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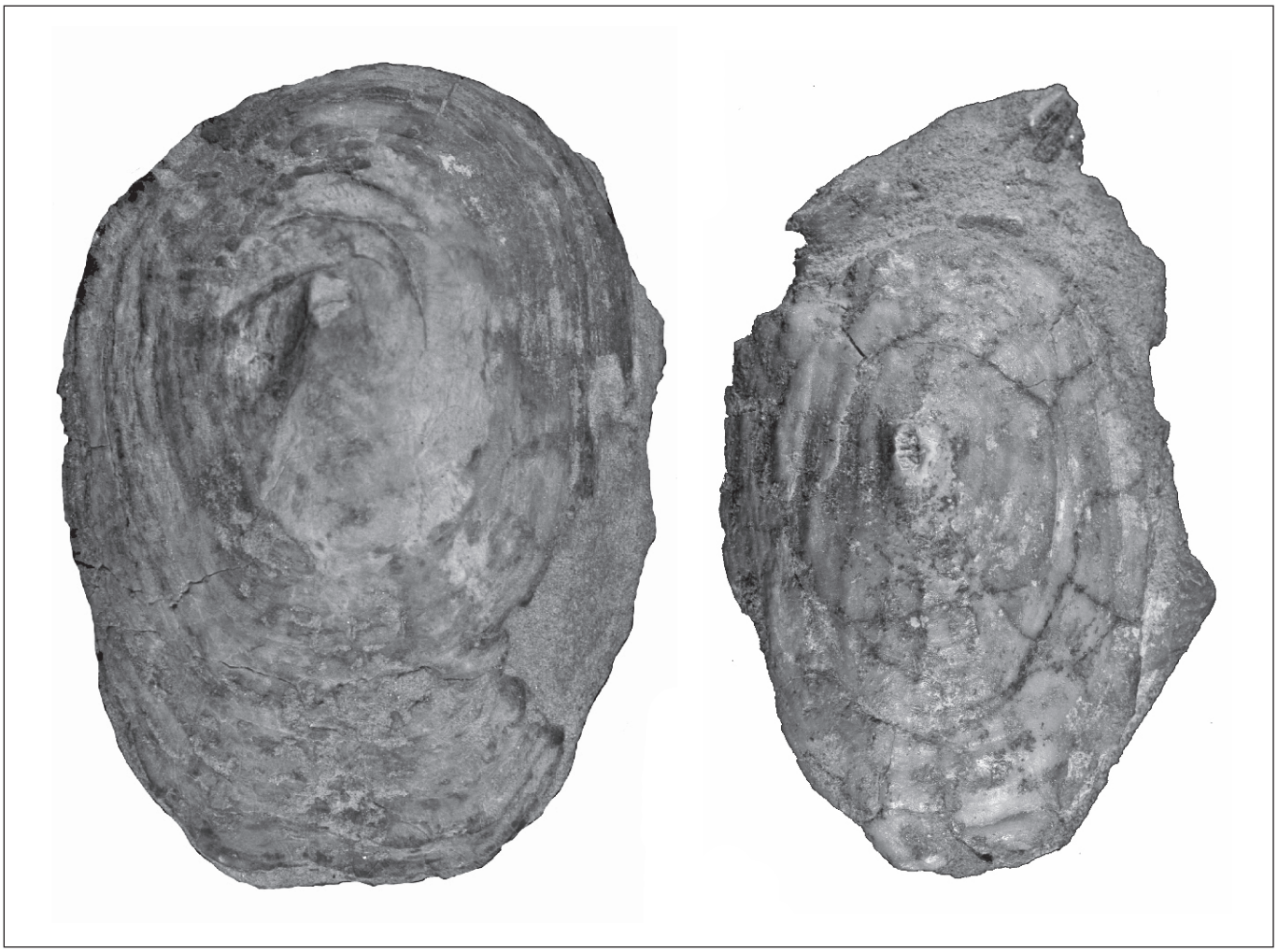

CHARLES L. POWELL, II and DANIEL L. GEIGER (2019). Two new Miocene limpets (Fissurellidae) from southern California, with notes on other fossil occurrences of the family in northwestern North America.

