Archaeological Investigations Associated with Mission San Juan (41BX5) Church Underpinning, San Antonio, Bexar County, Texas

by
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Lynn K. Wack, Lori Barkwill Love,
Steve A. Tomka, Mark P. Luzmoor,
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Volume II

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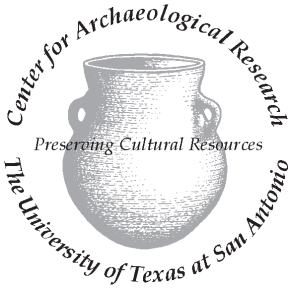

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Raymond P. Mauldin

Appendix 1

Radiocarbon Dating of Bone Collagen from Room 17 at Mission San Juan

Raymond P. Mauldin

This appendix presents the results of 10 radiocarbon samples run on bone collagen samples from faunal remains collected during the CAR's work at Room 17, Mission San Juan. The dates were on selected faunal remains on which we had previously run stable carbon and nitrogen isotopic analysis (see Appendix 7). Samples were selected based on collagen quality measures and on stratigraphic location. Initially, two broad strata, designated as "upper" and "lower," were defined in the sediments surrounding Room 17 at Mission San Juan. This stratigraphic distinction, defined in part on impressions gleaned by the excavators during the Phase 1 test unit (TU) work (see Chapter 5), were thought to reflect a minimally disturbed earlier Colonial deposit in the lower strata and an upper deposit containing a mix of later Colonial and more recent materials. CAR recommended that the sediment removed from around Room 17 during Phase 3 be provenienced and screened following this upper and lower distinction, and cultural material was collected in that manner. However, subsequent analysis of the Phase 1 material (Chapter 13) showed that this original stratigraphic distinction might not have been useful, an impression that we can support through the radiocarbon results presented in this appendix. The radiocarbon results show that there is significant mixing of the deposits. At least in terms of the dated faunal material, there is a low probability that any of the samples represent an early Colonial period occupation. One bone sample, collected from near the top of the lower strata, produced a modern age. Eight of the remaining nine samples likely date between about AD 1800 and the 1930s, and there is no patterning between the date ranges and upper and lower distinctions. The remaining sample, identified as bison (Bison bison), had a date range of between AD 1453 and 1633 (95.4% probability). This sample dates from the Terminal Late Prehistoric (Toyah) period, suggesting that some of the chipped stone and brownware ceramics that have been assumed to correlate to mission occupations may reflect this earlier period.

Sample Selection and Preparation

Prior to submission, the $\delta^{13}C$ of all bone collagen samples, along with their C:N ratios (see Ambrose and Norr 1992), were measured independently (see Appendix 7). The stable carbon isotopic ratio is used to correct for isotopic fractionation on individual samples. In addition, the C:N ratios, gathered during the course of the stable isotope work, provide an independent measure of collagen quality. For isotopic analysis, the C:N ratios above 2.9 and below 3.6 have been identified as providing good quality collagen, with modern, unaltered terrestrial mammal bone having ratios of around 3.2 (see Ambrose and Norr 1992; DeNiro 1985). Research by van Klinken (1999) suggests that a more limited C:N ratio is advisable for radiocarbon analysis of collagen. We used a range of above 3.05 and below 3.45 to identify good candidates for dating (see van Klinken 1999). This C:N range was present in all but one of the available bone samples (see Appendix 7).

We focused on dating the upper and lower components identified during Phase 1. Excavators first identified this distinction during work in TUs 9 and 10. We concentrated on sampling in these two units, selecting six samples. We also selected four additional samples from Sections C, J, and F to reflect other areas surrounding Room 17. The 10 selected specimens were split such that five samples were from the upper strata and five were from the lower strata. We focused on larger mammals and a mix of domesticated and non-domesticated species. Samples were from deer (n=3), bison (n=3), cow (n=2), and sheep/goat (n=2).

Table A1-1 provides a summary of the 10 San Juan samples selected for processing, along with two control samples. The table includes the previously measured $\delta^{13}C$ values, the C:N ratio of selected samples, and the sample provenience. The two control samples are both from a single bison recovered from excavations near Plainview, Texas. This sample has been previously dated by Beta Analytic to 3490 ± 40 radiocarbon years before present (RCYBP; Frederick et al. 2008). Bone from this animal is routinely included in our collagen dating work.

All sample preparation work for radiocarbon dating was conducted at the Paleo Research Laboratory (PRL) at CAR-UTSA. For radiocarbon dating, we followed an acid-base-acid procedure for bone collagen preparation outlined by Brock et al. (2010)

Table A1-1. Archaeological Samples and Controls Processed for Radiocarbon Dating

Sample Designation	CAR Sample #	Animal	Common name	Measured $\delta^{13}C$ (‰)	C:N Ratio	Provenience
PVB Standard B1	174	control *(Bison bison)*	Bison standard	-9.9	3.2	Plainview Texas, Previously dated
3011	175	*Odocoileus virginianus*	White-tail deer	-19.9	3.2	Lower Strata- Section C- Room 17
3035	176	*Odocoileus virginianus*	White-tail deer	-20.1	3.3	Lower Strata- Section J - Room 17
3013	177	*Odocoileus virginianus*	White-tail deer	-16.9	3.2	Upper Strata- TU 10-Level 4 - Room 17
PVB Standard B1	178	control *(Bison bison*	Bison standard	-9.9	3.2	Plainview Texas, Previously dated
3043	179	*Capra/Ovis*	Goat/Sheep	-16.5	3.2	Lower Strata- TU 9- Level 12- Room 17
3050	180	*Bos taurus*	Cow	-12.1	3.2	Lower Strata- Section C - Room 17
3021	181	*Bos taurus*	Cow	-14.6	3.2	Upper Strata- TU 9- Level 7 - Room 17
3022	183	*Bison bison*	Bison	-12.4	3.3	Upper Strata- TU 9- Level 7- Room 17
3048	184	*Bison bison*	Bison	-11.8	3.2	Upper Strata- TU 9- Level 3 - Room 17
3053	185	*Bison bison*	Bison	-13	3.2	Upper Strata-Section F- Room 17
3015	187	*Capra/Ovis*	Sheep/Goat	-16.4	3.2	Lower Strata- TU 9- Level 9 - Room 17

and Masayo et al. (2004). All glassware used in this preparation had previously been autoclaved and then heated to 350°C for 2 hours. In addition, all water used in sample preparation was ultra-pure (Type 1). Bone samples had been previously cleaned and crushed in preparation for the stable carbon and nitrogen isotopic analysis discussed in Appendix 7. For a given radiocarbon sample, we weighed out two 150 mg sub-samples of bone into prepared glass test tubes with caps. Once collagen isolation procedures had begun, samples were only uncapped for short periods to add or remove chemicals, and all work was done under laboratory conditions where air is routinely filtered. The two sub-samples were decalcified with the addition of 0.5N HCl at 4°C. After 30 hours, samples were washed to neutral with Type 1 water. The sub-samples were then treated with 0.1N NaOH for up to 45 minutes at room temperature. The sub-samples were again washed to neutral. They were then covered with 0.5N HCl and refrigerated for an additional 18 hours. The 0.5N HCl was replaced with .01N HCl without exposing the decalcified bone to air. Samples were then solubilized at 70°C for 20 hours in a heating block. The liquid was filtered into glass vials, frozen, and subsequently freeze-dried to isolate the collagen. Sample vials were then sealed in preparation for shipment and analysis. Ultrafiltration methods (see Potter and Reuther 2012) were not used on these samples.

Sample Analysis and Results

DirectAMS (Zoppi et al. 2007) of Seattle, Washington, analyzed the 12 radiocarbon samples. The pre-treated collagen samples were combusted and reduced to graphite in sealed vials. Samples were measured using a National Electrostatics Corporation Model 1.5SDH-1 Pelletron Accelerator. The system has achieved an overall precision and accuracy of 0.3 to 0.5 percent for modern samples (Zoppi et al. 2007). Sample dates were corrected using the previously measured $\delta^{13}C$ values.

Table A1-2 provides a summary of the results in RCYBP. The table includes the results from the two control samples (# 174 and 178). The radiocarbon dates for these two samples of 3473 ± 30 RCYBP and 3532 ± 28 RCYBP provided by DirectAMS overlap with the date range previously acquired by Beta Analytic of 3490 ± 40. This suggests that the collagen preparation and radiocarbon dating procedures are consistent and, at least with regards to these samples, provide precise results.

Table A1-2. Radiocarbon Results, Including Strata Association and Calibrated Age Ranges

CAR Sample #	Animal	Strata	RCYBP	1σ	Calibrated Age Ranges (95.4%)
177	White-tail deer	Upper	85	29	AD 1689-1730; 1809-1926
181	Cow	Upper	100	25	AD 1686-1732; 1808-1927
185	Bison	Upper	106	24	AD 1682-1735; 1805-1930
184	Bison	Upper	130	24	AD 1678-1765; 1772-1777; 1799-1893; 1906-1940
183	Bison	Upper	360	23	AD 1453-1526; 1556-1633
187	Goat/Sheep	Lower	modern	29	modern
176	White-tail deer	Lower	61	34	AD 1691-1730; 1810-1925
180	Cow	Lower	102	24	AD 1686-1732; 1808-1927
175	White-tail deer	Lower	107	23	AD 1683-1734; 1806-1930
179	Goat/Sheep	Lower	121	24	AD 1680-1764; 1801-1896; 1902-1939
174	Bison standard	n/a	3473	30	n/a
178	Bison standard	n/a	3532	28	n/a

The radiocarbon results for all San Juan archaeological samples listed in Table A1-2 have been corrected for fractionation using the previously measured $\delta^{13}C$ values and calibrated using OxCal Version 4 (Bronk Ramsey 2009). Table A1-2 also lists the calibrated age ranges at two sigmas. Comparison on the dates from the five upper samples (# 177, 181, 183, 184, and 185) and the lower strata samples (#175, 176, 179, 180, and 187) suggest that the lower samples, as a group, are identical or younger in age than the upper samples. To the degree that the radiocarbon dates from the sampled faunal material can be used to date the associated artifacts, these results suggest considerable mixing of deposits.

Figure A1-1 presents the probability distributions of the calibrated date ranges for nine of the 10 San Juan samples. We do not show the single modern date. For a given date, the calibrated age ranges listed in Table A1-2 are identified through the underling brackets, and the range with the highest probability is shaded in red. The probability associated with that range, also in red, is listed to the right of each date. For eight of the nine samples, the highest probability is associated with a beginning date sometime around AD 1800. The most probable age range appears to be from about AD 1800 through sometime around 1900 (samples # 179 and 184) or into the 1930s (samples # 175, 176,177, 180, 181, and 185; Figure A1-1). With the single exception of the bison that is reflected in the much earlier sample (# 183), it seems unlikely that any of these animals were alive prior to AD 1800.

Sample 183 clearly dates much earlier than the other dated samples (Figure A1-1). The overall age range for this bison is between AD 1453 and 1633 (Table A1-2), with the AD 1453 to 1526 having the highest associated probability of 50.8 percent (Figure A1-1). This bison, dating to the Toyah interval of the Late Prehistoric, died several centuries before Mission San Juan was founded. The presence of this animal at the site suggests the possibility that at least some elements in the artifact assemblage recovered from San Juan may not be associated with Mission use but reflect occupation during this earlier period.

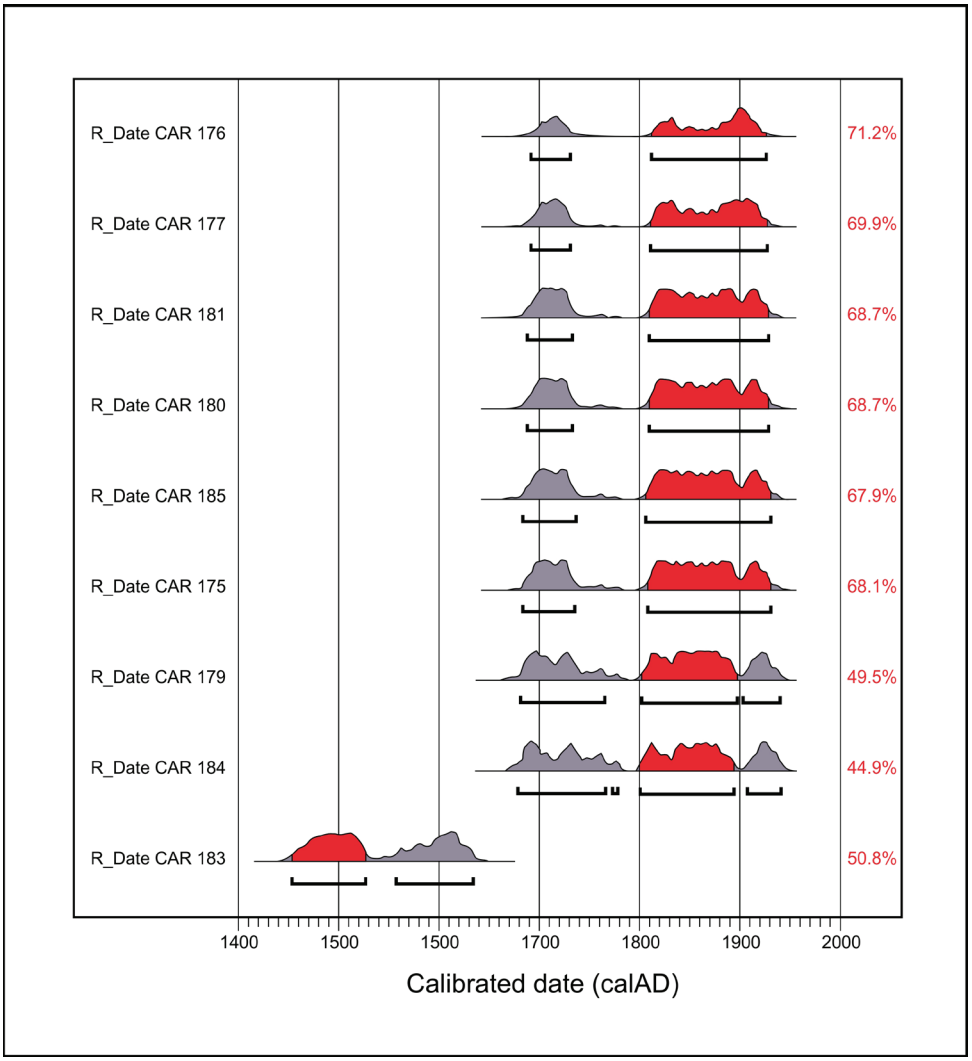

Figure A1-1. *Corrected, calibrated probability distributions for CAR radiocarbon dates (see Table A1-2) with 95 percent probability ranges identified by bold brackets under distributions. Highest probability distributions are shaded in red, and actual probability for those ranges are shown to the right, also in red.*

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Appendix 2:
Artifacts from Test Units

Appendix 2

Artifacts from Test Units

Table A2-1. Artifacts Recovered from Test Units 1, 2, 5, and 6

TU	Level	cmbs	Historic Ceramics	Native American Ceramics	Glass	Metal	Personal Items	Building Material	Debitage	Total Count	Modern Material	Faunal Bone (gm)	Mussel and Marine Shell (gm)	Total Weight (gm)
1	1	0-10	1		2	4		2		9	10	1.2		1.2
	2	10-20		1	6			2	1	10	5	4.1		4.1
	3	20-30			11	1	1	2		15	2	6.1		6.1
	4	30-40			36	65		4	1	106	6	1.3		1.3
	5	40-50			34	55		3		92	2	0.6		0.6
2	1	0-9			5	2		4	1	12	5			0.0
	2	9-19	1		3	2	1	2		9	6	34.3		34.3
	3	19-29	1		2	2		6	3	14		79.7		79.7
	4	29-39	1		8	3		3		15		46.5		46.5
	5	39-49			2			1		3		20.6		20.6
	6	49-59						2		2		13.4		13.4
	7	59-69				1		1		2		4.6		4.6
	8	69-79							1	1		1.2		1.2
	9	79-89						3		3				0.0
5	1	0-11	2		7					9	5			0.0
	2	11-21			2	2		1		5	3	5.9	2.6	8.5
6	1	0-8			62			2		64	10			0.0
	2	8-18			1					1		2.0		2.0
	3	18-28			1			1		2	2			0.0
	4	28-38				1		2		3		28.4		28.4
	5	38-48	1		2	1		1		5		5.2		5.2
	6	48-58			1			1		2		10.5		10.5
	7	58-68			1			1		2		5.0		5.0
Total			**7**	**1**	**186**	**139**	**2**	**44**	**7**	**386**	**56**	**270.6**	**2.6**	**273.2**

Table A2-2. Artifacts Recovered from Test Units 3 and 4

TU	Level	cmbs	Historic Ceramics	Native American Ceramics	Glass	Metal	Gunflints	Building Material	Debitage	Total Count	Modern Material	Faunal Bone (gm)	Mussel and Marine Shell (gm)	Total Weight (gm)
3	1	0-1	1		2	1				4				0.0
	2	1-6				2		2		4		13.9		13.9
	3	6-17	8		26	1		3	1	39		13.2		13.2
	4	17-25			14	5		2		21	1	4.9		4.9
	5	25-36			10	1		3		14		65.9		65.9
	6	36-46	1	2	4	1		3		11		580.9		580.9
	7	46-54			2			1		3		27.4		27.4
	8	54-65						1		1		9.4		9.4
	9	65-74				1		1		2				0.0
	10	74-86			1					1				0.0
	11	86-94								0		3.8		3.8
	12	94-106						1		1		106.8		106.8
	13	106-116						1		1		38.1		38.1
	14	116-125								0				0.0
	15	125-135						1		1				0.0
	16	135-145								0				0.0
	17	145-155								0				0.0
	18	155-165								0				0.0
	19	165-175								0				0.0
	20	175-185								0				0.0
	21	185-195								0				0.0
	22	195-200								0				0.0
4	1	0-6			14	5	1	1	1	22		7.8		7.8
	2	6-15	1	2	25	3		2	1	34		25.1		25.1
	3	15-26		3	32	7		3		45		197.5	2.2	199.7
	4	26-34	1	1	36	1		2		41		40.7		40.7
	5	34-47	3		34	1		3		41		40.9		40.9
	6	47-55	1		17	1		2	1	22		23.5		23.5
	7	55-65	1		28	5		2		36		24.9		24.9
	8	65-75	3		53	4		2	1	63		6.0		6.0
	9	75-85	1	1	79	5			2	88		8.6		8.6
	10	85-97	1	2	38	3		2		46		17.1		17.1
	11	97-107	2		59	4		1		66		87.1		87.1
	12	107-118	4	4	80	3		1		92		53.9		53.9
Total			**28**	**15**	**554**	**54**	**1**	**40**	**7**	**699**	**1**	**1397.4**	**2.2**	**1399.6**

Table A2-3. Artifacts Recovered from Test Units 7 and 8

TU	Level	cmbs	Historic Ceramics	Native American Ceramics	Glass	Metal	Personal Items	Gunflints	Building Material	Debitage	Lithic Tools	Total Count	Modern Material	Faunal Bone (gm)	Mussel and Marine Shell (gm)	Total Weight (gm)
7	1	0-3										0				0.0
	2	3-13			2	3			1			6	1	6.3		6.3
	3	13-23	2		4	4			1			11	8	16.2		16.2
	4	23-33			3	2				1		6	1	27.5		27.5
	5	33-43		1	10	3			2	2		18		7.0		7.0
	6	43-53							1	1		2		110.6		110.6
	7	53-63							2			2		8.0		8.0
	8	63-73							1			1		0.7		0.7
	9	73-83										0				0.0
	10	83-93	1		2				3			6		3.8	4.2	8.0
	11	93-103	1		1	1			1			4		61.1		61.1
	12	103-113			2							2		0.4		0.4
	13	113-123										0		1.5		1.5
	14	123-133							1			1				0.0
	15	133-143	1		1	4			1			7		0.9	1.2	2.1
	16	143-154	1			151			2			154		38.3		38.3
8	1	0-8			1	1			2			4	23	2.8		2.8
	2	8-18			1	1						2	4	0.4		0.4
	3	18-28	1		11	11				3	1	27	1	5.0		5.0
	4	28-38			9	16						25	4	89.3		89.3
	5	38-48	2		11	7			1			21		10.3		10.3
	6	48-58			9	5			1			15		7.1		7.1
	7	58-68		1	1	5			4			11		17.6		17.6
	8	68-78	2	1	4	4	1		1			13		14.0		14.0
	9	78-88	1			3		1	1	1		7		7.9		7.9
	10	88-98	1		1	7			1		1	11		38.0		38.0
	11	98-108			2	6			2		1	11		4.7		4.7
	12	108-118			3	4			1			8		8.3		8.3
	13	118-128			1	5			1			7		26.5		26.5
	14	128-138	2		1	3			2			8	1	10.3		10.3
	15	138-148			1	8			1	1		11		7.1		7.1
Total			**15**	**3**	**81**	**254**	**1**	**1**	**34**	**9**	**3**	**401**	**43**	**531.6**	**5.3**	**536.9**

Table A2-4. Artifacts Recovered from Test Units 9 and 10

TU	Level	cmbs	Historic Ceramics	Native American Ceramics	Glass	Metal	Personal Items	Gunflints	Building Material	Debitage	Lithic Tools	Total Count	Modern Material	Faunal Bone (gm)	Mussel and Marine Shell (gm)	Total Weight (gm)
9	1	0-2	2		2				1			5				0.0
	2	2-12	3		38	5			3			49	3	2.2		2.2
	3	12-22	16	1	22		1		1			41		200.0		200.0
	4	22-32	25	3	16	11	1		4			60	1	64.9	1.3	66.2
	5	32-42	42	12	6	2	1		1			64		46.6	7.7	54.3
	6	42-52	13	19		2			1	2		37		131.4	1.5	132.9
	7	52-62			1				3	1		5	1	108.8	1.6	110.5
	8	62-72										0		51.5		51.5
	9	72-82	1									1		110.2		110.2
	10	82-92					1		2			3		262.4		262.4
	11	92-102							1			1		6.3		6.3
	12	102-112										0		23.8		23.8
	13	112-122	1	2		1			2	2		8	1	175.9		175.9
	14	122-132	1	2						1		4		8.9		8.9
	15	132-142	2						1	1		4		3.9		3.9
	16	142-152			1				1			2		10.2		10.2
	17	152-162										0		0.2		0.2
	18	162-172										0				0.0
	19	172-182										0				0.0
10	1	0-8	12	1	82	20			4			119	8	22.1		22.1
	2	8-18	19	6	51	22			6	1		105	3	64.6	1.0	65.6
	3	18-28	39	45	17	4						105		79.5		79.5
	4	28-38	66	23	8	3	1		5	2		108		198.2	19.1	217.3
	5	38-48	44	19	7	3	3	1		5		82	1	232.9	4.6	237.4
	6	48-58	4	2		1		1	2			10		328.4	9.1	337.5
	7	58-68							1			1		47.3		47.3
	8	68-78		1	1				1			3	1	109.1	12.0	121.1
	9	78-88				1			1	1		3		11.1		11.1
	10	88-98							1			1		10.2		10.2
	11	98-108										0		213.7		213.7
	12	108-118	1						1	3		5		15.1		15.1
	13	118-128								4	1	5		4.9	0.2	5.0
	14	128-138	1							4		5		2.2		2.2
	15	138-148										0			2.3	2.3
Total			**292**	**136**	**252**	**75**	**8**	**2**	**43**	**27**	**1**	**836**	**19**	**2546.4**	**60.3**	**2606.7**

Table A2-5. Artifacts Recovered from Test Units 11 and 12

TU	Level	cmbs	Historic Ceramics	Native American Ceramics	Glass	Metal	Personal Items	Building Material	Debitage	Lithic Tools	Total Count	Modern Material	Faunal Bone (gm)
11	1	0-8			40	2		6			48	1	8.4
	2	8-18		1	39			1	2		43		35.6
	3	18-28		2	1	2		3			8		18.8
	4	28-38				2		1			3		20.1
	5	38-48						1		1	2		18.9
	6	48-58	3		2	5		1			11		122.3
	7	58-68				3					3		10.4
	8	68-78		1		3		1			5		24.0
	9	78-88		1		5		1			7		10.5
	10	88-98	2	3	3			2	1		11		25.5
	11	98-108				1		3	1		5		23.5
	12	108-118	1	1				1			3		12.4
	13	118-128	1	1		1		6	1		10		28.1
	14	128-138						1			1		0.3
	15	138-148						2			2		1.0
	16	148-158							1		1		
	17	158-168									0		
	18	168-178									0		
12	1	0-4	1		22	2		3			28	2	
	2	4-14		2	8	2		1			13	1	59.2
	3	14-24		1	3	3		2	3		12	1	17.5
	4	24-34	1		1			4	1		7		1.5
	5	34-44	2					2			4		9.2
	6	44-54				3		2	1		6		14.1
	7	54-64	1	1			1	2	1		6		14.3
	8	64-74	1	2	2	1		3			9		37.6
	9	74-84	1					3			4		37.3
	10	84-94			1			4			5		38.6
	11	94-104									0		
	12	104-114							1		1		
	13	114-124						3			3	1	4.6
Total			**14**	**16**	**122**	**35**	**1**	**59**	**13**	**1**	**261**	**6**	**593.7**

Table A2-6. Artifacts Recovered from Test Units 13 and 14

TU	Level	cmbs	Historic Ceramics	Native American Ceramics	Glass	Metal	Personal Items	Building Material	Historic Gunflints	Debitage	Total Count	Modern Material	Faunal Bone (gm)	Mussel and Marine Shell (gm)	Total Weight (gm)
13	1	0-11	1	2	21	6		2			32	6	11.7		11.7
	2	11-21	1	2	6	3		1		1	14	2	17.0		17.0
	3	21-31				1		2			3	1	40.8		40.8
	4	31-41	5		1	2		6			14	1	36.2		36.2
	5	41-51			1	1		3			5		38.2		38.2
	6	51-61				1		2		1	4	1	47.1		47.1
	7	61-71	1	1		2		2			6		44.8		44.8
	8	71-81			1			1			2		64.5		64.5
	9	81-91	1	3	1	4		2			11		40.2		40.2
	10	91-101		1		1		1			3		80.2		80.2
	11	101-111	1			1		3			5		31.2		31.2
	12	111-121		1	1			2			4		25.6		25.6
	13	121-131		1				2			3		3.1		3.1
	14	131-141						1		1	2		1.7		1.7
	15	141-151									0				0.0
	16	151-161						1		1	2		13.9		13.9
	17	161-178						1			1				0.0
	18	178-181									0				0.0
	19	181-191									0				0.0
14	1	0-8	2	1	10	5	1	3			22	3	13.5	2.3	15.7
	2	8-18	2		109	4		1			116	2	10.2		10.2
	3	18-28	2	3	9	2		1	1		18		42.4		42.4
	4	28-38	1					2			3		27.6		27.6
	5	38-48				4		2			6		57.2		57.2
	6	48-58	1	3	1	1		5		1	12		65.7		65.7
	7	58-68		1	1	3		3			8		65.9		65.9
	8	68-78		3		1		8			12		19.0		19.0
	9	78-88						2			2		14.1		14.1
	10	88-98	3		2	1		9			15	1	67.1		67.1
	11	98-108						1			1		7.4		7.4
	12	108-118						2			2		1.2		1.2
	13	118-128						1			1				0.0
	14	128-138						1		1	2		2.9		2.9
	15	138-148								1	1		0.7		0.7
Total			**21**	**22**	**164**	**43**	**1**	**73**	**1**	**7**	**332**	**17**	**891.1**	**2.3**	**893.4**

Appendix 3:
Room 17 Foundation Profiles

Appendix 3

Room 17 Foundation Profiles

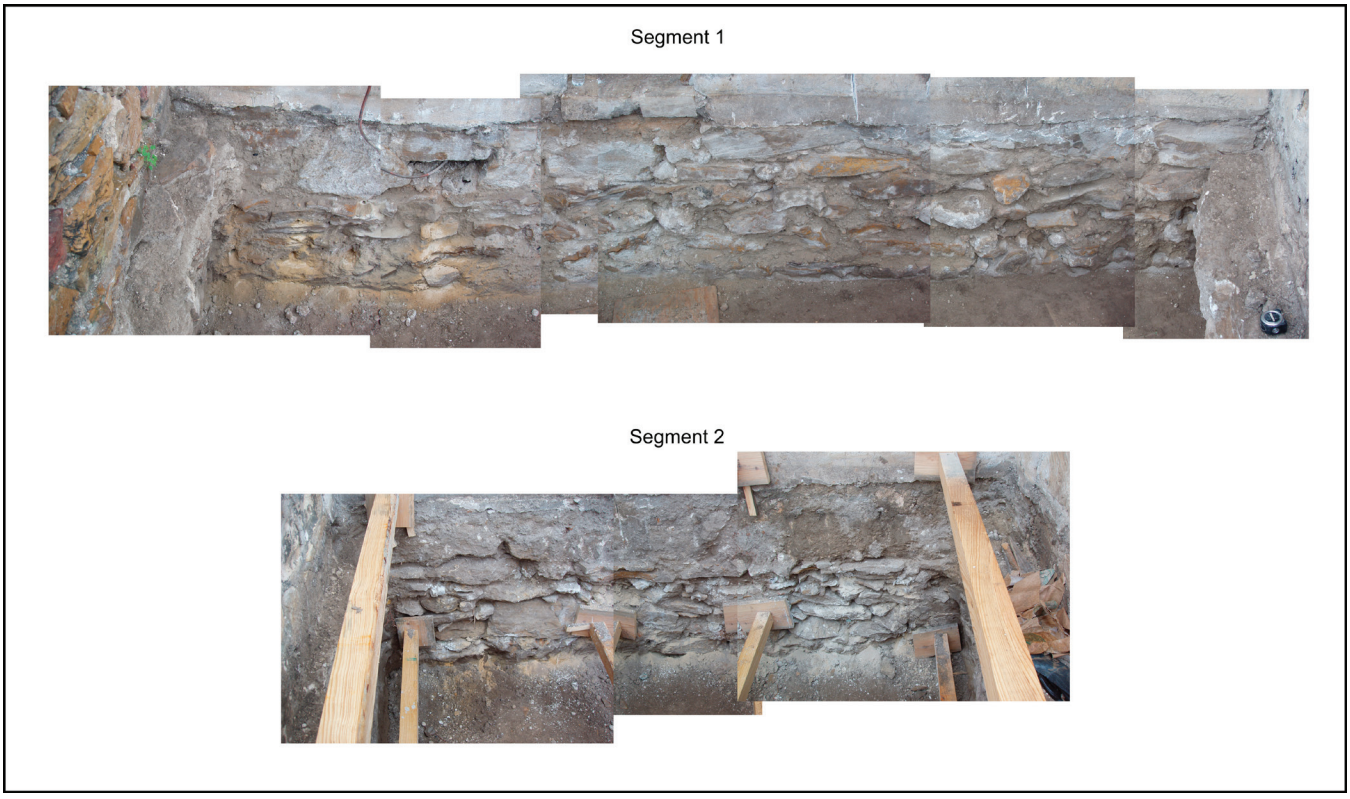

Figure A3-1. *Segments 1 and 2 of the foundation of the east wall of the church, southern portion.*

Figure A3-2. *Segments 3 and 4 of the foundation of the east wall of the church, middle portion.*

