

Articles

'Ain Ghazal: A Major Neolithic Settlement in Central Jordan

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'Ain Ghazal, an archeological site located on the outskirts of Amman, Jordan, is one of the largest early villages known in the Near East. The site dates to the Neolithic period, during which mankind made one of its most significant advances, the adoption of domestic plants and animals as primary subsistence sources. Recent excavations at 'Ain Ghazal have augmented considerably current knowledge of several aspects of the Neolithic. Of particular interest has been the documentation of a continuous, or near continuous, occupation from early through late Neolithic components, and a concomitant dramatic economic shift. This shift was from a broad subsistence base relying on a variety of both wild and domestic plants and animals, to an economic strategy reflecting an apparent emphasis on pastoralism.

AIN GHAZAL ("SPRING OF THE GAZELLES"), A LARGE prehistoric village located near Amman, Jordan (Fig. 1), has yielded significant new information on the Neolithic period. The Neolithic has long been a key focus of archeological inquiry because it played a major role in subsequent cultural developments. In many instances this period provided the stimulus for a series of complex processes culminating in the great civilizations of the world. The Neolithic also is significant in that it represented one of mankind's most dramatic transformations: the shift from hunting and gathering economies to ones based on food production, or the domestication of plants, and, often, animals. Once key economic resources came under human control, the framework for further advancement was established.

Perhaps the most studied area of Neolithic research is the Near East, where scholars generally agree that the earliest experiments with domestication occurred approximately 10,000 to 12,000 years ago. In that region, domestic economies were in operation during what is commonly referred to as the aceramic, or pre-pottery, Neolithic; this phase was followed by the pottery Neolithic. By about 7000 B.C. a variety of plants that were to become Near Eastern staples were widely domesticated, as was at least one animal, the goat. Numerous sites have contributed to defining the Neolithic; some of the more notable are Jericho and Beidha in the Levant (1). Recent excavations at 'Ain Ghazal have added new refinement to our concept of the Neolithic, particularly of its later phases.

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'Ain Ghazal is located in the northern suburbs of Amman. Initially exposed during road construction in 1974, the site lay unstudied until archeological excavations were first conducted in 1982. Since then, four additional seasons have been completed (2). Although only a small portion of the site has been excavated, the results have been impressive, and require reevaluation of some basic assumptions regarding Neolithic life. Some of the more provocative findings relate to chronology, size and population, economy, ritual and artistic life, ecological adaptation, and the ultimate abandonment of the village.

Chronology

A series of radiocarbon determinations bracket a major occupation at 'Ain Ghazal within the Pre-Pottery Neolithic B (PPNB) period (Table 1), dating to between about 7200 to 6000 B.C. Thus far, no clear evidence has been unearthed suggesting an earlier occupation. During the 1984 excavation season a small portion of

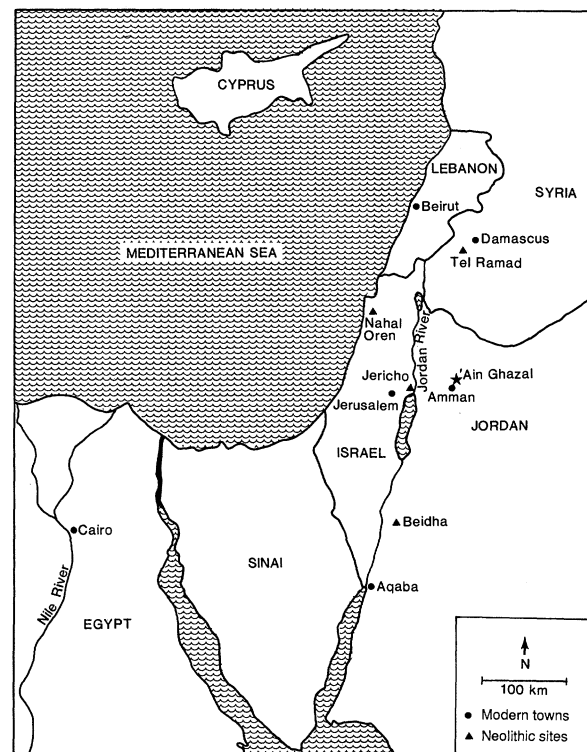


Fig. 1. Map of the Levantine Near East, showing the location of 'Ain Ghazal and other major Neolithic sites.

another component was revealed. This, too, is Neolithic, falling within the early Pottery Neolithic, to a phase locally known as the Yarmoukian. No radiocarbon dates are available for the Yarmoukian at 'Ain Ghazal, but elsewhere in the Levant it spans 5500 to 5000 B.C.

