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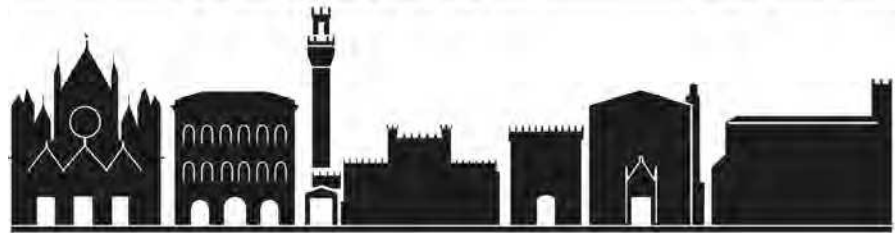
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# On Their Way Home ...

## A Network Analysis of Medieval Caravanserais Distribution in the Syrian Region, According to an 1D Approach

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*Abstract: The common theory on caravanserais states that they were built at one-day's march distance from each other. Such a pattern may fit some situations, but it does not seem to be present in Syria during the Ayyubid (1174–1260 CE) and Mamluk periods (1260–1517 CE), when most of the region's caravanserais were founded. Caravanserais built during these periods do not seem to follow a precise pattern of distribution along the communication axis of Syria and, as a result, the logic that underlines their distribution remains unclear. The authors face the problem through a GIS-based, network analysis approach that takes into account the building period of each structure and the one-dimensional criterion of distance to its nearest neighbour, also considered in relation to the closeness to urban centres. The results of the analysis are then compared to the historical Syrian caravan networks. The outcomes show interesting aspects both in terms of understanding the route organization, and of predictive methods for focusing on areas where structures not yet located may be expected.*

*Keywords: Spatial archaeology, Caravanserais, GIS, Syria, Middle Ages, Network analysis.*

### Introduction

Spreading throughout the Muslim world since the beginning of the Islamic period, wayside caravanserais have functioned for many centuries as sheltered stopovers providing lodging and security to all travellers (Fig. 1). The impressive diffusion of this institution clearly shows that caravanserais fulfilled a key role in society in relation to travel and trade; they represent the specific response developed by the Islamic world to travellers' needs. Despite such considerations, caravanserais remain inadequately studied and understood, particularly when considered as a network. In fact, even in regions such as Turkey and Iran where the study of caravanserais can boast a significant record of research, the overwhelming majority of the studies have focused on the architecture of these buildings, mainly trying to work out a periodization of these edifices based on their layout (e.g. Erdmann 1961; Kiyani and Kleiss 1995). Rare studies that do consider caravanserais as a complex system do exist, but their approach leaves aside geographical considerations to focus mainly on historical issues, such as the question of patronage (see Cytryn-Silverman 2010 for an example). An MA thesis dealing with the caravanserais of Central Anatolia appears to be the only attempt to approach caravanserais as a network of stopovers in relation to the road communication system using computer-based analyses (Ertepinar-Kaymakci 2005). A dissertation was proposed in 2009 (Tate 2009) aimed at widening the scope of the previous MA thesis by using a more comprehensive GIS approach as well as the methods of landscape archaeology, but the PhD was never completed (Scott Branting, personal communication). No study such as those mentioned above exists for the Syrian region, or more correctly Bilād al-Šām, whose caravanserais never attracted much of the scholars' attention.



FIG. 1. KHAN AL-'ARUS: THE CARAVANSERAI BUILT BY SALAH AL-DIN IN 1181 CE ON THE DAMASCUS-ALEPPO ROAD (PHOTO: C. TAVERNARI)

### 1 The geographical and historical framework

The geographical region that from the Middle Ages until the 20th century was known as Bilād al-Šām was formed by Jordan, Syria, Israel, Palestine, and the southern part of Turkey up to the Taurus Mountains (Fig. 2).

