
SINO-PLATONIC PAPERS

Number 223

April, 2012

Water Management in Jingjue 精絕 Kingdom:
The Transfer of a Water Tank System
from Gandhara to Southern Xinjiang
in the Third and Fourth Centuries C.E.

by
Arnaud Bertrand

Victor H. Mair, Editor
Sino-Platonic Papers
Department of East Asian Languages and Civilizations
University of Pennsylvania
Philadelphia, PA 19104-6305 USA
vmair@sas.upenn.edu
www.sino-platonic.org

SINO-PLATONIC PAPERS

FOUNDED 1986

Editor-in-Chief
VICTOR H. MAIR

Associate Editors
PAULA ROBERTS MARK SWOFFORD

ISSN
2157-9679 (print) 2157-9687 (online)

SINO-PLATONIC PAPERS is an occasional series dedicated to making available to specialists and the interested public the results of research that, because of its unconventional or controversial nature, might otherwise go unpublished. The editor-in-chief actively encourages younger, not yet well established, scholars and independent authors to submit manuscripts for consideration. Contributions in any of the major scholarly languages of the world, including romanized modern standard Mandarin (MSM) and Japanese, are acceptable. In special circumstances, papers written in one of the Sinitic topolects (*fangyan*) may be considered for publication.

Although the chief focus of *Sino-Platonic Papers* is on the intercultural relations of China with other peoples, challenging and creative studies on a wide variety of philological subjects will be entertained. This series is **not** the place for safe, sober, and stodgy presentations. *Sino-Platonic Papers* prefers lively work that, while taking reasonable risks to advance the field, capitalizes on brilliant new insights into the development of civilization.

Submissions are regularly sent out to be refereed, and extensive editorial suggestions for revision may be offered.

Sino-Platonic Papers emphasizes substance over form. We do, however, strongly recommend that prospective authors consult our style guidelines at www.sino-platonic.org/stylesheet.doc. Manuscripts should be submitted as electronic files, preferably in Microsoft Word format. You may wish to use our sample document template, available here: www.sino-platonic.org/spp.dot.

Beginning with issue no. 171, *Sino-Platonic Papers* has been published electronically on the Web at www.sino-platonic.org. Issues 1–170, however, will continue to be sold as paper copies until our stock runs out, after which they too will be made available on the Web.

Please note: When the editor goes on an expedition or research trip, all operations (including filling orders) may temporarily cease for up to three months at a time. In such circumstances, those who wish to purchase various issues of *SPP* are requested to wait patiently until he returns. If issues are urgently needed while the editor is away, they may be requested through Interlibrary Loan. You should also check our Web site at www.sino-platonic.org, as back issues are regularly rereleased for free as PDF editions.

Sino-Platonic Papers is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 2.5 License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/2.5/> or send a letter to Creative Commons, 543 Howard Street, 5th Floor, San Francisco, California, 94105, USA.

Water Management in Jingjue 精絕 Kingdom:
The Transfer of a Water Tank System from Gandhara to Southern Xinjiang in the
Third and Fourth Centuries C.E.¹

by Arnaud Bertrand²
Centre de recherche sur les civilisations de l'Asie orientale
Paris, France

Abstract

The present scholarly consensus is that the Chinese Han dynasty military force (second century B.C.E.–second century C.E.), when it reached the city-oases of the southern and northern

¹ During my year of research at Yale University in 2010–2011, I had the honor of working under the direction of Valerie Hansen, Professor of History, Yale University. Our intellectual exchange for my MA in East Asian Studies has given birth to this article. Prof. Hansen tirelessly read and corrected my drafts. I am very thankful to Victor Mair for generously accepting this article for *SPP* and for following its development from the early draft to this present published version. I also take the opportunity to thank the marvelous work made by Paula Roberts for the revision of the text and the magical work of Mark Swofford, the webmaster of *Sino-Platonic Papers*. I would also like to express my deep thanks to Stanley Insler, Salisbury Professor Emeritus of Sanskrit and Comparative Philology at Yale University, for his help and careful study of the Kharoṣṭhī documents that interested me when I was conducting my research at Yale. He reviewed my translations and corrected my interpretations of several tablets, so that no misreading could lead me to wrong conclusions. I wish to express my sincere thanks to Stefan Baums, Andrew Glass, and Doug Hitch for their constant verification of the Kharoṣṭhī transcription in the appendix. I am also particularly thankful to Professor Eric Trombert (CNRS, Paris) for the corrections he made on my final draft. Prof. Trombert and Prof. Hansen both advised me to publish this work and gave me the strength to finish it. The water of my canal, which I hope to pursue building in this field, could go nowhere without Sandrine and my parents, whom I thank every day for the love and strength they bring to me on my historical investigations.

All abbreviations used in the footnotes are listed at the end of this paper.

² Ph.D. candidate at the Ecole Pratique des Hautes-Etudes (EPHE) and at the Centre de recherche sur les civilisations de l'Asie orientale (CRCAO, UMR 8155) www.crcao.fr/BertrandArnaud

Taklamakan Desert (in the modern Xinjiang region of Western China), introduced new agricultural and water techniques to the region. If this theory stands confirmed for some oases, such as Miran, Dunhuang and Turfan, via the famous *tuntian* 屯田 technique, the influence nevertheless is not only from one side. In fact, a great majority of the water systems still existing today among the oases of the region are either a product of local invention or of Western influence. Among these, water tanks excavated on the site of old Niya 尼雅 (Uighur Nīya نىيه; Southern Taklamakan), known since the Han dynasty as Jingjue 精絕, strike one with their distinctive shape. They were discovered in the early twentieth century, but few scholars have taken the time to analyze in depth their historical and technical relationship with the site and with the cultural panorama of Southern Xinjiang. In this article, by examining a combination of archaeological, geological, and textual records, I intend to show that migrants from the Gandhara region (Pakistan) either introduced or developed a tank-based water technique within the agricultural, economic and perhaps religious systems of the Jingjue oasis during the Kroraina kingdom's rule over the Southern Taklamakan territories (third to late fourth century).

Introduction

Jingjue³ is located deep in the desert of Taklamakan (in the south of the modern Xinjiang region, China) and nearly 100 km north of the modern city of Minfeng 民丰 (see Figure 1). The chronology of this site is still subject to revision, but, according to the archaeological and historical documents recovered *in situ*, the actual city has been occupied at least since the third–second century B.C.E.⁴ Before the establishment of this new site in the second century B.C.E., the older Jingjue settlement, dated back to the Bronze Age (third–second century B.C.E.), with a city wall, was located just 40 km north in the desert lands of Taklamakan.⁵ At this time the Han

3 Considerable confusion has occurred about the names Niya (the ancient name for the site which is located under the modern northern part of Minfeng oasis) and Jingjue. Therefore, for this article, I will use the name Jingjue to designate this archaeological site.

4 All dates are of the Common Era (C.E.) unless otherwise noted.

5 Hill (2009), 81–82; Baumer (2000), 32.

dynasty military occupation extended into the western countries, and the *Hanshu* (汉书)⁶ explained that the city was known as the Kingdom of Jingjue 精絕,⁷ but it was never entirely occupied, militarily speaking, by the ruling factions of China.⁸ After the Han dynasty, Jingjue continued to be an independent kingdom occupied by people of various origins (mostly Indo-European, Indo-Iranian and Asian), the majority of whom spoke an Indo-European language (probably Tocharian).⁹ During the late second to late fourth century C.E., the site experienced a large Gandharan immigration in the southern part of Taklamakan, a migration of people who came directly from the Kushan and Kidarite territories.

Indeed, while the Han dynasty was experiencing internal difficulties, the Kushan Empire (second century B.C.E. – third century C.E.) dominated a large area between Uzbekistan and India, with Gandhara at the center of the kingdom (a strategic location, with direct access to the overland silk routes and links to the ports on the Arabian Sea). From this major spot in eastern Pakistan, a significant number of people migrated from the Gandhara region into some of the oases of the southern Xinjiang region, between the late second and early third century C.E. This migration may have been the result of the conquest by Ardashir I and Shapur I, the first rulers of the Sassanian Empire, who had taken control of the great Kushan empire by the end of the reign of Vasudeva I.¹⁰ The migration had a significant impact on the local people of Jingjue by

6 Hulsewé and Loewe (1979), 93–94; Whitfield (2004), 171.

7 SERINDIA, vol. 1, 219, note 12.

8 There is no archaeological proof confirming that the military control of Jingjue by the Han soldiers included this oasis. The only evidence of a military presence is recorded south of the archaeological site, next to the city of Tūlkichiköl. See: Xinjiang Bowuguan (1960), 9–12.

9 Hansen (2001), 275–298.

10 Concerning the shrinking of the Kushan Empire and the circumstance of the Eastern Kushan, the literature is rather thin, and even today much information is still based on works of the late 1990s. However, I recommend: *History of the Civilizations of Central Asia: The Crossroads of Civilizations: A.D. 250 to 750*, ed. Boris Anatol'evič Litvinskij, Vol. III (Paris: UNESCO Publishers, 1996), chapters 4, 5 and 7, a very well documented work. A work that came out just last year will be found in the bibliography: Kurbanov (2010) [Online]: http://www.diss.fuberlin.de/diss/servlets/MCRFileNodeServlet/FUDISS_derivate_000000007165/01_Text.pdf?hosts

introducing the new writing system called Kharoṣṭhī (a system used to write the Gandhari language and originating in Gandhara¹¹); by that period the name Jingjue had changed to Cadota.¹² The few Chinese documents found from the period after the migration seem to show that the Chinese continued to exchange contacts with Jingjue for a brief time.¹³

The last archaeological expedition at the site, in the late 1990s and the early twenty-first century, confirmed that Jingjue was probably abandoned in the very beginning of the fifth century. This *terminus post quem* was also confirmed by the Chinese Buddhist pilgrim Fa Xian 法显, who visited the kingdom by 400. In addition, a review of the archaeological literature compared with new geographical and hydrological studies of the southern Taklamakan Jingjue and Keriya rivers indicates that irrigated agriculture was widely practiced from 200 B.C.E. to 500 C.E. A possible climatic change toward drier conditions at *ca.* 500 C.E. is suggested as the cause of the abandonment of Jingjue city in the desert.¹⁴

Scholars have demonstrated that this western migration from Gandhara occurred progressively during the Kushan dynastic rule over Central Asia (40–260) and northern India¹⁵ and ended by the late fourth century.¹⁶ The dynasty used the Kharoṣṭhī script¹⁷ to organize the

(03/07/2012). See also: Craig (2007), a good work for its full survey of the Russian secondary works relating to the Kushan migration into Central Asia.

11 Salomon (1999), 11.

12 Concerning the literature that confirms that Cadota lies on the same site as Jingjue, see: Atwood (1991), 161–199. I have decided to retain the term “Jingjue” for the designation of this archaeological site, for the simple reason that “Cadota” reduces the chronology considerably to two centuries, where “Jingjue” has been used since the Han and not just during the time of the Gandharan administration presence at the site.

13 Padwa (2007), 72.

14 Yang (2005), 381–392. Although this article offers brand-new evidence concerning the Niya River and its ancient connection to the Keriya River, the authors did not consult the Kharoṣṭhī tablets recovered in situ, which provide much information on the use of water.

15 Salomon (2002), 119–34.

16 Brough (1970), 582–612.

17 Mukhejee (1979), 245–258.

bureaucratic system of this kingdom,¹⁸ which contained at least five subdivisions (*raya*, literally "kingdom"): "[...] the capital at Kroraina (modern Loulan), Calmadana (modern Qiemo), Saca (modern Andirlanggar, previously Endere and Xiaowan), Niya (modern Minfeng or Jingjue) and Cad'ota (Jingjue, north of Minfeng), the source of almost all the surviving documents."¹⁹ This migration also played an important part in the spread of Buddhism throughout Xinjiang.

Considering the historical, philological, and archaeological evidence that confirms this migration,²⁰ I suggest that there was also a Western influence in the development of the water tanks discovered on the site of Jingjue. If my conclusions are correct, we may start to change our east-to-west vision that China had the only influence on agriculture and water development in these Xinjiang oases in the early centuries of the first millennium C.E., when the Han dynasty progressively occupied this large region.

Many, among them Erik Zurcher,²¹ have favored the Chinese in the exchange of techniques when, in the Han dynasty, they initiated military conquest followed by occupation of the Xinjiang oases in Loulan, Hami, Turfan, Kucha, and Yutian. While local people resisted this occupation, many nevertheless were integrated into the Chinese administrative plan and therefore became subject to important technical changes in many spheres, including of course the hydraulic and agricultural systems. This interpretation originates in the confrontation of the narrative of the *Hanshu* (official history of the former Han dynasty) and the *Houhan shu* (official history of the Eastern Han dynasty) in the chapter concerning the western regions, "Xiyu" (西域). When stating the general demographic pattern of the city-states located in the now Xinjiang

18 By the fourth century C.E., the kingdom was called "Shanshan" by the Chinese. See: Enoki (1963), 125–171; Feng Chengjun 冯承钧, "Loulan Shanshan Wenti 楼兰鄯善问题" [On Loulan and Shanshan], in Feng Chengjun 冯承钧 (1976), 25–35.

19 Hansen (2004), 287.

20 Here I focus only on the water issues and features of the site, leaving aside the complex history of this migration. For further information refer to Hansen (2004), 279–315.

21 Zurcher (1990); see pp. 176–181.

region, we need to acknowledge a highly important economic development.²² For the states and cities taken into account in these two sources, the population rises from 14,311 houses to 82,323 in less than two centuries! From such a statement, it is not difficult to understand how historians linked the arrival of the Chinese to a "great leap forward" in the agricultural, military and also hydraulic systems in the western regions. The *tuntian* colonies 屯田, for instance, brought from the core of the Han dynasty empire to its westernmost periphery since the last years of the second century B.C.E., were known to have greatly improved "[...] the picture of agricultural underdevelopment in the oasis states."²³

It is a fact that the arrival of major Chinese military people in such oases had an effect on the exchange of knowledge and technique, but why should we constantly disregard the indigenous technical knowledge that was developed in the oases long before the Chinese arrival?²⁴ Western influence is equally important but is less often considered with any precision in archaeological and historical work.²⁵ Wang Binghua explains in a recent article that Xinjiang water technology developed through local inventions and then through Central Asian and/or Chinese influence. I hope to show, through this article, that we must take more seriously the local and Western influence over techniques developed in this ancient Xinjiang region.

Beyond the question of the arrival of the *karez*, or *qanat*, on the Chinese Central Asian borders in Turfan,²⁶ we must consider a most important method of irrigation, that of the water tank, a technique still used in some small villages on the southern part of Taklamakan Desert. It is a traditional technique that contributed substantially to the development of the economy of the oasis states of Xinjiang. Its study is now impossible to avoid, and so I humbly invite you now to follow the investigation into the ruins of old Jingjue kingdom...

22 Eric Trombert explained this fact with great precision in his last published article, Trombert (2011). I may add that this article must be taken into account for the reading of the pages quoted here from Zurcher.

23 Zurcher (1990), 179.

24 Trombert (1990), 67–94.

25 Trombert (1995).

26 Trombert (2008).

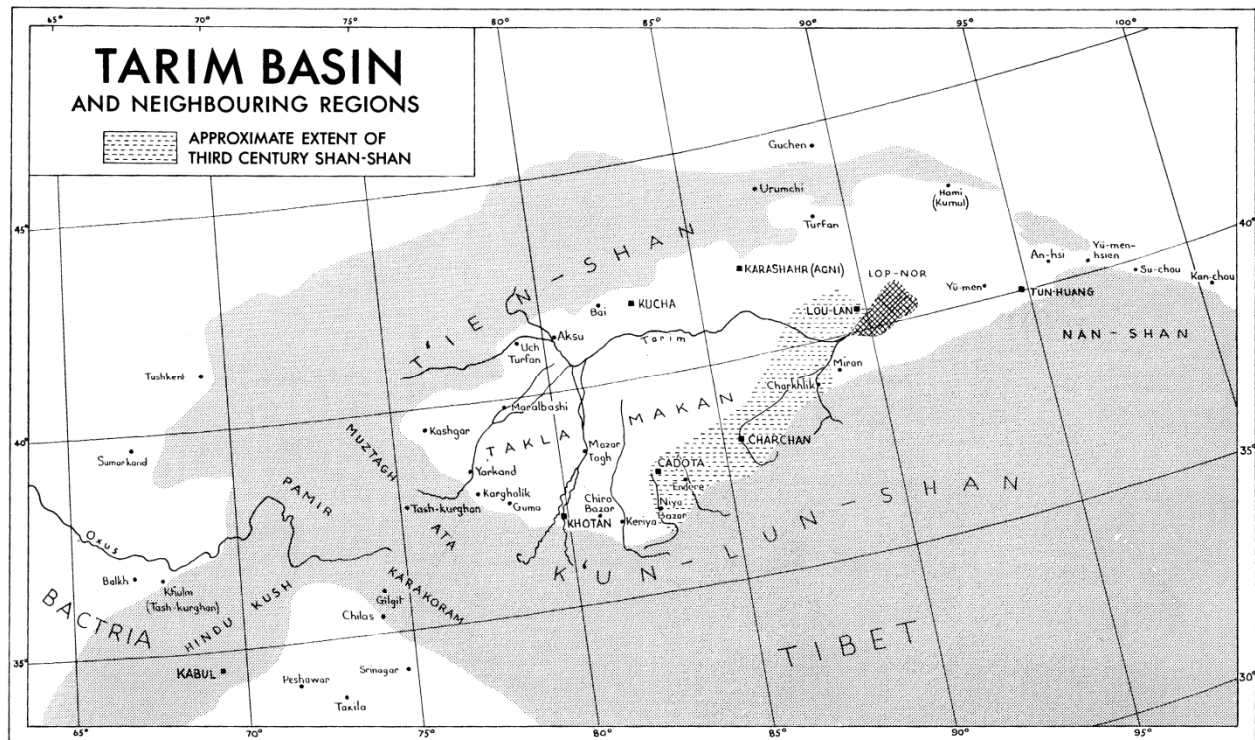


Figure 1 Location of Cadota in southern Xinjiang region (Brough [1965], 593)

We shall start our investigation by explaining how the site of Jingjue was provided with water from the late second century C.E. to the last period of its occupation. Sir Aurel Stein (1862–1943), a Hungarian who acquired British citizenship, and then British funding, is most famous for his controversial acquisition of manuscripts from the Caves of the Thousand Buddhas near Dunhuang, and the many stunning discoveries he made in the Chinese Central Asian region. He was the first to undertake a complete survey of the ancient site that he named his “modest Pompeii.”²⁷ In the course of four expeditions to Jingjue between 1901 and 1930,²⁸ he recorded ruined dwellings, temples, water systems, wooden documents, military garrisons, and vineyards, and he made a furrow survey of the ancient geography of the site. Although the quality and detail

27 OCAT, 101; Jeannette Mirsky, *Sir Aurel Stein, Archaeological Explorer* (Chicago: The University of Chicago Press, 1977), 363.

28 These four expeditions are referenced here in chronological order: AKH, vol. 1, 304–416; vol. 2, 316–385; RODC, vol. 1, 269–279; SERINDIA, vol. 1, 211–269; INNA, vol. 1, 140–155; OCAT, 71–95.

of his reports are impressive, the Sino-Japanese expedition²⁹ in Jingjue (1996–1999),³⁰ sponsored by Yatutaka Kojima, added new elements to what he had come to investigate: they discovered a group of tombs of the Eastern Han to the Jin dynasties (first–third centuries), excavated from Graveyard no.1, and new Buddhist shrines (stupas). They also made high quality pictures and established a Geographic Information Survey (GIS) map of the entire site and worked further on the water system remains (tanks and canals).³¹ These pieces of archaeological evidence lead us to explore more closely the technical connections among rivers, canals and tanks, so that we can determine their exact function on the site.

The various Kharoṣṭhī documents contribute to better knowledge of the city of Jingjue by providing rich intelligence about water works and social systems of the period. These records can help us draw a clearer picture of the water issues at around the third to late fourth century C.E.³² Still more important is the fact that, as I have observed through close study of these tablets, the term “water tanks” is mentioned in some of them. This supports my initial opinion that this water system and its use were a distinctive part of the Gandharan way of life and economic logic.

