

BingJam (Ice silkworm) and BingGeum (Ice brocade) of the East and Silk People Seres

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Abstract: The study explores the historical connection between the silk production of the Seres and the wild silkworm silk produced by the Bing-Yi Dong-Yi people in ancient East Asia. It focuses on several key aspects: Textiles-BingJam, BingGeum, and JakJam fibers, utilizing both Eastern and Western historical records for cross-referencing revealed the identity of the Bing-Yi, as early silk weavers. The Bing-Yi people had inhabited the WonGyo Mountain region of modern-day Shandong around 2,300 BC, utilized natural 5-colored BingJam fibers from wild silkworms, later dyeing to create intricately woven Saekdong textiles. The ancient BingJam is identified as present-day JakJam or CheonJam of autumn harvest. Additionally, the Bing-Yi were known by other names, including Pung-Yi, Mu-Yi, U-Yi, and Ram-Yi, indicating their classification as part of the Gu-Yi countries in the Go-Joseon period and their ties to the Dong-Yi of ancient Korea. The research emphasizes that the origins of silk production should not be attributed to India or the central region of China, but rather to the Dong-Yi culture in the Far East. It cites archaeological finds such as jade sculptures representing silkworms from the Hongshan culture and brocade silk artifacts excavated from the Weiyngzi area as critical evidence supporting the historical presence and the production of silk and Geum brocade of the Dong-Yi within Go-Joseon. Seres was Yuezhi, one among Ma(k)Han in the Sam(k)Han, were engaged in international trade, exporting not only their silk brocade containing sericin but also high-quality iron produced in the Jin/Byeon(k)Han region and luxury patterned furs of Bal-Joseon.

Key words: wild silk, JakJam, Bing-Yi Dong-Yi, Go-Joseon Korea, Yuezhi Ma(k)Han, Xiongnu

Introduction

A significant number of wild-silkworm relics have been excavated across the Eurasian Steppe, and there are references to silk in the works of Herodotus and Roman documents. The term 'silk' is derived from the Goguryeo word 'sil-kkury,' which combines 'sil'(thread) and 'kkury'(winder) [1]. Goguryeo, one of the Three Kingdoms of Korea, played a crucial role in the development of silk production and trade. Wealthy Roman women would unwrap heavy Far Eastern silk fabrics and reweave them into sheer fabrics or tapestries [2]. Silk was not only a luxury item but also served as international currency. During the Middle Ages, coins were issued in insufficient quantities and their

metal content was difficult to verify. As a result, durable, lightweight, and reliable 'sil-kkury' became a form of international currency. This silk thread was used to pay soldiers in Central Asia, and in some Buddhist temples, monks who violated religious orders were fined with silk thread [3].

Before the term 'sil-kkury' emerged, silk was known as 'Ser' or 'Seres' in ancient Western world. Seres, who brought silk fabrics from the Far East during the BC 5th century, were described by oriental scholar Henry Yule (1820-1889): "Serica, inhabited by the Seres, is vast and densely populated. To the east, it is bordered by the great sea, and to the west, it extends to the borders of Imaus and Bactria. The residents are enlightened people with a mild and gentle temperament: they refrain from conflicts with neighboring countries and are reluctant to have intimate relationships. They are not stingy in selling their products, such as silk fabrics, raw silk yarn, furs, and high-quality iron" [4]. The extensive land of Seres was referred to as Serica, Sericara on Ptolemy world map, and Sericarigio by Johann Schöner (1482). The size of this land suggests that its inhabitants were nomadic horse people.

A Roman poem praised the beautiful silk fabrics of Seres. "The Seres barbarian weaves richly colorful silk fabric in the desert lands, and their mastery is astounding. A shining flower garden spreads out over the silk fabric" [1]. This was not plain silk but patterned silk brocade, which was exported to Persia, Rome, and North Africa during the BC 6th ~5th centuries [5]. The Silk Road was established and actively used by Seres, not by Jina (支那, Thina, Cina). The origins of the Silk Road date back at least two thousand years earlier than commonly believed [6]. Facts can often differ from widely-known beliefs. For instance, although paper is traditionally attributed to CàiLún of Han (漢 蔡倫), hemp paper from Dunhuang (敦煌) predates this, and earlier still was broken silk-fiber paper (蠶絹紙) from Dong-Yi (東夷) [7]. Medieval paper produced in Damascus, Baghdad, and Samarkand was best suited for writing and Arab geographer's map was turned upside down, which placed the Caspian Sea and the city of Balasagun near Issyk Kul at the center of the world. For a long time, the world's leading intellectual centers were Baghdad, Balkh, Bukhara, and Samarkand, not Europe or the West [3].

Among the silk fabrics exported by Seres, there was a fabric called 'Geum (錦, Jin)' known for its multi-colored yarns and splendid patterns. Geum silk brocade was invented in BC 11th century in present-day Shandong (山東) [8]. Geum can be classified into warp Geum and weft Geum based on the direction of the colored threads (Fig. 2b). Warp Geum, which predates weft Geum by about 1,700 years, was made using more advanced weaving techniques and is thus significant in the history of weaving. Ancient literature before the 7th~8th centuries AD primarily refers to warp Geum. In the *Theory of Salt & Iron* (鹽鐵論) of the Han (漢) period, it is noted that the upper class wore 'Yok Su Ra Hwan' (縛繡羅紈), while the middle class wore 'So Je BingGeum' (綾緋冰錦). The term

BingGeum (冰錦), or "ice brocade," refers to this type of silk brocade. But why was Geum called Bing Geum?

Notice that the Geum silk brocade was exported alongside luxury furs and high-quality iron. At the time, the society producing these 3 items must have been highly advanced. So, where were high-quality iron and furs produced? Ancient Roman sources described Seres iron as the best, with Partian iron as the second best, according to the first Western dictionary [9]. Additionally, the Dong-Yi people were known for their advanced iron processing techniques, as indicated by the composition of the character for iron (鐵 = 金 + 夷). The original form of 'iron (鐵)' means 'metal (金) of the Yi (夷)'. Jin/Byeon (k)Han (辰/弁韓), Gaya (伽倻) and Silla (新羅) of ancient Korea were renowned for their excellent ironworking techniques [10]. There are also records of beautiful patterned animal furs (文皮) produced and exported by Bal-Joseon (發朝鮮) in the BC 7th centuries (管子). In ancient China (Jina), there were no looms capable of weaving Geum, nor was there significant trade with the outside world [11]. In contrast, ancient Korea had looms capable of weaving Geum [7], and a lot of both Geum records and Geum artifacts [12].

The people who wove beautiful silk jacquard from wild-silkworm threads and exported it to the West, along with high-quality iron and luxury furs, were significant figures in the 7th century BC. Thus, this study aims to uncover who the Seres were, where they lived, their relationship with Bing-Yi, where wild-silkworm threads were produced in large quantities, and the nature of the ice brocade known as 'Bing Geum.'

Silk relics found in the West before Silk Road

Silk relics dating back to around 2,000 BC have been found in Uzbekistan, indicating that silk was transported through east-west trade since prehistoric times. Silk fabrics, including Geum brocade, have been discovered in Siberia, Western Europe, and Mongolia, with most of these silks from wild silk of Manchuria or India (Fig. 1). These findings challenge the traditional theory that silk exclusively originated in China [2].

Wild-silk threads and fabrics have been excavated from various Iron Age sites in Europe and the Mediterranean, such as Hohmichele-Hallstatt and Hochdorf-Eberdingen. In Kerameikos, Greece (5th century BC), plain silk fabric from *Bombyx mori*, containing sericin, red threads, and wild-silk fabrics, was found. Sericin-containing embroidery threads were also discovered on tapestry fragments at the Cimmerian site of Gordion in Anatolia (6th~7th century BC), which bear technical and stylistic similarities to the Hohmichele and Hochdorf examples. Wild-silkworm silk fabrics found at Noin-Ula and Edsen Gol in Mongolia (2nd century BC) were not produced by sericulture in China, highlighting that they were made locally rather than being tribute or plunder [2]. Thus, ancient silk relics either retained sericin or were wild silkworm silk.

Movement in the Steppe area is largely unobstructed, allowing for high speeds. International trade market was held in Beijing (北京) as early as the BC 9th century [13],

where various goods were traded. Persian merchants soon became the primary intermediaries in the silk trade between East and West. When war broke out between Byzantium and Persia around 500 AD, supplies to the West were cut off [2]. Thus, understanding the characteristics of silk in long-distance exchanges accross the Steppe during the 1st millennium BC requires a thorough examination of related literature from the East.

