Supplemental data for: Stegner (2016) Stasis and change in Holocene small mammal diversity during a period of aridification in southeastern Utah. *The Holocene* DOI: 10.1177/0959683616632894

Supplemental 1: Excavation elevations.

Site/ Level	Average Level thickness (cm)
RBA	
1	9.2
2	9.8
3	14
4	9.9
5	13.5
6	8.6
ECR2	
1	5.5
2	5.8
3	8.3
4	7.5
5	6.1
6	5
7	4.6
8	4.7
9	3.4
10	2.3

Supplemental 2: Systematic Paleontology.

CLASS: MAMMALIA

ORDER: CHIROPTERA Blumenbach 1779

FAMILY: Vespertilionidae Gray 1821

Vespertilionidae indet.

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233619, tooth. UCMP Locality V36222 (RBA): UCMP 231407.

ORDER: RODENTIA Bowditch 1821

FAMILY: HETEROMYIDAE Gray 1868

SUBFAMILY: PEROGNATHINAE Coues 1875

Perognathinae indet.

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233288, 233353, 233381, 233565,233672, 233690, 257372-257373, right and left dentaries with and without cheekteeth; UCMP 233384, m1/2; UCMP 233449, Lm3; UCMP 233279, p4; UCMP 233415 palate with P4M1. UCMP Locality V36222 (RBA): UCMP 231272, 231416, 231435, 231472, 231508,

231623, 231632, m1s, m2s, m3s, p4s; UCMP 231474, 231558-231559, 237665, UCMP dentaries with and without teeth. UCMP 231554, left maxilla with P4
Remarks—Teeth of perognathines are low-crowned and rooted, with two transverse lophs. As compared to other heteromyids, teeth referred here are too small and low-crowned to be *Microdipodops*, *Liomys*, or *Dipodomys* (further, *Dipodomys* have unrooted teeth).

GENUS: *DIPODOMYS* Gray 1841
Dipodomys sp.
Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233266-233267, 233271, 231277, 231647, 233291, 233301-233302, 233305-233309, 233323-233324, 233332-233333, 233364, 233386-233391, 233393-233395, 233408-2333411, 233426, 233440-233442, 233450-233451, 233502-233504, 233521-233522, 233535-233537, 233553-233555, 233563, 233579233581, 233593, 233613, 233630, 233632m 233634, 233644, 233652, 233660, 233668, 233675-233678, 233686, 233691, 233696, 233697, 233699, 233705, 233712, 257400, 257422, 257436, cheekteeth; UCMP 233251-233254, 233292-233294, 233350, 257399, 257406, dentaries with cheekteeth; UCMP 233428-233429, 233714, 257369, 257389, 257391, maxillae with teeth; UCMP 257405, partial skull. UCMP Locality V36222 (RBA): UCMP 231293-231297, 231317-231319, 231333-231336, 231255-231358, 231364, 231367-231368, 231388-231390, 231400-231401, 231408-231412, 231428-231430, 231458-231461, 231463, 231465-231470, 231494-231501, 231515-231521, 231542, 231563-231565, 231568-231572, 231575-231589, 231615-231620, 231627, 231642-231644, 231664, 231666-231668, 238400-238405, cheekteeth; UCMP 231464, 231567, 231561, dentaries with cheekteeth; UCMP 231328, skull; UCMP 231562, 231566, maxillae; UCMP 231323, 231462, tooth sockets.
Remarks—Teeth of *Dipodomys* are easily distinguished from other North American Heteromyid genera because they are un-rooted. *Dipodomys* teeth are superficially similar to the cheekteeth of *Thomomys*—both are ever-growing and are composed of an anterior and posterior enamel plate—with is particularly relevant for identifying broken specimens. However, *Thomomys* teeth are considerably more robust, taller, and angle strongly from root to occlusal surface.

FAMILY: CRICETIDAE Fischer 1817
SUBFAMILY: ARVICOLINAE Gray 1821
Arvicolinae indet. (aff. *Microtus* or *Lemmiscus*)
Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233403, 233542, 233636, 257392, 257414, 257424, cheekteeth. UCMP Locality V36222 (RBA): UCMP 231421, 231493, 231591, 231645, cheekteeth.

GENUS: *MICROTUS* Schrank 1798
Arvicolinae indet. (aff. *Microtus*)
Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 257357, m12. UCMP Locality V36222 (RBA): UCMP 231492, Rm1.

