A TWELFTH CENTURY FAUNAL ASSEMBLAGE FROM AL-WU'AYRA IN THE SOUTHERN HIGHLANDS OF JORDAN

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Introduction

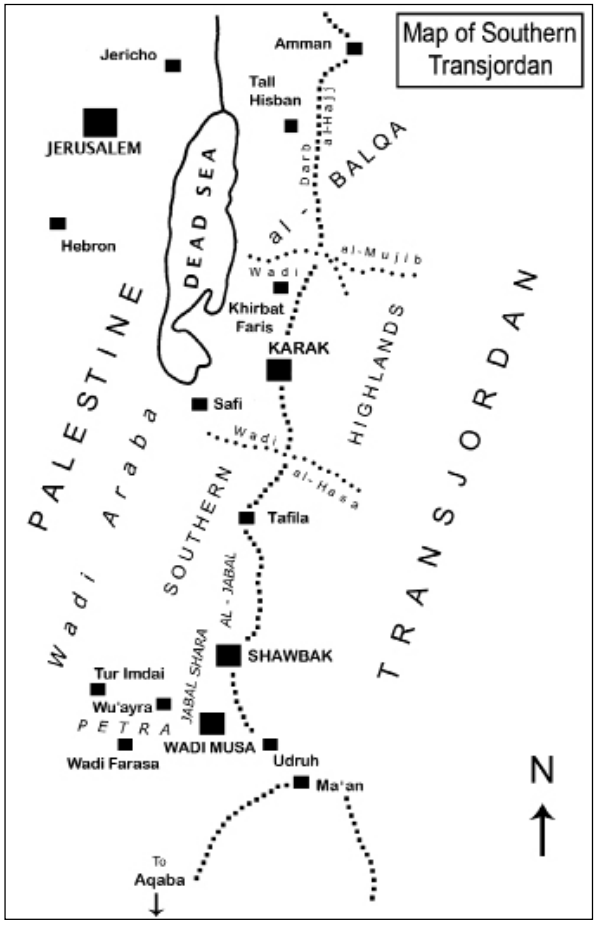
An investigation of fortified, medieval sites in the southern highlands of Jordan resulted in preliminary excavations at the fortress of al-Wu'ayra and the castles of ash-Shawbak and al-Karak, which were carried out in 1986 and 1987 (Brown 1987, 1988b, 1989a). Among the surviving Crusader facilities in Jordan, al-Wu'ayra is one of the most substantial and it provides an excellent resource for examining the Frankish presence in the Jabal ash-Sharāh mountains. Although the defensive architecture eventually suffered extensive damage, the site is relatively well-preserved because it was not heavily rebuilt during the post-Crusader centuries. This stands in contrast to the original twelfth century Frankish castles at ash-Shawbak and al-Karak where the implementation of major reconstructions, additions, and modifications continued from the thirteenth into the early twentieth century, and where recent restoration activities have been conducted . The significant stratigraphic and ceramic sequences that resulted from the 1987 excavations at al-Wu'ayra include the Phase I (A+B) and Phase II remains from Square 4 that are associated with Crusader (1115/16 to 1189) and Ayyubid (1189 to 1263) period occupations, as reported elsewhere (Brown 1987; 1988a; 1989b).

This paper describes the Phase I (A+B) faunal assemblage from al-Wu'ayra and the insights it offers with respect to food consumption practices among the occupants of the Frankish fortress (faunal elements from Phase II are excluded from the discussion as they were very few). The broader purpose of this study is to contribute to the recently growing corpus of environmental data from medieval or "Middle Islamic" sites in southern Jordan that were occupied during or through the twelfth to the sixteenth century. In this respect we hope to encourage further exploration and discussion of the roles of animals in the context of fortified and non-fortified settlements, and their relationship to land use practices and other aspects of the rural economy. Also in support of this effort are the recent publication of the faunal remains from the 1986 excavations at ash-Shawbak (Brown and Rielly 2010) and a forthcoming study of the animal bones from the 1987 excavations at al-Karak (Brown and Rielly in preparation). Additional comparative collections that are especially pertinent to the present study include the faunal material from the 1993 season of Italian excavations at al-Wu'ayra (Mazza and Corbino 2007a: 55 ff) and from the 2002 season of international investigations in the Wādī Farasa at Petra (Schmid and Studer 2003: 483-87, 2007: 51-55). Medieval faunal material was also gathered during the 1997-2000 Jordanian excavations at Khirbat an-Nawāfla, which was the principal settlement of the Wādī Mūsā valley during this period ('Amr *et al*. 2000: 244; 'Amr 2006: 25). The 2005 and 2006 Italian excavations at ash-Shawbak castle produced important faunal material as well (Mazza and Corbino 2005: 53-58, 2007b: 75-79, 2007a: 58-61). Together, these data provide a broad outline of species representation and diversity in the southern highlands during this period, while also shedding light on general patterns of animal usage.

Al-Wu'ayra in the Jabal ash-Sharāh: Environmental Summary

Al-Wu'ayra fortress is situated on a remote, rock plateau immediately northwest of Wādī Mūsā and along the outer rim of the Petra basin. The site takes its name from its surround-

ings, a rugged field of bare, sandstone knolls named al-Wu'ayra (derived from *wa'r*, meaning rock debris or rugged, inaccessible terrain), which lies north of the Bāb as-Sīq entrance to Petra and east of Jabal al-Khubtha. The substantial ruins of the Crusader fortress stand in the midst of this formation. The site's steep plateau is encircled by deep *wadi* channels that reinforced its defensive capacity. The Franks further enhanced the inaccessibility of the summit by hewing the east rock face to create a sheer, vertical wall. Al-Wu'ayra and the neighboring Wādī Mūsā valley and Petra basin (**Fig. 1**) are part of the Jabal ash-Sharāh range, where a semi-arid Mediterranean climate prevails and the mean annual rainfall range is 150-200 mm (Kürschner 1986: 49, map 1; Hashemite Kingdom of Jordan 1986: 14). While the immediate environment of al-Wu'ayra is a harsh, rocky landscape, the hillslopes to the north and northeast of the site once



1. Map of southern Jordan with selected archaeological sites occupied during the medieval and / or Ottoman periods

featured an evergreen oak forest that extended as far as the ash-Shawbak area. Today very little of this woodland remains and these slopes primarily support Mediterranean, non-forest, shrub growth or garigue (al-Eisawi 1985: 52-54; Kürschner 1986: 52-53), which is characteristic of degraded forest lands. During the medieval centuries, the forest areas in proximity to al-Wu'ayra would have provided a habitat for numerous plants and game animals, while the *wadi* channels below the fortress would have hosted seasonal foliage and offered narrow beds for *wadi*-bottom agriculture. Additional cultivated areas certainly existed along the *wadi*s winding into and through the Petra basin, while scattered tracts of dry-farmed grain would have been situated in pockets of shoulder and flat lands. However, the most extensive gardens and orchards were spread throughout the nearby Wādī Mūsā valley (see below).

The extent to which the region may have experienced climate changes sufficient to have significantly altered food production strategies between the twelfth century and the Modern era is undetermined, although broad climatic cycles have been proposed for southern Transjordan (Koucky 1987: 18-25). Faunal researchers at Tall Ḥisbān in al-Balqā' district observed an apparent increase in goats at the expense of sheep in deposits dating from the thirteenth through the fifteenth century (Strata 2-4; Driesch and Boessneck 1995: 72). This trend may indicate the onset of a hotter, dryer climate and a shift from pasturage to weeds during the Ayyubid and Mamluk periods (ibid.), for goats are better adapted than sheep to hot and dry environments, as well as to areas with poor forage (Redding 1984: 223; 1981: 78). With respect to the later centuries, dendrochronological analyses show frequent, episodic drought cycles from the seventeenth through the twentieth centuries (Touchan *et al*. 1999: 301, fig. 6). These findings appear to correlate with environmental data from Ṭūr Imḍayy, a site located five kilometers northwest of Petra, which indicate a period of relatively moist and cool climate from the mid-seventeenth through the early eighteenth century (Simms and Russell 1997: 464-66). The present, semi-arid vegetation that covers the southern highlands is the result of deforestation over a period of centuries, which was caused by

an expansion of cultivated land and overgrazing by sheep and goats. By the twentieth century this trend, coupled with soil erosion resulting from insufficient ground cover, had produced a degraded landscape that was detrimental for local agriculture (Willimott *et al*. 1964: 55-67).

