Mapping the Silk Roads

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One

Mapping the Silk Roads
Tim Williams

Introduction

In 1988 UNESCO launched the *Integral Study of the Silk Roads: Roads of Dialogue* project to highlight the complex cultural interactions that arose from the encounters along the Silk Roads. At broadly the same time, debates were taking place regarding cultural routes and the development of UNESCO's global strategy for addressing the representativeness of the World Heritage list.[1] In 2004, the International Council of Monuments and Sites (ICOMOS) published *The World Heritage List: Filling the Gaps – An Action Plan for the Future*.[2] These early efforts led to UNESCO developing the *Silk Roads World Heritage Serial and Transnational Nomination project*, and in 2011 ICOMOS commissioned a thematic study of the Silk Roads.[3] The thematic study aimed to explore the distribution and character of Silk Roads archaeology, reflecting the shifting systems of power and patronage over time along the Silk Roads. The study provides an analysis of sites to assist the States Parties participating in the project and to suggest a World Heritage serial transnational nomination strategy.[4]

The Silk Roads: not just silk and not a road

The term 'Silk Roads' (*Seidenstrassen*) was first coined by the 19th century German geographer, Ferdinand von Richthofen, in a

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[1] ICOMOS, *Desk study on the Asia Region* (Paris: ICOMOS, 2002); ICOMOS, *Analysis of the World Heritage List and Tentative Lists* (Paris: ICOMOS, 2003); Jukka Jokilehto, Giora Solar and Michael Petzet, *Draft Framework for World Heritage Cultural Representation*. (Unpublished report. Paris: ICOMOS, 2003).
[2] ICOMOS, *The World Heritage List: Filling the Gaps – An Action Plan for the Future* (Paris: ICOMOS, 2004).
[3] Tim Williams, *The Silk Roads: an ICOMOS thematic study* (Paris: ICOMOS, forthcoming).
[4] Ashgabat Agreement, May 2011. http://whc.unesco.org/en/news/751/

lecture in 1877. However, he also recognised that there was a wider phenomenon of trans-Eurasian exchanges that are "now encompassed by the shorthand we know as the Silk Road."[5] In essence, the Silk Roads were an interconnected web of routes linking the ancient societies of East, South, Central, and Western Asia, with the Mediterranean. It contributed to the development of many of the world's great civilizations, and enabled the exchange of technologies and ideas that reshaped the known world. This combination of routes represents one of the world's preeminent long-distance communication networks (Fig. 1).
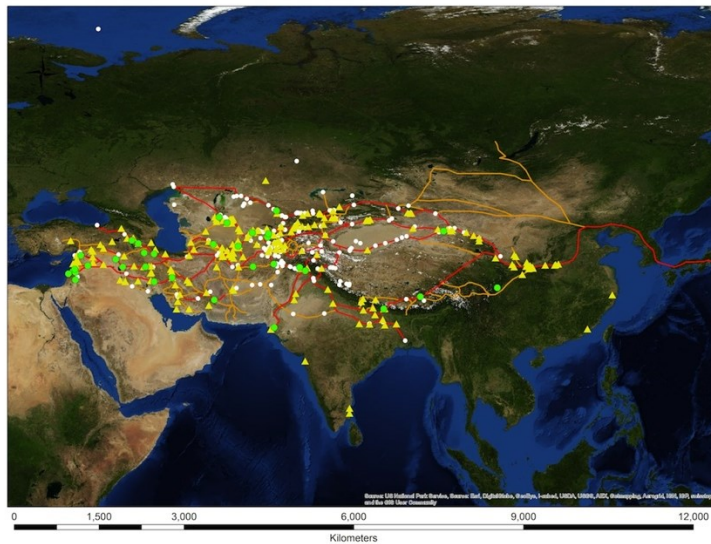

Fig. 1: The vast geographical extent of the Silk Roads (Green existing World Heritage Sites; Yellow Tentative List Sites; White other major sites) (Source of background imagery: World_Physical_Map - Source: US National Park Service).

There were a number of major impacts from this extensive network of interactions:

- The development of cities, which gained power and wealth from exchange, provided the infrastructure of production and redistribution, and policed the routes. Many became

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[5] James A. Millward, *The Silk Road: a very short introduction* (Oxford: Oxford University Press, 2013).

- major cultural and artistic centres, where peoples of different ethnic and cultural backgrounds intermingled.
- The development of religious centres, which benefitted from the patronage of political systems and wealthy individuals.
- The movement of technologies, artistic styles, languages, social practices and religious beliefs, transmitted by people moving along the Silk Roads.

There are a number of misconceptions that the name 'Silk Roads' embodies. The first is that *silk* was the primary commodity or driver of the exchange systems. In reality there were a great number of goods being moved, over both short and long distances, and through a variety of different mechanisms. Many had a far greater impact than silk, reflecting the spread of technologies (such as gunpowder or paper), or were moved in far greater volumes (e.g. cotton, salt, tea, copper or iron).

Elements of this inter-connected system have sometimes been labelled with other single-commodity terms, such as the *salt route* or *the tea-horse road*, or split by topographic terms, such as the *desert route*: again, these do not really capture the complexity of the trade goods or their impacts. These simple names obscure the complexity of goods, material, peoples and interactions. They also blur the interconnections between routes and their stimuli/drivers and serve to compartmentalise a complex system of interactions. Where did the tea-horse road stop and the salt route start, and how do these relate to the Silk Roads? However, these terms, and especially the 'Silk Roads,' have passed into common parlance, becoming evocative labels. As a result, this study and the UNESCO Silk Roads project use the term 'Silk Roads,' but adopt the very broadest possible definition of the routes and materials exchanged. What is of surpassing interest is the complexity of the interactions and their impact upon the development of past and present societies. So the term 'Silk Roads' is used to encompass this broad network, including routes that many might be more familiar with by other names, such as the tea-horse route.

A second misconception is that the major impact of the Silk Roads was as an economic trading network. There is no doubt that the movement of goods was crucial, although not always as trade, or that the volume of exchange (and the taxation systems that extracted wealth from this process) had a massive impact on the capacity of many societies to construct the cities, religious monuments, and elite

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structures for which the Silk Roads are famous. But, the most significant outcome of these complex networks of interactions was the movement of people and ideas—the spread of religions, social customs, languages, political ideas, agricultural practices, scientific knowledge, and technological innovations.

Another misconception is that the Silk Roads are primarily about the exchange of material between East and West, as typified by silk; initially produced in China and transported as far west as Europe. But the movements are much more complex; goods and people did not simply flow from east to west and vice-a-versa. Many of the materials traded emanated in Central or South Asia, and many of the ideas that moved along the Silk Roads started in neither the east nor the west (e.g. Buddhism). As a result, the patterns of routes from north to south are also vital elements of the complex system that is being explored.

There is no doubt that understanding the routes across Central and South Asia is essential to understanding the Silk Roads. Indeed, the Silk Roads have often been defined by their impact upon the end destinations—China and Europe. But this significantly underplays the complexity of their overall impacts, almost making them seem of more relevance to the ends than the rest of the regions through which they passed. The reality is that the Silk Roads were essential in shaping societies along their whole length.

There are also misconceptions regarding the number of routes and their variability in space and time. There was no single road winding from Asia to Europe. Rather there was a diversity of paths, tracks and roads, changing not only over time, but also fluctuating seasonal as river crossings and mountain passes became impassable, and shifting as travellers passed across wide valleys and steppes, choosing different routes across the landscape. Regional conflicts, changing markets and shifting political power meant that the Silk Roads were never static. The importance of specific sections of the routes changed over time, in response to a variety of socio-political factors. It is these spatial and temporal changes in exchange and trade, and the scale of movement of people and ideas, which articulates the significance of the Silk Roads. As a result this report always uses the plural 'Silk Roads,' rather than the singular.

Another issue to note is that the Silk Roads never comprised a systematically planned network of routes, or infrastructure, over its entire length. In certain regions, and at specific times, it was very

well planned and supported (e.g. the system of Seljuk caravanserais, or Han dynasty forts), but it often depended on very local responses to specific geo-political circumstances. The long-distance movement of materials and goods involved trade, exchange, gift giving, and the payment of tribute; indeed, the latter considerations may have sometimes overshadowed material motives in the exchange of goods.[6] Nevertheless, the exchange of goods, and with them ideas and knowledge, played a major role in the cultural, religious, and artistic exchanges that took place between Europe and Asia during antiquity. The routes served principally to transfer raw materials, foodstuffs, and luxury goods. Some areas had a monopoly on certain materials or goods: China, for example, supplied Central, South and West Asia, and the Mediterranean world, with silk. These goods were transported over vast distances—by pack animals and river craft – and by a string of different merchants.

