frest & Johannes (2002) further divide *Oreohelix* of the Black Hills into three separate species, *O. cooperi* and two unnamed species. An ongoing study of the *Oreohelix* in the region will determine the validity of these new species.

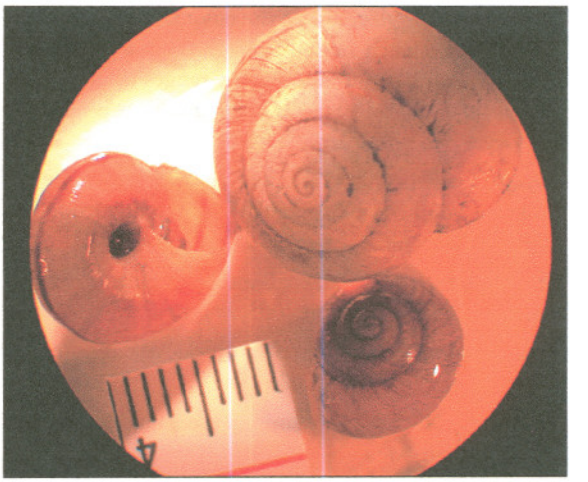

Figure 18. *Oreohelix* specimens from the Black Hills National Forest

Punctum minutissimum (Lea 1841), or the small spot, is light brown in color. The shell has 3.75 to 4.5 whorls, the earliest 1.5 of which are smooth. Later whorls have uneven striae that become sparse on the last whorls. The aperture is round with no teeth and the lip is not reflected. The shells are from 1.1 to 1.5 mm in diameter and 0.7 to 0.9 mm tall. (Pilsbry 1948)

Range: Canada to Florida in the east and Oregon and New Mexico to the west (Pilsbry 1948).

Local Distribution: Scattered locations across the Black Hills (Frest & Johannes 2002)

Habitat: Moist areas with extensive leaf litter and decaying wood, especially aspen, willow, and spruce areas (Hubricht 1984, Beetle 1989)

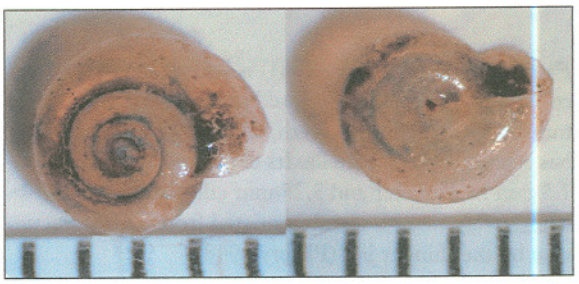

Figure 19. *Punctum minutissimum.* UCM#43358 from Missouri

Pupilla blandi (Morse 1865), or Rocky Mountain column, has an elongated brown shell. It commonly reaches 1.5 mm in diameter and 3 to 4 mm in height with 6 whorls, although the variation in North and South Dakota is shorter, 2.5 mm with 5.5 whorls (Pilsbry 1948). Wind Cave National Park specimens were 2.8 to 2.9 mm in height (Anderson *in press*). Pupilla blandi is differentiated from other area Pupilla by the presence of three teeth: a small parietal lamella, one columellar lamella, and a larger palatal fold set back from the opening. The lip may or may not be thickened.

Range: North Dakota to Texas on the east and Montana to Nevada and New Mexico on the west. (Pilsbry 1948)

Local Distribution: A few scattered locations in the central Black Hills, relatively common occurrences in the southern Black Hills, including Wind Cave National Park (Frest & Johannes 2002, Anderson *in press*).

Habitat: Deciduous leaf litter or under rocks (Beetle 1989).

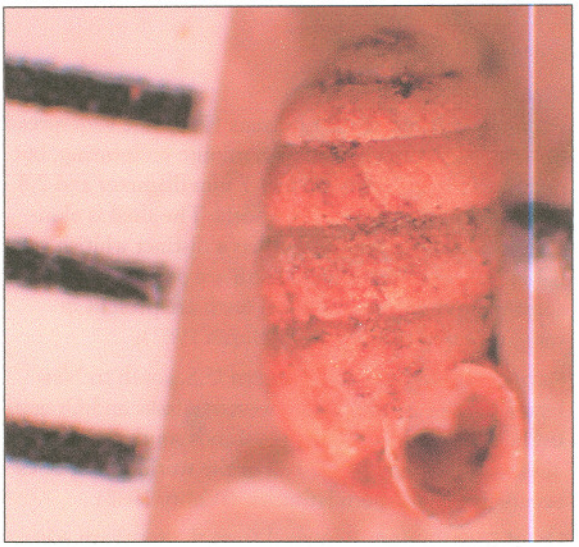

Figure 20. *Pupilla blandi*

Pupilla hebes (Ancey 1881) is known as the crestless column because it lacks a raised crest behind the aperture. It normally has no teeth, although it occasionally has a small parietal lamella. Its elongated shell is about 1.5 mm in diameter and 3.25 mm tall with 6 to 7 whorls. *Pupilla hebes* is differentiated from *Pupilla muscorum* by the thinner lip. (Pilsbry 1948)

Range: Found throughout the Rocky Mountain region from Washington and Idaho south to Arizona and New Mexico (Pilsbry 1948).

Local Distribution: Rare occurrences at Wind Cave National Park (Anderson *in press*).

Habitat: Rocky areas (especially limestone and sandstone), coniferous and deciduous litter (Beetle 1989).

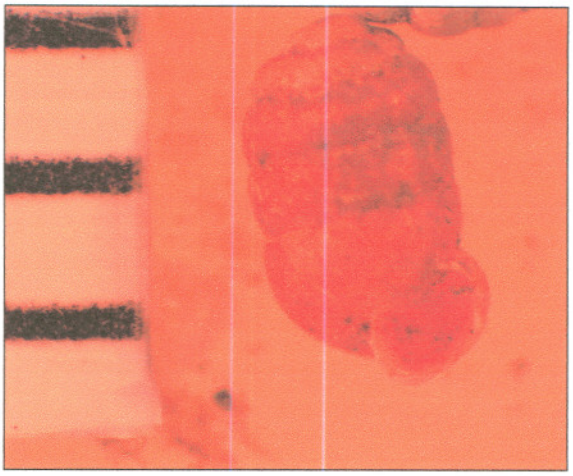

Figure 21. *Pupilla hebes*

Pupilla muscorum (Linnaeus 1758), the widespread column, has a brown shell with minute sculpturing, but no ribs. This species is 1.6 to 1.7 mm diameter and 2.8 to 4 mm tall with 5.5 to 7.5 whorls. The shell is elongate, as the other Pupilla, but has a distinct whitish crest behind the lip. Typically no teeth are present in the aperture, but up to three small teeth are present in some varieties. (Pilsbry 1948, Burch 1962)

Range: Canada and northeastern U.S. south to New Jersey in the east all the way west to Alaska and Oregon. In the central U.S., the range extends south to include Texas and Arizona. In the rest of the world, the species occurs in the northern latitudes. (Pilsbry 1948)

Local Distribution: Reported from the southern edge of the Black Hills in Custer State Park and Wind Cave National Park (Anderson 2003, *in press*).