The Crusader Presence in the Southern Highlands: Historical Summary

Following the establishment of the Latin Kingdom of Jerusalem in 1099, Baldwin I led Frankish military expeditions across the Jordan Valley rift and into Wādī Mūsā and Petra in 1100 and 1106/1107, on the latter occasion to eliminate the threat posed by the arrival of Seljukid troops from Damascus (Foucher of Chartres 1969: 146-47; Ibn al-Qalanisi 1932: 81-82). A major campaign followed in 1115/1116 to build the principal Frankish castle of Montréal on the site of ash-Shawbak and to establish a chain of smaller, fortified garrisons throughout the region that reached as far south as the Red Sea; while these sites are named, their present identifications are still a matter of discussion (e.g. Deschamps 1939: 36-39; Hammond 1970: 11; Milwright 2006: 9, fn. 43). This defensive network established the territorial basis of Oultrejourdain and protected Crusader Palestine by buffering its eastern frontier and controlling the Transjordan communication route that linked Syria with Egypt and Arabia. Oultrejourdain soon became an important source of revenue based on agricultural production and duties levied on trade caravans crossing southern Transjordan (see Mayer 1987: 201-202). In 1142, the largest of the Crusader castles in Oultrejourdain was constructed at al-Karak, which was known to the Franks as both Crac and Petra Deserti (William of Tyre 1976 [2]: 127, 499).

The Wādī Mūsā and Petra region was crucial to the Crusader strategy in southern Transjordan and substantial Frankish military installations were established at the prominent fortress known today as al-Wu'ayra and the smaller fort at al-Ḥabīs, within Petra (Vannini and Vanni Desideri 1995: 512-13; Vannini 2007: 15-21; see also Schmid 2006: 51-59). The former appears in Frankish documents as the castellum or castrum at Vallis Moysis / Moysi (li Vaux Moïse) and as *al-Wa'r* in Arab chronicles (see Pringle 1997: 105; Hammond 1970: 32). Construction at al-Wu'ayra was probably initiated during one of several Crusader campaigns into the area between the years 1108 and 1127, yet William of Tyre's first mention of the Frankish fortress at Wādī Mūsā appears later, in his chronicle of events having taken place in 1144 (1976 [2]: 144-45).[1]

Despite its cordon of fortifications, Frankish Transjordan was subjected to insurrection and penetration. In 1127, Baldwin II led a punitive expedition, destroying settlement in the Wādī Mūsā valley and scattering the population (Ibn al-Qalanisi 1932: 182). In 1144, infiltrating Syrian troops seized al-Wu'ayra for a brief period and massacred its Frankish inhabitants; possession of the fortress was restored when Frankish relief forces threatened to destroy the olive groves of Wādī Mūsā (William of Tyre 1976 [2]: 144-45). In 1158, the fortress successfully withstood an Egyptian siege (see Hammond 1970: 35). Finally, Ṣalāḥ ad-Dīn ibn Ayyūb's army brought Crusader occupation at al-Wu'ayra to an end in 1188 with the fall of Transjordan shortly after the catastrophic Frankish loss at the battle of ḤiṭṭĪn the year before (Hammond1970: 32). Post-Crusader remains at al-Wu'ayra indicate that Ayyubid forces moved to secure Petra following their victory (Brown 1987: 270 ff; Vannini and Tonghini 1997: 377, fig. 8; see also Milwright 2006: 10).

The Rural Economy of al-Wu'ayra and Wādī Mūsā

Al-Wu'ayra's strategic significance was grounded in its geographic position, natural defenses, extensive fortifications, and water system, yet the success of the fortress depended on adequate and sustained access to agricultural foodstuffs and livestock products. Although a small portion of the castle area may have been dedicated to cultivation and/or pasture where pockets of soil were available (see Vannini and Vanni Desideri 2005: 518), the majority of al-

1. Vannini and Tonghini suggest that al-Wu'ayra was constructed between 1107 and 1116 (1997: 376, fn 17), a view shared by Hammond (1970: 35; see also Deschamps 1939: 9; Kennedy 1994: 25). Others favor a later construction date, ca. 1127 or even later, as a consequence of Baldwin II's forceful raid on Wādī Mūsā (Mayer 1990: 99, 130; Tibble 1989: 82-83; see also Pringle 2001: 681).

Wu'ayra's food supplies would have come from the agricultural and pastoral environments of the Wādī Mūsā valley and neighboring areas such as the Petra basin and Bayḍā. As such, the fortress residents would have had access to fresh orchard and vine crops, dried fruits, olive oil, wine, legumes, grains, dairy products, and livestock, as well as woodland game animals found in the Jabal ash-Sharāh. Additionally, preserved fish was secured through overland trade (see below). However, the extent to which al-Wu'ayra's Frankish population availed itself of the variety of local products, remains a question.

Recent research led by Khairieh 'Amr has shed much light on the rich medieval economy of the Wādī Mūsā valley, which certainly provided revenues for the Frankish domain in addition to sustaining the fortress with foodstuffs. Archaeological investigations have shown that this fertile valley was continuously occupied from the tenth century (and earlier) through the end of the Ottoman period, while apparently reaching its greatest florescence between the twelfth and the fifteenth centuries ('Amr 2006: 18 ff). Among the agricultural villages that thrived in the Wādī Mūsā valley prior to, during, and after the Crusader period was the former Nabataean town of Gaia ('Amr 2006: 9, fig. 6, 18, 22-24). The valley's principal settlement, however, was at the site of present-day Khirbat an-Nawāfla, which appears as al-'Udmā in a thirteenth century text, but was apparently later known as al-'Udmal (Amr *et al*. 2000: 246; Zayadine 1985: 168-70).

The well-watered villages of Wādī Mūsā engaged in a robust agricultural economy specializing in the production of olives and olive oil, as documented by archaeological remains (see 'Amr 2006: 21-24) as well as historical texts. Foucher of Chartres, who accompanied the initial Frankish expedition to Transjordan in the year 1100, described the Wādī Mūsā basin as "... a valley very rich in the fruits of the earth", which he viewed as standing in stark contrast to the surrounding environment, for "... the land outside that valley was desert and uncultivated" (1969: 146-47). Referring to Baldwin III's foray into Wādī Mūsā in 1144, William of Tyre described the valley as "... covered with luxuriant olive groves which shaded the surface of the land like a dense forest" (1976 [2]: 145). In the post-Crusader era, the geographer Yaqut (d. 1225) also credited Wādī Mūsā for its abundance of olive trees (see Marmardji 1951: 204). A few centuries later, a 1596 edition of the Ottoman tax registers (daftar-il-Mufaṣṣal) indicates that the community at Wādī Mūsā (also known as Ribḥiyya) had a population of forty male heads of household and produced wheat, barley, and vine and fruit crops, in addition to maintaining livestock (Hütteroth and Abdulfattah 1977: 173). The absence of olive trees in this inventory is surprising and perhaps an oversight. Today the terraces of Khirbat an-Nawāfla support vegetable crops and orchards of olive, walnut, pomegranate, apricot, and mulberry (Amr *et al*. 2000: 233).

Status, Consumption, and Death at al-Wu'ayra: Archaeological Indicators

It has been suggested that al-Wu'ayra may have been a royal castle during the Crusader era (Tibble 1989: 82-83). This is an intriguing notion, but one that archaeology cannot confirm or refute at present. Nevertheless, there is evidence for rank and/or social differentiation among the fortress population, as would be expected in a military setting. Within the heavily defended upper citadel, large residences stand between the church and the stables; clearly, some occupants were authorized to use these facilities. One of the houses is exceptional for its reinforced strength and elaborate finishings, including archways and capitals (see Vannini and Vanni Desideri 2005: 521). This possibly multi-storied block probably housed the military commander, or perhaps an elite, entitled family. Another provocative aspect of the site is the cemetery located adjacent to the fortress chapel, in which twenty graves were excavated in 1997 (see Tonghini 2000: 587). The burials, which are unique in the archaeology of Crusader-era Jordan, indicate the presence of families at the site, for they included remains of fifteen infants and young children, apparently of European descent (Rose 2008; Rose *et al*. 1998). Reserved for a select few, the graves indicate distinctions of social rank as well as a priority on the internment of children next to the chapel. Most likely, the fortress residents who were entitled to raise families and bury their children within the chapel grounds over the course of the Frankish occupation were of commanding rank,

royal standing, or both. The primary cemetery for the community at al-Wu'ayra must have been located elsewhere.

