The Quaternary Vertebrate Fauna of Upper Sloth Cave, Guadalupe Mountains National Park, Texas

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Upper Sloth Cave is located in the extreme northwestern corner of Culberson County, Texas, at an elevation of 2000 m and approximately 2.5. mi. northwest of Guadalupe Peak. Vertebrate material obtained from excavations of Upper Sloth Cave provides an excellent opportunity to study the vertebrate faunal evolution of the southern Guadalupe Mountains from approximately 13,000 years Before Present (BP) to the present. A previous excavation of Upper Sloth Cave, then called High Cave (Mera 1938), yielded few vertebrate remains, but some perishable archaeological material was found. Previous work in the southern Guadalupe Mountains has shown that the Sangamonian-Wisconsian faunas contained extinct genera such as *Nothrotherium* (Ayer 1936; Van Devender et al. 1977a) and extant genera such as *Marmota* (Stearns 1942; Schultz and Howard 1935) and *Sorex* (Harris 1970b; Logan 1975) that are found only farther north, at higher elevations, or in more mesic habitats than now exist in the southern Guadalupe Mountains.

METHOD OF STUDY

The bones of the vertebrates were identified to the lowest possible taxonomic level. Specific identifications of most mandibles and maxilla with teeth were possible. Because of the extremely fragmentary nature of most of the postcranial material, identifications were not attempted except on the Serpentes.

The habitat preferences and environmental interpretations are based on modern literature reports regarding the species represented in the cave deposits.

The vertebrate specimens are cataloged in the vertebrate paleontological collections of The Museum of Texas Tech University (TTU-P), Lubbock,

under the locality number TTU-TEX-2. The molluscan fauna (Table 1) is deposited at the Dallas Museum of Natural History.

TABLE 1. Mollusca from Upper Sloth Cave.

Taxa	Depth in cm			
	0–10	10–20	20–30	30–40
Discus cronkhitei	X			
Gastrocopta ashmuni		X		
G. pellucida parvidens		X		
Glyphyalinia indentata paucilrata	X	X	X	
Helicodiscus eigenmanni	X			
H. s. singleyanus		X	X	X
Holospira pityis	X		X	
Holospira sp. (immature)	X	X		
Metastoma roemeri roemeri	X	X		X
Oreohelix socorroensis socorreonsis		X		
Oreohelix sp.	X	X		
Pupilla blandii		X		
Pupilla sp. (immature)	X	X	X	
Rabdotus sp. (immature)	X			
Succinea sp. (immature)		X		
Vallonia sp. (immature)		X		

PRESERVATION OF BONE

The bones of Upper Sloth Cave are well preserved with little or no mineralization, but with a high degree of breakage. The fragmentary nature of the bones and the fact that very little material present is larger than a jackrabbit suggest that the major bone accumulations were by small mammalian carnivores and predatory birds, although some of the mammals, such as *Neotoma* and *Bassariscus*, certainly live in and around the cave today.

STRATIGRAPHY

Two trenches were excavated in the front chamber of Upper Sloth Cave (Fig. 1) during the summer of 1974. Due to the very different nature of the deposits, the only correlation between the two trenches is based upon the appearance of *Sorex cinereus* and *Cryptotis parva* in the 30 to 40 cm level of trench 1 and in the 10 to 20 cm level of trench 2 (Table 2). The 30 to 40 cm level of trench 1 has been radiocarbon dated at 11,760±610 BP (A–1519), on artiodactyl fecal pellets from an adjacent, but previously excavated, trench (Van Devender et al. 1977a).

Trench 1, located near the west wall, shows the following stratigraphic units. Unit 1 is from the surface to a depth of 15 cm where it makes a hummocky and somewhat blended contact with unit 2. Unit 1 is composed

