

# Case Study 1: Nabta Ru'at el-Baqar

**Before reading this case study**, it is strongly recommended that you read Chapters 1 (introduction, which introduces the SRL approach and discusses how the ethnographic data is used in the case studies), 2 (detailed explanation of the modelling approach), 5 (ethnographic research that informed the case studies), the relevant bits of 6 (background information to the case studies, including excavation history and notes about chronology), and 7 (the SRL template) all of which are essential to an understanding of how the case studies were compiled and what they are designed to achieve. The case studies were never designed to be read as stand-alone pieces. Chapter 9 compares the case studies, and may be of interest to those who are interested in different approaches to livelihood management in dryland areas.

As explained within the thesis, my priority was to test the Sustainable Rural Livelihood model, which was derived from development economics. This means that the emphasis was on pushing the data to the absolute limit. This has resulted in speculative scenarios that match the data, many of which are by no means the only possible explanations and are open to challenge. I believe, however, that some speculation is a healthy move towards the creation of hypotheses that can be tested rather more empirically, and hope that the speculative relationship between the published data and my speculative extrapolations is made explicit.

## Table of Contents

Case Study 1: Nabta Ru'at el-Baqar .....	1
1.0 Introduction.....	4
2.0 The data available for each phase .....	6
3.0 The Livelihood Status.....	9
4.0 The Livelihood Variables.....	89
5.0 The Livelihood Outcomes .....	93
6.0 Answering the key questions .....	97
7.0 Gaps in the data .....	105
8.0 Conclusions – the value of the SRL model in this area .....	107

## Table of Figures

Figure 1 - Nabta in the context of the Western Desert .....	4
Figure 2 - Map of Nabta Playa. Modified from Wendorf and Schild 2001a, fig 1.2, p.5 .....	5
Figure 3 - A view of Nabta Playa (Source Schild and Wendorf 2015, p.354 figure 3).....	10
Figure 4 – The same pond near Thierola village, Mali, in the Sahel, during the wet and dry seasons. (Source: Drs. Adama Dao, Alpha S. Yaro and Tovi Lehmann, National Geographic. Source: <a href="https://bit.ly/2xi8Kvw">https://bit.ly/2xi8Kvw</a> ) .....	17
Figure 5 - Site E-92-7. Area A Hearths 9 and 10. (Source: Królik and Fiedorczuk 2001 p.343, fig 9.10) .....	19
Figure 6 - Site E-94-3, showing a small stone-filled hearth before excavation (Source: Mohamed 2001, p.456, figure 13.14 .....	22
Figure 7 - Raw materials from numbers of items of debitage at three sites at Nabta Playa in the Late Neolithic (totals compiled from Wendorf, Schild and Associates 2001, Tables 9.9, p.346; 10.5, p.364; 11.5, p.402). .....	23
Figure 8 - A selection of Ru'at el Baqar lithics from E-75-8 (Nelson 2001, p.396). a, c denticulates; b, notch; d, lunate; e, varia; f, endscraper; g, groundstone; h, retouched Aterian point; i, biface; j, crescent/lunate; k, backed piece; l, bifacial projectile point; m, retouched side-blow flake .....	25
Figure 9 - Site E-94-3 Retouched Tools. a, Endscraper on reused Levallois flake; b and f, perforators; c and d, points; e and h, denticulates; g, i and j pieces with continuous retouch (Source: Mohamed 2001, p.459, figure 13.15).....	26
Figure 10 - Criteria for assessing tool manufacturing strategy (based on Shea 2013, p.39-45) .....	28
Figure 11 - Lithics and worked bone from E-75-8 (Nelson 2001, p.399, figure 11.10). a, perforator; b, endscraper; c, lunate; d, truncation; e, retouched piece; f, denticulate; g, groundstone; h,i, worked bone). .....	29
Figure 12 - Site E-94-3, Groundstone artefacts: a, milling stone; b, handstone; c, notched stone (Source: Mohamed 2001, p.461, figure 13.16) .....	30
Figure 13 - Black-topped pottery (Nelson and Khalifa 2001, p.148, figure 4).....	32
Figure 14 - Site E-94-2. Red Ware bowl rims (Source: Nelson 2002, p.36, figure 3.19).....	33
Figure 15 - Plan views of tumuli E91-1N, the articulated cow burial and E-97-5, the human burial (Source: Applegate et al 2001, p.470, figure 15.1 and page 477, p.15.6).....	40
Figure 16 - Site E-92-9. Stone Circle (Source: Schild and Wendorf 2001a, p.37, figure 2.27) .....	41
Figure 17 - The E-92-9 stone circle (Source: Schild and Wendorf 2015, p.367, figure 24).....	42
Figure 18 - Alignment A, Megalith A-2. Tilted and collapsed, originally composed of four upright stelae (Schild and Wendorf 2015, p.357, figure 9). .....	44
Figure 19 - Site E-96-1 Complex Structure A showing : 1, the tablerock; 2, cemented sand with small rock slabs; 3, playa silt; 4, silt backfill inside pit; 5, sculptured stone; 6, laminated sand and silt; 7, surface stones (Wendorf and Królik 2001 p.509, figure 17.....	43
Figure 20 – Upper Nubian sites mentioned in the text (Source: Honegger and Williams 2015, p.1, figure 1, modified) .....	59

Figure 21 – a) <i>Panicum turgidum</i> (Microphotograph of seed impression on pottery, Magid 2001, p.608; photograph Mahmoud 2010, p.104) and b) <i>Setaria</i> sp (Microphotograph of seed impression Magid 2001, p.608; photograph Burke 2012, p.145). .....	84
Figure 22 - The Livelihood Variables part of the SRL Model, outlined in red .....	89
Figure 23 - The Livelihood Outcomes part of the SRL Model, outlined in red .....	93

## Table

Table 1 - Data types available for the Ru'at el-Baqar Late Neolithic .....	6
Table 2 - Ru'at el-Baqar Neolithic sites mentioned in the text (Wendorf, Schild and Associates 2001) .....	7
Table 3 - Ru'at el-Baqar Radiocarbon Dates. Wendorf, Schild <i>et al</i> 2001, p.53-4 .....	9
Table 4 - Natural Asset zones.....	9
Table 5 - Plant taxa present in the Ru'at el-Baqar Late Neolithic .....	14
Table 6 - Animal species present in the Ru'at el-Baqar (MNI).....	16
Table 7 - Aquatic species present in the Ru'at el Baqar .....	16
Table 8 - Evidence for domesticated animal species in the Ru'at el Baqar .....	65
Table 9 - Evidence for wild animal species in the Ru'at el-Baqar .....	66
Table 10 - Evidence for bird species in the Ru'at el-Baqar.....	66
Table 11 - Evidence for wild animal species in the Ru'at el-Baqar .....	67
Table 12 - Evidence for aquatic species in the Ru'at el-Baqar .....	67
Table 13 - Herders' daily routine (Schareika 2003, p.16, Table 1 .....	75
Table 14 - Edible plant species available in the Ru'at el-Baqar.....	83
Table 15 - Edible animal species available in the Ru'at el-Baqar .....	85
Table 16 - Qualitative ranking of variables.....	90
Table 17 - Overall vulnerability in the Ru'at el Baqar.....	91
Table 18 - Risk management strategies in the Ru'at el-Baqar .....	99

## 1.0 Introduction

The following section discusses the Late Neolithic of Nabta Playa, the Ru'at el-Baqar, within the framework of the Sustainable Rural Livelihood approach and is divided into the sections described in Chapter 6. An introduction to the case study is provided in Chapter 7. The Ru'at el-Baqar dates 7350 – 6600 cal BP or 5400 – 4650 cal BC. The site with the most complete stratigraphic record of the Nabta Playa archaeology, E-75-8, provides dates of 6550-5800bp (5200-4850 cal BC). The objectives of the case study are to draw out information about options, risk, sustainability and responses to all three in circumstances where a temporary water resource was available only on a seasonal basis. All aspects of the asset matrix contribute to sustainability for communities under conditions of vulnerability, whether overtly relating to economic activities or less transparently by social mechanisms that assist with marginal livelihoods and changes in those livelihoods. The location of Nabta Playa is shown in figure 1, together with other relevant sites. A map of the Nabta basin is shown in figure 2.



Figure 1 - Nabta in the context of the Western Desert

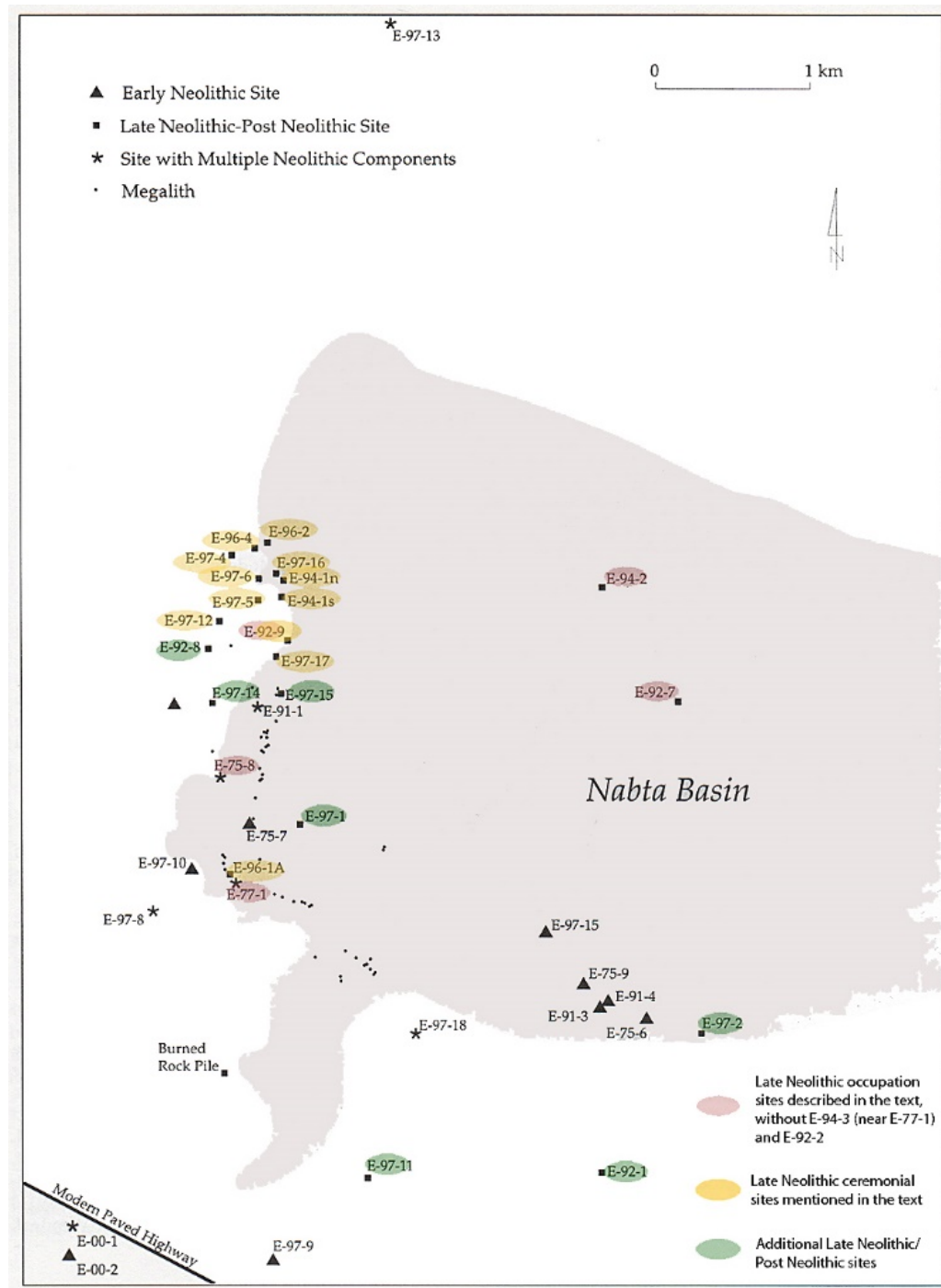


Figure 2 - Map of Nabta Playa. Modified from Wendorf and Schild 2001a, fig 1.2, p.5

## 2.0 The data available for each phase

The main forms of data are summarized in table 1 below. Variations in quality of that data will be discussed throughout the text, and a list of the main sites discussed is shown in table 2.

✕ Not present / ✓ Present

Category	Data	✕ / ✓
Site type	Settlement	✓
	Cemetery (concentration of multiple burials)	✕
	Ceremonial (monuments and ritual structures)	✓
	Unknown	-
Architecture	Domestic shelters / foundations	✕
	Hearths / Steinplätze	✓
	Storage	?
	Ceremonial structures	✓
Type	Stratified	Partial
	Palimpsest / Chronologically undetermined	✓
	Cave / rock shelter	✕
Funerary	Burial structures	✓
	Human physical remains	Few
	Grave goods	✕
Diet	Faunal remains	✓
	Botanical remains	✓
Environment	Faunal remains	Few
	Botanical remains	Few
	Sedimentary and geomorphological data	✓
	Other environmental / climatic indicators	✓
Tools/ Craft items	Stone tools	✓
	Grinding stones	✓
	Pottery	✓
	Ostrich eggshell	Few
	Basketry, cordage etc.	✕
	Animal products	✓
	Other artefact types	✓
Personal or symbolic material	Beads / other jewellery	✕
	Portable art	✕
	Palettes	✕
	Cultural components on everyday tools / pottery	✓
	Rock art	✕
	Prestige objects (potentially)	✕
Dating	Radiocarbon dates	✓
	Relative / stylistic	✓

Table 1 - Data types available for the Ru'at el-Baqar Late Neolithic

Site	Type of site	Key features
E-75-8	Stratified occupation	The largest of the Ru'at el-Baqar sites. Late Neolithic layer 7, 9 and 10 overlying earlier levels. Hearths, pits, hut, lithics, pottery, worked shell and bone, grinding implements
E-77-1	Occupation	Hearths, lithics, pottery
E-92-2	Occupation	Three separate groups of hearths. Associated with wells and ostrich eggshell
E-92-7	Occupation (extensive finds, 400 x 360m)	Late and Final Neolithic overlying Al Jerar Early Neolithic. NE part of Nabta. Surface finds of 100s of large hearths in different states of preservation, 18 of which examined (3 types), lithics, grinding implements, pottery, bone of domesticates (cattle, sheep/goat).
E-92-9	Stone circle	With surface debris and hearths, possibly associated with the circle.
E-94-1N ("Northern Tumulus")	Tumulus	Semi-articulated cattle burial in a pit beneath sandstone slabs forming tumulus with piece of wood overlying fill. Sheep/goat or Dorcas gazelle remains in tumulus fill.
E-94-1S	Tumulus	Sandstone slabs forming tumulus. Disarticulated cattle (up to x3) and sheep/goat remains (x1) and sheep (x1). Lithics (x3)
E-94-2	Occupation	Late and Final Neolithic. Hearths (3 groups), lithics, pottery, notched stones, grinding implements, sparse faunal remains on deflated surface
E-94-3	Occupation	Hearths, lithics, potsherds, grinding implements, notched stones
E-96-1	Complex Structure	Earliest in series of sandstone features constructed over pieces of tablerock. This is the only one dating to the Ru'at el-Baqar; the others date to the Final Neolithic
E-96-2	Tumulus	Undetermined function. Only 19 relatively small slabs and no animal or other remains or artefacts
E-96-4	Tumulus	Remains of disarticulated cattle (x4) and a possible canid. Two lithic tools.
E-97-4	Tumulus	Disarticulated cattle (x2) with tethering stones added to sandstone tumulus
E-97-5	Tumulus	Fragmentary tumulus over remains of single young male human, cranium and other bones absent
E-97-6	Tumulus	Sandstone slabs forming tumulus. Disarticulated cow
E-97-12	Tumulus	Southernmost. No faunal remains. Lithics (x2)
E-97-16	Tumulus	Sandstone slabs forming tumulus. Disarticulated cow (x1)
E-97-17	Burials	Three burials without artefacts, all poorly preserved on the same dune as E-92-9, the surrounding surface dominated by Ru'at el-Baqar material.
Alignment A	Stone row	Apparently the earliest of a series of stone rows, this one aligned towards Sirius.

Table 2 - Ru'at el-Baqar Neolithic sites mentioned in the text (Wendorf, Schild and Associates 2001)

## Case Study 1: Nabta Playa

Table 3 provides a list of the dates listed in Wendorf, Schild and Associates (Schild and Wendorf 2001c, p.53-54, Table 3.1) and calibrated using quickcal2007 ver1.5 (Cologne Radiocarbon Calibration and Paleoclimate Research Package - University of Cologne <http://www.calpal-online.de/index.html>).

Area	Site/Feature	Uncalibrated c-14 dates bp	Calibrated dates BC	Material	Lab. No.
Nabta Playa	E-75-8, Bed 2, A-B/18	6440±80	5408±66	Charcoal	SMU-487
Gebel Nabta Playa	E-94-3, Hearth 2	6550±60	5522±45	Charcoal	CAMS-16590
Gebel Nabta Playa	E-77-1, Hearth 2	6530±95	5484±89	Charcoal	DRI-2877
Nabta Playa	E-75-8, Bed 3a, Lowest Hearth	6500±80	5459±74	Charcoal	SMU-435
Nabta Playa	E-75-8, Hearth, 10-20cm bs	6430±75	5403±63	Charcoal	SMU-2504
Gebel Nabta Playa	E-77-1, Hearth 4	6350±60	5340±88	Charcoal	CAMS-16590
El Ghorab Playa	Gd-926, Hearth near burial	6330±100	5295±124	Charcoal	Gd-926
Nabta Playa	E-75-8, Hearth? Bed 4, A-B/15	6310±90	5271±116	Charcoal	SMU-441
Bir Murr	Tumulus? Hearth B	6310±70	5294±73	Charcoal	SMU-1120
Gebel Nabta Playa	E-77-1, Hearth 6	6290±60	5269±58	Charcoal	CAMS-17292
Gebel Nabta Playa	E-94-3, Hearth 6	6280±60	5238±77	Charcoal	CAMS-19294
Gebel Nabta Playa	E-77-1, Hearth 3	6260±60	5212±87	Charcoal	CAMS-17395
Gebel Nabta Playa	E-94-3, Hearth 3	6250±70	5199±97	Charcoal	DRI-2873
Nabta Playa	E-94-2, Area A, Hearth 5	6220±90	5172±112	Charcoal	DRI-2879
El Balaad Playa	E-79-5B, Hearth B	6180±70	5132±90	Charcoal	SMU-965
Nabta Playa	E-75-8, Feature 1	6155±105	5096±131	Charcoal	DRI-3547
Gebel Nabta Playa	E-94-3, Hearth 1	6120±95	5062±129	Charcoal	DRI-2880
Gebel Nabta Playa	E-77-1, Hearth 1	6120±70	5073±107	Charcoal	DRI-2872
Gebel Nabta Playa	E-94-3, Hearth 8	6070±60	4997±94	Charcoal	CAMS-19591
Nabta Playa	E-75-8, Bed 8, top	6030±195	4952±235	Charcoal	DRI-3552
Gebel Nabta Playa	E-94-3, Hearth 2	6020±60	4921±74	Charcoal	CAMS-16592
Nabta Playa	E-94-2, Hearth 9	6000±60	4898±75	Charcoal	CAMS-17287
Gebel Nabta Playa	E-94-3, Hearth 7	6000±50	4897±62	Charcoal	DRI-2879
Nabta Playa	E-94-2, Hearth 10	5980±60	4875±73	Charcoal	DRI-2884
Nabta Playa	E-94-3, Hearth 5	5970±90	4869±110	Charcoal	DRI-2876
Nabta Playa	E-94-2, Area A, Hearth 6	5970±50	4868±63	Charcoal	DRI-2883
Nabta Playa	E-92-7, Area A, Hearth 8	5940±110	4837±133	Charcoal	Gd-10114
Nabta Playa	E-94-2, Area A, Hearth 4	5910±50	4790±54	Charcoal	DRI-2881



Area	Site/Feature	Uncalibrated c-14 dates bp	Calibrated dates BC	Material	Lab. No.
Nabta Playa	E-94-2, Area C, Hearth 8	5860±70	4712±89	Charcoal	DRI-2871
Nabta Playa	E-94-2, Area A, Hearth 1	5840±60	5698±77	Charcoal	DRI-2869
Nabta Playa	E-94-2, Area B, Hearth 7	5830±60	4688±77	Charcoal	DRI-2882
Nabta Playa	E-75-8, Hearth	5810±80	4666±96	Charcoal	SMU-473
Nabta Playa	E-97-6, Tumulus, offering	5500±160	4326±185	Charcoal	DRI-3354
Nabta Playa	E-94-1, Burial Pit	6470±270	5363±272	Wood	CAMS-17289

Table 3 - Ru'at el-Baqar Radiocarbon Dates. Wendorf, Schild *et al* 2001, p.53-4

## 3.0 The Livelihood Status

### 3.1 Asset Matrix

#### *Natural Assets*

The following table (table 4) summarizes the main types of zone available for exploitation during the Late Neolithic Ru'at el-Baqar, with zones unavailable shown greyed out and crossed through, making it clear that this was not a resource that could have supported herders on a permanent or semi-permanent basis.

<b>Zone 1</b>	Sahel type / savannah conditions	In a largely featureless landscape, light seasonal rains produce a savannah and scrub type ecology similar to the modern day Sahel, with grassland and shrubs suitable for seasonal but not necessarily year-round herding
<b>Zone 2</b>	Highlands, low hills, high escarpments, Plateaus	Seasonal vegetation, attracting certain vegetation and game, sometimes offering different topologies and ecological niches
<b>Zone 3</b>	Riverine	Permanent water source with floodplains, attracting vegetation, game and containing aquatic resources
<b>Zone 4</b>	Lake / Playa / spring	With the potential for aquatic plants but not fish or other aquatic zoological species
<b>Zone 5</b>	Groundwater zone	Runs along the edge of water-filled basins and supports seasonal vegetation, attracting game on a temporary or permanent basis

Table 4 - Natural Asset zones

### Topography

At the time of the first excavations there were no topographical maps available for the Nabta area so most topographical information was derived from aerial photographs taken in the 1960s and GPS readings (Schild and Wendorf 2002, p.12).



Figure 3 - A view of Nabta Playa (Source Schild and Wendorf 2015, p.354 figure 3)

Nabta Playa sits between 22° and 23°N (latitude) and at 32°E (longitude). The central part of the basin measures 14km (east to west) by 10km (north to south) with wadis draining into the basin (Schild and Wendorf 2001b, p.11). A prominent hill called Gebel Nabta sits c.5km to the west of the playa, composed of Nubian sandstone capped with limestone, with a bigger hill of the same composition 32km southwest of Gebel Nabta (Wendorf and Schild 1980, p.82). The surface of Nabta Playa is characterized by sands that stretch in plains interrupted by scarps, low sand dunes, some of them forming strings, and higher fossil phytogenic sand dunes (figure 3) (Schild and Wendorf 2001b; p.11; Wendorf and Schild 1980, p.82). Nubian sandstone forms the bedrock of the Nabta area and appears on the surface in outcrops. Other outcrops of durable basement complex occur to the north and northeast, including pink granite (Wendorf and Schild 1980, p.82). Nubia Formation sandstone and shales form small rises in the east, south and west (Schild and Wendorf 2001b, p.11-2). Approximately 200km to the north, is an Eocene scarp and plateau, c.90m high, formed of sandstones, shales, limestones and marls. The average elevation of the Nabta area is 240m above sea level (Wendorf and Schild 1980, p.83). The landscape is marked by numerous basins and sand-infested wadis (Wendorf and Schild 1980, p.82, 84).

## Hydrology

The lakes in the basin at Nabta, known as playa lakes, are “dry lakes” as defined by Leity (2008, p.101), ephemeral rainfall lakes where groundwater is so far beneath the surface that neither water nor the minerals that it holds reach the surface. Following the end of the early Holocene climatic conditions in southern Egypt deteriorated, with a gradual drying of the environment (Nicoll 2004, p.569). The main source of water at Nabta Playa was rainfall that collected in basins and remained in place before evaporation reduced them and dried them out, but these playa lakes were not as extensive as they had been in previous early Holocene humid phases (Schild and Wendorf 2013, p.128). A wadi to the northwest of the basin, now known as the “Valley of the Sacrifices,” was the main low-energy drainage route by which water found its way into the main Nabta basin (Wendorf and Schild 2004, p.11, p.44-45). It is still active today on occasions (Schild and Wendorf 2001b, p.37). Unlike conditions during the climatic optimum in the early Holocene, there is “no evidence of extensive playa lakes” at Nabta during the mid-Holocene during which the Ru’at el-Baqar occupation took place (Schild and Wendorf 2013, p.128), and it is suggested that the volume of water in the basin and sub-basins at that time “was never large and its depth minimal” (Schild and Wendorf 2001b, p.45). Mohamed (2001, p.426) goes into more detail: “There is no evidence that the entire Nabta basin was seasonally flooded at this time . . . . Instead floodwaters from the rains were sufficient only to inundate the smaller basins located at the mouths of peripheral drainages.”

E-75-8 was probably located in the vicinity of a perched water table, which would have enabled wells to be sunk in the depression to access water as it diminished, and water was also held in the deep sandy substratum adjacent to impermeable layers, again meaning that wells could be employed to access water as it retreated (Kobusiewicz 2003, p.97; Schild and Wendorf 2001b, p.47). E-77-1 and E-94-3 were both on the site of a wadi that became blocked by sand dunes and into which water drained and became trapped, potentially forming deep seasonal lakes depending on rainfall (Wendorf and Schild 2001c, p.427). E-77-1 was quite high about the floor of the basin on a sand dune, but sedimentary evidence indicates that the site was covered with water during periods of high rainfall (Wendorf and Schild 2001b, p.454), as well as filling the blocked wadi below.

The smaller playa lakes dried more rapidly than in the early Holocene, and during the mid-Holocene tropical forms of vegetation retreated, to be replaced by Sahelian and desert species, and aeolian deposits were laid down, with only highland and oasis areas continuing to offer long-term predictable refuges for wildlife and people (Barakat 2001; Nicoll 2004, p.569). In the plains of the Western Desert there was little topographical variation to shelter open areas of water from evaporation, which could reach several metres per year in the Western Desert (Kröpelin 2005, p.51). In the immediate vicinity, a number of sub-basins also formed, and a series of other large basins were also used. Of these the most important was Bir Kiseiba, which was only a few days walk away and this too had playa resources that were used during drying periods due to its perched water table (Haynes and Haas 1980, p.715).

Beyond Nabta, in areas that were theoretically within the annual reach of Nabta, the Nubian aquifer, lying over the Basement Complex extends beneath the Western Desert, continued to provide perennial water to Dakhleh and Kharga c.200km to the north, but does not come to the surface at

Nabta itself. The highland areas of Gilf Kebir and Gebel Uweinat provided orographic rainfall to the west, whilst the Eastern Desert supplied orographic rainfall across the Nile to the east.

Finally, the Nile was only a few days walk from Nabta Playa, providing another water source for the occupants of Nabta as part of their general patterns of mobility. The same rainfall that filled the basins also watered the desert, which will have restored pastures and annual vegetation, whilst ensuring the survival of arid-adapted perennials including shrubs and trees. The hydrology of Nabta Playa can therefore be characterized as follows:

- 1) Playa resources in the immediate vicinity which were replenished annually by seasonal rainfall, providing highly seasonal and ephemeral resources, particularly where a perched water table was present, both in the main basin and surrounding deflated areas that drained into the main basin;
- 2) Groundwater resources were available via wells as evaporation depleted water levels seasonally;
- 3) Dune-blocked wadis providing seasonal water in temporary lakes;
- 4) In the nearby area other playa resources may have supplemented those at Nabta;
- 5) Other lake systems were available at a distance, dependent on a high degree of mobility;
- 6) Dakhleh and Kharga oases were 200km and several days walk to the north of Nabta;
- 7) The Nile Valley was a two-three day walk away;
- 8) More distant resources were also available if high levels of mobility were supported, including highly ephemeral basins that may have been found in patches throughout the Western Desert (Kuper and Riemer 2013) and highland areas.

It has already been seen how modern pastoralists are highly sensitive to localized conditions (Chapter 5) and how mobility is one of many strategies used to handle it. The hydrology of the Nabta area alone, without other considerations, would have required movement between different areas on a seasonal and perhaps more frequent basis.

### **Light and temperature**

Egypt has high light and temperature quotients throughout the year. The lowest mean annual temperature at Luxor is 13°C in January, the highest 32°C in July and August (Ibrahim and Ibrahim 2003) but a more realistic comparison is probably Dakhleh Oasis. The lowest mean annual temperature Dakhleh is 3.5°C in January, the highest 38.9°C in June (N.O.A.A *n.d.*). Night time temperatures are lower, but not to the point of being detrimental to livelihood options. Evaporation rates in the Western Desert are high (Kropelin 2005, p.51) The conditions of high heat and variable shade will have constrained forms of vegetation and fauna that can survive in the desert.

### **Aeolian conditions**

The prevailing winds in Egypt are north-eastern trade winds which, in winter are interrupted by west north-western winds from the Atlantic. In spring and early summer the hot dry dust storms called *khmaseen* are common (Ibrahim and Ibrahim 2003, p.52), and sweep across the plains of the southern Western Desert, visibly picking up, shifting and redepositing loose surface particles in dense,

fast-moving clouds. In the Western Desert aeolian activity has had considerable impact on desert and archaeological surfaces.

### Edaphic Conditions

Ibrahim and Ibrahim (2003, p.52-3) describe desert soils in Egypt as aridisols and sandy-rocky desert surfaces. They have low humus content with little biological activity and coarse to medium texture. Matters will have been better in the Holocene, where even sparse perennial vegetation will have helped to secure soil and build up a certain amount of topsoil. All drylands are characterized by low nutrient content of the soil, and particularly an absence of nitrogen, poor water retention and are at risk from soil depletion leading to the risk of poor germination (FAO 2004). The underlying sandy soils that seem to be inferior all ways to floodplain type conditions but they can produce earlier and fast-growing species, which is of benefit to herders (Schareika 2003, p.20). Animal dung will also have contributed to the quality of the soil in rangelands, and particularly where animals sheltered from the sun. Today, the lack of stabilizing root systems combined with an open topography and high winds mean that there is no topsoil remaining.

### Vegetation

During the mid-Holocene the Western Desert consisted of dry savanna, with Sahelian type conditions, consisting of “just a little grass after the rains in the summer, and temporary water in closed basins” (Schild and Wendorf 2004, p.11). Groundwater seepage zones will have produced salt-tolerant vegetation for the duration of the lake (Laity 2008, p.99). Table 5 shows the plant species recorded during excavations.

Plant Species				
Species	Sites	Sample size	Habitat	Reference
<i>Acacia ehrenbergiana</i>	E-75-8, E-94-2, E-92-7	286	The most drought and high temperature tolerant of trees in Egypt today. Tolerant of animal browsing.	Barakat 1996, p.64; Barakat 2001, p. 599, Table 22.7; Barakat 2001, p. 597, Table 22.4; Barakat 2001, p. 598, Table 22.5; Springuel 2006, p.68-70
<i>Acacia nilotica</i>	E-75-8	33	Prefers moist conditions, will grow beside pools in oases, tolerant of short droughts and some soil salinity.	Barakat 1996, p.64; Barakat 2001, p. 597, Table 22.4; Springuel 2006, p.74-5
<i>Acacia tortolis raddiana</i>	E-75-8	1	Desert adapted with a preference for non-saline wadis, oases and depressions.	Barakat 1996, p.64; Barakat 2001, p. 597, Table 22.4; Springuel 2006, p.81-82
<i>Capparis decidua</i>	E-94-2, E-92-7	1036	Drought resistant with preferences for silt alluvium.	Barakat 1996, p.64; Barakat 2001, p. 599, Table 22.7;

Plant Species				
Species	Sites	Sample size	Habitat	Reference
				Barakat 2001, p. 598, Table 22.5
<i>Chenopodiaceae</i>	E-94-2	1	Drought and highly saline tolerant.	Barakat 1996, p.64; Barakat 2001, p. 599, Table 22.7; Barakat 2001, p. 598, Table 22.5
<i>Maerua crassifolia</i>	E-92-7	3	Tolerant of high temperatures, drought and salinity.	Barakat 2001, p.598, Table 22.5; Springuel 2006, p.94-5
<i>Panicum turgidum</i>	Ceramic impression		Remarkably drought tolerant, and highly tolerant of grazing.	Magid 2001, p.608; Heneidy and Halmy 2009
<i>Salvadora persica</i>	E-94-2	37	Drought tolerant but not saline tolerant. Thorny scrub or grassland along river banks or on seasonal floodplains.	Barakat 2001, p.596; Barakat 2001, p. 599, Table 22.7; Springuel 2006, p.100-101
<i>Setaria</i>	Ceramic impression		Unspecified	Magid 2001, p.608
<i>Tamarix</i> sp.	E-94-2, E-92-7	1110	Tolerant of sandy and saline conditions.	Barakat 1996, p.64; Barakat 2001, p.599, Table 22.7; Barakat 2001, p.597, Table 22.4
<i>Ziziphus spina-cristi</i>	E-92-7	71	Not saline tolerant. Prefers alluvial deposits.	Barakat 2001, p.596; Barakat 2001, p. 598, Table 22.5; Springuel 2006, p.107-108

Table 5 - Plant taxa present in the Ru'at el-Baqar Late Neolithic

Due to the levels of deflation an exact profile of the vegetation present is not possible but there are clues. The species shown in Table 5 are typical of arid and semi-arid environments. Their root systems form phytogenic hillocks and they pioneer areas around water beds, wells, depressions, wadis and water tables up to 8m deep. They are saline tolerant (Barakat 2001, p.596). In the Ru'at el-Baqar contexts of E-75-8 *Acacia ehrenbergiana* (30 samples) *Acacia nilotica* (33 samples), *Acacia tortolis raddiana* (1 sample) and unspecified acacia species (106 samples) indicate that acacia was well represented. Acacia is very resilient in arid environments where it shares an environment with pastoralists, in spite of frequently intensive grazing, and seeds are propagated by browsing herbivores, meaning that it has a high recovery rate (Selemani *et al* 2013, p.146). There are also 72 samples of Tamarisk (Barakat 2001). These taxa indicate the availability of a certain amount of low level trees and shrubs whilst three taxa of sedges from E-75-8, suggest marshy environments along playa edges. Tamarisk pioneers around open water bodies, wells, depressions and wadis, but is saline tolerant (Barakat 1996, p.64; Barakat 2001; Wasylukowa *et al* 2001). At E-92-7 all the hearths

combined produced samples of *Tamarix*, *Capparis decidua*, *Acacia ehrenbergiana*, *Ziziphus spina cristii*, *Cassia* sp., and *Maerua crassifolia* (Barakat 2001, p.597). At E-94-2 charcoals from all hearths produced *Tamarix* sp., *Acacia ehrenbergiana*, *Capparis decidua*, *Salvadora persica* and *chenopodiaceae*, many of which indicate vegetation in depressions and along wadis, with a tendency towards contracting desert vegetation (Barakat 2001, p.598). Schild and Wendorf describe this as “contracted groundwater-bound desert vegetation accompanied by erratic and poor rainfall” (2001b, p.49). Barakat (2001) discusses a reduction of water-preferring taxa and the appearance of chenopods at E-92-7 and E-94-2, suggesting that they indicate the retreat of Sahelian elements in favour of desert conditions.

