

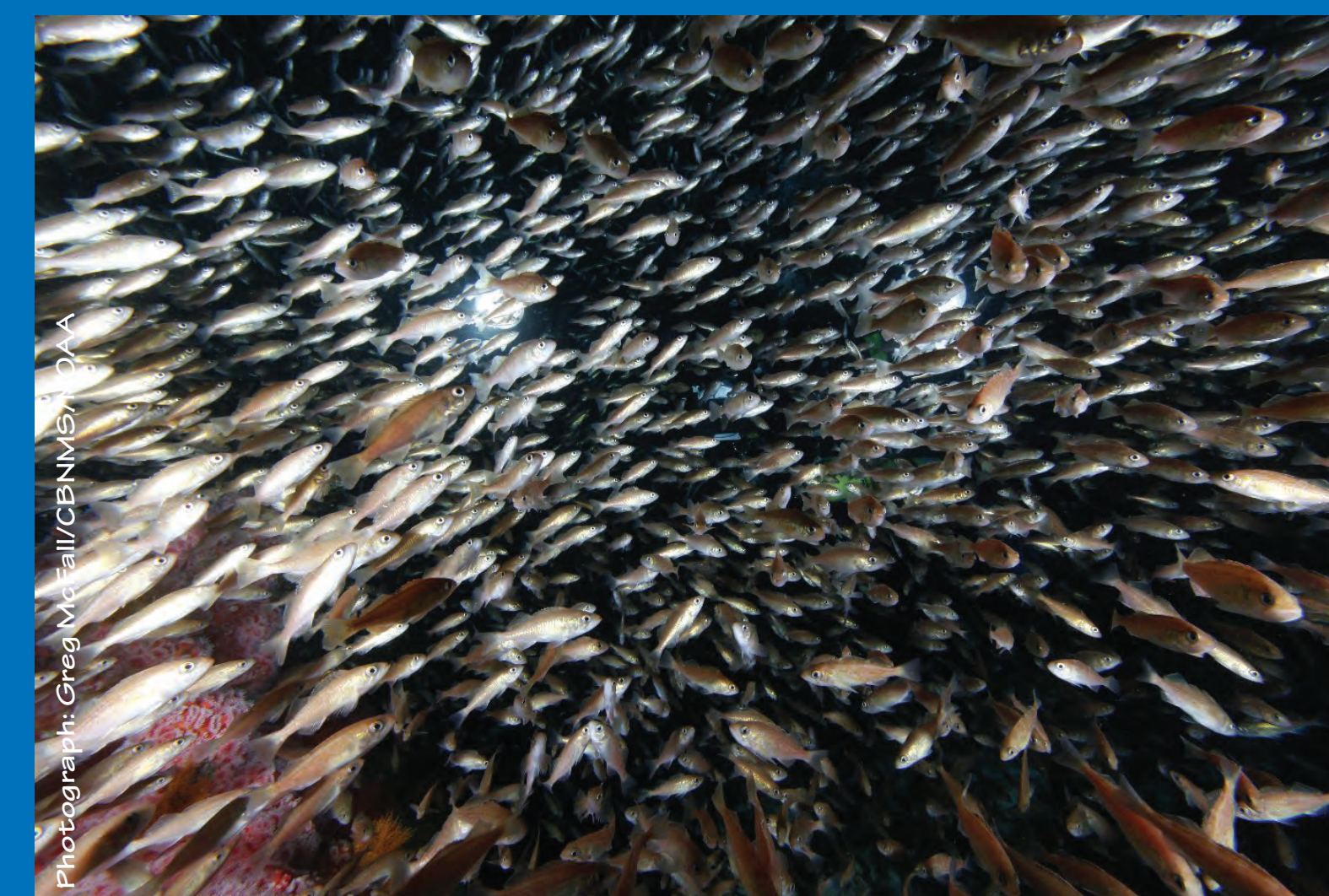
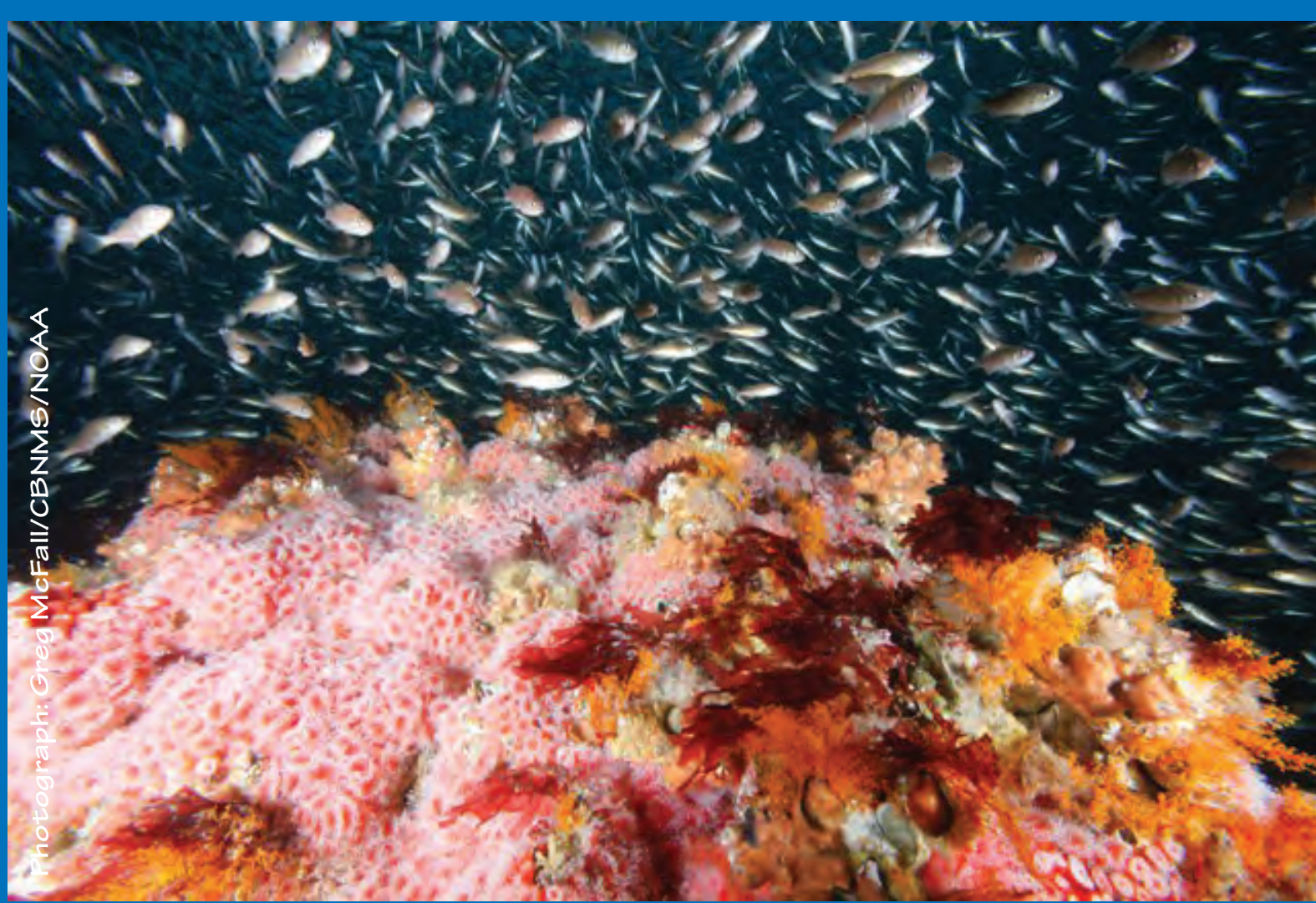
# CORDELL BANK NATIONAL MARINE SANCTUARY SEDIMENT YIELDS A DIVERSE MICRO- AND MACROFAUNA

