

Architectural Transmissions Across Central Asia: Contextualizing the Miran Squinch-Supported Dome

Susan WHITFIELD

Mapping cultural influences and differentiating them from independent development is often problematic and, in many cases, has to be left undecided with the acceptance that further evidence may emerge. The squinch-supported dome and the lanterndecke ceiling are cases in point. Both are found in different regions of Eurasia during the first millennium and simple narratives of intercultural transmissions fail to explain adequately their chronology and distribution. Here, in the first of two papers, I concentrate on the former and its appearance in eastern Central Asia.¹ I look at current scholarship to illustrate the issues with formulating a plausible narrative of transmission. This article is intended to raise questions and suggest ways forward rather than reach any conclusions, although I would argue that the most plausible hypothesis with the current evidence is that the squinch seen at Miran in eastern Central Asia is a case of architectural transmission from further west, most probably Bactria.

Keywords: Buddhism, architecture, dome, squinch, cultural transmission

Susan WHITFIELD (S.Whitfield@uea.ac.uk) is professor in Silk Road Studies, Sainsbury Institute for the Study of Japanese Arts and Cultures, at the University of East Anglia.

¹ Although the two forms sometimes intersect and so I will revisit the squinch in the following paper. For this intersection see Ignacio Arce García, “Un tipo inédito de trompas en la arquitectura omeya [An unpublished type of trompes in Umayyad architecture],” in *Actas del Tercer Congreso Nacional de Historia de la Construcción, Sevilla, 26–28 octubre 2000* [Proceedings of the third national congress on the history of construction, Seville, October 26–28, 2000], ed. A. Graciani, S. Huerta, E. Rabasa, and M. Tabales (Seville: Instituto Juan de Herrera, 2000).

The Squinch-Supported Domed Roof

Domes have been used in above and below-ground architecture in numerous places for thousands of years but before the first millennium CE, they were generally solid or small and made of light materials.² The challenge with a large open-domed ceiling above a walled room is supporting its weight. The obvious solution is to have a circular supporting wall as seen in the Round Hall at the Parthian site of Nisa (see map in fig. 1) so that the weight is distributed across the whole of the supporting wall. This probably had a mud-brick roof and is generally dated to the first century CE but possibly earlier.³ The other notable example is the Pantheon in Rome, probably built in the early second century, with a concrete roof supported by a brick wall with arches: the arch also helps to distribute weight to the floor.⁴ The architects of the Pantheon also reduced the weight of the dome by various methods including scooped-out sections, known as coffers, around the dome's base.

Much has been written about the evolution of such monumental domes and possible lines of transmission between cultures. Exchanges of this technology between the Parthian and Roman empires remain entirely speculative and it is probably fair to say that these are generally believed to be independent developments. But the case raises an issue that is pertinent to any discussion of the study of the Silk Roads: few scholars have extensive knowledge of more than one region and/or period and thus understanding fully and drawing conclusions about a region outside their expertise is often problematic. In many cases, scholars are not even aware of developments beyond their region. There is also inevitable, sometimes unintentional, bias with scholars of the Roman Empire, for example, assuming that it is the source of most developments, while those of the Parthian and Han empires often do the same. It might be thought that the availability of online resources and collaborative cross-regional studies should have mitigated this. It undoubtedly has but absorbing and contextualizing knowledge across cultures remains too daunting for many.

The use of the squinch in dome construction is a good case study for these problems. The squinch is a structural element that allows a square room to be built below the circular dome.⁵ Squinches are built into the transition stone of the dome to span the interior angle of each of the four walls transforming the circular cross-section closer to a square and

² I am using “dome” here to denote, as per the definition in John Fleming, Hugh Honour, and Nikolaus Pevsner, eds, *Dictionary of Architecture*, 4th ed. (Penguin Books, 1991), 126: “A vault of even curvature erected on a circular base. The section can be segmental, semicircular, pointed or bulbous.” But the ambiguity of the term is acknowledged.

³ Nicol Masturzo, “L’architettura della *Sala Rotonda* di Nisa Vecchia” [The architecture of the round hall of old Nisa], in *Nisa Partica. Ricerche nel complesso monumentale arsacide 1990–2006* [Parthian Nisa: Research in the Arsacid monumental complex 1990–2006], ed. Antonio Invernizzi and Carlo Lippolis (Florence: Le Lettere, 2008), 43–65. For a review article, which also considers the uncertainty of dating, see V. N. Pilipko, “Excavations of Staraia Nisa,” *Bulletin of the Asia Institute* 8 (1994): 101–16, <http://www.jstor.org/stable/24048768>.

⁴ Gene Waddell, *Creating the Pantheon: Design, Materials, and Construction* (L’Erma di Bretschneider, 2008).

⁵ A squinch is “a three-dimensional structure which transfers loads from the supporting drum or dome to the two intersecting walls or arches which it bridges diagonally and loads continuously” (D. Jones and G. Michell, “Squinches and Pendentives: Problems and Definitions,” *AARP* 1 (1972): 12).

so spreading the weight of the dome more evenly across the four walls. They appear in various forms, such as stepped arches, a funnel-like cone (the filposh squinch), or as a niche.⁶ There is probably consensus now that the earliest known squinches are found in Parthian and Sasanian architecture from the third century, including the filposh squinches from the Palace of Ardashir, built ca. 224 (figs. 2 and 3).

Several scholars argue that these surviving squinches are already advanced, suggesting an earlier developmental phase. For example, Dietrich Huff in his article in *Encyclopedia Iranica* claims “This most uncomplicated and solid of all constructive systems already appears fully developed in the buildings of Ardašīr I in Fīrūzābād.”⁷ But in an article on domes in the same publication, Bernard O’Kane interprets the construction differently: “Although the dome chambers at these sites are impressive in size, their conical squinches (arches across the corners of a cube, forming a zone of transition) are crude in design and execution...these chambers stood at the beginning of the series. There is no evidence of precursors.”⁸

Both scholars, however, agree that the support methods used for domed roofs in the Parthian/Sasanian and Roman/Byzantine worlds were probably developed independently and that the pendentive was most common in the latter. The pendentive transfers the weight of the domed roof to the ground through the triangular sections between arched walls (fig. 4). One of the earliest examples of the fully developed form is seen in Hagia Sophia in Istanbul, completed in 537. Simply put, squinches are built mainly into the dome to make its base more or less octagonal, thus distributing weight more evenly onto the square walls, while the pendentive is a curved part of the walls that creates a circular base for the roof.⁹ Confusion arises when a squinch is misidentified as a pendentive, as was the case with George Rawlinson (1812–1902) who noted the “unusual pendentives” of Ardashir as early as 1875.¹⁰ And, despite the evidence of Ardashir, it is still common to find the following assertion, which also seems to confound the squinch and pendentive: “The arched squinch that is often used in Byzantine architecture originally seems to have been developed, almost simultaneously, by

⁶ Gozari and Rabb identify four types, Filposh, Patkin, Sekonj, and Shouldered arches (Elaheh Golzari and Peter Rabb, “Earthen Squinches as a Sustainable Element in Iranian Architecture,” in *Kerpic’22: Re-Thinking Earthen Architecture for Sustainable Development, 9th International Conference Proceedings, June 30–July 3, 2022, Istanbul Medipol University*, Medipol University Press, 2022).

