

Exploring Science Culture at Gyeongju

- where are the UNESCO World heritages -



Date: Feb 15(Sat)~16(Sun), 2014

Organized by The Korean Association for Science Education

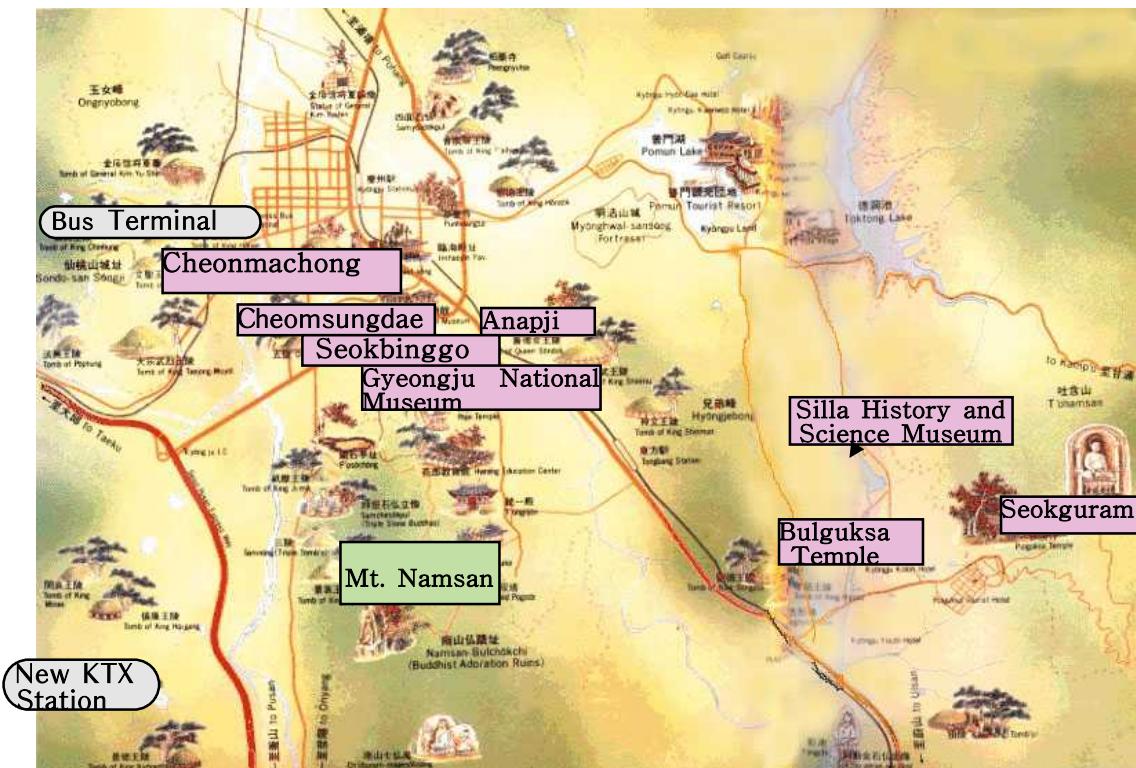
Managed by The Daegu University, Science Education Center

Supported by Gyeongju Science-Invention Education Center

Science Culture Education Research Institute

[Draft of a Pilot Version]

Map of Gyeongju and Visiting Places



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Schedule of Trips

To provide an opportunity to explore science and science education at a cultural site, there will be a special field trip to Gyeongju, which is the evergreen spirit of Silla Kingdom that has been alive for a thousand years. It is located at about one hour drive from Daegu University to East, and there possible to go Seoul directly by KTX train or express bus easily.

- * Please, refer to a handy free booklet in color, "Beautiful Gyeongju: Meeting Place the Scent of Culture Time to Surpass", by Gyeongju City, which will be presented..

The 1st day trip(Feb 15, Saturday)

- 8:30 Start from Daegu University to Gyeongju by a bus.
 - Will be guided all the general things
 - Show about Gyeongju thru Videos
 - Demo how to analyse Emille Bell sound thru App
- 10:30 **Grotto Seokguram**
- 11:30 **Silla History-Science Museum**
- 12:30 Lunch(Korean style restaurant Jungsugajung)
- 14:00 **Gyeongju Science-Invention Education Center** at Hwangnam School
- 15:30 **Tomb Cheunmachong**
- 16:30 **Gyeongju National Museum**
 - Scientific analysis the sound of Emille Bell with App
 - Visit Archaeology/History/Arts hall, books/souvenirs store, free inquiring
- 18:00 In the bus sight seeing the beautiful **Pond Anapji , Big Royal Tombs of King**, and many other relics at the down town bathed in the glorious light of the setting sun.
- 18:20 At Express Bus terminal(about 30~50 min interval to Seoul)
- 18:40 At KTX train station(18:58 and about 1 hr before/after to Seoul)

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- * If you participate the **second day trip**, we will arrange your hotel near from Grotto Seokguram , and provide transportation.

The 2nd day trip(Feb 16, Sunday)

- 4:30 Leave hotel(near from Grotto Seokguram)
- 5:30 A special observation in the interior of **Grotto. Seokgulam**
- 6:00 A fascinating scenary of sun rise at the East Sea and investigate the environment around Grotto
- 7:00 **Temple Bulguksa** including Three-story Stone Pagoda and Dabotap Pagoda, Inquiring science of pagodas and engineering design of the construction as modeling performance for science education
- 8:30 Breakfast(by your choice)
- 9:30 Happy walking
Observatory Cheomseongdae
Ice Storage Seokbinggo
Pond Anapji
- 12:00 Lunch(by your choice)
- 13:30 **Mt. Namsan** (expected to prepare for mountain-climbing)
1. Sambulsa Temple 2. Three Tombs 3. Gwaneumbosal Image Carved on Rock Surface, Buddha without Head 5. Yukjonbul Carved on Rock Surface 6. Seated Yeorae Image Carved on Rock Surface 7. Seated Stone Buddha 8. Seated Shakyamuni Buddha carved on Rock Surface 9. Sangseon-am Hermitage 10. Large Seated Buddha in Relief 11. Baduk Rock 12. Sangsa Rock
- 18:20 At Express Bus terminal(about 30~50 min interval to Seoul)
- 18:40 At KTX train station(18:58 and about 1 hr before/after to Seoul)

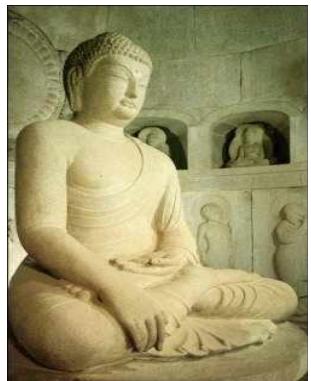
Leader: Prof Sung-Jae Pak(010-9266-0537)

Assist: Teacher Ms. Yung-Sun Suh(010-3000-6675)

Curator: Mrs. Kooc-Hee Whang Namgung(010-4523-3066)

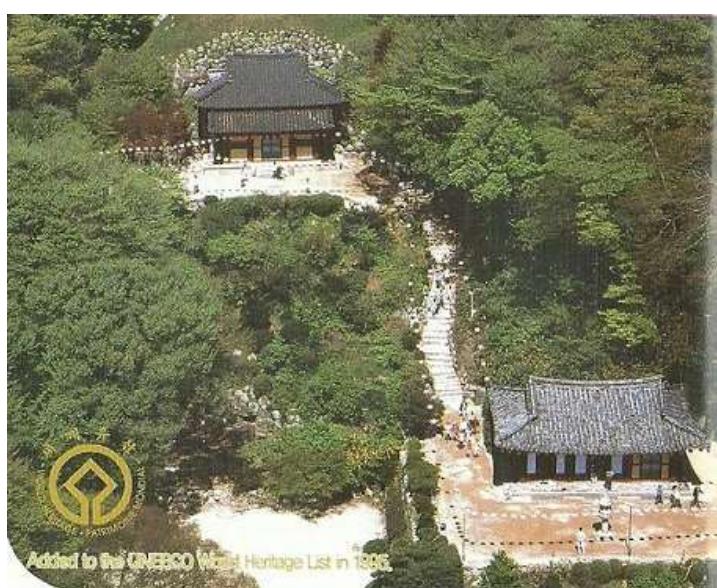
1. Grotto Seokguram (석굴암, 石窟庵)

Overlooking the East Sea far ahead beyond the mountain ridges from the southeastern tip of the Korean Peninsula, Seokguram stands as a proud testimony to Korea's brilliant tradition of classical sculpture. The construction of the Seokguram which rests 750 m above sea level, started in A.D.751 under the leadership of Prime Minister Kim Daeseong and was completed in 774.



