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Study on the east gate and the layout of the platform buildings at the Shalz uul 1 site

Abstract. This paper presents the results of archaeological surveys conducted at the Shalz Uul 1 site in Dornod Province, Mongolia, near the northeastern frontier of the Uyghur Khaganate. Excavations carried out between 2018 and 2024 revealed a highly standardised architectural complex comprising two central foundation platforms connected by an eaves corridor, forming an ‘H’-shaped layout. This configuration closely resembles those found at prominent Uyghur sites such as Khar Balgas and Por-Bajin, indicating the high status of the Shalz Uul 1 site. A uniquely constructed gate structure featuring well-frame-shaped ground beams was identified at the eastern entrance, marking the first known example of this type in the region. The architectural design and the roof tiles, based on typological analysis, suggest that the site dates to the early phase of the Uyghur Khaganate. However, radiocarbon dating of wooden components from the gate yielded earlier dates, which may indicate the reuse of older materials. The precise cause of this discrepancy remains unresolved. The absence of domestic artefacts from the central structures implies that the site was not used for residential purposes, but rather functioned as a ceremonial or administrative center. The site’s standardised layout, architectural sophistication, and strategic location on the border support the interpretation that it was a high-ranking regional facility intended to assert Uyghur authority over the Shiwei inhabiting the northeastern periphery of the Khaganate.

Keywords. *Walled complex, Turkic Khaganate, Uyghur Khaganate*

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Шалз уулын шороон хэрэм-1 дурсгалын хэрмийн зүүн хаалга болон төв барилгын туурийн бүтэц, зохион байгуулалтын судалгаа

Хураангуй. Энэхүү өгүүлэлд Дорнод аймгийн Баяндун сумын нутаг, Улз голын хөндийд орших Шалз уулын шороон хэрэм-1 дурсгалд хийсэн археологийн малтлага судалгааны үр дүнг танилцуулж байна. Тус дурсгал Уйгурын хаант улсын зүүн хойд хилийн бүс нутгаас олдсон нь судалгааны өндөр ач холбогдолтой билээ.

Судалгааны баг 2018–2024 он хүртэл шороон хэрмийн төв хэсэгт байх хоёр барилгын тууринд малтлага судалгааг хийсэн юм. Судалгааны үр дүнд энэхүү хоёр барилгын туурийг холбосон “Н” хэлбэрийн хүзүүвчээр

холбогдсон шаллагаа бүхий өндөр зэрэглэлийн ордны үлдэгдэл байсан бололтой. Энэхүү хэрмийн зохион байгуулалт бол Уйгурын нийслэл Хар балгас, Пор-Бажын зэрэг алдартай дурсгалын зохион байгуулалттай төстэй байгаа зэргээс үзвэл өндөр зэрэглэлийн орд харш байсныг илтгэж байна. Шороон хэрмийн зүүн талд байх хаалганы хэсэгт том модоор зангидаж хийсэн суурь дам нуруутай өвөрмөц хийц бүхий хаалганы бүтэц илэрсэн нь тухайн бүс нутагт анх удаа илэрч байгаа жишээ юм. Барилга архитектурын төлөвлөлт, дээврийн ваарын харьцуулсан ангилал зүйн судалгаа зэргийг үндэслэн үзвэл Уйгарын хаант улсын эхэн үед хамаарах бололтой. Гэвч хаалганы модны хэсгээс авсан нүүрстөрөгчийн (C^{14}) он цагийн судалгааны үр дүн илүү эртний үеийг зааж байгаа нь хуучин модыг дахин ашиглагдсан байж болзошгүй. Одоогоор нарийвчлан тодорхойлох үр дүнд хараахан гараагүй тул цаашдын судалгааг хүлээх шаардлагатай юм.

Төв барилгын тууриас ахуйн хэрэглээний эд өлгийн зүйл илрээгүй учир хүн байнга амьдардаг орд өргөө гэхээс илүүтэй ёслолын эсвэл засаг захиргааны төвийн үүрэгтэй байсан болов уу. Нэгдсэн зохион байгуулалт, архитектурын өндөр төвшин, стратегийн байршил зэргийг харгалзан үзвэл Уйгурын хаант улсын эхэн үеийн зүүн хойд, зүүн хил орчмын Шивэй, Татар аймгуудыг хянах зорилготой нутгийн захиргааны төв байж болзошгүй хэмээн урьдчилсан байдлаар таамаглаж байна.

Түлхүүр үг. *Шороон хэрэм, Түрэг, Уйгур*

1. Introduction

The The Shalz Uul (Шалз уул) 1 site is located on the south bank of the Ulz (Улз) River, in Bayandun District, Dornod Province, Mongolia (N49°23'43.24" E113°37'34.11"). It lies on the northeastern border of present-day Mongolia, which also formed the frontier of states that emerged on the Mongolian Plateau during ancient and medieval times (Fig. 1). This area is not only a border region but also a significant zone for understanding the historical development of Northeast Asia, as it is adjacent to the birthplace of the Tuobo Xianbei (拓跋鮮卑), founders of the Northern Wei dynasty, and the Mengwu Shiwei (蒙兀室韋), regarded as the putative ancestors of the Mongolian people.

Despite its importance, no archaeological investigations had previously been conducted in this area. The Shalz Uul 1 site was only recently discovered, and excavations have been underway since 2018, initially focusing on the foundation platform at the center of the site to reconstruct its structure and overall layout. Based on a typological study of the excavated roof tiles and the architectural configuration of the ruins, the site is interpreted as the remains of a local government office established along the northeastern border during the early phase of the Uyghur Khaganate to exert control over the Shiwei (Kiyama et al. 2020).

2. Site Description and Spatial Context

The Shalz uul 1 site is a rectangular complex surrounded by earthworks measuring approximately 30–50 cm in height. It is 105 m long from east to west and 70 m wide from north to south (see Fig. 2). The walled complex has two foundation platforms in the south-western area and an inner wall in the north-eastern corner. A room divided by earthworks is attached to the south-west outer wall. Around 490 m west of the Shalz Uul 1 site lies a square-shaped mound measuring 40 m per side and oriented in a north-east to south-west direction. This feature, named

Shalz Uul 3, is undated and lacks associated artefacts, but is interpreted as part of the same site complex, as shown below. Furthermore, approximately 280 m west of the site is a low hill known as Shalz Uul ('Red Hill'), which gives the site its name. On top of the hill are the remains of a stone-built foundation and a scattering of flat roof tiles from the same period as the Shalz Uul 1 site. The linear alignment of these three components — Shalz Uul 1, 3 and the hilltop structure — suggests contemporaneity and functional interrelation within a broader spatial scheme (Fig. 3).

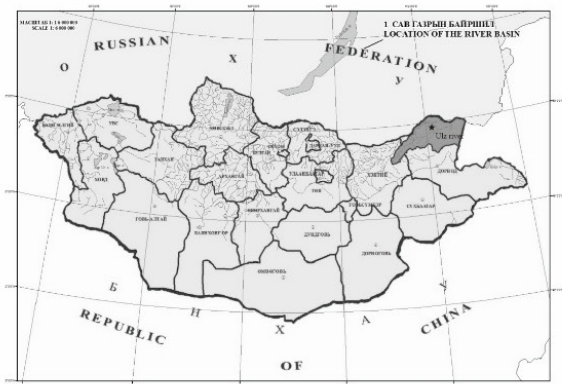
3. Excavation Methodology and Results

So far, we have surveyed the Foundation Platform 1 (SB01), the east gate (SB03), the eaves corridor (SB04), and the Foundation Platform 2 (SB02).

Foundation Platform 1 (SB01): surveyed in 2018 and 2019 (Photo 1)

The top of the platform had been severely disturbed and the foundation stones that were exposed on the surface were no longer in their original positions. The platform's dimensions are 15.6 m from north to south (frontage) and 14.1 m from east to west (depth). According to the Tang scale (唐尺), where 1 chi (尺) equals 29.6 cm, these measurements are 52 *chi* and 47 *chi* respectively, forming an almost square shape.