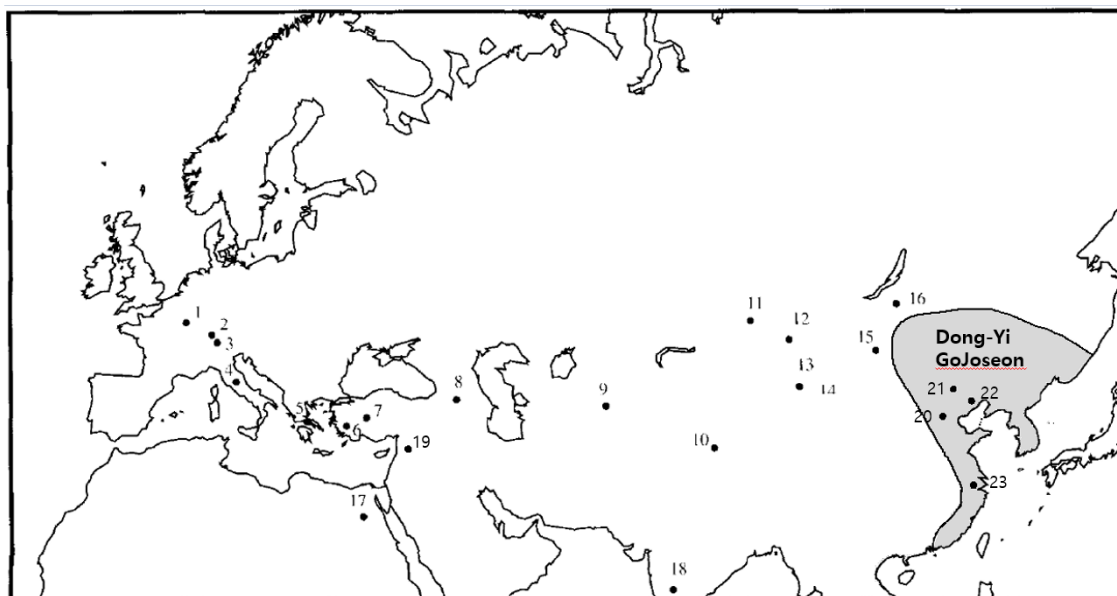


Figure 1. Silks in Eurasia during the period of the Far East Go-Joseon (古朝鮮) (BC 20th century ~ Sam(k)Han (三韓): Jin(k)Han, Byeon(k)Han, and Ma(k)Han)

1 Altrier	5 Kerameikos	9 Sapalli Tepe	13 Louran	17 Deir al Medina	21 Nasate 那斯台
2 Hochdorf	6 Sardis	10 Niya	14 Lop Nor	18 Nevassa	22 Weiyingzi 魏營子
3 Hohmichele	7 Gordion	11 Pazyryk	15 Edsen Gol	19 Palmyra	23 Qianshan yang 湖州
4 Chiusi	8 Toprak Kale	12 Arzhan Ukok	16 Noin Ula	20 Beijing	

Early wild silkworms of Hongshan & Ancient Korea

Jade silkworms found in the Hongshan (紅山) culture and Inner Mongolia suggest that silk fabric production was possible around BC 4,500 [14], necessitating a revision of the history and origins of silk. Silkworm sculptures were also excavated from Huwa, Liaoning (后洼 遼寧) (Fig. 2a), and numerous jade sculptures and jade silkworms were discovered at the Parim-ugi ruins in Inner Mongolia. Additionally, the world's first Geum

brocade, found in Weiyngzi culture (魏營子文化) of the Go-Joseon region, featured a high warp-yarn density of 52×14 threads/cm² and was brown and black (Fig. 2c) [15]. These findings strongly suggest that Geum originated in Go-Joseon, the earliest Korean dynasty.

Jade was a significant religious symbol representing faith. The relics excavated from the Hongshan culture are identical in material and style to those found in Korean sites, indicating that Hongshan culture is associated with the Go-Joseon [14]. Kwak Dae-sun (郭大順) of Jina scholar noted that from an archaeological perspective, the lower culture of Xiajiadian (夏家店下層文化) coexisted with both hunting and advanced agriculture, suggesting it could have been part of Sukshin (肅慎). Wang Hye-deok, Yoo Byung-ho and Seol Ji-gang said that the lower culture of Xiajiadian represents the Dong-Yi culture [16]. Sukshin, Dong-Yi, (K)Han (韓), DongHo (東胡), and SanYung (山戎) were various names for Go-Joseon [17], reflecting its extensive territory.

People from the Hongshan culture area migrated, and their culture naturally flourished in what is now Liaodong (遼東) and Shandong. These two peninsulas were connected by neighboring islands, facilitating frequent human and material exchange [18]. Dong-Yi was a region in present-day Shandong and Jiangsu Province (江蘇省), and Dong-Yi was not part of ancient Jina but rather a region within ancient Korea's GoJosen, as indicated by the *Dong-Yi Chronicles of the Three Kingdoms* (三國志), which list Buyeo (夫餘), Goguryeo, Dong-Okjeo, Eupru, Ye and (K)Han, and the *Dong-Yi Chronicles of Gu-Dangseo* (舊唐書), which include Goguryeo, BaekJe, Silla, Wae (倭), and Il-bon (日本, Japan) [17].

The character for silk fiber ‘糸’ and silkworm hieroglyphs appear on stone, bronze and oracle bone inscriptions dating back to around 2,000 BC. In interpreting 1,000 oracle bone characters, 10% were related to silk, including terms such as ‘mulberry trees’, ‘silkworms’, and ‘silk goddess’ [19]. The history of sericulture is traced back to a tabby silk fabric piece from *Bombyx mori* discovered at the Qianshanyang site (2,300 BC) in Zhejiang Province (浙江省) [2]. Furthermore, the 1st King Dangun of Korea promoted sericulture nation-wide as early as 2,333 BC. Buyeo, YeMaek (濊貊), and other so-called Dong-Yi of the ancient Korea wove a significant amount of Geum brocade (三國志 東夷傳), and ordinary people enjoyed Geum clothing during holidays (後漢書 東夷 列傳). Additionally, the Buyeo (夫餘) people exported Geum [20]. Many historical records indicate that ancient Korea produced a large quantity of beautiful Geum silk brocade [21].

This indicates that silk production in Go-Joseon began very early and that it was a wealthy society. Buyeo celebrated the Cheonje (天祭), a major national event, during the first lunar month of Yin (殷). During this festival, the people engaged in drinking, eating, singing, and dancing day & night. This event was called YeongGo in Buyeo and DongMaeng in Goguryeo (三國志 烏丸鮮卑東夷傳- 殷正月祭天 國中大會 連日飲食歌舞 名曰迎鼓) [22].

The *HanSu Geography* (漢書 地理志) records that the Dong-Yi nations were

known for their many specialties, including fur (Giju), mountain silkworms used for string instruments (Cheongju), five-colored soil as pigments and black-striped silk fabrics (Seoju), and Geum brocade (Yangju) (冀州-鳥夷皮服, 青州-萊夷作牧, 厥斐壓絲, 可以弦琴瑟, 徐州-貢土五色 厥斐玄織綺, 揚州-厥斐織貝) [7]. This shows that the people of the Far East enjoyed a rich cultural life, with musical instruments and colorful patterns created using five mineral dyes long ago. Korea has historically made excellent use of natural colors from plants and minerals. Particular, blue, the color of the East, has contributed to overall color harmony [23].

Various types of silk fabrics were already developed around the 10th century BC in the East. These included medium-thicknesses fabrics such as Gyeon (絹) and Baek (帛), thick Geum (錦) and Chum (縑), ultra-thin fabrics of Hwan (紬) and Sa (紗), crepe Gok (縠), leno Sa (紗) and Ra (羅), jacquard Geum (錦) of multi-colored pattern, and damask Gi (綺) & Reung (綾) with hidden pattern (暗花). Additionally, silk fabrics were decorated with drawing (畫, 績) & embroidery (繡) [8].

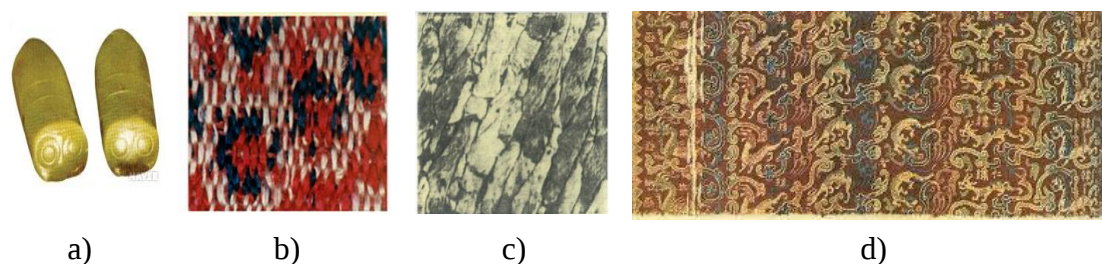


Figure 2. Jade sculptures in the form of silkworm & Geum fabric relics

- a) Jade silkworms from Huwa, Liaoning Province (BC 4,000) (Park, 2013)
- b) An example of warp-faced patterned silk fabric, Kyung Geum (經錦)
- c) The 1st Geum (warp-faced double silk fabric) in the world (魏營子文化- 遼陽 朝陽, BC 11th~10th century) (Hwang & Chen, 2016)
- d) KHan Geum (韓錦) of five-colored Saekdong warp-stripe (New Delhi museum, India)

Early Geum featuring the ‘韓 kHan’ character, sacred animal patterns from the north, and five-colored Saekdong stripes are considered Korean elements (Fig. 2d). ‘During the reign of King Ying (靈) and King Huan (桓) of the Later Han dynasty, kHan and Ye (濊) were strong, leading many people to migrate to the kHan region due to the lack of government’s control’ (桓靈之末韓濊彊盛郡縣不能制民多流入韓國) (三國志 東夷傳). This kHan Geum, woven when the kHan was powerful, was excavated in Louran of Takla-MakHan, Central Asia. The inscription reads: ‘韓仁繡文右衣子孫無極 May kHan’s descendants prosper forever!’ [7].

The Geum fabric is heavy, dense, and stiff, characteristic of brocade and jacquard, contrasting totally with the thin and drapey ‘China silk (紬)’ of plain structure. In addition

to Geum and Gye (罽, wool brocade), dense Chum (縑, made with two yarns together) was a specialty of Jin(k)Han (辰韓) and Byeon(k)Han (弁韓), and Byeon(k)Han wove wide, delicate fabrics (廣幅細布) [24]. Goguryeo was renowned for its Saekdong 5-colored Geum and white Goryeo Geum (高麗白錦). ‘Gogureyo people wove Geum, with purple tie-dye Geum (紫地縑文錦) being the best, followed by 5-colored Geum (五色錦), and cloud Geum (雲錦).’ (翰苑 蕃夷部 高(句)麗條, 三國志 高(句)麗條) [15].

