# CRICETID AND ARVICOLID RODENTS OF THE CALIFORNIA WASH LOCAL FAUNA, LATE BLANCAN, OF THE SAN PEDRO VALLEY, ARIZONA

by

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**Key-words**: Mammals, Cricetidae, Arvicolidae, Cenozoic, Blancan.

**Mots-clés**: Mammifères, Cricétidés, Arvicolidés, Cénozoïque, Blancien.

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ABSTRACT

An assemblage of micromammals is reported from California Wash, a fossil bearing continental deposit in the San Pedro Valley, Arizona, late Blancan in age. Cricetid and Arvicolid rodents are richly represented, including four and two species, respectively. This study mainly focuses on *Sigmodon*, the most abundant form. The sample of *Sigmodon* is compared to samples of the same genus from other localities of the San Pedro Valley of comparable age, and some inferences on the taxonomy of the genus are attempted. The specimens are referred to *Sigmodon minor* and *Sigmodon* cf. *S. curtisi*. Other cricetids (*Onychomys pedroensis* and *Baiomys brachygnathus*) and arvicolids (*Myctomys vetus* and *Ondatra idahoensis*) are also recognized and described.

RESUME

Un assemblage fossile riche en cricétidés et arvicolidés, représentés respectivement par quatre et deux espèces, a été retrouvé à California Wash, un dépôt continental du Blancien supérieur de San Pedro Valley, Arizona. Cette étude est essentiellement focalisée sur l'échantillon du genre *Sigmodon* qui est le plus représentatif. La confrontation de cet échantillon avec d'autres du même genre, et à peu près du même âge, permet quelques indications d'un point de vue taxonomique. les exemplaires ont été rapportés á *Sigmodon minor* et *Sigmodon* cf. *S. curtisi*. D'autres cricétidés et arvicolidés ont été reconnus et sont décrits dans cette note.

## INTRODUCTION

The California Wash local fauna is from sediments of the St. David Formation (Gray, 1967), exposed in the southern San Pedro Valley, west of the San Pedro River (Fig. 1). California Wash, loc. 4710, is one of several late Cenozoic fossil localities in the San Pedro Valley. This area has yielded a good record of both paleoindians and extinct mammals.

Vertebrate fossils were discovered in the San Pedro Valley in 1920 by Kirk Bryan; fossils were subsequently collected and studied by Gidley (1922, 1926), Gazin (1942), Lammers (1970), Jacobs (1977), and Harrison (1978). In 1976, Haynes studied surficial deposits which included the late Pleistocene fauna.

Thanks to the application of magnetostratigraphy, biostratigraphy and isotopic dating, the San Pedro Valley vertebrate fossil record has been placed in a framework of high geochronological resolution. It also provides a good basis for interpreting mammalian evolution, paleoclimatic changes and the sequence and effect of mammalian dispersal events during the late Cenozoic. Johnson *et al.* (1975) ordered the vertebrate localities in the St. David Formation based on magnetostratigraphy and identified a sequence of datum planes representing significant biostratigraphic faunal events in the area. These have proven useful for comparisons and correlations with other vertebrate fossil localities. The concept of the faunal datum plane had been previously used only in marine biostratigraphy (Berggren, 1972); its application on a terrestrial system was a consequence of the development of magnetic polarity stratigraphy as an absolute correlation tool (Opdyke, 1972). Small mammal fossils, particurarly rodents, are also useful for biostratigraphical and biochronological purposes, as well as for evolutionary analyses. This study focuses on samples of rodents collected in California Wash, belonging to the families Cricetidae (*Sigmodon minor*, *Sigmodon* cf. *S. curtisi*, *Onychomys pedroensis* and *Baiomys brachygnathus*) and Arvicolidae (*Mictomys vetus* and *Ondatra idahoensis*).

*Sigmodon* is the most common fossil rodent genus in the California Wash local fauna, and is the focus of this study.

## STRATIGRAPHY AND VERTEBRATE PALEONTOLOGY

The Quiburis and the St. David Formations have produced a good record of mammals from sediments that accumulated in the San Pedro Valley Basin. The St. David Formation spans the Plio-Pleistocene boundary and has produced a fairly robust picture of fossil life in the late Cenozoic. It is underlain by Mesozoic volcanic and

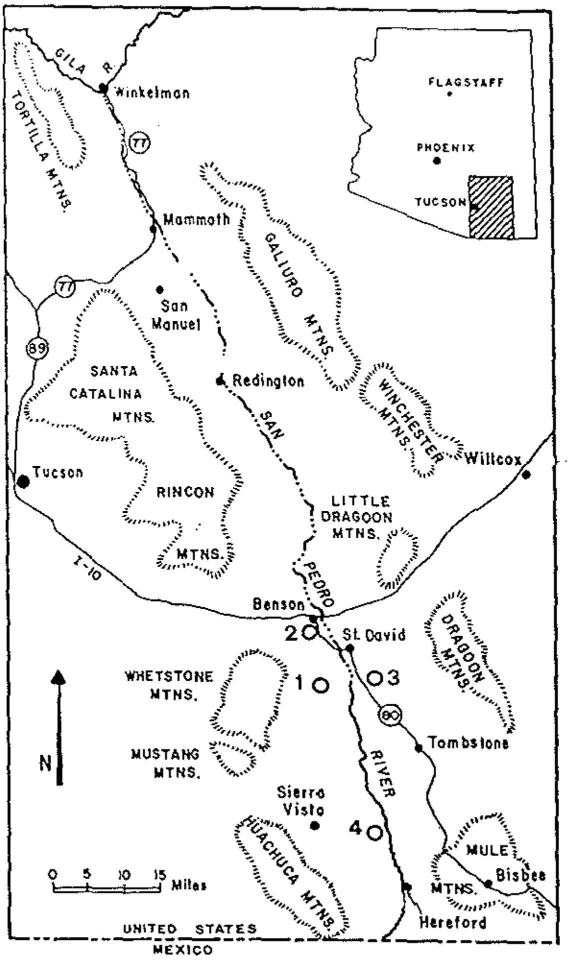



Figure 1.— The San Pedro Valley. Numbered circle refers to the area discussed in this paper.

1: California Wash
2: Benson
3: Curtis Ranch
4: Wolf Ranch.

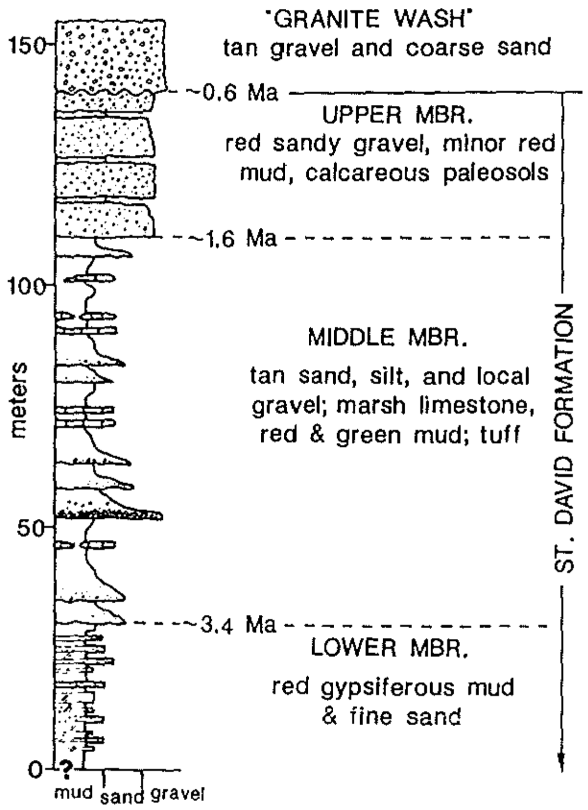



Figure 2.— Lithology of the St. David Formation and "Granite Wash" (from Lindsay *et al.*, 1990).

sedimentary deposits and overlain in the northern part of its exposure by coarse alluvial sediments, known as "Granite Wash" (Gray, 1965); in the southern part, the St. David Formation is overlain by fine to coarse alluvial sediments (Haynes, 1987).

Gray (1965) distinguished three members in the St. David Formation (Fig. 2). The lowest member consists of unfossiliferous clay and silt, sometimes gypsiferous; the middle member is characterized by a dominance of claystones, with the addition of marls, tuffs and fine-grained tan sandstones and bears most of the fossil record; the upper member marks a change in sedimentary regimen, with the absence of marl and the increase of sand, gravel, and thick paleosol deposits (Lindsay *et al.*, 1990).

The higlhy fossiliferous middle member also includes two volcanic ashes that have aided in calibrating the paleomagnetic sequence. In particular, the brown ash (Fig. 3) in the California Wash section has been dated at 2.0 Ma by Izett (1981). A partial stratigraphic column of the California Wash area, including U.A.L.P. loc. 4710, is presented in Fig. 3 (from Lindsay *et al.*, 1990). All of the small mammals reported in this paper come from one level at the top of the section (Fig. 3). Figure 4 shows the superposition of selected fossil sites within the San Pedro Valley: the sites are ordered according to their lithostratigraphic and magneto-stratigraphic position. The position of loc. 4710 on the magnetic time scale has been revised on the basis of the age of the brown ash (Lindsay *et al.*, 1990).

The magnetic zonation and the sequence of fossil localities are here correlated

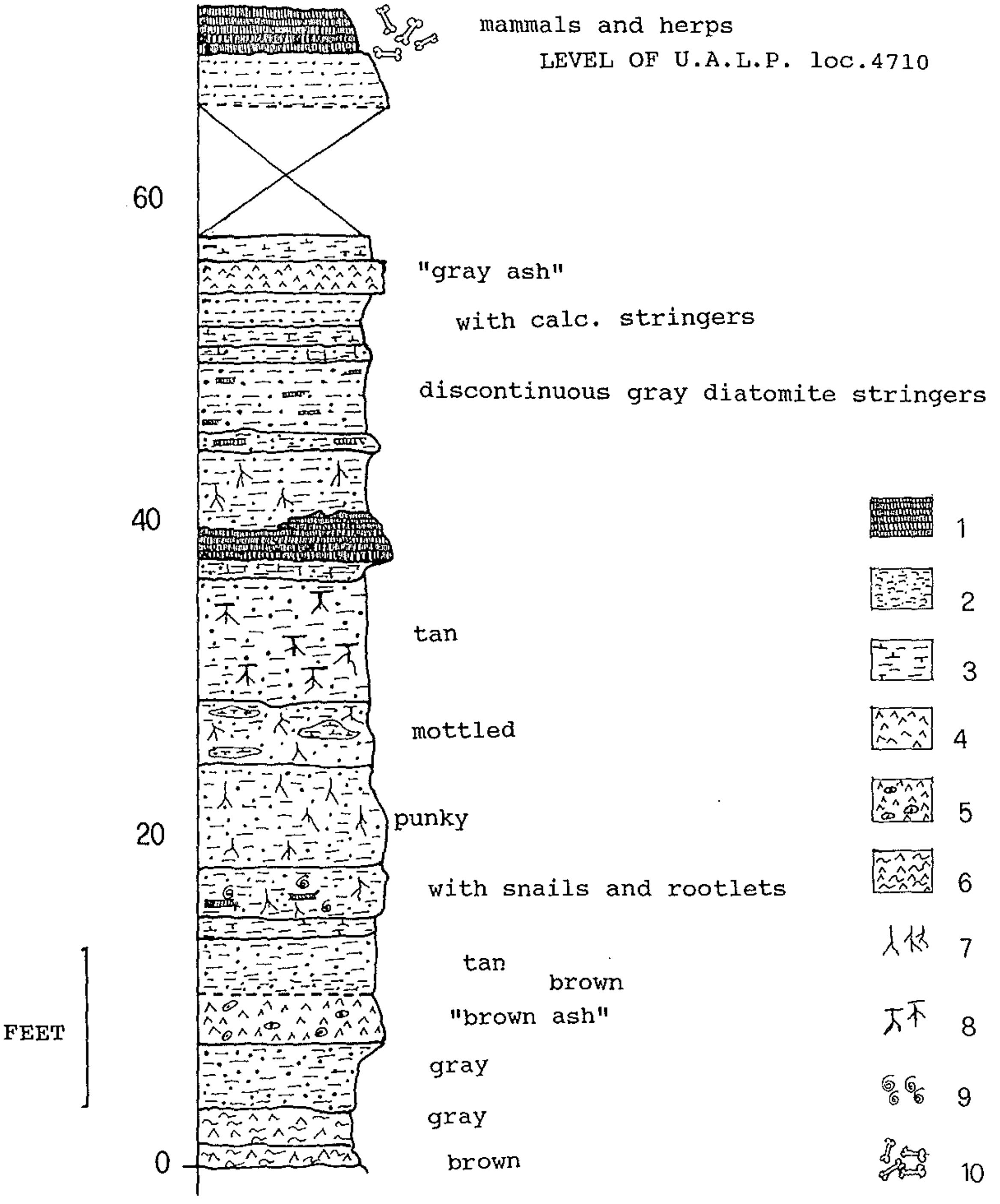



Figure 3.— Stratigraphic section of the St. David Formation as exposed in the California Wash area (from Lindsay *et al.*, 1990, modified).

