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NEW DEVONIAN GASTROPODS FROM THE BROKEN RIVER AND THEIR PALAEOECOLOGY

ALEX G COOK AND ALEXANDER NÜTZEL

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Gastropod collections from two localities of the Givetian Papilio Mudstone were compared for species richness and faunal composition. Despite lithological similarity and same age, both localities differ strongly in their gastropod faunas, one is fairly diverse with 15 species with even richness while the other comprises four species but is strongly dominated by one species (98% of all specimens). The diverse fauna is dominated by species of the genera *Murchisonia* and *Leptoptygma*, the other by *Brokenriveria*. Up to now, nine species have been reported from the diverse fauna. Seven taxa are described, of which *Frydacosta minuta* gen. et sp. nov., *Zlichomphalina panae* sp. nov., *Austroneilsonia yooi* sp. nov. and *Eucochlis withnalli* sp. nov are new. □ *Gastropoda, Devonian, Givetian, paleoecology, Queensland*.

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Gastropods are abundant faunal elements within the Middle Devonian platform sequences of the Graveyard Creek Subprovince, Broken River Province, north Queensland (Cook & Camilleri, 1997). Subsequent bulk collection has yielded a further seven species from the Papilio Mudstone (Givetian). The regional stratigraphy of the Graveyard Creek Subprovince was detailed by Withnall & Lang (1993) and locality data were provided by Cook & Camilleri (1997).

Material is lodged in the palaeontology collections of the Queensland Museum (QMF).

PALAEOECOLOGICAL COMMENTS

Cook & Camilleri (1997) identified three broad gastropod communities corresponding to muddy shelf (*Brokenriveria* community), high energy clastic shelf (*Labrocuspis* community) and peri-reefal (*Murchisonia* community) environments. Detailed collection in the Papilio Mudstone has identified stark differences in faunal composition between localities, which are difficult to rationalise on sedimentological evidence. The Papilio Mudstone locality that has yielded the most diverse and abundant gastropod collection is QML1092 (Cook & Camillieri, 1997; Table 1).

A second collection (Table 1) from this locality resulted in about 1340 specimens in 13 taxa; the most numerous Givetian gastropod fauna in the Southern Hemisphere. *Bellerophon* sp. B and Platyceratoidea gen. et sp. indet. were not found again, so that the number of reported species from QML1092 is 15. It is quite normal that additional collections produce rarer species. However, it is remarkable that additional collecting also resulted in a restructuring of the recognised trophic core of the community. *Murchisonia wandovalensis* is the most common species, but it is followed by *Leptoptygma queenslandicus* that ranked fourth in Cook & Camillieri's collection. *Denayella lomandraensis* had rank two and is now fifth in abundance. So in this case the increase of known specimens by a factor of about eight resulted in a clearly different faunal composition. Apart from gastropods, this locality yields abundant brachiopods and bivalves, e.g., nuculids, solitary rugose corals and sporadically the tabulate coral *Thamnopora*. Moreover, the fauna contains rare microcrinoid calices and nautiloids.

A fauna of four gastropods in the Papilio Mudstone at QML1016 and about 3km away at QML1092 (Cook & Camilleri, 1997) is nearly monospecific at QML1016 with *Brokenriveria pharlapensis* (389 specimens) representing 98% of the fauna, while the other three species are incidental: *Denayella lomandraensis* (3 specimens), *Palaeozygopleura dodgeyi* (2 specimens), and *Gemininodosa langi* (1 specimen). Other fossils includeabundant brachiopods e.g., *Warrenella* and *Desquamatia*, nuculid bivalves, and nautiloids. Rare colonies of

massive *Alveolites* sp. and *Heliolites* sp. are associated, several tens of metres along strike, forming micro-atolls. No microcrinoid calices were recovered.

