



EPICC TCN

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Eastern
Pacific
Invertebrate
Communities
of the
Cenozoic

66 million years of
marine invertebrate
evolution in the Pacific



Collaborators



UNIVERSITY OF CALIFORNIA
UCRIVERSIDE

2018-2020
PEN

Progress

- Specimen data digitized:
1.52M/1.61M records 95%
but only 15% to iDigBio
- Localities georeferenced: 22k/32.6k -- 67%
- Specimens photographed: 114k/83k -- 140%



Additional Products at epicctcn.org

Protocols:

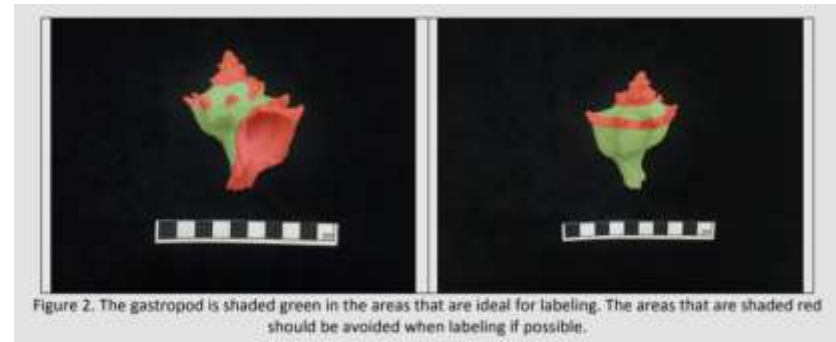
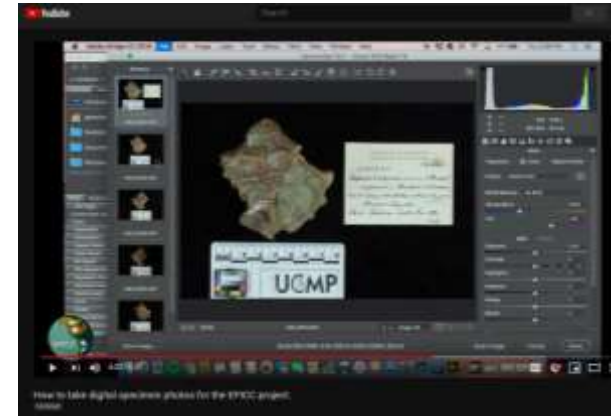
[How to take digital photos for the EPICC project](#) [YouTube]

[StackShot Method for photographing fossil specimens](#) [PDF]

[Standard views of invertebrates for photography](#) [PDF]

[Standard methods of labeling marine invertebrates](#) [PDF]

[Using GEOLocate for Collaborative Georeferencing](#) [PDF]



For sharing training across network and with new PENs
Sufficiently general for use across many types of collections
Written by students doing the work

Virtual Field Experiences launch

A virtual field experience

Explore Fossils - Past lives of the Kettleman Hills

"Explore Fossils" is one of five Virtual Fieldwork Experience (VFE) modules that explores the geology and paleontology of the Kettleman Hills, which sit on the western edge of California's Central Valley. The home page of the VFE, including access to other modules, is [here](#). The VFE is one in a series focusing on classic paleontological field sites and is part of the Eastern Pacific Invertebrate Communities of the Cenozoic (EPICC) Project, funded by the National Science Foundation.



Discoveries of Kettleman Hills

Fossils - a gateway to the biodiversity of the Kettleman Hills

The accompanying video shows the Kettleman Hills and the Kettleman Hills National Monument. The video is available on YouTube at [https://www.youtube.com/watch?v=...](#)

A virtual field experience

Explore Fossils - Past lives of the Kettleman Hills

Fossils of the San Joaquin Formation

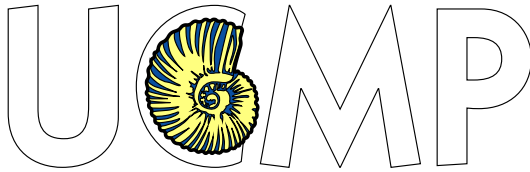
The next younger formation above the Etchegoyen Formation is the San Joaquin Formation, shown relative to the other formations in the diagram below. Within the San Joaquin Formation is the Pecten Zone, named for the fossil scallop shown in the photograph to the right. As you scroll down and view the additional photographs of Pecten, in what other sections of the Kettleman Hills are fossil scallops present? What are some similarities and differences you can notice in terms of size and shape between the variety of fossil scallops? Before you move to the next section, see [Link](#) While describe fossils from the Pecten Zone in this [video clip](#).