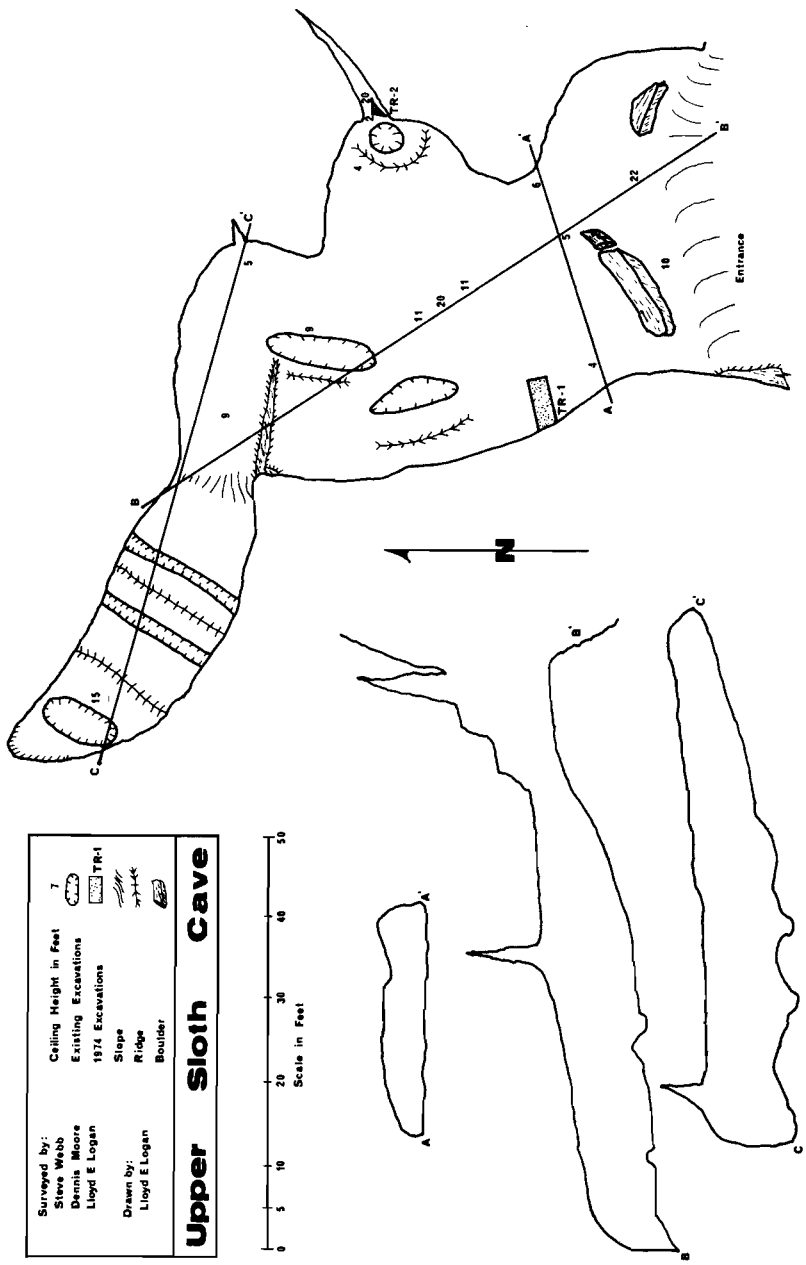

Fig. 1. Map of Upper Sloth Cave (GUMO Cave-08), Guadalupe Mountains National Park, Texas.

TABLE 2. Mammals from Upper Sloth Cave.

Taxa	Depth in cm				
	Trench 1	Trench 2			
		0–10	10–20	20–30	30–40
Sorex cinereus	30–40		X		
Cryptotis parva	10–20		X		
	30–40				
Notiosorex crawfordi		X	X	X	X
Myotis velifer		X			
Myotis sp.		X			
Lasionycteris noctivagans			X		
Eptesicus fuscus			X	X	
Plecotus townsendi		X			
Antrozous pallidus		X		X	
Nothrotherium shastense	25–45				
Sylvilagus sp.		X	X		
Lepus sp.		X			
Marmota flaviventris			X		
Spermophilus variegatus		X	X		
Thomomys bottae		X	X		
Pappogeomys castanops		X			
Peromyscus spp.		X	X	X	X
Peromyscus eremicus		X	X		
Neotoma cinerea		X	X	X	
Neotoma mexicana		X	X	X	X
Neotoma albigula			X		
Neotoma micropus			X		
Microtus mexicanus		X	X	X	X
Bassariscus astutus		X	X		
Mustela frenata		Surface of a spoil heap near trench 2			
Felis concolor		X			

of many cobble and gravel-sized limestone fragments, much plant material, limited archaeological material in the form of quids and charcoal fragments, and much fine grey dust. Small artiodactyl fecal pellets are present, but other vertebrate material is sparse. Unit 2 differs from unit 1 in that the archaeological material and most plant material are absent. The dust is more of a reddish tan, but not the typically red clays of most cave deposits. Unit 2 lies from 15 to 25 cm below the modern surface of the cave and makes a rather sharp but hummocky contact with unit 3. Unit 3 lies from 25 to 45 cm below the surface and is composed primarily of dung balls of *Nothrotheriops shastense* (Shasta ground sloth) in various stages of decomposition (Van Devender et al. 1977a). The majority of identifiable vertebrate remains found in this trench are from stratigraphic unit 3 at the 30 to 40 cm level and consist primarily of mandibles of *Sorex cinereus* and *Cryptotis parva*. Also present in unit 3, and increasing in mass toward the center of the chamber,

are sticks and small logs of *Pinus edulis* (limber pine). Unit 3a is an apparently wind-accumulated layer of leaf litter at the 40 to 45 cm level. This unit is present only in a local area in the east end of the trench directly under the largest concentration of small pine logs. One partial skull and associated mandibles of *Sorex cinereus* were recovered from this unit. Unit 4 consists of limestone cobbles averaging 20 cm in diameter, with the reddish dust filling the cracks between the rocks. Little vertebrate material was recovered from the 45 to 70 cm levels. Trench 1 was terminated at this level.

Trench 2, located at the mouth of a small passage on the east side of the main chamber (Fig. 1), contains the following stratigraphic units. Unit 1, from the surface to 6 or 7 cm, is composed of a dry, grey dust mixed with many pieces of broken flowstone. Fragmentary vertebrate material is extremely abundant. Unit 2 is a calcite cement layer up to 3 cm thick along the walls of the passage, but interrupted toward the center of the passage. Some vertebrate material is incorporated within the cemented matrix. Unit 3 is from 6 to 10 cm below the surface of the trench to a depth of approximately 40 cm, and is composed of a typically reddish and slightly damp clay fill with many gravel-sized limestone fragments. Vertebrate material is extremely common throughout the trench, but nearly all of it is of a fragmentary nature.

SPECIES ACCOUNTS

Sceloporus poinsetti Baird and Girard, Crevice Spiny Lizard

Material.—Right dentary (TTU-P-8312); right maxilla (TTU-P-8313).
Discussion.—*S. poinsetti* is a relatively common lizard in the vicinity of Upper Sloth Cave and is found throughout the rocky, arid areas of the southern Guadalupe Mountains. *S. poinsetti* does not indicate any change from present environmental conditions.

Sceloporus undulatus (Latreille), Eastern Fence Lizard

Material.—Two right dentaries (TTU-P-8315-8316); seven left dentaries (TTU-P-8317-8323); four left maxilla (TTU-P-8324-8327); five right maxilla (TTU-P-8328-8332).
Discussion.—*S. undulatus* has previously been reported only twice from prehistoric localities in the southwestern United States (Holman 1970; Gehlbach and Holman 1974). *S. undulatus* is an abundant lizard in the vicinity of Upper Sloth Cave and occurs in all biomes of the southern Guadalupe Mountains. This species is not useful as an ecological indicator because of its ecological plasticity.

Urosaurus ornatus Baird and Girard, Tree Lizard

Material.—Four left maxilla (TTU-P-8334-8337); five right maxilla (TTU-P-8338-8342); seven left dentaries (TTU-P-8343-8349); six right dentaries (TTU-P-8350-8355).
Discussion.—*U. ornatus* occurs in a wide variety of habitats in the southern Guadalupe Mountains today and is extremely common in the vicinity of Upper Sloth Cave. The wide range of habitats occupied by this species makes it nearly useless for climatic interpretations.