Both localities have the same lithofacies and are of same age. QML1016 is significantly south of the 'Burges Marine Valley' of Withnall & Lang (1993), negating shelf/slope as a possible ecological difference. Both faunas indicate moderately protected conditions well within the photic zone. Therefore these differences in the faunal composition are notable. It is reasonable to assume that the more diverse *Murchisonia/ Leptoptygma* community from QML1092 was under less environmental stress than the nearly monospecific *Brokenriveria*-dominated community. A particular autecology, maybe a broader tolerance towards certain environmental factors enabled *Brokenriveria* to cope with a harsher environment. Autecology in fossil gastropods is largely a subject of speculation, but fluctuation in oxygen concentration is always a reasonable guess in fine-grained deeper water environments. So maybe *Brokenriveria* was relatively tolerant to low oxygen concentrations, and the differences reflect minor variations in benthic circulation on the muddy shelf.

Table 1. Number of specimens collected from QML1092 in rank abundance order based on those made for this work.

Taxon	This work	Cook & Camilleri
Murchisonia wandovalensis	538	75
Leptoptygma queenslandicus	376	13
Austroloxa tasselli	162	22
Brokenriveria pharlapensis	77	3
Denayella lomandraensis	72	31
Austroneilsonia yooi	35	
Palaeozygopleura dodgeyi	34	4
Frydacosta minuta	17	
Eucochlis withnalli	12	
Gemininodosa langi	8	10
Zlichomphalina panae	3	
Soleniscus? sp.*1*	2	
Frydacosta sp.	1	
Soleniscus? sp. 2	1	
Platyceratoidea indet.		1

SYSTEMATIC PALAEONTOLOGY

Subclass ARCHAEOGASTROPODA Thiele, 1925
Family SINUOPEIDAE Wenz, 1938
Subfamily SINUOPEINAE Wenz, 1938

Frydacosta gen. nov.

ETYMOLOGY. For Jiři Frýda (Prague).

TYPE SPECIES. *Frydacosta minuta* sp.nov.

DIAGNOSIS. Rotelliform, low-spired sinuopeid with strong axial ribs.

REMARKS. Most sinuopeids lack the strong axial ribs of this new genus which is placed in the subfamily due to the wide central sinus. *Naticasinus* Pan & Erwin, 2002 from the Late Permian of Guangxi is similar but has fewer ribs and is slightly higher spired. *Frydacosta* is lower spired that *Sinuopea* Ulrich and *Sellenima* Perner. *Horiostomella* Perner is phaneromphalus, unlike this new genus.

Frydacosta minuta sp. nov.
(Fig. 1 A-M)