Aceramic and ceramic components are common at many major Neolithic sites in the Levant, but they invariably are separated by a hiatus of undetermined length. At 'Ain Ghazal, however, a transitional phase from aceramic to ceramic has been documented. This phase, provisionally termed the Pre-Pottery Neolithic C (PPNC), shares elements common to both the PPNB and the Yarmoukian components, but also is quite distinct in a variety of aspects (Tables 2, 3, and 4). As with the Yarmoukian component, only a small part of the PPNC has yet been investigated, but a similar phase has not been clearly defined at any other Neolithic site in the Levant. The implications of a transitional phase are important, since it suggests local cultural development and adaptation.

Size and Population

Survey, systematic testing, and examination of profiles exposed by the road construction indicate that 'Ain Ghazal spans some 30 acres. This is approximately three times the size of Pre-Pottery Neolithic Jericho, making 'Ain Ghazal one of the largest Neolithic sites documented in the Near East. As such, it probably was a major population center, although it is not yet clear if the entire site was occupied at once.

Table 1. Carbon-14 dates for 'Ain Ghazal in radiocarbon years. Abbreviations: PPNC and PPNB, Pre-Pottery Neolithic C and B.

Date (B.C.)	Laboratory	Phase	Comments
5870 ± 240	AA-1165	PPNC	Linear accelerator date
7000 ± 390	AA-1166	PPNC	Linear accelerator; far too early
6215 ± 50	GrN-12972	PPNB	Final PPNB level
6360 ± 230	GrN-14259	PPNB	
6510 ± 90	GrN-12971	PPNB	
6620 ± 180	AA-1167	PPNB	Linear accelerator; appears too early
6860 ± 80	GrN-12969	PPNB	
6670 ± 320	UCR-3273	PPNB	
6700 ± 200	GrN-12970	PPNB	
7150 ± 140	AA-1164	PPNB	Linear accelerator date
6860 ± 160	GrN-14258	PPNB	
6120 ± 230	UCR-1722	PPNB	Appears too late
7050 ± 90	GrN-12959	PPNB	
7080 ± 80	GrN-12960	PPNB	
6520 ± 650	UCR-1718	PPNB	
6980 ± 80	GrN-12967	PPNB	
7020 ± 110	GrN-12968	PPNB	
6730 ± 190	GrN-12962	PPNB	
6980 ± 60	GrN-12961	PPNB	
7020 ± 80	GrN-12964	PPNB	
6770 ± 80	GrN-14257	PPNB	
7020 ± 80	GrN-12963	PPNB	
7100 ± 80	GrN-12965	PPNB	
7250 ± 110	GrN-12966	PPNB	
6570 ± 110	Beta-19907	PPNB	Associated with a statue cache
7020 ± 150	Beta-19906	PPNB	
8310 ± 1300	Beta-20253	PPNB	Just above sterile clay; large variance
9925 ± 670	UCR-1723	PPNB	Unacceptable; far too early; very small sample
8900 ± 610	UCR-1724	PPNB	Unacceptable; far too early; very small sample
3180 ± 315	UCR-1725	PPNB	Unacceptable; far too recent; very small sample

To date, most architectural information comes from the earlier PPNB occupation. Architecture from this phase is impressive, with well-constructed multiroomed rectangular dwellings being characteristic (3). Most rooms were successively remodeled throughout the PPNB occupation, and at least five building sequences have been identified. Because entire buildings have not yet been excavated, we have limited information on community planning and spacing between structures. There is some evidence for the presence of large administrative or ceremonial structures as well. Although only a scant portion of the Yarmoukian deposits has been excavated, the available data suggest a radical departure from the earlier occupation. The Yarmoukian occupation also was large, but a decline in the standard of living is suggested. Structures were ephemeral, and the economy probably much more specialized.