On the east side, there is a 3.6 m (12 *chi*) wide and 2.4 m (8 *chi*) long staircase. On the west side, there is a 5.8 m (20 *chi*) wide slope. There are no architectural features on the north and south sides. Rectangular bricks measuring 36 × 18 × 6 cm were used around the platform, along the slope and on the steps. The bottom step was constructed with the short ends of the bricks facing outwards and the steps were stacked in the same way. Two bricks were stacked to form each step, with the next step created by shifting the bricks inward. Inside the slope, square bricks measuring 18



*painted area is Dornod province, Mongolia

Figure.1 Location of Shaltz Uul 1 site

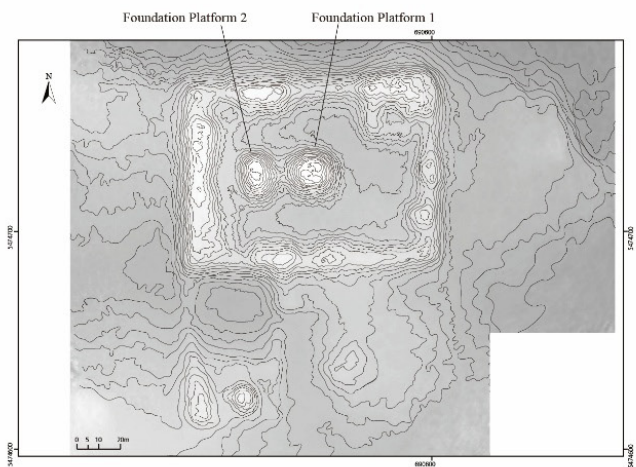
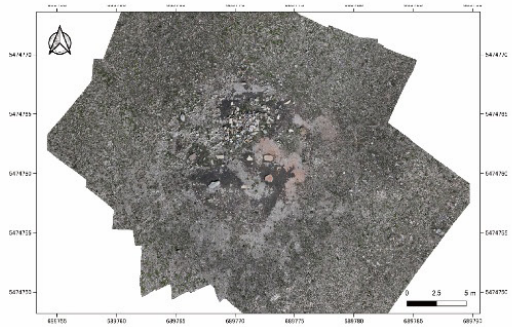
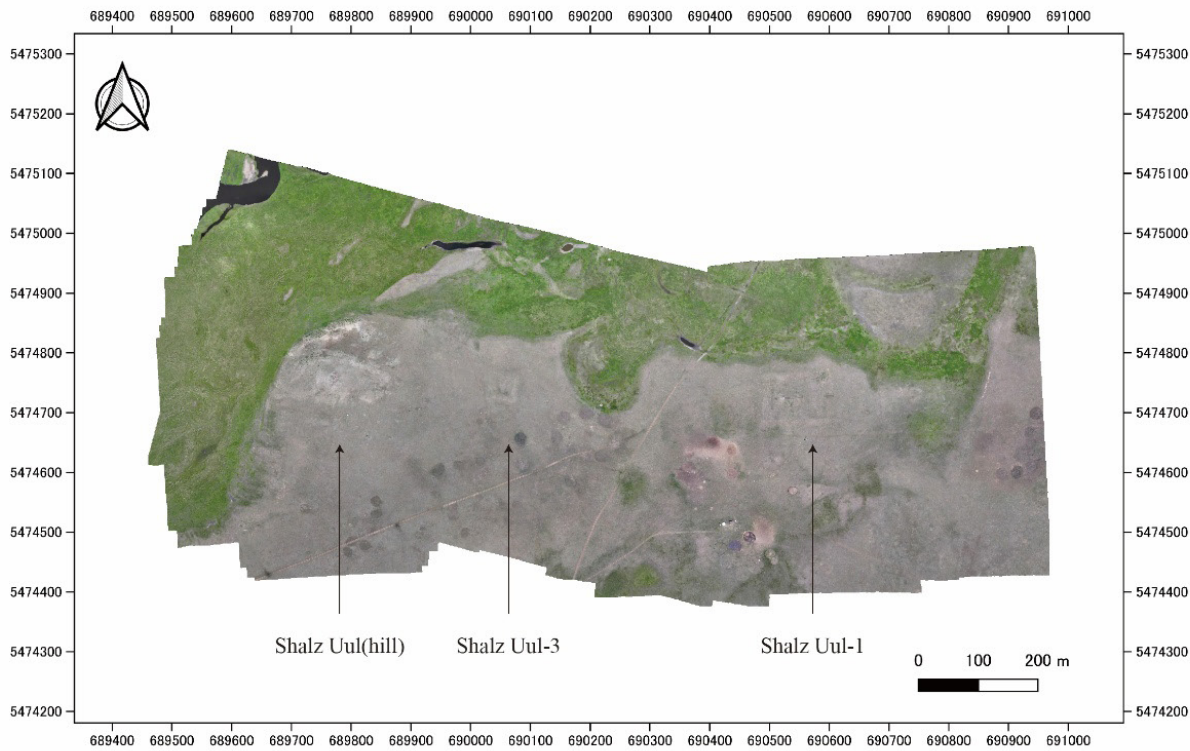


Figure.2 overviews of Shaltz Uul-1



Foundation stones of Shaltz Uul

Figure.3 Shaltz Uul(hill)-3site-1site

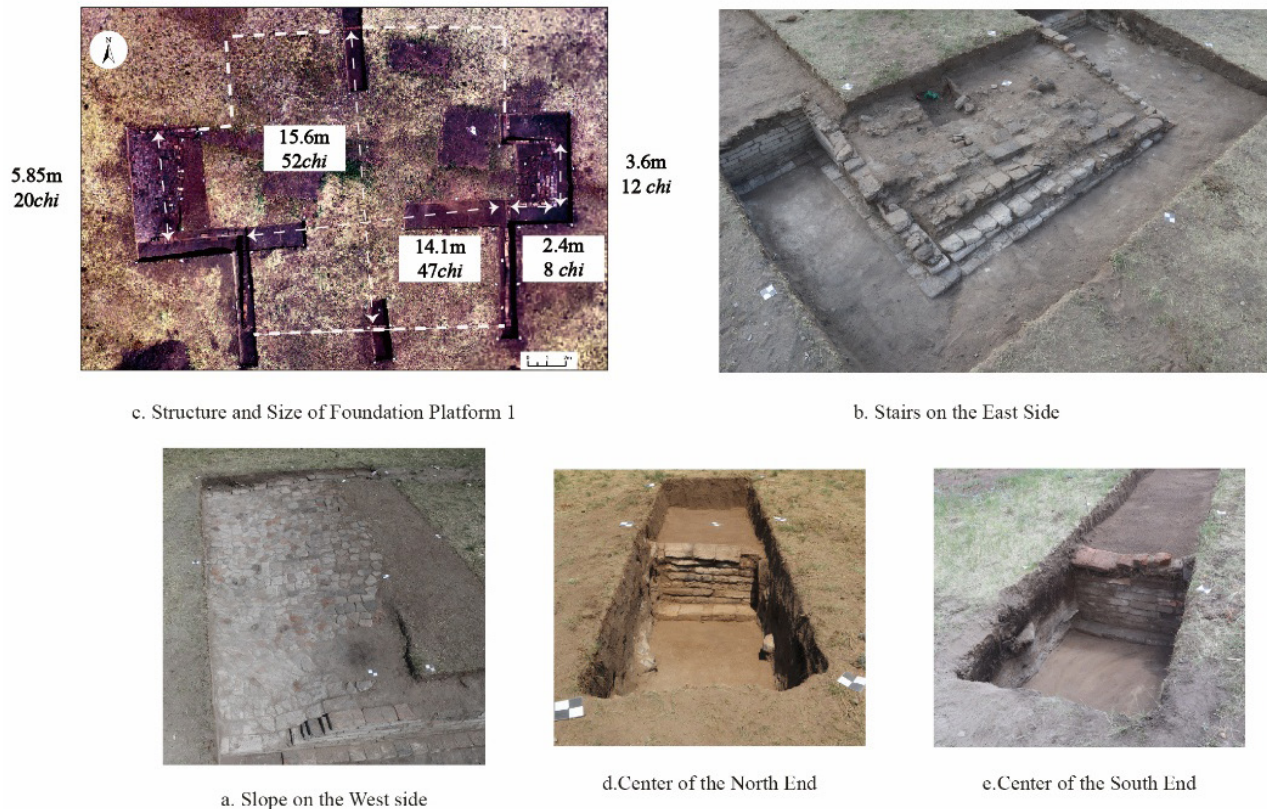


Photo1 Result of excavation at Foundation Platform 1

cm were laid (Kiyama et al., 2020).

