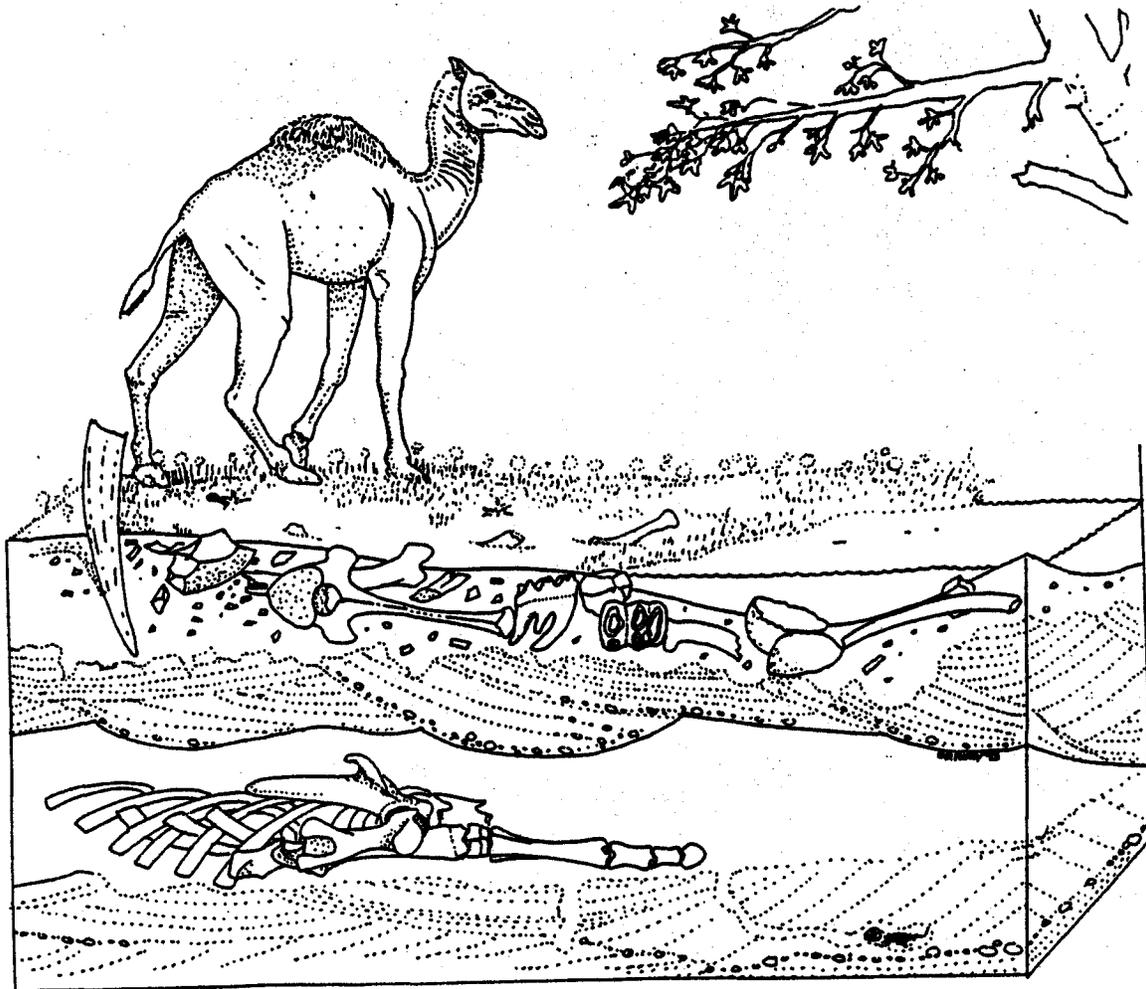


**STATE ROUTE 54
PALEONTOLOGICAL
MITIGATION PROGRAM**

FINAL REPORT

FROM ~~██████████~~



Prepared for:

Caltrans, District 11

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SECTION 1

EXECUTIVE SUMMARY

Paleontological resource mitigation work was conducted during highway improvements to State Route 54, Caltrans District 11, San Diego County, California. This mitigation work included construction monitoring, fossil salvage, laboratory preparation of salvaged specimens, curation of prepared specimens, and storage of curated specimens. This final report summarizes the work performed under this mitigation program.