The second part of this article is concerned mainly with the question of the origin and development of these famous, or should I say, infamous water tanks. Discovered in various places besides Jingjue in southern Taklamakan, and inherent in the Central Asiatic and Indian cultures, this system is part of the local culture of this southern part of Xinjiang, as we will show. What is most important is the realization that the same system exists in India and Central Asia; it is vital that our investigation revisit the ways in which this water system might have had an impact on the southern Taklamakan cultures.

29 SJJRNS.

30 These dates include also the latest excavations made in Dandanwulike, made by the same archaeological team (located between the Keriya and the Yurungkash rivers, west of Khotan oasis). See: *Zhongguo Xinjiang wen wu kao gu yan jiu suo* and *Riben fo jiao da xue Jingjue yi zhi xue shu yan jiu ji gou bian* (2009).

31 Zhao (2009), [Online]: <http://digitalcommons.unl.edu/tsaconf/63>.

32 Lin (1996), 188–220.

Section I. A historical survey of Jingjue ancient water systems

The course of the Niya River in Jingjue

Nearly 150 km north of Minfeng,³³ the shrines of old Jingjue spread south to north on a small terrain 25 km long and no more than 7 km wide.³⁴ Like most of the other oases positioned on the southern edge of the Taklamakan Desert, the water that feeds Jingjue comes from the highest part of the Kashtash mountain (in the Kunlun range). Two riverbeds take their water from lakes positioned at 6400 m and are still used today for irrigating the town of Minfeng itself.

The map made by Sven Hedin³⁵ between 1901–1902,³⁶ which pinpoints the position of the oasis in the southern Taklamakan Desert, indicates quite clearly that the Niya River was formed from the meeting of four different streams. At around 80 km north of the Jingjue bazaar located by Sven Hedin in the Central Asian tracks, just after the Imam Ja'far Sadiq Mazar's shrines, the Kutaklik Tarim (formed by another river which originates on the eastern range of the Kashtash mountains) approached the site from the eastern side.³⁷ Niya River formed, with the Keriya River, the two main water channels going north within the Taklamakan Desert.

Taklamakan hydrology is made up of very particular and unique features. Recent research on the desert shows that the formation of these dunes of sand was not completed until the late Holocene period (2000 B.C.E.) and so may have affected human culture and settlement patterns around this "island in bio-geographical terms" from the Han dynasty to the end of the fifth century C.E.³⁸ The dunes of this cold desert are quite mobile and change constantly through the year. Made of extremely fine-grained sand, "they follow the course of rivers and form a relatively stable valley," as observed by Stein. Consequently, in the course of human action on nature in this modern remote area, we know that these rivers kept changing course: "In their

33 Meicun, (1985), 22–23.

34 SJJRNS, 2 (1999), 33.

35 Hedin (1966), NJ.44 (map of Ho-tian).

36 Foret (2006), 51–64.

37 Hedin (1907), 28.

38 Yang (2007), 2–7.

basic physical aspects, the rivers penetrating into the desert from the south are complex hydrological environments which vary and have varied widely through time in response to the physical landscape and human agency.”³⁹ The maps contained in the works of Stein clearly show where the Niya River entered the site. From the shrines of Imam Ja’far Sadiq Mazar, the ancient bed crossed a cultivated land of nearly 12 miles (around 20 km) before approaching the first discovered houses of the southern part of Jingjue, a little more than 5 km before the foot-bridge, which was also discovered by Stein’s team.⁴⁰ This long distance, to which we will come back later, crossed a fertile land still partly irrigated in 1913, when Stein visited the site.⁴¹ Remains of old tamarisk cones, dead arbors, dead orchards, and ancient *toghraks* are proof that an ancient cultivation area existed here since the historical period of the Jingjue site. Today, the Niya delta is separated from the ruined city by more than 80 km.⁴²

On the northern part of the site (see Figure 2), where most of the dwellings are found, the Niya River flowed from the west. After passing through the ancient remains of XLI structure (L1),⁴³ where a footbridge passing over the river was discovered near this dwelling, Aurel Stein reported in 1921: “[...] the ancient bed was found to make a sharp bend to the south-west [...]. The bed resumed again its north-westerly direction, and when after crossing it we had ascended a big sandy ridge westwards to a height of fifty feet, we could see it joining a broad valley-like depression, stretching far away to the north-west, with living tamarisks and wild poplars.”⁴⁴

This river’s lateral shift west from the footbridge surprised Stein but reminded him of what he had already discovered in his earlier expeditions. Stein noted the same phenomenon in a modern village near the end of the Yartunguz River, adjacent to the Niya delta, near the site of

39 Padwa (2007), 28.

40 Jing (1999), 284–285.

41 INNA, vol. 1, 141–142; vol. 3, 305 (map 4: Detailed map of southern portion of Jingjue Site).

42 Padwa (2000), 98.

43 Throughout this article, the numbers of the structure in Jingjue correspond first to the numbering assigned by Stein, followed by the new number (in brackets) used during the Sino-Japanese expedition of 1996–1999.

44 SERINDIA, vol. 1, 241. A second description of the riverbed was made in INNA, 1, 144.

Endere.⁴⁵

Approaching the village, the narrow 'green belt' gradually widened into a *togrhak* forest. A little more than 20 km north of the hamlet, a canal manages to divert successfully the water from the river irrigating with good control the various lands of this ancient 'terminal oasis' of Endere. The cultivated area lay in clear distance from the river well situated to take advantage of spring floods for irrigation, without being vulnerable to the overflow of the river. The need to control water velocity in the fall and spring explains the position of the site in the extreme end of the river bed. However, there are no actual evidence explaining when this shift occurred in time.⁴⁶

45 SERINDIA, vol. 1, 156–163.

46 Padwa (2007), 28. See also: AKH, vol. 1, 418–419.

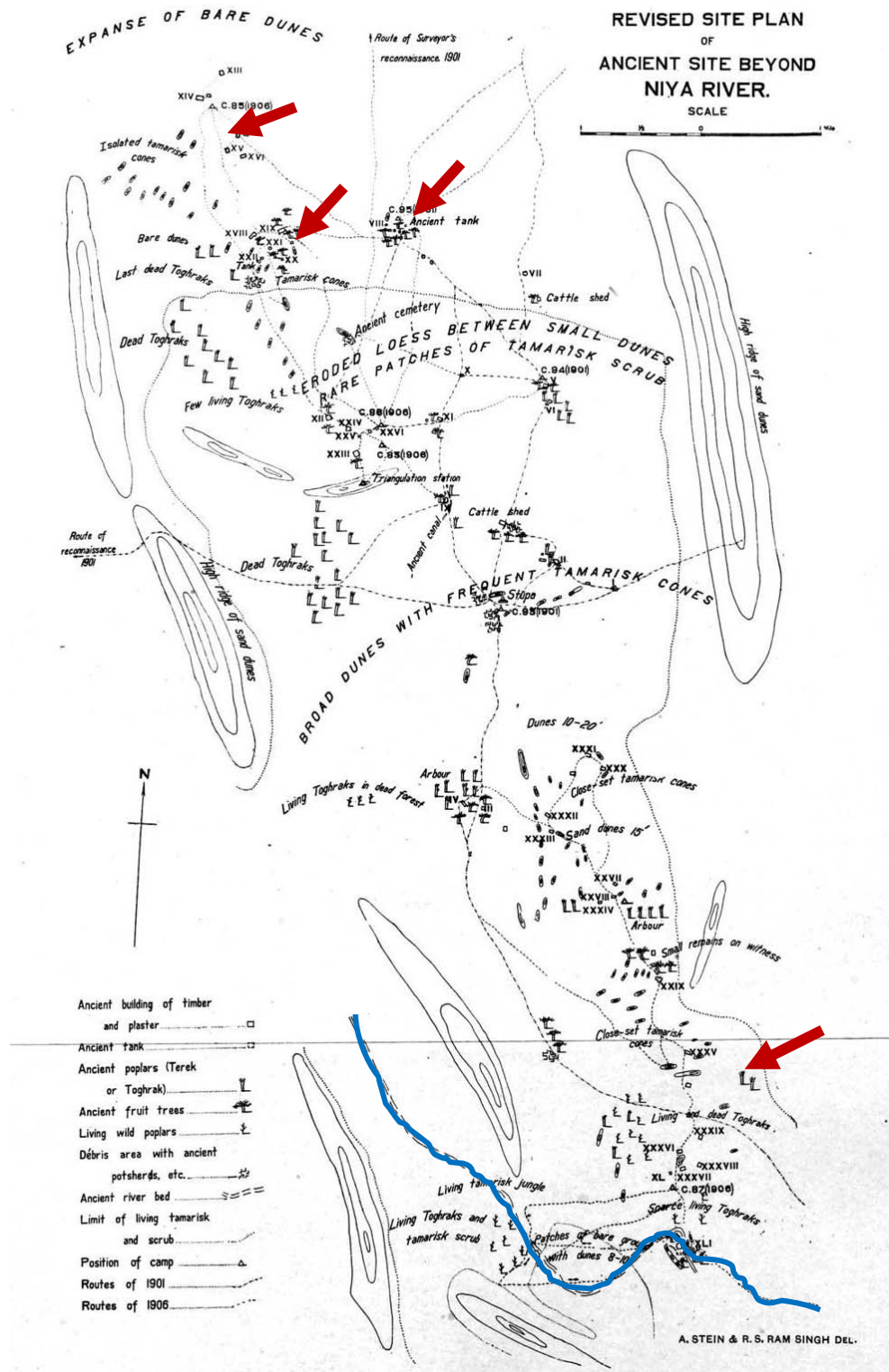


Figure 2 Niya beyond the river. The course of the river marked in light blue shows Stein's survey. The red arrows indicate the position of the excavated water tanks (SERINDIA, 3, Figure 7).

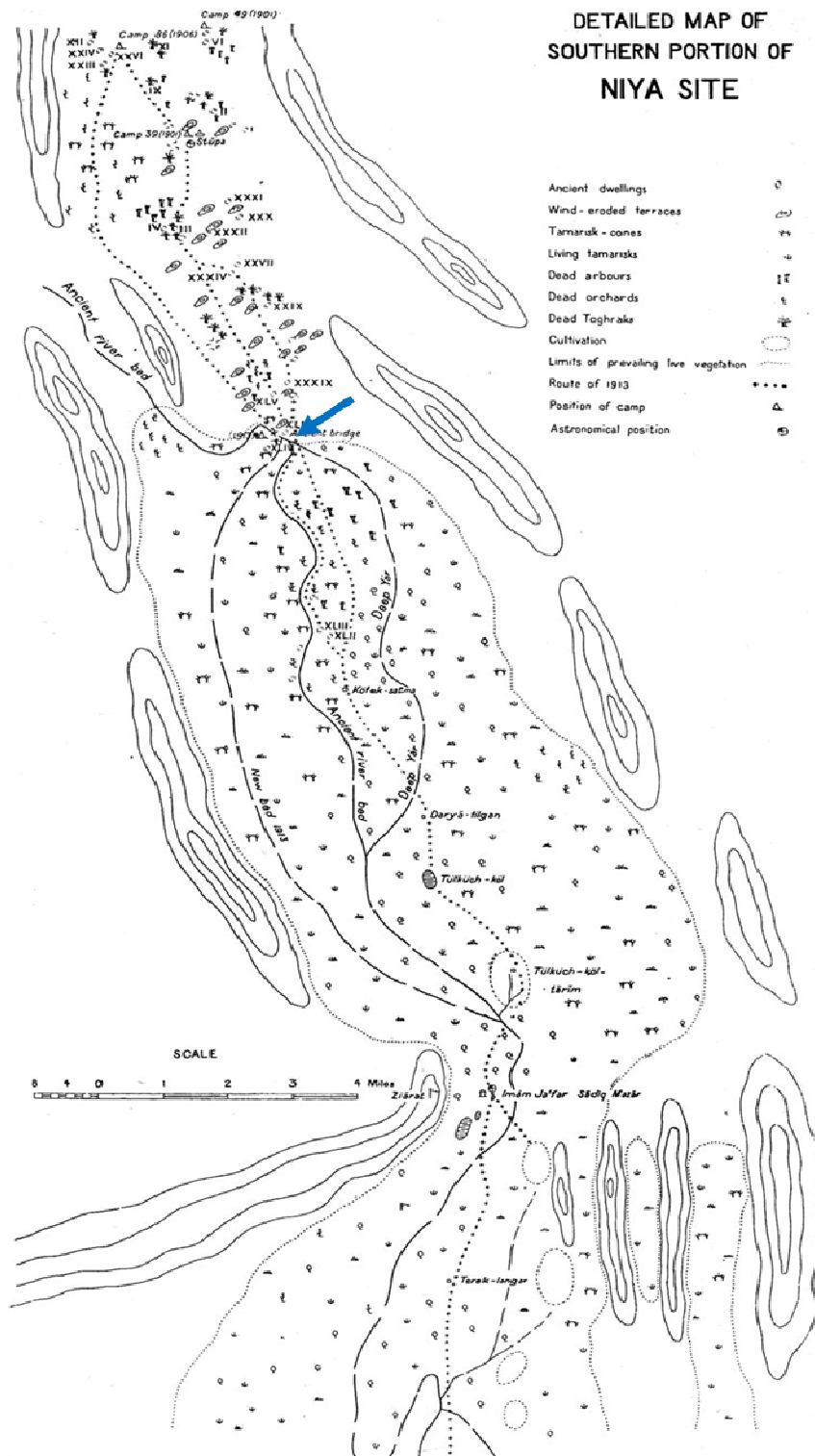


Figure 3 Northern and southern divisions of Ni, cut in two by the river. The blue arrow indicates the position of the footbridge (INNA, 3, map 4).

Accordingly, it seems likely that the river that formerly ran through the Jingjue site north did not shift because of natural causes.⁴⁷ In fact, it was instead an aspect of intentional settlement placement, putting the irrigated and inhabited areas away from the direct line of the riverbed in order to avoid flooding.⁴⁸ Could this change of course be the result of the first settlement period at this site, or did it occur progressively with the influence of the Gandharan migration in the region?⁴⁹

Although Stein did not follow the river further in the northwestern direction, the appearance of tamarisk and other fruit trees demonstrates the former presence of ancient vegetation and water presence in this modern desert. The path of the river north of the site was confirmed by the Sino-Japanese expedition of 1994, which successfully followed its course north, reaching the harbor located around structure N.III (D52) and N.IV (D51). This northern land is still rich in remains of dead poplar and of living *toghraks* in a dead forest. The archaeologist Shabiti Ahmat, when explaining the environment near dwelling N.III (far north of the site), confirmed that the river bed, which runs west, arrived at least to this point of the site.⁵⁰ A clean line of dead *toghraks* (which followed the course of the river) can be seen up until structures N.XXII (D16) and N.XVIII (D9).⁵¹ Considering the existence of these houses far north, Jing Ai has no doubt that the river, at least during the Han and in the time of the Kroraina kingdom, had enough water to go all the way north of the site through the western edge. This interpretation is clearly supported by modern hydrographical studies on the same river, confirming that it used to

47 Sohma (1995), 39–53.

48 Gentelle (1992), 554–594. Such flooding still occurs. Several occurrences at the Khotan River have led humans to use an orderly cluster method (deviation of the rivers) to avoid flooding the fields. See Cheng (1991), 148–164.

49 Ruan Qiurong 阮秋荣, "Niya yizhi juluo xingtai chutan 尼雅遗址聚落形态初探" (Guidelines to forms of villages or tribes of Jingjue Site), in SJJRNS, (1999), vol. 2, 195.

50 Shabiti Ahmat, "Lun Jingjue yizhizhong N3 fangwu yizhi de gaikuang he fangwu de jiegou" 论尼雅遗址中 N3 房屋遗址 的概况和房屋的结构 (Outline and housing structure of Jingjue Site N3) in SJJRNS (1999), vol. 1, 212–215; quotation appears on 212.

51 Jing (1999), 284–292.

meet the Keriya River located to the west, which initially could have flowed all the way north to feed the Tarim Basin.⁵²

This fact is not so surprising, however, when we know that an older city existed, located nearly 40 km north of Jingjue. When partially excavating it in 1955, the Chinese archeologist discovered there an older site named Niya North (尼雅北部), which dates back to the Iron Age (fourth–third century C.E.). According to Baumer: "The archaeologists discovered the ruins of numerous houses as well as clay pots, glass beads imported from the West and necklaces, in addition to objects made of iron and bronze. The inhabitants primarily lived off agriculture, since they had easy access to water from the Jingjue Darya for the artificial irrigation of their fields."⁵³ The ancient *darya* of the so-called "Niya River" lies north of Jingjue, and an artificial combination of water networks was used for the feeding of Jingjue North. Therefore, the river that passes through the western range of Jingjue had its *darya* 40 km north, in what is in modern times a complete desert land, and which could then reach all structures located on the site until the fifth century C.E.⁵⁴

Considering the position of Niya in relation to the other city-oases located to the west (Karadong), Rawak and Yotkan, and to the east with Endere (Cherchen), Qangan and possibly Miran, an old road must have passed through these important sites and so would explain an intense activity of crop raising, irrigation works and houses placed near this old road. With their progressive and slow abandonment in the fifth and sixth centuries C.E., at the time of the decline of the Shanshan kingdom, water could no longer be mastered and passengers provided with a safe passage through the southern edge of the Taklamakan. The same phenomenon occurred between Dunhuang and Loulan, a road very commonly taken by the Chinese since before the Han dynasty. By the fourth century C.E., the Kuruk-darya, "[...] which supported water and grazing for the Lou-lan colony and the 100 some miles of desert east of the colony, ceased to exist, thus making the stretch of 240 some miles of waterless desert from Tun-huang all the way

⁵² Yang (2005), 381–392.

⁵³ Baumer (2000), 32.

⁵⁴ Christa (1994), 102–103; Yue (1994), 36–123.

to the Lou-lan colony without the intermediate 'wells' too hazardous for overland."⁵⁵ If wells were not discovered on the road of Niya, tanks are attested on the northernmost area of the site (Figure 4).

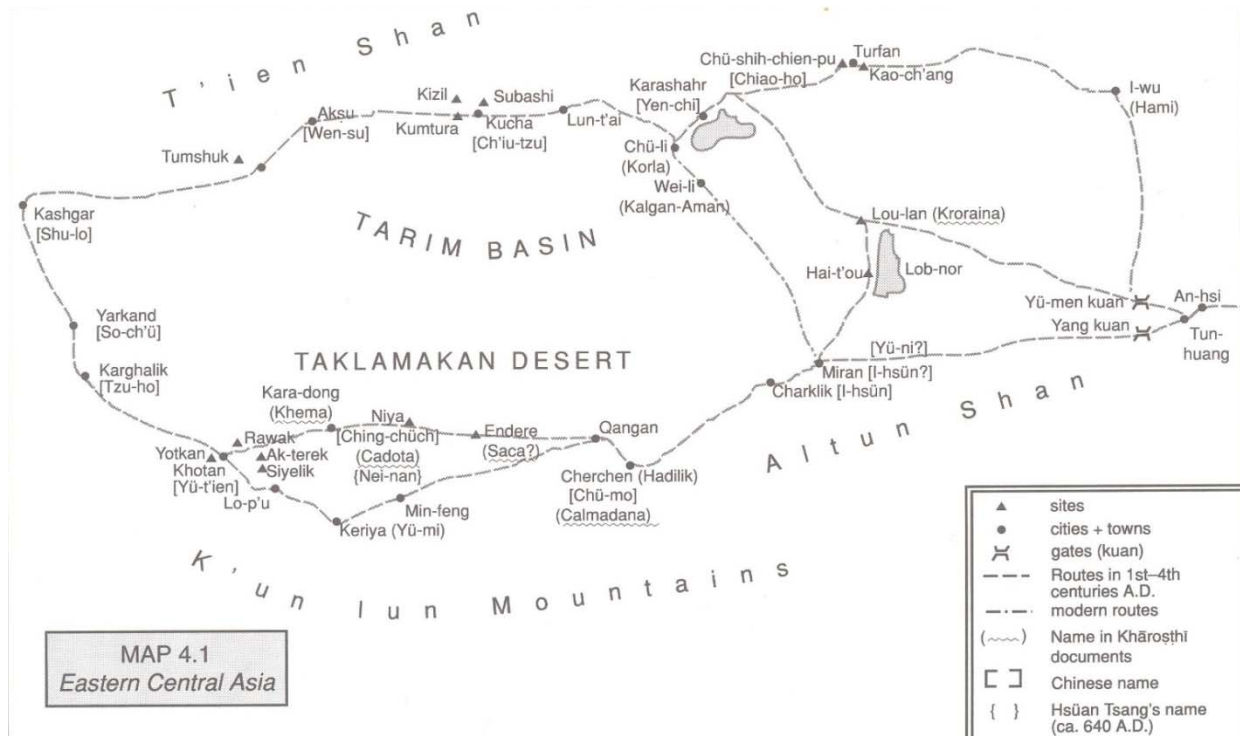


Figure 4 Roads passing through the Tarim Basin and the southern Taklamakan Desert in the first to fifth centuries C.E. (Rhie: 245)

Since this older city predates Jingjue, I believe that the shift of rivers mentioned above is the result of an already well-integrated technique that probably appeared when the settlement of Jingjue became substantial. Expanding along its long and quite narrow land, the site must have faced several floods before the idea of shifting the river course occurred to the residents. This fact is important since it explains how water entered the site from the west using artificial water systems. Since hydrological and geological studies confirm that changing river courses eastward and westward caused the abandonment of most of the ancient cities located in the southern

⁵⁵ Marilyn Martin Rhie, *Early Buddhist Art of China and Central Asia* (Leiden. Boston, Cologne: Brill, 1999).

