

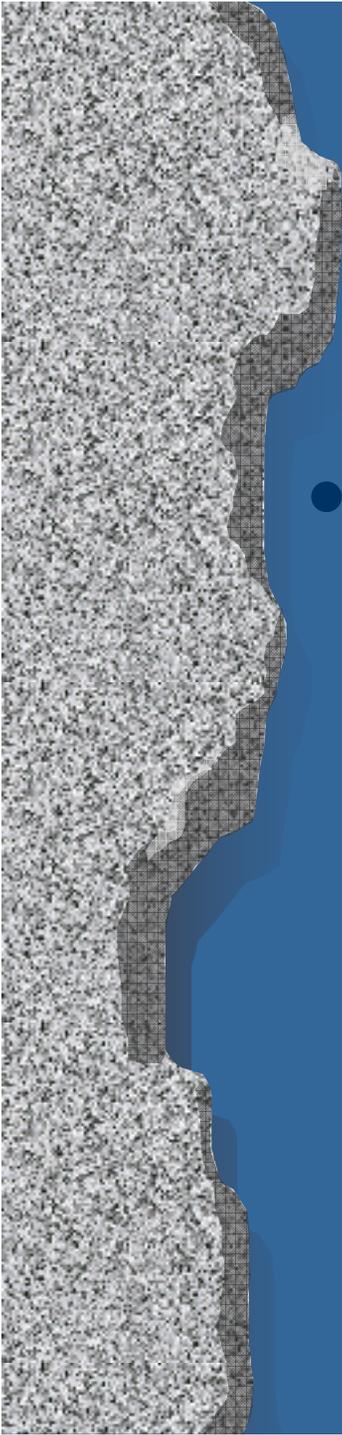
# The Importance of Landfills on Paleontology and the Need For Expediting the Removal of Fossils

Or

## The Land Before Trash

~Presentation By~

Jacques Graber, Associate Engineering Geologist  
California Integrated Waste Management Board



# Significance of Landfills As Sources of Fossils

- **Physical Aspects:**

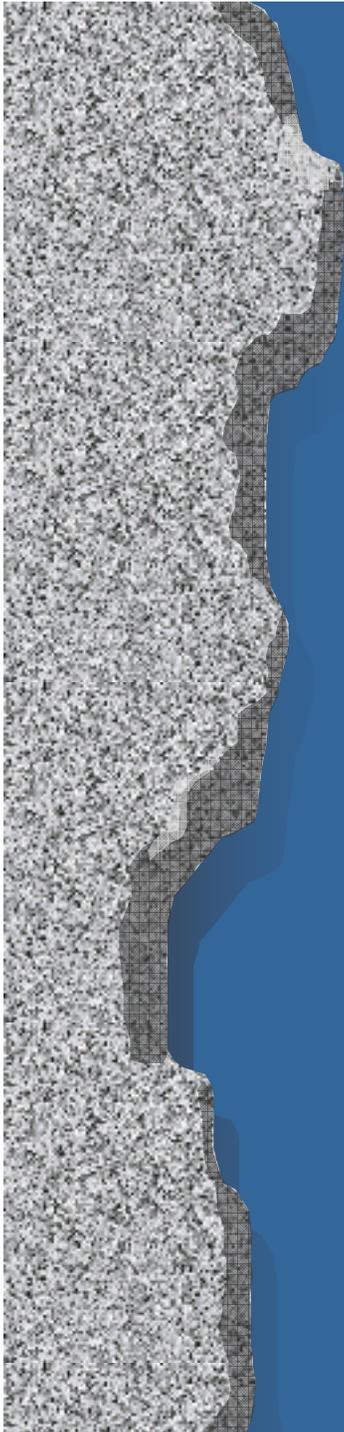
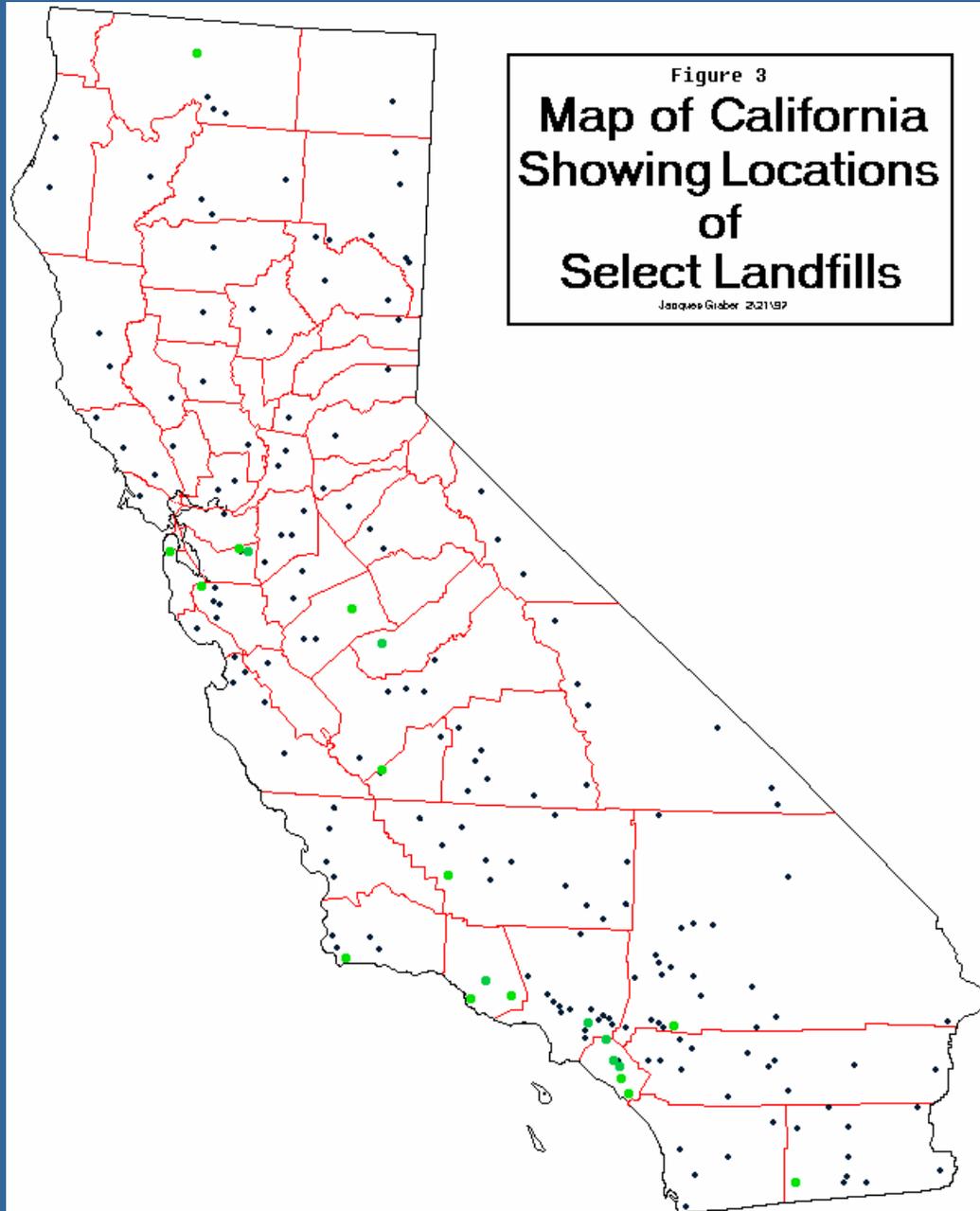
- Location:

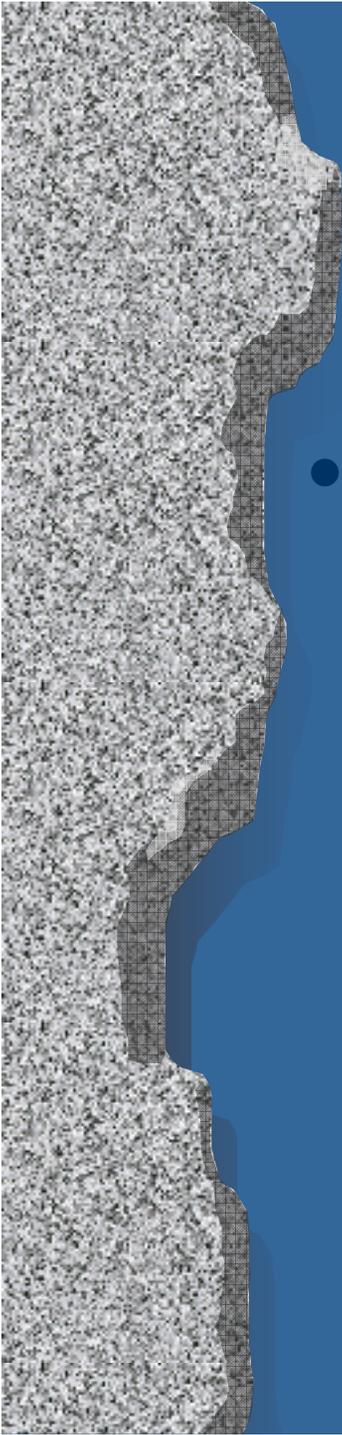
- Landfills are distributed throughout California from Oregon to Mexico.
    - They are located from the Pacific coast to the eastern slopes of the Sierra Nevada.

- Numbers: There are over 188 landfills operating within California (CIWMB SWIS Database as of April 1999).

- Map next page.

Figure 3  
**Map of California  
Showing Locations  
of  
Select Landfills**  
Jacques Giber 2/21/97





# Significance of Landfills As Sources of Fossils

- **Physical Dimensions:**

- Landfills range from 1 acre to 2,290 acres in size.
- Landfill Depths can attain over 100 feet, providing for a long, continuous stratigraphic record to be exposed.
- Volumes of material in soil moved or removed can range in millions of cubic yards.
- These volumes can be removed in relatively short periods of time.

- Photo.