It would be unwise to project population estimates for 'Ain Ghazal from available data, but hints of demographics are provided by the nearly 100 PPNB burials recovered. A wide age range is exhibited, and the inhabitants of 'Ain Ghazal do not appear to have suffered from many of the afflictions that were characteristic of many Neolithic economies, although arthritis and dental attrition appear common. Mortality among infants and young children also appears to have been high, but once adolescence was achieved, survival to at least early adulthood probably was likely (4).

Ritual and Art

Aspects of ritual and artistic behavior at 'Ain Ghazal are intertwined and are manifested in several ways. The most dramatic reflection of ritual behavior was the recovery of two groups of near life-size plaster statuary from the PPNB levels. Two caches of artfully molded human figures were recovered carefully buried beneath the floors of abandoned structures. These represent some of the earliest such art forms documented anywhere in the world, and the precision and detail of their crafting is unprecedented. Only at Jericho, some 50 km to the west, have similar statues been recovered, and these were in a much more deteriorated state. Because written records are lacking in the Neolithic, the meaning of these remarkable statues can only be guessed at, but they probably had ritual significance (5).

Additional ritual behavior at 'Ain Ghazal is evidenced by smaller clay figures (6). Numerous human and animal figurines have been recovered, including probable fertility objects similar to the "Venus" statuettes of much earlier European Paleolithic cultures. Among the animal forms, the most frequently represented group is cattle, although actual cattle remains in the faunal assemblage are relatively scarce. The significance of these artifacts is not clear. One cache located in a subfloor pit consisted of two cattle figurines with flint blades inserted into their cranial, thoracic, and heart areas. This may represent a symbolic gesture toward success in hunting. Alternatively, many of the cattle figurines are ornamented with what appear to be cords around their necks. This is suggestive of some degree of taming and lends credence to the possible cult status of cattle, a situation documented at other Neolithic sites (7).

Another striking element related to ritual behavior is treatment of the dead. By far the most common mode of interment was for a deceased individual to be placed in a flexed position beneath the floor of a structure. This burial pit was then plastered over, to be reopened at a later date. At that time, a particularly macabre mortuary practice was enacted: the skull was removed. The pit was then replastered. The fate of most of the skulls is unknown, although a few caches of skulls have been recovered. That this remarkable practice was widely endorsed is evidenced by similar treatment of human remains at other major PPNB sites (8).

Table 2. Frequencies of major chipped stone artifact classes from the Neolithic components of 'Ain Ghazal (1983–1985 sample). CTE, core-trimming element.

Class	PPNB		PPNC		Yarmoukian	
	Number	Percent	Number	Percent	Number	Percent
Tools	4,390	4.8	764	5.3	760	6.7
Bladelets	5,710	6.3	534	3.7	529	4.6
Blades	23,851	26.3	3,245	22.4	2,322	20.4
Flakes	22,864	25.2	6,036	41.7	3,783	33.2
CTE	1,762	1.9	75	0.5	66	0.6
Burin spalls	862	0.9	99	0.7	130	1.1
Other flakes	120	0.1	53	0.4	46	0.4
Cores	390	0.4	168	1.2	179	1.6
Microflakes	16,335	18.1	1,667	11.2	1,704	14.9
Debris	14,454	15.9	1,832	12.7	1,880	16.5
Totals	90,738	99.9	14,473	100.1	11,399	100.0

'Ain Ghazal has provided a rare opportunity to examine Neolithic ritual behavior. Several components of the material culture offer tantalizing clues to early ceremonial life at this village. Clarification of such behavior may be useful in assessing developments that ultimately led to the development of the classic Near Eastern civilizations.

Geomorphology, Environment, and Paleoecology

'Ain Ghazal is situated in a relatively rich environmental setting immediately adjacent to the Wadi Zarqa, the longest drainage system in highland Jordan. It is located at an elevation of about 720 m within the ecotone between the oak-park woodland to the west and the open steppe-desert to the east. Preliminary geomorphic examination of the region indicates that the Zarqa Valley contains a complex but orderly array of landforms and sediments.

