

New Occurrences of the Malleid Bivalve *Nayadina (Exputens)* from the Eocene of Jamaica, Mexico, and Washington

by

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Abstract. New collecting extends the geographic range of two of the three known species of the warm-water, Eocene malleid bivalve *Nayadina (Exputens)*. *Nayadina (E.) batequensis* Squires, 1990, formerly known only from north-central Baja California Sur, Mexico, is now also known from northwestern Jamaica and southern Baja California Sur, Mexico. *Nayadina (E.) llajasensis* (Clark, 1934), formerly recognized from southern California to central Oregon is now also known from northwestern Washington.

INTRODUCTION

Nayadina (Exputens) is a warm-water malleid bivalve with Old World Tethyan affinities (PALMER, 1967; GIVENS, 1989). Three species are known: *N. (E.) batequensis* Squires, 1990, from the lower Eocene part of the Bateque Formation, Baja California Sur, Mexico; *N. (E.) llajasensis* (Clark, 1934) from middle lower to lower middle Eocene deposits in southern and central California and central western Oregon; and *N. (E.) ocalensis* (MacNeil, 1934) from upper Eocene deposits in Florida, Georgia, and North Carolina. These species are reviewed and compared in SQUIRES (1990). New collecting has revealed additional occurrences of *N. (E.) batequensis* from Jamaica and Baja California Sur, Mexico, and *N. (E.) llajasensis* from northwestern Washington. It is the purpose of this present study to report on these new occurrences.

Abbreviations used for catalog and/or locality numbers are: CSUN, California State University, Northridge; IGM, Instituto de Geología, Universidad Nacional Autónoma de México; LACMIP, Los Angeles County Museum of Natural History, Invertebrate Paleontology Section; UF, University of Florida, Gainesville.

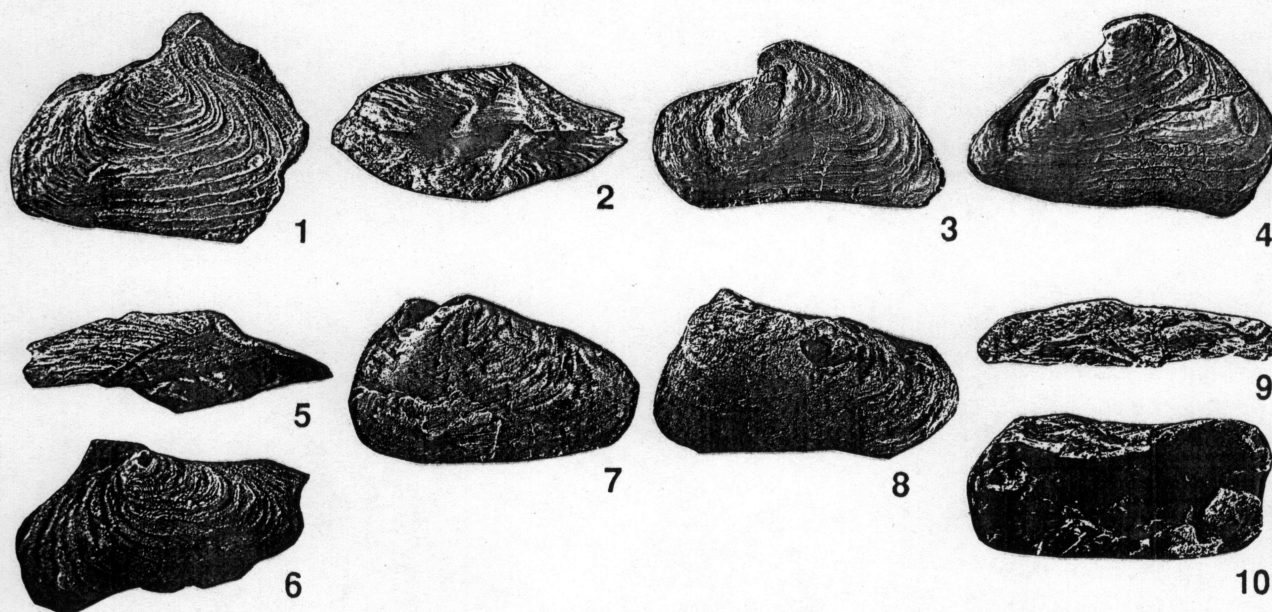
NEW OCCURRENCES OF *NAYADINA (EXPUTENS) BATEQUENSIS*