Silk was but one amongst several high-value, relatively low-weight, goods that moved along the Silk Roads. Commodities such as silk, rhubarb, spice, musk, and tea at various times have been used to describe parts of the routes, reflecting their importance. These high-value goods certainly moved over considerable distances, exchanged from one merchant to the next. But the variety of goods that moved through the Silk Roads networks is truly remarkable.[7] Many materials may have been shipped as raw materials, rather than finished goods: for example, the famous Damas steel, produced in

[6] David Christian, "Silk Roads or Steppe Roads? The Silk Roads in World History," *Journal of World History,* vol. 11(1) (2000): 1-26.

[7] For example, see Thomas T. Allsen, *Commodity & exchange in the Mongol Empire: a cultural history of Islamic textiles* (Cambridge: Cambridge University Press, 1997); Luce Boulnois, *The Silk Road. Monks, warriors and merchants on the Silk Road*, (London: Odyssey Publications, 2008); Xinru Liu, *Ancient India and Ancient China: trade and religious exchange AD 1-600*. (Delhi: Oxford University Press, 1988.); Xinru Liu and Lynda Norene Shaffer, *Connections Across Eurasia: Transportation, Communication, and Cultural Exchange Along the Silk Roads* (New York: McGraw-Hill, 2007); Edward H. Schafer, *The golden peaches of Samarkand: a study of T'ang exotics* (Berkeley: University of California Press, 1963); Jonathan Tucker, *The Silk Road: art and history* (London: Philip Wilson, 2003).

Central Asia and probably moved as ingots before being worked by craftsmen in Damascus.[8]

But not all the goods being moved were destined to be transported vast distances. Much of the material that made up the bulk of caravans was probably short-distance trade in bulkier, lower-value goods moving to regional markets. The scale of this movement, of domestic consumption rather than elite exchange, and the scale of social impact that this suggests, is currently becoming clearer from the archaeological evidence.[9] It has been argued that, without the high value and portable commodities, such as silk, there would have been insufficient profits to be made from other goods for the long-distance land routes to Central Asia and beyond to be sustainable.

As Susan Whitfield has argued:

> [T]rade in silk did not happen in isolation but was built on a foundation of trade in other commodities, not all of it long distance and much of it already well-established. It would be misleading also to assume that all silk from China was for a Roman market.[10]

Indeed, this perspective is shared by Smith who noted:

> [T]he demand for ordinary goods provides an explanation for the development, success, and long-term viability of regional trade networks. These ordinary goods—household furnishings, containers, and utensils—are valued for their social as well as for their functional content, where social content is expressed through decoration, form, and choice of material type."[11]

Nevertheless, trade in high-value commodities may be the best explanation for the creation of sufficient patronage to support the scale of development at sites like Dunhuang.[12]

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[8] Ann Feuerbach, *Crucible steel in Central Asia: production, use and origins* (Unpublished thesis: University of London. 2002a); Ann Feuerbach, "The Glitter of the Sword: The Fabrication of the Legendary Damascus Steel Blades," *Minerva*, vol 13(4) (2002b): 45-48.

[9] Monica L. Smith, "The role of ordinary goods in premodern exchange," *Journal of Archaeological Method & Theory*, vol 6(2) (1999): 109-135.

[10] Susan Whitfield, *Was there a Silk Road?* 2006. http://www.ucl.ac.uk/histmed/centre_projects/medicine_asia/silk_roads. Accessed 28/3/2013.

[11] Smith 109.

[12] Whitfield 2006.

Geographic scope

The Silk Roads span a vast geographic area and functioned over a protracted timeframe. The sheer scale of routes has meant that their complexity and impact is still under-researched and often simplified to anecdotes. Broad-scale maps are common—large pen strokes across a map of half the world stretching from Japan to the Mediterranean. There have also been some excellent regional studies as well as useful historical accounts of sections and collections of point data.[13] But there remain problems with the sheer scale of the routes and their impact, both spatially and chronologically.

The present chapter focuses on the *land routes* (Fig. 1). Clearly, the land and maritime routes were interlinked, especially through the interaction of entrepôts and terrestrial routes bringing material to and from the ports, but there were also a number of basic differences: the maritime routes developed later, and had profound impacts on the significance of the land routes. The two route-systems required fundamentally different infrastructures, which enabled very different goods to be transported and very different political and economic organisations develop to exploit them.

An exception to this is the development of short sea routes; for example, between Korea and Japan and mainland China, or across the Caspian Sea between Turkmenistan and Azerbaijan. These were not about linking into the long seaborne journeys of the 'Spice routes' that came to be so important in the later periods, but rather about short-sea crossings that enabled these areas to connect to the main land-based networks of the Silk Roads. In addition, the exploitation of water-born transport in places was inter-linked with the 'land routes', as in the movement of people and goods along the Syr Darya in Central Asia.

The study focused on a broad zone of movement from China to the Mediterranean through Central Asia, but extending southward to encompass the crucial routes connecting South Asia with this zone. For the purposes of this study we have taken an *east-west extent* to be Chang'an, China (modern day Xi'an) to the Eastern Mediterranean (e.g. Antioch in modern day Turkey). This is a

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[13] See the work on caravanserais, way-stations and monasteries on Matthew Ciolek's excellent OWTRAD website: http://www.ciolek.com/owtrad.html.

distance of 6,461 km (Fig. 2a), but closer to 7,500 km by the shortest practical route (Fig. 2b). There is no doubt that the study could be extended westward, through Turkey to Istanbul, and on to Italy; or eastward, to Korea and Japan (Nara lies some 8,700km from the eastern Mediterranean). However, as a start, this was considered a sufficiently broad study area.
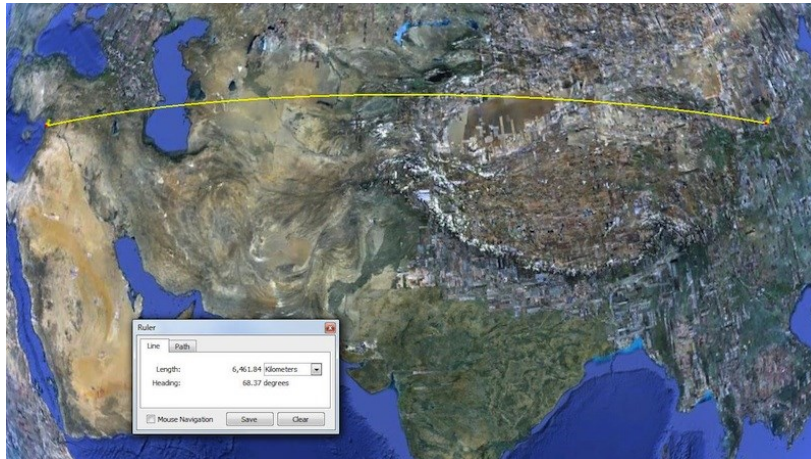

Fig. 2a: Chang'an in China to Antioch in Turkey: 6,461 km as the crow flies. Fig. 2b (below): The most direct route, taking into account geographic obstacles: closer to 7,500 km (Background Google Earth).

Defining the **north-south extent** of the study also posed some difficulties. As already noted the complex exchange and movement

patterns of the Silk Roads include considerable north-south movement as well as east-west. To practically constrain the enormous scale of this study it was decided to restrict the northern extent to routes along the Tien Shan mountain piedmont and along the major river systems of the Syr Darya and Amu Darya: this effectively excluded the so-called 'steppe routes' further north and means that the routes through Mongolia,[14] and northern Kazakhstan, for example, have not been explored. Similarly the study did not extend northward into Armenia, Azerbaijan, etc. or cover the areas north of the Caspian or Black Seas, again despite their clear relevance. There has also been no attempt to extend southward in the Mediterranean zone, to included Jordan, Palestine, etc., despite the obvious trade routes radiating though these regions. Even given these limitations the current ***area encompassed*** within the study comprises some 16 million km^2 (Fig. 1), and within this area we have mapped over 50,000 km of routes.

Chronology

There is evidence for long-distance trade from the fourth millennium BCE; for example, lapis lazuli from the Chagai Mountains (Pakistan) was traded 2,000 km to lowland Mesopotamia,[15] and by c. 2500-2000 BCE a web of trade routes connected the cities of the Mediterranean with those in western India.[16] From the mid-third millennium BCE there were complex movements of agricultural crops[17] and by the sixth century BCE

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[14] "For a time in the mid-thirteenth century, the Mongol capital of Karakorum, deep in Mongolia, was the single most important stopping point on the Silk Roads." Christian 18.

[15] Andrew Sherratt, "Trade Routes: The Growth of Global Trade," *ArchAtlas*. 2004. http://www.archatlas.org/Trade/Trade.php. Accessed 6/4/2013.

[16] Roberta Tomber, *Indo-Roman Trade: From Pots to Pepper* (London: Duckworth, 2008).