Habitat: Grasslands and moist leaf litter (Hubricht 1985, Beetle 1989)

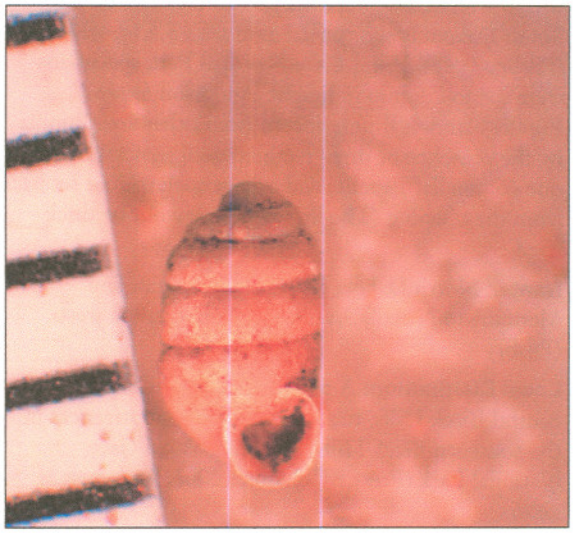

Figure 22. *Pupilla muscorum*

Pupoides albilabris (Adams 1841) is also named the white-lipped dagger because of the thick white lip and the slightly pointed shell shape. The shell is brownish, 2.2 mm in diameter, 4.2 to 5 mm in height, with 6 to 6.5 whorls. Often a small parietal lamella is present right where the outer wall of the aperture joins the top wall. (Pilsbry 1948)

Range: Ontario and Maine south to Florida in the east and west to Colorado and Arizona. Also in areas of Mexico, Cuba, Puerto Rico, and Bermuda. (Pilsbry 1948)

Local Distribution: Extreme southern Black Hills including Wind Cave National Park (Frest & Johannes 2002, Anderson *in press*).

Habitat: Limestone areas, grassy areas, even on plant stems or tree trunks (Pilsbry 1948, Hubricht 1985).

Taxonomy Notes: Older literature may refer to this species as *Pupoides marginatus*.

Figure 23. *Pupoides albilabris*

Striatura milium (Morse 1859) has a small (1.5 mm diameter) yellowish-gray shell with about 3 to 3.5 whorls. The common name, fine-ribbed striate, refers to the microscopic sculpturing on the shell. (Pilsbry 1946)

Range: Pilsbry (1946) lists records from Maine to Michigan in the north and West Virginia and Kentucky to Illinois in the south. Black Hills specimens may represent an isolated population, or records of occurrences in intervening areas may be incomplete.

Local Distribution: Scattered, apparently rare, locations across the Black Hills (Frest & Johannes 2002, Anderson *in press*).

Habitat: Leaf litter (Hubricht 1985).

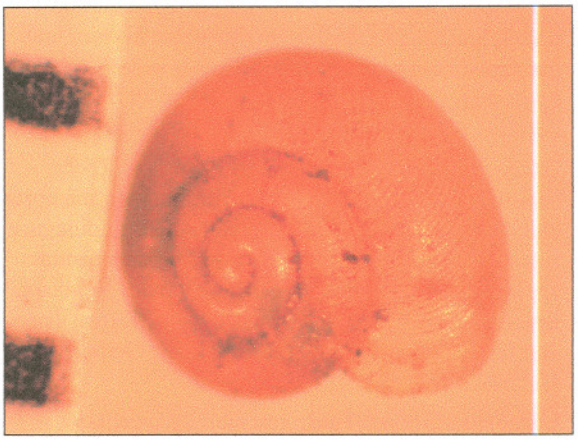

Figure 24. *Striatura milium*

Strobilops labyrinthica (Say 1817), with the common name maze pinecone, has a brown dome-shaped shell. The shell ranges from about 2.3 to 2.5 mm in diameter and 1.7 to 1.8 mm tall with 5.5 whorls. All but the first whorl have narrow ribs that become less distinct on the underside of the shell. The umbilicus is very narrow. The lip is reflected. Looking through the aperture, a prominent parietal lamella is visible. A shorter parietal lamella is also present. (Pilsbry 1948)

Range: Canada in the north to Georgia and Alabama in the south, west to Minnesota and Kansas (Pilsbry 1948).

Local Distribution: Rare occurrences in north-central Black Hills (Frest & Johannes 2002).

Habitat: Decaying wood and leaves (Pilsbry 1948)

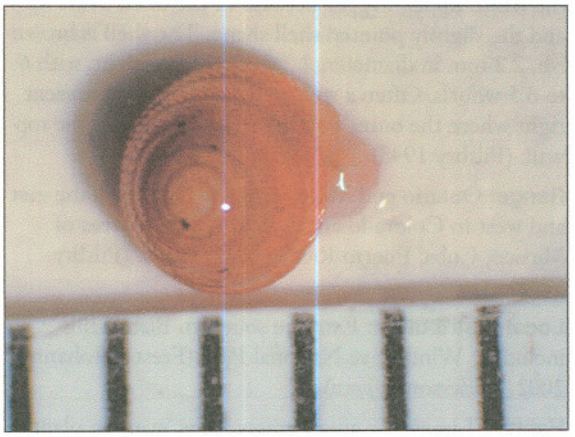

Figure 25. *Strobilops labyrinthica.* UCM #44381 from Missouri

Vallonia gracilicosta (Reinhardt 1883), or multi-rib vallonia, measures 2.5 to 3 mm in diameter and 1 mm in height. The shell is grayish-white in color and has about 3.5 whorls. The umbilicus is wide. The white lip is strongly reflected. There are 43 to 79 ribs on the outer whorl. (Pilsbry 1948, Burch 1962, Gerber 1996).

Range: Throughout the Central Plains and Rocky Mountain region from Idaho to Minnesota in the north and Arizona to Texas in the south. Isolated findings are reported from Maine and New York. Fossil locations are known from Illinois, Indiana, Colorado, Nebraska, Iowa, Kansas, Missouri, Kentucky, New Mexico, Texas, and Utah. (Pilsbry 1948, Hubricht 1985, Gerber 1996 [and references therein])

Local Distribution: Fairly common occurrences throughout Black Hills, though rare in Bear Lodge area (Frest & Johannes 2002, Anderson 2003, *in press*).

Habitat: Dry leaf litter or under rocks (Beetle 1989).

Taxonomy Notes: Sometimes *Vallonia albula* is combined with this species (Hubricht 1985), other times *V. albula* is considered a subspecies (Gerber 1996) or a completely separate species (Turgeon *et al.* 1998).