'Ain Ghazal itself is covered by a thin (~15 to 30 cm) layer of both colluvium and eroded archeological materials. The former is derived from exposed limestone on adjacent slopes. The lowest cultural deposits directly overlie a layer of red clay at least 3 m thick. This clay resembles the terra rossas common throughout the eastern Mediterranean. The presence of relatively "fresh" limestone cobbles scattered throughout the clay indicates that it is "soil sediment" deposited on the slope on which the site was later located. The presence of the red, clayey colluvium between cultural deposits suggests that deposition of slopewash was occurring during the period of occupation. Absence of A soil horizons in the upper sections of early Holocene colluvial deposits may be attributed to rapid accumulation of slopewash, to erosion and subsequent removal of surface horizons, or both. Strata of red colluvium were sealed by plaster floors at the site, thereby insulating the clayey sediment from middle and late Holocene pedogenesis. Regardless of whether erosion or deposition was occurring at 'Ain Ghazal, it is apparent that the landscape was unstable during the early Holocene (9).

Evidence recovered from the excavations suggests that much of the surrounding countryside was forested and offered the inhabitants a wide variety of economic resources. Arable land is plentiful within the site's immediate environs. These variables are atypical of many major Neolithic sites in the Near East, several of which are located in marginal environments. Yet despite its apparent richness, the area of 'Ain Ghazal is climatically and environmentally sensitive because of its proximity throughout the Holocene to the fluctuating steppe-forest border. Additionally, the site is located on the 250-mm isohyet, which is considered the minimum amount of precipitation

required for nonirrigation farming (10). Precipitation increases rapidly toward the west, however; the 450-mm isohyet is only 15 km to the west.

Economy

One of the most significant results of research at 'Ain Ghazal has been the retrieval of abundant floral and faunal remains. Recovery techniques have allowed retrieval of even small materials. The faunal assemblage alone consists of approximately 500,000 bone fragments, of which some 50,000 have been identifiable (11). The abundant data have provided an excellent opportunity for the detailed examination of Neolithic economy. Most of the material recovered dates to the PPNB component, but tantalizing evidence from the PPNC and Yarmoukian layers may shed light on why 'Ain Ghazal was ultimately abandoned.

The diet of the occupants of PPNB 'Ain Ghazal was remarkably varied. Domesticated plants included wheat and barley species, but legumes (primarily lentils and peas) appear to have been preferred cultigens. A wide suite of wild plants also were consumed (12, 13). The determination of domesticated animals, *sensu stricto*, is a topic of much debate (14). At PPNB 'Ain Ghazal goats were a major species, and they were used in a domestic sense, although they may not have been morphologically domestic. Many of the phalanges recovered exhibit pathologies that are suggestive of tethering. An impressive range of wild animal species also were consumed at the site. Over 50 taxa have been identified, including gazelle, *Bos*, *Sus* sp., *Lepus*, and *Vulpes*.

A wide range of wild and domesticated plants is evident at many contemporary Neolithic sites (Table 5), but the predominance of legumes at 'Ain Ghazal is not typical (Table 6), although this may reflect a sampling problem. Where 'Ain Ghazal stands out most dramatically from other sites, however, is in the remarkably wide variety of wild animal species exploited during the PPNB. 'Ain Ghazal's subsistence base during the PPNB is in many ways more similar to the broad spectrum economy postulated for the preceding Natufian period (15), although it should be noted that recent re-examination of Natufian economy suggests more specialization than previously thought (16).

The somewhat unusual pattern at PPNB 'Ain Ghazal, with its emphasis on wild as well as domestic resources, could be more

Table 3. Frequencies of major tool classes between Neolithic components at 'Ain Ghazal (1983–1985 sample).

Class	PPNB		PPNC		Yarmoukian	
	Number	Percent	Number	Percent	Number	Percent
Spear points	160	3.6	7	0.9	11	1.4
Arrowheads	15	0.3	12	1.6	15	2.0
Sickle blades	283	6.4	2	0.3	7	0.9
Burins	1206	27.5	103	13.5	135	17.7
Truncations	126	2.9	30	3.9	33	4.3
Scrapers	161	3.7	27	3.5	35	4.6
Denticulates	174	4.0	25	3.3	25	3.3
Notches	321	7.3	63	8.2	56	7.4
Perforators; drills	256	5.8	30	3.9	42	5.5
Bifacial tools	166	3.8	29	3.8	38	5.0
Backed blades	39	0.9	0	0.0	12	1.6
Tanged blades	49	1.1	1	0.1	1	0.1
Retouched pieces	470	10.7	202	26.4	135	17.8
Utilized pieces	664	15.1	137	17.9	115	15.1
Other	95	2.2	18	2.3	27	3.6
Indeterminate	167	3.8	73	9.6	64	8.4
Totals	4390	100.0	764	99.9	760	99.9

apparent than real. The distinction may be an artifact of archeological data recovery techniques more than a reflection of actual Neolithic economic parameters. Many major Neolithic sites throughout the Levant were excavated before the widespread use of precise retrieval methods, thus possibly introducing a bias due to inadequate recovery procedures. This is not to obviate the importance of domesticated plants and animals to Neolithic diets. This, after all, is perhaps the most significant hallmark of the period. It does suggest, however, that even once sufficient cultural control had been exerted over domesticates to ensure predictable food supplies, reliance on hunting and gathering continued to be of major importance.