⁷ Dietrich Huff, “Architecture III: Sasanian Period,” *Encyclopaedia Iranica* 2, no. 3 (1986–2011): 329–334, <https://www.iranicaonline.org/articles/architecture-iii>. Also see Gholamhossein Memarian and Hadi Safaeipour, *Structure and Construction of Persian Vaults and Domes* (Goljam Publisher, The Institute of Islamic Art Studies, 2018), 385.

⁸ Bernard O’Kane, “Domes,” *Encyclopaedia Iranica* 7, no. 5 (1995–2013): 479–485. <https://iranicaonline.org/articles/domes>. This difference of opinion is discussed by Elaheh Golzari and Peter Rabb, “Revisiting the Geometry of the Transition Zone Using Squinches in Ardashir Palace,” *Építés-Építészetudomány* 50, no. 3–4 (2022): 351–364. <https://akjournals.com/view/journals/096/50/3-4/article-p351.xml>.

⁹ The clearest simple explanation I have found explaining their difference is Team Kaarwan, “Pendentives and Squinches Architecture: Comparative Analysis,” *Kaarwan Architecture*, 2024. <https://www.kaarwan.com/blogs/architecture/pendentives-squinches-architecture-comparative-analysis?id=569>.

¹⁰ George Rawlinson, *The Seven Great Monarchies of the Ancient Eastern World*, vol. 7, *The Sasanian or New Persian Empire* (Project Gutenberg, [1875] 2005), <https://www.gutenberg.org/ebooks/16167>.

the Roman builders of the late imperial period and the Sāsānians in Persia.”¹¹

There is also the unfortunate persistence of a certain “orientalism” in the discussion of the two forms, exemplified by Eeerson H. Swift who wrote, “...progressive architects in the West had already realized in the sixth century that the squinch, though strong enough in a structural sense, was far from satisfactory esthetically. In itself, the squinch is an ugly form, difficult to bring into harmony with the design of a reasonably large interior and always retaining something of its primitive makeshift character.”¹² The idea that the pendentive is somehow superior persists, seen in the often reproduced judgment that it “eliminates the blocky appearance of the squinch, providing a more refined look.”¹³

While, as noted above, the pendentive is widely found in Byzantine architecture, such as churches, the squinch-supported dome is seen in Sasanian elite and religious architecture—Zoroastrian shrines—and spread to Buddhist shrines in Bactria, probably from the fifth century; to the churches of the Caucasus seen from the seventh century; and to Islamic mosques and mortuary architecture, also from the seventh century. It also appears as a non-structural element in rock-cut Buddhist temples in Central Asia, such as Bamiyan and Haibak (Takht-e Rostam), and, further east, at sites such as Kizil and Dunhuang.¹⁴ Aside from its original development(s), the transmission of this technology presents areas still very much open to discussion. Here I note apparent “outliers” in eastern Central Asia and the continued lack of narratives to explain their appearance.

The Squinch in Eastern Central Asia

In 1906/7 and again in 1914, Aurel Stein (1862–1943) visited the site now known as Miran in the southeast of the Tarim Basin (fig. 1). It had previously been mapped by the Russian explorer Nikolai Prejevalsky in 1876.¹⁵ The American geographer, Ellsworth Huntington, had also traveled there in 1905. There remains a cluster of ruins, which were identified as Buddhist stupas, temples and a monastery, other buildings, possibly residential, and a fort. Stein was able to carry out a more detailed investigation of the site (fig. 5). He recorded four

¹¹ Britannica, The Editors of Encyclopaedia, “Squinch.” *Encyclopedia Britannica*, April 19, 2017, <https://www.britannica.com/technology/squinch>.

¹² E. H. Swift, *Roman Sources of Christian Art* (Columbia University Press, 1951), 105. And thanks for this reference to David Khoshtaria, “The Squinch in the Architecture of the Caucasus,” Paper presented for the symposium *Against Gravity: Building Practices in the Pre-Industrial World*, Center for Ancient Studies and the History of Art Department, University of Pennsylvania, Philadelphia, March 20-22, 2015, https://www.academia.edu/28711134/THE_SQUINCH_IN_THE_ARCHITECTURE_OF_THE_CAUCASUS.

¹³ This wording is found in several online courses on architecture, e.g., Harvard University, “History of Architecture.” <https://www.coursehero.com/file/217628208/HOA-PRELIM-REVIEWER-2NDpdf/>. This suggests a common source but I have not yet identified this.

¹⁴ See Takayasu Higuchi and Gina Barnes, “Bamiyan: Buddhist Cave Temples in Afghanistan.” *World Archaeology* 27, no. 2 (1995): 282–302, <http://www.jstor.org/stable/125086> and S. Mizuno, ed., *Haibak and Kashmir-Smast: Buddhist Cave Temples in Afghanistan and Pakistan Surveyed in 1960* (Kyoto University, 1962).

¹⁵ Nikolai Mikhailovich Przhevalsky, *From Kulja, across the Tian Shan to Lob-Nor* (Sampson Low, 1879).

buildings that had domed roofs, one of which was in the monastery, M.II. In this case, the roof had completely collapsed so its original form was conjectural.¹⁶ The others were partially collapsed but their form was clear. Two of them were in the western cluster of buildings and originally enclosed a small stupa (M.III. and M.V). All three of these buildings had thick brick supporting walls that, although square on the outside, were round on the inside and so could support the domed roof (fig. 5),¹⁷ The enclosed circumambulatory passages around the stupa were painted with murals. The fourth domed building, however, south of the fort, had square supporting walls and the clear remains of brick squinches to transfer the weight of the dome onto the square walls. Both the squinches and dome were made of burnt brick (M.X., fig. 6) and there were windows by the side of the squinches. As Stein notes: “The use of burnt bricks alone would suffice to make this small ruin remarkable at this site. But even more interest is to be found in...the use of the squinch...the insertion of windows... is also illustrated in what seems the earliest extant Persian use of the squinch, in the Palace of Sarvistān.”¹⁸

Stein therefore made the link between the use of the squinch to West Asia: the fifth-century Sasanian building with a squinch, the earlier Ardashir Palace, had not been recorded at this time.¹⁹ In his report, he briefly discusses the implications of this use of the squinch, referring to the works available to him. He concluded:

It is impossible for me here to follow up on the interesting questions which are raised by the connexion thus suggested between our circular shrines of Miran, with their counterparts in Gandhara...no safe answers to them can be hoped for until we have recovered, if possible in the shape of structural remains, more links of the chain which once stretched from Syria and Mesopotamia across the Pamirs. Nowhere is the likelihood of the discovery of such links greater than in ancient Bactria and the regions adjoining it, and once more I must give voice to my old wish that they may soon become accessible to archaeology research.²⁰

Although Bactria opened up for archaeological research soon after this with the creation in 1922 of La Délégation archéologique française en Afghanistan (DAFA), Stein was not to excavate there and he died in Kabul at the start of a proposed archaeological tour in 1942. French archaeologists, however, under the umbrella of DAFA carried out extensive

¹⁶ M. Aurel Stein, *Serindia* (Clarendon Press, 1921), 490. Hu Phuoc Le assumes the use of squinches (*Buddhist Architecture*, Grafikol, 2010), mistakenly referencing the temple as M.I., which is the id. given by Stein to the fort.