The choice of the historical framework mainly depends on the information available on caravanserais. Within the framework of the intended study, it is essential to be able to locate the caravanserais quite precisely on the field and, at least, assign their construction to a particular period if not date. The scarce

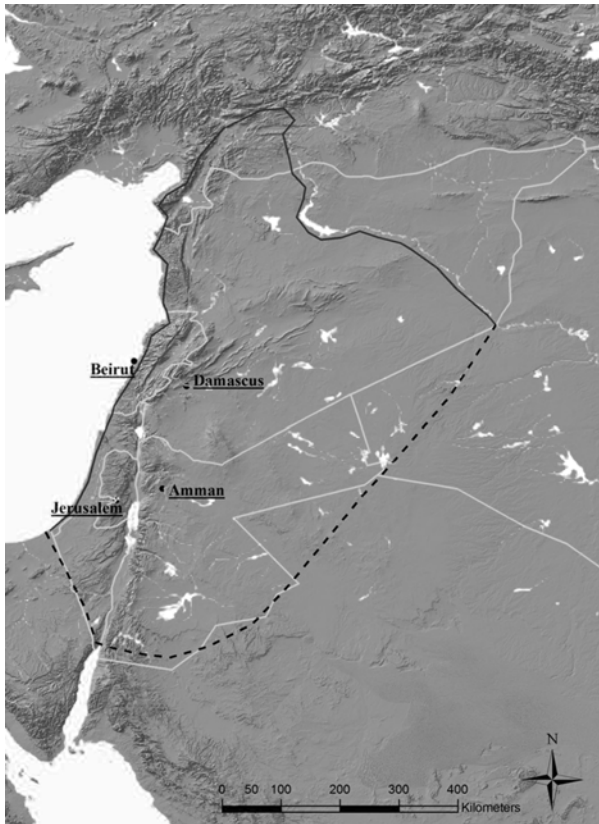


FIG. 2. THE HISTORICAL REGION KNOWN AS BILĀD AL-ŠĀM UNTIL THE 20TH CENTURY (MAP: C. TAVERNARI).

and scattered information available for the first centuries of the Islamic period (i.e. 8th–12th century), prevent any analysis of caravanserais as a system of stopovers along the roads. Starting from the beginning of the Ayyubid period (1174–1260 CE) both material and historical data are more largely available and it appears plausible that, whatever the number of earliest wayside caravanserais, their construction noticeably increased under the Ayyubids (Constable 2003: 75–76), a tendency that continued during the following Mamluk era (1260–1517 CE). The Ottoman conquest of Bilād al-Šām in 1517 CE saw the dawn of a new political and economic order in the region, thus representing a coherent chronological boundary for the present study. The 12th–16th centuries not only represent a pivotal period for the study and comprehension of the caravanserai phenomenon in Bilād al-Šām, but also constitute a moment of significant political upheavals in the region, due to the crusaders' presence and the Mongol invasion followed by the establishment of an aggressive empire at the eastern frontier of Bilād al-Šām.

## 2 The roads and caravanserais of Bilād al-Šām

The geopolitical situation of Bilād al-Šām during the 12th–16th century and its evolution most likely also affected the communication networks, which transformed accordingly. The development of the road network mainly towards the Euphrates and the regions to the east of it during the 12th–13th century probably follows the firm establishment of the crusaders' kingdoms along the coasts of the Mediterranean and the expansion of the Ayyubid empire towards more peaceful

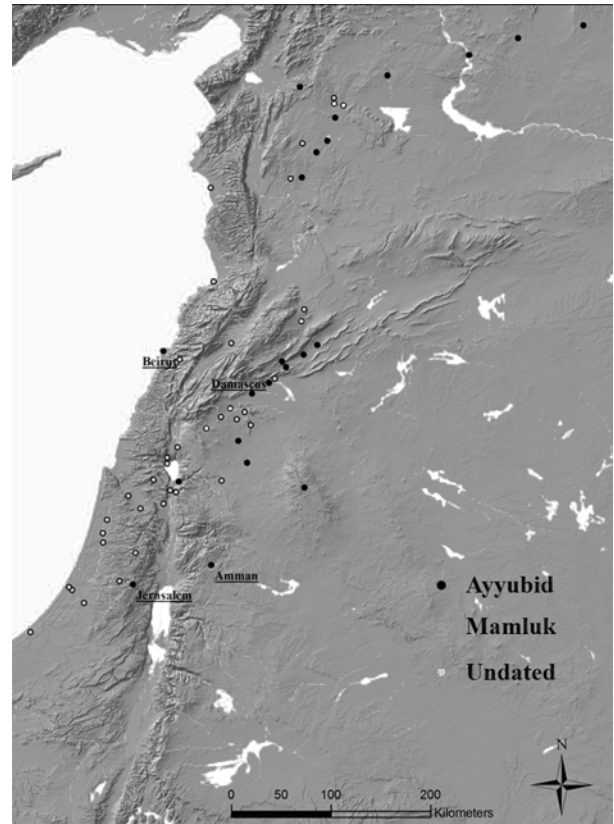


FIG. 3. THE DISTRIBUTION OF THE 72 WAYSIDE CARAVANSERAI BUILT DURING THE AYYUBID (1174–1260 CE) AND MAMLUK (1260–1517 CE) PERIOD IN THE REGION OF BILĀD AL-ŠĀM (MAP: C. TAVERNARI).

eastern lands. Under Mamluk rule, during the second half of the 13th century, the end of the crusaders' occupation on the Levantine coast combined with the dreadful Mongol invasion from Asia seemingly prompted a westward reorientation of the communication networks.

