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Premodern *Pleurobema rubrum* (Rafinesque 1820) from the Illinois River

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ABSTRACT

Premodern specimens of *Pleurobema rubrum* (Rafinesque 1820) from several sites in west–central Illinois confirm the former existence of this freshwater mussel (Mollusca: Bivalvia: Unionidae) in the Illinois River. Two subfossil specimens of *P. rubrum* were recovered from channel sediments of the Illinois River in Mason County. The species also comprises 1.1% of the identified mussel assemblage in a collection of redeposited prehistoric shells from Fulton County. *Pleurobema rubrum* appears to have been a subdominant species in the central reaches of the Illinois River during prehistoric and early–historic times. Its apparent extirpation during the first few decades of the 20th century may have been caused by pollution, siltation, and commercial development of the stream.

INTRODUCTION

William C. Starrett collected more than 4,200 live freshwater mussels during his 1966 mussel survey of the Illinois River (Starrett 1971). None of Starrett's 429 collections yielded any live specimens of the so–called *Pleurobema cordatum* complex, which consists of four species in the eastern Mississippi River basin: *Pleurobema coccineum* (Conrad 1834), *P. cordatum* (Rafinesque 1820), *P. plenum* (Lea 1840), and *P. rubrum* (Rafinesque 1820; =*P. pyramidatum* [Lea 1840]; Cummings and Mayer 1992). However, Starrett did report that two species of the *P. cordatum* complex had lived in the Illinois River in the past. *Pleurobema coccineum* was represented in several early museum collections and in four deposits of old shells located along the banks of the river (Starrett 1971). The only record of *P. rubrum* in the river was a pre–1900 collection housed at the Ohio State Museum (OSM 19230), although questions surround this record because it lacks specific locality data (Starrett 1971). This paper reports recent collections of premodern shells from the Illinois River near Havana, Illinois, which confirm the former existence of *P. rubrum* in the Illinois River.

MATERIALS AND METHODS

Premodern unionid mussel shells were recovered in 1991 from two locations in the middle reaches of the Illinois River. The first is near the left (east) bank of the river in Mason County, Illinois, just downstream from Grand Island and the re–entrant channel of Bath

Chute (40º09'08"N, 90º12'11"W; 171.7 km [106.7 mi] above mouth of Illinois River). An extensive bed of mussel shell intermixed with some prehistoric artifacts covers the beach at this location (True Temper archaeological site; 11MN288), but it has not been sampled. The collections reported here were taken from the bed of the river adjacent to the site at depths of about 1.0–1.3 m.

The second location is an archaeological deposit named the Nancy's Point site (11F2758), which is located on the right (west) bank of the Illinois River in Fulton County, Illinois (40º20'40"N, 90º03'11"W; 198.6 km [123.4 mi] above mouth of Illinois River). The site consists of an extensive bed of shell that runs along the beach and covers a low natural levee west of the shoreline. The deposit contains bivalve shell (Unionidae and Sphaeridae), gastropod shell, sand, and some prehistoric artifacts. The artifact assemblage is rather specialized, with a number of crude net weights occurring in association with the shell. Temporally diagnostic artifacts tend to occur along the shoreline and may or may not be associated with the shell. They date primarily to the Early Woodland period of about 2550–2100 years B.P. (contracting–stemmed projectile points and Marion Thick, Black Sand, and Morton ceramics), although several specimens associated with the younger Mississippian and Oneota cultures are also represented (Esarey 1990).

The sample of shell from the Nancy's Point site was recovered from three 1 m^2 collection units (CU 1–3), from which all "unconsolidated" shell and other material were removed and transported to the laboratory for processing and analysis. Excavations continued downward into the deposit to the point where shells became embedded in a sand matrix, at which point the collection terminated. CU–1 was located on a sloping beach about halfway between the shoreline and the crest of the natural levee; CU–2 was located on the crest of the natural levee about 20 m northwest of CU–1; CU–3 was located on the crest of the levee about 20 m north of CU–2. After shells had been removed from CU–1, the unit was excavated to a depth of about 1 m to expose a sediment profile.

