Venustaconcha sima (Lea), an Overlooked Freshwater Mussel (Bivalvia: Unionoidea) from the Cumberland River Basin of Central Tennessee

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Dick, I think you'll find that it doesn't take a Bogan to recognize that this species is NOT Villosa [illegible]. HA! Mark

ABSTRACT

Unio simus Lea, 1838, generally has been considered to be a junior synonym of *Villosa nebulosa* (Conrad, 1834). Examination of recently collected specimens indicates that it is a valid species of *Venustaconcha* restricted to the upper Caney Fork River system in central Tennessee. *Venustaconcha sima* may represent the Cumberlandian counterpart of *V. pleasii* (Marsh, 1891) of the southern Ozark Plateaus.

Key words: Bivalvia, Unionoidea, *Venustaconcha*.

INTRODUCTION

During recent studies of the mussel fauna of the Caney Fork River basin (e.g., Farzaad, 1991; Layzer *et al.*, 1993), a major tributary system of the Cumberland River, a diminutive purplish-nacred mussel was found, which possessed a posterioventral emargination with an associated radial sulcus in female shells and relatively heavy hinge dentition. Stansbery (personal communication) considered it to be an undescribed species of *Villosa*; however, the above morphological characters match diagnostic criteria in Haas (1969) for *Venustaconcha*. A review of the multitudinous species descriptions of Isaac Lea and subsequent examination of type specimens in the National Museum of Natural History, Smithsonian Institution, resulted in the identification of this mussel as *Venustaconcha sima* (Lea, 1838).