The presence of cattle, sheep and goat species are indicative that the local environment and more distant playa basins and more distant areas could be used together to support herds sustainably for the duration of the wet season and its immediate aftermath. Pastoralists need an extensive rangeland to provide the grazing necessary for herds (Wendorf and Schild 1998, p.109), and they would not have returned to Nabta if it could not have provided the necessary fodder and water requirements for herds.

## Fauna

All animal remains were of potential use for food as well as the fabrication of tools, leather, textiles, ropes, glue and ornamental items (Hurcombe 2014). An important by-product of animals is dung, which may be used as fuel (Hassan 1988). The species present are shown in tables 6 and 7 below in sample size order, and are the combined data from E-96-1, E-94-1, E-79-5 and E-75-8, as presented by Gautier 2001, table 23.1, p.610-611, p.612-629. It shows the type of environment to which the represented species were adapted, each contributing to a picture of arid and semi-arid conditions.

Faunal Species		
Data	Sample	Habitat
<i>Gazella dorcas</i> (Dorcas gazelle)	198	Dry-savannah but not hyper-arid adapted. Can manage without water for long periods, depending on plant moisture
<i>Zootecus insularis</i>	186	Arid and semi-arid adapted gastropod
<i>Lepus capensis</i> (hare)	176	Desert adapted
<i>Gazella dama</i> (Dama gazelle)	45	Desert adapted – can manage without water entirely, depending on food moisture
<i>Arvicanthis niloticus</i> (Field rat)	42	Human commensal
Small birds	29	Quails and migratory
Reptiles	22	Arid adapted
<i>Canis lupus</i> (dog)	14	Human commensal / domesticated
<i>Vulpes vulpes</i> (Jackal)	13	Savannah adapted



## Case Study 1: Nabta Playa

<i>Struthio camelus</i> (Ostrich)	8	Arid adapted, chicks need water but adults can survive for long periods on plant moisture
<i>Hystrix cristata</i> (Porcupine)	7	Preference for savannah to semi-desert
<i>Paraechinus aethiopicus</i> (Desert hedgehog)	3	The most desert adapted of the hedgehog species
<i>Ammotragus lervia</i> (Barbary sheep)	2	A preference for lower mountain and stony slopes
Small carnivores	1	Fenec fox is found in the Western Desert today

**Table 6 - Animal species present in the Ru'at el-Baqar (MNI)**

Freshwater gastropods are represented, but all are considered to be imports and are thought not to reflect local conditions at Nabta but are included here for the sake of completeness:

Evidence for aquatic species in Nabta Playa			
Data	No.	Context ID	Reference
Freshwater bivalves	4	E-75-8, S-trench (sub)surface	Gautier 2001, p.620, Table 23.1
	1	E-75-8, spits 1-4	Gautier 2001, p.620, Table 23.1
Small freshwater gastropods	15	E-75-8, C to F, surface	Gautier 2001, p.620, Table 23.1
	1	E-75-8, spits 1-4	Gautier 2001, p.620, Table 23.1

**Table 7 - Aquatic species present in the Ru'at el Baqar**

## Stone, minerals and ores

Although the Western Desert seems fairly barren of stone at first glance, Nabta lies on Nubian Formation Sandstone, which is plentiful in outcrops in the area. Additional sandstone and shale outcrops are found to the east, south and west (Schild and Wendorf 2001, p.11). Intrusions of igneous rocks from the basement complex can be found in the vicinity, notably granite (Schild and Wendorf 2001, p.11; Zedeño 2002, p.54). Although there is no geological database for Egypt to assist with provenancing material types (Aston *et al* 2000) observations on the ground indicate to the excavators that most of the stones used at Nabta were available locally, including chert, but that the nearest source of flint for stone tool manufacture was a limestone escarpment 70km to the north (Krölik and Fiedorczuk 2001, p.340; Mohamed 2001, p.422) or, further afield, from Kharga and Dakhleh some 200km to the northwest. Both jasper and agate were probably obtained from the Nile, although the authors do not specify where on the Nile (Krölik and Fiedorczuk 2001), so it is possible that it could also have come from the Eastern Desert, where both were also present (Aston *et al* 2000).



## Seasonality

Seasonality is usually considerable for all wild plant and animal species in dryland environments and its character is strongly influenced by rare but valuable rainfall events in the wadis and deserts and may be highly variable and unpredictable both temporally and geographically. At Nabta the dominant species found on occupation sites are gazelle and hare, with some ostrich, all of which could sustain life in the area on a year-round basis, meaning that they offer few insights into of seasonality; hare is highly adaptable to various conditions, ostrich can survive without water for many days except when young; Dorcas gazelle is a mixed feeder with minimal water requirements and Dama gazelle is a mixed feeder with no water requirements (FAO 1999 p.97-8; Pöllath 2007, p.91-2). Ostrich chicks, unlike adults, need regular access to water and it is probable that ostriches were using Nabta as a watering hole and were therefore more vulnerable to capture.

Seasonality therefore has to be assessed by reference to rainfall and the potential movements of humans with their herds. The extremes between wet and dry seasons mean that some areas were only available during the wet season (figure 4). At Nabta the sites were seasonal encampments. Each of them had a specific wet-season attraction, whether it was next to the main basin, on a deflated nearby basin or at the side of a blocked dune lake. There was no possibility of long-term occupation, and there is nothing to indicate that any occupation was of long duration. However, stone-covered hearths and the presence of site furniture (grinding equipment and tethering stones) argue for an intention to return and re-use the site as part of a routine of seasonal activity that included Nabta for short wet-season periods.



Figure 4 – The same pond near Thierola village, Mali, in the Sahel, during the wet and dry seasons. (Source: Drs. Adama Dao, Alpha S. Yaro and Tovi Lehmann, National Geographic. Source: <https://bit.ly/2xi8Kvw>)

## **Physical Assets**

### **Settlement location, character and size**

Nabta is a perfect example of a “persistent place,” a concept incorporates the idea that certain localities were used repeatedly over the long term, due to their particular characteristics, natural features that attract repeated occupation and the accumulation of material remains at those localities (Schlanger 1992, p.91). In the case of Nabta, the particular characteristics are the playa basin activated by rainfall, the suitability was the resource potential of pasture and game, and the repeated occupation dates from the beginning of the early Holocene. Hofman emphasises that repeated use of the same areas and sites reinforces knowledge about those areas and improves the chances of survival, so scheduled return visits are both practical and desirable (Hofman 1994), whilst Hunn and B. Smith both describe how this type of knowledge becomes embedded in traditions based on a background of memory and past experience (Hunn 1993, p.13; B. Smith 2011, p.263). Smith goes on to suggest that where such areas are perceived to offer predictability and abundance of high value resources, access will be tightly controlled (B. Smith 2011, p.263-4), with complex land tenure agreements in operation, which is supported by other research into land tenure and water rights (Binns 1992; McCann 1998; Dalal-Clayton *et al* 2003; Dasgupta and Heal 1979; Dika Godana 2016; Holland 1990; Quan 1998). Substantial ceremonial constructions indicate that as well as encampments there were other less tangible assets that may have contributed to the value of the Nabta area.

Unlike the early and middle Neolithic at Nabta, during which settlement structures were constructed, the Ru’at el-Baqar Late Neolithic has a far more ephemeral settlement arrangement. The most prominent and durable remnants of settlement in this period are deflated hearths, where only the lower portions were well preserved (Krölik and Fiedorczuk 2001; Schild and Wendorf 2001b, p.38). The hearths were apparently unenclosed and were used for only brief periods (Wendorf and Schild 2001c), but some of them were very substantial with carefully shaped profiles, and were often stone-lined. The hearths were accompanied by other deflated occupation remains, including surface scatters of lithics, ceramics, grinding equipment, occasional bone and occasional tethering stones (Krölik and Fiedorczuk 2001; Schild and Wendorf 2001b, p.37). Five examples are given below to represent the Ru’at el-Baqar Late Neolithic at Nabta: E-92-7, E75-8, E-94-2, E-77-1 and E-94-3.

**E-92-7** (figure 5) is an area of c.400x360m at the northeastern part of Nabta Playa, with Ru’at el-Baqar remains overlying features from the Al Jerar Early Neolithic. The hearths were in various different states of preservation but consisted of often substantial sub-circular constructions of stone slabs between 0.6-1.2m in diameter, none of them very deep. A total of 18 were examined of the 100s found in four areas at the site, some with almost straight sides, floors covered with small slabs and rich in charcoal flakes, and were divided by the excavators into three types of broadly similar features (Krölik and Fiedorczuk 2001).

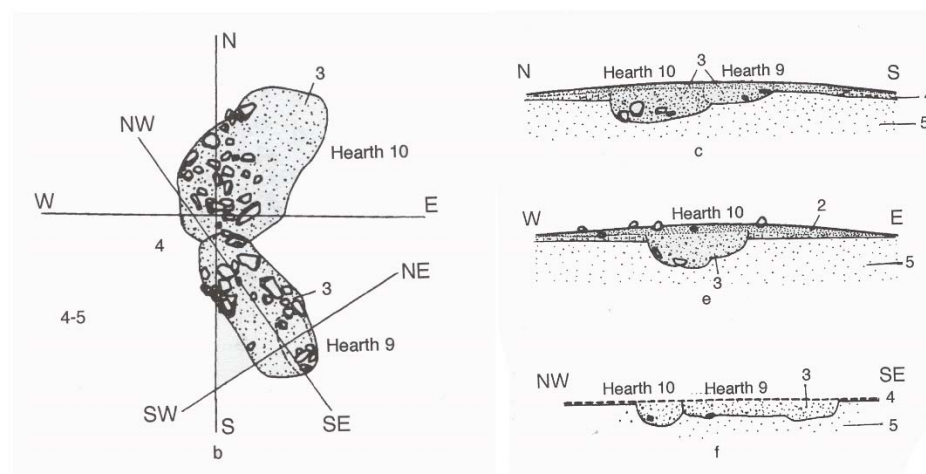


Figure 5 - Site E-92-7. Area A Hearths 9 and 10.  
(Source: Krölik and Fiedorczuk 2001 p.343, fig 9.10)

The hearths were associated with 1060 pieces of debitage, 57 cores, 72 retouched tools on quartz, quartzitic sandstone and flint (materials that made up 83.8% of the total debitage), as well as agate, chert and chalcedony. 60 cores consist of mainly single platform cores, which make up 48% of the core assemblage, most of which are made on quartz. They are followed in frequency by multiple (14%) and ninety-degree platform cores (12%), with opposed platform cores making up only 7.4%. 61% of all cores were made on quartz, 15% on flint, 13% on quartzitic sandstone, and 3.3% on agate. Of the 72 retouched tools, pieces with continuous retouch, notches and denticulates dominated, making up nearly half with only very small numbers of other tools (Krölik and Fiedorczuk 2001, p.338, 346). Grinding implements consisted of 7 fire-cracked fragments of sandstone quartzitic sandstone, sandstone and granite (Krölik and Fiedorczuk 2001, p.349). The pottery sherds found were well made, burnished and smudged. Only two ostrich eggshell beads were found. No botanical remains were recovered. The hearths and the surface scatter were interpreted by the excavators as seasonal camps that remained for short periods each year occupied by cattle and sheep/goat herders who were attracted by the temporary seasonal pools, with each hearth representing a single occupation event (Krölik and Fiedorczuk 2001, p.351).

**E-75-8** is a deeply stratified site containing a sequence of earlier deposits, and extends over an area of 500x300m, of which the *in situ* deposits cover an area of about 75x200/250m (Close 2001, p.352). The site was partially excavated in the mid-1970s and in the 1998 and 1999 seasons (Close 2001, p.352; Nelson 2001, p.386), with the latter excavation units connecting with the earlier ones. A large number of hearths were found, of which ten were excavated, together with a probable hut associated with two pits and a lithic cache. The hearths were basin-shaped and shallow (Nelson 2001 387-389). The largest was 147x120x7cm but most were smaller, not exceeding 70cm in length. They usually contained fire-cracked sandstone rocks, and some contained one or more artefacts, although others did not. The lithic cache contained five bifacially retouched pieces on Cretaceous

chert. A possible hut, Hut 1, was semi-subterranean, oval, measuring 275x260x30cm, and contained a number of retouched tools, cores, a hammerstone and handstone and there were five nearby postholes. It contained a clay- and rock-lined basin-shaped hearth with clay lining and several pieces of bone but no charcoal. Two basin-shaped pits were apparently associated with Hut 1 but nothing found within them gave any indication of function (Nelson 2001, p.387-391). Lithic assemblages found in excavations by Close (2001) and Nelson (2001) produced a recognizably Ru'at El-Baqar assemblage, with flint making up 50.3% of the raw materials in the debitage, quartz making up 32.6% and chert 8.6%. These frequencies are fairly consistent with the retouched tool materials with flint at 68%, and quartz at 21.8%.

**E-94-2** is also on the northeast side of the Nabta basin, bounded by the remains of a phytogenic dune on the edge of a sub-basin where rain and flash floods deposited playa sediments and where grass and perennials would have germinated (Mohamed 2001, p.412). Excavations were carried out in the hope of finding data about environmental setting and diet within hearth deposits but failed to produce useful data (Mohamed 2001, p.413). Eight radiocarbon dates indicate that it was occupied over a 900 year period, with multiple visits over that period, most concentrated within a 100 year period at around 5900bp (4787 cal BC). The site consists of three separate dense concentrations of hearths, some rather deflated, others well preserved, each consisting of between 18-23 hearths, the groups separated by 100-120m (Mohamed 2001, p.412). There were also additional hearths away from the main groupings. Most were elongated ovals, between 12 and 23cm deep, most with straight walls and some were deeper at one end than another, sloping upwards to the south or southeast. Hearths contained various small sandstone slabs, either as lining or along the bottom, probably used as a barrier between the fire and the soil, and to improve ventilation (Mohamed 2001, p.416). Some contained a small number of artefacts. They were covered with stones and rocks when finished with, apparently to protect them for when they were needed another time. Three wells are associated with the site, 2-3m in diameter and 2m or more deep. Surface finds included 853 pieces of debitage, 31 cores and 39 retouched tools. The usual range of raw materials was used, with quartz, flint and quartzitic sandstone dominating, except in the debitage where Egyptian flint and quartzitic sandstone are followed in volume by chert. Agate, petrified wood, chalcedony, basalt and granite were also employed (Mohamed 2001, p.417, Table 12.1; p.418, Table 12.6; p.419, Table 12.11). Again, single platform cores dominate, followed by initially struck and patterned multiple cores, none of which were subjected to much preparation, if any. Retouched tools are dominated by denticulated flakes, pieces with continuous retouch and notched flakes, and are crafted mainly on flint, rarely on quartz, and some were made on reused Levallois flakes (Mohamed 2001, p.422). Others in very low numbers are notched or denticulated blades, geometric microliths, and a small number of other types found in single numbers. Particularly skilled bifacial pieces included by Mohamed (2001, p.424, Figure 12.8) are an ouanan point, a bifacial barbed and tanged arrowhead, bifacial foliate points and other examples, but as these are exclusively surface items it is entirely possible that they belong to the Bunat el-Ansam Final Neolithic. There is no separate area in which manufacturing activities have been identified, and it seems as though suitable materials were brought to the site to be worked, although not in the vicinity of the hearths themselves, which were apparently

used as living spaces (Mohamed 2001, p.422). There were no house-like structures associated at the site, no storage pits, and there was no observable significance to the clustering (Mohamed 2001, p.426). Taking all the data together with the low volume of artefacts, occupations were probably brief, with two or three hearths at a time representing single occupation events (Mohamed 2001, p.426).

**E-77-1** is located on a phytogenic dune on the western edge of Nabta Playa where a large deflational basin drains into the main basin via a wadi that was blocked by the formation of a dune around existing vegetation. The blockage of the wadi formed a lake following rainfall (Wendorf and Schild 2001b, p.427). The site's location would have sheltered the site from northerly winds. It was excavated in 1977, 1990 and 1994. It consists mainly of stone-filled hearths surrounded by grinding stones, flaked stone, pottery sherds, and fragments of bone. Although it lies over Al Jerar Early Neolithic deposits, all the hearths were dated to the Ru'at el-Baqar. They are very much as described above at other sites, with circular and oval outlines, lined with fire-cracked sandstone slabs and filled with ash, charcoal and burned sand. Debitage includes flakes and blades, flakes from single platform cores and flakes from multiple platform cores and are "almost casual in character" (Wendorf and Schild 2001, p.438). Cores appear to have been made on quartz, but the cores of Early and Late Neolithic are treated together as a single unit (Wendorf and Schild 2001b, p.438-439). Radiocarbon dates indicate a long period of repeat use (Wendorf and Schild 2001b, p.433).

**E-94-3** (figure 6) is at the eastern edge of the lowest part of the sub-basin near which E-77-1 is located on the west of Nabta Playa, and sits on deflated playa sediments (Wendorf and Schild 2001b, p.427). It consists of deflated scatters of cultural debris over an area of c.150x50m, comprised of fire-cracked rocks, lithics, pottery sherds and hearths, of which ten intact examples were excavated. The surface scatter was not collected systematically, but a "grab sample" was picked up including some lithics and potsherds, including some very fine bifacially flaked leaf-shaped and stemmed projectile points including at Ounan point, but it is possible that these belong to the subsequent Bunat el-Ansam. Two shallow trenches were excavated near the surface of the scatter. The site was flooded seasonally during summer rains (Wendorf and Schild 2001b, p.457). Grinders and handstones littered the site, most broken. The hearths are in at least four clusters with possibly two more. Each was a shallow oval basin with a maximum length of 65cm, width of 38cm and depth of 25cm. They are floored with sandstone slabs and have burned silt walls that slope inwards. The fill consists of charcoal and sand.

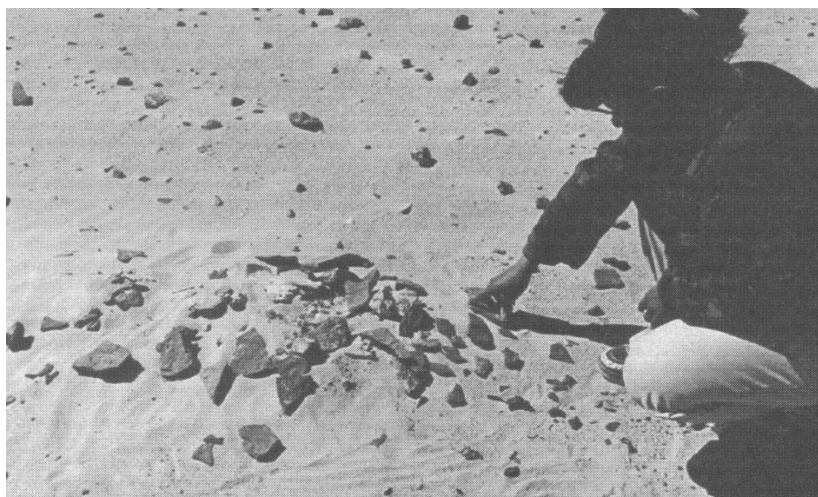


Figure 6 - Site E-94-3, showing a small stone-filled hearth before excavation  
(Source: Mohamed 2001, p.456, figure 13.14)

Although **E-92-9** is usually discussed in terms of the stone circle in that part of Nabta, it is worth noting that it is surrounded by rock-lined hearths and surface scatters with lithics, pottery, groundstone remains of the same sort that have been described above (Applegate and Zedeño 2001, p.463-464) and fragmentary, unidentifiable faunal remains (Applegate and Zedeño 2001, p.464). It was located at the end of a wadi on a young fossil sand dune at the northwest of the site, extending over around 2 hectares. A typical dominance of notches and denticulates was found. Low quantities of well-made pottery were almost certainly brought to Nabta, as there are no signs of local manufacture. Three undated burials were found close to the circle on the same dune mound, one topped with a few small Nubia sandstone slabs, collectively called E-97-17 (Applegate and Zedeño 2001, p.464).

In summary, the Ru'at el-Baqar sites are usually clusters of hearths unaccompanied by other structural components, and are surrounded by occupation debris, including tools and the by-products of tool production, grinding equipment and some animal bone. An exception is Hut 1 at E-75-8, but this is an isolated example from which it is inadvisable to extrapolate. Occupation appears to have been brief, but hearths and grinding stones formed site furniture indicative of the intention to return to the site and appear to form part of an infrastructure of mobility pursued by the visitors to Nabta in the Ru'at el-Baqar.

### Shelter

Nelson (2001, p.389-391) describes a hut, Hut 1, at E-75-8, which was semi-subterranean and accompanied by a stone-lined hearth and two pits. It is the only known example dating to the Ru'at el-Baqar.

### Raw material acquisition

The following graph (figure 7) shows debitage raw material frequencies at three excavations reported in Wendorf, Schild and Associates (2001 Table 9.9, p.346; Table 10.5, p.364; Table 11.5, p.402), indicating a dominance of quartz, followed by flint and chert, although the figures do not always correspond to frequencies for tool types. Unfortunately raw material frequencies were not shown for all sites, but this does usefully show how quartz was becoming more important, than flint that dominated in the Ru'at el-Ghanam Middle Neolithic. Close says that her excavations at E-75-8 produced double the quantities of quartz in the debitage from the Middle to Late Neolithic, tripling amongst cores and increasing by a factor of 10 in retouched Close 2001, p.374). Apart from the excavations by Nelson (2001), referred to in the graph as E-75-8(2) to distinguish it from the excavations by Close (2001) referred to as E-75-8(1), quartz is at least as important as flint and often more so.

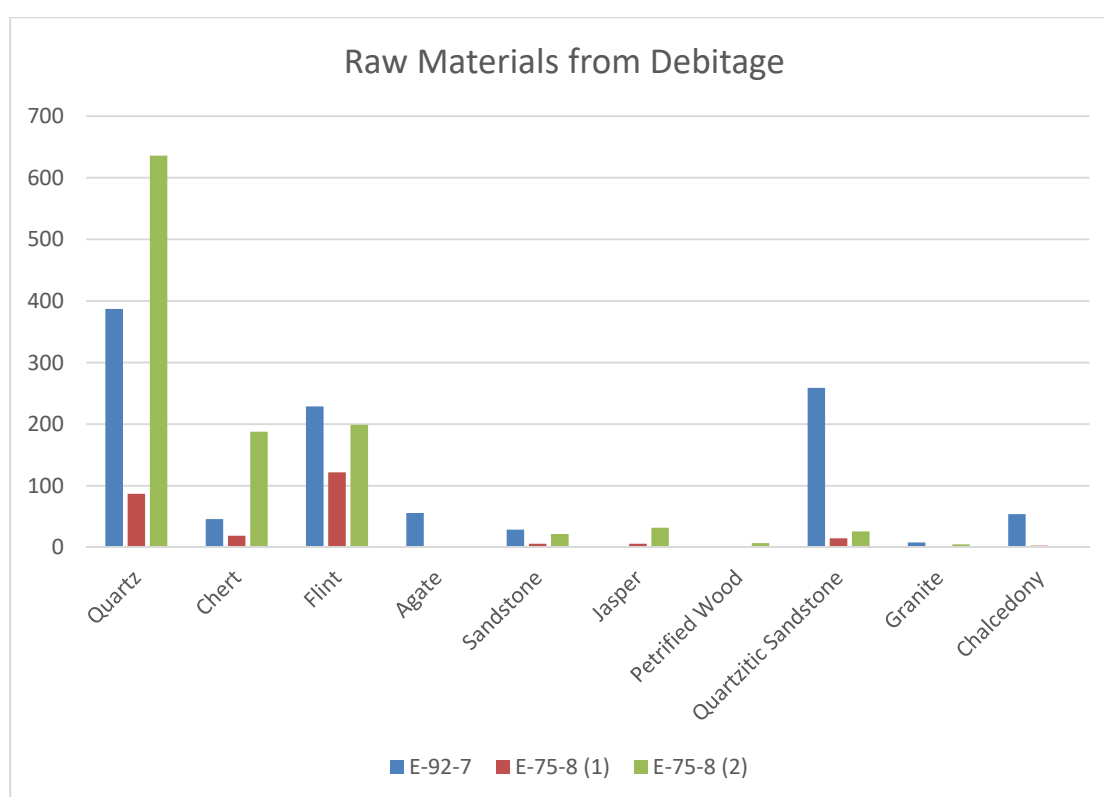


Figure 7 - Raw materials from numbers of items of debitage at three sites at Nabta Playa in the Ru'at el-Baqar (totals compiled from Wendorf, Schild and Associates 2001, Tables 9.9, p.346; 10.5, p.364; 11.5, p.402).

As mentioned above, most stone types used were available locally, including chert. Agate and jasper were not available locally and although Krölik and Fiedorczuk (2001) mention that it may have been sourced from the Nile, it is equally possible that it came from the Eastern Desert, where it is certainly found (Aston *et al* 2000). Specialized knowledge would have been required to identify and locate the material. It seems likely that with the possible exception of agate and jasper, no particular

difficulty was associated with the acquisition of the appropriate materials for tool manufacture. Chalcedony, chert, petrified wood, quartz and quartzitic sandstone, the main materials used, were available within a 10km distance (Wendorf and Schild 2001c, p.435). Chalcedony, which as in the Ru'at el-Ghanam Middle Neolithic was used to make microliths, was probably available locally in the form of small pebbles in playa silts and wash (Nelson 2001, p.395). The only question-mark lies with flint, which would be easily identifiable but was only available at a distance of 70km to the north (Mohamed 2001, p.422; Krölik and Fiedorczuk 2001, p.340), where it was found in Eocene limestone, a 140km round trip, could either have been acquired by resource acquisition parties or by trade/exchange. At E-75-8 quartz is much more important in the assemblage than it had been in the Ru'at el-Ghanam Middle Neolithic, doubling in volume in the debitage and almost trebling in the cores. Of the fine materials, flint was preferred, but other fine-grained types were also represented, including chert and chalcedony, meaning that fine-grained materials remained the same, suggesting that non-flint fine-grained materials may have been more easily acquired alternatives to flint (Close 2001, p.375).

Ground stone tools were made of sandstone, granite and basalt, which were available in the area (Wendorf and Schild 2001c), although no quarry has been identified in the publications.

The tumuli and the stone circle were made of the local Nubian Formation sandstone blocks, which was in plentiful supply. The local sandstone may have been chosen to ensure the durability of the structures themselves, but it may also have been selected because more pliable materials, like wood, were in short supply. It is also possible that it was chosen because it was representative of the Nabta landscape and all the ideas associated with it. At the moment it is not possible to state whether the use of sandstone was a positive choice or the default option.

Raw materials employed in tool and object manufacture demonstrate both a process of selection and a strategy for acquisition, which differed from that of the Ru'at el-Ghanam Middle Neolithic due to the lack of flint in assemblages, with a preference for locally acquired materials.

Quarries for the raw materials have not been identified, so it is not known what sort of tools or methods were used to extract stone from outcrops.

A different type of resource is pasture. Unlike stone or clays, pastures and marshes that form during periods of rainfall are highly seasonal and move around both geographically and temporally depending on where that rainfall is deposited. As described in Chapters 3 and 5 the hallmark of arid and semi-arid areas is variability, and those using Nabta will have had mechanisms for assessing the value of Nabta season to season and of responding to that information.

## **Food acquisition and production technologies**

### ***Lithic tool technologies***

The main fabric to survive in the form of implements is stone. As above, most tools were made partly on locally available materials but flint was also important, which was not available locally, and there are some stone types from outlying areas as well, particularly agate and jasper. At E-92-7, 1060 pieces of debitage, were found, as well as 57 cores and 72 retouched tools made on quartz, quartzitic sandstone and flint (materials that made up 83.8% of the total debitage), as well as agate,



chert and chalcedony. Examples of Ru'at el-Baqar tools are given in figures 8, 9 and 11. Of the cores, most were single platform cores, but multiple platform, opposed platform are also found, most of very similar size and made mainly on quartz and flint. Of the retouched tools, dominant forms are notched flakes, denticulated blades and denticulated flakes, making up nearly half of the tools, but some microliths in range of forms are also present, including 20 pieces with continuous retouch. Debitage at E-75-8 consisted primarily of flakes with blades in a minority. Single platform cores again dominate at 58% of the total cores, with Ninety-degree platforms next (17.2%) and the other types making up less than 10% between them (Close 2001).

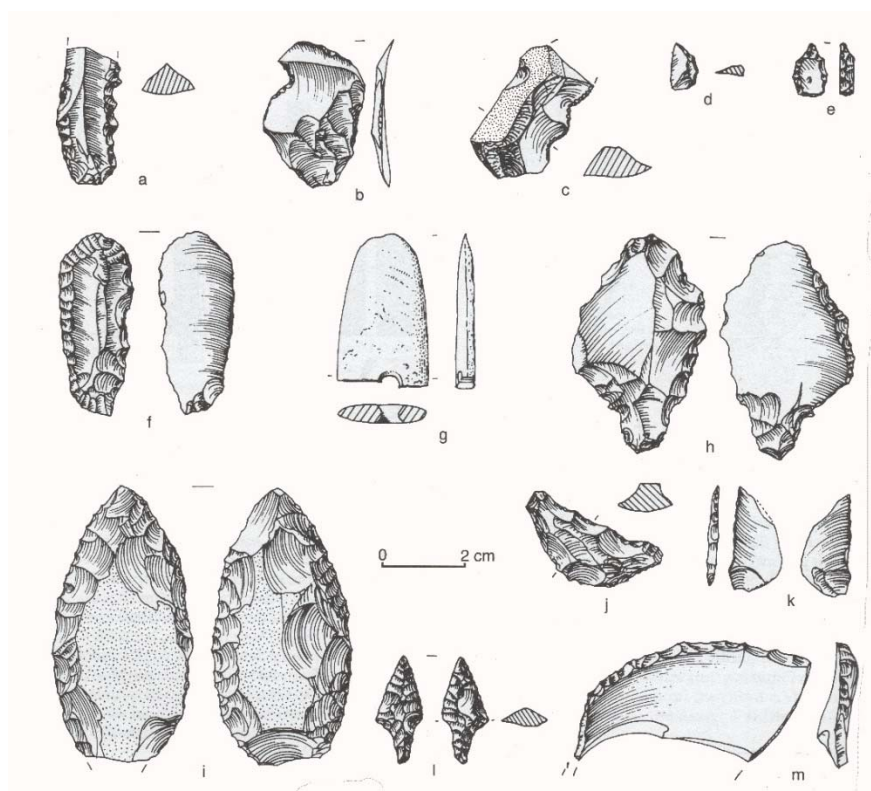
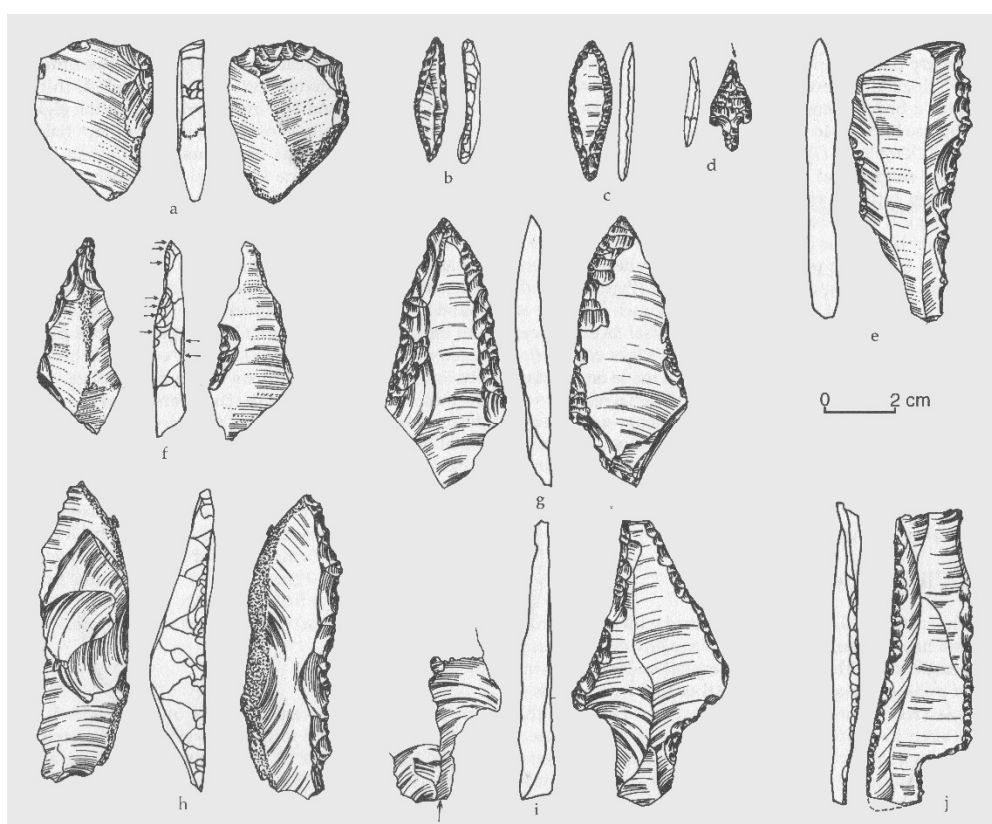


Figure 8 - A selection of Ru'at el Baqar lithics from E-75-8 (Nelson 2001, p.396).  
a, c denticulates; b, notch; d, lunate; e, varia; f, endscraper; g, groundstone;  
h, retouched Aterian point; i, biface; j, crescent/lunate; k, backed piece;  
l, bifacial projectile point; m, retouched side-blow flake

Different techniques were used for reducing fine-grained and quartz cores and for the use of primary, secondary and tertiary flakes (Close 2001, p.376), with quartz largely left without retouch, indicating that different materials had different roles and were perceived differently. There was very low usage of coarser materials and these too were treated differently from quartz and fine-grained materials (Close 2001, p.376). Materials were clearly carefully selected for different roles in the subsistence strategy.

Of the retouched tools, notches, denticulates and pieces with continuous retouch dominate, and overall there is an absence of geometric microliths made mainly on flakes. Bifaces also appear for the first time in the retouched tool repertoire, with a large number on side-blow flakes. Tools include a large number of pieces with continuous retouch, followed by notched flakes and denticulate flakes and a much smaller number of denticulate blades, truncations, projectile points and microliths, made on a variety of materials (Nelson 2001, p.401-403), a strategy that shows no particular preference for matching a specific raw material to a specific tool type for larger tools. There are examples of only a few other tool types, there are no burins and only very few microliths, although they are still present, and most were made on fine-grained and easily worked chalcedony (Nelson 2001, p.395). One roughed-out celt was found.



**Figure 9 - Site E-94-3 Retouched Tools.** a, Endscraper on reused Levallois flake; b and f, perforators; c and d, points; e and h, denticulates; g, i and j pieces with continuous retouch (Source: Mohamed 2001, p.459, figure 13.15)

Close states that between the Middle and the Ru'at el-Baqar Late Neolithic, apart from raw material choices “there is a profound underlying continuity in the predominance of pieces with continuous retouch, denticulates and notches” (2001, p.377). However, Nelson draws attention to differences between the lithic strategies of the two periods, including core reduction, which changed from a microblade to a flake/sideblow flake strategy, the beginnings of invasive thinning and bifacial flaking, the appearance of large numbers of sideblow flakes, a thicker length to width ratio, and the introduction of longer and heavily retouched projectile points (Nelson 2001, p.410), whilst Wendorf

and Schild (2001c, p.655) point to the introduction of ground and flaked celts that have lenticular cross sections and polished cutting edges.