Legend: **1**: diatomite; **2**: silts and sands; **3**: marls; **4**: volcanic ash; **5**: vitric ash; **6**: tuffaceous clay; **7**: rootlets; **8**: rootlet ghosts; **9**: snails; **10**: mammal bones.

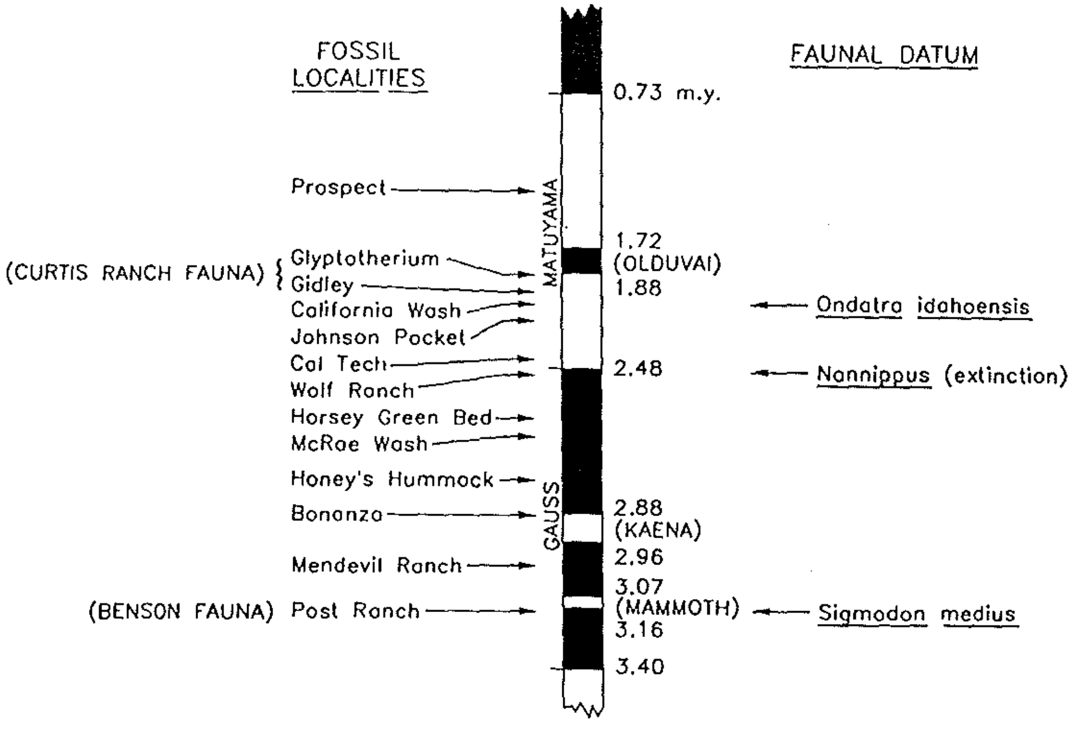



Figure 4.— Magnetic zonation, sequence of fossil localities, and revised faunal datum events in the St. David Formation (from Lindsay *et al.*, 1990).

**Soricidae**
*Sorex taylori* (shrew)

**Glyptotheriidae**
*Glyptotherium arizonae*

**Leporidae**
*Sylvilagus* sp. (cottontail)

**Sciuridae**
*Spermophilus bensoni* (squirrel)

**Geomyidae**
*Geomys persimilis* (gopher)

**Heteromyidae**
*Perognathus* sp. (pocket mouse)
*Prodipodomys idahoensis* (Kangaroo rat)

**Cricetidae**
*Sigmodon minor* (cotton rat)
*Sigmodon* cf. *S. curtisi* (cotton rat)
*Baiomys brachygnathus* (pigmy mouse)
*Onychomys pedroensis*
*Mictomys vetus* (lemming)
*Ondatra idahoensis* (muskrat)

**Gomphotheriidae**
*Cuvieronius bensonensis*

**Equidae**
*Equus* sp. (single toed horse)

**Camelidae**
*Camelops* sp.

Table 1.— List of mammals recorded from the California Wash local fauna (from Lindsay, 1984, modified for cricetids).

with the sequence of faunal datum events; the *Sigmodon medius* datum plane, the *Nannhippus* extinction datum plane, the *Ondatra* datum plane. The formerly-recognized *Lepus* datum plane (1.9 Ma) has been abandoned (Lindsay *et al.*, 1990).

Fossil mammals that are presently known from the California Wash site are listed on Table 1. Note the presence of *Sigmodon minor* and the absence of *Sigmodon medius*, here recognized as distinct species.

## METHODS AND MATERIALS

The fossils were collected by surface pick-up and screen-washing technique developed by Hibbard (1949) and modified by numerous researchers. The total sample of cricetids and arvicolids from California Wash consisted mainly of teeth. The lower first molar is the most diagnostic tooth for both families. Most of the teeth are isolated, but a few specimens are in maxillary or dentary fragments. The cusp terminology used in this paper (Fig. 5) is taken from Lindsay (1988).

Measurements of the material (length and width) were made on a binocular scope with the aid of an ocular micrometer. Dimensions are in millimeters and are maxima regardless of wear; transverse dimensions are perpendicular to anteroposterior dimensions. All the specimens were measured and, when possible, compared with samples from other late Cenozoic localities in the San Pedro Valley and those from the Safford and Duncan Basins (Tomida, 1987). The examined material is stored at the University of Arizona Laboratory of Paleontology (U.A.L.P.).

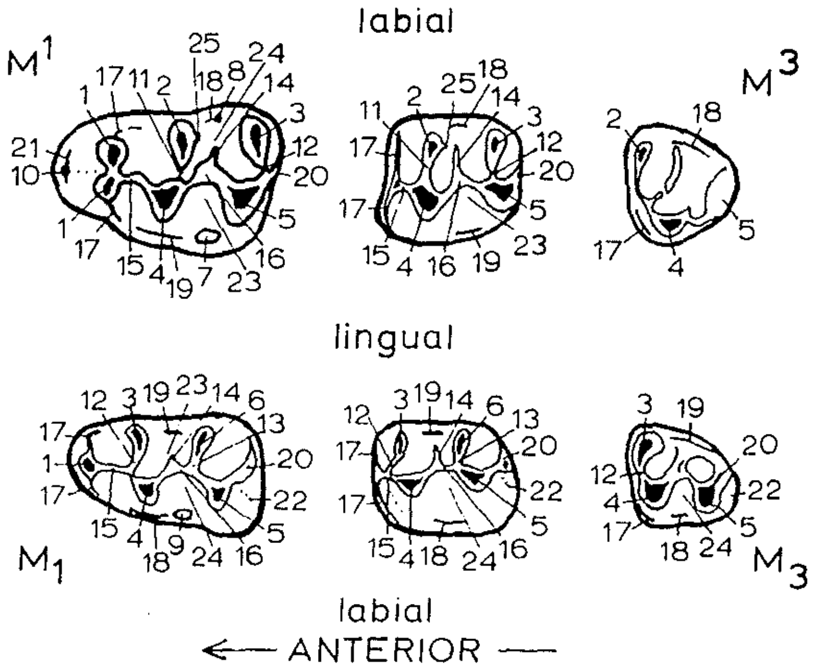
## SYSTEMATIC ACCOUNTS

Class **MAMMALIA** LINNAEUS, 1758
Order **RODENTIA** BOWDICH, 1821
Family **CRICETIDAE** ROCHEBRUNE, 1883

This family is represented at loc. 4710 by three genera and four species: two species (*Onychomys pedroensis* and *Baiomys brachygnatus*) are from small-to very small-sized, with brachydont cheek teeth, and *Sigmodon minor* is medium-sized, with hypsodont or mesodont teeth. Another species of the same genus, recognized as *Sigmodon* cf. *S.curtisi* is larger. Following are some molar characters that are useful to distinguish these genera.

*Onychomys*: anterocone on $M^1$ narrow, located near the labial edge; individual cusps of cheek teeth alternate with wide and deep labial and lingual reentrant valleys.

*Baiomys*: anterocone of $M^1$ is relatively centrally located and distinctly bilobed, with a wide ectoflexus; anteroconid on $M_1$ is placed close to metaconid.




1- Anterocone (-id)
2- Paracone
3- Metacone (-id)
4- Protocone (-id)
5- Hypocone(-id)
6- Entoconid
7- Enterostyle
8- Mesostyle (-id)
9- Ectosostylid
10- Anterostyle
11- Protoloph
12- Metaloph (-id)
13- Hypolophid
14- Mesoloph (-id)
15- Anterior mure
16- Posterior mure
17- Anterior cingulum
18- Labial cingulum
19- Lingual cingulum
20- Posterior cingulum
21- Anterior stylar shelf
22- Posterolabial shelf (or sulcus)
23- Lingual transverse valley (or sinus)
24- Labial transverse valley (or sinusid)
25- Posteriorly-directed spur

Figure 5.— Cusps and folds terminology of Cricetidae used in this paper (from Lindsay, 1988).

*Sigmodon*: anterocone and anteroconid quite symmetrical and single lobed; cusps and lophs generally robust and well developed; deep labial and lingual reentrant valleys.

Subfamily **HESPEROMYINAE** MURRAY, 1866
Genus *SIGMODON* SAY & ORD, 1825
***Sigmodon* cf. *S. curtisi*** GIDLEY, 1922
(Table 2, Fig. 6)

**Referred material**: U.A.L.P. loc. 4710: UALP 3724, 6401, $M_1$'s; 3746, 3747, 6398, $M_3$'s; 17824, 3743, $M^1$'s; 3739, $M^2$'s; 17782, $M^3$'s.
**Age**: late Blancan to early Irvingtonian.