Taklamakan basin, such as Jingjue, can we infer that the position of the river west of the inter-dune corridor was also a way to avoid this progressive deviation?⁵⁶

Jingjue water techniques

The Niya River entered the old site south through a large "cultivation area," as it was named by Stein, which spread along a narrow 12-km corridor before the streams combined paths and made a lateral shift after the footbridge. In fact, the later excavations at the site correctly reexamined this area, identifying seventeen new dwellings and a small workshop, where some walls, sheds and orchards remain. No evidence of canals or any other water system used for irrigating these fields suggests that the soil was sufficiently moist for crop-raising without any artificial water techniques. The rivers bordered the agricultural field, irrigating without too much difficulty the areas in need of water. Also, since the river continued north through the rest of the site (the most important part), land cultivation in the middle reaches of the river would risk the slowdown or even cut the flooding of the river water in the northern section.⁵⁷ This demarcation between the northern and southern part of the site is important since it explains how Jingjue city was geographically and probably socially organized. (See Figure 3.)

North of the site, the situation seems slightly different.⁵⁸ After the footbridge, moving water west from the riverbed, the canals were the primary means of feeding both fields and tanks in order to develop crops and bring drinkable water to the households of the site.⁵⁹ The system drew on both tanks and canals, which were interrelated, connecting back to the Niya River. Stein confirmed this connection when observing the location of the tank next to the dwelling N.LXI (D75): "The stream from which the canal once feeding it [the tank] must have taken off was not

⁵⁶ Bruelheide et al. (2003), 801–818.

⁵⁷ This of one of the main reasons for the abandonment of Jingjue by the fifth century. See: Yang (2005), 391.

⁵⁸ INNA, vol. 3, 305 (map 4: Detailed map of southern portion of the Niya site).

⁵⁹ Zhang Tienan 张铁男 and Wang Zonglei 王宗磊, "93 A 35 (N5) diaocha 调查 [Study of house N 5]," in *SJJRNS* (1999), 2, 63–65.

far to seek; for behind the nearest ridge of sand to the west there still lay a foot-bridge about ninety feet long, stretched across an unmistakable ancient river-bed.”⁶⁰

Stein discovered one of these canals near the triangular station at N.IX (D37). The canal, oriented south–north, had a very large width varying between 8 to 10 ft. (2.5 and 3m).⁶¹ These dimensions seem very impressive when compared to the canals discovered in Karadong or Miran, for example. Aurel Stein explained that the canals are easy to recognize as they used to be bordered “[...] by a double row of fine poplars, the dead trunks of which, massive and imposing even in their splintered and withered condition, lay stretched out in the sand more or less exposed.”⁶² Similar to the living organization in Karadong or Endere, the houses are spaced out and were conceived as small domains holding residences, several enclosures, barns, gardens, orchards planted with mulberry, fruit trees, vines, plantations of poplars and of course irrigation lands for these different vegetal species.⁶³

One particular Chinese document, unearthed *in situ* on the site of Jingjue near structure N.XIV, attests to the existence of a well next to a tank: “池中皆空，井中水泉减少，不足以给，人无马////” (N.XIV.ii.14/ T.O.16)⁶⁴ “ the tank is completely empty, water poorly springs inside the well, we cannot take it, man has no more horses ”

The mention of a well here is very surprising since no traces are found through the furrow archaeological work on the site. If a well did exist on the northernmost edge of the site, this would indicate that the soil was favorable for pumping water into the groundwater. With the use of wells, it seems quite possible to see that water in Niya was divided into two or three main

⁶⁰ RODC, vol. I, 296.

⁶¹ Stein says: “To the east of the dwelling numerous trunks of dead fruit trees marked an orchard, and beyond this, the line of an ancient canal about 8 ft.” in AKH, 2, 380. However, the plan of the canal passing through N.IX seems two feet larger than what Stein described. SERINDIA, Plate: XXXV.

⁶² AKH, 2, 380.

⁶³ Debaine-Francfort Corinne (2001), 57–58; Debaine (1994), 37–39.

⁶⁴ Lin (2000), n. 739.

systems: canals (for large irrigation networks), tanks (for irrigation around the houses), and wells (for domestic use).

Water tanks in the water technology of ancient Jingjue

Besides canals, excavation on the site attests the remains of four tanks: three were unearthed by Aurel Stein and one by the 1997 Sino-Japanese expedition. While their shape and logic on the site form part of a separate study, a closer examination into their form will lead us to reinterpret the reason for their presence on the site. Furthermore, we will see how their possible origin may help us better understand how the site was organized in the third to fourth centuries C.E.

Of those discovered by Stein, one is located next to the footbridge and the vineyard, on the eastern side of structure XLI (D76) (L:37°54'26"83 × l:82°43'26"24). Stein describes the tank as follows: "But a careful inspection of its surroundings, [...] some features of special interest. Only some sixty yards off there still stood a square of dead mulberry trees, raising their trunks up to ten feet and more, which had once cast their shade over a tank still marked by a depression."⁶⁵ (See Figures 8, 9.)

The second tank was discovered on the far northern part of the site, east of the dwelling N.VIII (D15) (L: 38°00'4"10 × l: 82°42'38"75): Here again are Stein's observations:

"But more curious than these was the clearness with which the position and arrangement of an ancient tank (see Fig. 4) could be made out about 200 yards to the north-east of the ruin N. viii. The ground there being quite clear of dunes, the embankment of the tank forming a square of about 48 ft. was distinctly traceable. On it were lying the shriveled trunks of the large poplars that had once given shade to the water, while one tree still upright raised its gaunt, bleached trunk, as seen in the photograph, to a height of close on 12 ft. In the center of the tank, which in spite of the drift-sand there accumulated still showed a depth of about 6

65 RODC, vol. I, 296.

ft, a small mound of earth, about 5 ft in diameter, and rising 2½ ft, above the sand attracted my attention.”⁶⁶ (See Figure 10.)

The third is located a little south next to N. XXII (D16) (L: 38°00'48"10 × 1: 82°42'38"75). Stein notes the following: “A short distance to the south the outlines of an ancient tank could still clearly be recognized within the oblong enclosure, about thirty-six by twenty-eight feet (11 × 8.5 m), formed by rows of large poplars. The big sand-cone, more than forty-two feet high, seen in the photograph by the side of the tank, was one of the very last in this direction still retaining living tamarisk growth.”⁶⁷ (See Figure 11.)

In 1997, the Sino-Japanese expedition excavated a fourth tank located west of the first one, in a perfect 9 × 9 meter square shape, next to the N.XIII (D1) and N.XIV (D2) dwellings.⁶⁸ This tank had not been recognized by Stein even though he did excavate houses located very close to this water system at both dwellings N.XIII and N.XIV.⁶⁹ (See Figures 2, 3.)

It appears through closer study that two types of tanks are to be noticed. The three tanks discovered by Stein bear the same shape: enclosed by a well-preserved circular stand of poplar, a thin layer of clay is usually found on the outside ring. The size of the tank varies between 9 and 30 m with a depth of 1 to 3 m maximum. A canal feeds the tank and a series of poplar trees follows the course of the canal to the tank, planted in order to preserve water from hot temperatures and resulting evaporation. At the water tank at N.VIII (D15), the canal, probably also protected by a substantial range of trees, entered the structure from the west side, bringing the water to a certain level where the “dömbel” (see below) would disappear. Aurel Stein’s laborers explained the system to him, since it was still used in many places in the southern Taklamakan at the beginning of the twentieth century. (See Figure 5.)

“My labourers at once recognized in it a feature still regularly provided in modern village

66 AKH, vol. 1, 378–379.

67 SERINDIA, vol. 1, 224.

68 SJJRNS vol. 2, 77–79.

69 SERINDIA, vol. 3, 569; RODC, vol. 1, 273–280.

tanks. When these are being excavated a small bank of earth, known as *dömbel*⁷⁰ is always left standing in the centre. As explained to me, it is used to mark the level down to which the water of the tank has first to be let out before fresh water is introduced from the feeding canal at the periodical renewals provided for. The latter are obviously necessary, since the tanks are the chief supply of drinking water during the season when irrigation ceases."⁷¹ If this explanation is correct, we need to understand these tanks as large water reservoirs able to feed the oasis during the long winter period. (See Figure 13.)

As for the tank discovered by the late Sino-Japanese expedition next to dwelling N.XIII (D1) and bearing the number (93A9), it has different characteristics⁷²: built on a square (rather than round) base, with no poplars circling it (perhaps the reason Stein did not recognize it as a water tank), it was surrounded by clay bricks piled in a square shape, with sides 9–9.5 m long and a depth of 1.5 m. On the south side, a place for the canal to enter it seems to have been identified, though the archaeologist did not manage to find the actual depth of this part. The tank is a compound of a large kiln center, which perhaps was closely related to the water: a metal workshop for example could use such a water supply for cooling the heat generated by the metalworking process. In Loulan, near the ancient delta position, Aurel Stein discovered the remains of a tank placed next to a fireplace in an ancient dwelling (identified by Stein as the quarters of a blacksmith.)⁷³ (See Figures 6, 7, 8.)

As we noted earlier, Stein's workers could easily identify these specific water systems since the same types were still commonly used by the Uyghurs in southern Taklamakan oases around the 1920s. Stein focused not only on archaeological material; he had a profound interest in anthropological factors in the many villages and towns he encountered during his travels.⁷⁴

70 "Dömbel," or دۆمبەل in Uighur, is usually translated either as "hill" or "height." It is used for measuring the water level in a basin, a reservoir or a pool in Central Asian and Southeast Asian cultures.

71 AKH, vol. 1, 378–379.

72 SJJRNS, vol. 2, 82.

73 INNA, vol. 1, 188.

74 Joyce (1903), 305–324.

Usually placed next to Muslim mosques, for example in Khotan, these tanks are all surrounded by tall trees (usually poplars), and the earth-cone known as "dömbel"⁷⁵ is still placed in the center for defining the depth of water. These tanks are usually filled via a canal that has traveled a long distance from the river before reaching these water reservoirs.⁷⁶ Stein's captions give us some specific details of their use, shape and function. Sluice gates are built next to the large reservoirs fed by the river. The water is supposed to be kept clean thanks to the way in which the soil lining the canal has been prepared, such that a minimum of dirt makes contact with the water. Furthermore, trees cover the course of the water through the canal and the tank, preserving its cool temperature⁷⁷. (See Figure 5.)

Sir T. D. Forsyth, in Yecheng (Kargalik, a place of crossroads from Cashmir and India to Southern Xinjiang) examined another of these tanks located a little farther west of Khotan: "From Karghalik to Egun, [...] beyond Egun desert, at three miles a Langar (Gombaz) with tank and two old tombs; eight miles beyond this through a bare desert to a place where a tank (containing about 20 mussuks⁷⁸ of water) is prepared and covered in."⁷⁹ In Sanju, a city located 80 km west of Khotan and south-east of Pishan, Forsyth also discovered a tank of water under the shade of tall poplars still in use in 1873.⁸⁰ According to these few examples, it appears that the shape of water tanks had not changed in 1700 years!

75 In my research, I noticed that these *dömbels* are specific to the southern Taklamakan water tanks. In the north Xinjiang region, tanks also exist but resemble large reservoirs built generally in a soil and clay surface. See 1973, 56–64.

76 RDC, vol. 1, 224.

77 Forsyth (1875), 1, 35.

78 Hindic term: "A large water-bag of skin or leather used by a Hindu bheesty or water-carrier. It is usually the whole skin of a goat or sheep tanned and dressed" in Whitney (1911), 3911.

79 Forsyth (1875), 1, 445.

80 Forsyth (1875), 1, Geographical Appendix: Section G, a79.



Figure 5 Tank near Ruknuddin Mazar, Yotkan (RODC, vol. I, fig. 53)



Figure 6 Picture of the tank in 93A9 (N14) in (SJJRNS, 1999), vol. 2, fig. 67)



Figure 7 Colored picture of the tank next to 93A9 (N14)

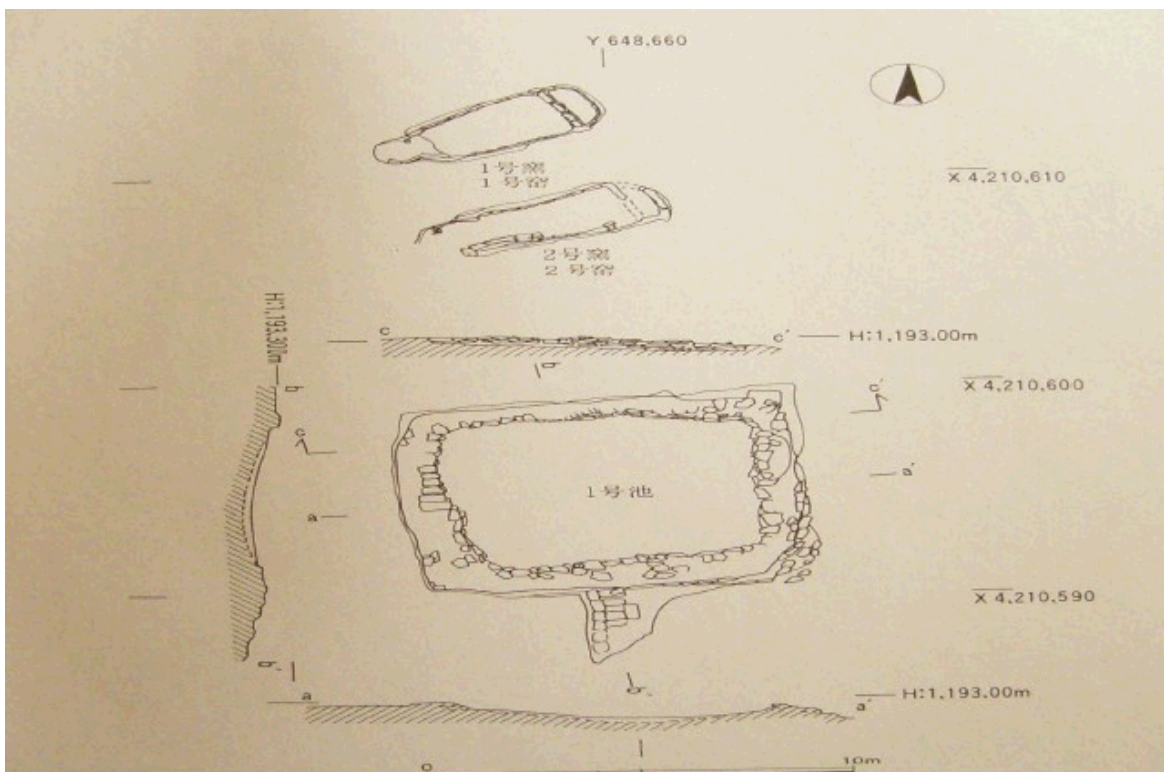


Figure 8 Sketch of tank located next to 93A9 (N14)



Figure 9 Remains of a circular tank placed next to structure XLI (D76)
(SERINDIA, vol. 1, fig. 104)



Figure 10 Remains of a circular tank placed next to structure XLI (D76). In
Zhou (2005), 111



Figure 11 Remains of ancient trees and tanks next to dwelling VIII (15) (AKH, vol. 1, fig. 47).



Figure 12 Remains of ancient tank south of ruin XXII (D16) (Serindia, vol. 1, fig. 55)



Figure 13 Trunks of dead trees enclosing ancient tank, Niya Site. (RDC, vol. 1, fig. 101)⁸¹

Section II. Tanks and water systems seen in the Kharoṣṭhī documents of Jingjue

Since these tanks are well attested on the site, it is important to relate them to the textual information discovered *in situ* there. A close study of the Kharoṣṭhī documents along with their shape and location on the site provide us with crucial information about the water techniques used by the local population. However, since they all date to between the third to fourth century C.E., they testify only to what existed during their use on the site. The various tablets all indicate the importance assigned by the local authorities of Jingjue to the control of water. Through these documents, we know that when a person desired to use water from a tank for the irrigation of his field, he had to make either a formal request to the authorities or needed to deal directly with the

81 The group shows sitting on left Rai Ram Singh and Ibrahim Beg, on right Naik Ram Singh and Ibrahim "the miller", in middle author with "Dash."

owner of the water system. Following the translations of Burrow, these documents can be organized topically according to the type of information found on them.⁸²

- One field is flooded and the canal irrigating the land needs to be repaired or replaced (tablet 47);
- The author of the document will break open the water and ask for a refilling of the area from which he will take the water (tablet 125);
- Water is muddy or in very low quantity (tablets 120, 347, 368, maybe 397);
- Documents relating to administrative matters concerning water irrigation (tablets 157, 160, 298, 502, 604);
- Documents confirming the good irrigation of crops (tablets 72, 604, 703).

The shape of the tablet indicates the type of bureaucratic document. Those recovered from Jingjue belong to five different forms: wedge-shaped tablet, with document on leather,⁸³ rectangular tablet, Takhtii-shaped tablet,⁸⁴ and oblong tablet.⁸⁵ Wedge-shaped tablets with leather documents⁸⁶ are the royal "courier" sent directly from the king of Shanshan (we have still much

82 For quotations from the documents cited in this article I always refer to Burrow (TKD), followed with the sign # and the number of the document. Allow me to thank again Stanley Insler (Former Salisbury Professor of Sanskrit and Comparative Philology at Yale University) for his help in checking the original tablets.

83 Documents on leather are very rare and required a special preparation before the ink could be accurately and clearly deposited on the material. According to Aurel Stein, this type of tablet was commissioned for important orders or messages given by the king. See AKH, vol. 1, 347.

84 According to David Diringer, this form of document was mostly used as " [...] memos, accounts, casual unimportant communications and similar matters." We can imagine the great quantity of these minor reports. See Diringer (1982), 354. This was already noticed and explained briefly by Aurel Stein, see AKH, vol. 1, 357.

85 This particular shape is explained by Stein: "That tablets of this class would often, after having been written upon, be utilized again for fresh notes or drafts, readily suggests itself; and in N. xv. t99, where part of the text on the reverse has been deleted by scraping, we have evidently an instance where this process had been begun." Following this logic, this shape is positioned last in the ranking of the Kharoṣṭhī documents. See AKH, vol. 1, 358.