Excavation operations were monitored from September 1992 through July 1993 and exposed a faulted stratigraphic sequence of Cenozoic sedimentary rocks that included white sandstones of the Otay Formation, gray sandstones of the San Diego Formation, and brown sandstones and siltstones here referred to as "unnamed Pleistocene stream deposits." Although sandstones of the Otay and San Diego Formations did contain sparse fossil remains, these fossils were either too fragmentary or poorly-preserved to warrant collection. In contrast, the "unnamed Pleistocene stream deposits" produced well-preserved fossil remains from 105 fossiliferous sites. Closely adjacent (stratigraphic and geographic) sites have been combined for a total of 32 recorded collecting localities.

Invertebrate fossils salvaged from these localities ranged from whole shells to internal skeletal elements and included remains of slugs, terrestrial and freshwater snails, and ostracods. Vertebrate fossils salvaged from these localities ranged from partial skeletons to single isolated bones and included remains of reptiles, birds, and mammals. The fragmentary skeletal remains of a single individual of the American Mastodon, Mammut americanum, was collected from a quarry excavation. This quarry produced interesting and puzzling taphonomic results. Radiometric dating of ivory and soil carbonate from the quarry yielded dates of 335+/-35 Ka (thousands of years before present) and 196+/-15 Ka, respectively, late Pleistocene, Rancholabrean NALMA (North American Land Mammal Age). Other fossil mammals salvaged from the Pleistocene stream deposits included ground sloth, shrews, rodents, rabbits, wolf, camel, deer, and mammoth. Overall, the collecting localities and their contained fossil remains represent the most significant Pleistocene paleontological discoveries yet known from coastal San Diego County.

Pleistocene stream deposits." Although not exposed, the contact between the San Diego Formation and the Otay Formation is assumed to be a fault.

The San Diego Formation was deposited in a broad marine embayment and preserves a range of paleoenvironments from nearshore exposed rock and sand bottoms to offshore protected middle shelf silty sand bottoms (Deméré 1983).

4.1.3 Oligocene (Otay Formation)

Oligocene sedimentary rocks exposed in the project area consisted of white bentonites, siltstones, and sandstones. The most common lithologies were brown, massive siltstone and white, medium-grained, compact sandstone. Bedding consisted of laminated sandstones interbedded with more massive sandstones. The overall exposed thickness of this unit was approximately 6 meters. The Oligocene sequence was exposed in the far eastern end of the project area between about Stations 231 and 255.

Kennedy and Tan (1977) mapped this sequence of fluvial sedimentary rocks as the Otay Formation and this is the stratigraphic terminology adopted here. The Otay Formation sandstones were seen to unconformably underlie the "unnamed Pleistocene stream deposits" along an irregular erosional surface.

The Otay Formation is inferred to have been deposited as a series of braided rivers feeding from alluvial fans immediately to the east. Farther east these fluvial sandstones interfinger with boulder conglomerates inferred to represent the proximal fan conglomerates of the Otay Fan depositional system (Walsh and Deméré 1991).

4.2 PALEONTOLOGICAL COLLECTING LOCALITIES

A total of 105 paleontological collecting sites were discovered during the monitoring and salvage phases of this project. Sites that were collected in close proximity (both geographic and stratigraphic) were later combined into general collecting localities for the sake of record keeping. Formal descriptions of the resulting 32 general localities are included in Appendix 2 along with lists of the cataloged specimens recovered from each locality. The geographic distribution of these localities is summarized in Figure 2.1. Localities that produced significant or unusual fossil remains are discussed more fully below.

4.2.1 Pleistocene

Mastodon Quarry (SDSNH Locality 3767) - This large quarry excavation was located on the north side of the sound berm (Figure 2.1) between Stations 230+00' and 230+50' at elevation 149.2'. The microstratigraphy at the quarry consisted of four primary horizons. These include in ascending order (Figure 4.1), Bed C (a rusty brown, massive, micaceous siltstone), Bed D (a yellowish, fine- to coarse-grained, massive to