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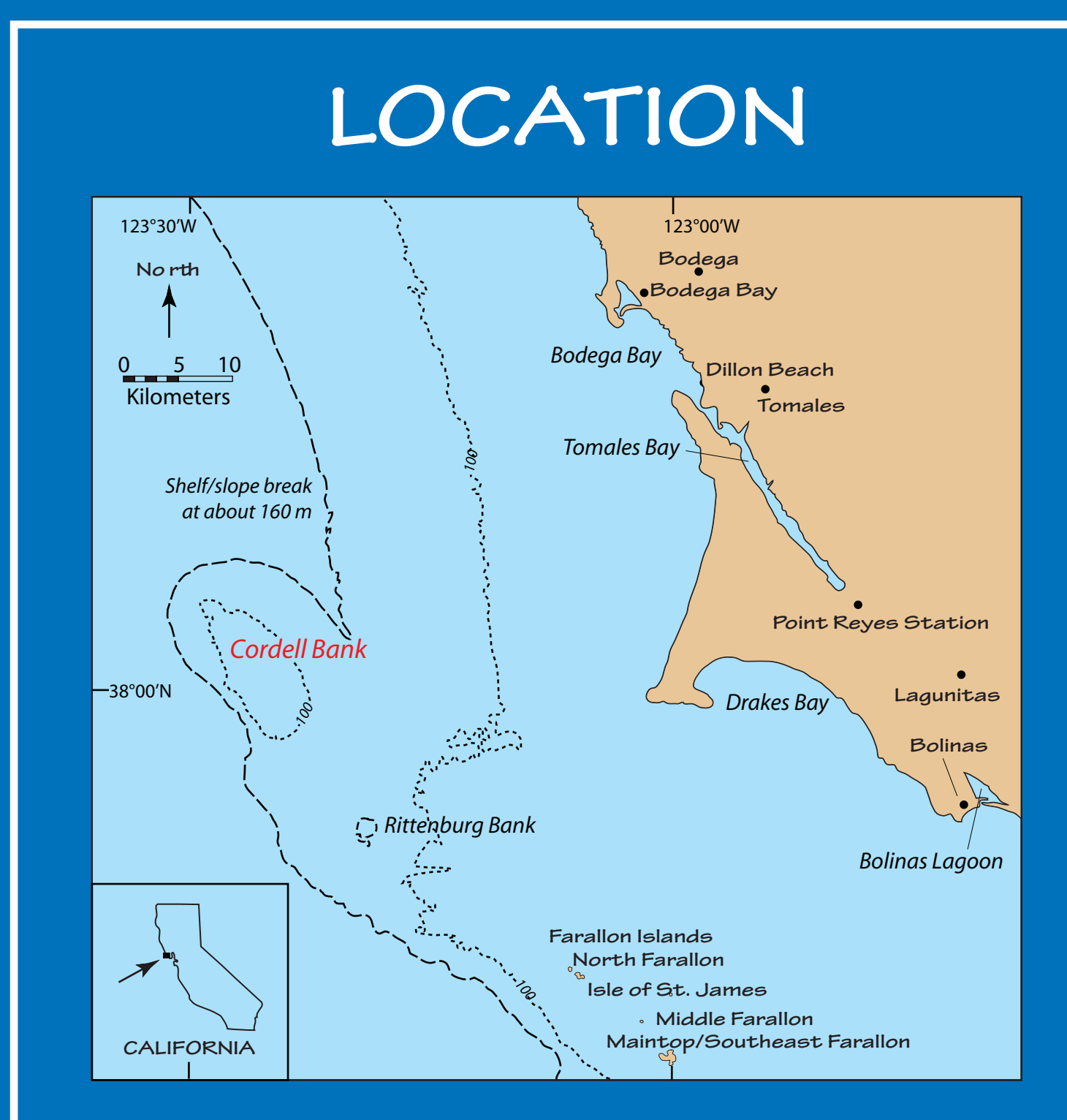
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## ABSTRACT

