

# HISTORICAL ASPECTS OF GEOTHERMAL ENERGY IN CHINA

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## ABSTRACT

China has a long history of utilization of geothermal energy. Early people used hot springs for irrigation and domestic purpose. During Han Dynasty, salt was extracted from thermal water in the Zigong area of Sichuan Province. In Ming Dynasty, Li Shi-zheng, a famous medical doctor at that time, used hot spring water for disease treatment. In this paper, historical aspects of geothermal energy in China, namely legends and myths about hot spring; hot spring for recreation and luxury; tea and wine culture from hot springs; hot spring for treatments were discussed in detail by the author.

**KEY WORDS:** Historical aspects; Geothermal energy; Legend and myths; Recreation and luxury; Wine culture and medical treatments; China

## INTRODUCTION

China has a long history (over 2000 years) of utilization of geothermal energy. Although the early people used hot springs for irrigation (both for heat and water) and domestic usage such as clothes-washing, food-cooking etc, the utilization of hot springs has mainly been focused on disease treatments and recreation purpose. Li Shi-zhen, a famous medical doctor from Ming Dynasty (1368- 1644 AD) advised people: "If you get ill, go to hot spring area and take a bath". In Xiaotangshan hot spring area near Beijing, two thermal water pools were sunk in 1666, the fifth year of Empress Dowager Cixi, specially for her bathing. In Huaqingchi hot spring area not far from Xi'an City, the ancient capital of Tang Dynasty, a quite fancy bathing house was built up for the Imperial Concubine Yang Gui-fei use only.

