The Production of Well Salt by Ethnic Minorities in Pre-modern Yunnan: The “Illustrations on the Salt Production Methods of Yunnan”

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Abstract: This paper makes use of regional historical sources to analyze and investigate the "Illustrations on the Salt Production Methods of Yunnan" (Diannan yanfa tu 滇南鹽法圖), a scroll held by the Chinese National Museum in Beijing. It postulates that pre-modern Yunnan salt works can be divided into three basic types: natural brine springs, brine wells on land, and brine wells in the middle of rivers. The last type, in particular, is characteristic of Yunnan well salt production. At the same time, this paper also discusses the arts of hoisting and transporting brine as well as the methods of boiling brine and forming salt, thus highlighting the diversity of Yunnan’s pre-modern well salt production methods. By reflecting the customs and practices of the Yunnan salt industry, the "Illustrations on the Salt Production Methods of Yunnan" is an important document for the history of science and technology of the ethnic minorities in the southwestern part of China.

Since ancient times, Yunnan has been famous for the production of well salt (jingyan 井鹽). The Dianhai yuheng zhi 滇海虞衡志 (Record of the Wilds of Yunnan) relates: "The great administrative concerns of Yunnan are solely copper and salt." The production of well salt was one of Yunnan’s most important economic activities, the salt tax being the second biggest tax category after land taxes. The supply of salt was of major concern to Chinese rulers throughout history, and hence the sources about the Yunnan salt industry are relatively detailed.

The "Illustrations on the Salt Production Methods of Yunnan" (Diannan yanfa tu 滇南鹽法圖; hereafter "Illustrations"; see Ill. 1-9), which was made in the 46th year of the Kangxi reign-period (1707), is a particularly valuable illustrated scroll about the production of well salt in Yunnan during the Qing period (1644-1911), and is today considered a first

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class item among the collections of the Chinese National Museum. It is the only extant illustrated scroll in colour that depicts in detail the production of well salt by Yunnan’s ethnic minorities. The scroll is 1,108.7 cm wide and 56.6 cm high. It consists of nine sections, showing the following salt works: Black Well (Heijing 黑井), White Well (Baijing 白井), Carnelian Well (Langjing 琅井), Cloud-dragon Well (Yunlongjing 雲龍井), Anning Well (Anningjing 安寧井), Alou-Hou Wells (Alou-Houjing 阿陋猴井), Jingdong Well (Jingdongjing 景東井), Overflowing-sand Well (Mishajing 彌沙井), and the Zhijiu and Grass-creek Wells (Zhijiu-Caoxijing 只舊草溪井). On the scroll, the “outlines of mountains and rivers, the circumstances of [salt] boiling, and the human conditions” of the nine salt works are shown. In addition, the illustrations carry “descriptive labels” (tibang 預榜), and every section has an “illustration explanation” (tushuo 圖說) (Ill. 1-9). Li Bi 李苾, Salt Distribution and Postal Service Commissioner (yanyishi 盐驛使) of Yunnan, ordered it to be painted delicately by a painter-craftsman. At the end of the document we find a “Colophon to the Illustrations on the Salt Production Methods” written by Li Bi himself (see “Translation of the Text of the Scroll”). The artist adopted a compact-image composition style and realistic technique. One by one, the nine famous salt works of Yunnan and their production conditions are shown in a concrete way. The human beings depicted are vivid and lifelike, and the production activities are arranged in a clear and orderly fashion. The illustrations offer us invaluable information about the types of salt works operated by Yunnan ethnic groups, and the distinctive technologies and different tools employed for hoisting brine and producing the salt. The nine salt works depicted in the “Illustrations” are all located in districts inhabited by ethnic minorities. The scroll can thus be called the "Qingming shanghe tu 清明上河圖 (Along the River during the Qingming Festival) of well salt production by Yunnan’s ethnic minorities”. By carrying out research on this scroll, we can enhance our knowledge not only of the different types of salt works and the crafts and techniques of well salt production in general, but also of the history and economics of well salt exploitation in Yunnan in particular.

Due to the fact that the “Illustrations” has never been published in its entirety and is difficult to access, studies on it to date have been very rare. Among its illustrations, only that of the Black Well (entirely) and the

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2 As we will see later, a Chinese record of the mid-fifteenth century makes clear that the composite name of this salt works had its origin in two distinct wells, the Alou Well 阿陋井 and the Monkey Well (Houjing 猴井). [Transl.]