Based on the overall east–west orientation of the complex, the presence of a staircase on the east side of Foundation Platform 1, and the plaza-like space situated in front of the platform, the walled complex is considered to have had an eastern front.

East Gate (SB03): surveyed in 2022 (Figure 4 and 5)

Since the main gate was expected to be located on the east side, the east–west central axis line of Foundation Platform 1 was extended toward the eastern wall, and the northern edge of the excavation area was defined as the continuation of this line. This was based on the assumption that, if Foundation Platform 1 and the eastern gate were aligned, the southern half of the eastern gate could be identified. As it turned out, the remains were indeed found at the expected location.

The structure discovered is the so-called "*difu* (地覆)", which serves as the foundation supporting the gate structure. It was constructed using planks of *Pinus densiflora*, assembled orthogonally to form a well-frame-shaped configuration. The *difu* consists of a single wooden plank, measuring 28 cm (1 chi) in width and 10 cm in thickness at the edge. A portion of the east–west plank was cut to allow the insertion of the north–south plank, which was joined using a so-

called "jaw-hanging" joint. Near the joint, the lower end of a pillar was preserved, with a diameter of 22 cm. After the pillar was removed, a square mortise hole measuring 15 cm (5 *cun*; 寸) on each side was observed in the plank (Fig. 4-b, c). The lower end of a pillar remains near the connection, and the diameter of the pillar measures 22 cm. After removing the pillars, a square mortise hole of 15 cm (5 *cun*; 寸) on each side drilled in the plank was observed (Fig. 4-b, c).

Although the excavation area was limited to the southwestern portion of the structure, the ground beams are believed to have been assembled in a well-frame-shaped configuration (Fig. 4-a). A gate threshold, 10 cm wide, was also found at the center. This threshold was not directly connected to the surrounding planks but was instead placed in a stationary position (Fig. 4-e).

Along the extension of the threshold, foundation stones or planks expected to serve as bearings for gateposts or the gateway structure could not be identified. However, a posthole was found near the center of the threshold on the inner side of the complex, and a flat stone—possibly a doorstep—was excavated from the western side of the trench. Given its position on the interior side relative to the threshold, it is inferred that the gate opened outward (Fig. 4-d).