With the utilization of hot spring water, the early people tried

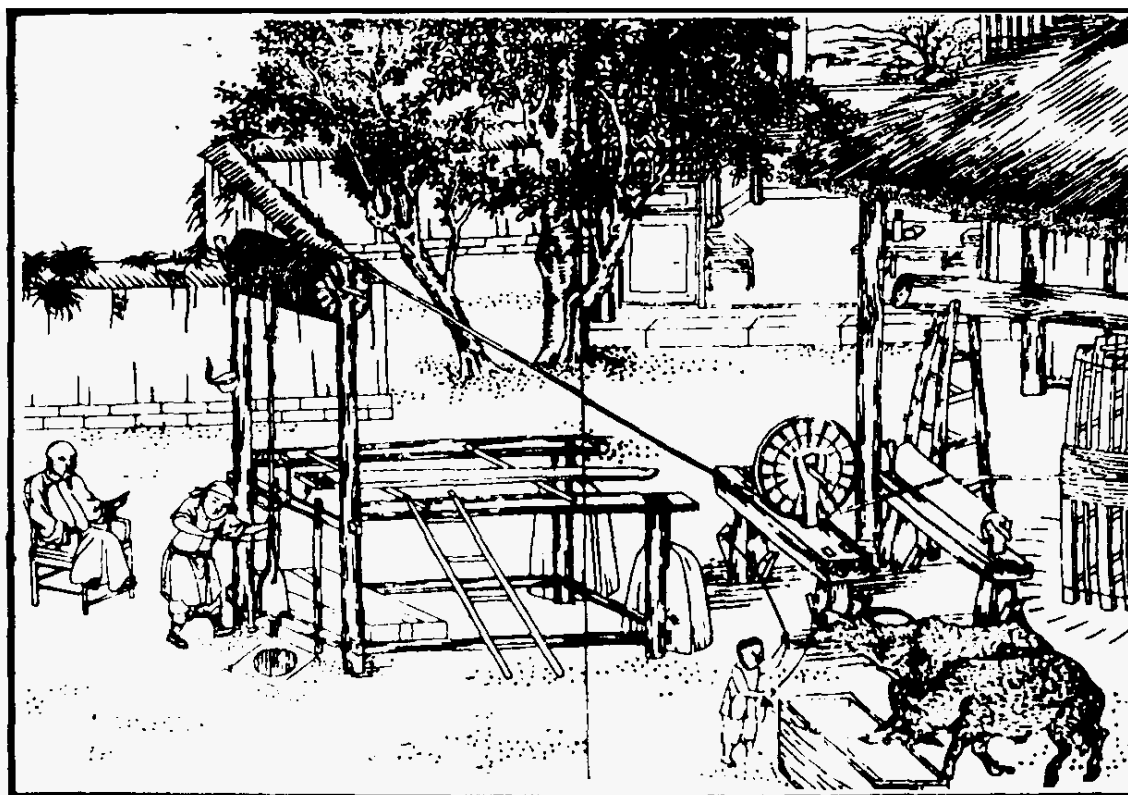


FIG. 1 Drilling for hot brine in Zigong City, Sichuan Province during Yuan Dynasty about 800 years ago

to understand the origin and genesis of hot springs. Li Bai, the great poet in Tang Dynasty wrote: "Where underground fire exists, there must be hot springs". Another great poet from Song Dynasty (1127-1279 AD) Su Shi said: "Where fire-mountain exists, there would be boiling springs". In addition to hot springs, thermal water were used for salt extraction in some inland places where salt from sea water was not available. During Han Dynasty (206 BC-220 AD), salt was extracted from thermal water in Zigong City, Sichuan Province, and afterwards the city became the major salt-supply area for SW China and gained the name of "Salt Capital" (Fig. 1).

In this paper, our effort would be concentrated on hot spring utilization and development in China "across the centuries from the early days of civilization to the beginning of Industrial Age" and to "reconstruct the 'impact' that geothermal phenomena had in the past on the evolution of man's habits and on the 'rapport' established between man and territory in many geothermal localities on earth" to meet the objectives of this Session.

### LEGENDS AND MYTHS ABOUT HOT SPRINGS

In China, there are a number of legends and myths about hot springs in the early days of Chinese civilization. Although there was no certain divinity cults like Fujiyama in Japan and Pelee in Hawaii, there did exist several mythical stories in China history. The most famous one is as follows:

There appeared a magic hot spring called "Fairy Spring" to the NW of Lishan mountain near Xi'an City. The hot spring was magic and could treat almost every kind of disease. However, before you got into it, you should pray to the hot spring with killed animals (ox, pig and sheep). Otherwise, the disease could not be treated but even became worse. One day, Qin Shi Huang, the first Emperor in China of Qin Dynasty (221-206 BC), travelled to that spring and jumped into hot spring water quickly without any praying. After a moment, Qin Shi Huang felt himself uncomfortable and his skin was swollen. At that moment, the fairy girl emerged from the hot spring water and asked Qin Shi Huang to excuse. Qin Shi Huang excused for not following the rule of that hot spring and prayed. After that, he became comfortable and enjoyable immediately.

Another magic hot spring occurred in Zhejiang Province. During Tang Dynasty, the daughter of Zhejiang Province governor got seriously ill and could not be treated by any means. Once, she went to that hot spring and took a bath, the disease was gone and she got recovered rapidly.

The third magic hot spring was located in Lushan Mountain, Jiangxi Province, this spring is very good for skin disease even for sex disease. It is believed that this is the only recorded hot spring in China for treating sex disease in ancient time.

### HOT SPRING FOR RECREATION AND LUXURY

The most famous one is Huaqingchi hot spring during Tang Dynasty. It has been 3000 years since Huaqingchi spring was utilized. The place started to be built for bathing-treatment since Qin Dynasty. In 644 AD of the Tang Dynasty, Tangqian (means "thermal spring") palace was built around the spring and changed the name into "Huaqing" (means "Glorious Purity"), i.e. water looks crystal-clear and sweet-tasting, which would keep everybody young for ever if one drinks the spring water everyday and bathes in it all the time) palace in 747 AD (Photo 1). It was the most luxurious Imperial Palace during Tang dynasty. The Emperor Tang

Xuan-zong and his beloved Concubine Yang Gui-fei lived there very often, spent most of their leisure time and took a bath everyday. The phrases in poem "Changheng" by Li Bai described the luxurious life of Emperor Tang and Concubine Yang at Huaqing palace vividly: "It feels so well bathing in Huaqing hot spring and the spring water can clean every thing out of the body even the 'make up' of Concubine Yang".