Cordell Bank, located west of San Francisco (37°59.01'N, 123°25.631'W), was initially investigated by divers of the nonprofit research organization Cordell Expeditions in 1978-1986, then again in 2006 when Robert Schmieder of Cordell Expeditions took Jean-Michel Cousteau to the Bank to obtain video footage. On October 7-9, 2010, Cordell Bank was revisited, this time by NOAA divers fielded by the Cordell Bank National Marine Sanctuary. On October 8, they collected a single sample at a depth of ~50 m on the Bank that consisted of coarse-grained sediment with a significant biogenic component. This sample contains a diverse microfaunal assemblage of 45 species of benthic foraminifera and 6 species of planktonic foraminifera that appears remarkably similar to the fauna collected from Point Lopez and Slate Rock at the Point Sur Pinnacles approximately 70 km to the south. The benthic foraminiferal fauna is dominated by *Cibicides fletcheri*, *Cassidulina tortuosa*, and *Globocassidulina subglobosa*. Planktonic foraminiferal species recovered include the upwelling-indicator species *Globigerina bulloides* and the warm water-indicating (right-coiling) form of *Neogloboquadrina pachyderma*.

The diverse macroinvertebrate portion of the assemblage includes taxa from six phyla, including Cnidaria (4 species: 2 hard corals and 2 hydrozoans), Bryozoa (2 species), Brachiopoda (1 or 2 species), Mollusca (about 20 species), Annelida (1 species), Arthropoda (2 species), and Echinodermata (1 species). Living representatives of these taxa are present at continental shelf water depths, generally on hard substrate at the latitude of Cordell Bank. Preservation varies from very good to very poor; the majority of the macroinvertebrates tend toward the latter.