Cover: New limpet species, *Scelidotoma aldersoni* n. sp. (left) and *Fissurella? stantoni* n. sp. (right), from the Miocene of southern California.

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Two new Miocene limpets (Fissurellidae) from southern California, with notes on other fossil occurrences of the family in northwestern North America

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Two new fissurellid limpets (Mollusca: Gastropoda: Fissurellidae), *Fissurella? stantoni* n. sp. and *Scelidotoma aldersoni* n. sp., are described from Miocene deposits in southern California. *Fissurella? stantoni* is described from a single specimen from the middle Miocene Topanga Canyon Formation in the Santa Monica Mountains, Los Angeles County, California. *Scelidotoma aldersoni* is described from two specimens, one from the middle Miocene Topanga Canyon Formation, and another provisionally (cf.) identified specimen of an internal mold from the middle Miocene "Vaqueros" Formation on Santa Cruz Island, Santa Barbara County, southern California. Other unreported fossil occurrences of *Scelidotoma* are a juvenile specimen attributed only to genus collected in the middle Eocene Crescent Formation in Washington state and *S. bella* from the Pliocene part of the San Diego Formation, San Diego County, California. The *Scelidotoma* occurrences extend the chronostratigraphic range of *S. bella* from the Holocene (living) to the middle Pliocene, and the range of the genus back to the middle Eocene.

Keywords: Mollusca, Gastropoda, Fissurellidae, *Scelidotoma, Fissurella,* Paleogene, Neogene

INTRODUCTION

Fissurellidae Fleming (1822) are a common component of the lower intertidal to subtidal regions around the world (Kaicher 1988), including the west coast of North America (McLean 1971, 1978). They are less common beyond the continental shelf in deeper water (e.g., McLean and Geiger 1998, Suárez-Mozo and Geiger 2017). Their fossilization potential should be good due to a robust, entirely calcitic, limpet-shaped shell (Geiger et al. 2008). However, the rocky habitat they predominantly live in imposes a negative taphonomic bias through high-energy conditions and a typical erosive depositional setting (Woodring 1931, Carter 1972, Kotaka and Ogasawara 1974, Parsons and Brett 1991). This bias is reflected in the California fossil record where Keen and Bentson (1944) recognized only six taxa in the family during the Paleogene-Neogene: two *Fissurella* Bruguière (1789), one possible *Fissurella*, and three *Diodora* Gray (1821). There is also a report of a questionable *Fissurella* from the Mesozoic of California (Kiel et al. 2008).

Here we describe *Fissurella? stantoni* n. sp. from a single specimen collected from the Topanga Canyon Formation in the Santa Monica Mountains. In addition, we describe a new species of *Scelidotoma* from two specimens, one from the middle Miocene Topanga Canyon Formation, and another steinkern provisionally identified from the middle Miocene "Vaqueros" Formation on Santa Cruz Island, Santa Barbara County. An indeterminate juvenile *Scelidotoma* from the middle Eocene Crescent Formation of western Washington is also mentioned.

The Topanga Canyon Formation in the Santa Monica Mountains of northern Los Angeles County contains the largest and best preserved middle Miocene molluscan fauna from a single formation in California. It exceeds those of the Kern County described from multiple formations by Addicott (1970). The first report on molluscan fossils in rocks later referred to the Topanga Formation (Kew 1923, 1924) is that of Arnold (1907). Yerkes and Campbell (1979) raised the Topanga Formation to group status and included within it, from base to top, the Topanga Canyon Formation, the Conejo Volcanics, and the Calabasas Formation. Takeo Susuki (University

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of California-Los Angeles, deceased) worked on the Topanga Canyon Formation fauna for many years. However, none of his work was formally published. Susuki's investigations have been resumed by John Alderson and Robert Stanton (Natural History Museum of Los Angeles County, Invertebrate Paleontology [LACMIP]). However, the fissurellids in this study are not included in their continuing work and are described here in their honor.