Wendorf and Schild (2001c, p.438) suggest that the shift from flint and chert in the Ru'at el-Ghanam Middle Neolithic to quartz in the Ru'at el-Baqar may be due to technological changes accompanying the shift from blades to flakes. It is interesting to note that at E-75-8 whilst quartz is much more important in the assemblage than it had been in the Ru'at el-Ghanam Middle Neolithic, flint was the preferred fine-grained type, but other fine-grained types were also represented meaning that whilst materials changed, the need for fine-grained materials remained the same. This suggests that non-flint fine-grained materials may have been more easily acquired alternatives to flint. Assuming, therefore, that cultural and industrial preferences for fine-grained material continued, Close argues that it was probably the cultural landscape itself that changed, including the access to sources of flint, thereby raising the cost of procurement and leading to other fine-grained rocks to be selected when necessary (Close 2001, p.375). This idea is supported by Nelson (2001, p.401) who draws attention to the more varied raw materials in the Ru'at el-Baqar, including chert, jasper and agate, which may have replaced flint.

The manufacturing industry described above is one of minimal investment of time and energy, representing a low risk strategy. Tools were versatile rather than specialized, although the tasks for which they were required may have been highly specific, requiring large numbers of denticulates and notches, and some bifaces as well as a selection of other tools in smaller numbers. The dominance of single platform cores, making up 58% of the assemblage (Close 2001) also argues for an opportunistic approach to tool manufacture, with low instances of either core or tool curation. A small proportion of the assemblage required higher levels of planning, skill and time and these were evidently required for either specialized tasks or to demonstrate a particular affiliation with certain tasks or ideas, or a combination of task-related production and cultural outputs. All of the flaked tool items were portable. Raw material acquisition patterns changed, with flint no longer represented in high volumes, but replaced with equivalents that were usually available within reach of the Nile. This seems to reflect not a change in preferred raw material but in its accessibility as well as availability. The provisioning strategy in terms of lithics alone was one of provisioning people, but to this should be added that grinding stones and hearths suggest also a provisioning of place. The chaîne opératoire was not a sophisticated one and there are no indications of any particular cognitive input, design or planning.

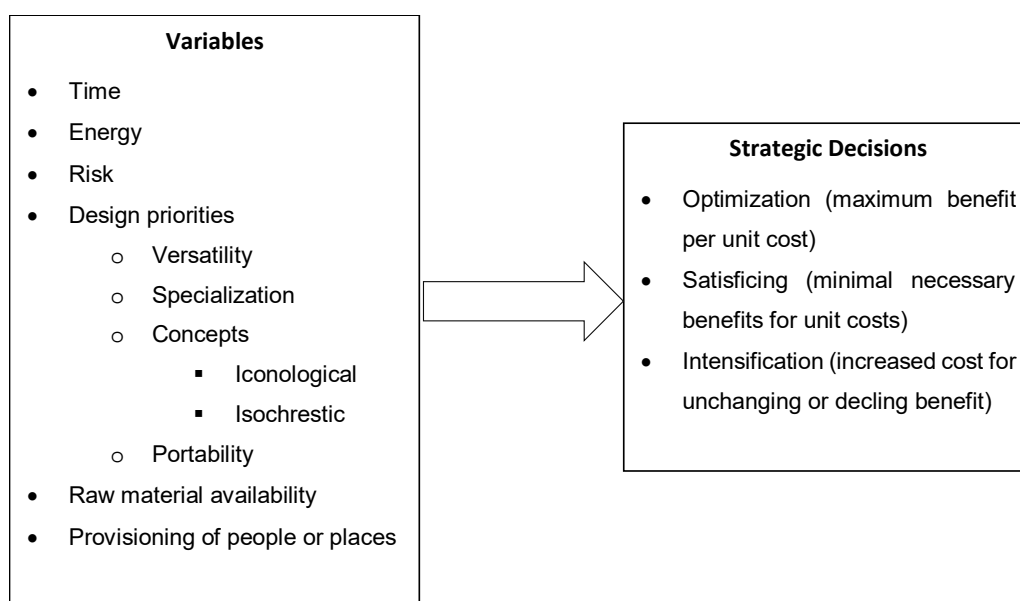


Figure 10 - Criteria for assessing tool manufacturing strategy (based on Shea 2013, p.39-45)

Using Shea's observations about costs and benefits as a guideline (figure 10) (2013, p.39-45) the lithics can be assessed in terms of the decisions that were made during the Ru'at el-Baqar. Wendorf and Schild describe the industry of the Ru'at el-Baqar Late Neolithic as "a less skilled and less formal, almost casual, character" than the Ru'at el-Ghanam Middle Neolithic, perhaps indicating that Ru'at el-Baqar stone working was either less important or that the strong sharp edges available without effort on quartz became particularly desirable (Wendorf and Schild 2001b, p.438). At E-75-8 the notches are very crudely shaped, "made by a single blow" and only sometimes provided with additional retouch (Nelson 2001, p.395). Emphasis was also placed on raw materials on which tools were made. This represents more investment and intervention in the output than the manufacturing approach implies.

At the same time, bifacially worked tools appear for the first time, suggesting a dichotomy between a high level of expediency on the dominant part of the assemblage and an intensified and optimized input into a very limited part of the assemblage. Bifacial tool manufacture is not necessarily very time-consuming, but specific knowledge and experience are required from core preparation to flaking technique, and cores and flakes need to be prepared with a view to the final object, requiring a specific reduction strategy based on specific ideas and combinations of task-related activities. These may fit into the category of "objects of thought" defined by Edmonds as partly symbolic as well as portable and functional, requiring a high degree of preparation and anticipation (Edmonds 1995, p.42).

The difficulty of accessing flint, suggested by Close above, was balanced by the use of other materials, showing a versatility and adaptability that are consistent with an opportunistic and optimizing strategy, and the dominance of quartz for the majority of tools shows a shift in the balance of technological strategies. As Wendorf and Schild say, "With little energy investment in the

acquisition of this raw material, informal quartz flakes could be produced, used and discarded at minimum cost” (2001c, p.440). In Shea’s terms, the strategic approach combines optimisation (the dominant strategy) with satisficing (a minor element). There are no signs of intensification in the stone tool manufacturing strategy.

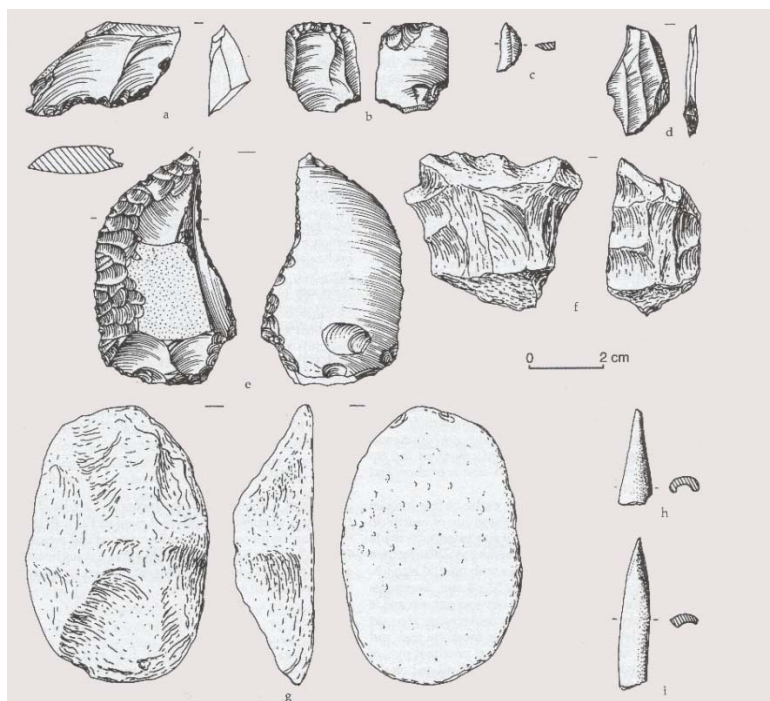


Figure 11 - Lithics and worked bone from E-75-8 (Nelson 2001, p.399, figure 11.10).  
a, perforator; b, endscraper; c, lunate; d, truncation; e, retouched piece;  
f, denticulate; g, groundstone; h,i, worked bone).

### ***Groundstone equipment***

Groundstone equipment was found throughout the Ru’at el-Baqar (figures 11-g; figure 12). At E-92-7 grinding implements consisted of 7 fire-cracked fragments of sandstone quarzitic sandstone, sandstone and granite, three of which had two grinding faces. At E-75-8 Ru’at el-Baqar hammerstones were found, together with handstones and lower grinders. They were made of quartzitic sandstone, sandstone, granite and one example each of petrified wood and quartz, and not all of them were complete, some of them very fragmented (Close 2001, p.382; Nelson 2001, p.403). At E-92-4 grinding stones of sandstone and basalt were found, mainly away from hearths. The shapes varied considerably, as did the sizes, but most featured shallow bowls. Some had grinding areas on opposing surfaces and one had two grinding areas on the same surface. At E-77-1 125 handstones were found, of which 476 were fragments. At E-94-3 (figure 12) grinding equipment included 133 whole and 174 fragmented pieces of handstone and 16 complete and 164 fragments of grinders. They were made of quartzitic sandstone and had one or two working surfaces.

Throughout the Ru'at el-Baqar, large notched stones were found (e.g. figure 10-c), but they are particularly prominent at E-94-2, where twenty two were found, made of Nubia sandstone with two or more notches midway along opposing edges. They are found near the hearths and it is proposed that they may have been tethering stones (Mohamed 2001, p.424).

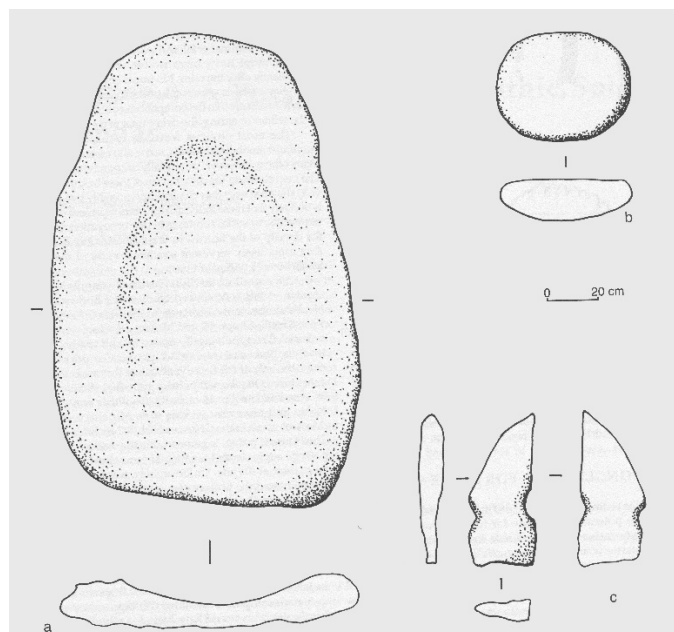


Figure 12 - Site E-94-3, Groundstone artefacts: a, milling stone; b, handstone; c, notched stone (Source: Mohamed 2001, p.461, figure 13.16)

At E-75-8 two items described as palettes were found. They were unknown in the previous Ru'at el-Ghanam so are novel in the Ru'at el-Baqar. Both are made of coarse-grained sandstone which was pecked into shape, producing thin artefacts, one that was sub-rectangular and one sub-circular. Although there is no direct indication of their function, it is possible that they were forerunners of the palettes that appeared in the later Final Neolithic cemetery at Gebel Ramlah near Gebel Nabta.

In summary, there does not appear to have been a particular design concept for grinders. They come in a variety of shapes and sizes and might have single or opposed working surfaces. This suggests that they were built at a household level and that there was no cultural pressure towards standardization. Grinding stones abandoned at sites for future use suggests that the value of such items was *in situ* at places where groups came to rest, rather than as part of their movement between nodes. Tethering stones seem to have been fairly standardized but this appears to have been due to functional requirements and experience rather than a design concept. The two palettes are interesting, but apart from noting their presence, there is no generalization possible, particularly as the two take very different forms.

### **Ceramic container technologies**

Whilst the changes to lithic technology were relatively minor, the differences between the Ru'at el-Ghanam and the Ru'at el-Baqar ceramics were considerable. Following a tradition established in the Early Neolithic and retained throughout the Ru'at el-Ghanam, a range of new ceramics was introduced in the Ru'at el-Baqar at sites like E-92-7, E-94-2 (671 sherds representing three types of pottery) and E-75-8, eliminating the thick-walled smoothed-over spaced rocker-stamped bowls, to which the new types show “no points of resemblance” and were “an unrelated ceramic tradition” (Zedeño 2002, p.53). The new types are characterized by fine paste, a relatively small volume of fine temper made of ground sherds minerals, sand and/or organic materials. All appear to have been made on playa silts in the area but the chemical patterning could have been the result of multiple manufacturing locations within the desert (Zedeño 2002, p.53, 57, 59). They were usually in the form of beaker-shaped vessels, as well as some small bowls, with thin walls less than 7mm thick, and show the first evidence of controlled firing (Nelson 2002a, p.7). Decorative schemes show a completely new approach to vessel treatment. Instead of being incised or stamped, entire surfaces were used to emphasize surface colour and subtle texture. Surface treatments included the use of burnishing, smoothing, scraping and slipping, often in combination (Nelson 2002a, p.7). These comprise Black-Topped Ware (figure 13) and Red Wares (figure 14) (sub-divided into 8 variants). The materials, construction techniques, technology, forms and surface treatments are all new, representing a significant departure from previous conceptualizations of pottery. Clays are finer and may have been refined by flotation, may include sand and/or carbonized organic materials and may have required higher firing temperatures, although it is uncertain how these were achieved (Nelson and Khalifa 2010, p.138-9). Decorative schemes largely relied on smoothing, burnishing and slipping rather than decoration applied with tools, creating a very different and more subtle decorative paradigm based on colour. These were whole-surface treatments rather than decorative schemes and patterns. They were all small forms, lacking constricted mouths, making them unsuitable for storage but perhaps making them more useful for milk and blood gathering and eating semi-liquid porridge-like foods (Nelson and Khalifa 2010). Overall the ceramics represent much greater technological complexity than in previous periods. All of the ceramics were hand-made, the majority using the coiling method, but firing techniques were improved, with greater control over higher kiln temperatures producing harder and more durable wares ((Nelson and Khalifa 2010, p.139). It is thought that black-topped pottery was probably achieved by placing a fired pot upside down in hot ash. Different effects on finished items were achieved using different techniques and decorative schemes are technically and perhaps conceptually more sophisticated. Burnishing was achieved by rubbing with a hard object.



Figure 13 - Black-topped pottery  
(Nelson and Khalifa 2001, p.148, figure 4)

Probably produced at the household level on an *ad-hoc* basis, (Arnold 1985; Balfet 1965; Rice 1987, p.183-91), and perhaps by women (Hodder 1982; Needler 1984, p.184) the knowledge of pottery production may have travelled within and between households over the generations, conforming to a broad set of ideas from both the distant and recent past. The social context within which these changes occurred will be discussed later. Unlike grinding equipment and standard flake-based tools, the ceramics were formed along specific lines, with repeated shapes, treatments and both a common technological approach and a specific preconceived final vision in mind. Both the firing technology and the surface treatment techniques represent not merely a departure from Early and Middle Neolithic technologies but a commitment to a new strategy for ceramic production and a new cultural paradigm. These approaches were already in use in the Nile Valley, suggesting that they represent the adoption of a pristine invention by one or more groups, and the transfer of knowledge to others who seized both the technological opportunity and the cultural ideas associated with it.

Both Eerkens (2008) and Grillo (2014) has made it clear that pottery is completely compatible with a pastoral, mobile lifestyle. Grillo gives the example of the Samburu of north central Kenya who us pottery produced by the Dorobo for a number of purposes but find it particularly crucial during the dry season and during droughts as a means of preserving liquids. Pottery is also important for extracting oils and nutrients from plants, and for breaking down otherwise indigestible plants into forms that could be suitable for human consumption, sometimes by softening and sometimes by reducing toxicity. Use of pottery also postpones spoilage. The Samburu transport pots without difficulty in baskets on donkeys (Grillo 2014, p.117-119). Pottery could be manufactured or acquired



in return for other goods if there was anything that groups had that was of value to potential trading partners, including foodstuffs and marriage partners.

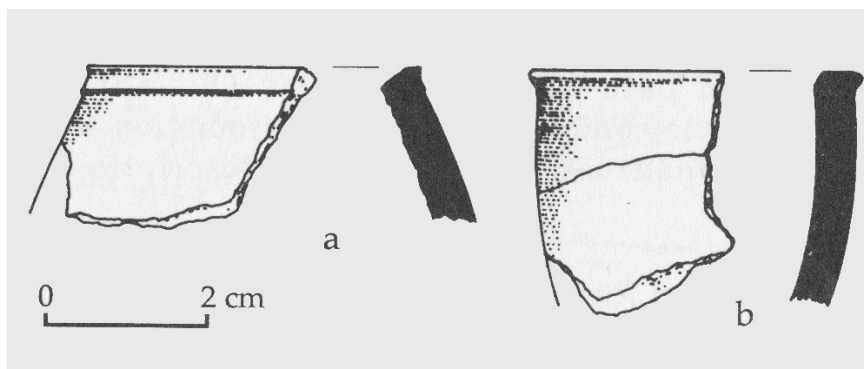


Figure 14 - Site E-94-2. Red Ware bowl rims  
(Source: Nelson 2002, p.36, figure 3.19)

### Craft skills

There is no evidence for basketry, matting, rope, textiles, or leather goods, although these must have been present (Hurcombe 2014). As Hurcombe demonstrates, it is difficult to imagine that life would have been possible without them and all the raw materials would have been available in the form of the trees and shrubs that have been noted at Nabta in the Ru'at el-Baqar archaeological remains, particularly the drought-tolerant *Acacia*, *Tamarix* and *Panicum turgidum* species, which today provide fibre for matting, rope and related goods (Mahmoud 2010; Springuel 2006). Tannins from *Acacia nilotica* could have been used for tanning leather, as it is today (Springuel 2006).

At E-75-8 three pieces of worked bone were found, including one awl and two projectile points, all burned, as well as the fragment of another bone point that was 10mm long and 3mm wide at its widest diameter and was polished all over (Close 2001, p.381). These hint that, as one would expect, a bone tool industry may have been present at Nabta but is simply not represented by the surviving material (figure 11-h and -i).

Ostrich eggshell beads are still found in the Ru'at el Baqar and although they are much less frequent than in the Ru'at el-Ghanam, there are no other differences visible. They were made by perforating an unshaped piece, which was then chipped into roughly circular disks, to a mean diameter of c.6.2mm, before being polished. Out of 131 pieces found only one was decorated, and many were broken during manufacture (Close 2001, p.379-381).

A Red Sea conid shell was found, which had had its apex removed, and is thought to have had a decorative role (Close 2001, p.381).

### Mobility

The physical environment is a constraint on the type of mobility that can be practiced in the movement of herds, but in the case of Nabta there are no observable physical constraints on movement between the Nile and the desert areas, a zone that is characterized today by undulating sand sheets. It would have been easier underfoot for both people and animals when it was

savannah, but the profile of the landscape would have been very similar, offering few impediments to movement. The ownership of pottery is perfectly consistent with residential mobility and indeed can help to improve pastoralist efficiencies, as in the case of the Samburu of north central Kenya (Grillo 2014, p.106). Larger items, like grinding stones, were left in situ, and hearths were often covered over with protective stones, ready for re-use.

### **Economic structures**

There are very few requirements for structures to support pastoral activities and although Riemer has suggested the use of hunting traps in some parts of the Western Desert (Riemer 2004a) there are no suggestions so far of them being connected with the Ru'at el-Baqar at Nabta.

### **Cemetery / Religious architecture**

There are four types of structure under this category: the stone circle, the tumuli, the so-called complex structures and the megalithic alignments, all constructed from Nubian Formation sandstone that was quarried locally. Although tumuli are known from the Early Neolithic (Bobrowski *et al* 2006) the complex structures, stone circle and megaliths are new to the Nabta Playa area in the Ru'at el-Baqar. In Complex Structure A the shaped stone above the table rock weighed in the region of three tons (Wendorf and Królik 2001, p.510). I have seen no estimates in terms of number of people or man-hours required to move such a structure, but the investment of time and energy must have been considerable – it required a 3 ton pulley, 12 workers, a wire cable and ropes for the C.P.E. team to pull it out (Wendorf and Królik 2001, p.508).

### **Food storage systems**

The only signs of food storage systems are at E-75-8 where a possible hut was associated with two pits of undetermined function. Given the short-term occupation of the site and the fairly sparse vegetation predicted for the area at this time, it seems likely that there was not sufficient wild plant food to merit storage and that it was collected for immediate consumption. It seems probable that food was eaten on an *ad hoc* basis, as it was acquired rather than stored.

### **Transport**

It is possible that cattle, sheep or goat were used as pack animals. Close suggests that domesticated livestock were used for carrying heavy stone items during the Neolithic of Safsaf (1996; 2002a), and there is data from ethnographic examples that supports this possibility. The nomadic Fulani, for example, use bulls to carry kitchen utensils and the frameworks for the provisional shelters that were erected along the 5 month migratory route from north to south (Lambrecht 1997, p.29).

Walking was also a perfectly viable means of transporting items that were lightweight and could be strapped to the body, carried or dragged.

Some heavy items, like mortars, were probably left in situ when people knew that they would return to favoured locations.

### Fuel

Given the available wild fauna, and assuming that domesticated herds were the main form of dung provision, dung should have been readily available, particularly concentrated beneath trees that would have provided shelter. Linseele (*et al*) 2010 attest to the large quantities of fuel that can be assembled from herd animals, and there are numerous modern examples of dung being used as fuel (for example, Butler 2002, p.181-2; Evans-Pritchard 1940, p.258; Hassan 1988; Hobbs 1989, p.90, p.104-6).

Burning wood, which was a relatively scarce resource, and one which was not readily renewable, would have been a much higher-risk option for the long term security of the environment, as recognized by Eastern Desert Bedouin today, who enforce strictly encoded social and religious prohibitions established to protect living trees (Belal *et al* 2009, p.70-71; Bollig 2006, p.336-337; Harir 1996; Hobbs 1989, p.53; Hobbs *et al* 2014; Krzywinski 1996; Simpson 1992; Wendrich 2007, p.74). However, in Nabta the number of Ru'at el-Baqar hearths containing plenty of wood charcoal suggest that either dead wood was being used in order to protect live trees (as it often is today) that there were mechanisms in place for ensuring that the host tree was left intact, or that wood was not considered to be in danger of being over-exploited. There is not enough data to select between these alternatives, but it seems unlikely that there was sufficient live wood to provide fuel sustainably. All of the woods that were present at Nabta would have been suitable for fuel, particularly *Acacia ehrenbergiana* which would have been a particularly good candidate for fuel as it has a relatively low moisture content of 29% and burns very slowly, providing heat over long periods (Belal *et al* 2009, p.70-71; Springuel 2006, p.4). Today Bedouin in the southern Eastern Desert in Egypt use *Tamarix* most frequently as it is most abundant, selecting branches already browsed by herbivores but would prefer acacia due to its greater efficiency for fuel purposes. Both are used sparingly (Belal *et al* 2009).

### Craft infrastructure

Kilns or equipment associated with pottery manufacture are missing from Nabta. In so far as lithics are concerned, debitage occurs around hearths, so was not isolated from living areas. There are no signs of specialized craft production areas.

### Summary

The stone toolkit of the Ru'at el-Baqar food producers has been demonstrated to be one of optimization and very little intensified activity in terms of lithic production. In Shea's terms the toolkit was highly portable and was more about provisioning people than places, but hearths were covered over for re-use and both grinding equipment and tethering stones were left behind for future use. The lithics show little cultural conceptualization, and raw materials were usually available locally. Those that were less readily available at Nabta may have been easy to acquire wherever the occupants of Nabta were based elsewhere during the year. Grinders were also low-skill items to manufacture and show no standardization. Only the ceramics show investment of time in terms of skill, material manipulation and treatment, and the rejection of earlier Neolithic forms and decorative schemes argue

for a new value system, or at least a new way of conceptualizing ideas. If there was specialization in the Ru'at el-Baqar, it was in the form of pottery production, but as there are no signs of infrastructure for local pottery manufacture it is impossible to speculate about who produced the pottery and how. Only one possible hut arrangement was found, and this was very ephemeral, and may have been accompanied by storage pits, but heavy deflation means that this evidence is sketchy at best. The pattern of use and re-use for short periods by highly mobile herder-hunters who collected plant materials for processing at the site, digging wells to maximize the water availability, before moving away to other areas that, based on similarities between pottery styles, probably included the Sudanese Nile.

### **Social Assets**

#### **Status, roles and social organization**

During the Ru'at el-Baqar, Wendorf and Schild believe that the creation of the tumuli, their contents and the stone circle would have required a considerable level of social organization, backed by a degree of social complexity embedded in religious or political authority (Wendorf and Schild 2001a, p.9). The stone circle did not, however, require the mobilization of much labour in order to build it. The slabs were not particularly heavy and they were available locally, and in practical terms it could have been built by one person. Some basic astronomical knowledge would have been required, but this was probably a form of knowledge common to a lot of people living in mobile communities (Applegate and Zedeño 2001). Of the tumuli, the maximum number of people required to move a single stone was four people, again requiring a common impetus, agreement about purpose, design and implementation and co-ordinate effort, but not extraordinary amounts of labour (Applegate *et al* 2001). This is not true of the complex structures, where considerable input of labor would have been required. As mentioned above, extracting the shaped stone from Complex Structure A required a 3 ton pulley, 12 workers, a wire cable and ropes to extract it (Wendorf and Królik 2001, p.508), indicating that however the stone was manipulated in the Ru'at el-Baqar, the people who carried out this task invested not only time and energy but considerable belief in the potential value of the outcome.

The act of materializing ideas as structures indicates a fundamental need to act upon beliefs, and to agree on how these ideas should be a) conceptualized and b) manifested. It also required impetus and incentive to develop a joint strategy for implementation and to deliver it successfully in the real world. We know that that this happened, but now how it was implemented. Whether or not this required leadership, it certainly demanded discussion, agreement and teamwork. Thomas, more abstractly, sees monuments as a socially driven strategy that both brings people together and divides them in other ways (2003, p.72), which carries with it the suggestion not merely of division of labour, but the defining and re-defining of roles at least during the periods over which monuments were constructed, if not in the longer-term.

In pastoral societies, where status is often based on valued characteristics rather than pre-defined and inherited hierarchical roles and where roles may encompass many functions (Klima 1970;

Manger *et al* 1996; Niamir 1991; Olupona 2014, p.40; Schareika 2014, p.4; Smith, A.B. 1996, p.30) other forms of status or role may be more important, based on perceived wisdom, experience, craft skills, negotiating skills, healing or spiritual mediation, or other valued characteristics. As researchers in both ethnographic and archaeological fields have demonstrated, socially stratified societies and pastoral livelihoods are fully compatible (Dika Godana 2016; Honeychurch 2013; MacDonald 1998; Robertshaw 1999). If there was a hierarchy of any sort, it might follow a less proscriptive model than that of a simple single-leader model or one of increasing social complexity leading towards hierarchies (MacDonald 1998). For example, Wengrow and Graeber (2015 p.603-4) discuss the Nambikwara in an impoverished area of Brazilian savannah. The Nambikwara practiced horticulture in villages of several hundred people during the rainy season, which then dispersed into foraging bands for the rest of the year, and were organized by a chief whose reputation could be made or lost “by offering guidance during the nomadic adventures of the dry season” and who, if he had given good guidance, might attract followers to settle in villages where he would direct activities (Wengrow and Graeber 2015, p.603). Such leaders were given status because of their expertise, ingenuity and experience, not due to hereditary systems. Vélou describes how, amongst the Herero of Namibia, even when a leader was appointed, dissatisfaction with his leadership would result in groups packing up and moving off (Vélou 1977, p.15). Although Layton *et al* suggest that nomadic pastoralist mobility and the inherent risks of the livelihood strategy, including loss of stock due to disease lead to mainly egalitarian communities (Layton *et al* 1991, p. 258) it is by no means clear that Nabta pastoralists were fully nomadic. More permanent leadership roles would be expected where potential conflict over water sources might arise (Bardhan and Ray 2008; Bollig 2006, p.325-339; Dasgupta and Heal 1979; DFID 2000a; Ostrom 2008; Tiffen 1996; Vélou 1977, p.15) but there is no indication of that at Nabta.

An alternative model, given the presence of processes and activities that required organization, and in the absence of any clear evidence for authority figures (e.g. religious paraphernalia; individualized symbols of power; luxury goods; burial of elders) is one of heterarchical organization, which is defined by Crumley as “the relation of elements to one another when they are unranked in a number of different ways” (1995, p.3). Whilst status may exist, the nature of power, and the people with whom it lies, may shift and change due to changing circumstances and inputs. Symbols of power of the sort discussed by MacDonald for the Pokot of Ghana and di Lernia for the Messak Plateau (di Lernia 2013; MacDonald 1998) are completely absent. In such a scheme short-lived leadership could be acquired on the basis of skills and abilities that are suitable for specific tasks, but may be fluid depending on the season or needs of the community on a temporal or geographical basis. This model is perhaps most in keeping with the available data at Nabta. If the Nabta pastoral and hunting groups were seasonal offshoots of a larger transhumant community, the arrangement of authority and roles is likely to have been extremely flexible, based on discussion, the pooling of ideas and the skill of certain members of society “for bringing together different points of view into some imaginative synthesis that stretches beyond parochial interests” (Spencer 1998b, p.249), which does not argue against incipient social complexity of the sort discussed by MacDonald (1998), but does argue in favour of discussing a range of possible models for organizing people to create monuments. As Wengrow and Graeber observe, “It is simply not possible to have an

evolutionary progression such as 'band' – 'tribe' – 'chiefdom' – 'state' if your starting point is a society that moves effortlessly between institutions" (Wengrow and Graeber 2015, p.608). As there are no obvious signs of social stratification it maybe that individual projects were organized on an *ad hoc* basis by whoever was most qualified at the time. That is not to suggest that such leadership roles were allocated informally; it is entirely possible that such agreements and allocations of status would be highly formalized.

The stone circle, tumuli and alignments have led to many discussions about religion and ritual activity, and Woods discusses this in terms of the role of religious authority (Woods 2016, p.176-199). Her vision of the ceremonial centre, like that of Wendorf and Schild, is partially dependent on its location on the edge of a major drainage wadi, "the focal point for rituals to the supernatural entities responsible for rain" (Woods 2016, p.188). She extrapolates from this to suggest that there may have been a rainmaker role at Nabta, bridging between the physical and non-physical in order to oversee rain-making rituals in a period characterized by unpredictable rainfall (2016, p.84-4, p.194-5). It is not unlikely that some form of spiritual specialist travelled with the group, and could have presided over the precise details of any rituals that might have taken place, but there is no evidence of such a person, at least not at Nabta in the Ru'at el-Baqar. For example, in E-97-5 was a young male (Applegate *et al* 2001, p.477-478) but he was unaccompanied by grave goods or personal ornamentation and there is no indication that he had any specific status. Malville *et al* (1998, p.489) suggest that the tumuli may have been symbolic structures, "proxy tombs for high-ranking individuals who died on the trail."

The presence of pottery of identifiable and consistent appearance and raw materials suggests some sort of organized thinking but there are no indications that in production this was an organized, centralized industry with a manufacturing class of people. Pottery manufacture was organized on a more *ad hoc* basis, perhaps organized by household. An alternative proposal, that the pottery was purchased rather than fabricated.

### **Ideology and religion**

Religion is defined here as the belief in supernatural elements, that may include deities, ancestors and spirits and which may include an afterlife. Religions and ideologies are often impossible to disentangle, with ideology representing ideas about how everyday life should be lived, frequently informed by religious doctrine and often incorporated into rules and laws forming the pattern around which lives are structured. Spiritualism is defined as the belief in the ability of humans and supernatural elements to communicate with each other. Within the broad definition of ideology as a group affiliation to a set of ideas that define economy, political structure and social organization, the matter of group and community identity translated into cultural output arise. Religion and related ideas may influence decisions about livelihoods and social arrangements.

There are two main components that give an indication of how Ru'at el-Baqar pastoralists at Nabta may have expressed ideas about religion and spiritualism: a set of fifteen tumuli are located within a wadi that is the main drainage of rainwaters into the Nabta basin, and the small stone circle E-92-9 lies at the end of the valley (Wendorf and Schild 2005, p.11). The first of the so-called

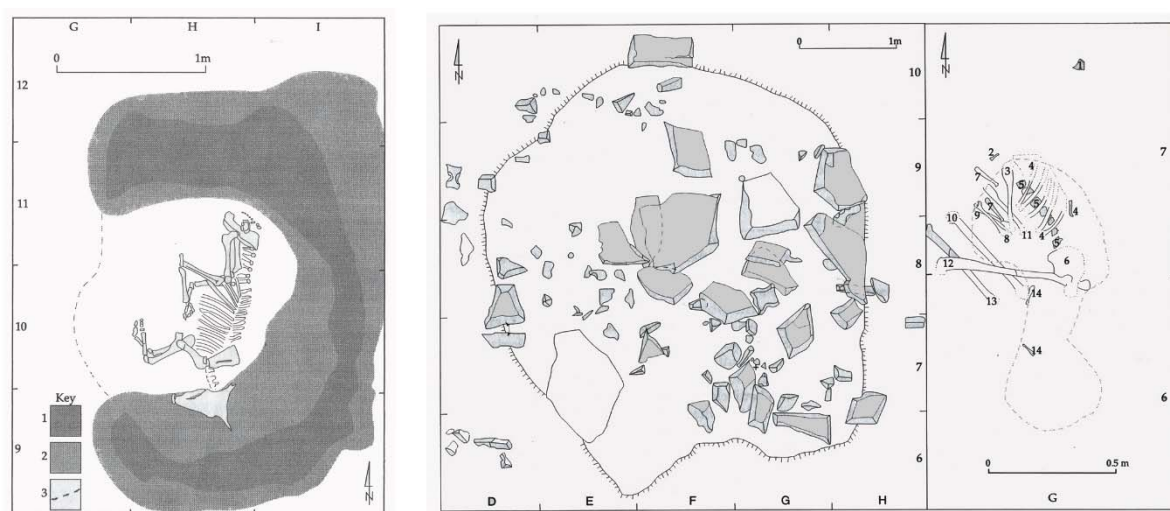
“complex structures” E-96-1A also appears to belong to this period, as do two of the megalithic alignments (Group A and Group C). All of the radiocarbon dates associated with the valley belong to the Ru’at el-Baqar Late Neolithic (Schild and Wendorf 2001b, p.53-4).