Eumeces cf. **E. multivarigatus** Hallowell, Many-lined Skink

Material.—Fragmentary left maxilla (TTU-P-8375).
Discussion.—*E. multivarigatus* has previously been reported from Pratt Cave (Gehlbach and Holman 1974) where it represented the first record of the species from a southwestern prehistoric locality. *E. multivarigatus* is a fairly common inhabitant in some portions of the southern Guadalupe Mountains and does not indicate any climatic change.

Thamnophis sp. Fitzinger

Material.—One precaudal vertebrae (TTU-P-8368).
Discussion.—*Thamnophis* is generally considered to be primarily a mesic-adapted genus (Raun 1965; Gehlbach and Holman 1974). The presence of this genus on the west face of the Guadalupe Mountains indicates either more mesic conditions or transportation of the material from place of origin to place of deposition.

cf. **Diadophis punctatus** (Linnaeus), Northern Ringneck Snake

Material.—One precaudal vertebrae (TTU-P-8372).
Discussion.—*D. punctatus* is usually considered a woodland species (Raun 1965). This single specimen (Table 3) may represent transportation from the forested area approximately 450 m above the cave, or it may represent a depression of the woodlands to the elevation of the cave as suggested by Van Devender et al. (1976b)

TABLE 3. Reptiles from Upper Sloth Cave.

Taxa	Depth in cm			
	0–10	10–20	20–30	30–40
Sceloporus poinsetti	X	X		
Sceloporus undulatus	X	X	X	
Sceloporus sp.	X	X	X	
Urosaurus ornatus	X	X	X	
Eumeces multivarigatus			X	
Eumeces sp.	X			
Thamnophis sp.		X		
Diadophis punctatus			X	
Coluber or *Masticophis*	X	X		
Opheodrys vernalis	X			
cf. *Salvadora*	X			
Elaphe subocularis	X	X	X	
Arizona elegans	X			
Trimorphodon biscutatus	X			
Crotalus sp.	X	X	X	
Unidentified snake	X	X	X	X

Coluber Linnaeus or **Masticophis** Baird and Girard

Material.—Four precaudal vertebrae (TTU-P-8370); two precaudal vertebrae (TTU-P-8371).
Discussion.—We are unable to assign these vertebrae to either *Coluber* or *Masticophis* with certainty. *M. flagellum* and *M. taeniatus* are found in the immediate vicinity of Upper Sloth Cave, with the latter species being the more abundant. Brattstrom (1964) reported *Coluber constrictor* from late Wisconsin deposits of south-central New Mexico, but this species has not

been reported from the southern Guadalupe Mountains. No change from present climatic conditions is indicated by this material.

Opheodrys vernalis (Harlan), Smooth Green Snake

Material.—Three precaudal vertebrate (TTU-P-8367).
Discussion.—In Texas, *O. vernalis* presently is known only from Ellis, Bosque, Austin, and Matagorda counties (Raun 1965). These specimens are the first Texas records of *O. vernalis* west of the Edwards Plateau and the first confirmed record for the Guadalupe Mountains. The presence of *O. vernalis* in the southern Guadalupe Mountains has been suspected for several years, based on a description given to Dr. John Mecham by a rancher in the Guadalupe Mountains of southern New Mexico (John Mecham, pers. comm.) In the western United States, *O. vernalis* inhabits damp, grassy environments such as stream borders, meadows, and rocky habitats interspersed with grass (Stebbins 1966). The presence of this species indicates a more mesic environment than presently occurs in the vicinity of the cave or possibly transportation from place of origin.

cf. **Salvadora** sp. (Baird and Girard)

Material.—One precaudal vertebrae (TTU-P-8373).
Discussion.—*S. grahamiae* was observed within 0.5 mi. of Upper Sloth Cave during the period of excavation. The presence of this genus does not indicate any change in climatic conditions.

Elaphe cf. **E. subocularis** (Brown), Trans-Pecos Rat Snake

Material.—24 precaudal vertebrae (TTU-P-8364); 10 precaudal vertebrae (TTU-P-8365); one precaudal vertebrae (TTU-P-8366).
Discussion.—Raun (1965) listed *E. subocularis* from the Guadalupe Mountains and stated that the preferred habitat is rocky areas at higher elevations, a condition that closely matches the area surrounding Upper Sloth Cave. The presence of this species in the deposits does not indicate any change from the present climatic conditions.

Arizona elegans Kennicott, Glossy Snake

Material.—Two precaudal vertebrae (TTU-P-8369).
Discussion.—*A. elegans* is a common inhabitant of the desert shrub community immediately to the southwest and approximately 500 m lower in elevation than the cave. This xeric-adapted species indicates no change from present climatic conditions.

Trimorphodon biscutatus Cope, Texas Lyre Snake

Material.—Five precaudal vertebrae (TTU-P-8374).
Discussion.—Raun (1965) listed *T. vilkinsoni* (=*T. biscutatus vilkinsoni*) from the Trans-Pecos region of Texas, but excluded the Guadalupe Mountains. These specimens represent the first known occurrence of *T. biscutatus* from the Guadalupe Mountains. The preferred habitat is rocky, arid, or semi-arid regions where it feeds primarily on lizards (Raun 1965). No change in climatic conditions is indicated by this species.

Crotalus sp. Linnaeus

Material.—27 precaudal vertebrae (TTU-P-8360); 13 precaudal vertebrae (TTU-P-8361); seven precaudal vertebrae (TTU-P-8362); one precaudal vertebrae (TTU-P-8363); two precaudal vertebrae (TTU-P-8377).
Discussion.—*C. atrox, C. molussus*, and *C. lepidus* are all found in the immediate vicinity of Upper Sloth Cave. Based on the large size of the vertebrae, these specimens most probably represent *C. atrox* or *C. molossus*. Rattlesnakes frequently are found around the entrances of caves and their presence in the deposit was expected. Due to the wide range of habitats occupied by this genus, *Crotalus* is of little use as an ecological indicator.