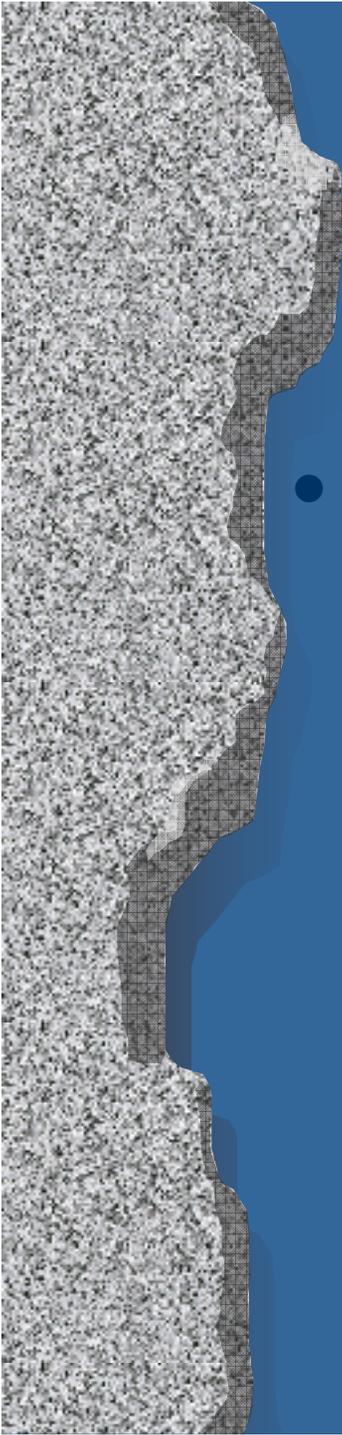
# Fairmead Landfill

Madera County (56 Acres Footprint)

View of New West Cell

Approximately 3 Ac and 56 Ft Deep

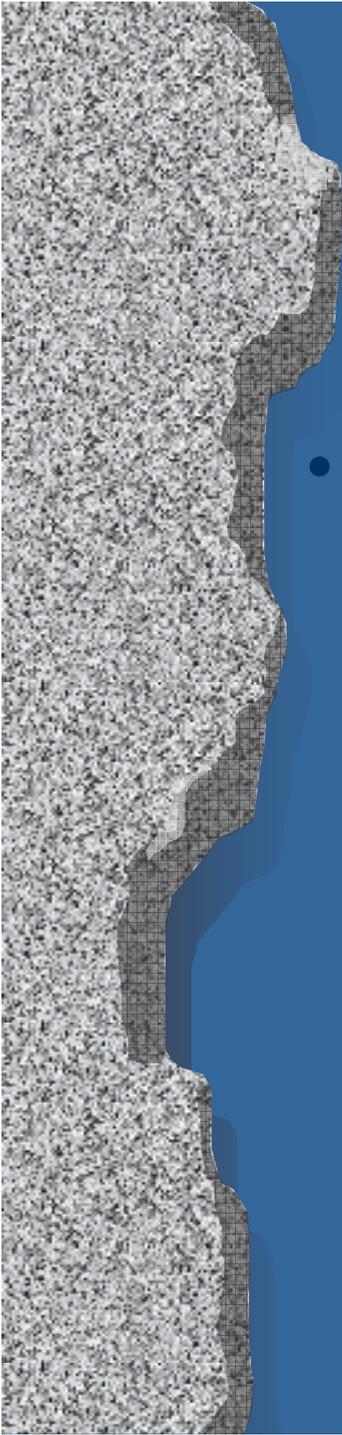




# Significance of Landfills As Sources of Fossils

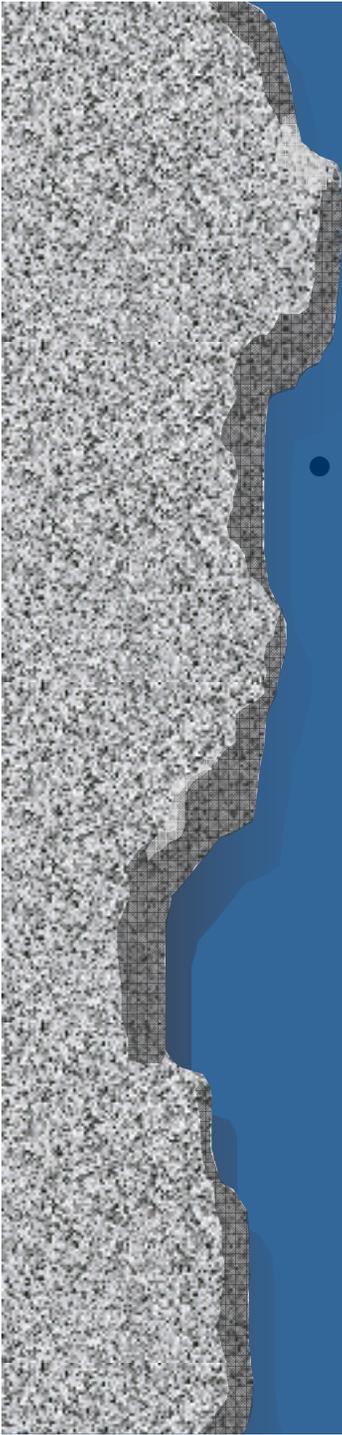
- **Time Durations:**

- Landfills can operate for long periods of time 5 to 100 years or longer..
  - Provides for long-term research plans.
  - Massive volumes of material can be removed over the lifetime of the landfill .
  - Materials that would take a lifetime with manual labor can be excavated within days.
  - Repeated visits to a site can be carried out until closure, which can be years away.



# Significance of Landfills As Sources of Fossils

- **Variety of Locations.**
  - 188 landfills scattered across the state provide potential for species geographic distribution data..
  - Temporal distributions can be researched as species occur in different age deposits, providing insight into longevity of species.
  - Fossils from a broad geologic time span and paleoenvironments are potentially accessible as landfills occupy every geologic province in California..