3 Anning, Alou, Jingdong and Zhijiu are probably place names. [Remark or annotation by translators; henceforth: Transl.]

4 See the scroll’s colophon.

5 Probably a combination of a salt commissioner and a postal official. [Transl.]
White Well (partly) salt works have been published, in the “History of the Salt Industry in China”, while Lü Changsheng, formerly of the Preservation Department of the Chinese History Museum, has written a preliminary introduction to it. Because of its unrivaled value for Yunnan salt industry history and the cultural history of Yunnan’s ethnic minorities, further research on this scroll is imperative.

1. Examination of the Nine Salt Works in the “Illustrations on the Salt Production Methods of Yunnan”

The earliest records about well salt in Yunnan date from the Han Dynasty. The “Geographical Treatises” of the “History of the Han Dynasty” (Hanshu 漢書) relate that there was a salt official (yanguan 盐官) in Lianran 连然 (modern Anning 安宁). The “Records of Nanzhong” in the “Records of States South of Hua Mountain” (Huayang guozhi 華陽國志), composed during the Jin period (266-420), tell us that Nanguang District 南廣縣 (today the region of Zhenxiong 镇雄 and Yanjin 盐津) and Qingling District 青蛉縣 (today the region of Dayao 大姚) also had salt officials (yanguan). From the Tang Dynasty onwards reports about salt wells in Yunnan not only multiply, but also provide information about their names and concrete conditions. These sources reveal a close relationship with the nine salt works as they are depicted in the “Illustrations”.

The “Illustrations” and the existing historical data about the salt industry in Yunnan make clear that the so-called “nine [salt] wells” are not at all—according to our common understanding—nine wells, but refer to nine salt works administration areas. Hence, one salt “well”, i.e. salt works, usually contains a number of individual wells. For instance, the “Explanation to the Illustration of the Black Well” states: “The general name [of the salt works] is Black [Well] (Hei 黑), but the individual wells

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are called Big [Well] (Da 大), Repeating-prosperity [Well] (Fulong 復 隆) and Eastern [Well] (Dong 東).” Another case is the “Explanation to the Illustration of the Cloud-dragon Well (Yunlongjing 雲 龍 井)” that states: “The Cloud Well (Yunjing 雲 井) is one of the eight wells, and people do not know that this one well [i.e. salt works] actually comprises eight wells.” Finally, the “Explanation to the Illustration of the Alou-Hou Wells (Alou-Houjing 阿 陋 猴 井)” tells us: “The one with the most wells (jingyan 井 眼) among the eight [salt] wells [i.e. salt works] is without doubt Alou. The ‘Investigation of [Yunnan] Salt Administration’ ([Quan Dian] yanzheng kao [全 滇 盐 政 考]) lists altogether 40 wells.” Therefore, in reality the term “nine wells” refers to the fact that each of them controlled the individual salt wells in their surrounding area. This is what is meant by the “Record of the Wilds of Yunnan” when it states that “three [Salt] Distribution Supervisorates (tijusi 提 舉 司) were established”\textsuperscript{10} for the purpose of facilitating administration.

The “Illustrations” reflect well salt production by Yunnan’s minorities at the end of the Ming Dynasty (1368-1644) and the beginning of the Qing period (1644-1911). From the Ming Dynasty on, Han people started to migrate to Yunnan in substantial numbers. However, compared to the situation during the Late Qing, the number of Han people in regions inhabited by minorities was still modest at the beginning of the Kangxi reign-period (1661-1722). Moreover, some of the nine [salt] works were located in remote and poor mountain regions with only few Han immigrants. This is confirmed by historical records, which demonstrate that Yunnan well salt was primarily developed and used by minority peoples.

The first section of the “Illustrations” depicts the Black Well salt works, located in the area inhabited by the Yi people. In old times this district, today’s Lufeng District祿 豐 縣 in Chuxiong 楚 雄 Autonomous Prefecture of the Yi people, was called Yanxing 盐 兴 (“Salt is prospering”). The “Comprehensive Encyclopaedia of Administrative Geography” (Hunyi fangyu shenglan 混 一 方 輿 胜 覽) of the Yuan period (1271-1368) reports: “There are more than forty salt wells in Yunnan, among which the White Well in Yaozhou 姚 州 and the Black Well in Weichu 威 楚 are considered to be the best.”\textsuperscript{11} We can conclude from this that, because the Black Well salt works was already famous during the Yuan period, it must already have been operating for some time. In the fourth chapter dealing with “Chuxiong Prefecture”, the “Records of Yunnan