Another famous place for hot spring recreation and luxury is Xiaotangshan hot spring area, 25 km to the North of downtown Beijing. This hot spring area was firstly recorded in "The Annals of the Yuan Dynasty" about 800 years ago. Since then, the royal family, the noble lords and the high-rank officials in Ming (368-644 AD) and Qing (1616-1911 AD) Dynasties visited this area very often and built their own mansions there. Two hot spring pools were sunk in 1666 and there were



Photo 1 Huaqing (Glorious Purity) hot spring at the foothill of Lishan Mt. The most luxurious Imperial Palace Huaqing Palace was set up in 747 AD during Tang Dynasty



Photo 2 Close up of two hot spring pools in Fig. 2

remains of the Empress, Dowager Cixi's bathing tank (Fig. 2, and Photo. 2).

### TEA AND WINE (LIQUOR) CULTURE FROM HOT SPRING

It is well-known that so called "Tea and Wine (liquor) Culture" in China has a long history and high quality water is of significant importance for both good tea and good wine (liquor). The most famous liquor "Maotai" and high-quality beer "Qingtao" plus good wine "Zhangyu" are all made of the nearby spring water. In ancient time, people also used some sort of hot spring water for tea. For instance, HgS hot spring

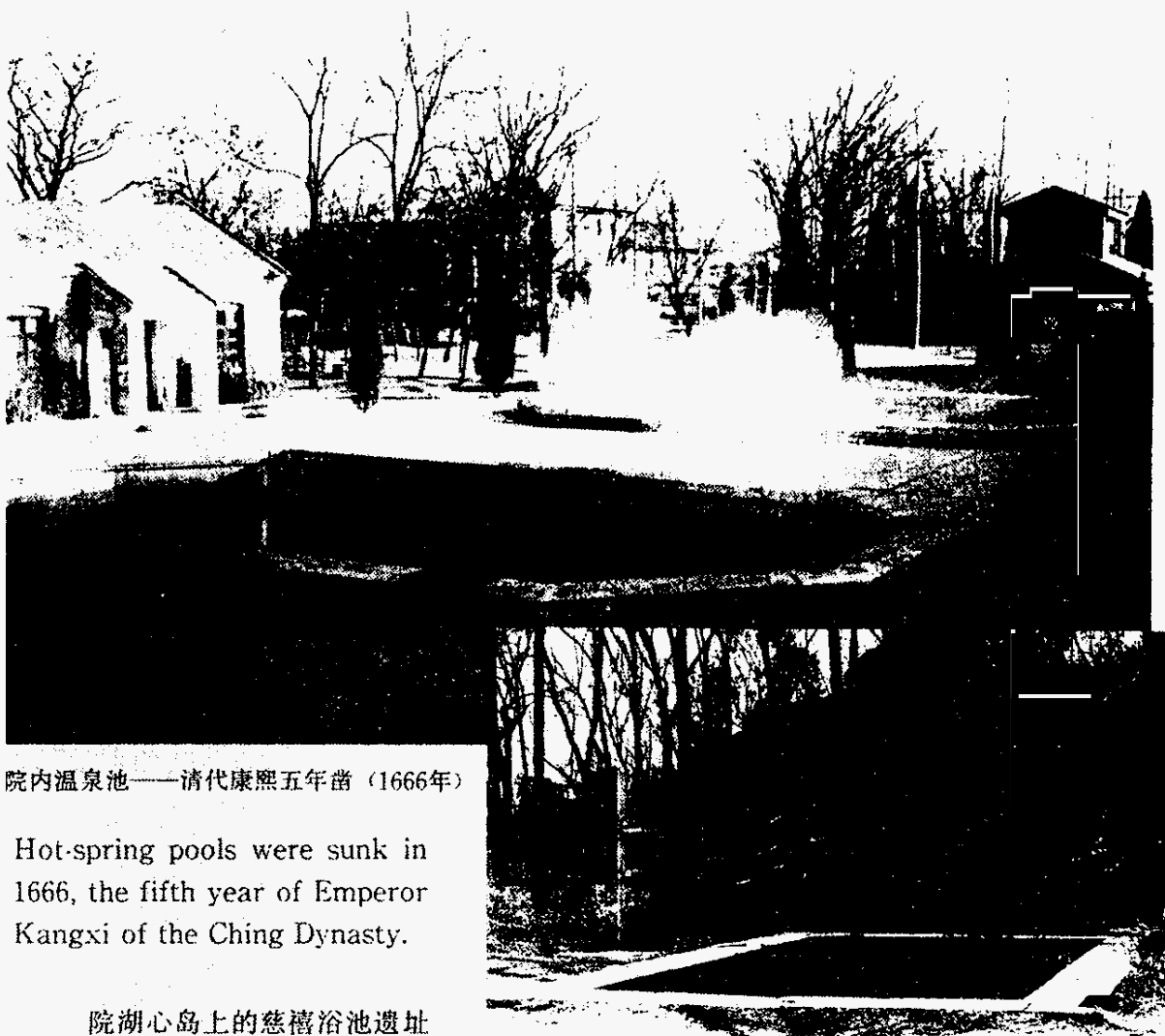
from Huangshan Mt., Anhui Province was used for tea and it was believed that this kind of tea was good for health.