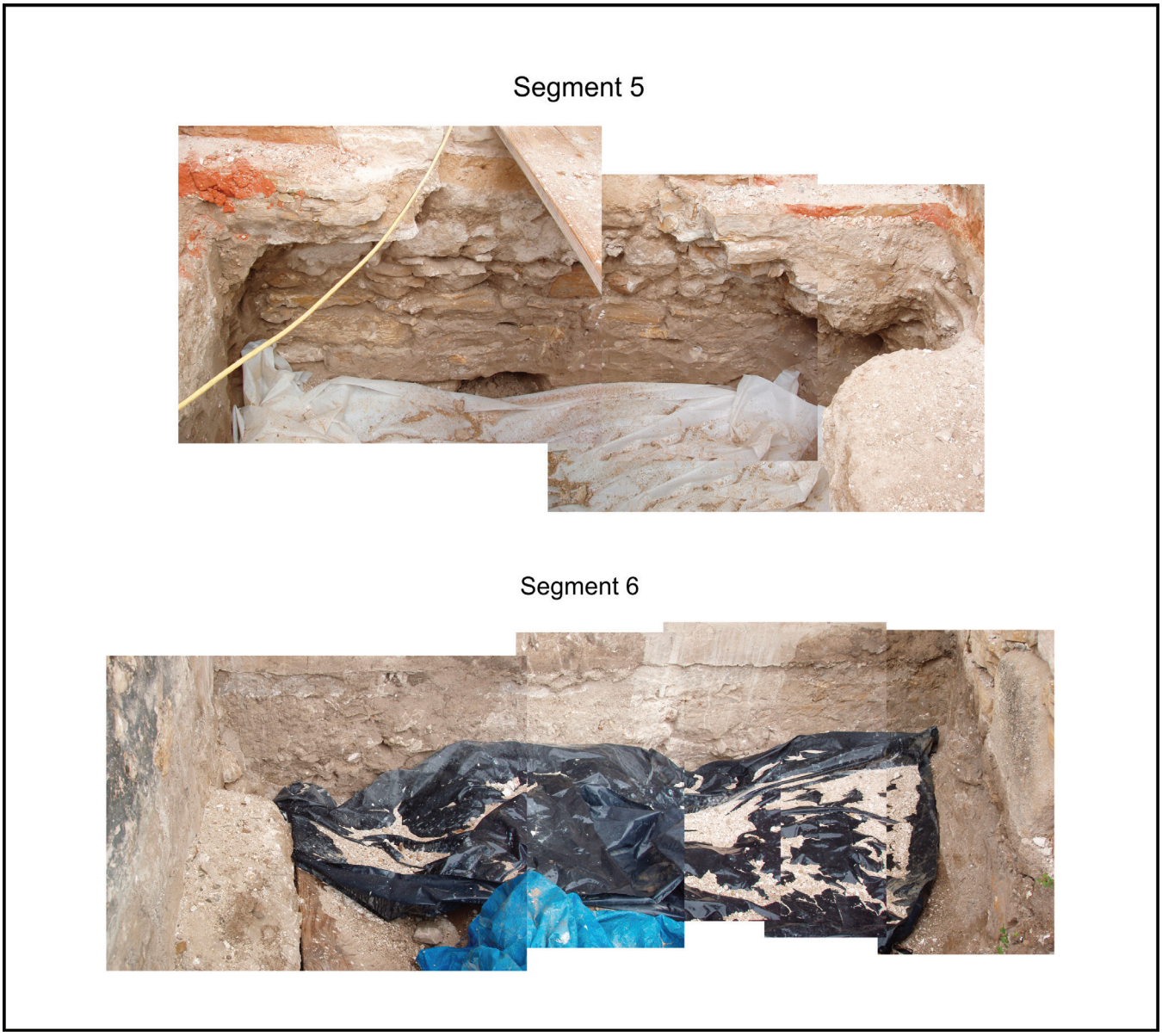

Figure A3-3. *Segments 5 and 6 of the foundation of the east wall of the church, northern portion. Segment 6 is located under the bell tower.*

Figure A3-4. *The foundation of the north wall of the church.*

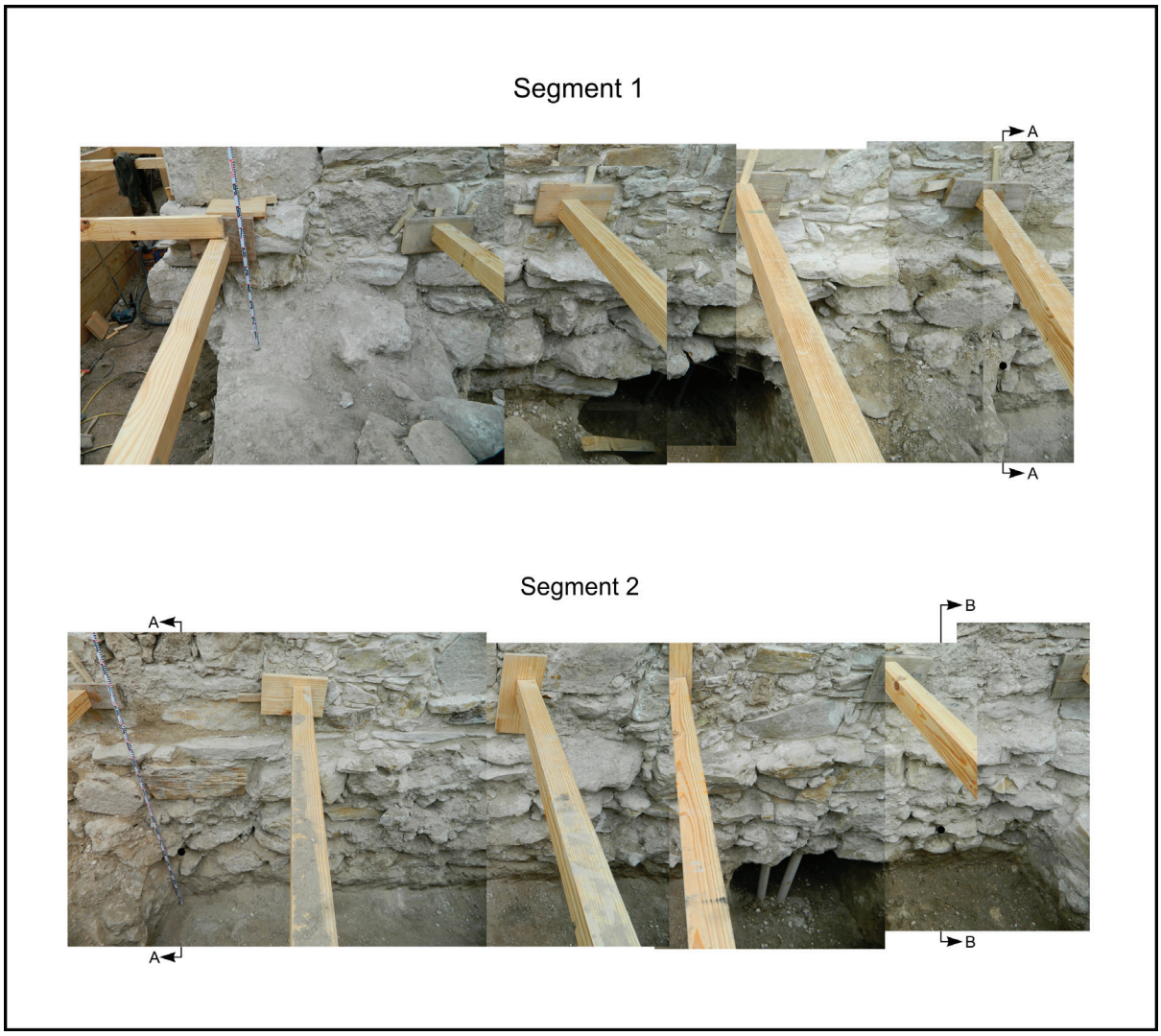

Figure A3-5. *Segments 1 and 2 of the foundation of the west wall of the church.*

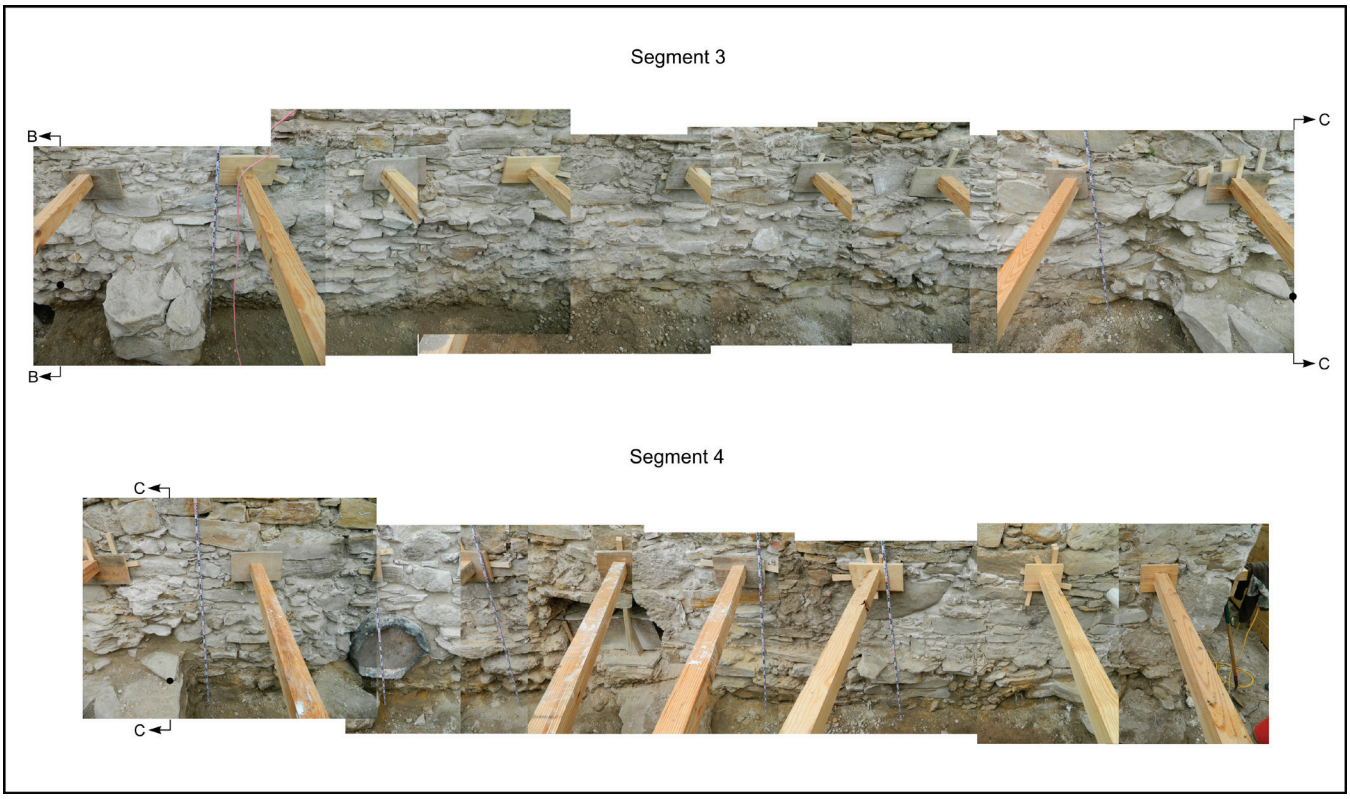

Figure A3-6. *Segments 3 and 4 of the west wall of the church foundation.*

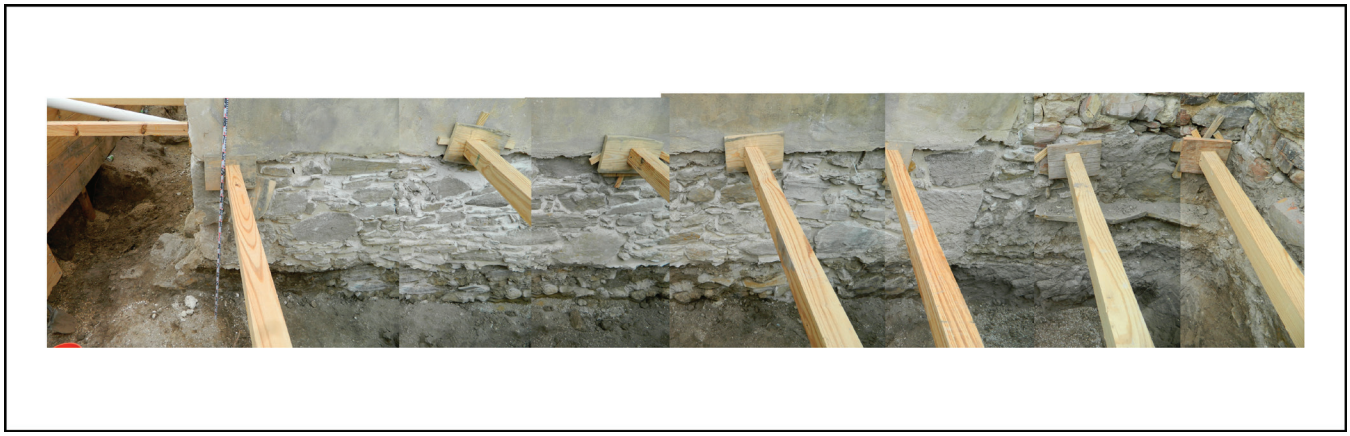

Figure A3-7. *The foundation of the south wall of the church.*

Appendix 4:
Ceramic Type Descriptions

Kristi Miller Nichols

Appendix 4

Ceramic Type Descriptions

Kristi Miller Nichols

Phase 1 test unit and Phase 3 section excavations recovered 1,317 fragments of Spanish Colonial (n=855) and European ceramics (n=462). Spanish Colonial fragments include unglazed, lead glazed, and tin glazed earthenwares. European specimens include white earthenwares, porcelains, and stoneware. This appendix presents type descriptions of the recovered artifacts.

Spanish Colonial – Unglazed Earthenwares

Valero

Valero ware, a wheel-thrown, red earthenware, was first identified during excavations conducted at Mission Valero (Fox and Hester 1976:19; Greer 1967:19). The type has been recovered from Colonial sites throughout Texas, and it has not been recorded outside of the state. Due to the lack of information on pottery manufacture during the Colonial period in Texas, it is unknown if wheel-thrown pottery was made at the missions. It is probable that the type was produced in Mexico and was brought to Texas by mule train. The location of manufacture in Mexico is unknown (Fox and Ulrich 2008). Valero ware vessels are typically large utilitarian wares. The lack of glaze on the vessel walls suggests that the majority of Valero ware were used as water storage containers. The lack of glaze would allow some water to seep through the pores in the walls and evaporate on the exterior, effectively cooling the water in the interior (Fox and Ulrich 2008).

Red Burnished

This type is defined by the color of the clay and vessel surface treatment. Although it is not a formal type, it is widely used to describe unglazed sherds found in Texas. Red Burnished ware has been recovered from many mission and Colonial sites within Texas. The ware was likely manufactured throughout much of the eighteenth century in central Mexico (Gregory 1980:49; Tunnell and Ambler 1967:24). Vessels were likely imported to mission sites by mule train (Fox 2002:204).

Red Burnished ware is characterized by a highly burnished red to black finish. The vessels are made of fine pastes with fine-grained, polished slips. Decorations, including curls, spirals, and other curvilinear figures, are found in matte areas (Fox and Ulrich 2008; Gilmore 1974:63). The type appears to be handmade rather than wheel-thrown. Vessel surfaces often spall during the firing process resulting in white speckles. Typical vessel forms include small bowls and jars.

Tonalá Burnished

Tonalá Burnished, produced in Tonalá, Mexico, is a distinctive type found in Texas, Florida, the southwestern United States, the Caribbean, and the Teotihuacan Valley of Mexico (Charlton and Katz 1979:45; Rishel and Stratton 2006:118). Because the Spanish highly valued the ware, it was also exported to Spain (Charlton and Katz 1979:52).

Tonalá is characterized by its fine, gray paste. When sherds become damp, a sweet, earthy fragrance can be noted (Fox and Ulrich 2008). The walls of Tonalá vessels are thin and often break into small fragments. The vessels are not wheel-thrown or handmade, but they are produced with a convex mold (Charlton and Katz 1979:47). Tonalá ware is typically decorated with red, black, and yellow geometric lines and designs. After painting, the vessel walls are highly burnished. Similar to Red Burnished ware, the surface of the vessels often spall during the firing process. Most of the sherds recovered from Texas sites are too small to determine vessel form. In other areas, bowls, small cups, plates, and figurines have been recorded (Charlton and Katz 1979:46; Deagan 1987:46; Goggin 1968:227). A Tonalá Burnished ware base of a figurine of Our Lady of Guadalupe was recovered from excavations conducted at Mission Valero in 2006.

Spanish Colonial – Lead Glazed Earthenwares

Yellow and Green Glaze

Two varieties of Yellow and Green Glaze wares have been identified. Type II is made with thinner vessel walls. Yellow and Green Glaze vessels were wheel-thrown and produced with an orange sandy paste. Depending on the firing conditions, the paste can range from orange to dark gray. The glaze varies from a pale yellow over the orange paste to a dark green. Yellow and Green Glaze ceramics were manufactured throughout the eighteenth century in Mexico and were imported into Texas. Vessel forms included bowls, jars, and pitchers (Fox and Ulrich 2008).

Green Glaze

Another variety of sandy-pasted lead glazed earthenwares is Green Glaze ware. It is possible that this is a variety of Yellow and Green Glaze that only exhibits green glazing. The thick, dark green glaze is present on both the interior and the exterior of the vessel. The paste is orange to gray in color. These vessels were also produced during the eighteenth century in Mexico (Fox and Ulrich 2008).

Black Luster

Black Luster is a fine-pasted lead glazed ceramic first encountered at Mission San Juan by Schuetz in the late 1960s (Schuetz 1969:52). Typical vessels were deep bowls with everted rims. Paste colors are either buff or terra cotta. The vessels were made in Santa Fe, Michoacán, and Puebla, Mexico, from 1750 to 1850 (Fox and Ulrich 2008).

Brown on Yellow

Brown on Yellow is a fine-pasted ceramic that is relatively rare in Texas. The vessels were manufactured with a wheel or were molded. The paste, ranging from yellow to orange, is enhanced by a clear glaze. The glaze only covers the interior of the bowl or shallow plate and the top of the rim. It does not age well and often exhibits pock marks. Brown on Yellow wares are decorated with brown designs under the glaze. They were produced in Mexico between 1750 and 1825 (Fox and Ulrich 2008).

Dark Brown

Dark Brown ware is characterized by brown glaze over a red-orange fine-paste. The vessels may have been slipped with brown prior to the glazing process. Bulbous pots with impressed dents on the shoulder are the common vessel form (Fox 2002:207). Dark Brown and Galera wares (discussed in the next section) have similar paste, wall thickness, and texture. Recovery of the type from missions that were occupied from 1731 to 1830 suggests that Dark Brown ware was in use from the middle eighteenth to the middle of the nineteenth century (Fox and Ulrich 2008). The vessels were produced in western Mexico; however, the exact location is unknown.

Galera

Galera is a fine-pasted lead glazed earthenware commonly found at Spanish Colonial sites in Texas. The molded vessels exhibit thin walls ranging between three and four millimeters and are orange pasted with a thin, clear glaze on the exterior. Cream, green, and brown designs are present on the outside surface. Common vessel forms included *chocolateras*, bean pots, serving dishes, plates, bowls, and cups (Fox and Ulrich 2008). Research indicates that there was an abrupt shift from copper chocolate pots to ceramic versions in circa 1750 (Tomka and Fox 1998:22). The archaeological record indicates that Galera was manufactured for Colonial sites occupied between 1725 and 1850. Historically, Galera was manufactured in Jalisco, Mexico, probably in Tlaquepaque, near Guadalajara (Gerald 1968:54). Similar wares are currently manufactured in Mexico.

Red Brown

Red Brown ware, previously termed Guadalajara ware (Schuetz 1969:51), has been recovered at Presidio La Bahia, Mission San Juan, Mission Concepción, and Mission San José. The thin-walled vessels are characterized by a red-brown tinted lead glaze over red-brown paste. The upper surface of fragments suggests that the pottery was wheel-thrown. Vessel forms include shallow plates, jars, and bowls. The ware was produced during the eighteenth century in Mexico and was imported to Texas by mule train.

Smooth Brown

Smooth Brown ware is an uncommon variety of lead glaze recovered from Spanish Colonial sites within the San Antonio area. The ceramics exhibit a red fine-paste covered with a thick, clear glaze that is often thicker on the interior. Decoration designs consist of dark brown bands and slashes on the vessel interior. Vessel forms include bowls and plates. Smooth Brown ware was likely produced from 1775 to about 1830. Although the exact location is unknown, it was possibly produced in Mexico (Fox and Ulrich 2008).

Tonalá Glazed

Like the burnished unglazed variety, this type is made of a brownish gray paste that exudes a sweet earthy smell when damp. It is characterized by a lead glaze over a white or cream slip on the interior and exterior of the vessel surfaces and designs in green, black, and red-brown. The slip on archaeologically recovered vessels tends to flake. Large fragments recovered from excavations at Mission Valero revealed that vessel forms were typically shallow bowls (Schuetz 1973). Tonalá Glazed appeared in Texas between 1780 and 1830 (Gerald 1968:54). It was manufactured in Tonalá, outside of Guadalajara, in Jalisco, Mexico (Fox and Ulrich 2008).

Spanish Colonial – Tin Glazed Earthenwares

Puebla Polychrome

Puebla Polychrome, one of the oldest varieties of ceramics encountered at Spanish Colonial sites in San Antonio, Texas, was manufactured between 1650 and 1725 (Fox and Ulrich 2008). This majolica (tin glazed earthenware) has been recovered from Mission Valero, San Fernando Cathedral, Mission San José, and Mission Concepción. Because it is probable that Mission Concepción was built over a previous location of Mission San José, the ware may be attributed to the former occupation. Puebla Polychrome has also been identified at Florida sites dating from the seventeenth to the early eighteenth century (Deagan 1987:81-82). It is uncommon to find the ware at sites established after 1720.

Typical vessel forms include bowls, plates, and cups. The majolica is characterized by a surface (interior of cups and bowls, exterior of plates) decorated with painted blue designs with black lace or cobweb accents and dots. The paste of the vessels ranges from cream to buff. Some ceramic analysts believe that Puebla Polychrome is an offshoot of the Talavera styles that were brought to the New World from Spain (Lister and Lister 1987:238-239).

Puebla Plain

Puebla Plain has been recovered from all the Spanish Colonial sites in Texas and typically comprises the majority of the assemblages. The ware is an undecorated, thin-walled, white majolica. It is important to note that it is highly likely that many of the sherds classified as Puebla Plain are actually fragments from a decorated variety of majolica. Other types, such as Huejotzingo, contain large areas of undecorated vessel sections (Fox and Ulrich 2008). Typical vessel forms include cups, bowls, plates, and chamber pots (Lister and Lister 1974:Figure 8). The white to cream glaze is usually crazed. The paste varies from cream to light orange. Puebla Plain was manufactured throughout the eighteenth century and into the nineteenth century (Lister and Lister 1974:30).

San Agustín Blue on White

San Agustín Blue on White has been recovered from many Texas Spanish Colonial sites, including all of the San Antonio Missions. The majolica's paste is cream to light buff. Vessel surfaces are completely covered with thick, chalk-white enamel. The interiors are decorated with different shades of blue. Light blue typically outlines dark blue decorations. Vessel rims usually are decorated with a light blue set of bands and exteriors are characterized by light blue loops (Fox and Ulrich 2008). San Agustín majolica was manufactured in Puebla, Mexico, from 1700 to 1780 (Barnes and May 1972:31).

Puebla Blue on White

One of the most common majolicas recovered from Spanish Colonial sites is Puebla Blue on White (Deagan 1987:83). Over the years, analysts have split the type into new categories of distinctively decorated varieties. The interior and exterior of the vessels are covered with white enamel and light and dark blue designs. Design motifs vary, but the most common is a banded rim with "petals" beneath. The central charger of the vessel has either a floral motif or a crane form. Decorations relied heavily on Chinese, Talaveran, and Sevillian ceramic influences (Lister and Lister 1974:29-31). The blue on white varieties are thought to mimic Chinese porcelain, which was much more expensive and harder to obtain. Vessel forms include plates, bowls, cups, jars, figurines, and tiles. The majolica, produced from 1650 to 1830, is common on Texas mission sites (Fox and Ulrich 2008).

Huejotzingo Blue on White

Huejotzingo, a variant of Puebla Blue on White, is present at many Spanish Colonial sites in Texas (Goggin 1968:196). Although Huejotzingo is typically blue and white, green on white and yellow on white have also been recorded. The majolica was manufactured in Huejotzingo in Puebla, Mexico, throughout the eighteenth century and into the nineteenth century. The paste and white enamel of the type are similar to Puebla Plain. A single band of blue, ranging from light grayish blue to dark blue, decorates the rim of the vessel. Vessels with green or yellow bands tend to date later and have been recorded more frequently at Spanish Colonial sites in California. The green variety is thought to have replaced the blue type by 1780 (Barnes and May 1972:33-34). A variation of the ware, Wavy Rim Band Huejotzingo, was produced from 1775 to 1825 (Fox and Ulrich 2008).

Molded Blue on White

Molded Blue on White resembles San Agustín Blue on White. Both types are covered with a white enamel glaze and blue and white decorations, but Molded Blue on White has molded, scalloped rims. Although the types are considered distinct in Texas, they are not separated in Florida or California. The ware was produced between 1775 and 1800 in Mexico (Fox and Ulrich 2008).

Aranama Polychrome

Aranama Polychrome is one ware within the Aranama Tradition. The tradition, also including San Diego and Monterey Polychromes, is characterized by majolicas with orange and green decorations (Goggin 1968:196-198). In some cases, the exact type cannot be determined, but decoration colors and motifs fall within the tradition characteristics. The Aranama Tradition succeeded the eighteenth-century blue on white varieties.

Aranama Polychromes have orange banded rims outlined in brown or black. The vessels are typically decorated with human figures in colorful outfits of green, yellow, orange, and blue. Floral designs are often placed around the figures. The paste ranges from pink to tan (Fox and Ulrich 2008). The variety was likely manufactured in Puebla, Mexico, during the last half of the eighteenth century into the first half of the nineteenth century (Goggin 1968:198). It has been recovered at many of the Spanish Colonial sites in Texas, including the San Antonio Missions.

San Diego Polychrome

San Diego Polychrome is part of the Aranama Tradition (but see Barnes and May 1972:36). The ware has the same coloring as Aranama Polychromes but varies in motif. Below the brown or black outlined orange banded rim, the decoration consists of yellow, green, and brown balls outlined in black. The remainder of the vessel contains floral designs in yellow, green, orange, and blue with black outlines. The colors tend to be the most vibrant of the Aranama Tradition ceramics (Fox and Ulrich 2008). San Diego Polychromes were manufactured in Mexico between 1770 and 1800 (Barnes and May 1972:35).

Monterey Polychrome

Monterey Polychromes exhibit the brown or black outlined orange banded rim, but they also have a second line under the band. The banded rim is present on the interior and the exterior of the vessels. The majolica lacks blue decoration. The decoration consists of yellow ovals and orange spirals with green fronds (Fox and Ulrich 2008). Monterey Polychrome has been recorded at Spanish Colonial sites throughout Texas with late eighteenth- to mid-nineteenth-century occupations.

La Bahia Polychrome

La Bahia Polychrome was first identified at the Presidio La Bahia in Goliad, Texas (Fox and Ulrich 2008). The ware is characterized by an orange band with a single black or brown line below the rim and another on the cavetto. The remainder of the vessel has blobs of yellow, green, and orange with blue dots and occasional slashes of blue. The colors are not as vibrant as varieties from the Aranama Tradition. La Bahia Polychrome was probably manufactured in Puebla, Mexico, between 1750 and 1820 (Fox and Ulrich 2008). It appears to be restricted to Texas.

Orange Band Polychrome

Orange Band Polychrome is decorated in orange and green in a motif resembling the Blue and White Tradition. The paste ranges from cream to pale pink. The majolica was manufactured in Puebla, Mexico, from 1775 to 1850 (May 1975:123).

San Elizario Polychrome

San Elizario Polychrome is one of the most common majolicas recovered at Texas Spanish Colonial sites. It has been recorded at all the missions in San Antonio, as well as at Rancho de Las Cabras in Floresville. With the exception of a brown or black outline on the blue rim band and black accents in some of the floral design, the ware is identical to Puebla Blue on White. The central design is often a crane figure in blue with legs in brown or black. The paste is typically pink or cream. San Elizario is a common variety at occupations dating between 1755 and 1780, but it was produced well into the middle of the nineteenth century (Gerald 1968; Goggin 1968; Ivey and Fox 1999:37).

Puebla Blue on White II

This variation of Puebla Blue on White is only found on cups and small bowls. The ware contains blue bands on the exterior of the vessels. Dark blue floral decorations, often over light blue bands, are located under the rim bands. The majolica, popular in Texas from 1775 to 1800 (Ricklis et al. 2000:110), was manufactured in Puebla, Mexico. It has been recovered from all the San Antonio Missions and Spanish Colonial sites in the area (Fox and Ulrich 2008).

Puebla Blue on Blue

Puebla Blue on Blue was first identified in Texas during the early excavations at Mission San Juan conducted by Schuetz (1969:56). It has also been recorded in Florida. The interiors are characterized by dark blue floral and geometric designs that are sometimes accented in black over a blue wash. Pale blue interconnected loops are found on the exteriors. Puebla Blue on Blue was manufactured in Puebla, Mexico, and was evident in Texas from 1775 to approximately 1830 (Fox and Ulrich 2008; Lister and Lister 1974:34).

Guanajuato Polychrome

Guanajuato is distinctively different from other majolicas. The paste of Guanajuato wares are dark terra cotta. Because the background enamel has a green tinge, it is easily identified when compared to the white and cream colors of most tin glazed wares. Decoration motifs, on the interior base of the vessels, consist of geometric, floral, and sun designs in green, yellow, and rust (McKenzie 1989:1). The ware was manufactured in Guanajuato, Mexico, as a result of encouragement to develop a ceramic industry in the area (Lister and Lister 1974:1). The majolicas were produced from 1800 to about 1850 (Fox and Ulrich 2008).

Sgraffito

Sgraffito is a technique in which two successive layers of contrasting slip are applied to an unfired vessel. Designs are scratched out of the glaze or clay before firing. In some cases, the white from the underglaze is exposed to accent a darker design that was added before the final firing. Sgraffito was originally developed by Islamic potters. The technique was widely applied to ceramics in the Middle East in the thirteenth century. It was produced in France in the Middle Ages, in England in the seventeenth century, by Minton in England in the 1870s and by Burmantofts in England from 1880-1904 (Karmason and Stacke 1989). The ware has been recovered from multiple Colonial sites. A fragment of yellow Sgraffito recovered from excavations at Jamestown, Virginia, was identified as Devonshire from North Devon, England, ca. 1670 (Watkins 1960). The type is still produced today.

English Ceramics – White Earthenwares

Annular Ware

Annular Ware is characterized by bands of colored slip that are applied to a vessel in its leather-hard state before firing. Typically, the vessels are white-bodied, with applied bands of brown, tan, yellow, green, black, and blue. Additional decoration techniques include incised geometric patterns produced with a mechanical lathe. Slip cups were used to make cat's-eye and swirling decorations. A decoration technique starting in the 1790s, applied acidic "mocha tea" to vessels by touching the tip of an application brush to wet slip. The subsequent chemical reaction created a leafless tree design. This variation of Annular Ware, Mocha Ware, was popular prior to 1840. Annular Ware vessels are present in San Antonio throughout the nineteenth century (Carpentier and Rickard 2001).