Seokguram is a artificial cave carved in white granite featuring a seated Buddha and 38 others on the walls. The Grotto exquisitely combines the knowledge of math, physics, architecture, art and religion from Silla(57 BC-935) into an organic whole. The Seokguram has long been preserved as National Treasure No.24 and was registered at the UNESCO as a world cultural heritage in 1995.

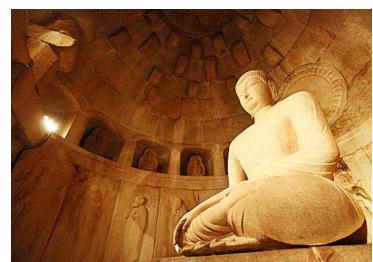
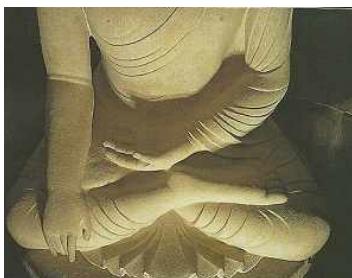
Old records describe the Seokguram as "the shrine that was built by weaving silk out of stones", and such delicate and beautiful features of the Buddha are unique aspects of Unified Silla Buddhist art. Seokguram is the masterpiece created by the profound Budhist culture, science, and artistic spirit of the Unified Silla era.



The 3.5 m high main Buddha is seated cross-legged on a lotus throne facing the east, eyes closed in quiet meditation, a serene, all knowing expression on its face. its gentle eyebrows, noble nose, long ears and tightly curled hair are exquisitely portrayed. The hands are poised and serenity, it presents Sakyamuni at the moment of enlightenment.

The personification of divine and human natures, an enigmatic combination of masculine strength and feminine beauty, the image represents Buddhist Sculpture at the zenith of classical realism. Many art historians consider it be one of the most perfect Buddhist statues in the world.

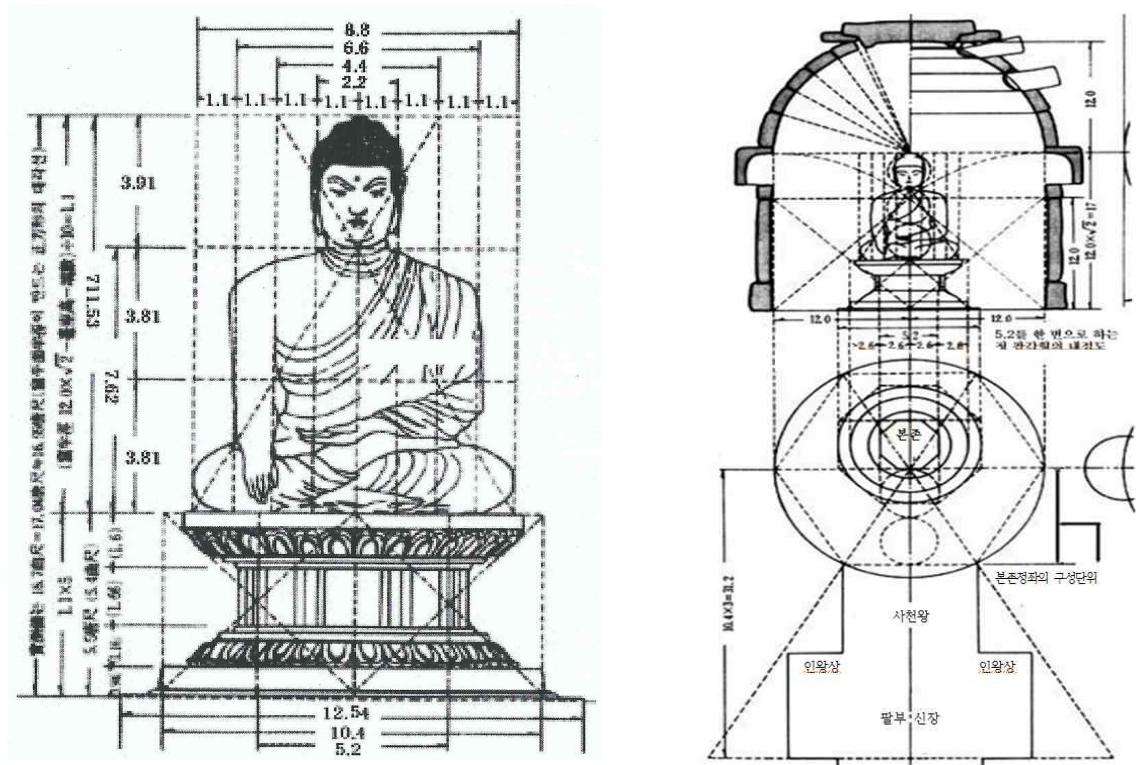
In Seokguram the Principal Buddha is placed slightly off the center and toward the back. Why? Are two hands of the principal Buddha same size? How about the size shoulder or the head? Are they in harmony with the whole body? Compare the petals at the aura of Buddha. Are they all same size? Do you notice that the face of the Statues is relatively large compared with the rest of the body? No mortar was used; the stones are held together by stone rivets. Natural ventilation was provided (how?) to control the temperature and humidity inside the cave, though the wisdom of ancient architects failed to be conveyed in the process of its preservation in modern times.



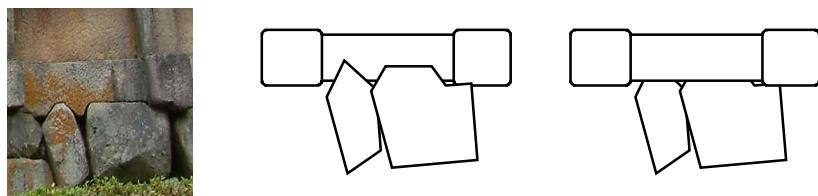
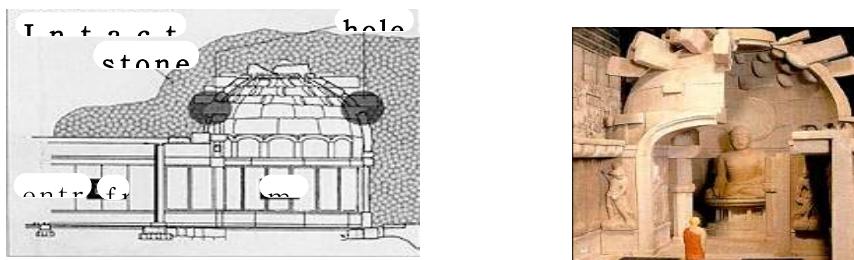
The extremely natural appearance of the principal Buddha seems to present to all the living people the ideal model of a man cherishing the profound and sublime mind deep inside him and easily pass to them his everlasting mercy.

The following figure shows the analysis done using the diameter of the main chamber, the size of the front chamber, ratios of various lengths, and symmetry, etc. Is it possible that this geometrical structure is formed by accident, or by elaborate design?

Let's consider the principal Buddha. The face is 2.2 feet wide, the chest 4.4 feet the shoulder 6.6 feet the distance between knees 8.8 feet. This is a ratio that face : chest : shoulder : knees = 1 : 2 : 3 : 4. (1.1 feet, a kind of a unit length for this ratio is one tenth of the Buddha's height). The simple geometrical structure used in Seokguram must be one of the important reasons for the beautiful appearance.