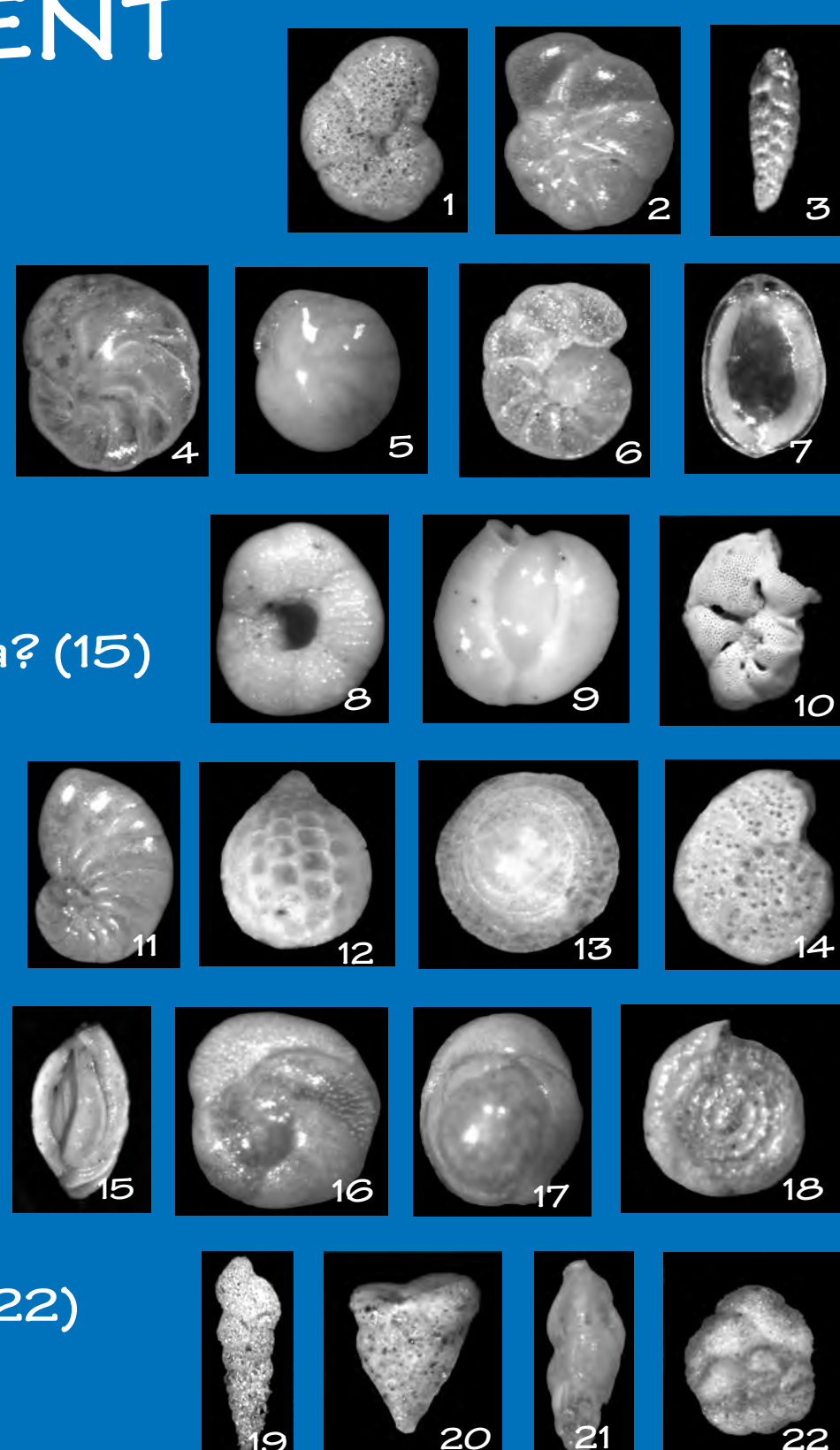
## MICROFAUNA IN THE SEDIMENT

### Benthic Foraminifera

(\*most abundant; numbers in parentheses refer to figured specimens)

- Alveolophragmium columbiensis? (1)
- Astrononion gallowayi (2)
- Bolivina vaughani (3)
- Cassidulina limbata (4)
- Cassidulina minuta?
- \*Cassidulina tortuosa (5)
- \*Cibicides fletcheri (6)
- Cibicides sp.
- Dyocibicides? sp.
- Fissurina spp. (7)
- Gaudryina arenaria
- \*Globocassidulina subglobosa
- Glabratella californiana (8)
- Glomospira gordialis
- Lagena sp.
- Miliolinella californica (9)