The specimens reported here include unionid mussels recovered from the Illinois River channel adjacent to the True Temper site and from the three collection units at the Nancy's Point site. Shells were identified at the Illinois State Museum using comparative materials from the museum's scientific collections. All specimens have been deposited at the Illinois State Museum.

For the purposes of this analysis, "identifiable" shells were defined as specimens that retained the beak or umbo portion of the shell in the vicinity of the pseudocardinal teeth, regardless of whether or not they could be identified below the family level. This criterion minimized the chances that fragmentary specimens would be counted more than once. All specimens lacking the beak or umbo portion of the shell were considered "unidentifiable." The counts or frequencies of identifiable specimens reported here represent numbers of identified specimens (NISP). Taxonomic nomenclature follows Turgeon and others (1988), except for revisions to the Anodontinae proposed by Hoeh (1990). Also, the nomenclature change from *Pleurobema pyramidatum* (Lea 1840) to *Pleurobema rubrum* (Rafinesque 1820) follows Johnson and Baker's (1973) selection of a lectotype for the latter species.

RESULTS

True Temper Site Locality

Several dead shells and a number of live mussels were collected from the bed of the Illinois River adjacent to the True Temper site. The dead shells occurred as pairs of closed valves joined by the dorsal hinge ligament. They were embedded in a silty substrate in life position, with the posterior–dorsal margins of the valves protruding above the river bed. Five species of dead shells were observed: *Amblema plicata* (Say 1817), *Arcidens confragosus* (Say 1829), *Fusconaia ebena* (Lea 1831), *Pleurobema rubrum*, and *Quadrula pustulosa* (Lea 1831). I collected one specimen of *F. ebena* and two of *P. rubrum*, neither of which has been collected live in the middle reaches of the Illinois River since 1912 (Forbes and Richardson 1913). All specimens are complete and in good condition. The proteinaceous periostracums and hinge ligaments are intact. However, the nacreous inner layer of shell is leached and somewhat chalky, suggesting that the shells had been exposed to dilute acids for an extended time after death occurred.

I also observed seven species of live mussels in the area. The most abundant, with 15 individuals, was *Amblema plicata*. This mussel was also the dominant species in this section of the river during Starrett's 1966 survey (Starrett 1971). The other species included 2 specimens of *Lasmigona complanata* (Barnes 1823), 7 specimens of *Leptodea fragilis* (Rafinesque 1820), 1 specimen of *Megalonaias nervosa* (Rafinesque 1820), 5 specimens of *Potamilus alatus* (Say 1817), 3 specimens of *Pyganodon grandis* (Say 1829), and 5 specimens of *Quadrula quadrula* (Rafinesque 1820).

The depositional history of the dead shell at this locality is suggested by the orientation of the valves and the historical changes in the species composition of unionid mussels in the Illinois River. The fact that shells were paired and oriented in life position indicates they died in place and had not been redeposited. The presence of two species that have not been observed alive in this section of the river for at least the past 80 years suggests the mussels may have died during or before the first few decades of the 20th century.

Nancy's Point Site

The three collection units at the Nancy's Point site yielded a total of 1,823 identifiable valves, 86% of which were identified to genus or species (Table 1). Twenty–eight species are represented. The predominant species is *Elliptio dilatata* (Rafinesque 1820), which comprises 62.6% of the total sample. *Pleurobema rubrum* is represented by 17 specimens and comprises 1.1% of the sample. *Pleurobema coccineum* is also represented, but is somewhat less abundant overall than *P. rubrum.*

The taphonomic history of Nancy's Point is indicated by the stratigraphy of the deposit and by the associations, condition, and distribution of the shell. First, a number of net–weight artifacts have been found in association with the shell. This suggests the shells were deposited by prehistoric people, although none of the shells appear to have been modified for use as artifacts. Second, consistent with the hypothesis of anthropic origin is the fact that 14.0% of the shells from CU–1 are medium to dark gray in color and one specimen is charred, presumably because of exposure to an artificial source of heat. Charred and discolored shells are common in archaeological assemblages, as mussels were often baked or steamed during food preparation or incidentally exposed to fire. Third, the