GENUS: *LEMMISCUS* Thomas 1912
Lemmiscus c.f. curtatus Cope 1868
Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233404, left dentary with m12; UCMP Locality V36222 (RBA): UCMP 231452, 231512, m1s

Summary remarks for Subfamily Arvicolinae—In m1s of *Microtus,* triangle 2 is distinctly smaller than triangle 1, while in m1s of *Lemmiscus*, triangle 2 is equal in length or longer than triangle 1 (Bell et al., 2004). All other specimens are referred to Arvicolinae indet because they lack diagnostic characters.

SUBFAMILY: NEOTOMINAE Merriam 1894

Neotominae indet. (aff. *Peromyscus* or *Onychomys*)

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233354, 233356-233357, 233380, 233467, 233470, 233606, 233628-233629, 233666, 233685, 257384, 257407, 257435, left and right dentaries, some with cheekteeth; UCMP 233465-233466, 233510, 257344, left and right maxillae with cheekteeth; UCMP 233312-233313, 233455, 233506, 233509, 233526-233528, 233530, 233544, 233564, 233585, 233607, 233612, 233615, 233622, 233667, 233692, 233713, 233716, 257394, 257397, 257416, upper and lower cheekteeth. UCMP Locality V36222 (RBA): UCMP 231271, 231273, 231274, 231275, 231478-231479, 231555, 231607, fragmentary left and right dentaries; UCMP 231403, maxilla with M2; UCMP 231288, 231374-231375, 231404, 231432, 231434, 231473, 231534-231536, 231605, 231622, 231650-231651, upper and lower molars.

Remarks—Specimens referred to Neotominae indet lack morphological characters that identify them to a finer taxonomic level. Among species that occur on the Colorado Plateau today, *Peromyscus*, *Reithrodontomys*, and *Onychomys* are all morphologically similar to the specimens reported here. Teeth *Reithrodontomys* and *Baiomys* (not present on the Colorado Plateau, but ranges into southern Arizona and Texas) are smaller than those of *Peromyscus* and *Onychomys*, but are a number of morphological differences as well (Hillson, 2005).

GENUS: *PEROMYSCUS* Gloger 1841

Peromyscus sp.

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233256, 233269, 233355, 233380233430, 233444, 233468, 233629, 233470 left and right dentaries with and without cheekteeth; UCMP 233257, 233445, 233466-233465, 233469, 233472, 233473, left and right maxillae with teeth; UCMP 233278, 233382-233383, 233385, 233442, 233505, 233507, 233509, 233526, 233529-233530, 233577, 233583-233584, 233586-233588, 233621, 233641-233642, upper and lower molars. UCMP Locality V36222 (RBA): UCMP 231476, 231537, left dentaries with molars; UCMP 231479, 231557, right dentary without molars; UCMP 231347, 231560, 231649, left and right maxillae with M12; UCMP 231254, 231276, 231287, 231309-231310, 231339, 231361, 231418, 231431, 231506-231507, 231531-231532, 231535, 231608, 231631, upper and lower molars.

GENUS: *ONYCHOMYS* Baird 1858

Onychomys sp.

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233255, 2333354, 233414, 233647, left and right dentaries with and without molars; UCMP 233342, 233508, 233661, M2s; UCMP 233413, maxilla with M1; UCMP 233510, right maxilla with M2; UCMP 233471, M1; UCMP 233506, 233531, 233582, Lm1s. UCMP Locality V36222 (RBA): UCMP 231289-231290, 231475, 231477, 231480, 231555, 231606, left and right dentaries with and without cheekteeth; UCMP 231286, 231417, 231433, 231504-231505, 231533, 231539, 231621, upper and lower molars.

Summary remarks for *Onychomys* and *Peromyscus*—*Onychomys*** and *Peromyscus* overlap in molar size, but *Peromyscus* usually has additional folds of enamel between the main cusps in both upper and lower molars (Hillson, 2005; Hooper, 1957). In *Onychomys*, the upper and lower 3rd molars are simplified: the M3 is peg-like and round, and the m3 is shaped like and 8, with a much larger anterior loop. In *Peromyscus*, the m3 is S-shaped, and the M3 is pocked with infundibula. The upper and lower first molars in *Peromyscus* have a more-infolded anterior loop, often with three lobes. *Onychomys* tends to have a single or, at most, double-lobed anterior loop in the first molars.

GENUS: *NEOTOMA* Say and Ord 1825

Neotoma spp.