The tumuli are all concentrated on the northwestern edge of the main basin, where playa silts, a large phytogenic dune and sandstone bedrock are all present. They are dated both by two radiocarbon dates and by their location on top of redeposited playa silts. There are 1000 years between the two dated sites, E-94-1N (placing it at the beginning of the Ru’at el-Baqar) and E-97-6 (Schild and Wendorf 2001c, p.54). All are assembled of broken sandstone blocks, placed along the west bank of a wadi that flowed into the Nabta basin. Of the fifteen identified, nine have been excavated. They are often located on a prominent geomorphological feature, like the top of a dune, on the edge of a bedrock outcrop or a knoll, although E-97-6 was built in a small hollow between knolls and would have been flooded when the playa was at its maximum reach and the early Ru’at el-Baqar site E-94-1N was built directly within the playa Applegate *et al* 2001, p.468; Schild and Wendorf 2001c, p.53). Each is about 3-5m in diameter, composed of unshaped and roughly shaped sandstone blocks to form a dome shape in some cases. It has been suggested that a single piece of tamarisk over the pit fill in E-94-1N may be the survivor of a roof, but there is no additional evidence to support or negate this (Applegate *et al* 2001, p.470). Height is only given in one case, and this is 85cm at E-97-12 (Applegate *et al* 2001, p.479). Stone counts are not given for most of the tumuli but E-97-5, the human burial, was topped with around 100 slabs, E-96-2, which had no contents, had only eighteen, and E-97-4 had gaps in the tumulus stone and appeared to be incomplete. E-97-4 additionally has tethering stones included in the tumulus stones (Applegate *et al* 2001, p.475). Although usually divided into two categories (animal and human) there are arguably six types of tumulus based on contents (Data assembled from Applegate *et al* 2001, Chapter 15):

- 1) An articulated young female cow laid on its left side in a backfilled pit (figure 15) over which was a tumulus in which sheep/goat or Dorcas gazelle bones were scattered in the stone (the articulated cow and pit are unique to E-94-1N)
- 2) Tumuli with cattle bones scattered into the stones of the tumuli (E-97-4 and E-97-16)
- 3) Tumuli with mixed cattle and sheep/goat bones scattered into the stones (E-94-1S and E-97-6)
- 4) Tumulus with mixed cattle bones and canine (E-96-4)
- 5) A human burial without a cranium, mandible, teeth and the majority of scapulae (E-97-5) (figure 15)
- 6) Empty tumuli (E-96-2 and E-97-12)

The remains of individual cattle in the tumuli containing only disarticulated cattle remains varied from one to four, totaling a maximum of nine individuals. Ages of cattle include the young cow in E-94-1N (2½ - 4 years old), a young and probably female adult in E-94-1S (slightly younger than E-94-1N), horn-cones from an older cow or younger bull and the tooth from a much older individual of 12+years also in E-94-1S. The “rich harvest of cattle bones” (Applegate *et al* 2001, p.475) found in E-96-4 included a sub-adult of 1.½-2.5 years, a fragment from a much younger adult and bones from

two young adults. Those in E-97-4 were juvenile and sub-adult. Those in E-97-16 represented a single sub-adult. This amounts to two juveniles, 4 sub-adults, 4 young adults and 1 possibly elder example, the latter an exception. The total number of sheep/goat represented are three. Artefacts were found in the stones of some of the tumuli, but amounted to a maximum of two in a tumulus. (Applegate *et al* 2001, Chapter 15). The disarticulated remains were apparently butchered prior to being deposited, apparently at random, among the stones of the tumuli, and the animal bones appear to have been added throughout the construction of the tumuli. Gautier suggests that the cattle tumuli may have been used repeatedly with each animal representing one event (Applegate *et al* 2001, p.483). In modern pastoral societies there are restrictions regarding which occasions merit animal sacrifice and which animals should be employed. These constraints reflect the importance of animals not only for their blood, milk and their ability to reproduce, but as social assets, conferring status upon owners and used for the transfer of wealth between individuals (Dahl and Hjort 1976, p.163; Evans–Pritchard 1940, p.26). Russell (1988, p.74) calculates that cattle provided over 3 ½ times more calories than sheep and over 4 ½ more than goat, indicating even when assessed in purely economic terms, the slaughter of cattle is a considerable act of sacrifice.



**Figure 15 - Plan views of tumuli E91-1N, the articulated cow burial and E-97-5, the human burial**  
(Source: Applegate *et al* 2001, p.470, figure 15.1 and page 477, p.15.6)

The poorly preserved human burial in E-97-5 (figure 15) was located on a white bedrock knoll in a tumulus composed of less than 100 sandstone slabs. The remains lie in aeolian sand in a shallow depression in the bedrock. The single adult is semi-articulated and flexed on its right side, spine to the east and head to the north. The cranium, mandible, teeth and major scapulae are missing, suggesting that the body was either incomplete at the time of deposition or that the components were removed later. Analysis indicates that the remains belong to a young and healthy male, 1.70m tall (Applegate *et al* 2001, p.477-478). Without excavation of the other tumuli it is unclear whether the unique tumuli (the semi-articulated cattle burial, the human burial and the inclusion of canine remains) are in fact unique.



The area around the tumuli is surprisingly lacking in occupation data, including the dense scatters and large hearths associated with other Ru'at el-Baqar sites: "Instead, smaller hearths are dispersed individually or in small groups across the landscape around the tumuli" (Applegate *et al* 2001, p.468). This may imply that the area was either reserved for specific socially important activities or that it was inappropriate for habitation, although it is not clear why it would have been unsuitable. The hearths, being atypical of the Ru'at el-Baqar, may represent activities related to the tumuli, but there is no record of them having been excavated in order to investigate this matter.

Near the tumuli at least three burials were found at E-97-17, which may be either Early or Late Neolithic but is most likely to belong to the Ru'at el-Baqar due to the content of surface scatter of typical Ru'at el-Baqar objects. Small sandstone slabs marked the northern burial but there are no other structural features (Irish 2001, p.521) and none were associated with a tumulus or other structural features and apart from noting their presence there is little to add.

At the end of the wadi was a small stone circle on top of a small sandy knoll (figure 16). Although a number of interpretations were considered by the excavators, including the possibilities that it was a house, an over-ground granary base or a burial, all of the evidence pointed to it being a ceremonial circle (Applegate and Zedeño 2001).

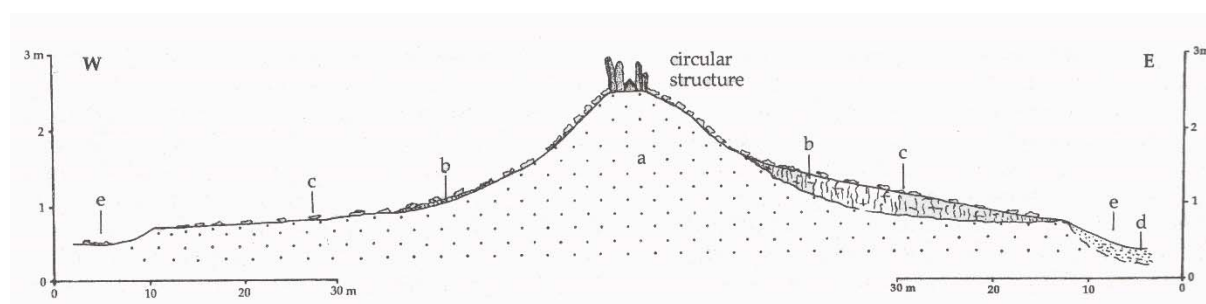


Figure 16 - Site E-92-9. Stone Circle (Source: Schild and Wendorf 2001a, p.37, figure 2.27)

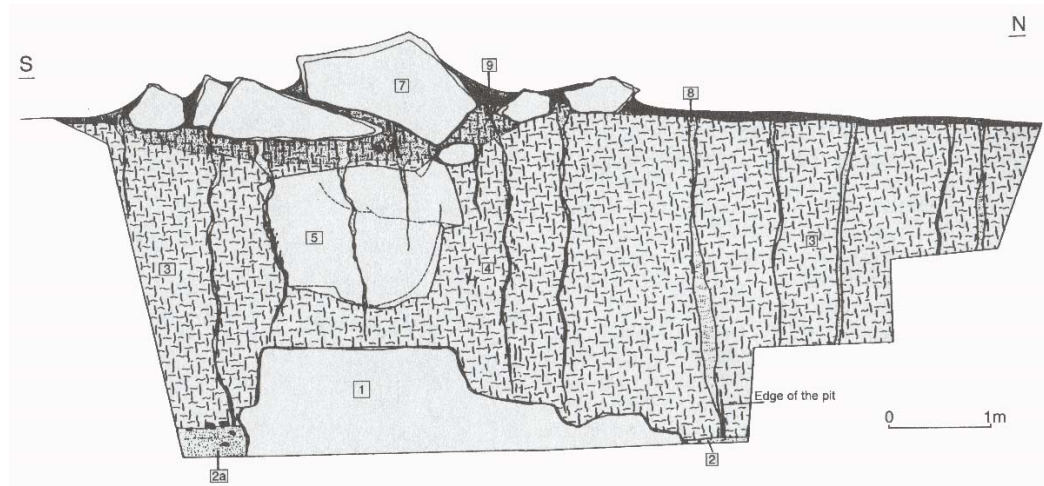
The stone circle, E-92-9 (figure 17), consists of pairs of narrow upright slabs, two lines of sights, one north to south, which parallels the line of the tumuli to the north and megalithic alignments to the south, and one of which points approximately to the place where the sun rose at the summer solstice at the start of the rainy season some 6000 years ago (Applegate and Zedeño 2001; Malville *et al* 1998). The 55 Nubia sandstone slabs were set into the fossil phytogenic dune (Schild and Wendorf 2001b, p.37) and range in height from 20cm to 70cm and do not exceed 20cm in width and 10cm in depth and enclosed an area of 49m<sup>2</sup> (Applegate and Zedeño 2001; Schild and Wendorf 2001b, p.37). Several of the stones remained upright, 8 out of the presumed 14, and many more were flat, forming what appeared to be a circle. An additional six uprights were initially identified

aligned east to west, and consisting of two parallel lines of three. The arrangement was re-interpreted during work carried out to move the circle to the protection of the Nubia Museum in Aswan, and a ring of slabs has been proposed enclosing the sights, which is considered to be “plausible but not incontestable” (Wendorf and Schild 2015, p. 366-367). Malville *et al* 1998 emphasize the proximity of Nabta to the Tropic of Cancer at this latitude, where the sun achieves its zenith on two days, approximately three weeks before and after the summer solstice: “Vertical structures cast no shadows under the zenith of the sun and within the tropics the day of the zenith sun is often regarded as a significant event” (Malville *et al* 2008, p.490). The four pairs of gates form two distinct axes, one of which marks the position of the rising sun at the summer solstice at c.6000 years ago (Applegate and Zedeño 2001, p.466). Malville *et al* say that “No evidence of astronomical orientations has been reported, and none is readily discernable in photographs of the circle” (Malville *et al* 2007, p.3).



Figure 17 - The E-92-9 stone circle  
(Source: Schild and Wendorf 2015, p.367, figure 24)

Alignment Group A ends in Complex Structure A, also called E-96-1A, which lies 500m to the south of E-95-8 (Wendorf and Królik 2001). It is one of a number of similar structures (collectively E-96-1), consisting of upright and horizontal stones arranged in an oval with between one and three larger stones at the centre constructed over tablerocks some 2-4m below the play clays and silts, and all located away from settlement areas (Wendorf and Królik 2001). Complex Structure A has been placed in the Ru'at el-Baqar at c.4800BC - a calendrical not a radiocarbon measurement (Wendorf and Królik 2001, p.520) whilst the others excavated to date (around 30 in total) belong to the Bunat al Ansam Final Neolithic. E-96-1A consists of roughly shaped and unshaped rocks that look very much like bedrock. There are no traces of animal or human remains. Of all the structures in the ceremonial centre, these required the most labour. Just digging down to the tablerocks (figure 18-1) would have required considerable effort. It is not known how the tablerocks were located but once they were reached, they were usually deliberately shaped in some way. Sections had been removed from the tablerock in Complex Structure A to create a curved surface.



**Figure 18 - Site E-96-1 Complex Structure A showing : 1, the tablerock; 2, cemented sand with small rock slabs; 3, playa silt; 4, silt backfill inside pit; 5, sculptured stone; 6, laminated sand and silt; 7, surface stones (Wendorf and Królik 2001 p.509, figure 17**

The stones covering the partially-refilled excavation pits could be enormous. In the case of Complex Structure A (E-96-1A), a quartzitic sandstone block greater than three tons was placed 50cm above the tablerock and 80cm below the surface and was shaped and smoothed, with one convex side pecked smooth and a head-like projection at one end, set upright, with the “head” slightly west of north and held in place by two large slabs (figure 18-5). Although it has become conventional to describe it as cow-shaped, the authors originally commented that in reality “it could represent almost anything” (Wendorf and Królik 2001, p.510). The pit was then refilled to surface level and an oval of 71 tightly packed quartzitic sandstone uprights was erected over the top, with a diameter of 5m x 4m, with three partially shaped slabs in the centre. There are various proposals about possible functions (Wendorf and Królik 2001, p.510) but it is impossible to choose between them. That they were important is indicated by the investment of time and energy that went into building them.

The only megalithic alignments that appear to belong to the Ru’at el-Baqar are Group A (figure 19) and Group C, dated on the basis of the stars towards which they were aligned (Wendorf and Melville 2001, p.500). All the alignments were built of quartzitic sandstone, which could be sourced at a maximum of 1km away. Stones were either roughly shaped or unshaped, and many were fractured, some naturally but others apparently as the result of deliberate destruction. Group A consists of clusters of stones, aligned roughly north to south, located c.100m southeast of E-91-1 (Wendorf and Malville 2001): “The entire group represents three sub-alignments, all with lines of site converging on the largest of the Complex Structures located about a km to the southwest” (Wendorf and Malville 2001, p.490).



**Figure 19 - Alignment A, Megalith A-2. Tilted and collapsed, originally composed of four upright stelae (Schild and Wendorf 2015, p.357, figure 9).**

Alignment Group A1 is formed by A-6 to A-10 and Complex Structure A. Each consists of groups of fractured stones, some of which have been successfully refitted and although now may consist of up to seven blocks were probably only one or two large blocks originally. A-10 is still vertical, its base deeply embedded, and probably stood about 1m above the surface at the time of its construction (Wendorf and Malville 2001, p.493). Its azimuth of  $21.194 \pm 0.25^\circ$  orients it to the rising position of circumpolar star Dubhe, the largest star of the Big Dipper, at a date of c.4742BC (Malville *et al* 2008; Wendorf and Malville 2001, p.500), which pointed to the north celestial pole when no Pole Star was visible for navigation (Malville 2009, p.14). Alignment C, consisting of C1 to C7, was aligned towards Sirius, and refitting suggests that blocks reached a maximum height of around 2m, and a width of 1.5-2m, and were substantial constructions. Sirius is the brightest star in the night sky and rose after a 70 day absence just ahead of the sun between 27<sup>th</sup> and 30<sup>th</sup> May and would have been clearly visible throughout June and July at 4820BC $\pm$ 50 (Malville *et al* 2008; Wendorf and Malville 2001, p.500). As Wendorf and Malville state, “The rising stars of Sirius in the dawn, coupled with the northernmost excursion of the sun at summer solstice, may have been viewed as harbingers of the summer rains” (2001, p.500). The authors go on to say that the light of the star may have been reflected in the monsoon waters as they surrounded the megaliths immediately following the rainfall, which would have been a remarkable sight. As Tilley points out, “the character of light and from where it shines may fundamentally alter the qualities of stone,” (2004, p.11) and perception may have had a lot to do with the location and the experience of the alignments. There is a gap of approximately 80 years between the two alignments, which suggests to the authors that they may have been part of a “co-ordinated effort” (Wendorf and Malville 2001, p.501). It certainly suggests a linkage of conceptualization and ideas, a continuity of belief from one generation to the next.

Wendorf and Malville suggest that the various components making up the ceremonial centre “may have been motivated, in part, by the diminishing availability of water at Nabta and a consequent attention to rainmaking rituals” (2001, p.502). They see a linkage between markers in the night sky

and the arrival of monsoon rains, the circle being aligned towards the solstice sunrise, and the megaliths being positioned towards bright stars. The waters of Nabta were in a state of constant change from the moment of rainfall to the sinking of the final wells. As reliability fluctuated this must have been part of the core relationship between people and their relationship with the basin, and this too may be part of why the ceremonial centre was built. Astronomical observations are not unique amongst pastoralists. The Wodaabe, for example, act upon the knowledge that when the Pleiades and Orion are set, rains are imminent (Schareika 2003, p.38), and use lunar cycles to time movements to new pastures, maintaining a strict system of moving camps every 2-3 days and moving out of an area every week (Niamir 1991, p.4). A knowledge of astronomy would have been fundamental to them. In purely functional terms it would not have been necessary to provide a marker to point to the solstice or the stars. Marking them would not have been about locating them, but a) about the action and intention of building the sites and b) about celebrating, activating or otherwise remarking upon the solar and stellar features. In terms of its actual usage it may have had more than one function, capable of acting as a predictive tool for weather, a scheduling tool for movement, a celebration of the predictable in a stochastic world, an interface to a religious mythology associated with celestial body or a trigger for certain rites of passage. It may also have been a signal of territorial affiliation, communicating the presence of a certain ethnic identity or allegiance.

That places become invested with meaning is not a new concept, and has been explored in many contexts. Sapignoli (2014, p.48) says that “virtually all small-scale and middle-range societies have strong locality ties. That is, they have a common territory or area to which they feel a strong connection” whilst Frederick (2014) observes that some sites that are used in a seasonally mobile routine have associations that reinforce identity, ideas and social stability. Above all, the ceremonial elements seem to materialize a concept of place, in the sense of Tilley when he says that identifying with place “requires work, repeated acts which establish relations between peoples and places” (2006, p.14). Tilley’s view that “self-identity and social identity are bound up with the contingencies and uncertainties of the present” and that non-verbal forms of expression are an essential part of that process (2006, p.16) seem to fit well with the different elements of the ceremonial centre and the need to negotiate and re-negotiate different aspects of the landscape under conditions of variability and vulnerability. Nabta seems to have been a locality to which people were attracted not merely for the benefit of livestock, but to express ideas that were associated with the area. In this sense it can be seen as both an expression of a strong affiliation to existing livelihoods and a response to environmental challenges that threatened livelihood management, requiring the development of new relationships and ideas of how to cope with them, all of which tied impacted collective and individual identity. Although the use of such sites are sometimes described as “non-utilitarian” (Sapignoli 2014, p.40), when ceremonies are enacted to support economic and social sustainability this is a highly utilitarian purpose.

Throughout the sites the dominance of notches and denticulates seems to argue for specific activities being carried out, but what these were is not known. Combining hunting, foraging *and* herding with other resource collection activities, will have required much more skill than hunting and gathering in terms of mobility, scheduling and territorial negotiations leading to new values and



ideologies and new cultural outputs. This idea is explored in Britain by Edmonds (1995, p.23) who states that whilst wild resources remained important “the shift to food production created the potential for changes in the manner in which relationships between people were structured, in the perception of thresholds between culture and nature and in conception of landscape and time.”

The subject of time is raised by Olupona (2014, p.6), who points out that many indigenous African religions have a dynamic character based on the combination of linear and cyclical time. Discussed by Bell and Walker (2005, p.11) who also point out that whilst cyclical time (such as repeated daily activities and movements of celestial bodies) may be the usual way of experiencing time, linear time may be marked by unusual events, disasters, and specific memories. These may each have different levels of importance at different times. Both aspects of the human temporal domain are important, with cultural activities and events to mark both. It is often difficult to detect an awareness of linear time archaeologically (i.e. one-off events in history or prehistory) but Nabta provides two examples: construction events and repeated depositions of animal and human remains, which were expanded upon with new construction episodes and new deposition events. Nabta represents not only an awareness of seasonal, cosmological and cyclical time, but episodic linear time as well. There must have been various different conceptualizations of time – when to arrive, when to depart, marking of time taken to travel between one place and another, and the lifecycles of different human, animal and plant species. Crandall (1998, p.109-11) discusses Himba concepts of time in Namibia, where gods live in an eternal realm and humans live within a fragmented, transient temporal scale that is quite different. This type of awareness of states of time may be represented at Nabta by the ephemeral nature of the settlements and the enduring character of the ceremonial stone structures.

As Whittle discusses (2003, p.105) time also encompasses ideas of memory and times past: “looking back is a central part of the identities of people.” Again, experience takes place at different scalar levels: that of erection of a monument and then the repeated actions that take place in the relation to it, reinforcing certain memories at the expense of others, but not constraining them. Memories, like Chinese whispers, mutate. Persistent places (Shiner 1989) have been much-discussed in connection with palimpsests, locales to which people return over decades and centuries. Nabta is very much a persistent place, attracting visitors for thousands of years and it is easy to imagine that memories associated with the livelihoods here were transmitted between generations, leading to ideas of continuity and ancestry growing up around the life-giving pastures and waters of the basin. Certainly the surface scatters of previous occupations will have given a sense of both continuity and change, with different cultural materials making up the living landscape. With each generation the earlier ceremonial components may have entered the realms of myth and oral history of the sort that Whittle describes when he says that ideas and ways of doing things were retained in the memory over centuries, or when an older practice was revived after an interval (2003, p.124). Certainly the surface scatters of previous occupations will have given a sense of both continuity and change, as different cultural materials made up the living landscape, and with each generation the earlier ceremonial components may have entered the realms of myth and oral (Whittle 2003, p.124; Kavari and Bleckmann 2009).

Building on Whittle's ideas about connections between Irish Sea area portal dolmens and the landscape (Whittle 2003, p.153) the tumuli are so similar to local outcrops in appearance that they were not initially recognized as artificial constructions, and this may have been a deliberate reference to the local topography, perhaps connecting people with the land and whatever memories or supernatural entities were associated with it. Overall, Nabta represents multiple types of conceptual and practical complexity, including temporal, geographical, environmental and social.

Wendorf and Schild (2001d, p.671-2) suggest that the stone circle, the Ru'at el-Baqar tumuli, stone alignment and Complex Structure "probably functioned as a regional ceremonial centre." They emphasize that there may have been boundaries between herders and hunters in the area that may have raised the importance of the role of such a centre (p.674). However, there is some variation between the tumuli and what was deposited in them, they may have been built over several hundred years, and whilst it seems unarguable that this area in the northwest section of the basin had a special significance to the groups who travelled to Nabta to herd and hunt, it is important not to overstate the size and number of components that existed at any one time. As a ceremonial centre Nabta probably only came to be a regional centre, if that is what it was, in the Bunat el-Ansam Final Neolithic when the more labour-intensive Complex Structures were built and many more megalithic alignments were established. The stone circle, the varied contents of the tumuli, and the addition of one Complex Structure and two megalithic alignments do not appear to have been a planned ceremonial centre, but something that evolved, building upon original conceptual ideas with new ones. Barratt (1994, p.13) argues against complexes of this sort being the outcome of "a planned intention" and instead suggests that architectural components "should be viewed as a series of localized spaces, created as ongoing projects by builders who rarely glimpsed the totality of their creation" (p.14), not unlike gothic cathedrals. However, there are running themes throughout the ceremonial centre that indicate a unified conceptual scheme. Bell's suggestion that explanations of such phenomena should be "close" to the data being examined in that they should themselves be directly testable or should entail statements that are testable (Bell 1994, p.20) is applicable here. The location and working of the table stones is indicative that they were important. The statement that they are important is indicative of a value system. The lack of any direct relationship between the location/modification of the stones and any economic benefit suggests that this was a conceptualization of an idea. It is not known what the conceptualization was, but it was sufficiently valuable to be initiated and repeated, fulfilling a specific and important role successfully. In other words, there was a demand that the constituents of the ceremonial centre supplied. Again, the ideas that drove the complex structures and other features are unknowable but the repetition in terms of both usage and construction indicates that the monuments were considered to be fulfilling their role successfully.

Whilst there is no indication that a single deity or multiple identifiable deities were worshipped Wendorf and Schild see developments in the Ru'at el-Baqar as the emergence of the "African Cattle Complex", in which cattle serve to symbolize status and power (Wendorf and Schild 1998, p.113). However, the tumuli, with mixed cattle, sheep, goat and, in one case a canine, do not seem to me to amount to strong evidence for a cattle cult, a concept introduced by Herskovits in 1926 and discussed

exhaustively ever since. That is not to argue that it was not an extension of a Nile-side cattle ritual that has not yet been connected with Nabta, but even then there are no direct analogues between the burials at Nabta and those in the Sudan, the latter being far more complex. In Sudanese cemeteries bucrania were found buried with human interments, for example, at Cemetery R12 at Dongola Reach, at Cemetery KDK1 at Kadruka and El Ghaba in the Central Sudan (Chaix *et al* 2012; Paris 2000; Reinold 2001, p.2-10; Salvatori and Usai 2008; Schild and Wendorf 2001a, p.16-17; Wengrow *et al* 2014), and cattle were also important in central Saharan mid-Holocene contexts, where cattle burials have been found (di Lernia 2006). number of writers have recently discussed the importance of relationships of herders with their livestock (Dittrich 2017; Honeychurch and Makar 2016, p.350-351; Oma 2010; Orton 2010; Russell 2010; Sykes 2014) and emphasize how there is often not a clear delineation between human and animal members of the community. Whatever symbolic role cattle may have had during the Ru'at el-Baqar at Nabta, they should not be isolated from goat, sheep, canine and human, which are also represented in some of the tumuli.

Paris warns that it is not possible to detect whether or not a ritual “concerns the *Bos* itself . . . or whether they were an offering to a separate individual or entity” (Paris 2000, p.114). Evans-Pritchard describes how oxen were sacrificed to gods, and were not seen as hosts of spirits, considered to have powers and nor were they venerated as individuals (1953, p.181). Whatever role cattle may have had at Ru'at el-Baqar Nabta, they should not be isolated from goat, sheep and canine, which are also represented in the tumuli.

The burials under tumuli are generally those of animals rather than humans, so there is no obvious indication of the type of human ancestor worship described by Olupona (2014, p.30-31). When considering the human burial and comparing it to the animal tumuli, it is tempting to draw a distinction between them, but this could be a mistake. In some modern groups the sacrifice of an animal may be connected with human ancestors via the act taking place in an area otherwise associated with the human ancestors, as exemplified by the Pokot and Himba today (Bollig and Schnegg 2013, p.11). Alternatively, if a clear division between human and animal worlds was not maintained, both animal and human remains may have been links with both the past and the spiritual, or what Bloch refers to as the transcendental (Bloch 2008, p.2056-2057). Certainly amongst the Himba of Namibia cattle are seen to represent the ancestors, although they are not themselves ancestors, and both are connected with ideas of immortality (Crandall 1998; Whittle 2003, p.80). Silberbauer observes that among the G/wi there is a worldview in which there are few perceptual boundaries between humans and animals (Silberbauer 1981, p.5). Hill describes how animals could be used for augury and had roles as both subjects and agents in the role of human wellbeing (E. Hill 2014, p.272, p.275) whilst Milner and Fuller demonstrate how the use of animals and the focus of feasts and prestige goods should prevent the use of rigid definitions of animals as economic units separated from the human domain (Milner and Fuller 1999, p.9). Kopytoff (1971, p.129-133) describes a continuum of hierarchy of life amongst the Suku of Congo where juniors of a kinship group look to their elders and elders look to the ancestors, in whom their authority resides, whilst Bloch also draws attention to the different types of realities incorporated into people's ability to define transcendental groups where membership may include a range of beings, living and dead (Bloch



2008, p.2057). So it is perhaps unwise to assume that the human burial has a separate status from those of the animals. It is also unclear whether any of the tumuli can be generalized as typical or atypical, given that they could have been built at any time over a 1000 year period, during which ideas can be expected to undergo changes. Woods interprets the human burial at E-97-5 as a sacrifice, arguing that it is consistent with the other tumuli “since the other tumuli contained the remains of sacrificed animals” or that animal burials were giving way to human burials as evinced elsewhere in the Sahara (Woods 2016, p.196). Given that at the moment it appears to be anomalous, either of these explanations could be viable, however there are other options too. What they all have in common is a desire to create markers in the same area of the landscape, implementing ideas and leveraging of labour make these ambitions a reality in this part of the Nabta landscape.

Woods, conflating the Ru’at el-Baqar and the Bunat el-Ansam Final Neolithic, believes that wadis were “places of potency and power since they were channels for run-off of the life-giving rains as a result of rains” (2016, p.188) and interprets the ceremonial components as rituals centred on wadis relating to supernatural forces when rains failed, as they must have done during the mid-Holocene, overseen by a special rainmaker (2016, p.194). This echoes Schild and Wendorf, who say that the wadi was “an ideal place to bribe the gods and beg for rains” (Schild and Wendorf 2004, p.12). Rain-making rituals are not uncommon in ethnographic data where rain could be a manifestation of divinity (e.g. Lienhardt 1961, p.85, 92-93, 101). di Lernia, discussing comparable findings in the central Sahara, sees animals as “mediators between group, territories and divinities” with rain-makers acting as the mediators between these elements (2006, p.61). Woods describes a conceptual worldview incorporated into the ceremonial centre, “a three-tiered cosmos: the heavens, the earth and the underworld represented by the pits under the complex structures” with the carved stone in the shape of a cow perhaps representing “a shamanic rain animal” employed by the shaman in rainmaking rituals (2016, p.194-5). The assumption that the location of the sites was associated with rain due to the location on the edge of a wadi may be erroneous. Other features of the wadi edge that might have been important are the vegetation that grew in the wadi itself and the animals that might have been trapped there. Given the lack of any concrete evidence for any shamanic activity at Nabta I prefer a more abstract interpretation that accepts the importance of the different components without trying to nail a specific religious framework or function to them.

Quite what this actually amounts to is completely opaque. What is clear is that the ceremonial components were new when first envisaged by herders who occupied Nabta, and seem to have been the product of either new types of livelihood, information and knowledge, perhaps aligned with new types of explanatory worldviews that developed as people tried to ensure both economic and social sustainability and that these new components developed into a tradition at Nabta that lasted for 100s of years but was, however, mutable and was modified over time to include variations and new components. With elements repeated but not precisely duplicated, the ceremonial components seem to have formed a narrative over time. It seems to be the perfect illustration of Tilley’s belief that places “are in flux rather than static nodes or points in a landscape” (Tilley 2006, p.21).

### **Ritual and rites of passage**

Ritual is defined here as the material expression of repeated actions carried out in support of religion. Rites of passage are defined as the ceremonies and activities surrounding important transitions that occur through the lives of individuals. These may or may not take place in or around religious monuments, which are structures designed to facilitate the performance of ritual activities. Ritual is an activity that formalizes and reinforces beliefs, ideologies, rules and obligations (Rappaport 1999), and acts as an information flow between the natural and transcendental (Robbins 2001, p.599), serving as a formalizing bridge between ideas and livelihoods. At Nabta the only signs of ritual activity are the deposition of animal and human remains within the tumuli described above.

As discussed above, construction and ongoing ritual activity exist within two separate types of time: linear (the construction of the monument as a fixed point in space and time) and ongoing (where the place is fixed but the activity is repeated and possibly cyclical). At the same time it is embedded in memory, which may have been described in myth or other oral history:

“Ritual tradition may exist in its own time, transmitted from generation to generation in stories and myth, to be enacted at intervals felt to be propitious, or simply contingent upon the actions and interventions of particular individuals” (Whittle 2003, p.124).

Except in the case of the articulated young cow found at E-94-1S, animal remains are disarticulated and scattered throughout tumulus components (e.g. sites E-97-4, E-97-16, E-94-1S, E-97-6 and E-96-4), perhaps in series of repeated events, each tumulus growing as new animal remains were added. The human remains in E-97-5 were in poor condition but it is certain that some skeletal components were missing, either lost before deposition, deliberately excluded, or removed after burial, leaving open the possibility that specific ritual activities surrounded the treatment of the young male with the tumulus. Whittle emphasizes that “an important element of creativity in the renewal of tradition” may be a part of how rituals were enacted (2003, p.124), and this might account for the differences in how the tumuli were used and what was deposited within them.

The deposition of bones that had apparently been butchered prior to burial, suggests that some sort of socially motivated activity, such as group sharing of meat, or ritual offerings may have taken place prior to deposition. Important occasions like rites of passage or sacrifices to deities are obvious candidates, because the killing of an animal represents a loss of resources, including milk, blood, meat and reproductive value, and possibly status. The killing of an animal therefore often represents an investment of another sort. Amongst the Nuer, for example, animals are only killed for consumption of meat when social traditions demand it, “sanctification of social undertakings” as Evans-Pritchard puts it (Evans-Pritchard 1953, p.196), or when starvation is threatened (Evans-Pritchard 1953, p. 193-4). The low number of animal bones in settlement remains at Nabta argues that herds were used for their ongoing benefits rather than their meat. Finally, Jesse *et al* (2013, p.93) see the incorporation of cattle into rituals as a means of allowing societies “to cope both physically and mentally with vulnerable conditions such as climate change.”

There are no signs of residential activity around the ceremonial components. There are small hearths, but they are not typical of the large settlement hearths that are found elsewhere in the Ru'at el-Baqar Late Neolithic Nabta, which argues that they were used for a different purpose. Although there are no records of these having been excavated, and therefore no indication as to their role is possible, it is worth noting that among the G/ui there are certain constraints on areas where deaths have occurred, which permit visits to honour the dead as ancestors who connect both the land and the spiritual world, but prevent habitation (Sapignoli 2014, p.59). A comparable concern with boundaries between the living world and the ritual context may have been enacted here.

The megaliths as a whole imply households working together to articulate not merely the continuity of affiliation to a particular place or area but also common ideas and shared values. There is a communality in the use of such space, a sense that although individual expression is important, this is set within a wider conceptual framework or worldview, perhaps partially associated with the conditions at Nabta.

The few visible remains of ritual activity were focused on the accumulation of stone and the deposition of animals. Stone, however, remains the dominant feature, acting as a durable bridge between the people, the local landscape, including the sky, and beliefs. They seem to serve much in the same way as Renfrew's "attention focusing devices" (Renfrew 1994, p.51-2).

### **Tradition, social values and social guidelines**

The idea of tradition is one of mutability, the use of accumulated experience to adapt and change, whilst building on existing wisdom and values (Spencer 1998, p.249). Hunn describes traditions as "the product of generations of intelligent reflection tested in the rigorous laboratory of survival" (Hunn 1993, p.13). Shared social values and guidelines, like rules of behaviour, and concepts of right, wrong and justice are largely unidentifiable in a prehistoric archaeological context, but tradition may be observed, and it is suggested that where strong traditions are adhered to, the underlying conventions for handling dispute, disagreement and infringements will have been formulated and practiced.

The main theme of the Ru'at el-Baqar is a break from previous traditions in the Nabta area and the establishment of distinctive new traditions. The idea that objects are involved in communication and social reproduction means that they are often connected to ideas of social change and new ideas, and may reflect major decisions about livelihood strategies (Sørensen 1999, p.185). If traditions helped to develop societies and define them, then the presence of a completely new ceramic tradition in the Ru'at el-Baqar at Nabta is something of a cultural revolution, presumably reflecting an entirely new way of conceptualizing life. In the Ru'at el-Baqar there is a remarkable change in form of ceramic material expression. There is no sign of an enforcing hierarchy imposing values, so any form of communication of identity and kinship affiliation is isochrestic, *sensu* Sackett (1982), or stylistically comparative, *sensu* Wiessner (1984). Sackett's isochrestic concept is a form of transmitting social relations unconsciously, whereas Wiessner's stylistic comparison is far more deliberate, a way of negotiating and creating identity and relationships. Hassan emphasizes that people "tend to cling to the paradigms, values and institutions that have proved to be successful in

their own past . . . As a result they are reluctant to undertake corrective actions that go against their social grain” (Hassan 2008, p.41-2) Reluctance to change is also emphasised by the case of the Puebloans in Appendix E. In the Ru’at el-Baqar, this involved not only new materials, tempers and colours but new surface treatments too (Nelson 2002a, p.13-17; Zedeño 2002). As observed above, the emphasis on colours and treatment of those colours, represents a new decorative paradigm, replacing thousands of years of stamped and impressed patterns of a broadly Saharan style. Taking the assemblage as a whole, the variety of shapes, colours and styles is remarkable when compared to earlier ceramic assemblages from Nabta Playa, which were very much in the earlier desert tradition of rocker stamping and impressed wares (Nelson 2002a). Most distinctive of these new vessels are the black-topped wares that were perfected in the later Badarian period. The style and associated techniques may have been learned or imported from elsewhere, for example the Terminal Abkan of Lower Nubia (Gatto 2009; Hays 1984, p. 65-73, 217-218; Lange, and Nordström 2006, p.299), or may have been part of a shared tradition. Later, Quessier Clastic Yellow Ware, Olive Ware, Black-topped and Final Neolithic Ripple Ware seem to have been incorporated into the Bunat el-Ansam Final Neolithic, Tasian, Badarian and A-Group sites, along with calciform beakers at some sites, building upon this new but widespread ceramic tradition (Longa 2011; Math 2006; Nelson and Khalifa 2010, p.137).

