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Tubules. Small tubes originating at the inner shell surface and extending outwards.

They are produced by the mantle surface.

Undifferentiated combined layer. Combined layer in which the component layers are indistinguishable.

Species examined¹

Family Nuculidae

Acila castrensis (Hinds); *Acila packardi* (Clark), Oligocene, Oregon.

Family Solemyidae

Solemya velum (Say), Connecticut; *Solemya* sp., no locality.

Family Pinnidae

Atrina sp., no locality; *Pinna mutica* (Reeve), no locality.

Family Pteriidae

Meleagrina margaritifera (Linnaeus), no locality.

Family Mytilidae

Mytilus edulis (Linnaeus); *M. californianus* (Conrad); *Hormomya searnsi* (Pilsbry and Raymond); *Septifer bifurcatus* (Conrad); *Volsella capax* (Conrad); *Brachidontes demissus* (Dillwyn); *Botula falcata* (Gould); *Lithophaga plumula* (Hanley).

Family Unionidae

Unio sp., no locality; *Anodonta* sp., no locality.

Family Trigoniidae

Trigonia (*Neotrigonia*) *pectinata* Lamarck, Australia.

Family Periplomatidae

Periploma planiusculum Sowerby.

Family Pandoridae

Pandora glacialis Leach, Northern Seas.

¹ Unless otherwise indicated, the species listed are represented by Recent specimens from the West Coast of North America. The species listed here have generally been sectioned or otherwise closely examined. Other species not listed here have been examined superficially.

Family Lyonsiidae

Entodesma saxicola Baird; *Lyonsia californica* Conrad; *Mytilimeria nuttallii* Conrad.

Family Pectinidae

Chlamys hericius (Gould); *C. hindsii* (Carpenter); *Patinopecten caurinus* (Gould), Pliocene, California; *P. coosensis* (Shumard), Pliocene, Oregon; *P. healeyi* (Arnold), Pliocene, California; *P. lohri* (Hertein), Pliocene, California; *P. yessoensis* (Jay), Japan; *Vertipecten perrini* (Arnold), Miocene, California; *Pecten bellus* (Conrad), Pliocene, California; *P. carrizoensis* Arnold, Pliocene, California; *P. coalingensis* Arnold, Pliocene, California; *P. maximus* (Linnaeus), France; *P. vogdesi* Arnold; *Euvola keepi* (Arnold), Pliocene, California; *E. zigzag* (Linnaeus), Colombia; *Lyropecten crassicardo* (Conrad), Miocene, California; *L. estrellanus* (Conrad), Miocene, California; *L. magnolia* (Conrad), Miocene, California; *L. miguelensis* (Arnold), Miocene, California; *L. subnodosus* (Sowerby), Pleistocene, Gulf of California; *L. terminus* (Arnold), Miocene, California; *Aequipecten circularis* (Sowerby); *A. gibbus* (Linnaeus), no locality; *A. latiauratus* (Conrad); *A. monotimeris* (Conrad); *A. raymondi* (Clark), Miocene, California; *Amussium japonicum* (Gmelin), China.

Family Spondylidae

Spondylus pictorum Chemnitz; *S. cf. crassisquama* Lamarck, no locality; *S. sp.*, Okinawa; *Plicatula gibbosa* Lamarck, Florida.

Family Limidae

Lima cf. scabra (Born), no locality; *L. sp.*, no locality.

Family Anomiidae

Pododesmus macroschismus (Deshayes); *Anomia peruviana* d'Orbigny; *Placenta papyracea* (Lamarck), China.

Family Ostreidae

Ostrea lurida Carpenter; *O. titan* Conrad, Miocene, California; *O. cf. vespertina* Conrad, Pliocene, Gulf of California; *O. virginica* Gmelin, Delaware; *Exogyra sp.*, Upper Cretaceous, Alabama.

Family Arcidae

Anadara grandis Broderip and Sowerby, Honduras; *Anadara incongrua* (Jay), no locality; *A. montereyana* (Osmont), Miocene, California; *A. multicosata* Sowerby; *A. trilineata*, Pliocene, California; *Arca pacifica* Sowerby, Central America; *Barbatia reeviana* (d'Orbigny), no locality; *Noetia ponderosa* (Jay), Florida; *Glycimeris coalingensis* Arnold, Pliocene, California; *Glycimeris inaequalis* (Sowerby), Panama; *G. major* Stanton, Paleocene, California; *G. pilosus* (Linnaeus), Mediterranean Sea. *G. septentrionalis* (Middendorff); *Cucullaea mathewsonii* (Gabb), Cretaceous, California.

Family Lucinidae

Lucina (Loripinus) edentula (Chemnitz), Florida; *Codakia orbicularis* (Linnaeus), Florida; *Divaricella eburnea* (Reeve); *Lucina californica* Conrad; *L. nuttallii* Conrad.