The limited economic data recovered from the PPNC and Yarmoukian levels reveal a distinct and dramatic shift. Sampling bias may have influenced the data, but the decline in the variety of animal species exploited is nonetheless impressive (Table 4). During the PPNC and Yarmoukian, sheep or goat (or both) are by far the predominant species. These also are now morphologically domesticated, as are pig, and, probably, cattle. Domestic and wild plants are rare, and an economy based largely on pastoralism is suggested by the Yarmoukian.

Table 4. Animal remains by Neolithic component (1984 sample representing the number of identified specimens) (11).

Taxon	PPNB		PPNC		Yarmoukian	
	Number	Percent	Number	Percent	Number	Percent
Reptiles	6	0.2	2	0.3	0	0.0
Turtles	53	1.8	5	0.6	1	0.4
Birds	55	1.8	0	0.0	0	0.0
Insectivores	12	0.4	0	0.0	1	0.4
<i>Lepus</i>	57	1.9	1	0.1	0	0.0
Rodents	10	0.3	3	0.4	0	0.0
Small carnivores	61	2.0	0	0.0	0	0.0
<i>Canid</i>	7	0.2	1	0.1	2	0.7
<i>Vulpes</i>	128	4.3	1	0.1	0	0.0
<i>Meles</i>	6	0.2	0	0.0	0	0.0
<i>Felid</i>	38	1.3	1	0.1	0	0.0
<i>Equus</i>	0	0.0	9	1.1	4	1.4
<i>Sus</i>	205	6.8	105	13.1	32	10.8
<i>Bos</i>	364	12.2	47	5.9	27	9.1
<i>Gazella</i>	401	13.4	79	9.8	19	6.4
<i>Ovis/Capra</i>	1591	53.1	549	68.4	209	70.6
Totals	2998	99.9	803	100.0	296	100.0

Discussion

The later phases of the Near Eastern Neolithic have not been as intensively studied as have the earlier ones, largely due to the research priority in origins of agriculture. At 'Ain Ghazal, a substantial and possibly unbroken succession from early to late Neolithic is present, and an intriguing pattern has emerged for the later occupation of the site. Perhaps as early as the PPNC, and certainly by the Yarmoukian, a dramatic adaptive shift occurred that ultimately led to the abandonment of 'Ain Ghazal. From heavy reliance on domesticated plants and animals, but supplemented by wild resources, the economy changed to a probable focus on pastoralism with an apparent decline in the standard of living. Interestingly, while the areal extent of 'Ain Ghazal may have expanded during the Yarmoukian, the impression is of a large but impoverished village that likely was occupied on a seasonal basis.

The best evidence for this radical economic shift is from faunal remains, and an ecological model to account for the apparent deterioration of 'Ain Ghazal during the late Neolithic recently has been proposed by Köhler-Rollefson (17).

The PPNB occupants of 'Ain Ghazal drew about half of their animal resources from herded goats and the remaining from hunting a wide variety of fauna. That this was a period of prosperity at 'Ain Ghazal also is reflected by the presence of a rich variety of domestic and wild floral resources, an unprecedented level of artistic achievement, sophisticated architecture, numerous animal and human figurines, and the remarkable statuary, as well as in highly evolved ritual behavior (18).

During the succeeding PPNC, a major decrease in the number of animal species exploited occurred. The proportions of caprines increased, and gazelle was the only animal hunted on any scale. A medium-sized equid (probably *Equus hemionus*) made its first appearance, but the large number of previously abundant species all but disappeared. The Yarmoukian assemblage is similar to that of the PPNC, and the number of species was reduced further, with goats being the predominant domesticate. Reliance on floral resources also seems to have declined radically.