- Montfortella bramlettei (10)
- Nonionella basispinata (11)
- Oolina melo (12)

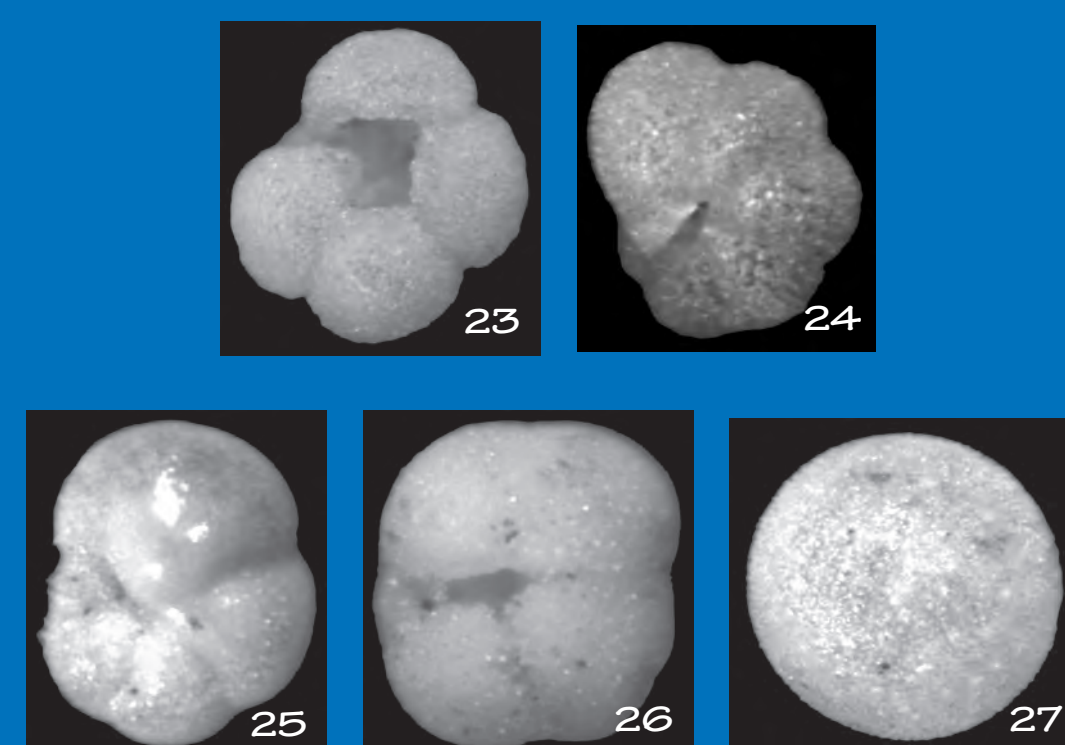
- Patella corrugata (13)
- Planulina exorna (14)
- Poroponides cribrerepandus
- Pullenia salisburyi
- Quinqueloculina angulostriata? (15)
- Quinqueloculina spp.
- Reophax scorpiurus
- Rosalina globularis (16)
- Rotorbina turbinata (17)
- Rudigaudryina inepta
- Spirillina vivipara (18)
- Textularia earlandi (19)
- Textularia schencki (20)
- Trifarina angulosa (21)
- Trifarina hughesi
- Trochammina charlottensis (22)
- Trochammina vesicularis
- Trochammina spp.