**Diagnosis and description**

The largest of the fossil forms of *Sigmodon*. It is distinguished from *S. medius*

| UALP | Element | Length | Width | Notes | UALP | Element | Length | Width | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 3764 | $rM_1$ | 2.02 | 1.16 | | 3763 | $lM^1$ | 1.92 | 1.28 | |
| 6400 | $rM_1$ | 0.00 | 1.04 | broken | 17795 | $rM^1$ | 1.94 | 1.68 | |
| 6319 | $rM_1$ | 2.00 | 1.20 | | 17779 | $lM^1$ | 0.00 | 1.48 | broken |
| 3723 | $rM_1$ | 2.12 | 1.20 | | 17778 | $lM^1$ | 0.00 | 1.60 | broken |
| 17828 | $rM_1$ | 1.90 | 1.26 | | 6404 | $rM^2$ | 1.76 | 1.60 | |
| 17790 | $rM_1$ | 2.04 | 1.34 | | 17784 | $rM^2$ | 1.36 | 1.52 | |
| 17827 | $rM_1$ | 2.24 | 1.34 | | 17785 | $rM^2$ | 1.44 | 1.48 | |
| 17791 | $rM_1$ | 2.22 | 1.32 | | 17783 | $rM^2$ | 1.36 | 1.40 | |
| 17789 | $lM_1$ | 0.00 | 1.28 | broken | 17781 | $lM^2$ | 1.48 | 1.32 | |
| 1 | $lM_1$ | 1.96 | 0.00 | broken | 17825 | $rM^2$ | 1.36 | 1.52 | |
| 3722 | $lM_1$ | 1.84 | 1.20 | | 3748 | $rM^3$ | 1.36 | 1.40 | |
| 6402 | $lM_2$ | 0.00 | 1.20 | broken | 3741 | $rM^3$ | 1.24 | 1.28 | |
| 17789 | $lM_2$ | 1.44 | 1.44 | | 17786 | $rM^3$ | 1.46 | 1.40 | |
| 17792 | $rM_2$ | 1.48 | 1.30 | on jaw | 17788 | $rM^3$ | 1.36 | 1.40 | |
| 17793 | $rM_2$ | 1.46 | 1.40 | | 3742 | $lM^3$ | 1.28 | 1.24 | |
| 3745 | $rM_3$ | 1.52 | 1.16 | | 3740 | $lM^3$ | 1.52 | 1.28 | |
| 3721 | $rM_3$ | 1.56 | 1.08 | | 17826 | $lM^3$ | 1.48 | 1.32 | |
| 3728 | $rM^1$ | 1.92 | 1.28 | | 17787 | $lM^3$ | 1.46 | 1.36 | |
| 3738 | $rM^1$ | 1.96 | 1.56 | | 6405 | $lM^3$ | 1.40 | 0.00 | broken |
| 3731 | $rM^1$ | 1.78 | 1.44 | | 3724 | $lM_1$ | 0.00 | 1.84 | broken |
| 3733 | $rM^1$ | 1.96 | 1.44 | | 6401 | $lM_1$ | 2.72 | 1.84 | |
| 3735 | $rM^1$ | 1.88 | 1.52 | | 3747 | $rM_3$ | 2.32 | 1.84 | |
| 3732 | $rM^1$ | 2.08 | 1.40 | | 3746 | $rM_3$ | 2.24 | 1.88 | |
| 3737 | $rM^1$ | 1.55 | 1.00 | | 6398 | $rM_3$ | 1.96 | 1.68 | |
| 3729 | $rM^1$ | 2.08 | 0.00 | broken | 17824 | $rM^1$ | 1.88 | 1.62 | |
| 3730 | $rM^1$ | 2.04 | 1.36 | | 3743 | $rM^1$ | 2.40 | 2.00 | |
| 3736 | $rM^1$ | 1.72 | 1.28 | | 3739 | $rM^2$ | 1.68 | 1.80 | |
| 3734 | $rM^1$ | 1.92 | 1.44 | | 17782 | $lM^3$ | 1.80 | 1.60 | |

Table 2.— Measurements of specimens of fossil *Sigmodon* from California Wash.

and *S. minor* primarily on the basis of size. Cusps are hypsodont, slightly more robust than in smaller species. Labial and lingual reentrant valleys are prominent. Upper dentition represented by $M^1$ with shallow anteroflexus on the anterocone, short and transversely oriented anterior mure, reduced and transversely oriented posterior arms of protocone and hypocone, short protoloph, narrow posterior cingulum, deep labial reentrants and three prominent roots plus a short accessory rootlet below the paracone. Lower dentition represented by $M_1$ and $M_3$. $M_1$ elongated, with broad and slightly asymmetrical anteroconid, well developed anterior cingulum, reduced mure and anterior arms of protoconid and hypoconid, no preserved root. $M_3$ suboval, with reduced anterior cingulum and well developed posterior one, S-shaped enamel crest, weakly developed reentrant, corresponding to the posterior lingual reentrant valley, in U.A.L.P. 6398, probably referable to the "notch", due to wear, as named by Cantwell (1969) in fossil *Sigmodon minor* from the Tusker locality, 111 Ranch, Arizona.

## Discussion

The sample of this fossil cotton rat from California Wash is very poor, with only

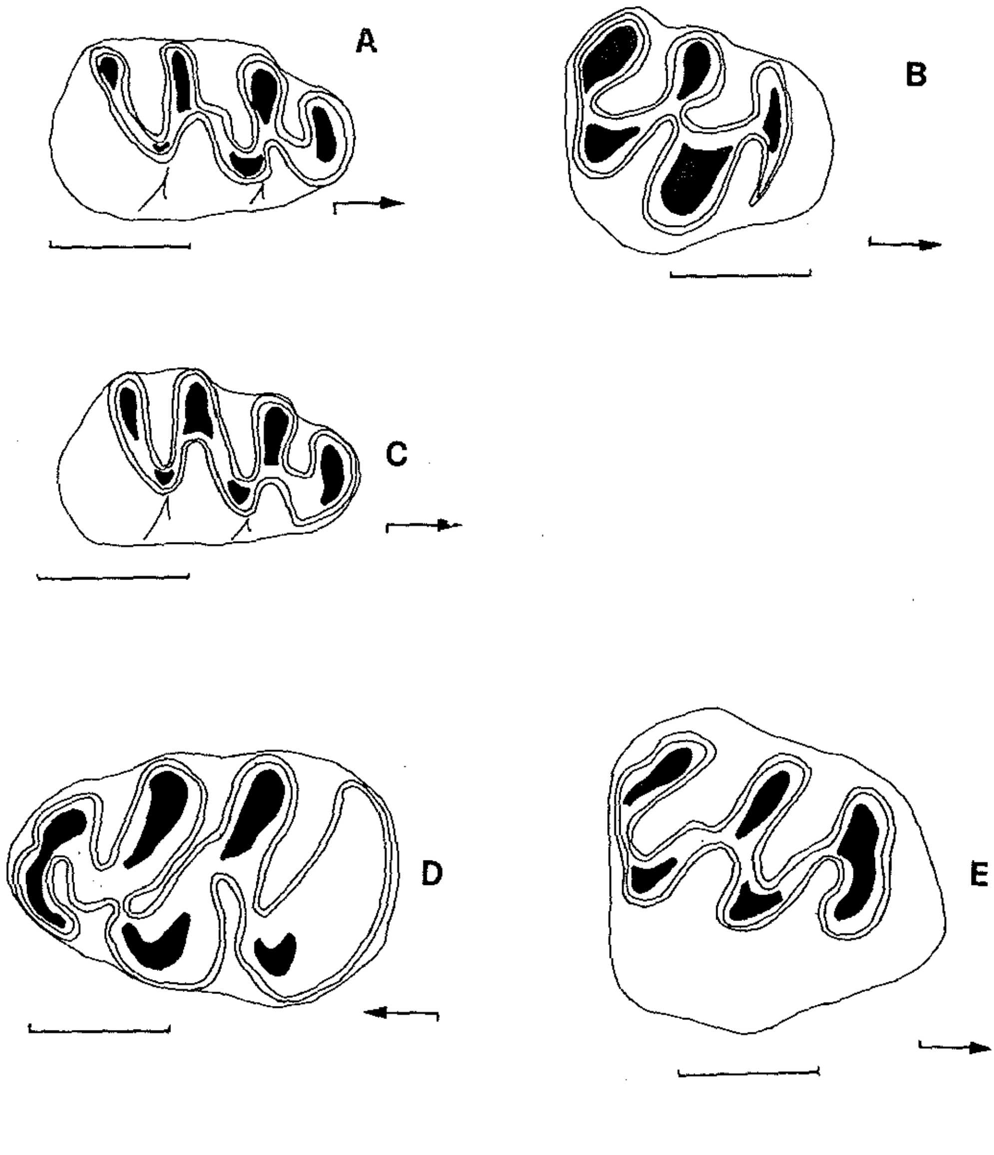



Figure 6.— *Sigmodon minor*: A) UALP 3723, $M_1$; B) UALP 17828, $M^1$; C) UALP 3738, $M^1$. *Sigmodon* cf. *S. curtisi*: D) UALP 6401, $M_1$; E) UALP 3743, $M^1$. Scale bars: A) - B) - E) 2.6 cm = 1 mm; C) 2.4 cm = 1 mm; D) 2.5 cm = 1 mm. Arrows indicate the anterior side of the tooth.

one measurable $M_1$ in a total of nine molars. A sample of *Sigmodon curtisi* from another late Cenozoic locality in the San Pedro Valley, Gidley Rodent, Curtis Ranch, U.A.L.P. loc. 25-3, also contains one $M_1$ (UALP 3220) in a total of ten teeth (4 $M_2$'s, 2 $M^3$'s, 1 $M^1$, 1 $M^2$, and 1 $M^3$). I have compared the samples of the genus *Sigmodon* from these two localities.

I have also considered the sample of fossil cotton rats from the superposed Vallecito-Fish Creek beds of the Palm Spring Formation, in Anza-Borrego State Park, California, early Irvingtonian in age, where specimens have been collected from different levels, or "zones" (zone 53.8 to zone 58.8), extending from approximately 610 to 305 meters from the top of the sequence. A new species, *Sigmodon lindsayi*, was recognized in the Vallecito-Fish Creek beds. Measurements are taken from Martin and Prince (1989) and have been compared to those of specimens from loc. 4710, and loc. 25-3. Dimensions of upper and lower molars from California Wash are reported on Table 2. Means for $M_1$'s from California Wash, Gidley Rodent, and for $M_1$'s of specimens of *Sigmodon lindsayi* from the different levels of Vallecito-Fish Creek are reported on Table 3. Measurements of the type specimen of *Sigmodon medius* (USNM 10519) are l = 2.20 mm and w = 1.50 mm; they are significantly smaller than the $M_1$'s from the localities cited above. The $M_1$ from Gidley Rodent is larger than that from California Wash and the total sample from the studied locality is smaller than that from U.A.L.P. loc. 25-3. Dimensions of $M_1$'s from the Cenozoic localities in the San Pedro Valley are both statistically larger than those of *Sigmodon lindsayi* from the Anza-Borrego sequence. In this sequence, from lower to upper levels, Martin and Prince (1989) have recognized a trend toward increasing dimensions and the distinction among the extinct forms of the *S. leucotis* species group has been based mainly on the presence of three or four roots on the first lower molar. Unfortunately, in the specimen from U.A.L.P. loc. 4710 no root is recognizable. Therefore, I consider it hazardous to attribute specimens from this locality to *Sigmodon lindsayi*, even though a pattern of high variability among the members of the *S. leucotis* species-group can be emphasized.

I provisionally name the form from U.A.L.P. loc. 4710, as *Sigmodon* cf. *S.curtisi* and predict that further studies on more robust samples could result in the evaluation of a potential continuum in size and dental evolution within this group.

### *Sigmodon minor* GIDLEY, 1922

(Table 2, Fig. 6)

*Sigmodon minor* (in part.), Cantwell, 1969, *Jour. Mammal.*, 50: 375.
*Sigmodon medius*, Martin, 1979, *Evol. Monog.*, 2: 18.