Many early California geologists assigned formation names on the basis of their enclosed fauna (biostratigraphically) not by correlating the rocks composing the formation (lithostratigraphically) as geologic formations should be correlated. Complicating this some formation names in California have been used in both a lithologic and biostratigraphic sense causing significant confusion in the literature. The "Vaqueros" Formation in the Channel Islands is one of these units. The type Vaqueros Formation was named for outcrops from Vaqueros Canyon in the Santa Lucia Mountains, Monterey County, California that are of late Oligocene age (Miles and Rigby 1990). The rocks unit "Vaqueros" Formation on the California Channel Islands, where the second *Scelidotoma* specimen was collected, is lithologically different from the type Vaqueros and should be given a new name, but that is beyond the scope of this report.

Fossils from the "Vaqueros" Formation on California's Channel Island are also not biostratigraphically similar to fauna reported from the type Vaqueros Formation (Loel and Corey 1932, United States Geological Survey (USGS) collections now housed at University of California Museum of Paleontology), and based on unpublished data on fossils from Santa Rosa Island (University of Calfornia-Santa Barbara and USGS collections) and southern Orange County (LACMIP, San Diego Society of Natural History collections) are middle Miocene in age correlating biostratigraphically with the younger "Temblor" California provincial molluscan stage (CPMS) (19.5–12.0 Ma; Smith 1991) further supporting the need for a new name for the "Vaqueros" Formation on California's Channel Islands (name used in quotes to signify it does not correlate with the type Vaqueros Formation and not to be confused with the 32.6–19.5 Ma "Vaqueros" CPMS [Smith 1991]).

MATERIALS AND METHODS

The specimens reported here from the Topanga Canyon Formation were pointed out to the senior author by John Alderson (LACMIP research associate) who is an expert on fossils from the Santa Monica Mountains. The Santa Cruz Island specimen was recognized among U.S. Geological Survey specimens being curated at the University of California Museum of Paleontology (UCMP).

Measurements are defined as follows: **height**=greatest distance between dorsal and ventral termini; **length**=greatest distance between anterior and posterior termini; **width**=greatest distance between left and right termini.

Institutional abbreviations—CSUNR, California State University Northridge, Northridge, California; **LACMIP**, Invertebrate Paleontology Section, Natural History Museum of Los Angeles County, Los Angeles, California; **LACMM**, Malacology section, Natural History Museum of Los Angeles County, Los Angeles, California; **SBMNH**, Santa Barbara Museum of Natural History, Santa Barbara, California; **SDSNH**, Paleontology section, San Diego Society of Natural History, San Diego, California; **UCMP,** Museum of Paleontology, University of California at Berkeley, Berkeley, California; **UCSB**, University of California, Santa Barbara, Goleta, California; **USGS**, U.S. Geological Survey, Washington, D.C.; **USGS M**, U.S. Geological Survey, Menlo Park, California (now housed at UCMP).

SYSTEMATIC PALEONTOLOGY

GASTROPODA Cuvier, 1795
VETIGASTROPODA Salvinia-Plawen, 1980
FISSURELLIDAE Fleming, 1822
EMARGINULINAE Children, 1834
FISSURELLA Bruguière, 1789