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233248, 233457, 233459, 233562, 233627, 257358, 257362, 257393, left and right dentaries, some with molars; UCMP 233222, 233241, 257401, 257427, 257432, maxillae, some with teeth; UCMP 233230, skull; UCMP 233261, 233270, 233276, 233327-233328, 233339-233340, 233349, 233367-233368, 233405-233406, 233421, 233448, 233458, 233501, 233543, 233552, 233578, 233600-233601, 233620, 233625-233626, 233683, 233698, 257366, 257368, 257370, 257387-257388, 257396, 257398, 257410, 257418, 257433, 257434, 257437, 257438, upper and lower cheekteeth. UCMP Locality V36222 (RBA): UCMP 231240, 231242, 231277, 231325, 231425, 231427, left and right dentaries, some with molars; UCMP 231442-231443, 231659, left and right maxillae, some with molars; UCMP 231247-231252, 231298-231301, 231311-231313, 231326, 231327, 231340-231342, 231344-231346, 231349, 231372-231373, 231391, 231402, 231419, 231426, 231444-231448, 231486-231488, 231511, 231546, 231590, 231610, 231626, 231634, 231661, 257491, upper and lower cheekteeth.

Remarks—*Neotoma* are semihypsodont and have no cementum in their reentrants; their teeth and cranial elements are easily morphologically distinguished from other Cricetids using criteria detailed by Repenning (2004). Because species of *Neotoma*, with the exception of *N. cinerea*, are extremely similar in size and morphology, specimens referred to *N. spp.* may represent more than one species. There are no reliable dental characters for distinguishing species of *Neotoma* from one another, except perhaps *N. cinerea* which is not present in these deposits (Grayson, 1988; Mead et al., 2003; Mead and Phillips, 1981). *Neotoma albigula* is present around Rone Bailey Mesa today.

FAMILY: GEOMYIDAE Bonaparte 1845

GENUS: *THOMOMYS* Wied-Neuwied 1839

Thomomys sp.

Referred Specimens—UCMP Locality V36221 (ECR2): 233303, 233310, 233318-233321, 233329-233331, 233341, 233351, 233369-233379, 233392, 233412, 233425, 233427, 233437, 233460-233463, 233490-233498, 233512-233520, 233538-233540, 233638, 23343, 233670-233671, 233687, 233702-233704, 233711, 233715, upper and lower cheekteeth; UCMP 233594, right dentaries. UCMP Locality V36222 (RBA): 231260-231262, 231302, 231304, 231314-231316, 231329-231332, 231352-231354, 231363, 231366, 231369, 231371, 231385-231387, 231395-231396, 231398, 231414-231415, 231420, 231423, 231436-231437, 231456, 231491, 231523, 231525-231529, 231540-231541, 231548, 231550, 231597-231604, 231614, 231629-

231630, 231636-231638, 231640-231641, 237669, 238406-238407, upper and lower cheekteeth; UCMP 231278, maxilla with cheekteeth; UCMP 231305, left dentary fragment.

*Thomomys (*subgenus *Thomomys)* sp. Elliot 1903

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233352, right dentary fragment with m1-3. UCMP Locality V36222 (RBA): UCMP 231258, 231259, p4s.

*Thomomys (*subgenus *Megascapheus)* sp. Elliot 1903

Referred Specimens— UCMP Locality V36221 (ECR2): UCMP 233322, 233407, 233541, p4s; UCMP 233595, left dentary fragment with p4. UCMP Locality V36222 (RBA): UCMP 231303, 231370, 231397, 231457, 231489-231490, 231524, 231530, 231549, 231596, p4s; UCMP 231613, 231628, P4s.

Summary remarks for genus *Thomomys*—Specimens identified to subgenus are all p4s or P4s. Subgenus *Megascapheus* has a flat anterior enamel plate that is widely separated from the lingual and buccal enamel plates; in subgenus *Thomomys*, this enamel plate is broad, recurved forming a shallow reentrant, located antero-lingual, and is very close to the more posterior lingual enamel plate (Thaeler, 1980). In subgenus *Megascapheus*, the P4 is strongly anteriorly angled and the infraorbital foramina are anterior to incisive foramina, and the angular process is continuous with the well-developed flange on the ventral surface of the jaw (Tomiya et al., 2011).

FAMILY: SCIURIDAE Fischer 1817

Sciuridae indet.

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233317, 233334, 233614, 233635, 233656, 233659, upper cheekteeth; UCMP 233236, 233436-233447, 233499, 233598, 233653-233654, 233658, lower cheekteeth; UCMP 233347-233348, dentary fragments. UCMP Locality V36222 (RBA): UCMP 231453, 231514, 231611, 231625, 231646, upper cheekteeth; UCMP 231253, 231405, 231413, 231592-231595, lower cheekteeth.