[17] Dorian Fuller, "Late Harappan "collapse," the opening of central Asia and long-distance crop movements," in Hitoshi Endo, ed., *Ethnogenesis of South and Central Asia (ESCA): 13th Harvard University Round Table, Kyoto Session, Research Institute for Humanity and Nature (RIHN), Kyoto, Japan, May 30-31, 2009*. (Kyoto: Research Institute for Humanity and Nature, 2009), 3-11.

onwards there is evidence for the movement of goods between China and the Mediterranean zone.[18]

Quantitative change, however, seems to have occurred in the last centuries of the first millennium BCE, with sustained exchange/trade across the Central Asia region, linking China with these pre-existing Afro-Eurasian exchange networks. It also seems that there was a qualitative change as well: from exchange dominated by socially-embedded activities towards more economic trade.

During the reign of the First Chinese Emperor, Shi Huangdi (reigned 221–210 BCE), policies were developed that began a new era of more frequent and longer journeys.[19] From the second century BCE, China was unified under the Qin and then particularly the Han rulers. This coincided with, and was probably in part a response to, the unification of many of the northern nomads in the Xiongnu (Hsiung-nu) confederation. Emperor Wudi augmented this by dispatching Zhang Qian on a mission to Central Asia in 138 BCE, thereby opening up further contacts.

The Silk roads gained momentum in the first BCE to third century CE with four contiguous empire systems - the Roman, Parthian, Kushan, and Han – along with the nomadic confederation of the Xiongnu - developing long-term connections. The latter are significant, as the interactions between nomadic and settled agricultural communities was an important component of the dynamics of the Silk Roads throughout its history. The relationships between major civilizations, and between these and complex nomadic societies, is woven into the processes of empire creation and destruction along the Silk Roads. These relationships were not static and fluctuations in connections sustained and changed societies and empires' fortunes.

Activity peaked in the eighth-ninth centuries CE, once again with large empires across its span aiding the process: including the Islamic empires of the Middle East and Central Asia, the Tang Dynasty in China, and the Byzantine Empire in the eastern Mediterranean. From around the tenth century, however, seaborne trade began to flourish and the land routes waned, although the latter experienced another surge of activity under the *Pax Mongolica* in the thirteenth century until the break-up of the Timurid Empire in the

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[18] Christian 5-6.
[19] Stephen S. Gosch and Peter N. Stearns, *Premodern Travel in World History* (London: Routledge, 2008).

early sixteenth century. The land routes have never entirely died; indeed, today the quantity of Chinese goods transported overland into Central Asian markets is evidence of this.

Geo-climatic context

The Silk Roads encompassed a wide variety of topographic, hydrographic, climatic and ecological regions, including the physical and climatic zones of mountain, steppe, grasslands, deserts, river valleys and deltas (Fig. 3). These geo-ecological zones lay at the core of some of the most important Silk Roads interactions, and their significance is reflected in the naming of sections of the route; such as the grass route, the steppe route, and the oasis route. These factors had a significant impact upon the nature of the routes, including the specific choice of routes (mountain passes, desert margins, river crossings, etc.), the seasonality of routes, and the ability to sustain major population centres along the routes. The "trans-ecological" nature of the routes[20] may have also been of major significance, providing an impetus for the movement of goods and materials between different zones. Silk Roads empires and societies adapted to the ecological context of regions, but they also exploited the contrasts between them to develop long-distance exchanges.

Defining geographic and ecological regions within the Silk Roads is a complex issue, accentuated by changing climate, hydrology, and ecology over time. However, a fundamental issue has always been access to water—both directly to sustain life and to irrigate the pastures and crops that supported the development of populations. Significant populations were supported, both in a dispersed form in the grasslands, and in sedentary concentrations in the oases, river valleys, and deltas. Recent research has highlighted the close interaction between pastoralists and agriculturalists.[21]

The high mountains, such as the Pamirs, the Altai and the Tian Shan, and the extensive deserts along the routes (Fig. 4), were formidable obstacles to travellers. There were significant variations in elevation, which is seldom considered except in the context of

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[20] Christian 22.
[21] Daniel C. Waugh, "The Silk Roads and Eurasian Geography", *Silk Road Seattle*. 2008.
http://depts.washington.edu/silkroad/geography/geography.html.
Accessed 27/3/2013.

mountain passes. For example, the route from Anxi to Kashgar through the Turfan depression would have required a significant climb of some 1,400 meters. Central Asia is a region of interior drainage, with steppes and mountains, desert floodplains (Turania) and their surrounding borders (Caspian Sea and Kopet-Dag, Pamir, and Tienshan mountain ranges).[22]
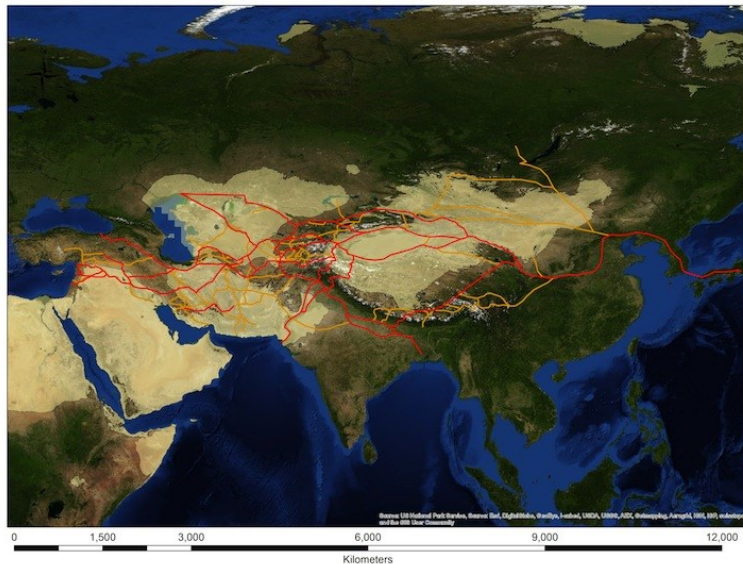

Fig. 4. The major desert areas along the Silk Roads. Even here, there is a complexity of desert forms, from the high plateau deserts surrounded by chains of high mountains, such as the Gobi, the Djungarian, and the Taklamakan, as opposed to the lowland dunal deserts such as the Karakum. (Source of background imagery: World_Physical_Map - Source: US National Park Service).

The climatic conditions mean that "dry farming can only be implemented in a narrow band of the middle mountain zone (between 800 and 1,700 meters) of the Kopet Dag, Pamir and Tien Shan ranges, … the surrounding high mountain ranges of Kopet-Dag (max. 2,900 meters), Pamir (max. 7,000 meters) and Tienshan (max. 7,000 meters) act as collectors of precipitation, mainly in the form of snow and ice, which is discharged by a few rivers across piedmonts and desertic flood plains down to interior reservoirs. … Even in

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[22] Robert A. Lewis, "Early irrigation in west Turkestan", *Annals of the Association of American Geographers*, vol. 56 (3) (1965): 467-491.

desertic lowlands with yearly precipitation less than 50-100 mm., basins seasonally moistened by floods exist along the lower course of small piedmonts streams and around mild distributaries of deltas of the large rivers."[23] Importantly, however, "perennial and seasonal streams, with peaking regimes in spring and summer, make the irrigation potential of Middle Asia very high, the water being sufficient for the reclamation of vast areas for agriculture."[24]

Unsurprisingly, there is a very wide variety of river and stream systems within the study area, including some major drainage systems such as the Tigris and Euphrates, the Indus, and the Wei He, which were major sources of irrigation and urban development from well before the rise of the Silk Roads. These river systems were often relatively easily exploited, with large alluvial and fertile lands, and these areas saw the rise of many of the major pre-Silk Roads civilizations. These areas were to become crucial staging points along the Silk Roads, with important social and cultural developments taking place though the stimuli of the Silk Roads.

Some issues and approaches

The study was a synthesis of existing information: it was necessarily a broad sweep and so undoubtedly there are many inaccuracies, but sufficient to establish broad patterns. The work was intended to act as a platform for more informed local researchers in the countries to add material and refine misunderstandings. As such it should be seen as very much a work in progress: it aims to provide a framework for debate, discussion and addition.

There have been many attempts at mapping the Silk Roads, often at a very broad scale, with many thousands of kilometres reduced to a single page in a book. The recent excellent map, for example, reproduces the whole route at a scale of approximately 1:19,000,000, with detailed maps of three zones, each at approximately 1:12,000,000.[25] Most maps in books are at considerably larger scales. Very occasionally more detailed regional studies have produced

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[23] Renato Sala, *Historical survey of irrigation practices in west central Asia*. 2003. http://www.lgakz.org/Texts/LiveTexts/CAsiaIrrigTextEn.doc. Accessed 24/3/2013, 3.

[24] Sala 3-4.

[25] *The Ancient Silk Road* (2nd ed.) (Hong Kong: Odyssey Publications, 2011).

more detailed maps of suggested routes.[26] In these cases mapping at this scale need not involve more than joining the dots, from one major city to another. For this study, an attempt was made to provide more accurate locations of sites, and more detail of the complexity of the routes. This has significant implications for the way that we have approached plotting the routes in the mapping of the Silk Roads (see below). There are a number of variables and biases in the study:

- Areas for which there are published detailed regional surveys or inventories, such as the caravanserai of Iran,[27] were better represented in the data. This is reflected in a greater complexity of mapped routes in these areas.
- Conversely, areas that have not been well-studied may appear as less intensively occupied. In some cases this may be accurate, but for many others this may simply reflects the current state of archaeological knowledge: for example, the upper Chuy Valley in Kyrgyzstan, or the routes through western Nepal – in both of these areas there are undoubtedly many more sites and routes, representing far greater complexity than it is currently possible to reflect on the basis of published data.

