

Ancient *Cannabis* Burial Shroud in a Central Eurasian Cemetery

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An extraordinary cache of ancient, well-preserved *Cannabis* plant remains was recently discovered in a tomb in the Jiayi cemetery of Turpan, NW China. Radiometric dating of this tomb and the archeobotanical remains it contained indicate that they are approximately 2800–2400 years old. Both morphological and anatomical features support the identification of the plant remains as *Cannabis*. Research discussed in this paper describes 13 nearly whole plants of *Cannabis* that appear to have been locally produced and purposefully arranged and used as a burial shroud which was placed upon a male corpse. This unique discovery provides new insight into the ritualistic use of *Cannabis* in prehistoric Central Eurasia. Furthermore, the fragmented infructescences of *Cannabis* discovered in other tombs of the Jiayi cemetery, together with similar *Cannabis* remains recovered from coeval tombs in the ancient Turpan cemetery along with those found in the Altai Mountains region, reveal that *Cannabis* was used by the local Central Eurasian people for ritual and/or medicinal purposes in the first millennium before the Christian era.

魔幻大麻——来自吐鲁番加依墓地的证据新疆吐鲁番加依墓地M231墓室内出土了13株保存完好的植物遗存。综合形态学与解剖学特征,这些植物被鉴定为大麻(*Cannabis sativa* L.)。年代测定显示加依墓地距今约2800年至2400年;同时,出土器物的特征与该时段颇为盛行的苏贝希文化吻合。由于出土的13株大麻完好的保存了根、茎、叶、果实等部分,我们推测其为当地收获或采集后不久即放入墓中。这些大麻植株整齐地覆盖在墓主人的身体上,似乎有着某种特定的用途。同时,加依墓地的另外3个墓葬内的部分陶器内发现了磨碎的大麻。另外,同时代的吐鲁番洋海墓地,以及阿尔泰山北侧的若干处墓地内也发现了宗教色彩浓厚的大麻遗存。上述现象显示出中亚先民在公元前一千纪期间对大麻的利用价值已有较为深入的理解。

Key Words: Archaeobotany, hemp, Jiayi cemetery, Subeixi culture, Turpan, ethnobotany.

Introduction

Cannabis is a multipurpose plant genus that has been utilized by humans for many millennia (Clarke and Merlin 2013; Merlin 2003). In addition

to its strong and durable fiber and its nutritious seed, its psychoactive and therapeutic uses are of particular interest. Parts of ancient *Cannabis* plants have been excavated from tombs dated to the first millennium BCE in the southern central region of Russian Siberia and northwestern China, and its early use in these grave sites for ritualistic, mind-altering purposes has been suggested (Rudenko 1970; Jiang et al. 2006). Fibers of *Cannabis*, utilized for horsetail making, were also discovered in the

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Astana cemetery (~third to ninth century CE) of Xinjiang, NW China (Chen et al. 2014). However, no one knows the origin of the *Cannabis* found in these and other early Central Eurasian sites. The *Cannabis* remains may have been gathered from locally growing plants or transported from another area, and it is also unclear whether the plants were growing wild or were cultivated. Here we report the discovery of numerous ancient, locally produced *Cannabis* plants that were combined and used as a burial shroud in a tomb in the Jiayi cemetery in northwestern China. This unique artifact, comprised of 13 nearly whole plants approximately two and half thousand years old, sheds new light on the ritual use of *Cannabis* in prehistoric Central Eurasia.

Site Description

The ancient Jiayi cemetery (42°12' N, 89°11' E) is located in a stony desert of the Turpan Basin in the Xinjiang Uyghur Autonomous Region of north-west China (Fig. 1). This cemetery is situated on the fringe of the oasis, where many grapevines are cultivated today. The climate here is so dry that there is almost no annual rainfall during many years. The climate and flora in this region have been published elsewhere (Jiang et al. 2009) and will not be redescribed in the present paper. This ancient cemetery was discovered during the construction of new tombs for modern use; subsequently, the whole cemetery was uncovered and salvage excavations were eventually undertaken.