What would be the above and following drawings and photos related with math, science, engineering, technology, arts, history and religion?



2. Silla History · Science Museum (신라역사과학관, 新羅歷史科學館)

This is a private museum of Mr. Seok opened in 1988. There are many models of science and cultural properties in Silla exhibited. Many miniatured models of traditional relics especially of Silla Period are made and exhibited, especially including a learning field that reveals the mystery behind the Seokguram Grotto through both two and three dimensional models of the stone caves. Observing them visitors can inquire many problems from various guesses and practises concerning each items exhibited.



The 1st exhibition hall:

a celestial globe, Observatory Cheomsongdae(1/5 miniature), Silla era sundial, a reconstruction of Mt. Namsan remains, Excavated relics of Hwangnam Dae Chong, ...

The 2nd exhibition hall:

Golden crown of Silla, Mugu jeonggwang dae daranigyeong, Buddhist Bell of Mt. Odaesan sang-won temple, Hemispherical Sundial, a rain gauge, ...

The underground exhibition hall:

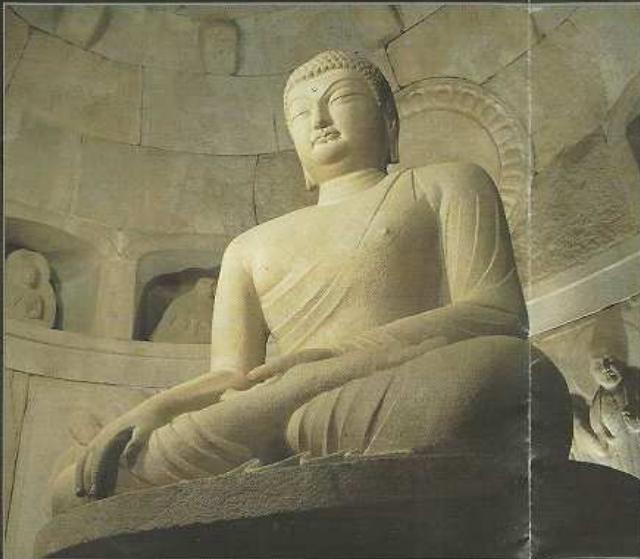
Seokguram model(1/5 miniature), Sweet water model of Seokguram, Structure model of Seokguram: roof framing, roof system, roof cross section, Books & data of Seokguram, ...

The upper-roof exhibition and Outside:

Gameunsa Temple Site, underwater royal tomb of Munmu great king, Tower of sunrise, ...

국보 제 24호 | AD 8세기 중반

석굴암 그 신비의 실체는?



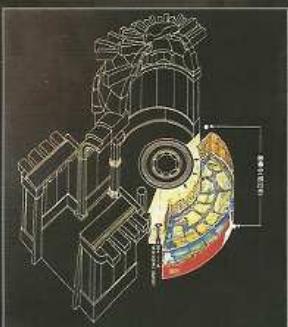
신라 불교 조형예술의 대명사 석굴암의 조형 원리와 그에 숨겨진 과학적 원리를 탐구하며
김취진 비밀을 실험하고 학술을 통해 찾아보고 있다.



석굴암에 사용된 신라인의 황금비례...
1939년 요네다 미요지의 석굴암 축조원리
고도의 기하학과 수학이 사용되었다.



석굴암 돔(Dome)지붕의 결속 원리
쐐기들의 형태와 기능이 어떠한지 그 원리
를 탐구하여 본다.



석굴암 김로수의 과학적 원리
차기운 물을 냉매로 이용하여 내부 이슬
맺힐 현상을 1200여년 동안 조절한
선조들의 지혜를 엿볼수 있다.

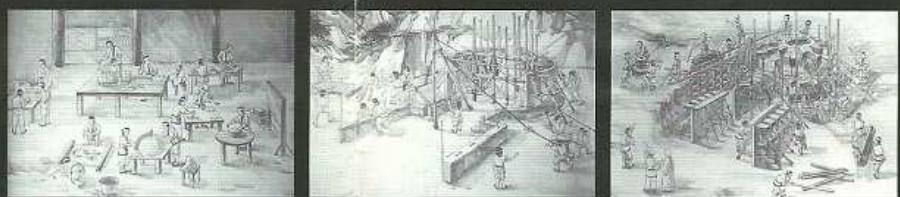


현재 석굴암의 지붕 단면
1913년부터 수차례에 걸쳐 지속된 잘못된 수리 복원 공사
의 과정으로 석굴암은 엄청난 추단을 겪게 된다.



광장은 과연 존재했을까?

석굴암
조성 과정
상상도



3. Gyeongju Science and Invention Education Center (경주과학발명교육센터, 慶州科學發明教育館)

Gyeongju Science and Invention Education Center(GSIEC) was established at Hwangnam Elementary School campus by Kyeongju County Education Board assisted by Gyeongju Elementary Teachers Association for Science Teaching and Gyeongju Secondary Science Teachers Association.

The study reports, posters, models and learning-teaching materials by students and teachers have been exhibited at this Center for the promotion of science education activities at Gyeongju city region. Many of them received the national prize of Science Fair and Teaching Materials Competition..

Especially, many projects are related with Seukgram Grotto and Bulguksa Temple.





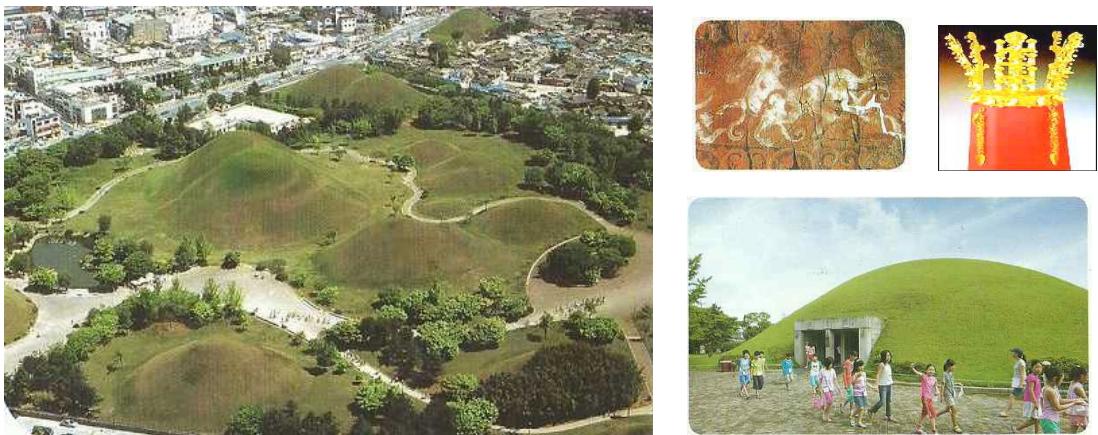
A few of titles of the report by students for project study and of the research paper by teachers for national competition are as followings(Korean):

- 김경아, 차민영/지도교사 최규석(2003), 신라인이 만든 석굴암에는 왜 이슬이 맺히지 않았을까?, 제49회 전국과학전람회 출품(지구과학부문)
- 박찬중(2000), 천마도가 그려진 자작나무의 특성에 관한 연구, 제46회 전국과학전람회 출품(화학부문)
- 손동찬/지도교사 이재경(1998), 불국사 청운교는 왜 이중아치모양일까? 제44회 전국과학전람회 출품(물리부문)
- 신동범, 이성빈/지도교사 빈왕기(2012), 불국사 범영루 모래시계 모양 돌기둥에 숨겨진 과학적 원리 지도, 제58회 전국과학전람회 출품(물리부문)
- 용민희, 김연경/지도교사 황문목(1995), 석빙고의 지붕에는 왜 구멍을 뚫었을까?, 제41회 전국과학전람회 출품
- 이상택, 이태일(1991), 포석정의 구조적 특징과 수류의 신비에 관한 연구, 제37회 전국과학전람회 출품(물리부문)
- 이승연, 안지영/지도교사 정진득(1998), 신라 천마총금관의 비밀 탐구, 제44회 전국과학전람회 출품(물리부문)
- 정용우, 오소현/지도교사 최상원(2002), 석굴암 감잡이돌의 신비에 관한 탐구, 제48회 전국과학전람회 출품(물리부문)
- 황혜령, 임성규/지도교사 장지화(2005), 불국사 극락적 남·서회랑 석축은 왜 잘 무너지지 않을까?, 제51회 전국과학전람회 출품(물리부문)

4. Tomb Cheonmachong (천마총, 天馬塚)

Daereungwon Tomb Park(Historic Site No. 40)

Some of large and small tombs in here were composing the ancient tomb park, called Daereungwon, which is the largest in size among the ancient tombs in Gyeongju. It contains 30 ancient tombs including Cheonmachong. This is a beautiful park so tourists can enjoy a relaxing and educational walk between ancient tombs.