Remarks—These small sciurid teeth overlap in size with *Ammospermophilus*, *Tamias*, and small ground squirrels. Finer taxonomic identification may be possible by morphological comparison to known modern specimens

GENUS: *CYNOMYS* Rafinesque 1817

Cynomys (subgenus *Leucocrossuromys*) sp.

Referred Specimens—UCMP Locality V36221 (ECR2): 233235, 233596, m3s; UCMP 233250, left dentary with p4m1-3.

Cynomys (*c.f.* subgenus *Leucocrossuromys*) sp.

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233289, 233597, 233599, 257367, 257409, cheekteeth; UCMP 257428, 257430, maxillae. UCMP Locality V36222 (RBA): UCMP 231454-231455, 231547, cheekteeth.

Summary remarks for genus *Cynomys*—*Cynomys* is easily distinguished from other sciurids; *Cynomys* has a deep trigonid trench lingual to the ectolophid, not present in other sciurids (UCMP 233235). As compared to ground squirrels (*Otospermophilus*, *Callospermophilus*, *Xerospermophilus*, *Poliocitellus*, *Ictidomys*, *Urocitellus*, *Spermophilus*, *Notocitellus*, and

Ammospermophilus) and *Marmota*, the cheekteeth are higher-crowned and the trigonid is higher relative to the talonid (UCMP 233250) (Goodwin, 2004; Hillson, 2005). Upper molars in *Cynomys* are mesiodistally compressed (UCMP 233289).

The two subgenera of *Cynomys*, *C.* (*Cynomys*) (black-tailed prairie dogs) and *C.* (*Leucocrossuromys*) (white-tailed) can be distinguished by several dental features described in Goodwin (1993) and (2004). UCMP 233235, 233250, and 233596 were identified by features of the m3s that distinguish *C.* (*Leucocrossuromys)* from *C. (Cynomys)*: 1) a crescent-shaped trench separating the talonid from the hypoconid, ectolophid, and protoconid is blocked by a bridge (in *C.* (*Cynomys*) this trench is unobstructed); and 2) there is a prominent bridge connecting the ectolophid and trigonid platform (Goodwin, 2004). All other specimens were referred to C. (*c.f. Leucocrossuromys*).

ORDER: LAGOMORPHA Brandt 1855

FAMILY: LEPORIDAE Fischer 1817

Leporidae spp.

Referred Specimens—UCMP Locality V36221 (ECR2): UCMP 233242, 23335, 233424, 233481-233483, 233523-233524, 233549, 233669, 257415, 257431, P2s; UCMP 233684, 233694, 233696, 233700, 233718, M3s; UCMP 233361, 233571, 233680, p3s; UCMP 257419, m3s; UCMP 233243-233244, 233343, 233359-233360, 233416, 233423, 233438, 233475-233478, 233500, 233548, 233556, 233589-233591, 233602-233604, 233617, 233639-233640, 233664-233665, 233688, 233709, 257386, upper cheekteeth; UCMP 233237-233238, 233264, 233272-233273, 233280-233281, 233297-231299, 233311, 233316, 233362, 233396, 233439, 233479-233480, 233546-233547, 233570, 233572, 257347, 257421, 257423, lower cheekteeth; UCMP 233258, 233296, 233358, 233363, 233456, 233474, 233605, 233682, 233710, 257342, 257343, left and right dentary fragments, some with teeth; UCMP 233249, 233295, 257404 left and right maxillae, some with teeth; UCMP 257355, 257364, 257375, 257378, cheekteeth. UCMP Locality V36222 (RBA): UCMP 231243-231244, 231267-231270, 231392-231393, 231450-231451, 231510, 231551-231553, 231655, upper cheekteeth; UCMP 231280-231283, 231291, 231365, P2s; UCMP 238408, M3; UCMP 231279, 231348, 231663, lower cheekteeth; UCMP 231255-231257, 231320, 238409, m3s; UCMP 231241, 231449, 231265-231266, fragmentary left and right dentaries with teeth; UCMP 231308, palate.

Remarks—The three genera of North American leporid—*Lepus*, *Sylvilagus*, and *Brachylagus*—are distinguishable from *Ochotona*, the only other North American Lagomorph, in that, on the lower cheekteeth the lingual reentrant is much deeper and anterior and posterior lophs are roughly the same width (buccal-lingual) in *Ochotona*, whereas in leporids the anterior loph is wider than the posterior. Upper cheekteeth of *Ochotona* also have deeper lingual and buccal reentrants.