86 TKD, # 368. Stein explained that: "Documents on leather are very rare and required a special preparation before the ink could be accurately and clearly deposited on the material. According to Stein, this type of tablet was commissioned for important orders or messages given by the king." In AKH 1, 347.

difficulty in identifying clearly the location of the capital during the time of these Kharoṣṭhī records).⁸⁷ Due to the close relations between Jingjue, Endere, Khotan, Miran and Loulan, it is not possible to confirm that each of these documents exclusively concerns the Jingjue site. Stein explains that the wooden tablets in Jingjue were not made on the site where they were discovered: "Whatever the reasons for this unquestionable preference may have been, it is certain that wooden tablets could not have been manufactured in loco, for no chippings or other remains of wooden stationery in the rough turned up in the rubbish-heap."⁸⁸

One key element can however confirm to us the strong relationship between some of these tablets found *in situ* and the physical site of Jingjue at the time it was occupied by the Shanshan kingdom followed by the Western Jin (265–316) and the Wei (535–556): in many of these tablets, we encounter the use of the term "bridge."⁸⁹ But Burrow never gives a plural to this word for the good reason that, in Jingjue, only one main bridge, located where the river changes its major course west, next to the dwelling N.XLI, was discovered by Stein. Rediscovered by the Sino-Japanese expedition, this bridge clearly provides the only solution for the population of Jingjue who wished to go into the southern part of the site. In contrast to Paris, where we can cross the Seine at a number of places, we can posit that the site of Jingjue had only one "pont d'Avignon," which made this bridge of critical importance for the survival and the well-being of the oasis. This particularity was not found in Loulan, Endere, Miran or Karadong, which provided multiple bridges. Thus the Jingjue site of has this one peculiarity—the word "bridge," and never "bridges"—that can enable us to distinguish it from others in the documents.⁹⁰

These tablets confirm the existence and use of sluice gates and canals. Moreover, we learn that the central authorities tried to control all water use. The following oblong wedge-shape document discovered in the ruin N.I.iv states: "Also in the morning we will break open the water

87 Enoki (1963), 125–171.

88 AKH, vol. 1, 317.

89 SJJRNS, (1999), 2, 31.

90 SERINDIA, vol. 3, 563 (figure 7: Revised site plan of ancient site beyond Niya river); Baumer (2000), 100–101.

in Kolamte's tama. Now there is need of more water here."⁹¹ Due to a need for more water to feed the herd, the author of the tablet will tap from a water system for this purpose. In this phrase, Kolamte, followed by the superlative suffix "tama," usually refers to a noun, suggesting that the tank from which the water is tapped was called "Kolamte."

All three documents inform us about the extent of the official power to close and open these gates. As to the wedge-shaped tablets, many scholars have shown convincingly their direct link to the king who sent and received information on the water systems from one precise site.⁹² The message is transmitted from the king to the local *cozbo* in charge of keeping his "kingdom" or more likely "region" in order.⁹³ The *cozbo* was supposed to ask after and report on important affairs that could have an effect on the whole kingdom and the central region.⁹⁴ Once the information was written down, the scribe then conveyed the document to the administration officers. The decision was also probably made in accord with the *cozbo*, the *apsu* and/or the *ari*, all terms designating the well-born people who had direct administration of the king's affairs.⁹⁵ The decision was reported directly to the *cozbo*.⁹⁶

Nevertheless, many water thefts occurred, bypassing the control of local officials. The following document confirms that someone might cut, close or open a canal for his own benefit, without permission: "At that time Sevasena borrowed water. Balasena cut off this water by force

91 Burrow Thomas #125.

92 Ma (1984), 50–63.

93 We might inquire why any kind of wedge-tablet was supposed to be sent by the king or from the central court. These tablets are issued from the royal environment and can refer to a particular topic which should help us identify more easily the geographical setting from which the document was written: In tablet # 157 (already quoted above) the mention of a "bridge" could for example refer directly to the only bridge vestige discovered in Jingjue by Aurel Stein.

94 Enoki (1963), 169–170; Enoki (1967), 25–29.

95 TKD #120.

96 TKD #368.

[...]. By Tamcgo the seal was broken [...] Lyimsu is witness."⁹⁷ This was not the first time that Balasena was accused: another tablet from Jingjue charges him with failing to pay anything at all for water.⁹⁸ This illegal water divergence probably took place from a canal that directed the water towards a tank, house or field.

Canals (a term that never appears in the tablet but is omitted, it seems, because that is so obviously the subject) are blocked for water storage, avoiding waste: "Also I have heard that you have kept blocked up the water there, and am very pleased" (#157).⁹⁹ This wedge-shaped tablet discovered in N.I.iv is of critical importance because it reveals details of the technology used for controlling water along with information on the way water was provided to the houses. Sluice gates positioned either at the water exit of the tank or at the upper level of canals next to the river closed and opened. When the administration wanted to avoid the spreading of water, local officials could close the gates at the point where canals are tapped from the river.

The document offers a second important piece of information on the use of sluice gates (though no archaeological evidence nor any precise term can confirm without any doubt the existence of sluice gates). Indeed, to keep the water "blocked" at one specific point may refer to water that was preserved (in a tank or a reservoir) so that it would not affect the fields of the person who wrote the letter. This water system needed also to be located on a higher ground than the field or the house of the person. The question of height between a water system such as a canal or a tank and the destination of the water is crucial. A wrong evaluation of the slope may cause a waste of water, its velocity being hard to determine and control. Hence, blocking water indicates a use of reservoirs placed probably a little higher than the fields and dwellings. The tanks that were recovered by Stein, for example, are placed at the same height as the dwellings, and so are those discovered by the Sino-Japanese expedition. I am convinced that the height of water systems in comparison to the surrounding areas can indicate its primary function. For example, one tank's position is lower than the structure XLI (D76) located on its left side. Stein

97 TKD #604.

98 TKD #433.

99 TKD #157.

noticed a visible depression around the tank, and that the canal feeding this reservoir was placed a little higher (1 or 2 m), so the water could follow the slope down to the water system without a need of any techniques for water elevation.

A few of the documents presented here attest to the everyday use of canals suggested by technical terms such as "divert" or "kept open." However, we have not yet come across any term that could refer directly to the tanks discovered on the site of Jingjue. The term *potge*, appearing in five tablets,¹⁰⁰ is a curious word, and it is interestingly related to "water" in three of these. Two different translations made by well-known Kharoṣṭhī specialists have been proposed. Bailey and Burrow have derived their translation from the commentary of the text written on tablet #120:

In the 3rd year, 4th month, 15th day, at this time, it was necessary to go to the sitga potge for the second time. All the work-people came to the bridge [...] the water was very muddy (kha[lu]sa). Owing to that fault the well-born people came to an agreement. We stopped and turned back the magistrates from the sitga potge. The well-born people who were there on account of the king's business were: Namarazma, the senior cozbo, Pamcimna, [Nam]masura, Tgaca, the apsu ApJingjue, Calmasa, and Kamciya, the ari Lyipana.¹⁰¹

In the present document, we learn that many people went to the "*sitga potge*," probably located near the "bridge," which was probably the same footbridge rediscovered by Stein near the house N.XLI. This structure was the only way by which the population of Jingjue could go down into the cultivation sites located south of the riverbed. This particularity was not found in Loulan, Endere, Miran or Karadong.¹⁰² The site at Jingjue has this one element that can enable us to distinguish it from others in the documents. Furthermore, Stein discovered a tank next to the footbridge on the eastern side of structure LXI. Whether this document directly refers to this

100 TKD #120, 204, 347, 397, 701.

101 TKD #120.

102 SERINDIA, vol. 3, 563 (figure 7: Revised site plan of ancient site beyond Niya River); Baumer (2000), 100–101.

artifact or not is hard to say, but its location close to the bridge indicates a clear connection with the riverbed before it shifted west. In 1934, Bailey made the following commentary on the word "potge": "The mention of workmen shows that potg'e is a structure of some kind, and since their activities were spoiling clean water, this can only be a bridge over a river. Potg'e seems to mean reservoir."¹⁰³ ¹⁰⁴ In 1951 and 1954, Bailey made the following comment on the same word: "In Krorain we have further in no. 347 *potjeci Icaryani*, which contains *potge*, *potgeya* with the adjectival suffix *-e?nci*, *-eci*, hence 'affairs of the kitchen, commissariat'; in no. 701 *potg'e rackatpna* refers to 'protection of the kitchen, commissariat.'"¹⁰⁵

Examining the archaeological evidence, we can understand how Bailey arrived at the identification of the "potge" with the term "kitchen." Neither Stein nor the Sino-Japanese excavations discovered the remains of a kitchen near the structure LXI where the famous bridge was located.¹⁰⁶ According to Stein's workers, tanks had the unique capacity of providing households with both drinkable water and water for irrigation when the Niya River froze in winter.¹⁰⁷ Since Bailey never mentions in his work the existence of tanks on the site of Jingjue, we may suppose that he either ignored this important detail or simply did not know of their existence on the site. Therefore, he tried to relate the term "potge" to places that would logically fit into the households of Jingjue, so kitchen was a logical translation choice for him.

However, in the historical context of Cadota under the Gandharan administration, the four other documents tend to follow Thomas Burrow's definition. Indeed, tablet 397 confirms the strong relation between water and the *potge*:

103 In this paper, the term "reservoir" is to be understood as a public storage water system. It is also called "tank" by the archaeologist. I have respected both definitions. They can be interchangeable since the system and its function is exactly the same. In French, "tank" is commonly translated by the term "reservoir d'eau."

104 Burrow (1935), 785.

105 Bailey (1954), 130.

106 According to Karl Menninger, the term "sitga" is to be translated "a shed for small animals." See Menninger (1934), V.I, 62.

107 SERINDIA, vol. 3, 563.

"His majesty, etc... The cozbo Samasena informs us that water in the potge [...] you must inquire whether it is really so. Like the rest of the people the soldiers in the potge [...] in such manner the people are to be written down by the cozbo Samasena."¹⁰⁸

This wedge-shaped¹⁰⁹ tablet bears an equally important fact: the *potge* is clearly a system in which water is placed into something. Unfortunately the tablet is incomplete, but we find now enough evidence to advance that there was a direct relationship between the *potge* and the tank.

Moreover, tablet 701 indicates the great importance of guarding this *potge*: "In the twentieth year, fifth month, twenty-first day, (?) the people guarding the potge were written down. (Then follows a list of names.)"¹¹⁰ "Guarding the potge" could imply here a full- or part-time surveillance of the water tank, preventing any forbidden use of the water and preserving the water-supply for a given number of households in the surrounding area. As translator of all the Kharoṣṭhī documents discovered in Jingjue by Stein, Burrow knew very well the history and archaeology of the site. Even though Burrow did not relate the reservoirs to the excavated tanks, his translation fits better the context in which the term "potge" appears. Stanley Insler, when going back through the original texts, explained that there is no logic in linking the Kharoṣṭhī term to the word "kitchen." How could "kitchen" be linked to the content of these tablets: Examining the dwelling plans of Jingjue, we know that each house had its own consumption place, whereas the tank belonged to an entire area and was therefore a gathering place, which is more likely to be cited in the few existing tablets discovered in Jingjue oases.¹¹¹

108 TKD # 397.

109 On the five tablets bearing the term "potge," three are wedge-shaped. This could also indicate that when the term "potge" is used, it is usually referring to a very important system and needs to be related to the upper hierarchy of the Gandharan administration system.

110 TKD # 701.

111 Further work is needed to analyze the other Kharoṣṭhī documents discovered in Central Asian and look for the term "potge." Only such research will bring to us a satisfactory confirmation of this argument and to Burrow's translation.

Through the tablets in which the relation of the term to "water" was found, I am now convinced that the word "potge" refers directly or indirectly to a water tank system. Whether these tanks are those referred to in the tablets is impossible to say, but their geographical positions do seem to match the information given in the documents. For example, tablet 120 refers to the footbridge located next to the structure N.XLI, where one of these water tanks was discovered by Aurel Stein's team. Therefore, even though the relationship I propose here between the two terms is tentative, pending reexamination of the wording of the original documents, comparison with other tablets located at other sites, and also deeper research into the Chinese documents discovered in Jingjue, our investigation indicates that the Gandharan migration did use a certain type of reservoir at the site of Jingjue during their stay. Could these reservoirs be the result of a direct influence from this migration, or did the method already exist before that time, during the Han dynasty?

Section III. Eastern or Western influence on the water tanks?

Water tanks in the Han dynasty northwestern agricultural process

During the Han dynasty, the Chinese organized the expansion of the agricultural system of planting in furrows west through Gansu and parts of Xinjiang. Jingjue was also part of this conquest and saw Chinese troops in the south by the first century C.E. Before exploring the path west in quest of the origins of the water tank system, we need to examine this expansion of Chinese planting methods to see if the expansion could have led to its establishment.

Before the Gandharan migration occurred, the city-oases of Loulan, Turfan, Kucha, Luntai, Miran, Endere and Jingjue, among others, were all subject to a complex relationship among the indigenous people, the Wusun, Xiongnu, Yuezhi, and the Chinese military forces. After nearly fifty years of battle with the Xiongnu and the Wusun, by the end of the second century C.E., the army of the Western Han had managed to overrun the nomadic power in the west and gradually entered the heart of what is now Xinjiang province. During this first period of their occupation of these oases, it is commonly explained that the Han imported a major

improvement in irrigation systems when establishing *tuntian* colonies 屯田卒.¹¹² Following the concise description made by Fan Ye in the official history of the eastern Han dynasty *Hou Hanshu* (后汉书), Hsu Cho-yun explains the system: "With the tuntian method, a *mu* of land was divided into furrows and the soil plowed up from the trench was piled beside the furrow to form a ridge one *chi* high. The seed was planted in the furrow and soil from the ridge was constantly pushed down to surround the root of the plant as it was growing. Eventually the soil on the ridge was all returned to the trench. The next year, new furrows were made between the old ones."¹¹³

After this system had been successfully employed in northern China, it was transferred into the oases of Turfan, Loulan, Miran and even Kuqa in the modern Xinjiang region.¹¹⁴ Eric Trombert explains that, with the use of these *tuntian* colonies, "[...] it is beyond doubt that the farming soldiers greatly improved the local irrigation networks."¹¹⁵ Could such a technique use tanks in order to improve local hydraulic systems?

According to Huang Wenpi, a Chinese archaeologist of the mid-twentieth century discovered the remains of a water tank in the oasis of Turfan (northern part of Xinjiang region) dated to the Han dynasty time.¹¹⁶ Located on the southern part of the Bezeklik Buddhist caves, he noticed that a canal connected this tank from the eastern side. Since the shape of the tank led him to make a direct connection with another remain discovered in Loulan old (occupied since the former Han dynasty by the early first century BCE), he assumed that the system was part of the Chinese *tuntian* colonies irrigation system.¹¹⁷

In Yixun and then Miran textual and archaeological records can lead us to a preliminary answer. In the *Hanshu*,¹¹⁸ we know that, by 77 B.C.E., a small *Tuntian* colony with a maximum

112 Hsu Cho-yun, (1980), 56–92; Needham Part II, (1965); Huang (1984), 174–176.

113 Hsu Cho-yun, (1980), 56–92; Needham Part II, (1965); Huang (1984), 174–176.

114 Matsushita (1981); see chapters 2 and 3, related to the spreading and development of this agricultural technique.

115 Trombert (2008), 122.

116 The date provided is difficult to prove without further evidence of these remains.

117 Huang (1954), 10.

118 *Hanshu* 96A/3878.

of forty soldiers from Loulan, started to organize a new irrigation network in Yixun 伊循, next to the present Miran oasis (Ruoqiang district 若羌县).¹¹⁹ Although the official source of the Han dynasty does not provide much information concerning this network, the *Shuijing zhu* 水经注, compiled by Li Daoyuan 酈道元 in 526 C.E., may help us find a way around the question. In this text, we learn that Suo Mai, who originated in Dunhuang, by the end of the first century C.E. had set up a new irrigation network in the Lob-nor area in the same area where Yixun was developed, close to the modern Miran city. This intention was implemented so that the *tuntian* system could be accurately employed and crops raised properly.¹²⁰ In this text, only canals and dams are used for describing this network, and tanks are once again not mentioned.¹²¹ In the archaeological studies on the specific irrigation system made by Aurel Stein and more specifically later by Chen Ge, precise work on the site of Miran has made possible the first reconstruction of the network as it was when it was active during the Han. Chen Ge explained that this irrigation system was mainly based on watergates and canals, which confirms once more the textual attestations.¹²²

The word *chi* 池, commonly understood to be one of the terms used in the Chinese classics and, along with *Xù shuǐchí* 蓄水池¹²³, clearly used since the Han dynasty to indicate water tanks, is very often quoted in the *Shuijing zhu* classic.¹²⁴ Since I have studied only a few of these chapters, it would be hasty for me to conclude that Han dynasty forces never used such a

119 Trombert (2011), 81–86.

120 Li Daoyuan (1990), 6b; Chen (1984), 91–102; Bray (1980), 5; Hsu (1980); Zurcher (1990), 179; Harmatta (1994), 241; Trombert (2008), 122.

121 *Shuijingzhu* 水经注, (j.2, p. 97–98).

122 Chen (1984), 91–94. See the map of the canals on p. 92. This map resembles the Turfan system: Nishimura (1959), 295–353. For other water works resulting from the same Han Tuntian colonies see Meng (1975), 27–34.

123 This term is more common in documents unearthed in Turfan (TAM :103 18/7) and dated from the 5th century. They do not seem to appear on the wooden tablets written during the Han dynasty. See: Wang (1984), 183. A database on agricultural techniques and accessible online on the site of the CRCAO (Centre de recherche sur les civilisations de l'Asie orientale) state the existence of various terms for the word "tank": http://labour.crcao.fr/index_F.php

124 *Shuijingzhu* 水经注, (j. 6, 20).

technique in northwestern territories. In the Han dynasty capital Chang'an, for example, various texts indicate the common use of large basins or tanks (mainly of rectangular shape), employed within the imperial city for water preservation and for esthetic purposes (they are usually connected to gardens).¹²⁵ However, it is probable that if the word "tank" had been used in explaining the logic of the *tuntian* irrigation improvement, it surely would be quoted in such a text.

Wang Binghua, describing this water system in his article, explains that although the technique was well known in Chang'an during the Han dynasty for irrigation in the Xinjiang region, these tanks served a different function.¹²⁶ In an arid region with little precipitation, the tanks made it possible to preserve water for a long period and to avoid wasting water through evaporation 晒水. Also, it is clear that these tanks were directly connected to canals, so that they were protected from freezing during winter. All these climatic conditions, so different from Chang'an (modern Xi'an in the Shaanxi region) logically led to the building of such structures. The builders of the *tuntian* colonies of the Han dynasty that were established at the various oases of Xinjiang understood the importance of preserving water for a long period of time, and they probably used such a system for their own purposes, but did not employ it for irrigation, since they had another technology well established prior to their arrival in the western regions. As a target for *tuntian* colonies of the former Han dynasty, the irrigation networks are concerned only with the development of land fertility and raising crops. By this logic, tanks did not fit with the primary mission given to the soldiers.¹²⁷

In India, Pakistan and western Xinjiang, we see that tanks are designed to improve the reliability of water for irrigation.¹²⁸ In Jingjue, tanks always appear next to houses but also next to irrigated fields, and so were probably used also for irrigation. One particular Chinese tablet,

125 Wang (1984), 183; Fujita Ktsuhisa, Kan To Choan no toshi suiri 漢唐长安の都市水利 (Urban water control in Chang'an from Han to Tang times), Chugoku suiri-shi kenkyu 22, (1992), 25–54.

126 Wang (1984), 183.

127 Trombert, (2011), 84.

128 Shanmugham (2001), 1–2.

quoted earlier, discovered in the northern part of the Jingjue site near structure N.XIV, does confirm the double presence of wells 井 and tanks 池 on the same site: “池中皆空，井中水泉减少，不足以给，人无马///”(N.XIV.ii.14/ T.O.16).¹²⁹

We find the same logic at other sites such as in Gaochang or Jiaohe (located at the Turfan oasis), where wells were probably designed for providing drinking water and tanks are used for irrigating fields for raising crops and intense irrigation works.¹³⁰

The Chinese, however, did not use this system, or at least no evidence leads us to believe that they did, and they demonstrated no knowledge of using tanks for irrigation networks. Therefore, from this major piece of evidence, I deduce from these sources that tanks were simply not part of the irrigation system used in the *tuntian* colonies, and furthermore that there is not part of a Chinese water system developed in the oases of Xinjiang region. Also, I would add that the *dömbel* level measuring system in the tanks discovered in Niya, is a particularity noted nowhere else in China and proper to these structures of Kroraina kingdom. It is even more close to Central Asian types which direct us in the west for finding traces of influence¹³¹.