### Planktonic Foraminifera

(numbers in parentheses refer to figured specimens)

- Globigerina bulloides (23)
- Globigerina quinqueloba (24)
- Globorotalia sp. (25)
- Neogloboquadrina dutertrei
- Neogloboquadrina pachyderma (26)
- Orbulina universa (27)



## MACROFAUNA IN THE SEDIMENT

(numbers in parentheses refer to figured specimens)

### Cnidaria (corals)

- Anthozoa
- Balanophyllia elegans Verrill, 1864
- Paracyathus stearnsii Verrill, 1869
- Hydrozoa
- Styaster californicus (Verrill, 1866)
- Indeterminate hydrocorals

### Bryozoa

- Indeterminate bryozoa

### Brachiopoda

- Terebratulina unguicula (Carpenter, 1865)

### Mollusca

- Bivalvia (clams)
- Chlamys sp.
- Miodontiscus prolongatus (Carpenter, 1864)
- Pododermus macrochisma (Deshayes, 1839) (1)
- Gastropoda (snails)
- Amphissa cf. A. columbiana Dall, 1916 (2)
- Astyris? sp.
- Calliostoma annulatum (Lightfoot, 1786) (3)
- Calliostoma canaliculatum (Lightfoot, 1786)
- Calliostoma sp.
- Cymakra gracilior (Tryon, 1884)

### Mollusca (continued)

- Eulithidium pulloides (Carpenter, 1865) (4)
- Fusinus? sp.
- Granulina margaritula (Carpenter, 1857) (5)
- Homalopoma luridum (Dall, 1885)
- Homalopoma sp.
- Lirobittium? sp.
- Ocenebrina cf. O. interfossa (Carpenter, 1864) (6)
- Parviturbo acuticostatus (Carpenter, 1864)
- Perimangella cf. P. interfossa (Carpenter, 1864)
- Polyplacophora (chitons)
- Lepidozona? sp.