\textsuperscript{10} Tan Cui, Dianhai yuheng zhi, p. 65.
\textsuperscript{11} Liu Yingli 劉 應 李, Hunyi fangyu shenglan 混 一 方 輿 胜 覽 (Comprehensive Encyclopaedia of Administrative Geography), in Fang Guoyu 方 国 瑜 (chief ed.), Xu Wende 徐 文 德 and Mu Qin 木 芹 (compilers and collators), Yunnan shiliao congkan 雲 南 史 料 資 刊 (Collection of Historical Materials on Yunnan), Kunming: Yunnan daxue lishixi minzu lishi yanjiushi, 1979, vol. 8, p. 115.
There are eight well [i.e. salt works] in Yunnan, among which the Black Well [salt works] occupies the first place, because it covers more than one half of the [total salt] tax (ke) produced by the eight salt wells [i.e. salt works]. It is located 150 li [ca. 86.4 km] north of the governmental seat of Chuxiong Prefecture. It is surrounded by many steep and green mountains and “a long [flat] bridge is set across the bubbling [river] waters.” Population there is dense, and it is indeed an important place with respect to public finance and taxation.

The second section of the “Illustrations” depicts the White Well, which is also one of Yunnan’s most important salt works. In old times the district to which it belonged was called “Salt-rich District” (Yanfeng xian), located in today’s Baiyang Town in Dayao District of Chuxiong Autonomous Prefecture of the Yi people. The “Bai Barbarians” (Baiman), the precursors of the Bai people, were the first to operate this salt works. In the “Records of Nanzhong”, a chapter of the mid-fourth century “Records of the States South of Hua Mountain”, we can read that “Qingling District has a salt official.” Since Qingling refers to Dayao, this proves that the excavation of this well must have started before the Jin Dynasty (265-420). The chapter “Brief Account of Production” of the Dianlüe (Brief Account of Dian [i.e. Yunnan]) from the Ming period records the following:

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12 Chen Wen, *Yunnan tujing zhishu (Records of Yunnan [Province] with Maps [and Illustrations]),* chap. 4, “Chuxiongfu”, manuscript, 1455.


14 Chang Qu, *Huayang guozi* p. 447.
There is a Male Goat Well (Diyangjing 羔羊井), which lies about one li west of the [Salt] Distribution Supervisorate (tijusi). During the time of the Meng 蒙 clan [of the Nanzhao Kingdom], a shepherdess was herding goats there. A male goat was licking the earth, and she tried to chase it away, but it would not leave. After digging into the ground, she found a brine spring. Subsequently it was called White Goat Well (Baiyangjing 白羊井), later being erroneously named White Salt Well (Baiyanjing 白鹽井).  

The third section of the “Illustrations” shows the Carnelian Well, located in today’s Mouding District 牟定縣 in Chuxiong Autonomous Prefecture of the Yi Minority in Yunnan province. The Carnelian Well produced excellent salt of high quality. This famous salt was exclusively used by the Nanzhao 南詔 (738-937) royal family during the Tang period (618-907). The “Records of Yunnan” (Yunnan zhi 雲南志) by Fan Chuo樊綽 of the Tang Dynasty reports:

Coming from Shengma 升麻 and Tonghai 通海, all the Cuan Barbarians 爨蠻 consume salt from the Anning Well. Only the salt of the Carnelian Well within the walled city of Lantan 覽賧 is pure white and of beautiful taste. Once the demand of the Nanzhao royal family is satisfied, [no more salt is produced, and] the [excess] hearths and wells are removed and sealed up.  