Cultivated silkworms vs. Wild silkworms

General silk is produced by raising silkworm (*Bombyx mori*) in controlled environments, feeding them mulberry leaves to yield fine white silk known as mulberry silk. *Bombyx mori* has been domesticated to the point of losing its natural pigment and can’t survive in the wild. In contrast, “wild” silk is produced by various caterpillar species, resulting in silk that is not white but comes in colors such as yellow, orange, brown, green, and dark gray [25]. The color of wild silk derived from the caterpillar’s diet: leaves high in tannins impart these colors of the silk [26].

Wild silk is coarser and stronger than cultivated silk, enhancing the garment’s durability and practicality. Wild silk fibers, mainly JakJam, are usually yellowish brown, triangular or flat in shape, and 2~3 times thicker than cultivated silk. They also have poor dyeing properties, so the unique natural color is often used without additional dyeing [27].

The Manchuria tussah moth (*Antheraea pernyi*) produces silk from larvae that feed on various species of oak trees (*Quercus spp.*) in a semi-sericulture process. The oak trees are pruned to a height of 1.5~1.8 m and the larvae are raised on the trees. The adult larvae measure 3~5 inches long and are light green with reddish-brown hair. Two crops are harvested each year: a smaller spring crop, which serves as a breeding resource, and a larger fall. Most of the silk from the fall crop is wound into filament yarns, while perforated cocoons cannot be reeled. From 1 acre of mulberry field, approximately 20 kg of raw reeled filament silk and 30 kg of spinning fiber can be obtained [26].

Most of ancient Japanese culture was influenced by external sources, including silk, clothing, ships, bronze, and ironware, until the AD 9th centuries [7]. It is said that sericulture was introduced to Japan in the 34th year of the reign of King Sango (尚故) of BaekJe of Korea, when King Gongman (功滿) brought silkworms to Japan and taught sericulture. In 1938, Japan’s silk production was about four times that of China (287,200 tons compared to 65,500 tons) and about 10 times that of Korea (22,000 tons). However, by 2010, Korea and Japan produced almost no silk, while China produced 290,000 tons, India 151,000 tons, and Uzbekistan 25,500 tons [27].

Methodology

Ancient historians often wrote vaguely or used metaphors to avoid punishment for revealing sensitive truths. Altering and recording letters with similar sounds is called the traditional writing (繁体) or Juseo (朱書). Also, ‘Gacha (假借)’ refers to ‘borrowing

the pronunciation of those who worship the sun' [28]. The Sun (해, 日, 奚) tribe, using phonetic characters, is identified as the Dong-Yi, the ancient Korea. Although it is challenging to find explicit references to Go-Joseon in ancient documents due to deliberate erasure, many traces and contextual clues remain. The technique of 'procedural syllogism' [21] was employed to uncover hidden truths in these documents: Shan Hai Jing (山海經), Shijing (詩經), SeoGyeong (書經), *Theory of Salt & Iron* (鹽鐵論), ShiYiJi (拾遺記), Dokdan (獨斷), Yi-A (爾雅) and SeoGyeong-JapGi (西京雜記). We also reviewed various types of silk fabrics, the previous literature on silk from Korea, Japan, China, and the West, and ancient records related to Geum brocade. An in-depth study of ancient literature related to wild silk in the Far East was conducted, aiming to determine the origins and properties of wild silkworms in the East.

The investigation included examining the geographical environments and cross-checking Western records on Seres' exports. We analyzed clues from multiple fields and current maps of China's agricultural specialty products. Additionally, we sought to identify the locations from which high-quality iron and fur were exported to the West in ancient times. Through convergence analysis of these factors in relation to silk production, we aim to identify the location of Seres and its connections with ancient Korea.

Results & Discussions

1. BingJam (冰蠶) silkworms of WonGyo Mountain

"In WonGyo Mountain (員嶠山), there were BingJam (Ice silkworms) that produce five-colored cocoons when covered by frost. Later, people dyed (cultivated) silk fibers into five colors and wove them into Geum, following this tradition" (員嶠山有冰蠶, 霜覆之, 然後成繭。其色五采, 後代效之, 染五色絲, 織以爲錦。拾遺記) [21]. This passage clearly describes the origin of wild silkworm and the five-colored Saekdong, with BingJam creating colorful brocade.

"WonGyo Mountain is the origin of a tree called YiSang (猗桑), whose berries are sweet. BingJam silkworms are black, 7 inches long, with horns and scales. When covered with frost and snow, they produce cocoons that can reach a foot in length, and are five-colored. The fabric woven from these ice silkworms is vibrantly patterned Geum. It does not get soaked in water and does not burn when thrown into fire. During the reign of the King Yao (堯), overseas foreigner (海人) presented this exquisite silk to the king, who made Bobul, the treasure cloth. The Busang tree (扶桑) sheds its leaves once every ten thousand years...To the north of WonGyo Mountain, lies the country of HwanChang (浣腸)" (員嶠山(環丘)有木名猗桑, 煎樅以爲蜜。有冰蠶長七寸, 黑色, 有角有鱗, 以霜雪覆之, 然後作繭, 長一尺, 其色五彩, 織爲文錦, 入水不濡, 以之投火, 經宿不燎。唐堯之世, 海人獻之, 堯以爲黼黻。扶桑萬歲一枯。北有浣腸之國 : 拾遺記).

Notice the references to ‘overseas foreigner’, and ‘King Yao’ who lived the same time of the 1st King Dangun (檀君) of Go-Joseon with the country of HwanChang and Busang. The origin of BingJam dates back to the reign of Dangun (BC 2,333), becoming a specialty of the Dong-Yi, and was highly valued by King Yao, who used it for ceremonial attire. The Jina people believed the Dong-Yi lived near the sea, around the current Shandong Province, separated by the Yellow River (黃河) or several large inland lakes. Recent evidence suggests that Balhae (渤海) was an inland lake (大陸澤) in Hebei Province (河北省) [29].

“Hundreds of millions of miles east of the Balhae, there are five mountains in a great valley: one is DaeYeo (岱輿), the second WonGyo (員嶠), the third BangHo (方壺), the fourth YoungJu (瀛洲), and the fifth BongRae (蓬萊).” “渤海之東不知几亿万里，有大壑焉……其中有五山焉：一曰 岱輿，二曰 員嶠，三曰 方壺，四曰 瀛洲，五曰 蓬萊。” (列子·湯問) These mountains were considered holy places, inhabited by mountain gods (神仙) who live thousands of years (中國 漢語詞典).

There is also a poem in the period of Tang (唐), which contains stories about the mountain god of WonGyo (山神), seaweed, BingJam, and King Yao, and highlights the historical significance of Go-Joseon's 5-colored silk Geum. The poem reads: “Mr. WonGyo has no gray hair; he eats green seaweed in the depths of the cloud sea. A person from mount Bong (逢人) asked Tang Yao (陶唐主) if he wished to purchase BingJam silkworms with five-colored silk fibers (員嶠先生無白發，海煙深處採青芝。逢人借問陶唐主，欲進冰蚕五色絲 -徐凝，唐.) This explains that WonGyo Mountain is near a deep sea where undying hermits live. It also indicates that this was the origin of the wild silkworms, the natural five-colored BingJam, and that the person of Bong presented this silk to King Yao.

These records consistently indicate that BingJam's 5-colored wild silk and BingGeum started from WonGyo Mountain in Dong-Yi since the time of the 1st Dangun King of Go-Joseon. Mr. WonGyo or the person from Bong is thought to represent Dangun as a mountain god. According to BuDoJi (符都誌), WonGyo mount was located in BongRae Mountain of present-day Shandong [30].

2. JakJam (柞蠶) & CheonJam (天蠶)

The main wild silkworms are JakJam (oak silkworm, Fig. 3a, b, & f, *Antheraea pernyi*) and CheonJam (sky silkworm, Fig. 3c, *Antheraea yamamai*) which live on oak trees. These silkworms are larger, and their threads are superior and stronger than those of GaJam (家蠶, house worms) or SangJam (桑蠶, mulberry-tree worms). Wild silk fibers are long in cross-section and have surface lines and a ribbon-like twist (Fig. 3d & e). The horn of the CheonJam worm is found in Manchuria (Fig. 3b). The appearance of the horned worm in the ShiYiJi and Aristotle's description of the silk origin as a curious “horned worm” reflects its significance [2]. JakJam silk was significantly more expensive and was used for string instruments and fishing in ancient times [31]. JakJam silk fibers

were found around the ancient Yalu River or Yap River (鴨(綠)江) [17].

The term 'Guol Bi Yom Sa' (厥筐槩絲, meaning 'barbarian's basket filled with mountain silkworm fibers-書經 禹貢),' indicates wild-mountain silk fibers were a specialty of Yi (夷) people. Similarly, 'Guol Gong Chil Sa' (厥貢漆絲) meaning 'barbarian tribute lacquer and silk fibers (書經 禹貢),' suggests that wild silk and lacquer were specialties of the Dong-Yi during the era of Xia Yu (夏禹). These records align with the account of BingJam from Bong person at WonGyo Mountain being presented to King Yao as a gift, implying that JakJam is historically understood as BingJam.