The distance between the ground beams in the

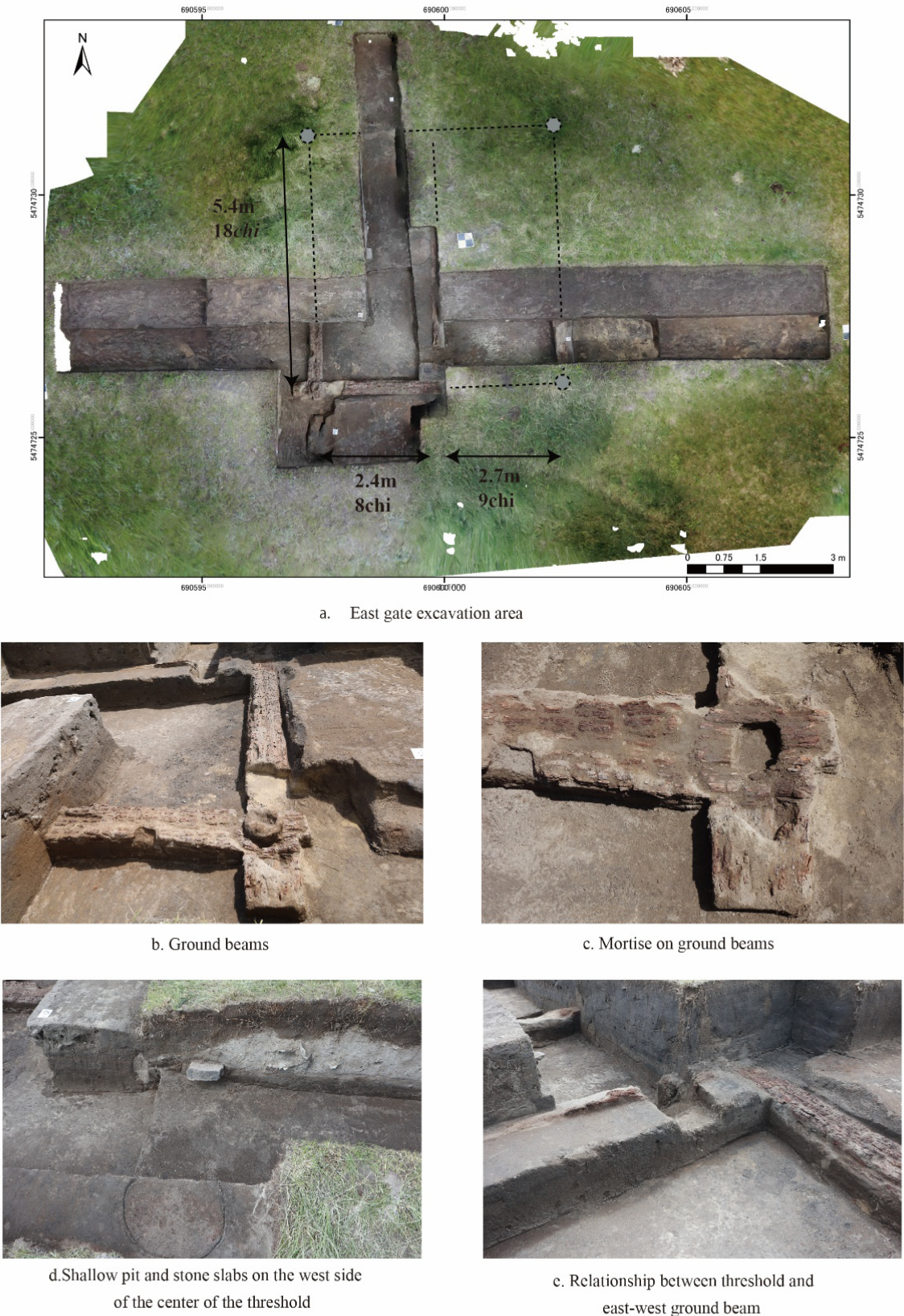


Figure 4 East gate excavation area

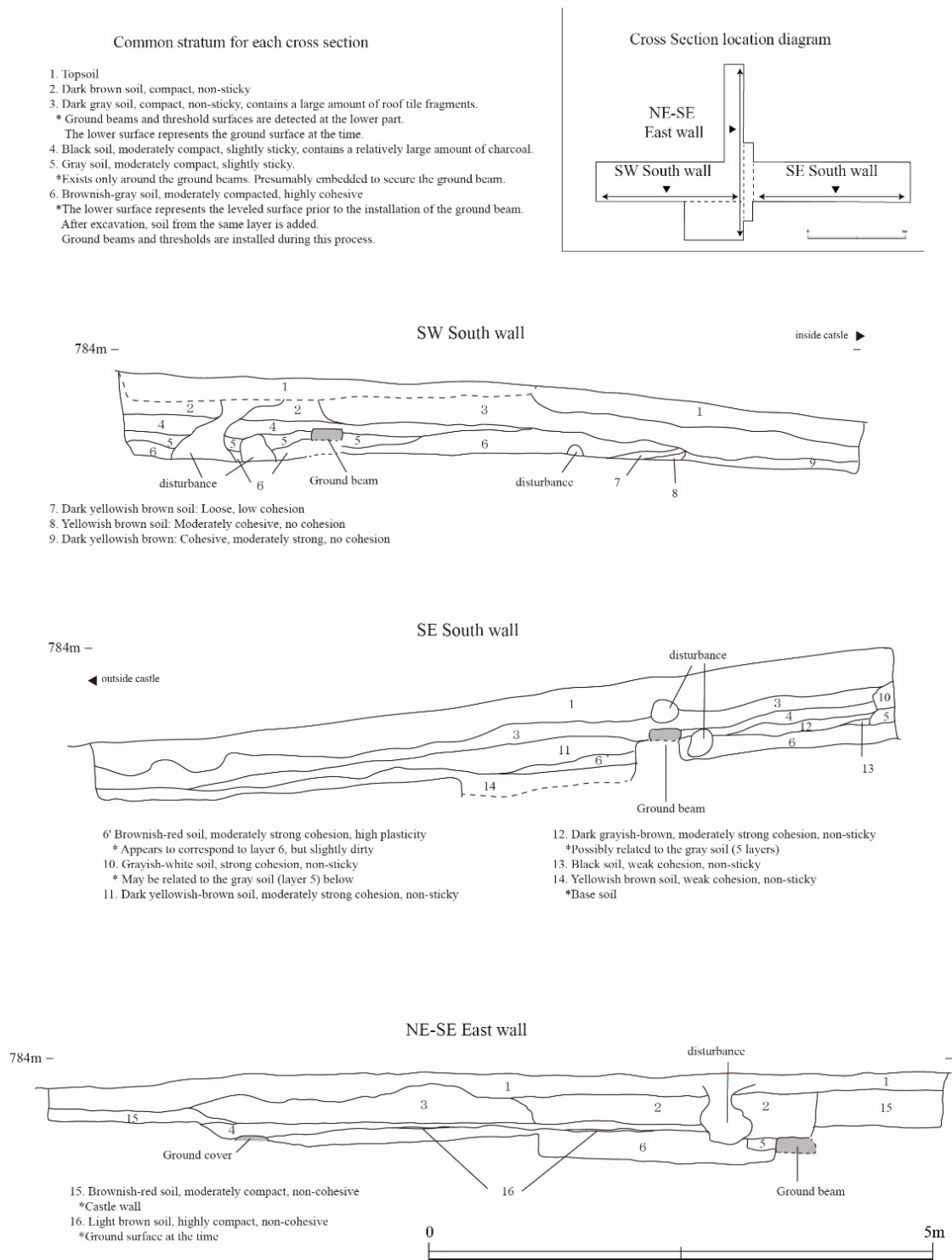


Figure 5 Cross Section of East gate

north-south direction is 5.6m. Although the wood on the north side was corroded, it was approximately 5.4 m between cores, and is estimated to have been designed to be 18 *chi* in Tang scale. The distance between a core of ground beams on the inner (west) side of the complex and the threshold is 2.4 m (8 *chi*). The distance between a core of ground beams on the outer (east) side of the complex is 2.7 m (9 *chi*) (Fig. 4-a).

Based on the above, the east gate is considered to have been constructed as follows. First, the construction site was cleared and filled with a certain amount of soil. The structure measures 18 *chi* in frontage and 17 *chi* in depth, and the boards are assembled in a well-frame-shaped configuration. In the center, a threshold is placed with the wood edge of the same size planks facing up. The area around each plank is "rooted" with slightly cohesive gray soil, and then the remaining area is filled with soil. It is thought that these soils were also hardened to some extent, but traces of thrusting are not evident, and the reason for this is a subject for further study. The upper surface of the threshold was placed so that it protrudes slightly above the ground surface, and the standing stones that served as doorstops were also placed inside the complex (Fig. 5).

Mortise holes were drilled in the four intersections of the ground beams, and pillars with mortises on the bottom were erected there. These four pillars are thought to have supported the gate structure as the basic structure. The roof is tiled, and since corner-cut tiles were excavated, it is assumed to have been a hip gable roof or a hipped roof, rather than a gabled roof. It is also possible that there was a pillar on the extension of the central threshold, but the details are unknown as no foundation stones were found. The Installation location of the ground beams and the soil inside the building are not consolidated by rammed earth i.e. "*hang tu* (版築)", making the structure appear unstable at first glance, but it is thought that four pillars were erected and the weight of the tiled roof stabilized the structure.

During the Tang and Song dynasties, castle gates generally took the form of pillars erected on foundation stones in a grid, or pillars erected on ground beams laid on foundation stones placed on both side of either gate(城倉2021).

The type of gate structure used at this site, in which the main pillars are erected at the four corners of the well-frame-shaped ground beams to support the structure, is a new type of gate structure not seen before, although there are similar examples as the foundation of a structure(張2021).

A portion of the north-south directional ground beam on the inner side of the walled complex was identified as *Pinus* spp. The outermost rings of the sample were dated to 563-597 cal AD (95.45%), indicating a late 6th century to late 6th century date (see appendix).

Eaves corridor (SB04): surveyed in 2023 and 2024 (Photos 2)

Subsequently, a survey was conducted to ascertain the structure of the Foundation Platform 2 and to determine the manner in which the slope on the west face of the Foundation Platform 1 connects to the rear hall. Consequently, it was determined that Foundation Platform 1 and 2 are interconnected by an eaves corridor.

The north-south width of the eaves corridor is measured at 5.9 m at the point of connection with the Foundation Platform 2, a measurement which is consistent with the width identified during the Foundation Platform 1 survey conducted in 2019. Consequently, it is hypothesised that the eaves corridor connecting platforms 1 and 2 possessed a uniform width. The length of the east-west axis is 14.26 m (48 *chi*).

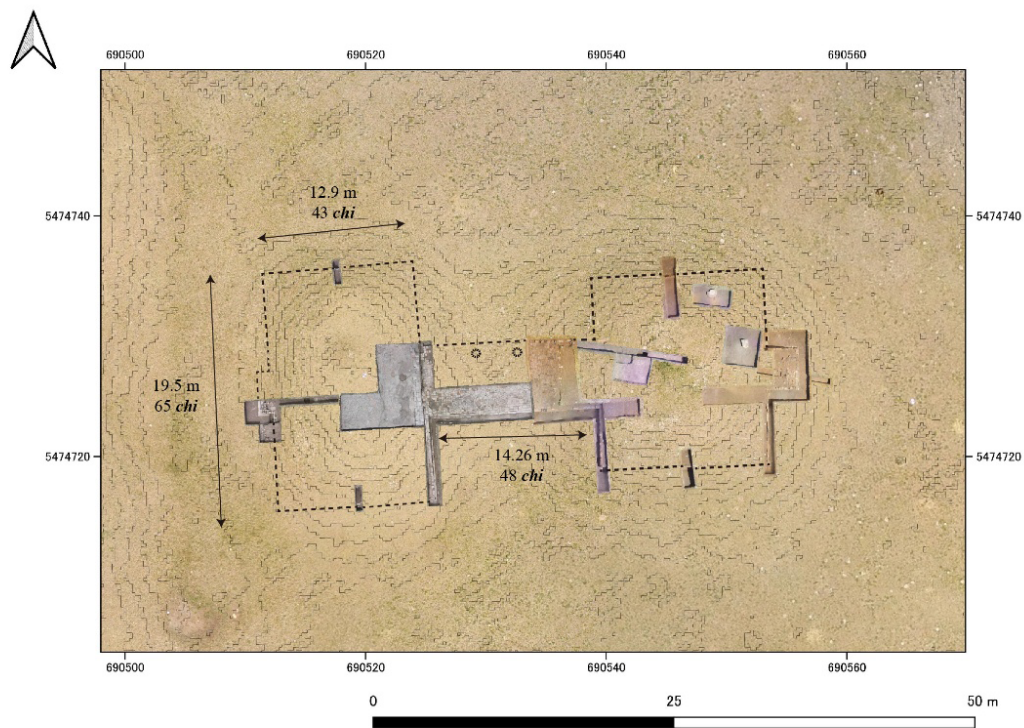
The length of the east-west axis is 14.26 m (48 *chi*). Three types of brick were identified in the eaves corridor: square bricks (36 x 36 cm and 18 x 18 cm) and rectangular bricks (36 x 18 cm). The thickness of the latter two is 6 cm. On the east side, rectangular bricks are utilised, while on the west side, square bricks measuring 18 cm are employed with greater frequency (Photos 2-b).