Tomb Cheonmachong (Ancient tomb No. 155)

Cheonmachong, the essence of Daereungwon, is included in the tumuli of the Silla period(57B.C.-A.D.935) located in the southwestern part of Gyeongju. It is a wood-lined chamber tomb with a 13 m high stone mound whose diameter at the bottom is 52 m. This is the only tomb that is open to the general public. Cheonmachong literally means 'heavenly horse tomb' and received its name from the picture of a flying white horse painted on the saddle flap, a leather flap hung on the sides of the horse saddle in order to prevent dirt from splashing up on the rider's clothes, which was excavated from this tomb in 1973.

This tomb is estimated to have been built between the 5th and 6th century(how do we know?). Luxurious gold relics such as gold crowns, a gold hat, a bird shaped crown, a gold belt, gold shoes, and other fancy garments worn by the dead were excavated from this tomb. Particularly, the Cheonmachong gold crown was the biggest and most luxurious gold crown to ever have been excavated(How did they make these?).

The interior structure of the tomb

After the excavation, it is opened so that visitors can see the inside of the tomb.

Cheonmachong tomb has almost perfectly preserved mound with the diameter of about 47 m and the height of about 13 m. Clay were spread out all over the base of mound except the chamber area, and filed up the earth horizontally in the lower part but gradually making slope in the upper part of the mound. The diameter of a pile of stones from east to west is 24 m in the ground, 16 m in the upper part and 13 m from south to north, and the height is 6 m. The top side of the stone pile is covered with clay. The wood chamber is 6.6 m long, 4.2 m wide and 2.1 m high from east to west direction with 17° tilt.

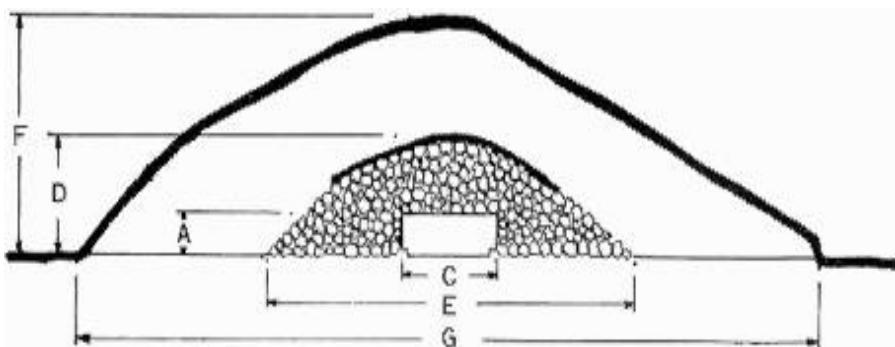


Fig. The mound, stone pile, and wood chamber

A : height of wood chamber	(2.1 m)
B : width of wood chamber	(4.2 m)
C : length of wood chamber	(6.6 m)
D : height of stone pile	(6 m)
E : diameter of stone pile	(24 m)
F : height of mound	(13 m)
G : diameter of the base of mound	(47 m)

material used/size	presumed volume/area
earth of mound	7,46m ³
stone pile	1,04m ³
wood chamber	58m ³
circumference stone	660m ³
clay coverage	588m ³
total volume of mound	9,81m ³
area of bottom dimensions	1,77m ²

How big could be the amount of materials and the number of service corps in the construction of the tomb? Try to estimate referring to the volume of each part of the mound as shown in the table. How many service men could be needed to transport the materials of earth, stone and clay to the tomb and construct the mound? Suppose the situation that materials has been transported already to the spot from which the distance to the tomb is about 50 m. Think one person can transport in the distance of 50 m for 1 day as follows : 1.6 m³ of earth, 1.2 m³ of stone pile, 1 m³ of clay, 1.2 m³ of stone pile. Service men are needed in construction work as one third as the number of transportation. Imagine the real life situation as possible and explain roughly how long the term of works would take with the data provided above.

5. Gyeongju National Museum (국립경주박물관, 國立慶州博物館)



Cultural sanctuary that cherishes the thousand years of Silla

Gyeongju National Museum is divided into sections classified by types of relics. Archeology Hall, Art Hall, Anapji Hall, and the Special Exhibition Hall. There is also a section of the museum for children, which helps young people acquire further interest understanding about Korean culture. Including materials such as the Sacred Bell of The Great King Seongdeok(National Treasure No. 29). There are about 3,000 pieces on display.



Geumgwanlong Gold Crown(National Treasure No. 87)

It is a royal crown of the Silla Dynasty which was excavated from a ancient Silla royal tomb site. There are many dots around the headband and trident-shaped decoration on the middle of the crown and jade, beads, and other fancy decorations are hung neatly on fine golden string around the entire crown(What kind technology did they need?).

Bell of Great King Seongdeok(National Treasure No. 29)

The bell has been highly praised for its solemn (echo of Buddhism!) and clear beautiful sound, elegant design and surface motifs, was said "there never was nor ever will be bell such as the Bell." This is the best bronze bell in the world in terms of sound and appearance. You can hear the beautiful Bell sound every hour and analyse the sound with your App!

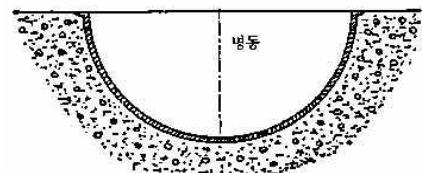
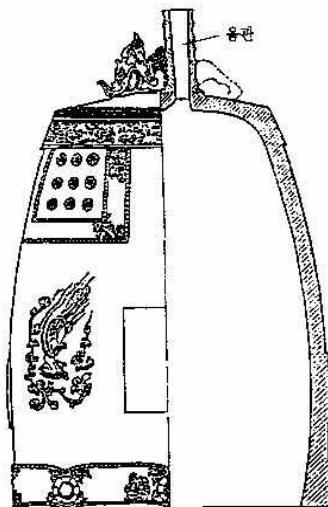


Exploring questions

1. This Bell, the largest existing in Korea and a masterpiece unparalleled by any other bells in the world, is about 3.3 m high, 2.3 m in rim diameter, 11~25 cm in wall thickness, and weighs 25 tons.

Try to estimate those dimensions by yourself, and ask your students to do and also to measure more accurately?

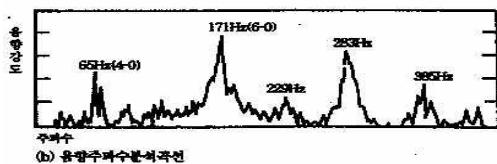
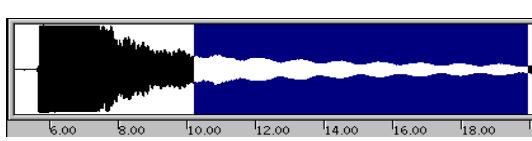
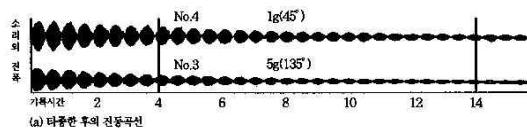
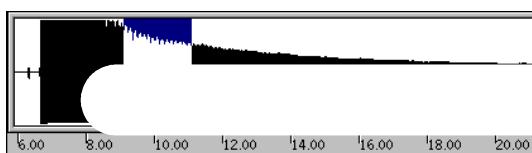
2. What would these drawing or pictures remind you?