The construction pattern of the 72 wayside caravanserais built in Bilād al-Šām during the end of 12th and the beginning of the 16th century (Fig. 3) largely appears to reflect the changes of the region's communication network, shifting from the Syrian steppe to the shores of the Mediterranean (e.g. Tavernari 2011). If this phenomenon is quite evident, it is difficult, on the other hand, to understand the caravanserais' pattern of distribution in detail. To the naked eye, their distribution is irregular and so far, it has not been possible to identify the factors that regulated their implantation at a precise location along the roads. No element common to all sites has been identified at this stage of the research, not even the presence of a source of water (e.g. fountain, cistern, river, etc.).

## 3 Aims and methods

Spatial pattern analysis models are well known in archaeology, well before the introduction of GIS and computer science (e.g. Hodder and Orton 1975) in the discipline. In recent years, the diffusion of such software-aided approaches has led to complex methodologies that mainly involve cost surface and viewshed

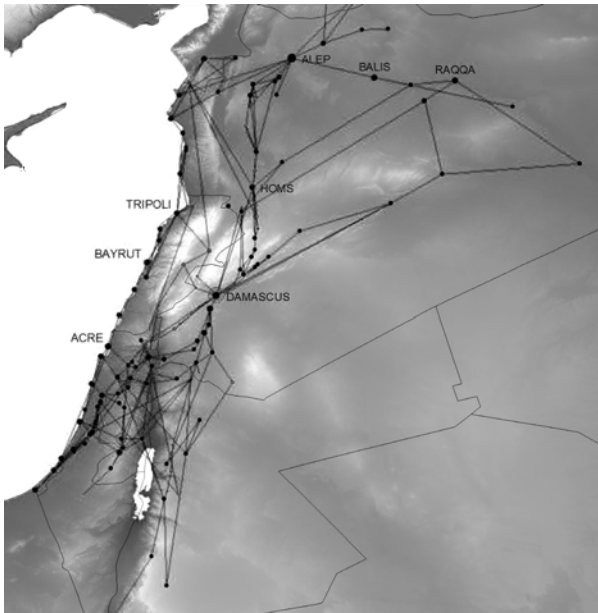


FIG. 4. THE NETWORK OF CARAVANSERAI AND URBAN AREAS IN THE REGION OF BILĀD AL-ŠĀM DURING THE AYYUBID (1174–1260) AND MAMLUK (1260–1517) PERIODS (MAP: A. DEL, C. TAVERNARI).

analysis (Van Leusen 1999) but we considered that, due to the characteristics of the research object and to the absence of GIS analyses on Syrian caravanserais, the research should focus on a simplified, one-dimensional approach to distance analysis.

The creation of a network and the choice of its nodes represented the first step of the research work (Fig. 4)

Dealing with such a stratified historical context as the one presented above, we could not build a single network but had to single out coherent networks of structures to conduct a significant historical analysis. In such a perspective, we built a timeline covering from 1200 CE to 1600 CE that we partitioned in 50 years' time slices, and we ordered all caravanserais in this timeline according to their construction date (as precisely as it is known) and assuming (according to the sources) an average life of 100 years for Ayyubid caravanserais, and a long-lasting existence well into the Ottoman era for Mamluk ones. The caravanserais that could not be located have been excluded from the dataset of buildings used for this work. The results led to the selection of 1200 CE and 1450 CE as the most representative and copious phases for the inquiry (Tab. 1). Successively, the two distinct sets of caravanserais (1200 CE and 1450 CE) were isolated and projected on a map together with the most significant urban areas of the region that undoubtedly served as stopovers along the main roads (e.g. Damascus, Aleppo, Gaza, Hama, etc.) during the considered period. Two different networks were created, whose nodes represented the stopovers in 1200 CE and in 1450 CE, and we superimposed them to the historic routes of the region as known from the sources.