¹⁷ As Stein observes of M.II., “To my eye the remains, badly decayed as they were, clearly suggested one of those small domed temples, or Viharas, square outside and circular within, with which I had become familiar in the Swat Valley to Kashmir” (*Serindia*, 490).

¹⁸ Stein, *Serindia*, 535.

¹⁹ Jane Dieulafoy (1851–1916) had visited in 1881–2 and her illustration from the outside was included in her 1881–2 publication, *Persia, Chaldea, and Susiana* but the squinch was not shown. Robert Byron visited in 1934 and discussed the use of squinches at this site in his 1937 book, *The Road to Oxiana* (MacMillan and Co. Ltd).

²⁰ Stein, *Serindia*, 536.

excavations, first under the direction of DAFA Director, Alfred Foucher (1865–1952) (who, incidentally, had thwarted Stein’s earlier attempts to visit Afghanistan) and subsequent directors. Numerous Buddhist sites were identified from the first few centuries CE, both in the Bactrian region to the north—also including southern Uzbekistan and Tajikistan—and in the area around Kabul, often described as “Greater Gandhara.”²¹ Several contained the remains of domed buildings with squinches: for example at Kara Tepe, Bamiyan, and Hadda.²² Archaeologists from other countries joined their work from the late 1930s—Stein would have been among them if he had lived—and again from the 1960s. The more recent excavations at the Buddhist site of Mez Aynak near Kabul have also revealed domed buildings with squinches.

However, in his review of Buddhist architecture of the Greater Gandharan region to the south, Shoshin Kuwayama noted that he failed to find any surviving examples of the squinch in areas east of Jalalabad.²³ Jalalabad itself is west of the heart of Gandhara, which lies around Peshawar, Taxila, and the Swat Valley.²⁴ Kuwayama has also noted that baked bricks are rarely used in the Buddhist temples of Gandhara but he suggests that when they are used—such as at Monastery G at Dharamajika Stupa and Shah-ji-ki- Dheri main stupa in Taxila—their use indicates a later stage of building and indicates a period of prosperity.²⁵

The source and date of the transmission of the squinch into this region is also generally accepted: “This construction method is estimated to have originated from the architecture of the Sasanian Empire, and is thought to have been introduced to areas such as Bactria and the periphery of the Hindu Kush mountain range in the fifth century.”²⁶ Thus Fussman concludes from the squinches found in monastic buildings in Kara Tepe in Bactria that they are dated to the fifth or sixth century.²⁷ This assumes that squinch technology took two

²¹ For a useful map of the sites see Shumpei Iwai, “Buddhist Temples in Tukhārīstān and Their Relationships with Gandhāran Traditions,” in *The Global Connections of Gandhāran Art: Proceedings of the Third International Workshop of the Gandhāra Connections Project, University of Oxford, March 18–19, 2019*, ed. Wannaporn Rienjang and Peter Stewart (Archaeopress, 2020), fig 1.

²² For a convenient list see Warwick Ball, *Archaeological Gazetteer of Afghanistan: Revised Edition* (Oxford University Press, 2019).

²³ Shoshin Kuwayama, *Across the Hindukush of the First Millennium: A Collection of Papers* (Institute for Research in the Humanities, Kyoto University, 2002). Stein also compares the use of burnt bricks with the Sasanian palace near Sarvestan (*Serindia*, 535) dated to about 350 CE.

²⁴ “This is also the case with the construction of domes in the Peshawar plain and beyond as depicted on the ceilings of the chapels and the cells as well as the passages in Takht-e Bahi, Thareli, Ranighat, and other sites in Swat. No squinch-arches are found in these districts. The excavations at Tapa Shotor done subsequent to my first visit have shown that some of the corridors in the monastic quarter are covered with barrel-vaulted roofs, and this type of ceiling is known from another site in Jalalabad (Mizuno 1970: Pl. 32, Nos. 2 and 3). In the districts west of Jalalabad the dome supported with squinch-arches and the vault are usual device for ceilings. Hence Jalalabad can be thought of as the easternmost boundary of this architecture” (Kuwayama, *Across the Hindukush*, 93).

²⁵ Kuwayama, *Across the Hindukush*, 273.

²⁶ Rishshō Daigaku Uzubekisutan gakujutsu chōsatai 立正大学ウズベキスタン学術調査隊 [Rissho University Uzbekistan academic research group], ed., *Kara-tepe: Terumezu no Bukkyō iseki* カラ・テペ: テルメズの仏教遺跡 [Kara Tepe: Buddhist complex of Termez, 2014–2017] (Tokyo: Rokuichi Shobō, 2020), 230.

²⁷ Gérard Fussman with a contribution by Nicholas Sims-Williams and in collaboration with Eric Ollivier,

centuries or so to move from the Iranian plateau in West Asia into northern Central Asia but that it was not transmitted or not adopted in southern Central Asia. Given the links between the two regions, it is most unlikely that it was not known and reminds us that adoption of a new technology is a choice not a given, dependent on several factors, such as local building practices and materials.

If the squinch is not found in Gandhara and we discount independent evolution then, as Stein hypothesized, Bactria is the probable transmitter of the technology eastwards to the Tarim Basin. We might then expect to find the squinch used at other Taklamakan sites, especially those on the northern Tarim. Of course, many buildings are in ruins and whether they originally used squinches is difficult to say but the squinch is indeed known on the northern Tarim, both as a structural element and as a non-structural decorative form. Both are recorded by the German expeditions contemporary with Stein led by Albert Grünwedel and Albert von le Coq. Examples are clustered around Turfan and include several buildings at the city of Karakhoja/Kocho (figs. 7 and 8) and at the rock-cut Buddhist temple sites of Bezeklik, Toyuk, and Sengim.²⁸ They are not specifically discussed as structural elements by Grünwedel: as Caren Dreyer notes, he was more interested in the decorations found on the plaster covering these squinches in the cave temples.²⁹ Neil Schmid has also noted the widespread use of the squinch at rock-cut temples in the Tarim and those around Dunhuang. He has focussed on the significance of the use of the skeuomorphic squinch and proposes a Sasanian influence transmitted through Khotan.³⁰

The Khotan connection is interesting, especially given that the kingdoms of Shanshan—which at times incorporated Miran—and Khotan were, as noted below, the main powers on the southern route at the start of the millennium. The lack of early ruins in Khotan is frustrating and even where we might expect to find domed shrines, such as the Dandan Uliq site, the remains are too ruinous to conjecture their existence. The dating of all these structures, including Dandan Uliq, Kocho, and Dunhuang is generally accepted to be the second half of the first millennium.³¹ This would fit with the squinch being transmitted

“Catalogue des Inscriptions sur Poteries” [Catalogue of inscriptions on pottery], in *Monuments Bouddhiques de Termez* [Termez Buddhist monuments], 2 vols., ed. Shakirjan Pidaev, Tukhtash Annaev, and Gérard Fussman (Paris: Édition-Diffusion de Boccard, 2011).