In Hangzhou City, which is famous for the beautiful West Lake and excellent green tea called “Longjing” (means “Dragon’s Well”), there exists a famous spring called “Hupao” (means “the Running Tiger”)(Photo 3). The spring water is so clear, pure and sweet that makes the Longjing tea marvellous. It is said in Hangzhou that the (“two uniques” (Longjing tea and Hupao spring) make the West Lake more beautiful. Nowadays in Japan, there exists so called “Tea Ceremony” (Photo 4). It is believed that this culture has been derived from the tea culture in China since ancient time.

In Zunhua County, Hebei Province, a famous hot spring called “Tangquan” (means “Hot-Water Spring”) is situated to the East of the Eastern Royal Tombs of the Qing Dynasty. A story is going around that the Emperor Tang Taizong of the Tang Dynasty stayed here on the way with an expedition to the East. He bestowed on the spring a name “Fuquan” (“Lucky Spring”) after seeing that his soldiers take a bath and made a quick recovery from illness and fatigue. For celebration, he gave a banquet near the hot spring and used the flowing hot spring water of about 60° to warm up the liquor. Soon after, the Fuquan Temple was built and the Fuquan mansion plus the spring pool followed. In addition, a pavilion called “Liubeiting” (means “Flowing Cup Pavilion”) was built up



Photo 3 Hupao (“Running Tiger”) spring in Hangzhou



院内温泉池——清代康熙五年凿（1666年）

Hot-spring pools were sunk in 1666, the fifth year of Emperor Kangxi of the Ching Dynasty.

院湖心岛上的慈禧浴池遗址

FIG. 2 Hot spring pools and bathing tank for Emperor Dowager Cixi in Xiaotangshan hot spring area near Beijing



Photo 4 "Tea Ceremony" during 29th International Geological Congress 1992 in Kyoto, Japan

next to the spring pool in memory of that event (Photo 5). From the photo it can be seen that the cup with liquor and/or wine warms up while the cup flows from one side to the another. This is the unique "Wine (liquor) Culture" in China from ancient times. You can imagine how fantastic it would be during such a banquet!