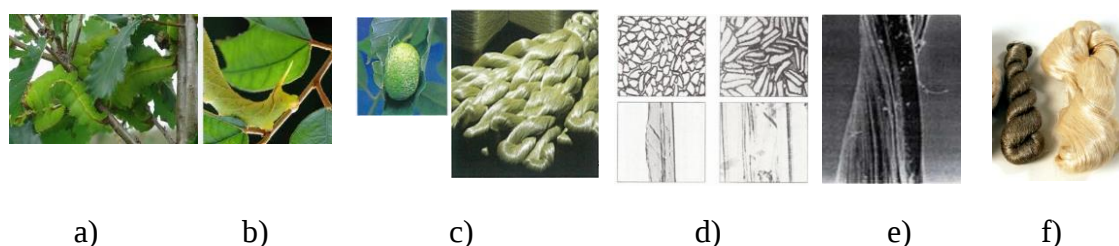


Figure 3. Various wild silkworms - Manchuria JakJam & Japan CheonJam

- a) JakJam silkworms on oak tree (Chu, 2017) b) CheonJam with (holy) horn
c) Natural green color of CheonJam of Nagano Japan (N. Maruyama, & M. Domei, 2012)
d) Microscope views of cross section & side view (cultivated-left vs. wild-right)
e) Ribbon twist and surface lines of JakJam fiber f) Natural colors of JakJam fiber

Another type of JakJam, CheonJam with natural green color (Fig. 3c), is raised in the Hodaka (穂高) village of Nagano (長野), Japan [32]. This CheonJam silkworm has been cultivated in Japan for over 1,000 years and is now produced in only a few places. It hold significant cultural and ritual valule, with products like small tablecloths, ties, belts, Buddhist altar cloths, and family picture frames, some of which are valued at thousands of U.S. dollars [33]. Known as 'the queen of fibers' and 'the diamond of fibers', it is admired for its luster and durability, often lasting for three generations. The term 'Cheon' (天), used to denote items from Korea, reflects the Dong-Yi people's reverence for the sky. Thus, CheonJam signifies "the silkworm of the sky."

The title 'CheonJa (天子),' meaning 'son of the sky,' was used by the Yi-Jeok (夷狄) people because they considered heaven as their father and earth as their mother (天子, 夷狄之所稱, 父天母地 故稱天子- 獨斷) [34]. The phrase 'Sky raises Joseon people, who live near water (朝鮮天毒 其人水居)' from the *Shanhaijing* (山海經) reflects this belief. The title 'son of the sky', CheonJa was first used by the Dong-Yi, and later appeared for the kings of the Xiongnu (匈奴), Yuezhi (月氏, 月支), and Kushan [3]. In a letter from the leader Mòdú SeonU (單于) of Xiongnu to Han Mun-Ti (漢文帝) in 176 BC, Mòdú refers to himself as 'The great SeonU established by the sky'[35].

Although ‘CheonJa’ has been mistakenly identified as the title of a Jina king, it was actually used by Dong-Yi (and Buk-Jeok) people. The title CheonJa was originally associated with the Gu-Ryeo (九黎)’s Chi-U and primarily referred to the Danguns of Go-Joseon dynasty. During the Xia, Yin, and Zhou period (夏殷周), the Jina referred to their leaders as ‘king (王)’ [34]. ‘CheonJa is extremely noble and... regards the world as his home, not the palace as his residence, travelling around the world in a chariot (天子至尊... 天子以天下爲家, 不以京師宮室爲常處, 則當乘車輿 以行天下-獨斷)’. The 1st King Dangun did not mind the hardships of traveling to care tribes and unify languages [30]. Dangun Go-Joseon regularly held heavenly ritual ceremony (祭天), which continued into modern Joseon. Except for Qin ShiHuang (秦始皇), the Mongol Yuan (元), and the Qing (清), none of the ancient Jina dynasties maintained this worship of the sky.

Jakjam wild silkworms (*Antheraea pernyi*) were widespread south of Siberia and the Mongol desert in the 2nd century BC [2]. This distribution area intriguingly aligns with the region believed to be the residence of the ‘silk people Seres’ (Fig. 4a & b) [36]. As will be mentioned later, Seres is Yuezhi moved west by the Xiongnu. While the Yuezhi was associated with present-day Tajikistan [2], it is believed to be Kyrgyzstan, which claims to have the oldest history in the world. Early Yuezhi (古月氏地) located in the Ordos, south of the Great Wall, and to its west is Dunhuang (Fig. 4c).

According to Marco Polo's 13th-century travelogue, he crossed the Ordos and noted that cities of Taiuanfu (太原府) and Pianfu (平陽府) (the territory of the Buk-Jeok Xiongnu) were the only places for their wine production (influenced by the West), and at the same time, silk was abundant due to the plentiful growth of silkworm trees [19]. This confirms the location of the Yuezhi, who were closely connected to both the West and the East, Dong-Yi.

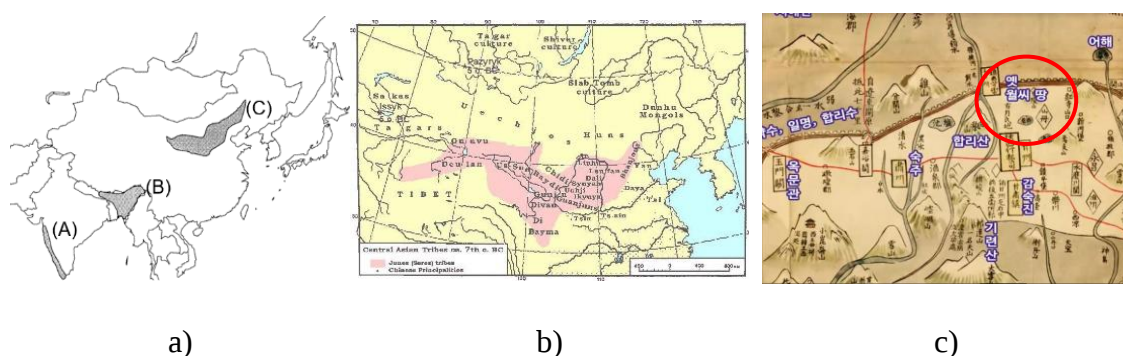


Figure 4. Maps showing the distribution of wild silkworms and the residences of silk people Seres and Yuezhi

a) Distributions of natural silkworms in the 2nd century BC (Good, 1995)

(A) *Antheraea mylitta* (B) *Antheraea assamensis* (C) *Antheraea pernyi*

b) Seres residence in the 7th century BC (Voevoda et al., 1998)

c) Early Yuezhi's location over Qilian Mountain (大清廣輿圖, 1785)

JakJam fibers are special products from the present-day Shandong and Liaodong Peninsula, according to the map of regional agricultural products of modern China (1950). The square marked in red indicates the area of JakJam fibers, while the circle denotes the region where GaJam fibers are cultivated (Fig. 5). Dandong in Liaoning Province has been a major center for Tussa silk production for two centuries, accounting for approximately 70% of China's production in 1980 [33]. The so-called 'Shandong silk' is a relatively thick fabric with irregular ribs, due to the use of wild silk fibers [27].

Dong-Yi was described as 'the land of long-lived immortals or as polite and noble. Despite its large size and strong army, it was not arrogant and did not invade other countries' (後漢書 東夷列傳). At the same time, U-Yi (嵎夷) of Shandong Dong-Yi was regarded as 'barbarians' as shown in the 'Guol Bi Yom Sa' (厥篚檿絲) and 'Guol Bi Jik Pae' (厥匪織貝) due to Sino-centric ideology (春秋筆法 - 書經禹貢).

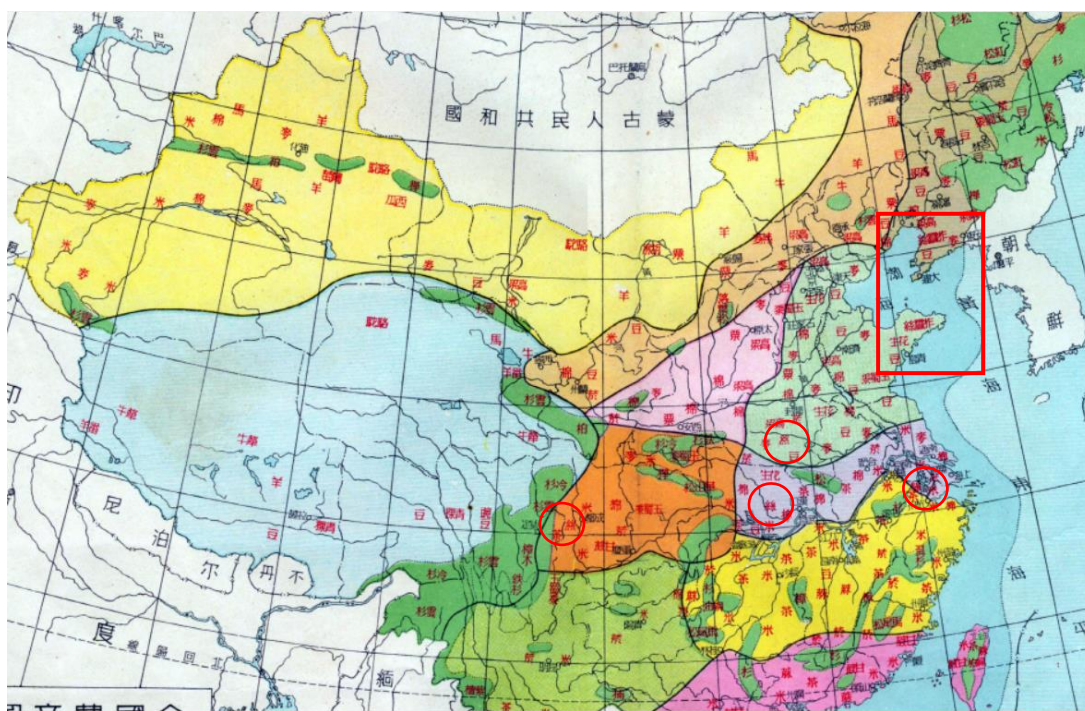


Figure 5. JakJam agricultural industry in Shandong & Liaodong (中國全國農產圖, 1950)

Map from the textbook of current China (Fig. 6a) show the locations of Jo-Yi (鳥夷), Gu-Ryeo (九黎), Gu-Yi (九夷), U-Yi (濩夷), Rae-Yi (萊夷), Hoe-Yi (淮夷), SamMyo (三苗), and Do-Yi (島夷). The map confirm that the Dong-Yi people occupied a vast area, covering much of the eastern part of the continent, with Go-Joseon likely located in the center of these regions. According to Seo Ryang-Ji (徐亮之), a Jina historian, present-day Shandong was the center of Go-Joseon as noted in his forbidden book (中國史前史話) [7]. Ancient literature about BingJam of WonGyo Mt. confirms also that BongRae, located in the east with water, mountains, and valleys, was centered in present-day Shandong

Province.