distribution of shell at the site suggests the entire assemblage has been redeposited. The western margin of the deposit is scalloped in plan view, as if the shell had been dumped on the surface in a series of loads that splayed out across the levee from east to west. Finally, the stratigraphic profile shows that several thin surface horizons, which together are 40 cm thick, disconformably overlie a massive brown silt comprising the natural levee. Horizon 1 is a surficial deposit of shell (bivalves and gastropods) and some sand (0–15 cm depth); Horizon 2 is a thin deposit of sand and some silt (15–20 cm depth); Horizon 3 consists of shell and some sand (20–30 cm depth); Horizon 4 is a finely bedded brown silt and yellowish sand that has deformed to convoluted bedding planes and an abrupt, irregular contact with the underlying horizon (30–40 cm depth); Horizon 5 is a massive, dark brown silt that grades downward to a lighter–colored silt with oxidation stains (>40 cm depth). Window glass recovered from the base of Horizon 4 indicates that everything above the basal silt was deposited historically. These observations suggest the shell component at the Nancy's Point site is redeposited dredge spoil that was removed historically from the Illinois River channel and deposited on the beach and natural levee along the west bank. The spoil consists primarily of shell and sand from a prehistoric deposit that is submerged beneath the river east of the current shoreline. Although the shells have been redeposited, they are probably representative of the unionid mussel species that occurred in this section of the river prehistorically.

Description of *Pleurobema rubrum*

The shells of *Pleurobema rubrum* from the True Temper locality are nearly complete (Figure 1). One measures 70.6 mm in length, 50.7 mm in height, and 40.9 mm in breadth (ISM 680132); the other is 83.1 mm in length, 57.9 mm in height, and 49.0 mm in breadth (ISM 680133). The shells are thick, moderately inflated, elongate, and obtuse triangular in outline. The anterior margin is somewhat flattened or truncated; the posterior margin is bluntly pointed. Dorsal and ventral margins are curved. The umbos are high, strongly directed forward, and anterior to the remainder of the shell. Beak sculpture consists of 2–3 concentric ridges near the end of the beak and 1–2 tubercles on the posterior ridge. There is a shallow radial sulcus beneath the posterior ridge. The periostracum is light to dark brown. Pseudocardinal teeth are large; lateral teeth are heavy and slightly curved. Beak cavities are shallow (older specimen) to moderately deep (younger specimen). The nacre is white to light gray, but coloration may have been leached by submersion.

The *Pleurobema rubrum* shells differ from *P. coccineum* in that their outlines are more obtuse, their anterior margins are less rounded, their beaks are directed anteriorly rather than apposed, and their radial sulcuses are more distinctive (see Stansbery 1983). *Pleurobema rubrum* is very similar to *P. coccineum* f. *mississippiensis* (Baker 1928) from the Mississippi River in Wisconsin, although the shell of the latter is less elongate and has a shallower beak cavity (Baker 1928:121–123).

DISCUSSION AND CONCLUSIONS

Specimens of *Pleurobema rubrum* from the True Temper and Nancy's Point sites confirm that this species inhabited the middle reaches of the Illinois River prior to modern times. Prehistoric specimens from the Nancy's Point site are probably redeposited food remains that may or may not be associated with the site's Early Woodland occupation. They

indicate that *P. rubrum* was a subdominant element of the Illinois River mussel fauna during prehistory.

The True Temper specimens appear to be part of a subfossil mussel bed that died and was preserved in place in the channel of the Illinois River, perhaps during the current century. Confirmed specimens of *Pleurobema rubrum* have not been collected from the river since before 1900, and *Fusconaia ebena*, a species found with it at True Temper, has not been seen alive in the middle reaches of the river since 1912. The extirpation of *P. rubrum* and *F. ebena* from this section of the river probably occurred before 1924, when Richardson (1928:457) failed to collect either species in Peoria Lake. The disappearance may have been part of a massive, progressive mussel die–off caused by the diversion of untreated Chicago sewage and industrial wastes into the Des Plaines and Illinois rivers after the opening of the Chicago Sanitary and Ship Canal in 1900. The mussel population of the lower Des Plaines River had been destroyed by 1908 (Wilson and Clark 1912), and in 1912 mussels were absent or on the decline in the upper section of the Illinois River near Morris, Ottawa, and Starved Rock (Forbes and Richardson 1913). The effects of pollution soon moved downstream into the middle section of the river, where Richardson (1925, 1928) documented a drastic decline in the abundance and diversity of mussel populations between 1912 and 1920. The expiration of the True Temper mussel bed may have occurred during this period, although independent radiometric evidence would be needed to confirm the date. If the True Temper specimens are evidence that *P. rubrum* lived in the Illinois River historically, the known range of this species in Illinois should be expanded beyond its mapped distribution in the Wabash and lower Ohio rivers in the eastern and southern parts of the state (cf. Cummings 1991a; Cummings and Mayer 1992:65).