The author obtained four specimens of *Nayadina (E.) batequensis* from limestones in the Chapelton Formation in

northwestern Jamaica. LEWIS & DRAPER (1990) assigned this formation to the lower to middle Eocene. Three of the specimens are from locality UF XJ012 near Montego Bay, and one specimen is from locality UF XJ018 near Christiana. Two of these specimens are illustrated (Figures 1-3). Specimen UF 37089 (Figure 3) is larger than those previously known for *N. (E.) batequensis*. Additional collecting from the Bateque Formation, Baja California Sur, Mexico (SQUIRES & DEMETRION, in press), however, has yielded comparable large-sized specimens (Figure 4).

The author obtained three early adult specimens of *Nayadina (E.) batequensis* from sandstones in the upper part of the Tepetate Formation about 75 km north of La Paz in southern Baja California Sur, Mexico. SQUIRES & DEMETRION (1991) showed that these sandstones are coeval with the lower Eocene ("Capay Stage") part of the Bateque Formation that is about 200 km to the north in north-central Baja California Sur. One of the Tepetate Formation specimens is from locality CSUN 1491, and two other specimens are from locality CSUN 1522. One of the specimens from locality CSUN 1522 is illustrated in Figures 5 and 6.

Nayadina (Exputens) batequensis is the earliest species of *Exputens* and can now be shown to have ranged more easterly than the other species of *Exputens*. The presence of this species in Jamaica and Baja California Sur strongly suggests that either the subgenus emigrated from the Old World into the North America region via the circum-equatorial current that flowed from east to west during



Explanation of Figures 1 to 10

Figures 1-6. *Nayadina (Exputens) batequensis* Squires, 1990. Figures 1-3: Chapelton Formation, Jamaica. Figures 1, 2: hypotype, UF 37088, locality UF XJ012, $\times 2.2$; Figure 1, left valve; Figure 2, dorsum. Figure 3: hypotype, UF 37089, locality UF XJ018, left valve $\times 1.1$. Figure 4: hypotype, IGM 5924, locality CSUN 1470, Bateque Formation, Baja California Sur, Mexico, left valve, $\times 1.1$. Figures 5, 6: hypotype, IGM 5925, locality CSUN 1522, Tepetate Formation, Baja California Sur, Mexico, right valve, $\times 1.8$; Figure 5, dorsum; Figure 6, exterior.

Figures 7-10. *Nayadina (Exputens) llajasensis* (Clark, 1934). Figure 7: hypotype, LACMIP 11525, locality CSUN 1516, from reworked clast of Crescent Formation in the Aldwell Formation, Pulali Point, Washington, right valve, $\times 1.7$. Figures 8-10: locality CSUN 1502, Crescent Formation near Quilcene, Washington; Figure 8, hypotype, LACMIP 11478, right valve, $\times 1.3$. Figures 9-10: hypotype, LACMIP 11489, left valve, $\times 2.1$; Figure 9, dorsum; Figure 10, interior.

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the early Eocene or that the subgenus originated in the Jamaica area.

NEW OCCURRENCES OF *NAYADINA (EXPUTENS) LLAJASENSIS*

The author obtained ten specimens of *Nayadina (E.) llajasensis* from Eocene rocks about 45 km west of Seattle, Washington. Six specimens are from reworked sedimentary clasts in the lower part of the middle Eocene Aldwell (?) Formation at locality CSUN 1516 at Pulali Point. Some of the reworked clasts consist of very distinctive whitish-colored, calcareous, medium-grained sandstone most likely derived from the underlying lower Eocene upper part of the Crescent Formation (SQUIRES *et al.*, in press). One of the *N. (E.) llajasensis* specimens is illustrated in Figure 7.