Comparatively few sites along the length of the Silk Roads have been well explored archaeologically. Indeed, a great many lack even basic surveys, let alone an understanding of sequence, buried deposit survival, dating, etc. The quality of dating evidence in particular is very variable along the routes, and often over-simplified in the published accounts. Not only is there a paucity of excavated sequences, but work on regional ceramic typologies, across much of the region, is still in its infancy. This, combined with a lack of absolute dating, means that many sites have vague chronologies, often based around historical accounts. A particular problem is the foundation dates for many deeply stratified cities, which may be considerably more complex than currently presented. In using the study we need to be careful that we are not simply selecting the 'well-studied' and under-estimating the potential of many other sites.

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[26] For example, see the maps in Michael Freeman and Selena Ahmed, *Tea horse road: China's ancient trade road to Tibet* (Bangkok: River Books, 2011) of the Tibetan area; or in Francis Wood, *The Silk Road: Two Thousand Years in the Heart of Asia* (Berkeley: University of California Press, 2002) of the area around the Taklamakan desert.

[27] Maxime Siroux, *Caravansérails d'Iran et petites constructions routières*, (Cairo: Institut Français d'archéologie Orientale, 1949).

Many sites lack accurate locations. In part this is due to the scale of maps that the sites are published on and partly the lack of recent survey. The advent of cheap handheld Geographic Positioning Systems (GPS) systems is likely to significantly improve this in the coming years, but in the short-term it was possible to use widely available satellite imagery to improve the location of sites. Where high-resolution imagery (1m resolution or better) was available via Google Earth™ it was often possible to identify specific sites and provide a more accurate coordinate. However, some sites fall in areas with only broad scale imagery (10 meters+ resolution), while in other cases it is not always clear where the ancient site lay beneath modern settlements.

Many sites have been known by multiple names, and in multiple languages - Turkic, Chinese, Arabic, Hindi, Persian, Latin, etc. – and with different transliterations. Many place names changed over time, while some historic names are not yet securely correlated with modern places. There are also often variable spellings of modern place names. To assist in exploring the spread and range of sites a Geographical Information System (GIS) was established for the thematic study,[28] drawing upon existing data sources such as published works,[29] historical accounts,[30] World Heritage tentative lists,[31] maps,[32] and online data.[33] In addition, data on climate,

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[28] For details, see Tim Williams, forthcoming. An online version of the data (database and maps) is currently available to Silk Roads partners through *Silk Roads CHRIS* http://arex.no-ip.org/specto/bin/view/home. A fully accessible public version will be made available to coincide with the publication of the Silk Roads Thematic Study.

[29] Published sources have been collated into an extensive bibliographic database currently containing over 3,500 references. A basic version of this is currently available through the Silk Roads CHRIS platform (see fn 28). A more complex coded version will be made available when the Thematic Study is published.

[30] See Jacqueline M. Moore, and Rebecca Woodward Wendelken, eds. *Teaching the Silk Road: A Guide for College Teachers* (Albany: State University of New York Press, 2010) for a discussion of sources.

[31] UNESCO World Heritage Centre: http://whc.unesco.org/en/tentativelists/ Accessed 12/6/2013.

[32] For example, Odyssey 2011; Yuri Bregel, *An Historical Atlas of Central Asia* (Leiden: Brill, 2003); Richard Talbert, ed., *Barrington Atlas of the Greek and Roman World* (Princeton: Princeton University Press, 2000).

ecology, hydrology and topographic/physical data were added to provide base-mapping and to help with the characterisation of sites by landscape, climatic and ecological zones. The aim was not to provide an extensive new database, but rather to draw attention to the existing sources of material and use these to help understand the range and diversity of the sites along this massive and complex set of routes.

Conceptual approach to mapping: nodes, route segments & corridors

The advantage of a computer-based mapping system over maps reproduced in books and wall charts is that it is extensively scalable, thus enabling the researcher to zoom into a very detailed exploration of one small segment of a larger route. Thus it would be possible to zoom in to examine a route entering a specific gate within a city, or which side of a river the route ran along. For the purposes of this study, however, it was not possible to drill down to such a local level for tens of thousands of kilometres of routes; to make suggestions regarding every alternative ford or river crossing, every possible deviation and alternative, would be many years work and in most cases unfeasible without local knowledge. This level of refinement must await local research. There are also some significant conceptual problems with drawing a single route:

- In some areas, especially extensive fertile zones or wide areas of grassland, there were probably a number of alternative routes through the landscape; all still negotiating the passage from node A to B.
- Paths may have changed, both over the centuries and seasonally: for example, fording a river at a different point depending upon whether it was the wet or dry season.

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[33] The most important sources were: Historical Atlas of Eurasia Online (http://productforums.google.com/forum/#!msg/gec-history-illustrated-moderated/9UrX_lQEzYE/ORYfbWZhPuEJ); Digital Silk Roads Project (http://dsr.nii.ac.jp/index.html.en); The Old World Trade Routes Project (http://www.ciolek.com/owtrad.html); ArchAtlas (http://www.archatlas.org/Home.php); Ancient Cities DataBase (https://sites.google.com/site/ancientcitiesdb/); Pleiades (http://pleiades.stoa.org/); Project HESTIA (http://hestia.open.ac.uk/); and the International Dunhuang Project (http://idp.bl.uk/).

For this study, therefore, we adopted the approach of identifying major **nodes** (large cities) along the Silk Roads; identifying **segments** of routes between these; and broadening these out to represent the **corridors** of 'movement and impact' that took place between the nodes (rather than suggesting specific 'roads').

Node: a major urban centre and usually a place where a number of routes intersect. These centres are likely to have played an important role in administration, re-supplying, redistribution /marketing, and production; and in reflecting the outcomes of the Silk Roads in terms of architecture, arts, society and beliefs.

There were difficulties in systematically selecting nodes:

- It was not easy to select cities simply on the basis of their **size**; in part, because we have too little data on many of them to be sure of their size at any given moment in their histories; in part, because size relates to other aspects of urbanism: functions; agriculturally productive capacity of the hinterland to support the population; scale of production/access to raw materials; ideological significance (ruler's home town, major religious connections); etc.
- It is also problematic to select cities solely on the basis of the **number of connecting routes**: some major cities developed because they control a limited number of route options through a region (e.g. Merv with its strategic position in the Murghab delta controlling routes from the Oxus to the northern Iranian plain – there were few other routes and none as direct).

These issues with the selection of nodes leave us with a number of choices regarding how to segment routes; broadly the three models are:

- Selecting long segments, between nodes at major ('mega') cities. Selecting major urban centres for the nodes has the advantage that it is likely that most of these have already at least been identified and in many cases there has been some archaeological work in developing their chronologies;
- Splitting routes into numerous segments between each reasonably large town;
- A combination of using urban size and route connectivity: focusing on substantial urban centres that also act as inter-connections between routes.

(See Fig. 5 for an example of the approaches.)

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Model (i) might seems to offer the best approach at present – given the tremendous scale of the project, the fact that the major nodes are more likely to have been identified, located and (at least partially) documented - combined with the concept of the junction of major routes. Of course, segments can always be grouped, or split, to suit specific research outputs.

EXAMPLE: *the route from Loulan to Khotan around the southern margins of the Taklamakan Desert, a distance of just short of 1,000 km.*
In *model (i)* this might be considered to be a single corridor between two very major cities.

In *model (ii)* Charklick to Khotan segment could be broken down, at Waxxari, Charchan, Endere and Niya (so a total of 7 segments between Loulan and Khotan). The problem with model (ii) is that we know very little about these smaller towns (indeed, in some cases, even their location is disputed), and if we adopted this approach, we would end up with many hundreds of segments along the Silk Roads.

In *model (iii)* we would have three segments[34]: Loulan to Miran (c 170 km); Miran to Charklick (c 70 km); and Charklick to Khotan (c 740 km): each a substantial settlement, and each acting as intersections of major route junctions.
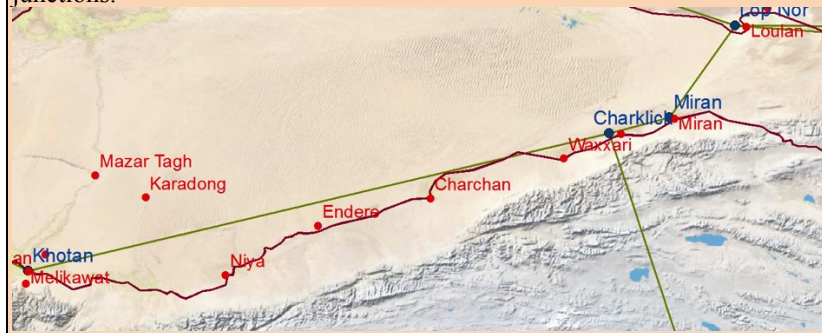

Fig. 5. Selecting nodes and segments. The principal sites between Khotan (left) and Lop Nor/Loulan (right). The green lines are the segments identified in the OWTRAD dataset, and simply link nodes with straight lines. In red, a more complex picture, with more settlements and a route digitised to reflect local topography (rivers, oases, etc.) (from the Historical Atlas of Eurasia).