3. East tartary Buyeo of ancient Korea weaved BingGeum

According to old records, 'Guol Bi Jik Pae' (厥匪織貝) from *SeoGyeong* (書經禹貢) means 'Barbarians Weaving Shells,' and 'Pae Geum Mun Ya' (貝錦文也) from *SiGyeong* (詩經 毛傳) translates to 'Shells are Geum Pattern.' This implies that Yi people and those in the mountains wove patterned Geum silk fabric, whereas the Jina people did not weave Geum [37]. Several hundred years later, around the 8th century BC, the silk industry had 'rapidly' developed in Qi (齊) and Lu (魯). When Chu (楚) attacked, Qi sent 100 silk weavers to aid them, which also boosted the silk industry in Chu [8].

The Buyeo people, who revered white, wore colorful, thick silk with embroidery, Geum silk, and patterned wool. Nobles added furs such as fox, black monkey, and black-and-white sable when traveling abroad (出國則尚繪繡錦罽, 大人加 狐狸狢 白黑貂 之裘 - 三國志 魏書 烏桓鮮卑東夷條). The Buyeo people of Go-Joseon, Jo-Yi of Dong-Yi, considered 'barbarians' or 'East Tartary,' were known for weaving Geum [38]. Buyeo originally resided in the Yim-Gi (臨沂) area of present-day Shandong Province, according to the book of Dong-Yi's origin (東夷原流史) by Ha Gwang-Ak (何光岳). Go-Joseon was famous for fur exports [40], as confirmed by records from the 7th century BC and contemporaneous accounts of the Seres people.

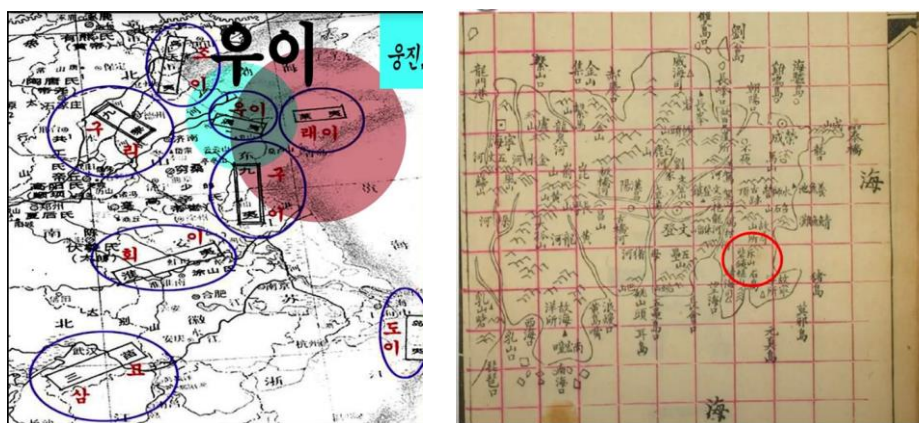


Figure 6. Locations of 8 Dong-Yi peoples and Cheok San Mt. in present-day Shandong

a) U-Yi/Mu-Yi of Dong-Yi in current Shandong (Chinese school textbook)

b) Cheok San (斥山) location near Mundeung Mt. (Lee, 2021)

Geum is relatively thick and stiff due to multiple layers of colored warp yarns, creating a bulky silhouette. The Jina people of the Han (漢) period did not favor stiff fabrics, as they preferred drapery and a slim silhouette. According to the *Theory of Salt & Iron* (鹽鐵論), 'the upper class wears "Yok Su Ra Hwan" (縛繡羅紈), while the middle

class wears “So Je BingGeum” (綾緋冰錦). The upper class of the Han Jina people preferred thin, filled (縹), embroidered (繡), transparent leno (羅) or very thin plain silk fabric (紬). In contrast, the middle class wore ‘So (綾 undyed, unrefined plain silk fabric)’ and ‘Je (緋 thick, rough plain silk fabric)’, and ‘Bing Geum (冰錦 brocade with high-density colored yarns). This proves that the stiff BingGeum was not favored by the upper classes of Han Jina people.

How was ancient Korea able to develop silk fabrics so early? The 1st Dangun WangGeom took Habaek's daughter as his queen and assigned her in charge of sericulture (養蠶), indicating that sericulture techniques were inherited from the Baedal (倍達) period preceding him, as evidenced by jade silkworms. Sericulture is estimated to have begun around 4,000~5,000 BC [19]. Thus, it is likely that silkworm farming flourished under Dangun WangGeom in Go-Joseon. Chinese records mention a silkworm god (蠶神) who pulled out the thread and presented it to Heonwon (黃帝軒轅氏), suggesting that sericulture techniques were passed from somewhere to the Jina; otherwise, the Jina people would have recorded the inception of sericulture themselves. Additionally, the *Book of Later Han* (後漢書 馬韓傳) notes that the Ma(k)Han (馬韓) people already knew how to farm and feed silkworms and produce silk cloth, highlighting the existence of sericulture in the Ma(k)Han region.

Silk materials excavated from the ancient city of Palmyra were analyzed using solubilization behavior and proteomic analysis, revealing that the fabric was made from wild silk produced by the Indian wild silkworm, *Antheraea mylitta* [42]. However, the culture of wild silkworms was introduced to India, with *Bombyx mori* originating from *Bombyx mandarina* [43]. These are saying that sericulture from Manchuria was delivered to India and Jina. Empress Heo, the wife of King Kim Suro of Gaya, hailed from Northeast India, suggesting that there were close exchanges with ancient Korea before her time [44]. By the 3rd century AD, India had begun to obtain spun yarns from wild silkworms, as the technique for producing filament yarns had not yet reached India [6]. In a region where cotton was the primary product [19], India produced few filaments due to religious practices and did not weave thick brocade. Therefore, it is reasonable to view the origins of wild silk as being from the Northeast Asia region.

4. Bing-Yi (冰夷) and Fung-Yi (馮夷) of Dong-Yi

Bing-Yi, Fung-Yi, or Mu-Yi/Ui-Yi (無夷) was the name of Habaek (河伯), water god (黃河, 清河 or 漳河), who was Dong-Yi according to Pobakja (抱朴子) and Goguryeo stone epitaph [45]. The character Pung ‘馮’ has a double sound of Bing. It is said that he rode a cloud chariot (雲車) in four directions and commanded two dragons (莊子 秋水篇 or 山海經 海內北經-郭璞 註釋). Many documents, such as SamgukYusa (三國遺事), DiwangYunjing (帝王韻紀), SejongSilok (世宗實錄), and Jiyan (記言), stated that the 1st Dangun married the daughter of Habaek. The mother of Go-Jumong (高朱蒙), the founder

of Goguryeo, is also said to be another daughter of Habaek [22]. These references suggest that Dangun, Jumong, and Bing-Yi/Pung-Yi lived near the river, a prominent area for Dong-Yi activity. He may have been called Bing-Yi due to wearing the splendid, colorful BingGeum brocade made from BingJam wild-silk fibers.

“The East is called Yi (夷). It is considered a root, benevolent and nurturing, much like how all things take root in the ground and grow. There is a country known as the Kingdom of Gentlemen (君子) and the Kingdom of the Immortals (不死), which is docile by nature and governed by principles.” Confucius expressed a desire to live in Gu-Yi of Dong-Yi (子欲居九夷) [22]. It is written that the Gu-Yi had many country names (九夷—嵎夷, 和夷, 島夷, 淮夷, 徐夷, 邾夷, 介夷, 莒夷, 杞夷, 萊夷, 郕夷, 黎夷, 串夷 : 論語 子罕篇). Interestingly, the sounds of some names are similar, that is, Bing-Yi (冰夷/馮夷), Pung-Yi (馮夷/風夷), and Pae-Yi (郕夷) are all connected, as the pronunciations of Pae (貝) and Bing (冰) were similar in ancient times [41].

The names of Gu-Yi changed over time (後漢書 東夷傳) (畎夷 于夷 方夷 黃夷 白夷 赤夷 玄夷 風夷 陽夷). The character Pung (風) is closely associated with the phoenix (鳳) of Jo-Yi (鳥夷, 島夷). Taihu Bokhui (太皞 伏羲), whose surname was Pung (風), was a leader of Pung-Yi (史記). Later, it is noted that ‘Ram-Yi is (old) Pung-Yi’ (藍夷即風夷 : 海東釋史). Ram (藍, indigo blue) shares a similar sound with Pung (風, 바람, Baram), as the pronunciation of ‘風’ was *prəm* about 2,500 years ago [41].

The land in the southwest (from TaeSan 泰山) was assigned to the descendants of Chi-U (蚩尤) (by CheonJa), as the region featured calm waters and a clear blue sky accross the vast plains. This land was called ‘Ram’ country (蚩尤氏之後封于南西之地巨野浩豁海天靚碧曰藍國宅奄慮忽), also known as Bal-Joseon (發朝鮮) or Byeon-Joseon (番朝鮮: 太白逸史 番韓世家). This Ram country (藍國) ruled over all the Dong-Yi until the 47th Dangun (高列加) (揆園史話). Thus, Bing-Yi/Pung-Yi, one of Gu-Yi Dong-Yi, lived in the fields of mulberry trees with a water god.

