

## ***Interactive comment on “Climate-driven desertification triggered the end of the Ancient Silk Road” by Guanghui Dong et al.***

**Anonymous Referee #3**

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Review: “Climate-driven desertification triggered the end of the Ancient Silk Road”

### Description

– The general argument of the paper is that cold and dry climate prevailing during the Ming dynasty in the region of Dunhuang around 1450 CE was the chief cause for the closure of the Silk Road (meaning by it the system of communication between the Chinese capital and Central Asia) – Evidence for this hypothesis is presented in the form of climate proxies from the site of Xishawo (XSW), consisting of paleosols and sediments, dated on the basis of  $^{14}\text{C}$  analysis of charcoal and wood samples from the same section of the site. The laboratory analysis showed an increase in desertification, attributed to especially dry and cold climate, between 1450 and 1530. – The authors also consulted historical sources and compared their results with written records. –

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The main thesis of the study is that the closure of the trade route and abandonment of Dunhuang in the early 16th century was due to climatic change rather than two other causes considered here, namely, the “alternative” maritime route and warfare. In their analysis the authors argue against these two possibilities, and exclude them in favor of a climate change as the single cause for the closure of the Silk Road. In their view after 1450 transit through Dunhuang would have been impossible because of drought conditions.

### General comments

The study suffers from insufficient analysis and methodological pitfalls, which are primarily the following.

1. The archaeological context of the site from where the samples were collected is not discussed. This is a critical issue since other studies have attributed the decline of the oases to Ming government policies that reduced the inhabitants.
2. A reduction in population density is attributed uniquely to environmental factors, without considering other possibilities for the same phenomenon.
3. Social-political analysis is uniquely based on frequency of “agri-nomadic” conflict. The category of conflict is too vague to be accepted as a proxy for political processes, and statistical means are not normally accepted in historical analysis for inferring government policies. In other words, a historical analysis should focus on specific actions by the Ming government to protect Dunhuang, increase its productivity, regulate trade and manage its population. Therefore, specific references to such policies are needed.
4. The authors assume that maritime trade could be in competition with the continental “Silk Road” trade, but in fact such trades were different and not in mutual competition. Therefore, debunking the notion that maritime trade might have led to the decline of the Silk Road in the 15th and early 16th century seems a “strawman” argument.
5. Other studies have contended that desertification was caused by a decline in population. The authors acknowledge the fragility of the oasis environment, but in fact the economy of the oasis is fragile even in relatively favorable conditions, given that maintenance of irrigation

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system is labor-intensive and requires substantial investments and constant attention. Therefore, a decrease in population could lead to lack of maintenance and accelerate desertification. This is a possibility that the authors do not contemplate, and requires a more accurate investigation of both the historical and archaeological contexts. 6. The authors present as evidence of desertification the cessation of embassies and tribute missions from the kingdoms and principalities in the Western Regions (today's Xinjiang) as evidence of the collapse of the Jiayuguan transit route. While there was a decline around 1450, by no means there was a total collapse of trade missions. If we take the periods 1436-64, 1465-1509 and 1510-1539, the embassies from Turfan were respectively 5, 40, and 14, those from Hami 84, 56 and 14, and from Samarkand (further west) 14, 15, and 14. Even after this time a few embassies continued to be sent from Hami and Samarkand. Unless the authors can show that there was an alternate route, the assumption that Hexi corridor was completely impassable after 1450 is not supported by the evidence. 7. The paper does not explain clearly why Dunhuang would be abandoned only seventy years after the drought event, and how the government reacted to it. In the meantime. 8. The conclusions presented in other studies that are especially relevant to the questions raised here should be discussed more explicitly, in particular Zhang, et al. "A late-Holocene pollen record from the western Qilian Mountains and its implications for climate change and human activity along the Silk Road, Northwestern China." *The Holocene*, 28(7) (2018), 1141-1150 (in the reference list), and Li, Haiming, et al. "Human settlement and its influencing factors during the historical period in an oasis-desert transition zone of Dunhuang, Hexi Corridor, northwest China." *Quaternary International* 458 (2017): 113-122 (not in the reference list).

Detailed comments

Abstract

20 This is a misleading statement since it suggests that there were no other interruptions.

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21 Demise is not synonymous with interruption: is it a demise or an interruption?

22 Wala: the standard term is Oirat (or other spelling, such as Oyirad)

24-26 Is it possible that there was more than one cause?

27-32 The dates seem to indicate a long gap between the time of the drought (1440-60) and the closure of the trade route going through Dunhuang (1539)

1. Introduction

43-47 Does this mean that there were no more contacts between China and central Asia, or between the Ming dynasty and the states in the Tarim Basin (today Xinjiang) after 1539?