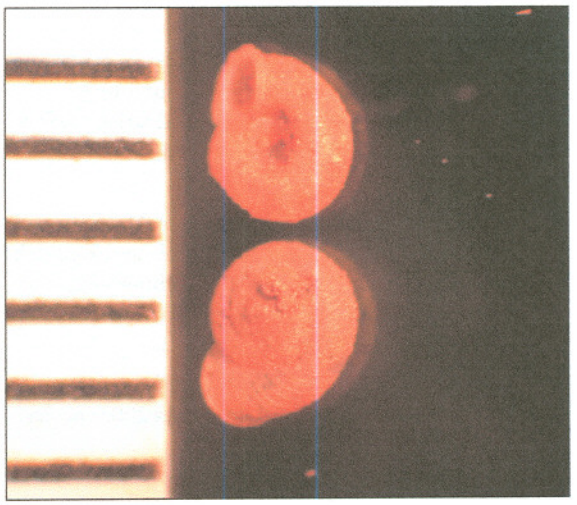

Figure 26. *Vallonia gracilicosta*

Vallonia parvula (Sterki 1893), or trumpet vallonia, measures 1.6 to 2 mm in diameter and about 0.9 mm in height, so is slightly smaller than *Vallonia gracilicosta*. The shell is yellowish gray to white with about 3 whorls. The umbilicus is wide. The outer whorl contains fewer ribs than *V. gracilicosta*, from 37 to 48. (Pilsbry 1948, Burch 1962, Gerber 1996)

Range: Central Plains of North America from South Dakota south to Texas, east to Iowa, Illinois, and Missouri. Other, isolated records exist for Ohio, West Virginia, and New York. (Hubricht 1985)

Local Distribution: Reported from Wind Cave National Park and Custer State Park (Anderson 2003, *in press*).

Habitat: Dry grasslands (Hubricht 1985).

Figure 27. *Vallonia parvula*

Vallonia pulchella (Müller 1774), or lovely vallonia, has a pale brown to white shell with 3 to 3.5 whorls. It measures 2 to 2.5 mm in diameter and 1.2 mm in height. All whorls can be seen in the umbilicus. The lip is fairly thick and reflected. Unlike other *Vallonia* species, no ribs are present, although some minute lines may be present. (Pilsbry 1948)

Range: East of the Rocky Mountains they stretch from Nova Scotia south to Kentucky and Missouri. Introduced populations in Texas and California. Elsewhere their range includes Europe, North Africa, and Siberia. (Pilsbry 1948)

Local Distribution: Rare occurrences in the southern Black Hills (Frest & Johannes 2002, Anderson *in press*).

Habitat: Grasslands, including lawns; under rocks (Pilsbry 1948, Hubricht 1985, Beetle 1989).

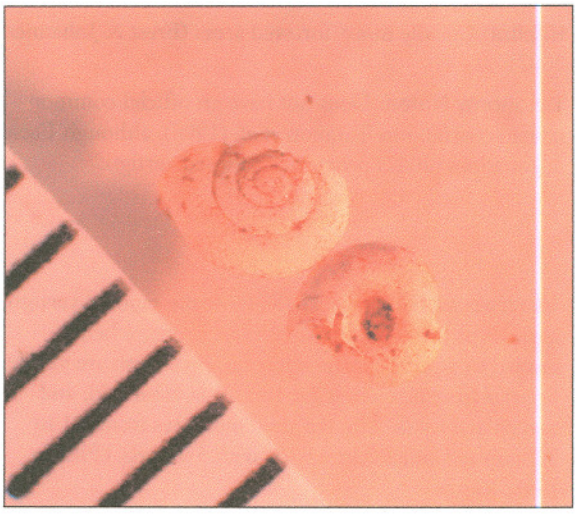

Figure 28. *Vallonia pulchella*

Other *Vallonia* species

Vallonia cyclophorella (Sterki 1892) and *Vallonia perspectiva* (Sterki 1892) were reported by Frest & Johannes (2002) in the Black Hills and by Beetle (1976) in the Badlands. Gerber (1996), who reviewed *Vallonia* species worldwide, considered *V. cyclophorella* individuals that are 2.9 mm in diameter and 1.4 mm tall with 55 to 84 ribs on the third whorl. Gerber (1996) defined *V. perspectiva* as having a flatter shaped shell 1.74 to 2.17 mm in diameter and 0.85 to 1.02 mm tall with 30 to 49 ribs. Because Gerber had limited Black Hills samples, some more investigation is necessary to fully understand the distribution of all *Vallonia* species in the Black Hills.

Vertigo arthuri (von Martens 1882) has a cylindrical shell that tapers slightly at the top. The lip is very thick, especially on the outer edge. The teeth are unique with the columellar lamella long and having an indentation. Two parietal lamellae are present, one larger than the other. A small basal fold, and two palatal folds (the lower one larger and set back from the aperture) are also present. Burch (1962) list the shell measurements 1.6 to 1.7 mm in height, 0.8 mm in diameter, with 4.75 to 5 whorls. Wind Cave specimens ranged from 1.7 to 1.9 mm tall with 4.5 to 5.5 whorls.

Range: Pilsbry (1948) reported it only from North Dakota. Nekola (2002) reports *V. arthuri* from the upper Midwest. The specimens from the Black Hills area may indicate that the species is more widespread than originally thought, or it may indicate only isolated populations exist.

Local Distribution: Scattered occurrences throughout the Black Hills (Frest & Johannes 2002, Anderson *in press*).

Habitat: Usually moist forested areas (Frest & Johannes 2002).

Taxonomy Notes: Does not have an official common name according to Turgeon *et al.* (1998), although Frest & Johannes (2002) proposed "callused vertigo."

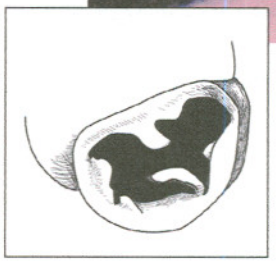

Figure 29. (a) Photo of *Vertigo arthuri.* (b) Detail of teeth
(Ilustration by Leigh Anne McConnaughey)

Vertigo elatior (Sterki 1894), or the tapered vertigo, narrows at the top of its shell. The aperture bends inward to a point on the outer lip. Five teeth are visible: parietal lamella, columellar lamella, a basal fold, and two palatal folds. The tan shell measures from 2.1 to 2.2 mm tall and 1.2 mm wide with 5 whorls. (Pilsbry 1948, Burch

Range: Ontario, Canada and scattered records in the northern U.S. from Maine to Montana (Pilsbry 1948, Hubricht 1985).

Local Distribution: Rare occurrences reported from the Black Hills (Frest & Johannes 2002).

Habitat: Locations range from moist wooded areas, including aspen and willow groves, to grassy meadows (Hubricht 1985, Beetle 1989, Frest & Johannes 2002).

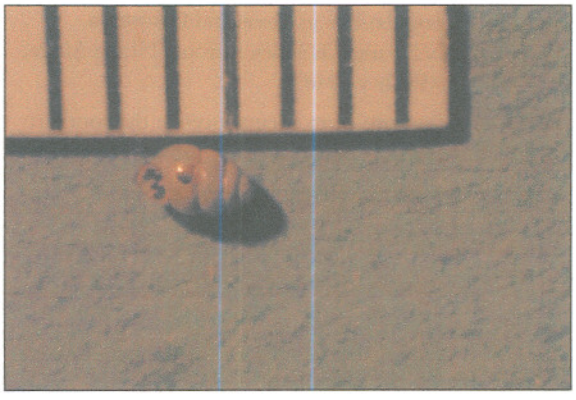

Figure 30. *Vertigo elatior.* UCM specimen #2499 from Lake George, Colorado.