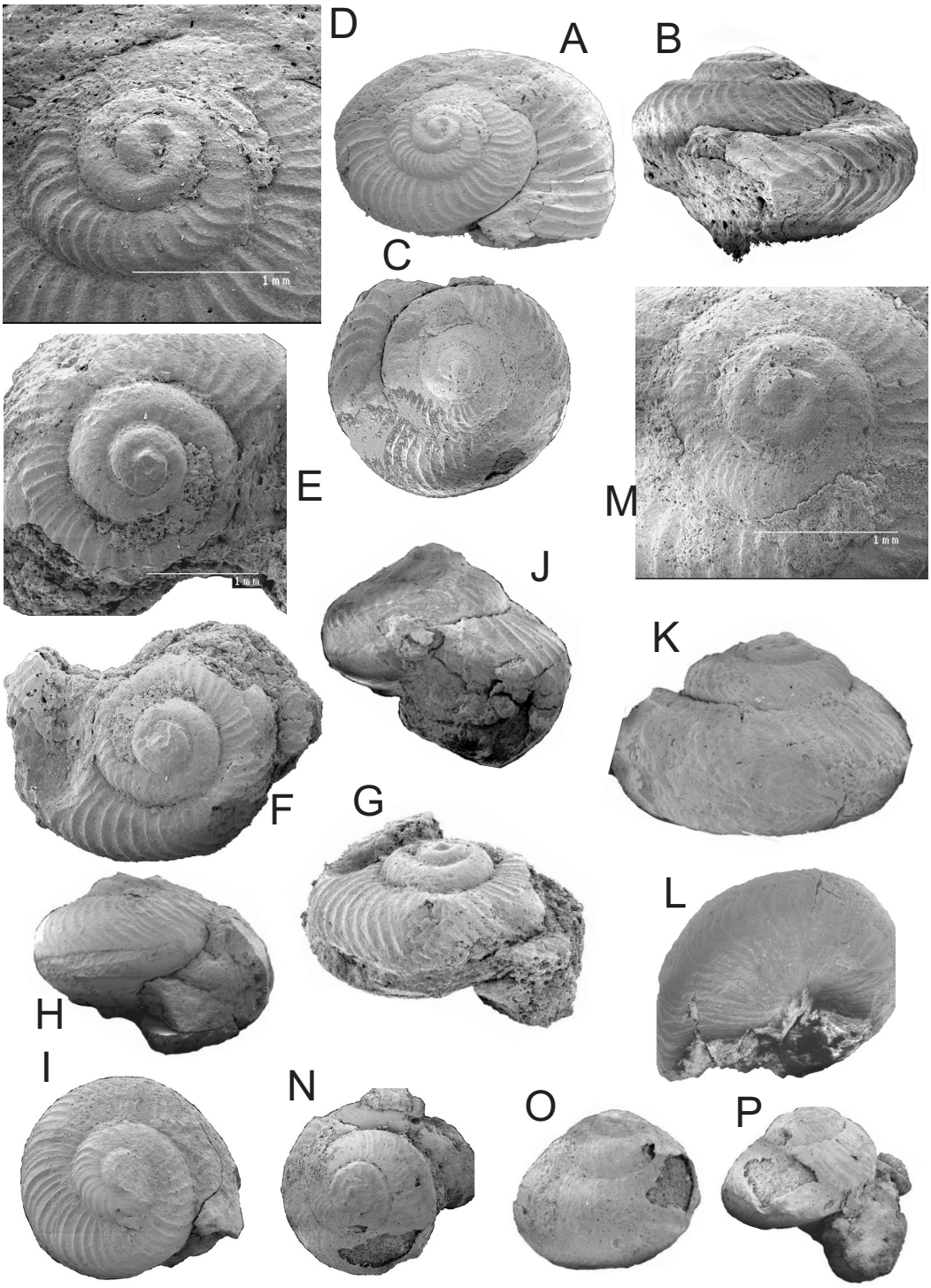
DIAGNOSIS. As for genus.

MATERIAL. Holotype QMF43371, Paratypes QMF 43372-43374, QMF41897-QMF41908 from QML1092.

ETYMOLOGY. Latin, *minuta,* small.

DESCRIPTION. Shell rotelliform, low-spired, whorls convex, sutures impressed, periphery just below mid-whorl; teleoconch whorls with numerous axial ribs, strongly prosocline forming wide, deep sinus just below periphery; ribs continue onto base; whorl profile unequally convex; upper whorl face nearly flat at suture, extending at low angle to a strongly convex mid-whorl; lower whorl surface nearly flat; upper whorl surface more convex in early whorls; aperture not well-preserved, simple, subcircular; base in early whorls anomphalous, in later whorls cryptomphalous; protoconch corroded, seemingly simple, paucispiral.

FIG. 1 (facing). A-M, *Frydacosta minuta* gen. et sp. nov. A-E, Holotype QMF43371. A-C, oblique apical, side and apical views, x15. D, E, oblique and apical view of protoconch, x25. F-H, Paratype QMF43372, apical, side and apertural view, x15. I-M, Paratype QMF43377. I-L apical, apertural, side and basal views, x15. M, apical view of protoconch. N-P, *Frydacosta* sp. QMF43375, apical, side and apertural views, x15.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Frydacosta sp.
(Fig. 1N-P)

MATERIAL. QMF43377 from QML1092.