Therefore, I only suppose here that the process of the Chinese colonization into the oasis of Xinjiang did not require, according to the available documentation (both archaeological and historical), the use of water tanks.¹³² I moreover insist on the fact that, compared to Miran, Loulan or Dunhuang, the military army of the Han dynasty did not occupy and settle on the site but only built a military camp in the southern area of Jingjue (discoveries of Han tombs in this space were made by the Sino-Japanese expedition). These observations indicate that the Han may not have introduced a water storage with this particular shape into the southern oasis of the Taklamakan Desert. Therefore, the origin of these tanks could be understood as a local invention used before, during and after the Chinese occupation.

¹²⁹ Lin, (2000), n°739.

¹³⁰ Trombert, (2008); Bertrand, (2008).

¹³¹ Padwa, (2007), 42.

¹³² I thank here Olivier Venture (Assistant Professor, EPHE, Paris) for his advice that I confine my argument to this geographical setting. See Meng (1975), 27–34.

Once again, archaeological data have shown that the position of the few existing tanks studied through the Sino-Japanese mission date back to the late third–fourth century C.E.¹³³ Furthermore, considering the important impact made by this western migration on Jingjue (e.g., bureaucratic system, use of Kharosti script)¹³⁴ we need to see if such a system was familiar to the Gandharan culture located in Central Asia and then finish this investigation with a close study of the other remains of tanks located near Jingjue.

A tank model from the West

The use of water tanks in Central Asia, India and Iran is well attested during the first millennium B.C.E., much more than in China at the same time. As Padwa M. Ezra described the water systems discovered in Jingjue, he logically traced the tank back to a Central Asian model: "Canals have also been traced at Jingjue, and other water-control features such as large tanks (pools, probably much like a modern central Asian *hauz*)."¹³⁵ Considering the importance of collecting rain water in fertile geographical areas such as South Asia (Cambodia, India) but also in modern Pakistan, these reservoirs are part of the irrigation and drinking water systems built in or outside cities.¹³⁶ They were used for irrigation and religious matters.

During the progressive Kushan occupation of Bactriane, Gandhara and northern India, historians have noticed a significant increase of irrigation systems all over these territories.¹³⁷ For example, the area under irrigation along the lower reaches of the Amu Darya and Syr Darya (modern Uzbekistan) totaled 35,000–38,000 km². This was probably due to the unification of the Central Asia's ancient agricultural regions under the authority of a single empire.

133 SJJRNS, vol. 2, (1999), 82. A very interesting view is given by the Japanese scholar Katsuhisa Fujita in which he clearly summarizes the various aspects of water technology developed during the Han, and how these influenced the people living in the outside realm of the central empire: Fujita (1983), 1–16.

134 Hansen (2004), 279–315.

135 Padwa (2007), 42. See for example the Hauz I-Sangin in the Istaravshan region of Tadjikistan which was built in stone and surrounded by stairs for accessing the water.

136 Lal (1985), 38.

137 Staviskij (1986), 140–147; Gentelle (2001), 163–172; Craig (2007), 195; Stavisky (1997), 3.

Mukhamaedjanov explains that the result of this Kushan control was an "intensive exploitation of new agricultural land and the expansion of agricultural oasis at the beginning of the Christian era in the river valleys and ancient agricultural oasis areas of Central Asia, especially in the southern regions."¹³⁸ Furthermore, the Kushans contributed in bringing under cultivation foothills and mountain regions of Central Asia. "To store the limited water from mountain gorges and springs, small covered reservoirs were built inside a ravine or at the point where the gorge opened out from it."¹³⁹ Measuring in general 50×40 m at most, these tanks had an upper opening for the intake and a lower one for the outlet. Mukhamaedjanov goes on, confirming that "The use of storage reservoirs for irrigation was typical of terraced agriculture, and in the Kushan period it was common practice in the upper Zerafshan valley and in the foothills of the Nuratau Mountain."¹⁴⁰

In Gandhara, from which the migration to the Tarim Basin seems to have originated, evidence of tanks through archeological excavations are also multiple, and many date back the Kushan period. These tanks are usually found in close proximity to Buddhist monasteries.¹⁴¹ Moreover, tanks are filled with rain water (spring water) and would be preserved in this container for a whole year before the next rainy period. In Jingjue these tanks are built of a clay and mortar mixture. In the Peshawar region, the Buddhist monastic complex of Takht-i-Bahi (Mardan, north-west of Peshawar), dated between the first century C.E.¹⁴² and the late sixth century, contain the remains of a central water tank placed north of the monastery and surrounded by small rooms on all sides.¹⁴³

In Taxila, one of the Kushan main cities of Gandhara region from which this migration seems to have taken place, the Chinese monk Xuanzang noted the existence of this system when

¹³⁸ Mukhamaedjanov (1994), 2: 265.

¹³⁹ Mukhamaedjanov (1994), 2, 270.

¹⁴⁰ Mukhamaedjanov (1994), 2, 270–271.

¹⁴¹ Khan (2001), 218–272.

¹⁴² Fleet (1906), 706–711.

¹⁴³ Marshall (1908), 1105–1112.

passing through this city in the seventh century C.E.: "North-west of the capital about 70 li is the tank of the Naga-*raja* Elapatra (I-lo-po-to-lo); it is about 100 paces round, the waters are pure and sweet; lotus flowers of various colors [...]"¹⁴⁴ Archaeological excavations have confirmed this testimony with the excavation in the early 1920s of a water tank, lined with the original lime plaster dated from the first century B.C.E. (Figure 13) John Marshall identified the tank as a monks' bathing pool which contained in its center a similar *dömbel* to those observed in Jingjue!¹⁴⁵ He also explained that tanks were already built on the same site with the Mauryan influence of this region: "In spite of the harsh and, in some respects, iniquitous character of Chandragupta's rule, much was undoubtedly done by him and his successors for the economic welfare of the people.[...] Lands were surveyed and agriculture aided by the constructions of canals, reservoirs, tanks and wells [...]"¹⁴⁶ Henceforth, in this area, tanks are attested before the Kushan arrival and are simply part of the water technology of this vast region. Xuanzang, visiting the ancient kingdom of Takshashila (Taxila) in 630 and then in 645, noted the following structure:

To the south-east of the city 40 or 50 li is a stone stupa which was built by Ashoka-*raja*; it is 200 feet or so in height. There are ten tanks, which are secretly connected together, and on the right and left (of the walks joining them) are covered stones (*balustrades*) in different shapes and of strange character. The water of the tanks is clear, and the ripples are sometimes noisy and tumultuous. Dragons and various fishes live in the clefts and caverns bordering on the tanks or hide themselves in the waters. Lotus flowers of the four colors cover the surface of the limpid water. A hundred kind of fruits surround them, and glisten with

144 *Xiyouji* 玄奘, (1906), 126.

145 Marshall (1918), 56–59.

146 Marshall (1951), vol. 1, 26.

different shades. The trees are reflected deep down in the water and altogether it is a lovely spot for wandering forth.¹⁴⁷

The Arthashastra prescriptive text, one of the main sources concerning the political stratagems of the Mauryan Empire, written by Kautilya around the year 150 C.E., offers more information on the importance of water tanks. According to this text, which is a theoretical guide to a perfect rule, water for irrigation is either manually transported, carried by bullocks, lifted by a mechanism into channels or tapped from the river, lakes, tanks and springs.¹⁴⁸ In the promotion section discussing economic activity, we learn the following: "A king shall augment his power by promoting the welfare of his people; for power comes from the countryside which is the source of all economic activity: He shall build forts, because they provide a haven to the people and the king himself; waterworks since reservoirs make water continuously available for agriculture [...]."¹⁴⁹ With their capacity for storing water, reservoirs or tanks represent the best irrigation system when building a new fort. Small reservoirs built in the mountain regions on fortified sites for terraced farming with a capacity of 1,200 m³ were introduced in Central Asia during the Kushan period.¹⁵⁰ "Along the northern slope of the Nuratau, at the points where streams emerge from their mountain gorges, fortified rural settlements have been identified and recorded, and around them remains of small ancient reservoirs with traces of terraced farming have been found," explains Mukhamedjanov; he also states that these tanks contained a similar *dömbel* system within its center. Whether or not these discoveries confirm this prescriptive text, we know that reservoirs were commonly used as a water storage device. The Kushan contributed this device in their expansion over the Bactriane region, and they probably increased their use in

147 *Xiyouji* 玄奘, (1906), 131.

148 Arthashastra (1992), 232–233.

149 Arthashastra (1992), 180–181.

150 Mukhamedjanov (1975).

Gandhara and northern India, where tanks have been very well known since the second or at least the third century C.E.¹⁵¹

Consequently, since these tanks were commonly used for irrigation or water storage, the migration east towards the oasis of Jingjue may have either increased or built tanks in Jingjue so that water could be better preserved. If we intend to confirm such a thesis, it would be troubling to discover that the tanks would only be used for a single oasis. Theoretically, if the use of tanks were brought along with this migration, the system should also have greatly influenced other territories, such as Endere, Miran or Loulan.

Were there water tanks at other Xinjiang sites?

Between the third and the late eighth century, Jingjue was not the only place where water tanks existed in the southern Taklamakan Desert. In Khotan, for instance, Stein unearthed, in the desert north of Jiya, evidence of an ancient tank, dated around the third century C.E.¹⁵² In their expedition on the site of Karadong, north of the Khotan oasis, the recent French–Uyghur team effort unearthed in 1994 one large circular tank (30 m in diameter) placed north of the ancient site next to the dwelling 60. The tank is made of clay and mortar (to make the reservoir hermetically sealed) and has an outlet and an inlet system.¹⁵³ Even if this structure dates back to the first and second century C.E., and so predates the water systems found in Jingjue, we do not know if the characteristic “dömbel” cone existed within these water tanks.¹⁵⁴

On the ancient site of modern Charkilik oasis (چاقىلىق, Ruoqiang 若羌, in Ruoqiang County), Stein discovered remains of a late Tang dynasty tank bearing the same features as the

151 Finally, the tanks with a *dömbel* are common not only in Central Asian cultures; in Cambodia, cities such as Angkor had the same style of water tanks (of course larger). The same technology for measuring water level existed here, but the use of a statue replaced in this culture the Central Asian devise of the *dömbel* used, for example, in Jingjue. I thank M. Eric Trombert for bringing to my knowledge this very interesting link.

152 SERINDIA 1,129.

153 Debaine-Francfort (1994), 37–39; Debaine-Francfort (2001), 57–58.

154 In the next year or so, we hope to obtain more information concerning this tank with the full publication of the Karadong site.

ones observed in Jingjue. This circular tank of important dimensions (30×24 m) has a sand-cone placed in the middle of the structure in order to measure the water level. A canal formerly fed this reservoir from the south.¹⁵⁵ Another remnant of a tank was discovered next to the stupa of Rawak, which dates to the fifth century C.E.: "There was the mark of a small tank, too, not far off; its earth embankment, once hardened by moisture, still rose above the level of the surrounding ground which wind erosion had lowered. Even the little earth-cone known as Dömbel, which the villagers to this day invariably leave in the centre of their tanks, was clearly recognizable."¹⁵⁶ Finally, the tank of Koyumal is very interesting because it once contained the same circular shape found in Jingjue. Although it was occupied during the later Tang, the site is composed of a tank of important dimensions (30×24 m) with a sand-cone placed also in the middle of the structure in order to measure the water level. A canal used to feed this reservoir from the south. Since these examples all exhibit the same geographical pattern, water tanks with this particular shape existed in many areas near the Niya River. Although the tank from Khotan does not now provide a clear example, enough evidence demonstrates that the shape appears increasingly during the Common Era. No clear pattern of these water tanks can be shown for other sites known to be part of the Gandharan kingdom, such as Endere or Miran. In Loulan, probably the capital of the kingdom, references to tanks do occur, but none have been fully excavated since the time of Aurel Stein. He did, however, excavate one particular cooling tank that appears to be very similar to the one found in Jingjue. The tank was found in a house next to a fireplace (identified by Stein as the quarters of a blacksmith) and probably had an important role to play as a cooling tank.¹⁵⁷ However, no dumbel system is mentioned by Stein within the discovery of the tank and so it is impossible to say that it is the same than the one found in Jingjue. In the Chinese documents unearthed in Loulan, Lin Meicun published one particular wooden tablet dated to the Han or the Jin/Wei dynasty¹ which contain some important details concerning one tank. Discovered in Loulan by the Lake, LA.II.ii the content is as follows:

155 INNA, vol. 3, pl.8.

156 RODC, vol. 1, 224.

157 INNA, vol. 3, 188.

为大涿池深大又来水少计月末左右已达楼兰 (LA.II.ii/191)

"Concerning the large reservoir Zhuo [perhaps the name of the tank] it is deep and its water, around the end of the month, comes to Loulan".¹⁵⁸ Such a tablet informs us only that tanks did exist in the whereabouts of Loulan but, as it is understood, the tank or its canal taken from it leads towards Loulan for a function we unfortunately ignore. The shape of the tank is not given and so we cannot talk of the existence of probable *dömbel*.

My interpretation of these finds is that the population living in Jingjue, and probably other neighboring oases such as Endere or Loulan, were of multiple origins but spoke a language probably having an Indo-European root. The cultural diversity of Jingjue is one of the main examples cited by specialists, in which many communities live in one territory and share lands, water and agricultural resources.¹⁵⁹ The water tanks of this particular model were probably indigenous to the populations that, before the Gandharan migration, brought the technology with them when settling on this site.¹⁶⁰

Xinjiang region is favorable for local development of such water systems¹⁶¹. In Turfan or Loulan, discoveries of similar prototypes tend to prove that tanks, in their general function, are a local invention, which developed considerably with the arrival of the Chinese from the east and from Central-Asian people from the west. The *dömbel* type recovered in Niya and still used in southern Xinjiang oasis by the nineteenth century and early twentieth, correspond to a system well developed in many southern oasis. To say that the system is the impact to the Gandharan migration is perhaps going too far; but it is at least possible to say that the flourishing of these oases is a result of a water-use technique that was probably an Indo-European development and progressed later within the Gandharan administration system.

158 Lin (1985), 51.

159 Hansen (2001), 275–298.

160 Wang (2007), 426–441.

161 Wang (1983), 183.

Section IV. Discussion: Two reasons to see the water tanks as a result of a Gandharan migration

Tanks in the economic system of the Gandharan migration

According to the Kharoṣṭhī tablets, these water tanks are clearly part of the administrative, geographical and cultural pattern of Cadota. I suggest that, although the geographic, cultural and hydrographic situation changes considerably between the terrain of Gandhara and that of southern Xinjiang, the people who migrated there must have followed the same logic in irrigating the field. The use of a system of laws, the implication of economic transaction, the plant crops chosen to be irrigated (such as Grapevine¹⁶²), the employment of a trade system that keeps the same logic so that the record (written in their own language) – all these would not require a change in their financial, economic and transaction values. In other words, the simpler the better in making their transition: if they could keep the same system, irrigating the field in the same way and using the same type of laws to control the water systems, then why change?

However, we need to be careful here since the changing of environments surely implies the need to adapt the water systems to a new hydrographic context. The following tablet can best explain who was in charge of providing the water in a new location: one particular rectangular shaped tablet discovered in N.I indicates that: "When Sarpika was settled here he used to provide the land, the people of Saca provided the seed and water, and the katmas did the cultivation." "Sarpika" was perhaps a former *cozbo* or a former owner of the same land occupied by Lyipeya when this document was written. We learn that he provided the field, which is cropped and irrigated (with no one technique) by the people of Sacas, and the work of cultivation is given to the "katmas" (farmers or underclass serfs?). Clearly a distinction is made between the people who provide the land and those who provide the seeds (selecting the crops which fit best with the climate and natural condition) and the water. This assumption seems logical since the people who lived on site knew well how properly to irrigate this land. The cultivation of the land is left to the farmers who were probably hired by the *cozbo*.

In Jingjue, the same hierarchic basis existed during the Gandharan presence. The people

162 Trombert (2002), 485–563.

of Jingjue could easily be people of various origins, having both western and eastern connections. They knew their own land and the way water can be brought, stored and used on the site. However, when the migration progressed into the area now called the Cadota site, an increase of population followed by the building of new houses (at least sixty during the third to fifth century C.E.) may have forced the systems in place to change or to increase in intensity. Whether the water tanks originated from the West is a less important matter than the way in which they were used, and it is clear that the Gandharan administration system used them for their own economic process.

A strong relationship between tanks and Buddhism

A second reason can explain why these water tanks need to require our attention in this article. As seen through the Kharoṣṭhī tablets, the "potge" is a central place where people gather for water of course but its position can also be related to possible religious matters. Indeed, a century after this migration occurred, tanks are widely depicted in Buddhist paintings. In Dandan Uiliq for example, Stein discovered a fresco painting and explained the following facts: "The cella wall immediately adjoining the relief group revealed at its base a series of small fresco paintings, which by their unconventional subjects and their spirited drawing at once attracted my attention. The one nearest on the left, as seen in the photograph, shows a woman standing in an oblong tank of water, enclosed by a tessellated pavement and filled with lotus."¹⁶³ In the fifth century, some early caves of the Thousand Buddhas in Dunhuang also contain many similar representations, such as the ancient silk painting representing Avalokitesvara Bodhisattva (Guanyin), thousand-armed, with attendant divinities, from the walled-up chapel. Stein described the painting: "Below the lotus seat of Avalokiteśvara are seen emaciated pretas or beings in hell clutching with outstretched hands at showers of white grains (ambrosia) which Avalokiteśvara pours on them. In front of his lotus seat lies a tank in which stand two stalwart Nagas upholding the stem of the lotus. They are in human shape, but carry above their heads a crest formed of five

163 AKH, vol. 1, 253, and vol. 2, plate II.

snake-heads, their ancient Indian emblem. Besides smaller Naga figures of the same type, the tank holds an infant soul (now almost destroyed) rising from a lotus.”¹⁶⁴

The migration, bringing Buddhist traditions with it, might have developed the tanks also for religious purposes so that they could continue to practice their ritual consistent with their tradition. These various paintings discovered in Dunhuang, Dandan Uiliq¹⁶⁵ but also in Kizil¹⁶⁶ could be in that sense understood as the artistic continuation of a larger religious tradition brought in southern Taklamakan by these Gandharan people. In India and Gandhara, we find a consistent proximity between these water tanks and the Buddhist monasteries. Xuanzang, when referring to the kingdom of Takshashila (Taxila), explains the following facts:

North-west of the capital about 70 li is the tank of the Naga-*raja* Elapatra (I-lo-po-to-lo); it is about 100 paces round, the waters are pure and sweet; lotus flowers of various colors, which reflect different tints in their common beauty (garnish the surface); this Naga was a Bhikshu who anciently, in the time of Kashyapa Buddha, destroyed an Elapatra tree. Hence, at the present time, when the people of that country ask for rain or fine weather, they must go with the Shamans to the side of the tank, and then cracking their fingers (or, in a moment), after praying for the desired object, they obtain it.¹⁶⁷

We have here a direct testimony explaining the relation tanks could have with religious and magical practice. But this is not a new fact if we do not relate those tanks to the development of the religious buildings in the city-states of Taklakamakan cultures. In Jingjue, no monasteries of this sort were discovered, but the religion did spread very substantially through this migration. Could the spread of the religion have had a direct influence over the change of water practice in the region?

¹⁶⁴ Stein (1921), 1, 31.

¹⁶⁵ Zhongguo Xinjiang wen wu kao gu yan jiu suo (2009).

¹⁶⁶ Grunwendel (1920), vol. 1, 42; Xinjiang Qiuci shi ku yan jiu suo (2008).

¹⁶⁷ *Xiyouji* 1906, 127.