SYSTEMATICS

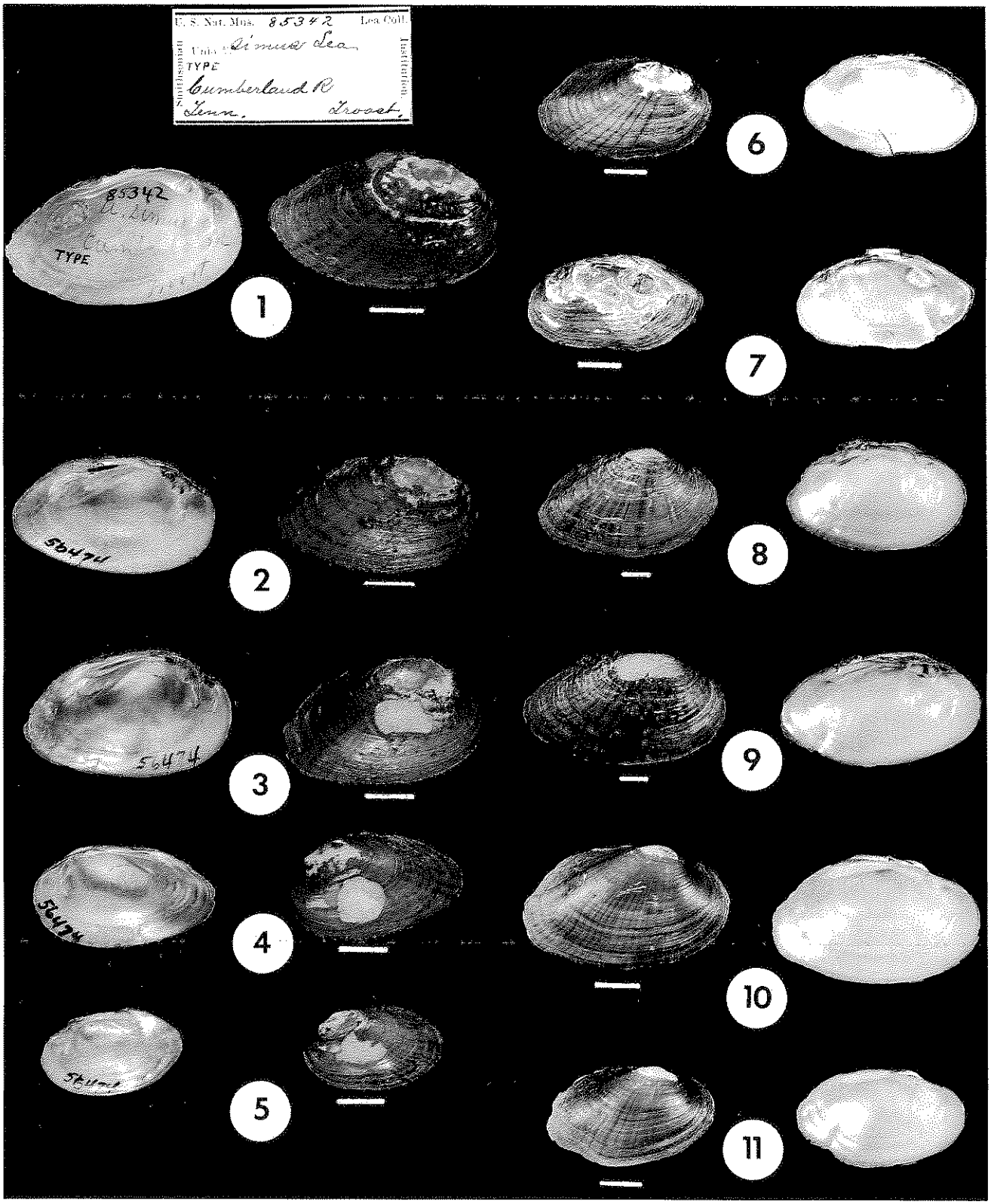
Tribe Lampsilini

Venustaconcha sima (Lea, 1838)
(Figures 1-7; Table 1)

Margarita (Unio) simus Lea (1836:29) *nomen nudum*.
Unio simus Lea (1838:26, figure 20 on plate VIII).
Margaron (Unio) simus Lea (1852:31).
Lampsilis simus Simpson (1900:556).
Lampsilis sima Simpson (1914:123).
Eurynia (Micromya) nebulosa (in part) Ortmann (1918:577).
Micromya nebulosa (in part) Ortmann (1924:102).
Lampsilis (Ligumia) nebulosa (in part) Frierson (1927:78).
Villosa nebulosa (in part) Burch (1975:173).

Description: Shell small, broadly elliptical (males) to somewhat ovate (females), barely inflated (W/H≅0.63: for interpretation of shell proportions, see Wu, 1978); solid, thinner posteriorly; anterior rounded; dorsal margin slightly convex, oblique, consequently shell may appear humped or somewhat winged, juncture with anterior margin sometimes angular; ventral margin slightly convex to virtually straight; posterior bluntly pointed to biangulate; posterio-ventral region of female shells may be swollen with some distention of the extreme posterior of the ventral margin, an emargination and associated radial sulcus may develop posteriorly to the distention; posterior ridge low, vaguely double, somewhat flattened between ridges but may appear rounded; posterior slope slightly concave with a shallow radial furrow, furrow may cause an indentation of the posterio-dorsal margin; ligament low, short; umbo compressed, low, barely elevated above dorsal margin; umbonal sculpture ". . .irregular, somewhat doubly-looped ridges. . ." (Simpson, 1914); periostracum rather smooth and somewhat shiny in younger specimens, may be dull and rough in older shells, annual growth lines well-marked, yellowish to dark brown or black with narrow dark green rays, raying most prevalent on posterior half of shell and may be wavy and clustered closely together.

Pseudocardinals thick, heavy, serrated, double in left valve, single in right valve but often with small anterior and posterior denticles opposite adjacent sulci; interdentum moderately wide, relatively short; lateral teeth short, straight, lamellar, may be slightly serrate, double in left valve, single in right valve; anterior adductor and retractor muscle scars confluent, rather small, deeply impressed; protractor muscle scar distinct, straight to crescent-shaped; posterior muscle scars typically confluent, impressed, adductor large, retractor small and positioned under distal base of lateral tooth; dorsal muscle scars



Figures 1-11. Shells of *Venustaconcha*. **1-5.** Type specimens of *Venustaconcha sima*. **1.** Holotype (male, USNM 85342). **2-4.** Male paratypes (ANSP 56474). **5.** Female paratype (ANSP 56474). **6-7.** *Venustaconcha sima* from Collins River, Mt. Olive, Grundy County, Tennessee, collected 15 July 1989. **6.** Male. **7.** Female. **8-9.** *Venustaconcha ellipsiformis* from Osage Fork of Gasconade River, Dryknob, Laclede County, Missouri, collected 3 October 1983. **8.** Male. **9.** Female. **10-11.** *Venustaconcha pleasii* from James River, east of Springfield, Greene County, Missouri, collected 4 October 1983. **10.** Male. **11.** Female. Scale bars = 1 cm.

Table 1. Shell dimensions of type specimens and representative shells of *Venustaconcha sima* (L = length, H = height, W = width, M = male, F = female; specimens other than types were collected from the Collins River, Tennessee, Grundy County, Mt. Olive, 15 July, 1989).