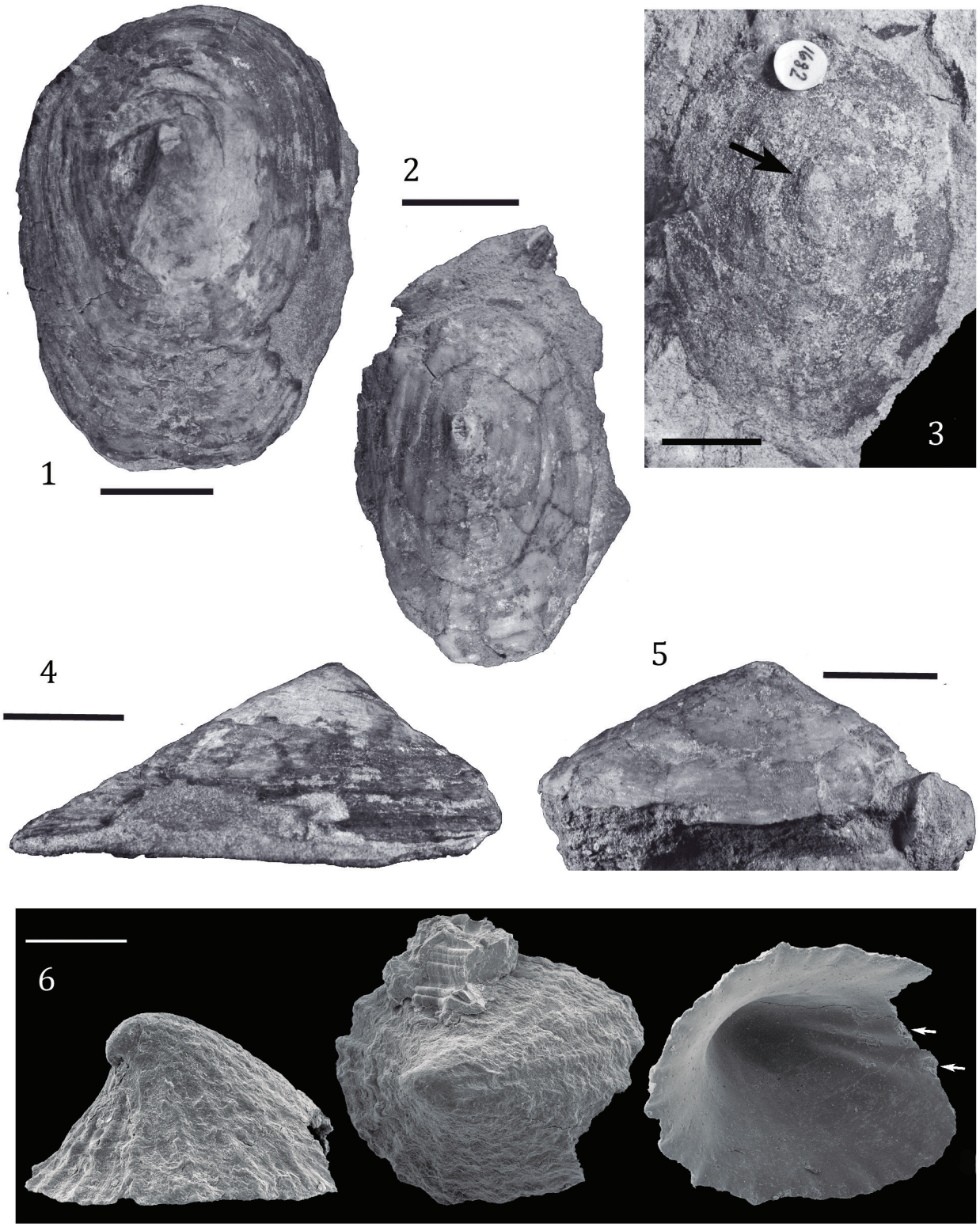
Diagnosis—Shells are conical with an overall oval outline, with or without inclined sides, topped by a centrally-placed apex wholly absorbed by an oval foramen in mature specimens. The foramen is bordered inside by a ring of callus that is not truncated or excavated posteriorly. Sculpture is chiefly radial.

Type species—*Fissurella nimbosa* Linnaeus (1758), by monotypy.

Remarks—The difference between *Fissurella* and the closely related genus *Diodora* is in the shape of the foramen at the apex and from the interior. In *Fissurella* the foramen is oval, while in *Diodora* the posterior end of the foramen is truncated. The interior of the shell described here is not available so the genus determination is questioned.

FISSURELLA? STANTONI Powell and Geiger, n. sp.
Figs. 2, 5

Diagnosis—*Fissurella? stantoni* n. sp. differs from all other northeastern Pacific fossil and modern fissurellids by a combination of its large size, oblong-oval shape with divergent margins towards the posterior end, and



Figures 1–6. New fissurellids from southern California. **1, 3, 4**. *Scelidotoma aldersoni* Powell and Geiger, n. sp. Holotype LACMIP 14846 (locality LACMIP 31503) in apical (**1**) and lateral (**4**) views (scale bars=1.0 cm). Paratype SBNHM 634129, internal mold in apical view (**3**) showing bryozoan colony at apex (arrow)(scale bar=1.0cm). **2, 5**. *Fissurella? stantoni* Powell and Geiger n. sp. Holotype LACMIP 14847 (locality LACMIP 31511) in apical (**2**) and lateral (**5**) views (scale bars=1.0 cm). **6**. *Scelidotoma,* indeterminate juvenile. Hypotype SBMNH 467091 from the Crescent Formation (locality CSUNR 1564: Rock Candy Mountain, Thurston County, Washington state). From left to right: specimen in lateral, apical, and interior views. Arrows indicate the thickened edges of the emarginulid channel diagnostic of *Scelidotoma.* Scale bar=1.0 mm.

lacking sculpture.