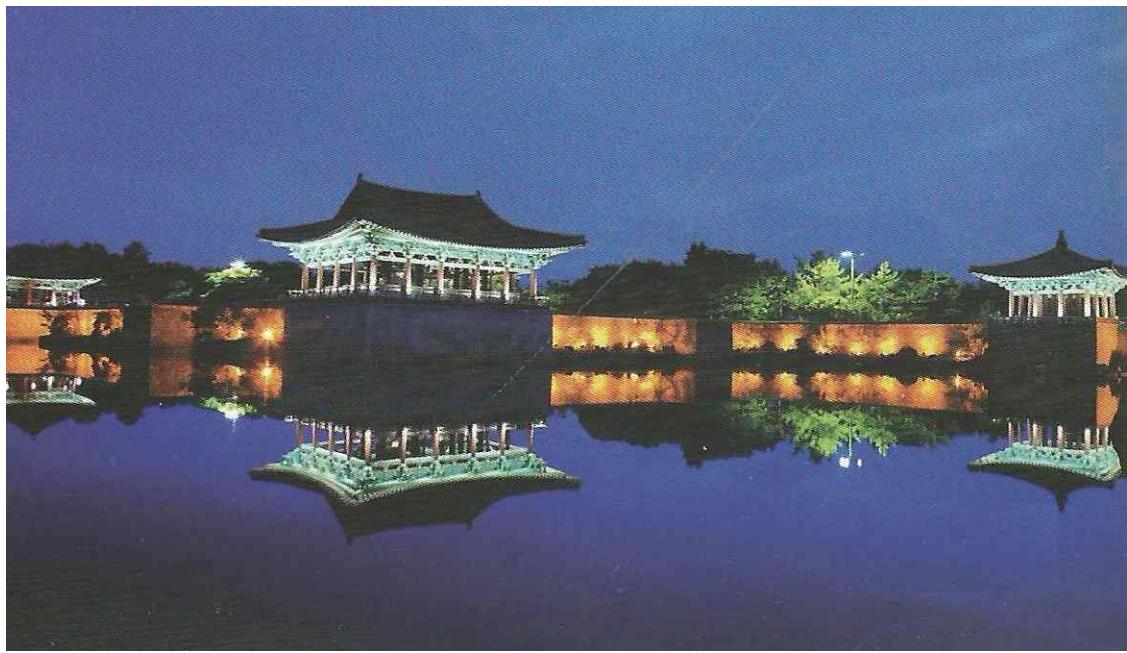
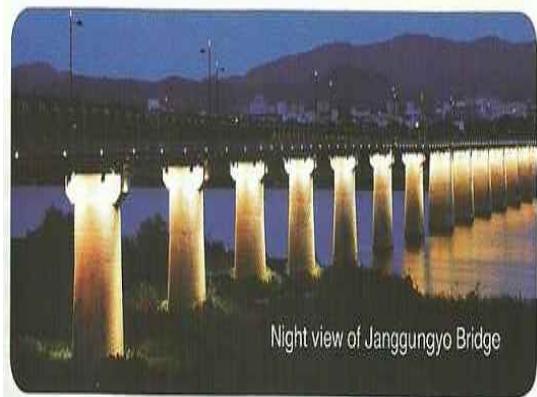
3. What would be the following numbers and graphs?

168.52Hz, 168.63Hz, (0.11Hz), 9 seconds

64.07Hz, 64.42Hz. (0.37Hz), 3 seconds



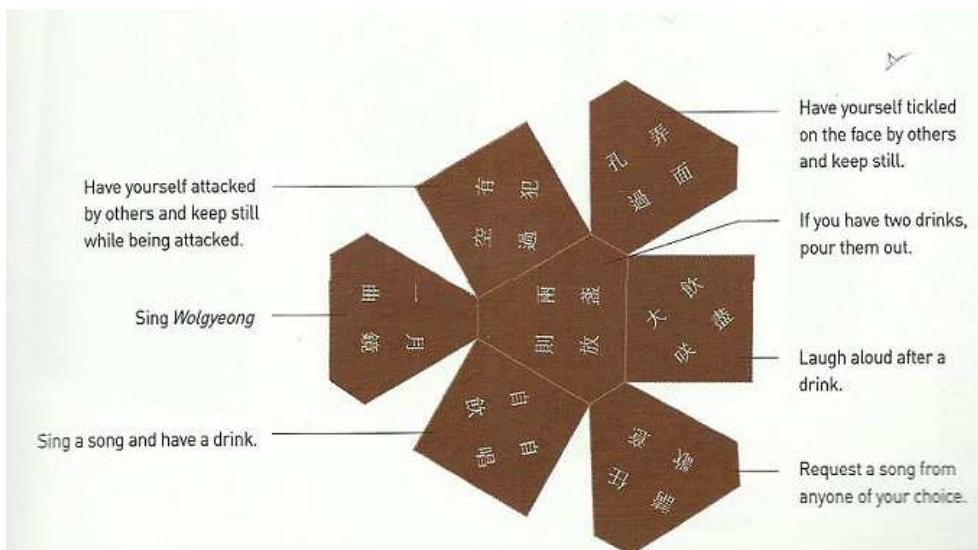
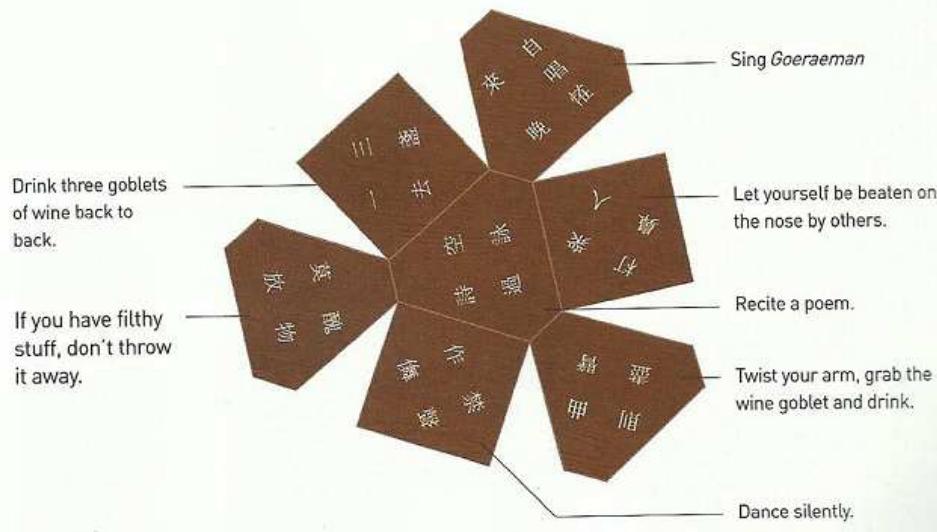
Beautiful Night Tour at Gyeongju, where would be?



The 14-face Dice(Juryeonggu, 주령구, 酒令具)

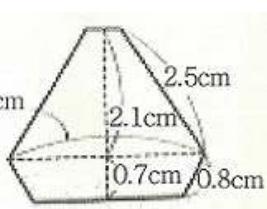
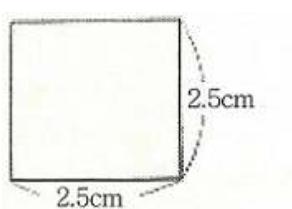


At the Pond Anapji site, a 14-face Juryeonggu was discovered. This dice is made of oak wood which was used for games during banquets. Each of the 14 faces has instructions which should be followed by the one who rolls the dice. Many instructions relate to drinking, indicating that this dice was mostly used at banquets involving alcoholic beverages. The artifact reveals an interesting facet of the entertainment culture among Unified Silla's royals and ruling elite members. Presently, only replicas of Juryeonggu are left.