Specimen	Sex	L	H	W	H/L	W/H
Holotype	M	43.9	25.4	15.2	0.57	0.60
Paratype	M	43.4	26.7	15.6	0.62	0.58
Paratype	M	42.0	24.3	15.2	0.58	0.63
Paratype	M	37.8	21.8	14.1	0.58	0.65
Collins River	M	47.3	27.1	17.5	0.57	0.65
Collins River	M	42.2	24.7	15.7	0.59	0.64
Collins River	M	46.5	27.5	15.8	0.59	0.58
Collins River	M	45.0	25.5	16.6	0.57	0.65
Collins River	M	42.3	24.0	14.9	0.57	0.62
Collins River	M	41.1	23.4	13.4	0.57	0.57
	M				$\bar{x} = 0.58$	$\bar{x} = 0.62$
Paratype	F	29.5	17.7	10.3	0.60	0.58
Collins River	F	42.8	23.4	14.5	0.55	0.64
Collins River	F	36.4	21.7	14.2	0.60	0.65
Collins River	F	33.0	19.6	13.4	0.59	0.68
Collins River	F	31.3	18.4	11.2	0.59	0.61
Collins River	F	34.7	20.7	12.2	0.60	0.59
Collins River	F	36.7	21.4	14.8	0.58	0.69
Collins River	F	30.5	18.3	11.8	0.60	0.65
Collins River	F	32.9	19.9	12.3	0.61	0.62
Collins River	F	30.6	18.3	12.3	0.60	0.67
	F				$\bar{x} \pm 0.59$	$\bar{x} = 0.64$
	Overall				$\bar{x} = 0.59$	$\bar{x} = 0.63$

deeply impressed on underside of interdentum, occasionally causing a notch in interdentum, extend from just posterior of the umbo to base of pseudocardinals; pallial line impressed, lighter posteriorly; beak cavity moderately developed; nacre variable, tends to be purple in living individuals but may be lighter, pinkish or whitish, and blotched with brown, color fades rapidly in dead shells.

Type locality: "Cumberland River, Tennessee . . . This shell was procured by Professor Troost from the Cumberland River, but whether near Nashville or not, I am not informed" (Lea, 1838).

Type specimens: Holotype, National Museum of Natural History, Smithsonian Institution (USNM) 85342 (male). Paratypes, Academy of Natural Sciences of Philadelphia (ANSP) 56474 (three males, one female). All type specimens have whitish nacre as noted by Lea (1838)[1], evidently reflecting the tendency for the purple coloration to fade in dead shells. Only one additional lot of this species was located at the USNM (782358) labelled "*Villosa trabalis perpurpurea* (Lea, 1861)", but containing a mixed collection of *Venustaconcha sima* and *Pleurobema gibberum* (Lea, 1838) from the Collins River, Grundy County, Tennessee. Additional lots are located at the Carnegie Museum, Museum of Comparative Zoology, and Ohio State University Museum. Voucher specimens from the present study have been deposited in the USNM, University of Michigan Museum of Zoology, Museum of Comparative Zoology, Carnegie Museum, and University of Colorado Museum.

Distribution: The distribution of this species is difficult to delineate due to the lack of historical records; however, recent collecting indicates that it is restricted to the Caney Fork River basin above Great Falls. Much of its presumed former habitat is inundated by Great Falls Reservoir.

Habitat: *Venustaconcha sima* appears to be associated with riffle systems in small to medium-sized streams, including headwaters. It is most abundant in sandy substrate between cobbles and boulders with slow to moderate current, although it also occurs in courser substrate and faster currents (see Farzaad, 1991).

Etymology: *Venustaconcha*– L. *venusta* [adj.] + *concha* [n., feminine]), pretty shell; *sima*–L. [adj.], snub-nosed.

DISCUSSION

Following its original description, *Venustaconcha sima* was known only by its inclusion in synoptic lists of fresh-

[1] Lea (1862:62) stated that *V. sima* had a salmon colored nacre. Since examination of available specimens at USNM and ANSP indicated that Lea only had access to specimens in the type lots (all with white nacre), he may have confused this particular attribute of the similarly-shaped *Unio notatus* Lea, 1838 (*incertae sedis*) with *sima*.