A further selection was then carried out to obtain results that are more reliable. For each period (i.e. 1200 CE and 1450 CE), we tried to choose the best-documented route both from the point of view of the historic network and of the number of

caravanserais that could have served as stopovers along each communication axes. The Damascus-Aleppo route for the 1200 CE phase and the Damascus-Khan Yunus route for the 1450 CE phase appeared to satisfy both conditions. These routes also represent two of the most important communication axes of Bilād al-Šām. The historic tracks of these roads have been reconstructed on the basis of the works of Qalqašandī (1963) and Ibn Ġi'ān (1922) for the 15th century and Ibn Ġubayr for the 13th century (Ibn Ġubayr 2003). The latter was a secretary to the ruler of Granada who in 1183 CE decided to perform the pilgrimage (hajj) to Mecca. As a secretary to the Mamluk sultan Qaytbay, in 1477 CE Ibn Ġi'ān accompanied his master on a journey across the Mamluk lands to inspect the conditions of the fortresses meant to prevent a predictable Ottoman attack. Qalqašandī also worked at the Mamluk court; he was a clerk who compiled all the itineraries followed by the royal postal couriers.

It is important to stress the difference between the historic networks and the networks of caravanserais and urban areas that we have reconstructed. Historic networks report a precise sequence of stopovers and two different sources, albeit approximately contemporary such as Qalqašandī and Ibn Ġi'ān, can record two different sequences of stopovers. The choice of the stopovers depends on elements that are not always easy to comprehend (e.g. the purpose of the travel) but it does not mean that an alternative sequence of stopovers was impossible. Several alternative paths could have existed at the same time to go from Damascus to Khan Yunus, on the Egyptian border. As a result, we considered the sequence of the stopovers registered in the historic networks as guidelines and not as defining an immutable road. The historic networks allowed us to demarcate a corridor or passage that was used to go from point A (e.g. Damascus) to point B (Khan Yunus) and to attribute a caravanserai to a corridor. Our purpose was to evaluate the overall consistency of the caravanserais' distribution pattern over a route, and not the regularity of the sequence of stopovers reported by historical sources and which reflect specific travelling needs. Thus, the 1200 CE and 1450 CE networks do not represent physical roads on a territory but connecting edges between nodes for the purpose of distance analysis.

This research also aims at investigating whether the study of distances between caravanserais can provide useful information to locate those caravanserais whose position is unknown. At the same time, the reasonable measure of a one-day's walk span as a maximum distance between structures seems a necessity-driven plausible criterion for the analysis of caravanserais' distribution. Medical studies show that a human being in normal physical condition and not trained can walk at 4.8 km/hour (Tate 2007; Silverstein 2007). Animals can move faster than 4.8 km/hour but the analysis of the historical sources appears to reveal that the majority of the travellers went on foot and, in any case, the load the caravan animals carried — merchandise or travellers' baggage — slowed down their pace (e.g. Phelps-Grant 2010). In the Middle East, travellers often assembled in caravans whose logistics appear to be well organized and who could march up to twelve hours without stopping, thus being able to cover approximately 50 km per stage (Ibn Ġubayr 2003). In some cases, caravans could cover 70 km in 24 hours by stopping for 3–4 hours after 15–20 km and resuming the march to the following stopover (Ibn Ġubayr 2003). Depending on the needs of the travellers and on factors

Tab. 1. TIME MATRIX OF CARAVANSERAIS ACCORDING TO THEIR CONSTRUCTION DATE (BLUE ROWS REPRESENTS UNCERTAIN STRUCTURES, TO BE EXCLUDED FROM THE PROCESS) AND THEIR LIFE PERIOD (ASTERISKS), ASSUMING (IN CASE OF UNKNOWN LIFE PERIODS) AN AVERAGE LIFE OF 100 YEARS FOR AYYUBID ONES AND A LONG-LASTING EXISTENCE WELL INTO THE OTTOMAN ERA FOR MAMLUK ONES. 1200 CE AND 1450 CE APPEAR AS THE MOST SIGNIFICANT PHASES FOR THE INQUIRY (GREEN COLUMNS) (DATA PROCESSING: A. PALOMBINI, C. TAVERNARI).