DESCRIPTION. Like *F. minuta* but more high-spired, sinus much wider and deeper; ribs a little finer especially on base; about 4.5 whorls, 5.2mm wide, 3.8mm high, base cryptomhalous, convex; whorl profile rounded; upper whorl meets sutures at about 20°; periphery at mid-whorl; sinus just below mid-whorl; sutures moderately impressed.

Family EOTOMARIIDAE Wenz, 1938
Subfamily EOTOMARIINAE Wenz, 1938

Zlichomphalina Frŷda, 1998

TYPE SPECIES. *Pleurotomaria (Ptychomphalina) texta* Barrande in Perner, 1907.

Zlichomphalina panae sp. nov.
(Fig. 2A-E)

ETMYOLOGY. For Dr Pan HuaZhang (Nanjing).

MATERIAL HOLOTYPE QMF 43378; PARATYPES QMF43379-43380 from QML1092.

DIAGNOSIS: Lenticular shell form.

DESCRIPTION. Shell small, lenticular, low-spired; up to 8.3 mm wide, 5.5 mm high; sutures weakly impressed; periphery just at the midwhorl suture; slit at lower suture; upper whorl face gently sloping, till it meets the wide slit which is bordered by cords and the lower suture; slit occupies the lower one third of the upper whorl face. Upper whorl face with numerous distinct prosocline and curved axial threads, whorl base convex base minutely phaneromphalous, bearing numerous ribs; ribs deflected backwards at selenizone. Upper cord bordering selenizone making an angulation; first two whorls corroded without visible ornament; aperture apparently rounded

REMARKS. *Zlichomphalina* was erected for Early Devonian eotomariines with a small gap between the suture and the lower bounding cord of the selenizone which is relatively high on the shell. This Queensland material extends the generic range to the Middle Devonian. It differs from the types species in its lenticular shell form.

Subfamily NEILSONIINAE Knight, 1956

Austroneilsonia Sabattini, 1975

TYPE SPECIES. *Austroneilsonia argentina* Sabattini, 1975 from the Late Carboniferous of Argentina.

REMARKS. Two portmanteau neilsoniins characterise this typically post-Devonian subfamily, *Peruvispira* Chronic and *Neilsonia* Thomas. Their origin is unclear, but given the presence of neilsoniines within the Middle Devonian (*Peruvispira churkini* Blodgett, 1992 and herein) there is a long geological history to the subfamily. The confusion between *Neilsonia* and *Peruvisprira* is common, with the subtlety of axial ornamentation and selenizone position confusing many (eg, Qiao, 1983). *Austroneilsonia* Sabatini, 1975 was erected for neilsoniins present on the Late Carboniferous to Permian Gondwanan faunas, which possessed coarse collabral ornament, but lacked subsutural nodes. Traditionally these coarsely ornamented taxa had been placed within *Peruvispira* Chronic 1949. This material before us presents a particular problem, a coarsely ornamented neilsoniin which predates all the exemplar members of the family. Its selenizone position and lack of nodes prevent assignment to *Neilsonia* and its coarse ornament preclude *Peruvispira*, which would be restricted to those with growth lines only. We accommodate the material within *Austroneilsonia* Sabatini on the basis of the coarse collabral ornament which is continuous across the whorl face.
Included species are *Peruvispira gundyensis* Yoo, 1988 and *P. churkini* Blodgett, 1992.

Austroneilsonia yooi sp. nov.
(Fig. 2F-S)