**Referred material**: U.A.L.P. loc. 4710: UALP 3764, 6400, 6319, 3723, 1, 3722, 17828,

| Species | Locality/ Level | Length | Width |
|---|---|---|---|
| *Sigmodon* cf. *S. curtisi* (2) | U.A.L.P. 4710 | 2.72 | 1.84 |
| *Sigmodon curtisi* (1) | U.A.L.P. 25-3 | 3.12 | 1.72 |
| *Sigmodon lindsayi* (1) | Vallecito Fish-Creek, lev. 53.8 | 2.24 | 1.67 |
| *Sigmodon lindsayi* (4) | Vallecito Fish-Creek, lev. 55.5 | 2.39 | 1.79 |
| *Sigmodon lindsayi* (12) | Vallecito Fish-Creek, lev. 57.6 | 2.46 | 1.83 |
| *Sigmodon medius* (type specimen) | USNM 10519 | 2.20 | 1.50 |

Table 3.— Means of specimens of *Sigmodon* near *S. curtisi* (California Wash, U.A.L.P. loc. 4710), *Sigmodon lindsayi*, and *Sigmodon curtisi* (Gidley Rodent, U.A.L.P. loc. 25-3). Numbers between parenthesis indicate the number of measured specimens.

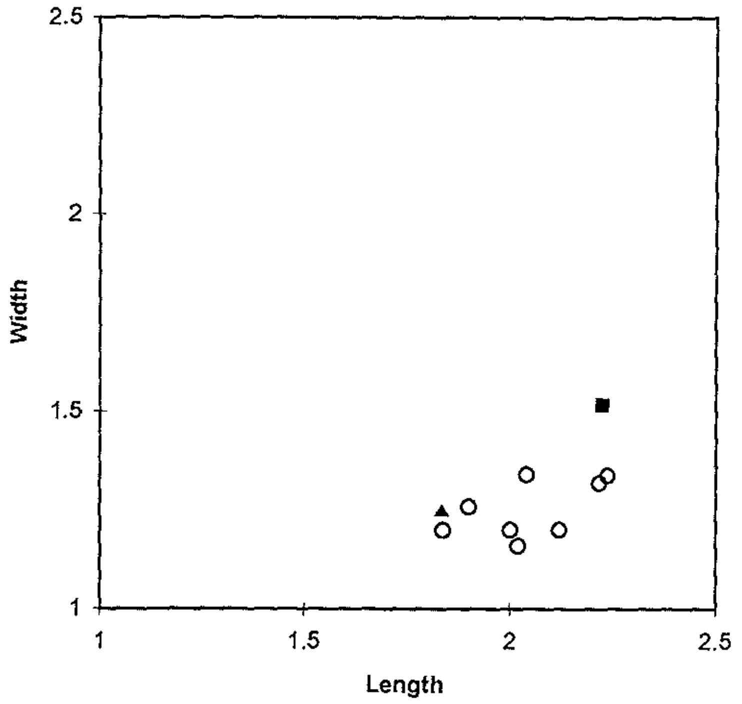



Figure 7.— Variation in measurements of $M_1$'s of the fossil sample of *Sigmodon* from California Wash. Measurements of the type specimens of *Sigmodon minor* (USNM 10512) and *Sigmodon medius* (USNM 10519) are included.

Symbols: empty circle for sample of *Sigmodon minor* U.A.L.P. 4710; dark triangle for USNM 10512, dark square for USNM 10519.

17790, 17827, 17791, $M_1$'s;. 17789, $M_{1-2}$; 6402, 17792, 17793, $M_2$'s; 3745, 6405, 3721, 17794, $M^3$'s; 17823, 17780, 17795, 17779, 17778, 3728, 3738, 3731, 3733, 3735, 3732, 3737, 3729, 3730, 3736, 3734, 3763, $M^1$'s; 3739, 6404, 17784, 17785, 17783, 17781, 17825, $M^2$'s; 3748, 3741, 3742, 3740, 17788, 17787, 17826, 17786, $M^3$'s.

**Age**: Blancan (late Pliocene) to early Irvingtonian.

### Diagnosis and description

Smallest known species of *Sigmodon*, with brachydont cheek teeth having relatively inflated cusps, anterocone of $M^1$ and anteroconid of $M_1$ relatively narrow, symmetrical and single cusped, reentrant valleys of cheek teeth relatively deep and narrow. Upper dentition represented by $M^{1-3}$. $M^1$ short, with reduced posterior arms of protocone and hypocone, short transverse protoloph and transversely oriented metaloph. $M^2$ subquadrate, with long and narrow anterior cingulum, indistinct posterior arms of

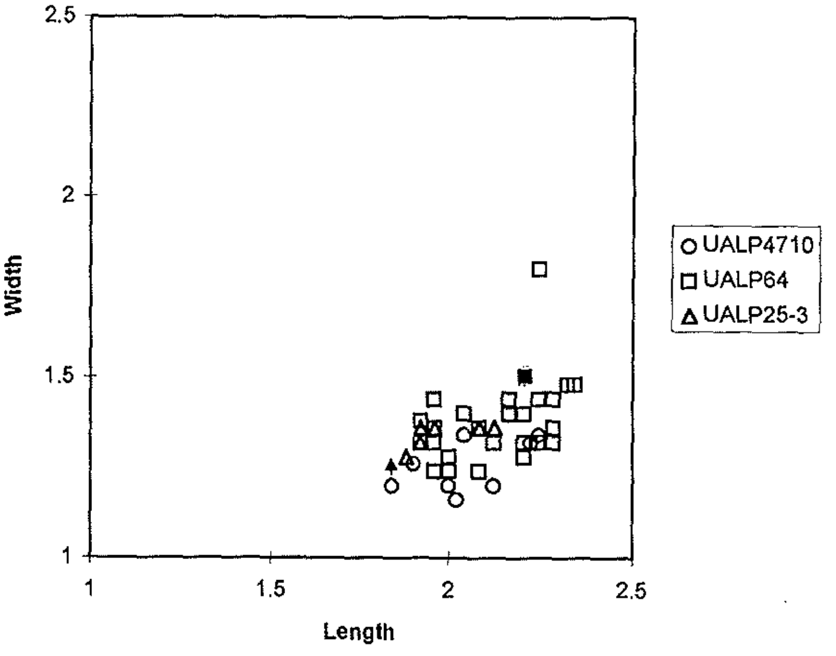



Figure 8.— Scatter diagram with length plotted against width for $M_1$'s of *Sigmodon minor* from California Wash, U.A.L.P. loc. 4710, Wolf Ranch, U.A.L.P. loc. 64, and Gidley Rodent, Curtis Ranch, U.A.L.P. loc. 25-3. Specimens from U.A.L.P. loc. 64 and 25-3 have been remeasured by the author: measurements are correspondant to those of Harrison (1978) and Tomida (1987, table 29, p. 102), respectively.

Symbols: dark triangle and square are for type specimens of *Sigmodon minor* (USNM 10512) and *Sigmodon medius* (USNM 10519), respectively.

protocone and hypocone. $M^3$ inflated triangle-shaped, with prominent protocone, smaller hypocone and paracone, minute metacone, long anterior cingulum, developed protoloph, short metaloph, directed posteriorly to join the posterior cingulum (in six specimens) or anteriorly to weakly join paracone (in two specimens). One specimen (U.A.L.P. 17786) has the large lingual root slightly bifurcated distally.

Lower dentition represented by $M_{1\text{-}3}$. $M_1$ elongated, with short anterior cingulum and anterior mure, reduced anterior arms of protoconid and hypoconid, short metalophid and hypolophid directed transversely. $M_2$ rectangular, with reduced anterior arms of protoconid and hypoconid, short anterior cingulum, long posterior one. $M_3$ suboval, with S-shaped enamel with posterior to top, indistinct anterior cingulum.

Roots of $M^1$ with three large roots and small accessory rootlet below paracone; roots of $M^2$ and $M^3$ with three large roots, lacking accessory rootlets. Tendency to bifurcate medial root of $M^3$ (weakly bifurcated in some specimens). Roots of $M_1$ with large anterior and posterior roots, plus small accessory rootlet below protocone; roots of $M_2$ and $M_3$ with two relatively small anterior roots and large posterior root, lacking accessory rootlets. Mandible with masseteric scar prominent and extending anteriorly to terminate below the anterior margin of $M_1$; mental foramen on dorsal side of mandible, at the posterior end of diastema, below the anterior margin and lingual to the anterior root of $M_1$, at the level of masseteric crest.

## Discussion

The total sample of fossil *Sigmodon minor* from California Wash consisted of fourty-eight teeth, twenty-one of which have been recently collected. I measured all the teeth, thus comparing the newly collected specimens to the previously recognized specimens of *Sigmodon minor* from the same locality and to the $M_1$'s type specimens of *Sigmodon minor* (USNM 10512) and *Sigmodon medius* (USNM 10519) (Fig. 7).

This analysis resulted in the identification of the newly collected specimens as *Sigmodon minor*.

Measurements of the total sample of *Sigmodon minor* from U.A.L.P. 4710 are almost completely included within the combined ranges of *Sigmodon minor* and *Sigmodon medius*. The type specimen of *Sigmodon medius* represents the largest member, the type specimen of *Sigmodon minor* is close to the smallest member.

Measurements of specimens of *Sigmodon minor* from California Wash are listed in Table 2. Means and observed ranges (O.R.) for $M_1$'s of *Sigmodon minor* from California Wash are reported in Table 4. These means are intermediate between those of the type specimens of *Sigmodon minor* (USNM 10512) and *Sigmodon medius* (USNM 10519), also reported on Table 4.

A set of comparative analyses with samples of *Sigmodon minor* and *Sigmodon medius* from other late Cenozoic localities, Blancan to Irvingtonian in age, in the San Pedro Valley has also been attempted, with the purpose to evaluate the evolution of dental features within these two species, in the *S. medius* species group (Martin, 1979), and possibly clarify their undecided boundaries. The samples of *Sigmodon minor* are from Wolf Ranch, U.A.L.P. loc. 64, and Gidley Rodent, U.A.L.P. loc. 25-3; those of *Sigmodon medius* are from U.A.L.P. loc. 15-24, U.A.L.P. loc. 15-10, Dry Mt. East

| Locality | Length | O.R. | Width | O.R. |
|---|---|---|---|---|
| U.A.L.P. 4710 (11) | 2.03 | 1.84-2.24 | 1.23 | 1.04-1.34 |
| USNM 10512 (type specimen) | 1.85 | — | 1.25 | — |
| USNM 10519 (type specimen) | 2.20 | — | 1.50 | — |

Table 4.— Means of specimens of *Sigmodon minor* (California Wash, U.A.L.P. loc. 4710) and of the type specimens of *Sigmodon medius* (USNM 10519) and *Sigmodon minor* (USNM 10512). Numbers between parenthesis indicate the number of measured specimens.

U.A.L.P. loc. 7933, and U.A.L.P. loc. 7914, in the 111 Ranch section, Duncan South U.A.L.P. loc. 7937, in the Duncan Basin area, and U.A.L.P. loc. 8042, in the Country Club area. The remarkable difference in the numbers of specimens from these localities suggests caution with the results of the biometric and statistical analyses.

These studies allow the recognition of intermediate sized forms within a continuum of dental evolution and a gradual phyletic change from *Sigmodon medius* through *Sigmodon minor*, thus confirming the recognition of the existence of a chronocline between *Sigmodon medius* and *Sigmodon minor*, as pointed out by Harrison (1978), Martin (1979), and Tomida (1987).

The samples from California Wash, Wolf Ranch, and Gidley Rodent are *Sigmodon minor* (Fig. 8).This total sample encompasses a time interval from about 2.45 Ma, for the Wolf Ranch fauna, to about 1.8-1.9 Ma, for the California Wash and Gidley Rodent faunas, that are quite contemporaneous, both being near the Olduvai event, as established by Lindsay *et al.* (1990). This scatter diagram suggests the Wolf Ranch *Sigmodon*, recognized by Harrison (1978) as *Sigmodon minor*, is closer to the type specimen of *Sigmodon medius*. If the separation between *Sigmodon minor* and *Sigmodon medius* can be established on the basis of size, it is preferable to assign the Wolf Ranch sample to *Sigmodon medius*, but the size of the specimens of California Wash is close to that of *Sigmodon minor* from Gidley Rodent. The variation in time of these three samples is also shown in Fig. 9.