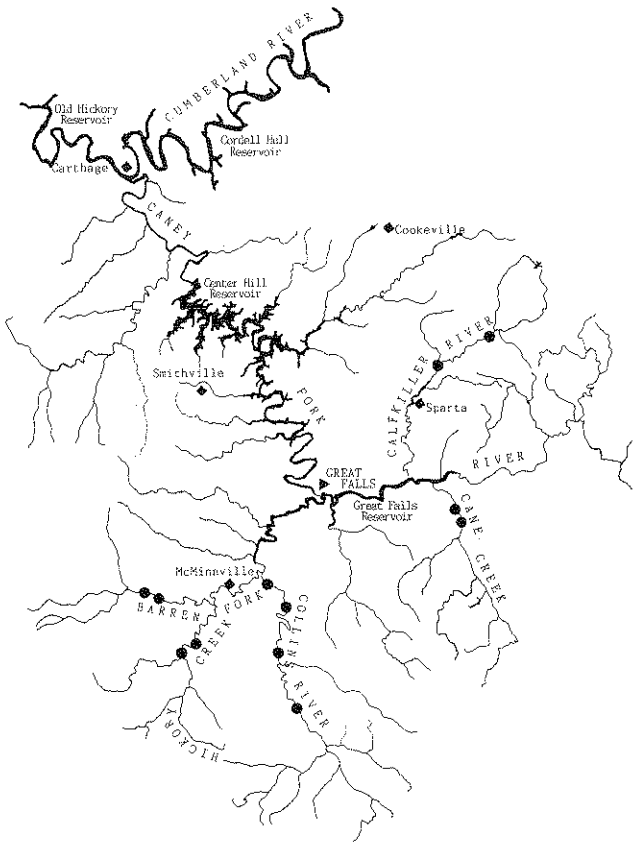


Figure 12. Distribution of *Venustaconcha sima* within the Caney Fork River system, Tennessee.

water mussels (e.g., Troschel, 1839; Conrad, 1853; Lea, 1870). Call (1885) alluded to an affinity with "*Unio iris*, Lea," 1829, which Simpson (1900, 1914) subsequently followed. Simpson (1914) did note its resemblance to "*Lampsilis*" *nebulosa* (Conrad,1834) and "*L.*" *ellipsiformis* (Conrad, 1836). Ortmann (1918) relegated *sima* as a junior subjective synonym under "*Eurynia (Micromya)*" *nebulosa*. *Venustaconcha sima* is a heavier shell than *Villosa iris* or *V. nebulosa*. It tends to be relatively shorter and broader than either of the latter and, particularly in the case of females, more closely resembles *Venustaconcha ellipsiformis* by virtue of its posterior-ventral swelling with associated emargination and radial sulcus, heavy pseudocardinal teeth, wide interdentum, and fine, wavy, closely-spaced rays (Figs. 8-9). These characteristics were among those employed by Haas (1969) to distinguish *Venustaconcha* Frierson, 1927[2], from *Villosa* Frierson, 1927.

Within the Cumberland River basin, *Venustaconcha sima* is similar in appearance to and occasionally may be confused with species in the *Villosa iris / nebulosa* complex (see above) and *V. trabalis* (Conrad, 1834) (e.g., (USNM 782358). Compared to *Venustaconcha sima*, the latter species is a relatively heavier, larger and more elongate shell. Its periostracum tends to be darker, the posterior-ventral emargination of the female is not as acute, pseudocardinal teeth are relatively larger, and the nacre tends not to be blotched. These two species also appear to be distributed allopatrically. Interestingly, the shells of *V. trabalis* and *V. ellipsiformis* are more similar to each other than either is to *V. sima*, and Frierson (1927) included *trabalis* in his original list of species under *Venustaconcha*. Although further investigation into generic relationships of advanced lampsilines is required (Hoeh and Frazer, personal communications), classification of *trabalis* under *Venustaconcha* may be more representative of actual relationships that an association with *Villosa*.

The distribution of *Venustaconcha sima* appears to be restricted to the portion of the Caney Fork River basin draining the Highland Rim upstream from Great Falls, the cataract at the escarpment between the Highland Rim and Nashville Basin (Fig. 12). Call (1885) listed its range as the "Cumberland river, Tennessee, and Swamp Creek, Whitfield County, Georgia." To this, Simpson (1900, 1914) added ". . .Tennessee river system(s); Othcalooga Creek, northwest Georgia." As noted above, only two lots of *V. sima* were observed at the USNM. It is unclear upon which specimens Simpson based this range. Call (1885) and Simpson (1900, 1914) possibly may have confused *V. sima* with species of *Villosa* (e.g., *V. iris* complex; *V. vanuxemii* [Lea, 1838][3], particularly the *umbrans* Lea, 1857, morph).