Transferware

Transferware is very common at historic sites in Texas. A design printed on a piece of tissue paper was placed on a ceramic vessel to transfer the wet ink. The vessel was subsequently fired to set the design. The most common color produced is blue, though brown, maroon, and green designs have also been recorded. The production of Transferware began in England in the 1750s. The ware was exported to the New World well into the late 1800s. To meet growing demand for the type, production of more affordable Transferware started in the United States. The majority of the ware was manufactured in Ohio (Miller 1980). Transferwares became common in San Antonio around the mid-nineteenth century. Clobbered Transferware is the result of the addition of blobs of color within the outlines of a transfer print.

Flow Blue

Flow Blue is a variety of Transferware. The ink from the transfer would blur during firing sometimes resulting in a blue tint in the decorated portion of a vessel. Manufacture of Flow Blue began in the 1820s (Carpentier and Rickard 2001).

Edgeware

Edgeware is characterized by undecorated white vessels with edge decoration. The decoration is typically a blue or green shell or feather design. The design may be incised into the vessel or painted on. Edgeware fragments may be mistakenly identified as undecorated white earthenware. Incised feather-edges date as early as 1820, and painted edges date to 1870 (McAllister 2001). Blue Edgeware became popular in the United States during the 1860s (Tennis 1997).

Spongeware/Spatterware

Spongeware is decorated with dabs of color sponged onto a vessel before firing. The method leaves a distinctive imprint. Colors are typically vibrant shades of blue, green, red, maroon, yellow, and pink. Cut Spongeware uses the same method except that the sponge is cut into a design and is used as a stamp. Cut Spongewares are characterized by floral, geometric, and animal prints (Tennis 1997). Spatterware is decorated by blowing color in a powder form, or powder mixed with oil, onto the surface of an unfired vessel. The resulting tiny dots are typically blue, pink, maroon, and green (Kelly et al. 2001). Additional decoration is sometimes hand painted on the wares. Sponge/Spatterware is produced from a combination of the methods.

Handpainted

Handpainted White Earthenwares are typically decorated with bright colored floral motifs prior to final firing. The flowers are often blue, pink, and yellow with light to dark green leaves. Brush strokes are apparent. Vessel forms include plates, cups, saucers, and shallow bowls. The type is very common at historic sites throughout Texas. The ware was produced from 1830 throughout the nineteenth century (Tennis 1997). The vessels were manufactured in England and likely came into San Antonio via the railroad in the 1870s.

Creamware

Creamware is a variation of White Earthenwares where the paste and color of the vessel is cream rather than white. Creamware was manufactured in England between 1760 and 1820. Early varieties had a deep yellow tint (Miller 1980).

Rim-Banded

Rim-banded vessels date to the later portion of the nineteenth century and were popular as hotel wares. These vessels were decorated with a simple band in blue or black at the rim (Tennis 1997).

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Appendix 5:
Petrographic Analysis - Thin Section Descriptions

Lori Barkwill Love

Appendix 5

Petrographic Analysis - Thin Section Descriptions

Lori Barkwill Love

Summary information and photos for each petrographic sample are presented by temper groupings. All photos are at 4x magnification with plane light on the right and cross-polar light on the left. The photos are followed by point count and frequency tables. See Chapter 8 for description of the methodology for the petrographic analysis.

Unsandy Paste – Light Bone Paste Group

SAAN-32570

Provenience: Section B
Paste Matrix (PPL): Slightly Mottled
Paste Color (PPL): 10YR 6/6 (brownish yellow) with spots of 10YR 5/4 (yellowish brown) and 2.5Y 7/6 (yellow)
B-fabric (XPL): Speckled-Slightly Active – lighter color paste is striated-active
Slip: No
Edges: Same as rest of paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 1.7%
Also Present: calcium carbonate, muscovite, chert
Comments: Possible mixing of clays, lots of hematite on calcite
Table: see A5-1

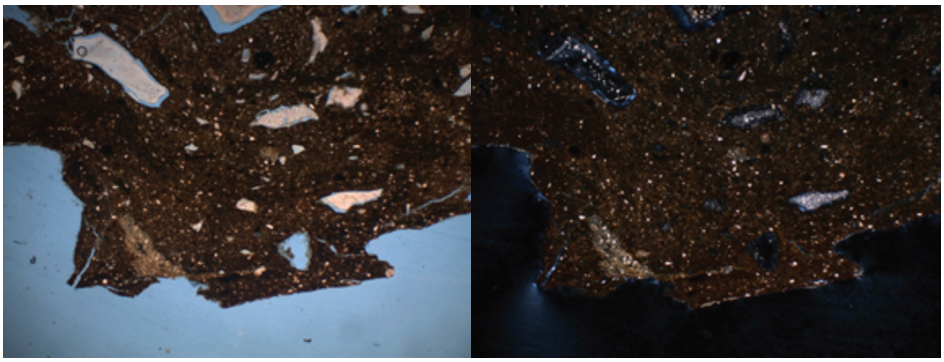

Figure A5-1. *SAAN-32570.*

SAAN-32601-33

Provenience: Section J
Paste Matrix (PPL): Mottled
Paste Color (PPL): 2.5Y 7/6 (yellow) with spots of 2.5Y 7/4 (pale yellow)
B-fabric (XPL): Speckled-Active
Slip: Indeterminate one side
Edges: One edge was darker/redder – 10YR 6/8 (brownish yellow)
Secondary Calcite: Moderate
Sand Size Category: Very fine sand
Voids: 5.2%
Also Present: muscovite, calcium carbonate, polycrystalline quartz
Table: see A5-1

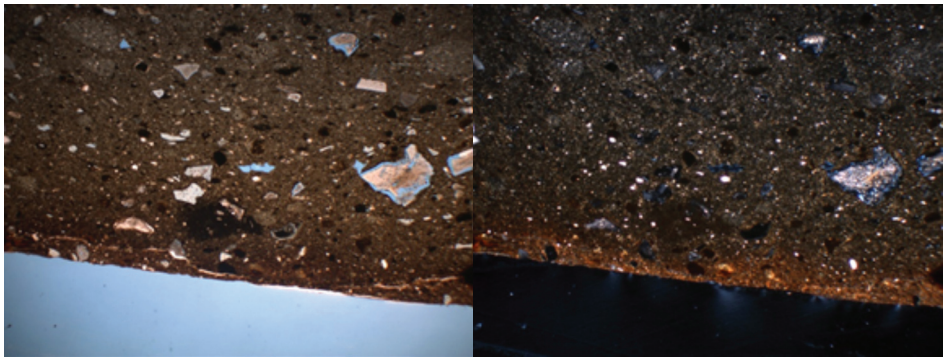

Figure A5-2. *SAAN-32601-33.*

SAAN-32602-34

Provenience: Section J
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 5/6 (yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Same as rest of paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 1.6%
Also Present: muscovite, calcium carbonate, calcite
Table: see A5-1

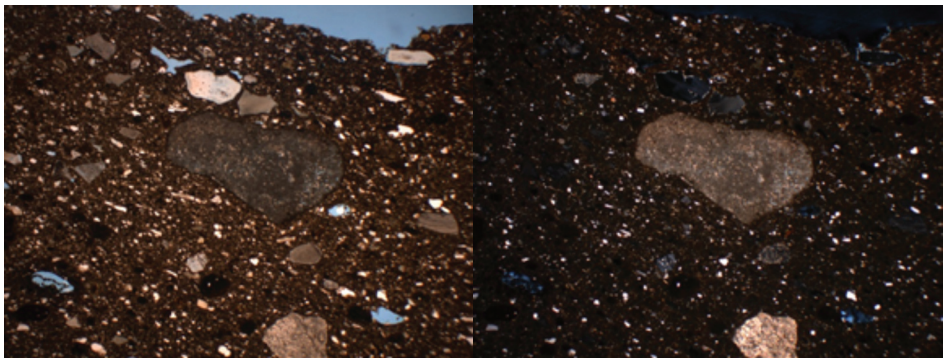

Figure A5-3. *SAAN-32602-34.*

SAAN-32618-50

Provenience: Section J
Paste Matrix (PPL): Continuous – Lighter Core
Paste Color (PPL): 2.5Y 6/6 (olive yellow) – edges 10YR 6/6 (brownish yellow)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Same as rest of paste
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 0.9%
Also Present: alkali feldspar
Comments: Paste is darker (black) around bone
Table: see A5-1

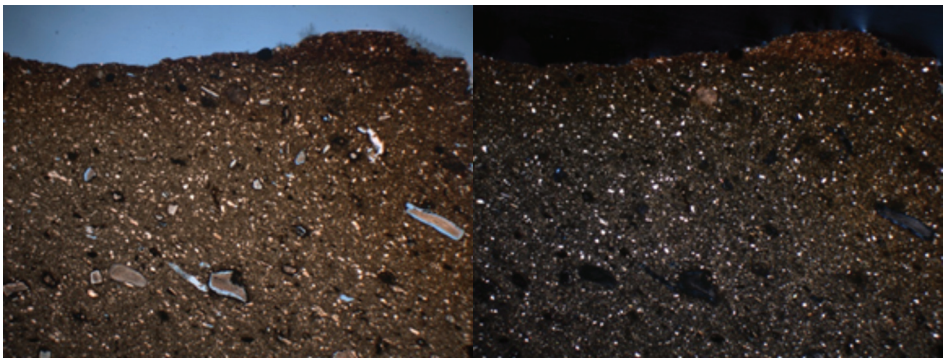

Figure A5-4. *SAAN-32618-50.*

Table A5-1. Point Counts and Frequencies for Unsandy Paste - Light Bone Temper

SAAN #	Paste		Bone		Sand						Carbonates				Mica Muscovite		Other				Total (n)
					Quartz		Alkali feldspar		Polycrystalline quartz		Calcite		Calcium carbonate				Opaque		Clay pellet		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
32570	100	**86.2**	8	**6.9**	5	4.3	1	0.9			1	0.9					1	0.9			116
32601-33	100	**90.9**	6	**5.5**	3	2.7											1	0.9			110
32602-34	100	**80.0**	11	**8.8**	10	8.0			1	0.8							2	**1.6**	1	**0.8**	125
32618-50	100	**86.2**	4	**3.4**	9	7.8							1	**0.9**	1	**0.9**	1	0.9			116

Unsandy Paste – Moderate Bone Paste Group

SAAN-32568

Provenience: Section B
Paste Matrix (PPL): Slightly Mottled
Paste Color (PPL): 7.5YR 4/8 (strong brown) with spots of 10YR 7/6 (yellow)
B-fabric (XPL): Speckled-Active – lighter paste more active
Slip: No
Edges: One edge darker 7.5YR 2.5/3 (very dark brown)
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 4.6%
Also Present: calcite, shell
Comments: Most secondary calcite is concentrated on one side
Table: see A5-2

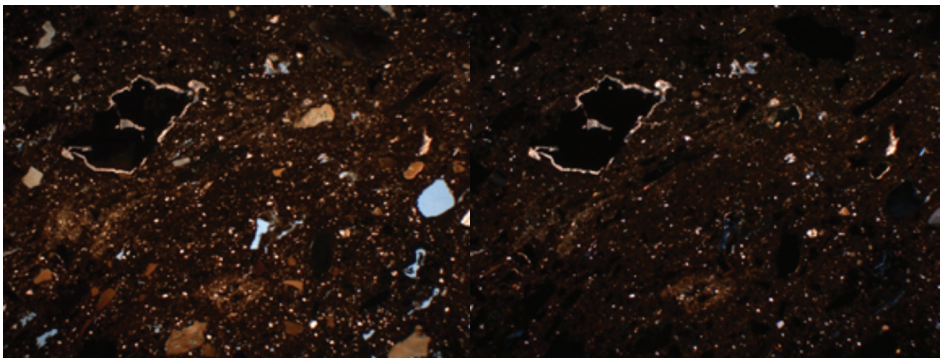

Figure A5-5. *SAAN-32568.*

SAAN-32571

Provenience: Section B
Paste Matrix (PPL): Slightly Mottled – Slightly Lighter Core
Paste Color (PPL): 2.5Y 6/6 (olive yellow) with spots 2.5Y 4/3 (olive brown)
B-fabric (XPL): Speckled-Slightly Active – darker spots undifferentiated
Slip: No
Edges: Darker edges on both sides – 10YR 4/6 (yellowish brown)
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 7.0%
Also Present: calcium carbonate, calcite, muscovite
Table: see A5-2

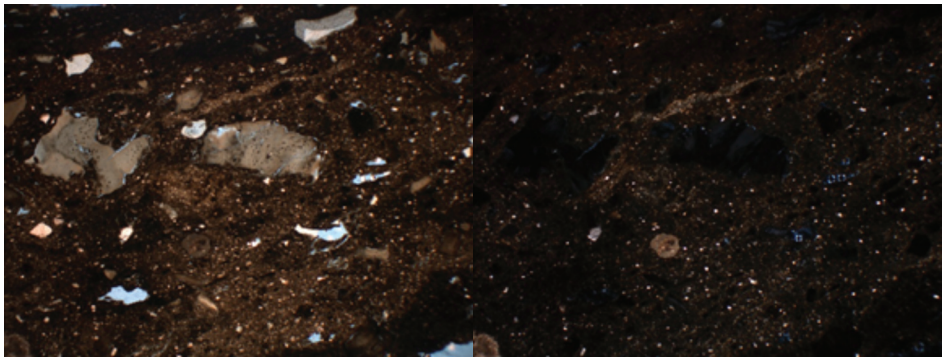

Figure A5-6. *SAAN-32571.*

SAAN-32574

Provenience: Section J
Paste Matrix (PPL): Mottled
Paste Color (PPL): 7.5YR 4/4 (brown) with spots 7.5YR 5/8 (strong brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: One edge all 7.5YR 5/8 (strong brown)
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 2.4%
Also Present: muscovite, alkali feldspar
Table: see A5-2

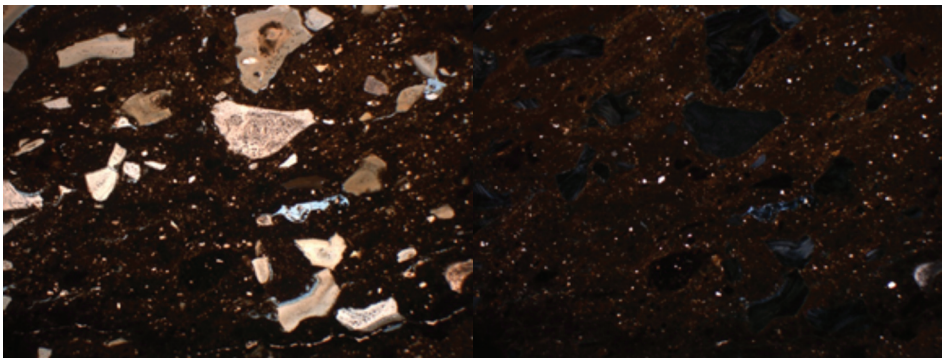

Figure A5-7. *SAAN-32574.*

SAAN-32575

Provenience: Section J
Paste Matrix (PPL): Slightly Mottled
Paste Color (PPL): 2.5Y 6/6 (olive yellow) with spots 2.5Y 4/4 (olive brown)
B-fabric (XPL): Speckled-Slightly Active – darker spots undifferentiated
Slip: No
Edges: One edge black
Secondary Calcite: Heavy
Sand Size Category: Very fine sand
Voids: 4.7%
Also Present: calcite, calcium carbonate, alkali feldspar
Table: see A5-2

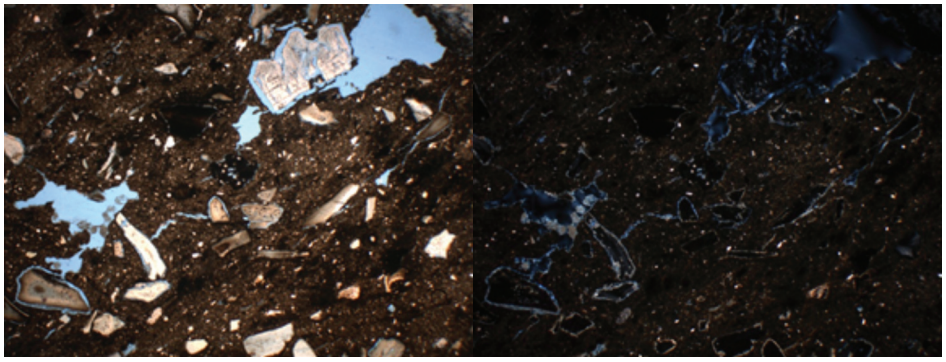

Figure A5-8. *SAAN-32575.*

SAAN-32576

Provenience: TU 04 – 15-26 cmbs
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 4/6 (dark yellowish brown)
B-fabric (XPL): Undifferentiated
Slip: No
Edges: One edge black
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 9.4%
Also Present: polycrystalline quartz, calcium carbonate, muscovite
Comments: Paste around bone is black – very porous
Table: see A5-2

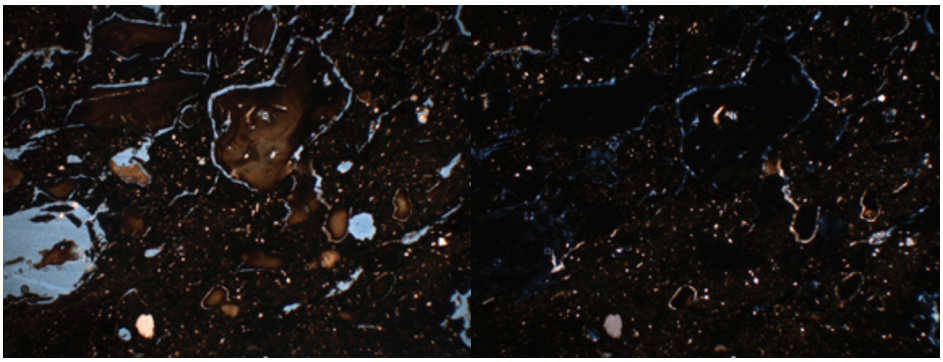

Figure A5-9. *SAAN-32576.*

SAAN-32578

Provenience: Section C
Paste Matrix (PPL): Continuous
Paste Color (PPL): 7.5YR 5/8 (strong brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Same as rest of paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 4.9%
Also Present: muscovite, clay pellets
Table: see A5-2

Figure A5-10. *SAAN-32578.*

SAAN-32579

Provenience: Section F
Paste Matrix (PPL): Mottled
Paste Color (PPL): 10YR 5/8 (yellowish brown) with streaks 10YR 4/3 (brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: One edge darker – 7.5YR 3/4 (dark brown)
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 6.7%
Also Present: muscovite, calcium carbonate
Table: see A5-2

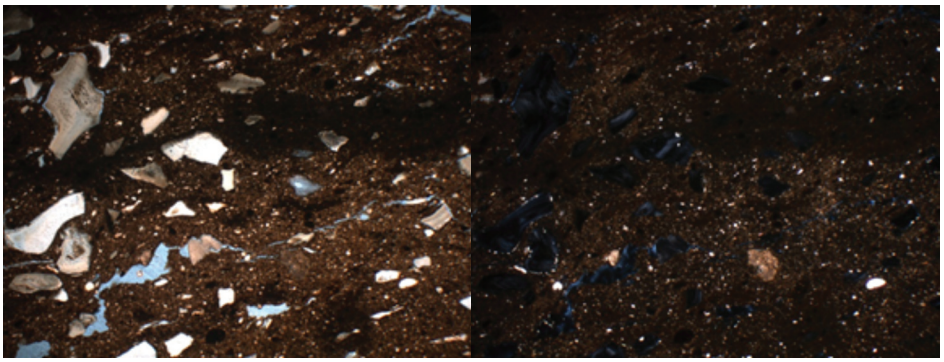

Figure A5-11. *SAAN-32579.*

SAAN-32581

Provenience: TU 14 – 108-118 cmbs
Paste Matrix (PPL): Continuous – Slight Core
Paste Color (PPL): 10YR 4/6 (dark yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Both edges 10YR 6/8 (brownish yellow) – one edge has a streak of 7.5YR 4/6 (strong brown)
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 1.6%
Also Present: calcite, muscovite, plagioclase
Table: see A5-2

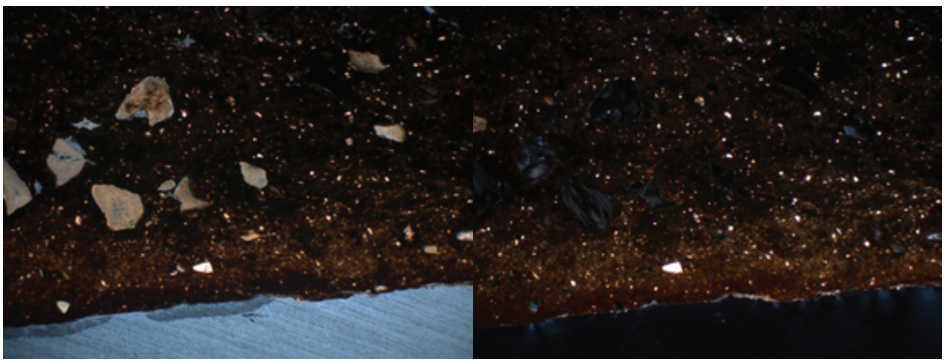

Figure A5-12. *SAAN-32581.*

SAAN-32582

Provenience: TU 04 – 107-118 cmbs
Paste Matrix (PPL): Mottled – Lighter Core
Paste Color (PPL): 2.5Y 7/6 (yellow) with spots 2.5Y 4/3 (olive brown)
B-fabric (XPL): Speckled-Active – darker colors are undifferentiated
Slip: No
Edges: 10YR 6/8 (brownish yellow) – one edge a little darker 10YR 5/8 (yellowish brown)
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 2.4%
Also Present: calcite, polycrystalline quartz, muscovite
Table: see A5-2

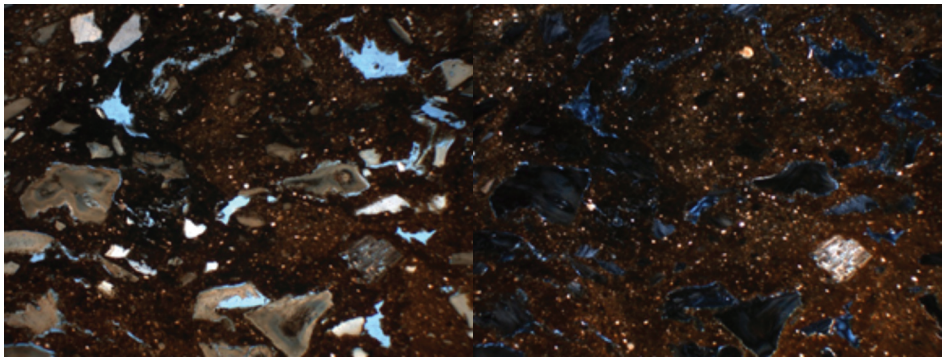

Figure A5-13. *SAAN-32582.*

SAAN-32584

Provenience: Section J
Paste Matrix (PPL): Mottled – Core
Paste Color (PPL): 2.5Y 5/6 (light olive brown) with spots 2.5Y 7/8 (yellow)
B-fabric (XPL): Speckled-Slightly Active – edges are speckled-active
Slip: No
Edges: Darker – 10YR 6/8 (brownish yellow)
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 3.7%
Also Present: muscovite, alkali feldspar, polycrystalline quartz
Table: see A5-2

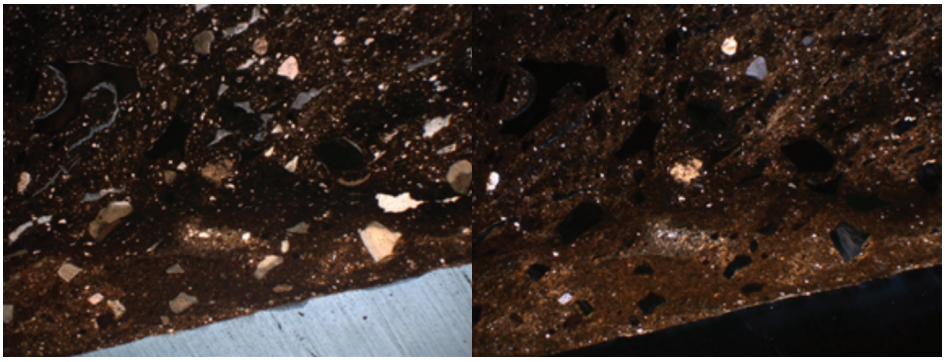

Figure A5-14. *SAAN-32584.*

SAAN-32593

Provenience: Section B
Paste Matrix (PPL): Mottled - Core
Paste Color (PPL): 10YR 5/8 (yellowish brown) with spots 10YR 4/4 (dark yellowish brown)
B-fabric (XPL): Speckled-Slightly Active – dark spots and edges are undifferentiated
Slip: No
Edges: Darker edges – 10YR 4/4 (dark yellowish brown)
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 2.2%
Also Present: muscovite, polycrystalline quartz
Table: see A5-2

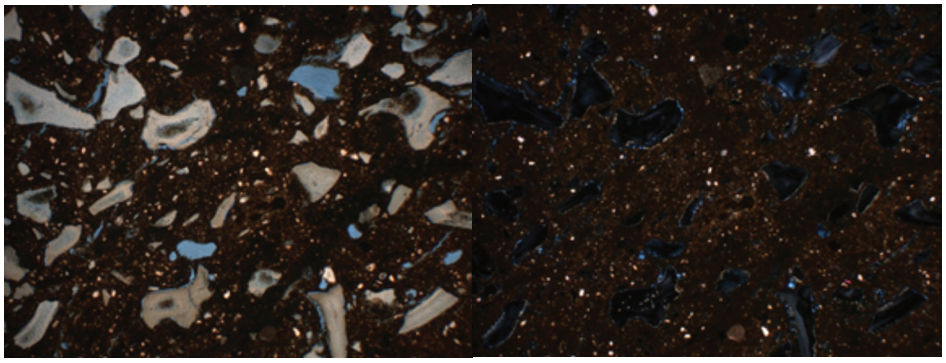

Figure A5-15. *SAAN-32593.*

SAAN-32596-28

Provenience: Section B
Paste Matrix (PPL): Slightly Mottled
Paste Color (PPL): 10YR 5/6 yellowish brown with spots 2.5Y 7/6 (yellow)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Same as the rest of the paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 5.6%
Also Present: rock conglomerate, chert, muscovite, fossils, calcium carbonate
Table: see A5-2

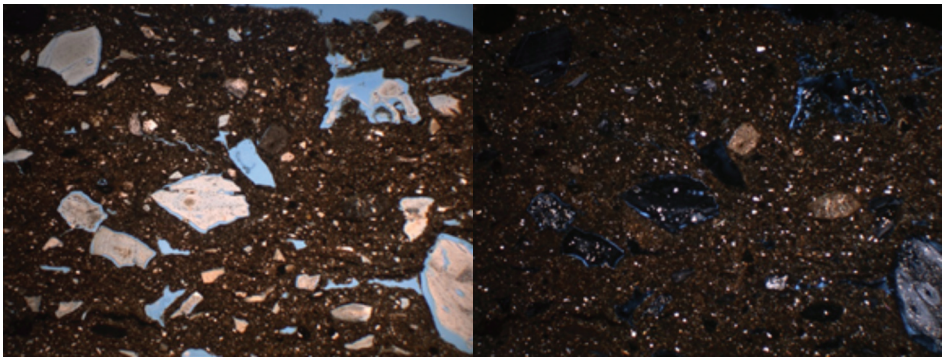

Figure A5-16. *SAAN-32596-28.*

SAAN-32604-36

Provenience: TU 10 – 8-18 cmbs
Paste Matrix (PPL): Continuous – Core
Paste Color (PPL): 10YR 4/2 (dark grayish brown)
B-fabric (XPL): Undifferentiated
Slip: No
Edges: Darker – 10YR 2/1 (black) with spots of calcium carbonate
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 5.8%
Also Present: muscovite, calcium carbonate
Table: see A5-2

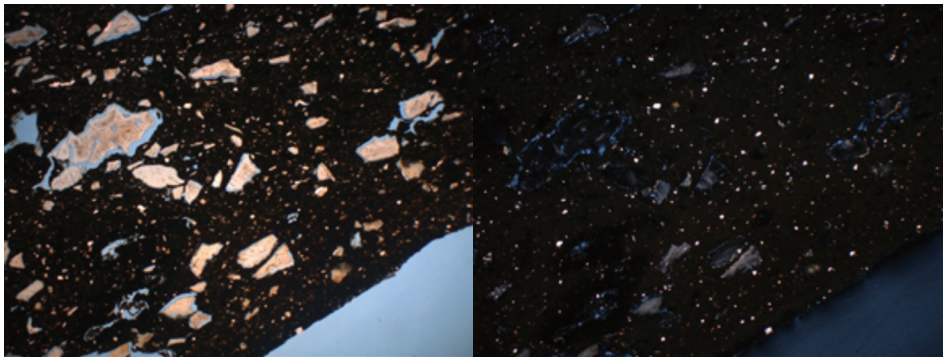

Figure A5-17. *SAAN-32604-36.*

SAAN-32606-38

Provenience: TU 14 – 58-68 cmbs
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 5/6 (yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: One edge darker – 10YR 3/6 (dark yellowish brown) to black – both edges have spots of calcium carbonate
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 2.3%
Also Present: calcium carbonate, muscovite, calcite
Comments: Dark 10YR 4/3 (brown) paste around bone
Table: see A5-2

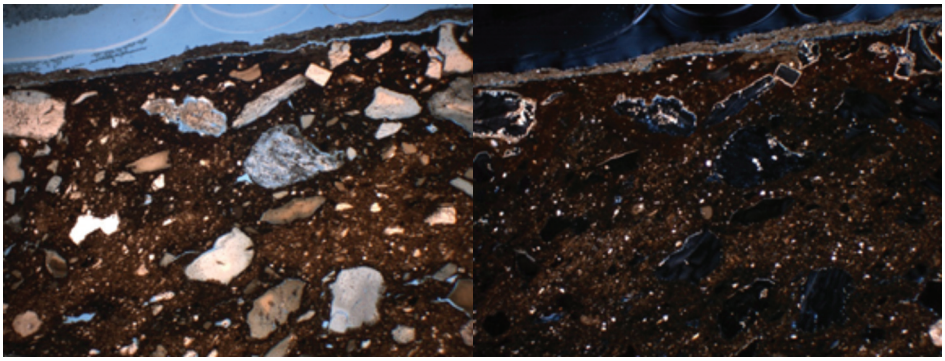

Figure A5-18. *SAAN-32606-38.*

SAAN-32607-39

Provenience: Section C
Paste Matrix (PPL): Slightly Mottled – Lighter Core
Paste Color (PPL): 10YR 6/6 (brownish yellow) with spots 10YR 7/6 (yellow)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Darker – 10YR 4/4 (dark yellowish brown)
Secondary Calcite: Heavy
Sand Size Category: Silt
Voids: 4.0%
Also Present: muscovite, calcite, alkali feldspar
Table: see A5-2