In the fourth section we see the Cloud-dragon Well salt works, which is in present-day Yunlong雲龍 District, Dali大理 Autonomous Prefecture of the Bai 白 Minority. Its most famous well is the Nuodeng Well 諾鄧井, which is also mentioned in the “Records of Yunnan”: “In Jianchuan劍川 there is the Xinuodeng Well 細諾鄧井.” Another work, the “Records of Yunnan [Province] with Maps [and Illustrations]” (Yunnan tujing zhishu 雲南圖經志書) from the Jingtai reign-period (1450-1456) states:

The Salt Tax Control Office (yanke tijusi 盐課提舉司) of the Five Wells is located 300 li [ca. 173 km] northwest of Langqiong District 濃穹縣 and was set up in the sixteenth year of the Hongwu reign-period (1383). It includes an Office of the Chief of Police (linu ting 目廳). Five Salt Tax Offices (yanke si 盐課司) are subordinated

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15 Xie Zhaozhe 謝肇淛, Dianlüe 滇略 (Brief Account of Dian [i.e. Yunnan]), manuscript of the Ming period (1368-1644), chap. 3, “Chanlüe” 產略 (Brief Account of Production).
17 ibid.
The Cloud-dragon Well salt works was already operated in the Tang Dynasty by the Bai Barbarians 白蠻, who have exploited it until today. The “Explanation to the Illustration of the Cloud-dragon Well [Salt Works]” comments: “Cloud-dragon is the name of a department, which is located in a very remote border region, adjacent to [the area of] the Lisu 傣倮 savages. It has no city walls.” From this we can conclude that in the Kangxi reign-period (1661-1722) Han immigrants still constituted a minority.

The fifth section of the scroll depicts the Anning Well, located in today’s Anning City. It is the first Yunnan salt well recorded in historical accounts. The “Geographical Treatises” of the “History of the Han Dynasty” (Hanshu) has the following entry: “There was a salt official (yanguan 盐官) in Lianran 連然 [modern Anning].” Therefore it is clear that this salt well has a history of about two thousand years. It already was being exploited in the Han period (206 BC-220 AD) by the Dian people and thereafter appears continuously in historical records. The “Records of Nanzhong” in the “Records of States South of Hua Mountain” (Huayang guozhi) tell us: “Lianran District has salt sources on which all of Nanzhong relies.”

Outside the city there are also four wells. People are encouraged to boil [the brine] themselves.

The sixth section portrays the Alou-Hou Wells salt works, located in today’s Guangtong District 廣通縣 in Chuxiong Autonomous Prefecture of the Yi Minority. The “Records of Yunnan [Province] with Maps [and Illustrations]” (Yunnan tujing zhishu) of the mid-fifteenth century tell us the following: “One is called Alou Well 阿陋井, the other Monkey Well 大理府, manuscript, 1455.

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18 Chen Wen, Yunnan tujing zhishu, chap. 5, “Dalifu” 大理府, manuscript, 1455.
19 Ban Gu, Hanshu, p. 1601.
20 Chang Qu, Huayang guozhi, pp. 399.
21 1 chi = ca. 32 cm. See Qiu Long et al., Zhongguo gudai duliangheng tuji, 1984. [Transl.]  
22 Fan Chuo, Yunnan zhi, chap. 7, p. 263.
(Houjing 猴井). They are situated in Shezi Village 舍资村 in Guangtong District. Both produce brine springs, [the water] of which is boiled down to salt.”

The “Explanation to the Illustration of the Alou-Hou Wells [Salt Works]” reports: “The meaning of the name ‘Alou’ is unknown. Although [the salt works contains the character] lou 陋 (‘vulgar’), the conditions of the salt administration are worthy of praise.” In fact, Alou, Nuo-deng, Lang and Misha are names given to salt works by the local minorities, and are related to their languages.

The seventh section is dedicated to the Jingdong Well salt works, located in modern Jingdong District 景东县 of the Simao 思茅 region, inhabited by the Dai 傣 people before the Ming Dynasty. The “Records of Yunnan” by Fan Chuo informs us: “Moreover, in the walled cities of Weiyuan 威远, Fengyi 奉逸 and Lirun 利润 there are more than one hundred salt wells.” The “Essentials of Geography for Reading History” (Dushi fangyu jiyao 读史方舆纪要), chapter 119, records: “The north [of Weiyuan Department] extends to the border of Jingdong Prefecture.” These brief entries make clear that this well was already being operated in the Tang period (618-907).

The scroll’s eighth section gives us an insight into the Overflowing-sand Well salt works, located in today’s Jianchuan District 剑川县 in Dali Autonomous Prefecture of the Bai Minority. For the Tang period, again we can refer to Fan Chuo: “Moreover, further to the west one comes to the walled city of Bangmiqian 傍弥潜; to the west of it there are salt wells.” Another entry can be found in the “Newly Compiled Provincial Gazetteer of Yunnan” (Xinzuan Yunnan tongzhi 新纂云南通志), chapter 33: “Further to the west there was the Bangmisha Well 傍弥沙井, now called Misha Well.” Because Jianchuan was inhabited already by the Bai Barbarians in the Tang Dynasty, this salt works must have been open by then.