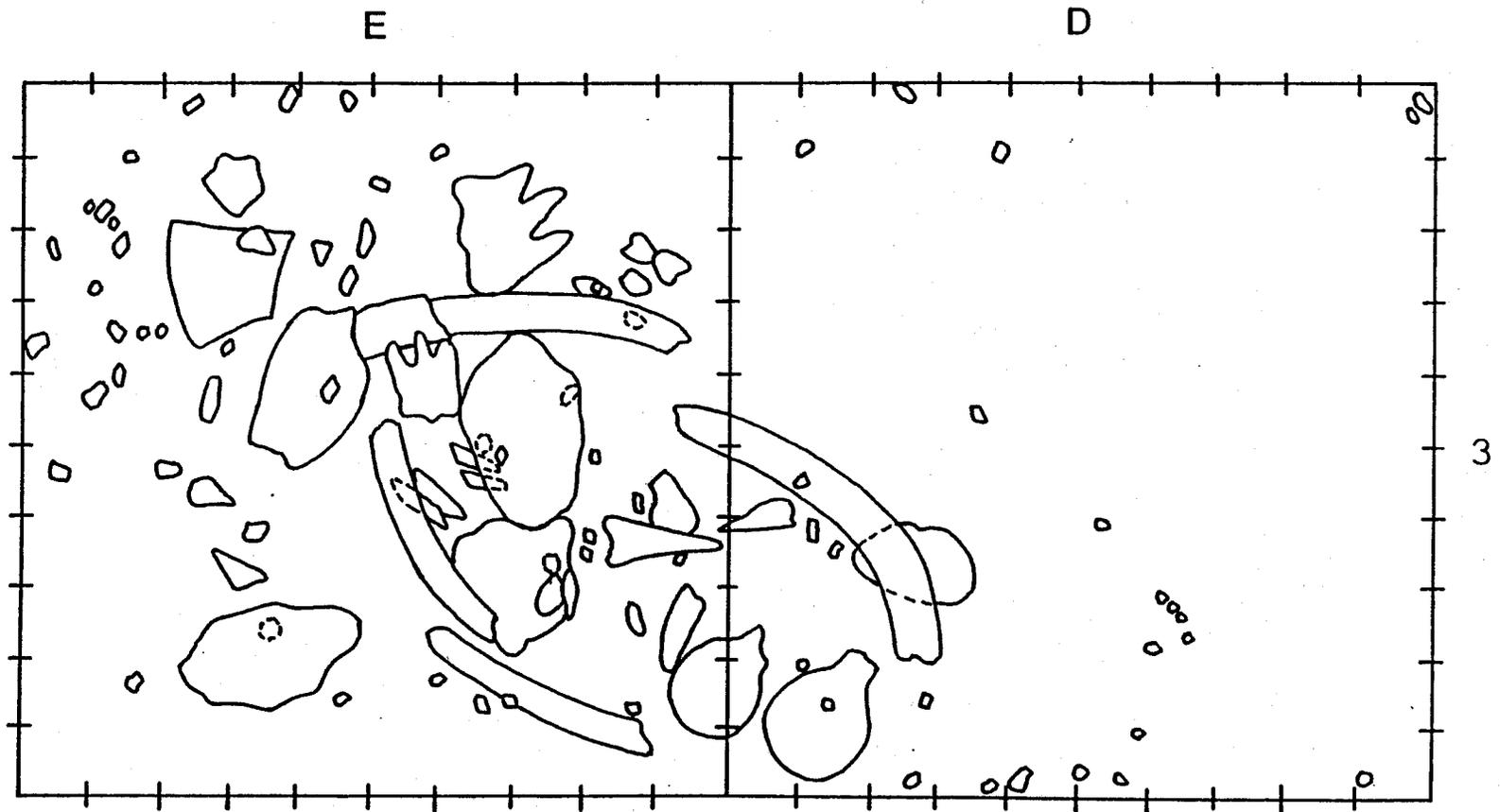


Figure 4.5 - Plan of Units D3 and E3, Mastodon Quarry, showing concentration of fossil and rock specimens. Individual units measure 1 X 1 meters. Graduations within units is every 10 cm. North is towards top of figure.