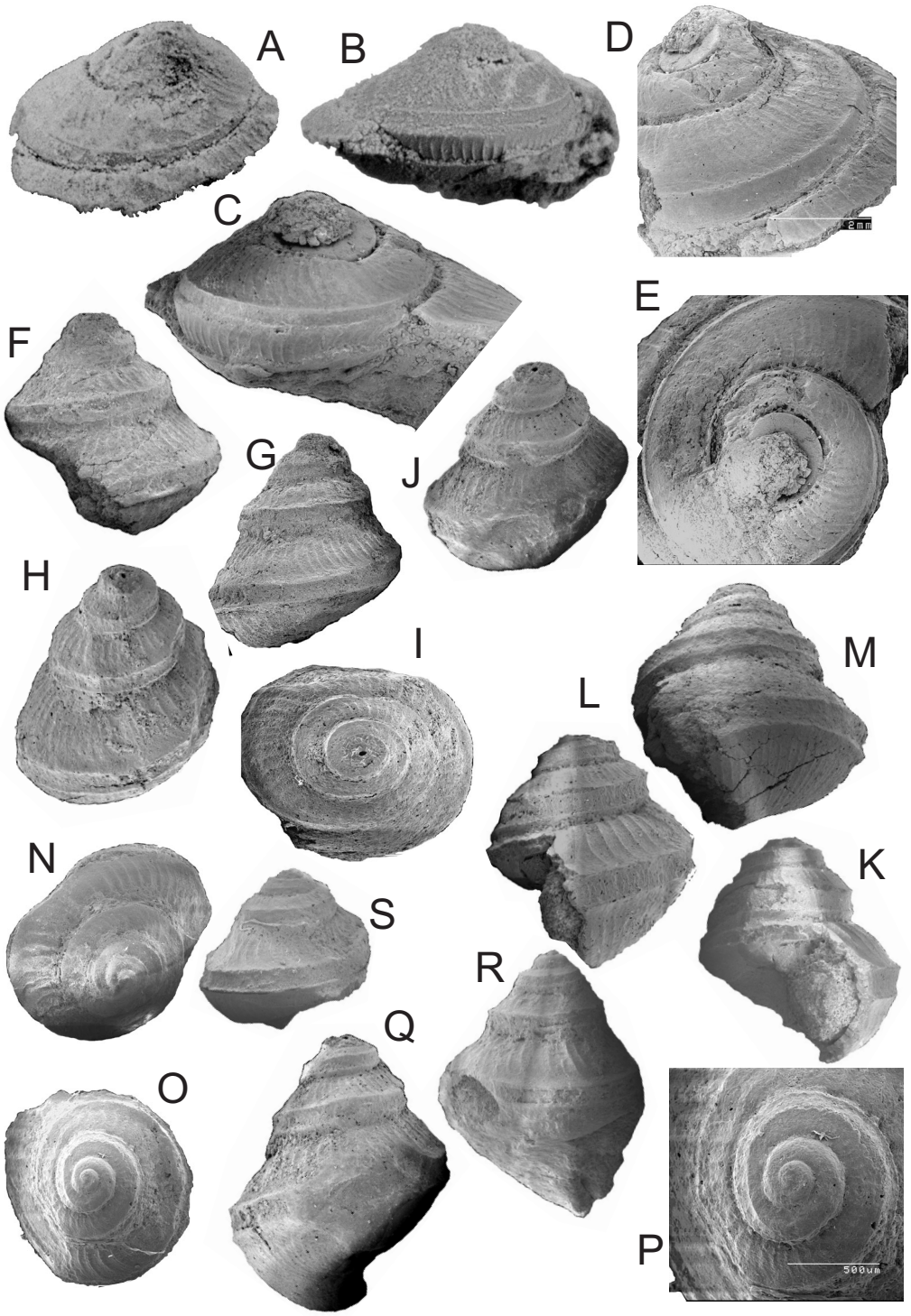
ETYMOLOGY. For E. K. Yoo

DIAGNOSIS. *Austroneilsonia* with coarse widely spaced collabral ornament,

MATERIAL. Holotype QMF 42064, Paratypes QMF 42065-42092 from QML1092

DESCRIPTION. Shell small, turbiniform, relatively high-spired of up to 5 whorls, up to 3.2mm high, 2.1mm wide at base; whorl profile angular: selenizone at mid-whorl periphery;