	AYYUBID		MAMLUK					OTTOMAN
	1200-1250	1250-1300	1300-1350	1350-1400	1400-1450	1450-1500	1500-1550	1550-1600
Abu Ghosh				*	*	*	*	*
Aqabat al-Rumman				*	*	*	*	*
Araq al-Manshiyya				*	*	*	*	*
Atni	*	*						
Bab (al-)	*	*						
Baydha (al-)	*	*						
Bayt Daras				*	*	*		
Bayt Jibrin/Bethgibelin	*	*						
Cane								
Enane								
Fandaqumiyya								
Dhra al-Khan		*	*	*	*	*	*	*
Ghabaghib					*	*		
Jabala				*	*	*	*	*
Jaljuliya			*	*	*	*	*	*
Jinin			*	*	*	*	*	*
Julajjil	*	*						
Khan 'Abde/Orthosie							*	*
Khan al-Ahmar/Baysan			*	*	*	*	*	*
Khan al-Aqabah						*	*	*
Khan Aqabat Fiq	*	*						
Khan Arnabah								
Khan 'Arus	*	*	*	*	*	*		
Khan Asal			*	*	*	*	*	*
Khan Ayyash		*	*	*	*	*	*	*
Khan Barur	*	*						
Khan Burj al-'Atash		*	*	*	*	*	*	*
Khan Dannun				*	*	*	*	*
Khan Jisr Banat Yaqub				*	*	*	*	*
Khan Jisr Majami			*	*	*	*	*	*
Khan Jubb Yusuf						*	*	*
Khan Jukhadar								
Khan Hathrura/Khan al-Ahmar					*	*	*	*
Khan Kamar al-Din								
Khan Khattab								
Khan Husein								
Khan Izdud								
Khan Lajjun			*	*	*	*	*	*
Khan Lubban					*	*	*	*
Khan Maysalun			*	*	*	*	*	*
Khan Minya					*	*	*	*
Khan Sabil				*	*	*	*	*
Khan Shaykhun						*	*	*
Khan Shih								
Khan Tujjar					*	*	*	*
Khan Tuman						*	*	*
Khan Turkman								
Khan Yunus				*	*	*	*	*
Hasya						*	*	*
Hawd al-'Azariya				*	*	*		
Khisfin								
Muzayrib			*	*	*	*	*	*

Qal'at Najm	*	*						
Qaqun			*	*	*	*	*	*
Qara	*	*	*	*	*	*	*	*
Qinnasrin	*	*						
Qtayfa	*	*						
Qunaytra						*	*	*
Qusayr	*	*						
Ruhin	*	*						
Sa'la	*	*						
Sanamayn	*	*						
Shaqhab			*	*	*	*	*	*
Saraqeb						*	*	*
Sa'sa						*	*	*
Suq al-Khan/Wadi al-Taym						*	*	*
Tamna								
Tall sultan	*	*						
Tira			*	*	*	*	*	*
Tizin								
Wadihi/Udehi								
Zur'a/Izra	*	*						
TOT	18	21	16	25	31	40	37	37

such as the weather conditions or unexpected casualties, the schedule could vary, the same distance being covered in seven days, ten days, or even more according to different sources (Ibn Ġubayr 2003; De Varthema 1885; Ibn Ġi'ān 1922). Finally, it is important to note that carts pulled by animals were not used in the Middle East during the period under consideration.

#### 4 Analysis and results

##### 4.1 The 1200 CE phase

The majority of the caravanserais built in the 1200 CE phase are concentrated in the region between Damascus and the present Syrian-Turkish border. As stated above, we chose to compute distances between nodes constituted by both the caravanserai and urban area networks and to limit the analysis to the most eminent area of the region, the Damascus-Aleppo segment (Fig. 5). The result is a stage sequence average of 24.56 km  $\pm$  12.8 km (Tab. 2), which shows that distances, if not usually substantial, were nonetheless fairly irregular. The longest stage is Hama-Ma'arrat al-Nu'man, which is 54 km. From the travels of Ibn Ġubayr (2003) and a recent study (Tate 2007) we know that this remarkable distance could nonetheless represent a one-day stage (4.8 km/hour  $\times$  12 hours = 57.6 km), albeit a demanding one. At any rate, the analysis shows that such vast distances were uncommon on an important road such as the Damascus-Aleppo road, one of the north-south backbone axes of the Syrian region. To break the unusually large distance between Hama and Ma'arrat al-Nu'man, the Mamluks then built a caravanserai at Khan Shaykhun (Fig. 5), approximately halfway between the two cities. The existence of a Mamluk caravanserai at Khan Sahykhun might suggest that a similar structure also existed before the Mamluk period or rather that, if a caravanserai was to exist before the Mameluks it would have probably been built at this location. Unfortunately, it is not possible to confirm or deny such a hypothesis because we