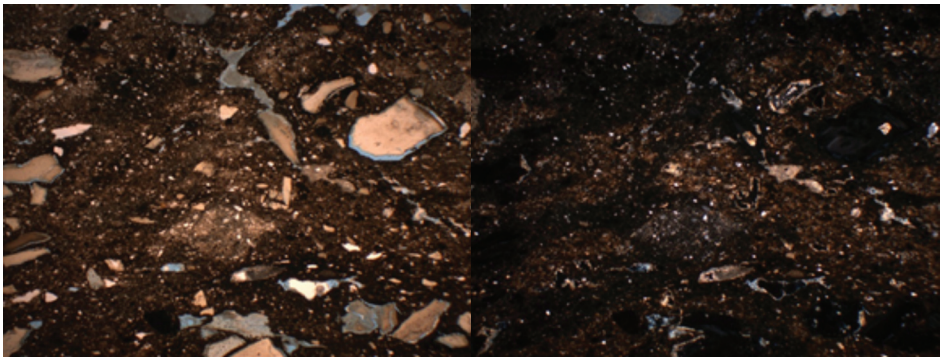

Figure A5-19. *SAAN-32607-39.*

SAAN-32615-47

Provenience: Section J
Paste Matrix (PPL): Continuous
Paste Color (PPL): 2.5Y 7/6 (yellow)
B-fabric (XPL): Speckled-Active
Slip: No
Edges: Both edges have spots of 7.5YR 5/6 (strong brown) and spots of calcium carbonate
Secondary Calcite: Heavy
Sand Size Category: Silt
Voids: 3.0%
Also Present: calcite
Table: see A5-2

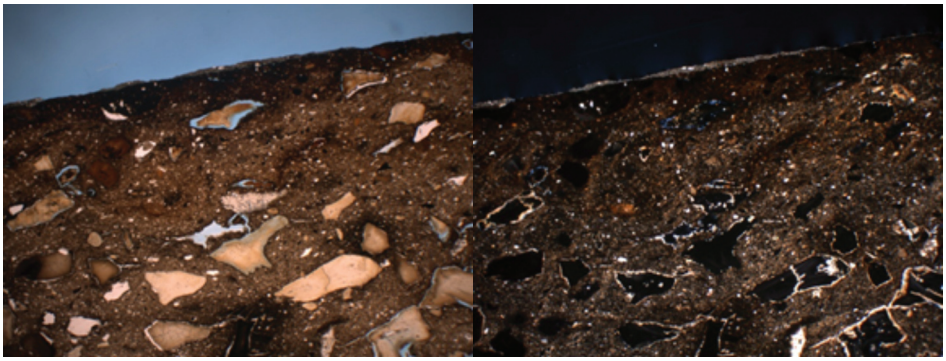

Figure A5-20. *SAAN-32615-47.*

Table A5-2. Point Counts and Frequencies for Unsandy Paste - Moderate Bone Temper

SAAN #	Paste		Bone		Sand						Carbonates				Mica Muscovite		Other				Total (n)
					Quartz		Alkali feldspar		Polycrystalline quartz		Calcite		Calcium carbonate				Opaque		Clay pellet		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
32568	100	**80.0**	18	**14.4**	4	**3.2**	1	**0.8**					1	**0.8**	1	**0.8**					125
32571	100	**83.3**	18	**15.0**	1	**0.8**											1	**0.8**			120
32574	100	**81.3**	19	**15.4**	**3**	**2.4**											1	**0.8**			123
32575	100	**81.3**	17	**13.8**	4	**3.3**									1	**0.8**	1	**0.8**			123
32576	100	**74.1**	26	**19.3**	7	**5.2**					1	**0.7**					1	**0.7**			135
32578	100	**85.5**	14	**12.0**	1	**0.9**							1	**0.9**			1	**0.9**			117
32579	100	**80.6**	19	**15.3**	2	**1.6**					1	**0.8**					2	**1.6**			124
32581	100	**78.7**	17	**13.4**	5	**3.9**	2	**1.6**	1	**0.8**									2	**1.6**	127
32582	100	**81.3**	17	**13.8**	3	**2.4**							1	**0.8**			2	**1.6**			123
32584	100	**76.3**	26	**19.8**	3	**2.3**							2	**1.5**							131
32593	100	**75.8**	24	**18.2**	6	4.5							2	**1.5**							132
32596-28	100	**84.7**	12	**10.2**	4	**3.4**											2	**1.7**			118
32604-36	100	**87.7**	13	**11.4**	1	**0.9**															114
32606-38	100	**78.1**	23	**18.0**	3	**2.3**	1	**0.8**									1	**0.8**			128
32607-39	100	**84.7**	15	**12.7**	2	**1.7**							1	**0.8**							118
32615-47	100	**76.9**	18	**13.8**	5	**3.8**			1	**0.8**			3	**2.3**	2	**1.5**			1	**0.8**	130

Unsandy Paste – Heavy Bone Paste Group

SAAN-32572

Provenience: Section B
Paste Matrix (PPL): Continuous – Lighter Core
Paste Color (PPL): 10YR 5/6 (yellowish brown)
B-fabric (XPL): Speckled-Active – edges are undifferentiated
Slip: No
Edges: Both edges darker – 10YR 3/6 (dark yellowish brown)
Secondary Calcite: Heavy
Sand Size Category: Silt
Voids: 7.3%
Also Present: calcite, calcium carbonate, muscovite
Table: see A5-3

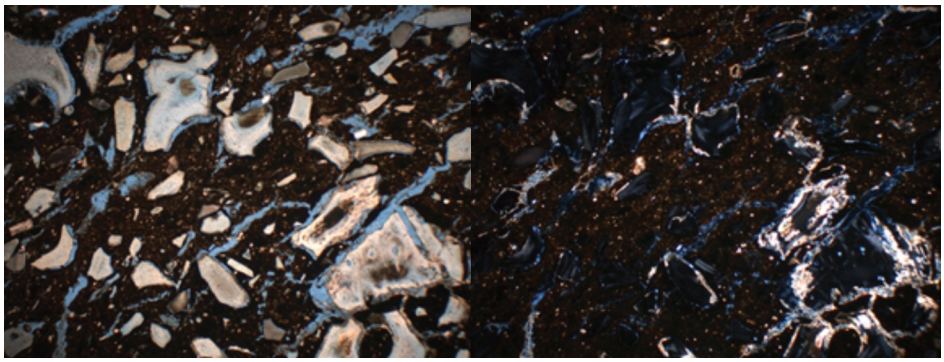

Figure A5-21. *SAAN-32572.*

SAAN-32573

Provenience: Section H
Paste Matrix (PPL): Continuous – Slight Core
Paste Color (PPL): 10YR 2/2 (very dark brown)
B-fabric (XPL): Undifferentiated
Slip: No
Edges: Both edges lightly lighter – 10YR 3/6 (dark yellowish brown)
Secondary Calcite: Sparse
Sand Size Category: Very fine sand
Voids: 11.4%
Also Present: calcium carbonate, muscovite
Table: see A5-3

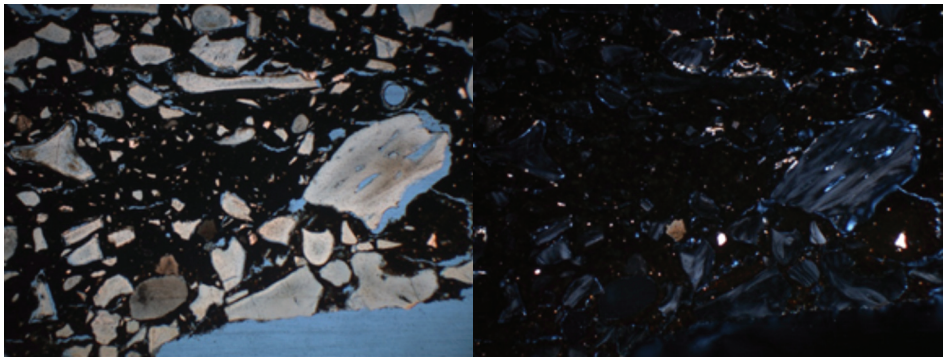

Figure A5-22. *SAAN-32573.*

SAAN-32577

Provenience: Section C
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 5/8 (yellowish brown)
B-fabric (XPL): Speckled-Slightly Active – dark edge undifferentiated
Slip: No
Edges: One edge darker – 10YR 3/8 (dark yellowish brown)
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 8.3%
Also Present: quartz, calcium carbonate, alkali feldspar, muscovite, polycrystalline quartz, calcite
Table: see A5-3

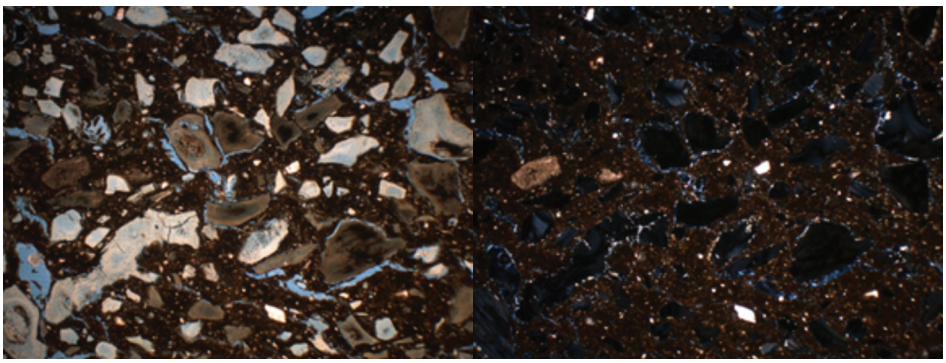

Figure A5-23. *SAAN-32577.*

SAAN-32580

Provenience: TU 04 – 6-15 cmbs
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 3/6 (dark yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Same as the rest of the paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 5.1%
Also Present: plagioclase
Table: see A5-3

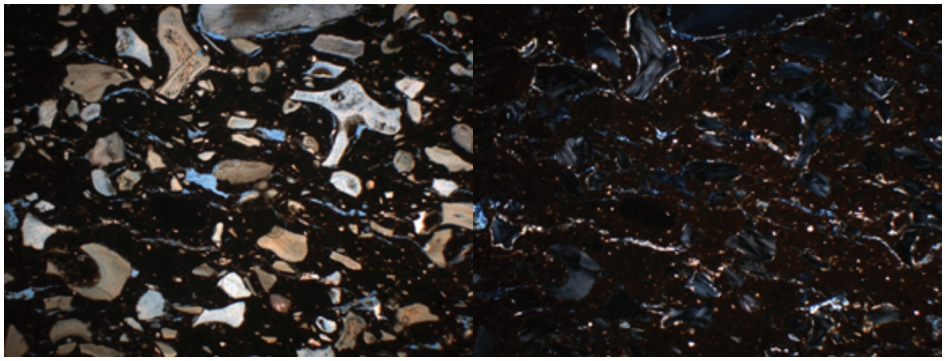

Figure A5-24. *SAAN-32580.*

SAAN-32583

Provenience: TU 14 – 58-68 cmbs
Paste Matrix (PPL): Slightly Mottled
Paste Color (PPL): 10YR 5/8 (yellowish brown) with spots 10YR 3/4 (dark yellowish brown)
B-fabric (XPL): Speckled-Slightly Active – dark spots are undifferentiated
Slip: No
Edges: Same as the rest of the paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 5.1%
Also Present: calcite
Comments: Most of the secondary calcite is on one side of the thin section
Table: see A5-3

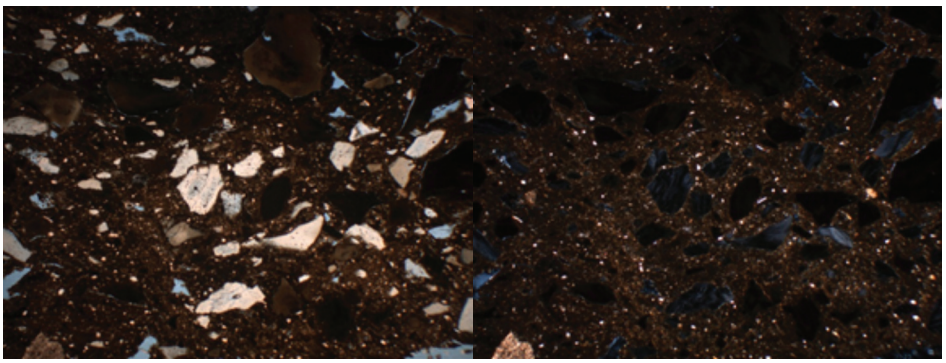

Figure A5-25. *SAAN-32583.*

SAAN-32587

Provenience: Section F
Paste Matrix (PPL): Continuous
Paste Color (PPL): 7.5YR 4/6 (strong brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Same as the rest of the paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 2.2%
Also Present: muscovite, calcite, alkali feldspar
Table: see A5-3

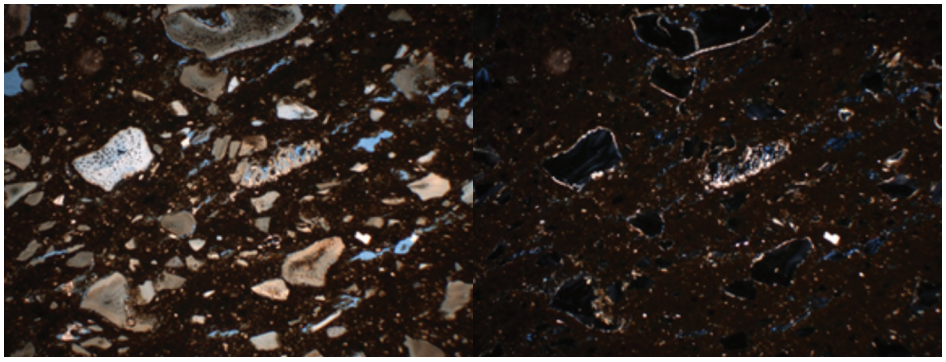

Figure A5-26. *SAAN-32587.*

SAAN-32588

Provenience: Section F
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 5/8 (yellowish brown)
B-fabric (XPL): Undifferentiated
Slip: No
Edges: One edge darker – 7.5YR 3/4 (dark brown)
Secondary Calcite: Moderate
Sand Size Category: Very fine sand
Voids: 2.6%
Also Present: muscovite, fossils, calcite, alkali feldspar
Comments: Lots of calcite/calcium carbonate in paste
Table: see A5-3

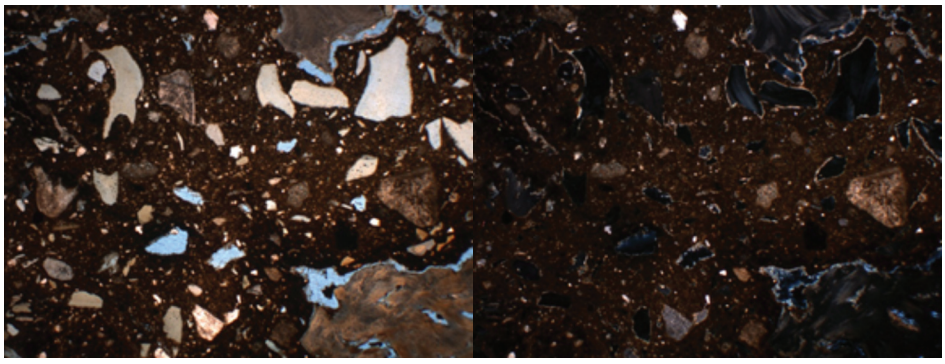

Figure A5-27. *SAAN-32588.*

SAAN-32589

Provenience: Section F
Paste Matrix (PPL): Mottled
Paste Color (PPL): 10YR 4/6 (dark yellowish brown) with spots/streaks 10YR 7/6 (yellow) and 10YR 5/8 (yellowish brown)
B-fabric (XPL): Undifferentiated
Slip: No
Edges: Same as the rest of the paste
Secondary Calcite: Heavy
Sand Size Category: Silt
Voids: 2.6%
Also Present: calcium carbonate, muscovite
Table: see A5-3

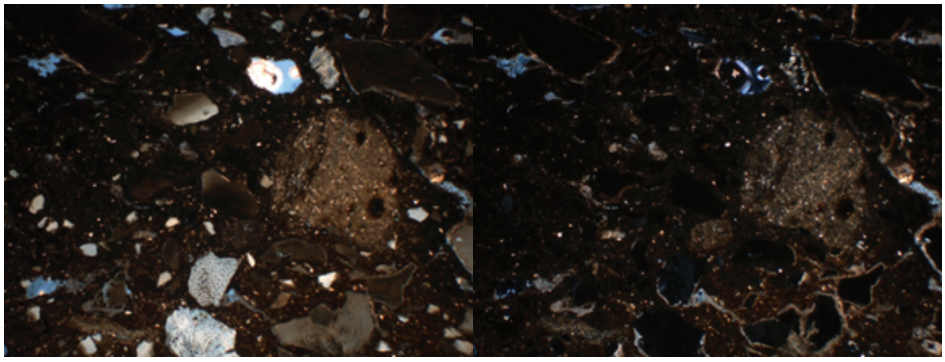

Figure A5-28. *SAAN-32589.*

SAAN-32591

Provenience: Section C
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 4/4 (dark yellowish brown)
B-fabric (XPL): Undifferentiated – lighter edge is speckled-slightly active
Slip: No
Edges: One edge lighter – 10YR 5/6 (yellowish brown)
Secondary Calcite: Heavy
Sand Size Category: Silt
Voids: 1.3%
Also Present: No other inclusion found
Table: see A5-3

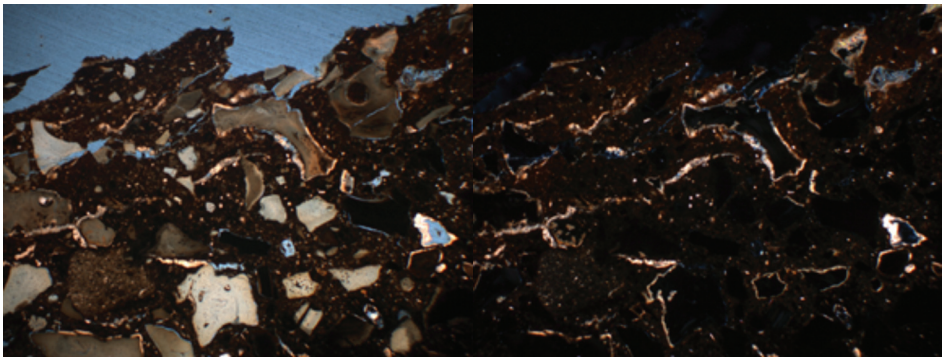

Figure A5-29. *SAAN-32591.*

SAAN-32592

Provenience: Section B
Paste Matrix (PPL): Mottled
Paste Color (PPL): 10YR 5/8 (yellowish brown) with spots 10YR 4/4 (dark yellowish brown)
B-fabric (XPL): Speckled-Slightly Active – dark spots are undifferentiated
Slip: No
Edges: Same as the rest of the paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 4.6%
Also Present: alkali feldspar, muscovite, polycrystalline quartz
Table: see A5-3

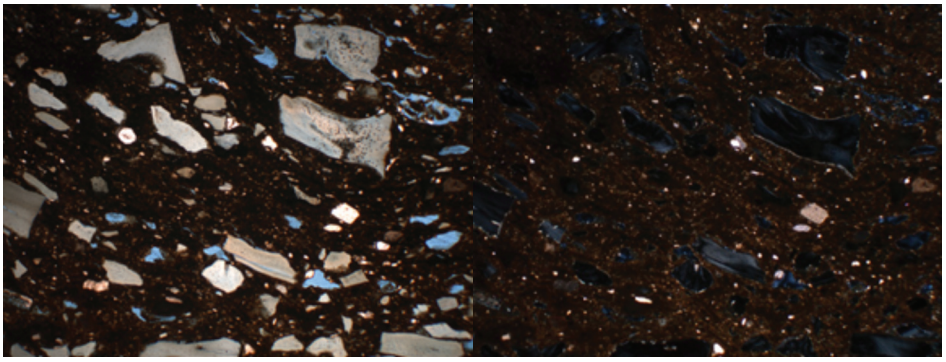

Figure A5-30. *SAAN-32592.*

SAAN-32594-26

Provenience: Section B
Paste Matrix (PPL): Half & Half
Paste Color (PPL): 10YR 5/6 (yellowish brown) and 10YR 3/2 (very dark grayish brown)
B-fabric (XPL): Speckled-Slightly Active – dark side is undifferentiated
Slip: No
Edges: Same as the rest of the paste – spots of calcite on edges
Secondary Calcite: Heavy
Sand Size Category: Silt
Voids: 9.6%
Also Present: rock conglomerate, plagioclase
Table: see A5-3

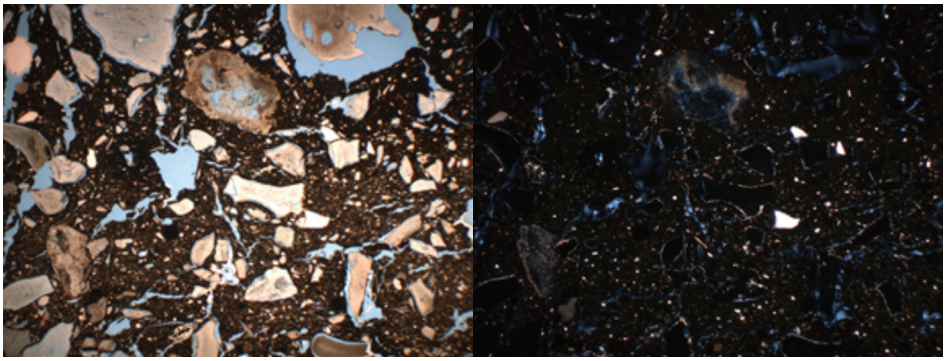

Figure A5-31. *SAAN-32594-26.*

SAAN-32595-27

Provenience: Section B
Paste Matrix (PPL): Continuous – Slight Core
Paste Color (PPL): 2.5Y 5/6 (light olive brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: Indeterminate
Edges: 10YR 5/6 (yellowish brown) – one edge has a .08 mm layer of calcite/calcium carbonate
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 7.8%
Also Present: calcium carbonate, chert, muscovite, alkali feldspar
Table: see A5-3

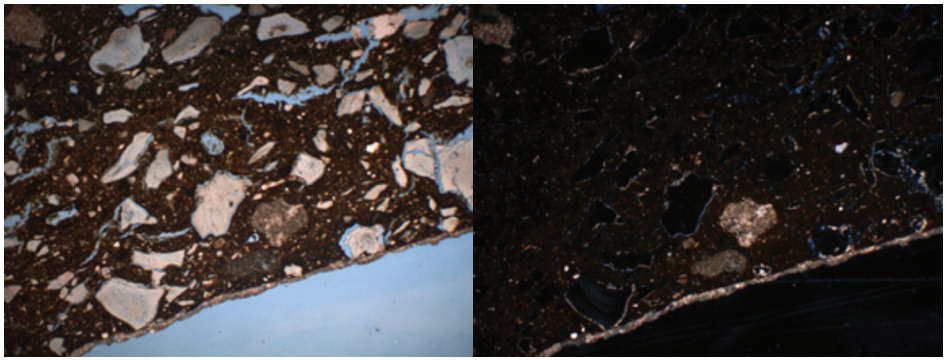

Figure A5-32. *SAAN-32595-27.*

SAAN-32597-29

Provenience: Section B
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 5/6 (yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: One edge darker – 10YR 3/5 (dark yellowish brown) with spots of calcite/calcium carbonate
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 4.1%
Also Present: alkali feldspar, calcite
Table: see A5-3

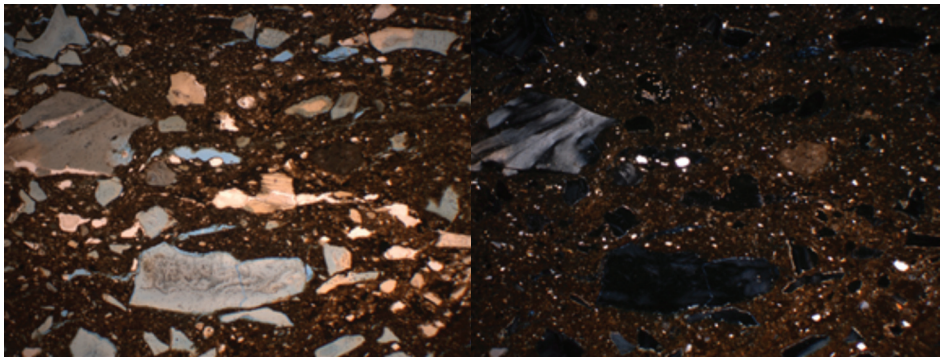

Figure A5-33. *SAAN-32597-29.*

SAAN-32599-31

Provenience: Section B
Paste Matrix (PPL): Half & Half
Paste Color (PPL): 10YR 5/6 (yellowish brown) and 10YR 4/4 (dark yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Same as the rest of the paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 5.5%
Also Present: muscovite, calcite
Table: see A5-3

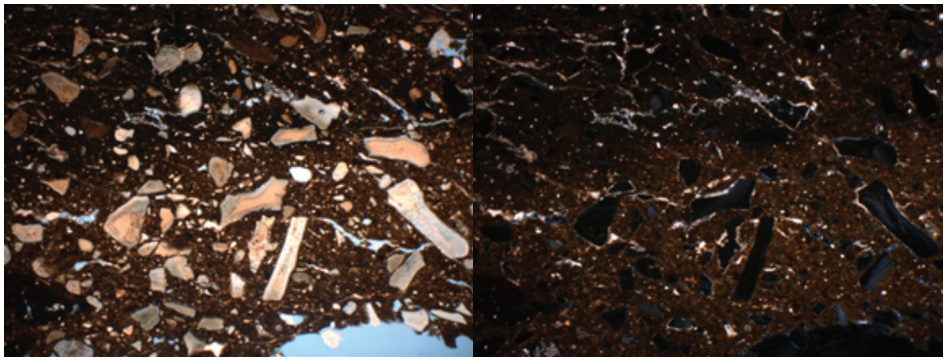

Figure A5-34. *SAAN-32599-31.*

SAAN-32603-35

Provenience: Section H
Paste Matrix (PPL): Continuous - Core
Paste Color (PPL): 10YR 4/3 (brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Lighter edges – 10YR 5/6 (yellowish brown) – one edge has spots of calcium carbonate
Secondary Calcite: Moderate – heavy along the edges
Sand Size Category: Silt
Voids: 7.4%
Also Present: muscovite, calcium carbonate
Comments: Very porous
Table: see A5-3

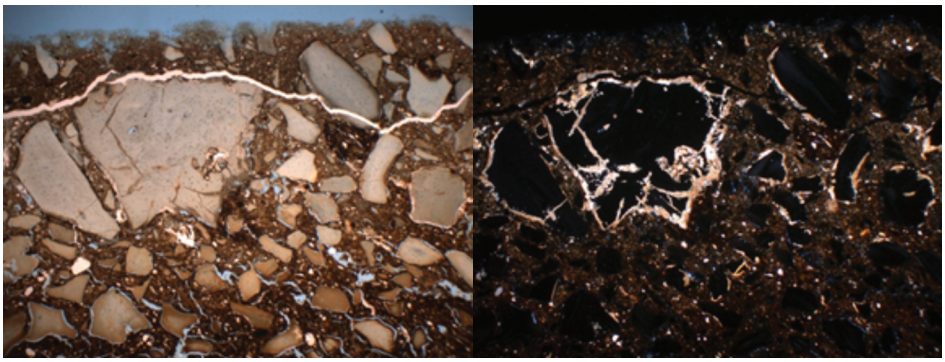

Figure A5-35. *SAAN-32603-35.*

SAAN-32608-40

Provenience: Section C
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 3/4 (dark yellowish brown)
B-fabric (XPL): Undifferentiated
Slip: No
Edges: Same as the rest of the paste
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 8.6%
Also Present: muscovite, polycrystalline quartz, calcite
Comments: On one side, the bone is tan to brown in color with little to no secondary calcite, but on the other side, the bone is white with a heavy amount of secondary calcite
Table: see A5-3

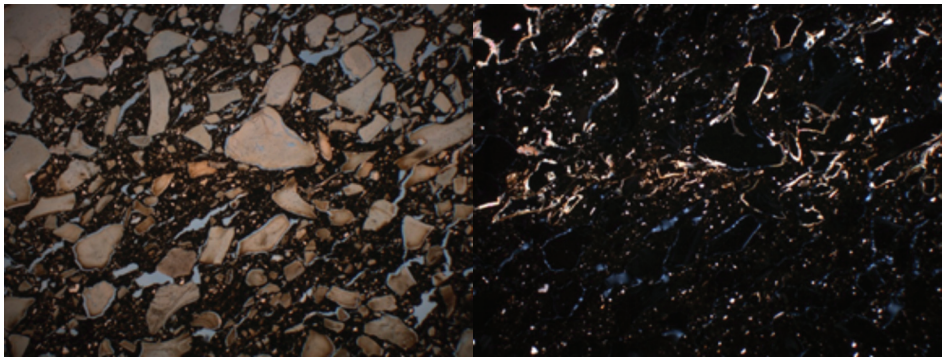

Figure A5-36. *SAAN-32608-40.*

SAAN-32609-41

Provenience: TU 10 – 48-58 cmbs
Paste Matrix (PPL): Continuous – Lighter Core
Paste Color (PPL): 10YR 4/4 (dark yellowish brown)
B-fabric (XPL): Speckled-Slightly Active – edges are undifferentiated
Slip: No
Edges: 10YR 3/2 (very dark grayish brown) – spots of calcium carbonate on one edge
Secondary Calcite: Heavy
Sand Size Category: Silt
Voids: 3.4%
Also Present: muscovite
Table: see A5-3

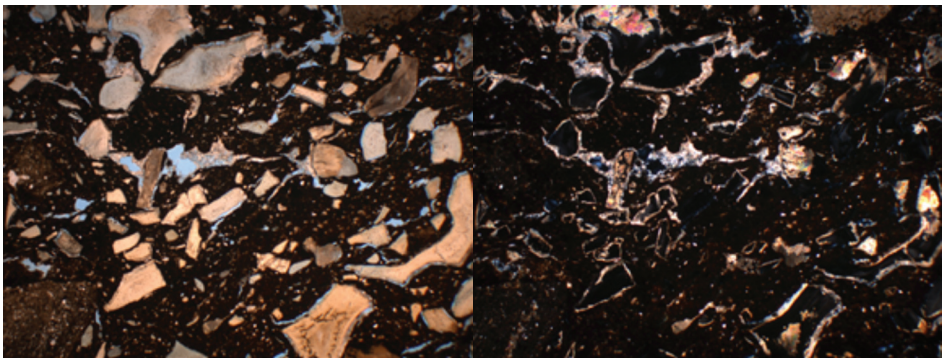

Figure A5-37. *SAAN-32609-41.*

SAAN-32610-42

Provenience: TU 10 – 48-58 cmbs
Paste Matrix (PPL): Continuous – Lighter Core
Paste Color (PPL): 10YR 6/6 (brownish yellow)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: 10YR 4/6 (dark yellowish brown) – same as the rest of the paste
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 5.6%
Also Present: calcium carbonate, muscovite, fossils, shell, calcite
Table: see A5-3