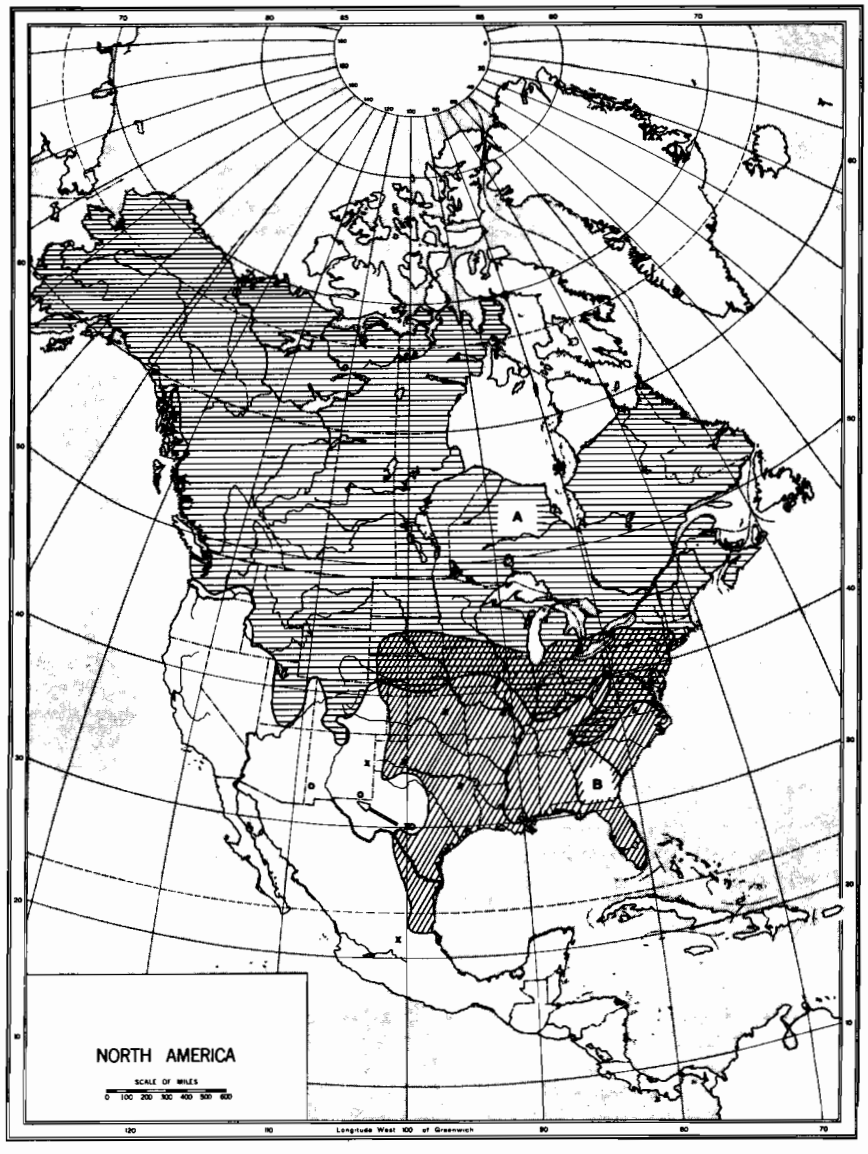

Fig. 2. Recent distribution (A) and Pleistocene occurrences (x) of *Sorex cinereus* and Recent distribution (B) and Pleistocene occurrences (O) of *Cryptotis parva*.

cf. **Tympanuchus** sp. (Linnaeus)

Material.—One fragmentary sternum (TTU–P–8396).

Discussion.—This fragmentary sternum closely resembles *Tympanuchus* sp., but is too

fragmentary to permit specific identification. *T. pallidicinctus* presently occurs in limited numbers on the plains to the east of the Guadalupe Mountains. This genus does not indicate any change from present climatic conditions.

Passeriformes

Material.—Abundant material.
Discussion.—These bones represent at least three taxa of passeriform birds. The majority of the bones are of young birds and are incompletely ossified, making further identifications uncertain.

Sorex cinereus Kerr, Masked Shrew

Material.—Skull and Mandibles (TTI-P-8273); two, R_1-M_3 (TTU-P-8274–8275); three, LI_1-M_3 (TTU-P-8276–8278); LI^1-P^4 (TTU-P-8279); LM^{1-3} (TTU-P-8280); LM_{1-3} (TTU-P-8281); LP^4-M^2 (TTU-P-8282); RI_1-M_2 (TTU-P-8283); LI_1-P_1 (TTU-P-8284); LM_{1-2} (TTU-P-8285); RI_1-M_1 (TTU-P-8286).
Discussion.—*Sorex cinereus* is differentiated from other members of the genus by a shorter and much shallower dentary, a shorter molar row, and a lower coronoid (Findley 1953). The closest occurrence of *S. cinereus* today is in northern New Mexico (Fig. 2), a distance of approximately 300 mi. Specimens from the cave deposit agree closely with a modern specimen (MALB-2684) from San Miguel County, New Mexico, that is deposited in the collections of the Museum of Arid Lands Biology, the University of Texas at El Paso. *Sorex cinereus* "prefers mesic and hydric communities from which it rarely wanders" (Findley 1953). The presence of this species in the deposits is an indicator of more mesic conditions than presently occur in the southern Guadalupe Mountains.

Cryptotis parva (Say), Least Shrew

Material.—RI_1-M_3 (TTU-P-8287); LI_1-M_2 (TTU-P-8288); RI_1-M_1 (TTU-P-8289); LI_1-P_4 (TTU-P-8290).
Discussion.—*C. parva* has been reported from Dry Cave, Eddy County, New Mexico, by Harris et al. (1973), associated with a radiocarbon date of 10,730±150 BP. This date compares favorably with the date 11,760±610 BP (A-1533) obtained from the 23 to 30 cm level of trench I. This is the first record of *Cryptotis parva* from the Trans-Pecos of Texas and represents a former range extension of at least 200 mi. to the southwest of its present range (Fig. 2). The presence of *C. parva* in the deposits is an indicator of at least slightly more mesic conditions than now exist in the area.