There are no dental characters that definitively distinguish *Lepus* and *Sylvilagus*. The P2s *Brachylagus* have a single anterior reentrant, whereas in *Lepus* and *Sylvilagus* there are two. Cheekteeth in all three species are morphologically very similar, but *Brachlagus* is smaller than both *Lepus* and *Sylvilagus*. However, cheekteeth from juveniles and small individuals of *Lepus* and *Sylvilagus* could be confused with *Brachylagus*. Non-dental morphological differences between *Lepus* and *Sylvilagus* are few, and none pertain to the available fossil material. Specimens too large to be *Brachylagus* are referred to Leporidae spp. (aff. *Lepus* or *Sylvilagus*).

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Supplemental 3: Dental patterns and morphological affinity of ECR2 and RBA fossil *Peromyscus* to known species. Dental types form Hooper (1957): a=enamel valley unobstructed; neither mesoloph/id nor mesostyle/lid present; b=a style present, unattached to neighboring cusps or lophs; no mesoloph; c=a style only, one face of it joined to the paracone (or entoconid); d=a style joined to a loph that projects from positions 4 or 5 (indicates loph projects from side of paracone and curves toward style); e=a style fused with a loph that extends from positions 6 or 7 (loph extends from the mure, not the paracone); f=style and loph not united, the style of any type the loph arising from position 5, 6, 7, but not reaching the style; g=style absent, loph arising at positions 4-7, but terminating short of the tooth's margin.

UCMP #	Site	Level	Tooth	Species affinity	Type of mesoloph(id)/ mesostyle(id), if present in M1	Mesoloph(id) present in M1	Meso style (id) Present in M1	Type of mesoloph(id)/ mesostyle(id), if present in M2 (see key)	Meso loph(id) present in M2	Meso style (id) Present in M2
233257	ECR2	1	LM12	P. maniculatus P. boylei	g	X		d,e	X	X
233269	ECR2	1	Rm123	P. maniculatus P. crinitus	a			a		
233256	ECR2	1	Lm123	P. maniculatus P. crinitus	a			a		
233713	ECR2	3	Lm1	P. crinitus	a					

				P. maniculatus						
233383	ECR2	4	RM1	P. boylei P. truei	e	X	X			
233380	ECR2	4	Rm123	P. crinitus P. maniculatus	a			a		
233443	ECR2	5	LM1	P. boylei P. truei	e	X	X			
233444	ECR2	5	Lm12	P. maniculatus	c		X	a		
233526	ECR2	6	LM1	P. boylei P. truei	e	X	X			
233472	ECR2	6	LM1	P. maniculatus	c		X			
233507	ECR2	6	LM1	P. maniculatus P. boylei	d	X	X			
233469	ECR2	6	RM1	P. maniculatus P. boylei	d	X	X			
233577	ECR2	7	LM1	P. boylei P. maniculatus	d	X	X			
233586	ECR2	7	LM1	P. boylei P. truei	e	X	X			
233584	ECR2	7	Rm1	P. crinitus P. maniculatus	a					
233588	ECR2	7	RM1	P. maniculatus	f	X	X			
233587	ECR2	7	LM123	P. maniculatus	c		X	c	X	
233583	ECR2	7	Lm1	P. maniculatus P. crinitus	a					
233621	ECR2	8	LM1	P. crinitus	b		X			
231254	RBA	1	RM1	P. boylei P. truei	e	X	X			
231309	RBA	1	LM1	P. boylei P. truei	e	X	X			
231287	RBA	1	LM1	P. crinitus	a					
231310	RBA	1	Lm1	P. crinitus P. maniculatus	a					
231276	RBA	1	Rm1	P. crinitus P. maniculatus	a					
231375	RBA	2	Lm1	P. crinitus P. maniculatus	a					
231339	RBA	2	Rm1	P. crinitus P. maniculatus	a					
231347	RBA	2	RM12	P. maniculatus	a			c		X
231361	RBA	2	Rm1	P. maniculatus P. truei	g	X				
231431	RBA	3	Rm1	P. maniculatus P. truei	g	X				
231535	RBA	4	LM1	P. boylei P. maniculatus	g	X				
231506	RBA	4	LM1	P. boylei P. truei	e	X	X			

231537 RBA	4	Lm123	P. crinitus	b		X	a		
231531 RBA	4	Rm1	P. crinitus	b		X			
231532 RBA	4	Lm1	P. crinitus P. maniculatus	a					
231560 RBA	5	LM12	P. boylei P. truei	d,e	X	X	d,e	X	X
231608 RBA	5	RM1	P. boylei P. truei	e	X	X			
231631 RBA	6	LM1	P. boylei P. maniculatus	g	X				
231649 RBA	6	LM12	P. boylei P. truei	e	X	X	e	X	X