This Late Neolithic deterioration does not occur only at 'Ain Ghazal. It has been observed at many Neolithic sites throughout the Levant, where once thriving PPNB villages were abandoned and often replaced by new, but less sophisticated, settlements. This has been widely interpreted as reflecting a shift to pastoralism. Many of

Table 5. Presence of plant taxa recovered from 'Ain Ghazal and compared to other Neolithic collections (12).

Taxon*	'Ain Ghazal	Jericho	Beidha	Abu Hureyra	Aceramic Hacilar
Wild two row, hulled barley			x	x	
Domestic two row, hulled barley	x	x			x
Domestic six row barley				x	x
Wild einkorn wheat				x	x
Domestic einkorn wheat		x		x	
Domestic emmer wheat	x	x	x	x	x
Field pea	x	x			
Lentil	x	x		x	x
Chick-pea	x	x		x	
Horsebean		x		x	
Vetch			x	x	
Fig	x	x			
Wild pistachio			x		
Wild flax	x				
Bedstraw, cleavers	x				
Gromwell	?			x	x
Mallow	x				x
Catchfly	x				

*All weedy taxa from comparative sites have not been included.

Table 6. Comparison of relative seed frequencies (%) at 'Ain Ghazal and two other Neolithic sites (13).

Seed	'Ain Ghazal (n = 1549)	Jericho (n = 7425)	Mureybit (n = 2235)
Cereals			
Wheat	17.2	83.2	70.2
Barley	12.8	2.1	15.3
Legumes	42.0	2.5	13.7
Perennials	15.4	0.3	0.6
Weeds	9.2	11.8	

these new sites continued to be occupied after the Neolithic.

What makes 'Ain Ghazal stand out sharply is the demonstrable shift during continuous, or near continuous, occupation at the same site. Elsewhere in the Levant a pattern of abandonment and settlement of new sites is more common. Even at PPNB sites with a subsequent Pottery Neolithic occupation, such as Jericho, a substantial temporal gap occurs. At 'Ain Ghazal, with the documentation of the PPNC phase, a shift from a broad-based economy with a reliance on agriculture to one largely based on the exploitation of a few species of domestic animals can be observed. In addition, 'Ain Ghazal was abandoned after the Neolithic, never to be reoccupied.

Köhler-Rollefson's model (17) offering a possible explanation for this narrowing of the subsistence base between the early and late Neolithic is framed in ecological terms. The model suggests that it is likely that at 'Ain Ghazal nonirrigation cultivation and animal husbandry initially were complementary economic strategies before a critical population size was reached and before the degradation of the immediate local environment. This pressure was exacerbated by 'Ain Ghazal's location at the 250-mm isohyet and the unpredictability of a limited rainfall distribution. For both plant and animal domestication to succeed in this situation in the long run, they had to become spatially segregated and independently managed operations. At 'Ain Ghazal, the amount of cultural control exerted over goats ultimately required that more and more land be made available in order to feed them, with the end result that herding and farming were no longer mutually compatible and viable subsistence modes. The only way to continue animal husbandry without endangering the crop harvest was to take the herds farther and farther away, returning to the village only for limited times of the year. This would have been the first step in a series of developments eventually leading to spatial and social separation between agricultural and pastoral populations.

In a sense, the early inhabitants of 'Ain Ghazal literally may have consumed themselves out of their once rich environment, forcing an economic dichotomy where a stronger and stronger reliance on pastoralism became more adaptive. At the same time, reliance on agriculture may have decreased due to the lack of arable land brought on by overexploitation. This had consequences for 'Ain Ghazal, and although it undoubtedly remained a regional center, its former prosperity was greatly diminished, leading to abandonment after the Neolithic. This conclusion was graphically borne out by a recent survey of the area: no major Neolithic or later habitation sites were located within an approximately 5-km radius of 'Ain Ghazal. This suggests that the environmental degradation caused by over

2000 years of use during the Neolithic may have rendered the region incapable of supporting major agriculturally based communities until the advent of modern technology.

It must be cautioned that the above scenario is based on only the small sample of 'Ain Ghazal that has been excavated. It may not be appropriate to expand this model to other Neolithic centers, but it does fit with the data so far recovered from 'Ain Ghazal and offers one explanation for the demise of the site. It also has more widespread implications for ways in which pastoralism may have developed.

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