Essential to this discussion is Jerome Rose's valuable osteological analysis of the burial assemblage, which concludes that both light-skinned European parentage and European dietary preferences among the child-bearing women of the fortress population contributed to problem pregnancies and the vulnerability of young children to scurvy and other life-endangering deficiencies (Rose 2008; Rose *et al*. 1998). Specifically, a failure to take advantage of some nutritious, local foods may have led to deficiencies in vitamin C, iron, and folic acid (Rose 2008; Rose etal. 1998). Thus the challenges to survival experienced by at least some of the population at al-Wu'ayra were specifically linked to European ancestry and food consumption habits. As described above, the Wādī Mūsā environment provided a rich array of foods. Ironically, the European women at al-Wu'ayra, whose apparently exceptional status enabled them to bury their children in the limited space next to the chapel, probably had ample access to whatever foods the region had to offer. Yet they appear to have chosen a limited diet that ultimately contributed to infant and child mortalities.

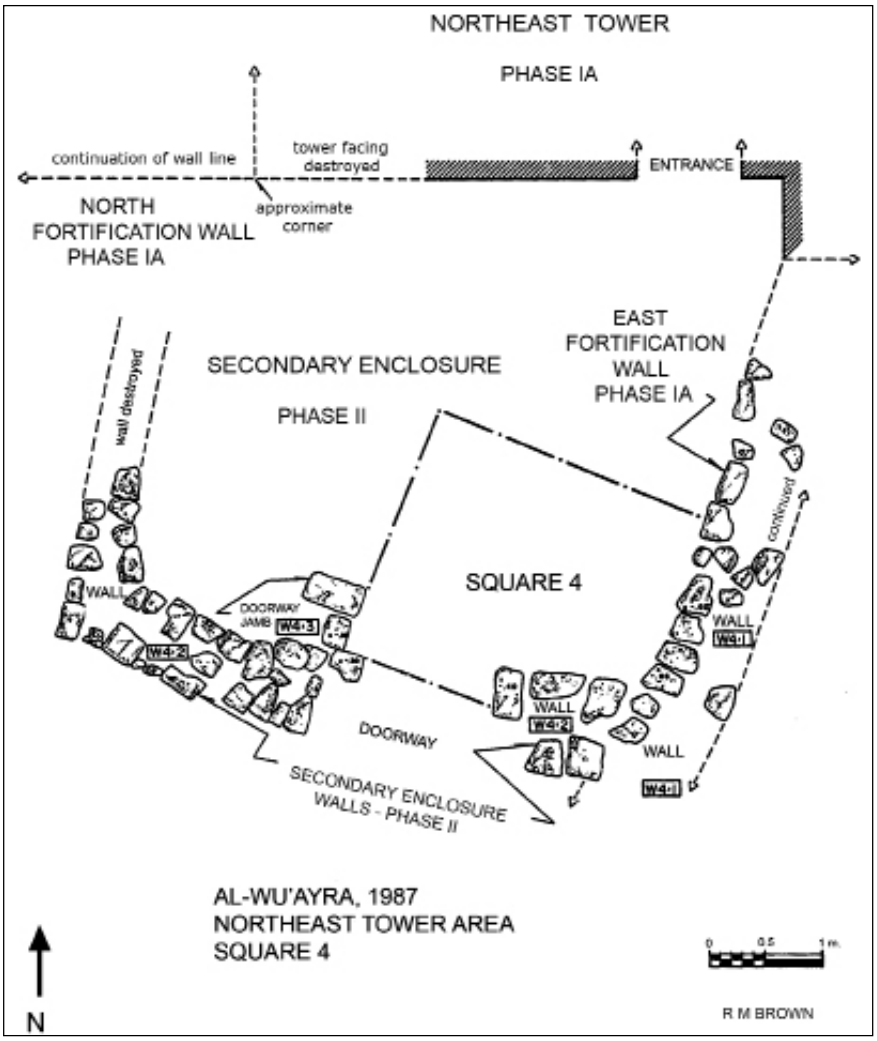
The History of Exploration at al-Wu'ayra

A few of the early travellers who visited al-Wu'ayra toward the close of the Ottoman era conducted brief field studies. At the turn of the twentieth century, Savignac published notes and a sketch plan of the outer fortification walls (1903: 116, fig. 1), and several years later Musil produced his observations, accompanied by a more detailed plan of the architectural remains (1907: 58-70, fig. 27). Langendorf and Zimmermann studied the chapel in 1962 and concluded that its striking similarity with the chapel at ash-Shawbak castle, which is dated to 1115/1116, indicated that al-Wu'ayra fortress was constructed at the same time (1964: 140 ff).[2] The initial excavations at al-Wu'ayra were directed by Robin M. Brown in 1987 with the assistance of architect Colin H. Brooker and Department of Antiquities representative Suleiman Farajat (Brown 1987, 1988a). The site was subsequently investigated by an Italian team from the University of Florence led by Guido Vannini; the results of these campaigns (1988-1998) are presented in several publications.[3] This work has been particularly important in defining the large scope of the fortress environment, which includes multiple rings of defensive works, an inner citadel standing on an elevated platform, and a village area to the southwest of the citadel. The chapel burying ground with its numerous child graves (see above) is also significant, as shown above. In 1998 an additional review of the fortress architecture was undertaken by German specialists Thomas Biller, Daniel Burger, and Hans-Heinrich Häffner (Biller *et al*. 1999: 39-45).

The 1987 Excavations: Stratigraphic Summary for Square 4

The initial archaeological campaign at al-Wu'ayra in 1987 consisted of several soundings within the fortress. The faunal assemblage reported here was gathered during the excavation of Square 4 (**Fig. 2**). Situated in front of the northeast tower, this excavation unit revealed two phases of Frankish occupation. Phase IA, which consisted of substantial, sequential debris accumulation overlying bedrock, dates to the construction and early occupation of the fortress during the first half of the twelfth century. The following Phase IB began with a distinct surface level, but like the preceding phase it consisted largely of debris accumulation. Phase IB most likely dates from the mid-twelfth century to the end of the Frankish occupation with the 1188 capitulation of the fortress to the forces of Ṣalāḥ ad-Dīn. The latest occupation in Square 4 belongs to Phase II, which was distinguished by the construction of a secondary enclosure (with an interior floor surface) in front of the entrance to the tower. This phase consists of a brief Ayyubid period habitation during the last decade of the twelfth century, which may have extended into the early thirteenth century. Phases IA, IB,

2. Additional references to early explorers at al-Wu'ayra are provided by Brünnow and Domaszewski (1904: 415-18) and Pringle (1997: 105-106).
3. Citations include Vannini and Vanni Desideri (1995), Vannini and Tonghini (1997), Ruschi and Vannini (2001), Tonghini and Vanni Desideri (2001), and Vannini (2007: 10-21).



2. Plan of square 4, from the 1987 excavations, with the northeast tower (constructed in phase IA) and secondary enclosure (constructed in phase II).

and II, documented in Square 4 in 1987, correlate with Phases I, II, and IIIa/IV identified during the later Italian campaigns at the site (see Vannini and Tonghini 1997: 376, fig. 8).

Material remains were relatively abundant in Phases IA and IB, but sparse in Phase II where there was also less debris accumulation. The ceramic assemblage from each phase was dominated by rudimentary, handmade pottery types that were produced by local craft-practitioners who probably worked at the castle or in Wādī Mūsā. Among the remains of these rudimentary ceramics was a group of twelfth century sherds painted in a distinctive linear-style displaying dots, lines, and wavy or crossed lines (Brown 1987: 277 ff). Similar pottery has been documented at other sites of this period, including Khirbat an-Nawāfla (Amr *et al*. 2000: 243-44) and ash-Shawbak (Brown 1988b: 232). In the later debris from Phase IB, fragments from handmade vessels painted with geometric designs (of a tradition widely documented in post-Crusader deposits throughout the region) were more frequent, and occurring with them were a few monochrome-glazed wares (Brown 1987: 279 ff; 1988a: 57 ff).