The historical extirpation of *Pleurobema rubrum* from the Illinois River was part of a major decline in the biodiversity of unionid mussels in the river. Counting *P. rubrum*, there has been a 52% decrease in the number of mussel species living in the Illinois River—down from 48 species prior to 1960 to only 23 species since 1960 (cf. Cummings 1991b). The decline was probably caused by such factors as pollution, siltation, and commercial development of the stream (Cummings 1994). Shells from archaeological and geological deposits may be used to better define the extent and severity of these changes.

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Table 1. Freshwater unionid bivalves from three collection units at the Nancy's Point site (11F2758), Fulton County, Illinois.

Taxon	Unit			Total	Percent
	No. 1	No. 2	No. 3		
Anodontinae					
Arcidens confragosus (Say 1829)	2	0	0	2	0.1
Lasmigona costata (Rafinesque 1820)	2	2	1	5	0.3
Strophitus undulatus (Say 1817)	9	7	5	21	1.3
Ambleminae					
Amblema plicata (Say 1817)	65	56	26	147	9.4
Elliptio crassidens (Lamarck 1819)	12	4	8	24	1.5
Elliptio dilatata (Rafinesque 1820)	316	423	242	981	62.6
Fusconaia ebena (Lea 1831)	7	9	4	20	1.3
Fusconaia flava (Rafinesque 1820)	34	10	7	51	3.3
Megalonaias nervosa (Rafinesque 1820)	5	0	0	5	0.3
Pleurobema coccineum (Conrad 1834)	3	7	0	10	0.6
Pleurobema rubrum (Rafinesque 1820)	7	2	8	17	1.1
Pleurobema spp.	2	3	1	6	0.4
Quadrula nodulata (Rafinesque 1820)	2	0	0	2	0.1
Quadrula pustulosa (Lea 1831)	11	6	3	20	1.3
Quadrula quadrula (Rafinesque 1820)	2	2	0	4	0.3
Quadrula spp.	2	1	4	7	0.4
Tritogonia verrucosa (Rafinesque 1820)	2	2	0	4	0.3
Lampsilinae					
Actinonaias ligamentina (Lamarck 1819)	33	20	10	63	4.0
Ellipsaria lineolata (Rafinesque 1820)	1	1	0	2	0.1
Epioblasma triquetra (Rafinesque 1820)	1	2	0	3	0.2
Lampsilis siliquoidea (Barnes 1823)	0	0	2	2	0.1
cf. *Lampsilis teres* (Rafinesque 1820)	0	1	0	1	0.1
Lampsilis spp.	1	1	2	4	0.3
Leptodea fragilis (Rafinesque 1820)	2	0	0	2	0.1
Ligumia recta (Lamarck 1819)	1	0	0	1	0.1
Obliquaria reflexa Rafinesque 1820	6	6	5	17	1.1
Obovaria olivaria (Rafinesque 1820)	2	0	1	3	0.2
Potamilus alatus (Say 1817)	7	1	2	10	0.6
Toxolasma parvus (Barnes 1823)	6	2	2	10	0.6
Truncilla donaciformis (Lea 1828)	12	19	3	34	2.2
Truncilla truncata Rafinesque 1820	33	35	21	89	5.7
Unionidae spp.	125	70	61	256	–
Total	713	692	418	1823	100.0

Figure 1. *Pleurobema rubrum* from a subfossil shell bed in the Illinois River in Mason County, Illinois. (a) ISM 680132 (Length: 70.6 mm); (b) ISM 680133 (Length: 83.1 mm).

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