The close relation among samples of both *Sigmodon minor* and *Sigmodon medius* in a temporal sequence is summarized in Fig. 10. There is no marked distinction between samples of the two species, and a gradual phyletic change through time can be recognized. As a result, I refer the taxon from California Wash to the species *Sigmodon minor*.

### Genus *ONYCHOMYS* BAIRD, 1858

### ***Onychomys pedroensis*** GIDLEY, 1922

(Fig. 11, Table 5)

**Referred material**: U.A.L.P. no. 17798, $M_1$; no. 17797, $M_2$; no. 17830, $M^1$; nos. 17796, 3724, $M^2$'s; no. 17799, $M^3$. U.A.L.P. nos. 17798 and 17830 are very worn and no diagnostic description is possible. U.A.L.P. 3724 had been previously identified as *Calomys (Bensonomys) arizonae*.

**Age**: late Blancan-Irvingtonian.

**Diagnosis and description**

Brachydont cheek teeth, with relatively thin and distinct cusps; pattern of cusps alternating, with the lingual cusps slightly anterior relative to the labial ones, more pronounced in lower dentition. Upper dentition represented by $M^2$'s and $M^3$. $M^2$ oval-shaped, with narrow anterior and posterior cingulum, well developed and rounded main cusps in an alternating pattern, short protoloph and metaloph, relatively deep labial anterior and central reentrant valleys, narrow anterior and posterior labial reentrant valleys. $M^3$ small, with minute hypocone, indistinct metacone.

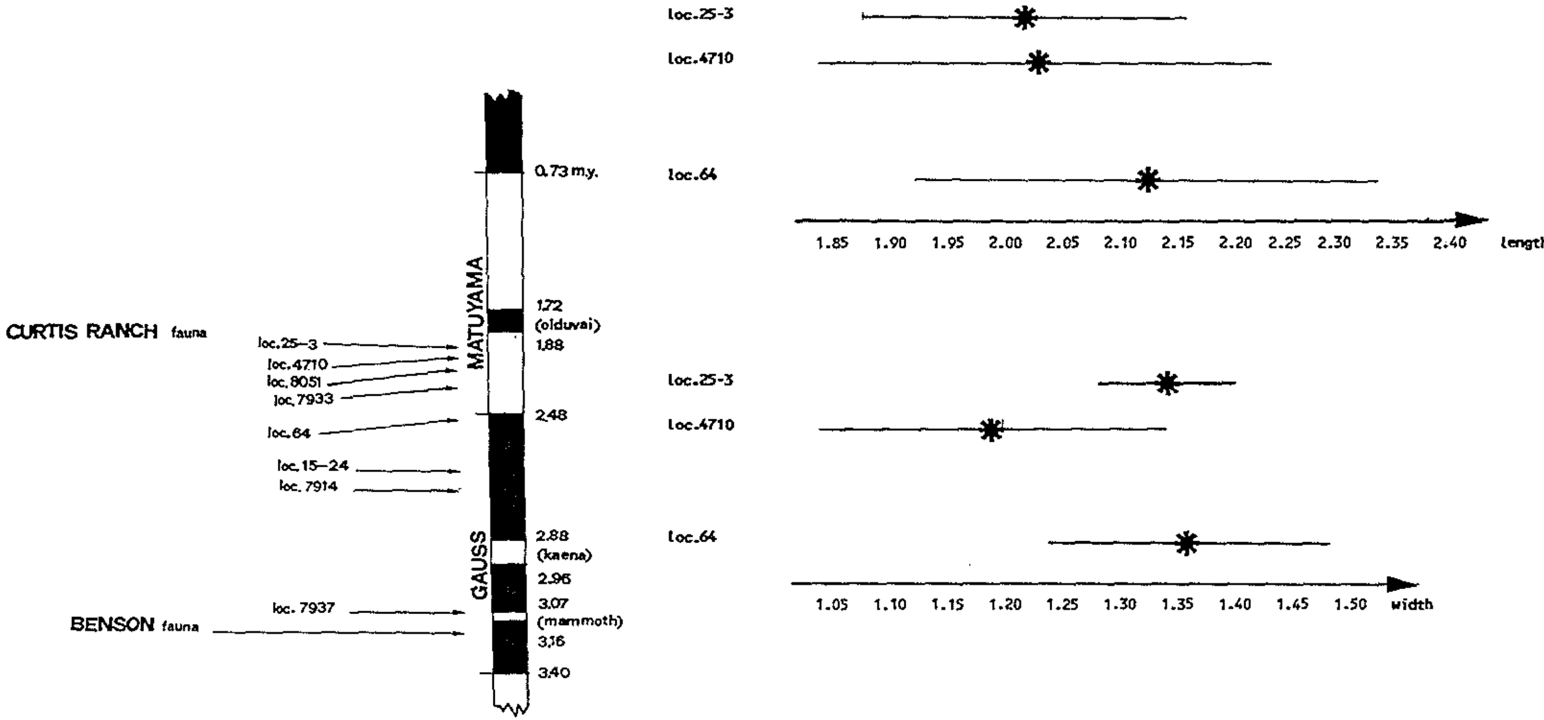



Figure 9.— Variation in measurements of $M_1$'s of three fossil samples of *Sigmodon minor* from California Wash, U.A.L.P. loc. 4710, Wolf Ranch, U.A.L.P. loc. 64, and Gidley Rodent, Curtis Ranch, U.A.L.P. loc. 25-3. Means of specimens of Gidley Rodent are from Tomida (1987, table 29, p. 102). Their sequence in time is indicated in the MPTS. Marked lines represent the observed range.

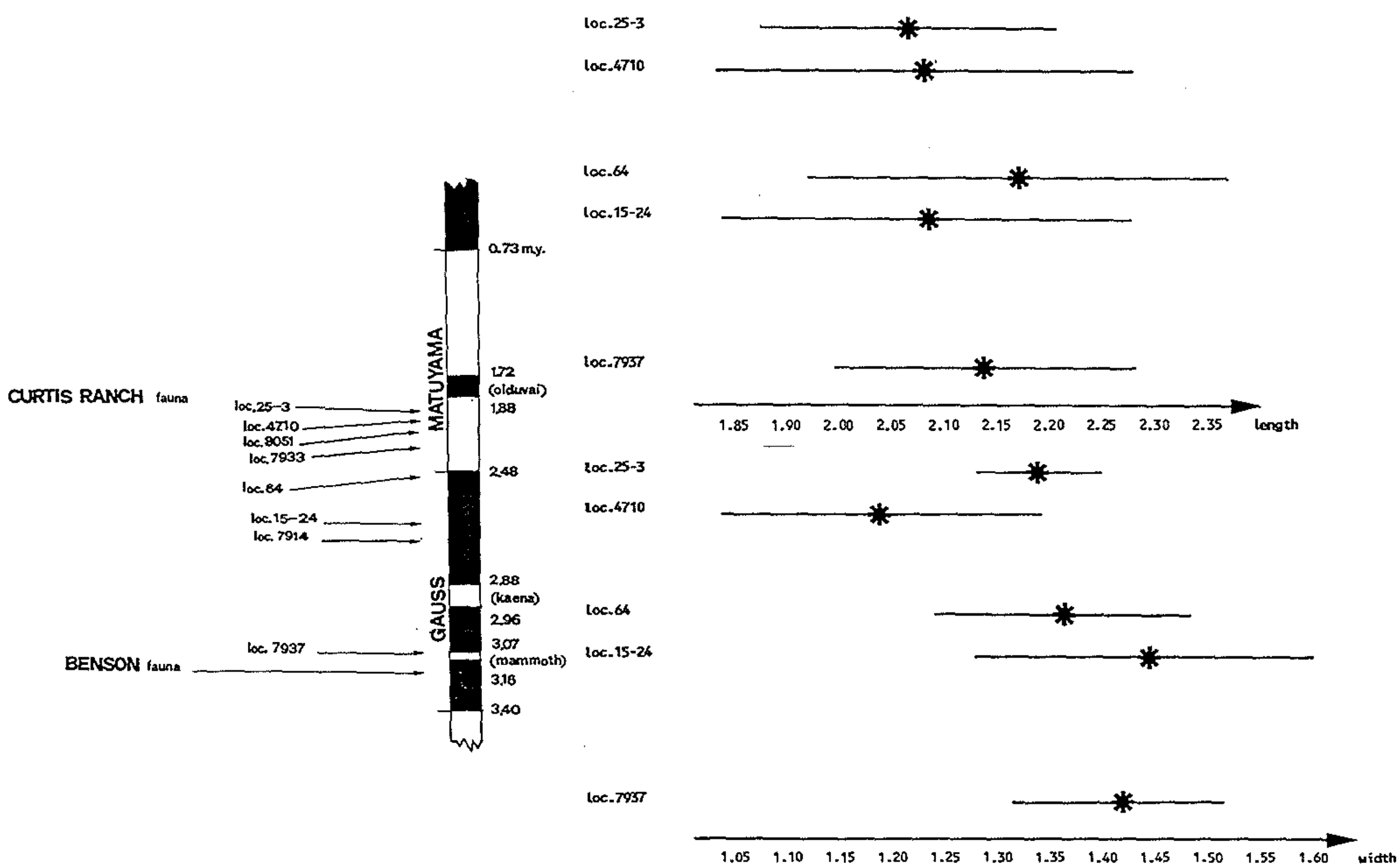



Figure 10.— Variation in measurements of $M_1$'s of five fossil *Sigmodon minor* and *Sigmodon medius* samples. Samples of *Sigmodon minor* are from U.A.L.P. loc. 4710, U.A.L.P. loc. 64, and U.A.L.P. loc. 25-3. Samples of *Sigmodon medius* are from U.A.L.P. loc. 15-24 (111 Ranch), and U.A.L.P. loc. 7937 (Duncan Basin area). Means of specimens of U.A.L.P. loc. 25-3, 15-24, and 7937 are from Tomida (1987, table 25, p. 99). Their sequence in time is indicated in the MPTS. Marked lines represent the observed range.

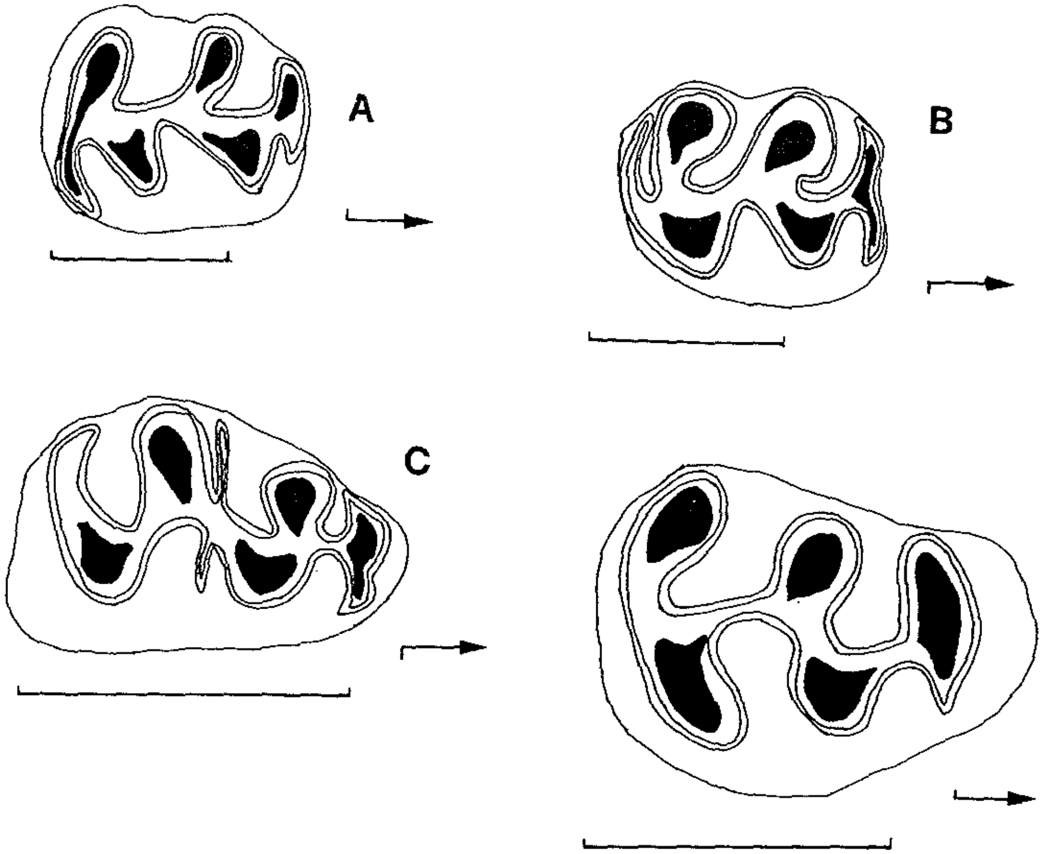



Figure 11.— *Onychomys pedroensis*: A) UALP 17796 and B) UALP 3724, $M_2$'s. *Baiomys brachygnatus*: C) UALP 17801, $M_1$; D) UALP 17800, $M^1$. Scale bars: A) 2.9 cm = 1 mm, B) 3.1 cm = 1 mm; C) 5.3 cm = 1 mm; D) 5 cm = 1 mm. Arrows indicate the anterior side of the tooth.