# Significance of Landfills As Sources of Fossils

- Currently, 28 landfills have yielded significant assemblages of fossils.
  - 10 sites have yielded significant vertebrate assemblages;
    - 7 Land Vertebrate assemblages.
      - Megavertebrates: Camelidae, Oreodonts, Equus.
      - Microvertebrates: Squirrel, pocket mouse, shrew.
    - 6 Marine vertebrate assemblages.
      - Smaller bony fishes; barracuda, surgeonfish.
      - cartilaginous fishes; sharks, rays.
      - Whales, dolphins, sea lions, manatee-like, and walrus-like mammals.

# Significance of Landfills As Sources of Fossils

Mammoth Tusk Recovered at Fairmead LF



# Significance of Landfills As Sources of Fossils

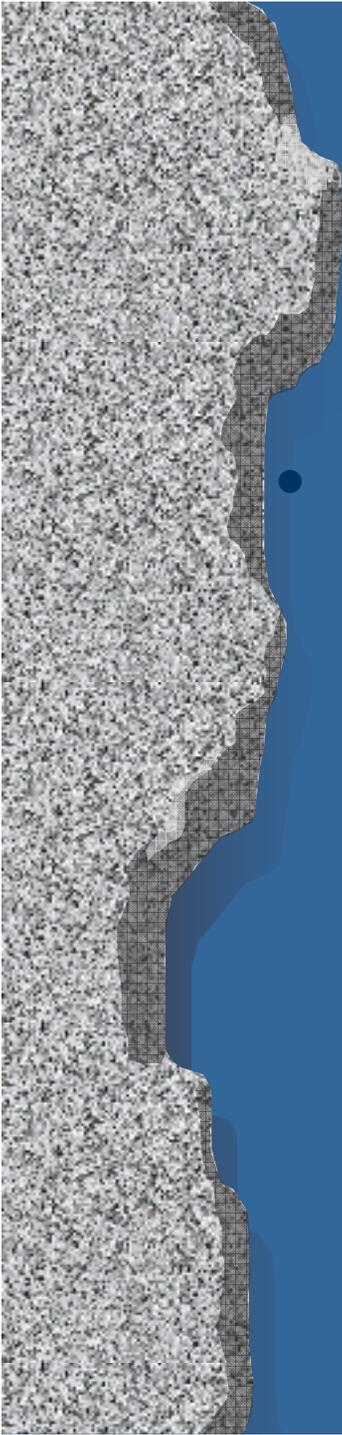
Camel Vertebrae



# Significance of Landfills As Sources of Fossils

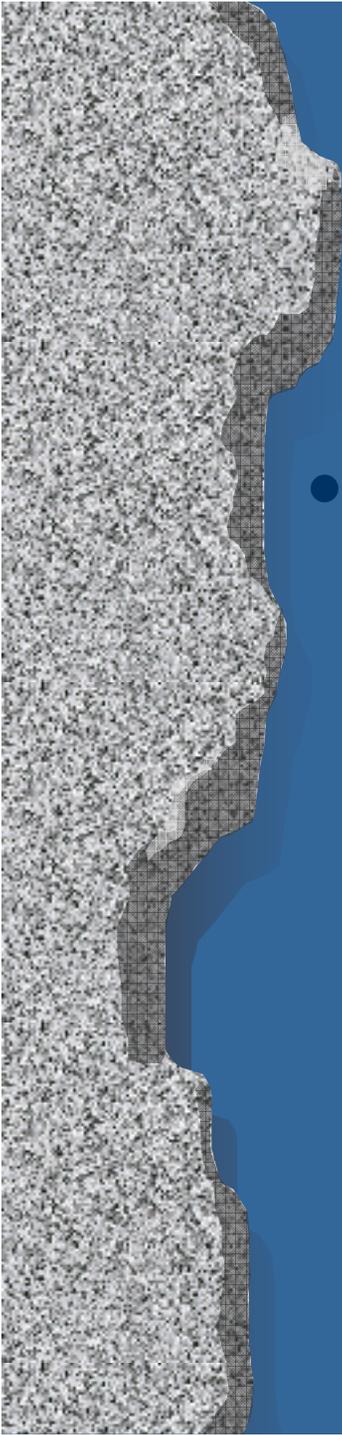
Camel Jaw





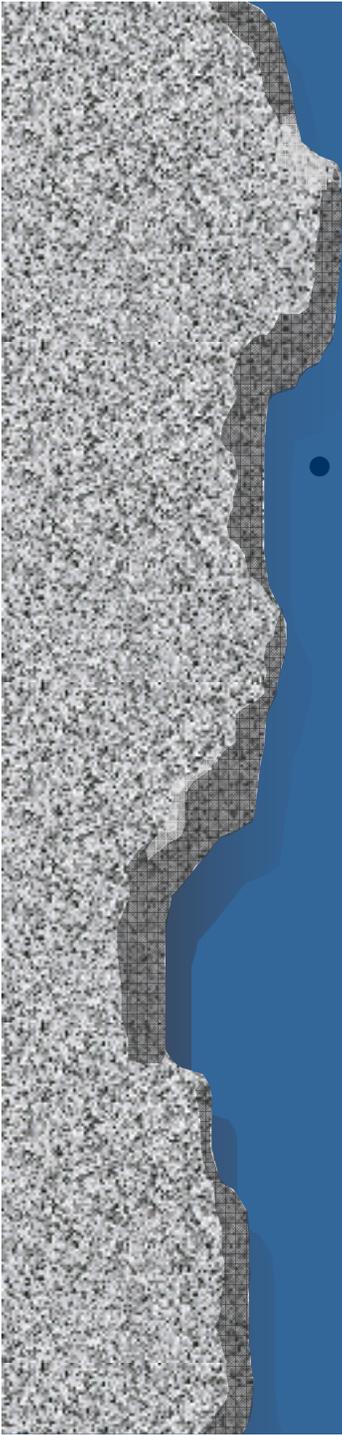
# Significance of Landfills As Sources of Fossils