The discovery of many bows, arrows, and domesticated animal bones such as those of goats or sheep and a horse skull in the Jiayi cemetery indicates that both hunting as well as animal husbandry played important roles in the culture of those people who constructed this cemetery; however, the small amount of cereal remains suggests that the ancient inhabitants of the area probably led a predominantly pastoral life. Field survey indicates that the Jiayi cemetery was located close to a riverbed, as fluvial deposits such as sand and pebbles were discovered. In addition, hygrophilic plants such as reeds (*Phragmites australis* (Cav.) Trin. ex Steud.) and horsetails (*Typha* sp.) that were found in the Jiayi cemetery tombs indicate there was at least a seasonal water supply nearby.

According to the ceramic pots, and other unearthed artifacts, this cemetery can be linked to the Subeixi Culture. Many other contemporaneous Subeixi

cemetery and settlement sites have also been excavated within the Turpan Basin, such as those at Aidinghu, Alagou, Subeixi, Shengjindian, Yanghai, and Yuergou (Fig. 1). All of them were occupied from about 1000 BCE to 100 CE. People associated with the early stage of the Subeixi Culture led a pastoral life with only a small amount of cereal cultivation, but eventually developed a more balanced semi-pastoral and semi-agricultural society, as demonstrated by the discovery of increased cereal and other horticultural remains found in their later cemeteries and settlements (Jiang et al. 2009, 2013).

In all, 240 ancient tombs were excavated at the Jiayi cemetery. The *Cannabis* burial shroud was found in tomb M231, a vertical earth pit with a rectangular shape (Fig. 2a, c). A low-lying bed frame made of wooden slats had been placed in the bottom of this pit and a cluster of sweet wormwood (*Artemisia annua* L.) stems was attached to each of the bed's long sides (Fig. 2d). Macro remains of a few other plant species including green foxtail millet (*Setaria viridis* (L.) P. Beauv.), Russian box thorn (*Lycium ruthenicum* Murray), and naked barley (*Hordeum vulgare* var. *coeleste* L.) were also found in tomb M231. All the plant materials were in a desiccated condition. The corpse of a male Caucasoïd about 35 years old was laid down on the bed with a pillow made of common reeds (*P. australis*) under its head. Found alongside the bed were intact and broken red-colored earthenware pots with some additional smaller fragments of pottery (Fig. 2a–c).

In tomb M231, 13 nearly whole female *Cannabis* plants were laid diagonally across the body of the deceased like a shroud, with the roots and lower parts of the plants grouped together and placed below the pelvis; the stems and foliage were arranged in a parallel alignment extending upwards to just under the chin and along the left side of the face (Fig. 2a–c). Due to the extremely dry climate, the stems and foliage retained their characteristic natural shape although they had turned yellowish brown. The plants were branched and all of them had roots attached. The terminal inflorescences had been cut off of all the plants, with only some small leaves and a few short inflorescences remaining along the lower parts of the stalks.

Materials and Methods

All the specimens were deposited in the Turpan Museum. Three samples from Jiayi cemetery tomb M231 were selected for reliable

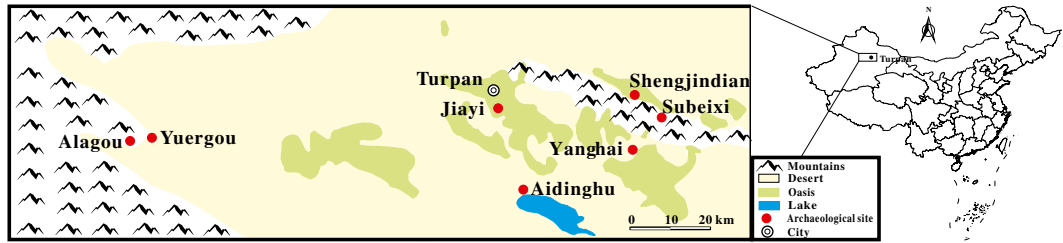


Fig. 1. Location of the ancient Jiayi cemetery. Other contemporaneous archeological sites referred to in the text are also shown.

age determination. One was a stem from a *Cannabis* plant that had been placed over the corpse; the second was a reed straw from the pillow, which was placed beneath the head of the deceased; and the third was a femur of the male human buried in the tomb.