Introduction to the Faunal Analysis

The faunal data from al-Wu'ayra, shown in **Tables 1-5**, contribute to an emerging archaeological perspective on land use strategies and consumption trends in southern Transjordan during the twelfth century. However, faunal data are inevitably complex and challenging with respect to interpretation, particularly in the absence of a site-wide assemblage. On-site consumption practices are influenced by a range of factors such as consumer demographics, meat

Table 1: Species representation by total fragment counts (TF) per phase.

Species Representation by Phase					
Species	**IA**	**IB**	**IA+IB**		**II**
Identified Species (IS)	N	N	N	*% IS*	N
Sheep/Goat (undifferentiated)	93	21	114	24.8	
Sheep (*Ovis orientalis f. aries*)	29	5	34	7.4	1
Goat (*Capra algagrus f. hircus*)	16	3	19	4.1	
Gazelle (*Gazella* sp.)	3	1	4	0.9	
Pig (Suidae)	44	11	55	12.0	
Cattle (*Bos primigenius f. taurus*)	39	15	54	11.8	
Equid (Equidae)	2		2	0.4	
Chicken (*Gallus gallus f. domestica*)	33	7	40	8.7	
Chukar Partridge (*Alectoris chukar*)	6		6	1.3	
Egyptian Vulture (*Neophron percnopterus*)	2		2	0.4	1
Parrotfish (Scaridae)	105	17	122	26.6	
Longnosed Parrotfish (*Hipposcarus harrid*)	2		2	0.4	
Grouper (Serranidae)	2	2	4	0.9	
Wrasse (Labridae)	1		1	0.2	
Sub-totals per phase	377	82	459		2
Sub-total Identified Species for all phases: 461					
Unidentified Species (US)	N	N	N	*% US*	N
Sheep-sized	238	85	323	47.4	6
Cattle-sized	37	11	48	7.0	
Cattle/Sheep-sized (undifferentiated)	41	12	53	7.8	1
Bird	6	2	8	1.2	
Fish	231	18	249	36.6	1
Sub-totals per phase	553	128	681		8
Sub-total Unidentified Species for all phases: 689					
Grand Totals per phase	930	210	1140		10
Grand Total for all phases: 1150					
Notes: N = number of bones per species. Latin names from Driesch and Boessneck (1995: 68-69).					

preferences, and access to animal products through production, exchange, or direct control over resources. Once deposited, on-site faunal distributions are subject to sample bias as a result of disturbances, including taphonomic distortions. Furthermore, as the objectives of the 1987 excavations were limited, the assemblage was gathered by hand, and therefore smaller species and smaller elements of larger species are potentially underrepresented. While such factors need to be acknowledged, the assemblage provides valuable information, nevertheless.

Al-Wu'ayra was constructed principally to house a Frankish military garrison, and the majority of food-consumers within this population were probably single or unaccompanied males. Yet the ancillary village standing adjacent to the upper citadel would have accommodated craft-

Table 2: Large mammal representation by total fragment counts (TF) and epiphysis only / minimum number of elements (EO/MNE).

Large Mammal Representation						
Large Mammals	**Phase**					
	IA		**IB**		**IA+IB**	
TF Counts by Species	N	%	N	%	N	%
Sheep/Goat	138	61.1	29	51.8	167	59.2
Pig	44	19.5	11	19.6	55	19.5
Cattle	39	17.3	15	26.8	54	19.1
Equid	2	.8			2	0.7
Gazelle	3	1.3	1	1.8	4	1.4
Totals by Phase	226		56		282	
EO/MNE Counts by Species	N	%	N	%	N	%
Sheep/Goat	76	68.5	12	40.0	88	62.4
Pig	16	14.4	6	20.0	22	15.6
Cattle	15	13.5	11	36.7	26	18.4
Equid	2	1.8			2	1.4
Gazelle	2	1.8	1	3.3	3	2.1
Totals by Phase	111		30		141	
Notes: N = number of bones based on TF or EO/MNE counts.						

Table 3: Estimated proportions of cattle, sheep / goat, and pig meat yields (MY) for Phases IA + IB using epiphyses only / minimum number of elements (EO/MNE) counts.

Estimated Meat Yields for Cattle, Sheep/Goat and Pig		
Major Domesticates	**MY**	**%**
Cattle	16250	63.7
Sheep/Goat	7040	27.6
Pig	2200	8.7
Total MY	25490	
Notes: MY = meat yield (in kg) calculated by EO/MNE (from figures in Table 2) x the estimated carcass weight. Percentage MY (%) = total MYx 100. Estimated carcass weights: 80 kg for sheep/goat, 625 kg for cattle, 100 kg for pig (Grigson 1995).		

practitioners and other occupational specialists, including service providers, whose work was to aide in the functioning of the fortress. This relatively small population probably consisted of family-units from among the local Christian population. As noted above, it is possible that a royal family lived on the site at times as well (see Tibble 1989: 83). The presence of at least several, if not more, European wives is indicated by the Frankish child-burials next to the chapel (Rose 2008), which demonstrate that European-descended nuclear families were in residence, although perhaps not more than one or two at any given time. As such, the food-consuming population at al-Wu'ayra included both sexes, various age groups, and some family units (probably of both local and European Christians), in addition to a cadre of adult males who were probably unaccompanied, at least for the most part. Some individuals, and possibly families, were distinguished by military rank and social class, factors that may have also influenced patterns of food access and choice.

The organization of food preparation would have been a major, daily activity at al-Wu'ayra as the acquisition of meats and other foods was essential to meet immediate consumption needs and promote the ongoing work of preparing and maintaining ample storage supplies. It is likely that slaughtering and butchering facilities existed on-site, as well as multiple kitchen and dining areas serving the garrison, its leadership and associated families, and the small village

Table 4: Sheep / goat epiphyses fusion data for Phases IA + IB.

Sheep/Goat Epiphysis Fusion Data by Age Group															
Early Juvenile				Intermediate Sub-Adult				*Early and Intermediate Aggregated*				Late Adult			
F	%	UF	%	F	%	UF	%	F	%	UF	%	F	%	UF	%
21	95.5	1	4.5	3	50.0	3	50.0	24	85.7	4	14.3	12	50.0	12	50.0

Notes: Skeletal parts in the fusion groups are listed below (fusion ages are from Schmid 1972: 75).
Early epiphysis fusion group includes: scapula P, humerus D, radius P, and pelvis A (fusing at 3 to 6 months of age). Intermediate epiphysis fusion group includes: tibia D, metacarpus D, and metatarsus D (fusing at 16 to 24 months of age). Late epiphysis fusion group includes: humerus P, ulna P, radius D, femur P and D, and tibia P (fusing at 36 to 42 months of age). Abbreviations: P = proximal, D = distal, A = acetabulum, F = fused epiphyses; UF = unfused epiphyses; F %= proportion fused.

Table 5: Sheep / goat skeletal part representation for Phases IA + IB by total fragment counts (TF) and epiphysis only / minimum number of elements (EO/MNE).