Lower dentition represented by a single subrectangular $M_2$, with very short metalophid and hypolophid, narrow posterior cingulum, broad and deep anterior labial and lingual reentrant valleys, posterolingual valley narrower and partially closed by the union of the posterior cingulum and the basis of entoconid, two large roots.

## Comparison and discussion

Measurements of the specimens described here are very close to those reported by Tomida (1987) for specimens of *Onychomys pedroensis* from U.A.L.P. loc. 7933, Dry Mt. East, in the upper part of the 111 Ranch section.

Figure 12 shows a scatter diagram with dimensions of the upper and lower molars of *Onychomys* from California Wash plotted along with those of samples of *Onychomys pedroensis* from Dry Mt. East and Curtis Ranch. There is a significant overlap in the size range of *Onychomys* from the three localities. So, one can argue that

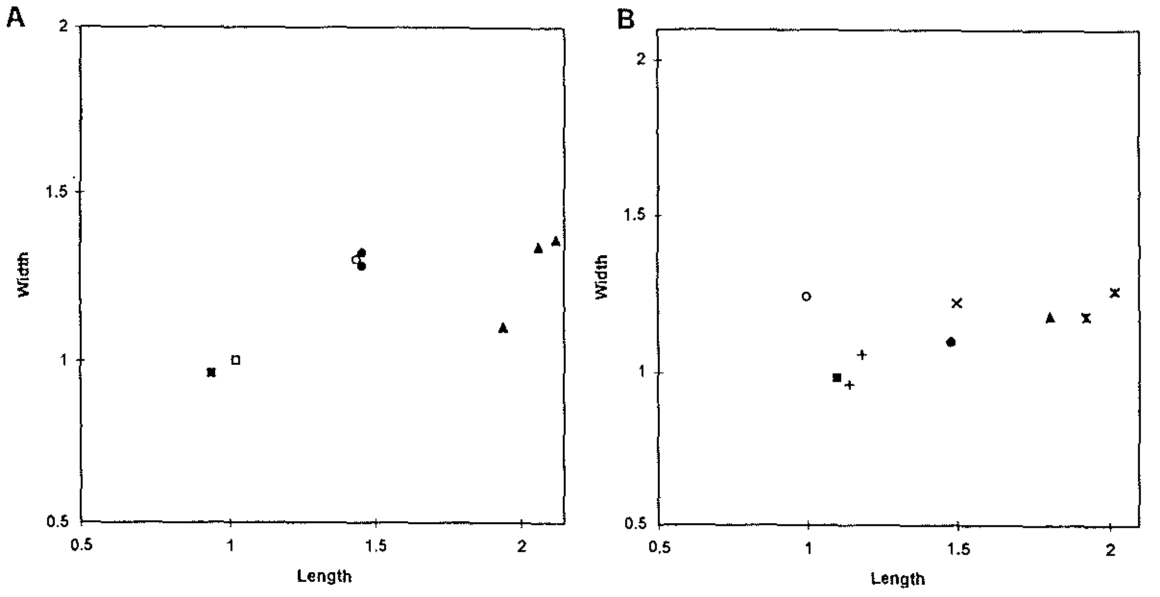



Figure 12.— Scatter diagrams with length plotted against width for upper (A) and lower (B) molars of *Onychomys pedroensis* from California Wash, U.A.L.P. loc. 4710, Dry Mt. East, U.A.L.P. loc. 7933, in the 111 Ranch area, and Curtis Ranch. Measurements of specimens of U.A.L.P. loc. 7933 and Curtis Ranch are from Tomida (1987, table 19, p. 75).

Symbols: empty circles and squares are for samples of U.A.L.P. loc. 4710; full triangles, circles and squares are for samples of U.A.L.P. loc. 7933; asterisk, x and + are for the sample of Curtis Ranch.

the sample of *Onychomys* from California Wash is closely related to those of *Onychomys pedroensis* from the other late Cenozoic localities used in the comparative analysis. It is important to note that the total number of specimens used in this comparison is very low, so that caution is needed in the evaluation of the suggested results. On this assumption, I refer the sample of *Onychomys* from California Wash to the species *Onychomys pedroensis.*

Carleton and Eshelman (1979) are the most recent reviewers of the genus: they recognize the species *pedroensis* as larger-sized than other species of *Onychomys*, such as *Onychomys bensoni*, that occurs in the Wolf Ranch local fauna, as reported by Harrison (1978). The species *Onychomys bensoni* was originally described in the Benson local fauna and is a smaller and more primitive form of *Onychomys*, relative to the *Onychomys pedroensis* that occurs in the Curtis Ranch local fauna.

### Genus *BAIOMYS* TRUE, 1894

### ***Baiomys brachygnathus*** GIDLEY, 1922

(Fig. 11, Table 6)

**Referred material**: U.A.L.P. no. 17801, $M_1$; no. 17800, $M^1$.

**Age**: middle to late Blancan.

| UALP | Element | Length | Width | Notes |
|---|---|---|---|---|
| 17798 | l$M_1$ | 1.86 | 1.24 | worn |
| 17797 | r$M_2$ | 1.50 | 1.24 | |
| 17830 | l$M^1$ | 0.00 | 1.12 | broken |
| 17796 | l$M^2$ | 1.46 | 1.28 | |
| 3724 | l$M^2$ | 1.44 | 1.30 | |
| 17799 | r$M^3$ | 1.06 | 1.00 | |

Table 5.— Measurements of specimens of *Onychomys pedroensis* from California Wash, U.A.L.P. loc. 4710.

## Diagnosis and description

Small cricetine with brachydont cheek teeth. Upper dentition represented by a single $M^1$, narrowing anteriorly and less elongate than $M_1$'s, with single-asymmetrical anterocone, cusps alternating, indistinct protoloph and metaloph, no posterior cingulum, labial reentrant valleys more open than lingual reentrant valleys and posteriorly flexed, three large roots, plus a small accessory rootlet beneath the paracone. Lower dentition represented by a single elongated $M_1$'s, with marked bilobed and symmetrical anteroconid, cusps alternating, no mesolophid and ectolophid, reduced anterior and posterior mure, posterior cingulum present, but small, broad labial reentrant valleys, two large roots with no accessory one.

## Comparison and discussion

The sample of *Baiomys* from California Wash is very poor, consisting of two teeth, one of which, $M_1$, is diagnostic. Comparisons with measurements of samples from other Blancan localities suggest a possible attribution to *Baiomys brachygnathus,* distinguished from many other Blancan species by its larger size.

Regarding the morphological features of the upper and lower first molars from U.A.L.P. loc. 4710, the only difference from specimens from other late Cenozoic localities in the San Pedro Valley is that the $M^1$ shows a single lobed anterocone. However, as Gidley (1922) stated in his description of *Baiomys brachygnathus*, the absence of some characteristic features may be due to wear. Comparisons with casts of extant species of *Baiomys*, such as *Baiomys musculus* (U.A.L.P. 4916) and *Baiomys taylori* (U.A.L.P. 8528) show a high degree of morphological similarity, even though all the recent specimens have weakly bilobed anterocones on $M^1$'s. The only difference is the size, the specimen from California Wash being larger than *Baiomys taylori* and comparable in size with specimens of *Baiomys musculus*. On this feature, I tentatively identify the specimens from California Wash described here as *Baiomys brachygnathus*: the temporal range of this species is late Blancan and this is also in agreement with the age of the California Wash local fauna.

Figures 13 and 14 show the occurrence of different species of *Baiomys* in some other late Cenozoic localities in the Duncan area (U.A.L.P. loc. 7937) and in the 111 Ranch section (U.A.L.P. loc. 7914, 7933 and 8051).

*Baiomys* is also present in the Wolf Ranch local fauna, U.A.L.P. loc. 64: Harrison

| UALP | Element | Length | Width | Notes |
|---|---|---|---|---|
| 17801 | $M_1$ | 1.24 | 0.80 | |

| UALP | Element | Length | Width | Notes |
|---|---|---|---|---|
| 17800 | $M^1$ | 1.44 | 0.98 | |

Table 6.— Measurements of specimens of *Baiomys brachygnathus* from California Wash, U.A.L.P. loc. 4710.

(1978) reported the occurrence of *Baiomys* cf. *brachygnathus* from Wolf Ranch which is about 0.6 Ma older than the Curtis Ranch local fauna, the type locality of *B. brachygnathus*. Harrison (1978) also reported the presence of *Baiomys minimus* from Wolf Ranch, the two species being separate on the basis of the very small size and relatively brachydonty of *Baiomys minimus*.

Tomida (1987) reported *Baiomys minimus* from Duncan South, U.A.L.P. loc. 7937, in the Duncan section, *Baiomys brachygnathus* from Dry Mt. East, U.A.L.P. loc. 7933, and U.A.L.P. loc. 8051, in the upper part of the 111 Ranch section, and *Baiomys* sp. from U.A.L.P. loc. 7914, from the lower part of the 111 Ranch section. *Baiomys* sp. and *Baiomys* cf. *brachygnathus* are late Blancan in age. *Baiomys minimus* is middle Blancan. The species of *Baiomys* from these late Cenozoic localities in the St. David Formation are quite similar in overall tooth morphology and their distinction is mainly on the basis of size.

Measurements of *Baiomys minimus* from U.A.L.P. loc. 7937 and *Baiomys* sp. from U.A.L.P. loc. 7914 have short ranges, if compared with the measurements from U.A.L.P. loc. 4710. The size of individual teeth from the studied locality are closer to those observed for specimens of *Baiomys brachygnathus* from U.A.L.P. loc. 7933 and loc. 8051 and it is to the species *Baiomys brachygnathus* that I tentatively refer the studied material.

## Family ARVICOLIDAE GRAY, 1821

The Suborder Myomorpha (Brandt, 1855) is the most successful among rodents, and includes more than one thousand extant species and a great variety of forms, resulting from several evolutionary radiations in the late Tertiary. Arvicolids had their major radiation during the Pliocene. This family is considered polyphyletic and includes several recognized separate subfamilies, generally characterized by hypsodont pillar-like cheek teeth, becoming evergrowing in the more derived forms, and triangular prismatic cusps.

The teeth consist of a variable number of alternating triangles: in $M_1$'s and $M^3$'s, the development of hypsodonty is accompanied by the increase of the number of triangles in the anteroconid complex (ACC) and the development of cementum on reentrant angles. Figure 15 shows the terminology of the occlusal surface of arvicolid teeth. The terminology follows Van der Meulen ( 1973).