At a point about 3.8 to 6 m east of the Foundation Platform 2 connection, a circular area of deliberately placed tong was observed, but no clear pattern structure was found inside. Around this area, the placement of the bricks was disorganized, and in some areas the broken bricks were used to fill in the gaps, and the entire surface was covered with bricks.

At the edge of the eaves corridor, the rectangular bricks were lined up in an east-west direction. However, at a point 1 m east of the connection with the Foundation Platform 2, two 36 cm square rectangular bricks were arranged, and at 4.2 m, rectangular bricks were arranged in a north-south direction.

The eave corridor descends from the Foundation Platform 1, passes through a flat area of about 4.5 m, and then rises again to the Foundation Platform 2.

Near the connection between the eaves corridor and the Foundation Platform 2, an approximate 40 x 50 cm, roughly circular-shaped sagging area was observed. Although the possibility of a pillar hole was considered, a semi-sectional survey of the south side revealed that the interior was filled with soil constituting the platform, and it was determined that it was a foundation stone installation mark. Although the foundation stone itself was not yet excavated, a pair of similar traces were found on the north side, and similar traces were also found about 4 m and 8 m east of the connection of the Foundation Platform 2. These are thought to be the traces of foundation stones that supported the structure.



a. Overview of excavation area at Eaves Corridor and Foundation Platform 2



b. overview Eaves Corridor taken from east



c. The spot where the person is standing is the foundation stone placement points.



d. connection between Eaves Corridor and Foundation Platform 2



e. Staircase on the west side of Foundation Platform 2



f. North side of Foundation Platform 2



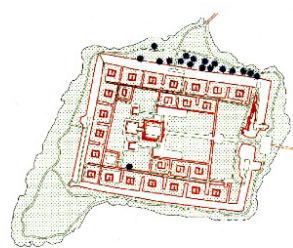
g. South side of Foundation Platform 2



h. Cross section of Rammed floor of Foundation Platform 2



Khar Balgas



Por Bajin

i. The "H"-shaped layout of the central Foundation Platforms buildings connected by the corridor.

Photo2 Eaves Corridor and Foundation Platform 2

These foundation stones were placed in a north-south direction at a distance of 4.2 m (14 *chi*) and in an east-west direction at a distance of 3.9 m (13 *chi*) between cores (Photo 2-c). A large amount of roof tiles was excavated from the research area, and together with the presence of foundation stone installation marks, it is judged that an eaves corridor with a roof-tiled structure existed between the Foundation Platform 1 and 2.

Foundation platform 2 (SB02): surveyed in 2023 and 2024 (Photo 2)

Foundation Platform 2 was also constructed on a base of surrounding bricks. As noted above, its eastern face forms a sloped approach leading to the eaves corridor. The upper surface of the eastern side is paved with square bricks, but this pavement is interrupted 108 cm from the eastern edge, which is thought to mark the boundary between the building's interior and exterior. This suggests that the perimeter of the platform was bordered by a rim-like passage resembling a dogtrot (Photo 2-a, d).

The interior floor was not brick-paved but consisted of rammed white clay (Photo 2-h). No foundation stones or installation traces were identified.

The eastern face of the platform base is built with rectangular bricks measuring 36 × 36 cm and 18 × 18 cm. On the bottom row, bricks are arranged with their short ends facing outward; above this, bricks are stacked with their short ends also facing outward.

On the western face, there are three staircases. Each staircase consists of two 18 × 36 cm bricks laid with their short sides facing outward, and each subsequent step is offset slightly inward. The ground in this area was fragile, and particularly at the southern edge of the platform, collapse of the sills was observed (Photo 2-e).

No ancillary structures were identified on the north or south sides (Photo 2-f, g). These sides share the same construction as the eastern face: the bottom row of bricks has the short ends facing outward, and the upper layers have the long ends facing outward.

The platform measures 19.5 m (65 *chi*) in the north-south direction (frontage) and 12.9 m (43 *chi*) in the east-west direction (depth), forming a long rectangular plan aligned north to south. A sloped approach is present on the eastern side, while the western side features a staircase 1.2 m (4 *chi*) wide.

4. Architectural Analysis and Chronology

Walled complex design and building layout

Previous investigations have revealed the structure of the central building group; the center of the Foundation Platform 1 is located 180 *chi* (54 m) each from the east-west double-sided wall and 130 *chi* (39 m) each from the north-south double-sided wall, which

is estimated to correspond to the center of the walled complex (Kiyama et al. 2020). The excavation results demonstrated the validity of the proposed building layout for the walled complex, since the distance from the center of the Foundation Platform 1 to the east gate threshold is approximately 180 *chi* (54 m) and the center of the east gate is located on the east-west mid-axis line of the walled complex.

Furthermore, the axes of the south edge of the staircase and the foundation stone installation traces of the eaves corridor of Foundation Platforms 1 and 2 coincide, indicating that highly standardized design, surveying, and construction were carried out (Fig. 6).

Furthermore, it was ascertained that the two central platform buildings were connected by an eaves corridor, thus forming an "H"-shaped building layout. This configuration is also observed at the Khar Balgas (Хар балгас) site, the capital of the Uyghur Khaganate, and at the Por Bajn (Пор бажын) site, which is also considered a Khaganate detached palace (Burkart 2017). Moreover, the Uyghur Khaganate forts and walled complexes exhibit distinctive structural characteristics (木山ほか., 2022; Ишцэрэн et al., 2024). The "H"-shaped platform layout, as elucidated in this study, can be regarded as one of these distinctive features (Photo 2-i).

The architectural design of the fort was informed by the principles of Tang-era scaling techniques, and the technological sophistication of the tilework also finds its origins in Tang tradition. Conversely, certain characteristics of the forts and walled complexes, such as its orientation towards the east, are rooted in the traditions of the steppe world.

Artifacts

The excavated artifacts consist primarily of a large quantity of roof tiles and bricks, with the exception of two pieces of earthenware and three iron objects. No decorative tiles, such as gargoyle roof tiles or ornamental ridge-end tiles, were found. However, a complete set of roof components—including round eaves tiles, flat eaves tiles, and functional tiles such as split ridge tiles—was recovered.

All of the round eaves tiles feature lotus flower designs and can be classified into three types based on their patterns (Fig. 7). Since the excavation contexts of each type vary, it is presumed that different buildings were roofed with distinct tile types. Specifically, Type IA was used on Foundation Platform 1, Type IB on the east gate, Type IIA on the eaves corridor, and both Type IB and Type IIA on Foundation Platform 2. This differentiation further indicates the high level of architectural standardization within the walled complex.

Additionally, no mixing of tile types was observed, nor were there signs of major roof repairs after the