### Arthropoda (crabs, barnacles)

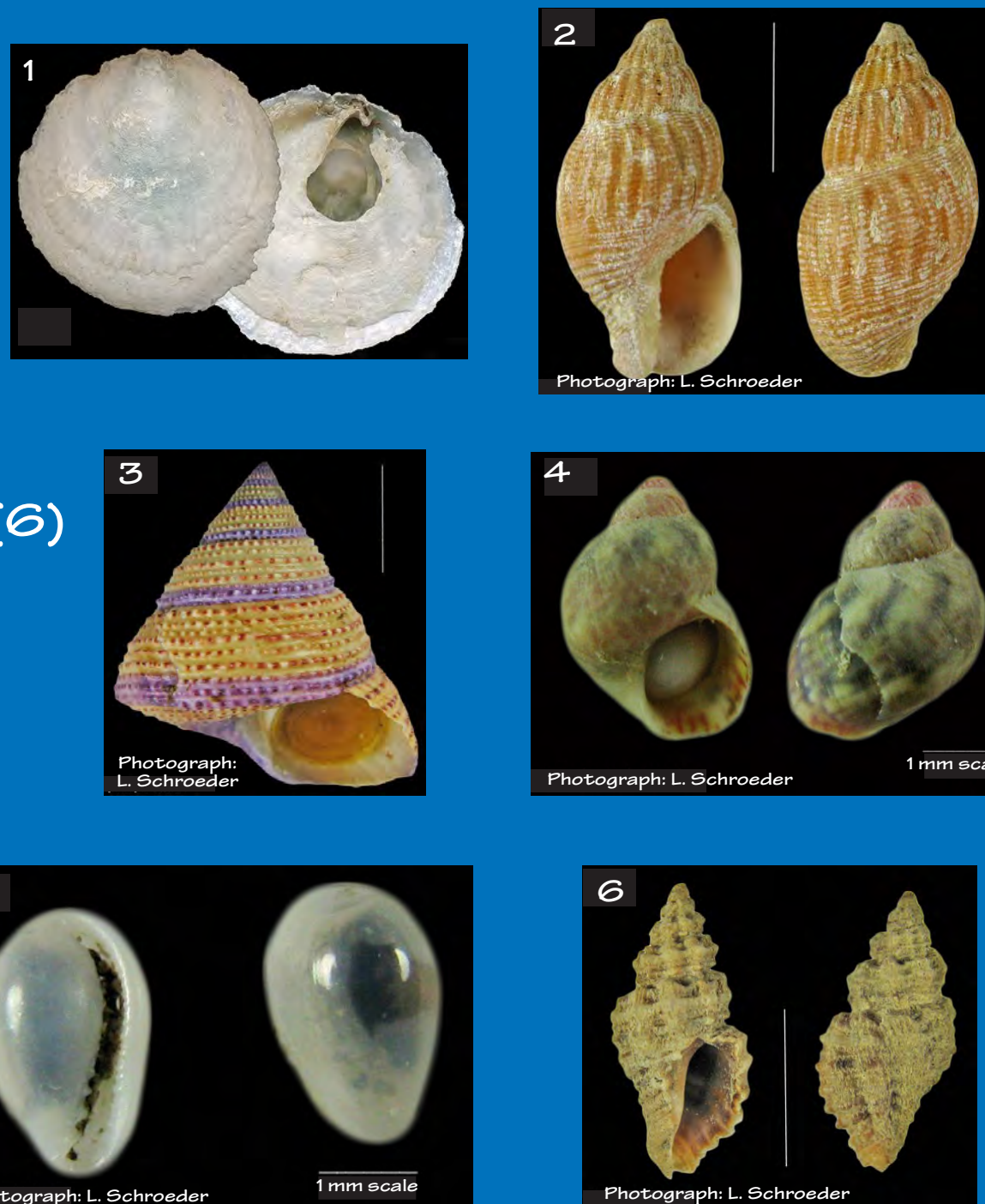
- Malacostraca
- Indeterminate crab claw
- Maxillopoda
- Balanus cf. B. nubilus Darwin, 1854
- Balanus? sp.

### Echinodermata (sea urchins)

- Echinoidea
- Strongylocentrotus sp.

### Cordata (vertebrates)

- Chondrichthyes (cartilaginous fish)
- Indeterminate otolith (fish ear bone)



Photograph 1 from [http://www.idscaro.net/sci/O1\\_coll/plates/bival/pl\\_anomidae\\_1.htm](http://www.idscaro.net/sci/O1_coll/plates/bival/pl_anomidae_1.htm); photographs 2-6 from Gastropods of the Pacific Northwest website (<http://www.bily.com/pnwec/web-content/Gastropod%20Identification.html>). Scale line = 1 cm



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