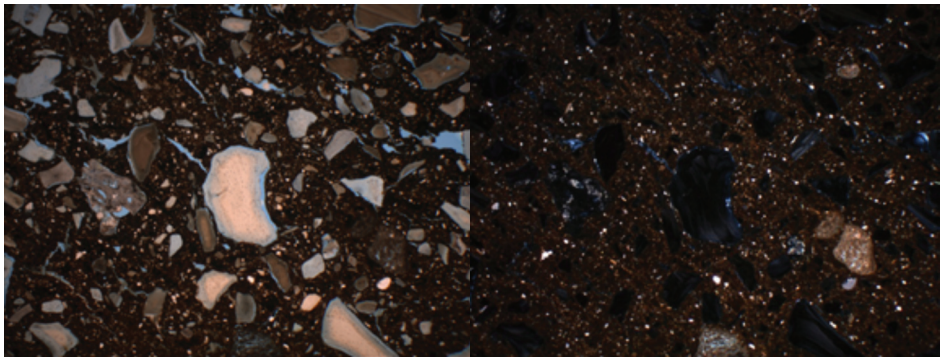

Figure A5-38. *SAAN-32610-42.*

SAAN-32611-43

Provenience: Section F
Paste Matrix (PPL): Continuous – Slightly Lighter Core
Paste Color (PPL): 10YR 5/6 (yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: 10YR 3/4 (dark yellowish brown) – spots of calcite/calcium carbonate on both edges
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 10.1%
Also Present: muscovite, chert, alkali feldspar
Table: see A5-3

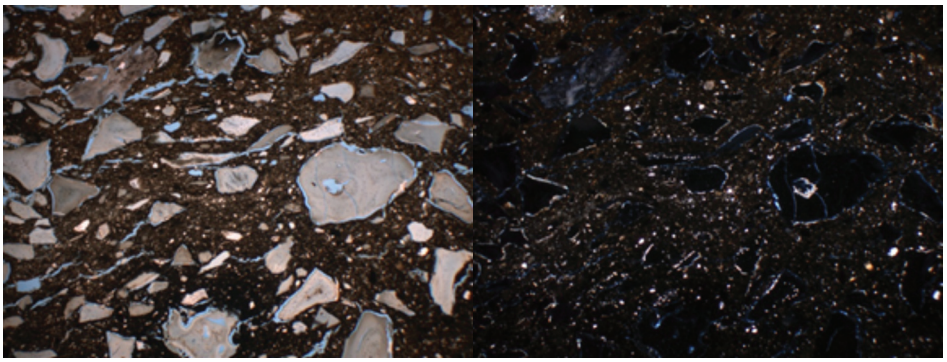

Figure A5-39. *SAAN-32611-43.*

SAAN-32612-44

Provenience: Section F
Paste Matrix (PPL): Continuous – Narrow Core
Paste Color (PPL): 10YR 4/3 (brown)
B-fabric (XPL): Speckled-Active
Slip: No
Edges: 10YR 5/6 (yellowish brown) with 10YR 4/4 (dark yellowish brown) on outer edges – spots of calcium carbonate on both edges
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 4.7%
Also Present: muscovite, microcline, alkali feldspar
Table: see A5-3

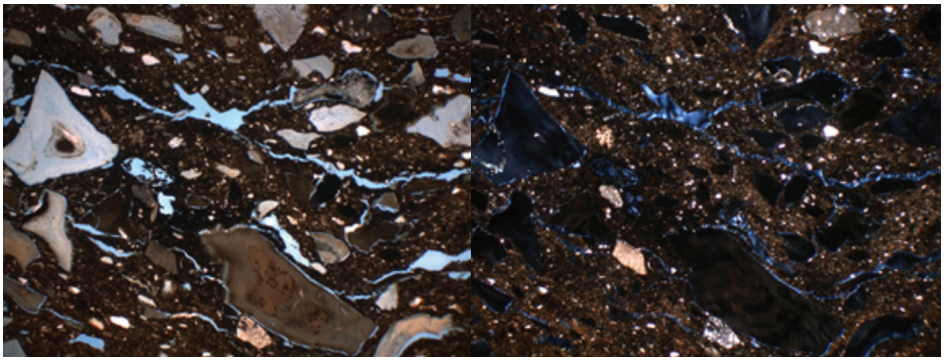

Figure A5-40. *SAAN-32612-44.*

SAAN-32613-45

Provenience: Section F
Paste Matrix (PPL): Continuous – Slight Core
Paste Color (PPL): 10YR 5/4 (yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: 10YR 5/6 (yellowish brown) – same as the rest of the paste – spots of calcium carbonate on both edges
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 6.2%
Also Present: muscovite, alkali feldspar, polycrystalline quartz
Table: see A5-3

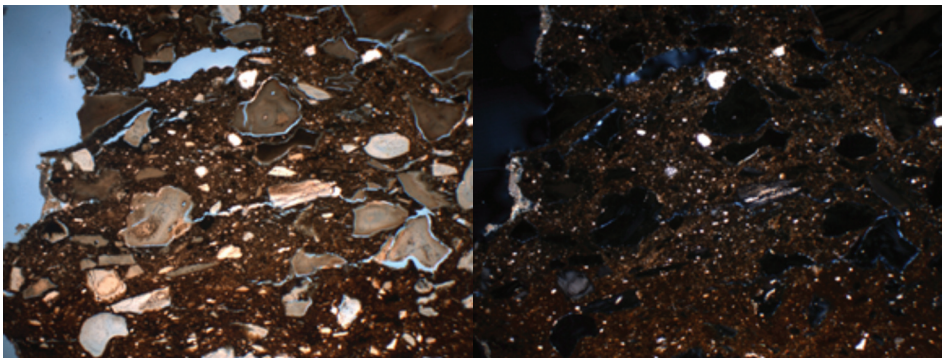

Figure A5-41. *SAAN-32613-45.*

SAAN-32616-48

Provenience: Section J
Paste Matrix (PPL): Slightly Mottled
Paste Color (PPL): 10YR 5/6 (yellowish brown) with spots 2.5Y 7/6 (yellow)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Both edges a little darker 10YR 3/4 (dark yellowish brown) – spots of calcium carbonate along one edge
Secondary Calcite: Heavy
Sand Size Category: Very fine sand
Voids: 0.6%
Also Present: plagioclase, calcite, muscovite, alkali feldspar
Table: see A5-3

Figure A5-42. *SAAN-32616-48.*

Table A5-3. Point Counts and Frequencies for Unsandy Paste - Heavy Bone Temper

SAAN #	Paste		Bone		Sand						Carbonates				Mica Muscovite		Other		Total (n)
					Quartz		Alkali feldspar		Polycrystalline quartz		Calcite		Calcium carbonate				Opaque		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
32572	100	**66.7**	46	**30.7**	3	**2.0**	1	**0.7**											150
32573	100	**67.6**	46	**31.1**	1	**0.7**	1	**0.7**											148
32577	100	**69.9**	43	**30.1**															143
32580	100	**66.7**	45	**30.0**	2	**1.3**							2	**1.3**			1	**0.7**	150
32583	100	**67.1**	39	**26.2**	7	**4.7**							1	**0.7**	1	**0.7**	1	**0.7**	149
32587	100	**74.6**	32	**23.9**	1	**0.7**							1	**0.7**					134
32588	100	**65.8**	36	**23.7**	7	**4.6**			1	**0.7**			8	**5.3**					152
32589	100	**68.0**	44	**29.9**	1	**0.7**					2	**1.4**							147
32591	100	**66.2**	45	**29.8**	2	**1.3**					2	**1.3**	2	**1.3**					151
32592	100	**68.5**	42	**28.8**	2	**1.4**							2	**1.4**					146
32594-26	100	**62.9**	50	**31.4**	6	**3.8**							2	**1.3**	1	**0.6**			159
32595-27	100	**70.9**	34	**24.1**	6	**4.3**											1	**0.7**	141
32597-29	100	**71.9**	33	**23.7**	1	**0.7**			1	**0.7**			3	**2.2**	1	**0.7**			139
32599-31	100	**74.1**	31	**23.0**	3	**2.2**							1	**0.7**					135
32603-35	100	**53.8**	78	**41.9**	6	**3.2**			1	**0.5**							1	**0.5**	186
32608-40	100	**60.6**	58	**35.2**	5	**3.0**							2	**1.2**					165
32609-41	100	**62.9**	53	**33.3**	4	**2.5**					1	**0.6**	1	**0.6**					159
32610-42	100	**65.8**	43	**28.3**	7	**4.6**											2	**1.3**	152
32611-43	100	**69.9**	34	**23.8**	6	**4.2**							3	**2.1**					143
32612-44	100	**69.9**	40	**28.0**	1	**0.7**					1	**0.7**	1	**0.7**					143
32613-45	100	**66.2**	46	**30.5**	2	**1.3**							2	**1.3**			1	**0.7**	151
32616-48	100	**64.5**	35	**22.6**	14	**9.0**			1	**0.6**			4	**2.6**			1	**0.6**	155

Sandy Paste – Light Bone Paste Group

SAAN-32585

Provenience: Section I
Paste Matrix (PPL): Continuous – Lighter Core
Paste Color (PPL): 10YR 6/6 (brownish yellow)
B-fabric (XPL): Speckled-Active – edges are undifferentiated
Slip: No
Edges: 10YR 4/6 (dark yellowish brown)
Secondary Calcite: Moderate
Sand Size Category: Silt
Voids: 4.4%
Also Present: muscovite, plagioclase, calcium carbonate
Table: A5-4

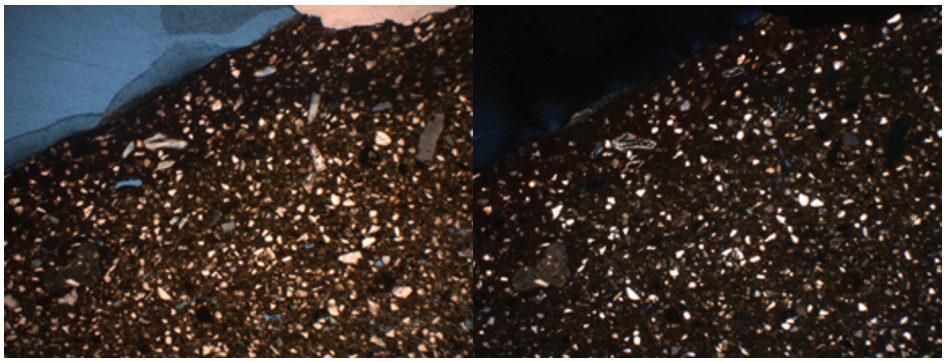

Figure A5-43. *SAAN-32585.*

Very Sandy Paste – Light Bone Paste Group

SAAN-32586

Provenience: Section J
Paste Matrix (PPL): Mottled
Paste Color (PPL): 10YR 4/6 (dark yellowish brown) with spots of 2.5Y 7/4 (pale yellow)
B-fabric (XPL): Undifferentiated
Slip: No
Edges: One edge darker – 10YR 2/2 (very dark brown)
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 6.3%
Also Present: muscovite, biotite, perthite, chert
Table: see A5-4

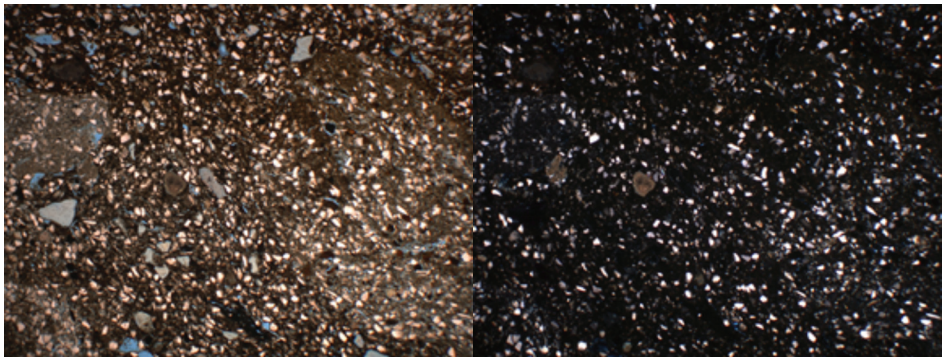

Figure A5-44. *SAAN-32586.*

Very Sandy Paste – Moderate Bone Paste Group

SAAN-32590

Provenience: Section C
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 3/6 (dark yellowish brown)
B-fabric (XPL): Undifferentiated – lighter edge is speckled-slightly active
Slip: No
Edges: One edge slightly lighter – 10YR 5/6 (yellowish brown)
Secondary Calcite: Sparse
Sand Size Category: Silt
Voids: 3.3%
Also Present: muscovite, plagioclase
Table: see A5-4

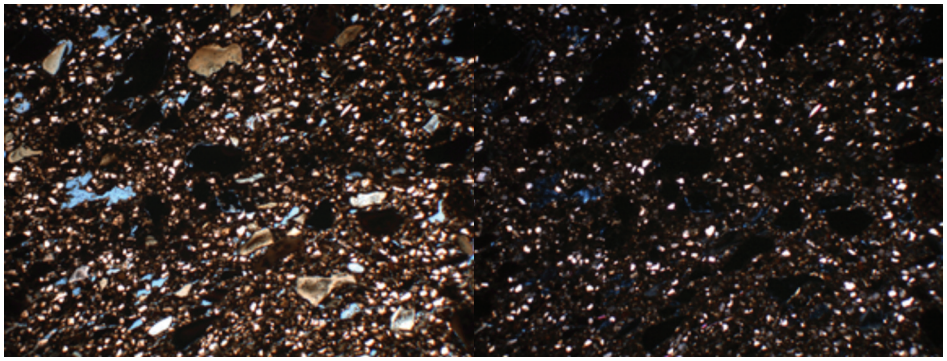

Figure A5-45. *SAAN-32590.*

Table A5-4. Point Counts and Frequencies for San Juan Petrographic Analysis

SAAN #	Paste		Bone		Sand						Carbonates				Other		Total (n)
					Quartz		Alkali feldspar		Polycrystalline quartz		Calcite		Calcium carbonate		Opaque		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Sandy paste - light bone																	
32585	100	**76.9**	6	**4.6**	19	**14.6**	4	**3.1**	1	**0.8**							130
Very sandy paste - light bone																	
32586	100	**67.6**	6	**4.1**	29	**19.6**	7	**4.7**	2	**1.4**			2	**1.4**	2	**1.4**	148
Very sandy paste - moderate bone																	
32590	100	**57.1**	33	**18.9**	31	**17.7**	3	**1.7**	3	**1.7**	1	**0.6**	2	**1.1**	2	**1.1**	175

Very Sandy Paste – Sand Tempered Paste Group

SAAN-32605-37

Provenience: TU 10 – 38-48 cmbs
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 5/6 (yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: One edge slightly darker – 10YR 4/6 (dark yellowish brown) – also has spots of calcium carbonate
Secondary Calcite: None
Sand Size Category: Fine sand
Voids: 7.7%
Also Present: augite, biotite, muscovite
Table: A5-5

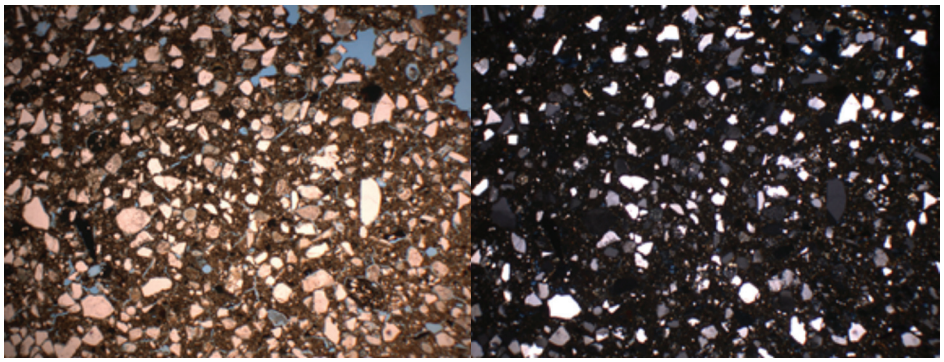

Figure A5-46. *SAAN-32605-37.*

SAAN-32614-46

Provenience: Section F
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 6/6 (brownish yellow)
B-fabric (XPL): Speckled-Active
Slip: Indeterminate one side
Edges: On one edge there is a 0.08 mm thick strip of slightly transulscent grayish color – 10YR 5/1 (gray)
Secondary Calcite: None
Sand Size Category: Very fine sand
Voids: 1.3%
Also Present: biotite, augite, plagioclase, rock
Table: see A5-5

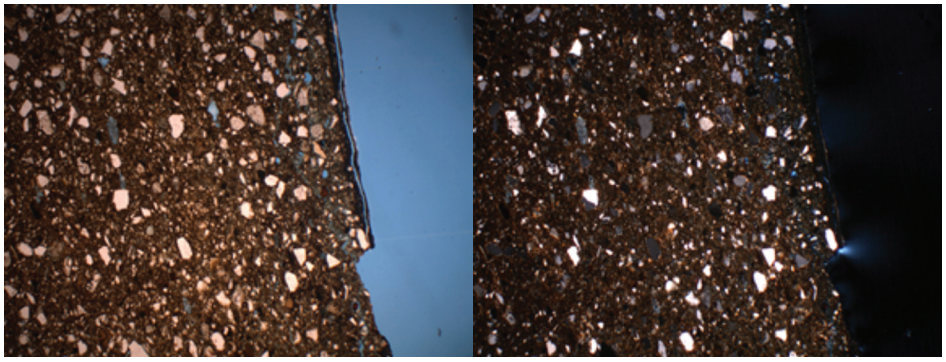

Figure A5-47. *SAAN-32614-46.*

SAAN-32617-49

Provenience: Section J
Paste Matrix (PPL): Continuous
Paste Color (PPL): 10YR 5/6 (yellowish brown)
B-fabric (XPL): Speckled-Slightly Active
Slip: No
Edges: Same as the rest of the paste – one edge has spots of black approximately 0.04 mm thick
Secondary Calcite: None
Sand Size Category: Very fine sand
Voids: 13.3 %
Also Present: muscovite, plagioclase, augite, rock
Table: see A5-5

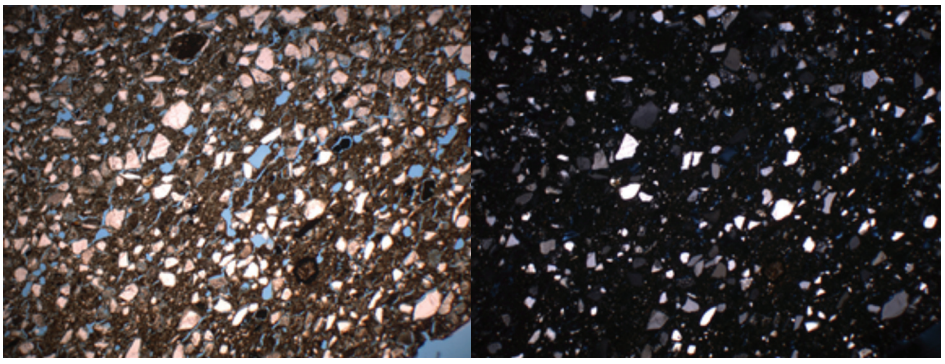

Figure A5-48. *32617-49.*

Table A5-5. Point Counts and Frequencies for Very Sandy Paste - Sand Temper

SAAN #	Paste		Sand														Calcium carbonate		Mica Muscovite		Other						Total (n)
			Quartz		Alkali feldspar		Polycrystalline quartz		Chert		Rock		Plagioclase feldspar		Microcline feldspar						Opaque		Clay pellet		Amphibole		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
32605-37	100	**59.5**	47	**28.0**	7	**4.2**	7	**4.2**	3	**1.8**	1	**0.6**	2	**1.2**	1	0.6											168
32614-46	100	**63.7**	32	**20.4**	4	**2.5**	9	**5.7**	6	**3.8**					1	**0.6**	2	**1.3**	1	0.6					2	**1.3**	157
32617-49	100	**64.1**	33	**21.2**	6	**3.8**	7	**4.5**	4	**2.6**					1	**0.6**					3	**1.9**	1	**0.6**	1	**0.6**	156

Appendix 6:
Faunal Data

Appendix 6

Faunal Data

Table A6-1. NISP and Weight (gm) of All Identified Faunal Specimens from the South Wall of Room 17

Species	Common Name	Section J				Test Unit 9/10			
		NISP	Wt. (gm)	% NISP	% Wt. (gm)	NISP	Wt. (gm)	% NISP	% Wt. (gm)
Actinopterygii	Unidentified Boney Fish	28	7.6	5.18	0.34	32	10.2	4.03	0.40
Anas sp.	Duck	0	0.0	0.00	0.00	1	1.6	0.13	0.06
Apalone spiniferous	Spiny Softshelled Turtle	0	0.0	0.00	0.00	1	8.6	0.13	0.34
Apalone sp. (*Trionyx* sp.)	Softshelled Turtle	2	2.1	0.37	0.09	1	0.2	0.13	0.01
Artiodactyla	Deer, Sheep, or Goat	3	4.4	0.55	0.20	33	58.6	4.16	2.31
Aves-lg.	Chicken-size	4	2.9	0.74	0.13	3	0.9	0.38	0.04
Aves--med.	Pigeon-size	3	0.5	0.55	0.02	2	0.1	0.25	0.00
Aves--small	Mockingbird-size			0.00	0.00	1	0.1	0.13	0.00
Bison bison	Bison	1	8.9	0.18	0.40	4	178.1	0.50	7.01
Bos taurus	Cow	3	241.7	0.55	10.77	9	360.9	1.13	14.20
Bovinae	Cow or Bison	3	19.7	0.55	0.88	12	297.6	1.51	11.71
Canis latrans	Coyote	1	5.1	0.18	0.23	0	0.0	0.00	0.00
Canis sp.	Dog, Coyote, or Wolf	3	2.6	0.55	0.12	4	4.0	0.50	0.16
Capra hircus	Domesticated Goat	1	27.0	0.18	1.20	1	2.5	0.13	0.10
Capra/Ovis	Domesticated Goat or Sheep	1	36.8	0.18	1.64	1	4.0	0.13	0.16
Carnivora	Carnivores	0	0.0	0.00	0.00	2	0.4	0.25	0.02
Conepatus mesoleucus	Hog-nosed Skunk	0	0.0	0.00	0.00	1	0.3	0.13	0.01
Crotalus atrox	Rattlesnake	0	0.0	0.00	0.00	2	1.1	0.25	0.04
Galliformes	Quail, Chicken, Pheasant, or Turkey	0	0.0	0.00	0.00	3	3.8	0.38	0.15
Gallus gallus	Chicken	2	1.6	0.37	0.07	0	0.0	0.00	0.00
Gopherus sp.	Tortoises	1	1.4	0.18	0.06	0	0.0	0.00	0.00
Ictalurus sp.	Freshwater Catfish			0.00	0.00	1	0.1	0.13	0.00
*Lepisosteu*s sp.	Gar	5	0.9	0.92	0.04	1	0.1	0.13	0.01
Mammal--sm.	Rabbit-size	9	5.3	1.66	0.24	12	2.9	1.51	0.11
Mammal--med.	Dog-size	7	6.3	1.29	0.28	6	4.5	0.76	0.18
Mammal--lg.	Deer-size	276	550.4	51.02	24.51	347	591.3	43.70	23.27
Mammal--V. lg.	Cow-size	174	1243.8	32.16	55.40	160	921.6	20.15	36.27
Meleagris gallopavo	Turkey	1	4.8	0.18	0.21	1	0.4	0.13	0.01
Mephitis mephitis	Striped Skunk	1	0.5	0.18	0.02	1	0.2	0.13	0.01
Odocoileus virginianus	White-tailed Deer	3	67.0	0.55	2.99	5	45.4	0.63	1.79
Ovis aries	Domesticated Sheep	0	0.0	0.00	0.00	2	4.1	0.25	0.16
Pecari tajacu	Peccary	0	0.0	0.00	0.00	1	9.5	0.13	0.37
Rattus rattus	Black Rat	0	0.0	0.00	0.00	1	0.2	0.13	0.01
Rodentia	Rodent	7	1.1	1.29	0.05	133	15.2	16.75	0.60
Sciurus sp.	Squirrel	0	0.0	0.00	0.00	2	0.8	0.25	0.03

Table A6-1. NISP and Weight (gm) of All Identified Faunal Specimens from the South Wall of Room 17, continued....

Species	Common Name	Section J				Test Unit 9/10			
		NISP	Wt. (gm)	% NISP	% Wt. (gm)	NISP	Wt. (gm)	% NISP	% Wt. (gm)
Sigmodon hispidus	Cotton Rat	0	0.0	0.00	0.00	1	0.2	0.13	0.01
Sus scrofa	Domestic Pig	0	0.0	0.00	0.00	4	11.0	0.50	0.43
Testudines	Turtle	2	2.9	0.37	0.13	3	0.9	0.38	0.03
Total		**541**	**2245.3**	**100.00**	**100.00**	**794**	**2541.2**	**100.00**	**100.00**

Table A6-2. NISP and Weight (gm) of All Identified Faunal Specimens from Sections B and F

Species	Common Name	Section B				Section F			
		NISP	Wt. (gm)	% NISP	% Wt. (gm)	NISP	Wt. (gm)	% NISP	% Wt. (gm)
Actinopterygii	Unidentified Boney Fish	25	10.7	0.86	0.09	85	40.7	3.90	0.64
Anas sp.	Duck	0	0.0	0.00	0.00	1	1.0	0.05	0.02
Apalone sp. (*Trionyx* sp.)	Softshelled Turtle	0	0.0	0.00	0.00	1	1.5	0.05	0.02
Artiodactyla	Deer, Sheep, or Goat	30	147.1	1.03	1.22	25	90.3	1.15	1.41
Aves-lg.	Chicken-size	4	6.4	0.14	0.05	2	2.0	0.09	0.03
Aves--med.	Pigeon-size	2	0.3	0.07	0.00	2	0.3	0.09	0.01
Bison bison	Bison	1	20.3	0.03	0.17	2	29.5	0.09	0.46
Bos taurus	Cow	13	761.4	0.45	6.33	2	209.5	0.09	3.27
Bovinae	Cow or Bison	29	502.2	1.00	4.18	4	95.9	0.18	1.50
Canis familaris	Domesticated Dog	0	0.0	0.00	0.00	1	3.1	0.05	0.05
Canis sp.	Dog, Coyote, or Wolf	1	0.4	0.03	0.00	7	8.8	0.32	0.14
Capra hircus	Domesticated Goat	6	48.0	0.21	0.40			0.00	0.00
Capra/Ovis	Domesticated Goat or Sheep	0	0.0	0.00	0.00	6	65.8	0.27	1.03
Carnivora	Carnivores	0	0.0	0.00	0.00	13	2.0	0.60	0.03
Didelphis virginiana	Opossum	2	1.4	0.07	0.01			0.00	0.00
Felis catus	Domesticated Cat	0	0.0	0.00	0.00	1	3.7	0.05	0.06
Galliformes	Quail, Chicken, Pheasant, or Turkey	4	3.2	0.14	0.03	2	1.4	0.09	0.02
Gallus gallus	Chicken	1	0.7	0.03	0.01	2	2.3	0.09	0.04
Ictalurus sp.	Freshwater Catfish	1	1.0	0.03	0.01			0.00	0.00
Mammal--sm.	Rabbit-size	16	5.4	0.55	0.05	37	13.0	1.70	0.20
Mammal--med.	Dog-size	33	22.0	1.14	0.18	21	12.4	0.96	0.19
Mammal--lg.	Deer-size	1628	2329.7	56.04	19.38	1386	2513.5	63.52	39.24
Mammal--V. lg.	Cow-size	1036	7812.3	35.66	64.98	541	3258.5	24.79	50.87
Mephitis mephitis	Striped Skunk	1	0.8	0.03	0.01			0.00	0.00
Odocoileus virginianus	White-tailed Deer	19	266.7	0.65	2.22	3	17.6	0.14	0.27
Ovis aries	Domesticated Sheep	7	58.7	0.24	0.49	6	12.6	0.27	0.20
Passeriformes	Perching Bird	1	0.3	0.03	0.00			0.00	0.00
Pylodictus olivaris	Bullhead Catfish	1	1.2	0.03	0.01		6.4	0.00	0.00
Rodentia	Rodent	38	6.5	1.31	0.05	23		1.05	0.10
Sciurus sp.	Squirrel	1	0.7	0.03	0.01		0.4	0.00	0.00
Serpentes	Snake	2	0.8	0.07	0.01	2		0.09	0.01

Table A6-2. NISP and Weight (gm) of All Identified Faunal Specimens from Sections B and F, continued....