Vertigo modesta modesta (Say 1824), or the cross vertigo, usually has four teeth in cross formation. Beetle (1989) reports teeth may very from zero to 6. The shell, measuring from 2.2 to 2.7 mm long and 1.3 mm diameter with 4.5 to 5.5 whorls, is medium to dark brown with visible striations, especially on the middle whorls. (Pilsbry 1948, Burch 1962)

Range: Maine to California, in the Rocky Mountains from Alaska to New Mexico and Arizona (Pilsbry 1948, Burch 1962).

Local Distribution: Reported only from the central Black Hills (Frest & Johannes 2002).

Habitat: Leaf litter, moss, downed wood; aspen, spruce, or willow stands (Beetle 1989).

Other Names: Pilsbry (1948) suggests that Rocky Mountain forms are actually different than eastern forms because of the presence of a second parietal lamellae, but this has apparently not been formally investigated.

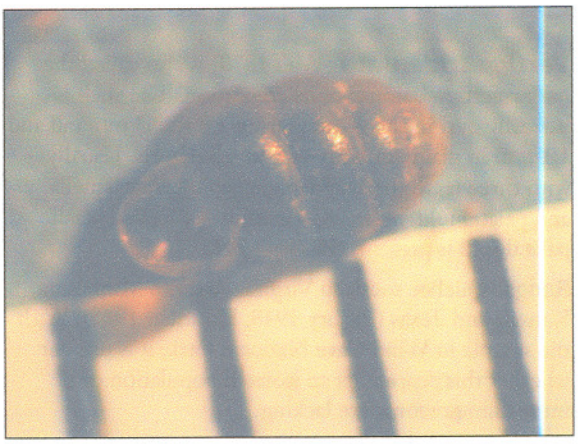

Figure 31. *Vertigo modesta modesta.* UCM specimen #13902 from British Columbia.

Vertigo paradoxa (Sterki 1900), or the mystery vertigo, has four teeth (a small columellar lamellae, parietal lamellae, and two palatal folds, the lower set back from the aperture edge). The shell is about 1.75 mm by 1 mm with 4.5 to 5 whorls. (Pilsbry 1948)

Range: Reported from Canada and scattered locations across the northern U.S. including Maine, Indiana, Michigan, Minnesota, Vermont, New York, South Dakota, and Wisconsin (Hubricht 1985, Nekola personal communication, Pearce personal communication).

Local Distribution: Rare in the central Black Hills (Frest & Johannes 2002, Anderson personal observation, Table 1)

Habitat: Forest habitat with deep litter (Nekola 2002b)

Other Names: Earlier considered a subspecies of *Vertigo gouldi*. Turgeon *et al.* (1998) still consider the classification uncertain.

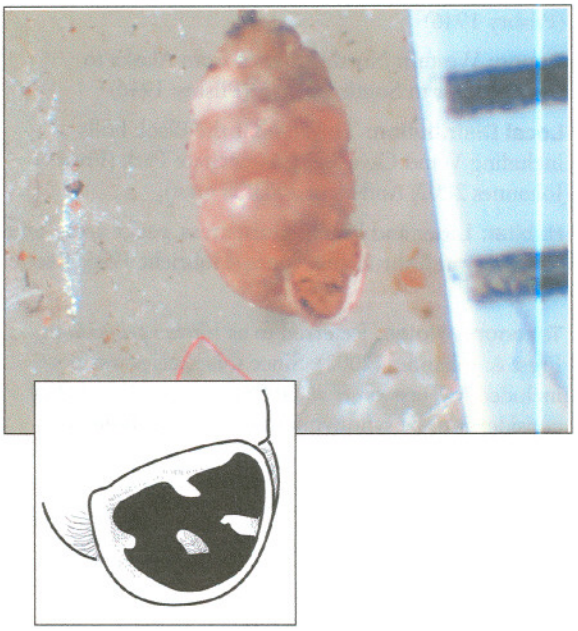

Figure 32. (a) *Vertigo paradoxa* (b) detail of aperture opening showing teeth. (Illustration by Leigh Anne McConnaughey)

Vertigo tridentata (Wolf 1870) is also called the honey vertigo because of its coloration. The shell is basically oval in shape, measuring 1.8 to 2.3 mm tall and 1.1 mm in diameter with 4.75 to 5.5 whorls. Usually with three teeth (parietal lamella, columellar lamella, and palatal fold) although sometimes a second small palatal fold is present. (Pilsbry 1948)

Range: Quebec south to Virginia, west to Minnesota, Kansas, and Texas (Pilsbry 1948, Hubricht 1985). With the sample in Wind Cave National Park, it is unclear whether this represents an isolated population or if intervening records are lacking.

Local Distribution: Wind Cave National Park (Anderson *in press*).

Habitat: Live specimens can be found on plant stems (Pilsbry 1948, Hubricht 1985).

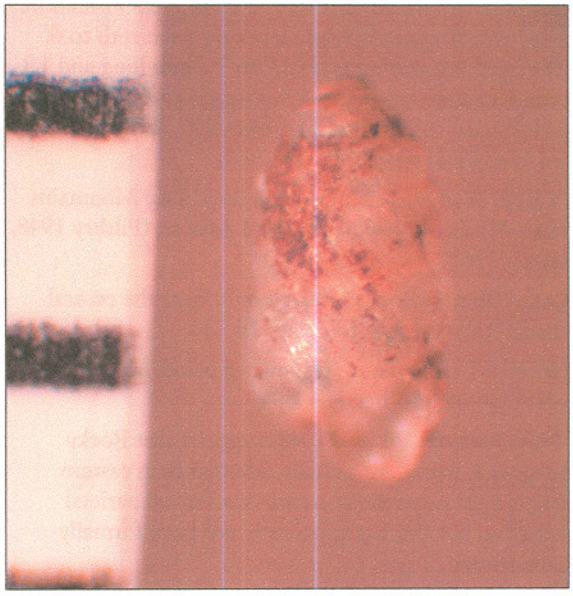

Figure 33. *Vertigo tridentata*

Vitrina alaskana is characterized by a thin shell with 3 whorls, the last one much larger than the others. The shell is 5 to 7 mm in diameter and has a smooth and shiny appearance. The umbilicus is mostly closed. (Pilsbry 1946)

Range: Western North America from Alaska to Arizona, east to South Dakota. (Pilsbry 1946)

Local Distribution: Throughout the Black Hills including Wind Cave and Custer State Park (Frest & Johannes 2002, Anderson 2003, *in press*).

Habitat: Litter and logs in moist areas, rocky areas, and dry grassy and shrubland slopes (Hubricht 1985, Beetle 1989).

Taxonomy Notes: Referred to as *Vitrina pellucida* in Frest & Johannes (2002). Since this species was not included in Turgeon *et al.* (1998) it is not clear if they consider it to be synonymous with *Vitrina pellucida*.