lack any historical or archaeological data on the presence of a caravanserai at Khan Shaykhun before the Mamluk period. The comparison between our network of structures and urban areas and the Damascus-Aleppo road as described in sources also highlights some differences (Fig. 6). It is thus possible to confirm that the caravanserai of 'Atni does not represent a stopover of the Damascus-Aleppo road, but of the Damascus-Palmyra road. The caravanserai of 'Atni is then excluded from the list of structures catering to the Damascus-Aleppo road and a new computation of distances is carried out on the basis of the new list. The results, however, are very similar to the previous ones — the average stage sequence is 24.6 km and the standard deviation  $\pm$  13.2 km.

##### 4.2 The 1450 CE phase

For the 1450 CE phase, we chose to consider the Damascus-Khan Yunus segment. This segment was selected both because the majority of caravanserais belonging to this phase were built in the historical Palestinian region and it is one of the best-documented routes of the Mamluk period. The computation of distances used the same criteria of the 1200 CE phase (i.e. caravanserais and urban areas) and the results were then compared to the historic networks recorded by Qalqaṣandī (Fig. 7) and Qaytbay (Fig. 8).

Notwithstanding the construction of numerous caravanserais during the Mamluk period, the stage sequence average for the 1450 CE phase along the Damascus-Khan Yunus segment presents similar results to the previous case, the main difference being a shorter average distance (20.8 km) while the standard deviation remains quite high ( $\pm$  12.1 km). Only one stage shows a remarkably high distance that significantly distinguishes it from the others and that recalls the situation along the Damascus-Aleppo segment during the 1200 CE phase. The Muzayrib-Ghabaghib stage peaks at 56 km, nearly



FIG. 5. THE WAYSIDE CARAVANSERAIS OF THE AYYUBID PERIOD ALONG THE DAMASCUS-ALEPPO SEGMENT AND THE CARAVANSERAI OF KHAN SHAYKHUN BUILT DURING THE MAMLUK PERIOD (MAP: A. PALOMBINI).

TAB. 2. THE DAMASCUS-ALEPPO SEGMENT DURING THE AYYUBID PERIOD. DISTANCES ARE CALCULATED ON THE BASIS OF THE NETWORK OF CARAVANSERAIS AND URBAN AREAS (UPPER-CASE LETTERS) (DATA PROCESSING: A. PALOMBINI, C. TAVERNARI).

AYYUBID PERIOD			
route (from-to)	Km.		
DAMASCUS-Qusayr	11	average	24,569
Qusayr-Qtayfe	21	st dev	12,811
Qtayfe-Khan al-'Arus	7		
Khan al-'Arus-'Atni	20		
'Atni-AL-NABK	19		
AL-NABK-QARA	15		
QARA-HASIYA	17,4		
HASIYA-HOMS	36		
HOMS-HAMA	40		
HAMA-MA'ARRAT AL-NU'MAN	54		
MA'ARRAT AL-NU'MAN-Tall Sultan	30		
Tall Sultan-Qinnasrin	23		
Qinnasrin-ALEPPO	26		



Tab. 3. THE DAMASCUS-KHAN YUNUS SEGMENT DURING THE MAMLUK PERIOD. DISTANCES ARE CALCULATED ON THE BASIS OF THE NETWORK OF CARAVANSERAI AND URBAN AREAS (UPPER-CASE LETTERS) (DATA PROCESSING: A. PALOMBINI, C. TAVERNARI).

MAMLUK PERIOD			
route (from-to): DAMASCUS-KHAN YUNUS	Km		
Khan Yunus-GAZA	27	average	20,888
GAZA-ASCALON	16	st dev	12,113
ASCALON-Khan Izdud	18		
Khan Izdud-RAMLA	26		
RAMLA-Jaljulya	27		
Jaljulya-Tira	9,4		
Tira-Qaqun	15,4		
Qaqun-Jinin	31,2		
Jinin-Khan Jukhadar	31		
Khan Jukhadar- Jisr al-Majami	8,6		
Jisr al-Majami-Dhra al-Khan	5		
Dhra al-Khan-IRBID	22		
IRBID-Muzayrib	23		
Muzayrib-Ghabaghib	56		
Ghabaghib-Shaqhab	12		
Shaqhab-KISWA	10,5		
KISWA-DAMASCUS	17		