Species	Common Name	Section B				Section F			
		NISP	Wt. (gm)	% NISP	% Wt. (gm)	NISP	Wt. (gm)	%NISP	% Wt. (gm)
Sus scrofa	Domestic Pig	2	6.1	0.07	0.05			0.00	0.00
Testudines	Turtle	1	7.8	0.03	0.06	5	7.7	0.23	0.12
Urocyon cinereoargenteus	Grayfox	0	0.0	0.00	0.00	2	6.3	0.09	0.10
Total		**2905**	**12022.0**	**100.00**	**100.00**	**2182**		**100.00**	**100.00**

Table A6-3. NISP and Weight (gm) of All Identified Faunal Specimens from Sections C and E

Species	Common Name	Section C				Section E			
		NISP	Wt. (gm)	% NISP	% Wt. (gm)	NISP	Wt. (gm)	% NISP	% Wt. (gm)
Actinopterygii	Unidentified Boney Fish	38	20.1	2.28	0.29	1	0.3	7.14	0.24
Anas sp.	Duck	1	1.1	0.06	0.02	0	0.0	0.00	0.00
Apalone spiniferous	Spiny Softshelled Turtle	1	1.6	0.06	0.02	0	0.0	0.00	0.00
Apalone sp. (*Trionyx* sp.)	Softshelled Turtle	1	1.4	0.06	0.02	0	0.0	0.00	0.00
Artiodactyla	Deer, Sheep, or Goat	28	85.1	1.68	1.24	0	0.0	0.00	0.00
Aves-lg.	Chicken-size	11	6.3	0.66	0.09	0	0.0	0.00	0.00
Aves--med.	Pigeon-size	1	0.2	0.06	0.00	0	0.0	0.00	0.00
Bos taurus	Cow	13	442.3	0.78	6.43	0	0.0	0.00	0.00
Bovinae	Cow or Bison	14	275.5	0.84	4.00	1	6.3	7.14	5.87
Canis sp.	Dog, Coyote, or Wolf	1	0.7	0.06	0.01	1	0.7	7.14	0.61
Capra hircus	Domesticated Goat	4	53.3	0.24	0.78	0	0.0	0.00	0.00
Crotalus atrox	Rattlesnake	1	0.3	0.06	0.00	0	0.0	0.00	0.00
Didelphis virginiana	Opossum	1	0.6	0.06	0.01	0	0.0	0.00	0.00
Equus sp.	Horse Family	1	9.8	0.06	0.14	0	0.0	0.00	0.00
Galliformes	Quail, Chicken, Pheasant, or Turkey	5	3.3	0.30	0.05	0	0.0	0.00	0.00
Gallus gallus	Chicken	5	8.6	0.30	0.13	0	0.0	0.00	0.00
Ictalurus sp.	Freshwater Catfish	1	0.8	0.06	0.01	0	0.0	0.00	0.00
Mammal--sm.	Rabbit-size	6	1.1	0.36	0.02	0	0.0	0.00	0.00
Mammal--med.	Dog-size	10	6.4	0.60	0.09	0	0.0	0.00	0.00
Mammal--lg.	Deer-size	804	1254.5	48.14	18.24	7	25.1	50.00	23.47
Mammal--V. lg.	Cow-size	622	4462.4	37.25	64.88	2	67.4	14.29	62.96
Neotoma sp.	Wood Rat	2	0.6	0.12	0.01	1	0.1	7.14	0.08
Odocoileus virginianus	White-tailed Deer	14	154.8	0.84	2.25	0	0.0	0.00	0.00
Ovis aries	Domesticated Sheep	5	62.1	0.30	0.90	1	7.3	7.14	6.77
Pecari tajacu	Peccary	1	3.2	0.06	0.05	0	0.0	0.00	0.00
Rodentia	Rodent	74	17.0	4.43	0.25	0	0.0	0.00	0.00
Sciurus sp.	Squirrel	2	0.8	0.12	0.01	0	0.0	0.00	0.00
Sigmodon hispidus	Cotton Rat	1	0.1	0.06	0.00	0	0.0	0.00	0.00
Sus scrofa	Domestic Pig	1	3.3	0.06	0.05	0	0.0	0.00	0.00
Testudines	Turtle	1	1.2	0.06	0.02	0	0.0	0.00	0.00
Total		**1670**	**6878.3**	**100.00**	**100.00**	**14**	**107.1**	**100.00**	**100.00**

Table A6-4. NISP and Weight (gm) of All Identified Faunal Specimens from Sections D, G, and H

Species	Common Name	Section D				Section G				Section H			
		NISP	Wt. (gm)	% NISP	% Wt. (gm)	NISP	Wt. (gm)	% NISP	% Wt. (gm)	NISP	Wt. (gm)	% NISP	% Wt. (gm)
Actinopterygii	Unidentified Boney Fish	1	0.5	10.00	1.68	7	5.2	2.81	0.42	0	0.0	0.00	0.00
Apalone sp. (*Trionyx* sp.)	Softshelled Turtle	0	0.0	0.00	0.00	1	2.3	0.40	0.19	0	0.0	0.00	0.00
Artiodactyla	Deer, Sheep, or Goat	0	0.0	0.00	0.00	1	2.6	0.40	0.21	0	0.0	0.00	0.00
Bos taurus	Cow	0		0.00	0.00			0.00	0.00	1	33.6	10.00	61.46
Bovinae	Cow or Bison	0	0.0	0.00	0.00	1	15.3	0.40	1.26	0	0.0	0.00	0.00
Capra hircus	Domesticated Goat	0	0.0	0.00	0.00	1	10.1	0.40	0.83	0	0.0	0.00	0.00
Gallus gallus	Chicken	0	0.0	0.00	0.00	1	0.7	0.40	0.06	0	0.0	0.00	0.00
Mammal--med.	Dog-size	0	0.0	0.00	0.00	3	2.0	1.20	0.17	0	0.0	0.00	0.00
Mammal--lg.	Deer-size	6	9.6	60.00	36.02	160	322.0	64.26	26.57	8	20.5	80.00	37.48
Mammal--V. lg.	Cow-size	3	16.7	30.00	62.29	66	830.4	26.51	68.53	0	0.0	0.00	0.00
Odocoileus virginianus	White-tailed Deer	0	0.0	0.00	0.00	1	3.7	0.40	0.31	0	0.0	0.00	0.00
Ovis aries	Domesticated Sheep	0	0.0	0.00	0.00	2	16.8	0.80	1.38	0	0.0	0.00	0.00
Rodentia	Rodent	0	0.0	0.00	0.00	5	0.9	2.01	0.07	0	0.0	0.00	0.00
Testudines	Turtle	0	0.0	0.00	0.00			0.00	0.00	1	0.6	10.00	1.02
Total		**10**	**26.8**	**100.00**	**100.00**	**249**	**1211.8**	**100.00**	**100.00**	**10**	**54.7**	**100.00**	**100.00**

Table A6-5. Butcher Data for Domesticated Species by Modification and Element

Modification	*Bos taurus*					*Capra hircus*		*Capra/Ovis*	*Ovis aries*		*Sus scrofa*	Total
	1st phalange	2nd phalange	Humerus	Thoracic Vertebrae	Tibia	Humerus	Ulna	Metatarsal	Humerus	Radius	Rib	
1 Chop	1	0	1	0	0	0	1	0	0	1	0	**4**
1 Chop, 1 Shallow Cut	0	0	0	1	0	0	0	0	0	0	0	**1**
1 Cleaver Chop	0	0	0	0	0	1	0	0	0	0	0	**1**
1 Deep Cut, 1 Handsaw, 1 Shallow Cut	**0**	**0**	**0**	**0**	**0**	0	0	0	1	0	0	1
1 Fractured	0	0	0	0	0	0	0	1	1	1	1	**4**
1 Puncture	1	0	0	0	0	0	0	0	0	0	0	**1**
1 Shallow Cut	1	0	0	0	0	0	0	0	0	0	0	**1**
4 Shallow Cut	0	1	0	0	0	0	0	0	0	0	0	**1**
1 Machine saw, 1 Fracture	0	0	0	0	1	0	0	0	0	0	0	**1**
Total	3	1	1	1	1	1	1	1	2	2	1	15

Table A6-6. Butcher Data for Wild Species by Modification and Element

Modification	***Bison bison***			***Meleagris gallopavo***	***Odocoileus virginianus***					**Total**
	Radial Carpal	Radius	2nd phalange	Femur	Astragulus	1st phalange	Radius	Tibia	Antler	
1 Chop	0	0	0	0	1	0	0	0	0	**1**
1 Deep Cut	0	0	1	0	0	0	0	0	0	**1**
1 Handsaw	0	0	0	0	0	0	0	0	1	**1**
1 Fractured	0	1	0	0	0	0	1	0	0	**2**
1 Shallow Cut	0	0	0	0	0	1	0	0	0	**1**
3 Shallow Cut	1	0	0	0	0	0	0	0	0	**1**
1 Deep Cut, 1 Fracture	0	0	0	0	0	0	0	1	0	**1**
2 Chop, 1 Shallow Cut	0	0	0	1	0	0	0	0	0	**1**
Total	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**9**

Table A6-7. Butcher Data for Unidentified Mammals by Modification and Element

Modification	**Mammal--lg.**										**Mammal--V. lg.**											**Total**
	Calcaneus	**Cranial**	**Lumbar vertebrate**	**Pelvis**	**Rib**	**Thoracic vertebrate**	**Tibia**	**Ulna**	**Vertebrae**	**Unidentified**	**1st phalange**	**Calcaneus**	**Femur**	**Lumbar vertebrate**	**Metapodial**	**Rib**	**Scapula**	**Thoracic vertebrate**	**Vertebrae**	**Ulna**	**Unidentified**	
1 Chop	1	1	1	1	0	1	0	0	5	6	1	0	0	1	0	2	0	2	2	0	12	**36**
1 Chop, 1 Deep Cut	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	**4**
1 Chop, 1 Shallow Cut	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	**2**
1 Chop, 2 Deep Cut, 9 Shallow Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
1 Chop, 2 Shallow Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**1**
1 Chop, 3 Deep Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
1 Chop, 3 Shallow Cut	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**
1 Deep Cut	0	0	0	0	1	1	0	0	0	10	0	0	0	0	0	4	0	0	0	1	7	**24**
1 Deep Cut, 1 Handsaw	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
1 Deep Cut, 1 Shallow Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	1	**4**
1 Deep Cut, 2 Shallow Cut	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**
1 Fractured	0	0	0	0	0	0	2	0	0	103	0	1	1	0	1	1	0	1	0	0	40	**150**
1 Fractured, 1 Shallow Cut	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	**3**
1 Fractured, 3 Shallow Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
1 Handsaw	0	0	2	0	0	2	0	1	8	26	0	0	0	1	0	2	0	1	9	0	36	**88**
1 Shallow Cut	0	0	1	0	3	0	0	0	0	12	0	0	0	0	0	4	1	0	1	1	7	30
11 Deep Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
2 Chop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
2 Deep Cut	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	**2**

Table A6-7. Butcher Data for Unidentified Mammals by Modification and Element, continued....

Modifications	Mammal--lg.										Mammal--V. lg.										Total
	Calcaneus	Cranial	Lumbar vertebrate	Pelvis	Rib	Thoracic vertebrate	Tibia	Ulna	Vertebrae	Unidentified	1st phalange	Calcaneus	Femur	Lumbar vertebrate	Metapodial	Rib	Scapula	Thoracic vertebrate	Vertebrae	Ulna	Unidentified	
3 Chop	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**
3 Deep Cut	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
3 Shallow Cut	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	1	**5**
4 Shallow Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	**3**
5 Deep Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
5 Shallow Cut	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	**2**
1 Handsaw, 1 Shallow Cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
1 Machine saw	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**
2 Shallow Cut	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**
4 Deep Cut	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**
Total	**1**	**1**	**5**	**2**	**6**	**4**	**2**	**1**	**13**	**168**	**1**	**1**	**1**	**2**	**1**	**21**	**1**	**7**	**14**	**3**	**114**	**369**

Table A6-8. Butcher Data for Artiodactyla and Bovinae by Modification and Element

Modification	Artiodactyla							Bovinae			Total
	1st phalange	Calcaneus	Carpal	Metapodial	Pelvis	Rib	Tibia	1st phalange	Humerus	Rib	
1 Chop			1					2			3
1 Chop, 1 Fracture									1		1
1 Fractured		1				1	2			1	**5**
1 Handsaw				1							1
1 Shallow Cut					1						1
2 Shallow Cut	1										1
Total	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**12**

Appendix 7:
Stable Isotope Analysis of 41BX5 Fauna

Cynthia M. Munoz

Appendix 7

Stable Isotope Analysis of 41BX5 Fauna

Cynthia M. Munoz

This appendix presents the results of the stable isotope analysis of archaeological faunal skeletal remains recovered during the Mission San Juan excavations. The bone samples were processed at the Paleo-Research Lab (PRL) at UTSA-CAR to determine the stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) ratios in bone collagen and the stable carbon ($\delta^{13}C$) ratios in bone carbonate. The samples represent 41 distinct animals, including bison, cow, goat, sheep, pig, deer, chicken, turkey, turtle, and catfish. The carbon and nitrogen isotopic ratios in faunal bone are related to the animals' diets and provide data on the type of vegetation consumed. This data in turn may offer dietary answers for questions further up the trophic ladder, reflecting isotopic values of human consumers. Stable isotope analysis data reflect the variation in the abundance of stable isotopes in various classes of food resources and have the potential to determine a population's subsistence strategy, i.e., the extent of reliance on terrestrial, agricultural, and/or marine resources. To fully interpret isotopic results from human consumers, an accurate assessment of the isotopic composition of local food sources is essential. Although an isotopic analysis of human bone samples from Mission San Juan was outside of the scope of this project, the assessment of the isotopic composition of their food resources provides basic data for future studies and comparative data for previous analyses (see Cargill 1996; Hard and Katzenberg 2011).

Stable isotope analysis has been widely used for the reconstruction of patterns of prehistoric subsistence (see Ambrose et al. 2003; Ambrose et al. 1997; Ambrose and Norr 1992; Chisholm et al. 1983; Corr et al. 2008; DeNiro 1987; Hard and Katzenberg 2011; Katzenberg 2008; Kellner and Schoeninger 2007; Mauldin et al. 2013; Munoz et al. 2011a; Norr 1995; Schoeninger et al. 1983; Sharp 1997; Tykot 2004; van der Merwe 1982; Vogel and van der Merwe 1977). Experimental studies have shown that $\delta^{13}C$ of animal tissue and bone collagen closely reflects that of their diet. The $\delta^{13}C$ of bone collagen and carbonate, therefore, can be used to reconstruct the diet of animals.

The incorporation of carbon into bone commences with plant photosynthesis. Terrestrial plants absorb carbon from atmospheric CO_2 via the C_3 (Calvin-Benson), C_4 (Hatch-Slack), or CAM (Crassulacean Acid) pathway (see Farquhar and Ehleringer 1989; Hatch 1999; O'Leary 1988; Sage and Monson 1999). Because the C_3 pathway discriminates against the heavier isotope of carbon, C_3 plants have lighter $\delta^{13}C$ values that range from approximately -37 to -20‰ (Deines 1980; Kohn 2010). The majority of vegetation in temperate zones, including most deciduous shrubs and trees, wetland and cool season grasses, fruits, nuts, beans, and tubers use the C_3 pathway. Terrestrial plants that use the C_4 pathway have heavier $\delta^{13}C$, ranging from -16 to -9‰ (Deines 1980). These plants, dominated by warm season grasses, include amaranths, maize, sorghum, millet, and sugarcane (Mays 1998). The CAM pathway, dominated by cacti and other succulents, produces variable $\delta^{13}C$ values. They overlap primarily with the C_4 range, falling between -10 and -20‰ (Boutton et al. 1998; Deines 1980; Griffiths 1992).

During photosynthesis, carbon stable isotopes are integrated into plant tissues. The isotopic differences are incorporated, with some fractionation, into animal bone when the different types of plants are ingested. In addition to absorption of carbon from atmospheric CO_2, aquatic ecosystems incorporate dissolved inorganic carbonate and organic carbon from rivers and oceans. This results in enriched $\delta^{13}C$ values (i.e., more positive) for aquatic plants and organisms relative to the values of terrestrial plants (Boutton 1991). The $\delta^{13}C$ of the consumer's bone collagen and carbonate reflect the isotopic composition of the plants at the base of the food chain (DeNiro and Epstein 1978). Although protein source causes some variability, typically $\delta^{13}C$ in bone collagen of herbivores is about 5‰ heavier than diet (Tykot 2004) and in bone collagen of humans approximately 2‰ heavier than animal flesh. For example, an animal consuming plants with an average $\delta^{13}C$ of -14.7‰ will have a $\delta^{13}C$ collagen value of roughly -9.7‰. The $\delta^{13}C$ collagen value in a human consuming the animal will be approximately -7.7‰.

Variations in collagen isotopic values of $\delta^{15}N$ are complex and appear to result from a combination of factors, the relative impact of which is not fully understood. Atmospheric nitrogen (N_2) has a $\delta^{15}N$ of 0‰ (Mariotti 1983). Plants absorb atmospheric nitrogen from soils either as legumes with $\delta^{15}N$ values between 1‰ and 3‰ or as non-legumes with values between 2‰

and 6‰ (Ambrose 1991; DeNiro and Hastorf 1985; Virginia and Delwiche 1982). This variability has been attributed to environmental factors such as salinity, aridity, and habitat characteristics (Ambrose 1991; Ambrose and DeNiro 1986; Heaton 1987; Heaton et al. 1986), and attributes of animals such as age, digestive characteristics, and urea concentration/excretion (Ambrose 1991; Cormie and Schwarcz 1996; Minagawa and Wade 1984; but see Ugan and Coltrain 2011).

Bone collagen and carbonate have different patterns of incorporation. Collagen is the organic component of bone and contains both nitrogen (^{15}N) and carbon (^{13}C) isotopic signatures. Both nitrogen and carbon in bone collagen reflect protein intake (Froehle et al. 2010). $\delta^{13}C$ values in carbonate or apatite, the inorganic component of bone, are strongly correlated with the isotopic signature of the whole diet (Froehle et al. 2010; Kellner and Schoeninger 2007). Although apatite values alone provide no information about dietary protein source, when combined with collagen $\delta^{13}C$ values a detailed reconstruction of past diets can be inferred.

Laboratory Procedures and Analysis

The isotopic analysis of Mission San Juan faunal bone provides an opportunity to gather dietary data relevant to the Spanish Mission period and refine our understanding of the protein sources consumed by early nineteenth-century mission inhabitants. All sample preparation was done at the CAR's PRL. Bones analyzed included five bison, eight cows, four goats, five sheep, four chickens, one wild turkey, five deer, three pigs, four turtles, and two catfish. For all collagen/carbonate samples prepared at the PRL, we process sample sets that include up to 12 individual samples of interest at a time. For each of these sets, we process one or two additional bone samples as standards. We have previously established a range of expected values for these standards. This is done to assure that processing steps produce consistent sample quality. In the current case, prehistoric bison samples from Plainview, Texas, and modern deer from Camp Maxey in northeast Texas and Camp Bowie in central Texas were processed along with the 41 San Juan samples.

For all analyses, the initial steps focused on cleaning bone samples. A rotary tool with a sanding attachment was initially used to lightly clean any foreign material observed on the bone surfaces. This was followed by multiple cleanings in ultrapure (Type 1) water in an ultrasonic bath. When the rinse water was clear, samples were removed and dried under low heat. The dried bone was then lightly crushed to small fragments (ca. 0.5-2 mm size) with a ceramic mortar and pestle. Crushed samples were again sonicated in Type 1 water. Water was changed after each run, and the process continued until the rinse water was clear. Samples were then dried under low heat.

For collagen processing, we initially weighed out 300 mg of clean dried bone. This was achieved in all cases with the exception of one sample (TR1) where only 150 mg of bone were available. For each sample, except TR1, the clean bone fragments were split into two glass test tubes designated sample A and B. Each split was then decalcified by reacting the bone with 0.5N HCl at 4°C for 30 hours (Ambrose and Norr 1992; DeNiro and Epstein 1978, 1981; Longin 1971). Samples were rinsed to neutral and subsequently treated with 0.1N NaOH for 45 minutes to remove humic acids and lipids. The samples were again rinsed to neutral. For a given bone, the A and B samples were then combined and were solubilized in 0.01N HCl at 70°C in a heating block for 11 hours. The supernatant was then filtered into glass vials, frozen, and subsequently freeze-dried under vacuum. Once dried, ~ 600 µg of each collagen sample was placed into tin capsules for subsequent bulk stable carbon and nitrogen isotope analysis (Munoz et al. 2011b).

Following the initial rotary cleaning and ultrasonic wash, bone fragments designated for carbon isotope analysis from apatite were crushed to a fine powder with a ceramic mortar and pestle. When possible, 100 mg of powdered bone was weighed into glass test tubes. Eighteen of the apatite samples did not have enough bone available resulting in samples ranging from 51.1 to 97.5 mg. A 5% solution of NaOCl (0.04ml/mg of sample) was added to the test tubes to remove organic matter. The tubes were placed in a rocker to assure complete chemical exposure and refrigerated at 4°C. After 12 hours, the NaOCl solution was changed, and after 24 hours, the samples were removed and washed to neutral. Dilute acetic acid (0.1M) was then added (0.04ml/mg of sample) to remove recent carbonates. After 4 hours the samples were again washed to neutral and dried at 50°C (see Garvie-Lok et al. 2004). The samples were then ground with a ceramic mortar and pestle, and the remaining carbonate powder passed through a 0.25-mm mesh screen to assure uniform sample size. Samples were placed in glass vials for shipment.

The isotopic compositions of both the collagen and carbonate samples from San Juan were assessed at the Colorado Plateau Stable Isotope Laboratory at Northern Arizona University (CPSIL-NAU). Collagen samples were analyzed using a Thermo-Electron Delta V Advantage Isotope Ratio Mass Spectrometer (IRMS) configured through the CONFLO III using a Carlo Erba NC2100 elemental analyzer. Both carbon and nitrogen isotopic composition was obtained during a single run. The CPSIL uses a variety of biological standards from the National Institute of Standards and Technology (NIST), as well as elemental standards from the IAEA (International Atomic Energy Agency), for internal calibration and raw data normalization. Bone carbonate powders were analyzed using a Thermo-Finnigan Gasbench II coupled with a Thermo-Finnigan Delta Plus IRMS and a CTC Analytics GC Pal auto-sampler. Carbonate powders were initially weighed into vials, which were purged with helium gas to remove ambient air and CO_2. Samples were reacted with 100% phosphoric acid and incubated for at least 1 hour at 70°C to produce CO_2 for analysis. Isotopic standards used for carbonates at the CPSIL include NIST standards (NBS 18, NBS 19) and lithium carbonate (LSVEC). Collagen and carbonate $\delta^{13}C$ values are reported in per mil relative to the Vienna Pee Dee belemnite (PDB) standard and $\delta^{15}N$ values are reported relative to AIR. Based on replicative analysis, the CPSIL has an uncertainty of $\leq 0.10‰$ for $\delta^{13}C_{collagen}$, $\leq 0.20‰$ for $\delta^{15}N$.

Following the assessment of the collagen carbon returns, and given available sample sizes, ten bone fragments were selected for radiocarbon dating of the collagen fraction. These were B6, B7, B10, C2, C8, G3, D13, D15, D17, and SP7. Radiocarbon dating is discussed in Appendix 1.

Results

The results of the stable isotope analysis of the San Juan faunal remains are shown in Table A7-1. Data are reported for each animal, with multiple runs for a given animal averaged. Collagen recovery yields are visually accessed and noted upon removal from the freeze-dryer. Recovery was present on all but one sample (C7). All but one collagen sample, CK3, had atomic C:N ratios between 3.2 and 3.4, within the commonly accepted range of 2.9 to 3.6. C:N ratios outside this range have a high probability of containing poor quality collagen that may be degraded or contaminated (Ambrose and Norr 1992; DeNiro 1985; Van Klinken 1999). Sample CK3 (C:N = 3.6) was not considered in our analysis. All of the samples had acceptable %C and %N returns also suggesting that the collagen was of good quality (Ambrose and Norr 1992). Two prehistoric bison samples (B1 and B3) were analyzed as internal standards at the PRL. They both produced expected results for carbon and nitrogen in collagen. Five samples from B1 and three from B3 prepared at the same time as the San Juan samples produced average $\delta^{13}C_{collagen}$ values of -9.7‰ and -8.6‰ and $\delta^{15}N$ values of 7.4‰ and 5.4‰, respectively. Results of previously run samples of B1 (n=13) give a mean $\delta^{13}C_{collagen}$ value of -9.8‰ and $\delta^{15}N$ values of 7.8‰. The mean for previously run B3 samples (n=4) is -8.6‰ for δ13Ccollagen and 5.9‰ for $\delta^{15}N$. These assessments suggest that the collagen is of good quality and will produce reliable $\delta^{13}C_{collagen}$ and $\delta^{15}N$ values.

An independent assessment of the quality of carbon recovered from San Juan bone carbonate samples was not performed. Two PRL internal standards (modern deer) were processed and run with these samples to determine if the procedures resulted in consistent results. Seven samples of D2 run with the San Juan samples produced an average carbon value of -15.3‰, lower than the mean $\delta^{13}C_{carbonate}$ value of -14.3‰ from five previously run samples. Of the five, one was anomalous with a value of -13.0‰. Removing this sample, the mean of the remaining four is 14.7‰. Six samples of D4 yielded a $\delta^{13}C_{carbonate}$ value of -16.0‰, lower than the mean $\delta^{13}C_{carbonate}$ value of -14.9‰ from three previously run samples. Again one of the three was anomalous with a value of -13.8‰. Removing this value, the mean of the remaining two is -15.5‰. Although the San Juan carbonate values are lower than both internal standards, the small sample size of the previous runs should be noted.

The isotope values in Table A7-1 show a large range with $\delta^{13}C_{collagen}$ from -22.9‰ to -7.1‰, $\delta^{15}N$ from 5.5‰ to 10.2‰, and $\delta^{13}C_{carbonate}$ from -13.0‰ to -1.6‰. When looked at by species, the variability, for the most part, decreases with a clustering of values (Table A7-2). The $\delta^{13}C_{collagen}$ values for pigs, sheep, and goats did not cluster as tightly around their means as the values for other animals. Figures A7-1 and A7-2 plot the $\delta^{13}C_{collagen}$ and $\delta^{15}N$ values for domesticated (sheep/goat, cow, pig, chicken) and non-domesticated animals (turtles, deer, turkey, catfish, bison), respectively. Due to difficulty in distinguishing between sheep and goat faunal elements, these animals were combined into one grouping, i.e. sheep/goat. $\delta^{13}C_{collagen}$ values for sheep/goat ranged from -18.6‰ to -11.2‰ and from -16.7‰ to -10.4‰ for pig. Two of the pigs clustered tightly suggesting they may be the same animal. Chickens had the most variable $\delta^{15}N$ values ranging from 7.9‰ to 10.3‰.

Table A7-1. Stable Isotope Results from 41BX5

Animal ID	Species	Site or Location	Radiocarbon date	$\delta^{13}C$ PDB Collagen	$\delta^{13}C$ PDB Apatite	$d^{15}N$ AIR Collagen	C/N ratio (atomic)	%C	%N
TR4	*Apalone* sp. (soft-shelled turtle)	41BX5	n/a	-22.7	-9.4	9.9	3.3	36.8	12.9
B6	Bison	41BX5	360+/-23	-12.4	-5.4	7.6	3.3	33.2	11.8
B7	Bison	41BX5	130+/-24	-11.8	-4.8	6.2	3.2	39.3	14.3
B8	Bison	41BX5	n/a	-13.7	-5.5	7.8	3.2	29.2	10.5
B9	Bison	41BX5	n/a	-14.1	-7.0	6.3	3.3	34.3	12.2
B10	Bison	41BX5	106+/-24	-13.0	-5.6	5.5	3.2	35.9	13.0
C2	*Bos taurus* (cow)	41BX5	100+/-25	-14.6	-5.6	6.9	3.2	40.6	14.8
C3	*Bos taurus*	41BX5	n/a	-13.1	-4.6	6.8	3.2	31.4	11.3
C4	*Bos taurus*	41BX5	n/a	-9.9	-3.8	8.8	3.2	36.8	13.3
C5	*Bos taurus*	41BX5	n/a	-11.5	-5.1	6.9	3.3	19.6	7.0
C6	*Bos taurus*	41BX5	n/a	-14.0	n/a	6.8	3.2	37.1	13.4
C7	*Bos taurus*	41BX5	n/a	n/a	-7.0	n/a	n/a	n/a	n/a
C8	*Bos taurus*	41BX5	102+/-24	-12.1	-6.4	7.9	3.2	41.1	14.8
C9	*Bos taurus*	41BX5	n/a	-11.7	-4.5	8.1	3.2	42.4	15.4
G1	*Capra hircus* (goat)	41BX5	n/a	-11.2	-6.2	6.2	3.3	38.6	13.6
G2	*Capra hircus*	41BX5	n/a	-18.6	-9.4	7.0	3.3	26.3	9.4
G3	*Capra hircus*	41BX5	121+/-24	-16.5	-9.2	7.2	3.2	39.8	14.5
G4	*Capra hircus*	41BX5	n/a	-17.5	-8.3	7.2	3.2	42.1	15.3
CK1	*Gallus gallus* (chicken)	41BX5	n/a	-7.0	-1.6	7.8	3.3	41.2	14.7
CK2	*Gallus gallus*	41BX5	n/a	-8.3	-3.1	10.3	3.4	35.0	12.2
CK3	*Gallus gallus*	41BX5	n/a	-17.1	-7.7	6.6	^ **3.6**	17.5	5.7
CK4	*Gallus gallus*	41BX5	n/a	-7.1	-2.6	10.2	3.3	39.7	14.0
FH1	*Ictalurus* sp. (catfish)	41BX5	n/a	-13.7	-4.8	9.3	3.2	37.1	13.3
FH2	*Ictalurus* sp.	41BX5	n/a	-12.8	-3.2	8.8	3.2	39.7	14.6
TK1	*Meleagris gallopavo* (wild turkey)	41BX5	n/a	-18.4	-7.9	7.4	3.3	20.2	7.1
D13	*Odocoileus virginianus* (white-tailed deer)	41BX5	107+/23	-19.9	-10.8	6.6	3.2	32.7	11.8
D14	*Odocoileus virginianus*	41BX5	n/a	-18.7	-8.2	7.4	3.2	38.9	14.0
D15	*Odocoileus virginianus*	41BX5	85+/-29	-16.9	-10.2	8.7	3.2	39.8	14.5
D16	*Odocoileus virginianus*	41BX5	n/a	-20.6	-11.3	6.6	3.2	36.9	13.3
D17	*Odocoileus virginianus*	41BX5	61+/-34	-20.1	-13.0	6.4	3.3	37.5	13.4
SP7	*Ovis aries* (sheep)	41BX5	Modern	-16.4	-9.5	7.8	3.2	40.3	14.7
SP8	*Ovis aries*	41BX5	n/a	-16.8	-7.8	7.2	3.3	23.8	8.4
SP9	*Ovis aries*	41BX5	n/a	-16.0	-7.7	7.2	3.3	36.0	12.7
SP10	*Ovis aries*	41BX5	n/a	-14.2	-6.8	6.5	3.3	36.6	12.8
SP11	*Ovis aries*	41BX5	n/a	-16.3	-8.5	7.3	3.2	30.9	11.2
P1	*Sus scrofa* (domestic pig)	41BX5	n/a	-10.7	-5.4	7.2	3.3	23.4	8.2
P2	*Sus scrofa*	41BX5	n/a	-10.4	-5.4	7.2	3.3	19.3	6.8
P3	*Sus scrofa*	41BX5	n/a	-16.7	-7.7	7.0	3.2	31.2	11.2
TR1	Testudines (turtle)	41BX5	n/a	-22.9	n/a	8.5	3.2	40.1	14.4

Table A7-1. Stable Isotope Results from 41BX5, continued....