Holotype—LACMIP 14847.

Type locality—Locality LACMIP 31511 is from a prominent sandstone bed about 50 feet thick in the amphitheater on Old Topanga Road, Santa Monica Mountains, Los Angeles County, California. Collected by Bert Draper, date unknown. Coordinates are latitude 34.12502°, longitude -118.63786°. This site is from the Cold Creek Member of the Topanga Canyon Formation of lower to middle Miocene age ("Temblor" California provincial molluscan stage, =the uppermost Burdigalian/Langhian stages of the International Commission on Stratigraphy stages).

Etymology—Named for Dr. Robert Stanton for his remarkable and continued work on California geology and paleontology.

Description

Known only from the type specimen. The shell has an incomplete margin but appears to be a long oval with lateral margins diverging slightly towards the posterior end. It is 55.9 mm long, 37.7 mm wide and 17.7 mm tall. The apex is located at about 60% of the length of the shell. The apex is of moderate height, has a small, square-oval foramen with a thickening around its margin and a steeper shell slope proximal to the foramen. The shell is without growth lines or sculpture and moderately thick. A profile through the apex and anterior and posterior margins show a slight concavity and then convexity between the anterior end and the apex, and a relatively straight profile between the apex and the posterior end.

Comparisons

Only a single fossil species of *Fissurella* occurs in Miocene strata of California, *F. rixfordi* Hertlein (1928), which was described from the "Vaqueros" Formation near Crook Harbor on San Miguel Island, Santa Barbara County, however, it also occurs in the "Topanga" Formation of southern Orange County (Stadum and Finger 2016). *Fissurella rixfordi* is easily distinguished from *F.? stantoni* by its smaller size, higher shells, and moderately strong radial sculpture. The only other *Fissurella* from California is the Pleistocene to Holocene *F. volcano* Reeve (1849), which is easily distinguished by its smaller size, diverging lateral margins, and comparatively higher shell. The large shell size makes this new species most similar to Peruvian and Magellanic *Fissurella* (see McLean 1984), however, *F.? stantoni* is easily distinguished from all South American species in the genus by its narrower shell and small foramen.

SCELIDOTOMA McLean, 1966

Diagnosis—"Shell large, white, apex posterior to center. Radial sculpture of numerous primary and secondary ribs, intersecting the concentric growth lines as imbrications. *** Interior with channel corresponding to selenizone; muscle scar horseshoe-shaped, with inturned hooked process." (McLean 1966, p. 2).

Type species—*Emarginula bella* Gabb (1865) (=*Subemarginula yatesii* Dall (1901).

Remarks—*Scelidotoma* is most similar to the genus *Scutus* Montfort (1810), but differs by having axial sculpture and an interior channel both of which are absent in the genus *Scutus.*

SCELIDOTOMA ALDERSONI Powell and Geiger, n. sp.
Figs. 1, 3, 4

Diagnosis—*Scelidotoma aldersoni* n. sp. differs from all other northeastern Pacific fossil and modern fissurellids by a combination of its large size, oblong-oval shape with convergent margins towards the posterior end, and lacking an oval or circular opening or slit that is common to most Fissurellidae.

Holotype—LACMIP 14846.

Paratype—SBMNH 634129.

Type locality—Locality LACMIP 31503, approximately 1200 feet north and 1800 feet east of the southeast corner of section 35, T1N., R17W. (Malibu Beach 7.5' Quadrangle), from a *Tellina* Linnaeus (1758) bed about 5–6 m above 50 foot sandstone bed in amphitheater along Old Topanga Road. Collected by John Alderson, ca. 2001. Coordinates are latitude 34.12°, longitude -118.64°. This locality was collected from the Cold Creek Member of the Topanga Canyon Formation, lower to middle Miocene ("Temblor" California provincial molluscan stage, =the uppermost Burdigalian/Langhian Stage of the International Commission on Stratigraphy).