What are the 14 instructions/penalties!

Chinese	Korean	Penalty(adult with wine)	#	Modified for family
penalties for the tetragon(4 sides)				
禁聲作舞	금성작무	Dance silently	1	Receive massage from anyone of your choice
衆人打鼻	중인정비	Let yourself be beaten on the nose by others	2	Let yourself be beaten on the nose by others
飲盡大笑	음진대소	Laugh aloud after a drink	3	To be kissed by the pointed person
三盞一去	삼잔일거	Drink three goblets of wine at arms	4	Sing a song
有犯空過	유범공과	Have yourself attacked by others keep still while being attacked	5	Embrace the neighbours
自唱自飲	자창자음	Sing a song and have a drink	6	Writing your name by heap
penalties for the hexagon(6 sides)				
曲臂則盡	곡비즉진	love shot! (Twist your arm, grab the wine goblet and drink)	7	5 times of push-up
弄面孔過	농면공과	Have yourself tickled on the face by others and keep still	8	Tickle the neighbours
任意請歌	임의청가	Request a song from anyone of your choice	9	Point a person sing a song and dance
月鏡一曲	월경일곡	Sing a song related moon (Sing Wolgyeong)	10	Praise a person and ask a big laugh
空詠詩過	공영시과	Recite a poem	11	Recite a poem
兩盞則放	양잔즉방	Two drinks and Laugh aloud	12	Let anyone to do some thing
醜物莫放	추물막방	Confess a shy thing. (If you filthy stuff, don't throw it away)	13	Confess a secret story and cry
自唱怪來晚	자창괴래만	Sing a song aloud as dance (Sing Goeraeman)	14	5 times rounding with elephant nose



$$S \sim 6.25\text{cm}^2, \quad 6.265\text{cm}^2$$

$$P \sim 1/14$$

6. Bulguksa Temple(불국사, 佛國寺)

Bulguksa Temple is the palace of Buddha where the idea of Buddhist nation is expressed through harmony and balance. It is the basis of Unified Silla culture accomplished by the aesthetics and science of the people of the Silla Dynasty.



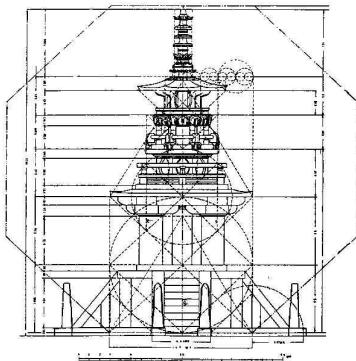
The majestic entrance to Bulguksa Temple, which is An Eternal Palace of Buddha

Bulguksa is classified as Historic and Scenic Site No. 1 by the South Korean government. In 1995, Bulguksa was added to the UNESCO World Heritage List together with the Seokguram Grotto, which lies 4 km to the east.

The temple encompasses seven National treasures of South Korea, including Dabotap and Seokgatap stone pagodas, Cheongungyo(Azure Cloud Bridge), and two gilt-bronze statues of Buddha. Among the earliest wood block prints in world, a version of the Dharani sutra dated between 704 and 751 was found there in 1966. Its Buddhist text was printed on a 8 cm × 630 cm mulberry paper scroll.

Two large stone balustraded staircases that were constructed without mortar dominate the temple's facade. The one on the right comprises a lower flight of steps called Baegungyo(White Cloud) and an upper flight of steps called Cheongungyo(Azure Cloud) and the one on the left, two flights of steps called Chilbogyo and Yeonhwagyo. This staircases are called bridges because symbolically they lead from the secular world to Bulguk, the Land of the Buddha.

Dominating the courtyard of Daeunjeon Hall are two of Korea's most beautiful pagodas: the 10.4 m high Seokgatap(Pagoda of Sakyamuni) and the 10.4 m high Davotap(Pagoda of Many Treasures), both were built around 751. A mimicry of wooden structure dominates the motifs of both pagodas. It is recorded that Kim Dae-seong had them built for his parents, which is perhaps why the Seokgatap is rather masculine and the Dabotap feminine in appearance. Seokgatap is characterized by simplicity and princely dignity whereas Dabotap is highly decorative. The simple Seokgatap represents spiritual ascent via the rules put forth by Sakyamuni, whereas the more complex Dabotap symbolizes the complexity of the world.

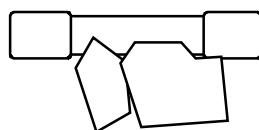
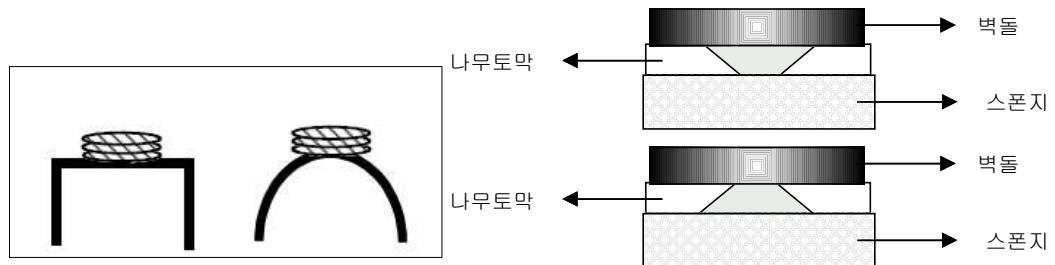
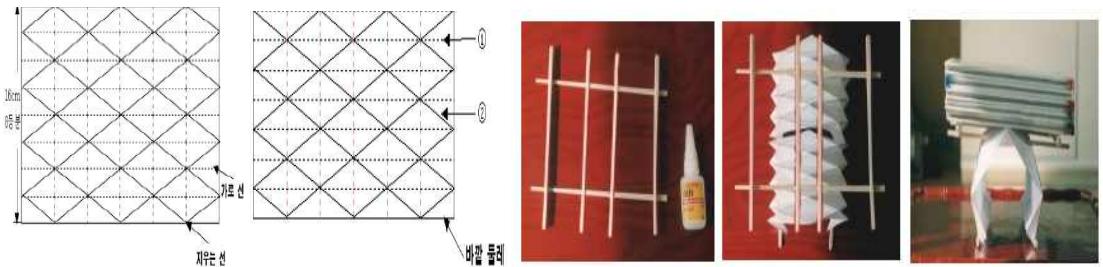


Pagodas: Dabotap(left): and Seokgatap(right)

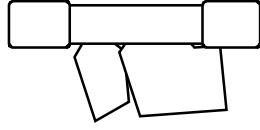
Look at the wings of Seokgatap Pagoda 8.2 m high. Does it look straight line or curved one? The edge of roof stone looks as if raised up a little bit and it gives the sense of upwardness. How can the straight line of eaves be looked as curved? In addition to that, the ratio of the length of frame stones from the 1st floor is 4 : 2 : 2 and it gives the sense of stability. The construction style of Dabotap Pagoda is unique in the orient because it had been constructed by putting stones only together without any adhesives. Nevertheless, how surprise the Harmony of the geometric progression of Dabotap Pagoda!

Going to left side from the front of the stone wall of Bulguksa Temple. look at the way how the stone wall is constructed with foundation stones of native rocks and imposing stones. Some imposing stones are carved along with the foundation stones, native rocks, and others are just put on the foundation stones of which top parts are cut straight along the base surface of imposing stones. The former technique is called as Gurangyi Architectural Technique(What is it?). Let's find the examples. Think about and explain the characteristics of Gurangyi Architectural Technique. Let's make a more precise observation and discover the beauty, science and technological appearance of Bulguksa Temple.

What would be the following drawings and photos related with math, science, engineering, technology, arts, history and religion?