- In addition, 15 sites have yielded marine invertebrate assemblages.
  - Molluscs: Gastropods, Pelecypods, Cephalopods.
  - Echinoidea: Urchins, sand dollar.
  - Corals, Annelid worms, Foraminifera.
  - One very rare, diverse faunal association of marine vertebrate, invertebrate, microinvertebrate, land and marine plant fossils found in a single assemblage. (Puente Hills LF)..



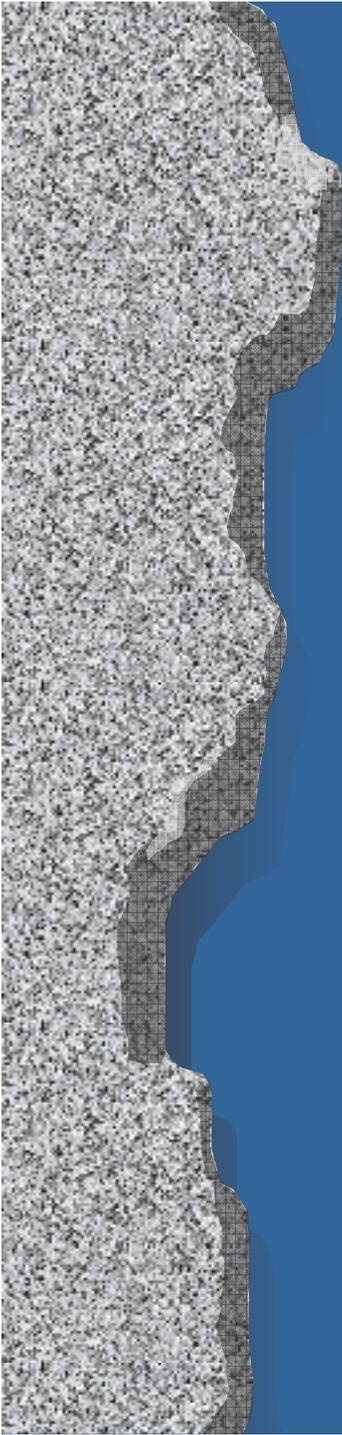
# Significance of Landfills As Sources of Fossils

- Significant Discoveries from landfill finds, including:
  - **New Species :**
    - Iguanid lizards, mice, didelphid marsupial- Frank R. Bowerman LF.
    - *Paradjidaumo, Namatomys, Simimys, Simimeryx heliscomys, Macrotarsius roederi* (Primate). Simi Valley LF.
    - Great White Shark (*Carcharocles megalodon*): (rarely found) Santiago LF.



# Significance of Landfills As Sources of Fossils

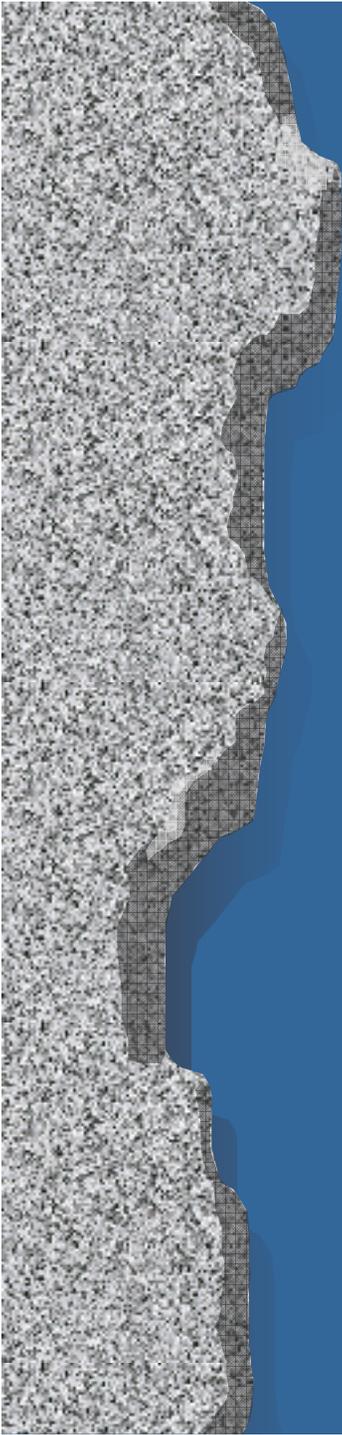
- Significant discoveries from Landfill Finds.
  - **Extended species distributions:**
    - Eurhinodelphidae: Dolphin found at F.R. Bowerman LF extends its living (geographic) range several hundred miles SW of its current known range.
    - Nautiloid cephalopod: first found in California F.R. Bowerman LF. Expands from W. Pacific, to Eastern Pacific region.
    - Smaller vertebrates: more common than once realized (Simi Valley LF).