The sky descendants, CheonSon (天孫), were fond of indigo blue. The word for indigo plants, Ram (藍), is *Huhe* (呼和) in Mongolian, and the term Ram-Yi (藍夷) is associated with the ‘Huhe clan’(呼和氏). This eventually led to the ethnic name ‘回紇’(Hoehle, i.e., Uighur). Therefore, the name ‘BingGeum’ was related to both ‘Bing-Yi/Pung-Yi/Ram-Yi’ in the East and the blue ‘Hoehle’ in the North.

HyeonJo (玄鳥), the black bird, is considered the ancestor god of Dong-Yi and Yin (殷) according to *GoSaByeon* (古史辯), relating Jo-Yi (鳥夷) from the Hongshan culture. King Hyeon (玄王桓發- *ShiJing*) of Hyeon-Do (玄都) country came from Hyeon-Yi (玄夷), who revered the black bird as their totem [47]. The account of Prince BuRu (扶婁), known as Hyeon-Yi (玄夷) envoy (蒼水使者), teaching Xia Yu (夏禹) flood prevention techniques suggests that the Hyeon-Yi can be traced back to the 1st King Dangun of Go-Joseon (吳越春秋).

5. BuSang country (扶桑國) in the East, Go-Joseon

To obtain silk, large-scale harvesting of mulberry leaves is essential. For instance, 12,000 silkworms consume approximately 20 sacks of mulberry leaves daily, meaning about 220 kg of leaves are needed to produce 1 kg of silk fibers. Historically, cutting down mulberry trees was prohibited in Jina due to the scarcity of leaves [19].

There was a huge mulberry tree called Busang (扶桑樹) in the East (Go-Joseon), linked to the origins of sericulture, as mentioned in *ShiYiJi*. BuSang country, likely part of Go-Joseon, suggests an abundance of mulberry trees and silk. ‘There is a BuSang (country) above the YangGok (湯谷), where 10 suns bathe, and is located to the north of Heukchi (黑齒)...There is a large tree in the middle of the water, with nine suns on its branches and one sun on the top branch, and the suns come out one after another, and there is a crow in the middle of all of them’ (山海經 海外東經). ‘The silkworm is called CheonChung (天蟲, sky bug), the leaf is called CheonYeop (天葉, sky leaf), and the tree is called CheonMok (天木, sky tree) or BuMok (扶木) which is 300 里 (about 118 km) in height (maybe the area)’ (山海經 大荒東經) [22]. Big mulberry tree, ten suns, and crows frequently appear in Dong-Yi stories, reflecting their active silkworm-farming lifestyle and ancestral rites to the sun and sky. SangYeok (桑域), SangYa (桑野), and SangMok (桑木之國) indicate a rich history of mulberry cultivation and silk production of Go-Joseon.

According to *Shan Hai Jing* (山海經 海內經), there was a Joseon country, in the East Sea, on the corner of the North Sea, described as a nurturing land with people living near water and caring for each other (東海之內 北海之隅 有國名曰 朝鮮天毒 其人水居 俚人愛之). Ancient idioms about mulberry trees and silk production, such as references to Balhae and the Yellow River, highlight the region's long history with sericulture (隰桑-詩經). “Chang Hae of mulberry-tree field (滄海桑田),” or “Sang Jeon Byeok Hae (桑田碧海)” explain the people of blue water had produced a lot of silkworm long ago. ‘Sericulture is prevalent widely in Go-Joseon’ also was written in *HanSu Geography* (漢書 地理志) [48]. The tradition of consuming silkworm pupae and mulberry fruits remains in Korean culture, reflecting the enduring legacy of their silk-producing past.

6. Seres were Yuezhi (月氏)

Brocade from Seres, renowned for its exquisite quality, was traded along with fur coats to the West during the 5~6th century BC. The Romans went on long voyages to Seres, eager to acquire this luxurious silk. Greek geographer Strabo mentioned Seres as silk producers located beyond Bactria. Seres is identified as Yuezhi (月氏, 月支), a type of Schythia or Sak (朔, 塞), centered around Mountain Qilian (祁連) (Fig. 4c) [35, 49]. Yuezhi was also known as the ‘jade people (禺氏之玉)’, and historical records show that Yuezhi, U-Ji (禺氏), YungJeok (戎狄) have similar pronunciations of Yue (月), suggesting that Yuezhi dates back to the Spring & Autumn Period [35]. Yuezhi could make a significant

profit by selling horses, achieving a tenfold profit by trading them for goods [3].

The origin of the name “Qilian Mountain” dates back to the Xiongnu period. In the Xiongnu language, “Qilian” means “sky,” so Qilian Mountain was “Cheon San/天山”. This region includes Bin (邠) and Qi (歧) in Shaanxi Province (陝西), where Gyeon-Yi (畎夷) among Go-Joseon settled during the last years of the Xia (夏) period (後漢書) [17]. These nomadic peoples were important livestock trading partners, through Central Asia. Thus, it is reasonable to view Yuezhi Seres of the 7th century BC as Gyeon-Yi of Go-Soseon.

Shamanism was widespread in Central Asia, including among the Xiongnu [3] and Dong-Yi. The Xiongnu expelled Yuezhi, who then moved to the Haseo Corridor (河西回廊), and Kim Ilje, a right-side king (右賢王) of the Xiongnu, worshiped a 3 meter golden-statue god, believed to be HwanUng (桓雄) or Dangun Tangri. Xiongnu shamans predicted fortunes, healed diseases, and made military decisions. The Xiongnu leader, SeonU (單于), and his wife, Yeon-ji, who symbolized life’s origins, practiced daily rituals involving the sun and moon. They considered the left side, where the sun rises, as more auspicious, the left-side king (左賢王), who ruled the east, had power next to SeonU. The Xiongnu also had customs like drinking blood wine made from a sacrificed white horse when forming alliances [52]. Their religion, language, and customs were similar to those of neighboring cultures [53, 54].

The old sound of ‘Sira (尸羅) / Silla (新羅)’ of Korea was ‘Sere’ [46], and Sira appears on the lists of 9 large countries of Go-Joseon (世宗實錄 地理志), so Seres was surly the name of ‘Silla’ of Korea [21]. Seres was identified as ‘Saro, Sira’ of Silla, based on the Xiongnu’s genealogy & maps, ancient phonetics of their language, type of exchanged goods, and religion.

Yuezhi was one of the 54 countries within Ma(k)han, alongside Saro (斯盧) and BakJe (伯濟). Yuezhi of Ma(k)Han was powerful entity through trade. Sam(k)Han Gap Jok (三韓甲族) consisted of 3 strong (k)Hans -Jin, Byeon, and Ma- similar to the 3 brave Huns of 3 direction: Buk-Jeok, Dong-Yi, and Seo-Yung, who formed great power with excellent technique for harnesses, weapons, bows, and arrows. Ma(k)Han was the westernmost part of the vast Go-Joseon (8,000里, 管子 戒篇) (馬韓在西凡五十餘國辰王治月支國 - 三國志 東夷傳). Thus, there were the frequent exchanges of clothing and language between Seres and the Far East [50, 51]. Choi Chi-won said that Jin(k)Han was inherited by Silla, Ma(k)Han by Goguryeo, and Byeon(k)Han by BaekJe. The unification of the three (k)Han by Silla was called Il-Tong-Sam-(k)Han (一通三韓).

DongHo (eastern-tartary Buyeo) was powerful in Hebei (河北) and the Yuezhi was strong in Dunhuang, while the Tumen Xiongnu (匈奴 頭曼單于) was insignificant between the two powers (史記 匈奴傳). The next Mòdú Xiongnu (冒頓 單于) drove part of the Yuezhi westward in the the 3rd century BC [35]. ‘Ma(k)Han was the biggest, and together they established Jin King (辰王), and the capital was located in Mu-ji (馬韓最大共立其種爲辰王 都目支國- 後漢書)’. This *Later Hanshu* mistakenly wrote Yuezhi (月支) as Mu-ji (目支) by adding just one stroke, so it is true that Yuezhi was the capital of Ma(k)han.

7. Furs & High-quality Iron of Sam(k)Han Go-Joseon

The fur trade was a central industry in the Steppe region [3]. Its modern popularity is due to its utility in winter, aesthetic appeal, and status as a luxury item. High-quality furs come from animals such as tigers, foxes, martens (貂), yellow-breasted martens (貂鼠), leopards (豹), lynxes (猯, 土豹, 金猫), and otters (水獭).

Fur garments have been discovered in the Pazyryk Tomb in Altai and the Noin-Ula Tomb of the Xiongnu. Additionally, fur clothing appears in artworks, including tomb murals from Goguryeo, Khitan (契丹), Liao (遼), and Yeojin (女眞). Early Goguryeo society used its wealth for elaborate burials (厚葬), such as large stone tombs (Kurgan 積石冢), murals, and planting pine trees in front of them (三國志), in contrast to practices in Jina.

Fur processing tools from the 9th to 1st century BC, during the Bronze and Iron Ages, were found in the Ob-Irtysh basin of western Siberia. These tools included scrapers for skinning and side scrapers of plate rock (板岩) for fine leather trimming. Fur-bearing animal bones were also discovered in the middle of the Songhua River (松花江), the current Yalu River (鴨綠江), and the Xiajiadian culture region (夏家店文化, 內蒙古 東南部) [40]. This evidence indicates that fur was actively exported from Manchuria, the northern territories of ancient Korea through Siberia.