The paratype comes from "lower Kinton Point" formation (informal; ="Vaqueros" Formation) in the first sandstone north of Posa Canyon on the southwest side of Santa Cruz Island, Santa Barbara County, at an approximate latitude of 34.0°, longitude -119.8°. The "Kinton Point formation" is an undescribed manuscript name and does not have any lithostratigraphic significance. Collected by Ron Hoeppel and Bob Bereskin sometime in the 1960s. Associated with the specimen are the bivalves *Dosinia merriami* Clark (1915), *Macoma* Leach (1819) sp., and *Yoldia* Möller (1842) sp. (identified by Ron Hoeppel; information provided by Greg Wahlert of UCSB).

Occurrences—Known from a single specimen from the type locality (LACMIP 31503) in the early and middle

Miocene Topanga Canyon Formation in the Santa Monica Mountains and provisionally (cf.) from an internal mold from the middle Miocene "Vaqueros" Formation exposed in Canada Posa on the southwest coast of Santa Cruz Island in the northern southern California Bight (locality UCMP 1402, =locality UCSB 1682).

Etymology—This new species is named for John Alderson who collected the Topanga Canyon Formation specimens and is an expert on the Topanga Canyon Formation in the Santa Monica Mountains.

Description

The shells are shaped like an oblong oval with the sides slightly inclined with a rounded, but blunt posterior end that on the holotype may be slightly impressed. The holotype is 54.4 mm wide, 39.6 mm wide and 23.2 mm tall (Figs. 1, 4) and the paratype is 48.2 mm long, 35.5 mm wide and 19.2 mm tall (Fig. 3). The apex is approximately ⅓ of the shell length from the anterior end. On the holotype, the surface of the shell shows very low, faint, rounded top growth lines, although it appears nearly smooth to the naked eye. A profile through the apex and anterior and posterior margins show a slight concavity between the anterior end and the apex, and a relatively straight profile between the apex and the posterior end. There is a wide, shallow, rounded selenizone running from about a centimeter below the apex to the dorsal margin. Towards the apex from this point the preservation differs and the depression cannot be observed. The shell is of moderate thickness and light to medium gray in color, although the coloration appears to be an artifact of preservation and not related to the original coloration. The aperture is broken off on the holotype and the paratype is an interior mold.

Discussion

Scelidotoma aldersoni is the first fossil member of the genus described from western North America. Inclusion in the genus is indicated by the limpet-shape of the shell, the presence of axial sculpture, the anterior notch, and the interior channel. The only known modern (Holocene) member of *Scelidotoma* is the northeastern Pacific *S. bella*, from which *S. aldersoni* differs by a more eccentric apex (~55% vs. 70% from anterior margin). It is similar in appearance to the genus *Scutus* from the western Pacific differing in many features of the shell and living animal, but is distinguished above.

The only previous fossil records of *Scelidotoma* in western North America is MacNeil (1957) who reported *Emarginula (Subemarginula)* aff. *E. yatesii* Dall (1901) (=*Scelidotoma* aff. *S. bella*) from the Nuwok Member of the Sagavanirktok Formation, exposed in the Marsh Anticline at Carter Creek, Arctic National Wildlife Refuge on the North Slope of Alaska. Age determination of the Nuwok Member are wide ranging with ages of Oligocene (McNeil and Miller 1990), Miocene (in part Dall 1920, MacNeil 1957), and Pliocene (in part Dall 1920, Fouch et al. 1990, Marincovich and Powell 1991) having been determined for exposures at Carter Creek, where Dall's (1901) specimen was collected.

The genus *Scelidotoma* is also reported here as a fossil from several widely separated locations and ages in the western United States. A single juvenile *Scelidotoma* (Fig. 6) from the middle Eocene Crescent Formation in the Black Hills, near Olympia in western Washington State, can be positively identified to genus based on the interior axial channel from the anterior notch and the axial cords on the exterior of the shell and is illustrated here (Fig. 6). In addition, collections from the San Diego Formation (LACMIP and SDSNH collections) contain specimens of *S. bella*, extending its biostratigraphic range from the Holocene back to the Pliocene and the biostratigraphic range of the genus *Scelidotoma* from the Holocene to the Eocene in the western western North America.

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