²⁸ Ruin Beta J and I, Ruin O in the northeastern corner of the city, in ruin T north of U in Kocho and in stupa-like buildings outside the eastern city wall out of Kocho (Albert Grünwedel, *Bericht über Archäologische Arbeiten in Idikutschari und Umgebung im Winter 1902–1903* [Report on archaeological work in Idikutschari and surroundings in the winter of 1902–1903] (Munich: Verlag der K. Akademie der Wissenschaften, 1906), 11). Thanks to Caren Dreyer and Lilla Russell-Smith for this information and the image reproduced here. They are currently working on the architecture of Kocho. See Caren Dreyer and Ines Konczak-Nagel, “Architecture of the Great Monastery: Ruin B,” in *Ruins of Kocho: Wooden Architecture on the Ancient Silk Road*, ed. Lilla Russell-Smith and Ines Konczak-Nagel (2016), 69–80. Although this does not specifically mention the squinch.

²⁹ Dreyer, personal communication.

³⁰ Neil Schmid, personal communication: forthcoming article, “Dunhuang Caves and the Aesthetics of Scale,” based on a talk for the Buddhist Road project at Ruhr University Bochum on October 28, 2021.

³¹ Guiseppe Vignato, “Kocho Rammed Earth, Adobe, and a Little Timber,” in *The Ruins of Kocho: Traces of Wooden Architecture on the Ancient Silk Road*, ed. Lilla Russell-Smith and Ines Konczak-Nagel (Museum für Asiatische Kunst, Staatliche Museen zu Berlin, 2016), 81–88.

through Bactria, where its appearance is currently dated to the fifth century, and thence to the Taklamakan. Intriguingly, the Miran building is earlier than this on current dating. Can we be confident with the dating of Miran?

Dating Miran

The Buddhist ruins of Miran are usually attributed to the second–fifth centuries CE. The site is in the region of a kingdom that existed by the second century BCE, known as Krōrainā. Chinese histories record that the Xiongnu Empire of the steppe conquered this region in 176 BCE driving out the native Yuezhi population.³² In 108 BCE, the histories further record, the Han emperor Wudi sent troops to drive out the Xiongnu to open the routes westward. This was initially successful but the rulers of Krōrainā continued to play both sides against each other until 77 BCE when the Han ordered the killing of their king, the renaming of the kingdom as Shanshan, and the appointment of a new king with a Han imperial princess given as his wife. The king asked for imperial protection, in the form of a military presence, and it was granted with a garrison established at Yixun.

Two main towns are mentioned in the early historical accounts of this site: Yixun and Yuni. Stein concluded that the site now known as Charklick was the former and Miran the latter based on a sixth-century account, which records Yuni as “the eastern capital,”³³ however, Chinese scholars generally associate Miran with Yixun.³⁴ Excavations by the Xinjiang Archaeological Institute in 1989 discovered further remains consisting of residential buildings southeast of the fort on the bank of the river. Han coins and pottery supported the link with the empire to their east, however, Han influence waned with the death of their General, Ban Chao (21–102 CE), who had been based in Khotan. During this period, Krōrainā had been subsumed into the larger kingdom of Shanshan, whose territory also included the former independent kingdom of Cadota (Niya), which bordered Khotan. During the first century CE Shanshan and Khotan were recorded in Chinese histories as the two great kingdoms of the southern Tarim route.

When the pilgrim monk, Faxian, passed through this region in 400 CE he noted that the kingdom was Buddhist, following the Theravada or Hinayana school, and he estimated there to be 4000 monks. When did Buddhism first become established here? The narrative given by Eric Zürcher (1928–2008) is still widely accepted. He argued that the Tarim did not contain any significant Buddhist communities until the third century and played the part of a “neutral transit zone” in the transmission of Buddhism to China.³⁵ This argument, which has

³² The Yuezhi are hypothesized to be the peoples who, after fleeing west, were to establish the Kushan empire in the first century CE.

³³ Stein, *Serindia*, 324–6.

³⁴ See, for example, Wenbi Huang 黄文弼, *Xinjiang kaogu fajue baogao* 新疆考古发掘报告 [Report on archaeological excavations in Xinjiang] (Cultural Relics Publishing House, 1983), 50, 52.

³⁵ “The unanimous testimony of the archaeological data and the Chinese written sources leads us to conclude that

perpetuated the idea of the Tarim as a largely homogenous cultural desert with subsistence economies that only started to flourish after Chinese input, is still widely accepted.³⁶ It relies on the absence of evidence for both early Buddhist sites and for Tarim cultures being more than subsistence economies until the influx of Chinese. As I have argued elsewhere, I believe both of these conclusions are open to challenge and I am not alone in concluding that the Kushan Empire (first–fourth c. CE) was an important influence in this region, especially its adoption of Buddhism given the early Buddhist architecture of the Tarim, such as seen at Miran.³⁷

Song Yun, another pilgrim monk, arrived here in 519 and noted that it was now under the control of the Duyuhun (284–670). At this time the north China plains were controlled by the Northern Wei (386–535) with their western boundaries extending to this region. The Duyuhun and Northern Wei were allies at this time, both tracing their origins to the peoples of the steppe empire of the Xianbei (third c. BCE–third c. CE). Importantly, the Northern Wei rulers adopted Buddhism as their state religion and so it was during this period that Buddhism became firmly established in the north China plains. In 609, Emperor Yangdi of the Sui (581–618) in China is recorded to have driven out the Duyuhun from this region and established Shanshan and Qiemo but this was brief as Sui power was challenged with rebellions in central China from 616 and Shanshan returned to the Duyuhun. The Tang (618–907), who succeeded the Sui, sent troops to assert their control in 635 but this was again short-lived and, by this time, most scholars agree that the site of Miran was no longer occupied.

Xuanzang noted the abandonment of towns from Endere to Qiemo when he passed through in 644.³⁸ The Miran site is then generally believed to have been largely deserted in the sixth and seventh centuries until the armies of the Tibetan Empire (618–848) established a fort here in the eighth century to control the routes south through the mountains to the

at the time when Buddhism started to settle in China, in the first two centuries of our era, Serindia remained untouched by monastic Buddhism.” Eric Zürcher, *The Buddhist Conquest of China: The Spread and Adaptation of Buddhism in Early Medieval China* (Brill, 1990), 176.