Go-Joseon was a hub of the fur trade, with the famous furs (文皮) from Cheok San (斥山) in present-day Shandong being highly prized in China Jina [49]. Guanzhong (管仲) selected patterned skins of tigers or leopards (文皮) as a special product of Bal-Joseon (發朝鮮) (管子, 7th century BC). Records state that “the patterned furs of Cheok San in the Northeast are the most beautiful (東北方之美者, 有斥山之文皮焉 - 爾雅, 淮南子).” Cheok San is located near Mundeung san on the current Shandong Peninsula (Fig. 6b). Mencius (孟子) referred to Go-Joseon as the “Maek (貉)” of marten and considered low taxes a sign of an affluent Maek’s law. YeMaek (濊貊) in Go-Joseon was associated with ‘wide abundant water & wild animals’. Thus, the beautiful patterned furs from Cheok San in Bal Go-Joseon were already being exported to Jina China and other regions in the 8th~7th centuries BC, coinciding with Seres exporting silk, fur, and iron to the West.

In the ancient West, ‘Ser’ referred to both silk and arrow (矢) [21]. A birdhawk arrived at the Chen (陳) court after being struck by a ‘Sar (矢/살)’, a stone-tipped arrow about 1尺8寸 long (approximately 55cm). Confucius identified this arrow as belonging to Sukshin [17], and Sukshin was close to the Chen. Bows and arrows were a specialty of the Northeast people, known for their archery skills and use of animal furs.

Recent excavations of the Arzhan Tomb (about 10th century BC) are identified as the origin of Scythia, revealing similarities between the Xiongnu and Scythia in lifestyle, stone tomb traditions, gold craftsmanship, and religious beliefs [7]. The discovery of pure copper earring from the Wuxia Culture (牛河梁文化 3,000 BC), the

earliest metal artifacts in East Asia, supports historical accounts of Gu-Ryeo's early metal culture. CheonJa Chi-U was noted as the first to create armor and helmet, believed to have had a copper head and iron forehead (of helmet) (銅頭鐵額 - 雲笈 軒轅記) (太白逸史).

Dong-Yi were renowned for their advanced metal craftsmanship [57], producing a range of inventions and goods [56]. Notably, Byeon-Jin(k)Han excelled in iron production, using iron as currency and exporting it to Ma(k)Han, Ye (濊), and Wae (倭) (三國志 烏桓鮮卑東夷傳). This is consistent with the record that iron from Seres was of the highest quality, followed by Parthian iron. "Parthian Shot" has related to the Xiongnu's techniques [58]. Silla also demonstrated advanced casting techniques by producing the world's first and largest iron Buddha statue (丈六尊像) in AD 573 (三國遺事).

Turkic ancestors (鐵勒) worked as ironworkers in Mountain Altai and served Joseon (柔然, 朝鮮) (周書 異域下). The Asana family (阿史那), a branch of the Xiongnu, founded the Turkic Khaganate, establishing the first Turkic nation, Göktürk (Sky Turk). Lim Hae-Sang noted that medieval Eurasia, dominated by Turks, covered 40% of the Earth, with a population of 180 million and a GDP of 60%.

8. Rare silk in Jina

MoTzu (墨子) noted that 'brush-writing on bamboo or silk Baek (帛)...silk Gyeon Baek (絹帛) is expensive and most people can't afford it' (書之竹帛...但絹帛價格昂貴, 一般人用不起), and Confucius remarked that the poor could not afford plain silk 'So素,' Gyeon Baek (貧不及素, 这里的“素”, 指的就是絹帛) [21]. This confirms the rarity and high value of silk in Jina. Mencius advised the Jina kings on royal politics (王道政治), saying, "Let the people plant 5 rows (畝) of mulberry trees in each house: they will be able to wear clothes by their 50s. Let them raise chickens, pigs, and dogs, and if they do not miss the right time, they will be able to eat meat by their 70s" (孟子 仁政說 恒產). The Jina lacked mulberry trees, making silk fabrics expensive during the Spring & Autumn Period.

According to *Theory of Salt & Iron*, it was said that only people aged 70-80 could afford silk clothes in the Han (漢) period [20]. 'The price of plain silk fabric Gyeon Baek (about 10 m long) was equivalent to 720斤 of rice (about 170 kg)' (漢代一匹絹帛(10米) 的價格相當於720斤大米' - "絹帛", 2022). During Wang Mang's era (9~23AD), one roll of plain silk fabric could be exchanged for about 60 kg of rice, and a roll of fine silk for about 80 kg of rice [26]. Silk price was traded 600斤 in the north 'Ho胡' market, while 1,000斤 in the south 'Han漢' market [59]. This extremely high price of plain silk fabric in Jina indicates that the ordinary people could not afford it.

The character for Geum "錦" dates back to the 7th century BC [8], coinciding with the period when Geum silk was exported westward by the Seres. The character combines 'gold/iron' and '帛silk', indicating that Geum was as valuable as gold in Jina (錦金也, 作之用功重, 其價如金 - 釋名) [8].

The Jina people preferred delicate and thin silk fabric, so the upper class did not

wear BingGeum. However, thin silk Hwan (紬) and regular silk Gyeon Baek (絹帛) were also expensive. High-density Chum (縑), good for writing with brush, was more expensive than Gyeon Baek, while Geum & Chum were produced in abundance in every household in ancient Korea and exported to the Jina [57]. Geum was produced in Jina only for a short period of time, because the special looms and techniques for weaving Geum had been lost due to short dynasties and wars [48]. This is supported by the note that wealthy Ma(k)Han valued beads more than gold, silver, brocade Geum, embroidery Su (繡), and wool brocade Gye (罽).

Conclusion

To identify the wild silk and Seres to the West in the 5th~6th centuries BC, a convergence approach was used, including cross-checking the records of the East and West, as well as old and current maps and the artifacts. The results of the investigation are as follows:

1. The origin of the wild silkworm was Bingjam of five natural colors from the Mt. WonGyo in the East, a place of immortals. The history of BingJam dates back to BC 2,300, when Dangun or Dong-Yi presented Bingjam to King Yao or Xia Yu of ancient China. However, according to jade silkworm sculptures of the Hongshan culture, sericulture history traces back to BC 4,500. Wild silkworm BingJam was produced by the Bing-Yi people of Dong-Yi. Bing-Yi or Pung-Yi used it to weave thick and colorful silk fabric, and the natural colors of Bingjam fibers created BingGeum/PaeGeum brocade with patterns. This practice dated back to the 11th century BC, and the world's first warp-faced Geum piece from the Weiyngzi culture of this period is the origin of Geum brocade to this day.

Wild silkworm JakJam, a special product of current Shandong and the Liaodong Peninsula, is known as CheonJam, 'descended from the sky'. Due to similarities such as fall harvest, large worm size, and high strength of fibers, ancient BingJam is identified with JakJam and CheonJam. The people who produced wild silkworm of BingJam/JakJam and BingGeum brocade were Dong-Yi of Go-Joseon. And these were produced widely from Inner Mongolia to the current Liaodong Peninsula, corresponding to the territory of Seres around the 7th century BC.

The colorfully patterned Geum was stiff and dense, earning it the nickname 'ice brocade BingGeum' due to its hard, ice-like texture. The wealthy class in ancient China did not prefer BingGeum. Instead the Han upper class favored the limp and drapery silhouette of thin plain silk Hwan (紬). Although it was said Geum was named for its gold-like value, it was not popular among the rich in Jina but rather worn by the middle class. Contrary to popular belief, silk fiber production was low in Jina. On the other hand, Go-Joseon's Sam(k)Han Buyeo had produced a lot of Gyeon Baek plain silk, Geum brocade, and double-yarn structure Chum, as the first King Dangun encouraged sericulture. In the

affluent Ma(k)Han, Geum, Gye, gold and silver were less valued than jade beads. BingJam was a specialty of Dong-Yi Go-Joseon, and the producing sites of Geum brocade from BingJam confirm the current Liaodong and Shandong regions as centers of Go-Joseon, ancient Korea. This fabric characterised the colorful costumes and bulky silhouettes of Northeast Asia. Thus, the nickname Bing-Yi of Go-Joseon might be derived from the stiff BingGeum worn by its people. Bing-Yi (冰夷), Pung-Yi (馮/風夷), Mu-Yi/U-Yi (無夷/隅夷/渦夷) and Ram-Yi (藍夷) was all names for Dong-Yi Go-Joseon.

2. Seres of silk people known as Yuezhi, exported the ancient world's highest quality iron, furs and Geum brocade. Yuezhi was one of 54 countries of Ma(k)Han Go-Joseon centered around the Mountain Qilian (祁連), and served as the capital of Ma(k)Han, one of three kHans of ancient Korea. Yuezhi & DongHo flourished from the 5th to the 3rd century BC before the rise of the Xiongnu. They were open societies with trade in furs, cattle, horses, and had great techniques for producing Geum brocade and furs. Seres or Yuezhi, prospered for several hundred years through exports of horses and others, while Persia also became wealthy by relaying Seres' trade. Seres people included the Xiongnu, and the Sira, ancient Silla of Korea, who were nomads skilled in long-distance trade. However, crossing the borders was illegal in ancient China due to fears of population loss. This suggests that the exporters of Geum fabrics, high-quality iron, and furs in the 7th century BC were not the Chinese people, but the Yuezhi Seres.

Iron production began with Gu-Ryeo of Dong-Yi around BC 2,500 according to ancient documents, with Chi-U CheonJa making iron and armour, and excellent ironware relics later found in Jin(k)Han/Byeon(k)Han of Go-Joseon. The three KHans interacted closely with each other, respecting the CheonJa Dangun. Yuezhi of the west, Xiongnu of the north, DongHo of the east had been stronger than central China, due to equipped with horses, iron, and bows. It is no coincidence that the emergence of the Geum '錦' character, patterned fur exports of Bal-Joseon (管子), and the peak period of Seres' prosperity all occurred around the 7th century BC.