자연석에 맞춰 장대석
을 깍은 경우



장대석에 맞춰 자연석
을 깍은 경우



Treasure No. 26



Treasure No. 61



Museoljeon Hall

7. Observatory Cheomseongdae(첨성대, 謲星臺)

Cheomseongdae is known as the oldest observatory in Asia (National Treasure No. 31). It is a structure that reflects the scientific spirit of the Silla people with every piece of stone having a symbolic meaning. The circular shapes of this structure represent the curvy and flow image of the sky, while the square shapes represent the flatness of the ground. The proper arrangement of brick secures a stable and gentle impression. What would be your estimation about the upper diameter and height?



It is considered an astronomical observatory in Silla Period from which they observed the movement of the heavenly bodies. The astronomical observatory is estimated to have been built in the period of Queen Seondeok (632~647) in Silla Period. It is presently a little tilted to the northeast, but remains almost as it used to be (How so long time?). As a precious cultural property, it shows the development level of the technology at that time.

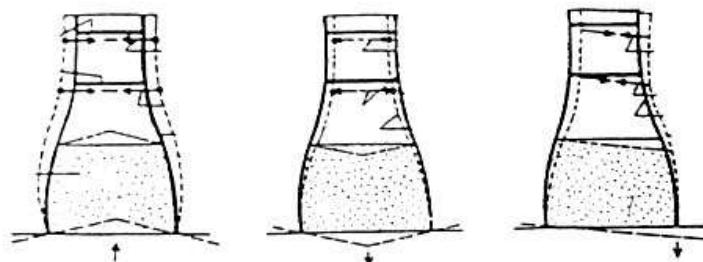
Liquor bottle-shaped cylinder stands on a platform that plays a role of pedestal, and the rectangular-shaped top is put on the highest part. They made the cylinder by piling 27 steps of fan-shaped stones, and the outer face is trimmed smooth. At the upper part, long ends of stone material that is geared into inside part of 井 shape are extended to the outside. This shape can be seen at the 19th–20th steps and 25th–26th steps, and so it seems that a ladder was easy to put on those steps in the inside.

A square top made of long stone bars on top of each other surmounts the hollow structure. The special top is believed to have aided astronomical observation. We can see that the astronomy was deeply related to the agriculture in that it could decide the farming time according to the move of the heaven. And it was also deeply related to the politics in that the horoscope was considered to be important since they could foretell the good and bad luck of a nation according to the result of observing the heaven in the ancient times. Accordingly, the astronomy became a

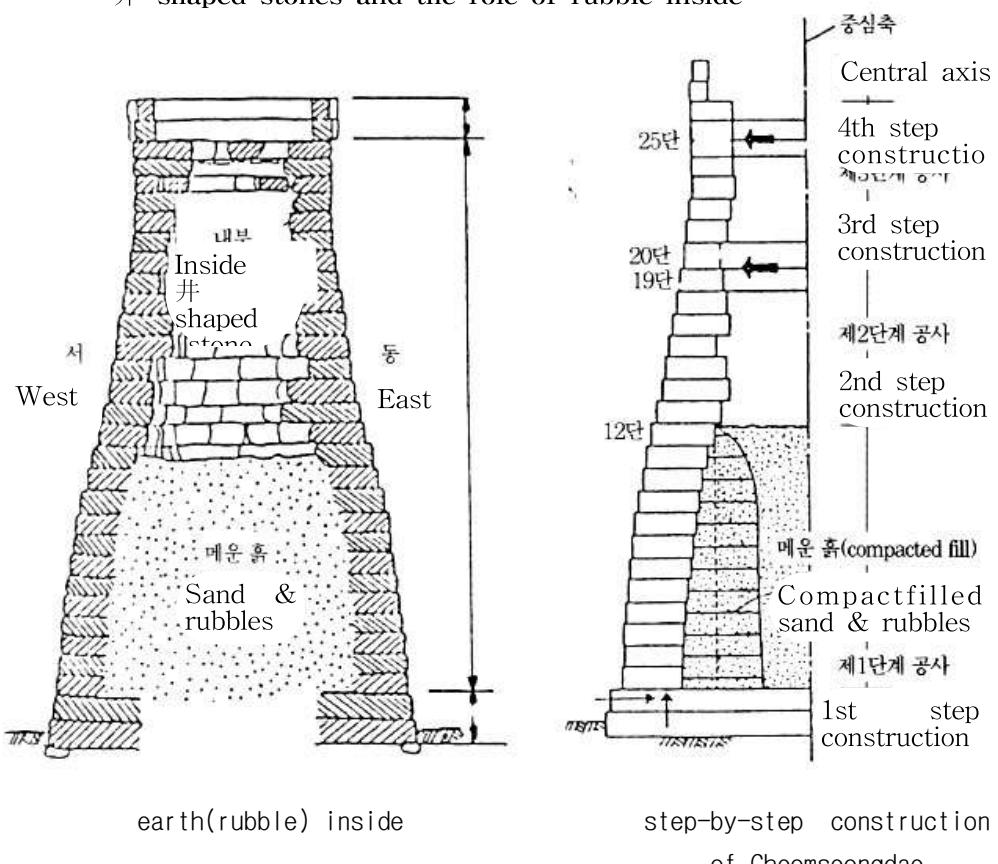
great interest of a nation at the early times to build observatory Cheomseongdae.

The record of an ancient book says, 'People can climb it up through the middle.' It seems that one put a ladder on its outside and went into the inside through a window, and then climbed up to the top by ladder to observe the heaven.

There was a intense debate among scientists, engineers, historians, and other scholars over the role of Cheomseongdae at a conference in 1981. It is difficult to make clear conclusion. The most commonly accepted interpretation is that Chemseongdae was a simple astronomical observatory. What was Cheomsongdae for?



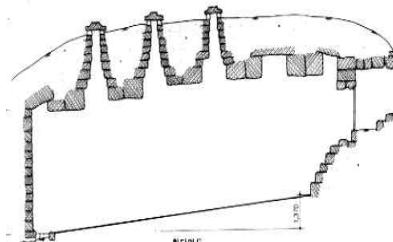
uneven sinking of the base, A Chinese character
井-shaped stones and the role of rubble inside



8. Ice Storage Sukbingko(석빙고, 石氷庫)

Seokbinggo (Treasure No. 66) is the ice storage built during the reign of King Yeongjo of the Joseon Dynasty. It is considered a masterpiece in terms of size and architectural technique.

According to Samguksagi, chunks of ice were stored here during the reign of King Jijeung, 22nd King of Silla. This is proof that ice storages were in use since the Three kingdoms era, but unfortunately only the Joseon Dynasty ice storage remains today.



9. Anapji Pond(안압지, 雁鴨池) (Historic Site No. 18)

It is said that during his 14th year of reign(A.D. 674), King Munmu of Silla had the pond dug, added some plants, and even raised rare birds and animals inside the palace. According to records, King hosted a banquet in 931, and by this it can be assumed that this part of Palace used for sovereign and subjects or as a reception hall for royal guests. Originally named Wolji (월지, 月池, pond of the moon), it was later renamed Anapji as geese and ducks began to fly to the pond. During the excavation research and dredging work conducted in 1975, the figure of Anapji, which was constructed in the Silla era, were almost identified. The names carved in Bosanghwamunjeon meaning (carving of jewels and flowers on brick), which was excavated from the Imhaejeonji Site, confirms the year the palace was constructed. A 14-face Dice(주령구 酒令具) was discovered in the Anapji.



water-in at Anapji



14-face
dice



multi-stage of water-in at
Anapji

10. Mt. Namsan(남산, 南山)

You cannot say that you have been to Gyeongju, until you have visited Mt. Namsan, a UNESCO World Heritage Site, which is a fascinating mountain with numerous relics from the Silla Kingdom.