Lea (1838) noted the Cumberland River, Tennessee, as the type locality for *U. simus*, but commented that he did not know the exact collection site. Lea's locality information often was increadibly vague (e.g., *Unio grayanus* Lea, 1834: type locality - China) or reflected the address of the collector (e.g., *Lampsilis reeveiana* Lea, 1852: see Gordon & Kraemer, 1984). The latter may be the case with *Venustaconcha sima*. Since the type specimens were sent by Prof. Troost from Nashville, Lea may have assumed that they had been collected from the Cumberland River. With respect to its known distribution (Fig. 12), the type specimens may have originated from the Collins River or possibly its principle

[2] On several occasions (e.g., Vokes, 1980; Oesch, 1984; Stansbery, xeroxed ephemera), authorship of *Venustaconcha* has been attributed to Thiele, 1934 or 1935. *Venustaconcha* was proposed as a replacement name by Frierson (1927) in the "*errata et corrigenda*" for *Venusta* Frierson, 1927 (*non* Boettger, 1877, *nec* Barrande, 1881).

[3] Lea (1838) stated that he named this species after Prof. Lardner Vanuxem, yet the original spelling ended with the suffix for a locality name rather than the masculine genetive. The spelling of *vanuxemensis* was corrected to *vanuxemii* by Lea (1858). This change is in accordance with Articles 19a (i), 32c (ii), 32d, 33b (ii) and Appendix D of the International Code of Zoological Nomenclature (third edition). Johnson (1974) previously noted this correction of the *lapsus calami*.

tributary, Barren Fork, in the vicinity of McMinnville, Warren County, Tennessee (the largest town in that area in 1838).

Venustaconcha sima does not appear to have a counterpart in the Tennessee River or drainages northward into Kentucky. As previously observed, Simpson (1914) noted similarities between *V. sima* and *V. ellipsiformis*. However, in both shell morphology and habitat preference, *V. sima* seems to be allied more closely to *V. pleasii* (Marsh, 1891), a small mussel endemic to the Ozark Plateau drainages of the White River system, Arkansas and Missouri (Figs. 10-11) (personal observations; Gordon, 1980). This hypothetical association would be consistent with previously observed molluscan affinities between the fauna of the Cumberlandian and Interior Highlands regions (e.g., Ortmann, 1917; van der Schalie & van der Schalie, 1950).

Although major surveys of the Cumberland River have been conducted (Wilson & Clark, 1914; Neel & Allen, 1964), its mussel fauna has received relatively little attention in comparison with that of the Tennessee River system. Starnes and Bogan (1988) listed 85 species from the Cumberland River drainage, while Gordon and Layzer (1989) reported 94 species. Previous faunal compilations for the Caney Fork included 27 species (Miller, 1984) and 14 species (Starnes & Bogan , 1988); however, Layzer *et al.* (1993) have found that the historical fauna was considerably more diverse than the former accounts indicate. It is apparent that the species richness of the Cumberland River mussel fauna is greater than previously considered.

Ortmann (1924) concluded that the Cumberland River system lacked an endemic mussel fauna. Starnes and Bogan (1988) similarly stated that "all of the mussel species recorded from the Cumberland River occur in the Tennessee River system" despite the inclusion in their synoptic table of two mussels (*Alasmidonta atropurpurea* [Rafinesque, 1831][4] and *Pleurobema gibberum*) that are restricted to portions of the Cumberland River drainage. A distinct endemic mussel fauna did evolve in the upper Cumberland River system. Despite massive habitat destruction within the basin (e.g., reservoir construction, acid coal mine run-off), a fragment of this fauna persists, as represented by *A. atropurpurea*, *Quadrula tuberosa* (Lea, 1840: possilby extinct), *P. gibberum*, and *Venustaconcha sima*.

[4] Clarke (1981) reported *A. atropurpurea* from the Collins River at a site within the Highland Rim province. This specimen appears to have been a misidentified shell of *A. marginata* Say, 1818 (Anderson, personal communication). *Alasmidonta atropurpurea* is restricted to the Cumberland River drainage on the Cumberland Plateau upstream from the hypothesized pre-erosional locality of Cumberland Falls (Gordon & Layzer, 1993).

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