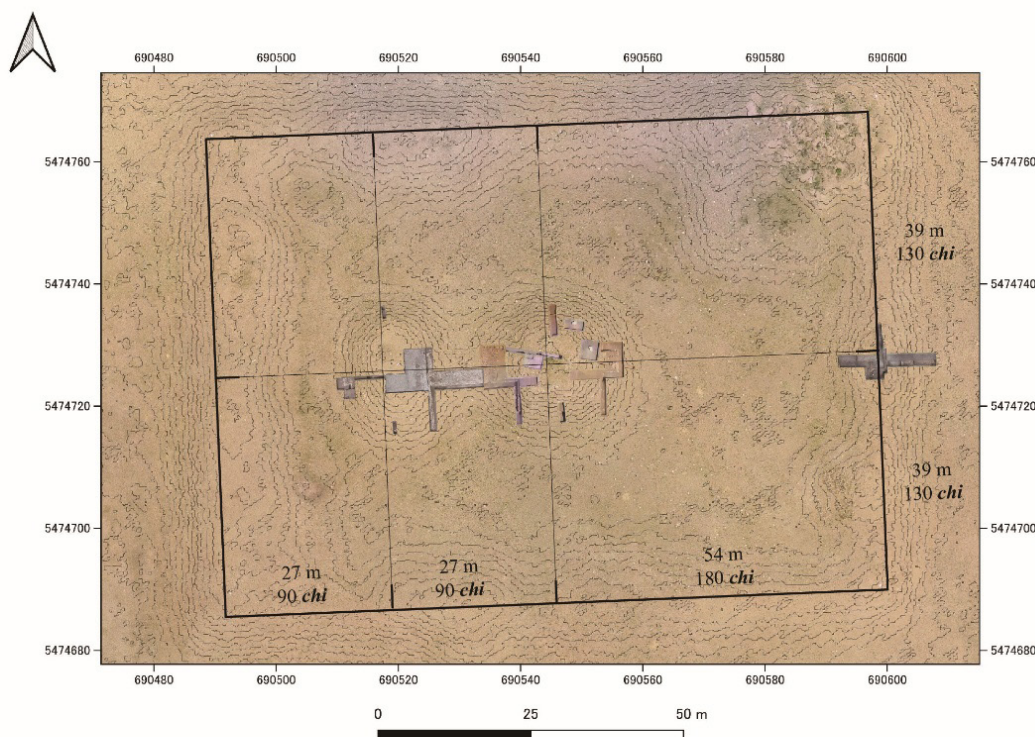


Figure 6 Overall design and building layout of the Shalz Uul 1 site

site's construction, suggesting that the buildings were relatively short-lived

Dating and Chronology

Based on the characteristics of the round eaves tiles, this site is estimated to date to the first half of the Uyghur Khaganate period. The elaborate lotus-petal motifs seen on round eaves tiles from the end of the Second Turkic Khaganate through the early to late phases of the Uyghur Khaganate gradually became simplified and faded away over time. The tile cross-sections also changed—from more three-dimensional profiles to flatter forms—and the width of the outer edges increased.

Typologically, the tiles excavated from this site are positioned after those from the Khöshöö Tsaidam (Хөшөө Цайдам) site (built in 732/735) at the end of the Turkic period, but before those from the Por-Bajin site, which dates to the mid-Uyghur Khaganate (late 8th century) (Kiyama et al. 2020). Furthermore, the site's similarities to the Xinhure (新忽热) Ancient City—believed to correspond to the Tang Dynasty's Hensaijun (横塞军) fortress (dated to 744–759)—provide additional support for this chronological placement (Fig. 7).

The construction of forts and walled complexes on the Mongolian Plateau is primarily associated with the Xiongnu, the Uyghur Khaganate, the Khitan, and the Yuan dynasties. While the forts of each period exhibit distinct characteristics, those of the Uyghur Khaganate

are notable for their unique features (木山ほか2022, Ишцэрэн et al. 2024). This site also shares several architectural characteristics with forts and walled complexes of the Uyghur Khaganate, including an eastern frontage, an H-shaped base layout, an inner wall located in the northeastern corner, and a similarly constructed outer wall.

On the other hand, the Wiggle matching dating of the wood used for the east gate cover yielded a 2σ calendar age of 563–597 cal. AD, which is from the late to the end of 6th century (see appendix). The ends of the planks were sampled, but because they were processed as building material, there is no final formation year ring for the wood and not the year of the wood's death (felling). Therefore, it is dated older than the site. In any case, it is dated to the First Turkic Empire period. However, the roof tiles and architectural typology do not date to that period. There are no known clear-cut fortress remains from that period in the Mongolian plateau. At this point, it is not possible to determine the cause of this difference in age, and this remains an issue for the future.

5. Conclusion

The northern and north-eastern regions of the Uyghur Khaganate state are inhabited by the Shiwei people. Indeed, the cultural sphere of the Burkhotui (бурхотуйская) culture and the Xieertala (謝爾塔拉) culture, which are believed to have been left by the Shiwei, extends into this area. The Shalz Uul 1 site is

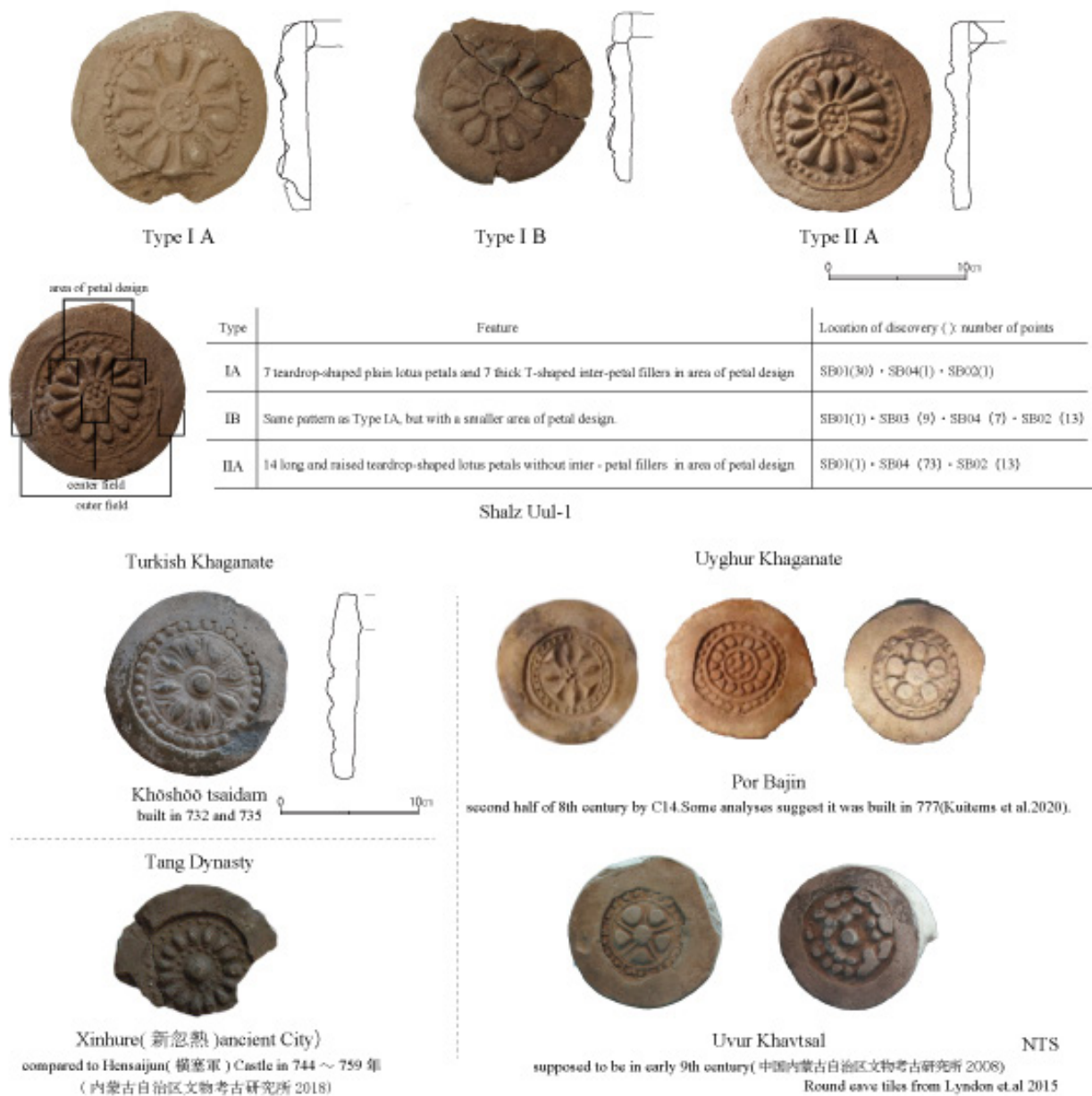


Figure 7 Round eaves tiles from Shalz Uul-1 and related sites

located within or near these cultural spheres.

What sets Shalz Uul 1 apart is its strategic location far from the central domain, yet built to remarkably high standards. The rationale behind constructing a fortress of such scale and quality in this remote area likely lies in its symbolic and representational functions. Positioned at the interface between the Uyghur state and the Shiwei populations, the site was not merely administrative but also demonstrative—a visible assertion of Uyghur authority intended to impress or deter external groups.