Four other specimens of *Nayadina (E.) llajasensis* are from the upper Crescent Formation at locality CSUN 1502, about 5 km north of Pulali Point. At CSUN locality 1502, the specimens were found in boulder-sized rocks that are not in place but are in a modern landslide block at the base of a steep cliff mapped by HAMLIN (1962) as

Crescent Formation basalt. He did not mention any sedimentary rocks interbedded with the Crescent Formation in this area, but sedimentary interbeds are present (J. L. Goedert, personal communication). Brachiopods are very abundant at locality CSUN 1502, with numerous specimens of *Hemithiris reaganii* Hertlein & Grant, 1944, and common specimens of *Terebratulina unguicula weaveri* Hertlein & Grant, 1944. There are also a few specimens of a calcareous? sponge, a single specimen of a new anomiid bivalve, and a single large specimen of *Ostrea* sp. All the associated macrofauna is also present in the upper Crescent Formation at Pulali Point (SQUIRES *et al.*, in press). Additional evidence from the *N. (E.) llajasensis* specimens at CSUN locality 1502 are most likely from the upper Crescent Formation is that the specimens are in a distinctive whitish-colored, calcareous, medium-grained sandstone identical in lithology to some reworked clasts in the basal part of the Aldwell (?) Formation found by SQUIRES *et al.* (in press) at Pulali Point at locality CSUN 1516. Two of the *N. (E.) llajasensis* specimens from CSUN locality 1502 are illustrated (Figures 8-10).

Localities CSUN 1502 and 1516 in northwestern Washington are the northernmost occurrences of any species of

Nayadina (Exputens) and show how extensive warm-water conditions were along the Pacific coast of North America during early to middle Eocene time. Previously, the northernmost occurrence of *Nayadina (Exputens)* was central western Oregon. BALDWIN (1955) reported *Exputens alexi* (Clark, 1934) from the lower Eocene Siletz River Volcanic Series in central western Oregon. SQUIRES (1990) showed that *Exputens alexi* is conspecific with *N. (E.) llajasensis*.

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LOCALITIES CITED

- CSUN 1471. Near middle of canyon wall along W side of Arroyo San Juan de Abajo, about 80 m elevation, about 0.75 km W of dirt road from San José de Gracia to El Datilon, at 112°44'W and 26°29.5'N, Mexican government 1:50,000 topographic quadrangle map of Punta Santo Domingo (number G12A47), Baja California Sur, Mexico, 1982. Bateque Formation. Age: Middle early Eocene ("Capay Stage"). Collectors: R. L. Squires and R. A. Demetron, April 1990.
- CSUN 1491. In a small quarry on S side of Mexico Highway 1, at 74.5 km N of La Paz, coordinates 9.5 and 71.5 of Mexican government 1:50,000 topographic quadrangle map of El Conejo (number G12D81), Baja California Sur, Mexico, 1983. Tepetate Formation. Age: Middle early Eocene ("Capay Stage"). Collectors: R. L. Squires and R. A. Demetron, June 1991. = LACMI 1603
- CSUN 1502. From boulder-sized rocks not in place but in a modern landslide block, 2 km S of Quilcene on W shore of Quilcene Bay just S of latitude 47°47'30", NE¼, section 36, T27N, R2W, Quilcene quadrangle (7.5 minute), 1953, Jefferson County, northwestern Washington. Upper Crescent Formation. Age: Early Eocene (near the boundary between the "Capay Stage" and the "Domengine Stage"). Collectors: J. L. Goedert and K. Kaler, April 1990. (Note: this locality is probably the same as locality University of Washington 353 described by WEAVER (1943:602)). = LACMI 1603
- CSUN 1516. About 20 m above the base of the Aldwell(?) Formation, 1380 m N of tip of Pulali Point, in beach cliff along W shore of Dabob Bay, section 18, T26N,

- R1W, Seabeck quadrangle (7.5 minute), 1953, photo-revised 1968, Jefferson County, northwestern Washington. Aldwell(?) Formation. Age: Middle Eocene (Narizian Stage). Collector: J. L. Goedert, June 1990.
- CSUN 1522. In a small arroyo about 0.5 km N of Mexico Highway 1, at 75 km N of La Paz, coordinates 9 and 72 of Mexican government 1:50,000 topographic quadrangle map of El Conejo (number G12D81), Baja California Sur, Mexico, 1983. Tepetate Formation. Age: Middle early Eocene ("Capay Stage"). Collector: R. A. Demetron, July 1991.
- UF XJ012. Small exposure on W side of road, 5 km S of Johns Hall Quarry, Spring Mount, St. James Parish, Jamaica. Chapelton Formation. Age: Middle Eocene. Collectors: Portell, Bryan, Heller, and Frederick, May 1990.
- UF XJ018. Along stream between Pump Station and Wait-A-Bit Cave at Wait-A-Bit, Trelawny Parish, Jamaica. Stettin Member of Chapelton Formation. Age: Early Eocene. Collectors: Portell, Bryan, Heller, and Frederick, May 1990.

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