Age	Stratigraphic Unit	Formations / Zones
1.0	San Joaquin	San Joaquin
0.8	San Joaquin	San Joaquin
0.6	San Joaquin	San Joaquin
0.4	San Joaquin	San Joaquin
0.2	San Joaquin	San Joaquin
0.0	San Joaquin	San Joaquin




Lesson learned:

Your data won't be what you think they are



Ammonoidea

≠



Ammozoides

Flag: image replaced

- Data cleaning is mostly a good thing.
- Aggregator data cleaning has not always been.
 - Filling in of taxonomic ranks can create fake occurrence data and muddled results
 - Taxonomic backbones will never be complete or as current as museum data may be

Lesson learned

Lack of transparency is a key problem.

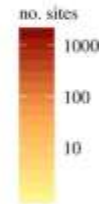
- Tens of thousands of records being modified
- No clear signals to users what they are necessarily searching
- Flags don't provide sufficient feedback on why changes made (e.g., taxon updates vs. typos; exact matches vs. fuzzy matches) to be useful to providers
- Close matches of indeterminate fossils matched to living relatives are particularly problematic (e.g., e.g., *Polinices* sp. becoming *Polinices immaculatus*,)

Quantifying “dark data”

(a) literature database



(b) museum collections



Question: How much more is gained when we invest in collections?

Published record vs. EPICC holdings

23x more localities (faunas) in EPICC institutions than recorded in the literature



Marshall et al. 2018. Quantifying the dark data in museum fossil collections as palaeontology undergoes a second digital revolution. *Biology Letters*. DOI: 10.1098/rsbl.2018.0431

A popular treatment can spread to many more outlets ...

Scientists quantify the vast and valuable finds stored on museum shelves

Quantifying 'dark data' in fossil collections is a call to arms; heralds a digital revolution

ScienceDaily

Your source for the latest research news



We're Hardly Using Any of Our Fossils

The vast majority are languishing in museum storage. Is it time to dig them up all over again?

 **Atlas Obscura**

salon

NEWS & POLITICS ECONOMY & INNOVATION CULTURE SCIENCE & HEALTH FOOD

Digitizing the vast “dark data” in museum fossil collections

With a lot not on display, museums may not even know all that's in their vast holdings

Dark Data: The Vulnerable Treasures Sitting On Museum Shelves

SCIENCE FOR THE CURIOUS
Discover



The Washington Post
Democracy Dies in Darkness

Health & Science

The precious scientific artifacts that will never see the light of day

Acknowledgments



- PIs, students, staff and volunteers of EPICC
- iDigBio staff and trainings
- NSF DBI awards
1502500, 1503065,
1503545, 1503611,
1503613, 1503628
and 1503678



Developing Stratigraphic References



ELIZABETH A. NESBITT (2018). Cenozoic Marine Formations of Washington and Oregon: an annotated catalogue.

Building a Taxonomic Dictionary

- Existing sources of paleontological taxonomy incomplete, not intended for use as backbone
- Building dictionary based on primary literature
- Can be incorporated in GBIF backbone as checklist upon completion
- A.J.W. Hendy and C. Souto et al.; 6400 rows currently

KINGDOM	PHYLUM	CLASS	ORDER	FAMILY	GENUS	SUBGENUS	SPECIES	AUTHOR	ORIGINAL	SYNONYMS
Animalia	Mollusca	Gastropoda		Acmaeidae	<i>Acmaea</i>		<i>mitra</i>	Rathke, 1833	<i>Acmaea mitra</i>	<i>Acmaea mitra</i>
Animalia	Mollusca	Gastropoda	Cephalaspide	Acteocinidae	<i>Tornastra</i>		<i>cerealis</i>	(Gould, 1853)		<i>Tornastra cerealis</i>
Animalia	Mollusca	Gastropoda	Cephalaspide	Acteocinidae	<i>Tornastra</i>		<i>culcitella</i>	(Gould, 1853)		<i>Acteocina culcitella</i>
Animalia	Mollusca	Gastropoda	Cephalaspide	Acteocinidae	<i>Acteocina</i>		<i>eximia</i>	(Baird, 1863)		<i>Acteocina eximia</i>
Animalia	Mollusca	Gastropoda	Cephalaspide	Acteocinidae	<i>Acteocina</i>		<i>harpa</i>	(Dall, 1871)		<i>Coleophysis harpa</i>
Animalia	Mollusca	Gastropoda	Cephalaspide	Acteocinidae	<i>Acteocina</i>		<i>inculta</i>	(Gould, 1855)		<i>Acteocina inculta</i>
Animalia	Mollusca	Gastropoda	Cephalaspide	Acteocinidae	<i>Tornastra</i>		<i>infrequens</i>	(Adams, 1852)		<i>Acteocina anomala</i>
Animalia	Mollusca	Gastropoda	Cephalaspide	Acteocinidae	<i>Acteocina</i>		<i>oldroydi</i>	Dall, 1925	<i>Acteocina oldroydi</i>	<i>Acteocina oldroydi</i>