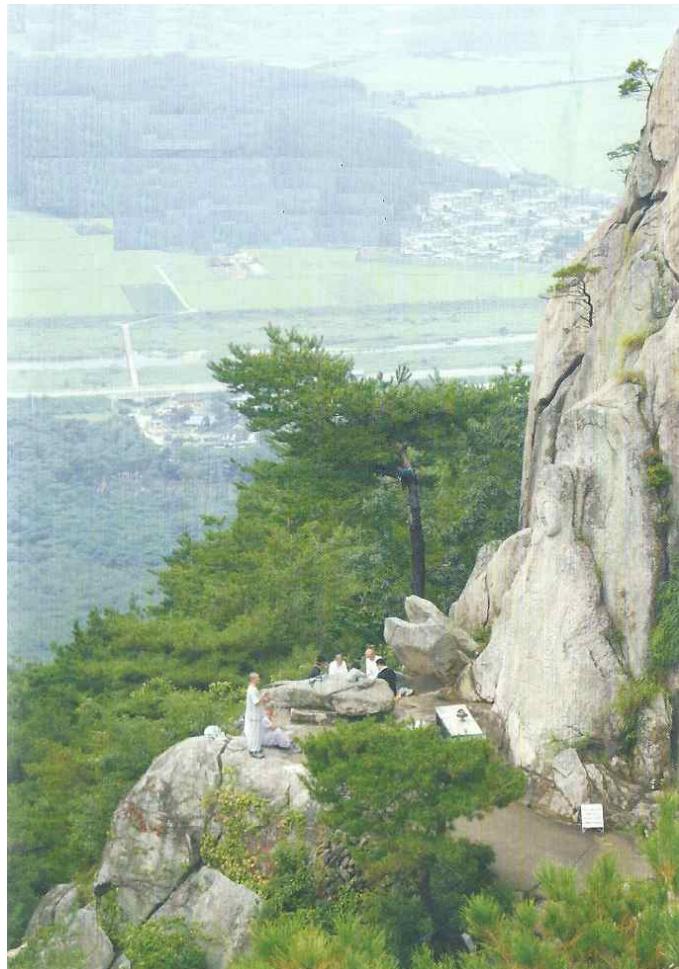
Mt. Namsan, about 10km long and 4km wide, has about 40 valleys and ridges, extending from the two main peaks, Geumo-bong (468m) and Gowi-bong (494m). Located in the south of the city, Mt. Namsan contains 13 royal tombs, 150 temple sites, 130 stone Buddha statues and carvings, 100 stone pagodas, 22 stone lanterns, and 4 mountain fortresses from the Silla Kingdom (57BCE–935CE).

It is not known exactly how many more relics are hidden or lost on this mountain.

Exploring the entire mountain can be a lifelong task. If you have only one day to explore it, however, the trail from the Samneung (Three Royal Tombs) valley will definitely give you the best experience.

You can do all kinds of scientific inquiries with your students and friend.

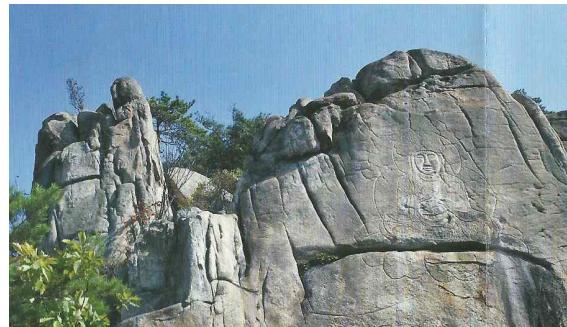
The geological, biological and archaeological investigation can be done in addition to hear about historical and cultural stories Silla Kingdom.



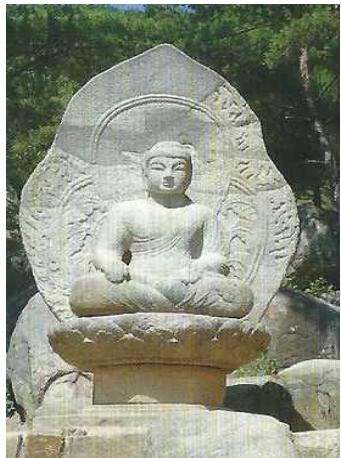
Mt. Namsan



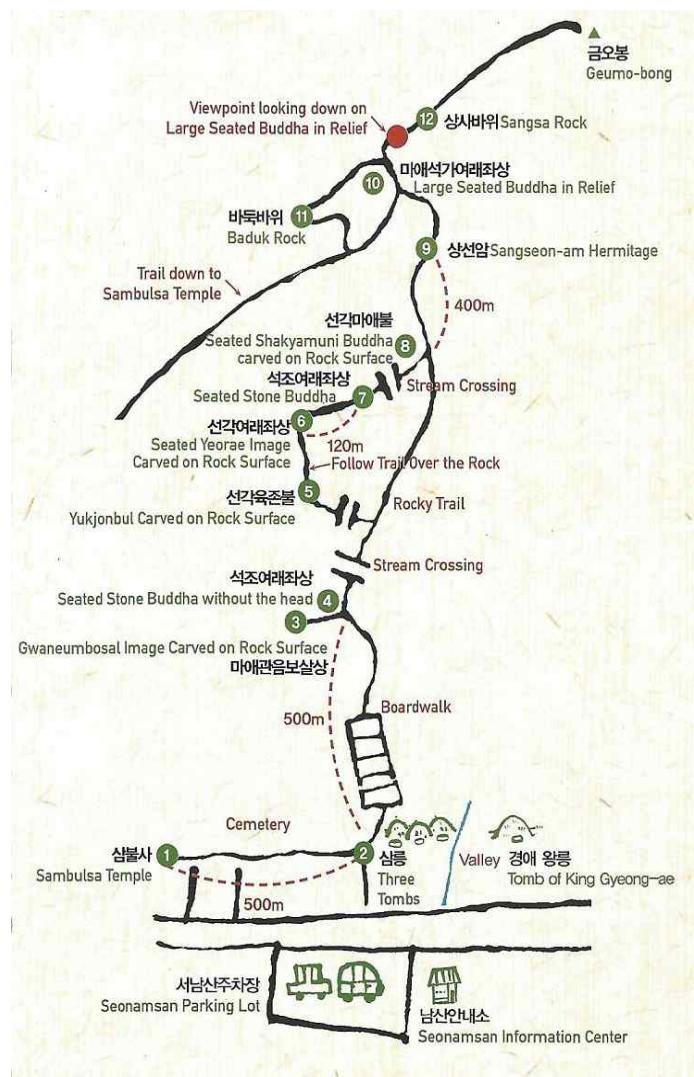
Baduk Rock(Viewpoint)
Surface(바득 바위)



Seated Yeorae Image Carved on Rock
(선각여래좌상)



Seated Stone Buddha of
Samneung Valley
(석조여래좌상)



Three Royal Tombs
(삼릉)

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- <http://seer.snu.ac.kr> Science Culture Education Research Institute
- <http://bolog.com> Bolock Media
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UNESCO Treasures in Korea

Year	Site	Image	Location	Area ha (acre)
1995	Seokguram Grotto and Bulguksa Temple		North Gyeongsang Province	—
1995	Haeinsa Temple Janggyeong Panjeon, the Depositories for the Tripitaka Koreana Woodblocks	 	South Gyeongsang Province	—
1995	Jongmyo Shrine		Seoul	19ha
1997	Hwaseong Fortress		Gyeonggi Province	—
1997	Changdeokgung Palace Complex		Seoul	—
2000	Gochang, Hwasun and Ganghwado Dolmen Sites		North Jeolla Province, South Jeolla Province and Incheon	52ha
2000	Gyeongju Historic Areas		North Gyeongsang Province	2880ha
2007	Jeju Volcanic Island and Lava Tubes		Jeju Province	9475 ha
2009	Royal Tombs of the Joseon Dynasty		Gyeonggi Province and Seoul	1891ha
2010	Historic Villages of Korea: Hahoe and Yangdong		North Gyeongsang Province	600ha

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