Animal ID	Species	Site or Location	Radiocarbron date	$\delta^{13}C$ PDB Collagen	$\delta^{13}C$ PDB Apatite	$d^{15}N$ AIR Collagen	C/N ratio (atomic)	%C	%N
TR2	Testudines	41BX5	n/a	-23.9	-10.4	9.2	3.2	40.3	14.7
TR3	Testudines	41BX5	n/a	-22.3	-9.4	10.2	3.2	39.4	14.3
B1	Bison	Plainview	n/a *	-9.7	n/a	7.4	3.3	36.9	13.3
B3	Bison	Plainview	n/a **	-8.6	n/a	5.4	3.2	28.6	10.3
D2	*Odocoileus virginianus*	Camp Bowie	Modern	n/a	-15.3	n/a	n/a	n/a	n/a
D4	*Odocoileus virginianus*	Camp Maxey	Modern	n/a	-16.0	n/a	n/a	n/a	n/a

* Previously dated to 3490+/-40 by Beta Analytic

** Previously dated to 2740+/-40 by Beta Analytic

^ C:N ratio outside acceptable range

Table A7-2. Stable Isotope Means and Standard Deviation by Species

Species	n	$\delta^{13}C$ PDB Collagen		$\delta^{13}C$ PDB Apatite		$\delta^{15}N$ AIR Collagen	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Bison	5	-13.0	0.94	-5.7	0.81	6.7	0.99
Deer	5	-19.3	1.48	-10.7	1.74	7.2	0.97
Turkey	1	-18.4	n/a	-7.9	n/a	7.4	n/a
Turtles	4	-23.0	0.70	-9.7	2.62	9.4	0.77
Catfish	2	-13.2	0.62	-4.0	1.17	9.0	0.35
Cow	7	-12.4	1.60	-5.3	1.15	7.4	0.80
Sheep/Goat	9	-16.0	2.13	-8.2	1.14	7.1	0.47
Pig	3	-12.6	3.53	-6.2	1.31	7.1	0.08
Chicken	3	-7.5	0.74	-2.5	0.77	9.4	1.38

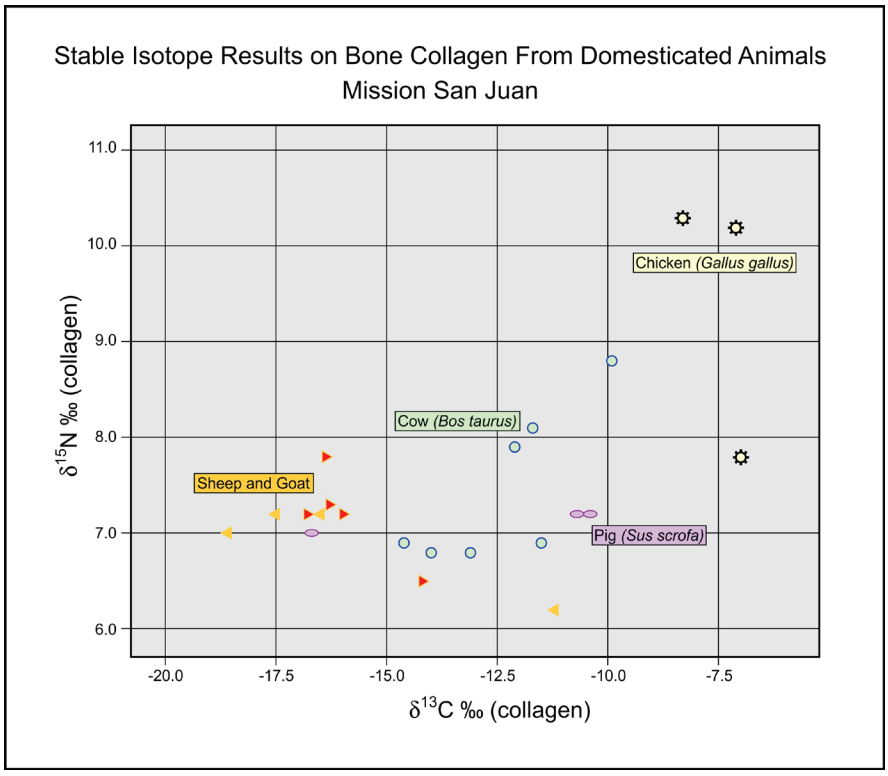

Figure A7-1. *Stable isotope results on bone collagen from domesticated animals from Mission San Juan.*

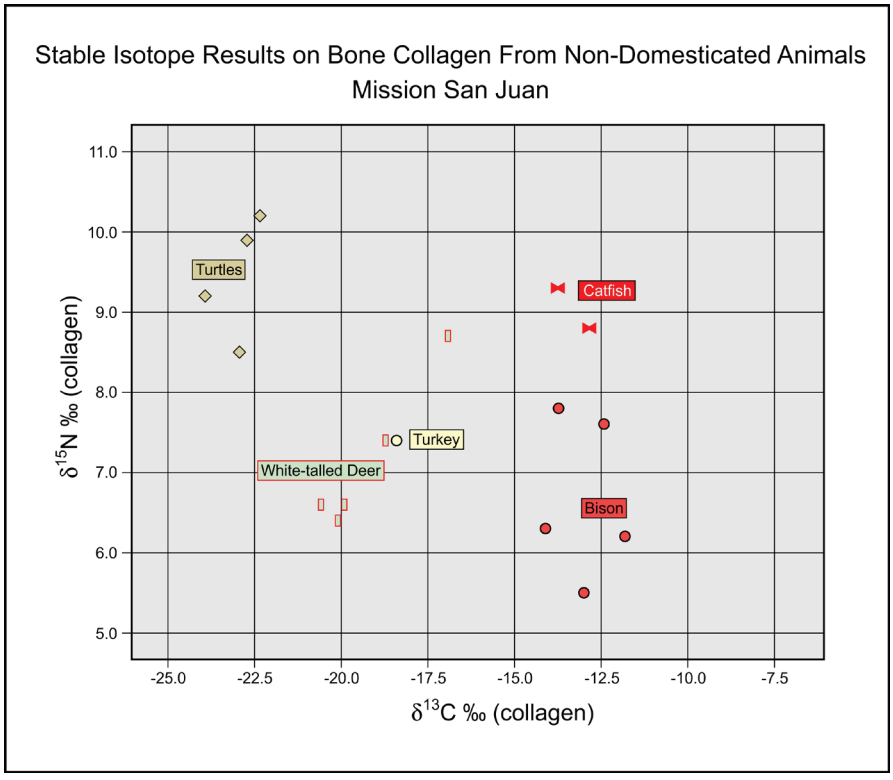

Figure A7-2. *Stable isotope results on bone collagen from non-domesticated animals from Mission San Juan.*

Figure A7-3 plots $\delta^{13}C_{collagen}$ and $\delta^{13}C_{carbonate}$ values. The C_3 and C_4 protein lines developed by Kellner and Schoeninger (Froehle et al. 2010; Kellner and Schoeninger 2007) indicate protein and non-protein portions of the diet, e.g. a sample with a $\delta^{13}C_{carbonate}$ value of -17‰ and $\delta^{13}C_{collagen}$ of -22‰ reflects a diet made up of 100% C_3 protein and non-protein sources, whereas, -12‰ $\delta^{13}C_{carbonate}$ and -14‰ $\delta^{13}C_{collagen}$ indicates C_4/marine protein and C_3 non-protein dietary sources. The faunal material from San Juan, with the possible exception of pigs, turkey, and chickens, are herbivores obtaining their protein and non-protein from the same source. Turtles, deer, turkey, and sheep/goat (with the exception of G2), cluster along and below the C_3 protein line suggesting a subsistence base of C_3 plants. Sample G2 lies near the C_4 protein line. Two pigs (possibly the same animal) lie on the C_4 protein line towards a C_4 total diet, whereas the third pig (P3) lies on the C_3 protein line with a mix of C_3/C_4 non-protein. These two outliers suggest a possible misidentification of samples G2 (sheep/goat) and P3 (pig). Chickens cluster at the 100% C_4/marine diet area of the graph. The remaining herbivores (cow and bison) fall between the C_3 and C_4 protein lines but lie toward the C_4 non-protein portion of the graph suggesting a reliance on C_4 dietary sources, most likely corn. The two catfish also appear to have a diet made up from C_4 resources.

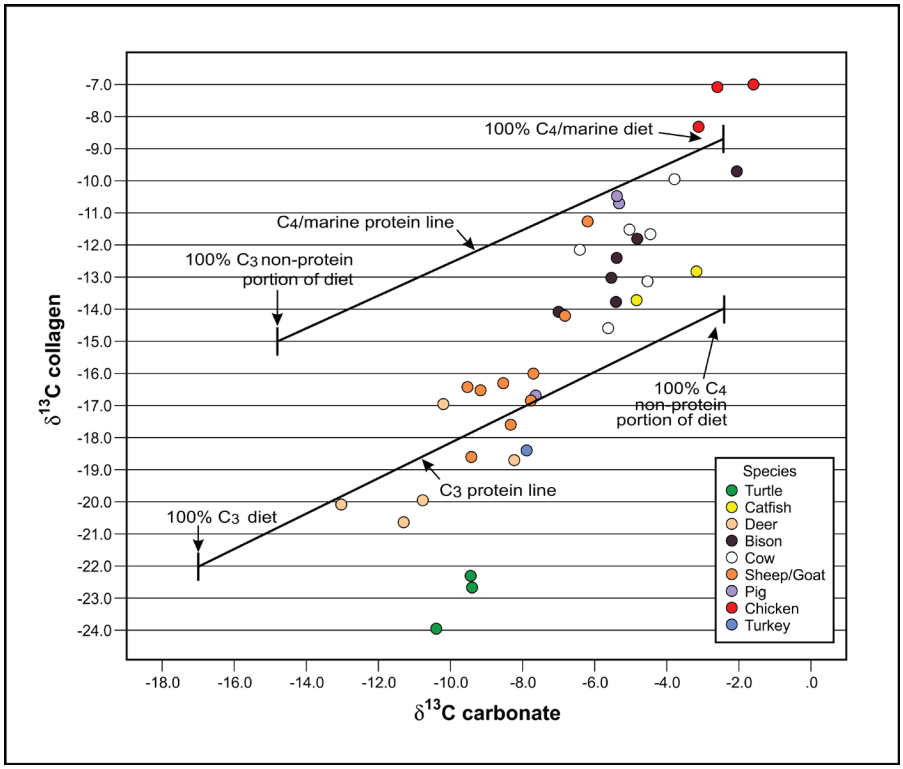

Figure A7-3. *$\delta^{13}C_{carbonate}$ and $\delta^{13}C_{collagen}$ for Mission San Juan fauna. The C_3 and C_4 regression lines follow Kellner and Schoeninger 2007 and Froehle et al. 2010.*

The results of previous isotopic analyses of human bone collagen and carbonate from Mission San Juan are presented in Table A7-3 (Cargill 1996; Cargill and Hard 1999). Nineteen individuals were sampled from a burial population excavated from Room 26 of the mission in 1968 (Schuetz 1968, 1969). The burials were likely interred from 1764 to the 1780s (Schuetz 1968:215). Although the dated faunal remains (AD 1800-1930, see Appendix 1) removed from Room 17 are later than the Room 26 burials, two previously analyzed domesticates from Room 26, a cow ($\delta^{13}C_{collagen}$ = -15.0‰, $\delta^{13}C_{carbonate}$ = -6.1, $\delta^{15}N$ = 5.7) and a sheep/goat ($\delta^{13}C_{collagen}$ = -17.3‰, $\delta^{13}C_{carbonate}$ = -8.3, $\delta^{15}N$ = 6.5) have values similar to the Room 17 fauna (Cargill and Hard 1999:205) suggesting similarity in domesticate feeding practices over time. No data for Room 26 chickens or pigs could be found.

The Room 26 humans' $\delta^{13}C_{collagen}$ ranged from -11.8‰ to -7.9‰ (mean -9.6‰, s.d. 0.94), $\delta^{13}C_{carbonate}$ ranged from -6.3‰ to -3.8‰ (mean -5.0‰, s.d. 0.72), and $\delta^{15}N$ ranged from 11.0‰ to 12.8‰ (mean 11.9‰, s.d. 0.49). The carbon values suggest a dietary reliance on C_4 protein and non-protein resources. The dietary values of the 19 burials reflect a subsistence strategy

Table A7-3. Stable Isotope Results from
Mission San Juan Humans (taken from Cargill and Hard 1999)

ID	$\delta^{13}C$ Collagen	$\delta^{13}C$ Apatite	$\delta^{15}N$ Collagen
12B	-9.9	-5.7	11.5
13A	-9.6	-4.9	11.6
13C	-8.9	-4.4	11.9
16B	-8.5	-4.7	12.1
16C	-11.8	-6.3	12.3
17B	-10.1	-5.5	12.8
18A	-9.9	-5.6	11.3
18B	-9.4	-4.6	11.9
18C	-11.5	-6.3	12.8
1	-9.8	-6.0	11.9
7D	-9.6	-4.3	12.4
8B	-7.9	-3.8	11.5
9	-10.2	-5.0	12.2
10	-9.7	-4.7	11.8
11A	-9.0	-4.1	12.2
11C	-9.8	-5.1	12.0
11E	-9.0	-4.5	11.3
11F	-8.7	-4.8	12.2
11G	-9.0	-5.3	11.0

that may have focused on C_4 plants (maize), CAM plants (possibly prickly pear), and some high nitrogen resource, possibly marine resources or chicken and catfish. Cargill and Hard (1999) concluded that the isotope values of the San Juan individuals do not reflect a typical mission diet of maize and beef, but the values do suggest a marine hunting and gathering adaptation. They suggest that the population recently migrated from the coast or relied on a mission diet regularly supplemented with marine resources. The reliance of cow and pig on C_4 dietary sources and the presence of chicken and C_4 catfish with high $\delta^{15}N$ values would elevate the human population's isotopic values causing it to appear similar to a coastal signature. The results suggest that the Room 26 population may have been coastal immigrants or may have been local on a diet with high C_4 and high nitrogen components. Because of the small sample size, more San Juan faunal will be analyzed in the future to examine this pattern further.

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Appendix 8:
Human Remains Analysis Tables

Appendix 8

Human Remains Analysis Tables

Table A8-1. Skeletal Element Inventory for Articulated Individuals - Cranial Bones and Unidentified Fragments

Element		Portion	Side	1	1a	1b	2a	2b	2f	2h	2j	2k	2l	2m	2n	2q	3	3a	4
Cranial Bones	Frontal	n/a	left	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
	Frontal	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
	Parietal	n/a	left	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
	Parietal	n/a	right	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Occipital	n/a	left	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
	Occipital	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
	Temporal	n/a	left	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Temporal	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
	TMJ	n/a	left	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	TMJ	n/a	right	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Sphenoid	n/a	left	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Sphenoid	n/a	right	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Zygomatic	n/a	left	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Zygomatic	n/a	right	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Maxilla	n/a	left	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
	Maxilla	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
	Palatine	n/a	left	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Palatine	n/a	right	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Mandible	n/a	left	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
	Mandible	n/a	right	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
Unidentified Fragments (gm)				80	267	11	2	8	1	87	0.4	84	1	0.2	0.4	17	87	0.8	15

Complete = 75-100% of the skeletal element present; **P**artial = 25-75% of the skeletal element present;
Fragmented = 1-25% of the skeletal element present

Table A8-2. Skeletal Element Inventory for Articulated Individuals - Postcranial Bones

Element	Portion	Side	1	1a	1b	2b	2f	2h	2j	2k	2l	2m	2n	2q	3	3a	4
Clavicle	n/a	left	C	C	C	C	C	C	C	C	F	C	C	C	C	C	C
Clavicle	n/a	right	C	C	C	C	*	C	C	C	F	C	C	C	C	C	*
Scapula	Body	left	C	C	C	C	C	C	C	C	P	C	C	C	C	C	C
Scapula	Body	right	C	C	C	C	C	C	C	P		C	C	C	C	C	C
Scapula	Glenoid fossa	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C
Scapula	Glenoid fossa	right	C	C	C	C	C	C	C			C	C	C	C	C	C
Sternum	Manubrium	n/a	C	C	C			C	C	C	C	C	C	C	C	C	*
Sternum	Body	n/a	C	C	C			C	C	C	C	C	C	C	C	C	*
Patella	n/a	left	C	C	C			C		C				C	C		
Patella	n/a	right	C	C	C					C				C	C		
Sacrum	n/a	left	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Sacrum	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Os Coxae	n/a	left	P	P	C	C	C	C	C	C	C	C	C	C	C		C
Os Coxae	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Ilium	n/a	left	P	P	C	C	C	C	C	C	C	C	C	C	C		C
Ilium	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Ischium	n/a	left	P	P	C	C	C	C	C	C	C	C	C	C	C		C
Ischium	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Pubis	n/a	left	*	*	C	C	C	C	C	C	C	C	C	C	C		C
Pubis	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Acetabulum	n/a	left	*	*	C	C	C	C	C	C	C	C	C	C	C		C
Acetabulum	n/a	right	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Auricular Surface	n/a	left	C	C	C	C	C	C	C	C		C	C	C	C		C
Auricular Surface	n/a	right	C	C	C	C	C	C	C	C		C	C	C	C		C

Complete = 75-100% of the skeletal element present; **P**artial = 25-75% of the skeletal element present;
Fragmented = 1-25% of the skeletal element present; * = may be in unidentified fragments

Table A8-3. Skeletal Element Inventory for Articulated Individuals - Vertebrae

Element	Portion	1	1a	1b	2a	2b	2f	2h	2j	2k	2l	2m	2n	2q	3	3a	4
C1	centrum	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
C1	neural arch	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
C2	centrum	C	*	C		C	C	C	C	*	C	C	C	C	C	C	C
C2	neural arch	C	*	C		C	C	C	C	*	C	C	C	C	C	C	C
C7	centrum	C	*	C		C	C	C	C	*	C	C	C	C	C	C	C
C7	neural arch	C	*	C		C	C	C	C	*	C	C	C	C	C	C	C
T10	centrum	C	C	C		C	C	C	C	*	C	C	C	C	C	C	C
T10	neural arch	C	C	C		C	C	C	C	*	C	C	C	C	C	C	C
T11	centrum	C	*	C		C	C	C	C	*	C	C	C	C	C	C	C
T11	neural arch	C	*	C		C	C	C	C	*	C	C	C	C	C	C	C
T12	centrum	C	*	C		C	C	C	C	*	C	C	C	C	C	C	C
T12	neural arch	C	*	C		C	C	C	C	*	C	C	C	C	C	C	C
L1	centrum	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
L1	neural arch	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
L2	centrum	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
L2	neural arch	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
L3	centrum	C	C	C		C	C	C	C	C	C	C	C	C	C		C
L3	neural arch	C	C	C		C	C	C	C	C	C	C	C	C	C		C
L4	centrum	C	C	C		C	C	C	C	C	C	C	C	C	C		C
L4	neural arch	C	C	C		C	C	C	C	C	C	C	C	C	C		C
L5	centrum	C	C	C		C	C	C	C	C	C	C	C	C	C		C
L5	neural arch	C	C	C		C	C	C	C	C	C	C	C	C	C		C
C3-C6	centrum	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
C3-C6	neural arch	C	C	C		C	C	C	C	C	C	C	C	C	C	C	C
T1-T9	centrum	C	C	C		C	C	C	C	C	7	C	C	C	C	C	C
T1-T9	neural arch	C	C	C		C	C	C	C	C	5	C	C	C	C	C	C

Complete = 75-100% of the skeletal element present; **P**artial = 25-75% of the skeletal element present;
Fragmented = 1-25% of the skeletal element present; ***** = may be in unidentified fragments

Table A8-4. Skeletal Element Inventory for Articulated Individuals - Ribs

Element	Side	1	1a	1b	2b	2f	2h	2j	2k	2l	2m	2n	2q	3	3a	4
1st	left	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
1st	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
2nd	left	C	C	C	C	C	C	C	F	C	C	C	C	C	C	C
2nd	right	C	C	C	C	C	C	C	F	C	C	C	C	C	C	C
11th	left	C	C	C	C	C	C	C	F	C	C	C	C	C	C	C
11th	right	C	C	C	C	C	C	C	F	C	C	C	C	C	C	C
12th	left	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12th	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
3-10	left	C	C	C	C	C	C	C	7	C	C	C	C	C	C	C
3-10	right	C	C	C	C	C	C	C	8	C	C	C	C	C	C	C
3-10	unsided								1							

Complete = 75-100% of the skeletal element present; **P**artial = 25-75% of the skeletal element present; **F**ragmented = 1-25% of the skeletal element present

Table A8-5. Skeletal Element Inventory for Articulated Individuals - Longbones

Element	Portion	Side	1	1a	1b	2b	2f	2h	2j	2k	2l	2m	2n	2q	3	3a	4
Humerus	Proximal Epiphysis	left	C	C	C	C		C		C				C	C		
Humerus	Proximal Epiphysis	right	C	C	C	C		C		C				C	C		
Humerus	Proximal Third	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C
Humerus	Proximal Third	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Humerus	Middle Third	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C
Humerus	Middle Third	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Humerus	Distal Third	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C
Humerus	Distal Third	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Humerus	Distal Epiphysis	left	C	C	C			C		C				C	C		
Humerus	Distal Epiphysis	right	C	C	C			C		C				C	C		
Radius	Proximal Epiphysis	left	C	C	C			C		C				C	C		
Radius	Proximal Epiphysis	right	P	C	C			C		C				C	C		
Radius	Proximal Third	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C
Radius	Proximal Third	right	*	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Radius	Middle Third	left	C	C	*	C	C	*	C	*		C	C	C	*	C	C
Radius	Middle Third	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Radius	Distal Third	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C
Radius	Distal Third	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Radius	Distal Epiphysis	left	C	C	C			C		C				C	C		
Radius	Distal Epiphysis	right		C	C			C		C				C	C		
Ulna	Proximal Epiphysis	left	C	C	C			C		C				C	C		
Ulna	Proximal Epiphysis	right	F	C	C			C		C				C	C		
Ulna	Proximal Third	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C
Ulna	Proximal Third	right	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Ulna	Middle Third	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C

Table A8-5. Skeletal Element Inventory for Articulated Individuals - Longbones, continued....

Element	Portion	Side	1	1a	1b	2b	2f	2h	2j	2k	2l	2m	2n	2q	3	3a	4
Ulna	Middle Third	right	P	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Ulna	Distal Third	left	C	C	C	C	C	C	C	C		C	C	C	C	C	C
Ulna	Distal Third	right		C	C	C	C	C	C	C	C	C	C	C	C	C	C
Ulna	Distal Epiphysis	left	C	C	C			C		C				C	C		
Ulna	Distal Epiphysis	right		C	C			C		C				C	C		
Femur	Proximal Epiphysis	left	C	C	C	C		C		C				C	C		
Femur	Proximal Epiphysis	right	C	C	C	C				C				C	C		
Femur	Proximal Third	left	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Femur	Proximal Third	right	C	C	C	C	C		C	C	C	C	C	C	C		C
Femur	Middle Third	left	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Femur	Middle Third	right	C	C	C	C	C		C	C	C	C	C	C	C		C
Femur	Distal Third	left	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Femur	Distal Third	right	C	C	C	C	C		C	C	C	C	C	C	C		C
Femur	Distal Epiphysis	left	C	C	C			C		C				C	C		
Femur	Distal Epiphysis	right	C	C	C					C				C	C		
Tibia	Proximal Epiphysis	left	C	C	C	C	C	C		C		C		C	C		
Tibia	Proximal Epiphysis	right	C	C	C	C				C		C		C	C		
Tibia	Proximal Third	left	C	C	C	C	C	C	C	C		C	C	C	C		C
Tibia	Proximal Third	right	F	C	C	C	C		C	C		C	C	C	C		C
Tibia	Middle Third	left	C	C	C	C	C	C	C	C		C	C	C	C		C
Tibia	Middle Third	right		C	C	C	C		C	C		C	C	C	C		C
Tibia	Distal Third	left	C	C	C	C	C	C	C	C		C	C	C	C		C
Tibia	Distal Third	right		C	C	C	C		C	C		C	C	C	C		C
Tibia	Distal Epiphysis	left	C	C	C			C		C				C	C		
Tibia	Distal Epiphysis	right		C	C	C				C				C	C		
Fibula	Proximal Epiphysis	left	C	C	C			C		C				C	C		
Fibula	Proximal Epiphysis	right	C	C	C			C		C				C	C		
Fibula	Proximal Third	left	C	C	C	C	C	C	C	C		C	C	C	C		C
Fibula	Proximal Third	right	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Fibula	Middle Third	left	C	C	C	C	C	C	C	C		C	C	C	C		C
Fibula	Middle Third	right		C	C	C	C	C	C	C		C	C	C	C		C
Fibula	Distal Third	left	C	C	C	C	C	C	C	C		C	C	C	C		C
Fibula	Distal Third	right		C	C	C	C	C	C	C		C	C	C	C		C
Fibula	Distal Epiphysis	left	C	C	C	C		C		C				C	C		
Fibula	Distal Epiphysis	right		C	C	C		C		C				C	C		
Talus	n/a	left	C	C	C	C	*	C	*	C	C	C	C	C	C		*
Talus	n/a	right		C	C		*	C	C	C	C	C	C	C	C		*
Calcaneus	n/a	left	C	C	C	C	*	C	C	C	C	C	C	C	C		*
Calcaneus	n/a	right		C	C	C	*		*	C	C	C	C	C	C		*

Complete = 75-100% of the skeletal element present; **P**artial = 25-75% of the skeletal element present; **F**ragmented = 1-25% of the skeletal element present; ***** = may be in unidentified fragments

Table A8-6. Skeletal Element Inventory for Articulated Individuals - Hand/Foot

Element	Portion	Side	1	1a	1b	2a	2b	2f	2h	2j	2k	2l	2m	2n	2q	3	3a	4
Carpals	n/a	left	C	C	C				C		7					6		
Carpals	n/a	right		C	C				C		C					4		
Carpals	n/a	unsided													16			5
Metacarpals	n/a	left	C	C	C			C	C	4	C	C			*	C		
Metacarpals	n/a	right		C	C				C	4	C	C			*	2		
Metacarpals	n/a	unsided											10	10	7			5
Phalanges	hand	left	C	C	12			C	13		6							10
Phalanges	hand	right		*	C				C		7							
Phalanges	hand	unsided					12			27		21	26	25	28	28		13
Tarsals	n/a	left	C	C	C			1	6		C				6	C		
Tarsals	n/a	right		C	C			1	1		C				6	C		
Tarsals	n/a	unsided													2			
Metatarsals	n/a	left	C	C	C		C	C	3	C	C	C			3	C		
Metatarsals	n/a	right		C	C		C	C	2	C	C	C			3	C		
Metatarsals	n/a	unsided											10	5	3			3
Metacarpal/tarsal	hand/foot	unsided																7
Phalanges	foot	left	9	2	11		6	1	13						5	10		
Phalanges	foot	right		2	12		5	4		3					1	13		
Phalanges	foot	unsided									26	11	8	7	8	2		
Phalanges	hand/foot	unsided			2	1	7	4		5	11	3		2		3	2	9

Complete = 75-100% of the skeletal element present; **P**artial = 25-75% of the skeletal element present;
Fragmented = 1-25% of the skeletal element present; ***** = may be in unidentified fragments

Table A8-7. Commingled Remains from Area 1

Element	Portion	Side	1c * - adult	1d - perinate	n/a - juvenile
Deciduous Molar	n/a	unsided		1/C	
Epiphyses	n/a	unsided			1/C
Foot - Tarsal	Lateral Cuneiform	right	1/C		
Hand - Metacarpal	4th	right	1/P		
Patella	n/a	left	1/C		
Permanent Molars	n/a	unsided	1/C		
Skull	Mandible	left	1/F		

*Burial Number Assigned from MNI Assessment. If the element could belong to an articulated burial (see Table A-1) it is labeled as n/a. C = 75-100% complete, P = 25-75% complete, F = 0-25% complete

Table A8-8. Commingled Remains From Area 2

Element	Portion	Side	2g * - 2-4 yr	2r - adult	2s or 2t - perinate	2u - ~1.5 yr	n/a - ~3 yr	n/a - ~4-5 yr	n/a - 1 yr +/- 4 mo	n/a - adult	n/a - birth to 6 mo	n/a - infant	n/a - juvenile	n/a - perinate	n/a - unknown
Clavicle	Acromial end and diaphysis	unsided												1/P	
Clavicle	n/a	left			1/C		1/C								
Deciduous Canine	n/a	unsided											3/C		
Deciduous Incisor	Mandibular	unsided											3/C		
Deciduous Incisor	Maxillary	unsided											2/C		
Deciduous Incisor	n/a	unsided											1/C	1/C	
Deciduous Molar	1st	unsided											1/C		
Deciduous Molar	Mandibular	unsided							1/C				1/C		
Deciduous Molar	n/a	unsided									1/C			1/C	
Deciduous Premolar	n/a	unsided											2/C		
Epiphyses	n/a	unsided											16/C	2/C	
Femur	Diaphysis	right			1/P										
Femur	Proximal and distal ends and diaphysis	left			1/C										
Femur	Proximal and distal ends and diaphysis	right			1/C										
Femur	Proximal end	unsided			1/C										
Femur	Proximal end and diaphysis	left				1/P									
Femur	Proximal end and upper and middle diaphysis	right					1/P								
Fibula	Proximal and distal ends and diaphysis	left										1/C			
Fibula	Proximal and distal ends and diaphysis	right			2/C										
Foot - Metatarsal	4th	left		1/F											
Foot - Metatarsal	4th	right								1/C					
Foot - Metatarsal	n/a	unsided												1/C	
Foot - Phalanx	Distal 1st	unsided								1/C					
Foot - Phalanx	Proximal 1st	unsided								1/C					
Foot - Tarsal	Unidentified	unsided												2/C	
Hand - Carpal	Capitate	right		1/C											
Hand - Carpal	Scaphoid	left		1/C											
Hand - Carpal	Trapezium	right		1/C											
Hand - Carpal	Trapezoid	right		1/C											
Hand - Metacarpal	2nd	left		1/C											
Hand - Metacarpal	3rd	left		1/C											
Hand/Foot - Metacarpals/ Metatarsals	Diaphysis	unsided								1/P			1/P		
Hand/Foot - Metacarpals/ Metatarsals	Proximal and distal ends and diaphysis	unsided											3/C	13/C	

Table A8-8. Commingled Remains From Area 2, continued...

Element	Portion	Side	2g * - 2-4 yr	2r -adult	2s or 2t - perinate	2u - ~1.5 yr	n/a - ~3 yr	n/a - ~4-5 yr	n/a - 1 yr +/- 4 mo	n/a - adult	n/a - birth to 6 mo	n/a - infant	n/a - juvenile	n/a - perinate	n/a - unknown
Hand/Foot - Phalanges	n/a	unsided											2/F		
Hand/Foot - Phalanges	Proximal and distal ends and diaphysis	unsided								9/C			6/C	6/C	
Humerus	Diaphysis and distal end	right				1/P									
Humerus	Proximal and distal ends and diaphysis	left												1/C	
Longbone Fragments	Diaphysis	unsided			2/P								1/P	1/C	
Os Coxae	Ilium	right			1/C										
Os Coxae	Ischium	left			1/C										
Os Coxae	Ischium	right					1/C								
Os Coxae	Pubis	left			2/C			1/P					1/C		
Os Coxae	Pubis	right			2/C										
Permanent Canines	n/a	unsided											2/C		
Permanent Incisors	Central	unsided											1/C		
Permanent Incisors	Maxillary - Lateral	unsided											2/C		
Permanent Incisors	n/a	unsided								1/P					
Permanent Molars	Mandibular	unsided								3/C					
Permanent Molars	n/a	unsided								1/C			1/C		
Permanent Premolar	n/a	unsided								1/C					
Radius	Diaphysis and distal end	left					1/P								
Radius	Distal epiphysis	right		1/F											
Radius	Proximal and distal ends and diaphysis	left			2/C									1C	
Radius	Proximal end	left					1/F								
Rib	1st	unsided												1/C	
Ribs	n/a	left											2/C		
Ribs	n/a	right											1/C		
Ribs	n/a	unsided								26/P			15/P	34/P	
Sacrum	1st segment	n/a		1/F											
Scapula	n/a	right				1/C									
Scapula	n/a	unsided								1/F					
Skull	Frontal and unidentified fragments	unsided	1/P												
Skull	Occipital - Basilar portion	n/a			1/C										
Skull	Sphenoid - Greater Wing	left			1/C										
Skull	Temporal - Petrous	unsided		1/P	1/P										
Skull	Temporal - Squama	right			1/C										
Skull	Unidentified fragments	n/a		6/F	58/F										
Skull	Zygomatic	unsided		1/C	1/C										

Table A8-8. Commingled Remains From Area 2, continued....