Sheep/Goat Skeletal Part Representation		
TF Counts by Skeletal Group	**N**	**%**
Head (H) - skull, mandible (*EF: N=4, %=18.2*)	29	20.6
Upper limb (UL) - scapula, humerus, pelvis, & femur (*EF: N=8, %=36.4*)	70	49.6
Lower limb (LL) - radius, ulna, & tibia (*EF: N=6, %=27.2*)	36	25.5
Metapodials (MP) - metacarpus & metatarsus (*EF: N=4, %=18.2*)	6	4.3
Total	141	
EO/MNE Counts by Skeletal Group	**N**	**%**
Head (H) - skull, mandible (*EF: N=4, %=18.2*)	7	13.2
Upper limb (UL) - scapula, humerus, pelvis, & femur (*EF: N=8, %=36.4*)	26	49.1
Lower limb (LL) - radius, ulna, & tibia (*EF: N=6, %=27.2*)	16	30.2
Metapodials (MP) - metacarpus & metatarsus (*EF: N=4, %=18.2*)	4	7.5
Total	53	

Notes: N= number of bones per skeletal group. Figures for expected frequency (EF) of parts refer to the number of bones found in a skeleton limited here, as described under the general headings of Head, Upper Limb etc, to the major 22 parts (dividing the skull into left and right halves). For example, as there are 2 metacarpals and 2 metatarsals, the number of metapodials (MP) is 4, which is 18.2 percent of 22.

population. Waste dumping may have been restricted to certain areas, and dumping locations may have differed for butcher's waste, kitchen waste, and dining waste. On a site-wide basis, activities linked to animal processing practices and meal service would have influenced the distribution of faunal remains substantially. As Square 4 was located close to the entrance to the northeast tower, the faunal sample probably reflects casual remains left by Frankish soldiers who ate meals in and around this post, discarding some food waste and broken pottery vessels on the spot.

Analytical Methods

The relative abundance of species in this assemblage is measured by total fragment counts (TF), referring to the raw number of bones, and epiphyses only counts/minimum number of elements (EO/MNE) following Grant (1975, 1984). With respect to the principal domesticates of sheep/goat, cattle, and pig, their predicted relative meat contributions are based on species size. Thus the estimated proportional meat yields of these major contributors to the meat diet were calculated by multiplying the EO/MNE figures for sheep/goat, cattle, and pig by their estimated carcass weights. However, meat yields calculated by this method offer mere approximations of the contribution of each species to the meat diet, and should be treated as such. Evidence for exploitation strategies involving major animal and bird domesticates is based on patterns of epiphysis fusion and mandibular tooth eruption and toothwear (Grant 1975, 1982; Schmid 1972: 75; see also Payne 1973: 293). The epiphyses fusion method (using EO/MNE counts) categorizes epiphyses into groups according to the age at which they are expected to fuse. These data produce distributions showing the age of death for sheep/goat. Skeletal representation data derive from both TF counts and EO/MNE counts. Skeletal parts, including skull, maxilla, mandible, atlas, axis, and sacrum, are quantified by the MNE method, which tabulates non-repeatable characteristics and is the basis for determining the minimum number of individuals (MNI) represented.[4] The EO/MNE method reduces potential species and skeletal representation biases associated with TF counts, particularly with respect to the major mammalian domesticates, but the resulting figures tend to be small, which limits their reliability for comparative purposes.

Bone characteristics were recorded with respect to species, skeletal part, sex, age, size, and modifications due to burning, gnawing, butchery, working, and pathology. Bone measurements are based on Driesch (1976). Measurable bones are whole limb bones (bird and mammal domesticates) and those with an epiphysis fused in the Intermediate or Late stage and/or mandibles with an adult third molar in wear. Identification of very young animals is based on tooth wear patterns and the smallness and porosity of limb bones (following Amorosi 1989). Sexual distinctions are determined by certain teeth, such as pig canines, horn cores from sheep and goat, pelves from cattle and sheep, and spurs and medullary bones from chicken (after Grigson 1982: 8; Prummel and Frisch 1986: 576; Driver 1982).

Quantity, Distribution, and State of the Faunal Assemblage

The great majority of the 1,150 elements in the faunal assemblage from Square 4 was retrieved from deposits belonging to Phase I (IA+IB combined), as shown in **Table 1**. Phase II deposits provided only 10 fragments (with 2 identifiable to species) and these elements are excluded from further discussion in this paper. The Phase I (A+B) bones, which include 459 elements identifiable to species, are very well preserved, showing show no damage from scavengers. Relatively few gnawed bones are expected because this process typically results in total destruction or extreme fragmentation, yet a complete absence of gnawing may indicate

4. Counts for the maxilla and mandible are based on the representation of particular teeth, while vertebrae counts are based on the presence of articular surfaces. The skull is quantified by counts of key areas including the orbit, horn core, occipital and temporal condyles, occipital crest, and zygomatic arch. The final count for skull is taken from the best represented of these key areas, including the maxilla. The expected frequencies (EF) of the various skeletal parts are taken into account by multiplying the number of vertebrae (atlas and axis) by 2, and then dividing the first and second phlanges by 2 (by 4 in the case of pig) and pig indeterminate metapodials by 8.

relatively rapid burial of the faunal remains. The assemblage is in good condition, but displays a moderately high level of fragmentation with 75 (or 28.1 percent) of the 267 Phase I (A+B) sheep-sized limb bones with articular ends exhibiting fragmentation. This could indicate redeposition (the movement of bone waste dumps) or other post-depositional disturbances, including recovery breakages (butchered specimens and the effects of butchering on skeletal distributions are treated below).

Species Representation

The species representation data in **Tables 1 and 2** demonstrate the clear numerical dominance of the ovicaprids at al-Wu'ayra during the Phase I (A+B) Frankish occupation. Of the identified species and species groups listed in **Table 1**, sheep and goat are the most abundant according to TF counts (167 bone elements representing 36.4 percent of identified species elements), followed by parrotfish, pig, and cattle. Among the major domesticates, a similar pattern of abundance is shown by the EO/MNE data in **Table 2**, which indicate a greater representation of sheep/goat, and lesser representations of pig and cattle, when compared with the TF results. The relative contributions of each of these species to the meat diet of the fortress occupants are indicated by their respective meat yields based on weight. Standard adult meat yields for the major domesticates are: 625 kg for cattle; 80 kg for sheep and goat; and 100 kg for pig (see Grigson 1995: 248, fig. 4). These figures are derived from modern adult domesticates and while they do not account for variances based on age, sex, or breed, calculations using these standard yields offer approximate indications of the relative quantities of meat provided by these groups of food animals. The parrotfish are assumed to have weighed 3 kg on average (based on comparison to specimens of known size and weight), yet this figure refers to dead-weight, rather than meat yield, and therefore overestimates their contribution. It should be mentioned that the meat yield estimations for this sample (see below) are offered with the assumption that all of the animals and fish represented in the collection were ultimately used for their meat.

Estimated meat yields for this sample are calculated in two ways. According to MNI figures, meat yields and proportional representations for the most abundant species are: 3 cattle at 1,875 kg (70 percent); 6 sheep/goat at 480 kg (17.9 percent); 3 pig at 300 kg (11.2 percent); and 8 parrotfish at 24 kg (0.9 percent).[5] The second method provides a larger comparative base by applying EO/MNE percentages (listed in **Table 2**) to the calculations for the estimated meat yields among the major domesticates, with the results shown in **Table 3** (parrotfish are not relevant to the EO/MNE analysis). The results from both methods suggest a dominance of beef in the diet followed by mutton and then pork.[6] Cattle are represented solely by adult animals as demonstrated by 9 fused Early epiphyses, 1 fused Intermediate epiphysis, and 1 fused and 3 unfused Late epiphyses. This suggests that beef may have provided an even greater relative contribution, for the sheep/goat and pig assemblages include significant proportions of sub-adults with lesser meat yields than the adults (see below).

The estimated meat weights based on the MNI figures (cited above) indicate that parrotfish provided a minor supplement to a meat diet that was largely dependent on major domesticates. Most of the parrotfish remains could not be assigned to particular species, however, a few bones may belong to the long-nosed parrotfish. These bones indicate a standard body length (as measured from the tip of the snout to the base of the caudal fin) of 50-60 cm. While this length is consistent with long-nosed parrotfish, other species fall within this size range as well (Randall 1983: 9, 128). The assemblage also includes 1 possible wrasse and 1 grouper, the latter represented by 2 or more individuals (each at least 5 kg in weight and 70 cm in length). All of the parrotfish specimens that are archaeologically documented in the Levant originated in the Red Sea (see Neer *et al.* 2004: 105; see also Lepiksaar 1995: 192-93). Grouper and wrasse are native to both the Red Sea and the Mediterranean

5. The MNI figure for parrotfish is based on a minimum count of the dentaries and premaxillae.
6. Estimated meat yields based on the faunal assemblage from Phase I at ash-Shawbak show a similar distribution (Brown and Rielly 2010: table 6) and these remains also date to the twelfth century.