Family Erycinidae

Kellia laperousii (Deshayes); *Lasea rubra* (Montagu), Europe.

Family Tellinidae

Macoma nasuta (Conrad); *Macoma secta* (Conrad); *Tellina bodegensis* Hinds.

Family Semelidae

Semele decisa (Conrad); *S. rupicola* Dall; *Cumingia lamellosa* Sowerby.

Family Donacidae

Donax asper Hanley, no locality; *Iphigenia altior* (Sowerby), Panama.

Family Sanguinolariidae

Heterodonax bimaculata (Linnaeus); *Sanguinolaria nuttallii* Conrad; *Tagelus californianus* (Conrad).

Family Mactridae

Mactra californica Conrad; *Pseudocardium densatum* (Conrad), Pliocene, California; *Rangia* sp., Pliocene, California; *Schizothaerus nuttallii* (Conrad); *Spisula alaskana* Dall.

Family Cardiidae

Trachycardium (Trachycardium) consors (Sowerby); *T. (T.) isocardia* (Linnaeus), Florida; *T. (T.) muricatum* (Linnaeus), Florida; *T. (T.) senticosum* (Sowerby); *T. (Dallocardia) quadrigenarium* (Conrad); *Mexicardia procerum* (Sowerby); *Papyri-dea aspersa* (Sowerby), Panama; *Americardium biangulatum* (Broderip and Sowerby); *Nemocardium linteum* (Conrad), Eocene, California; *Laevicardium elatum* (Sowerby); *L. substriatum* (Conrad); *Cerastoderma edulis* (Linnaeus), Mediterranean Sea; *Clinocardium blandum* (Gould); *C. californiense* (Deshayes); *C. coosensis* (Dall), Pliocene, Oregon; *C. meekianum* (Gabb), Pliocene, California; *C. nuttallii* (Conrad); *Serripes groenlandicus* (Brugière), Arctic Ocean; *Dinocardium robustum* (Solander), Texas; *Cardium costatum* Linnaeus, West Africa.

Family Adacnidae

Didacna trigonoides (Pallas), Iran.

Family Tridacnidae

Hippopus sp., Solomon Islands; *Tridacna* sp., no locality.

Family Carditidae

Cardita ventricosa Gould; *Cardita* sp., Sumatra; *Glans affinis* (Sowerby); *Venericardia laticostata* (Sowerby); *Venericardia* cf. *aragonia*, Eocene, Oregon; *Venericardia* cf. *hornii* (Gabb), Eocene, California.

Veneridae

Venus verrucosa Linnaeus, Algeria; *Circe gibba* (Lamarck), Pacific Ocean; *Gafrarium divaricatum* (Chemnitz), Philippine Islands; *Sunetta scripta* (Linnaeus), China; *Grateloupia cytheriopsis* (Conrad), Eocene, Alabama; *Meretrix meretrix* (Linnaeus), Japan; *Tivela stultorum* (Mawe); *Amiantis callosa* (Conrad); *Macrocallista aequore* (Gabb), Eocene, Alabama; *M. conradiana* (Gabb), Eocene, California; *Pitar californianus stewartvillensis* Clark and Woodford, Paleocene, California; *P. lupanaria* (Lesson); *P. vulneratus* (Broderip), no locality. *Dosinia discus* Reeve, Florida; *D. ponderosa* (Gray); *Gemma gemma* Totten, Connecticut; *Compsomyax subdiaphana* (Carpenter); *Paphia papilionacea* (Lamarck), China; *Psephidia lordi* (Baird); *Tapes malabarica* (Chemnitz), China; *Ruditapes decussata* (Linnaeus), France; *Anomalocardia subrugosa* (Sowerby); *Chione* (*Chione*) *cancellata* (Linnaeus), Florida; *C. (C.) succincta* (Valenciennes); *C. (Gnidiella) gnidia* (Broderip and Sowerby); *Humilaria kennerlyi* (Carpenter in Reeve); *Mercenaria campechiensis* (Gmelin), Texas; *Protothaca laciniata* (Carpenter); *P. semidecussata* (Deshayes); *P. staminea* (Conrad); *P. tenerrima* (Carpenter); *P. fluctifraga* (Sowerby); *P. grata* (Say); *Securella securis* (Schumard), Pliocene, California; *Irus lamellifer* (Conrad); *Saxidomus giganteus* (Deshayes); *S. nuttallii* (Conrad); *Irus irus* (Linnaeus), France.

Family Petricolidae

Petricola carditoides (Conrad).

Family Astartidae

Astarte borealis (Schumacher), Northern Seas.

Family Crassatellidae

Crassatellites digueti Lamy; *C. grandis* (Gabb), Eocene, California.

Family Panopeidae

Panope generosa Gould, no locality.

Family Chamidae

Chama florida Lamarck, no locality; *Chama pellucida* Broderip; *Chama* sp., no locality.

Family Dreissenidae

Dreissenia polymorpha (Pallas), Europe.