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[34] Which is effectively what OWTRAD adopted, based on Susan Whitfield, *Life along the Silk Road.* (London: John Murray, 1999.).

Route segment: the route between two major nodes, taking into account known topographic and cultural features. For example, in Fig. 5, the red route reflects the complexity of the route utilising the rivers and oases of the region. The routes defined are not trying to reflect every path and track, but rather provide insight into major movements of people and goods.

Corridor: a uniform buffer applied to all the digitised route segments. This is intended to cope with the potential variability of specific paths and roads between the nodes, and to capture sites/landscapes along the segments: the latter reflecting the impact of the route in terms of the development of way-stations, forts, bridges, smaller towns, religious sites, etc.

We tested a variety of buffer sizes against the known sites recorded in the GIS and a buffer of 30km on either side of the route segment (i.e. a 60km wide corridor) worked most effectively in capturing most key elements.[35] The process of buffering the route segments also highlighted places where groups of sites lay outside any designated corridor, suggesting the presence of subsidiary routes that had not been identified from other sources (Fig. 6).

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[35] A buffer of 2km was used by André Del and Cinzia Tavernari when exploring caravanserai routes, but the purpose was to capture complex movements and impacts through the landscape. *Utilisation d'un réseau de polygones de Thiessen pour la géolocalisation robuste de caravansérails décrits dans les récits anciens de voyageurs* (Esri France. 2009. Accessed 5/4/2013)
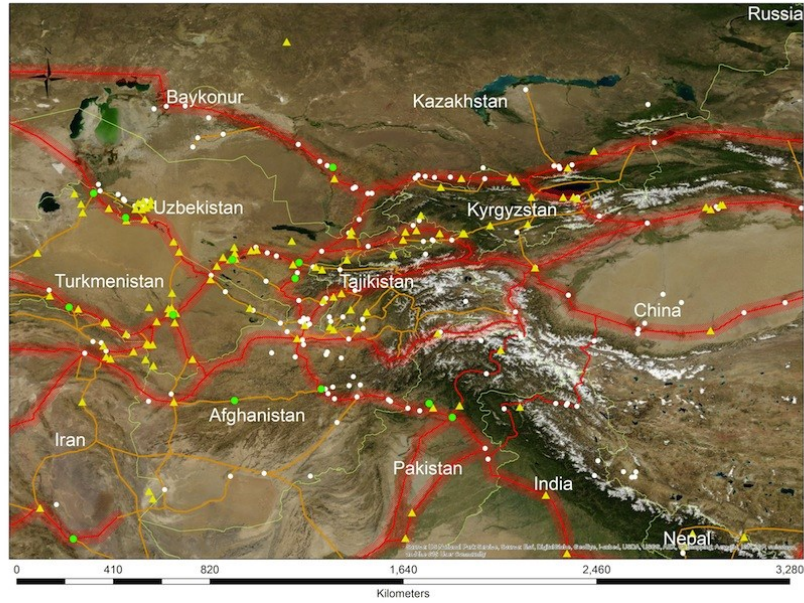
Fig. 6. Example of the corridors in Central Asia. (Green existing World Heritage Sites; Yellow Tentative List Sites; White other major sites) (Source of background imagery: World_Physical_Map - Source: US National Park Service).
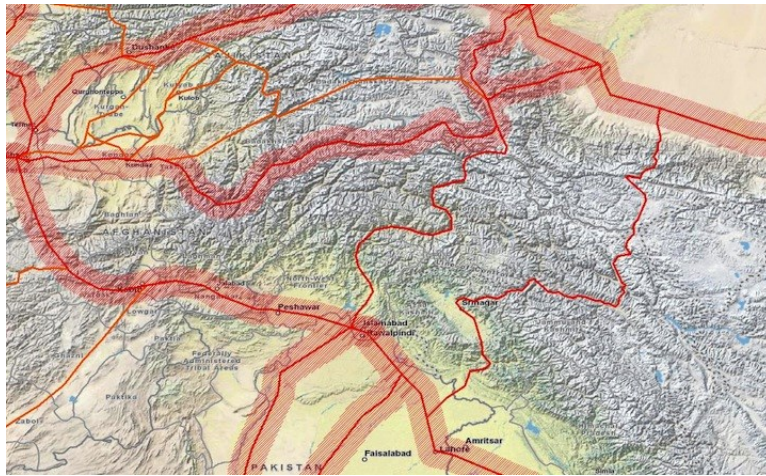

Fig. 7. Mountain passes and steep-sided valleys would require a spatially much tighter definition of the corridor, which might, in places, only extend a few hundred metres from a very discreet route. Here the Karakoram

highway and through the high Karakoram have been deliberately left un-buffered.

Obviously this is a relatively coarse approach: it cannot take into account all of the subtleties of local topography, environment or vegetation, and undoubtedly local knowledge and research will add to, and deepen, this picture (Fig. 7). However, this was a viable approach when dealing with in excess of 50,000 km of routes. We would argue that it creates a reasonably robust tool, in terms of identifying key elements of the overall Silk Roads and patterning their diversity.

We digitised the routes at an approximate scale of 1:25,000. In drawing the routes we took account of obvious topographic features (mountain passes, well-known fords and river crossings, known bridging points, etc.), along with known way-stations, forts, and smaller towns. Major shrine complexes were also taken into account, although it is also clear that these were sometimes located off the main routes of movement, perhaps taking advantage of the siting (on a hill or mountainside overlooking such routes), or reflecting the specific desire for remote locations.

Discussion

More than 50,000 km of routes have been plotted and the resolution on many of these is necessarily broad-brush: undoubtedly these can and will be augmented in the future.[36] In many cases there has been insufficient field research to convincingly argue the detailed chronology of specific segments or routes. We know that different routes rise to prominence at different times - for example, the shifting emphasis on the routes around the Taklamakan Desert[37] – but often without a great deal of precision about the chronology of these fluctuations.

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[36] For example, the routes into South Asia, including those across the Tibetan plateau need to be elaborated. See Tao Tong, *The Silk Roads of the Northern Tibetan Plateau During the Early Middle Ages (from the Han to Tang Dynasty)* (Oxford: Archaeopress, 2013).
[37] Especially between the northern *Tianshan bei lu* route and the southern *Nan Shan Bei Lu* route.

The Silk Roads concept paper[38] proposed that the types of monuments, sites and cultural landscapes found along the Silk Roads could be categorized under:

- **Category 1 Infrastructure** - facilitating trade and transportation (including caravanserais and inns; military posts, garrison stations and fortifications; bridges; irrigation systems; natural and cultural landmarks).
- **Category 2 Production -** of trading goods (including mining, metal working, manufacturing and handicrafts, and other industrial and production sites).
- **Category 3 Outcomes -** such as cities, art, knowledge as a result of contact and exchange (including trade cities, urban centres and settlements; religious, spiritual and ceremonial sites (including shrines, caves, tombs, sites of pilgrimage); and places of associations with political events, transfer of ideas, language, music, dance, poetry, etc.).

Infrastructure

The scale of way stations, caravanserai, khans, funduqs, etc.,[39] along the Silk Roads was enormous. OWTRAD identified 684 significant stopping places supporting long-distance communication routes within the study area, but OWTRAD is very much a work in progress,[40] and detailed local inventories show that the picture is likely to be even more complex: Siroux,[41] for example, identified 259 caravanserais in Iran alone. Recent research in Turkmenistan[42] suggests that there are at least 30-40% more stations than previously recognised. The OWTRAD coverage is also patchy at present, with

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[38] UNESCO. *A Concept for the Serial Nomination of the Silk Roads in Central Asia and China to the World Heritage List* [updated text after the Consultation meeting in Xi'an (China), June 2008] (Unpublished report. Xi'an: UNESCO. 2008).

[39] For a terminology see http://www.ciolek.com/OWTRAD/trade-routes-glossary.html

[40] OWTRAD has a variety of data concerning way-points along routes, including some substantial settlements and some way-stations. See, for example, the Bulianov 1999 Turkmen dataset.

[41] Siroux 1949.

[42] Tim Williams and Paul Wordsworth, "Merv to the Oxus: a desert survey of routes and surviving archaeology," *Archaeology International*, vol. 12, 2008/09 (2010): 27-30.

little work done on China, Kazakhstan, Kyrgyzstan, Nepal, etc. So the density of sites currently known probably largely reflects where there has been intensive work (Turkey, Syria, Iran, India, etc.), and thus reflects research rather than original distributions.