The absence of domestic artifacts and the short-lived use of the buildings further support the interpretation that Shalz Uul 1 was designed less for

continuous occupation and more as a ceremonial or ideological marker. In this sense, the site exemplifies how frontier architecture could serve diplomatic and political functions in addition to administrative ones.

As a well-preserved and carefully constructed example of Uyghur Khaganate frontier architecture, Shalz Uul 1 offers critical insights into statecraft, symbolism, and identity projection at the edges of imperial space. Future comparative studies with similar sites may further clarify the mechanisms by which the Uyghur Khaganate exerted influence across its vast territory.

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Appendix .Radiocarbon Dating and Tree Species Identification Results

A portion of the north-south ground beam on the interior (west) side of the walled complex was sampled for tree identification and radiocarbon dating by Paleo Labs, Inc. The following is a report on the tree identification and dating results. The original report was in Japanese, and translated by Kiyama.

RADIOCARBON DATING

Paleo Lab AMS Dating Group
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Kobayashi Katsuya

1. Introduction.

Radiocarbon dating using the Wiggle Matching Method with Accelerator Mass Spectrometry (AMS) was performed on samples excavated from the Shatz Uur 1 site in Dornod Province, Mongolia. Tree identification of the same samples has also been conducted.

2. Samples and Methods

The sample was a ground beam on the west side of the east gate (sample no. SHU0001). The tree species is of the subgenus *Pinus duplex vascularis*, with no last-formed annual rings remaining, and 34 annual rings were observed (Figure Plate 1-1). The measurement samples were collected at three locations from the outside: 1～ 5th year ring (PLD-47261), 11～ 15th year ring (PLD-47262), and 26～ 30th year ring (PLD-47263).

Information and preparation data of the measured samples are shown in Table 1. After pre-treatment, samples were measured using an accelerator mass spectrometer (Paleo Labs, compact AMS: NEC 1.5SDH). After correction for isotope fractionation effects on the obtained ^{14}C concentrations, ^{14}C ages and calendar ages were calculated.

3. Result

Table 2 shows the carbon isotope ratios used to correct for isotope fractionation effects ($\delta^{13}\text{C}$), the age values used for calendar year calibration with correction for isotope fractionation effects and the age range obtained by the calibration, the ^{14}C ages with age values and errors rounded according to convention, and the Wiggle matching results in Figure 1. respectively. The age values used for the calendar year calibration are unrounded to the last digit, and are included so that calendar year calibration can be performed using these age values when the calendar year calibration curve is updated in the future.

The ^{14}C age is an age that indicates how many years ago AD 1950 was the base year. The Libby half-life of 5568 years was used as the ^{14}C half-life for the ^{14}C age (yrBP) calculation. The appended ^{14}C age error ($\pm 1\sigma$) is calculated based on the statistical error of the measurement, standard deviation, etc., and indicates that there is a 68.27% probability that the ^{14}C age of the sample falls within that ^{14}C age error.

The details of the calendar year calibration and wiggle-matching method are as follows.

[Calendar year calibration]

Calendar year calibration is the process of calibrating variations in atmospheric ^{14}C concentration due to past variations in cosmic ray intensity and the Earth's magnetic field and differences in half-lives (half-life of ^{14}C of 5730 ± 40 years) against a ^{14}C age calculated with a constant atmospheric ^{14}C concentration and a half-life of 5568 years to more closely match actual age values. The purpose is to calculate an age that is closer to the actual age.

OxCal 4.4 (calibration curve data: IntCal20) was used for calendar year calibration of ^{14}C ages. The 1σ calendar age range is the calendar age range with a 68.27% confidence limit, which corresponds to the ^{14}C age error calculated using OxCal's probability method, and similarly, the 2σ calendar age range is the calendar age range with a 95.45% confidence limit. The percentage values in parentheses refer to the probability of a calendar age falling within that range. The curves on the vertical axis in the graph indicate the probability distribution of ^{14}C ages, and the double curves indicate the calendar year calibration curves.

[Wiggle Matching method]

The wiggle-matching method is a method of obtaining highly accurate age values by measuring multiple samples and calculating the age value that best matches the pattern of the calibration curve with the age pattern of the sample using information on the age difference between each sample. In the measurement, several annual rings are prepared for each year or for several years of wood for which the number of annual rings obtained can be confirmed, and each ring is dated. The probability distribution of the outermost sample is calculated by performing calendar year calibration on the individual measurements and multiplying the obtained probability distribution by the difference between the outermost sample and the center value of the sample in question to obtain the age range. The age range of the outermost sample obtained represents the age of the center of the five annual rings compiled. Therefore, to obtain the outermost age of the sampled wood, it is necessary to consider 2 years (2.5 years rounded down to the nearest decimal place), which is the number of annual rings outside the center of the outermost sample.

4.Consideration

Below, we organize the results focusing on the 2σ calendar year age range (95.4% probability).

The outermost annual ring age of sample No. SHU0001 was 563-597 cal AD (95.45%), indicating a late 6th to late 6th century calendar age. Note that

in the case of wood, measurement of the last-formed annual ring portion yields a death or felling age, while measurement of the inner annual rings yields an age that is older the further inward it is from the last-formed annual ring (old tree effect). Since the sample SHU0001 did not have any last-formed annual rings, it is possible that the measurement results are affected by the old-growth effect, in which case the actual date of death or felling is considered to be older than the measurement results.

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Table 1. Wiggle matching measurement samples and processing

sample No.	Site and Sample Data	sampled data	pre-treatment
PLD-47261	Sample No. SHU0001 Survey area: East Gate SW Zone Structure: East -west ground cover west of the East Gate Stratigraphy: 3 layers Type: Raw material (Pinus subgenus Pinus) Sample characteristics: All growth rings except the final growth ring; part unknown Number of growth rings: 34 Condition: Dry	Sampling location: 1 to 5 annual rings from the outer side (excluding the final growth ring; location unknown)	Ultrasonic cleaning Organic solvent treatment: Acetone Acid, alkali, and acid cleaning (hydrochloric acid: 1.2 mol/L, sodium hydroxide: 1.0 mol/L, hydrochloric acid: 1.2 mol/L
PLD-47262		Sampling location: 11th to 15th growth rings from the outer side	Ultrasonic cleaning Organic solvent treatment: Acetone Acid, alkali, and acid cleaning (hydrochloric acid: 1.2 mol/L, sodium hydroxide: 1.0 mol/L, hydrochloric acid: 1.2 mol/L
PLD-47263		Sampling location: 26th to 30th growth rings from the outer side	Ultrasonic cleaning Organic solvent treatment: Acetone Acid, alkali, and acid cleaning (hydrochloric acid: 1.2 mol/L, sodium hydroxide: 1.0 mol/L, hydrochloric acid: 1.2 mol/L

Table 2 Results of radiocarbon dating, calendar calibration, and Wiggle matching

Sample No.	$\delta^{13}\text{C}$ (‰)	calendar year calibration year (yrBP $\pm 1\sigma$)	^{14}C age (yrBP $\pm 1\sigma$)	Age range calibrated to calendar age based on ^{14}C dating	
				1 σ chronological range	2 σ chronological range
PLD-47261 sample No.SHU0001	-25.92 \pm 0.30	1517 \pm 21	1515 \pm 20	548-584 cal AD (68.27%)	482-491 cal AD (1.40%) 537-603 cal AD (94.05%)
PLD-47262 sampe No.SHU0001	-24.73 \pm 0.28	1530 \pm 20	1530 \pm 20	541-578 cal AD (68.27%)	440-451 cal AD (2.65%) 455-460 cal AD (0.79%) 478-496 cal AD (6.18%) 534-599 cal AD (85.84%)
PLD-47263 sample No.SHU0001	-24.20 \pm 0.28	1528 \pm 20	1530 \pm 20	543-578 cal AD (68.27%)	441-450 cal AD (2.06%) 456-459 cal AD (0.45%) 478-496 cal AD (5.15%) 534-600 cal AD (87.79%)
		Age of outermost sample		566-583 cal AD (68.27%)	561-595 cal AD (95.45%)
		Age of outermost tree ring		568-585 cal AD (68.27%)	563-597 cal AD (95.45%)