³⁶ See, for example, Jason Neelis, *Early Buddhist Transmission and Trade Networks* (Brill, 2010), 289–313. Valerie Hansen’s argument that the later wealth of the Tarim came primarily from payment to Chinese soldiers stationed there also perpetuates this idea (*The Silk Road: A New History*, Yale University Press, 2015) and see my response to her hypothesis: “On the Silk Road: Trade in the Tarim,” in *Trade and Civilization: Economic Networks and Cultural Ties, from Prehistory to the Early Modern Era*, edited by Kristian Kristiansen, Thomas Lindkvist, and Janken Myrdal (Cambridge University Press, 2018).

³⁷ For a useful and clear discussion of Buddhism in neighbouring Cadota (Niya) at this time, see Valerie Hansen, “Religious Life in a Silk Road Community: Niya During the Third and Fourth Centuries,” in *Religion and Chinese Society*, edited by John Lagerwey (The Chinese University of Hong Kong Press, 2004), vol. 1, 279–315. She argues that the Buddhist monks married and did not necessarily live as a separate community: the absence of monastic remains does not indicate the lack of Buddhism, just a different practice of the time and place. See also Sam van Schaik, “Married Monks: Buddhist Ideals and Practice in Kroraina,” *South Asian Studies* 30, no. 2 (2014): 292–72, <https://doi.org/10.1080/02666030.2014.962322>.

³⁸ “It has long been deserted and its walled towns were all in ruins.” Xuanzang, *Da Tang Xiyuji* 大唐西域記 [Buddhist records of the Western world], 2 vols., trans. Samuel Beal (reprint in 1 vol., Oriental Books Reprint Corporation, [1884] 1969), 325.

Tibetan plateau, where they reused the site of an old walled city.³⁹ By this time Buddhism was their official religion and Miran was largely abandoned again after the Tibetans withdrew in the ninth century. Although the broad chronology is clear, there remain discrepancies and disagreements, including over the *terminus ante quem* of the Buddhist buildings. So while most often dated to the second–fourth centuries, others see building continuing into the fifth century before the site’s first abandonment.⁴⁰ There is also the possibility that some buildings were repurposed or rebuilt during the Tibetan period. There is, I would argue, sufficient uncertainty about the *terminus post quem* of the Buddhist structures to support keeping a more open mind about this until other data become available.

Nevertheless, there are several factors that provide evidence for dating the buildings.⁴¹ Stein dates M.II.—the temple which might originally have had a domed roof supported by squinches—on the basis of the style of the architectural decorations and the sculptural remains, along with the discovery in the ruins of a Sanskrit palm-leaf *pothi* in Brahmi script, which he argues cannot be later than the fourth–fifth century. Stein also reported that the two stupas with domed roofs (M.III. and M.V.) had circular bases and contained wall paintings on the stupa base and the enclosing circular walls.⁴² But, as more recent excavations have shown, M.III. is, in fact, on a square platform.⁴³ Other stupa at the site, such as M.IV and M.VI, are also on rectangular or square platforms, the use of which is known from the 1st century CE further west, such as at Saidu Sharif, and became the more common form over the following centuries.⁴⁴

Anna Filligenzi’s argument that the paintings of M.III. are based on the model of the frieze at Saidu Sharif I, which she dates to ca. 25–50 CE, is convincing and suggests a close link between the two sites: although she does not dispute the third to fourth-century dating of M.III. Zhou Ding and Chen Jingjing’s argument that aspects of the mural show influence from the north China plains, that is of a Han-dynasty flying immortal, is an example of the

³⁹ See the brief report of the 2012 excavations Zhongguo wenwubao xinxi 中国文物报消息 [China cultural relics news], *Xinjiang Ruoqiang Milan yizhi kaogu fajue xin shoubuo* 新疆若羌米兰遗址考古发掘新收获 [New discoveries from archaeological excavations at the Milan site in Ruoqiang, Xinjiang], *Bianjiang kaogu liulan cishu* 边疆考古 浏览次数 685 (2023). They do not propose a dating for the older walled city but, given the historical records we can hypothesize that it’s *terminus ante quem* was earlier than the sixth century or earlier. Its *terminus post quem* is more relevant here, given the reports in the Chinese histories of existing walled cities when they the Han moved into the region and the excavation by a Sino-French team of an Iron age walled city, Djoumboulak Koum, west of Miran. See Corinne Debaine-Francfort and Abduressul Idriss, *Keriya : mémoires d'un fleuve. Archéologie et civilisation des oasis du Taklamakan* [Keriya: Memories of a river archaeology and civilization of the oases of the Taklamakan] (Éd. Findakly, Fondation EDF, 2001).

⁴⁰ For example, Folke Bergman dates two temples as fifth century (*Archaeological Researches in Sinkiang, Especially the Lop-Nor Region*, Bokförlags aktiebolaget Thule, 1939).

⁴¹ I hope to work with colleagues on this material in the near future.

⁴² Miran stupa M.II. was also within a square building with a roof, but the roof had collapsed. Stein hypothesizes that the roof was domed and used squinches, which Le (*Buddhist Architecture*, 2010) repeats as a certainty.

⁴³ See Zhongguo wenwubao xinxi. For a translation see <https://mongolschinaandthesilkroad.blogspot.com/2013/06/new-excavations-in-miran.html>.

⁴⁴ See Takayasu Higuchi and Gina Barnes, “Bamiyan: Buddhist Cave Temples in Afghanistan,” *World Archaeology* 27, no. 2 (1995): 282–302, <http://www.jstor.org/stable/125086>.

increasingly prevalent Chinese historiographical narrative discussed below.⁴⁵

The artists of Miran (whatever their provenance) did not simply look to generic Gandharan models, but worked with certain particular examples before their eyes... perpetuating the memory of Gandhara's almost totally lost painting at another time and in another place, offers us a possible image of it, as the same time reflecting the fame that one of Swat's finest works must have enjoyed in the Buddhist world around it, and that proved far longer lasting than the brief artistic season that produced it.⁴⁶

The Buddhist world she is describing therefore encompasses Gandhara and the Tarim, with the influence moving from the former to the latter, both in style of architecture and art. This, I would argue, continues to be a plausible narrative for the architecture of the southern Tarim over the following centuries, exemplified by the use of the cruciform style for the stupa at Rawak in Khotan, soon after its appearance further west.⁴⁷ This, for me, raises the question of how far this influence moved: that is, even though there might be no traces left, is it unreasonable to hypothesize that there were domed temples containing stupa in China under the Northern Wei?⁴⁸ Although Rawak is clear evidence in the early period of influence from Gandhara—where no squinches have been found—to the southern Tarim, since no squinches are found in Gandhara it does not, alas, help with our narrative of transmission.

Material was found in both the extant domed Miran temples, which could be scientifically dated, notably textiles and, in M.III., wood with pigments in the form of the capital of a small column (The British Museum: MAS.628). One of the textiles from M.V. included prayers written in Prakrit in *keharosthi* script (The British Library, Or.8212/190). This script is only found in Gandhara up to around the third century and is attested in the Tarim up to the fourth century.⁴⁹ It is, of course, possible, that it continued to be used in the Tarim for longer, as some scholars have suggested.⁵⁰ The textile from M.V. was found between the dome of the stupa and the collapsed roof. This strongly suggests that this stupa temple was not repaired after it fell into ruin.