Nevertheless, there were clearly some distinct local variations in the density and chronology of buildings. For example, it has been suggested that "during the Middle Ages caravanserais were apparently not built along Syrian desert roads, apart from rare cases. Some stopovers were built only along the Damascus-Palmyra axes and, even in this case, hardly ever on the first stages of the road, the nearest to Damascus. … Caravanserais concentrated along the Aleppo-Damascus road during both the Ayyubid and Mamluk period alike."[43] However, the problem is that often only later, more substantial, way-stations have been identified and it is probable that there was a range of earlier structures along the routes through the Syrian deserts[44]. To the east of Palmyra, however, there appears to be a dearth of way-stations on the routes to the Euphrates.[45]

Overall, however, some form of way-station seems to have been prevalent across most of the study area. Indeed, the functional need was almost inescapable. Way-stations enabled the exchange, distribution, and storage of goods, and the re-victualing of travellers with food, fodder and drinking water. The distance between way-stations, and the types of services they provided, was conditioned by a number of factors:

- Terrain (e.g. the differences between flat valley bottoms and steep mountain climbs).
- Aridity and the availability of fodder/grazing.[46]
- The type of shelter required (e.g. inclement mountain terrain).

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[43] Cinzia Tavernari, "Roads & caravanserais in Medieval Syria," *ArchAtlas* 2009. http://www.archatlas.org/workshop09/works09-tavernari.php Accessed 30/3/2013.

[44] Survey work is currently being conducted by the University of Bergen.

[45] Although there are a number of desert castles in the east, such as Qasr al-Hayr al-Sharqi, which probably performed a variety of administrative, military, and palatial functions.

[46] The carrying capacity of a caravan was heavily conditioned by the availability of water and fodder as well as temperature and terrain: see T. Matthew Ciolek, "Trade Routes," in Roland Robertson and Jan Aart Scholte, eds. *Encyclopaedia of Globalization* (London: Routledge, 2006).

- Political context: the balance of private and state sponsorship, and issues of security, taxation and control.

As a result, we see different types of networks develop - with different forms of architecture, and intervals between stations – changing over both times and space - reflecting these changing ideas and responses to control and local eco-climatic factors. However, while the posts around the Taklamakan, for example, are physically very different to the caravanserais of Central Asia and the Middle East, they probably performed many of the same functions – protection, refuelling, and the control of the flow of goods and taxes. The scale of shelter, the degree of transhipment and storage, the scale of the refuelling (food, water, fodder), all varied – but the basic need for such way-stations did not: they occur along the majority of the Silk Roads routes.

Where there is detailed evidence available, way-stations often seem to have lain about one-day's travel apart[47] - where there was a need for (and infrastructure to provide) these services, they existed. However, in other areas they were more widely spaced (more than a single day's journey), when it was possible to camp, where supplies of water and fodder could be gleaned from the landscape, and/or where security was good.

Similar to caravanserai, the control of routes, whether for protection or extraction/taxation, was a noticeable feature of most sectors of the routes. In places these functions were inseparably from way-stations/caravanserai: for example in some of the high mountain passes. Elsewhere, specific military control points were established, for example with the forts and watchtowers of the Taklamakan region. Again these reflect specific regional political and social responses to the organisation and infrastructure of the routes, and as such are an important component of capturing the complexity and diversity of the Silk Roads. At present the problem is that few of the smaller sites (watchtowers, small forts, military staging posts/postal stations, etc.) have been accurately mapped and published.

Relatively few historic bridges have survived in anything like an authentic form along the Silk Roads. The main concentration of published material comes from Afghanistan (11 in Ball's gazetteer, including the monumental structure at Pol-i Malan,[48] Iran (including

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[47] Siroux 1949.
[48] Warwick Ball, *Archaeological Gazetteer of Afghanistan*. (Paris: Documentation Française, 1982.).

a group of some 60 bridges in Lorestan[49]), southern Turkmenistan (Pulkhatyn), Syria (good examples at Cyrrhus & Qanawat) and the Lebanon. To some extent this reflects the geographic conditions of this region, from western Central Asia to the Mediterranean, with relatively deeply incised and un-fordable rivers requiring more permanent crossing points, combined with the availability of stone building materials. The amazing early fifteenth century iron suspension bridges of Thangtong Gyalpo in the Himalayas are also important,[50] reflecting the adaption to specific conditions. It is likely that bridges where needed in other parts of the Silk Roads: however, documentation is remarkably scare. This may reflect different local adaptions; such as fordable rivers, crossing points significantly changing to reflect seasonal flood waters, or timber bridges which have not survived.

Irrigation was vital in many regions along the Silk Roads to provide an agriculturally productive base to sustain significant population densities. The ability to manage and exploit major glacier or mountain rainfall-fed river systems - for example the Murghab (Turkmenistan), Amu Darya (ancient Oxus) (Turkmenistan, Uzbekistan, Kazakhstan), Zarafshan (Uzbekistan), Syr Darya (Kazakhstan), and Yarkand and Ak-su rivers in the Taklamakan (China) - became an important facet of supporting the development of intensive urbanisation along the Silk Roads.[51] The flourishing of urban centres, and the scale of craft specialisation and artistic outputs that they achieved, would not have been possible in many places without complex hydrological management.

In many cases dams were probably used to manage these many of the irrigation systems: normally located at the headwater of a delta or upstream of the land to be irrigated, and used to control the flow of water into channels and canals radiating from those points. But relatively little archaeological work has been done on these. For example, we are aware of systems at Soltan Band (Turkmenistan) to control the Murghab River and the canals/channels of the delta, but

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[49] Included on the Iranian tentative list under 'The Collection of Historical Bridges': http://whc.unesco.org/en/tentativelists/5273/

[50] Manfred Gerner, *Chakzampa Thangtong Gyalpo - Architect, Philosopher and Iron Chain Bridge Builder* (Thimphu: Center for Bhutan Studies, 2007).

[51] For example, in Central Asia - Sala 2003.

as yet we know little of their date or construction.[52] In part, this is because these strategic points in the landscape are oft reused, and the traces of early hydraulic systems has been destroyed or disappeared under, more modern adaptions. Recent work in the Zarafshan Valley in Uzbekistan[53] demonstrates that the construction of canal systems can be explored to good effect and the complexity of the hydraulic management reconstructed.

Fig. 8. Qanāts crossing a now desertified landscape in Central Asia (Google Earth).

One particular form of irrigation and water-supply system that has received some attention is the underground systems variously referred to as Qanāts, Karez and al-Falaj systems (Fig. 8). These were very effective in managing water resources, especially in hot climates where open systems are prone to massive evaporation loss. They are complex and require considerable labour to construct. The

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[52] Abdyrakhman G. Gubaev, Gennadii Andreevich Koshelenko and Maurizio Tosi, eds., *The Archaeological Map of the Murghab Delta: Preliminary reports 1990-95* (Rome: Istituto Italiano per l'Africa e l'Oriente, 1998); Sandro Salvatori and Maurizio Tosi, eds., *The Archaeological Map of the Murghab Delta. Volume II. The Bronze Age and Early Iron Age in the Margiana Lowlands, Facts and methodological proposals for a redefinition of the research strategies* (Oxford: Archaeopress, 2008).
[53] Sebastian Stride, Bernardo Rondelli and Simone Mantellini. "Canals versus horses: political power in the oasis of Samarkand", *World Archaeology*, vol 41 (1) (2009): 73-87.

spread and development of this form of water-management seems to have been a crucial factor in the development of the Silk Roads urban centres in many regions between Iran and China: they are well known in Iran (e.g. Bam & Yazd), Afghanistan (e.g. Herat), Turkmenistan (e.g. Nisa), Central Asia,[54] India (e.g. Gulburga, Bidar and Burhanpur), and China.[55] They are also present in areas outside the study area, such as Azerbaijan. However, at present we know too little about variations in the engineering and organisation of these systems or their dating.

There are a number of mountain passes that were an integral part of the infrastructure of the Silk Roads, enabling passage through key mountain ranges, especially in Central and Southern Asia. Many of these have become iconic to the routes: such as the Iron Gates (between Termez and Sharisiyabz/Samarkand in Uzbekistan); Takhta-Karacha Pass (from Samarkand to Shakhrisiabz, Uzbekistan); Irkeshtam Pass (between Kyrgyzstan's Alay valley and China: shortest route between China and the Ferghana valley); the Hajigak, Unai, Shibar and Salang Passes (Afghanistan); Khyber Pass (connecting Afghanistan and Pakistan); Khunjerab Pass (between China and Pakistan through Kashmir: linked to the Karakorum Highway); Yangguan Pass (China: opened up by Emperor Wudi in the second century BCE to access areas west of the Yellow River in Gansu: strategic point through which passed the caravans when travelling westward from Dunhuang to follow the southern route of the Silk Route into Central Asia); Sangju and Han'gu Passes (China).