the one-day limit distance and 25 km more than the second longest stage of the Damascus-Gaza segment (i.e. Qaqun-Jinin). Several structures that, due to their characteristics, have not been considered in our first computation could actually have broken the long path between Muzayrib and Ghabaghib. To the west of Muzayrib, the undated caravanserai of Khan Arnabah does not represent the best candidate, as the two sites are 53 km away from each other. The two structures of Sanamayn and 'Izra that were used during the Ayyubid period seem to be better candidates, especially Sanamayn which, if not halfway between Muzayrib and Ghabaghib, lies on a seemingly direct north-south axis between the two sites. We know that the caravanserai of Sanamayn was in use in 1217 CE (Régner-Bohler 1997) but we had considered it decayed by 1450 CE because historical sources appear to indicate that Ayyubid caravanserais had a shorter life than their Mamluks counterparts, whose use well into the Ottoman period is often documented. The comparison to the stopovers mentioned in historical sources indicates that Sanamayn was indeed a stopover of the postal route recorded by Qalqaṣandī in the 15th century and, although the presence of a caravanserai is not mentioned, it is possible that the Ayyubid building was still in use (Tab. 3).

**5 Conclusions and perspectives**

The main result that emerges from the two case studies under examination is that they yield similar results in relation to both the average stage distance and the standard deviation, notwithstanding the differences in time and place. It thus appears that caravanserais and urban areas did not represent a regularly spaced network. Also noteworthy is the fact that the distance that separates most stages is significantly lower than the distance that can be covered if we calculate a speed distance

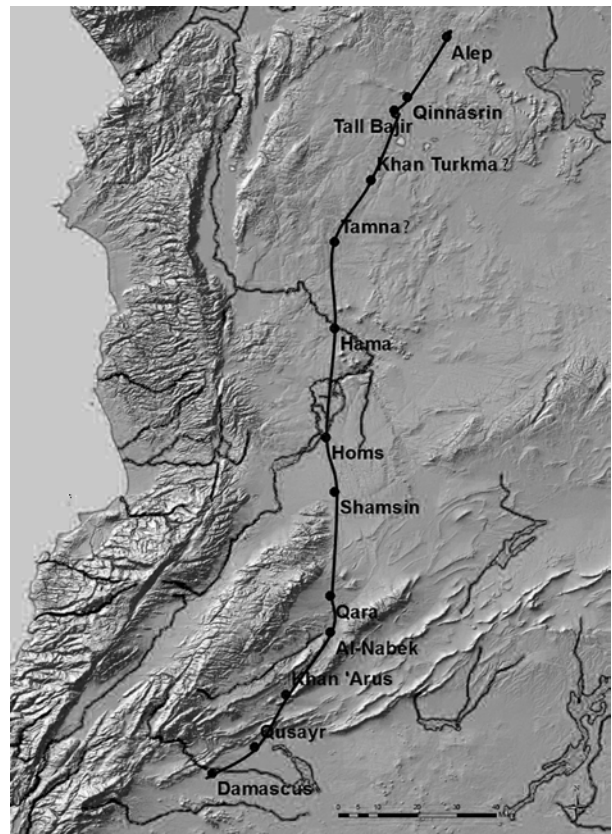


FIG. 6. THE DAMASCUS-ALEPPO ROAD FOLLOWED BY IBN ĞUBAYR AT THE END OF THE 12TH CENTURY (MAP: C. TAVERNARI).