Notiosorex crawfordi (Coues), Desert Shrew

Material.—Two, RI_1-M_1 (TTU-P-8291-8292); two, LI_1-M_3 (TTU-P-8293–8294); rostrum with RI_1-M_3, LI_1-M_1 and M_3 (TTU-P-8295); RM_{1-2} (TTU-P-8296); LM_{1-2} (TTU-P-8297); RM_{1-3} (TTU-P-8298); RP_4-M_3 (TTU-P-8299).
Discussion.—Specimens from Upper Sloth Cave do not differ significantly from recent specimens from Garza County, Texas. *N. crawfordi* possibly occurs in the vicinity of the cave today although no specimens are known from the Guadalupe Mountains National Park. Desert shrews are known from a variety of habitats and thus are relatively useless as climatic indicators.

Myotis velifer (J. A. Allen), Cave Myotis

Material.—LM_{2-3} (TTU-P-8300).
Discussion.—*M. velifer* is larger than other American members of the genus, with the exception of the extinct *M. magnimolaris* (Choate and Hall 1967). *M. velifer* is differentiated from *M. magnimolaris* by a slightly less massive mandible and slightly smaller dentition; the greatest crown length of *M. magnimolaris* has a range of 1.50 to 1.65 mm and a mean of 1.57 mm (Choate and Hall 1967). TTU-P-8300 has a crown length of 1.47 mm on the M_3 and is assigned

to *M. velifer* on this basis. *M. velifer* is a common inhabitant of caves in a wide variety of habitats and thus is not useful as an ecological indicator.

Myotis sp. Kaup

Material.—LP_4–M_3 (TTU–P–8301); RP_4–M_3 (TTU–P–8302).
Discussion.—Several species of small *Myotis* are found in the immediate vicinity of the cave today and are extremely difficult to differentiate on the basis of fragmentary material. The presence of a small *Myotis* in the fauna does not reflect any change in the environmental conditions.

Lasionycteris noctivagans (Le Conte), Silver-haired Bat

Material.—LC_1–M_3 (TTU–P–8303).
Discussion.—*L. noctivagans* is a migratory, tree-dwelling bat that is also known to occupy caves, mines, and buildings (Schwartz and Schwartz 1959). Although *L. noctivagans* is presently an uncommon bat in the Trans–Pecos, its presence in the deposits does not necessarily reflect any change in climatic conditions in the area.

Eptesicus fuscus (Beauvois), Big Brown Bat

Material.—Edentulous left mandible (TTU–P–8304); LM_{2-3} (TTU–P–8305).
Discussion.—The material from Upper Sloth Cave closely resembles a modern specimen from Jeff Davis County, Texas. *E. fuscus* commonly inhabits caves, especially in the winter, and has been observed hibernating in nearby caves. Its presence is not unexpected and indicates no climatic change.

Plecotus townsendii (Cooper), Townsend's Big-eared Bat

Material.—LM_{2-3} (TTU–P–8306); RM_{2-3} (TTU–P–8307).
Discussion.—The above-mentioned specimens do not differ significantly from Recent specimens collected in Upper Sloth Cave. During the period of 20 July 1974 to 17 August 1974, Upper Sloth Cave was the site of a nursery colony of *P. townsendii* consisting of approximately 50 individuals. Its presence in the deposit was not unexpected. The presence of *P. townsendii* does not indicate any change in climatic conditions.

Antrozous pallidus (Le Conte), Pallid Bat

Material.—LC_1–M_2 (TTU–P–8308); LM_3 (TTU–P–8309); RM_2 (TTU–P–8310).
Discussion.—*A. pallidus* is a rather common inhabitant of caves and mine shafts in the southwestern United States, thus its occurrence in the deposits was expected. No change in climatic conditions is indicated by this species.

Nothrotherium shastense Sinclair, Shasta Ground Sloth

Material.—Abundant dung balls from the 25 to 45 cm level of trench 1 are referred to this species (TTU–P–8259).
Discussion.—The dung of *N. shastense* is known from only six other North American sites—Rampart Cave and Mauv Caves in the Grand Canyon of Arizona; Gypsum Cave, Nevada; Aden Crater, New Mexico; Williams Cave and Lower Sloth Cave, Guadalupe Mountains National Park, Texas. Radiocarbon dates available for these locations are all 11,000 YBP or older and agree closely with the date of 11, 760±610 YBP (A–1533) on artiodactyl fecal pellets associated with the sloth dung (Van Devender et al 1976a). No bones of *N. shastense* have been recovered from Upper Sloth Cave, but the dung balls agree closely in size and texture with the dung balls from the other North American sites (Paul Martin, pers. comm.). *N. shastense* is the only extinct species represented in the deposits of Upper Sloth Cave.

Sylvilagus sp. Gray

Material.—Two, LP_3 (TTU-P-8379–8380); two, RP_3 (TTU-P-8381–8382).
Discussion.—*S. floridanus* and *S. auduboni* both presently occur in the southern Guadalupe Mountains, with the latter species being more abundant. The presence of this genus gives no indications of climatic conditions due to the wide variety of habitats in which it is found today.

Lepus cf. **L. californicus** Gray, Black-tailed Jackrabbit

Material.—LP_3 (TTU-P-8378).
Discussion.—*L. californicus* is a common inhabitant of grasslands and desert areas of the southwestern United States (Burt and Grossenheider 1964) and is a common inhabitant of the shrub-desert community to the southwest of Upper Sloth Cave. This species does not indicate any change in climatic conditions.