Tanks, filled with pure water, had the convenient aspect of not being higher than the land, so worshipers could easily have access to the water and make their religious rituals in or next to it. The tanks discovered in Taxila also were usually connected to monasteries, and this was probably one of the sites from where the migration took place, since it is understood as one of the major religious and cultural centers of Gandhara during the Kushan empire. John Brough explained that: "Thus Gandhara, with its great centre of Buddhist learning at Taxila, in the heart of the region in which the Kharoṣṭhī script was dominant, was well favored historically and geographically to become the main channel for the further transmission of Buddhism into Central Asia."¹⁶⁸ Jingjue was one of the oases that were experiencing the development of this religion from the west.¹⁶⁹

Conclusion

Through the course of this study, my intention as outlined in my introduction has changed. I started with the initial conviction that the entire water tank system was a result of the Gandharan migration into Jingjue, but I can in fact confirm only two important facts: first, when this migration occurred and developed, the Kharoṣṭhī tablets do indicate the existence and importance of these small tanks in Cadota. Second, the shape of the water tanks is clearly not of a Chinese type nor of a Chinese water technique which could be developed during their military progress in the oases city-states of ancient Xinjiang region.

This overall study has helped me to clarify certain historical data which seemed to me strange when looking at the only water technology used during this period in southern Taklakamakan oasis. When approaching the geographical division of the southern oasis kingdoms during the Gandharan migration and partial control of this territory, historical records indicate that Khotan was not, for example, among the Krorainan oases. "From the third century onwards several oasis city-states came to dominate the Tarim and overshadow their weaker neighbors. The oasis in the south and west were separately united to the kingdoms of Kashgar

¹⁶⁸ Brough (1965), 584.

¹⁶⁹ Xiyouji (1906), 127; Lal (2000), 38–48.

and Khotan. Kucha, Karashahr and Kocho were consolidated into independent powers to the north while the kingdom of Lou-lan still held sway in the east towards Lop Nor."¹⁷⁰

This is evidently possible on a cultural pattern, but the discovery of similar water structures in Khotan may indicate that water technology such as the tanks is not concerned with such historical boundaries. Such structures are very similar from one oasis to another. Moreover, if the Gandharan people did indeed develop the water tank technology, we could probably retrace their migration via a furrow study of these tanks through archaeological and textual documentation. I, however, do not possess enough historical evidence for confirming this supposition, but the idea should intrigue us to look differently upon these water systems. This simple, nearly basic observation, may at least have an impact on the way we must understand the technical development of those city-states of Xinjiang region.

Nearly forty years ago the scholar Eric Zurcher explained that the progressive agricultural spread of these oases was mainly due to the Han military tuntian techniques.¹⁷¹ This theory can now be challenged. Indeed, Wang Binghua explains in a recent article that Xinjiang water technology developed through local inventions and through Central Asian and/or Chinese influence. In this particular example, the existence of these water tanks around the southern Xinjiang region in Jingjue is not the result of a Han dynasty expansion west. It must be either an indigenous development by people who lived in these oases, who might have developed their ancient city-oasis with Western influence, or it might be a result of Western oasis technology.

If this theory is correct, we might embrace a larger view of the agricultural development of these oases in the early periods of the first millennium C.E. After the problematic questions concerning the arrival of the *karez* within the Xinjiang region,¹⁷² we have here a new example which needs now to be developed over the entire southern Taklamakan basin. These reservoirs, which certainly have their origins in relationship to the West, have lain within the cultural panel

170 Litvinovskii (1999), 284.

171 This theory is well established and subsequently followed by later work on the same subject. See Debaine-Francfort (1994), 37–39; Debaine-Francfort (2001), 57–58 and also 78.

172 Bertrand (2009), 27–41.

of the Xinjiang region since at least the first two centuries C.E. Their still existing and active use in the early twentieth century around the same geographical area demonstrates their cultural importance for the people who have lived in this area since the Han dynasty.

Final discussion on this migration

Following the various ideas that have taken shape in this article, I would like to embark on a short discussion explaining why such a study can help us open a new path for the study of water technology on the silk roads.

The migration is an established fact, but the reasons have not yet been determined. Perhaps this study on hydraulics may give us new evidence on the link between the people who lived in Kroraina and those who lived in the Eastern Kushan territory in modern Gandhara region, (Pakistan).

In fact, I have noticed, while concluding this research, some intriguing historical events that had occurred in Gandhara and in the Krorainan oasis by the end of the third century. As I said earlier, this migration may have been the result of the conquest of Ardashir I and Shapur I, the first rulers of the Sassanian Empire (224–651 C.E.), who took control over the Kushan empire by the end of Vasudeva I's reign (190–230 C.E.). One outcome was that, after twenty years of war against the Sassanians (220–248 C.E.), the Kushan (who now became the Eastern Kushan), understood themselves as the remnant population of their empire and reorganized in the Gandhara region¹⁷³.

The migration from Gandhara towards the city states of Niya stemmed perhaps from the desire of the Eastern Kushan to gain new territories in the southern Taklamakan cultures. In fact, it is well established now that the Kushan not only had strong connections with the city-oases of Xinjiang region, but also that the Indo-European culture had already been established there long before a migration of this importance took place.¹⁷⁴ With regard to the historiography of this migration, Valerie Hansen explains that two different groups have formed concerning the study of the Kharosthi documents and the link between Niya and the Kushan. The first group favors

¹⁷³ Grenet (2002), 203–224.

¹⁷⁴ I prefer not to enter into a long resume concerning this fact. I suggest the following works that deal with this statement: Mair and Mallory, (2000); Yu (1998), Appendixes 1 and 2.

Kushan direct rule over this oasis. This argument has long been corrected, since the time of John Brough, with the following reinterpretation of the facts. Indeed, the second group understands the presence of such documents as the result of an important migration that occurred from the Kushan territories during the late second century to the early fifth century C.E. These people integrated a new cultural circle that was probably in close relationship to the other cultural groups located in their native lands.¹⁷⁵ Considering the Kushan historical context acknowledged earlier, I believe that, when Sassanian forces entered the realm of Kushan lands, the Kushan were reduced to the south of Central Asia within the Gandharan region. From there, looking for new territories into which to expand, the choice between developing new or renewing communities in Taklamakan city-states became one of practicality. In this way the Later Kushan could continue trading with China through the now determined silk roads where Buddhism had already begun to flourish a century previous.

Through the present work, I believe that we can add to this explanation the importance of these water tanks and irrigation development that occurred in Niya but also in the native land of this migration by the same period. Indeed, although the loss of many parts of their former Kushan lands had a logical impact on their economy: "Indeed, the international trade routes that had earlier supplied gold and other luxury items passed out of the hands of the Eastern Kushans, a loss that is clearly reflected in the currency of the time," various sources (mainly archaeological discoveries) indicate that cities, religious places and agriculture expanded at an unprecedented rate. The valley of Taxila, which we have here examined for the many remains of water tanks, experienced agricultural and architectural development until the late fifth century C.E. Even after the conquest of Shapur II (309–379 C.E.), Faxian (347–422 C.E.), a Chinese Buddhist monk, found it to be flourishing with Buddhist shrines and monasteries.¹⁷⁶ This progress reached its climax with the Kidarites.¹⁷⁷ Named for their first ruler, Kidara (or Chi-to-lo in the Chinese sources), this nomadic kingdom originated from the same Kushan territories (in

¹⁷⁵ Lin (1996), 188–220.

¹⁷⁶ Legge (1965), chapter X; Liu (1988).

¹⁷⁷ Enoki (1955), 231–237; Enoki (1958), 283–334.

Tokharistan, now Afghanistan and southern Uzbekistan and Tajikistan). After being pushed south by the Hun Hephtalites, the Kiarites managed to conquer the region of Gandhara and Kashmir, which they controlled circa 400–410 to 581.¹⁷⁸ During this long period, from the end of the Great Kushan to the Hephtalite conquest of the land located in modern Pakistan,¹⁷⁹ several pieces of archaeological evidence testify to a development in irrigation and water technology: "There are at least three pieces of archaeological evidence: from the Idak-Spinwam region in north Waziristan, from Gilgit proper and from Skardu. In all these places new irrigation channels were opened up. In other areas, natural springs were channeled to irrigate terraced fields. Consequently, there does not appear to have been any loss in agricultural production although the landless labourers undoubtedly suffered and slavery must have been rampant as a consequence."¹⁸⁰

In Jingjue the evidence linked together in the present paper shows that, with the arrival of this migration, multiple factors led to adopting the same irrigation and water system development. First of all, there was a probable demographic increase requiring new households and, more importantly, sufficient water. Second, from the early discoveries made by Aurel Stein, we know also that the grapevine developed in the oasis required different irrigation technology. At one moment in Jingjue's history, the river shifted substantially west, so that floods could be avoided and the river could be better controlled, allowing water to arrive from the western part of the site towards the northern delta located nearly 10 km above Jingjue. This shift is difficult to date, but we need to take into account this very important engineering work, which of course had an impact on the way people lived in the oasis. Finally, the carbon dating of these water tanks made by the Sino-Japanese expedition indicates that they were in use since the third century C.E. Could these tanks be the result of the migration? It is impossible to say for sure, but all these pieces of evidence combined with the documents unearthed at the site of Jingjue seem to show that this migration had a clear beneficial action on the development of the oasis. Water tanks

178 Bivar (2003), 198–201.

179 Yamada (1989), 79–113.

180 Litvinovskii (1999), 173.

develop in the administrative system of the Kharoṣṭhī and do not seem to be part of any kind of Chinese irrigation system used in the region. We know that, without these water tanks, water would not have been properly protected during the harsh winter period, and therefore they had an immediate impact the living conditions on the site.

I hope that new studies on those structures, with parallels with other oases in the same region and other documents, can lead us to a different history of this migration in the north-western part of China. I am confident that water technology is to be considered alongside other evidence, as a direct testimony to the way people lived and developed in a given geographical space. Water systems are never logical and should not be taken for granted. Like strata, they can be a powerful tool to help establish chronology. The dating of the site of Niya, for example, and a better understanding of the different historical occupations may be established partly through these water tanks and the canals.

We know that with water tanks, canals and a well-controlled river, Jingjue not only survived but lived very well until its mysterious end in the fifth century C.E. Perhaps its sudden collapse into the desert mounts was the result of the destruction of these water tanks more than the shrinkage of the river; it is a possibility to be taken into account in future geographical, hydrographical and of course historical research.

List of Abbreviations

- AKH M. Aurel Stein. *Ancient Khotan: Detailed Report of Archaeological Explorations in Chinese Turkestan* (Oxford: Clarendon Press, 1907).
- HS Ban Gu 班固. *Hanshu 汉书* (Beijing: Zhonghua shuju, 1997).
- INNA M. Aurel Stein. *Innermost Asia: Detailed Report of Explorations in Central Asia, Kan-su and Eastern Iran* (Oxford: The Clarendon Press, 1928).
- OCAT M. Aurel Stein. *On Ancient Central-Asian Tracks: Brief Narrative of Three Expeditions in Innermost Asia and North-Western China* (Chicago: University of Chicago Press, 1933[1964]).
- RODC M. Aurel Stein. *Ruins of Desert Cathay: Personal Narrative of Explorations in Central Asia and Westernmost China* (London: Macmillan and Co., Ltd., 1912).
- SERINDIA M. Aurel Stein. *Serindia: Detailed Report of Exploration in Central Asia and Westernmost China Carried Out and Described under the Orders of H.M. Indian Government* (Oxford: Clarendon Press, 1921 [1980]).
- SJJRNS Zhong-Ri gong tong Jingjue yiji xueshu kaocha dui 中日共同尼雅遺跡學術調考察隊, *Zhong-Ri gong tong Jingjue yiji xueshu* 中日共同尼雅遺跡學術調查報告書 (Research report of the joint Sino-Japanese academic investigation of the Niya ruins) (Kyōto-shi: Bukkyo Daigaku Jingjue Iseki Gakujutsu Kenkyu Kiko, 1996–1999).
- TKD Thomas Burrow. *A Translation of the Kharoṣṭhī Documents from Chinese Turkestan* (London: The Royal Asiatic Society, 1940).

Bibliography

1. Primary Sources

Arthashastra = *Kautilya CA150 AD*, L. N. Rangarajan, ed. and trans. New York: Penguin Books, 1992.

Datang xiyuji = 大唐西遊記. Beijing: 中華文庫, 1985.

Hanshu = 漢書. Beijing: Zhonghua shuju 中華書局, 1962.

Houhanshu = 後漢書. Beijing: Zhonghua shuju 中華書局, 1973.

Li Daoyuan 酈道元. *Shui jing zhu xuan yi* 水經注選譯, yi zhu Zhao Wangqin, shen yue Xu Jialu 譯注趙望秦, 申閱許嘉璐. Chengdu 成都: Ba Shu shu she 巴蜀書社: Sichuan sheng xin hua shu dian jing xiao 四川省新华书店经销, 1990.

Shuijingzhu = 水經注 (The classic on water with commentary), by Li Daoyuan 酈道元: Yang Shoujing 楊守敬 et al., eds. *Shuijingzhu shu* 水經注疏 (Jiangsu guji chubanshe), 1999.

Xuanzang 玄奘 = *Xuanzang, Xiyouji* 西遊記 (Buddhist records of the western world), Samuel Beal, trans. London: 1884.

2. Secondary Works

Agrawala (1953) = Agrawala, R. C. "Form of Taxation as Depicted in the Kharoṣṭhī Documents from Chinese Turkestan", *Indian Historical Quarterly* 29, (1953).

Agrawala (1954) = Agrawala, R. C. "Life of Monks and Serfs in the Kharoṣṭhī Documents", *Swaroop Bharati*.

Atwood (1991) = Atwood, Christopher. "Life in Third–Fourth Century Cadh'ota: A Survey of Information Gathered from the Prakrit Documents Found North of Minfeng (Niy.)," *Central Asian Journal* 35 (1991), 161–199.

Bailey (1954) = Bailey, H. Walter. "Indo-Iranian Studies II," *Transactions of the Philological Society* 55 (1954), 88–126.

Baumer (2000) = Baumer, Christopher. *Southern Silk Road*. Bangkok: Orchid Press, 2000.

Bertrand (2009) = Bertrand, Arnaud. "The Ancient Hydraulic Systems in Turfan Oasis: A Final Understanding of the Qānat Introduction," *The Silk Road* 8 (2009), 27–41.

- Bivar (2003) = Bivar, A. D. H. "Hephthalites," in *Encyclopaedia Iranica*, ed. E. Yarshater (New York 2003), XII. 2, 198–201.
- Boyer (1927) = A. M. Boyer et al. *Kharosthi Inscriptions Discovered by Sir Aurel Stein in Chinese Turkestan*, (Oxford: Oxford University Press, 1927).
- Bray (1980) = Bray, Francesca. "Agricultural Technology and Agrarian Change in Han China," *Early China* 5 (1980), 3–13.
- Brough (1965) = Brough, John. "Comments on Third-Century Shan-Shan and the History of Buddhism," *Bulletin of the School of Oriental and African Studies* 28, 3 (1965), 582–612.
- Brough (1970) = Brough, John. "Supplementary Notes on Third Century Shan-Shan," *Bulletin of the School of Oriental and African Studies* 33, 1 (1970), 39–45.
- Bruehlheide et al. (2003) = Bruehlheide, Helge, et al. "Vegetation Changes in a River Oasis on the Southern Rim of the Taklamakan Desert in China Between 1956 and 2000," *Phytocoenologia* 33, no. 4 (2003), 801–818.
- Burrow (1934) = Burrow, Thomas. "Iranian Words in the Kharoṣṭhī Documents from Chinese Turkestan—II," *Bulletin of the School of Oriental Studies* 7 (1934), 509–16.
- Burrow (1937) = Burrow, Thomas. "Further Documents from Niya," *Bulletin of the School of Oriental Studies* 9, Issue 1, 111–123.
- Burrow (1940) = Burrow, Thomas. *A Translation of the Kharoṣṭhī Documents from Chinese Turkestan*. London: The Royal Asiatic Society, 1940.
- Chavannes (1913) = Chavannes, Edouard. *Les documents chinois découverts par Aurel Stein dans les sables du Turkestan oriental*. Oxford: Oxford University Press, 1913.
- Chen (1984) = Chen Ge 陈戈. "Xinjiang Milan gu guangai qudao jiqi xiangguan de yixie wenti 新疆米兰古灌溉渠道及其相关的一些问题 (Questions concerning the irrigation canals and related systems used in Miran, Xinjiang province of China), *Kaogu yu wenwu* 6 (1984): 91–102.
- Cheng (1991) = Cheng, Heshing. "Impact of Water on the Eco-geographic Environment along the Keriya River" in *Reports on the 1986 Sino-German Kunlun Shan Taklimakan-Expedition*, ed. D. Jakel, and Zhu Zhenda, *Die Erde*, Ergänzungsheft 6 (1991): 148–164.

- Christa (1994) = Christa, Paula. *The Road to Miran: Travels in the Forbidden Zone of Xinjiang*
London: Harper Collins, 1994.
- Craig (2007) = Craig, G. R. Benjamin. *The Yuezhi: Origin, Migration and the Conquest of Northern Bactria*. Turnhout: Brepols, cop. 2007.
- Debaine-Francfort et al. (1994) = Debaine-Francfort, Corinne, et al. "Agriculture irriguée et art bouddhique ancien au coeur du Taklamakan," *Arts Asiatiques* 49 (1994), 34–52.
- Debaine-Francfort (2001) = Debaine-Francfort, Corinne. *Keriya mémoires d'un fleuve*. Paris: Findakly ed. P. d'orient, 2001.
- Diringer 1982 = Diringer, David. *The Book Before Printing: Ancient, Medieval, and Oriental*. New York: Dover Publ., 1982.
- Enoki (1955) = Enoki, Kazuo. "The Origin of the White Huns or Hephthalites," *East and West* 3 (1955), 231–237.
- Enoki (1958) = Enoki, Kazuo. "Kidara Ocho no Nendai ni Tsuite" キダラ王朝の年代について (Dating Kidarites), *Galcuho* 41–3 (1958), 283–334.
- Enoki (1963) = Enoki, Kazuo. "The Location of the Capital of Lou-lan and the Date of Kharoṣṭhī Inscriptions," *Memoirs of the Research Department of the Toyo-Bunko* 22 (1963), 125–171.
- Enoki (1967) = Enoki, Kazuo. "Hoken no Tsiika Shita Zenzenkoku ni tsuite 法顯の通過した鄯善国について" (The location of the state of Shanshan visited by Faxian), *Tohogaku 東方学*, 34(1967): 12–31.
- Fan and Cui (1979) = Fan Shengzhi 汜胜之 and Cui Shi 崔寔著. *Liang Han nongshu xuan du: Fan Shengzhi shu he Si min yue ling* (两汉农书选读: 汜胜之书和四民月令, Reading of the agricultural classics during the Han dynasty: The Fan Shengzhi classic and the iminyueling). Beijing: Nong ye chu ban she: Xin hua shu dian Beijing fa xing suo fa xing, 1979.
- Feng (1976) = Feng Chengjun 冯承钧. "Loulan Shanshan Wenti 楼兰鄯善问题" (On Loulan and Shanshan), *Xiyu Nanhai Shidi Kaozheng Lunzhu* 西域史地考證論著彙輯 (A corpus of papers on the Western Regions and the Southern Sea) (1976), 25–35.

- Fleet (1906) = Fleet, J. Faithful. "The Date in the Takht-i-Bahi Inscription," *Journal of the Royal Asiatic Society of Great Britain and Ireland* (1906), 706–711.
- Foret (2006) = Foret, Philippe. "Les frontières du Central Asian atlas de Sven Hedin: Un exemple de dilemme politique?," *Journée d'étude annuelle de la Commission d'histoire de la cartographie* à Paris (05/12/2005) 187 (2006): 51–64.
- Forsyth (1875) = Forsyth, T. D. *Report of a Mission to Yarkund in 1873 under Command of K.C.S.I., C.B., Bengal Civil Service, with Historical and Geographical Information Regarding the Possessions of the Ameer of Yarkund*. Calcutta: Foreign Department Press, 1875.
- Francfort and Lecomte (2002) = Francfort, Henri-Paul, and Olivier Lecomte. "Irrigation et société en Asie centrale des origines à l'époque Achéménide," *Annales HSS* no. 3 (May-June 2002), 625–663.
- Fujita (1983) = Fujita Katsuhisa 藤田勝久. Kan-dai ni okeru suiri jigyo no tenkai 課に汉代おける水利事の展開 (The development of water-control operations during the Han dynasty), *Rekishi-gaku kenkyu* 521 (1983): 1–16.
- Fujita (1992) = Fujita Katsuhisa 藤田勝久. Kan To Choan no toshi suiri 漢唐长安の都市水利 (Urban water control in Chang'an from Han to Tang times). *Chugoku suiri-shi kenkyu* 22 (1992): 25–54.
- Gentelle (1992) = Gentelle, Pierre. "Une géographie du mouvement: le désert du Taklamakan et ses environs comme modèle," *Annales de Géographie* 567 (1992) : 554–594.
- Gentelle (2001) = Gentelle, Pierre. "Irrigations antiques en Bactriane du nord: l'image de satellite, la prospection archéologique, les inférences historiques," in *La Bactriane au carrefour des routes et des civilisations de l'Asie Centrale*, ed. Leriche Pierre, Pidaev Chakir, Gelin Mathilde, and Abdoullaev Kazim, 163–172. Paris : Maisonneuve et Larose, 2001.
- Grenet (2002) = Grenet, Frantz. "Regional interaction in Central Asia and North-west India in the Kidarite and Hephtalite periods", dans N.Sims-Williams (ed.), *Indo-Iranian languages and peoples (Proceedings of the British Academy, 116)*, Oxford, 2002, 222–223.