# Significance of Landfills As Sources of Fossils

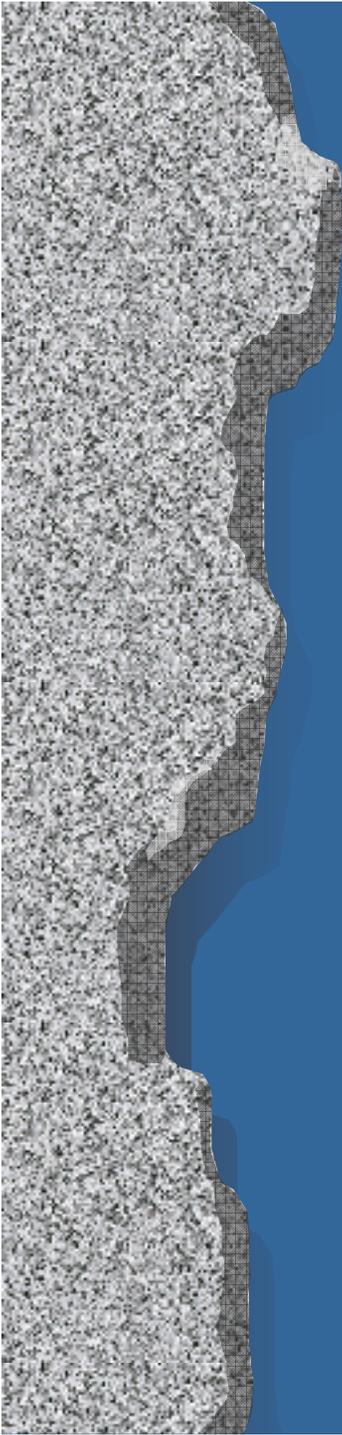
## - Extended temporal distributions:

- Didelphid marsupial specimen extends N. American age range.
- Baleen whale skeleton- First reported in Sycamore Canyon fm.
- Crocodile- Oldest recorded for the Sespe Fm. (Simi Villy LF).
- Discovery of youngest known record of genus Eohaplomys (beaver).



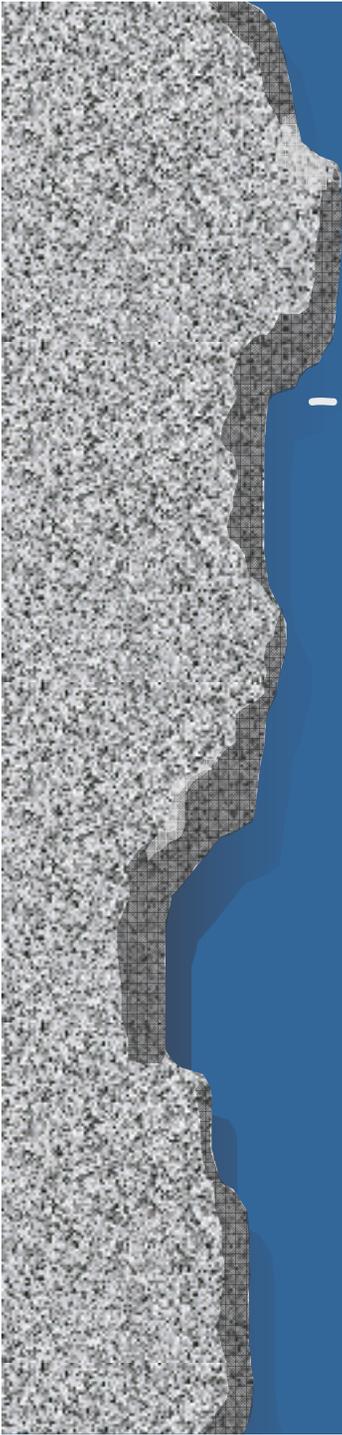
# Significance of Landfills As Sources of Fossils

- Better understanding of paleoenvironments.
  - Santiago LF- Indicates floodplain environments.
  - F.R. Bowerman LF.- Marsh environments and accompanying shallow bays, sandy beaches and rocky areas.
  - Signs at Simi Valley LF- point to a tropical climate with intermittent flooding and seasonal drought.
  - Signs of cool climate Repetto Fm, (Puente Hills LF).



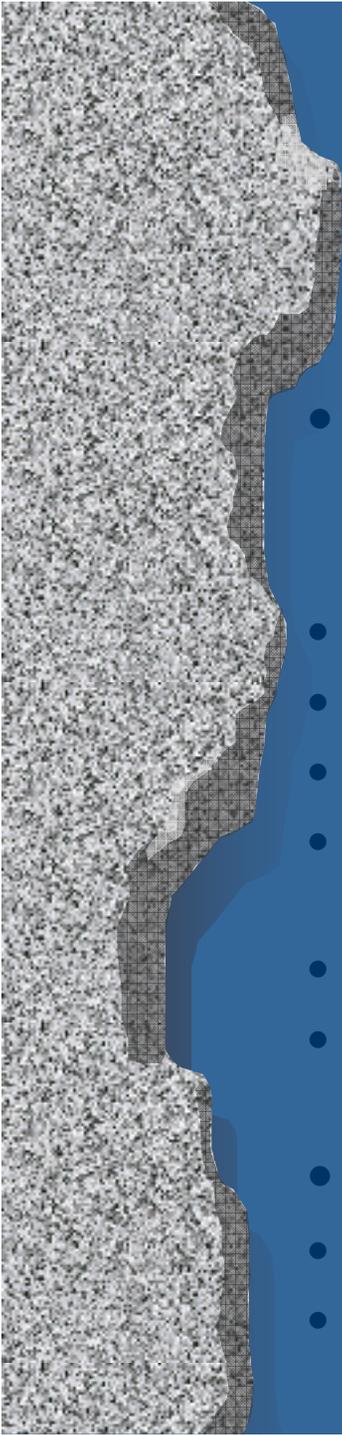
# Significance of Landfills As Sources of Fossils

- Better age-dating of formations.
  - Microvertebrates' rapid evolution provides finer dating of formations.
  - Irvington Antelope and Armbrusters Wolf found at Fairmead site firmly date the sediments there.