Sea (Randall 1983: 44 ff, 109 ff; Golani *et al*. 2006: 136 ff, 181 ff), but these specimens from al-Wu'ayra were likely to have been traded into the southern highlands from the Red Sea. The parrotfish and the grouper provide high quality meat; the former are available throughout the year, but most plentiful in quantity and species diversity during the summer months.

Among the other species in the assemblage, domesticated chicken is relatively well-attested. Game animals, however, are represented only by gazelle and chukar partridge. Considering the local terrain, the former was probably mountain gazelle (Gazella gazella; see Harrison and Bates 1991: 194). The chukar partridge prefers stony habitats and rocky slopes with thin vegetation, as well as high mountains and semi-desert areas where some agriculture is practiced (Hollom *et al*. 1988: 73). Non-food animals in the sample include equid, which is represented by 2 bones that appear too large for donkey, thus suggesting either horse or mule.[7] Another non-food animal is the Egyptian vulture, which presently migrates into the Jordan rift valley in spring and autumn (Andrews 1995: 62; Disi 1987: 52). As a scavenging bird, the vulture is commonly found close to habitation sites and has been observed from Tall Ḥisbān (Boessneck 1995: 134-35; Alomia 1978: 295).

Animal Production and Processing

At al-Wu'ayra, sheep/goat provided antemortem products such as milk, wool, and hair, in addition to meat. The relative importance of these secondary products is suggested by the sheep/goat age distributions in **Table 4**, which indicate that relatively few juvenile animals were slaughtered, and that some sheep/goat were culled as sub-adults during their second year (according to the presence of unfused Intermediate epiphyses). Similarly, the aggregated data for the Early and Intermediate fusion group show that the proportion of unfused epiphyses is only 14.3 percent. Adult survival through ages three to three and one-half years, or beyond, is shown in the Late fusion group where half the specimens (50 percent) are fused. This same overall age distribution is apparent among the smaller group of ovicaprid bone elements that are identified as specifically belonging to either sheep or goat (see **Table 1**). Research on age/kill-off profiles for sheep/goat has demonstrated that a greater proportion of adult animals (especially old adults) is consistent with a greater economic priority on secondary products (Payne 1973: 282-84).

The topography at al-Wu'ayra indicates that limited areas within the site may have been used for cultivation or pasturage (see Vannini and Vanni Desideri 1995: 512-13). This is a compelling observation as security concerns are likely to have encouraged the garrison to keep and breed at least some stock within the fortress. Hints of on-site stock are found within the faunal assemblage as well. Specifically, a small quantity of bones belonging to very young lambs or kids could represent infant mortalities. Similarly, chicken and pig are well-represented, and both of these species can be farmed in relatively confined spaces. One chicken bone from a very young bird may indicate an infant mortality. The remaining chicken are adult (of the 19 articular ends, 17 are fused), indicating a general priority on egg production. The fortress residents may have taken similar advantage of the chukar partridge, for this non-domesticated game bird is easily bred in captivity as a provider of meat. Age indicators for pig (18 epiphyses and 4 mandibles) show a concentration of juveniles (aged up to one year) and an absence of adults (aged one and one-half years to two years, or more). This high proportion of youngsters is typical of intensive pig farming, which could have been maintained with a small number of adult breeders. Pig at al-Wu'ayra was valued primarily for its meat, and piglets may have been produced in sties within the fortress or supplied by local livestock farmers, then slaughtered on-site.

Aside from the potential for small, on-site livestock reserves, most of the major domesticated animals (sheep, goat, and cattle) probably arrived at al-Wu'ayra on foot, where they were slaughtered and butchered. This is indicated by the wide range of skeletal parts retrieved for each of these species, a pattern that would not occur if the meat arrived as dressed carcasses

7. The 2 equid bones belong to one or two adults over three and one-half years of age. These meat-rich bones were recovered from an area with food waste, but neither shows butchery marks and it is unlikely that these animals were consumed.

or selected joints. Slaughtering methods are not evident from the remains, but butchery marks on a large proportion of bones, mainly belonging to sheep/goat, demonstrate how the carcasses were divided. One cattle phalange was cut near the proximal end (a result of skinning), while a small number of sheep/goat lower leg bones display dressing cuts through the carpal and tarsal joints in order to separate the meat-rich parts of the carcass. The sheep/goat butchery marks indicate a fairly consistent subdivision of the carcass along the vertebral column, showing that these carcasses were either split and then sectioned, or vice versa. A number of vertebrae were split down the middle and most were chopped again in the same plane, just to one side of the bone (to remove the transverse process). Butchery of the rest of the carcass was less consistent, showing: cuts through, or adjacent to, the articular surfaces of bones in the shoulder, elbow, pelvic, and knee joints; cuts through the midshaft of the same bones; and defleshing cuts, as indicated by knife marks. While there is no clear consistency regarding the production of limb joints, the number of specimens with jointing marks suggests that meat was generally cooked on the bone. The cattle and pig bones display jointing cuts within the meat-rich areas of the skeleton as well. Knife marks to a distal tibia of a chicken also resulted from dressing procedures. Butchery of fish can leave cut marks on the posterior head bones and the shoulder bones, particularly the cleithrum. The absence of butchery marks on the fish bones in this assemblage suggests expert filleting or cooking with the skeleton relatively intact.

Despite the presence of a wide range of sheep/goat skeletal parts, metapodials (foot bones) are poorly represented. This is demonstrated in **Table 5**, which compares the abundance of retrieved skeletal parts with their expected abundance based on a predicted death assemblage, as if the entire carcass had been deposited on-site. According to the EO/MNE data, metapodials represent only 7.5 percent of the assemblage, in contrast to the expected frequency (EF) of 18.2 percent. This suggests that the deposited bones consisted largely of kitchen waste (from the dressed or meat-rich part of the carcass). If sheep/goat arrived at the fortress on foot, butcher's waste (from initial carcass preparation) may have been discarded elsewhere on or near the site, perhaps in an area adjacent to the slaughtering facility and routinely used for dumping.

Discussion of Animal Resources and Representations at al-Wu'ayra

The establishment of Frankish military garrisons at various locations in the southern highlands certainly had a profound and complex socio-economic impact on the existing communities of the region. One broad question that emerges from this study is the extent to which the Crusader presence, and the dietary preferences of this population, may have influenced local economic practices in the Wādī Mūsā and Petra region. Hopefully, more environmental data will become available and provide inspiration for ongoing research on this topic. For now, a few preliminary comments may be offered on the basis of the faunal assemblage from al-Wu'ayra.

The data suggest that the twelfth century, Crusader-era residents of the fortress at al-Wu'ayra experienced a diversified meat diet. Sheep and goat are well-represented and were clearly an important aspect of the meat diet. This would be expected at any settlement in the region during this period, particularly as the ovicaprids are well-adapted to the southern highland environment. Furthermore, the sheep and goat economy may have prioritized ante-mortem commodities such as dairy products, wool, hair, and hides. The representation of cattle is also notable and this species may have contributed heavily to meat resources. Pig was clearly desirable among the population at al-Wu'ayra as well. To the extent that the Frankish settlement maintained a relatively high demand for beef and pork, local production of these animals may have increased.

The Wādī Mūsā valley was environmentally well-suited to the rearing of domestic cattle, and these draft animals would have facilitated local crop production by providing traction and manure, in addition to producing milk for dairy products (see Prawer 1980: 180). For purposes of comparison, it may be noted that cattle are well-represented at some sites in Crusader-era Palestine, such as Suba (27.3 percent in Phase B) and Tall Qaimun (37.2 percent in Stratum IIIa-b), relative to other major domesticates, as shown in **Table 6**. In these instances, the major-

ity of cattle at Suba and half the cattle at Tall Qaimun were slaughtered as sub-adults (Croft 2000: 177; Horwitz and Dahan 1996: 247), suggesting a Frankish preference for high quality beef in these communities.