Element	Portion	Side	2g * - 2-4 yr	2r -adult	2s or 2t - perinate	2u - ~1.5 yr	n/a - ~3 yr	n/a - ~4-5 yr	n/a - 1 yr +/- 4 mo	n/a - adult	n/a - birth to 6 mo	n/a - infant	n/a - juvenile	n/a - perinate	n/a - unknown
Skull	Zygomatic and unidentified fragments	n/a			4/F										
Sternum	One Segment	n/a												1/C	
Tibia	Proximal and distal ends and diaphysis	left			1/C									1/C	
Tibia	Proximal and distal ends and diaphysis	right			1/C									1/C	
Tibia	Proximal end	left			1/F										
Ulna	Distal end	unsided			1/F										
Ulna	Proximal and distal ends and diaphysis	left			1/C									1/C	
Unidentified Fragments (gm)	n/a	n/a	0.7									0.5			155
Vertebrae	Centrum	n/a											10/C	7/C	
Vertebrae	Cervical	n/a											1/P		
Vertebrae	Cervical - Axis	n/a											1/C		
Vertebrae	n/a	n/a								15/F					
Vertebrae	Neural Arches	n/a											7/C 3/P	24/C	

*Burial Number Assigned from MNI Assessment. If the element could belong to an articulated burial (see Table A8-1) it is labeled as n/a. C = 75-100% complete, P = 25-75% complete, F = 0-25% complete

Table A8-9. Commingled Remains from Section F

Element	Portion	Side	F1 * - perinate	F2 - adult
Fibula	Diaphysis	unsided	1/C	
Hand/Foot - Phalanges	Proximal and distal ends and diaphysis	unsided		1/C
Longbone - Ulna or Radius	Diaphysis	unsided	1/C	
Ribs	n/a	unsided	2/P	

*Burial Number Assigned from MNI Assessment.
C = 75-100% complete, P = 25-75% complete, F = 0-25% complete

Table A8-10. Commingled Remains from Section J/K

Element	Portion	Side	J1 - perinate	J2 - 2nd trimester fetus	J3 - 3rd trimester fetus	J4 - adult
Clavicle	Acromial end	unsided	1/C			
Femur	Diaphysis	unsided	1/P			
Fibula	Distal 1/3 of diaphysis and distal end	unsided	1/C			
Hand - phalanx	Proximal and distal ends and diaphysis	unsided	1/C			
Hand/Foot - Metacarpals/Metatarsals	Diaphysis	unsided	1/P			
Hand/Foot - Metacarpals/Metatarsals	Proximal and distal ends and diaphysis	unsided	2/C			
Humerus	Diaphysis and distal end	right	1/C			
Longbone - femur or humerus	Diaphysis	unsided	1/C			
Longbone Fragments	Diaphysis	unsided	1/P			
Os Coxae	Ilium	left	1/C			
Os Coxae	Ischium	left	1/C			
Os Coxae	Pubis	left	1/P			
Permanent Premolars	n/a	unsided				1/C
Radius	Distal 1/3 of diaphysis and distal end	unsided	1/C			
Radius	Proximal and distal ends and diaphysis	right	1/C		1/C	
Radius	Proximal end and proximal 1/2 diaphysis	left	1/C			
Rib	1st	left	1/C			
Ribs	n/a	unsided	4/C 15/P			
Scapula	n/a	unsided	2/P			
Skull	Mandible	right	1/C			
Skull	Sphenoid	n/a	1/C			
Skull	Sphenoid - Greater Wing	left	1/C			
Skull	Unidentified fragments	n/a	14/F			
Tibia	Diaphysis	unsided	1/P			
Tibia	Diaphysis and distal end	unsided	1/P			
Tibia	Distal 1/3 of diaphysis and distal end	unsided	1/C	1/C		
Ulna	Proximal and distal ends and diaphysis	left	1/C			
Ulna	Proximal end and proximal upper 1/3 diaphysis	right	1/C			
Vertebrae	Centrum	n/a	2/C			
Vertebrae	Neural Arches	n/a	1/C			

*Burial Number Assigned from MNI Assessment. C = 75-100% complete, P = 25-75% complete, F = 0-25% complete

Table A8-11. Morphological Traits for Determining Adult Sex

Burial	Pelvis												Skull									
	Ventral Arc (1-3)		Subpubic Concavity (1-3)		Ischiopubic Ramus Ridge (1-3)		Greater Sciatic Notch (1-5)		Preauricular Sulcus (0-4)		* Estimated Sex Pelvis (0-5)		Nuchal Crest (1-5)	Mastoid Process (1-5)		Supraorbital Margin (1-5)		Glabella (1-5)	Mental Eminence (1-5)	* Estimated Sex Skull (0-5)		
	L	R	L	R	L	R	L	R	L	R	L	R	M	L	R	L	R	M	M	L	M	R
1		3		3		3		4		0		5		4	4	3			4	4	4	4
1a	3	3	3		3						5	4			3	3			4	3	4	3
2h	2	3	3	3	3	3	4		4		5	5	2	3	4		3		4	4	4	4
2k						1			1		2	1	3		2				2		2	2
3		2		3		3			4	2	0	4		1		3	3	3	4	3	4	3

* 0 = undetermined sex, 1 = female, 2 = probable female, 3 = ambiguous sex, 4 = probable male, 5 = male

Table A8-12. Morphological Traits for Determining Adult Age

Burial	Pelvis				* Suture Closure																		Overall Age (yrs)
	Todd (1-10)		Suchey-Brooks (1-6)		Midlambdoid	Lambda	Obelion	Anterior Sagittal	Bregma	Midcoronal	Pterion	Sphenofrontal	Inferior Sphenotemporal	Superior Sphenotemporal	Incisive	Anterior Median Palatine	Posterior Medial Palatine	Transverse Palatine	Sagittal	Left Lambdoid	Left Coronal	
	L	R	L	R																			
1		5		2			0	0	0	0	0	0			0	0			0	0	0	20-35
1a		4		4	0	0	0	0	0	0					0				1		0	20-35
2h	9/10	9/10	6	6	2	2	3	3											3	3		50+
2k					0	0																20-35
3		10		6	3	3	3	3	3	3	3	3	2	3	2	2	2	2	3	3	3	50+

* Suture Closure: blank = unobservable, 0 = open, 1 = minimal, 2 = significant, 3 = complete

Table A8-13. Codes for Scoring Dentition

Category	Code	Description
Presence	1	present, but not in occlusion
	2	present in occlusion
	3	missing with no alveolar bone
	4	missing with resorbing bone (premortem loss)
	5	missing with no resorption (postmortem loss)
	6	missing congenitally
	7	present but damaged
	8	present but unobservable (in crypt)
Development	1	initial cusp formation
	2	coalescence of cusps
	3	cusp outline complete
	4	crown 1/2 complete
	5	crown 3/4 complete
	6	crown complete
	7	initial root formation
	8	initial cleft formation
	9	root length 1/4
	10	root length 1/2
	11	root length 3/4
	12	root length complete
	13	apex 1/2 closed
	14	apex closed
Wear	n/a	see Smith (1984) and Scott (1979)
Caries	0	no lesion present
	1	occlusal surface
	2	interproximal surfaces
	3	smooth surfaces
	4	cervical caries
	5	root caries
	6	large caries
	7	noncarious pulp exposure
Calculus	1	small amount
	2	moderate amount
	3	large amount

Table A8-14. Inventory of Permanent Maxillary Dentition

Burial	Tooth	Maxillary Right								Maxillary Left							
		M^3	M^2	M^1	P^2	P^1	C	I^2	I^1	I^1	I^2	C	P^1	P^2	M^1	M^2	M^3
1	Presence	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
	Development	14	14	14	14	14		14	14	14	14	14	14	14	14	14	14
	Wear									5	4	4	4	3	22	12	12
	Caries	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
	Calculus	0	1	1	0	1		0	0	0	0	0	0	0	0	0	1
1a	Presence	6	1	3	1	1	1	1	3	5	2	2	2	2	2	2	6
	Development		14		14	14	14	14			14	14	14	14	14	14	
	Wear		15		3	4	5	5			5	5	4	2	18	13	
	Caries		0		0	0	0	0			0	0	0	0	0	0	
	Calculus		1		0	1	0	1			1	1	1	0	1	1	
1b	Presence		2	2				2	2	2	2	2	2		2	2	
	Development		4	14				9	11	11	9	7	7		14	4	
	Wear		0	0				0	0	0	0	0	0		0	0	
	Caries		0	0				0	0	0	0	0	0		0	0	
	Calculus		0	0				0	0	0	0	0	0		0	0	
2a	Presence			1		1	1		1			1	1		1		
	Development			7		1	4		7			4	1		7		
	Wear			0		0	0		0			0	0		0		
	Caries			0		0	0		0			0	0		0		
	Calculus			0		0	0		0			0	0		0		
2b	Presence			1											1		
	Development			2											2		
	Wear			0											0		
	Caries			0											0		
	Calculus			0											0		
2h	Presence	6	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
	Development		14	14	14	14	14	14	14	14	14	14	14	14	14		
	Wear		18							3	6	4	3	3	16		
	Caries		0	0	0	0	0	0	0	0	0	0	0	0	0		
	Calculus		3	3	3	3	2	1	1	1	1	2	3	3	3		
2k	Presence	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Development	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Wear									1	2	2	2	2	16	8	4
	Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Calculus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2q	Presence			2	8	8	8	2	2	2	2	8	8		2	8	
	Development			11	6	6	7	6	11	11	6	7	6		10	5	
	Wear			0	0	0	0	0	0	0	0	0	0		0	0	
	Caries			0	0	0	0	0	0	0	0	0	0		0	0	
	Calculus			0	0	0	0	0	0	0	0	0	0		0	0	

Table A8-14. Inventory of Permanent Maxillary Dentition, continued....

Burial	Tooth	Maxillary Right								Maxillary Left							
		M^3	M^2	M^1	P^2	P^1	C	I^2	I^1	I^1	I^2	C	P^1	P^2	M^1	M^2	M^3
3	Presence	3	3	3	3	3	3	1	1	2	2	2	4	4	4	4	4
	Development							14	14	14	14	14					
	Wear							8	8	8	8	8					
	Caries							0	0	0	0	0					
	Calculus							0	0	0	0	0					
4	Presence			1			1	1	1		1				1		
	Development			5			3	4	4		4				5		
	Wear			0			0	0	0		0				0		
	Caries			0			0	0	0		0				0		
	Calculus			0			0	0	0		0				0		

Table A8-15. Inventory of Permanent Mandibular Dentition

Burial	Tooth	Mandibular Left								Mandibular Right							
		M^3	M^2	M^1	P^2	P^1	C	I^2	I^1	I^1	I^2	C	P^1	P^2	M^1	M^2	M^3
1	Presence	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
	Development	14	14	14	14	14	14	14	14	14	14	14	14	14			
	Wear	15	15	15	3	2	2	5	6								
	Caries	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Calculus	0	0	0	0	0	0	0	0	0	0	0	0	0			
1a	Presence	6	2	5	5	2	5	2	2	2	2	2	2	2	2	2	6
	Development		14			14		14	14	14	14	14	14	14	14	14	
	Wear		17			2		5	5	5	5	5	3	4	21	12	
	Caries		0			0		0	0	0	0	0	0	0	0	0	
	Calculus		0			0		1	1	1	1	0	0	0	1	0	
1b	Presence		2	2				2	2	2	2				2	2	
	Development		4	14				11	11	11	11				14	4	
	Wear		0	0				0	0	0	0				0	0	
	Caries		0	0				0	0	0	0				0	0	
	Calculus		0	0				0	0	0	0				0	0	
2a	Presence																
	Development																
	Wear																
	Caries																
	Calculus																
2b	Presence			1													
	Development			2													
	Wear			0													
	Caries			0													
	Calculus			0													

Table A8-15. Inventory of Permanent Mandibular Dentition, continued....

Burial	Tooth	Mandibular Left								Mandibular Right							
		M^3	M^2	M^1	P^2	P^1	C	I^2	I^1	I^1	I^2	C	P^1	P^2	M^1	M^2	M^3
2h	Presence	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Development	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Wear									5	5	6	2	3	15	15	11
	Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Calculus	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2k	Presence	3	3	1	3	3	2	2	2	2	2	2	2	2	2	5	5
	Development			14			14	14	14	14	14	14	14	14	14		
	Wear						3	5	5				2	2	16		
	Caries			0			0	0	0	0	0	0	0	0	0		
	Calculus			1			1	1	1	1	1	1	1	1	1		
2q	Presence			2				2	2	2	2	8	8	8	2		
	Development			10				11	11	11	11	7	6	6	10		
	Wear			0				0	0	0	0	0	0	0	0		
	Caries			0				0	0	0	0	0	0	0	0		
	Calculus			0				0	0	0	0	0	0	0	0		
3	Presence	4	4	4	2	2	2	4	4	4	4	4	4	4	4	4	4
	Development				14	14	14										
	Wear				3	3	4										
	Caries				2	5	6										
	Calculus				0	0	0										
4	Presence			1											1		
	Development			5											5		
	Wear			0											0		
	Caries			0											0		
	Calculus			0											0		

Table A8-16. Inventory of Deciduous Maxillary Dentition

Burial	Tooth	Maxillary Right					Maxillary Left				
		M^2	M^1	C	I^2	I^1	I^1	I^2	C	M^1	M^2
1b	Presence	2	2	2					2	2	2
	Development	14	14	14					14	14	14
	Caries	0	0	0					0	0	0
	Calculus	0	0	0					0	0	0
2a	Presence	2	2	3	3	3	3	3	3	2	2
	Development	14	14							14	14
	Caries	0	0							0	0
	Calculus	0	0							0	0
2b	Presence	1	1	1	2	2	2	2	3	3	3
	Development	5	8	6	11	10	11	11			
	Caries	0	0	0	0	0	0	0			
	Calculus	0	0	0	0	0	0	0			
2f	Presence	3	1	1	1	1	3	1	3	3	3
	Development		3	4	6	6		6			
	Caries		0	0	0	0		0			
	Calculus		0	0	0	0		0			
2j	Presence	3	1	1	1	1	1	3	3	3	3
	Development		4	4	6	6	6				
	Caries		0	0	0	0	0				
	Calculus		0	0	0	0	0				
2l	Presence	1	3	1	3	3	1	1	1	1	1
	Development	3		5			6	6	5	4	3
	Caries	0		0			0	0	0	0	0
	Calculus	0		0			0	0	0	0	0
2m	Presence	1	1	1	1	1	1	1	3	1	1
	Development	2	3	4	6	6	6	5		3	2
	Caries	0	0	0	0	0	0	0		0	0
	Calculus	0	0	0	0	0	0	0		0	0
2n	Presence	1	1	1	1	1	3	1	3	3	1
	Development	3	4	4	6	6		6			3
	Caries	0	0	0	0	0		0			0
	Calculus	0	0	0	0	0		0			0
2q	Presence	2	2	2					2	2	2
	Development	14	14	14					14	14	14
	Caries	0	0	0					0	0	0
	Calculus	0	0	0					0	0	0
3a	Presence	3	1	1	1	1	1	1	3	3	3
	Development		4	4	6	6	6	6			
	Caries		0	0	0	0	0	0			
	Calculus		0	0	0	0	0	0			
4	Presence	1	1	1	2	2	2	2	1	1	1
	Development	7	7	7	11	11	11	11	7	7	7
	Caries	0	0	0	0	0	0	0	0	0	0
	Calculus	0	0	0	0	0	0	0	0	0	0

Table A8-17. Inventory of Deciduous Mandibular Dentition

Burial	Tooth	Mandibular Left					Mandibular Right				
		M^2	M^1	C	I^2	I^1	I^1	I^2	C	M^1	M^2
1b	Presence	2	2	2					2	2	2
	Development	14	14	14					14	14	14
	Caries	0	0	0					0	0	0
	Calculus	0	0	0					0	0	0
2a	Presence										
	Development										
	Caries										
	Calculus										
2b	Presence	3	1	1	3	2	2	3	3	1	1
	Development		6	7		10	10			9	5
	Caries		0	0		0	0			0	0
	Calculus		0	0		0	0			0	0
2f	Presence	1	1	1	1	1	1	3	1	1	1
	Development	3	5	4	6	6	6		4	5	3
	Caries	0	0	0	0	0	0		0	0	0
	Calculus	0	0	0	0	0	0		0	0	0
2j	Presence	1	1	1	1	1	1	1	1	1	1
	Development	2	5	4	6	6	6	6	4	5	2
	Caries	0	0	0	0	0	0	0	0	0	0
	Calculus	0	0	0	0	0	0	0	0	0	0
2l	Presence	1	3	3	3	3	3	3	3	3	3
	Development	3									
	Caries	0									
	Calculus	0									
2m	Presence	1	1	1	1	1	1	1	1	1	1
	Development	3	4	4	6	6	6	6	4	4	3
	Caries	0	0	0	0	0	0	0	0	0	0
	Calculus	0	0	0	0	0	0	0	0	0	0
2n	Presence	1	3	3	1	1	1	1	3	3	3
	Development	3			6	6	6	6			
	Caries	0			0	0	0	0			
	Calculus	0			0	0	0	0			
2q	Presence	2	2	2					2	2	2
	Development	14	14	14					14	14	14
	Caries	0	0	0					0	0	0
	Calculus	0	0	0					0	0	0
3a	Presence	1	1	3	1	1	1	1	3	1	3
	Development	2	3		6	6	6	6		3	
	Caries	0	0		0	0	0	0		0	
	Calculus	0	0		0	0	0	0		0	
4	Presence	1	1	3	1	2	2	1	1	1	1
	Development	7	7		7	11	11	7	7	7	7
	Caries	0	0		0	0	0	0	0	0	0
	Calculus	0	0		0	0	0	0	0	0	0

Table A8-18. Dental Measurements for Permanent Teeth (mm)

Burial	Tooth	Maxilla								Mandible							
		I^1	I^2	C	P^1	P^2	M^1	M^2	M^3	M^3	M^2	M^1	P^2	P^1	C	I^2	I^1
1	Mesiodistal diameter	8.74	6.36	7.01	6.36	5.73	10.89	8.61	8.23	9.63	9.46	10.55	6.11	6.52	6.40	5.91	5.14
	Buccolingual diameter	7.19	6.45	8.18	8.73	8.26	10.80	10.54	10.40	8.89	9.51	10.06	7.45	7.58	8.12	6.58	6.50
	Crown height	9.11	8.28	8.91	6.82	5.35	4.28	5.03	5.24	5.10	5.26	5.57	5.87	7.30	10.85	7.72	8.13
1a	Mesiodistal diameter		6.56	7.11	6.69	6.17	9.90	9.80			11.33	10.40	6.84	7.54	6.15	5.53	4.71
	Buccolingual diameter		6.67	8.27	8.40	8.68	11.66	12.12			9.95	10.00	7.65	7.44	7.47	6.29	6.45
	Crown height		9.19	9.43	7.80	6.73	7.24	6.30			6.55	6.20	4.85	7.98	8.51	9.38	8.71
2h	Mesiodistal diameter	8.62	6.31	7.61	6.17	5.94	9.73	10.22		8.77	9.75	10.62	6.06	6.64	6.47	5.89	5.30
	Buccolingual diameter	6.77	6.25	8.40	8.20	8.43	11.87	10.45		9.19	9.11	10.20	6.97	7.56	7.99	6.24	5.77
	Crown height	10.25	7.62	9.04	7.01	7.16	7.97	6.32		5.92	5.60	5.79	5.86	7.67	9.05	8.25	8.02
2k	Mesiodistal diameter	9.21	7.06	7.69	6.92	6.90	10.65	10.43	10.06			11.21	6.85	6.91	6.83	6.32	5.46
	Buccolingual diameter	6.76	6.36	8.05	9.49	9.38	11.42	10.24	10.60			10.57	8.35	7.79	7.48	5.89	4.05
	Crown height	10.85	9.47	10.33	7.27	8.34	8.85	6.87	6.50			7.57	6.68	8.95	10.16	9.22	8.66
3	Mesiodistal diameter	*	*	*									*	*	*		
	Buccolingual diameter	*	*	*									*	*	*		
	Crown height	*	*	*									*	*	*		

* = excessive wear

Table A8-19. Cranial Measurements of Adult Remains (mm)

Measurement	Burial				
	1	1a	2h	2k	3
Maximum Cranial Length					
Maximum Cranial Breadth	145.00				
Bizygomatic Diameter					
Basion-Bregma Height					
Cranial Base Length					121.02
Basion-Prosthion Length					105.30
Maxillo-Alveolar Breadth					
Maxillo-Alveolar Length					
Biauricular Breadth					
Upper Facial Height					61.47
Minimum Frontal Breadth	101.02				
Upper Facial Breadth	113.00				
Nasal Height					57.24
Nasal Breadth					23.91
Orbital Breadth		40.41	35.14		38.58
Orbital Height					35.95
Biorbital Breadth		93.79			18.00
Interorbital Breadth		15.25	29.15		
Frontal Chord	110.63	111.40			
Parietal Chord	94.08	94.16			
Occipital Chord			101.10	108.93	
Foramen Magnum Length					
Foramen Magnum Breadth			27.39		
Mastoid Length		**31.92**	**36.74**	**29.28**	28.80
Chin Height	29.71	32.86	29.16	27.43	23.59
Height of the Mandibular Body	31.20	35.40	28.21	**29.54**	22.27
Breadth of the Mandibular Body	9.33	12.26	14.16	11.50	10.01
Bigonial Width		94.64	91.93		
Bicondylar Breadth		124.21	115.86		
Minimum Ramus Breadth	32.09	32.26	35.70	**29.60**	35.90
Maximum Ramus Breadth	45.20	44.83	43.70	**42.94**	46.46
Maximum Ramus Height	71.12	72.55	64.99	**61.32**	64.17
Mandibular Length	101.05	96.88	95.13	**88.97**	91.59
Mandibular Angle					

Bold font indicates measurement of the right side.

Table A8-20. Postcranial Measurements of Adult Remains (mm)

Element	Measurement	Burial				
		1	1a	2h	2k	3
Clavicle	Maximum Length	**152.00**	**159.00**	**139.94**	**148.04**	136.00
	Ant.-Post. Diameter at Midshaft	**13.49**	**11.63**	**11.72**	**12.16**	10.55
	Sup.-Inf. Diameter at Midshaft	**10.50**	**14.25**	**11.03**	**8.40**	11.37
Scapula	Height	**176.00**	153.66			
	Breadth		112.73	**104.76**		
Humerus	Maximum Length	318.00	370.00	286.00		305.00
	Epicondylar Breadth	62.90	70.76	57.98	58.41	61.73
	Vertical Diameter of Head	44.70	**51.30**	41.03	44.32	45.93
	Maximum Diameter at Midshaft	23.26	23.25	23.81		22.40
	Minimum Diameter at Midshaft	17.16	19.18	17.35		17.66
Radius	Maximum Length		**293.00**	225.00	233.00	
	Ant.-Post. Diameter at Midshaft	10.74	**12.24**	11.65	11.98	
	Med.-Lat. Diameter at Midshaft	16.20	**14.80**	16.06	13.38	
Ulna	Maximum Length	260.00	301.00	250.00	**257.00**	
	Ant.-Post. Diameter	20.21	17.61	12.66	**16.45**	
	Med.-Lat. Diameter	15.12	15.39	18.59	**11.51**	
	Physiological Length	230.00	271.00	217.00	**227.00**	
	Minimum Circumference	38.00	46.00	40.00	**39.00**	
Sacrum	Ant. Length			119.48	130.37	
	Ant.-Sup. Breadth				116.78	
	Maximum Transverse Diameter of Base			54.63		
Ox Coxae	Height			250.00		
	Illiac Breadth			145.50		
	Pubis Length		82.68	84.20		
	Ischium Length		62.92	70.44		
Femur	Maximum Length	436.00		399.00		**414.00**
	Bicondylar Length	444.00				
	Epicondylar Breadth	78.85				
	Maximum Diameter of the Femur Head	45.22	**48.86**	42.55		
	Ant.-Post. Subtrochanteric Diameter	25.33	31.59	29.05		25.69
	Med.-Lat. Subtrochanteric Diameter	32.25	42.14	29.40		32.07
	Ant.-Post. Midshaft Diameter	27.36	32.53	32.56		30.67
	Med.-Lat. Midshaft Diameter	26.93	27.96	26.59		27.20
	Midshaft Circumference	87.43	96.00	92.00		92.00

Table A8-20. Postcranial Measurements of Adult Remains (mm), continued....

Element	Measurement	Burial				
		1	1a	2h	2k	3
Tibia	Length	367.00				
	Maximum Proximal Epiphyseal Breadth	75.32			**75.73**	77.63
	Maximum Distal Epiphyseal Breadth	54.28	55.75	50.23	51.77	48.76
	Maximum Diameter at the Nutrient Foramen	32.55	35.97		36.29	38.20
	Med.-Lat. Diameter at the Nutrient Foramen	24.73	24.70		24.44	22.11
	Circumference at the Nutrient Foramen	90.60	97.00		94.00	99.00
Fibula	Maximum Length	364.00	390.00	327.00	**355.00**	324.00
	Maximum Diameter at Midshaft	15.69	16.46	16.90	**15.90**	14.87
Calcaneus	Maximum Length	81.97	85.96	76.44	74.09	
	Middle Breadth	42.81	48.37	41.14	46.38	

Bold font indicates measurement of the right side.

Table A8-21. Epiphyseal Fusion for Immature Remains

Bone	Epiphysis	Burial										
		1b	2a	2b	2f	2j	2l	2m	2n	2q	3a	4
Cervical Vertebrae	superior	2	2	0	0	0	0	0	0	2	0	0
	inferior	2	2	0	0	0	0	0	0	2	0	0
Thoracic Vertebrae	superior	1		0	0	0	0	0	0	1	0	0
	inferior	1		0	0	0	0	0	0	1	0	0
Lumbar Vertebrae	superior	1		0	0	0	0	0	0	1	0	0
	inferior	1		0	0	0	0	0	0	1	0	0
Scapula	coracoid	0		0	0	0		0	0	0	0	0
	acromion	0		0	0	0		0	0	0	0	0
Clavicle	sternal	0		0	0	0	0	0	0	0	0	0
Humerus	head	0		0	0	0	0	0	0	0	0	0
	distal	0		0	0	0	0	0	0	0	0	0
	medial epicondyle	0		0	0	0	0	0	0	0	0	0
Radius	proximal	0		0	0	0	0	0	0	0	0	0
	distal	0		0	0	0	0	0	0	0	0	0
Ulna	proximal	0		0	0	0	0	0	0	0	0	0
	distal	0		0	0	0	0	0	0	0	0	0
Os Coxae	iliac crest	0		0	0	0	0	0	0	0		0
	ischial tuberosity	0		0	0	0	0	0	0	0		0
Femur	head	0		0	0	0	0	0	0	0		0
	greater trochanter	0		0	0	0	0	0	0	0		0
	lesser trochanter	0		0	0	0	0	0	0	0		0
	distal	0		0	0	0	0	0	0	0		0
Tibia	proximal	0		0	0	0		0	0	0		0
	distal	0		0	0	0		0	0	0		0
Fibula	proximal	0		0	0	0		0	0	0		0
	distal	0		0	0	0		0	0	0		0

Blank = unobservable, 0 = open, 1 = partial union, 2 = complete union

Table A8-22. Bone Union for Immature Remains

Bone	Area of Union	Burial										
		1b	2a	2b	2f	2j	2l	2m	2n	2q	3a	4
Os Coxae	ilium-pubis	0		0	0	0	0	0	0	0		0
	ischium-pubis	0		0	0	0	0	0	0	0		0
	ischium-illium	0		0	0	0	0	0	0	0		0
Sacral Segments	1-2	0		0	0	0	0	0	0	0		0
	2-3	0		0	0	0	0	0	0	0		0
	3-4	0		0	0	0	0	0	0	0		0
	4-5	0		0	0	0		0	0	0		0
Cervical Vertebrae	neural arches to each other	2	2	2	0	0	0	0	0	2	0	
	neural arches to centrum	2	2	0	0	0	0	0	0	2	0	0
Thoracic Vertebrae	neural arches to each other	2		2	0	0	0	0	0	2	0	
	neural arches to centrum	1		0	0	0	0	0	0	1	0	0
Lumbar Vertebrae	neural arches to each other	2		2	0	0	0	0	0	2	0	2
	neural arches to centrum	1		0	0	0	0	0	0	1	0	0
Cranium	spheno-occipital synchondrosis	0		0	0	0	0	0	0	0	0	0
Occipital	lateral part to squama	2		0		0	0	0	0	2	0	
	basilar part to lateral part	2		0	0	0	0	0	0	2	0	

Blank = unobservable, 0 = open, 1 = partial union, 2 = complete union

Table A8-23. Cranial Measurements for Immature Remains (mm)

Element	Measurement	Burial								
		1b	2b	2f	2j	2l	2m	2n	2q	3a
Lesser Wing of Sphenoid	Length				15.53		14.97			16.17
	Width				11.63		12.54			11.16
Greater Wing of the Sphenoid	Length		**39.25**			30.31	28.16	**31.84**		**28.24**
	Width		**27.94**			22.29	22.24	**20.59**		**20.20**
Body of the Sphenoid	Length			13.16	12.33		8.37	11.85		11.47
	Width			18.86	17.98	18.33	19.32	19.94		17.73
Petrous and Mastoid Portions of the Temporal	Length	65.26	**66.17**	39.10	38.97	39.29	42.83	40.42		39.98
	Width	21.07	**21.59**	17.92	14.70	14.26	16.96	17.42		16.74
Basilar Part of the Occipital	Length		16.10	13.18	12.27	13.52	12.35	13.63		12.17
	Width		23.10	14.91	14.46	14.95	15.87	15.55		14.66
Zygomatic	Length			23.63	20.85	25.48	23.79			**20.96**
	Width			20.28	17.89	16.02	18.52			**18.44**
Maxilla	Length						24.36			
	Height						24.77			
	Width						30.94			
Mandible	Length of the Body	71.98		40.48	43.62		40.78	**37.31**	**73.96**	39.34
	Width of the Arc	39.14		19.42	19.61		17.53	**17.78**	**31.59**	17.12
	Full Length of Half Mandible	101.25		53.69	50.85		49.18	46.17	100.68	46.70

Bold font indicates measurement of the right side.

Table A8-24. Postcranial Measurements for Immature Remains (mm)

Element	Measurement	Burial									
		1b	**2b**	**2f**	**2j**	**2l**	**2m**	**2n**	**2q**	**3a**	**4**
Clavicle	Length	101.08	**55.50**	50.50	43.87		42.41	44.77	90.26	42.50	
	Diameter	7.23	**6.09**	4.61	3.64		4.35	4.22	7.91	3.82	
Scapula	Length (height)				36.63		33.45	**38.99**		**32.99**	
	Width				30.52		28.32	**28.02**		**27.45**	
	Length of Spine				35.93		30.72			**29.91**	
Iilium	Length	105.81	45.73	37.28	37.72	35.30	33.53	**37.26**	93.43		**47.28**
	Width	91.00	45.11	33.05	32.80	27.58	30.70	**32.94**	79.21		**48.06**
Ischium	Length	60.07	26.92	19.26	19.58	19.11	18.93	**19.42**			**31.65**
	Width	40.22	19.91	12.89	13.23	13.38	12.27	**12.79**	37.35		18.76
Pubis	Length	**48.72**	**24.59**	16.01	16.72	16.14	**16.52**	**16.04**	42.88		25.37
Humerus	Length	203.00	**97.00**	68.50	66.00	**66.50**	65.00	66.50	174.50	60.50	**105.50**
	Width	37.35		17.88	16.73	**17.44**	16.76	16.37	33.68	15.63	**21.93**
	Diameter	12.68	**9.52**	6.78	5.97	**6.65**	6.34	5.50	14.27	5.93	**11.18**
Ulna	Length	168.00		64.50	62.00	**64.00**	59.00	62.76	143.00	56.00	**98.00**
	Diameter	11.14	**7.05**	4.30	4.69	**5.12**	5.16	4.60	9.90	4.70	**7.44**
Radius	Length	153.50	**77.00**	**55.60**	53.00	**54.00**	51.00	55.59	131.00	48.00	
	Diameter	10.35	**6.55**	**4.84**	4.19	**4.35**	4.65	4.33	11.61	4.40	
Femur	Length	**276.00**	**120.00**	79.80	77.50	77.50	74.00	76.50	234.50		
	Width	42.90	**26.51**	22.97	19.82	21.33	19.06	18.94	55.12		
	Diameter	18.72	**10.34**	7.67	6.69	7.02	7.43	6.44	18.15		
Tibia	Length	231.00	**99.50**	69.50	68.50		65.00	64.50	**198.50**		
	Diameter	20.56	**11.29**	7.99	6.67		6.84	6.76	**20.45**		
Fibula	Length	228.00		67.00			61.00	68.00	195.00		
	Diameter	10.19		4.56	3.58		4.30	4.08	10.19		

Bold font indicates measurement of the right side.

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