60-62 "The Ming . . . frontier": meaning unclear. Clarify especially "transfer of the leadership to Mongolia"

63-87 The hypotheses presented here do not include archaeology-based hypothesis. Any discussion on the "closure" of the Silk Road should be documented by looking at arguments based on archaeological investigation.

66-67 vague, not relevant

67 unclear what "expand agri-nomadic wars" means: suggest to provide references to historical events

69 Necessary to provide dates and other details and background of invasions by nomadic tribes

73-74 The reference to the rise of the maritime routes as an explanation for the decline of Silk Road in Western literature usually refer to the late 16th and especially 17th century but these are old theories that have since been criticized. The references cited here are to generic articles to which I have no access, but should be supplemented with references to a broader discussion. The ban on Dunhuang trade was irrelevant

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to the rise of international maritime trade, in South China which is due to Spanish and Portuguese commercial and diplomatic activities.

## 2. Study area

92-93 The statement about newly-discovered historical archives requires a reference

115-119 These lines can be deleted since they are vague and not relevant.

130 Tulufan, normally known in English as Turfan

135 Altun Mountains, normally known in English as Altyn-Tagh

139-157 This is one of the most problematic, as well as critical, passages of the essay, since reference is made to a “newly-discovered site” but no information is given as to the nature of the site (settlement, village, city, palace, fortress. . .?), the conditions of the discoveries, the date of the discovery and archaeologists involved (if any). Since the evidence upon which the whole argument rests comes from this location, it is essential to provide the full picture of this site.

## 3. Methodology

203-206 Unclear where these paleoclimatic records are located. References are required for published studies. See Below

207-210 References are not to the historical sources but to secondary studies or limited collections. No reference is made to actual historical sources, which were not consulted (Ming shi, Ming shilu, etc.). Unclear which “sociohistorical records” relative to Dunhuang and Jiayuguan were actually used (gazetteers, memoirs, standard histories, local archives etc.)

## 4. Results and Discussion

212-223 As mentioned before, the flourishing of maritime trade in the late 16th century cannot be simply attributed to a government decision (why was then ban lifted?)

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223 Zheng He’s voyages have been amply investigated (see for instance Dreyer, Edward L. Zheng He: China and the oceans in the early Ming dynasty, 1405-1433. Pearson Longman, 2006.)

224-239 The section of Zheng He’s voyages is immaterial, and also historically inaccurate. I would be weary of statements that attribute to “national prestige” the reason for Zheng He’s voyages.

248 Few specialist historians would agree with the assumption mentioned here, especially if understood (as presented here) as a sharp break.

260 What is “frequent”?

261-68. Presumably this refers to wars between Ming and Mongols in the early 16th century, but it is impossible to assess the actual impact of warfare on trade without details about when, where, and between whom the conflicts occurred.

274 Clarify what is meant by “nomadic peoples.” Not all of them were at war with the Ming. Also, statistical data about “conflict” are basically irrelevant to historical analysis unless the category of “conflict” is explained.

275 Reference to the source for data on frequency of tribute and trade is required.

282-283 The category of “agri-nomadic conflict” is not correct when discussing specific periods and cases (conflict occurs between polities, or otherwise defined groups of people, not between modes of production)

303-4 Can the absence of a relationship demonstrate something? Possibly reconsider.

354-355 This seems to be a misunderstanding. The reference in Yang et al. is to lower precipitation during the 14-century period 900 BC- 500 AD. It does not indicate a specific desertification event from 900-550 BC, as is contended here. Therefore, there is no correlation with the XSW data. More generally, the significance of the “first desertification event” is difficult to place in terms of the main thrust of this article, which

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is about the collapse of the Silk Road from an environmental perspective.

362-65 Gou et al. 2015a does not mention the period 1447-1567, but 1426–1555. Moreover, in Gou et al. 2015a and Gao et al. 2015b the climate data are based on scPSDI (self-calibrated Palmer Severity Drought Index) and SPEI (standardized precipitation and evapotranspiration index) values. It is unclear how these values match the data provided in this paper.

387-402 Evidence for this region from the 4th to 1st millennium BCE is based uniquely on archaeological documentation and therefore it would be better to replace “documentary” in the subtitle with either “archaeological” or “material”.

407-414 The migration of the Yugur requires context: when did it happen and how can we relate the difficulties mentioned in their oral history to the site of XSW at around 1450 CE? 445-466 The contention that between 1450 and 1530 the oases of Dunhuang and Guazhou were not functioning is belied by the evidence of trade-tribute missions listed in Chinese sources for this period. Therefore, more research is required on communication routes. Moreover, the evidence presented in this article does not support the notion that no ground water was available through natural wells along the caravan route. In other words, evidence of drought conditions in one place does not mean that water disappeared for the limited use of watering camels en route.

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