In some places evidence of the complexity of the physical landscapes survive without major modern interventions, particularly in the more remote mountain passes of the Pamirs, Tien Shan, and Himalayas. Not only were these passes integral to the routes, but the control of these key strategic points attracted a number of empire systems and led to the establishment of a number of forts and watchtowers. There is, unsurprisingly, considerable diversity in the nature of these controlling mechanisms, based upon empires and local adaption. There is some archaeological evidence that reflects the use of these strategic points; for example, the watchtowers at

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[54] Erbulat Smagulov and Renato Sala, "Karizi Turkestankogo oasika", *Promislennost II* (2003).

[55] For example, at Turfan see Arnaud Bertrand, "The Hydraulic Systems in Turfan (Xinjiang)", *The Silk Road*, vol. 8 (2010): 27-41.

Yangguan (China), Baltit Fort on the Karakuram Highway from Gilgit (Pakistan), or the mountain forts and settlements of Ladak (India).

There are likely to have been many forms of markers along the Silk Roads, commemorating events, recording empires, providing guidance on routes, edicts of control, or warnings. But by their very nature, many were relatively ephemeral and there is a paucity in the archaeological record of what was probably once a common feature of the Silk Roads landscape. Prominent landmarks, in the form of wayside shrines and religious sites, forts and watchtowers, way-stations and watering-points, would have made up an important part of the visual reference of the routes for many travellers. There are some notable examples of locating other forms of monuments to specifically impact upon the traveller, such as the bas-reliefs rock edicts at Shahbazgarhi and Mansehra (Pakistan), which were clearly carefully located alongside the trade routes connecting the Vale of Peshawar with the valleys of Swat, Dir and Chitral to the north and the city of Taxila to the south east.

Perhaps the most amazing survival and regional adaption are the pillar stones of Nepal and India. These provide both route markers but also reinforce the political patronage of the routes. Interspersed with small forts, these routes are a remarkable survival of the complexity of route infrastructure and control.

Production

Most productive activities – crafts, textiles, dying, ceramics, metalworking, wood-working, etc. - were embedded within other forms of settlement; especially within, or on the periphery of, urban centres. Many major cities had extensive industrial suburbs[56] and many smaller towns where centres for industrial and craft

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[56] For example, at Merv see Tim Williams "The city of Sultan Kala, Merv, Turkmenistan: communities, neighbourhoods and urban planning from the eighth to the thirteenth century", in Amira K. Bennison and Alison Gascoigne, eds., *Cities in the pre-modern Islamic world: the urban impact of religion, state and society* (London: Routledge, 2007), 42-62; Tim Williams, "The landscapes of Islamic Merv, Turkmenistan: Where to draw the line?", *Internet Archaeology*, vol. 25 (2008).

production[57]. There were, of course, many productive activities of the Silk Roads that are not adequately captured by urban settlements. One obvious omission is agricultural production, not simply staple food stuffs, but the production of goods that travelled many hundreds or thousands of kilometres: viticulture, sericulture (the very basis of the Silk Roads name), dried fruits (such as the famous dried melons), horses, cotton textiles, etc. Some of these may have been processed in settlements and can leave tangible remains (silk production vats, wine presses, tanning and dying vats, etc.), but the productive landscapes are perhaps difficult to capture in the archaeological record.

Another important element was mining and extractive industries: to support craft and industrial production along the Silk Roads. At present sites and landscapes are poorly understood and certainly under-represented in both academic studies and heritage protection.

Outcomes

Cities are integral to capturing the complexity of the outcomes, infrastructure and often the modes of production of the Silk Roads. The scale and complexity of cities along the Silk Roads is phenomenal. Within the currently defined geographic and chronological scope there are more than 300 major historic cities, ranging from mega-cities like Antioch, Merv and Chang'an, to substantial regional centres.

Spatially, there are significant differences between the cities. For example, the contrast between the cities of the eastern Mediterranean, with their classical traditions, as opposed to those in central Asia, created by the interplay between the spread of classical influences, initially during Hellenistic expansion (with a complex mix of rectilinear street networks, classic public buildings and spaces), and pre-existing Asian urbanism (for example, large open areas in the corners of cities). The character of the cities also reflected local adaption to building materials, such as the use of earthen architecture, or the lack of good building stone, and reflect differing styles of architecture. Further east, we see very different forms of urbanism,

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[57] For example, at Talgar in Kazakhstan. See Jang Sik Park and Dmitri Voyakin, "The key role of zinc, tin and lead in copper-base objects from medieval Talgar in Kazakhstan", *Journal of Archaeological Science*, vol. 36 (3) (2009): 622-628.

including Chinese urbanism with a very clear demarcation and organisation of urban space from the Han dynasty onwards[58]. There were also different attitudes to urban and suburban, the location of industrial production, the location of the elite in the urban space, etc. The nature of the cities along the Silk Roads also changed over time, including the growth of discrete neighbourhood planning in the Islamic city[59], the increasing role of order, uniformity and rank in the Chinese city,[60] or the changing location of palatial complexes in many forms of urbanism, away from the core to periphery of the urban area.

The complexity of the urban process along the Silk Roads is not simply reflected in the major cities: for example, see the complexity of cities and settlements around the Taklamakan Desert/Tarim Basin[61]. Urban centres reflect craft, industrial and artistic outputs (above), but again this will not always be best reflected by simply the largest urban centres: indeed, in many instances the larger centres are performing very different functions, and reflecting very different types of social and political elite display, to the smaller urban centres along the routes.

The spread of ideas and beliefs along the Silk Roads is a key feature of the significance and impact of these routes on world culture. The scale and diversity of ideological penetration into societies is complex to chart from the physical/tangible remains, but

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[58] Victor F. S. Sit, *Chinese City and Urbanism: Evolution and Development* (Singapore: World Scientific Publishing, 2010); Paul Wheatley, *The Pivot of the Four Quarters* (Edinburgh: Edinburgh University Press, 1971).
[59] Amira K. Bennison and Alison Gascoigne, eds., *Cities in the pre-modern Islamic world: the urban impact of religion, state and society* (London: Routledge, 2007); Paul Wheatley, *The places where men pray together. Cities in Islamic Lands, Seventh through the Tenth Centuries* (Chicago: University of Chicago Press, 2001); Whitcomb, Don, "An urban structure for the early Islamic city: an archaeological hypothesis", in Amira K. Bennison and Alison Gascoigne, eds., *Cities in the pre-modern Islamic world: the urban impact of religion, state and society* (London: Routledge, 2007), 15-26.
[60] Sit 2010; Wheatley 1971.
[61] Nicola Di Cosmo, "Ancient City-States of the Tarim Basin", in Morgens Herman Hansen, ed., *A Comparative Study of Thirty City-State Cultures* (Copenhagen: Royal Danish Academy of Sciences and Letters, 2000), 393-407.

chronology, speed of movement, and the scale of institutions, can give some proxy indications of the range and depth of the impacts.
The spread of Buddhism from South Asia along the Silk Roads is well known. Literary, epigraphic, and archaeological sources reveal the growth of Buddhist monasteries from c. the fifth century BCE to the end of the first millennium CE. Dynamic mobility was closely linked to trans-regional trade networks, extending from South Asia through the upper Indus into the Central Asian Silk Roads and through the high passes and the Tibetan plateau, to Tarim Basin and beyond.[62] There are also important interactions with other religions in the first millennium CE: for example, leading to the Hindu-Buddhist interactions at monasteries such as Kakrebihar in western Nepal.

The spread of Islam was initially a very different process to that of Buddhism, with the conquest of large portions of Western and Central Asia taking place during the rapid expansion of the seventh century CE. After that early diffusion, however, came a longer period of acculturation and interaction, with Islamic beliefs spreading through contact and travel, and with communities developing throughout the area of the Silk Roads. Many other religions and beliefs, such as Manichaeism, Nestorianism, and Zoroastrianism also spread along the Silk Roads and had extensive impacts upon the development of the societies along its routes.

The Silk Roads were also the routes along which technologies (e.g. cast iron), inventions (e.g. magnetic compass), engineering (e.g. bridge-building), sciences (e.g. medical knowledge), and agricultural practices (e.g. vine cultivation) were transmitted. Not all the movements were east-west: glass manufacturing techniques moved from west to east,[63] and "the Roman craftsmen who incorporated Persian textile and stucco ornament into the mosaics of Justinian I's Hagia Sophia, the weavers of Sogdian textiles who used Persian and

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[62] Jason Neelis, *Early Buddhist Transmission and Trade Networks: Mobility and Exchange within and beyond the Northwestern Borderlands of South Asia* (Leiden: Brill, 2011).

[63] Gan Fuxi, Robert H. Brill and Tian Shouyun, eds., *Ancient glass research along the Silk Road* (New Jersey: World Scientific, 2009).