Yet the squinch ruin of M.X, just south of the fort, shows signs of repair and reuse as

⁴⁵ Ding Zhou 周鼎 and Jingjing Chen 陈晶晶, "Dong 'yuan' xi 'liu'—gulou lanshan diqu milan yizhi fosi yixiang yuanliu yanjiu" 东“源”西“流”——古楼兰鄯善地区米兰遗址佛寺翼像源流研究, *Xinjiang yishu xueyuan xuebao* 新疆艺术学院学报 4, no. 9 (2011): 14–23.

⁴⁶ Anna Filigenzi, "From Saidu Sharif to Miran," *Indologica Taurinensia: The Journal of the International Association of Sanskrit Studies* 32 (2006): 78.

⁴⁷ Often cited as a model is the stupa of Shah-ji-ki-Dheri near Peshawar, which dates from ca. 3–4th centuries under the Kushan.

⁴⁸ Steinhardt has, of course, considered the early Buddhist architecture of northern China and, while she does not go so far as to conclude that there might have been domed stupa.

⁴⁹ Brough dates documents from Cadota (Niya) up to 325. John Brough, "Comments on Third-Century Shan-shan and the History of Buddhism," *Bulletin of the School of Oriental and African Studies* 28 (1965): 582–612.

⁵⁰ Enoki originally dated some of these texts to later but, in his 1961 article, revises his conclusions and agrees with Stein's dating of up to fourth century ("The Location of the Capital of Loulan and the Date of the Kharosthi Inscription," *Memoirs of the Research Department of the Toyo Bunko* 22 (1961): 125–71).

Christa Paula has noted: “The whole edifice had apparently been rebuilt several times and, with it, its function must have changed. Originally it may have been of a Buddhist nature; later a site for smelting metal was attached to it, producing arrows for the soldiers of the Tibetan fort.”⁵¹ The size and domed roof suggest that M.X. was originally a Buddhist shrine but it is too ruinous to indicate whether it originally held a statue or a stupa (see fig. 6). Li Lin interestingly compares the domed halls of M.III and M.V to the Round Hall of Nisa but does not mention the squinch in M.X.⁵² She groups M.X. with the domed stupas and M.III. and M.V. as belonging to a first phase of building starting in the second century. She includes the monastery and most of the other buildings in a second, fourth–fifth century, phase.

Meanwhile, Stein only found three items in this ruin: a pottery fragment, some dyed woolen fragments in twill weave, and a piece of plain-woven silk, which he suggested might have been used as a girdle.⁵³

Contextualizing the Miran Squinches

Wherever the squinch building is placed in the Miran chronology, it is early enough to attract curiosity, only reinforced by its apparent singularity in the southern Tarim—and in the northern Tarim if we place it in the fifth century or earlier. Placing it in the Tibetan period would fit more readily with the use of the squinch in Kocho but it would still remain an anomaly. In both scenarios, it is worthy of comment that, since Stein, the question of its transmission has not been discussed in any detail.⁵⁴ In her monumental work, Marylin Rhie concentrates on the stupa and paintings in M.III. and M.V. and suggests these stupa forms were influenced by second and third-century western Central Asia, namely “model *stupas* of Taxila...*stūpa* shrines in Swat...and with the parabolic dome style seen in Kara-tepe (near Termez, Uzbekistan) and Kashgar.”⁵⁵ She also describes M.X. and its use of the squinch and burnt bricks, following Stein, and mentions that the use of the squinch in the Bamiyan caves

⁵¹ Christa Paula, *The Road to Miran* (Flamingo, 1994), 235. Paula’s book does not give references and I have not managed to track down the source for the identification of the metal smelting workshop. Higuchi and Barnes (*Bamiyan*, 283) note M.X. as belonging to the “secular site” and, although they do not explain what they mean by this, they could be referring to the Tibetan period (despite the fact that the Tibetans were Buddhist). However, the domed roof suggests that it was originally built as a shrine.

⁵² Li Lin 林立, “Milan fosi kao” 米兰佛寺考 [A study of Miran Buddhist temples], *Kaogu yu wenwu* 考古与文物 3 (2003): 47–55. And since she suggests that the building was originally a lecture hall—very unlikely given its size—it is possible there is confusion over identification.

⁵³ The wool fragment and silk are at the V&A (Stein Loan 257 and 276). The sherd is at the British Museum (1928, 1022.8). I would suggest that the silk could also have been used as a wrapping cloth for some precious item and hope to investigate it further.

⁵⁴ Apologies to anyone who might have written on this and who I have missed: I would love to hear from you. I also cannot say that I have read everything written in Chinese on this site, although I have tried to review the major publications.

⁵⁵ Marylin Martin Rhie, *Early Buddhist Art of China and Central Asia*, vol. 1, *Later Han, Three Kingdoms, and Western Chin in China and Bactria to Shan-shan in Central Asia* (Brill, 1999), 375.

might be third–fourth century, earlier than that accepted by most scholars.⁵⁶ Furthermore, Huu Phuoc Le has suggested a link between the domed stupa buildings, M.III. and M.V., and Indian *caityagriha* and noted similar structures in Kocho but does not discuss M.X.⁵⁷ Nancy Steinhardt also discusses Miran without mentioning the squinch.⁵⁸ A problem with these accounts is that they generally approach the architecture of the Tarim from the “Chinese” perspective, even when mentioning influences from Gandhara/Bactria/India.⁵⁹ There is a need for the Tarim region to become a distinct area of study as exemplified by the work of scholars such as Guiseppe Vignato and others cited above.⁶⁰

But the question remains: even if we accept the transmission from Sassania through Bactria—with the examples at Bamiyan and Kara-Tepe—to the Tarim, why do we not see more structures in the Tarim with squinches? Their use in rock-cut temples suggests that they were known and, given the ruinous state of most structures, it is probably reasonable to conclude that more domed buildings existed—probably in both the northern and southern Tarim—but have been ruined or rebuilt. And perhaps not all were Buddhist: we also know there were Zoroastrian communities living here and, indeed, further east in Chang’an where there was a Zoroastrian temple. Extant fire temples further west are often domed with squinches and the possible link between Zoroastrian and Buddhist shrine architecture has been discussed by several scholars.⁶¹ The evolution from the domed stupa on square platforms to the multi-storied towered form and thence, in East Asia, to the wooden pagoda form, is generally accepted.⁶² Nevertheless, during the early Northern Wei period the domed

⁵⁶ The rock-cut temples at Bamiyan are generally dated to the 4th–7th centuries, with Klimberg-Salter proposing a later date for most activity during the 7th–9th centuries. See Deborah Klimberg-Salter, *The Kingdom of Bamiyan: The Buddhist Art and Culture of the Hindu Kush* (Naples-Rome: Istituto Uversitario Orientale & IsMEO, 1989), 12–17 for a discussion. In their discussion of Bamiyan, Higuchi and Barnes also mention the squinch in Miran and Kucha but do not expand (“Bamiyan,” 283).