In order to determine the age range of the Jiayi cemetery, several other samples from different tombs in this cemetery were also

selected for dating. All the samples were dated with an accelerator mass spectrometer (AMS) C^{14} in the Radiocarbon Dating Laboratory at Peking University and then calibrated using Intcal04 calibration curve (Reimer et al. 2004) and Oxcal v3.0 (<https://c14.arch.ox.ac.uk/oxcal/OxCal.html>, data of access 21/07/2015).

The samples were first observed and photographed under a Nikon SMZ1000 stereo

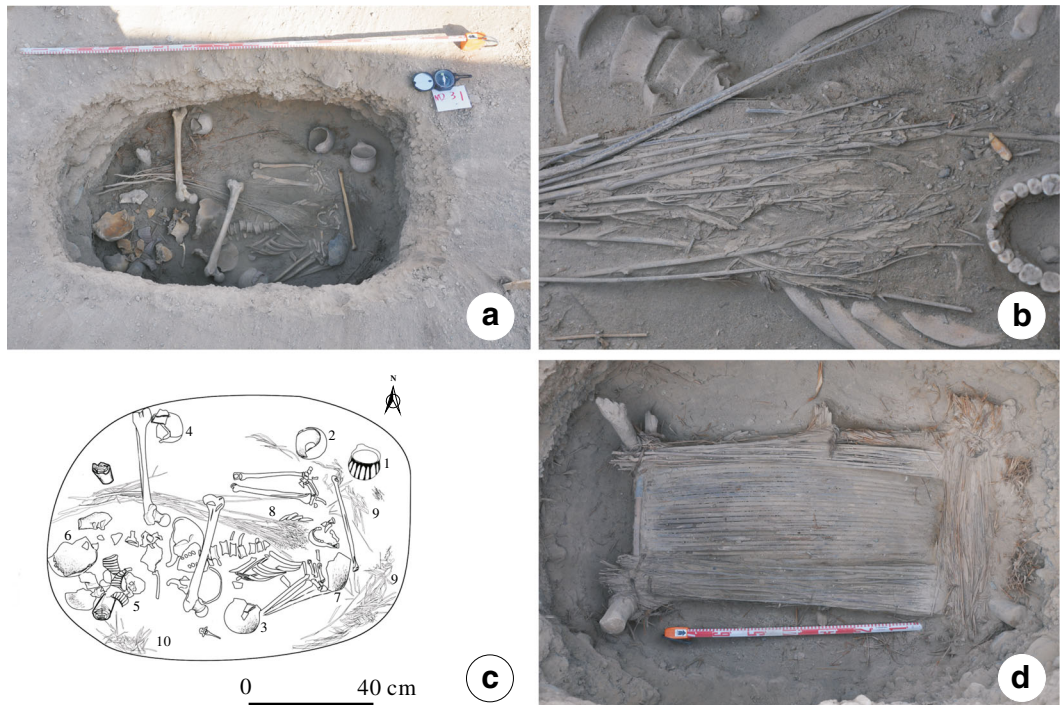


Fig. 2. **a** The upper layer of tomb M231. This shows the skeleton, funeral objects, and *Cannabis* plants laid over the corpse. **b** Magnification of the upper part of the *Cannabis*. **c** Line drawing of burial contents. 1–4 are nearly intact earthenware pots; 5–7 are broken earthenware pots; 8 indicates *Cannabis* plants; 9 marks pillow fragments above the bed; and 10 denotes wild grasses. **d** The lower layer of tomb M231 showing the wooden bed frame and reed pillow.

microscope. Some of the specimens were subsequently observed and photographed under a Quanta 200 SEM at an accelerating voltage of 30 kv.