The importance of these new styles and the continuing prominence of some components in later periods cannot be assessed merely in technological terms but must be understood in socio-economic terms. If Garcea and Hildebrand are correct in thinking that Saharan pottery from the early and mid-Holocene act as “significant cultural markers” (Garcea and Hildebrand 2009, p.310) then the distinctive design of the Black-Topped and Red Wares may be indicative of a broad set of shared values and attitudes, as well as a shared knowledge and skillset amongst craft specialists, together with a rejection of earlier ideas and traditions in favour of new ideologies and concepts. There is an implied tension between the need to source and use increasingly stochastic water and pasture resources in a mobile strategy, whilst at the same time building in risk-management strategies that acknowledge the increasingly high-risk nature of the desert areas. The need to diversity livelihood strategy may have involved experimentation with new areas and the establishment of new contacts. Nelson and Khalifa speculate that greater interaction would have been necessary between groups and that these new spheres of interaction might have led to cultural exchange, eventually leading to the “melding of cultures” as mobility became increasingly constrained (2010, p.140).

Gatto discusses the implications of “fluidity of group affiliation in boundary areas” and sees the desert and Nile as a nuanced continuum between the Nile and the nearby deserts (Gatto 2009, p.127). Although she is discussing later phases, corresponding to the Bunat el-Ansam Final Neolithic onwards, her comments seem to be just as valid for Nabta in the Ru’at el-Baqar. Crumley’s research has shown that in frontier situations there may be various boundary situations that crosscut each other including social, linguistic, topographic, climatic, administrative and commercial, forming a “complex dynamic system” (Crumley 1995, p.2). As Gatto suggests (2009, p.127) the work of Lightfoot and Martinez (1995) is valuable in this context. They suggest that frontiers are “socially charged places where innovative cultural constructs are created and transformed” involving processes

of creolization or syncretization (Lightfoot and Martinez 1995, p.472). In the Ru'at el-Baqar Nabta there are four potential frontier-type situations. First, whereas Nabta lies in modern Egypt, it is very near the modern Sudanese border and has more in common with the archaeology of northeast Sudan or Nubia than it does with northern Egypt (Edwards 2004; Gatto 2011; Gatto and Hildebrand 2009), although Nabta is often discussed as a phenomenon contributing to later Egyptian soci-economic development (e.g. Wendorf and Schild 2004). The second scenario focuses on the Nile. Even though Nabta is only a couple of days walk from the river there may have been a perceptual dichotomy between desert and Nile not unlike the Pharaonic period's mythological distinction between the black land of the Nile floodplain and the red land of the deserts (Sidebotham *et al* 2008, p.21). Whilst there is a third boundary, the natural granite barrier across the Nile at Aswan called the First Cataract, this was only really relevant if water transport was an important factor at the time, which it does not appear to have been. Model boats only appear from the later Badarian (Brunton 1928, p.34; 1937, p.7, 57) and there is no other evidence of water transport in this period. A fourth, and perhaps more realistic type of barrier is each group's own identity, expressed via material culture, which would have had to be negotiated between groups in a number of ways.

As Klima points out in his discussion of the new knowledge brought in and implemented amongst the Barabaig by exogamous marriages, adoption of new ideas does not necessarily challenge group or kinship identity (Klima 1970) but can reinforce the strength of a group's risk-handling abilities. At the same time, Lightfoot and Martinez highlight how group identities may be manipulated during a process of transformation by the meeting of diverse groups where they meet (Lightfoot and Martinez 1995, p.474). And at the other end of the spectrum, Appendix E illustrates how Puebloan Indians, amongst many other examples, resisted all forms of new economic and cultural innovation because they did not gel with traditional livelihoods and worldviews (Vlasich 2005). There is potentially a wide range of possibilities in between. Nabta's ceramic technology, material expression and innovation exist somewhere along this continuum of possibilities. As Wiessner states, "style is not just a means of transmitting information about identity, but an active tool used in social strategies, because in the process of presenting information about similarities and differences, it can reproduced, disrupt, alter or create social relationships" (1984, p.194).

As environmental conditions influenced and constrained patterns of movement for all groups using the Western Desert as a resource, people will have circled more closely together, sharing increasingly limited resources. What was happening at Nabta Playa may well be explained by a blending of different traditions, where new ceramics are a component of a revised way of thinking, an outlook that incorporated new conceptualizations of the material world to establish a new and mutually compatible approach to living.

The ceremonial centre probably had its own set of traditions relating to it. Occupied throughout the period of the Ru'at el-Baqar, it will have become embedded in the ideas of those who occupied Nabta, and probably formed a mutating part of oral tradition. Kavari and Bleckman (2009) discuss how semi-nomadic Otjiherero pastoralists in northwest Namibia practice praises of places called omitandu. This is an oral tradition that leaves no material remains. It references the collective memory of the community, capturing aspects of history that it was thought should be remembered

such as concrete items like people, lineages and events, or less easily definable aspects of living, like landscapes and places. Lack of evidence of such celebrations does not mean that such conceptualizations and linkages were not made.

The Ru'at el-Baqar Late Neolithic tumuli of the northwestern part of the playa were thought to have been unprecedented in the Nabta area when published in 2001 (Applegate *et al* 2001). However, excavations at Gebel el-Muqaddas (sacred mountain) in 2007/8 identified tumuli of a different type from those in the Ru'at el-Baqar, which contained pits that were apparently re-opened several times and occasionally contained small pieces of gazelle bone and artefacts, dating to the El Nabta/Al Jerar Early Neolithic (c.7000-6800BC) (Bobrowski *et al* 2014). The tumuli at E-06-04, on the northern extremity of the Ru'at el-Baqar ceremonial area consist of a total 224 structures to date, of which 28 were excavated. There are also three stone structures at Bir Murr 1, 100km northwest of Nabta that remain unexplored (Connor 1984) but are associated with a date of c.5250BC (Applegate *et al* 2001). It is therefore uncertain if the Ru'at el-Baqar tumuli should be considered as an innovation, or whether they are in fact the persistence, in a modified form, of a tradition established in the El Nabta/Al Jerar Early Neolithic, at a time when semi-permanent settlement and grain silos are also found. To date there have been no comparable features found in the Ru'at el-Ghanam Middle Neolithic, but as the discovery of a Bunat el-Ansam Final Neolithic cemetery E-06-04 at Gebel Ramlah itself demonstrates (Kobusiewicz *et al* 2010), the potential for new discoveries at Nabta Playa and the surrounding area have not been exhausted. Cattle burial traditions are known from Nubia and Libya, but Wendorf and Schild believe that these are probably C-Group or later in date. Similarly, 100 tumuli at El Bahrein oasis seem to have been contemporary with the C-Group (Wendorf and Schild 2001d, p.668).

### Material articulation

Whilst it is now unclear whether the tumuli and Complex Structures at Nabta represent an innovation (due to the discovery of comparable Early Neolithic examples), the stone circle and megalithic rows are an entirely new idea, and the ceramic style is a complete departure from earlier types. The new ceramic types may be seen as “objects of thought” (Edmonds 1995, p.41), a deliberate response, amongst others, to aspects of economic life, movement through the landscape, stochastic weather conditions, negotiated relationships with Nile valley inhabitants and the cascade of new decisions that these implied. Just as climate change was slow and patchy (Riemer *et al* 2008), so responses to it will have been on a generational scale, with new ideas, experiences and even new people helping communities to redefine themselves in ways envisioned by Wiessner, both economically and symbolically. The stylistic paradigm appears to have developed out of Abkan, Khartoum Variant and other Nubian and central Sudanese forms of pottery design, implying increasing contact between formerly desert-based communities and Nile communities, with the resulting exchange of ideas, knowledge and worldview that increasing proximity would have encouraged and perhaps required. Whilst there are only minor changes in lithic technology, which appear to have been largely functional rather than stylistic, the pottery represents not just a stylistic reinvention of a functional component, but a rejection of former material expression. This appears to

tie in with identity and new economic practices. Whereas the early Holocene ceramics were regionally differentiated but identifiably homogenous stylistic template and graphical symbolic medium across the eastern Sahara, the new styles found at Nabta were typical only of the Nubian and Sudanese Nile region. The contrast between a widely adopted conceptualization of pottery form and decoration that was replaced by a more regionally constricted type argues for different ethnic or cultural negotiations, perhaps with increasing proximity amongst groups, and increasing porosity between them. As Edmonds discusses (1995, p.18) increasing skill and specialization may have incorporated both the recreation of ideas through everyday routines as well as the more explicit acknowledgement of ideas about self and society. Wobst (2000, p.47) suggests that uniformity of design is a way of reinforcing ideas and routines that are under threat – an act of social interference to preserve certain conditions. In the case of Nabta what began as a way of reinforcing a new way of negotiating between tradition and innovation may have become a way of reinforcing identity over generations, particularly in the face of creeping environmental deterioration. In short, the impact of the decisions made in response, over generations, to a new rainfall regime, increasing risk and uncertainty, new contacts and new patterns of mobility was expressed, at least partially, through new forms of material expression.

Although there are many drivers for social behaviour and its development, production is always an important part of biological and social reproduction (Kössler 2003, p.12). The ceremonial centre may be as much about the materialization of concepts as about the creation of the structures. The building and ritual surrounding the use of the structures will have been just as important a component of their value as the result. Building on the work of Barratt, Richards focuses on circles in particular as “analogous to places of worship” where the actual practice and process of construction becomes subordinate to function (Richards 2013, p.3-5), the result not necessarily of a fixed plan but a negotiated outcome leading to “a reaffirming of relations between people” (Barratt 1994, p. 13-23; Richards 2013, p.7-8). At the same time, adopting Tilley’s description of landscapes as “systems of signs” that are incorporated into identity and become agents of that identity, the monuments could have been a way of both connecting with and celebrating the group’s relationship with the Nabta basin. Incorporating ideas of time (linked to appearances of celestial bodies), navigation (a familiarity with the night skies) and space (enclosure or definition of space) there are different types of idea built into the circle. The term “calendar” circle applied by the Combined Prehistoric Expedition imposes declarative assumptions about function, but the truth is that how it was used is unknown. It could have been a tool to predict weather and the need to move; be a celebration of repeated astronomical activity in the face of a stochastic world; a trigger for rites of passage, or a focus for rituals that identified religious mythology with celestial bodies. It is also possible that its role changed over time. The tumuli closely resemble fragmented outcrops, and the all of the monuments were manufactured from local stones rather than imports, which would have been available if required. This suggests that either the exact material was unimportant to the purpose of the construction or that the material, being local, was a fundamental part of the conception, an extension of the valuable resource potential of the site. Finally, Richard Bradley’s work in northern England suggests that some monuments may have roles as territorial indicators – the idea that resources are affiliated with a group or set of related

groups (Bradley 1994). In each case, natural items taken from the immediate landscape are transformed from natural into cultural forms.

### **Mobility**

The presence of cattle, sheep and goat, all with slightly different requirements, the temporary nature of both plant and aquatic resources and the presence of Nile components argues that Nabta was just one component in a much wider landscape of experience and usage. The desert is likely to have formed part of the mental worldview in which risk negotiation was one of many factors. Whilst most of this case study focuses on the character of the settlement and the ceremonial centre, and the resources that brought people into that area, the perception of the people who visited Nabta was almost certainly much wider, comprising a view of a much larger world of landscape use and understanding, as groups moved between areas along familiar routes, where activities were carried out and memories were formed (Sheller and Urry 2006, p.210). Whittle (2003, p.43) discusses routine movements that “imply structure separations, fragmentation and fission, followed by fusion and aggregation” and directs attention to the multiple negotiations and interactions that this would have entailed. Bender (1992, p.735) talks in terms of multi-vocal landscapes with people understanding and engaging with the landscape in their own ways depending on time, place, gender, age, class and religion. Bender *et al* (1997) discuss “nested landscapes” as linkages between the smallest dwelling space and the most distant topographical feature, connected via the medium of identity. Tilley suggests that landscapes are “being bound up with power, domination, labour, love and life” with “massive ontological import from the moment we conceptualize them as being lived through, mediated, worked on and altered” (Tilley 2004, p.24-25). Helpful in this area is Schareika’s assessment of mobility amongst the Wodaabe of southeastern Niger (2003, p.18), which indicated that it was essential to an individual’s status as a good manager of herds and because it is the only means by which stock loans became available there is an element of social risk both for the individual and the community if mobility is not practiced. It also makes up an important component of the Wodaabe’s worldview, with both animals and men becoming integrated with the environment “and the rhythm of life exercised therein” (Schareika 2003, p.18). Taking this a step further, Turton’s analysis of mobility amongst the agro-pastoral peoples of the lower Omo valley (southwest Ethiopia) concludes that it is not just a practical necessity but that it was essential to their sense of self: “the very *idea* of movement was a defining feature of what it meant to be Bodi, Mursi, Nyangatom, Daasanach etc . . . In a sense they *were* movement.” (Turton 2011, p.165, author’s italics). This is a point reinforced by Belal *et al* (2009) with respect to the Ababda of Wadi Allaqi where today women remain by the permanent water source to take advantage of the benefits of water, space to supervise children and small animals and carry out small scale cultivation, whilst men depart to herd livestock, an arrangement in which “being at one with the desert” was important to the sense of identity of many of the men interviewed (Belal *et al* 2009, p.131).

Whilst most of this case study focuses on the character of the immediate vicinity of Nabta, and the resources that brought people into that area, the perception held by the people who visited Nabta will have comprised a much larger world of multi-vocal landscape use and understanding, as



groups moved between areas along familiar routes, where activities were carried out and memories were formed as part of a process of aggregation and dispersal (Bender 1992, p.735; Bender, Hamilton and Tilley 1997; Honoré 2017; Sheller and Urry 2006, p.210; Whittle 2003, p.43). Helpful in this area is Schareika's assessment of the Wodaabe of southeastern Niger (2003, p.18), where mobility contributes to an individual's status as a good manager of herds which is the only means by which stock loans became available. In the Wodaabe's worldview both animals and men become integrated with the environment "and the rhythm of life exercised therein" (Schareika 2003, p.18). Turton's analysis of mobility amongst the agro-pastoral peoples of the lower Omo valley (southwest Ethiopia) concludes that it is not just a practical necessity but that it is essential to a sense of self: "the very *idea* of movement was a defining feature of what it meant to be Bodi, Mursi, Nyangatom, Daasanach etc . . . In a sense they *were* movement." (2011, p.165, author's italics). Amongst the Ababda of Wadi Allaqi where today women are based at a permanent water source to supervise children and small animals and carry out small scale cultivation, men depart to herd livestock because "being at one with the desert" is important to the sense of identity of many of the men (Belal *et al* 2009, p.131). A similar point was made by Roe (2008) who says that knowledge of the desert confers status on men.

Travelling to Nabta and beyond Nabta may have combined economic activity with the spirit of a pilgrimage, endowing the process of travel with a spiritual component with the route as much as the playa basin containing associations that were unique to that destination (Claassen 2011; Sheller and Urry 2006, p.213). Nabta was a destination that had been materialized both by broadly contemporary site furniture and the development of ceremonial features. Nabta was a place embodied in both the physical and numinous realms of the landscape. This landscape endured but fluctuated and the features at Nabta suggest more than mere adaptation but rather an intention to exert control. Nabta was a node in a wider landscape that made up people's activities situated within the wider framework of movement and experience. The routes between the nodes would have made up part of this experience. These routes have not been identified but it can be proposed that they were perceived and experienced in clearly differentiated ways, in a similar relationship to fuel stations, hotels and the routes between them (Sheller and Urry 2006, p.210), with different types of activities taking place with different materials and technologies in nodes and along routes (Claassen 2011; Sheller and Urry 2006, p.213). Niamir makes the point that routes taken are influenced by a number of social considerations including proximity to markets, cultural gatherings, territorial boundaries and social relations (1991, p.4). The activities in different nodes may be essential to the identities of people, and may be very different from one node to another, but as discussed above may at the same time require group identities to be fluid. Claassen's discussion of pilgrimage routes in modern Mexico concludes that what she terms "landscapes of movement" act to "create a narrative of experience which chronicles local, even regional history, built upon the experiences of individuals and families" (Claassen 2011, p.502) raises the possibility that in the case of travelling to Nabta and beyond Nabta, the combination of playa resources and the ceremonial centre may have combined economic activity with the spirit of a pilgrimage, endowing the process of travel with a spiritual component with which travel between other types of node might not have been associated, with the route as much as

the playa basin containing associations that were unique to that destination. Nabta was a destination that had been materialized both by broadly contemporary site furniture and the development of ceremonial features. Both were an ongoing articulation, perception and conceptualization of Nabta as a place embodied in both the physical and numinous realms of the landscape. This landscape endured but fluctuated and the features at Nabta suggest more than mere adaptation but rather an intention to exert influence over outcomes.

The role of Nabta within this wider landscape of experience may have skewed perceptions towards a compulsion to return to Nabta in the Ru'at el-Baqar, revisiting both routes towards the node and the site itself as one integral experience. This possibility is reinforced by ethnographic studies. Turton, for example, says that amongst the Mursi of southwest Ethiopia the community have a sense that their hold over place as precarious and that locations have to be maintained carefully by both martial means and "spatializing" rituals (Turton 2005, p.268). Similarly, Appadurai describes how people have to carve out a sense of identity from both the social and natural environment, in order to hold onto the "inherently fragile social achievement" of maintaining a sense of identity connected to place "against various types of odds" using rites of naming and initiation to reinforce that identity in a particular place (Appadurai 1996, p.179).

### **Craft manufacture**

In Physical Assets I looked at some of the skills involved in craft manufacture, from raw material acquisition to eventual output. However, there are also aspects of these skills that belong not merely in physical and subsistence realms of life but also, fundamentally, in the social dimension.

Stone was brought to Nabta to work into finished products. However, there are few signs that stone tools required a significant cognitive and technical investment to produce. Production took place around hearths, suggesting that there was no requirement for specialized workshop areas. An exception is E-94-2 where debitage was found at the site but not in the vicinity of hearths.

Ceramics are radically different from those of the Ru'at el-Ghanam Middle Neolithic. The Ru'at el-Baqar represents a new decorative paradigm that may have been as much about abandoning previous affiliations and modes of expression as acquiring new ones. However, in the absence of manufacturing sites, there is no indication of how these changes were incorporated into livelihoods or perceived socially. The lack of information about craft production is a stumbling block, because the production and consumption of craft items is of major interest in this area, and must have taken place (Hurcombe 2014).

### **Internal relationships of trust and care**

Although the mechanisms so important to modern ethnographic communities are often archaeologically invisible, co-operation is implicit in these sites. However, one of the key difficulties in assessing Nabta is the overwhelming sense that it is only one small part of the story, and that elsewhere other parts of the story are waiting to be recognized and these are where complex relationships might be enacted.

### Inter-group relationships

Relationships between Nabta and other areas, presumably mainly to the southeast where material cultural has considerable similarities, are likely (figure 20). Grandval emphasises that today in Africa mobility relies on a mixture of scouts and extensive social networks for understanding where grasslands are available and what sort of quality they represent (2012, p.3), but other types of relationship are also possible, including exchange meetings, land tenure and other resource sharing negotiations and acquisition of marriage partners.

The presence of a cattle skull in a grave at el Barga dating to 5800BC, the earliest date confirmed so far, suggests that cattle were introduced to the Kerma area of Upper Nubia at around that time (Honneger 2014, p.27), which in turn indicates that there was some sort of movement between the two areas, and a relationship in which products and knowledge were being transferred. To the south, the main pastoral activity in the same area begins at around around 5000BC in the central Sudan (Honneger 2014, p.27). In the Kerma area the mid-Holocene is associated with an intensification of pastoral activity in the 6<sup>th</sup> Millennium, with settlement sites from Kadruka featuring cattle, followed by sheep and goat and only rare wild remains. Burials contained cattle skulls next to the body. Neolithic sites beneath Kerma burials have been excavated and produced remains of huts, small fences and fireplaces accompanied by enclosures that may have formed dry season camps that could be used in conjunction with wet season pasture (Honneger 2014, p.27-28). Again, this suggests a similar pattern of movement for Upper Nubia as the one being proposed for Nabta, and this spread of the pastoral livelihood strategy could be an indication of links between the two areas, although more work needs to be done to relate different phases between the two areas and search for more determinative similarities between the two areas.

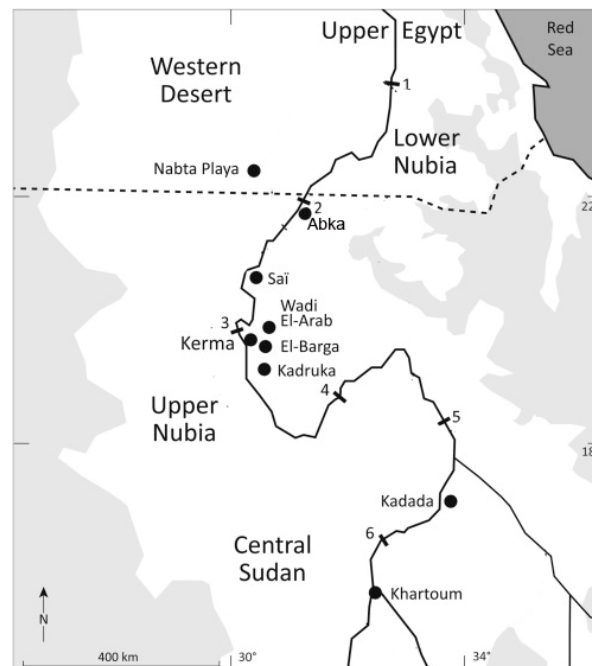


Figure 20 – Upper Nubian sites mentioned in the text  
(Source: Honneger and Williams 2015, p.1, figure 1, modified)

The acquisition of flint has been mentioned, with the closest source 70km to the north, but it is possible that another source was the Kharga-Dakhleh basin, some 200km away, and that the Eocene scarp was used by both oasis and Nabta occupants. That there was contact with people from Dakhleh or Kharga is supported by the presence of bifacially worked tools in the Ru'at el-Baqar, a technique characteristic of the northern oases. There is usually a north-south divide in tool technology, with bifacially worked tools being confined mainly to the north of Egypt (Kuper and Riemer 2013, p.41). The south of Egypt belongs to a different tradition, more closely linked to those of the Sudan. The presence of bifacial tools in the Nabta assemblage therefore implies a connection further to the north, with the contemporary Bashendi B of Dakhleh or the Late Baris of Kharga.

Freshwater bivalves (Gautier 2001, p.620) reinforce the idea of connections with the Nile, whilst Red Sea *conid* shell (Gautier 2001, p.620) suggest contacts across the Eastern Desert. Agate and jasper may also have been sourced from the Eastern Desert. Acquisition expeditions to acquire flint from 70km to the north may have put people into contact with contemporary oasis inhabitants from Kharga and Dakhleh, as suggested by the presence of bifaces in Ru'at el-Baqar assemblages.

The new types of ceramic appear to define new patterns of contact, exchange and symbolic expression, as discussed above.

All of these are possible signs of “acculturation” as defined by Sam and Berry: “phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original culture patterns of either or both groups” (Sam and Berry 2010, p.473). Decreasing humidity and increasing contact with other groups, could have lead, to some degree of interdependence and even some assimilation, which might lead to both positive and negative impacts, including stress and psychological difficulties that could lead to cultural responses (Sam and Berry 2010, p.474) of the sort that are visible in the changed cultural output and acquisition of the Ru'at el-Baqar Late Neolithic.

The maintenance of kinship relationships, the acquisition of marriage partners and the reaffirmation of religious and ideological connections may have made such connections imperative (MacDonald and Hewlett 1999; Whallon 2006). At the same time, the need to negotiate for territory and expand into new areas may have created the “shared visions of space” identified as a concept by Calvo *et al* (2016), a vision that could undergo change and challenges as increasing variability in environmental conditions influenced decisions about land use and territorial boundaries. As groups gradually dispersed from increasingly inhospitable desert areas, some converging along the Nile valley (Hassan 1986a, p.71) new ways of mediating relationships and handling resources must have become necessary. McIntosh's suggestion that when similar patterns of aridification occurred in Middle Niger, the intensification of contact in a set of microenvironments, a new “symbolic ‘contracts’ for exchange” took place, and this may be applicable here and for other refugia (McIntosh 1993, p.217). The abandonment of a wider regionally relevant symbolic repertoire in favour of a more localized and newly innovated ceramic output could be an indicator of precisely this sort of social mechanism in which “formal and regular relations of mutual accommodation and generalized reciprocity” were established (McIntosh 1993, p.212). The increasingly specialized livelihoods that

developed along the Middle Nile would be the types of response that McIntosh predicted. If Nabta herders were derived from one of these increasingly specialized communities, they would have brought both their own individuality, in this case a traditional toolkit, along with a ceramic repertoire representing a symbolic repertoire shared by multiple ethnicities. These shared symbolic components could have served to facilitate a number of social and economic, including gatherings based on rites of passage, trading expeditions, or the movements of spiritual experts (Cliggett 2005; MacEachern 1994, p.218). Understanding how craft was organized at this time would have given us a much better insight into relationships between craft producers and craft consumers, types of knowledge transfer and the means by which items were produced and acquired.

Close (1992) has suggested that E-75-8 might be an aggregation site, an idea also proposed by Woods for the ceremonial centre at Nabta (2016, p.194). Hofman defines an aggregations as “a means of conducting important large-group activities in environments where situation where continuous long-term large-group coexistence is not viable or economically/socially effective,” the purposes of which could include socially impelled activities, information exchange, sourcing of marriage partners and maintenance of group identity (Hofman 1994, p.346-8). Permanent rather than temporary water sources tend to be preferred (Hofman 1994, p.346), so if one were to predict this type of aggregation, the Nile would be a more attractive prospect than Nabta. However, the predictability of the resource availability is another factor, as is the apparent importance of the area from a spiritual and ceremonial point of view. If the waters at Nabta were reliable enough to make it a fixed seasonal destination, this would significantly improve the likelihood of aggregation (Hofman 1994, p.351), with different ethnic groups, converging upon a resource-rich area and sharing the space in spite of differences in kinship, ethnicity or economy. Although the size of E-75-8 suggests a concentration of people, and the three separate groups of hearths found at E-94-2 might suggest a division of groups based on something other than time, the homogenous nature of the lithic and ceramic assemblage and the shortage of exotic materials do not immediately suggest multiple groups converging on Nabta. Until further work is carried out to investigate this question, the issue of whether Nabta was used by single or multiple groups at a time remains unresolved.

I think that it is reasonable to conclude that the people of Nabta had contacts with external groups, not merely parts of their own kinship network, contacts that encouraged them to identify themselves in new ways. These contacts may have extended as far south as the Khartoum area of the Sudan. This would tie in increased evidence of the north-south axis of contacts along the Nile, increased interest in ceremonial deposition of animal and human remains at Nabta and changes in the entire paradigm of pottery manufacture (Edwards 2004; Gatto 2011; Nelson and Khalifa 2010).

None of this either supports or eliminates the possibility that Close was right, and at the moment stable isotope analysis has not been carried out on cattle remains to help determine signs of aggregation from different areas as it did in the central Sahara (di Lernia 2013).

### **Ethnicity**

Cultural output is often used to form and renegotiate identities, meaning that cultural output can sometimes be identified as measures of broad ideas of ethnicity in archaeology (Barth 1969;

Knapp 2014, p.43) but may also disguise more subtle processes. Díaz-Andreu's view of ethnicity is as something perceptual and fluid, rather than something embedded in the material (Díaz-Andreu 1998; 2015), a perception based on "identification with one or more broader groups on the basis of perceived cultural differentiation and belief in a common descent" (Díaz-Andreu 2015, p.102). As Díaz-Andreu says (2015, p.102) "people can identify with one or more broader groups . . . multiple ethnic affiliations usually coexist and overlap in the same person." These larger units of membership may also be subject to challenge and change. How this sort of ethnicity can be identified archaeologically continues to be debated (Bentley 1987; Cribb 1999, p.44-58; Díaz-Andreu 1998; 2015; Knapp 2014; Jenkins 2015; Shennan 1989/1994). The greater understanding of the role of adoption of symbols, trade, exchange and social fluidity (Hodder 1982c, 1982d, 1985, 1990; Kratz and Pido 2000, p.47) indicates that materials are not always unambiguously associated with individual communities but may be more representative of manipulated messages about larger units of membership to which communities belong or with which they associate.

For the mobile pastoralists at Nabta ethnicity may be temporary for the individual and may change in both the short and long term for the community as a whole as conditions change, and particularly if groups are in the habit of forming and reforming and moving through different territories. Social fluidity may exist, and often clearly does (Cliggett 2005; Hobbs 1989; Manger *et al* 1996; Wachuku 1979, p.247) within a larger identification with kinship groups, religious beliefs and other core ideas of identity, belonging and differentiation. A general correspondence between ceramics and animal remains in particular, as well as lithics, suggest a broad ethnic association between Nabta and the Middle Nile (Edwards 2004; Honegger 2014; Midant-Reynes 1002/2000; Nelson and Khalifa 2010; Tassie 2014) but ceremonial elements at Nabta are quite unlike anything elsewhere. If Tilley is correct in thinking that places or landscapes can be viewed as agents that actively produce social identity (2004, p.31), and that social identity "always requires specific concrete material points of reference in the form of landscapes, places, artefacts and other person" (Tilley 2004, p.217) then the ceremonial centre may be part of the process by which the groups that came to Nabta differentiated themselves from other groups within and beyond a broader ethnic grouping, with ideas expressed along a continuum between ethnic and kinship group identities.

### **Symbolic and social risk**

Richards (2013) defines three types of risk associated with the construction of megalithic monuments: physical (the risks of handling massive stones), symbolic (items undergoing transformation into an object via symbolic value via ritual, which carries a risk because the rituals must be perceived to succeed) and social (individual social status, advancement and social debt risk being undermined if the project fails). The ceremonial centre components were not destroyed when Nabta was abandoned at the end of the Ru'at el-Baqar, so they were not necessarily seen with the sort of rejection that Barbara Bender identifies for the Stonehenge area in Britain's later Neolithic (Bender 1992, p.751). The lack of any assemblages other than the typical Ru'at el-Baqar items suggest that the site was not used by other groups, so if components of the ceremonial centre were intended to secure access to land, it was apparently a successful one, minimizing both economic and social risk.

In the day to day management of their livelihoods, social risk is most likely to have impacted individuals and households. Questions about when to move herds and where to move them to might involve elders, experienced herders, offspring and informed outsiders in order to reach a decision. The exchange of information, ranking of the quality of that information and the decision to act upon it and the logistics of so doing may allocate prestige on individuals, but may also undermine their prestige if the information acted upon is bad (Schareika 2014).

The investment in domesticated animals and the contrast of this and the relationship with hunted animals, involving delayed return and potentially the increasingly important and symbolic role of herds in human lives (Dyson-Hudson and Dyson-Hudson 1980; Evans-Pritchard 1940) means that the tumuli containing the remains of cattle and ovicaprids should come as no surprise. Tying in human, herd and land, the burials may be an indication that any threat to herds was associated not merely with the three types of risk defined by Richards (2013) economic risk (the potential loss of food products and exchange capital) but also with social risk (loss of status and ability to negotiate for social benefits) and symbolic risk (the loss of whatever numinous qualities were embedded in herd animals). When bound together, these are complex ideas.

Close (1992) has suggested that Nabta Playa, specifically E-75-8, may have been an aggregation site where different groups met to exploit the same resources. Although I have already discussed this in *Physical Assets*, and have been unable to find any data either for or against the hypothesis, it is worth mentioning that Zori and Brant draw attention to increased ceremonial or ritual activity in situations where people coalesce and are forced to, or agree to share resources, where such activities help to foster social cooperation and cohesion to minimize conflict and minimize social risk (Zori and Brant 2012, p.4006) a topic also discussed by Hofman (1994).

There are no unambiguous signs of social segregation at Nabta but the association of kiln-based crafts with caste groups and social proscription in some groups might indicate that increased specialization is a candidate for social risk – the risk of being segregated in a negative and reductive way (Jalata 2010, p.12-13).

## **Subsistence Assets**

### **Evidence for subsistence activities**

#### ***Food Production***

As I have described in the section on Natural Assets, the character of the Western Desert rangelands was becoming increasingly unpredictable throughout the mid-Holocene, with water sources both drying up more rapidly and probably increasingly saline. This would have provided a challenge to subsistence strategies, and in Nabta there seem to have been a variety of responses, although the data is limited. In the following tables (tables 8, 9, 10, 11 and 12) the potential for food production and consumption is examined; in the next section, the mechanisms by which these could have been leveraged is discussed. The table shows only samples that have been confidently labelled

as dating to the Ru'at el-Baqar Late Neolithic. Those where contexts are unclear have been excluded.