- Hansen (2001) = Hansen, Valerie. "Jingjue xue yanjiu de qishi" 尼雅学研究的其实 (What we can learn from one hundred years of studying Jingjue), in *Han Tang zhijian wenhua yishu de hudong yu jiaorong* 汉唐之间文化艺术的互动与交融 (Cultural and artistic interaction in a transformative period), ed. Wu Hung 巫鸿, 275–298. Beijing: Wenwu chubanshe, 2001.
- Hansen (2004) = Hansen, Valerie. "Religious Life in a Silk Road Community: Jingjue During the Third and Fourth Centuries," in *Religion and Chinese Society: Ancient and Medieval China*, ed. John Lagerwey, 279–315. Hong Kong: Chinese University Press, 2004.
- Harmatta (1994) = Harmatta, Janos. "Languages and Literature in the Kushan Empire," in *History of Civilisations of Central Asia: The Development of Sedentary and Nomadic Civilizations: 700 B.C. to A.D. 250*, ed. Harmatta Janos, Vol. 2. Paris: Unesco Publishing, 1994.
- Hedin (1907) = Hedin, Sven. *Scientific Results of a Journey in Central Asia 1899–1902*. Stockholm: Lithographic Institute of the General Staff of the Swedish Army (K. Boktryckeriet, P.A. Norstedt & söner; etc., etc., 1904–07]. 1907.
- Hedin (1966) = Hedin, Sven. *Central Asian Atlas: Reports from the Scientific Expedition to the North-Western Provinces of China under the leadership of Dr. Sven Hedin: the Sino-Swedish Expedition*. Stockholm: Statens Etnografiska Museum, 1966.
- Hill (2009) = Hill, John. *Through the Jade Gate to Rome: A Study of the Silk Routes During the Later Han Dynasty 1st to 2nd centuries CE: An Annotated Translation of the Chronicle on the "Western Regions" in the Hou Hanshu*. Charleston, S. C.: BookSurge Publishing, 2009.
- Hoyanagi (1975) = Hoyanagi, M. "Natural Changes of the Region along the Old Silk Road in the Tarim Basin in Historical Times," *Memoirs of the Research Department of the Toyo Bunko*, no. 33 (1975).
- Hsu (1980) = Hsu, Cho-yun. *Han Agriculture: The Formation of Early Chinese Agrarian Economy (206 B.C.–A.D. 220)*. Seattle: University of Washington Press, 1980.
- Huang (1954) = Huang Wenpi 黄文弼, *Tulufan kaoguji* 吐鲁番考古记, Zhongguo kexue chubanshe 中国科学院出版社, 1954.

- Huang (1984) = Huang Shengzhang 黄盛璋. "Xinjiang shuili jishu de chuanbo he fazhan" 新疆水利技术的传播和发展 (The spreading and development of hydraulic techniques in Xinjiang), *Nongye kaogu*, no. 1: 79; no. 2: 78–86.
- Hulsewé and Loewe (1979) = Hulsewé, Anthony, and Michael Loewe. *China in Central Asia: The Early Stage, 125 B.C.–A.D. 23: An Annotated Translation of Chapters 61 and 96 of the History of the Former Han Dynasty*. Leiden: E. J. Brill, 1979.
- Jing (1999) = Jing Ai 景爱. *Sha mo kao gu tong lun* 沙漠考古通论 (An introduction to desert archaeology), 284–285. Beijing 北京: Zi jin cheng chu ban she 紫禁城出版社, 1999.
- Joyce (1903) = Joyce, T. A. "On the Physical Anthropology of the Oases of Khotan and Keriya," *The Journal of the Anthropological Institute of Great Britain and Ireland*, 33 (Jul.-Dec., 1903): 305–324.
- Khan (2001) = Khan, Nasim. "Exploration and Excavation of the Earliest Sivaite Monastic Establishment at Kashmir Smast: A preliminary report, *Ancient Pakistan* 14 (2001): 218–272.
- Kurbanov (2010) = Kurbanov, Aydogdy. "The Hephtalites: Archaeological and Historical Analysis," Ph.D. dissertation, Department of History and Cultural Studies of the Free University, Berlin, 2010).
- [Online]: http://www.diss.fuberlin.de/diss/servlets/MCRFileNodeServlet/FUDISS_derivate_000000007165/01_Text.pdf?hosts (03/07/2012)
- Lal and Dikshit (1985) = Lal, Braj Basi and Kashina Narayan Dikshit. "A 2000 year old feat of Hydraulic Engineering in India," *Archaeology*, Jan–Feb 1985, 38–48.
- Legge (1965) = Legge, James. *A Record of Buddhistic Kingdoms: Being an Account by the Chinese Monk Fa-Hien of His Travels in India and Ceylon (A.D. 399–414) in Search of the Buddhist Books of Discipline*. New York: Dover Publications, 1965.
- Lin (1985) = Lin Meicun 林梅村, *Loulan Niya chutuwen shu* 楼兰尼雅出土, Qin Han Wei Jin chutuwen xian 秦汉魏晋出土文献, (Pékin: 文书出版社, 1985). [This book only published the documents until tablet n°728.]
- Lin (1996) = Lin Meicun 林梅村. "Kharoṣṭhī Bibliography: The Collection from China (1897–1993)," *Central Asiatic Journal* 40 (1996): 188–220.

- Lin (2000) = Lin Meicun 林梅村. "Loulan Niya chutuwenshu 楼兰尼雅出土, Online : <http://www.cp.com.cn/emd/17/newsdetail.cfm?iCntno=1044> (Last accessed 23/04/2012). [This page gathers the last chinese tablets concerning Niya and following the book published in 1985 with tablet 729.]
- Litvinovskii (1999) = Litvinovskii, Boris Abramovich. *History of the Civilizations of Central Asia, Vol. 3, The Crossroads of Civilizations: A.D. 250 to 750*, ed. Zhang Guang-Da and Shabani Samghabadi. Paris: Unesco Publishing, 1999.
- Liu (1988) = Liu Xinru. *Ancient India and Ancient China: Trade and Religious Exchanges, AD 1–600*. Delhi: Oxford University Press, 1988.
- Loewe (1969) = Loewe, Michael. "Chinese Relations with Central Asia, 260–90," *Bulletin of the School of Oriental and African Studies* no. 32.1: 91–103.
- Ma (1980) = Ma Yong. "Xinjiang suoshu Quelu wenshu de duandai wenti" (On the dates of the Kharoṣṭhī documents unearthed in Xinjiang), *Wenshi* (Beijing, Zhonghua), no. 7.
- Ma (1984) = Ma Yong. "Xinjiang Qulu Wenshu Zhong de Kosava Ji Qusou Kao-lianlun Qusou Gudiming" 新疆佉卢文书中的即 𑖀𑖩𑖪𑖫考—廉论𑖀𑖩𑖪𑖫考古地名 (The identity of "kosava" in the Kharoṣṭhī documents from Xinjiang and "QUSOU," and a discussion of the ancient place name Qusou), *Zhong guo Minzu Guwenzi Yanjiu* 中国民族古文字研究, (Beijing 北京, 1984), 50–63.
- Maillard (1973) = Maillard, Monique. "Essai sur la vie matérielle dans l'oasis de Tourfan pendant le haut moyen-âge," *Journal arts asiatiques*, vol. XXIX (1973).
- Mair (1998) = Mair, Victor, ed., *The Bronze Age and Early Iron Age Peoples of Eastern Central Asia*. 2 vols. Philadelphia: University of Pennsylvania Museum Publications, 1998.
- Mallory and Mair (2000) = Mallory, James Patrick, and Victor Mair. *The Tarim Mummies: Ancient China and the Mystery of the Earliest Peoples from the West*. London: Thames & Hudson, 2000.
- Marshall (1908) = Marshall, John "Archæological Exploration in India, 1907–8," *Journal of the Royal Asiatic Society of Great Britain and Ireland* (1908), 1105–1112.
- Marshall (1918) = Marshall, John. *A Guide to Taxila*. Calcutta: Superintendent Government Printing, 1918.

- Marshall (1951) = Marshall, John. "Taxila," *Archaeological Excavations*, vol. 1. Cambridge: Cambridge University Press, 1951.
- Matsushita (1934) = Matsushita Yoshio 松下芳. *Tonden heiseishi* 屯田兵史 (History of the Juntian system) Tokyō: Gogatsu Shobō, 1981.
- Meng (1975) = Meng Chi 孟池. "Cong Xinjiang lishi wenwu kan Handai zai xiyu de zhengzhicuoshihejingjijianshe 从新疆历史文物看汉代在西域的政治措施和经济建设" (The political organization and economic construction in western countries during the Han dynasty as seen from historical relics), *Wenwu* 7–8 (1975): 27–34.
- Menninger (1998) = Menninger, Karl. *Zahlwort und Ziffer: eine Kulturgeschichte der Zahl?* Band: Vandenhoeck & Ruprecht, 1998.
- Mirsky (1977) = Mirsky, Jeannette. *Sir Aurel Stein, Archaeological Explorer*. Chicago: The University of Chicago Press, 1977.
- Mukhamaedjanov (1975) = Mukhamaedjanov, A. R. "K istorii irrigatsii v Kushanskuyu êpokhu. Tsentral'naya Aziya v Kushanskuyu êpokhu," *TMKIAKTSAK*e, 2.
- Mukhamaedjanov (1975) = Mukhamaedjanov, A. R. "K istorii irrigatsii v kushanskuiu epokhu", in *Tsentrālnaia Aziia v kushanskuiu epokhu*, vol. 2. Moscow: Nauka, 1975.
- Mukhamaedjanov (1994) = Mukhamaedjanov, A. R. "Economy and Social System in Central Asia in the Kushan Age" in *History of Civilizations of Central Asia: The Development of Sedentary and Nomadic Civilizations: 700 B.C. to A.D. 250*, ed. Janos Harmatta, vol. 2. Paris: Unesco Publishing, 1994.
- Mukhejee (1979) = Mukhejee, B. Nath. "Kharoṣṭhī Documents of Shan-shan and the Kushana Empire," in *Studies in the Sources on the History of Pre-Islamic Central-Asia*, ed. Janos Harmatta, 245–258. Budapest: Akademiai Kiado, 1979.
- Needham (1965) = Needham, Joseph. *Science and Civilisation in China: Physics, Physical Technology and Mechanical Engineering*, Part II. London: Cambridge University Press, 1965.
- Nishimura (1959) = Nishimura Genyū 西村元佑. "Tōdai Torufan ni okeru kindensei no igi" 唐代吐鲁番における均制の意義 (Truth of Chun-t'ien system of the T'ang period in Turfan district), in *Saiiki bunka kenkyūkai* 西域研究文化研究会, ed. Saiiki bunka

- kenkyū dai 2, Tonkō Torufan shakai keizai shiryō (A)西域文化研究第二 敦煌吐鲁番社会经济资料(上, 295–353. Kyoto: Hōzōkan, 1959.
- Padwa (2007) = Padwa, M. Ezra. "An Archaic Fabric: Culture and Landscape in an Early Inner Asian Oasis (3rd– 4th Century C.E. Jingjue). Ph.D. dissertation, Harvard University, 2007.
- Rhie (1999) = Rhie, Marilyn Martin. *Early Buddhist art of China and Central Asia*, Leiden; Boston; Köln: Brill, 1999.
- Salomon (1999) = Salomon, Richard. *Ancient Buddhist Scrolls from Gandhara: The British Library Kharoṣṭhī Fragments*. Seattle: University of Washington Press, 1999.
- Salomon (2002) = Salomon, Richard. "Gandhari and the Other Indo-Aryan Languages in the Light of Newly-discovered Kharoṣṭhī Manuscripts," in *Indo-Iranian Languages and Peoples*, ed. N. Sims-Williams, 119–34. Oxford: The British Academy, 2002.
- Shanmugham (2001) = C.R.Shanmugham. "Revival and Management of Traditional Water Harvesting Systems". Keynote paper presented at the National Workshop on "Water Harvesting with special reference to artificial recharge" held at National Geophysical Research Institute, Hyderabad on 9th October 2001. [Online:] <http://www.indiawaterportal.org/sites/indiawaterportal.org/files/revival.pdf> (last accessed: 23/04/2012)
- Sohma (1995) = Sohma, Hidehiro. "Environmental Changes in the Taklamakan Desert," *Bulletin of the Research Center for Silk Roadology* 1(1995): 39–53.
- Stavisky (1997) = Stavisky, B. Ja. "The Archaeology of Central Asian and the 'Kushan Question' in the Light of Research Carried Out Between 1966 and 1993," *CIAA Newsletter* 5 (May 1997).
- Stavisky (1986) = Staviskij, B. Ja. *La Bactriane sous les Kushans: Problèmes d'Histoire et de Culture*. Paris: Librairie Jean Maisonneuve, 1986.
- Stein (1907) = Stein, M. Aurel. *Ancient Khotan: Detailed Report of Archaeological Explorations in Chinese Turkestan*. Oxford: Clarendon Press, 1907.
- Stein (1912) = Stein, M. Aurel. *Ruins of Desert Cathay: Personal Narrative of Explorations in Central Asia and Westernmost China*. London: Macmillan and Co., Ltd., 1912.

- Stein (1921) = Stein, M. Aurel. *Serindia: Detailed Report of Exploration in Central Asia and Westernmost China Carried Out and Described under the Orders of H.M. Indian Government*. Oxford: Clarendon Press, 1921 [repr. 1980].
- Stein (1921) = Stein, M. Aurel: *The Thousand Buddhas: Ancient Buddhist Paintings from the Cave-Temples of Tung-huang on the Western Frontier of China*. London: Bernard Quaritch, 1921.
- Stein (1928) = Stein, M. Aurel. *Innermost Asia: Detailed Report of Explorations in Central Asia, Kan-su and Eastern Iran*. Oxford: The Clarendon Press, 1928.
- Stein (1933) = Stein, M. Aurel. *On Ancient Central-Asian tracks: Brief Narrative of Three Expeditions in Innermost Asia and North-western China*. Chicago: University of Chicago Press 1933 (repr. 1964).
- Trombert (2002) = Trombert, Eric. "La vigne et le vin en Chine: Misères et Succès d'une tradition allogène," *Journal Asiatique* 209.2 (2002): 485–563.
- Trombert (2008) = Trombert, Eric. "The Karez Concept in Ancient Chinese Sources: Myth or Reality?" *T'oung Pao* 94 (2008): 115–150.
- Wang (1984) = Wang Binghua 王炳华, "Xinjiang shuili jishu de zhuanbo he fazhan 新疆水利技术的传播和发展", *Nongye kaogu* 农业考古 n°2, (1984), 172–183.
- Wang (2007) = Wang Binghua 王炳华, "Xihan yiqian xinjiang he zhongliang dixu lishi guanxi kaoji 西汉以前新疆和中原地区历史关系考索" (A study of the historical relations between China proper and Xinjiang before the Western Han period), in Wang Binghua 王炳华, *Xiyu kaogu lishi lunji* 西域考古历史论集 (Study on the history of the Western Regions), 426–441. *Xiyu lishi yuyan yanjiu congshu* 西域历史语言研究丛书 (History and languages of the Western Regions collection). Beijing 北京: Zhongguo renmin chubanshe 中国人民大学出版社, 2007.
- Whitfield (2004) = Whitfield, Susan. *The Silk Road: Trade, Travel, War and Faith*. London: Serindia Publications, 2004.
- Whitney (1911) = Whitney, W. Dwight, and B. Eli Smith. *The Century Dictionnary and Encyclopedia* 6. Chicago: University of Michigan Libraries, 1817, last edition 1911).
- Xinjiang Bowuguan (1960) = Xinjiang Bowuguan 新疆博物馆. "Xinjiang Mingfeng Xianbei

- Dashamuzhong Gu Yizhi Muzhangqu Donghan Hezhangmu Qingli Baogao 新疆博物新疆民丰县北大沙漠中古遗址墓葬区东汉合葬墓清理简报 (Excavation report of double burial tomb of Eastern Han from the desert site of northern Mingfeng, Xinjiang), *Wenwu* 文物 6 (1960): 9–12.
- Xinjiang Qiuci shi ku yan jiu suo bian (2008) = Xinjiang Qiuci shi ku yan jiu suo bian 新疆龟兹研究所编. *Zhongguo Xinjiang bi hua: Qiuci* 中国新疆壁画: 龟兹 (Mural paintings in Xinjiang of China: Qiuci). Urumqi: Xinjiang mei shu she ying chu ban she, 2008.
- Yamada (1989) = Yamada, M. "Hūna and Hephtal," *Zinbun* 23 (1989), 79–113.
- Yang (2005) = Yang Xiaoping et al., "Hydrological Changes and Land Degradation in the Southern and Eastern Tarim Basin, Xinjiang, China," *Land Degradation and Development* 17(2005): 381–392.
- Yang (2007) = Yang Xiaoping, "Desert Research in Northwestern China: A Brief Review," *Géomorphologie: relief, processus, environnement* 4 (2007): 2–7.
- Yue (1994) = Yue Feng 岳峰. *Si chou zhi lu yan jiu wen xian shu mu suo yin* 丝绸之路研究文献书目索引. Urumqi: Xinjiang ren min chu ban she 新疆人民出版社, 1994.
- Yu (1998) = Yu Taishan, "A Study of Saka History," *Sino-Platonic Papers* 80 (July 1998).
- Zhao (2009) = Zhao Feng 赵丰. "Woven Color in China: The Five Colors in Chinese Culture and Polychrome Woven Textiles," *Textiles Society of America Symposium Proceedings* (University of Nebraska, Lincoln, Nebraska), Paper 63. [Online]: <http://digitalcommons.unl.edu/tsaconf/63> (09/09/2011)
- Zhongguo Xinjiang wen wu kao gu yan jiu suo and Riben fo jiao da xue Jingjue yi zhi xue shu yan jiu ji gou bian (2009) = Zhongguo Xinjiang wen wu kao gu yan jiu suo and Riben fo jiao da xue Jingjue yi zhi xue shu yan jiu ji gou bian 中国新疆文物考古研究所, 日本佛教大学尼雅遗址学术研究机构编. *Dandanwulike yi zhi: Zhong Ri gong tong kao cha yan jiu bao gao* 丹丹乌里克遗址: 中日共同考察研究报告 (Research report of the joint Sino-Japanese academic investigation of the Dandan-Uiliq ruins). Beijing: Wen wu chu ban she, 2009.
- Zhong Ri gong tong Jingjue yiji xueshu kaocha dui (1996–1999) = Zhong Ri gong tong Jingjue yiji xueshu kaocha dui 中日共同尼雅遗址学术调考察队. *Zhong Ri gong tong Jingjue*

yiji xueshu 中日共同尼雅遺跡學術調查報告書 (Research report of the joint Sino-Japanese academic investigation of the Niya ruins). Kyōto-shi: BukkyōDaigaku Jingjue Iseki Gakujutsu Kenkyū Kikō, 1996–1999.