Roman motifs, as well as Chinese ceramicists who adapted Persian shapes and motifs all provide ready examples of this phenomenon."[64] A major impact of the Silk Roads was the spread of varieties and species of plants and animals. Archaeologically these processes can be studied, through botanical and faunal remains from well stratified and dated archaeological sequences. There has been considerable research into this field.[65] This is now being supplemented by research into genetics into the movement and origins of both plant and animal species: for example, animal exchange networks are known to have played "an important role in determining gene flow among domestic animal populations,"[66] or Robert Mattock's research on the movement of rose species along the Silk Roads[67].

A significant impact of the movement of peoples and ideas along the Silk Roads was the transfer of architectural and artistic styles, often resulting in complex adaptions; for example the spread of early Buddhist stone-carving practices throughout Asia. This gave rise to the distinctive development of Buddhist art and architecture, but there were also significant amalgamations with local styles. The interplay of architectural styles is also evident in the Islamic empires, where architectural forms incorporated many design elements for neighbouring areas, such as Hindu naturalistic plant motifs.

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[64] Matthew Canepa, "Distant Displays of Power: Understanding Cross-Cultural Interaction Among the Elites of Rome, Sasanian Iran, and Sui-Tang China" *Ars orientalis*, vol. 38 (2008): 139.

[65] For example, Françoise Aubaile, "Voies de diffusion de quelques plantes et animaux entre l'Asie et la région méditerranéenne [Pathways of diffusion of some plants and animals between Asia and the Mediterranean region]," *Revue d'ethnoécologie*, vol. 1 (2012): 2-26; Jade d'Alpoim Guedes, Hongliang Lu, Yongxian Li, Robert Spengler, Xiaohong Wu and Mark Aldenderfer, "Moving agriculture onto the Tibetan plateau: the archaeobotanical evidence," *Archaeol Anthropol Sci,* (2013): 1-15; Jianping Zhang, Houyuan Lu, Naiqin Wu, Xiaoguang Qin and Luo Wang, "Palaeoenvironment and agriculture of ancient Loulan and Milan on the Silk Road", *The Holocene*, vol. 23 (2) (2013): 208-217.

[66] Vera M. Warmuth, Michael G. Campana, Anders Eriksson, Mim Bower, Graeme Barker and Andrea Manica, "Ancient trade routes shaped the genetic structure of horses in eastern Eurasia", *Molecular Ecology*, vol. 22 (21) (2013): 5340.

[67] See http://www.plantresearch-bath.org/tropical-biotech/robert-mattock/ [Accessed 1/11/2013]

MAPPING THE SILK ROADS

The changing dynamics of the empires that spanned the Silk Roads is hugely complex. Major empires - such as the Han, Tang, Kushan, Mauryan, Sassanid, Roman, Parthian, Abbasid, Seljuk - held sway over considerable territories for protracted periods of time. The importance of these systems, and their interaction, are fundamental attributes of the Silk Roads. Empire systems not only shaped the development of settlements and societies within their boundaries, but also the interaction and exchanges between empires was vital in shaping identities: for example, the "processes of cross-cultural interaction between the courts of Rome, Sassanian Iran, and Sui-Tang China were primarily concerned with the formation and maintenance of imperial identity."[68]

There were also numerous smaller polities, which controlled significant areas for varying lengths of time, such as the Kasa Malla in Nepal, the Himalayan kingdom of Ladakh, or the Buddhist kingdom of Khotan. And many smaller city states held local control, existing within, or often between, the dynamics of larger empire systems. Not only did empire boundaries change over time, expanding and contracting in struggles for control of neighbouring polities, but also they were often more fluid than the simple boundaries that are often drawn on maps. Sometimes borders were marked by hard boundaries, such as forts, walls, border posts, etc.: while the Great Wall was clearly a tangible demarcation of imperial space, even here the influence of the empire was not contained by this physical marker.[69] Often boarder zones were complex areas of negotiated power, without hard edges, reflecting sometimes rapidly changing spheres of influence.[70] In addition, regional conflicts and changing markets meant that the Silk Roads were never static: for example, Rome's attempts to find routes to avoid Parthian control.

Empire systems provide one framework for viewing the significance of archaeological evidence, but various merchant

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[68] Canepa 144.

[69] Piper Gaubatz, *Beyond the Great Wall: Urban Form and Transformation on the Chinese Frontiers* (Stanford, CA: Stanford University Press, 1996.).

[70] Touraj Daryaee, "Ethnic and territorial boundaries in Late Antique and early medieval Persia (third to tenth century)", in Florin Curta, ed., *Borders, barriers, and ethnogenesis: frontiers in late Antiquity and the Middle Ages* (Turnhout: Brepols, 2005), 123-138; Eberhard W. Sauer, *Persia's Imperial Power in Late Antiquity: The Great Wall of Gorgan and the Frontier Landscapes of Sasanian Iran* (Oxford: Oxbow Books, 2013).

diaspora, such as the Sogdians, form a vital element of the Silk Roads. While the Sogdians never established a territorial empire outside their homeland (in the oases and river systems of modern-day Uzbekistan and Tajikistan) their influence, from the third to eighth centuries CE, came from the extensive colonies and trading enclaves they established in the regions to the east and south, from China and to northern Pakistan.[71]

The nomadic communities of Asia were also a dynamic part of the interactions and productive systems of the Silk Roads. The tensions between nomadic and sedentary communities are often emphasised: usually characterised as the shift from subsistence to surplus farming, with changing land use leading to the displacement of nomadic peoples. Agricultural development, sedentarisation and urbanisation are seen as interlocking elements of this process. However, recent research has tended to suggest a more complex set of interactions, with nomadic and sedentary communities involved in the exploitation of different resources, and with exchange systems existing between them.[72] Indeed, Xuanzang observed at Samarkand that nomads from the steppes further north brought their fur, cattle, and hides to trade[73] – feeding into the wider Silk Roads network.

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[71] Ètienne de la Vaissière, "Sogdians in China: A Short History and Some New Discoveries", *The Silk Road*, vol. 1 (2) (2003): 23-27; Ètienne de la Vaissière. *Sogdian Traders: A History* (Leiden: Brill, 2005); Frantz Grenet "The Pre-Islamic Civilization of the Sogdians (seventh century BCE to eighth century CE): A Bibliographic Essay (studies since 1986)," *The Silk Road*, vol. 1 (2) (2003): 28-36; Jonathan Karam Skaff. "The Sogdian Trade Diaspora in East Turkestan during the Seventh and Eighth Centuries," *Journal of the Economic and Social History of the Orient*, vol. 46 (4) (2003): 475-524.

[72] Annette L. Juliano and Judith A. Lerner, eds., *Nomads, Traders and Holy Men Along China's Silk Road: Papers Presented at a Symposium Held at the Asia Society in New York, November 9-10, 2001* (Turnholt: Brepols, 2003); Karl M. Baipakov, *Po sledam drevnikh gorodov Kazakhstana: Otrarskiĭ oazis* (Alma-Ata: "Nauka" Kazakhskoĭ SSR, 1990); Sebastian Stride, Bernardo Rondelli and Simone Mantellini, "Canals versus horses: political power in the oasis of Samarkand," *World Archaeology*, vol. 41 (1) (2009): 73-87.

[73] Sally Hovey Wriggins, *The Silk road journey with Xuanzang* (Oxford: Westview Press, 2004), 38.

Conclusion

It is evident that there are specific geographic aspects to the distribution of sites along the Silk Roads, reflecting very specific responses to their geo-topographic setting or the extent of different empire systems or beliefs. Most site types – such as cities, way-stations, or religious complexes – existed over much of the Silk Roads, but they differ considerably in terms of their specific form: reflecting local building materials, architectural styles, responses to climatic conditions, ideas about the organisation of urban space, the scale of centralised administration, and different political, ideological and cultural regimes. The research identified different corridors along the Silk Roads where different responses, driven by both geo-climatic and socio-political forces, have resulted in different manifestations of infrastructure, production and outcomes.

(1) Corridors that reflect the cultural responses to topographic, climatic and ecological variations: using observable characteristics of contemporary landscapes and ecologies, with some extrapolation to historic conditions (e.g. the processes of desertification). Corridors that run through high plateaus and mountain passes, fertile valleys and oasis, deserts and their margins, coastal littorals, along major rivers, etc.

(2) Corridors that reflect empires and geo-political variations: these are more difficult to identify given the lack of archaeological research and problems dating the earlier sequences at many sites. Nevertheless, we do understand much of the scale, distribution and chronology of the empire systems.

The research has suggested that a number of the corridors could form the basis for separate Silk Roads serial nominations, reflecting the cultural diversity of the overall Silk Roads, and enabling the smaller sites of the Silk Roads to be captured within a nomination strategy, linked by an overall concept. Two nominations have now been prepared[74] and gone forward for consideration by the World Heritage Committee in June 2014.

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[74] By China, Kazakhstan and Kyrgyzstan; and by Uzbekistan and Tajikistan.

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Acknowledgements

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