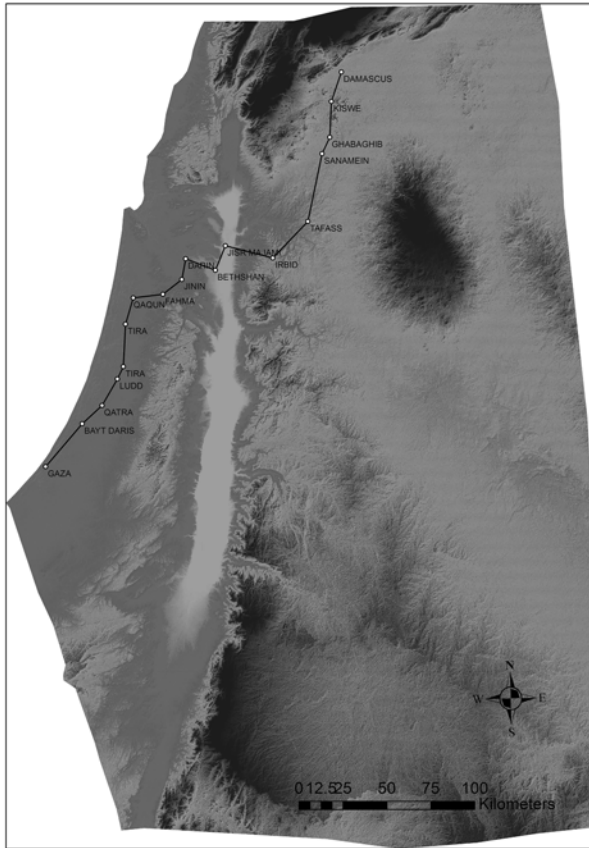


FIG. 7. THE DAMASCUS-GAZA ROAD DESCRIBED BY QALQAŠANDĪ IN THE 15TH CENTURY (MAP: C. TAVERNARI).

of 4.8 km × 12 hours. While we know that in some cases large distances should be covered every day due to the characteristics of the travel and the condition of the terrain — such as in the case of a pilgrimage to Mecca which should follow a precise schedule stipulated by religious imperatives and the harsh geographical and climatic conditions (e.g. the scarcity of water) — it is possible to imagine that many travellers adopted a slower pace. The proposed figure of 4.8 km × 12 hours should be considered as a culminating point when travelling in ideal climatic and geographical conditions or when following a demanding schedule that could be dictated by religious or commercial imperatives (e.g. the caravan with whom Ibn Ğubayr was travelling managed to cover approximately 70 km in 24 hours; cf. Tavernari 2011).

Such a study may be seen as a methodology useful in different ways. It can be used to argue a possible non-documented path, on the basis of recurrent distances between structures along the same direction, and it can be fundamental in verifying the position of those caravanserais whose location has not yet been firmly established, as well as their building and decaying dates. Because of the destruction of several edifices and the changes in the toponymy of the region, the precise location of some wayside caravanserais is still hypothetical (e.g. Khan al-Turkman at Baqidin, cf. Ibn Ğubayr 2003). The study of the distances between the caravanserais is thus essential to verify the soundness of our hypothesis and may represent a research tool suitable for similar route-based problems in other historical contexts.

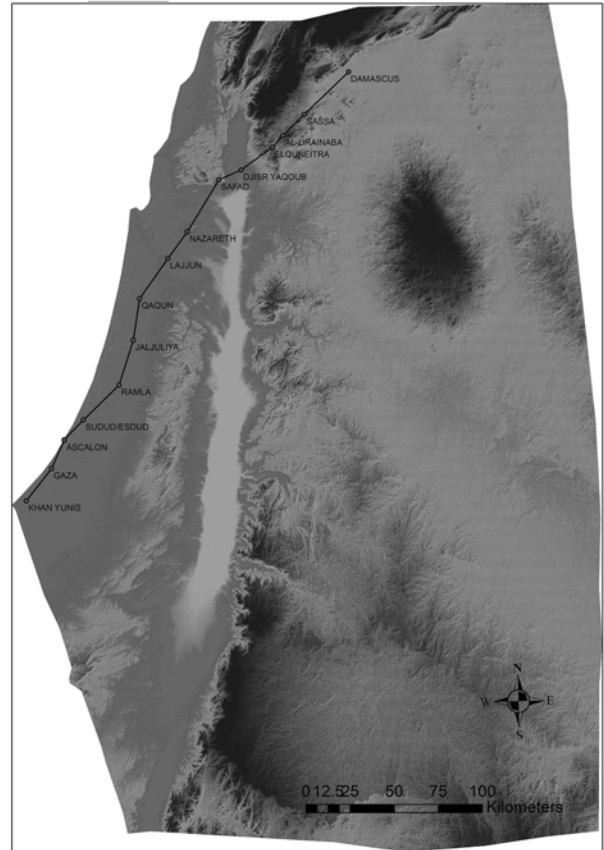


FIG. 8. THE ROAD FOLLOWED BY THE MAMLUK SULTAN QAYTBAY DURING HIS TRAVELS TO NORTHERN SYRIA (MAP: C. TAVERNARI).

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