FIG. 2 (facing). A-E, *Zlichomphalina panae* gen. et sp. nov. Holotype QMF43378. A,B, oblique, side views, x10. C, side view, x15. D, oblique view, x20. E, apical view, x20. F-S, *Austroneilsonia yooi* sp. nov. F-G, Paratype QMF42066 side view, x15. H-J, Holotype QMF42064 oblique, apical, side views, x15. K-N, Paratype QMF42065. K, apertural view, x15. L, side view, x10. M, oblique basal view, x15. L, apical view, x10. O, S Paratype QMF42067 apical, side views, x12. P-R, Paratype QMF42093 side views, x15, apical view, x30.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sutures impressed; whorls embrace just below lower border of selenizone; selenizone bordered by two spiral threads; upper whorl face meets suture at about 45°; upper whorl face with numerous axial threads; collabral threads prosocline, curving backward towards selenizone; base rounded, anomphalous, with numerous collabral threads; aperture simple round; apex flattened, protoconch corroded.

REMARKS. This material differs from the type species in its more widely spaced collabral ornament. It differs from *A. gundyensis* (Yoo) by the lack of strong deflection of the cords as they approach the selenizone.

Family ELASMONEMATIDAE Knight, 1956

Eucochlis Knight, 1933
Eucochlis withnalli sp. nov.
(Fig. 3 A-G)

ETYMOLOGY. For Ian W. Withnall for his contribution to north Queensland geology.

MATERIAL. Holotype QMF41909, paratypes QMF41910-42920 all from QML1092.

DIAGNOSIS. Small, turbiniform, anomphalous.

DESCRIPTION. Shell small, turbiniform, with at least four whorls, up to 3.5mm high and 3mm wide; teleoconch whorls convex with numerous sharp, strongly prosocline curving ribs, more than 20 per whorl, continuing onto base; sutures impressed; base round, convex, anomphalous; aperture not well-preserved, seemingly simple, subcircular with reflexed inner lip; protoconch corroded, seemingly simple, paucispiral.

REMARKS. This species closely resembles the type, *E.perminuta* Knight, 1933 from the Pennsylvanian of North America, however it is not cyrtoconoid and has no minute umbilicus. This is the first report of *Eucochlis* from the Devonian. *Eucochlis australis* Yoo, 1988 from the Tournaisian Dangarfield Formation (NSW) is minutely phaneromphalous and has more inflated whorls.

Subclass CAENOGASTROPODA Cox, 1959
Family SUBULITIDAE Lindstrom, 1884
Subfamily SOLENISCINAE Wenz, 1938

Soleniscus Meek & Worthen, 1861
Soleniscus? sp. 1
(Fig 3H)

MATERIAL. QMF43381, QMF43382, from QML1092.

DESCRIPTION. Shell fusiform, up to 7.3 mm high, 5.4mm wide; last whorl at least one half of shell height; sutures moderately impressed; whorl face meeting suture at about 30°; no obvious growth lines; periphery just below midwhorl; whorls convex bearing no visible ornament.

REMARKS. We were unable to identify a columellar fold, the generic assignment is uncertain, and the specimens were too worn for specific identification. The subulitid *Leptoptygma queenslandicus* Cook & Camilleri, 1997, which is abundant at this locality, has a much more robust and squat shell form.

Soleniscus? sp. 2
(Fig 3 I-K)

MATERIAL. QMF42063 from QML1092.

DESCRIPTION. Shell small, fusiform, about five whorls present, 5.8mm high, 3.1 mm wide; last whorl occupies about two thirds of shell height; whorls embrace at periphery; whorls convex with numerous fine axial threads; sutures shallow; aperture elongated, with anterior notch, twisted so that a weak columellar fold is present.