Results

Carbon-14 dating indicates that the Jiayi cemetery is 2800 to 2400 years old (Table 1), which is in accordance with the cultural age at that stage. The recovered *Cannabis* plants have been pressed flat and measure 48.5 to 89.6 cm in length and 3.7 to 10.5 cm in greatest width. The main tap roots remain, while the lateral roots are missing (Fig. 3 a, b), likely torn away when the plants were uprooted. The main stalks have branches arising from the base or middle part of the main stem and are yellowish brown with white pith. Both the main stalks and the branches are nearly square in cross-section. The stalks are ribbed and covered with densely packed glandular and non-glandular trichomes.

The leaves are opposite or alternate in phyllotaxy, compressed and broken. The petioles measure 3.7

to 23.6 mm long (Fig. 4f). The apex of each leaflet is acuminate, while the remainder of each leaflet has coarsely serrated margins. Glandular and non-glandular trichomes are sparsely distributed on the adaxial surface, while more densely distributed on the abaxial surface.

Fruits are born in the axils of the leaves and leaflets. There are also some non-glandular as well as glandular trichomes on the surface of the inflorescences (Fig. 4a, b). Each fruit is covered by a perianth (Figs. 4d and 5c), while the fruit and its perianth are surrounded by a bract (Figs. 4c and 5a). Each bract has a pointed, straight beak and is covered with both glandular and non-glandular trichomes (Fig. 5a). The perianths are free but adhere closely to the fruits, and the walls of epidermal cells are either straight or undulate (Fig. 5c).

The fruits are oval, flattened achenes, each with two ribs. The fruits usually have a tapering apex and a rounded to truncate base, and are 2.3 to 2.7 mm long and 1.8 to 2.2 mm wide. The outer surface of the epicarp beneath the perianth is shiny and mostly smooth, but marked by some finely reticulate

TABLE 1. AGE OF REMAINS FOUND IN JIAYI CEMETERY DETERMINED BY RADIOCARBON DATING.

| Lab. No. | Tomb No. | Sample type | Carbon ¹⁴ date (BP) | Calibrated age (BCE) |
|----------|----------|------------------------|--------------------------------|--|
| | | | | 2σ (95.4 %) |
| BA142064 | M49 | <i>Phragmites</i> stem | 2515 ± 30 | 790-530 (95.4 %) |
| BA142073 | M57 | Human bone | 2295 ± 25 | 410-350 (78.6 %) 290-230 (16.8 %) |
| BA142072 | M65 | Human bone | 2585 ± 25 | 810-750 (90.8 %) 690-670 (4.6 %) |
| BA142075 | M66 | Human bone | 2350 ± 20 | 490-430 (5.9 %) 420-380 (89.5 %) |
| BA142074 | M84 | Human bone | 2460 ± 20 | 760-680 (32.0 %) 670-480 (53.1 %) 470-410 (10.3 %) |
| BA142065 | M109 | <i>Typha</i> leaves | 2510 ± 30 | 790-520 (95.4 %) |
| BA142066 | M125 | <i>Phragmites</i> stem | 2505 ± 30 | 790-520 (95.4 %) |
| BA142067 | M148 | <i>Phragmites</i> stem | 2635 ± 25 | 835-785 (95.4 %) |
| BA142068 | M156 | <i>Cannabis</i> fruits | 2650 ± 25 | 890-875 (1.8 %) 845-790 (93.6 %) |
| BA142069 | M157 | <i>Cannabis</i> fruits | 2600 ± 30 | 830-760 (92.2 %) 690-670 (3.2 %) |
| BA142070 | M230 | Human bone | 2610 ± 25 | 820-770 (95.4 %) |
| BA141328 | M231 | <i>Cannabis</i> stem | 2510 ± 30 | 790-520 (95.4 %) |
| BA150020 | M231 | <i>Phragmites</i> stem | 2510 ± 30 | 790-520 (95.4 %) |
| BA142071 | M231 | Human bone | 2545 ± 25 | 800-740 (48.5 %) 690-660 (18.9 %) 650-550 (27.9 %) |
| BA142076 | M237 | Human bone | 2395 ± 20 | 540-390 (95.4 %) |

The radiocarbon age is measured as years before 1950 CE. The half-life of Carbon¹⁴ is taken as 5568 years.