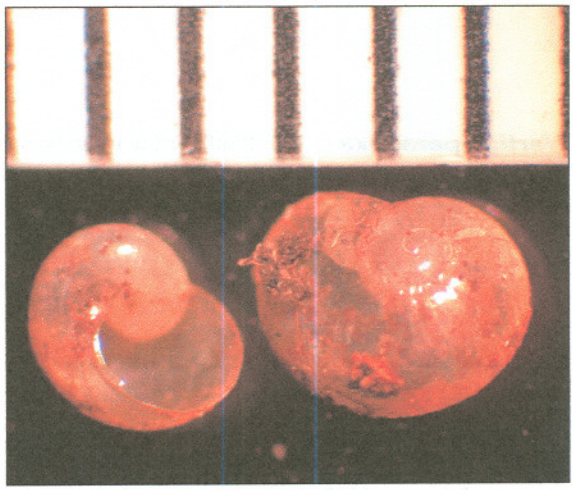

Figure 34. *Vitrina alaskana*

Zonitoides arboreus (Say 1816), or quick gloss, ranges from 5 to 6 mm in diameter with 4.75 whorls. The shell is olive colored and shiny. The umbilicus is of moderate diameter, but not too deep. The aperture opening is oval. (Pilsbry 1946)

Range: Known from all states in the United States. Also Canada, parts of Mexico and Central America, even as far as Australia. (Pilsbry 1946, Hubricht 1985)

Local Distribution: Throughout the Black Hills (Frest & Johannes 2002) including Wind Cave National Park (Anderson *in press*).

Habitat: Widespread from lowland to upland, even roadsides (Hubricht 1985, Beetle 1989).

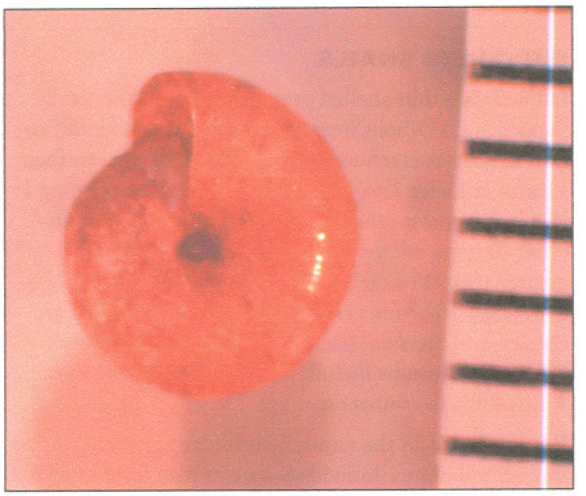

Figure 35. *Zonitoides arboreus*

Zoogenetes harpa (Say 1822) is also known as the boreal top because it is traditionally known to have a northern, boreal, distribution. This species has a thin, glossy, olive-colored shell with some ribs on the later whorls. The umbilicus is narrow and the lip is slightly reflected where it meets the umbilicus. Almost four whorls are present on shells that reach 2.5 mm in diameter and 3.25 mm tall. Live animals have gray bodies with white dots, dark antennae with large eyes at the end, and a white foot. (Pilsbry 1948)

Range: Canada south to the northern tier of states from Maine to Minnesota. In the west, the range extends south to Wyoming and Colorado. It is also known from Asia and Europe. (Pilsbry 1948, Burch 1962)

Local Distribution: Not common, but locations stretch across the Black Hills (Frest & Johannes 2002).

Habitat: Litter layer, not very deep. Aspen and willow stands, mossy bogs. (Pilsbry 1948, Beetle 1989)

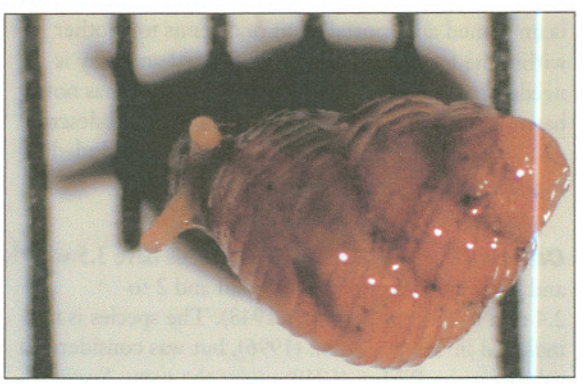

Figure 36. *Zoogenetes harpa.* UCM specimen #31261 from Colorado

SUCCINEID SNAILS

Catinella is a thin-shelled group of snails in the family Succinidae. Without internal anatomy work, identification to species is tenuous at best. *Catinella* are less than 11 mm tall with 2 to 4 whorls. The aperture opening is larger than most other species, but not as large as in other *Succinea* where the length of the aperture is greater than the height of the rest of the shell. Species with larger apertures and shells taller than 12 mm are classified as *Succinea*. (Burch 1962) Some of Pilsbry's (1948) descriptions include smaller shells as *Succinea*, which leads to confusion.

Range: Snails in the family Succinidae are found across the United States. Individual species may have localized distributions.

Habitat: Succineid habitat varies for different species but can include: areas near springs, in damp depressions, marshes, in leaf litter, near limestone cliffs, shrub or grassy areas on rocky slopes, and even dry open grassy areas (Hubricht 1985, Beetle 1989).

Taxonomy Notes: Pilsbry (1948) uses *Quickella* instead of *Catinella* for the genus. Many individual species have been named and moved from one genus to another within the family. Inspection of internal anatomy is needed for confident identification, and that has not been done for Black Hills specimens. General descriptions of species reported from the area are included here, but more study is needed on this group.

Catinella gelida (Baker 1927) shells have 3.5 whorls and measure from 6.6 to 8 mm tall and 2 to 2.4 mm in diameter (Pilsbry 1948). The species is not included in Turgeon *et al.* (1996), but was considered a subspecies by Pilsbry (1948) under the name *Succinea grosvenori gelida*. Pilsbry reports only fossil specimens from Illinois and Iowa. Frest & Johannes (2002) report scattered locations in the Black Hills.

Succinea indiana (Pilsbry 1905) or the xeric ambersnail is described as a brownish to reddish shell of 10-11 mm long and 6-7 mm in diameter with 3.5 whorls (Pilsbry 1948). It is reported from only a few locations in the central and southern Black Hills (Frest & Johannes 2002).

Catinella stretchiana (Bland 1865) or the Sierra ambersnail is called *Succinea stretchiana* in Frest & Johannes (2002) and has a western range including Wyoming, California, Idaho, and Nevada (Pilsbry 1948). The shell has 3 whorls and measures 6 to 8.5 mm tall and 5 mm in diameter. The aperture is oval, measuring about 5 mm by 4mm. (Pilsbry 1948). Frest & Johannes (2002) reported this to be a common species throughout the Black Hills.