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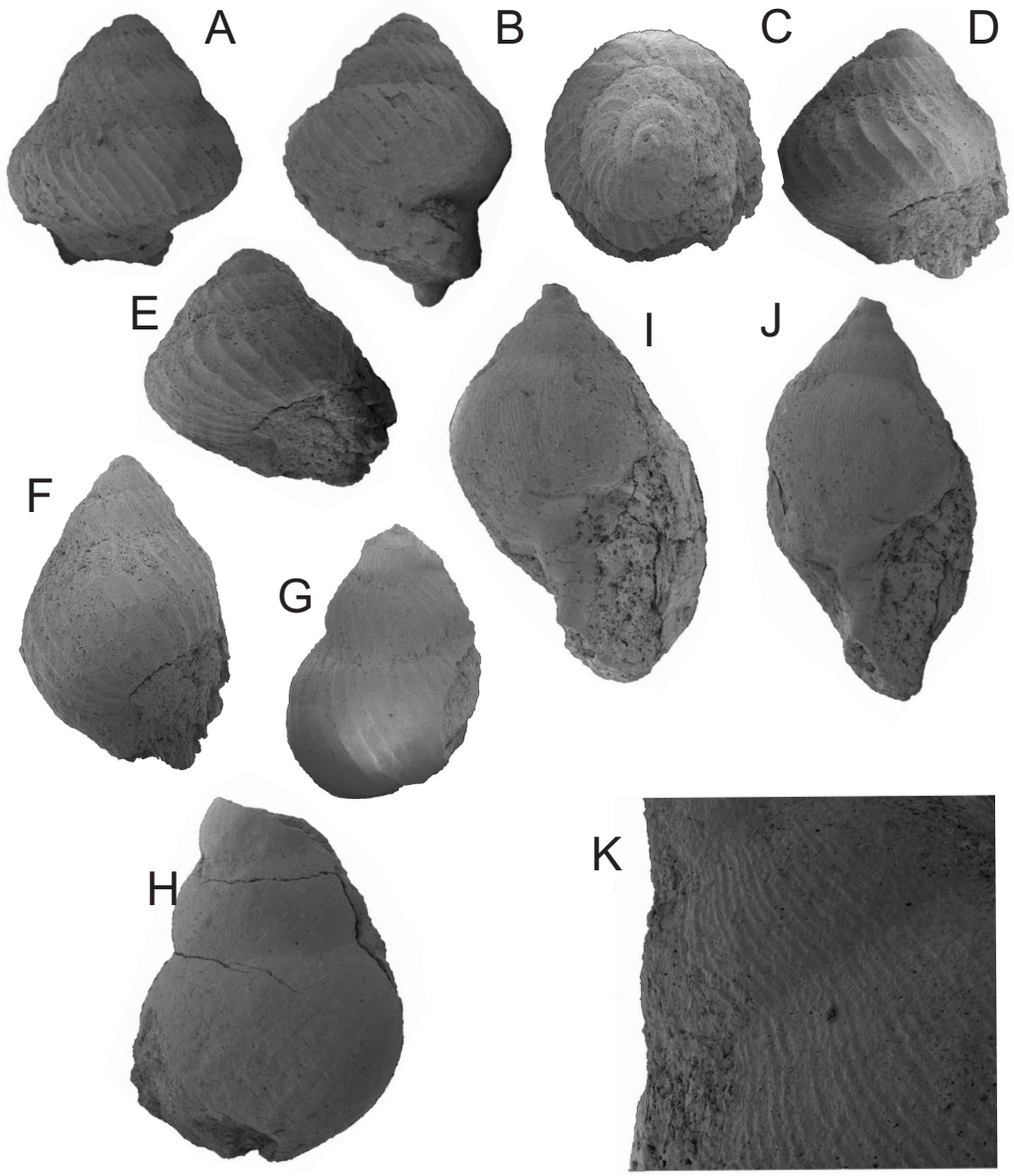

FIG. 3. A-G, *Eucochlis withnalli* sp. nov. A-C, Holotype QMF41909, side, apical views x10. D,E, Paratype QMF41910 side, apertural views x10. F,G, Paratype QMF41911 (distorted), apertural, side views x10. H, *Solensicus*? sp. 1, QMF43381. I-K, *Solensicus?* sp. 2, QMF42063. I,J, apertural, side views x10. K, detail of ornament x40.

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