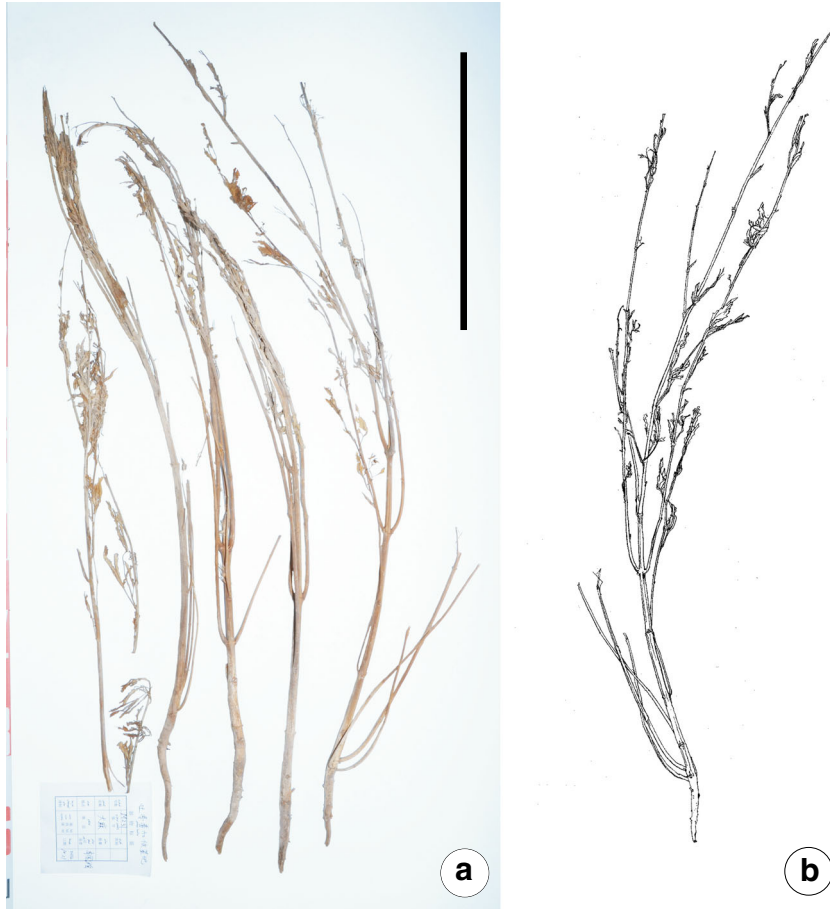


Fig. 3. Whole *Cannabis* plants and branches discovered in tomb M231. **a** Photograph of five of these ancient plants. **b** One of the ancient *Cannabis* plants showing the reverse side. Scale bar = 40 cm.

venations (Figs. 4e and 5b). The epidermal cell walls of the perianth are both straight and undulate (Fig. 4c) while on the inner surface of the endocarp the anticlinal walls are sinuous and interlocking (Fig. 5d).

Discussion

Within some of the inflorescences, immature fruits adhered tightly, which suggests that the plants were uprooted (and the corpse buried) in late summer, likely around the end of August or early September (Yang 1992). The *Cannabis* plants were all females with nearly ripe seed, and the inflorescences were covered with golden colored glandular trichomes. Were these plants harvested for their psychoactive resin? The way the leaves were pressed flat indicates that fresh plants

were placed on top of the corpse, and therefore, they were most likely growing locally. This evidence differs from the contemporaneous Yanghai grave M90 where *Cannabis* inflorescences alone were recovered (Jiang et al. 2006), and which may well have been an item of trade from a neighboring region.