The advanced production techniques of Geum brocade of Bing-Yi Dong-Yi indicate a highly developed society influenced by the Liaoha (遼河) Civilization. Evidences in the Hongshan culture show that wild silk originated in the present-day Shandong of Dangun Go-Joseon. The delicate five-colored patterns of BingGeum silk from Seres Yuezhi and Go-Joseon influenced the arts: poetry, music, religion, and metal crafts, enriching lives and promoting cultural exchange between the East and West. This study aims to uncover the true history of the Silk Road and contribute to research on silk trade culture between East and West.

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References

1. H. Cho, The word “silk” comes from the word “Sil-kkury” used in country “Kokkury”. *Seni Gakkaishi* (2012), 68(6), 7-12.
2. I. Good, On the question of silk in pre-Han Eurasia. *Antiquity* (1995), 69(266), 959-968.
3. P. Francopan, The silk roads. (J. Lee, Trans.), Seoul: Chaeggwahamkke (2015), 8-33.
4. S. Cheong, The encyclopedia of Silk Road (2013) Seoul: Changbi.
5. A. Miyaji & H. Motamedi, (Eds.). *Wonders of the World's Museums 19* (1979) Tokyo: Kodansha.
6. M. Hann, Origins of central Asian silk Ikats. *The Research Journal of the Costume Culture* (2013), 21(5), 780-791.
7. Y.-J. Na, Y., S. Hwang, J. Lee, K. Lee, Y. Kim, S. Jeong, J. Jeon & H. Lee, *Silkroad Reread - Silla brocade goes to Rome* (2023) Seoul: ksbookup.
8. N. Huang & J. Chen, 7000 years of Chinese silk history (H.Y. Lee, Trans.) (2016) Paju: Korean Academic information Co. Ltd.
9. G. Plinius, *Naturalis historia- The world's first encyclopedia-*. Edited by White, J.S. (K.J. Seo, Trans.) (2021) Seoul: Nomad.
10. National Museum of Korea (2019) *The iron kingdom of Gaya, swords and strings*.
11. H. S. Shin, A study on the cultural exchange of the weaving skills and patterns witnessed in Geum-textiles between the East and West-from ancient times to the Tang dynasty. *Journal of the Korean Society of Costume* (2012), 62(4), 107-122.
12. H. J. Jang & Y. S. Kwon, A study on the Geum-silk fabrics excavated from Chunmachong tomb - focused on the Geum silk fabrics currently housed in Gyeongju National Research Institute of Cultural Heritage -. *Journal of Korean Traditional Costume* (2014), 17(4), 41-53.
13. G. Beguin & D. Morel, *Fobidden city* (J. Kim, Trans.) (1999) Seoul: Sigonsa.
14. S. Park, *Political history of Goguryeo gold crown* (2013) Seoul: Jisiksanupsa.
15. Y. Kim, J.-S. Kim, Y.-J. Na, T. Kim, C. Nam, S. Min, D. Park & O. Song, *Northeast Asian ancient history seen through convergence science* (2021) Seoul: daehansarang, 192.
16. C. Lee, *Anthropological light on Hongshan culture* (2018) Seoul: Gaebyeoksa.
17. S. Hwang, *Understanding of ancient Korea history* (2024) Seoul: Right historical era.
18. S. H. Park, Old Joseon culture and the origin of seals shown during the Hongshan Culture excavation. *Asian Comparative Folklore* (2012), 49, 45-99.
19. S. Kassia, *The golden thread* (J.Y. An, Trans.) (2018) Seoul: Willbooks.
20. K. Min, *Study on Korean traditional textile history* (2000) Seoul: Hanrimwom.
21. J.-S. Kim & Y.-J. Na, “Seres” silk people were Silla. *Journal of Korean Society of Clothing & Textiles* (2023), 47(1), 191-213.

22. K. H. Yi, Korean history written by China before the Northeast Project (2019) Seoul: Juluesung.
23. E. Yun & H. Kwon, Nondestructive Analysis of Textile Dyed with Traditional Blue and Green. *Conservation Science in Museum* (2013), 14, 81-89.
24. Y. Park, Characteristics and weaving techniques of BaekJe fabrics. *BaekJe Hakbo* (2014), 0(12). 54-74.
25. N. Hollen, J. Saddler & A. Langford, *Textiles* (2002) New York: Macmillan.
26. C. Kolander, *Silk workers notebook* (1985) Colorado: Interweave Press Inc.
27. S. Kim, *Textiles* (2009) Seoul: Gyomoonsa, 3rd revised and expanded edition.
28. D. Lee, *In search of Old Joseon* (2016) Seoul: Chaekmirae.
29. K. H. Yi, Reconsidering the location of Bohai (渤海) Sea from Han (漢) to Tang (唐) Dynasties. *The Journal of Korean History & Convergence* (2024), 8(2). 7-60.
30. J. Park, *BuDoJi* (E.S. Kim, Trans.) (1986) Seoul: HanMunwha.
31. C. Chu, *Chaotang Choson: Looking for nomadic mongolian roots* (2017) Seoul: HyeAn.
32. N. Maruyama & M. Domei, *Easy way to tell the difference between dyeing and weaving* (2012) Tokyo: Tokyo art.
33. R. Peigler, *Wild Silks of the World*. *American Entomologist* (1993), 39(3) 151-162, <https://doi.org/10.1093/ae/39.3.151>
34. M. Kim, *Dokdan GoGeumJu JungwhaGogeumju* (2019) Seoul: Youkrack. 35-38.
35. N. Odani, *Great Yuezhi* (H.H Min, Trans.) (2008) Seoul: i-field.
36. M. I. Voevoda, V. V. Sitnikova, A. G. Romashchenko, T. A. Chikisheva, N.V. Polos'mak, & V. I. Molodin, Reconstruction of the genofond peculiarities of the ancient Pazyryk population (I-II Millenium BC) from Gorny Altai, according to the mtDNA structure, *Türkic History* (1998) Retrieved from http://s155239215.onlinehome.us/turkic/64_Pazyryk/Pazyryk_gensEn.html
37. J.-S. Kim & Y.-J. Na, Triangulation proves Geum brocade with the horizontal loom of Go-Joseon. *Fashion and Textiles* (2022), 9(32).
38. J. C. Covell, *Searching for the root of Korean culture - from Shamanism to the blossom of Unified Silla Buddhism* (Y. K. Kim, Trans.) (1999) Seoul: Hakgojae (Original work published 1990).
39. Y. J. Cho, A study on JoWoo–Guan (brids worship-derived attire) of ancient Korea and the Silk Road. *Prehistory and Ancient History* (2013), 39, 121-146.
40. I. U. Kang, Go-Joseon's fur trade and Myeongdojeon. *Korean ancient history research* (2011), 64. 243-284.
41. C. Choi, *Northeast Project on Colonial History through Oracle Bone Sounds* (Language Edition) (2024) Seoul: Language and History.
42. B. Lee, E. Pires & A. Pollard, et al., Species identification of silks by protein mass spectrometry reveals evidence of wild silk use in antiquity *Sci* (2022), Rep. **12**, 4579. <https://doi.org/10.1038/s41598-022-08167-3>

43. W. Ciesla, Chapter 9 Non-Wood Forest Products 15 Rome ("Chapter 9". FAO.org. Archived from the original on 2012-10-21, <https://www.fao.org/4/y4351e/y4351e0d.htm>)
44. J. Y. Han, Reconsideration of identifying Ayuta (Ayodhya) based on the beginning of Buddhism of Gaya. *East Asian Buddhist Culture* (2018), 33, 87-106.
45. Y. Lee, *Sil Jeung Han Dan Go Gi* (2000) Seoul: JeongSinSeKyeSa, 110-176.
46. C. Choi, A study on the name of a country Silla. *The Journal of Linguistics Science* (2013), 64.
47. B. Shim, *Ancient Korean history HwanGuk* (2021) Seoul: Barunhistory.
48. Y.-J. Na & J.-S. Kim, Go-Joseon's Geum, the oldest brocade in East Asia. *The Asian International Journal of Life Sciences* (2019), 19(3), 1-23.
49. J. Lee, *Omnibus Korean History* (2021) Seoul: Korean Culture Broadcasting.
50. H. J. Lee & Y.-J. Na, The symbolism of Korean 'Gat' and the etymology of 'Hat'. *Science of Emotion & Sensibility* (2022), 25(4), 3-20.
51. Y. Chang, Empirical review of the Scythian origin theory of ancient Korean costumes - analysis of commonalities and differences between artifacts of the two costume types. *Journal of the Korean Society of Costume* (2020), 70(2), 188-208.
52. J. Jang, *The story of the Xiongnu Empire* (E.S. Nam, Trans.) (2010) Seoul: i-field.
53. C.P. Atwood, The Qai, the Khongai, and the names of the Xiōngnú. *International Journal of Eurasian Studies* (2015), 2, 34-63.
54. K. S. Chae & E. K. Kim, A study on the costume of Loulan - centered around interrelationship with ancient Korean costume. *Journal of the Korea Fashion & Costume Design Association* (2016), 18(3), 197-211.
55. J. Y. Lee, Meaning and Symbolism of the Patterns on Gilt Bronze Shoes from Three Kingdoms Era. *The Journal of the Korea Contents Association* (2018), 18(10), 618-630.
56. J. W. Park, *Korean pride, the Al-si-rang* (2020) Gyeonggi-do: Malgunsae.
57. D.S. Oh & Y.H. Kim, *I'm going to the Museum* (2018) Daejeon: Sangsaeng Pub.
58. J.H. Sung, A study of 'Parthian Shot' in Parthia Era. *The Korean Journal of History for Physical Education, Sport, and Dance* (2019), 24(4), 83-99.
59. M. Żuchowska, From China to Palmyra: The value of silk (2013) Światowit. XI, 133-154.