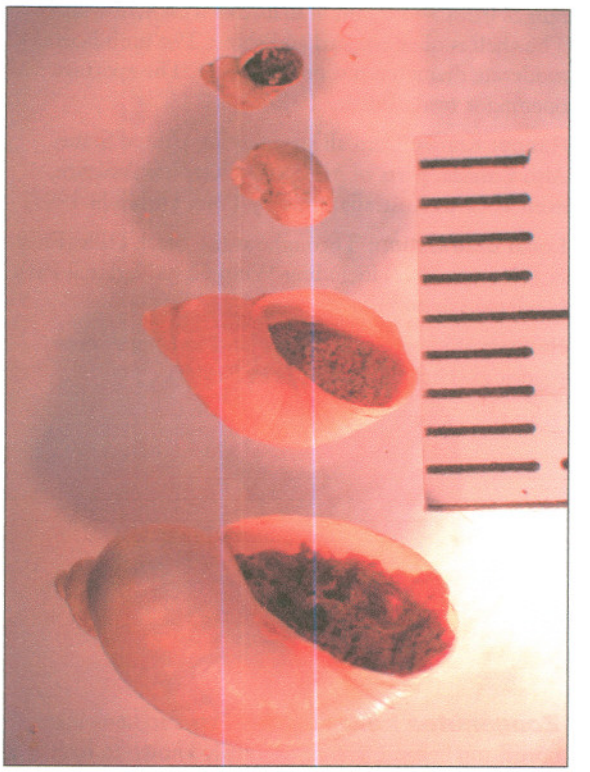

Figure 37. A variety of Succineid snails found in the Black Hills.

SLUGS

Arion fasciatus (Nilsson 1823), the orange-banded arion, has a colored band running the length of its gray body. The mantle has a visible breathing pore in the anterior half unlike other slugs or the region whose breathing pore is positioned posteriorly. The base of the foot is white. The animal ranges from 25 to 35 mm long. The tail is rounded. (Burch 1962)

Range: In the eastern U.S. from Maine to Wisconsin, Washington, D.C. to Illinois. In the western U.S. it is known from California (Burch 1962).

Local Distribution: A few Black Hills locations in Lawrence County (Frest & Johannes 2002).

Habitat: Unknown.

Deroceras laeve (Müller 1774), or the meadow slug, has no hard shell but still has a mantle. This species is a grayish-yellow color that can reach 15 to 30 mm in length. The mantle is located in the middle of the body. The back has a slight peak or keel and the tail is pointed. (Burch 1962)

Range: Across North America and worldwide. Like most slugs in North America, this species is believed to be introduced by Europeans (Burch 1962), but this is sometimes disputed (Hubricht 1985).

Local Distribution: Common in moist areas of the Black Hills including Spearfish Canyon and Wind Cave National Park (Frest & Johannes 2002, Anderson *in press*).

Habitat: Inhabits a variety of settings, such as: urban areas, open grasslands, leaf litter, moss, near ponds (Hubricht 1985, Beetle 1989).

Taxonomy Notes: Formerly known as *Agriolimax campestris*.

Limax maximus (Linneus 1758), the giant gardenslug, is 80 to 120 mm long. Its mantle is located near its head. The body and mantle have black spots on a yellow to gray background. The back has a slight peak or keel and pointed tail. (Burch 1962)

Range: Introduced across the northern part of the U.S. (Burch 1962)

Local Distribution: A few, so far localized, areas in the Black Hills (Frest & Johannes 2002).

Habitat: In areas associated with humans, such as gardens, cellars, etc. (Burch 1962).

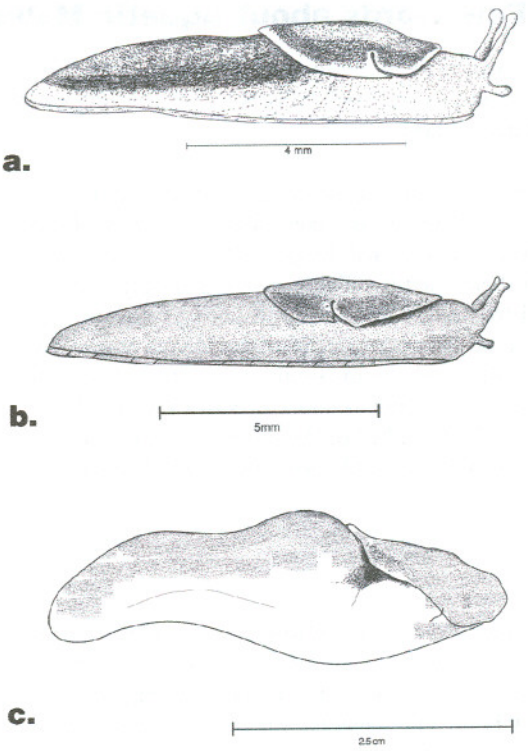

Figure 38. Three slug species are found in the Black Hills (a) *Arion fasciatus*, (b) *Deroceras laeve*, and (c) *Limax maximus*. (Illustrations by Leigh Anne McConnaughey)

A Few Words about Aquatic Mollusks in the Black Hills

Very little is known about the aquatic mollusk community in the Black Hills. A few species of note are highlighted here.

Melanoides tuberculata, or the red-rimmed melania, is an introduced species. It is cone-shaped with red splotches or stripes on the shell. Ridges and nodules are prominent shell sculpture. The species is generally found in semi-tropical waters and is only known from warm springs in the northern part of the United States. The U.S. range includes the southern U.S. from Florida to Texas and scattered locations in South Dakota (Black Hills), Montana, Idaho, Wyoming, Nevada, Utah, Arizona, California, Oregon, and Hawaii (Anderson 2004).

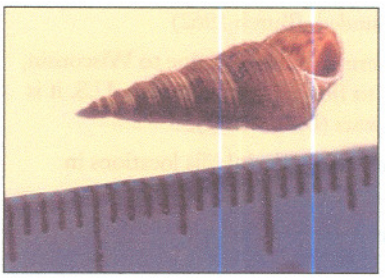

Figure 39. *Melanoides tuberculata*

Pisidium species, or pea clams, are bivalves that range from 0.5 to 12 mm in width (McMahon and Bogan 2001). They are found in very moist spring areas in the Black Hills. The shells are not necessarily found only in the water (personal observation). Members of this group are found in many areas of the United States but they are difficult to identify to the species level.

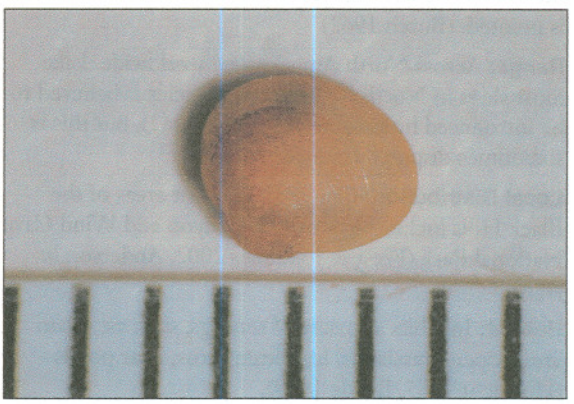

Figure 40. *Pisidium* species. UCM specimen #33095 from South Dakota

Species in the Family Physidae, including *Physa* and *Physella* species, are extremely difficult to identify because there are very few differences in shell characteristics. The Family has representatives across the United States with more than 30 individual species recognized. Aquatic environments of all types may potentially house individuals in this group. (Clark & Perez 2004)