Evidence for domesticated animal species in Nabta Playa			
Specie	Site	Data	Reference
Cattle ( <i>Bos primigenius</i> f. <i>Taurus</i> )	Settlement E-75-8	Surface: Upper milk molar, a few tooth fragments and a distal subadult metatarsus, several enamel fragments (surface)	Gautier 2001, p.624-5
		Unit 5: Several tooth fragments , scapula fragments, a proximal half of a first phalanx and possible juvenile sesamoid, a carpal, a distal half of a meta-tarsus,	Gautier 2001, p.624
		Spit 1: Several fragments derived from at least 4 jugal teeth, a scapula fragment and perhaps a metacarpus shaft fragment	Gautier 2001, p.625
		Spit 2: Several fragments derived from at least 7 jugal teeth	Gautier 2001, p.625
		Spit 3: Several fragments derived from at least 6 jugal teeth	Gautier 2001, p.625
		Spit 4: Lower molar fragment, an enamel fragment, a mandible fragment and a metacarpus fragment	Gautier 2001, p.625
	Complex Structure E-96-1	Surface: three enamel fragments	Gautier 2001, p.625
	Tumulus E-94-1N	Articulated cow burial probably about 2½ - 4 years old.	
	Tumulus E-94-1S	Most disarticulated cattle – up to three individuals, a subadult, a young adult and an older individual. A distal humerus, radius, complete metacarpus, first and second phalanges, other leg elements, part of a vertebral column, two fragments of horncore, two upper molars and one lower third molar.	Applegate <i>et al</i> 2001, p.473
	Tumulus E-96-4	Remains of disarticulated cattle representing four individuals, a one juvenile, one subadult and two juveniles. An astralagus and tarsals of	Applegate <i>et al</i> 2001, p.475



Evidence for domesticated animal species in Nabta Playa			
Specie	Site	Data	Reference
		the right leg, left and right distal humerus, pair of petrous temporal bones and a larger left one, two upper third molars, a thin walled long bone.	
	Tumulus E-97-4	Disarticulated cattle, probably two individuals, a juvenile and subadult represented by a mandible fragment containing five teeth, lumbar vertebrae , a metacarpus shaft and a first phalanx	Applegate <i>et al</i> 2001, p.476
	Tumulus E-97-6	Disarticulated cow - longbone splinters	Applegate <i>et al</i> 2001, p.479
	Tumulus E-97-16	Disarticulated cow, possibly subadult, represented by a mandible, a skull tooth fragment, two molars and some longbones splinters of <i>Bos</i> .	Applegate <i>et al</i> 2001, p.481
Sheep/goat ( <i>Ovis ammon</i> f.aries / <i>capra aegagrus</i> f.hircus	Settlement E-75-8	Bone fragments	Close 2001, p.324
		3 horncore fragments	Gautier 2001, p.624
		Lower 1 <sup>st</sup> /2 <sup>nd</sup> molar (spits 1-4)	Gautier 2001, p.624
		Horncore (South Trench B, Hearth F7, subsurface)	Gautier 2001, p.625
		Horncore	Gautier 1980, p.333-334
		A horncore from a young or castrated sheep	Gautier 2001, p.625
	Tumulus E-97-6	Possible anterior cannonbone flake	Applegate <i>et al</i> 2001, p.479
Sheep	Tumulus E-94-1S	Remains of one individual – one front leg and two hind legs	Applegate <i>et al</i> 2001, p.473
Sheep/goat or Dorcas Gazelle	Tumulus E-94-1N	Remains of one individual, semi-articulated. Over two dozen bones including rib and subadult tibia	Applegate <i>et al</i> 2001, p.471

Table 8 - Evidence for domesticated animal species in the Ru'at el Baqar

***Hunting and foraging*****Evidence for wild animal species in Nabta Playa**

## Case Study 1: Nabta Playa

Data	Site	Data	Reference
Dama gazelle	Settlement E-75-8	Unspecified	Close 2001, p.384; Gautier 2001; p.632, Table 23.6
Dorcas gazelle	Settlement E-75-8	Unspecified	Close 2001, p.384; Gautier 2001; p.632, Table 23.6
Hare	Settlement E-75-8	Unspecified	Close 2001, p.384; Gautier 2001; p.632, Table 23.6
	Tumulus E-97-12	Intrusive	Applegate <i>et al</i> 2001, p.479
Barbary sheep ( <i>Armotragus lervia</i> )	Settlement E-75-8	2 individuals	Gautier 2001, p.624
<i>Zootecus insularis</i> (land snail)	E-96-1, tumulus (sub)surface	1 individual	Gautier 2001, p.620, Table 23.1
Unidentified small bones	Settlement E-94-2	Heavily burned and too fragmentary to be identified	Mohamed 2001, p.425

Table 9 - Evidence for wild animal species in the Ru'at el-Baqar

Evidence for bird species in Nabta Playa			
Data	Context ID	Data	Reference
Ostrich	Eggshell survives throughout Nabta Playa		Gautier 2001

Table 10 - Evidence for bird species in the Ru'at el-Baqar

The bone frequencies shown by Gautier (2001, p.632, Table 23.6) indicates that hare and gazelle make up 61.1% of the wild species at Nabta during the Ru'at el-Baqar, with ovicaprids making up 26.8% and cattle 12.1%. Of the wild species, hare makes up 41.1% and gazelles 58.9%.

Evidence for plant species in Nabta Playa			
Data	Context ID	Data	Reference
<i>Acacia ehrenbergiana</i>	E-94-2; E-75-8 Area A, top of dune; E-92-7	Charcoal	Barakat 2001, p.599, Table 22.7; Barakat 2001, p.597, Table 22.4; Barakat 2001, p.598, Table 22.5
<i>Acacia nilotica</i>	E-75-8 Area A, top of dune;	Charcoal	Barakat 2001, p.597, Table 22.4
<i>Acacia tortolis raddiana</i>	E-75-8 Area A, top of dune;	Charcoal	Barakat 2001, p.597, Table 22.4

## Case Study 1: Nabta Playa

<i>Capparis decidua</i>	E-94-2; E-92-7	Charcoal	Barakat 2001, p.599, Table 22.7; Barakat 2001, p.598, Table 22.5
<i>Cassia</i> sp.	E-92-7	Charcoal	Barakat 2001, p.598, Table 22.5
<i>Chenopodiaceae</i>	E-94-2; E-92-7	Charcoal	Barakat 2001, p.599, Table 22.7; Barakat 2001, p.598, Table 22.5
<i>Maerua crassifolia</i>	E-92-7	Charcoal	Barakat 2001, p.598, Table 22.5;
<i>Panicum turgidum</i>	E-94-3 / E-94-1*	Imprints in pottery	Magid 2001, p.608
<i>Salvadora persica</i>	E-94-2	Charcoal	Barakat 2001, p.599, Table 22.7
<i>Setaria</i>		Imprints in pottery	Magid 2001, p.608
Tamarix leaves, fruits, containing seeds ( <i>Tamarix aphylla</i> and <i>Tamarix</i> sp).	E-94-1; E-94-2; E-75-8 Area A, top of dune;	Charcoal	Barakat 2001, p.599, Table 22.7 Barakat 2001, p.597, Table 22.4;
<i>Ziziphus spina cristi</i>	E-92-7	Charcoal	Barakat 2001, p.598, Table 22.5;
* The imprints were derived from sherds from these two sites, but Barakat does not specify which imprints were derived from which site.			

Table 11 - Evidence for wild animal species in the Ru'at el-Baqar

Evidence for aquatic species in Nabta Playa			
Data	No.	Context ID	Reference
Freshwater bivalves	4	E-75-8, S-trench (sub)surface	Gautier 2001, p.620, Table 23.1
	1	E-75-8, spits 1-4	Gautier 2001, p.620, Table 23.1
Small freshwater gastropods	15	E-75-8, C to F, surface	Gautier 2001, p.620, Table 23.1
	1	E-75-8, spits 1-4	Gautier 2001, p.620, Table 23.1

Table 12 - Evidence for aquatic species in the Ru'at el-Baqar

In the burial E-97-17 although no mandible survived, 13 friable teeth were available for analysis, and these have suggested to Irish (2001, p.523) that the individual was probably an older adult who consumed a large amount of plant foods, the wear being consistent with agricultural diets, and probably the result of eating intensively gathered wild seeds. As he says, this is supported by the presence of grinding stones and the admittedly small number of botanical remains (Irish 2001; Magid 2001, p.608). Chenopods may have been used as a subsistence asset. Harlan (1989, p.70) quotes

Gast (1968) who describes how two species of grass were subject to grazing bans by the Kel Ouilli of Hoggar for two months until wild seeds had matured and could be harvested. One of the two species was *Chenopodium vulvaria* L. Harlan also quotes Nicolaisen (1963, p. 179, 181) who says that a single household might collect up to 1000kg of seeds in a season. Harlan emphasizes the importance of *Panicum turgidum*, which is the primary grass in the southern Sahara and is still harvested in some areas (1989, p.71). A deep-rooted perennial, it can be collected by beating with a stick and is often ground into a form of porridge. As a perennial, *Panicum* is vulnerable to over-grazing, which can threaten soil stability as its root system forms a loose mesh of stolons.

The presence of remains of cattle and sheep/goat, together with the presence of tethering stones, argue for the presence throughout at least part of the Ru'at el-Baqar of herded animals. There has been no question about the domesticated status of sheep/goat, which were Near Eastern imports, and by the Ru'at el-Baqar, Gautier is confident on the basis of osteometric data from the Nabta tumuli that cattle were "beyond doubt 'good' domestic cattle" (Gautier 2001, p.628).

As well as the presumed mixed pasture, there are a number of specific plant species represented at Nabta with properties that are recognized by today's Eastern Desert Bedouin as excellent animal fodder plants, with fruit, leaves and young branches of all *Acacia* species, *Maerua crassifolia*, *Panicum turgidum*, *Crassifolia decidua*, *Tamarix tortolis* and *Tamarix nilotica* and *Ziziphus spina-cristi* providing high value nutrition for herbivores (Goodman and Hobbs 1988; Hobbs 1989; Mahmoud 2010; Springuel 2006). Some of the trees, due to their shape, would have been particularly useful for providing shade for herds, particularly the umbrella-shaped tree *Acacia tortolis*, which also has the benefit of promoting the growth of palatable grasses beneath its canopies.

### Capital Assets

All components of a livelihood that are owned or to which households or communities have rights may become the means by which production can be converted into capital assets for trade. Some assets may be owned by the community as a whole, including any shared infrastructure. Other assets may be more complicated. Livestock can be assets held simultaneously by the community, in the form of herds, and by the household, in the form of individual animals. Wells such as the ones at Nabta may be owned at community or household level (and may be associated with complex management systems (Binns 1992). How capital assets are managed depends on the priorities of the community and the availability of related resources, like labour, individual household preferences and access to land.

At Nabta the most obvious capital assets are livestock, access to the land used for grazing and living, wells and the ceremonial centre. Ceramics and lithic tools, together with the invisible items made of perishable materials that must have been manufactured and used, and probably livestock, are assets at the household level. Wells were probably owned at the community level because there are too few of them to represent individual households. Hearths were probably household items, whereas grinding stones may have been either communal (shared by those processing grains) or household (belonging to a particular family).

### Practice of subsistence activities

Cattle are a minority in the bone assemblages, making up 12% of the remains, whilst small livestock represent 27% of Ru'at el-Baqar remains. Gautier (2001, p.631) concludes that either cattle herds were never large at this time, or that there was a reluctance to slaughter animals for consumption. Research by Dahl and Hjort indicated that only 4-8% of herds were slaughtered each year in modern pastoral groups (1976). This is in keeping with the suggestion by Nelson and Khalifa that most of the vessels found at Nabta were too small and open-mouthed for grain storage purposes and that they may, instead have been used to collect, process and serve milk and blood (Nelson and Khalifa 2010, p.139), although Daniel Miller's comments about the failure of pottery forms to match functions in at least one ethnographic example should be remembered here (Miller 2010, p.47).

Of the wild animal species, all are arid and semi-arid tolerant (Gautier 2001). Bone assemblages indicate that gazelle and hare were dominant, making up 61.1% of the assemblage (with hare at 41.1% and gazelle at 58.9%) (Gautier 2001, Table 23.6 and 23.7, p.632-3), but see **Human Assets** for how this is measured in dietary terms. Both were lightweight, with a maximum weight of 75g, and would have been easy to carry from the point of kill to where it was needed for consumption. Little discrimination was made between male, female, adult or juvenile, indicating that both gazelle and hare were hunted opportunistically (Gautier 2001, p.632). The occurrence of blades at E-92-7, albeit in small quantities argues for a certain amount of hunting activity, whilst Mohamed (2001, p.425) believes that the heavily burned and fragmentary faunal remains from E-94-2 probably represented small mammals and birds and that they "probably indicate that small animal hunting was an important activity." At the same time, Wendorf and Schild (2001c, p.480) suggest that when compared to the Ru'at el-Ghanam Middle Neolithic the shift in raw materials and the fewer blades indicate a decline in hunting. Combining hunting, foraging with the addition of herding will have required much more skill than hunting and gathering in terms of mobility, scheduling and territorial negotiations (Dale *et al* 2004; Marshall and Hildebrand 2002, p.112) leading to new ways of handling subsistence, potentially involving separate parties for herding, hunting, foraging and livestock management both close to settlements and over distances.

Numerous grinding stones are indicative of the exploitation of plants, particularly seeds. The research by Lucarini (2014b) confirms that at least in mid-Holocene Farafra Oasis where grinding stones were also present in large numbers, and although no sickles were found there either, his analysis suggests that "small and unretouched flakes or blades, probably hand-held and used without being hafted, may have been used to cut a limited amount of plants" (2014, p.366). The umbrella-shaped tree *Acacia tortolis*, which is recorded from Ru'at el-Baqar contexts, is known for promoting the growth of palatable grasses beneath its canopies. The wear on teeth from the burial at E-97-17 also supports the proposal that intensive plant collection took place (Irish 2001, p.523). This is given additional support from the plant impressions of drought-resistant *Panicum turgidum* (Magid 2001, p.608), the grains of which are used by the Tuareg in the central Saharan Ahaggar Mountains in the central Sahara for grinding into a flour to make into porridge (FAO Grasslands Species Projects *n.d.*), and the Sahelian annual *Setaria* (Magid 2001, p.608), a member of the millet group which has again been used for making porridge (FAO Grasslands Species Projects *n.d.*) and has been found at other

Holocene archaeological sites, such as Uan Tabu, Uan Afuda and Ti-nTorha in Libya (Garcea and Mercuri 2007, p.97). Both species can be used for human consumption and are valued today as animal fodder (Magid 2001, p.608).

According to Edwards and O'Connell (1995, p.772) seeds were probably most important "when groups were closely tied to permanent or near-permanent water sources and entirely dependent on foods available within a day's round-trip walk" and after the depletion of higher-ranked resources, which would suggest that intensive plant collection would have taken place towards the end of each visit to Nabta, when a pattern of "lower risk foraging" around a plentiful water supply with a wide area of pasture and forage became "higher risk foraging" (Ramsey *et al* 2016). The term "intensive" seems appropriate, given the cost in time and energy to collect sufficient seeds to provide adequate calorific intake, although whether it reflects the volume consumed is another matter. Edwards and O'Connell estimate that without factoring in travel and search times, it takes between two and seven hours a day to collect and process seeds for just half of the daily calorific intake for a family of five (2005, p.775). Cliggett (2005, p.4) similarly observed that amongst the Tonga of the Gwembe in Zambia most people don't choose to collect wild grass grains because of the time cost of the work, which in one example would take a single person three hours to collect enough to make a small bowl of porridge that would be eaten in one sitting (Cliggett 2005, p.4). Brokensha (1975, p.25) also helps to fill out this picture with the information that in central Australia it took three women gathering seed grasses less than 1km from the camp three hours to collect two kilos of seed, which then required two hours of processing and cooking. However, there are clearly exceptions. Kuper and Riemer cite the cases of the Tauareg in Mali where one man can gather 50kg of grass seeds in a day, and the case of the MahMahria nomads in northern Darfur where 33 women harvested about 375kg per season (2013, p.55). Out *et al* (2016), have found substantial evidence of mid-Holocene plant processing in the mid-Holocene along the Nile in cemeteries R12 (Upper Nubia) and Ghaba (Central Sudan), describing the findings as evidence of "a plant-based economy" (Out *et al* 2016, p.50). Wasylikowa *et al* (2001) have demonstrated that intensive plant collection and storage took place in early Holocene Nabta, the use of the remote and otherwise resource-free Safsaf would seem to be a measure of the value of grass foods (Close 1996) and Torrence (1989, p.60) points to the low risk involved in plant collection. Although I am not suggesting that this information can be used to re-assess the Nabta data, it is worth bearing in mind that in the broad area of ethnic or cultural affiliation visible throughout the Nubian and Central Sudanese Nile centres of population, plant foods were important and knowledge of the preferred species and their values probably spread over much the same areas, transmitted from generation to generation, and were almost certainly known to visitors to Nabta too. Although seed may have a high nutritional value, and may have been an important part of the diet, it is laborious to collect and process, and it is arguable that only easily harvested plants would have been used regularly, and more labour-intensive species would only have been used as hunger food when other options were depleted.

Plant foods may have been collected as fodder, as well, as suggested by the pre-agricultural Bedouin of Wadi Allaqi, where the greatest demand made on women's time "was the collection of plants for feeding sheep and goats" (Belal *et al* 2009, p.129), including aquatic species which had to

be dried before being fed to livestock. Fodder plants were also harvested when they were at their peak and stored against times of scarcity. Whatever material infrastructure surrounded plant collection and processing (for example baskets and storage pits) have not survived, although some of the expedient stone tools may have been used to cut stems.

Close (2001, p.384) points out that identifiable bone is significantly higher in the Ru'at el-Baqar than in the previous Ru'at el-Ghanam and suggests that this could represent differences in carcass processing techniques. It is also possible that it reflects different food preparation ideas, with less use of bone or bone marrow, and it could also signify different uses of bone as raw materials.

The low numbers of animal bones found at the site suggest either that herds were small or that few were killed – or that preservation has been too poor to represent the composition of the diet. In economic terms large herds are only required when needed for purchasing power or to make up an important component of the diet, but in practice small herds produce sufficient milk for small communities and today most herders only maintain large herds for social status (Schareika 2003, p.9). Whilst it is not possible to attribute modern values to prehistoric contexts, the slaughter of animals for deposition in tumuli implies that animals were valued both for sacrifice as well as nutrition.

Whilst small herds of goats are important scavengers of waste in villages, and are willing to browse on shrubs and degraded rangeland vegetation (Aboul-Naga *et al* 2014), sheep are grazers that are less drought tolerant and require higher quality forage. Cattle may require more complex management due to higher water requirements the need for good quality grazing material, and need to be close to water resources for regular intake (Dyson-Hudson and Dyson-Hudson 1980).

Mixed herds of cattle, sheep and goat, termed “fherds” have proved to be successful in modern contexts (D.M. Anderson *et al* 2012; Kitsteiner 2014; Voth 2014). It is more common, however, for herd splitting to take place in order to maximize the value of different types of vegetation for which different species have preference, thereby making the most of all the available environmental niches, spreading the load of grazing on the rangeland and providing animals with the types of fodder that they prefer (Niamar 1991, p.2-3). It is possible that herds were grazed together when Nabta groups were on the move but were herded separately when groups were stationary for more than a few days.

It seems likely that stocking rates were heavily influenced by the perceived reliability of Nabta as a source of wet season pasture and water deposits. It would be useful to know precisely what sort of stocking scenario was adopted, in terms of whether it was a constant or opportunistic strategy and although there is no data to inform an answer, Campbell *et al* (2006) suggest that on a continuum between a constant stocking rate (where a low or high constant number of heads of herd is maintained) or a variable/ “tracking” stocking rate (where numbers vary in dry and wet years and are either within ecological carrying capacity or at the level of ecological capacity) constant strategies are followed when tracking rainfall is difficult (Campbell *et al* 2006, p.76-78, 82). Moule describes conservative stocking a risk reduction strategy for variable environments (Moule 1970, p.436), a management approach that would be suitable for the type of mobility and environment represented by visits to Nabta. Multiple occupations at Nabta are recorded but are not chronologically detailed enough to know whether visits were consistent or intermittent throughout the Ru'at el-Baqar.

However, assuming on the basis of data in the climate chapter that this was a period of fluctuating rainfall and unpredictable conditions, a low constant stocking strategy with herd levels kept within predicted carrying capacity would have been the most appropriate strategy, contrasting with the more humid early Holocene when a tracking strategy might have been feasible. Of course, this only considers practical ecological and livestock management without considering the social value of households etc.

Whatever the precise stocking rate, it can be safely concluded that groups moved into the area when rainfall was available, stayed with their herds whilst water remained in the ground long enough to provide potable water, pasture and hunting resources, concentrated progressively on the basin area when pasture began to dry up and intensified plant use as hunted prey became depleted, and moved away with herds only after digging wells to access the groundwater down to around 2-3m (cf. Kobusiewicz 2003, p.97). The Nile was only a few days walk away, and cattle in particular would have suffered during this movement, so water provision must have been made. Plenty of water would have been available when the Nile was reached, assuming that there was no conflict of interests with any groups already based at Nile-side locations.

In years of good rainfall a seasonal use of Nabta of the sort described above could be envisaged. However there were undoubtedly bad years too, when rains failed and Nabta could not be used as part of the annual herd movement. This will have broken any seasonal routines which, however, would be resumed whenever rainfall was available.

Hunting of arid-adapted species took place, with the evidence of a small number of animal bones supported by the presence of microliths, albeit in smaller volumes than in the Ru'at el Ghanam Middle Neolithic, and bifacial arrowheads, again a minority of the Ru'at el-Baqar assemblage. Preferred species appear to have been gazelle and hare. The bone frequencies shown by Gautier (2001, p.632, Table 23.6), mentioned above, indicate that hare and gazelle make up 61.1% of the wild species at Nabta, with hare making up 41.1% and gazelles 58.9%. It is probable that the occupants at Nabta were able to hunt opportunistically, taking advantage of animals that were attracted by the playa lake.

### **Animal diseases, viruses, pests and parasites**

There is no evidence for ill health amongst the few animal remains at Nabta Playa. This is as much due to the lack of skeletal remains as the lack of diagnostic data. Nabta was to the north of the tsetse zone, which was therefore not a risk.

### **The potential for and indications of trade networks**

Exchange depends on both a demand and a source of supply, it is possible to search for items that seem to have been produced or acquired in one place by one groups for use in another place by someone else. The most obvious products with the potential for trade locally, between households or groups, are domesticated animals, dairy products, wild resources (e.g. honey and specific plant species) ceramics and marriage partners. Other objects like basketry, cordage and leather goods have not been preserved but are likely to have been of value for exchanging goods



(Hurcombe 2014). There are no obvious components that could be brought from the desert to the Nile to provide value in a trade negotiation. Bearing in mind the warning that trade or exchange “*must be demonstrated* rather than assumed” (original italics, Summerhayes 2015, p.482), this section focuses only on items that might demonstrate links with other households, communities or areas, but does not attempt to claim that such links demonstrate that trade was actually taking place.

Looking first at long distant trade, Shirai proposes (2006, p.14) that following the diffusion of goats and sheep from the Sodmein and Tree Shelter areas, there would have been ongoing movements between the Red Sea coast and the Western Desert, with trade and exchange links expanding through time, beginning with Neolithization and developing with the wide dispersal of Red sea shells and other items from the 6<sup>th</sup> Millennium BC. Whilst freshwater shells from the Nile would have been relatively easy to acquire, the presence of Red Sea shells (Gautier 2001, p.633) suggests either long distance movements or exchange networks. The latter is perhaps a more likely scenario given the specialist knowledge that would be required to navigate the topography of the Eastern Desert unless fixed routes were established. Even if a major route from the Nile to the Red Sea existed, such as that provided by the Wadi Hammamat today, there are no archaeological features that would tie Nabta groups more closely into that area.

Over shorter distances, it is unknown whether domesticated animals and their produce (live animals, meat and dairy) would be of consistent ongoing value to hunting and fishing groups along the Nile, and there is nothing to indicate whether or not such negotiations took place.

Hand-made ceramics are an obvious candidate for exchange both between households and between groups. Unlike lithic technology which can be learned very easily from childhood (Edmonds 1995, p.37, 40), a certain amount of knowledge and skill is required and may be restricted to certain families or households (Arnold 1985; Balfet 1965; Needler 1984, p.184; Rice 1987, p.183-91). However, there is no sign of specialized or centralized production, and although skills must be learned, these can be acquired at any age. It seems likely that pottery was produced by each group as required, rather than traded.

The casually made lithics are unlikely candidates for trade, unless bifacial tools exchanged hands. Like pottery, bifacial tools require a certain level of skill beyond that needed for the very rough and ready flakes that were the main toolkit of the Ru'at el-Baqar at Nabta. However, this too could be learned quite easily when the existing stone knapping skills were already in place and it is by no means clear if bifacial tools would have been sufficiently valued to become objects of exchange, although they might have been seen as novelty items until the skills were learned. The presence of bifaces at Nabta, probably originating from Dakhleh, gives some support to the idea that these were acquired rather than made at Nabta, but it is not known what might have been offered in return.

Cultural similarities to the south in the Sudan are notable, both in terms of object characteristics and funerary traditions. As Agbe-Davies and Bauer emphasize, trade is a social activity “a concept that focuses not just on the movement of goods but also on the social context and consequences of the exchange” (2010, p.13). As a process that connects people, not merely in short term transactions but long term relationships, exchange can be expected to have had an influence on the way in which people perceived each other, themselves and their physical and social environment.

In short, it seems most probable that any trade and exchange negotiations took place not at Nabta itself but at other places on the seasonal round, most plausibly or near the Nile, and that this as well as the management of herds had a lot to do with the material changes that appear in the pottery and the ceremonial components at Nabta. This can be expected to have economic consequences as people from different areas and groups exchanged not merely products and ideas but ways of doing things, new strategies and new technologies.

### **Savings and credit**

The presence of cattle, sheep and goat in the archaeological record indicates that households retained savings in the form of livestock, which could have been used for leveraging various types of commitment in return, including credit and loans (Bollig 2006, p.285-290; Harir 1996, p.89-90). Credit, used as a staple of pastoral negotiations in modern groups, could have taken place wherever livestock and kinship relationships were both available when conditions were good, but there is no evidence that this was taking place, mainly because there are currently no archaeological measures for such a relationship.

### **Labour**

As stated in Chapter 5, herding and hunting were ongoing activities requiring both knowledge and experience in the implementation of a herding-hunting strategy. The Wodaabe cite labour as one of the five principal factors ensuring herd fertility and health, for tasks like searching for pasture, driving animals to graze, removing parasites, searching for lost animals, providing medical care, tethering calves, milking cows, making ropes, work with newborns, and maintenance of any related equipment (Schareika 2003, p.10). For pastoralists, the amount of labour required depends on the size of the herds, and the demand for labour fluctuates on a seasonal basis with higher levels of activity required during wet seasons when higher levels of mobility are required, new camps must be established, herds must be protected from predators and animals are at their most productive. Young animals may need to be tended. Dairy animals need to be milked, milk needs to be transformed into dairy products, and storage devices and other relevant equipment need to be manufactured. Demands on labour are at their lowest during dry seasons, particularly towards the end of the dry season. The task of moving mixed herds to Nabta will have required healthy and knowledgeable labour, but activities will have eased slightly once camps were built and animals were at pasture, although Schareika (2003, p.16) lists a number of tasks that need to be carried out at camp, as follows (table 13).

Time of the Day	Herd Activity
Just before sunrise	Inspecting the herd
After sunrise	Milking the cows; freeing calves from calf rope
Morning hours	Morning pasture
Noon	Cattle rest; calves separated from herd
Afternoon hours	Afternoon pasture, sometimes without herder
Late afternoon	Calves tethered to the calf rope
Early evening	Herd comes back from pasture; lighting herd fire
Before sunset	Milking the cows
Before sleep	Tethering older calves to the calf rope
During the night	Night pasture, only supervised when in the vicinity of fields

Table 13 - Herders' daily routine (Schareika 2003, p.16, Table 1)

In table 13, putting the herds out to pasture “is an activity that supplies the animals with grass, browse and water, and structures their own and the herders' daily routine” (Schareika 2003, p.13). As water is essential for the health of the herd and particularly for lactating females (Little and Leslie 1999, p.12) water provision would have been a major part of both the daily and seasonal rounds. Where multiple groups use the same pastures and water sources this is also the time when herders and their livestock come into contact with others, exchanging information and negotiating access to limited resources (Cliggett 2005, p.81-83; Bollig 2009; Johnson 1999). Towards the end of the seasonal occupation at Nabta it is possible that animals would have been watered manually as the lake evaporated and the water table dropped and had to be extracted from wells (Kobusiewicz 2003, p.97; Schild and Wendorf 2001b, p.47).

Towards the end of the occupation it is possible that animals would have been watered manually as the water table dropped and water had to be extracted from wells, and this would have been highly labour intensive. In the quieter periods, raw material acquisition and tool and craft production are probable activities.

Hunting activities may have been scheduled around herding, but at Nabta hunters may have been in a position to optimize labour by relying on the opportunistic capture of animals using the basin as a waterhole.

Plant gathering is a more intensive activity, as discussed above, requiring the gathering of a substantial amount of plant foods to feed a community, particularly if seed is a particularly important part of that plant intake (Edwards and O'Connell 1995, p.772; Cliggett 2005, p.4; Brokensha 1975, p.25). It is possible that this was carried out by women and children if they were present at Nabta, thereby dividing the labour within the community. It may be an argument for whole households being present at Nabta to enable just such a division of labour, but the lack of any habitation remains does not necessarily support this.

There are no signs of settlement structures, apart from one ephemeral hut, and certainly nothing that required the input of more than one person's labour. Hearths are the dominant feature and could have been very easily assembled.

The ceremonial centre (tumuli, stone circle and complex structure) required rather more energy. The stone circle required conceptualization, discussion, agreement, motivation, and knowledge of the night skies; it did not, however, require the mobilization of labour in order to build it. The slabs, not exceeding 70cm tall or 20cm wide, were not particularly heavy and they were available locally, and it could have been built by one or two people. The tumuli, also involving the implementation of ideological or religious ideas, required a higher level of labour input. Applegate *et al* estimate that E-94-1N, in which the semi-articulated cow was found "required the most substantial construction labor of any of the excavated animal tumuli" with the largest quantity of sandstone employed, and they estimate that it would have required at least three people to have moved some of the covering blocks, (Applegate *et al* 2001, p.469). However, although most of the tumuli formed a domed shape, less than a metre tall, they were not provided with any form of architectural structure, and apart from quarrying, carrying and dropping into position not much additional manpower was required, and certainly not beyond what would have been readily available in a herding and hunting group. The same story is true at E-94-1S, where it is suggested that a maximum of two people would have been required for construction, whilst E-97-12 contained slabs at its base that would have required around four individuals to move (Applegate *et al* 2001, p.473). Some of the slabs at E-94-S, quarried intact, were dropped with so much force that they split as they fell on top of previously placed slabs (Applegate *et al* 2001, p.473). Quarry marks remained on stones in E-94-1-S, E-97-12 and E-94-1N and the stone for E-94-1S, for example, is thought to have been brought from an outcrop 30m to the east (Applegate *et al* 2001, p.468). Although, as the authors point out, the tumuli "represent significant expenditures of both time and energy" (Applegate *et al* 2001, p.468), they were well within the capacity of even a small group of people.

Complex Structure A is a different matter altogether, and required a considerable investment in labour to dig down to the tablerock, to modify it, and then to provide the architectural elements to complete it, including the shaped upright block positioned over the tablerock (estimated to weigh over 3 tons) and the upright stones that topped the refilled pit. There have been no estimates in terms of number of people or man-hours required to accomplish such a structure, but the investment of time and energy must have been considerable – it required a 3 ton pulley, 12 workers, a wire cable and ropes for the C.P.E. team to pull it out (Wendorf and Królik 2001, p.508).

Unfortunately the lack of human remains means that it is not possible to assess how groups using Nabta might have been composed, and if a full spectrum of community labour was available, in terms of the usual mix of men, women, children and older household members. Nor is it visible how these labour resources would have been allocated.

In conclusion, there is no sign that there was a shortage of labour. Everyday activities did not require more labour than was available in even a small herding, hunting and gathering group. Although impressive in terms of the ideas that they may have represented and the motivation and

dedication needed to build them, there is no indication that the requirements of the group exceeded its ability to meet them.

### **Knowledge and information**

Both the transmission of knowledge and the ability to acquire information are visible at Nabta. Knowledge is embedded in mobile lifestyles, in knowing how and where to move and how to behave, *en route* to and on arrival at the destination. At Nabta knowledge specific to temporary occupation of an area is visible in the production of expedient tools, the management of herds, the presence of hunted species and semi-arid and arid adapted plants and the various benefits that Nabta offered to the group on a repeated, possibly annual basis, knowledge that is embedded in both economic and social dimension of life. The ability to move through the landscape depended upon such knowledge. Use of the environment is also highly dependent upon the sort of knowledge shared from one generation to the next. Amongst the Ababda of Wadi Allaqi, for example, “women have developed a deep environmental knowledge of the different types of grazing available in their immediate surroundings,” which enables them to ensure that livestock eat the correct species, both terrestrial and aquatic, at the correct time, avoiding other species that livestock may choose to consume but which will cause health problems. For example, only young shoots of Tamarisk are collected because more mature material is too salty, and mature scorpion grass is used only as a last resort because it causes excessive thirst which results in animals drinking too much water and potentially experiencing respiratory problems (Belal *et al* 2009, p.135).

Information is less easy to observe archaeologically, because it is more transient, but is implied by the repeat presence of groups at Nabta who must have known, either by sending scouts (Grandval 2012, p.3) or by obtaining information from others, that water and pasture were available and was sufficient to support herds and attract game.

The repeated occupation of Nabta indicates the successful combination of knowledge and information to make the most of what Nabta had to offer, reinforced by ceremonial components that represent a more esoteric but equally important form of knowledge.

### **Mobility**

The Ru'at el-Baqar was a period when groups set up temporary camps in the vicinity of the main basin and sub-basins in order to take advantage of the ephemeral waters that gathered following sporadic and seasonal rainfall. By being fully nomadic or transhumant, pastoralists can optimize the productivity of their herds by driving them to rich resources to ensure that they gain weight, improve the quality of the meat they provide and maximize dairy production (Grandval 2012, p.2; Harir 1996, p.97-98; Manger 1996c, p.179; Schareika 2003). The view that these visits were no more than a few weeks or months at most in duration is supported by the number of hearths that were used for short periods, the lack of substantial concentrations of artefacts and the absence of habitation structures, combined with the temporary nature of the playa lake and pools (Close 2001; Nelson 2001a; Królik and Fiedorczuk 2001; Mohamed 2001; Wendorf and Schild 2001b). That this is somewhere that was returned to many times during the Ru'at el-Baqar is borne out by radiocarbon

dates that span the period between two arid phases, and the presence of a complex of monuments which were built over a long span of time and, it can be reasonably suggested, were probably a destination in their own right.

Schareika (2003, p.18) describes how pastoral mobility includes the concept of biological habit, in which animals and men become accustomed to a particular environment, and that decisions about range are made in accordance with what animals have become accustomed to. Knowledge of the landscape is also a primary factor in mobility, where herders depend upon their intimate familiarity with certain regions, to the point where lack of knowledge will prevent them from going into other regions where they might graze successfully. The choice of Nabta as a destination will therefore have been influenced both by resource availability and the importance of embedded knowledge about the landscape. As discussed above, and emphasised by Sheller and Urry (2006, p.210), routes and points between nodes are also of primary importance in the task of moving herds from one place to another. Naimir (1991, p.4) suggests a number of variables influencing the patterns of movement chosen in addition to water and forage: location of salt licks, soil conditions, dew, heat and shade, avoidance of pests and diseased areas, proximity to markets, labour availability, cultural gatherings, territorial boundaries and social relations (particularly alliances and enmities. Lambrecht (1976) describes how the Fulani, who migrate on a north south axis consisting of around 10-20 families and 20-40 head of cattle usually travel south at the onset of the dry season and their pace over the 5-6 month journey is usually “a leisurely one, with stops at favorable places.” One of these points along the route from or to Nabta may, for example, have been Bir Safsaf, where pooled water and plant life were seasonally available, and where Ru’at el-Baqar type lithics were discovered. Nabta is some 200 miles away to the north, and sources of the raw materials used at Safsaf were available about half way between the two areas (Close 2000a).