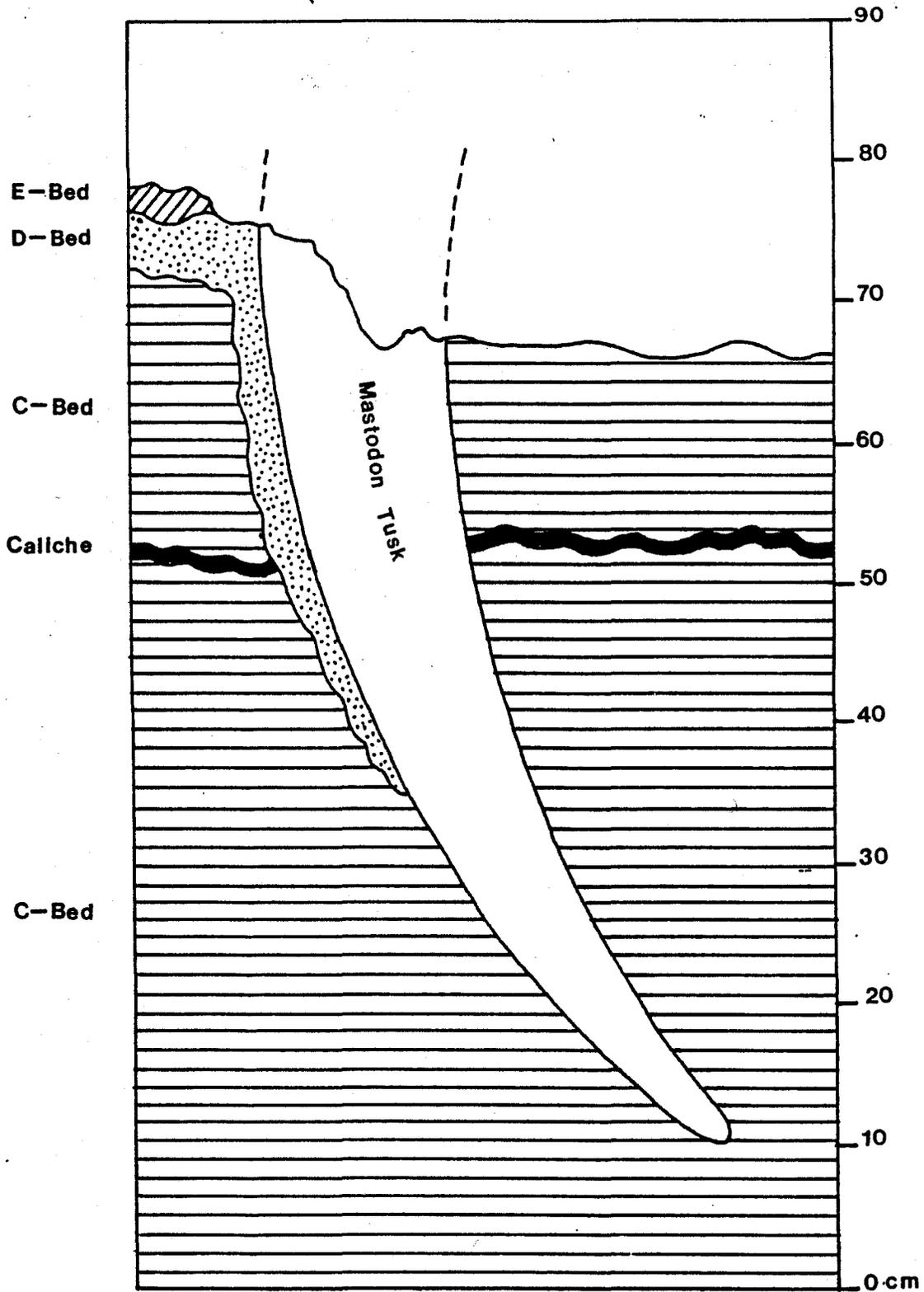


Figure 4.9 - Cross section showing near vertical orientation of tusk in Unit B2, Mastodon Quarry. Microstratigraphy annotated along left margin, scale (in cm) along right margin.

well-laminated, friable, arkosic sandstone), Bed E (a medium-brown, massive, sandy mudstone with abundant caliche nodules, calcified root casts, fossils), and Bed F (a rusty-brown, massive, silty mudstone with common small caliche nodules). Over 430 individual fossil (345) and rock (85) specimens were plotted and recovered from this quarry excavation. The vast majority of fossils came from the Bed E horizon. Almost all of the fossils are bones, bone fragments, and teeth of a single individual of Mammut americanum, the American Mastodon. Other fossils collected from the quarry include remains of rodents, birds, reptiles, and terrestrial invertebrates (see Appendix 2 for a complete listing of cataloged specimens).