Another interesting story about "Wine (liquor) Culture" comes from West China on the "Silk Road" to Europe. There exists a famous spring called "Jinquan" ("Golden Spring") in Gansu Province in the suburb of Jiuquan County. During West Han Dynasty (140–117 BC), a great general Huo Qu-bing commanded his soldiers to expedite to the West and win the war. An Emperor of Han Dynasty named Wudi bestowed wine for the victory. It is obvious that it was impossible to share the wine with so many soldiers. Instead of drinking wine by himself alone, General Huo decided to pour the wine into the spring water and enjoyed the "spring-wine" with the whole army. Since then, the spring was named "Jiuquan" ("Wine Spring") and become more and more famous as the story spread over day after day.

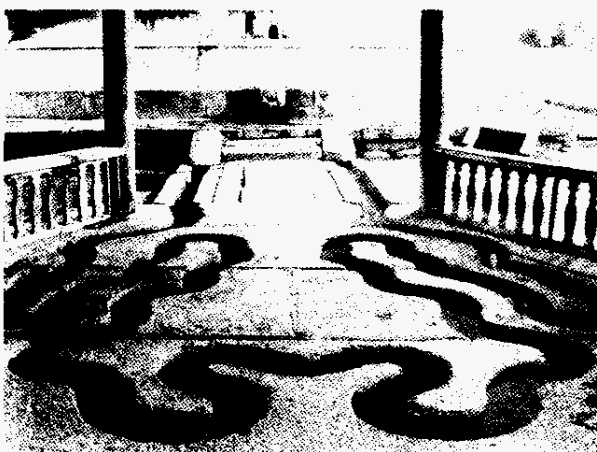


Photo 5 "Liubeiting" ("Flowing Cup Pavillion") next to the hot water pool of Tangquan ("Hot-Water Spring") spring in Zunhua County, Hebei province

## HOT SPRINGS FOR TREATMENTS

From the afore-mentioned it is clear, that hot springs more or less bear therapeutic nature and in early days people already used hot springs for treating various kinds of diseases. With time, some "academic" people intended to investigate the effect of hot spring water on human being's body and tried to interpret the mechanism of "Water-Body" interaction from the theory of Chinese traditional medicine. For instance, Ban Gu of East Han Dynasty thought that hot spring belongs to "Fire" of the so called "Five Behaviors" (Gold, Wood, Water, Fire, and Soil) of the Universe. Therefore, the "cold disease" such as arthritics, rheumatism, digestible system disease must be treated by hot spring water. On the contrary, the "fever disease" such as typhoid, yellow fever etc. could never be treated by hot springs. Sulphur hot springs is very good for skin disease because in Chinese traditional medicine, skin disease is always be treated by sulphur alone.

In Inner-Mongolia, there appears a "holy" hot water spring called "Arxan" hot spring with a temperature of about 50°C (Photo 6). The spring water is effective for fibrous tissue syndrome, arthritis and psoriasis. As a result, the local herders take it as the "Holy Water".

Tanggangzi (means "Hot Water Hill") hot spring is most famous for its medical treatment in China which is located at the southern suburb of Anshan City (the largest city for steel industry), Liaoning Province. This spring was found in 644 AD of Tang Dynasty and a county called Tangchi (means hot water pond) was set up around the hot spring area in Liao and Jin Dynasty. During Qing Dynasty, more and more people came over here, took a bath and/or hot mud treatment. In 1950, a sanatorium was set up and nowadays Tanggangzi Sanatorium is a well-appointed physiotherapeutic hospital as well as one of the biggest physiotherapeutic centers in our country.