Precise patterns of mobility are impossible to determine from the available evidence, because we do not know where these people were moving to and from. Thompson’s examination of the seasonality of Australian Aborigines has demonstrated that different activities are carried out at different sites during the seasonal round using different toolkits, so matching up different sites into a circuit of annual activity is difficult (Thompson 1939). Similarly, Usai states that the detection of seasonal movements between the Nile Valley and the adjacent is difficult particularly because “lithic industries may have been oriented to different economic activities forwarded in these two different environments” (2005, p.103). Although she was talking about the early Holocene, her comment is just as valid for the mid-Holocene. There is sufficient similarity in pottery styles between Upper and Lower Nubia and Nabta at this time (Garcea and Hildebrand 2009, p.307) to suggest that the movements of Nabta groups brought them into contact with pastoralists of the Sudanese Nile valley. Certainly an east-west or northwest-southeast movement would be a much better strategy for optimizing different types of environment at different times of the year than a north-south trajectory and it seems likely that the Nile was part of the seasonal round (Garcea and Hildebrand 2009, p.319) but it is possible that a north-south route was also used along the edges of the Nile to move herds between different locations, and there is evidence for a north-south axis in the 5<sup>th</sup> millennium BC (Edwards 2004; Gatto 2011; Gatto and Hildebrand 2009).

The presence of Eocene flint, the nearest source of which was 70km to the north (Mohamed 2001, p.422; Krölik and Fiedorczuk 2001, p.340), puts a northern limit on mobility, suggesting a 140km round trip to that part of the seasonal round. It is unlikely that the Nabta groups extended north of Dakhleh, due to the marked difference in cultural remains between the Nabta area sites and those to the north of Dakhleh and the lack of any data to substantiate contacts (Riemer *et al* 2013). If the Kharga-Basin area was used a 400 round journey would have been completed, but there is little intervening data to support that this happened.

There are no signs of pastoralists at the ephemeral pools to the far west and northwest that were used by contemporary hunting groups (Riemer 2005) and the material remains of the Gilf Kebir were quite unlike those at Nabta, so it is unlikely that Nabta pastoralists moved that far to the west at this time. They would have had to cross the Selima Sand Sheet, which has evidence of early and middle Neolithic remains (Schuch 1993) but none from the later Neolithic. However, nearer to Nabta, very small sites at Bir Safsaf revealed late Neolithic stone tools, and may have been part of the resource base of Nabta, the source of pools of water and patches of vegetation, used for only very brief periods (Close 1990, p.92; 1996; 2000a). 100km away from Nabta, Safsaf could have been used as a temporary stop on the way to somewhere else, or making use of other areas of grazing whilst it was available would be a good risk-spreading practice, and would help break the journey. Close describes how it seems as though an advance party moved into the area before herds arrived, probably indicative of scouts ensuring that conditions were ideal for livestock.

There are certainly elements that Binford refers to as "site furniture" (1976, p.242), components that may have been too heavy to move over long distances, including grinding stones and large ceramics, although as Close points out there is no reason why herded livestock could not have been used as beasts of burden for carrying heavier items (Close 1996, p.550), in much the same way as people later used donkeys and camels. Usai's model for the early Holocene, in which Nabta was part of a seasonal circuit involving Bir Kiseiba in the desert to the northwest and Abka at the Nile near the Nubian border to the southeast, could have served as a perfectly sound model for the mid-Holocene as well, as there is evidence for occupation within the same broad date ranges at all sites, with broadly corresponding lithic and ceramic toolkits (Usai 2005).

The question remains what role Nabta itself had in the interplay of movements and interactions between nodes. The ceremonial centre, more than any other feature, implies that Nabta was a fixed point in that landscape of both physical and social mobility. The implication is that in the general round of movement, this was one of the nodes in a complex network of interchanges. It seems to have been an important node, but was only one part of a much wider mobile round that extended at least as far as Dakhleh to the north and as far south as central Sudan to the south, providing a range of different geographical, economic and social landscapes.

The role of craft goods made from organic materials is opaque at Nabta. Hurcombe (2014) emphasizes that the fabrication of basketry, cordage, wooden tools and other items made of plant-based materials may have required scheduling of group activities in their own right. However, if it is correct that groups were only at Nabta for a short period and that the main patterns of mobility never lead the groups who used it more than a few days from the Nile, it is unlikely that of the ephemeral

plant materials from Nabta would have been more influential in settlement scheduling than those available on the Nile.

The Fulani/Borani model of perpetual movement (Binns 1992) does not seem to apply in this case. A more plausible one is that of the G/ui and G//ana where groups depend upon rain-filled depressions in the central Kalahari for up to two months in the rainy season and then disperse into smaller family sized groups in the dry season (Hitchcock and Ebert 1989; Sapignoli 2014, p.44).

Another plausible model is that of transhumance (Wendrich and Barnard 2008, p.7-9), where part of the community stays behind and a group detaches to take herds into the wet season grasslands. Wendorf and Schild (1980, p.270) cite the example of the Nile-based Awazim Bedouin, in Central Egypt who still use six playa lakes, limestone basins and blocked wadis. The wadi of Ramdin was used for at least 200 years by the Awazim, and is cultivated. Nearby wadis are used for sheep and goat grazing every three to five years. The area can only be used following rainfall and produces good quality crops. A group of twenty, taking one to two days remain for around a month. It can only be used following rainfall and produces good quality crops. A group of twenty, taking one to two days and remained for around a month, drinking from natural limestone pools. The most likely model, therefore, is that in order to take advantage of pasture, resources like Nabta were used during the wet season, to take advantage of the waters in the basins and behind dune barriers. Wells were used to maximize the available water, and then people and their herds moved on again, in all probability to the Egyptian Nile, which was only a few days walk away to the east, and where water for herds could be guaranteed. A direct route across the savannah to the south is also possible, but the availability of pasture and water would have been much less predictable.

As discussed above, in all cases it is probable that group membership was fluid and that communities were highly dynamic in terms of organization and self-identity as it has been proposed for Pleistocene groups of hunter-gatherers (Wengrow and Graeber 2015) and observed in modern hunter-gatherer and pastoral groups (Bonfiglioli 1988; Hitchcock and Ebert 1989; Hofman 1994; MacEachern 1994, p.216; Spencer 1998; Wengrow and Graeber 2015, p.603, 607). Herd size too may have been flexible (Campbell *et al* 2006). As discussed above there are no signs of group movement beyond Dakhleh to the north, or to the far west, but there are plenty of signs of connection between Nabta and the Nile, implying that these were two of the main nodes in movement through the landscape. Here the fluidity of group membership becomes of particular interest, as a circumscribed annual regime would require greater exchange of members between groups to ensure genetic diversity (i.e. marriage partners), and the ability to split communities into groups and reform them in response to land shortages, water shortages, disputes, the need to gain access to craft specialists and spiritual experts, and other challenges to the concept of a stable and easily defined community (MacEachern 1994, p.216-8).

It should be noted that different rates of mobility will have existed within the larger scheme of annual movements, with herding, hunting, gathering plant foods, engaging with different topographies, establishing camps, acquiring raw materials, building monuments and carrying out everyday tasks like butchery, tool making, milking and cooking each having their own dynamic structure within the seasonal round. A mobile lifestyle involved continual dynamism.



## Land Tenure

During the period of occupation at Nabta, more than one group could have been in residence at the end of the wet season. Binns (1992, p.177) points to the need for reciprocal arrangements between groups using marginal areas and Sapignoli observes that connection to place is a strong driving force that can exceed shared language and identity (Sapignoli 2014, p.48-49). The three groupings of hearths at E-92-2 could reflect different contemporary encampments, for example. Shared use of important resources is common amongst pastoral communities. A.B. Smith (1996, p.30, 32) suggests whereas pastoral societies rely on communal landscapes with no attachment to parcels of land. However, as discussed previously, there is no evidence for different groups occupying Nabta simultaneously.

Tilman Lenssen-Erz (2012) has argued convincingly that rock art and archaeology in the Ennedi highlands of Chad, where rainfall was between 150-250mm between 6000 and 4300BC demonstrate that different groups of pastoralists occupied the area simultaneously. He believes that the rock art depictions, which can be grouped according to a number of criteria “are pictorial manifestations of localised identities,” the means by which the landscape is appropriated (paragraph 30) and one of the devices by which territories are negotiated. He also suggests that whilst several groups were using the same resources, the wide open plains would have made cooperation more practical than conflict (paragraph 31). Whilst there is no rock art at Nabta, it is possible that the ceremonial components formed a similar function, establishing a right to access the basin area. I was also interested to see that McCorriston *et al* proposed that social strategies, particularly cattle sacrifice, may have been used as devices of risk management, specifically “boundary defense behaviour” in the Neolithic of southern Arabia in the early Holocene (McCorriston *et al* 2012, p.47). Their argument is that rainy season pools and pasture would attract various groups but that access to those resources would be regulated either through membership of a social group or access to it, which would be celebrated by feasting and lead to reciprocal arrangements (McCorriston *et al* 2012, p.56-57). Similar arguments have been proposed for areas in northern Africa where signs of social complexity, the presence of burials and the introduction of storage and less mobile lifestyles have been connected with the idea of ideas of land tenure in the early Holocene to mid-Holocene (di Lernia 2001; Garcea 2004; McDonald 2008; Sereno *et al* 2008 ). Again, although these arguments for multiple groups using the same territories under similar conditions to those pertaining at Nabta suggest that similar processes should be looked for at Nabta, there is no indication from Nabta of either conflict over or sharing of resources.

The Egyptian Nile was not sufficiently populated to present many problems to mobile groups transferring from Nabta to the Nile at the end of the wet season, but in the more densely populated Sudanese Nile agreements may have been needed to herd in the territory of others, or the Sudanese Nile may have been the transhumant home base of the Nabta groups, with their territory already established. As Campbell *et al* (2006, p.79) point out, property rights influence access to resources and add another dimension to temporal variability, leading to new patterns of negotiation for access to land and water. Decisions about when and where to move will have been based not merely on

preferred locations and the availability of resources but on the claims to resources that have already been made and the value of the land in ideological terms (Sapignoli 2014, p.42). The appearance of new types of pottery at Nabta in the Ru'at el-Baqar requires some explanation and one possibility is that following the better conditions of the early Holocene the Nile became more important to both hunters and herders, who found themselves in increasingly close proximity, sharing land on a rather more formal basis than before, and creating new ways of creating and sharing identity whilst maintaining and supplementing livelihoods, with traditional toolkits. These features could relate strongly to the need to share land or to identify ownership of land that was in close proximity to other parcels of land that was held by other communities as part of what Sam and Berry refer to as "acculturation" as discussed above.

### **Human Assets**

#### **Potential nutrition**

This section represents the optimal nutritional possibilities under conditions of maximal use of all options visible in the archaeological record at Nabta. It also seems reasonable to assume, on the basis of how modern groups function, that knowledge about wild species, including fruit, seeds, tubers, wild grasses, roots and other plant foods, was communicated from one generation to the next for use both in the daily diet and as hunger foods (see Chapter 5). With respect to animal herding, available data suggests that cattle, sheep and perhaps goat were kept, and that they were used for blood, modified dairy products and occasionally for meat. When used for meat, both domesticated and wild species would have been used as completely as possible when killed, making use of meat, organs, blood, marrow-bone and fat. Food types were available on a seasonal basis throughout the year, and scheduling would have been required (Anderson 2005; Marshall and Hildebrand 2002, p.112; Hurcombe 2014), meaning that the quality of human nutrition would have fluctuated throughout the year. With some level of mobility, energy intake would have been an essential requirement but probably not as high as for fully mobile hunter-foragers. Although fats are not a dietary requirement but it is difficult to make up energy requirements from carbohydrates and protein alone (D.A. Bender 2014, p.23), so it seems reasonable to suggest that fat would have been an essential requirement in Ru'at el-Baqar diets, available from milk, some game animals and some domesticated animals.

The data suggests that the visitors to Nabta practiced hunting, herding and either low level cultivation and foraging for wild grasses (either of which grinding stones indicate were used), and were mobile for at least part of the year. Seeds, roots, tubers and other plant resources that were almost certainly employed but are not found, will not be referred to.

Tables 14 and 15t the complete data that we have for the Ru'at el-Baqar from the point of view of nutritional requirements.

Nutritional Values of Plant Species	
Species	Value
<i>Acacia ehrenbergiana</i>	Used today by the Bedouin for making a type of coffee.
<i>Acacia nilotica</i>	Edible gum can be obtained from the bark and soft inner bark may be used to curdle milk. Seeds and pods are also sometimes eaten. Traditionally used for medicinal purposes.
<i>Acacia tortolis raddiana</i>	Traditionally used for medicinal purposes.
<i>Capparis decidua</i>	Edible and well flavoured fruits with high quantities of phosphorous and calcium, and useful quantities of fat and protein. Traditionally used for medicinal purposes.
<i>Chenopodiaceae</i>	Used as herbs and leaves for human consumption. Provides nitrogen and absorbs salt, so is a useful source in human diets.
<i>Maerua crassifolia</i>	Fruits are valued by the Bedouin for their sweet taste and they are a good source of nectar for honey. Leaves are a good source of calcium, linoleic acid and alpha-linolenic acid.
<i>Panicum turgidum</i> (figure 21-a)	Contains high levels of potassium, phosphorous, sodium and calcium. The grains are used by the Tuareg in the central Sahara for grinding into a flour to make into porridge
<i>Salvadora persica</i>	Fruit can be eaten fresh, cooked, dried and stored or made into a fermented drink. Leaves are eaten as a green vegetable or made into a sauce. A source of nitrogen, phosphorus, potassium, and calcium
<i>Setaria</i> (figure 21-b)	A member of the millet group which has again been used for making porridge
Tamarix leaves, fruits, containing seeds ( <i>Tamarix aphylla</i> and <i>Tamarix</i> sp).	Traditionally used for medicinal purposes
<i>Ziziphus spina cristi</i>	Fruits are well flavoured and have a high vitamin C content. Traditionally used for medicinal purposes.
Sources of nutritional data: ARKive n.d.; Cook <i>et al</i> 1998; FAO Grasslands Species Projects <i>n.d.</i> ; Heneidy, S.Z. and Halmy, M.W. 2009; Kew Gardens: Useful Plant and Fungi <i>n.d.</i> ; Mahmoud 2010; Springuel 2006; van Wyk <i>et al</i> 2011.	

Table 14 - Edible plant species available in the Ru'at el-Baqar

Not many conclusions can be drawn from the surviving botanical remains at Ru'at el-Baqar Nabta. However, the fruit available provided sugars, carbohydrates and calories, as well as vitamin C in the case of *Ziziphus spina cristi*. As Layton *et al* suggest, wild grasses tend to rank low in an optimal diet regime in dryland environments (1991, p.260), but the contribution of wild cereals can be inferred from the large number of grinding items at the site. Out *et al* (2016) suggest that during the mid-Holocene wild grasses and fruits were very important in subsistence strategies, but at Nabta, without knowing

## Case Study 1: Nabta Playa

which cereals were employed it is difficult to estimate what sort of value they would have contributed to the diet.

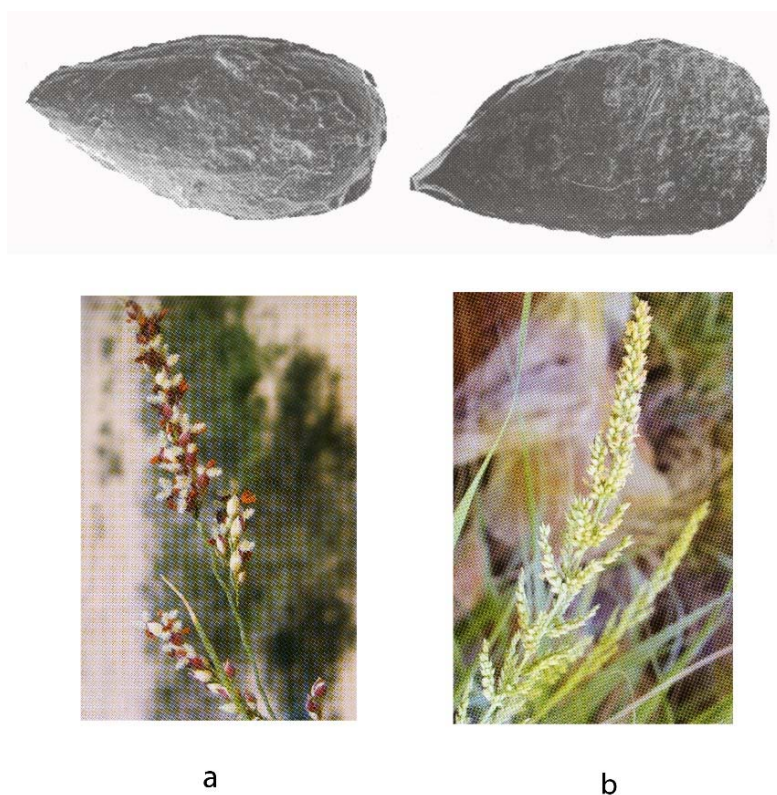


Figure 21 – a) *Panicum turgidum* (Microphotograph of seed impression on pottery, Magid 2001, p.608; photograph Mahmoud 2010, p.104) and b) *Setaria* sp (Microphotograph of seed impression Magid 2001, p.608; photograph Burke 2012, p.145).

Nutritional Values of Animal Species		
Species	Seasonal availability	Value
Antelope (various African species of the family Bovidae that are not sheep, goat, cattle), but most likely to be gazelle	At any time	Meat products: protein; iron, zinc, fat
Barbary sheep	At any time	Meat products: protein; iron, zinc, fat
Cattle	Dairy products: Only when animals are lactating (3-8 months) Blood: available all year round but less during dry-seasons and not at all during drought Meat: at any time	Dairy products: Calcium, Vitamins A, C, D, zinc, phosphorous, fat (4-5.5%), carbohydrates Blood products: Iron, zinc, protein, some calcium and phosphorous Meat products: protein; fat; folate/folic acid; Vitamins A, B2, B3, B6, B12
Dama gazelle ( <i>Gazella dama</i> )	At any time	Meat products: protein; iron, zinc

## Case Study 1: Nabta Playa

Dog ( <i>Canis lupus</i> )	At any time	Meat products: protein; fat; folate/folic acid; Vitamins B2, B3, B6, B12, zinc
Dorcas gazelle ( <i>Gazella dorcas</i> )	At any time	Meat products: protein; iron, zinc
Fowl	Non migrating species: any time Migrating species: winter months	Meat: protein, fat, Vitamins B2, B3, B6, B12, zinc Eggs: fat, phosphorous, protein
Goat	Dairy products: Only when animals are lactating (3-8 months) Meat; at any time	Dairy products: Calcium, Vitamins A, D, phosphorous, zinc, fat (3.5%) Meat products: protein; iron, zinc, vitamins A, B2, B3, B6, B12, D, carbohydrates
Hare ( <i>Lepus capensis</i> )	At any time	Protein, lipids, cholesterol, sodium, potassium, iron, calcium, phosphorus
Jackal	At any time	Meat products: protein; iron, zinc
Ostrich	Meat: at any time Eggs: winter	Meat products: low in fat but is high in protein, vitamin B12, selenium, niacin, vitamin B-6, phosphorus and zinc and smaller but significant levels of thiamin, riboflavin, pantothenic acid, iron, potassium and copper Eggs: high in fat and contain vitamin A, thiamine, zinc, calcium, iron, magnesium and manganese
Porcupine	At any time	Protein, iron
Sheep	Dairy products: Only when animals are lactating (3-8 months) Meat: at any time Blood: at any time	Dairy products: Calcium, Vitamins A, C, D, phosphorous, zinc, fat (5%) Meat products: protein; fat; folate/folic acid; Vitamins A, B2, B3, B6, B12, D, carbohydrates Blood: Protein, iron, salt

**Table 15 - Edible animal species available in the Ru'at el-Baqar**

Of the wild species, bone assemblages indicate that gazelle and hare were dominant, making up 61.1% of the assemblage (Gautier 2001, Table 23.6, p.632). Gautier's analysis indicates that cattle are a minority in the bone assemblages, making up 12% of the remains, whilst sheep/goat represent 27% of Ru'at el-Baqar remains, and wild species the rest. The difference between cattle and sheep/goat can be accounted for by either Nabta groups using cattle herds for blood and milk or being reluctant to slaughter cattle (Gautier 2001, p.631). However, he also discusses the value of animals in purely dietary terms: "if we turn to dietary ratios, it becomes clear that livestock contributed substantially more to the diet, because the live weight and hence dressed carcass weight of sheep or goat (50kg?), and cattle (250g?) exceed markedly that of hare (3.5kg) and the combined gazelles (20kg)." He estimates that by the Ru'at el-Baqar cattle and small livestock make up around 85% of the diet (Gautier 2001, p.632). Applegate *et al* (2001, P.487) calculate that a single animal could have fed up to 120 people whereas the combined energy of the cattle in E-96-4 could have fed up to 474 people. Porcupine meat is considered to be a delicacy in North and West Africa and is slow-moving, meaning that it is easy to catch, and it can weigh up to 30kg (ARKive, *n.d.*). Combined with the likelihood that cattle, goat and sheep were used for blood and milk as well as, or as an alternative to meat, this argues that the potential diet for the short season at Nabta was potentially very strong on animal products and high in protein.

If dairy was not consumed due to lactose intolerance (see Appendix E), the outlook becomes less clear-cut, with much greater effort needed to obtain calcium, saturated fats, vitamin A and vitamin

D. It is certainly the case that the diet of the Turkana consists primarily of milk during the rainy season in northwest Kenya (Galvin and Little 1999).

Ostrich has a number of nutritional benefits. Their meat is rich in protein iron and zinc, and a single ostrich will lay 40-60 eggs per year after the summer breeding season, with an incubation period of around six weeks. Until the last decade ostrich bones were almost unknown at desert archaeological sites, but ostrich eggshells have been ubiquitous, suggesting that ostrich was a commonly used resource throughout Egyptian Holocene prehistory.

Bearing in mind the caveats and the poor preservation of data, using the tabulated data in Appendix E and the above tables as guidelines, the above nutritional components would have provided the inhabitants of Nabta, potentially, with a diet rich in protein, fat, iron and calcium but short of carbohydrates, polyunsaturated fats and certain vitamins that are confined to plant foods, such as vitamins C and E, folic acid, magnesium, and potassium. These deficiencies, if real, could have led to poor energy levels, high blood pressure, slow healing of wounds, scurvy, and muscle weakness.

*Panicum Turgidum* and *setaria* grain impressions are evidence of the use of cereal plants at Nabta, and it can be assumed that much greater quantities than those represented by these two examples were present and consumed, providing valuable nutrients, including calcium. *Panicum* is one of the most important grains in Africa today, the most abundant and the first to ripen after rains. It requires little preparation, is easy to digest and can be stored with little loss of quality for up to two years (S.E. Smith 1980, p.471). The tree and shrub component in the Ru'at el-Baqar is very similar to that in the El Nabta Early Neolithic.

At E-97-17, Irish has confirmed that wear on teeth re consistent with high volumes of plant food in the diet (Irish 2001). It is assumed that a much greater plant food component was present but has not been preserved.

### **Evidence of physical condition**

The burial that is most securely associated with the Ru'at el-Baqar is the one in tumulus E-97-5. Although not particularly well preserved, and missing its cranium and other parts of the body, the skeletal data "suggest a young and healthy individual" with no sign of stress on lumbar vertebrae (Applegate *et al* 2001 p.478).

### **Medicinal components**

Whether or not the species listed above were used for human or animal medicinal treatments or both is unknown, but it seems unlikely that the properties of available tree and plant species were unknown and that medicinal treatments were not assembled and applied, because numerous ethnographic examples cite uses of medicinal plants (e.g. Belal *et al* 2009, p.117-8; al Tabini *et al* 2012; Fratkin 1996). It can therefore be proposed with relative confidence that local species were used to treat ailments, bites and infections. Whether or not they were effective is another matter.

### **Skills and knowledge**

In previous sections the value of knowledge and information to society and economy have been considered. The transmission of traditional skills and knowledge to ensure well-being for all people within households and the larger group in the Ru'at el-Baqar will have been transmitted in a social context. Although much knowledge may be transmitted with ease between generations, specific technological skills may require more investment. Lithics and other traditional crafts would have required little investment in knowledge transmission; similarly, hunting and herding would have been communicated from adult to child in daily routines. Ceramic manufacture, which requires an understanding of the composition of fabrics, (clays and tempers), the treatment of surfaces and the function of heat in the hardening of fabrics requires rather more specialist knowledge and investment in both education and learning.

### **Sex and gender**

There are the remains of one male but no other remains can be confidently assigned to the Ru'at el-Baqar. Unfortunately, therefore, there is no indication of whether women were present or not at Nabta at this time. Their presence at Nabta would depend on how mobile pastoralism was organized (centrally or by household) and what skills and knowledge were required for the duration of occupation at Nabta, including wild plant collection, food preparation and dairy activities.

### **Age**

There is no data to provide information about the age profiles of groups who visited Nabta in the Ru'at el-Baqar. Food security and territorial security may have been under threat, and individual status and personal security may have been considerably undermined, particularly amongst the elderly whose knowledge and experience may have been of diminishing value as changes were required to develop new strategies of risk to dealing with uncertainty. If they were part of the group that accompanied herds to the basin, children and young adults may have found themselves of particular value as they grew up in an adaptive economy and society. Children in particular are often employed in tending young animals, collecting water and learning to manage herds (Abati 1998, p.122-125).

### **Population numbers**

There is not enough data to define how big the population was at Nabta. The lack of chronological granularity and funerary remains sabotage any attempts to assess numbers.

### **Gene pool**

Whilst it is by no means a requirement for groups who prefer to marry within clans, the possibility that finding partners either inside or outside the immediate group was a requirement was considered desirable for purposes of reproduction and social relationships (Kusimba 2003, p.85) as well as genetic diversity. The mobility indicated by Nabta and the presence of Sudanese type pottery in the Nabta assemblage suggests that relationships were maintained with groups along the Nile, possibly other ethnic groups. The potential fluidity and porosity of these types of community,

discussed above, would give opportunities for marriage partners outside the immediate groups, either within the broader kinship group or beyond it with different ethnic entities.

### ***Personal Assets***

#### **Individual status**

Looking at the data there is little to identify the individual in Nabta. There are individual animals, one articulated others broken down into key components, and one human individual, but there is not enough here to get a sense of individual contributions to the economic life of the community, and only a little to indicate the role that individuals may have played in influencing decisions. I have suggested that a plausible model for the organizational structure used to create the monuments of Nabta was one of a heterarchy. This suggests that at least amongst a part of the population there may have been the opportunity to make an individual impact in some of the ideological aspects of the decisions that were made and the activities that took place at Nabta. Whether pastoralism provided new definitions of gender, age and associated ideas of responsibility led to new perceptions of roles amongst herders is unknown, but the potential for new roles may well have led to improved personal status amongst some individuals in society.

#### **Personal well-being**

There are few clues about the quality of life at Nabta. As individuals, the visitors to Nabta may have looked forward to the experience of returning to the familiar and the special, but these visits may also have been associated with the anxiety about potential water shortages.

#### **Security**

There are no signs of conflict or competition for resources, and the use of Nabta over a period of centuries argues that it was regarded as a secure and attractive resource zone, providing security at household level and above.

Towards the end of the Ru'at el-Baqar conditions were certainly highly variable as aridification leading up to the arid phase became more obvious and was eventually accompanied by abandonment of the desert areas. Feelings of both group and household security must have been undermined towards the end of the Ru'at el-Baqar under such conditions.

#### **Ability to gain influence decisions**

Most pastoral societies include a number of individuals in decision-making processes (e.g. Schareika 2014) and it can be proposed, on the basis of the complexity and social arrangements that are visible together with the lack of any indication that power was centred in one person, that decisions were required on an ongoing basis and that there were multiple participants involved. Although we cannot identify the contributors to these process we can be confident that they existed and that their opinions were factored into livelihood decisions.



## 4.0 The Livelihood Variables

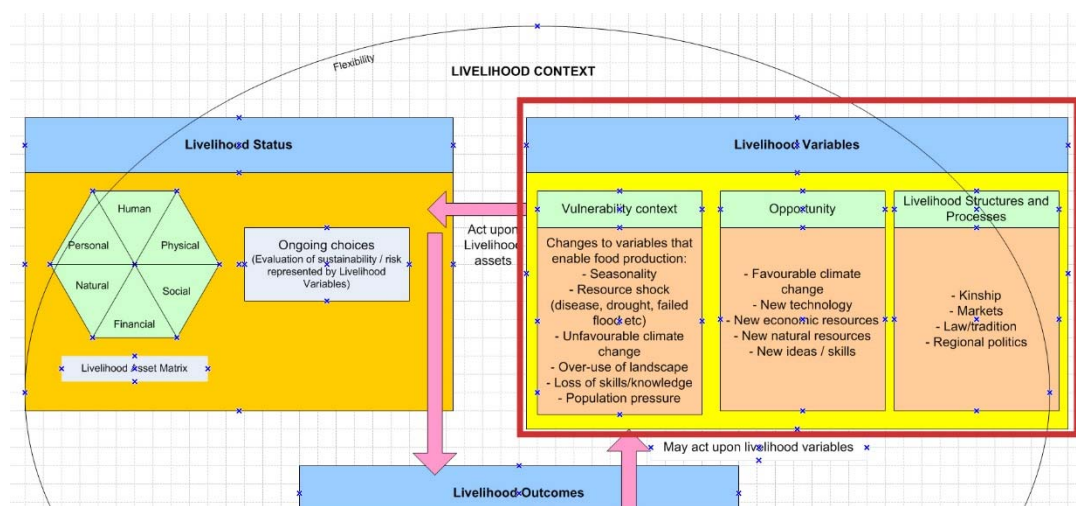


Figure 22 - The Livelihood Variables part of the SRL Model, outlined in red

The Livelihood Outcomes reflects changes that take place when the Vulnerability Context acts on the Asset Matrix (figure 22). This is discussed below in terms of three outcomes: economic, environmental and cultural.

### 4.1 Vulnerability Context

The asset matrix captures many of the important features of a community, but all the components that make up the matrix are dynamic and in a constant state of flux. The main visible vulnerability is that of initial climatic deterioration at the end of the early Holocene, the southward movement of the ITCZ transforming rainfall regimes and increasing unpredictability of rangeland availability, and creating conditions in which risk was balanced by new economic systems based around herds and new social systems based around the multiple experiences of desert, Nile and the nodes within and routes through them. The most obvious areas of vulnerability that would have impacted life within that area include differing levels of desert water, influencing the availability of pasture during the rainy season and the availability of floodplain resources. As Nelson *et al* state (2016, p.298) “Managing disasters, especially those that are climate-induced, call for reducing vulnerabilities as an essential step in reducing impacts.” The Nabta Playa story in the Ru’at el-Baqar Late Neolithic was one of managing risk via economic, social and ritual devices.

## Case Study 1: Nabta Playa

In this section, the system developed by Nelson *et al*/described in Chapter 2 is used to gauge vulnerability in access to food will be used to give a top-level assessment of the food resource situation at Nabta Playa. The variables are ranked using a simple qualitative scale to measure its contribution to overall vulnerability. The variables contributing to vulnerability load are shown in the following table (table 16) (Nelson *et al*/2016, p.300):

Variability variables		Evidence for vulnerability	Value for variable for resilient food system
<b>Population-resource conditions</b>			
V1	Availability of food	Insufficient calories or nutrients	Balance of available resources and population reduces risk of shortfall
V2	Diversity of available, accessible food	Inadequate range of resources responsive to varied conditions	Diverse portfolio reduces risk, increases options
V3	Health of food resources	Depleted or degraded resources, habitats	Healthy habitats, contribute to managing risk and change
<b>Social conditions</b>			
V4	Connections	Limited connections with others experiencing different conditions	Social networks expand access to food and land
V5	Storage	Insufficient, inaccessible storage	Stored foods reduce risk in times of shortage
V6	Mobility	Inability to move away from challenging food conditions	Movement to alternative places, landscapes and social groups offers potential for addressing resource shortfall through access to food/land
V7	Equal access	Unequal control and distribution of land, water and food resources	Equal access avoids challenges to coping and adaptive capacity in disaster risk management
V8	Barriers to resource areas	Physical barriers limiting access to key resource areas	Lack of barriers enhances capability of people to provision themselves with food

**Table 16 - Qualitative ranking of variables**

The qualitative ranking scheme is as follows for measuring each variable, based on contribution to vulnerability (2016, p.300):

1. No contribution
2. Minor contribution
3. More substantial contribution
4. Substantial contribution

A score of 1 would indicate for variable 1 (availability of food) would indicate that food supply did not contribute to vulnerability and would not therefore be a problem for the community. A score of 4, however, would indicate high vulnerability. A total of all variables (a possible maximum of 32) gives an estimate of how vulnerable the entire community was. By dividing vulnerability into resource and

## Case Study 1: Nabta Playa

social conditions, the importance of natural versus human influences can be made explicit. The variables for Nabta, using best judgement best on the data captured in the assets are as follows (table 17):

	Population-resource conditions			Social conditions					Total
	V1	V2	V3	V4	V5	V6	V7	V8	
Data	3	3	3	2	4	2	?	2	19/32
Extrapolation	2	2	3	2	2	1	3	2	17/32

Table 17 - Overall vulnerability in the Ru'at el Baqar

**V1 Availability of Food:** It is inferred that access to food and water was a short term requirement in Nabta, where the playa lake was only a seasonal phenomenon. For that time both the lake and the surrounding resources were sufficient to support herders and their livestock. All indications are that low numbers of people occupied temporary camps. It has been proposed that more secure resources were returned to after the lake dried up. If this was the case, food vulnerability should have been relatively low.

**V2 Diversity of available, accessible food:** Although preservation of plant materials is poor, the availability of a suitable mixture of plant foods can be inferred from the species including fruits and cereals. Wild and domesticated faunal remains and the the availability of dairy argue that Nabta occupants had adequate resources to compensate for shortages in any one resource area.

**V3 Health of food resources:** All data points to temporary use of Nabta. Late rainfall and drought could reduce the value of plant and wild resources, and introduce vulnerability into the seasonal visit, impacting the effectiveness of livelihood managaement.

**V4 Connections:** It is inferred, on the basis of seasonal occupation and cultural indicators, that Nabta occupants had connections with Laqiya to the south, the Nile to the southeast at Abka, or further to the south in the Kerma region. If these connections were secure, inhabitants at Nabta potentially had access to both dry season resources and support networks.

**V5 Storage:** There are almost no signs of storage, apart from the herds themselves. This might suggest failure to provide themselves with a fall-back supply of food for the duration of the stay, but is probably of marginal importance due to the brevity of the occupation and is unlikely to represent a serious vulnerability.

**V6 Mobility:** Mobility was clearly at the heart of the Nabta livelihood strategy, because the basin could only be occupied on a seasonal basis.

**V7 Equal access:** There seem to have been serious attempts to establish a symbolic and physical identity at Nabta, which may suggest that access rights had to be defended, but may also have been a reflection of the security that Nabta represented.

**V8 Barriers to resource areas:** The desert itself forms a barrier to food provision in times of low rainfall. Even with the Nile to fall back on, this might represent a form of risk, particularly if arrangements at the Nile required herds to be removed during the wet season.

This suggests that throughout the mid-Holocene occupation at Nabta, access to food for the short period of occupation was deemed to be sufficient for the area to be used over a very long period of time, even if not every year, and visits to Nabta would therefore have been relatively low risk. Should the proposal that Nabta was only used for seasonal visits in conjunction with more permanent occupation along the Nile be incorrect, these findings would need to be challenged.

## 4.2 Opportunity

Although Nabta was in an area of low rainfall in the mid-Holocene, there were various options for pastoralists and their herds. For a few weeks of the year, water accumulated in basins and behind dunes, and penetrated the thin soils as groundwater, promoting the regeneration of pasture and annuals as well as the maintenance of arid-adapted perennial species, and species that thrived under marginal aquatic conditions. Vegetation would fix limited organic nutrients into otherwise impoverished soils, helping to renew pasture annually. Conditions were probably not dissimilar from those pertaining in arid parts of the Sahel today, stochastic but offering variable subsistence opportunities for pastoralists. Although environmental change was detrimental to early Holocene subsistence strategies, the opportunities represented by domesticated species allowed dryland areas to remain in use.