The mastodon material collected from Bed E consists of the right and left tusks, two molars, three vertebrae, 10 ribs, portions of both femurs, at least two phalanges, and numerous large and small bone fragments. The bone is moderately well-preserved with many elements found encased in calcium carbonate (caliche) nodules. Figure 4.2 summarizes the distribution of all fossil and rock specimens from Bed E as uncovered and plotted in the quarry excavation. Separate plots of fossils (Figure 4.3) and rocks (Figure 4.4) are also provided. There was no articulation of mastodon elements and no anatomical trend to their placement in the quarry. Many bones were fragmentary and displayed distinct types of breakage. In one case, portions of a single mastodon molar were found scattered over three different units. The anterior half of the tooth (quarry specimen # 286) was found in Unit E3, while the posterior half (# 103) came from Unit C1. An enamel cusp fragment (# 148) of this same tooth was found in Unit D2. The greatest concentration of bones came from Units D3 and E3, which contained portions of molars, long bones, and ribs (Figures 4.5 and 4.6). Of special note was the discovery of both isolated femur heads side-by-side, one with its articular surface up (# 252) and one with its articular surface down (# 258). Adjacent to the femur heads lay fragments of ribs, one of which (# 253) was found lying directly on a plutonic cobble (# 254). Also found in this concentration was a large piece of a long bone shaft displaying distinct spiral fracturing. In Units J4 and K4 a large, sharply fractured piece of long bone (# 340) was found with a distinct impact scar on its internal surface. This fractured bone occurs adjacent to two complete thoracic vertebrae and two complete ribs (Figures 4.7 and 4.8). In Unit B2 the distal 70 cm of a tusk (# 56) was found distal end down in an upright orientation (62°-64° dip), concave portion of curvature to the south. **The proximal end of the tusk had been removed by the backhoe at the level of Bed E (shown as a circular feature in Unit B2, Figure 4.2).** The tusk extended from Bed E through Bed D, reaching 65 cm into Bed C (Figure 4.9). Coarse sand from Bed D was found as an infilling alongside the tusk some 40 cm into Bed C.

In contrast to the disarticulated condition of the mastodon remains was the discovery of a partially articulated skeleton of Fulica americana, the American Coot,

collected in Unit B5. The entire pectoral region including the right and left wings and coracoids was found still articulated with the sternum. Articulated portions of the legs were also recovered. Several rodent skulls recovered from Bed E were found with articulated lower jaws.

The boulders and rock fragments recovered from Bed E (Figure 4.4) consisted of fine-grained metavolcanic rocks (andesite) and coarse-grained plutonic rocks (pegmatite). These lithic materials ranged from approximately 1 to 30 cm in size. The more intact larger rocks displayed smoothly rounded surfaces, indicative of stream transport. Many of the smaller rock fragments had sharp, angular edges that lacked signs of abrasion. Of the boulder-sized (> 25.6 cm) rocks, two are metavolcanics and one is plutonic. Of the cobble-sized (> 6.4 cm) rocks, one is metavolcanic and three are plutonic. There are seven instances in which rock fragments and/or boulders found separated in the quarry were able to be reassembled after laboratory preparation. In the case of the plutonic boulder found in Unit G5, rock fragments in Units D3 and E2 could be reattached to it. The E2 rock fragment was separated by over 3 meters of quarry floor from the parent boulder in G5. It is plausible that all of the plutonic rock fragments, except for the cobble from Unit H4, are part of the same original boulder.

A total of approximately 16,000 pounds of Bed E matrix was stockpiled and screenwashed from the Mastodon Quarry. The washed and floated concentrate produced dental remains of small mammals including rodents (e.g., *Microtus*, *Neotoma*, *Peromyscus*, and *Thomomys*) and rabbit (*Sylvilagus*). Calcareous nodules/internal shells of the slug, *Deoroceras* sp., were also common in the washed concentrate.

"Steve's Horse Quarry" (SDSNH Locality 3677) - This quarry site was located between Stations 230+10' and 230+ 40' on the south side of the sound berm (Figure 2.1) at elevation 144.5'. The site was in a 60 cm thick yellowish-brown, massive siltstone. This horizon lay stratigraphically below the Bed E horizon of the Mastodon Quarry and is possibly equivalent to Bed C as exposed in that quarry (Figure 3.3). The site was excavated quarry-style and produced 65 bones from the skeleton of a single individual (SDSNH 47731) of *Equus* sp., a fossil horse. Micromammals recovered from this locality are summarized in Appendix 2.

The following discussion concerns only the horse specimen. Recovered elements included 21 vertebrae, 21 ribs, one scapula, one humerus, one ulna, one carpal, three metapodials, four phalanges, three unguals (hoofs), portions of both innominates, one femur, both tibiae, one fibula, three tarsals, and two sesamoids. No portion of the cranium or lower jaw was recovered. The bone is permineralized and well-preserved. Many specimens were collected with caliche coatings. Figure 4.10 summarizes the distribution of individual bones as uncovered and plotted in the quarry excavation. There was no articulation of elements and no anatomical trend to their placement in the quarry.