Marmota flaviventris (Audubon and Bachman), Yellow-bellied Marmot

Material.—RP_4 (TTU-P-8255).
Discussion.—The present closest occurrence of *M. flaviventris* to Upper Sloth Cave is in the high mountain forests of northern New Mexico (Fig. 3). *M. flaviventris* has previously been reported from Burnet Cave (Murray 1957) and Dry Cave (Harris 1970b). Murray (1957) attributed the presence of this species at Burnet Cave to the movement of the forests southward and to a lower elevation than where they presently occur. This interpretation is supported by plant macrofossils and pollen samples from the southern Guadalupe Mountains (Van Devender et al. 1976a). In a study of a late Pleistocene fauna from north-central New Mexico, Harris and Findley (1964) pointed out that *M. flaviventris* occurs in other habitats and its presence in conjunction with nonforest forms, as in Dry Cave (Harris 1970b), may indicate an open habitat that now exists even farther to the north. Harris (1970a) suggested that a minimum winter rainfall of at least 2 in. would probably provide enough green fodder to carry *M. flaviventris* through the spring dry season. *M. flaviventris* is an indicator of a more mesic environment than presently occurs in the southern Guadalupe Mountains.

Spermophilus variegatus (Erxleben), Rock Squirrel

Material.—Two LP^4-M^3 (TTU-P-8244–8245); four, $RM_{1\text{ or }2}$ (TTU-P-8246–8249); two, LM_1 (TTU-P-8250, 8254); LM^1 (TTU-P-8251); RP^4 (TTU-P-8252); R and L P^4-M^2 (TTU-P-8253).
Discussion.—The material referred to this species is indistinguishable in size and morphology from modern specimens from Culberson County, Texas. *S. variegatus* is a common inhabitant of rocky areas throughout the southern Gaudalupe Mountains, and has been observed in the immediate vicinity of Upper Sloth Cave. This species is of little value as a climatic indicator.

Thomomys bottae (Eydoux and Gervais), Botta's Pocket Gopher

Material.—Four, LP_4 (TTU-P-8384–8386, 8390); three, RP_4 (TTU-P-8392–8393, 8387); two, $LM^{1\text{ or }2}$ (TTU-P-8388–8389); $RM^{1\text{ or }2}$ (TTU-P-8391).
Discussion.—*T. bottae* is the most abundant pocket gopher in the higher elevations of the Guadalupe Mountains today. *T. bottae* occupies valleys and mountain meadows of the southwestern United States, where it prefers a loamy soil, but it also occurs in sandy or rocky soil (Burt and Grossenheider 1964). This species is of little value as a climatic indicator.

Pappogeomys castanops (Baird), Yellow-faced Pocket Gopher

Material.—LP_4 (TTU-P-8383).
Discussion.—*P. castanops* is found primarily on the high plains and in mountain basins (Blair et al. 1957) and is found in the Guadalupe Mountains today. This species is of little use as a climatic indicator.

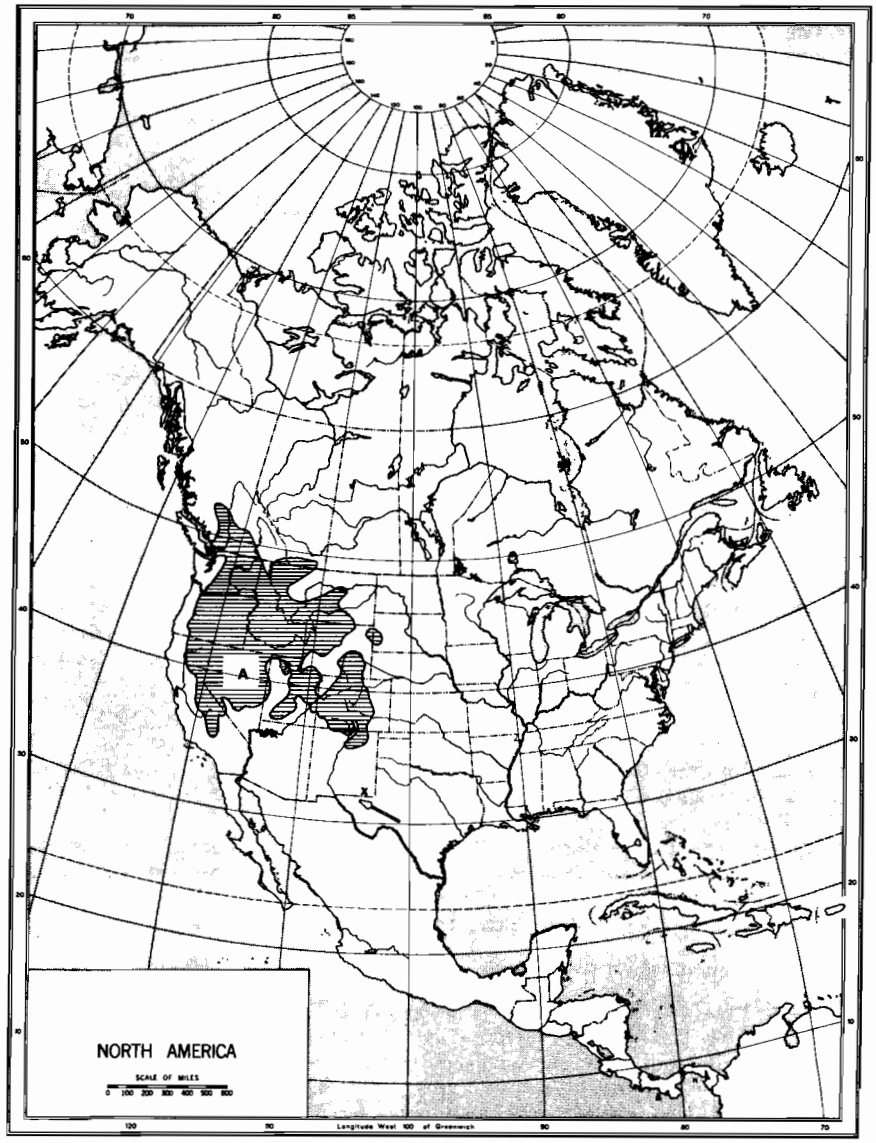

Fig. 3. Recent distribution (A) and Pleistocene occurrences (x) of *Marmota flaviventris*.