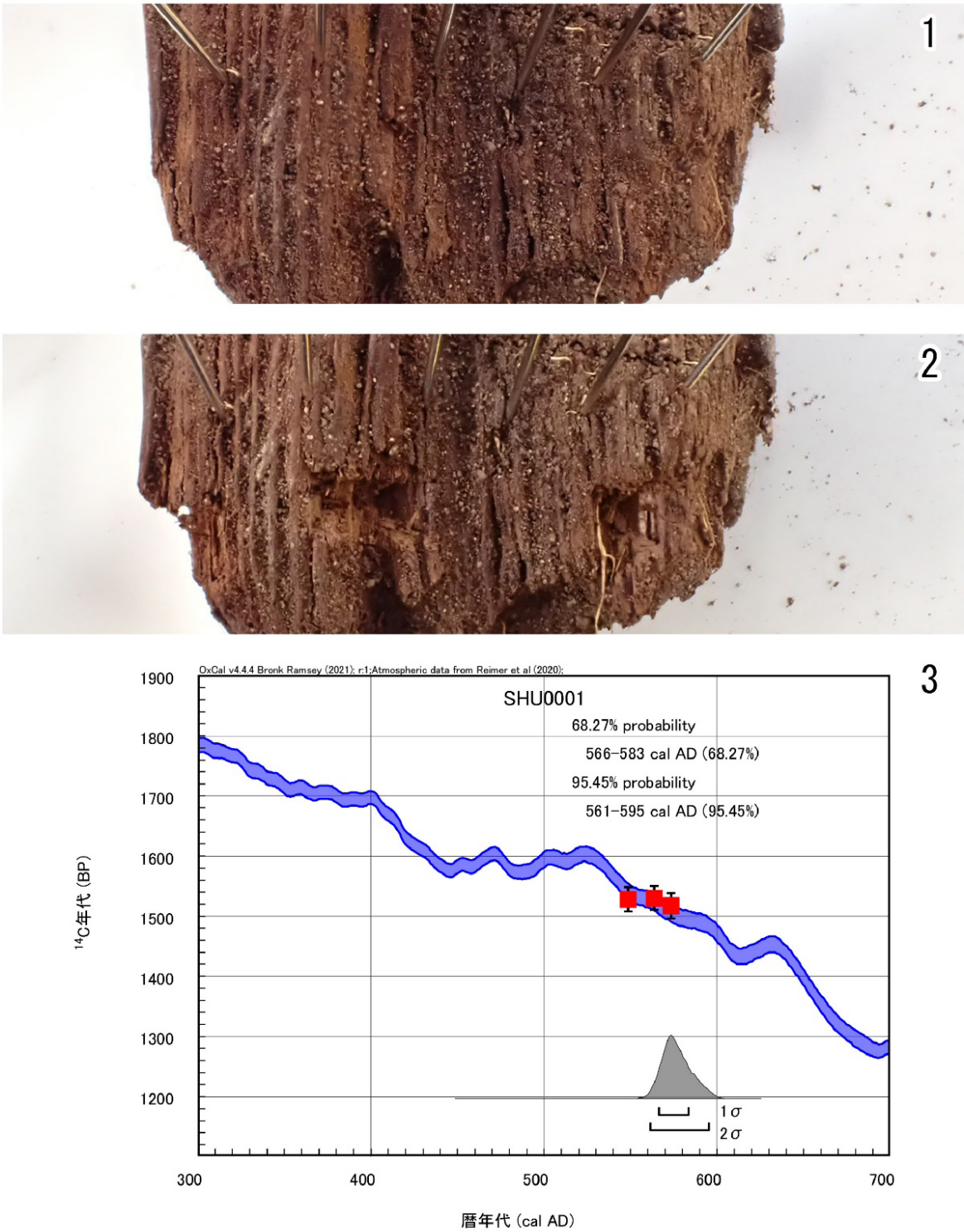


Figure 1: Samples subjected to Wiggles Matching (pin spacing is 5 years)
1. Sample No. SHU0001: Dendrochronological measurement results (PLD-47261-47263)
2. Sample No. SHU0001: Sample collection location (PLD-47261-47263)
3. Sample No. SHU0001: Uyghur matching results

IDENTIFICATION OF WOOD SPECIES FROM THE CHARLZ ORR 1 SITE.

Kobayashi Katsuya (Paleo Lab)

1.Introduction

Wood excavated from the Shalz Uur 1 site in Dornod Province, Mongolia, has been identified to species. The same samples were also radiocarbon dated (see Radiocarbon Dating).

2. Samples and methods

The sample is one ground beam (SHU0001) on the west side of the east gate in the SW section of the east gate.

For species identification, razor-thin sections were cut from the cross-sectional (wood mouth), tangential (board), and radial (quarter-sawn) sections of the wood and sealed with gum chloral to create a permanent preparticle. They were then dried, examined and photographed under an optical microscope.

3. Results

The results of the identification showed that the sample consisted of one coniferous *Pinus biflora* subgenus.

The characteristics of the identified wood are described below, and optical micrographs are shown in the figure plate.

(1) *Pinus* subgen. *Diploxylon* *Pinus* subgen. *Diploxylon* Pinaceae Fig. 1 1a-1c (SHU0001)

It is a conifer composed of pseudotubules and vertical and horizontal resin canals, radiating parenchyma cells and radiating pseudotubules. The radiating tissue is composed of radiating parenchyma and radiating pseudotubules. The inner wall thickening of the radial canals is serrated, and the field wall pores are window-like.

The subgenus *Pinus tabuliformis* Carrière, Traité Gén. Conif. ed. (Manshu Black Pine or Manshu Red Pine, *Abies sachalinensis*) can be identified in Mongolia.

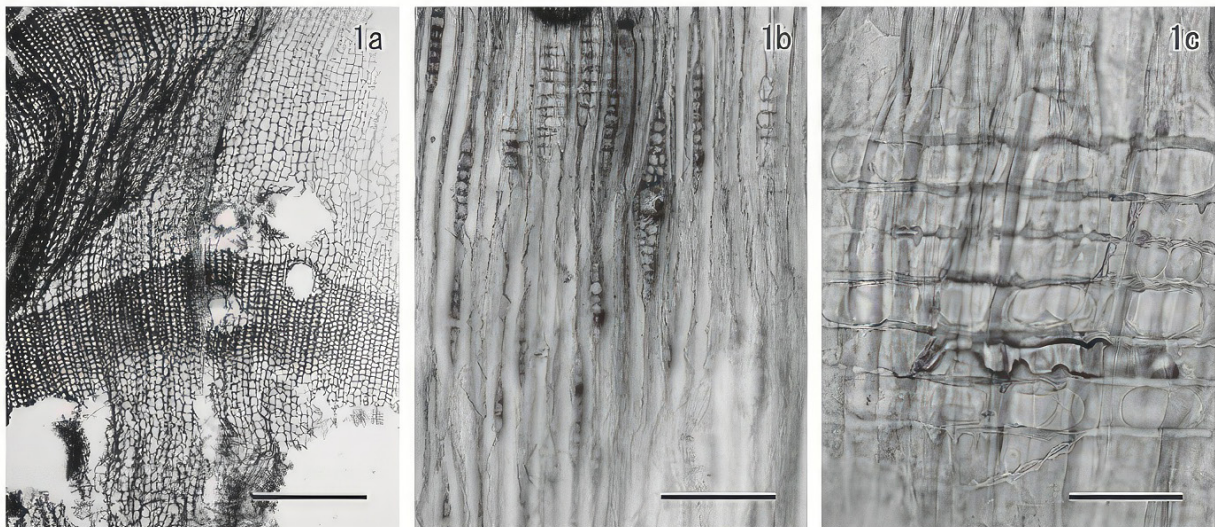


Figure 1 Optical microscope photographs of wood excavated from the Shalz Uul 1 site

1a-1c: *Subgenus Pinus* (No. 1)

1a: Cross section (scale = 500 μm) 1b: Tangential section (scale = 200 μm) 1c: Radial section (scale = 50 μm)