Pig was clearly a factor in the diet at al-Wu'ayra, although it may have provided a relatively low meat contribution, as suggested by the estimated meat yields (see **Table 3**). The presence of pig demonstrates both an immediate supply of these animals and a specifically European preference for pork. It appears likely that at least some pigs were locally farmed outside of the fortress, probably by breeders from among the Christian population of Wādī Mūsā or another neighboring village. It is possible that some of the pig bones belong to wild boar, none are clearly identifiable as such. While domestic pig and wild boar are not suited to all southern Levantine habitats (see Toplyn 2006: 486-87), pig remains are documented at sites in a variety of environmental settings. **Table 6** shows the proportional representations of pig, relative to sheep/goat and cattle, as they occur in archaeological contexts ranging from the eleventh through the fifteenth century (according to total fragment counts). The highest proportions of pig shown in **Table 6** are from Crusader-era deposits at al-Burj al-Aḥmar (62.0 percent in Phases B+C), Suba (34.8 percent in Phase B), and al-Wu'ayra (19.9 percent in Phase IA+B).

The meat diet at al-Wu'ayra was supplemented by chicken, game, and fish. The relatively abundant chicken bones show a good representation of adults, which were undoubtedly valued for eggs and eventually meat. The scant representation of game species at al-Wu'ayra (see **Table 1**) is not unique. A pattern of poor representation of game species is also documented at Crusader sites in Frankish Palestine including Suba (Croft 2000: 186-87, table 4), al-Burj al-Aḥmar (Cartledge 1986: 177, table 12), and Tall Qaimun (Horwitz and Dahan 1996: 247, table XXII.1), and appears to stand in contrast to the fondness for hunting in western European culture at this time. However, the lack of remains of hunted animals in these assemblages could indicate a scarcity of game in the region due to a number of factors, such as over-exploitation, a heavy reliance on a steady supply of domesti-

Table 6: Comparative representation of sheep / goat, cattle, and pig at eleventh to fifteenth century sites in the southern Levant.

Comparative Representation of Sheep/Goat, Cattle and Pig										
Site Name	Stratum/Phase	Period	Date	Sheep/Goat		Cattle		Pig		Total
				N	%	N	%	N	%	N
Tall al-Husn (Pella)	Area XXIX	Abbasid-Fatimid	8th-11th c	711	84.5	125	14.9	5	0.6	841
Tall Qaimun	Stratum IVa-b	Fatimid	9th-11th c	264	46.2	295	51.6	13	2.2	572
Wadi al-Farasa (Petra)	Cistern	Crusader or Ayyubid	11th-13th c	317	99.7	1	0.3	0	0	318
Suba	Phase B	Crusader	12th c	252	37.8	182	27.3	232	34.8	666
al-Wu'ayra	Phase IA+B	Crusader	12th c	167	60.5	54	19.6	55	19.9	276
al-Burj al-Ahmar	Phase B+C	Crusader	12th-13th c	24	30.4	6	7.6	49	62.0	79
Tall Qaimun	Stratum IIIa-b	Crusader	12th-13th c	196	57.8	126	37.2	17	5.0	339
ash-Shawbak	Phase I [1986]	Ayyubid	12th-13th c	82	80.4	13	12.7	7	6.9	102
Tall Hisban	Stratum 4	Ayyubid	12th-13th c	71	88.8	9	11.2	0	0	80
ash-Shawbak	Area 6000c [2005]	Ayyubid-Mamluk	12th-14th c	248	75.8	61	18.7	18	5.5	327
Khirbat Sumaqa	Cistern 266	Crusader-Mamluk	12th-15th c	138	68.3	47	23.3	17	8.4	202
Tall Hisban	Strata 2-3	Mamluk	13th-15th c	6901	84.6	1117	13.7	139	1.7	8157
ash-Shawbak	Phase III [1986]	Mamluk	13th-15th c	99	98.0	2	2.0	0	0	101
al-Karak	Phase I	Mamluk	13th-15th c	146	89.0	18	11.0	0	0	164
Suba	Phase C	Ayyubid-Mamluk	13th-16th c	391	74.3	98	18.6	37	7.0	526

Notes: N = total fragment counts (TF). Calculations are based on reported data.
Citations: al-Burj al-Ahmar (Cartledge 1986: 177, table 13); Khirbat Sumaqa (Horwitz 1999: 378, table 1); al-Karak (Brown and Rielly in preparation); ash-Shawbak (for 1986 see Brown and Rielly 2010; for 2005 see Mazza and Corbino 2007b: 75, fig. 51); Suba (Croft 2000: 186, table 1); Tall Hisban (Driesch and Boessneck 1995: 72, table 5.9); Tall al-Husn (Rielly 1993: 220, table 2); Tall Qaimun (Horwitz and Dahan 1996: 247, table XXII.1); Wadi al-Farasa (Schmid and Studer 2003: 485, fig. 32); al-Wu'ayra (see above, Table 1).

cated food-animals, or a preference for processing and consuming of game animals at or near kill sites, as an alternative to transporting the carcasses.

Marine fish are well represented at al-Wu'ayra, accounting for 33.2 percent of the total faunal assemblage (calculated from **Table 1**), and at other sites in the southern highlands, as shown in **Table 7**. The identifiable specimens from al- Wu'ayra (**Table 1**) are almost exclusively parrotfish (Scaridae) that originated in the Red Sea coastal areas, and these were probably procured by traders at the entrepot of 'Aqaba. Preservation would have been necessary in order to transport fish over the distance between 'Aqaba and the Jabal ash-Sharāh highlands (see Neer *et al*. 2004: 102; Hamilton-Dyer 1994: 275). Skeletal evidence from this assemblage shows that fish, which were probably dried or salted, arrived at al-Wu'ayra as whole specimens. Similarly, the fish assemblage at Wādī Farasa in the Petra basin is also dominated by parrotfish that were imported as whole specimens (Schmid and Studer 2003: 485-87, 2007: 51-55). Red Sea parrotfish are documented at Khirbat an-Nawāfla in the Wādī Mūsā valley ('Amr *et al*. 2000: 244; 'Amr 2006: 25, fig. 32) and in Ayyubid and Mamluk contexts at ash-Shawbak (Brown and Rielly 2010: table 3; Mazza and Corbino 2005: 53 ff, 2007b: 75 ff). Fish are represented in the Mamluk phase at al-Karak, but unfortunately these few remains are not identifiable to species (Brown and Rielly in preparation). At Tall Ḥisbān the Mamluk era assemblage of marine fish includes specimens of four species (see **Table 7**), yet parrotfish dominate this corpus as well (see Driesch and Boessneck 1995: 98). Consistent with the findings from al-Wu'ayra and Wādī Farasa, parrotfish arrived at Tall Ḥisbān as whole specimens, which the investigators suggest had been dried or smoked (Driesch and Boessneck 1995: 102; Lepiksaar 1995: 195-96). While freshwater fish are documented at Tall Ḥisbān in the Mamluk period (Chichlidae, Clariidae, and Cyprinidae), marine specimens account for nearly all fish remains found in the southern highlands to date. The broad geographic distribution of saltwater

Table 7: Comparative representation of marine fish at medieval sites in the southern highlands of Jordan.

