

Lithomphalus enderlini gen. et sp. nov. from cold-seep carbonates in California—a Cretaceous neomphalid gastropod?

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Abstract

The new genus and species *Lithomphalus enderlini* is described from two Early Cretaceous (Valanginian) suspected cold-seep carbonates in western California, USA. These carbonates were found within turbidites of the Great Valley Group, and were deposited at slope depth. Considering its shell shape and its crossed-lamellar shell structure, this species might belong to the enigmatic vent and seep endemic gastropod group Neomphaloidea. It cannot be assigned with certainty to any of the extant neomphaloidean families, and thus may represent an independent Mesozoic radiation of the Neomphalina. However, until additional and better-preserved specimens are discovered (e.g., those with protoconchs), caution is advised with regard to verifying the earliest occurrence of the Neomphalidea in the fossil record.

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1. Introduction

The extant members of the unique gastropod clade Neomphalina are endemic to hydrothermal vents and hydrocarbon seeps (cold-seeps) in the deep-sea. They show an odd mixture of morphological characters of both the Vetigastropoda and Caenogastropoda, which has triggered various biological

studies of gastropod phylogeny (Haszprunar, 1988; McArthur, 1999; Harasewych and McArthur, 2000). Like many organisms from hydrothermal vents, neomphalids were initially considered to be “living fossils”, and were placed within higher-order taxa of their own. In particular, McLean (1981) allied living vent *Neomphalus* with the extinct Paleozoic group Euomphaloidea, and erected a new suborder Euomphalina (Euomphaloidea+Neomphaloidea) to accommodate *Neomphalus* and its relatives. The euomphalids have been placed in their own subclass among the Gastropoda based on their openly coiled protoconchs, which

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differ from all known protoconch-types of recent gastropods (Bandel and Frýda, 1998). This character excludes relationships between euomphalids and neomphalids with their tightly coiled protoconchs (Warén and Bouchet, 2001). However, the classification of Bandel and Frýda (1998) has recently been questioned (Nützel, 2002), and the higher systematic position of the Neomphalidae remains unsettled (Batten, 1984; McLean, 1989; Warén and Bouchet, 1993; Ponder and Lindberg, 1997; McArthur, 1999; Warén and Bouchet, 2001).

Molecular investigations of neomphalids point to at least a Mesozoic or even Paleozoic origin (McArthur and Tunnicliffe, 1998; McArthur, 1999; Colgan et al., 2003) and thus to a long geological history. Ancient hydrothermal vent deposits have yet to yield fossil neomphalids. However, a growing fossil record in Cenozoic cold-seep carbonates is emerging for these unusual gastropods (Goedert and Benham, 1999; Little and Vrijenhoek, 2003). In this study we introduce a gastropod from Early Cretaceous (Valanginian) cold-seep carbonates in western California, USA, that based on its shell characters might be the first neomphalid described from Mesozoic strata.

2. Material and methods

Specimens were collected at two sites in northern California, Rocky Creek and Bear Creek (Fig. 1a–b), which are inferred as cold-seep related based on the strong petroliferous odor of the limestones, stratigraphic and sedimentologic similarity to other Great Valley seep-carbonates (e.g., similar carbonate cements, pyrite-coated corrosion surfaces, isolated lenses in fine-grained turbidites; Fig. 1b), and fossil content, particularly seep-related fossil taxa (Campbell et al., 1993, 2002). The mudstone strata in which the suspected seep-carbonates were found have been interpreted as submarine-slope deposits, and locally basin–plain deposits (Ingersoll, 1978; Bertucci, 1983). Many Great Valley seep-suspect carbonates such as these (e.g., Fig. 1a) await more detailed geochemical assessment. Stratigraphic, outcrop, and associated faunal characteristics of the two localities include:

1. Rocky Creek, Morgan Valley, Lake County, California, NE 1/4 of SW 1/4 of section 12, T12N, R6W, Wilson Valley Quadrangle, 7.5' series (1993 revised edition, U.S. Geological Survey). In the historical palaeontological literature, the site (Fig. 1a) was referred to as isolated white limestones “1 mile NW of Palmer’s” ranch (Gabb, 1869; Stanton, 1895), although the gastropod described herein was not noted by these early palaeontologists. The majority of the specimens (35) are from this locality, including those designated as holotype and paratypes. Stratigraphically this area has been mapped as Valanginian (Early Cretaceous) as part of the Blue Ridge member, which is the lower member of the Crack Canyon formation (informal name of Lawton, 1956), Great Valley Group. However, the extent and complexity of the bedding-plane faults in this area, with the resulting unconformities, was not fully appreciated in Lawton’s time, and many of the age assignments are based on inferences that require further structural and stratigraphic evaluation (Dean A. Enderlin, personal communication, 2004). Sedimentary serpentinite lies in fault contact beneath the Rocky Creek deposit, and indicates regional fluid dewatering of the deep-seated, subducting, Mesozoic oceanic plate (Lawton, 1956; Campbell et al., 1993). A local economic geologist, Dean Enderlin, collected the gastropods in this study from fossiliferous carbonate boulders at a creek crossing on a small tributary to Rocky Creek, and from a limestone outcrop ~100 m west of the creek crossing (Figs. 1a and 2a). Lawton (1956, p. 87) listed fauna for this site including “numerous specimens of *Pecten complexicosta* Gabb, *Turbo morganensis* Stanton, a clam which may be *Astarte* (?) *trapezoidalis* Stanton, a gastropod that might be *Atresius liratus* Gabb, and *Aucellas* which are more inflated than *Aucella piochii* but not as large as *Aucella crassicolis*”. The *Aucella* (= *Buchia*) may be *B. pacifica*, or possibly *B. crassicolis* (Stanton, 1895, p. 58), either of which support a Valanginian age assignment (Jones et al., 1969). On-going research suggests that the scallop may be seep-related, owing to its widespread distribution solely in other Mesozoic seep-carbonates of California; furthermore, the *Turbo* and *Atresius* gastropods reported by Lawton may be provannids (Campbell, 1996).
2. Bear Creek, Colusa County, California, ~170 m E of benchmark 1243, NW 1/4 of NW 1/4 of Sec-

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