Photo 6 Arxan ("Hot Holy Water") hot spring from Inner-Mongolia

## DISCUSSION

From the above-mentioned it is obvious that China has a long history of utilization of geothermal energy at least more than 2000 years. In most cases, hot springs were regarded as the gifts and/or valuables by the nature and many cities, towns and villages have grown up around the hot spring area. The most famous ones are the Fuzhou and Zhangzhou cities,



Photo 9 Tagejia geyser in S. Tibet, the biggest geyser in China during eruption at 15:20, August 2, 1975 (Photo courtesy of Zhang Ming-tao)



Photo 10 Crater caused by hydrothermal explosion in Gangba County, S. Tibet; Diameter of crater is about 7 m; Water temperature is 105.5°C (Photo courtesy of Zhang Ming-tao)

the former now is the capital of Fujian Province. In Fuzhou, there is a “hot spring” street in the very downtown of the city center and the local residents use the hot spring water for bathing since the early days of settlement. Zhangzhou city is located in the so called “Golden Triangle” of southern Fujian Province. Many people in Taiwan have immigrated from that area and the former President of Philippines Mrs. Akino originally also came from the Zhangzhou area. Several years ago, she made a short visit to her home-town and took a hot spring bath. Now, Zhangzhou is the biggest center for utilizing geothermal energy for non-electrical direct use in our country. In addition to bathing houses, spas, fish-farming and vegetable-drying are the two main geothermal industries in Zhangzhou and make a lot of money for the local residents. The only hot spring with some terror and/or fear in China could be found in Taiwan and in Tengchong volcanic area of SW Yunnan Province. Located about 12 km to the West of Taipei (Taipei) City, the Beitou hot spring is famous for its “Geothermal Valley” (“Hell Valley”) because of its mystic and terrible nature. Geologically, Beitou hot spring is related to Datun active volcano and has a number of high-temperature geothermal manifestations on the ground, which made the valley mystic and terrible and the valley gained the name “Hell Valley” (Photo 7). However, the Beitou hot spring water is very good for treating beriberi, favus of scalp and scabies because the water contains a lot of sulphur. In history, the sulphur mining in Taiwan was also concentrated in Datun volcanic zone including Beitou hot spring area. The earliest record of sulphur mining in Taiwan could be traced back to Yuan Dynasty about 800 years ago.

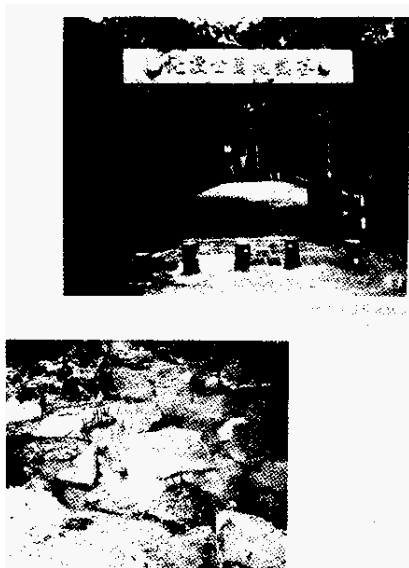


Photo 7 Geothermal valley (“Hell Valley”) in Beitou hot spring area related to Datun volcano in Taiwan



Photo 8 “Water-Fire-in-One” hot spring from Tainan County of southern Taiwan

Another hot spring with some-degree of mystic nature is situated in Tainan County of southern Taiwan for its “Water-Fire-in-One” spectacle. Actually, the hot water with temperature about 75°C and the natural gas gush out of the fracture at the same time and flames will burn and nicker up on the water surface forming a “Water-Fire-in-One” picture if the natural gas meets with a fire (Photo 8).

Hot springs and various geothermal manifestations such as “sulphur pond” (or “boiling pot”), “hot sea” and “frog mouth” fumarole etc. from Tengchong volcanic area in SW Yunnan Province on the border with Burma and close to Thailand are most spectacular and scenic but never caused any fear or terror in the history. The same thing is also correct for the numerous geothermal manifestations in Tibet such as geysers, steaming ground, hydrothermal explosion etc. (Photo 9, 10).

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