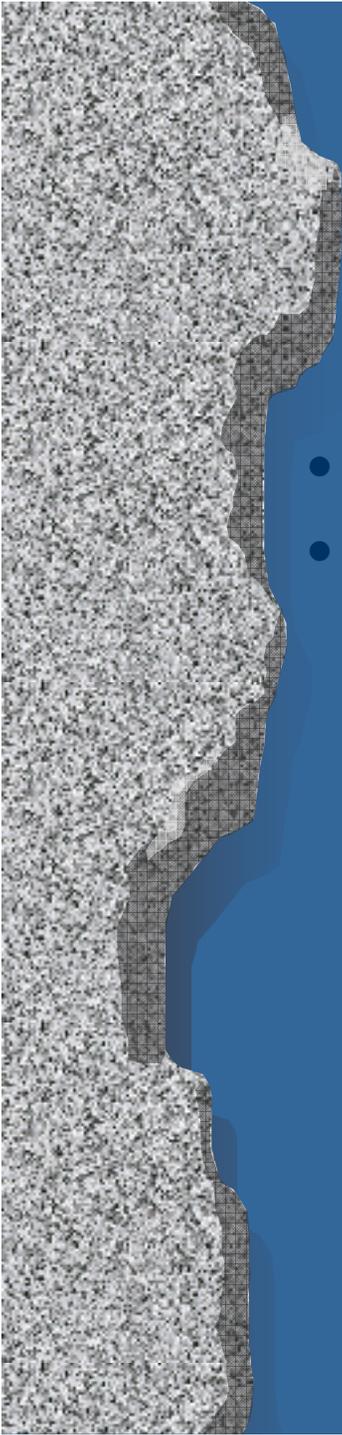
# Significance of Landfills As Sources of Fossils

- Improved understanding of known species, paleoenvironments, etc.
  - *Pachycetus*: whale skeleton provided new information on its sketchy record.
  - New finds of rare known species: Wolf Eel and Mantis Stabbing Shrimp, Prima Deshecha LF.
  - Rare, or once considered absent, species of lizard (*Paleoxantusia*) and shrew-like insectivores; Centetodon, Batodonoides, Proterixoides, and first bats; Simi Valley LF.
  - Accurate representation of species population ratios: Fairmead LF.



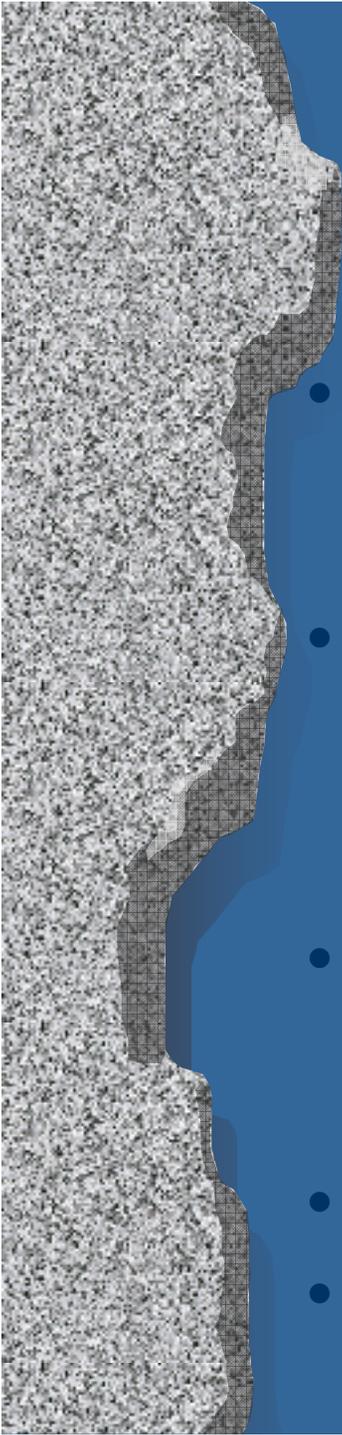
# Significance of Landfills As Sources of Fossils

- These programs and legislation provide protections for paleontological resources:
- National Historic Preservation Act (16 USC 470 Et Seq.).
- The Antiquities Act of 1906.
- The National Landmark Program, 1962.
- Surface Mining and Reclamation Act, 1977 (when dealing with mining and gravel extraction sites.).
- Federal Land Management and Policy Act 1976.
- National Environmental Policy Act 1969.(42 USC 4321-4347).
- In California:
- California Environmental Quality Act (CEQA).
- California Public Resources Code, Sec. 5097.