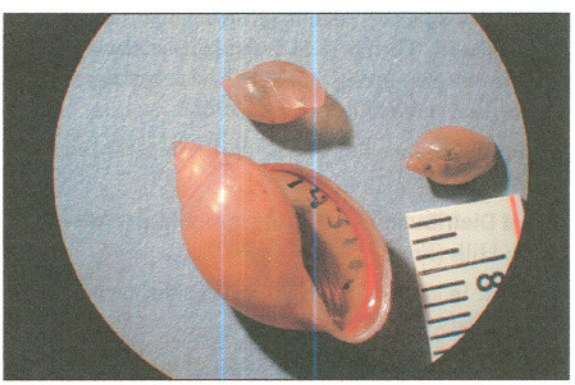

Figure 41. *Physidae* species UCM specimens #14317 and 13667 from South Dakota

Table 1. Data Sources of Snail Species in the Black Hills

Species Name	BHNF	WCNP[2]	CSP[3]
Carychium exiguum	X[1]		
Cionella lubrica	X[1,4]	X	X
Columella columella alticola		X	
Columella simplex	X[1]		
Discus catskillensis	X[4]	X	X
Discus shimeki	X[1]		
Discus whitneyi	X[1,4]	X	X
Euconulus fulvus	X[1,4]	X	X
Gastrocopta armifera	X[1,4]	X	X
Gastrocopta holzingeri	X[1]	X	X
Gastrocopta pellucida		X	
Gastrocopta procera	X[1]	X	
Hawaiia minuscula	X[1]	X	X
Nesovitrea binneyana	X[1,4]	X	X
Nesovitrea electrina	X[4]	X	X
Oreohelix cooperi	X[1,4]		
Punctum minutissimum	X[1]		
Pupilla blandi	X[1]	X	
Pupilla hebes		X	
Pupilla muscorum		X	X
Punctum minutissimum	X[1]		
Pupoides albilabris	X[1]	X	
Striatura milium	X[1]	X	
Strobilops labyrinthica	X[1]		
Vallonia cyclophorella	X[1]		
Vallonia gracilocosta	X[1,4]	X	X
Vallonia parvula		X	X
Vallonia pulchella	X[1]	X	
Vertigo arthuri	X[1]	X	
Vertigo elatior	X[1]		
Vertigo modesta modesta	X[1]		
Vertigo paradoxa	X[1,4]		
Vertigo tridentata		X	
Vitrina alaskana	X[1,4]	X	X
Zonitoides arboreus	X[1]	X	
Zoogenetes harpa	X[1]		
Catinella sp.	X[1,4]	X	X
Catinella gelida	X[1]		
Succinea indiana	X[1]		
Succinea stretchiana	X[1]		
Arion fasciatus	X[1,4]		
Deroceras laeve	X[1,4]	X	
Limax maximus	X[1,4]		

[1] Black Hills National Forest locations as reported by Frest & Johannes (2002).

[2] Wind Cave National Park locations as reported by Anderson (*in press*). Specimens deposited at the Field Museum of Natural History in Chicago, Illinois.

[3] Custer State Park locations as reported by Anderson (2003b). Specimens deposited at University of Colorado Museum in Boulder, Colorado.

[4] Black Hills National Forest specimens collected by Anderson (unpublished data). Specimens to be deposited at University of Colorado Museum in Boulder, Colorado.

Acknowledgements

Funding for this work was provided through the Non-Game Small Grants Program of the South Dakota Department of Game, Fish, and Parks. Layout and printing was made possible through the University of Colorado Publications Office and the University of Colorado Museum. Funding for some collections was also provided by Wind Cave National Park. Special thanks go out to the many people who provided professional advice and support throughout this project: Doug Backlund (SD GF&P), Rob Guralnick (University of Colorado Museum), Gene Hall (University of Colorado Museum), Jochen Gerber (Field Museum of Natural History), Patti Lynch (USDA Forest Service), Gary Brundige (Custer State Park), Barbara Muenchau (Wind Cave National Park), Bob Paulson (The Nature Conservancy). Special thanks to Leigh Anne McConnaughey for the illustrations and for helping with some of the museum photos.

References Cited

Anderson, T. K. 2003 Land Snail Survey at Custer State Park. Report to South Dakota Game, Fish, and Parks.

Anderson, T. K. 2004. A review of the United States distribution of *Melanoides tuberculatus* (Muller, 1774), an exotic freshwater snail. *Ellipsaria* 6: 15-18.

Anderson, T. K. *In Press. Land Snail Diversity in Wind Cave National Park, South Dakota*. Western North American Naturalist

Beetle, D. E. 1976. Mollusks of Badlands National Monument, SD. Bulletin of the American Malacological Union, Inc. 1976: 49-50.

Beetle, D. E. 1989. Checklist of recent mollusca of Wyoming, USA. *Great Basin Naturalist* 49: 637-645.

Burch, J. B. 1962. *How to Know the Eastern Land Snails.* Brown Company Publishers, Dubuque, Iowa.

Clark, S. and K. E. Perez. 2004. *Physidae*. Pgs. 36-39 in: *A Primer to Freshwater Gastropod Identification* (K. E. Perez, S. A. Clark, and C. Lydeard, eds.). Freshwater Mollusk Conservation Society, Freshwater Gastropod Identification Workshop, Tuscaloosa, Alabama.

Falkner, G. 1990. Binnenmollusken. Pgs. 112–273 in: *Weichtiere* (Fechter, R. and G. Falkner, eds.). München (Mosaik).

Frest, T. J. & E. J. Johannes. 2002. Land snail survey of the Black Hills National Forest, South Dakota and Wyoming, summary report 1991-2001. Contract #43-67TO-8-1085. Final Report to the USDA Forest Service, Custer, South Dakota.

Gerber, J. 1996. Revision der gattung Vallonia Risso 1826 (Mollusca: Gastropoda: Valloniidae). (Revision of the genus Vallonia) *Schriften zur Malakozoologie* 8: 1-227.

Heller, J. 1990. Longevity in mollusks. *Malacologia* 31: 259-295.

Hubricht, L. 1985. The distributions of the native land mollusks of the eastern United States. *Fieldiana Zoology* No. 24. Field Museum of Natural History, Chicago.

Jass, C. N., J. I. Mead, A. D. Morrison, & L. D. Agenbroad. 2002. *Late Pleistocene mollusks from the southern Black Hills, South Dakota*. Western North American Naturalist 62: 129-140.

McMahon, R. F. and A. E. Bogan. 2001. Mollusca: Bivalvia. Pgs. 331–429 in: *Ecology and Classification of North American Freshwater Invertebrates*, 2nd edition (J. H. Thorp and A. P. Covich, eds.). Academic Press, San Diego, California.

Nekola, J. C. 2002a. Effects of fire management on richness and abundance of central North American grassland land snail faunas. *Animal Biodiversity and Conservation* 25: 53-66.

Nekola, J. C. 2002b. Distribution and ecology of terrestrial gastropods in northwestern Minnesota. Final report to: Natural Heritage and Nongame Research Program, Division of Fish and Wildlife, Minnesota Department of Natural Resources, St. Paul, Minnesota.

Over, W. H. 1942. Mollusca of South Dakota. *Natural History Studies*, No. 5. University of South Dakota, Vermillion, South Dakota.