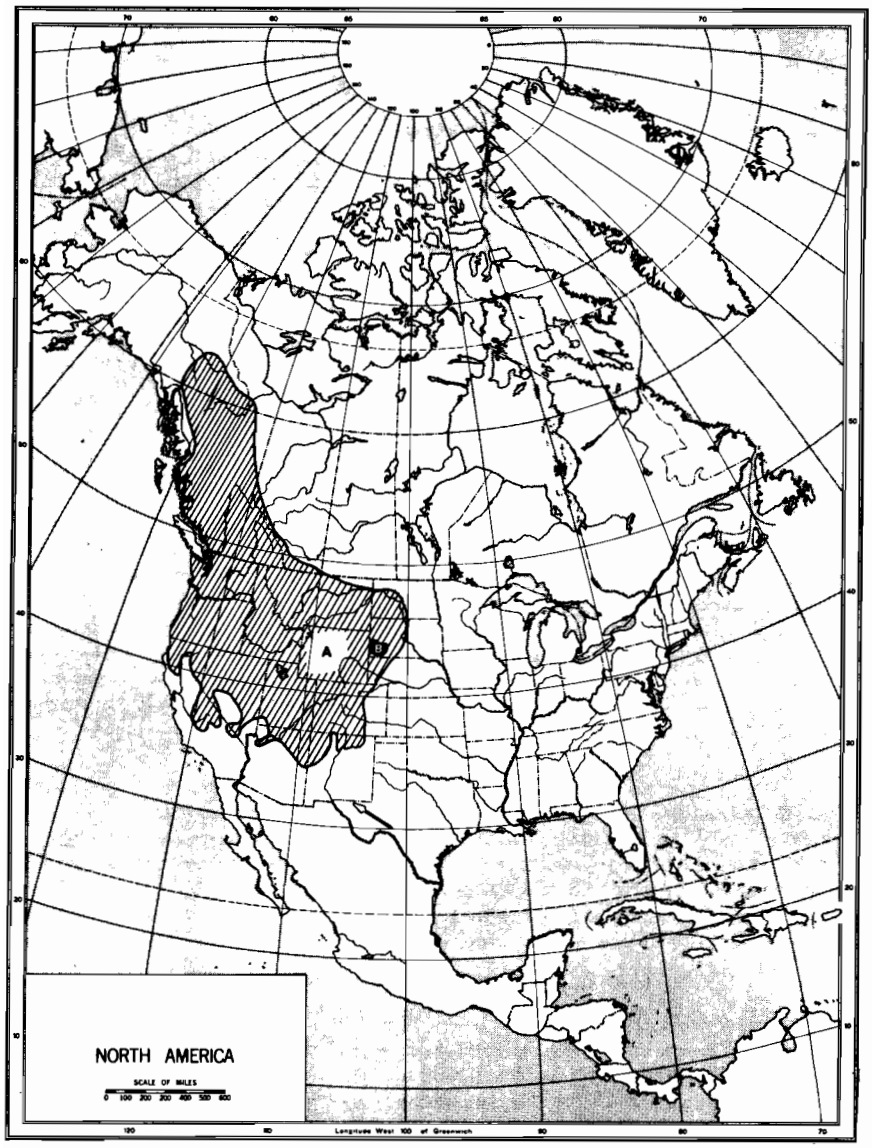

Fig. 4. Recent distribution (A) of *Neotoma cinerea* and present area of sympatry (B) for *Sorex cinereus, Cryptotis parva, Marmota flaviventris,* and *Neotoma cinerea.*

Peromyscus spp. Gloger

Material.—Abundant fragmentary material.
Discussion.—*P. eremicus, P. leucopus, P. maniculatus, P. boylei, P. truei, P. difficilis*, and *P. pectoralis* all presently occur in the southern Guadalupe Mountains (Genoways et al. 1977). Of these seven species, only *P. eremicus* can be identified to species with any degree of certainty on the basis of fragmentary material. *P. eremicus* is differentiated from the other six species by the lack of, or, at the most, rudimentary accessory cusps in the two principal outer angles of the M^1 and M^2 (Hall and Kelson 1959). Due to the extreme range in habitats occupied by members of this genera and the difficulty of distinguishing the various species, *Peromyscus* are nearly useless as climatic indicators.

Peromyscus eremicus (Baird), Cactus Mouse

Material.—RM^{1-2} (TTU-P-8394); RM^1 (TTU-P-8395).
Discussion.—Characters to differentiate *P. eremicus* have already been discussed in the previous account of *Peromyscus* spp. *P. eremicus* is an inhabitant of deserts from central Mexico through the southwestern United States (Blair et al. 1957). The presence of this species in the fauna does not indicate any change from present climatic conditions.

Neotoma cinerea (Ord), Bushy-tailed Woodrat

Material.—RM^1 (TTU-P-8264); RM_2 (TTU-P-8265); LM_1 (TTU-P-8266); three, LM_2 (TTU-P-8267-8270); RM_2 (TTU-P-8271); LM_{1-2} (TTU-P-8272).
Discussion.—*N. cinerea* is differentiated from *N. mexicana* on the basis of accessory cusps developed in the re-entrant angles of some of the teeth (Lundelius 1976), a condition found in 50% of the Recent specimens of *N. cinerea* examined and lacking in all Recent specimens of *N. mexicana* examined.

N. cinerea is essentially a boreal animal and is found at higher latitude or higher elevations today (Hall and Kelson 1959). The present closest population of *N. cinerea* to Upper Sloth Cave is in the mountains of north-central New Mexico (Fig. 4). The presence of *N. cinerea* in the fauna is an indicator of cooler and/or more mesic conditions than now exist in the southern Guadalupe Mountains.