The Yanghai cemetery is also located in the Turpan Basin and belongs to the same culture as the Jiayi cemetery (e.g., Fig. 1); both the Yanghai and Jiayi cemeteries have been dated to the first millennium BCE (Jiang et al. 2006, 2009). In one of those grave sites (Yanghai tomb M90), a large supply of processed female *Cannabis* flowers (bracts, seeds, and stems) was found in two containers. One was a coiled leather basket placed next to the head of the male corpse, while the other was a wooden bowl close to his body (Jiang et al. 2006). Based on the presence of cannabinol (a degradation product of

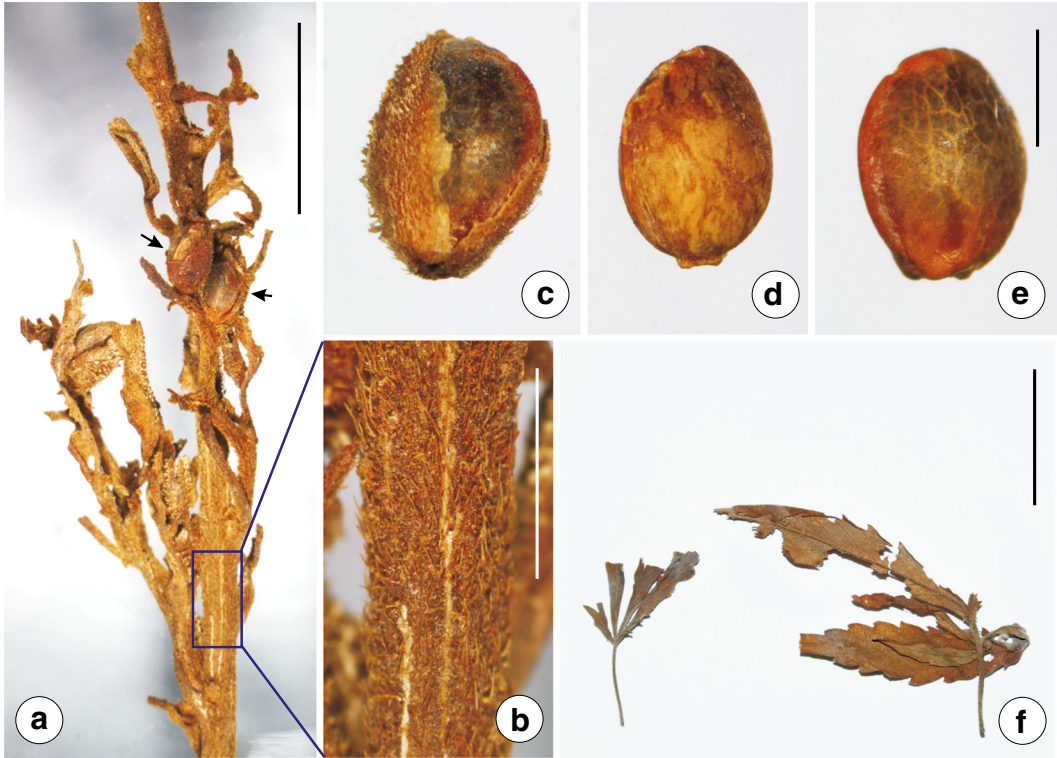


Fig. 4. Light microscope photos of parts of the recovered *Cannabis* plants. **a** Female floral remnants along a central stalk (scale bar = 8 mm). **b** Hairy non-glandular trichomes covering the epidermis of a stem. **c** Mature fruit with surrounding bract. **d** Fruit enclosed within the perianth. **e** Fruit without the perianth. **b–e** Scale bar = 2 mm. **f** Leaf fragments with a characteristically palmate compound form and serrated margins.

psychoactive Δ^9 -THC) and the lack of cannabidiol in the ancient *Cannabis* samples found in Yanghai tomb M90, along with the large seed size, and no evidence of hemp clothing or rope, researchers concluded that these ancient remains were derived from cultivated *Cannabis* plants that had been selected for “pharmaceutical, psychoactive, or divinatory purposes” and should therefore be classified as *C. indica* (Russo et al. 2008).