Although domesticates were present in the Ru'at el-Ghanam, they were confined to sheep and goat in relatively small numbers. By contrast, in the Ru'at el-Baqar cattle were added to the livelihood mix, suggesting that the Ru'at el-Ghanam Middle Neolithic experiment was a successful one, and eventually became the strategic solution for the prevailing environmental conditions. By taking up the opportunity to diversify livestock, different benefits could be obtained for little more investment in terms of ongoing maintenance and knowledge acquisition.

The new livelihoods were accompanied by new cultural outputs, with new ideas and priorities reflected in the material record. These changes are probably connected to patterns of acculturation representing both the costs and benefits of taking up new livelihood opportunities in an increasingly constrained landscape of environmental stress and regional differentiation (Kuper and Kropelin 2006; Riemer 2007a; Riemer and Kindermann 2008).

## 4.3 External Livelihood structures and processes

The Nabta occupation, seasonal and dependent on the presence of playa lake hydrology, gives few opportunities for exploring the potential impact of external structures and processes. It seems clear that at some point between the Ru'at el-Ghanam and the Ru'at el-Baqar the inhabitants of Nabta came into contact with new ideas, particularly in the social and symbolic realm, and that these were due to communication with other communities along the Nile Valley. However, the nature of those contacts cannot be examined from the Nabta outpost.

## 5.0 The Livelihood Outcomes

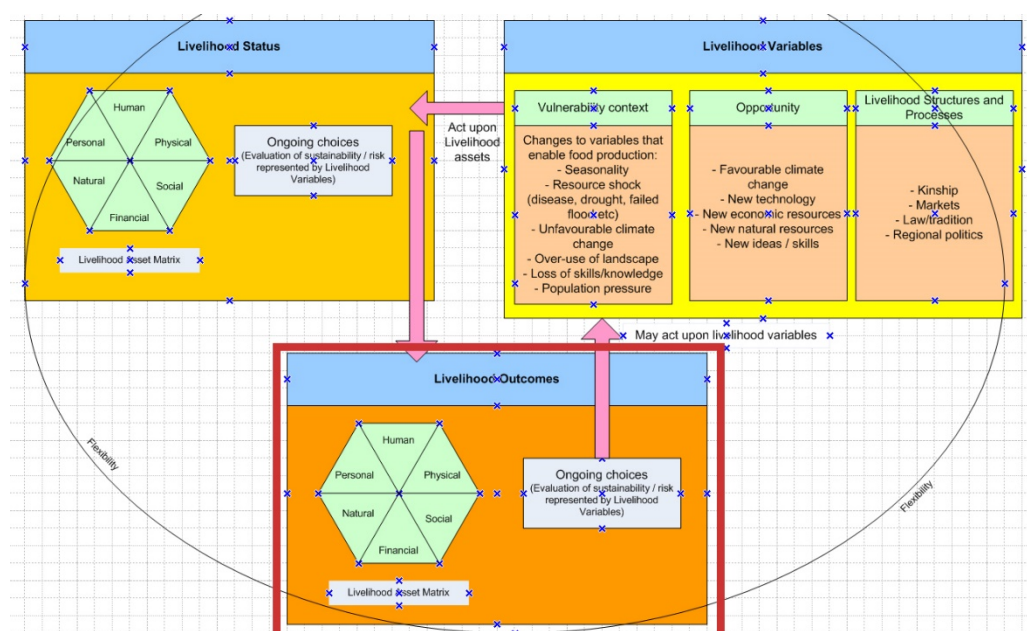


Figure 23 - The Livelihood Outcomes part of the SRL Model, outlined in red

The Livelihood Outcomes reflects changes that take place when the Vulnerability Context acts on the Asset Matrix (figure 23). This is discussed below in terms of three outcomes: economic, environmental and cultural.

### Economic Outcomes

The most frustrating aspect of Nabta Playa, from an SRL point of view, is that when the Nabta area is abandoned, there are no signs of what happened next to the people who had occupied the playa.

Just as it was impossible to suggest a possible home base for them, it is not possible to track them after they left. There was, however, a legacy of pastoralism along the Nile in the Sudan, which seems to have reached the 35km stretch of the Qau to Matmar stretch of Middle Egypt, from south to north known, archaeologically, as the Badarian (see Case Study 2). To the south and west pastoralism was also the dominant way of life, with cattle spreading west from Egypt. The impact of the drying of the desert seems to have been the dispersal of various peoples to different places but there were no neat breadcrumb trails left behind, to show which groups went where.

### Environmental Impact

Barakat (2002, p.599-600) states that there are no patterns in any of the woody taxa from Ru'at el-Baqar Nabta to indicate that human presence at the site had any significant impact on the vegetation of the region, with the possible exception of *Acacia nilotica* and *Ziziphus*, both of which could be related to human presence, brought into the area either by humans or animals eating and passing the fruit and seeds or bringing seeds into the area. The impact of these on the environment would have been negligible and they did not survive the downturn of the environment at the end of the Ru'at el-Baqar, when humans abandoned the area during the Post Late Neolithic Arid phase (Schild and Wendorf 2002, p.24). In the Final Neolithic, the Gebel Ramlah cemeteries have many similarities with the Badarian, albeit with notable differences, particularly in terms of ceramic production and personal display. The use of wood in hearths, however, does raise the question of whether there were isystems in place to limit the use on sustainable resources. However, climatic deterioration is suggested by the absence of *Acacia nilotica* and the appearance of chenopods at E-92-7 and E-92-4, with Sahelian elements becoming desertified. This is reinforced by the presence of just one arid-adapted taxa, *tamarix*, at E-94-1 (Barakat 2001).

There is no evidence of human/herd impact on Nabta but it is entirely plausible that herds exacerbated environmental deterioration as increased variability led to fluctuating resource availability. In fact, it is difficult to imagine that it would not, particularly as even small-scale societies often modify their local environments in a number of ways as part of a livelihood management process that Smith calls "niche construction" (B. Smith 1994, p.264-5) and to improve production value of wild resources (Hurcombe 2014, Anderson 2005). Ceramic change at Nabta may be an indication of a positive feedback system, or at least an aspect of one in which new economic practices lead to new cultural practices, or vice versa, and both may have had consequences for the environments if the changes involved new approaches to land management. However, the Nabta area did not succumb to desertification as a result of over grazing. Whilst herds must have had an impact on the environment, it is unlikely that herds were present long enough to do serious damage, and the Nabta area was part of a cycle that included conditions where herds could not survive and had to be move elsewhere, which protected it from overgrazing. The benefits of grazing, trampling and dung deposition include compacting of seeds and plant matter into soil to improve soil quality, improvement of water penetration, removal of dead biomass at the end of the dry season, reduction of bush fires and the revival of forage (Grandval 2012, p.2). Savory (2015) describes how in today's arid

environments desertification can actually be reversed by livestock herding following Voisin's demonstration that overgrazing was a function of time (1988), the period of which plants were exposed to grazing and not due to the number of individuals in a herd. A climatic downturn at the end of the Ru'at el-Baqar Late Neolithic resulted in the abandonment of most of the Western desert (Schild and Wendorf 2000). The mobile lifestyle and the ephemeral nature of the desert argues against the ability to amalgamate surplus herds that could be sustained, which would have been a barrier to the types of pastoral hierarchical complexity described by a number of authors (Brooks 2006a; Holl 2006; MacDonald 1998; Minnis 1996; Rogers 2012). Environmental downturn may have resulted in the type of competition or consolidation of groups and resources that might be expected to lead to hierarchy, and it did apparently result in the growing importance of funerary traditions along the Nile and at Gebel Ramlah in the Final Neolithic.

New patterns of usage of the available environments are suggested by Garcea and Hildebrand's work on Sai Island:

"In the end, riverside sites such as 8-B-10C may have been the receiving grounds for Saharan peoples as desiccation forced them to the Nile. The evident sedentary or near-sedentary use of 8-B-10C . . . indicated by closely spaced dwellings with numerous substantial support posts – might indicate that people became increasingly tethered to the Nile as rainfall decreased in the early middle Holocene" (Garcea and Hildebrand 2009, p.319).

Fekri Hassan, amongst others, suggested that population movements into the Nile valley over the period of a millennium would have taken place as the climate deteriorated (Hassan 1986, p.71), and it is useful to have archaeological data to support the idea.

### **Social Impact**

The Ru'at el-Baqar Late Neolithic was followed by the Bunat el-Ansam Final Neolithic, with the final developments of the ceremonial centre Complex Structures with the addition of new Complex Structures, megalithic alignments and, a new feature, the Gebel Ramlah cemeteries. Marshall and Hildebrand (2002, p.112) make the point that herding involves scheduling conflicts, concepts of ownership, and new rules of sharing labour resources and products. Relationships with animals was also different, a shift from perceiving them as prey to managing them as livestock (A.B. Smith 2005, p.201; Hesse 1982). These may have been key drivers for social developments that included the formalization of handling the dead as well as the need to embed functional and explanatory activities in rites that were expressed materially both through the ceremonial centre and the provisioning of the dead. The heavy deflation makes the settlement side of Nabta's Final Neolithic very difficult to assess, but the importance of burials seems to have more to do with the Nile than desert traditions, perhaps suggesting that mobility was more confined, perhaps restricted to a dichotomy of Nile and Nabta movements, and that Nile traditions were becoming increasingly important. Again, it is pure

speculation but if the Nile was the most reliable and sustainable livelihood option, the associated traditions could be expected to be dominant.

Sapignoli's observation that a connection to a territory is common in small-scale societies (2014, p.48) and Frederick's observation that some sites when used repeatedly throughout a year's seasonal movement, are part of what reinforces identity, ideas and social stability (2014) both seem to hold true for Nabta, where components that were initiated in the Ru'at el-Baqar continue after an arid break into the Final Neolithic and were accompanied by new funerary behaviours. Riemer *et al* see a "transition from nature-dominated to human-dominated" environmental management after the drying of the deserts (2013, p.163). They are probably right. With the Badarian and the introduction of flood irrigation, herding, cultivation, a more closely managed mobile herding component, centralized and specialized craft manufacturing and a growing cultural output, the human domination of the Nile landscape was probably the main outcome of the drying of the Sahara.

Di Lernia sees a spread of a cattle cult from the Egyptian Sahara to the central Sahara, as small groups dispersed following the climatic deterioration at the end of the mid-Holocene (2006, p.59-60). If this is true, any cattle cult would seem to have been crystalized as it moved west, because there are too few indications of an exclusively cattle-based cult at Nabta.

Looking east, Wendorf, Schild and Close (1992, p.17) suggest that the development of the complex features at Nabta may be related "in a way not yet understood to the development of complex society in Upper Egypt." Since that publication, much more investigation has taken place along the Sudanese Nile valley and it seems very likely not only that Nabta and the Abkan were related (Garcea and Hildebrand 2009, p.307) but that many of the features that manifest in the Badarian, the earliest of the early Predynastic Upper Egyptian Nile Valley occupations, were derived from the Sudan (see Badarian case study), with a spread of Sudanese cultural traits to the north influencing but not determining the unique character of the Badarian.

Ultimately, Nabta was completely abandoned. Hassan argues that movements of cattle can be tracked in an east to westward movement, with the movement of people taking up better watered areas in the Saharan highlands such as Tibesti, Tassili, Ennedi and Hoggar (2008, p.52). At the same time, it is likely that the development of links with the Nile valley will have led to permanent settlement of at least some groups along the river (Hassan 1986a). Others may have moved south into the better-watered rangelands of the Sudan. The risks associated with the abandonment of Nabta could have been considerable, including the costs of devising new methods of livelihood management, the risk of abandoning any divine entities associated specifically with the ceremonial centre and the embedded tradition of seasonal mobility, and the loss of geographical diversity and economic flexibility.



## 6.0 Answering the key questions

### 6.1 What drew occupants into the area and why did they remain?

The dominant feature of Nabta Playa was the main basin and series of sub-basins that filled with water during the wet season, providing a temporary resource that continued to be accessed by wells after the water had retreated beneath ground level. The wet season was also responsible for sustaining a number of tree and shrub species which, in earlier periods, were associated with various grasses and leguminous species, and must have created sufficient pasture to attract herders repeatedly to the area throughout the mid-Holocene. It was only two to three days walk from the Nile, so could have been used in conjunction with Nile territory without major commitment of resources. Additionally, there may have been a tradition of herding in Nabta, building on 100s of years of occupation at the site, which groups wished to maintain as part of their social identity.

### 6.2 What types of risk were experienced and

#### 6.2.2 *Natural risk*

Nabta was inherently a high-risk environment from a subsistence point of view. It was dependent on rainfall, and rainfall in these types of environment can vary both temporally and spatially. As the mid-Holocene proceeded precipitation would have become increasingly stochastic. Even when it arrived on time, volume would have been variable, and low levels of precipitation would have resulted in pasture but lower levels of potable water. High evaporation would have been responsible for lowering the water levels even in good years. Most of the plant resources would have been seasonal, with only a low density covering of tree and shrubs to provide shelter and fodder for goats.

#### 6.2.3 *Economic risk*

It is unclear to what extent the economy of the Nabta occupants actually *required* a seasonal visit to Nabta. If the purpose was to rest dry season pasture elsewhere, any failure of precipitation would have required decisions to be taken about how best to manage the situation. It is also possible that the annual trip to Nabta was based on social and symbolic as well as purely economic reasons.

#### 6.2.3 *Social risk*

For individuals social risk lies in the loss of perceived status or prestige. There are no signs at Nabta of status or prestige lying with an individual on an ongoing basis. The continued use of Nabta may have been as much due to tradition and the desire to maintain links with Nabta as with economic

reasons, and the social risk could have been high if continued visits were prevented. For the group as a whole, any other social risk probably lay elsewhere, beyond Nabta. Traditional social structures may have been challenged after Nabta had been abandoned and new mechanisms were put in place to ensure the ongoing health of herds, but these are not visible at Nabta.

### 6.2.4 Symbolic risk

The potential risks come in two parts – the risk to the belief system of the group should its investment and its sacrifices fail to produce the desired outcomes, and the risk to any individual who was mediating between the real and the supernatural worlds. Whatever function the ceremonial centre served, it was probably invested with ideas originating in the numinous, or in the liminal area of rites of passage. With investment on this scale, symbolic risk is tied into the idea that where there is a large investment in symbolic mediums of risk management and there is a risk embedded in those chosen symbolic mediums.

At Nabta symbolic risk must have been high. The ceremonial centre was not merely an investment in planning and labour but in ongoing use, of a commitment to the ideas and beliefs that were incorporated into it. Failure of the ceremonial centre could have translated into the failure of entire belief systems and the underlying sense of livelihood security that went with it. At Nabta the intensification of ceremonial activity may have corresponded to increasing subsistence stress, but there does not seem to have been any negative response to the symbolic aspects of the centre, which was not destroyed at the end of the Ru'at el-Baqar and was added to in the Bunat El-Ansam Final Neolithic. This seems to indicate that either the dating of the ceremonial centre was wrong and it should be placed entirely in the Final Neolithic, or that the ideas that were initially expressed in the Ru'at el-Baqar continued to be observed during the arid period between the two phases. An individual mediator (such as a shaman) between the living world and the supernatural might not have fared as well, being an easy target for blame. Although I could find no convincing indications of a shaman type role at Nabta it is not unlikely that such a person existed.

## 6.3 How were risks managed?

Vulnerabilities have already been considered. This question looks at how the risks involve in vulnerabilities were managed. The available data has been checked against the list of risk management strategies in Chapter 5, using it as a checklist. The checklist for risk management strategies forms the basis for a comparison of all areas. In table 18 I have used a simply yes/no/? judgement on whether there is evidence for a practice, but I have also indicated how much confidence there is in the data and the judgement, using a simple High (H), Medium (M) and Low (L) scale. The contents are discussed in brief immediately afterwards.

	Evidence for strategy present ✓ / ✗	Quality of data available	Confidence that strategy practiced
Food procurement Diversification	✓	M	H
Food procurement Specialization	✗	M	L
Storage	?	L	L
Mobility	✓	H	H
Habitat management	✓	L	M
Social networks	✓	H	H
Communication of knowledge	✓	M	M
Exchange of information	?	M	M
Leadership / roles	?	M	M
Division of labour	?	L	M
Technology specialization	✗	M	H
Ideology and religion	✓	H	H
Opportunity and innovation	✓	M	H
Conflict	✗	L	L
Trade/exchange	✓	M	M
Stint/hunger foods	✗	L	L
Migration out of the area	✓	H	H
Remaining to experience impoverished conditions/death	✗	L	L

Table 18 - Risk mangement strategies in the Ru'at el-Baqar

- The combination of domesticated livestock, hunted game and the presence of grinders, presumably for processing grasses and other plant materials, combined with a certain amount of mobility, indicate a **diversified approach** to food procurement. Short term occupations combined beneficial effects on animals with the maintenance, via grazing, trampling and fertilization, of the land to which they returned, presumably on an annual basis, helping to achieve long term sustainability of both livelihood and the environment.
- Apart from Hut 1, there are no signs of **storage**, and even those at Hut 1 had no contents so their function remains unconfirmed
- The strongest risk management strategy, apart from diversification, was **mobility**, with the movement of individuals in and out of Nabta at appropriate times of the year. By taking herds to the richest pasture that was available, the health and value of herds was maximized. The ephemeral character and small size of sites suggest that mobility was probably logistical rather than residential.
- **Habitat management** may be indicated by the very presence of people at Nabta if they were resting dry season pasture elsewhere. It is possible that niche management was practiced by using briefly abundant areas like Safsaf (Close 1990; 1996; 2000a; B. Smith 2011), where small

temporary sites were found, may have been used as supplementary zones for herding animals away from Nabta, returning to the basin when resources were depleted.

- **Social networks** are strongly implied by the ceramics, which have strong affiliations to the Nile.
- Successful **knowledge transmission** is also strongly implied by the ceramics, which indicate transfer of skills, as well as the ongoing need to manage herds, familiarity with the landscape, hunting of wild animals and collection the appropriate plant materials.
- There is no evidence for the exchange of **information**, which is archaeologically difficult to identify, but it seems unlikely that this sort of livelihood could be maintained without information about rainfall events, trading opportunities and social aggregation events.
- It is possible that religious **leadership** was required for the commissioning and ongoing use of the ceremonial components, and it seems likely that various projects required more than guidance and direction, but some of these roles could have been transient and there are no personal symbols of status or power or other archaeological indicators of leadership.
- Although there is no data, **division of labour** was almost certainly practiced in order to make the most of all ages and skill sets.
- There are few signs of **technological specialization**. The lithic industry was expedient, with only few distinctive types recognized as diagnostic indicators of the Ru'at el-Baqar, and it seems clear that nothing more sophisticated was required. Ceramics required greater investment of learning, skill and time.
- Risk was almost certainly mediated by **ideological and religious** values embedded in the ceremonial centre and associated with the change in ceramic design, both of which represent investments in activities that don't connect directly with food production but probably connect to ideas of identity and social reinforcement. The tumuli suggest that people were ideologically pastoralist in their thinking, whilst the alignments and stone circle suggest that some ideas materialized at the site were centred on stellar observation. The ceremonial centre is a materialization of ideas in the enduring form of stone. The design includes multiple components with which, or within which, participants engaged.
- **Opportunity and innovation** have been discussed above.
- There are no signs of **conflict**.
- **Trade and exchange** are again difficult to assess, but indications of connections with a variety of different areas argue for links with different peoples, which may have involved exchange mechanisms.
- With respect to **hunger foods**, there are no indications that Nabta inhabitants were short of food, but choice would have been limited, and as the playa lake dried both food and water for human and animal consumption would have been in increasingly short supply.
- At the end of the mid-Holocene Nabta was **abandoned** and the seasonal occupants of Nabta in the Ru'at el-Baqar presumably migrated towards the Nile and/or elsewhere and re-arranged their subsistence strategies accordingly.

## **6.4 How can the livelihood be characterized in subsistence terms?**

The Nabta Ru'at el-Baqar occupants were mobile herders of cattle, sheep and goat, who also used wild resources to provide adequate nutrition and preserve livestock during the wet season occupation. They are perhaps best characterized as herder-hunter-gatherers, or multi-resource nomads (as used by Salzman 1972), at least for the part of the year when they were at Nabta. It is clear that there are various types of pastoral livelihood available, and as discussed in Chapter 5, no pastoral livelihoods today are exclusively dependent on herds, and plant nutrients may have been sourced. When they moved to other geographical areas the Nabta inhabitants may have practiced other forms of subsistence strategy, and the use of Nabta itself may have been highly variable in frequency. There may have been years when Nabta was not viable, making the occupation of the basin less seasonal than one of a number of available options open to herders. Based on the lack of evidence for contacts further to the west of Safsaf, and with only marginal connections up to 70km to the north, it is most probable that the mobility exhibited by the Nabta inhabitants was restricted, possibly a form of semi-nomadic pastoralism that involved settlement at one or more Nile-side locations during the dry season, with herds moved to Nabta during the wet season. Judging by the fact that only a few hearths appear to have been used contemporaneously at some sites, it is possible that in most years only a few households moved to Nabta, or that households were left behind and only herding labour was required for Nabta. The presence of ceremonial components argues a tie with Nabta, and a purpose that more than ephemeral tenancy would suggest, so perhaps Nabta was used differently from year to year, depending on the information received about conditions at the Nabta area. Whilst most resources seem to have been available for the duration of the occupation, it is possible that resource acquisition trips were made to the north. The presence of bifacial tools in the Ru'at el-Baqar assemblages suggests that contact between people in the two areas was made.

## **6.5 Has it been possible to identify where decisions have been made and what they were?**

Most of the occupation at Nabta probably represents a routine that did not require unusual decisions. Whilst individual decisions cannot be observed, the accumulation of decisions are implicit in any risk management strategy. From an economic point of view, risk is a constant process of problem solving and decision making (Segal 1994, p.25). Problem solving and decision making may be "relatively automatic" when the problem solver is experienced and the problem familiar (Segal 1994, p.26) but in conditions of environmental variability droughts may result in unusual or even extraordinary situations. Most decisions about occupation at Nabta were probably concerned with the interpretation of information about when to move and which routes to take, and who should take part in that move.

Problem solving components would have become more pronounced as the environment deteriorated and rainfall became less predictable. Droughts may represent complete failure of seasonal rains or shifting of the time of year when it falls, its intensity or its geographic location (Moule 1970).

Repeated failure of droughts can lead to serious distress in dryland areas, and access to the Nile or other water sources will have been critical at such times, and considerable knowledge and skill will have been applied to preserving the traditional livelihood strategy. Problem solving, which is goal-orientated, operates within social constraints and the conditions under which decisions were made at Nabta towards the end of the Ru'at el-Baqar may have been influenced by existing proscriptions and land tenure agreements. Negotiating not merely subsistence issues but also the challenge to traditional livelihood expectations may have been both difficult and traumatic.

Decisions are visible in the ceremonial centre, where different requirements were met with different solutions. A proposal to create the various elements required agreement, design, implementation, refinement and reinforcement in the acts of repetition and ritual use of each element (Moser 2014; Olupona 2014). At each stage proposals were made, and decisions were acted upon. Above all the ceremonial centre is a statement of successfully implemented intention and may itself have been used in order to inform decisions about when to schedule certain activities, forming a bridge between the physical and the numinous. An example can be given in the case of the table rocks. We know that a requirement was identified and that this was conceptualized. The conceptualization took the form of the location and modification of the table rock as a process that was considered to meet that need. At least some individuals were responsible for and capable of acting upon the requirement to shape and rebury the table rocks, but they are not necessarily the same people who identified the requirement and decided upon its form. This can be broken down into a series of elements: identification of a problem or risk (use of knowledge or information); proposal/s of one or more solutions (conceptualization and communication); a decision about which solution should be chosen (negotiation and conflict resolution); design of the solution (conceptualization and negotiation); planning about how and when to deploy labour (negotiation, delegation); supervision of works (leadership, management and delegation). It may also have required decisions about religious aspects of the process, which may have required the intervention of ritual specialists. We can assume that the first of these projects was successful, because it was repeated.

In lithic tool technology, although the toolkit was largely expedient, decisions were made about raw materials that these should be made on, and some lengths were taken to acquire it. The adoption of the bifacial tool technology, which are generally an oasis phenomenon, represents a decision, although how this should be interpreted is uncertain.

The only other decision that is completely unambiguous in the archaeological record is that of abandonment following climatic deterioration at the end of the mid-Holocene. The decision not to return to Nabta may have been fraught with social and religious risk but was probably unavoidable due to the collapse of mid-Holocene rainfall regimes.

## 6.6 How has group identity manifested itself in the archaeological record?

There are multiple indicators that the Nabta inhabitants had mechanisms in place for expressing cultural identity. These include the ceremonial centre, which may have expressed a common religion, affiliation with and rights over land, and clearly indicates shared knowledge about its purpose and how it was used. The act of using the ceremonial centre may itself have been an integrating and reassuring activity, reinforcing and consolidating group identity by acting out roles that mediated beliefs. The distinctive ceramics seem to extend this sense of identity by incorporating the herders at Nabta within a wider realm of shared culture with the Nubian and Sudanese Nile, a deliberate statement of association. There are, however, very few indications of personal identity. Ornamentation was not a big feature of the Nabta Ru'at el-Baqar, for example. It is possible that other methods were used to express individuality, such as body paint, scarring or tattoos, but it is also possible that a lack of individual expression was a device to prevent comparison or to enforce concepts of similarity (Wiessner 1984, p.226). At least with the available evidence, at Nabta the emphasis seems to lie in group identity rather than individual differentiation.

## 6.7 Were opportunities taken up in periods of stability or stress?

Hassan (2002a, p.3) and di Lernia (2006, p.132) and both suggest that aridification was the source of increasing complexity in the material expression of ideas, new technologies and economic systems to enable existing resources to be used more successfully. An opposing view is that well-being was the primary inspiration for innovations taking place in humid periods (Wendorf and Schild 2003, p.132). di Lernia (2006, p.132) discusses the question of whether hardship or well-being pushes innovation and concludes that aridification was the source of increasing complexity in the material expression of ideas that he investigates in the central Sahara, particularly because it forced people to move. Hassan also supports this view, suggesting that one response to environmental change is the development of "innovative technological, economic, social or ideological means to enhance the productivity or quality of new or pre-existing resources" (Hassan 2002a, p.3). Wendorf and Schild, by contrast, suggest that the well-being was the primary motivator at Nabta, with key innovations taking place in humid periods: "We believe that many of the technical and economic innovations that developed in the Sahara during the Holocene did not occur in intervals of aridity, but during periods of increased moisture" (2003, p.132), an idea that reverses their proposal in 1992-3 that the incipient social complexity of Ru'at el-Ghanam Middle Neolithic Nabta was the result of social adaptation to the "sheer stress of survival in the desert" (Wendorf *et al* 1992-3, p.15) and in the Ru'at el Baqar "the incipient social complexity reflected by the building of small-scale public architecture developed out of the social adaptation to the stress of survival in the desert (Wendorf, Schild and Close 1992, p.15).

Ovicaprids had been added to the subsistence mix in the Ru'at El Ghanam, and by the time the herders returned to Nabta in the Ru'at El-Baqar, following a period of abandonment, they brought with them cattle, sheep and goat, and a new cultural repertoire. The Ru'at el Ghanam is unfortunately poorly understood but the main activity appears to have been hunting, and a dry spell forced these people to abandon the deserts. Ovicaprids were, however, adopted during a comparatively humid phase, and may have been seen merely as a buffer against deteriorating climatic conditions. It could be argued that ovicaprids were adopted somewhere along the continuum between stability and stress. The addition of cattle appears to have occurred during the arid phase, as did the cultural transition, but as we don't know where this occurred it is impossible to know what the conditions were at the time. The ceremonial centre appears to have been innovated in the late part of the Ru'at El-Baqar and may therefore have been a response to increasing environmental stress.

It seems plausible that deteriorating humidity and increasing stress spurred material expression of complex ideas that related to stone, the sky and animal remains, an incentive to sustain ideal conditions. This only makes sense, however, if the linkage between rainfall and the night sky is accepted. Although Wood argues that a spiritual component is involved, requiring negotiation between the living and spiritual domains (Wood 2016), which seems very plausible and is supported by the available data, there is unfortunately nothing specific to assist with a definition or clarification of this relationship or an understanding of how it might have functioned.

### **6.8 Can the livelihood be characterized as sustainable?**

The Nabta occupation was one of temporary seasonal occupation based around a water source that was evaporating from the moment it formed. In a sense, this component of the livelihood strategy was never intended to be sustainable. However, the livelihood strategy as a whole, with the Nabta locale used as a supplement to a livelihood that may have been based primarily on Nile resources, was an opportunity to take advantage of fresh, nutritious and palatable herbaceous growth for livestock, and was sustainable just as long as the rain continued to fall. The livelihood strategy had been developed to meet contemporary conditions and it worked.

### **6.9 Why was the area abandoned / why did the type of occupation change?**

The most obvious explanation for abandonment of this area, which had otherwise been used as a resource for hundreds of years is environmental deterioration followed by a hyper-arid phase. The switch from tolerable to intolerable conditions is unlikely to have been sudden, but rainfall at Nabta must have become increasingly unreliable, reducing its value over decades so that other economic



solutions would have had to have been implemented to compensate. If the Nabta basin was associated with complex symbolic ideas, the adjustment could have been difficult on more than one level.

## 7.0 Gaps in the data

### 7.1 Unavailable data

Many of the gaps in the SRL asset matrix were due to the absence of skeletal remains, which might have permitted analysis into various aspects of human living conditions including: congenital conditions; endemic conditions, genetic conditions; trauma; infection; metabolic disease; stature and strength; health; dental health; types of labour practiced; sexual dimorphism in activity; mobility; genetic diversity (Davies *et al* 2014; Irish 2004; Judd 2006; Stock *et al* 2011; Zakrzewski 2003, 2006, 2009).

Poor preservation of botanical and faunal remains has meant that reconstruction of environmental conditions and nutrition available for both animal and human physical well-being has been minimal. Comparison with modern ecologies in similar climatic conditions suggests that biodiversity was much greater, and was represented by many more species of both herbaceous and tree types.

Diachronic data is minimal due to the absence of stratified contexts in all but one site.

### 7.2 Opportunities for future research

As observed above, the functionality of tools is poorly understood so it would be very useful to initiate a comparison of lithics with studies in other regions and countries. In the Levant microwear analysis has been used to indicate variations in tool motions and contact materials and these are considerable, suggesting that there is an enormous amount of variability of function and use of tools concentrated on specific parts of a tool (Shea 2013, p.309). There is no comparable microwear analysis database currently available for eastern Saharan contexts (Shirai 2015, *pers comm*). Similarly, there is no geological database available for the sourcing of materials used in the manufacture of stone objects in the eastern Sahara, and this inhibits analysis of the acquisition of stone as part of the overall chaîne opératoire.

The same is true of the function of ceramics, where use-wear and residue analysis has been lacking, meaning that even though there are long sequences of ceramic use at Nabta, this line of investigation has not been pursued (Nelson 2002b, p.99).

The analysis of ceramics seems to be inconsistent. An initial analysis of the 1998-99 assemblage by Gatto is referred to by Nelson (2001, p.539) but is not referred to anywhere else, and was apparently unpublished because Nelson does not cite a source. The new analysis in 2002 does not state why a new categorization was considered necessary. In addition, it is difficult to tie in the pottery described throughout Wendorf, Schild and Associates 2001 with the analyses in Nelson and Associates 2002. A running theme in Nelson and Associates 2002 is that authors had considerable difficulty acquiring sufficient samples with which to work, and this situation is unlikely to have improved. This highlights the importance of maintaining objects in an accessible place for research purposes. As in all the case studies, I found the lack of colour plates frustrating, as it is impossible to get a sense of the pottery from illustrations alone.

Seasonal occupation might be tightened up with phytolith and diatom analysis of playa beds and the isotopic data from cow teeth with a view to understanding seasonality of occupation, mobility patterns and links to other water sources (Nelson 2002b).

Malville *et al* (2007, p.3) note that Bagnold's Circle, a stone circle found by Bagnold in 1930 450km west of Nabta, ought to be excavated in order to judge whether or not it was related to Nabta. It is twice the size of the Nabta circle but made with similar sized stones and so far appears to be undisturbed.

It would be useful to compare past and present vulnerability variables using the scheme proposed by Nelson *et al* (2016). It was out of the scope of this thesis, but comparing Nabta in the final early Holocene and the mid-Holocene would provide an interesting insight into the different livelihood strategies between different periods of occupation. It seems fairly certain that vulnerability increased, but the degree to which is this true and in which areas would make for an interesting research project. As archaeology is uniquely geared towards assessing change, desert contexts rarely have stratified contexts but Nabta has a stratified sequence at E-75-8, this would be a useful consideration of how desert livelihoods could and did change. It would also be useful to compare this data with contemporary Nile valley archaeology over the two periods, to see how the richer resources of the valley and the more variable and marginal ideas of the desert contrasted. Nelson *et al*, for example, find that in the seven areas under consideration (extreme dry and extreme cold) only little change occurred where the vulnerability load was low but that where vulnerability loads were high transformation did occur (Nelson *et al* 2006, p.301). This type of observation would be a considerable contribution to understanding the main drivers behind how the Nile valley and the Final Neolithic of the desert developed, and why.

## 8.0 Conclusions – the value of the SRL model in this area

At Nabta there was one of the most comprehensively published of the four case studies, and was excavated using modern techniques, it offered great scope for testing the value of the SRL model and assessing whether it is a viable tool. The range of the questions that the SRL approach demands is considerable, and it was rewarding to apply a tool used by development economists on a much more restricted database. Certain parts of the matrix could not be populated with archaeological data, either because the data was not available or because of the way in which it had been published. Completing the Asset Matrix both made such gaps transparent. These gaps include poor preservation of botanical and faunal remains, an absence of stratified sites, and the absence of skeletal remains that might have produced insights into various aspects of human living conditions that could not be substituted with other types of archaeological data. Where data was available, a very rich understanding of aspects of Ru'at el-Baqar livelihoods could be developed, particularly when supported by insights from ethnographic studies. The development of the **Social Assets** section particularly demonstrated the value of discussing the relationship between data and what it represented in terms of socially embedded concepts like ethnicity, identity and ideology. Certain questions arose during the completion of the SRL framework that suggested opportunities for future research. Some of these were specific to Nabta, like the investigation of seasonal occupation with phytolith and diatom analysis of playa beds and stable isotopic analysis of data from livestock remains. Others are more general, for example the need to improve understanding of the functionality of stone tools and the requirement for a geological database of Egyptian and the Sudanese stone and mineral types. Other opportunities for future research are discussed in the longer version of the case study and referred to in Chapter 10.

The key questions have provided a test for the SRL approach, indicating that problem orientated research is a suitable use of this method. Although it was not possible to answer some of the questions definitively, or even usefully, this again highlights gaps in the data and might suggest potential areas for future research, some of which are mentioned in Chapter 10.

The case study required considerable investment of time. Although fragmentary data is available in publications, assembling it in the required format and putting it to work was far more time consuming than I had anticipated. It was a rewarding and productive exercise, but the large amount of time required to use the approach in archaeology would need to be factored into any future projects on a similar scale.