Zhou (2005) = Zhou Peiyan 周培彦. *Si chou zhi lu: Niyayi zhi zhi mi* 丝绸之路: 尼雅遗址之谜 (The Silk Road: the mystery of the Niya ancient site). Tianjin: Tianjin Shi ren min mei shu chu ban she, 2005.

Zurcher (1990) = Zurcher, Erik. “Han Buddhism and the Western Region,” in *Thought and Law in Qin and Han China*, ed. Erik Zurcher and Wilt Lukas Idema, 11–101. Leiden: E. J. Brill, 1990.

Zurcher (2007) = Zurcher, Erik. *The Buddhist Conquest of China: The Spread and Adaptation of Buddhism in Early Medieval China*. Leiden: Brill, 2007.

Appendix

The Kharoṣṭhī Documents excavated in Niya ancient site (Jingjue) relating to water issues

The Kharoṣṭhī Documents presented here concern the use of water. This appendix will I hope provide further research regarding the use of water in this oasis. We should add to this brief list the other Kharoṣṭhī documents still kept in various places in China, India and Europe. In addition to this appendix, we hope in the near future to make a collection of all such documents dealing with water. This should bring to this field a chance for readers to examine more extensive information than the small elements I have presented and studied for this article. I hope that in the next years, a project will start on the entire documents concerning the city-oases of ancient Xinjiang region and relating to water techniques. This will only then initiate a necessary dialogue between the textual sources, the archaeological discoveries and the geographical sources.

For every tablets, the number is first followed by the place of discovery in Niya and then with the information on the shape. The transliteration is taken from the online Catalog of Gāndhārī Texts created by Stefan Baums and Andrew Glass¹, however we must add that the transcription conventions in the digital text are modernized vis à vis Boyer et al.². In order to preserve a consistency in the translation of these documents between the entire article and this appendix, the English translations are also taken from Burrow³. Finally, it is only natural to include in the footnote the reference to the publication of the Ancient Khotan and Serindia written by Aurel Stein⁴ in which is published every tablets presented here.

¹Baums, Stefan and Andrew Glass, *Catalog of Gāndhārī Texts*. [Online]: http://gandhari.org/a_catalog.php (Last accessed: 23/05/2012)

²Boyer et al, (1921).

³TKD (1940). This translation is fully available online through the Silk Road Seattle website directed by Daniel Waugh: <http://depts.washington.edu/silkroad/texts/niyadocts.html> (Last accessed: 23/05/2012)

⁴AKH (1907).

Tablet 47, N.i. 67, Double-Wedge tablet⁵

Transliteration

Cov. Obv.

1. coꣳboṣamaṣenapugoṣa ca dadavo

Und. Obv.

1. Mahanuava maharaya lihati coꣳboṣamaṣenapugoṣa ca matra deti ṣa ca
ahono iśa
2. lyipeya viṃṇaveti yatha eḍaṣa goṭha gṛha vasa apgeyena udagena sargita
yahi eḍa kilamudra atra eṣati praṭha eḍa vivada samuha anada prochiḍavo
yatha dharmena niḥe kartavo
3. atra na paribujiśatu hastagada rayadvarammi viṣajidavc iśemi niḥe
bhaviṣyati

Und. Rev.

1. lyipeya . . apgeyena ṣadha

Translation

His majesty, etc..... Lyipeya reports that his farm and living house were flooded with
water by Apgeya. When this wedge-tablet, etc.....⁶

Tablet 72, N.iii.I, Takhti-shaped tablet⁷

Transliteration

Rev.

2. . . . [go]huma dvivara trevara utaga [pe]taga tasyeṣa pa ga

⁵AKH (1907), 389; Boyer (1920), 16; http://gandhari.org/a_document.php?catid=CKD0047

⁶TKD # 47.

⁷AKH (1907), 318, 390; Boyer (1920), 24; http://gandhari.org/a_document.php?catid=CKD0072

Translation

.....] the wheat was two and three times watered. This is a register of it. (List follows.)⁸

Tablet 120, N.iv.56, Stick-like tablet⁹

Transliteration

Obv.

1. saṃvatsare 3 maṣe 4 divaṣe 10 4 1 iśa kalaṃmi ṣitgapotgeyaṃmi bhiti vara
gaṃdavo hoati

Obv.

2. pirova ṣarva jaṃna karmakare aitaṃti . . . prapaṃma bahu kha . . ṣa utaga
tena doṣena azade
3. jaṃna abhisammitaṃti rajadaraga mahatvana sitgapotgeyade varidama
nivartavidama rajakicaṣa

Rev.

1. kicaṣa kridena tatra azade jaṃnaṣa jeṭha cozbo namara[z]ma paṃciṃna
[kaṃ]maśura gaca apsuapñiya
2. calmaṣa kaṃciyaṣa ca arilyipana

Translation

In the 3rd year, 4th month, 15th day, at this time, it was necessary to go to the sitga potge for the second time. All the work-people came to the bridge [.....] the water was very muddy (kha[lu]sa). Owing to that fault the well-born people came to an agreement. We stopped and turned back the magistrates from the sitga potge. The well-born people who were there on account of the king's business were: Namarazma, the senior cozbo,

⁸TKD # 72.

⁹AKH (1907), 393; Boyer (1920), 47-48; http://gandhari.org/a_document.php?catid=CKD00120

Pamcimna, [Nam]masura,Tgaca, the apsu Apniya, Calmasa, and Kamciya, the ari Lyipana.¹⁰

Tablet 125, N.iv.81, Wedge-shaped tablet¹¹

Transliteration

Obv.

1. mogataša bhagena śakha uṭi rakṣiṣyati arikutgeya uṭiyana paride nikhalidavo

Obv.

2. khula poṣidavo ariapemnaša uṭa acovammi ukasidavya apemna durbala
hudaē
3. pača acovimna gaṇdavo ma imci śitilya oḍiṣyatu kiṃcana

Rev.

1. stora na aneṣyati bhradara putra praharidavo avi utaga kolaṃteša taṃammi
pratu biṃniṣyama
2. aja bhuya iśa utagaša karya

Translation

Sakha will look after the camels in place of Mogata. The ari Kutgeya is to be removed from the camels. The herd is to be fed. The ari Apemna has to ride out on a camel to the aco. Apemna has become sick. Later he must go as acovimna. Do not allow any slackness. If he does not bring any beast, his brothers and son are to be beaten. Also in the morning we will break open the water in Kolaṃte's tama. Now there is need of more water here.¹²

¹⁰TKD # 120.

¹¹AKH (1907), 393; Boyer (1920), 49; http://gandhari.org/a_document.php?catid=CKD00125

¹²TKD # 125.

Tablet 157, N.iv.136, Wedge-shaped tablet¹³

Transliteration

Obv.

1. bhaṭaraganana priyadarśanana sunaṃmapratikirtitanana priyabhratuana
cozbotsmayativiratgacacarakasucamṃmasya ca soṭhaṃgha lyipeya namakero
kareti

Obv.

2. divyaśarira arogi saṃpreṣeti bahu anega evaṃ caṣa ca yo mahi iśa bharya
gilani tutahu praśadena jivaṃtiyae asti avi ca iśa śrudemi
3. tusya tatra udaga baṃnideṣi ahu suṭha śada hudemi avi ca jaṃnana kride na
iśa lihitetu atra jaṃna aniṣyati avi ca pirovami bhatrodevataṣa goyaṃña
huda
4. arikungeya maṃtreti ahu sumiṃna triṭhemi se pirovami goyaṃña na
paḍichitaga devataṣa ema arikungeya matreti nanaṃ ciya opiṃtaṣa
gośaḍaṃmi go vito asti
5. eda śatogo2 bhatrodevataṣa yajeti yaṃñakaraṃnaya ema maṃtreti
arikungeya ekharamotgeyaṣa3 goṭhaṃmi eda yaṃña kaṭa[vo]
6. eda go . . ṣa karaṃna ma imci śiśiia oḍiṣyatu tasuca lyimsu cavala viṣajitavya
aricalaṃmaṣa ca go aniṣyati
7. na imci vithana kartavo

Rev.

1. puna arikungeya sumiṃna triṭha treya apsuana paride paśupursa
buṃniyaṃmi [ṣa]rmanammi yaṃñakaraṃnae cavala taṣa karaṃna
2. osuka avajitavo

Translation

To the masters, etc..... sothamgha Lyipeya pays respect, etc..... and thus (writes): My
wife who was ill here is alive through your favour. Also I have heard that you have kept

¹³AKH (1907), 395; Boyer (1920), 62-63; http://gandhari.org/a_document.php?catid=CKD00157

blocked up the water there, and am very pleased. Also you wrote here about some people. The people will be taken there. Also there has been a / [p. 29] sacrifice of a cow at the bridge to the god Bhatro. The ari Kungeya says: "I saw a dream; that sacrifice of a cow at the bridge was not accepted by the god." So the ari Kungeya says. In nanamciya Opimta's cow enclosure there is a vito cow. He asks for that vito cow to make a sacrifice to the god Bhatro; so says the ari Kungeya. This sacrifice is to be made at the farm of ekhara Motgeya. Let no slackness be allowed in the matter of this cow. The tasuca Lyimsu is to be quickly sent; along with the ari Calamma he will bring the cow. It is not to be withheld. Again the ari Kungeya saw a dream about a pursa sheep from the three apsus to make a sacrifice in Bumni and Samana (?). Quickly in that matter zeal is to be applied.¹⁴

Tablet 160, N.iv.139, Rectangular under-tablet¹⁵

Transliteration

Obv.

1. priyadevamanuṣyasam̐pujitana priyadarśanana priyabhṛatu
cozboḷyipeyalýimsuṣa ca

Obv.

1. tasucakunalasunakaṣa ca namakero kareṃti divyaśarira arogya preṣeṃti
bahu anega evaṃ caṣa
2. ca adehi catonena íśa viśarjideśi udagabhiśaṣa prace kriṣivatra karaṃnae
ahu íśa
3. kilamum̐tra vaśidemi eta kilamum̐tram̐mi udagabhiśaṣa nama nasti
maham̐te vṛdhijam̐na im̐thu mam̐treṃ-
4. ti cozboḷyipeyaṣa sacam̐mi goṭhaohara titaga uhati udagabhiśa na titaga
uhati yatha

¹⁴TKD # 157.

¹⁵AKH (1907), 395; Boyer (1920), 63-64; http://gandhari.org/a_document.php?catid=CKD0160

5. devaputraśa mulade bhumakṣītra ladhaga emeva tanu yo atra kēma
hastalekha udagabhiśaśa prace sya-
6. ti athava levistarena anatilekha hakṣati taha margidavo iśa prahadavo yati
taha nasti bhaviṣyati
7. adehi udagabhiśaśa muli prahadavo kṛṣivatra iśa bhaviṣyati avi ca mahamte
jaṃna im-
8. thu mamtreṃti yaṃ kala sarpika iśa asitaga uhati bhuma se nikhaleti
udagabhiśa saciṃci-
9. ye nikhaleṃti katma kṛṣivatra kareṃti tena karaṃna tuo ciṃdidavo

Translation

To dear brother cozbo Lyipeya, etc..... the tasuca Kunala and Sunaka, etc..... thus
(write):

From there you sent Catona / [p. 30] here concerning the water and seed, to do the cultivation. I have read the wedge-tablet here. In this wedge-tablet there is no mention of water and seed. The old people speak thus: The use of a farm was given to the cozbo Lyipeya in Saca, water and seed were not given. According as how the field was received from the feet of his majesty, in such wise it belongs to you. Whatever hand-(written) letter there may be there concerning water and seed, or if there is a letter of command with a detailed account, it is to be looked for and sent here. If there is no such (document) there, the price of the water and seed is to be sent from there and the cultivation will take place here. Also the old people say thus: When Sarpika was settled here he used to provide the land, the people of Saca provided the seed and water, and the katmas did the cultivation.¹⁶

¹⁶TKD#160.

Tablet 298, N.xv.122 ,Lath-like tablet¹⁷

Transliteration

Rev.

1. saṃvatsare 10 4 3 mahanuava maharaya jituṃgha mairiya devaputraśa iśa
kṣunaṃmi maśe 4 divaśe 10 4

Rev.

2. caku mogi aśena śaca lastana kritamti caku vakośida goṭhi karma karaṃnae
aśena
3. mogiya śaca rayadvarammi vakośamti garahamnae yo goṭhi kriṣavatra
kriṣidaga

Obv.

1. saṃma udaga kaṭavo saṃma paripalidavo yo apyamtara kriṣavatra yo
laṭhaya kriṣivatra
2. saṃma paripalidavo

Translation

In the 17th year of his majesty the great king Jitumgha Mairiya son of heaven at this date in the 4th month, on the 17th day Caku, Moge, and Asena made a lawsuit. Caku took it upon him to do the farm work, (while) Asena and Moge undertake to make the complaint at the king's court. Those ploughed fields of the farm which have been ploughed are to be properly watered and looked after. Both the internal and external cultivation is to be properly looked after.¹⁸

¹⁷AKH (1907), 404; Boyer (1920), 110; http://gandhari.org/a_document.php?catid=CKD0298

¹⁸TKD#296.

Tablet 347, N.xv.195, Wedge covering-tablet¹⁹

Transliteration

Obv.

1. cuvalayina malbhutaṣa dadavo

Rev.

1. anodaḡa yahi eda kilamudra atra eṣati praṭha atra anada pruchidavo
bhudārtha eva hakṣati ahono
2. cozbo ṣamaṣena potgeci karyani prace śighra anatilekha harati ma imci
caule paṁtha chiṁniṣya ..
3. nevi baṁdhana ṣayiṣyati yaṁ kala rayadvarammi samuha bhaviṣyati taṁ
kala niṇe
4. bhaviṣyati

Translation

. . . . (is) without water. When this wedge and seal arrive there, you must carefully inquire whether it is really so. At present the cozbo Samasena is speedily bringing a letter of command concerning the affairs of the potge. Caule must not bar his way nor take him into custody. At such time as they are in our presence at the king's court there will be a decision.²⁰

Tablet 368, N.xv.319, Document on Leather (fragment)²¹

Transliteration

Obv.

1. mahanuava maharaya lihati ///

¹⁹AKH (1907), 407; Boyer (1920), 126; http://gandhari.org/a_document.php?catid=CKD0347

²⁰TDK#347.

²¹AKH (1907), 408; Boyer (1920), 133; http://gandhari.org/a_document.php?catid=CKD0368

Obv.

1. caṣa kridena anati dita taha rajakaryami osuka avajidavo avi spṣa jivida
paricagena anata rakṣidavo yahi khema khotamṇa ///
2. nadi avavyagata kriṣivatrami udaga nasti huta anodaka huta ahuno teṣa
rajammi udaga nivartavidavya na śakya teṣa ek. [ṣam] ///
3. yena jamṇa lihidavo piṃḍa śadha 1 Sa ṣahda aresahi puraṭhida śapuka ni
camakaṣa hastami sacammi satamṇamasasya paṃcadaśami anidavya tuo
cozbo somjaka . . . u ///
4. siyaṃti athava kala . . . atikramiṣaṃti yo sacammi karyani vinajiṣyaṃti
ṣarva ahu maharaya tahi paride parimargiṣya yo kariṣyati pula [ka] .
..... ///
5. maṣe 4 2 divaṣe 20 4 4

Rev.

1. cozbosom . . jakāṣa dadavo

Translation

His majesty, etc..... (3) (?) There is no water in the cultivated land, it has become waterless. Now the water is to be diverted into their province. It is not possible [.....] the people are to be written down. The whole amount (pimda) is 100. Along with the are_sas they are to be taken on the fifteenth day of the seventh month to Saca in the hand of Camaka of gapuka. You the cozbo Somjaka [.....] or (if) they go beyond the (stated) time, such affairs as are ruined in Saca, I the great king will demand (recompense) from you [.....].²²

²² TDK#368.

Tablet 397, N.xv.05, Wedge under-tablet²³

Transliteration

Obv.

1. mahanuava maharaya lihati . . .

Obv.

1. iśa cozboṣamaśena viñaveti yatha udaga na potge yaṃ . . [ra]ji jaṃ[na]
2. [a gi tha] [se na] potge yaṃ[mi] śati matra jaṃna yahi
eda ki[lamu]
3. pruchidavo yati bhudārtha eva hakṣati yatha avaśiṭhe jaṃnaśa seṃniye na
potge yaṃ . . .
4. tatha vidhanena cozboṣamaśenaśa jaṃna lihidavya yati . . .

Rev.

1. . . [zbo] ṣa . . .

Translation

His majesty, etc..... The cozbo Samasena informs us that water in the potge [.....]
you must inquire whether it is really so. Like the rest of the people the soldiers in the
potge [.....] in such manner the people are to be written down by the cozbo
Samasena.²⁴

Tablet 502, N.xxiii.ii.13, Wedge under-tablet²⁵

Transliteration

Obv.

1. mahanuava maharaya lihati cozbo kranaya ṣoṭhaṃga līpeyaśa ca maṃtra

Obv.

²³AKH (1907), 410; Boyer (1920), 142; http://gandhari.org/a_document.php?catid=CKD0397

²⁴TDK# 397.

²⁵SERINDIA (1921), I, 256; Boyer (1929), II, 181; http://gandhari.org/a_document.php?catid=CKD0502

2. deti ṣa ca ahuno iśa śramana mokṣapri viṃṇaveti yatha apsu apñi yaṣa udaga
yaji taga huati tade eda udagade aṃñeṣa dita
3. dita yahi eda kilamudra atra eśati praṭha a[tra] anada pruchidavo yati
apñiyaṣa udaga yajI taga huati
4. tade udagade aṃñeṣa ditaga siyati athava apane na ditaga siyati eda prace
apñi-
5. yaṣa vaṃti nasti parihaṣa yati aṃñatha siyati

Rev.

1. mokṣapri
2. udaga prace[ya]
3.

Translation

“His majesty, etc..... The monk Moḥhapriya informs us that water was borrowed by Apniya. He gave to others from this water. When this wedge and seal reach you, careful investigation must be made (to find out) if this water was borrowed by Apniya and (water) from this water was given to others. (If) on the other hand an outlet (apanaya) was not provided, there is no claim against Apniya. If it is otherwise [.....]”.²⁶

Tablet 604, N.xxxvi.vi.I, Oblong tablet²⁷

Transliteration

Obv.

1. saṃvatsare 4 3 mahanua(*va)[ma]harāyajiṭṭhaVaṣmanadevaputraṣa maṣe
4 2 tivaṣe 20 4 1 iśa kṣunaṃmi śakhusa śakha muṃtra biṃnita

Obv.

1. ca mu preteyaṃmi muṃtra utaga kritaga huati tatra sakṣi aṣṣara līyimsu
śramaṇna sevaṣena ṣa ca

²⁶TDK# 502.

²⁷SERINDIA (1921), I, 264; Boyer (1929), II, 229; http://gandhari.org/a_document.php?catid=CKD0604

2. yaṃ kālāṃ ramakaṣa śi tiyaṃmi caṣgeya soṃgha anita taṃ kālāṃ muṃtra
biṃnitaḡa ṣoṭha[m]gha lýipeya

Rev.

1. taṃ kālāṃ sevaṣenaṣa utaga yaḡitaḡa huati eta utaga balakarena balaṣena
achinita huta u . . ga . . [c.]
2. taṃogoṣa muṃtra azo biṃnita . . [kṣ̣]i t.[m]ga [hi a r] . .
3. sakṣ̣i lýimsu.

Translation

“In the 7th year of his majesty the great king Jitugha Vasmana, son of heaven, in the 6th month, 25th day, in this reign Sakhusa Sakha broke the seal. The seal was in Camu Prete. Water was provided. Witnesses there are the asgara Lyimsu and the monk Sevasena. When Casgeya brought somgha (=?) to the side of Ramaka, at that time the sothamgha Lýipeya broke the seal. At that time Sevasena borrowed water. Balasena cut off this water by force [...]. By Tamcgo the seal was broken [...] Lyimsu is witness.”²⁸

²⁸TDK#604.

Since June 2006, all new issues of *Sino-Platonic Papers* have been published electronically on the Web and are accessible to readers at no charge. Back issues are also being released periodically in e-editions, also free. For a complete catalog of *Sino-Platonic Papers*, with links to free issues, visit the *SPP* Web site.

www.sino-platonic.org