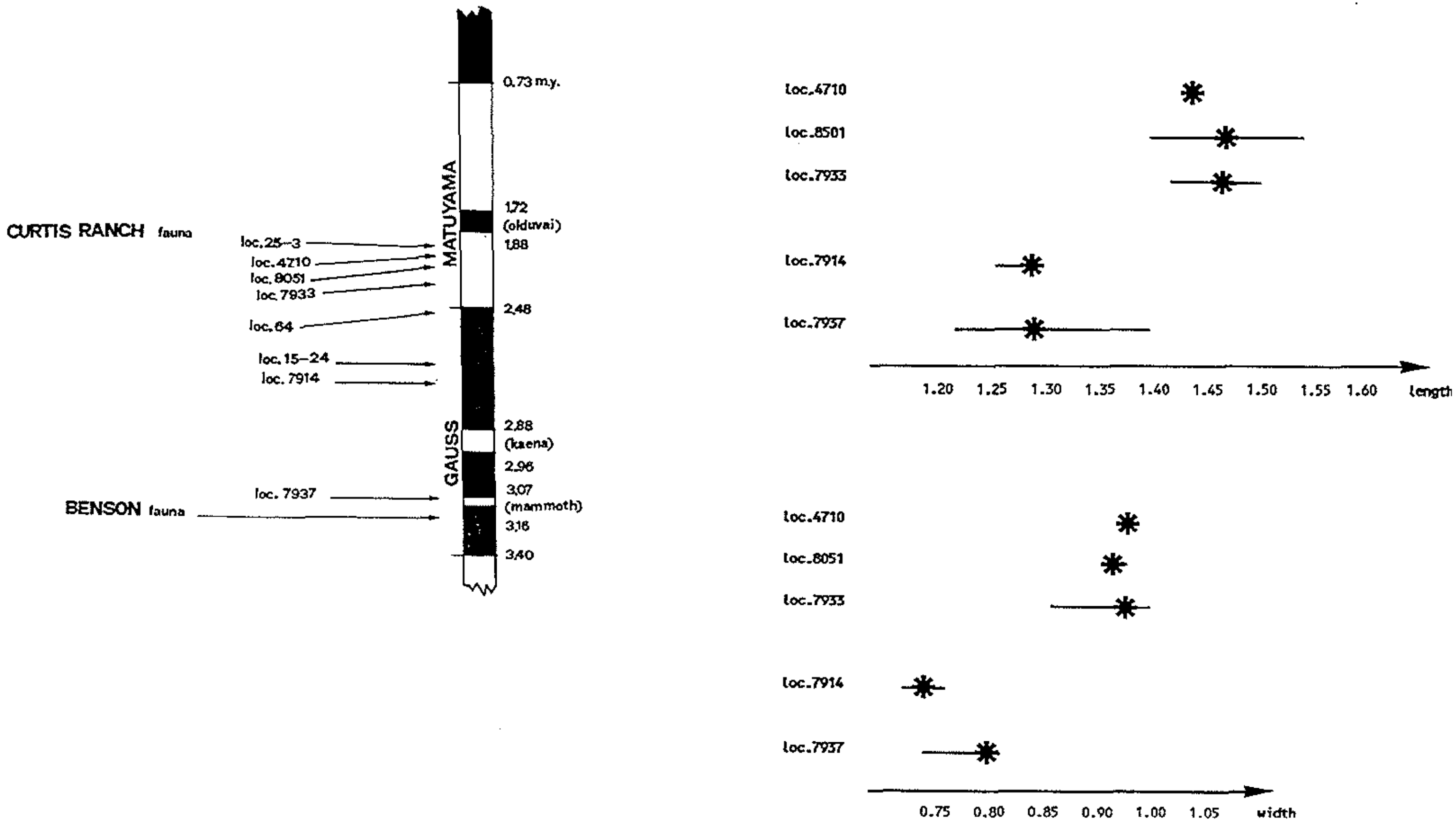



Figure 13.— Variation in measurements of $M_1$'s of five fossil *Baiomys* samples from late Cenozoic localities in the San Pedro Valley. The sample from Duncan South, U.A.L.P. loc. 7937 consists of *Baiomys minimus*. Samples from Dry Mt. East, U.A.L.P. loc. 7933, and U.A.L.P. loc. 8051, in the 111 Ranch section, consist of *Baiomys* cf. *brachygnathus*. The sample from U.A.L.P. loc. 7914, in the 111 Ranch section, consists of *Baiomys* sp. Means of specimens of U.A.L.P. loc. 7937, 7933, and 7914 are from Tomida (1987, tables 21 and 22, p. 83 and 86). The sequence in time is indicated in the MPTS.

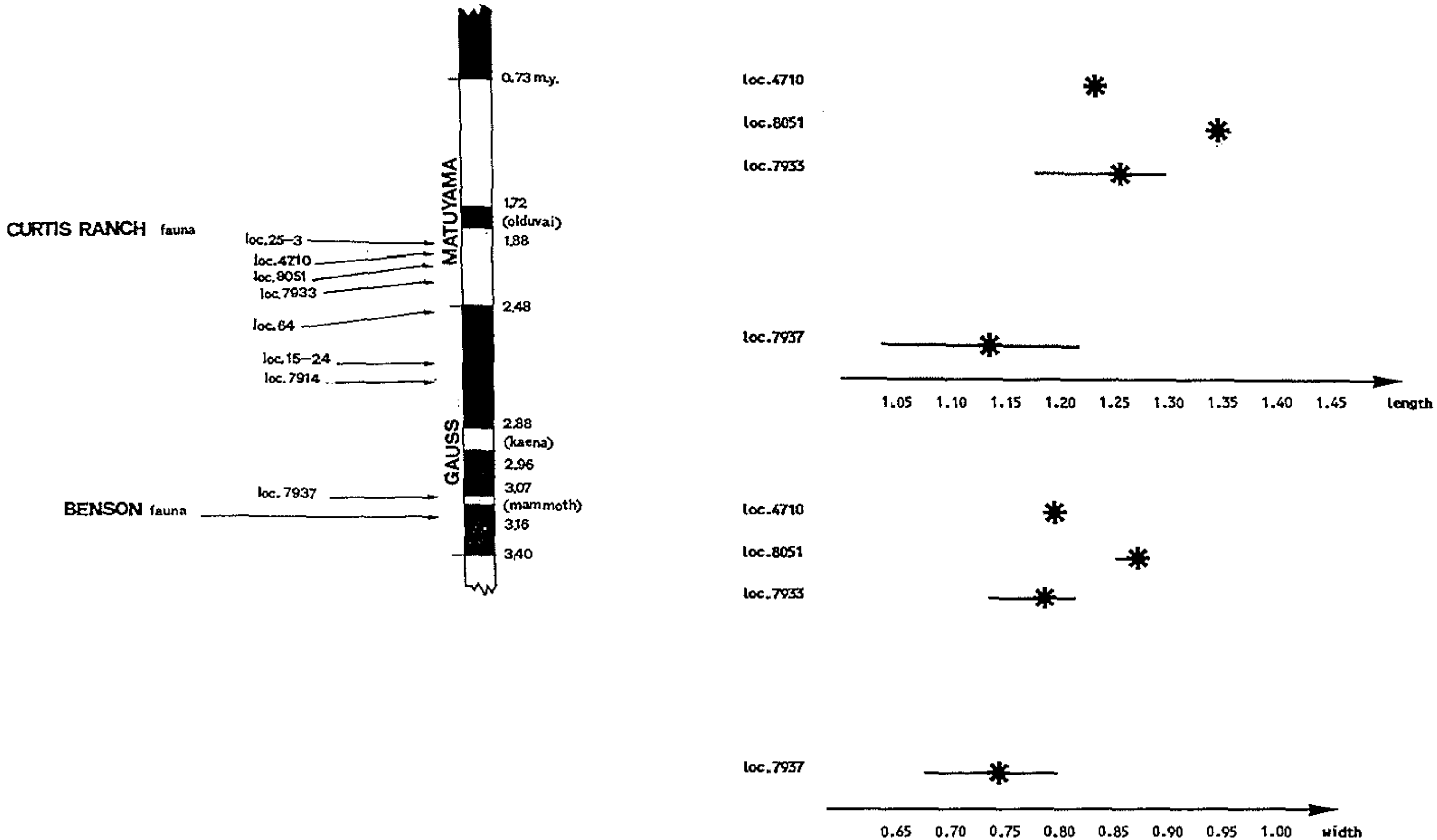



Figure 14.— Variation in measurements of M [1]'s of five fossil *Baiomys* samples from late Cenozoic localities in the San Pedro Valley. The sample from Duncan South, U.A.L.P. loc. 7937 consists of *Baiomys minimus*. Samples from Dry Mt. East, U.A.L.P. loc. 7933, and U.A.L.P. loc. 8051, in the 111 Ranch section, consist of *Baiomys* cf. *brachygnathus*. Means of specimens of U.A.L.P. loc. 7937, 7933, and 8051 are from Tomida ( 987, tables 21 and 22, p. 83 and 86). The sequence in time is indicated in the MPTS.

Subfamily LEMMINAE GRAY, 1825
Genus *MICTOMYS* BAIRD, 1857
***Mictomys vetus*** WILSON, 1933
(Figs. 15, 16, Table 7)

**Referred material**: UALP 17809, 17810, 17811, 17812, 17813, 17814, 6395, 3762, $M_1$'s; UALP 17818, 17816, 17815, 17820, 17817, $M_2$'s; UALP 6396, 17819, 17821, $M_3$'s; UALP 17802, 17803, 17804, $M^1$'s; UALP 17805, 17806, $M^2$'s; UALP 17807, 17808, $M^3$'s. For specimens UALP 17814, 17818, 17820, 6396, 17803, 17806, no measurement has been possible.

**Age**: Late Blancan.

**Diagnosis and description**

Lemmine rodents with rootless cheek teeth, formed by hypsodont, triangularly prismatic cusps. Upper dentition represented by $M^{1-3}$, all with tooth axis lingually shifted. $M^1$ composed of well developed anterior loop isolated from the four alternating triangles by closure of the commissure with the first anterior alternating triangle T1, with T1-T2 and T3-T4 junctions slightly confluent, T2-T3 junction closed, labial reentrants deeper than the lingual reentrants, same enamel thickness on both the anterior and the posterior walls. $M^2$ with large anterior loop, small triangles and closed junctions of the anterior loop and T2, barely open junction of T2-T3 and T3-T4, labial reentrants deeper than the lingual reentrants, LRA2 more pronounced, same enamel thickness on both the anterior and the posterior walls of reentrants. $M^3$ with anterior loop, three alternating triangles, small rounded posterior cap, closed connections between anterior loop and T2 and between T2 and T3, T3 and T4 confluent, BRA1 and BRA2 and LRA3 deeper than LRA2 same enamel thickness on both the anterior and the posterior walls of reentrants.

Lower dentition represented by $M_{1-3}$. $M_1$'s with tooth axis slightly shifted labially, asymmetrical anterior loop, joining T3 labial to the midline of the tooth, broad posterior loop, three alternating triangles, with T1 and T2 confluent. $M_2$ tooth axis markedly shifted buccally, small T4 and T2. $M_3$ with tooth axis markedly shifted lingually, large T1 and minute T2 and T3.

| UALP | Element | Length | Width | Notes | UALP | Element | Length | Width | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 17811 | r$M_1$ | 2.80 | 1.03 | | 17815 | l$M_2$ | 1.90 | | |
| 17812 | r$M_1$ | 0.00 | 1.12 | broken on TTC | 17821 | r$M_3$ | 1.70 | | |
| 17809 | l$M_1$ | 2.83 | 1.12 | | 17819 | r$M_3$ | 1.51 | | |
| 17810 | r$M_1$ | 2.90 | 1.06 | | 17802 | r$M^1$ | 2.45 | | |
| 3762 | l$M_1$ | 2.83 | 1.12 | | 17804 | l$M^1$ | 2.58 | | |
| 17813 | r$M_1$ | 3.00 | 1.22 | | 17805 | l$M^2$ | 2.06 | | |
| 6395 | r$M_1$ | 0.00 | 1.03 | broken | 17808 | l$M^3$ | 2.12 | | |
| 17816 | r$M_2$ | 1.80 | | | 17807 | l$M^3$ | 1.93 | | |

Table 7.— Measurements of specimens of *Mictomys vetus* from California Wash, U.A.L.P. loc. 4710.