⁵⁷ Le, *Buddhist Architecture*, 119.

⁵⁸ Nancy Shatzman Steinhardt, “5. The Fifth Century Architecture for Barbarian Dynasties,” in *Chinese Architecture in an Age of Turmoil, 200–600*, ed. Ronald G. Knapp and Xing Ruan (University of Hawaii Press, 2014), 38, <https://doi.org/10.1515/9780824838232-009>.

⁵⁹ Steinhardt’s chapter title: “The Fifth Century Architecture for Barbarian Dynasties” reinforces the occidentalist narrative often found in works on “China” and gives misleading ideas that this was a region that was part of “China.”

⁶⁰ For example, Vignato’s article on the wooden structure at the rock-cut temples of Kizil where he concludes: “The considerations based on the study of wooden structures complementing the caves of Kizil have been largely overlooked, with the result that the knowledge of the kind of Buddhism that lived in Kizil, based almost exclusively on incomplete iconographical and stylistic data and fragmentary written documentation, has not improved much over the course of time. In the context of this topic I have offered some new elements useful to the continuation of the study of Buddhism in Kizil. And previously argued by myself” (Guiseppe Vignato, “The Wooden Architecture of the Kizil Caves,” *Journal of Inner Asian Art and Archaeology* 1 (2006): 19).

⁶¹ See Yumiko Yamamoto, “The Zoroastrian Temple Cult of Fire in Archaeology and Literature (I),” *ORIENT* 15 (1979): 19–53 and, more recently, Young-Jae Kim and Dong-Soo Han, “Evolution, Transformation, and Representation in Buddhist Architecture—The Square Shrines of Buddhist Monasteries in Central Asia after the Fourth Century,” *Architectural Research* 13, no. 4 (2011): 31–42, 10.5659/AIKAR.2011.13.4.31.

⁶² Heinrich G. Franz, “Pagode, stūpa, turmtempel: untersuchungen zum ursprung der pagoda” [Pagoda, stūpa, tower temple: Studies on the origin of the pagoda], *Kunst Des Orients* 3 (1959): 14–28 and see Le, *Buddhist Architecture*.

form was still predominant in the Tarim and, as Steinhardt notes, in the *History of the Wei (Weishu)* describing early Buddhist architecture, “The architectural system was expanded from old Indian models...”⁶³ Even if monumental stupa funded by patrons started developing different forms, might not the north China plains around the fifth century have been dotted with small traditional domed stupa and even possibly domed shrines at this time, long destroyed or rebuilt beyond recognition?

Domes in the Central Chinese Plains and Beyond?

An increasing issue in studying the cultural transmission of the arts and architecture of the Silk Road kingdoms of Central Asia is that many of them were occupied by the Qing Empire (1644–1911) and were incorporated into the modern territory of the People’s Republic of China (PRC). The region is therefore primarily studied by scholars of China. In addition, although a narrative of diversity was previously encouraged by the PRC, in recent years this has been replaced by one of a unity of peoples and cultures within the imperial lands: the extreme of which is the argument that everyone within these lands is originally “Han” and therefore it is erroneous to consider regions such as Tibet, Mongolia, or Xinjiang as colonial appropriations.⁶⁴ There is also the increasing prevalence of “China” being the inventors of not just clearly evidenced technologies such as silk and gunpowder but much else. The conclusion, seen in a recent appraisal of the Buddhist architecture of Miran, is typical: “Under the leadership of the central government, the architectural remains of the Miran site have obvious cultural characteristics of construction in the Central Plains, showing its multicultural connotation of integrating the East and the West under the unified pattern.”⁶⁵

There are two obvious methods of denying external cultural influence: first, to appropriate any examples as a development that occurred prior or, at least, independently in the homeland and, if there was any cultural influence, it was in the direction of the homeland to the other; the second is to destroy the evidence. Both are used by the PRC today. The former is exemplified by the conclusion above and, more extremely, by the interpretation of tombs recently excavated within PRC territory and identified as Zoroastrian: “All the

⁶³ Kim and Han, “Evolution, Transformation, and Representation,” 30.

⁶⁴ For further discussion see Susan Whitfield, “Silk Road Narratives in East Asia: Cultural Heritage, Cultural Propaganda, and Cultural Erasure,” in *Asia’s Heritage Trend: Examining Asia’s Present Through its Past*, ed. Jong-Il Kim and Minjae Zoh (London: Routledge, 2023). For a recent example relating to Miran, see Fei Li’s 李飞 paper which concludes “Miran site is a well-conserved site of the Han and Tang dynasties culture on the ancient Silk Road. The remains one fort, thirteen pagodas, three Buddhist temples and two beacon towers, were built by rammed earth or adobe” (“Xinjiang Milan tu jianzhu yizhi de fenghua naijiuxing yanjiu” 新疆米兰土建筑遗址的风化耐久性研究 [Weathering durability of Milan ancient earthen architecture in Xinjiang] (Master’s thesis, Lanzhou University, 2015), 1–53). This is misleading and, in the case of the building materials, omits to mention the brickwork.

⁶⁵ Jing Wu 武晶 and Liu Qin 刘琴, “Xinjiang Milan yizhi de wenwu jiazhi yu Han Tang jianzhu yicun tanjiu” 新疆米兰遗址的文物价值与汉唐建筑遗存探究 [Research on the cultural relic value and architectural remains from Han to Tang dynasties at Milan site in Xinjiang], *Gujian yuanlin jishu* 古建园林技术 3 (2023): 116.

evidence leads to one conclusion: Zoroastrianism originated in the east on China's Pamir Plateau...it's a logical conclusion that the origin of the religion is here, not in Persia."⁶⁶

Either of these methods would be difficult to argue in the case of domes and squinches given their lack in East Asia in above-ground free-standing architecture in the pre-Islamic period.⁶⁷ Their use in rock-cut Buddhist temples, however, suggests that, at some point, free-standing models were emulated even, as Schmid discusses, the squinch transforms into a skeuomorphic element. The dome of the eighth-century Seokguram stone temple in Gyeongju, South Korea is a rare example of its movement further east. It has been discussed by Pierre Cambon who concludes, rather enigmatically: "It is a true Korean creation, even if it is also an echo, or an adaptation, of a model in the West, and through India."⁶⁸ Given the links between Buddhists in Silla Korea and Tang China and their known pilgrimages, some of which would have incorporated visits to rock-cut temples, its existence is certainly explicable. The relevant question might be why are there not more?