Pilsbry, H. A. 1946. *Land mollusca of North America (north of Mexico)*, vol. 2, part 1. Academy of Natural Sciences of Philadelphia, Monograph no. 3.

Pilsbry, H. A. 1948. *Land mollusca of North America (north of Mexico)*, vol. 2, part 2. Academy of Natural Sciences of Philadelphia, Monograph no. 3.

Pokryszko, B. M. 1990. Life history and population dynamics of *Vertigo pusilla* OF Muller, 1774 (Gastropoda: Pulmonata: Vertiginidae) with some notes on shell and genital variability. *Annales Zoologici* 43: 407-430.

Roth, B. and P. S. Sadeghian. 2003. *Checklist of the Land Snails and Slugs of California*. Santa Barbara Museum of Natural History, Contributions in Science (3).

Tompa, A. S. 1984. Land snails (Stylommatophora). Pgs 47-140 in: *The Mollusca*, vol. 7, Reproduction (A.S. Tompa, N. H. Verdonk, and J.A.M. van den Biggelaar, eds.) Academic Press, Inc.

Turgeon, D.D., J.F. Quinn, Jr., A.E. Bogan, E.V. Coan, F.G. Hochberg, W.G. Lyons, P.M. Mikkelsen, R.J. Neves, C.F.E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F.G. Thompson, M. Vecchiione, & J.D. Williams. 1998. *Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks*, 2nd edition. American Fisheries Society, Special Publication 26, Bethesda, Maryland.

A Sample of Additional References with General Information on Snails

Meglitsch, P. A. and F. R. Schram.1991. *Invertebrate Zoology*, 3rd edition. Oxford University Press, New York.

Pearse, V., J. Pearse, M. Buchsbaum, and R. Buchsbaum. 1987. *Living Invertebrates*. Blackwell Scientific Publications, Palo Alto, California.

Natural History Inventory of Colorado

No. 1 Botany
Vascular plants, lichens, and bryophytes. 2nd ed. with bibliography. By William A. Weber and Barry C. Johnston. ii + 220 pages. October 1979. (Out of print)

No. 2 Zoology
The Bivalvia of Colorado. Part 1. The fingernail and pill clams (Family Sphaeriidae). By Shi-Kuei Wu. 39 pages & 9 tables. Part 2. The freshwater mussels (Family Unionidae). By Nancy E. Brandauer and Shi-Kuei Wu. 20 pages, 19 figures, and 3 tables. February 8, 1978. $4.00.

No. 3 Zoology
The crayfishes (Crustacea: Cambaridae) of Colorado. By Philip A. Unger. 20 pages, 30 figures, and 2 tables. August 1, 1978. $2.50.

No. 4 Zoology
The fresh-water sponges (Porifera: Spongillidae) of Colorado. By Ruth E. Williams. 12 pages, 6 figures, and 1 table. February 1, 1980. $1.50.

No. 5 Zoology
The occurence of a freshwater shrimp *Palaemonetes paludosus* (Gibbes, 1850) (Crustacea: Palaemonidae) in a warm spring of Wellsville, Colorado. By Shi-Kuei-Wu and Susan E. S. Brown. 10 pages, 18 figures, and 3 tables.

Eubranchiopoda of Colorado. Part 1. Introduction and Notostraca. By James F. Saunders III. 14 pages and 25 figures. May 1, 1980. $2.50.

No. 6 Zoology
Eubranchiopoda of Colorado. Part 2. Anostraca. By James F. Saunders III. 14 pages and 25 figures. February 15, 1981. $2.50.

No. 7 Zoology
Type specimens of Recent Mollusca in the University of Colorado Museum. By Shi-Kuei-Wu and Nancy E. Brandauer. 47 pages. October 1, 1982. $5.00.

No. 8 Zoology
Eubranciopoda of Colorado. Part 3. Conchostraca. By James F. Saunders III and Shi-Kuei-Wu. 19 pages and 23 figures. May 1, 1984. $2.50.

No. 9 Zoology
Family Oreohelicidae (Gastropoda: Pulmonata) in Colorado. By Nancy E. Brandauer. 32 pages, 15 figures, and 6 tables. January 25, 1988. $4.00.

No. 10 Zoology
Freshwater planarians of Colorado, with special reference to their vertical distribution in the Rocky Mountain National Park Region. By Masaharu Kawakatsu, Wataru Teshirogi, Shi-Kuei-Wu, and Robert W. Mitchell. 26 pages, 11 figures, and 2 tables. October 31, 1989. $3.50.

No. 11 Zoology
Colorado freshwater mollusks. By Shi-Kuei-Wu. 117 pages and 126 figures. November 30, 1989. $8.00

No. 12 Botany
A floristic survey of the Eagle Nest Wilderness Area in the southern Gore Range of Central Colorado. By Tim Hogan. 35 pages, 3 figures, and 2 tables. July 15, 1992. $5.00.

No. 13 Botany
A floristic survey of the Boulder Mountain Park, Boulder, Colorado. By Tim Hogan. 63 pages, 2 figures, and 3 tables. March 15, 1993. $5.00.

No. 14 Botany
A floristic survey of the Black Forest of the Colorado Front Range. By Anne Maley. 31 pages and 3 figures. October 15, 1994. $5.00.

No. 15 Zoology
Distribution and ecology of bats of Colorado. By David M. Armstrong, Rick A. Adams, and Jerry Freeman. 83 pages, 19 figures, and 9 tables. December 1, 1994. $7.00.

No. 16 Botany
Checklist of vascular plants of Boulder County, Colorado. By William A. Weber. 66 pages. November 1, 1995. $5.00.

No. 17 Botany
A floristic survey of the Mesa de Maya Region, Las Animas County, Colorado. By Dina A. Clark. 44 pages, 1 figure, and 4 tables. September 15, 1996. $5.00.

No. 18 Botany
The flora and vegetation of the Needle Mountains, San Juan Range, southwestern Colorado. By Joan Michener-Foote and Tim Hogan. 39 pages, 2 figures, and 2 tables. February 15, 1999. $5.00.

No. 19 Zoology
Distribution and habitat of freshwater mussels (Bivalvia: Unionida: Unionidae) in Colorado. By James R. Cordeiro. 56 pages, 5 figures, 6 tables, and Appendices A-C. March 15, 1999. $8.00.

No. 20 Zoology
Glass snail, *Vitrina pellucida* (Müller) (Gastropoda: Pulmonata) in Colorado. By Erin B. McCray. 21 pages, 9 figures, and 3 tables. December 15, 1999. $3.00.

No. 21 Anthropology
Native American Ceramics of Eastern Colorado. By Priscilla B. Ellwood. xii + 115 pages, 133 figures, 3 tables, and Appendices A-C. April 20, 2002. $15.00.

No. 22 Zoology
Field Guide to Black Hills Land Snails. By Tamara Anderson. 32 pages, 41 figures, and 1 table. December 2004. $5.00.

Institutional libraries interested in publication exchange with *Natural History Inventory of Colorado* should write to the Publication Committee; persons interested in a particular number of this series should send their order to 218 UCB, University of Colorado, Boulder, Colorado 80309-0218. Please make check payable to *University of Colorado Museum*.