Neotoma mexicana Baird, Mexican Woodrat

Material.—Abundant isolated teeth from all levels of trench 1 and trench 2.
Discussion.—*N. mexicana* is identified on the basis of dentine tracts on the anteroexternal sides of the M_1 that extend from one-fourth to one-third the distance from the root to the crown of an unworn tooth. The dentine tracts on the M_2 are shorter (Lundelius 1977).

This species is very common among the limestone ledges and cliff faces that dominate the west face of the Guadalupe Mountains. *N. mexicana* is not useful as a climatic indicator.

Neotoma micropus (Hartly), Southern Plains Woodrat

Material.—LM_1 (TTU-P-8400).
Discussion.—Dalquest et al. (1969) separated *N. micropus* from *N. albigula* on the width of the second lophid of the M_1. They found that this measurement in *N. albigula* was always less than 1.94 mm whereas in *N. micropus* this measurement was always greater than 1.94 mm. This criterion was followed in the identification of the *Neotoma* from Upper Sloth Cave. When these two species are sympatric, *N. albigula* is restricted to rocky areas and *N. micropus* is restricted to more open areas (Finley 1958). *N. micropus* presently occurs in the flats in the western portion of the park.

Neotoma albigula (Baird), White-throated Woodrat

Material.—Two, LM_1 (TTU-P-8401-8402); RM_1 (TTU-P-8403).
Discussion.—Criteria for identification and habitat preferences were discussed in the preced-

ing account of *N. micropus*. *N. albigula* occurs at middle to lower elevations in the park at present.

Microtus mexicanus (Saussure), Mexican Vole

Material.—Abundant isolated teeth.
Discussion.—*M. mexicanus* presently occurs in grassy meadows in the higher elevations of the southern Guadalupe Mountains and is common in local areas. The presence of this species in the fauna does not indicate any significant change in climatic conditions.

Bassariscus astutus (Lichtenstein), Ringtail

Material.—LP_3 (TTU-P-8256); LM_1 (TTU-P-8257).
Discussion.—*B. astutus* is an inhabitant of the more rocky areas of the southern Guadalupe Mountains where it feeds on a wide variety of small mammals, birds, insects, and plants. This species does not indicate any change in climatic conditions.

Mustela frenata (Lichtenstein), Long-tailed Weasel

Material.—RP_3-M_3 (TTU-P-8258).
Discussion.—*M. frenata* has not been taken from the Guadalupe Mountains National Park in Recent times (Genoways et al. 1977) although it occurs widely in the United States and Mexico. It has been recorded from Culberson County (Davis 1966:87). *M. frenata* is found in a variety of habitats and is therefore not useful as an ecological indicator.

Felis concolor Linnaeus, Mountain Lion

Material.—RdP_3 (TTU-P-8311).
Discussion.—*F. concolor* presently occurs in limited numbers in the southern Guadalupe Mountains. The presence of this species in the deposit was not unexpected and gives no information concerning climatic conditions.

CLIMATIC INTERPRETATIONS

Upper Sloth Cave provides a good record of faunal transition from a more mesically adapted vertebrate community to the present more xerically adapted vertebrate community. Five taxa of xerically adapted vertebrates are found in the 0 to 10 cm level of trench 2, whereas only two taxa of mesically adapted vertebrates occur in this level. The 10 to 20 cm level of trench 2 presents the opposite picture, with five taxa of mesically adapted vertebrates and only two taxa of xerically adapted vertebrates still present in the deposit. In the 20 to 30 cm level, one additional taxon of mesically adapted vertebrate is gained, whereas all xerically adapted vertebrates are absent. This drop in the number of mesically adapted taxa can probably be attributed to the relatively small amount of matrix removed from the 20 to 30 level of trench 2 because of the configuration of the cave walls at this depth. The actual numbers of specimens obtained also follow the trends discussed above.

If we assume that *Sorex cinereus, Cryptotis parva, Marmota flaviventris*, and *Neotoma cinerea* existed contemporaneously in the vicinity of Upper Sloth Cave and look for a modern area of sympatry, we find that the eastern portion of the Black Hills of South Dakota is the only area where these four taxa presently occur together. The elevation of the Black Hills is

similar to that of Upper Sloth Cave and the vegetation of the Black Hills is similar to that proposed for the southern Guadalupe Mountains by Van Devender et al. (1976b). On the basis of the previously discussed floral and faunal similarities, we are therefore postulating that approximately 11,000 years ago the climatic conditions in the southern Guadalupe Mountains may have been similar to the climatic conditions existing in the Black Hills of South Dakota today.

This more xeric trend in the southern Guadalupe Mountains may have begun approximately 11,500 years ago and been a contributing factor in the extinction of the Shasta Ground Sloth, *Nothrotherium shastense*, or it may not have started until as late as 5000 years ago as suggested by Van Devender and Worthington (1977). Lack of a radiocarbon date directly associated with the deposits in trench 2 precludes a more definite timetable.

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ACKNOWLEDGMENTS

We would like to thank Mr. Donald Dayton, Superintendent of Guadalupe Mountains National Park and the National Park Service for permission to excavate Upper Sloth Cave. Dr. Gary Ahlstrand, John Chapman, Phil Van Cleave, and Charlie Peterson of the National Park Service assisted in many ways. We would also like to extend a special thanks to Roger Reisch for his invaluable friendship and assistance in all phases of this project. Richard Fullington, Dallas Museum of Natural History, and Hal Pierce, Department of Geosciences, Texas Tech University, identified the

molluscan fauna. Dr. Thomas Van Devender, University of Arizona, assisted in some of the reptile identifications as well as identifying all the plant macrofossils. Dr. Paul Martin, University of Arizona, provided all radiocarbon dates as well as the pollen analysis and many valuable hours of discussion. Drs. Ernest Lundelius, University of Texas at Austin, Arthur Harris, University of Texas at El Paso, and Hugh Genoways, Texas Tech University, provided access to collections in their care as well as participating in many hours of discussion. Albert Hernandez sorted the bulk of the screened concentrate. Dave Bohaska provided invaluable assistance during the excavations. We would also like to thank the many others, too numerous to mention by name, who have contributed to the completion of this project.