Domes, of course, are seen later in parts of the China plains and coast with the growth of Muslim communities, through conversion and arrival by land and sea, and their construction of mosques, some undoubtedly in the West-Asian style. Their evolution and architectural "sinification" have been the subject of many papers that I will not discuss here but in the rebuilding, destruction, and repurposing of the tens of thousands of mosques throughout the PRC's empire in recent times, the dome and minarets are the elements that are almost always removed, even if the building continues to be used, nominally, as a mosque or is repurposed as a secular space.⁶⁹ The dome, as it appeared across the Silk Roads, is too alien to be appropriated. Indeed, in the discussions of the domes of the wooden *zaojing* and the Temple of Heaven, these are presented as separate and unique developments of Chinese civilization: there is no influence from outside.⁷⁰

⁶⁶ Wu Xinhua, Xinjiang Director, Archaeological Inst, Chinese Academy of Social Sciences, 2014 quoted in "Archaeologists Uncover Zoroastrian Links in Northwest China," *Dr. Kaveh Farrokh*, January 18, 2024, <https://www.kavehfarrokh.com/uncategorized/archaeologists-uncover-zoroastrian-links-in-northwest-china/>.

⁶⁷ They exist across the region in tomb chambers: I will discuss this further in my following paper on the lanterndecked ceiling.

⁶⁸ Pierre Cambon, "Dome Architecture in Ancient Asian Art and Seokguram Grottoes: In Comparison with Western Dome Constructions," *Misulsabak yŏn'gu* 美術史學研究 313 (2022): 155–70, <http://dx.doi.org/10.31065/kjah.313.202203.006>.

⁶⁹ In 2014, there were almost 40,000 mosques in the PRC territory, the majority of them in Xinjiang. A 2023 study of 2312 domed mosques found that at least 1714 of them had been altered, repurposed, or destroyed. A report in 2024 argued that the dome had been removed from the last "Arabic-style mosque," i.e., with domes and a minaret (FP Staff, "'Sinification of Islam': China's Major Arabic-Style Mosque Loses Its Domes, Minarets, and Crescent Moon," *Firstpost*, May 26, 2024, <https://www.firstpost.com/world/sinification-of-islam-chinas-major-arabic-style-mosque-loses-its-domes-minarets-crescent-moon-13775195.html>).

⁷⁰ See J. Ye and C. Fivet, "The Zaojing: Review of a Unique Wooden Construction Typology," *International Journal of the Construction History Society* 35, no. 1 (1990): 23–49, DOI: 10.5281/zenodo.3941502.



Figure 1. Map showing Ardashir, Jalalabad, Kara-tepe, Khotan, Kocho, Mez Aynak, Miran, Nisa, and Gyeongju.



Figure 2. Ardashir Palace. Courtesy of the Madain Project:
https://madainproject.com/palace_of_ardashir.



Figure 3. A squinch at Ardashir Palace. Photograph by Aliparsa at Wikipedia Commons: <https://commons.wikimedia.org/wiki/File:Squinch.jpg>.

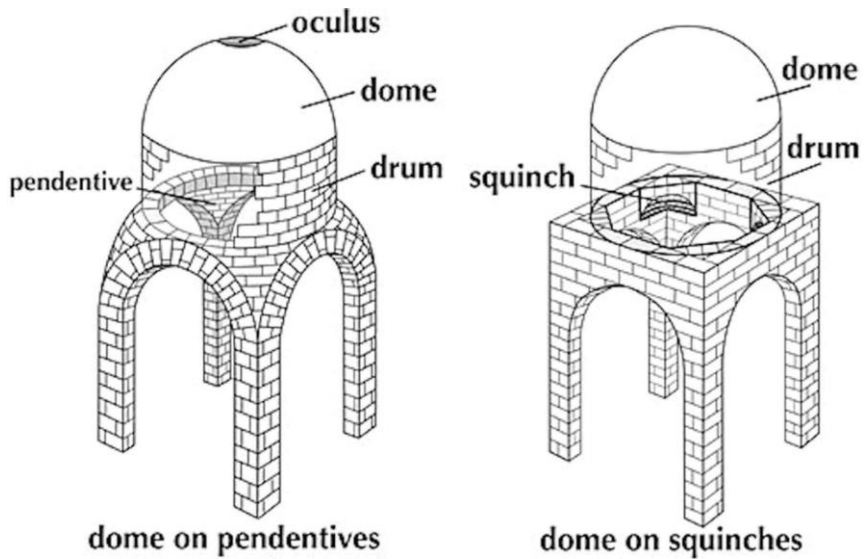


Figure 4. Diagrams illustrating the squinch and pendentive systems for distributing the weight of a dome. Image from Team Kaarwan, “Pendentives and Squinches.”

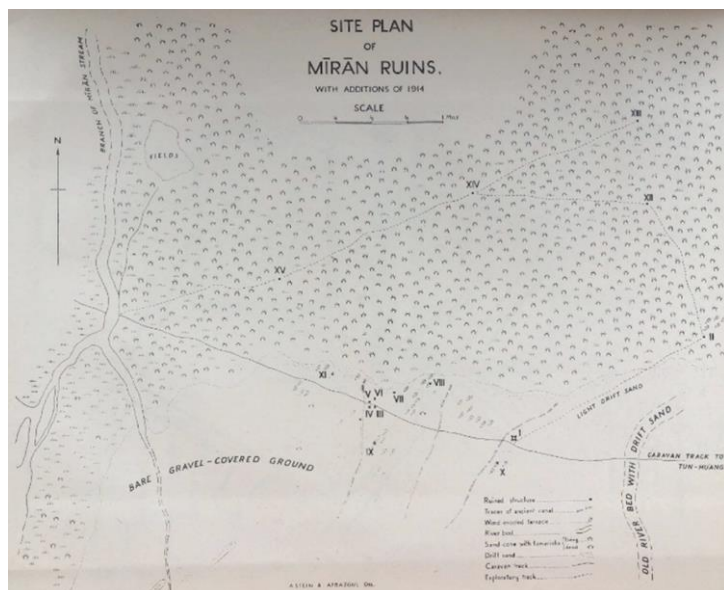


Figure 5. Plan of the ruins of Mīrān, according to Aurel Stein and Afrazgul Khan, 1914.



Figure 6. Detail of Miran ruin M.X. with Mulla Aka M. Photograph by Aurel Stein, February 9, 1907, the British Library, photograph 392/26 (253).



Figure 7. A detail of Kocho ruin B in 1902/3, captioned view from the southwestern corner of the courtyard to Hall 1. Photograph by George Huth, Museum für Asiatische Kunst, Stiftung Preußischer Kulturbesitz.



Figure 8. The southwest part of Kocho today with rebuilt hall (left). Photograph by Zossolino at Wikipedia Commons, CC by SA 4.0: [https://commons.m.wikimedia.org/wiki/File:2015-09-17-102307_-_Ruinenst%C3%A4tte_Gaochang_\(Kocho\)_S%C3%BCDwestlicher_grosser_Buddhatempel.jpg](https://commons.m.wikimedia.org/wiki/File:2015-09-17-102307_-_Ruinenst%C3%A4tte_Gaochang_(Kocho)_S%C3%BCDwestlicher_grosser_Buddhatempel.jpg).

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