In addition to the nearly whole plants recovered from Jiayi tomb M231, fruits, bracts, fragmented leaves, as well as small stem segments of *Cannabis* were also discovered in earthenware pots recovered from tombs M156 (M156C-1 and M156C-6, see Fig. 6), M157 (M157-4), and M237 (M237-1); these *Cannabis* remains are similar to those discovered in the 2700-year-old Yanghai tomb M90. Researchers concluded that the finely cut and gathered *Cannabis* (~0.8 kg) recovered from that Yanghai tomb was associated with the tomb’s occupant, who may have been a shaman based on associated artifacts, e.g., a

rare and distinctive harp (*konghou*) seldom discovered in coeval cemeteries within the region. We suggest that this prepared *Cannabis* was probably deposited in the Yanghai tomb M90 grave with the corpse for its psychoactivity, possibly to facilitate communication between the human and spirit worlds and/or for its medicinal value (Jiang et al. 2006); however, it may have been simply placed there as an appetite stimulant (e.g., see Patel and Cone 2015). A cache of caper seeds (*Capparis spinosa* L.) and *Cannabis* inflorescences which were likely used for medicinal purposes was also discovered in another ancient Yanghai cemetery tomb (Jiang et al. 2007).

In addition, *Cannabis* remains have also been discovered at several other Central Eurasian archeological sites. Carbonized seeds of *Cannabis* were discovered in the first millennium BCE Pazyryk Culture tombs of south Siberia and were also considered to be evidence for ritualistic if not psychoactive usage (Rudenko 1970). Recently, *Cannabis* seeds were discovered in the

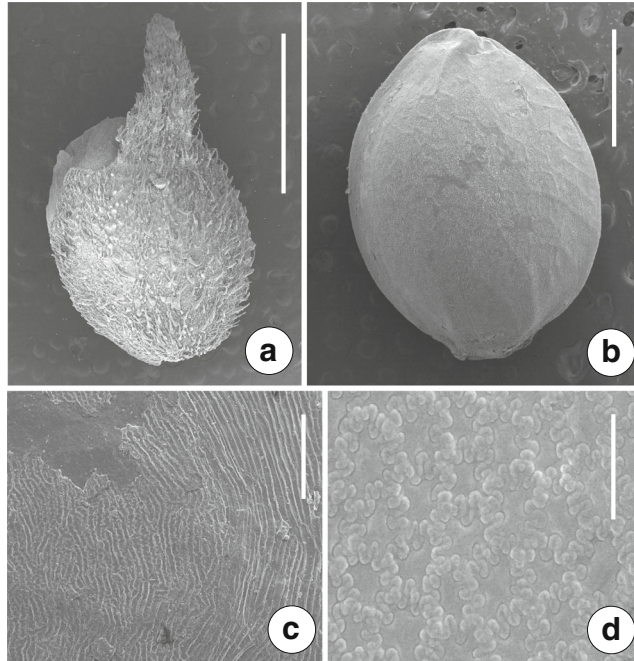


Fig. 5. Scanning electron microscope (SEM) images of *Cannabis* fruit remains. **a** Fruit with bract. **b** Fruit with perianth, showing the slightly tapered apex, truncate base, as well as the finely reticulate venations. **c** Aligned perianth cells, showing both straight and undulate cell walls. **d** The inner surface of the endocarp showing the undulate cell walls.

contemporaneous (first millennium BCE) Altai Mountain Pazyryk Culture tomb of the Ukok “princess” who may have died of breast cancer, with

researchers suggesting that the *Cannabis*, in this case, was used “to cope with the symptoms of her illnesses and evidently gave her “an altered state of



Fig. 6. *Cannabis* fragments discovered in Jiayi cemetery tomb M156 C-1.

mind,” leading her kinsmen to the belief that she could communicate with the spirits” (Liesowska 2014). Apparently, medicinal and possibly spiritual or at least ritualistic *Cannabis* use was a widespread custom among Central Eurasian peoples during the first millennium before the Christian era.

The unique discovery of 13 *Cannabis* plants produced locally approximately two and half thousand years ago, and found intact and nearly whole, is a remarkable archeobotanical discovery in its own right. The purposeful combination of these culturally useful plants into an apparent burial shroud which was placed upon a deceased male, who may have been a shaman as well, in a tomb in northwestern China, provides new insight into the sacramental use of *Cannabis* in prehistoric Central Eurasia.

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Compliance with Ethical Standards

Author Contributions. HJ, MM, and LW proposed the current study and engaged in field work. HJ, MM, and RC wrote the article drafts. LW, YZ, GX, and XD performed the majority of the background research. YP performed the chronological research.

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