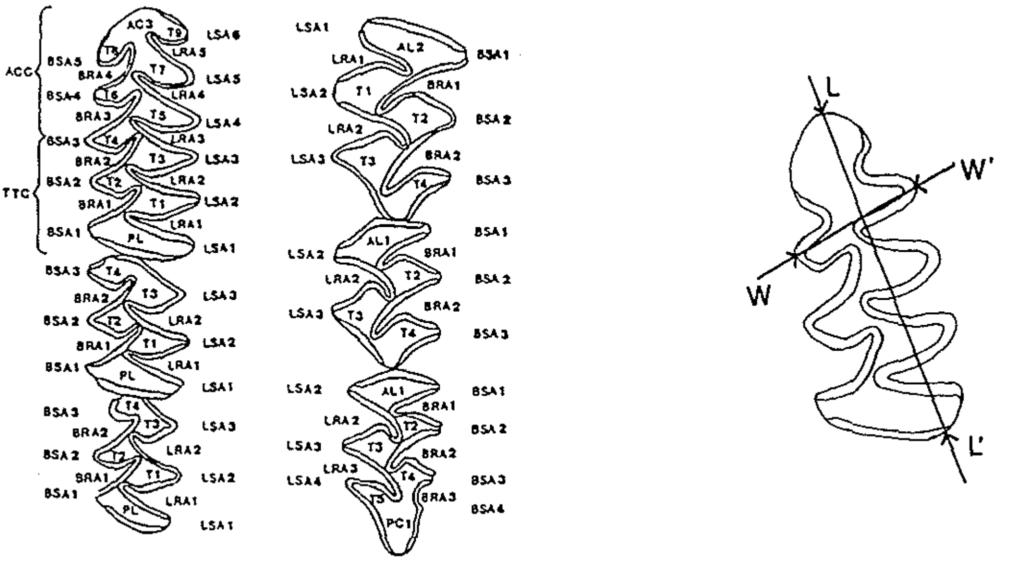



Figure 15.— Terminology of occlusal surface of arvicolid teeth (after Van der Meulen, 1973). **AC** = anterior cap, **ACC** = anteroconid complex, **AL** = anterior loop, **BRA** = buccal reentrant angle, **BSA** = buccal salient angle, **LRA** = lingual reentrant angle, **LSA** = lingual salient angle, **PC** = posterior cap, **PL** = posterior loop, **T** = triangle,**TTC** = trigonid-talonid complex. On the right, illustration of measurements of $M_1$'s taken for this study. **L-L'** = length, **W-W'** = width (modified from Van der Meulen, 1973). For the other teeth, length only has been considered.

## Discussion

Measurements of *Mictomys vetus* from California Wash are reported on Table 7; means for $M_1$'s are l = 2.87 mm, w = 1.10 mm. *Mictomys vetus* from California Wash is very similar to *Mictomys (Metaxyomys) vetus*, described from 111 Ranch fauna (Tusker fauna) of Arizona by Tomida (1987). The vole from California Wash differs from the vole from 111 Ranch in being slightly smaller, in having a slightly more labial shift of the axis of $M_1$, with the anterior loop asymmetrically enlarged and displaced more posteriorly on $M_1$, and in having $M^3$ with only T3-T4 broadly confluent, a shallower LRA2 and a deeper LRA3.

These probably represent different but closely related species of *Mictomys*, the species from California Wash (about 1.85 Ma) being derived, relative to the species from 111 Ranch (about 2.5 Ma). The Duncan material could be eventually assigned to a new species, but, in my opinion, it could also represent a further complication in the very inflated taxonomy of the genus *Mictomys*.

Both species are placed in the genus *Mictomys*, characterized by having hypsodont and evergrowing cheek teeth with cementum in reentrants, T2 and T3 confluent in all lower molars, labial shift of the tooth axis and shallowing of labial reentrants in lower molars.

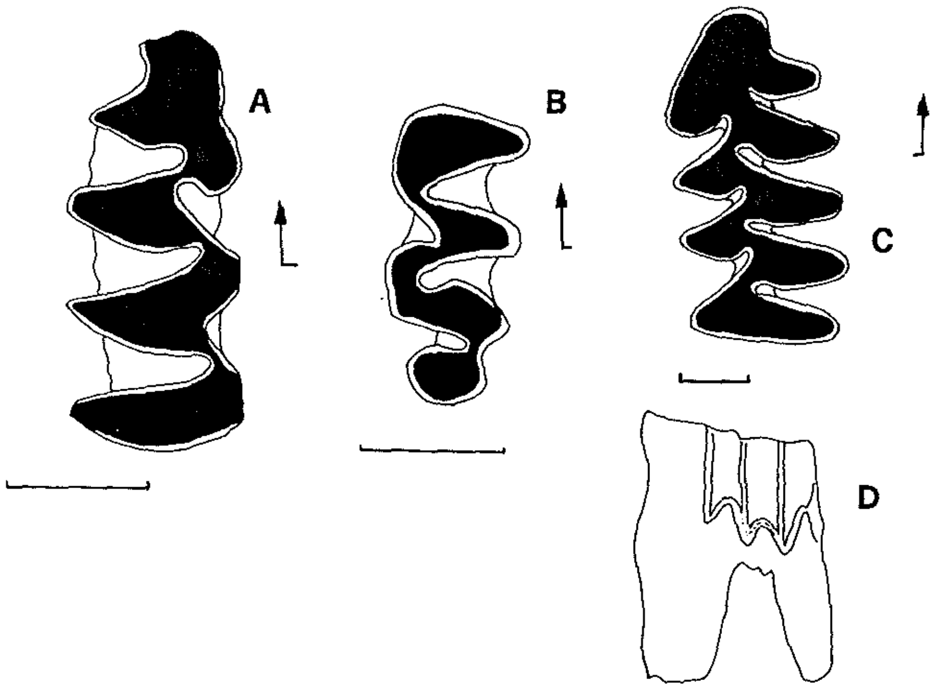



Figure 16.— *Mictomys vetus*: A) UALP 17811, $M_1$; B) UALP 17808, $M^3$. *Ondatra idhaoensis*: C) D) UALP 17822, $M_1$, occlusal and lateral view. Scale bars: A) 2.7 cm = 1 mm; B) 2.5 cm = 1 mm; C) 1.25 cm = 1 mm. Arrows indicate the anterior side of the tooth.

### Subfamily ONDATRINAE KRETZOI, 1955
### Genus *ONDATRA* LINK, 1795
### *Ondatra idahoensis* WILSON, 1933
(Figs. 15, 16)

**Referred material**: U.A.L.P. no.17822, 1 $M_1$.

**Age**: Blancan to Recent.

**Diagnosis and description**

Rodents of large size (the largest in the subfamily), increasing with evolution. Rooted cheek teeth. Upper dentition not represented; lower dentition represented by a single $M_1$ with tooth axis sligthly shifted labially, broad anterior and posterior loop, five nearly closed triangles, with labial triangles smaller and offset posteriorly to the lingual ones, same enamel thickness on both the anterior and the posterior walls of the triangles, thinning in the tightly folded anterior part of reentrant angles, weakly developed cementum and developed dentine tracks on the labial side, lingual and labial reentrants deep, anterior reentrants deeper and more tightly flexed anteriorly, two large roots and a small central accessory rootlet.

### Discussion

Muskrats are rodents of large size, which were and are widespread and conspicuous members of many faunas. Their origin is uncertain, but the first representatives of this subfamily (*Pliomys* and *Dolomys*) appeared by Late Ruscinian time in Europe, characterized by five alternating triangles on $M_1$'s and rooted cheek teeth. The trend was to an increase in size with evolution. This fact has been recognized by Nelson and Semken (1970), who established a progressive increase from *Pliopotamys* to *Ondatra*. A high degree of variability in the size of $M_1$'s has been recognized.

The dimensions of the only specimen recognized in the sample from California Wash, U.A.L.P. loc. 4710, are: l = 5.0 mm, w = 2.06 mm.

These data are sufficient for the assignment to the species *Ondatra idahoensis*.

## SUMMARY AND CONCLUSIONS

The California Wash local fauna is from sediments of the middle member of the St. David Formation, in the southern part of the San Pedro Valley, west of the San Pedro River, Arizona. The middle member consists primarly of lacustrine and paludal strata and contains most of the fossils found in the Formation. Abundant mammalian fossils have been collected in the San Pedro Valley since the early 1920's, but the fossils from California Wash were collected after 1965.

Magnetic polarity stratigraphy in the area of exposure of the St. David Formation has been combined with biochronological data, based on fossil assemblages from the different Cenozoic localities, thus providing a good temporal framework.

Cricetid rodents are represented by three genera and four species (*Sigmodon minor*, *Sigmodon* cf. *S. curtisi*, *Onychomys pedroensis*, *Baiomys brachygnathus*). Two genera and two species (*Onychomys* and *Baiomys*) are from small to very small sized; the species of the genus *Sigmodon* (*Sigmodon minor*) is medium sized, while *Sigmodon* cf. *S. curtisi* is large sized.

*Sigmodon minor* is the most common and abundant species of the small mammals from California Wash. The sample of *Sigmodon minor* consists of fourty-nine molars, twenty-one of which have been recently collected. Their dimensions and descriptions have allowed to make comparisons with samples of *Sigmodon minor* and *Sigmodon medius* from other late Cenozoic localities in the San Pedro Valley. The comparative biometric and morphological analyses on the samples at disposal have resulted in the assignment to *Sigmodon minor* for the sample from California Wash and Gidley Rodent, Curtis Ranch, U.A.L.P. loc. 25-3, on the basis of a gradual phyletic change through time occurring in the studied samples. In particular, the means for $M_1$'s from the California Wash and Gidley Rodent local faunas are closer to the means for the type specimen of *Sigmodon minor* (USNM 10519), while the means for the sample from the Wolf Ranch local fauna is significantly closer to the means for the type specimen of *Sigmodon medius* (USNM 10512).

*Onychomys* is represented by few specimens, with brachydont cheek teeth. The dimensions of the specimens have been compared with those reported for specimens of *Onychomys pedroensis* from localities of the 111 Ranch section and from Curtis Ranch; the specimens from California Wash are assigned to that species, even though caution in the evaluation of the results is needed due to the scarcity of the material.

The genus *Baiomys* is represented only by two teeth. Comparisons with samples from other Blancan localities has suggested a tentative attribution to the species *Baiomys brachygnathus*. This is a comparatively large species of pigmy mouse, late Blancan in age, with a temporal range that agrees with the age of the California Wash local fauna (2.0 Ma).

Arvicolid rodents are represented by two genera, *Ondatra* and *Mictomys*, belonging to two subfamilies, Ondatrinae and Lemminae, respectively.

*Ondatra* is the largest form in the subfamily Ondatrinae. Its size increases in evolution. The genus shows a very high degree of morphological variability. The sample from California Wash is represented by one measurable specimen. Its specific identification as *Ondatra idahoensis* is possible, on the basis of the morphology and dimensions of the $M_1$'s.

*Mictomys* has a larger sample. It is a bog lemming, with rootless cheek teeth, known since the late Blancan.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