Comparative Representations of Marine Fish			
Site and Context	**Date**	**N**	**Number of Fish per Species**
Wadi al-Farasa [2002], Rubbish Pit (Schmid and Studer 2003: 485, fig. 32)	11th-13th c	359	249 parrotfish (Scaridae); 1 wrasse (Labridae); 141 unidentified
al-Wu'ayra [1987], Square 4, Phase IA+B (see above, Table 1)	12th c	378	124 parrotfish (Scaridae); 4 grouper (Serranidae); 1 wrasse (Labridae); 249 unidentified
al-Wu'ayra [1993], UT 83 (Mazza and Corbino 2007a: 57, fig. 52)	12th c	58	58 parrotfish (Scaridae); ? unidentified (undisclosed)
ash-Shawbak [1986], Palace Area, Phase I (Brown and Rielly 2010, table 3)	12th c	18	3 parrotfish (Scaridae); 15 unidentified
ash-Shawbak [2006], Area 1000 (Mazza and Corbino 2007a: 59, fig. 55)	12th c	4	3 parrotfish (Scaridae); 1 wrasse (Labridae); ? unidentified (undisclosed)
ash-Shawbak [2005], Area 6000c (Mazza and Corbino 2007b: 75, fig. 51)	12th-14th c	106	106 parrotfish (Scaridae); ? unidentified (undisclosed)
ash-Shawbak [1986], Palace Area, Phase III (Brown and Rielly 2010, table 3)	13th-14th c	13	5 parrotfish (Scaridae); 8 unidentified
Tall Hisban [1968-1978], Strata 2-3 (Driesch and Boessneck 1995: 98, table 5.22)	13th-15th c	146	4 grey mullet (Mugilidae); 84 parrotfish (Scaridae); 1 drum/croaker (Sciaenidae); 1 sea bream (Sparidae); ? unidentified (undisclosed)
al-Karak [1987], Palace Area, Phase I (Brown and Rielly in preparation)	14th-15th c	4	4 unidentified
Notes: N = total number of fish by total fragment counts (TF) based on reported data. Figures for al-Wu'ayra [1993] and ash-Shawbak [2006] are close approximations based on bar charts.			

fish not only illustrates their popularity throughout the region from the twelfth century through the fifteenth century, but also describes a trading network that channelled a flow of goods from the shores of the Red Sea up through the southern highlands, at least as far as the al-Balqā' region. This archaeologically demonstrated overland trade in food commodities is further confirmed by the thirteenth century geographer and historian Ibn Sa'īd al-Maghribī (d. 1274 or 1286), who described the ash-Shawbak and al-Karak communities as receiving dried fish in exchange for their agricultural products (cited in al-Bakhit 1992: 35).

The faunal assemblage from the medieval military outpost in Wādī Farasa provides a particularly interesting comparison with the assemblage from al-Wu'ayra. The Wādī Farasa excavations uncovered a cistern containing animal bones and fragments of ceramic vessels dating in the range of the eleventh to the thirteenth century (Schmid and Studer 2003: 483-87, 2007: 46-49). The faunal elements exhibit a nearly exclusive reliance on sheep/goat and fish. Dependence on an off-site slaughtering facility and an emphasis on storable, prepared meats are indicated by the fact that over three-quarters of the Wādī Farasa elements are meat-rich bones of sheep/goat or parrotfish (Schmid and Studer 2003: 487, 2007: 51-52). This stands in contrast to the sheep/goat data from al-Wu'ayra, which indicate on-site slaughtering facilities (see above) and further raise the possibility that al-Wu'ayra supplied the population at Wādī Farasa with prepared, storable joints of meat, if in fact these sites were occupied concurrently. The parrotfish at Wādī Farasa account for over one-third of the total fragment count for identified species, and virtually all of the identifiable fish bones belong to parrotfish (Schmid and Studer 2003: 484-86, fig. 32, 2007: 51-55; Schmid 2006: 58, 59, fig. 33). Although the al-Wu'ayra and Wādī Farasa assemblages are similar in their robust collections of fish remains, they are also sharply divergent in that the latter assemblage is notable for a near absence of cattle (represented by a single bone) and a complete absence of pig. The ceramics remains indicate that the Wādī Farasa site may have been occupied during the Crusader era, at the same time as al-Wu'ayra and al-Ḥabīs, and as part of the same defensive network. Furthermore, a Christian presence in the vicinity is indicated by dislocated, medieval gravestones with Christian funerary iconography that had been dumped in debris at the site (Schmid and Studer 2007: 49-50). Nevertheless, the absence of pig in the faunal assemblage is striking when compared with the assemblage from the nearby fortress at al-Wu'ayra. As such, it remains possible that the outpost in Wādī Farasa belonged to the succeeding Ayyubid forces that held control over Petra after 1188. In either event, the Wādī Farasa outpost may have defended another installation located at a higher elevation (see Schmid and Studer 2007: 51, 55). It has been suggested that a Crusader-built fort once stood above Wādī Farasa, on the summit of Jabal al-Madhbaḥ (Vannini and Vanni Desideri 2005: 512), but there is no evidence to support this notion. While the medieval defensive works and faunal assemblage from Wādī Farasa raise intriguing questions, they also provide a unique perspective on what may be another twelfth century occupation in the area of Petra and Wādī Mūsā.

Summary

The faunal data from al-Wu'ayra show that the food supply for the Frankish fortress depended on both local resources and trade networks. In addition to preparing daily meals on-site, fortress occupants had to prepare and warehouse storable food supplies in order to reduce their vulnerability during times of disruption or siege, when access to local markets would have been diminished or lost. The garrison's strategy for long-term and emergency supplies included stores of dried fish, preserved joints of meat, and probably a small number of animals domiciled on the premises, possibly chicken, chukar partridge, sheep/goat, or even pig. On-site slaughtering and butchering facilities would have provided the meats needed for immediate consumption, as well as storable joints, some of which may have been distributed to the garrison at al-Ḥabīs or other Crusader posts in the Petra region. Both the al-Wu'ayra and Wādī Farasa assemblages show a strong priority on storable foods, as would be expected at military installations and outposts. Yet the differences between the two assemblages, particularly with respect to the dearth of cattle and lack of pig at Wādī Farasa are noteworthy.

The food economy of the garrison at al-Wu'ayra would have been closely tied to the production regime in the Wādī Mūsā valley to ensure adequate meat supplies and access to grains, fruits, and olives, in addition to craft products, raw materials, and labor. Overall, the Frankish presence at al-Wu'ayra, and throughout the surrounding region, probably had a strong influence on systems of food production and distribution, as well as a significant impact on trade and marketing practices. These socio-economic aspects of the Crusader period deserve further investigation, and future studies of faunal collections from sites in the Jabal ash-Sharāh will undoubtedly contribute to a much fuller perspective on land use and food consumption patterns in southern Transjordan during the twelfth century.

A Note on the University of Florence Faunal Assemblage from al-Wu'ayra

An analysis of the faunal data from the 1993 season of excavations conducted by the University of Florence in the ancillary village at al-Wu'ayra has been prepared by faunal specialists Paul Mazza and Chiara Corbino (2007a: 55 ff). The assemblage excavated in Area UT 83, within the village settlement to the southwest of the upper citadel, includes 369 identifiable elements and is dominated by sheep/goat remains. Most of these animals were slaughtered as juveniles or subadults, indicating an emphasis on meat consumption. This finding differs from the sheep/goat age profile from the Square 4, Phase I (A+B) assemblage (see above), which was retrieved from the far opposite side of the site, next to the northeast tower. Given these differing contexts and the distance between the excavation units, the contrasts between the two samples are hardly surprising and contribute to a broader perspective on faunal distributions at the site. Also represented in the UT 83 assemblage (in order from largest to smallest total fragment counts) are parrotfish (Scaridae), small galliformes (probably a variety of partridge), and pig (domestic and/or wild boar). A few fragments of cattle and chicken are present as well. The authors note both the lack of species diversity in this assemblage, and the general absence of game, with the exception of the small galliformes and possibly some or all of the pig remains (Mazza, corbino: 2007a: 55-56). In general, the Square 4, Phase I (A+B) assemblage from al-Wu'ayra is quite similar to that of UT 83, but the former also includes gazelle, equid, Egyptian vulture, and marine fish identified as grouper and wrasse.

Acknowledgements

We thank the Council for British Research in the Levant at Amman and the Natural History Museum at Tring (UK) for the use of their animal bone reference collections. Additional thanks are extended to Dr. Sheila Hamilton-Dyer for identifications of the fish bones. The authors appreciate Dr. Paul Mazza and Dr. Chiara Corbino for their comments on an earlier draft of this paper and helpful communications. Thanks are also due to Ms. Micaela Sinibaldi for sharing reports with relevant data. The authors are similarly grateful to Dr. Jerome Rose for making available his important manuscripts. The 1987 excavation project at al-Wu'ayra was supported by the US Department of Education's Fulbright-Hayes Program, the Teagle Foundation, and the American Schools of Oriental Research, with additional support from the American Center of Oriental Research and its former-Director, Dr. David McCreery. Support from the Department of Antiquities of Jordan is gratefully acknowledged with special appreciation to former Director-General Dr. 'Adnan Hadidi, Dr. Khairieh 'Amr, Dr. Ghazi Bisheh, and Mr. Suleiman Farajat.

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