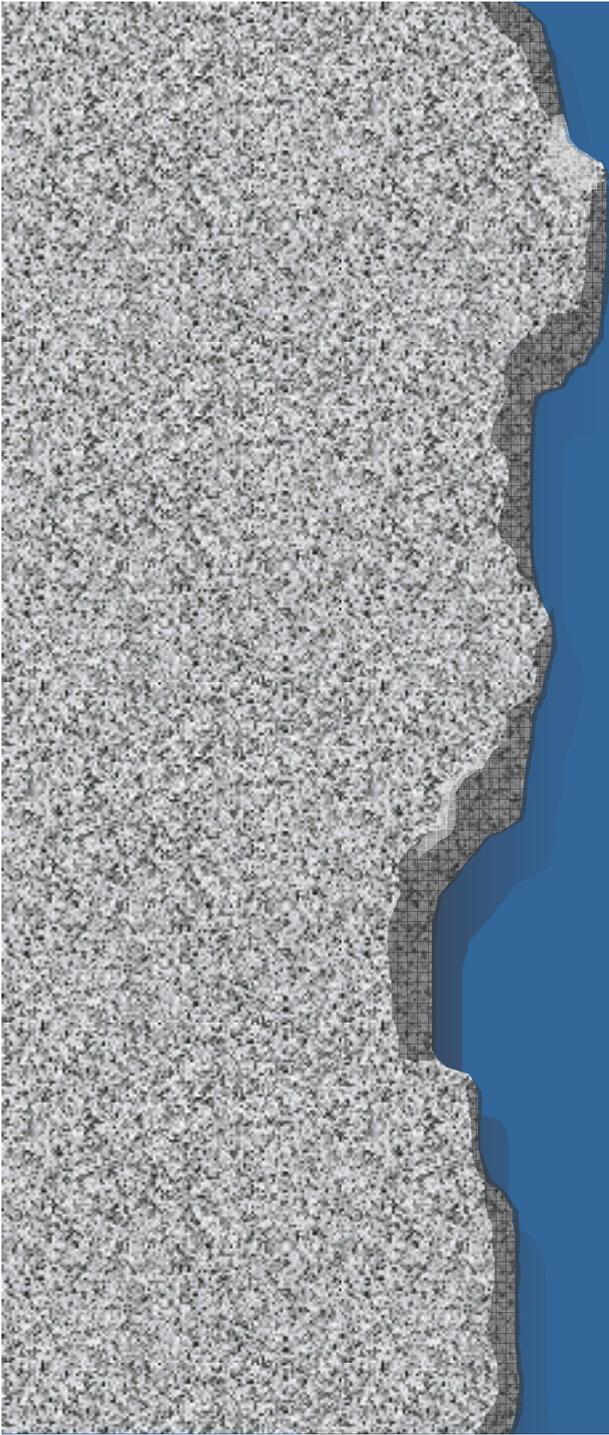
# Significance of Landfills As Sources of Fossils

- In Light of these regulations:
- Importance of a prepared plan for retrieval of fossils:
  - Avoids delays to operator for preparation of disposal site; their main goal;
  - Improves operator's confidence in the procedure the next time a locality is discovered;
  - Assures specimens will be retrieved;
  - Assures compliance with state and federal regulations (CEQA, etc).



# Plans for Future Statewide Contact Listing and Policy

- CIWMB Policy/ LEA Advisory for procedures of operator contact and remediation based on current working models.
- Reference list of institutions, qualified individuals for contact by operators and Local Enforcement Agencies. Available through CIWMB, for future needs in Landfills inexperienced with the process.
- Study, resolve shortcomings still present in current process. Work with experts in the process for future projects.
- Coordination with CEQA requirements.
- Informational database in SWIS and web page for research use.



To Participate in the CIWMB  
Policy and Database Project  
Contact

Jacques Graber

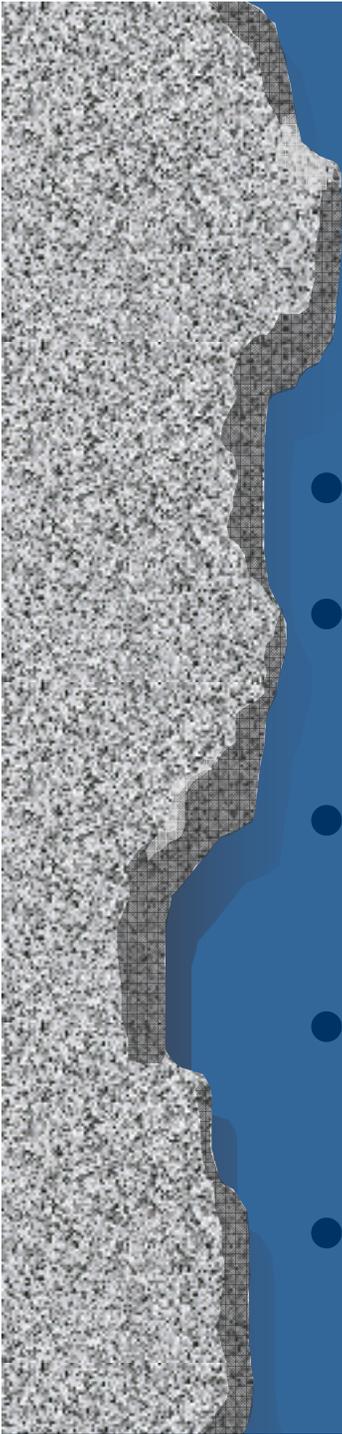
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