The ninth and final section deals with the salt works of Zhijiu and Grass-creek Wells 只旧草溪井. The Zhijiu Well is located in modern Wuding District 武定县, and the Grass-creek Well in today’s Yuanmou District 元谋县, both inhabited by the Yi Minority. The scroll’s explana-

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23 Chen Wen, Yunnan tujing zhishu, chap. 4, “Chuxiongfu” 楚雄府, manuscript, 1455.
24 Fan Chuo, Yunnan zhi, chap. 6, p. 245.
25 The Dushi fangyu jiyao, compiled between 1630 and 1660 by Gu Zuyu 顾祖禹 (1631-1692 or 1624-1680), covers aspects of natural, historical, and administrative geography, focusing especially on the relevance of topography for military strategy. [Transl.]
26 Fan Chuo, Yunnan zhi, chap. 6, p. 245.
27 Zhou Zhongyue 周钟岳, Xinzuan Yunnan tongzhi 新纂云南通志 (Newly Compiled Provincial Gazetteer of Yunnan), manuscript, 1949, chap. 33.
tion to these salt works relates: "The two wells, Zhiji and Grass-creek, are located amidst deep mountains and secluded valleys to the south-west of the Hequ Department [Capital of Hequ], and had been operated since the Hongwu reign-period [1368-1398] of the Ming Dynasty." Moreover, it states that the salt works were ordered to close down in the tenth year of the Kangxi reign-period (1671), and that since then it was the Black Well salt works which paid the taxes silver (kefu 銜賦) on their behalf.

More records on all these salt works are available from the Qing period onwards, but need not to be mentioned here.

2. Categories of Ancient Salt Works in the "Illustrations on the Salt Production Methods of Yunnan"

Fan Chuo’s "Records of Yunnan" (Yunnan zhi) tell us that in the Tang period (618-907) there already existed more than one hundred salt wells in the walled cities of Weiyuan 威遠, Fengyi 峩逸 and Lirun 利潤. After the Tang Dynasty, especially in the Qing period (1644-1911), the salt works continued to flourish and the number of wells grew dramatically. This was not only reflected in the quantity of wells, but also in the substantial variety of their types. Our scroll provides us with a direct insight into these particular features. Generally speaking, Yunnan’s pre-modern salt works can be divided into three types, namely, salt springs, salt wells on land, and salt wells in rivers.

2.1 Direct Use of Natural Brine Springs

The direct use of natural brine springs is a convenient method to obtain salt. The brine can be collected in pools or wooden basins and then boiled. Hence, in these cases there is no need to dig salt wells. The eighth section of our scroll describes the Overflowing-sand Well salt works (Mishajing 彌沙井), which is not a salt well, but a brine spring gushing forth from a cliff. In the illustration we can see that a long bamboo tube is inserted into the mountain rock, and that the salty water flows out slowly into a brine pool at the other end. The descriptive label states the following: "A bamboo tube is used to conduct the brine and have it trickle into the pool." The explanation to the illustration puts it this way:

The Overflowing-sand Well is the smallest of the eight wells [i.e. salt works]. On all four sides it is surrounded by mountains, with a meandering stream in the middle. The well [i.e. the spring] is located at the foot of the western mountains. Its brine, coloured like ambrosia (qiongjiang 琼漿), flows out of the rock, neither too fast nor too slow. The septa of a bamboo are removed to form a pipe which guides the brine to flow into the
pool. It takes one day and one night to turn the brine into salt sand (yansha 鹽沙). …

The scroll’s fourth section on the Cloud-dragon Well salt works shows the Shundang Well 顺盪井, which also uses natural brine directly:

From the Master Well (Shijing 衛井) going downstream in twists and turns for 150 li [ca. 86.4 km] we arrive at a well called Shundang, which is already more than 240 li [ca. 138.2 km] away from the departmental capital. The farther we get, the stranger the situation. The [brine] spring flows out from a hole in the rock, and there is no need for hoisting with a windlass. Its taste is more salty and its colour whiter, but compared with the other wells, it is just about the same.

The Shundang Well mentioned in our scroll is a famous artesian well (ziliujing 自流井) of Yunnan. Xie Zhaozhe wrote in his “Brief Account of Dian [i.e. Yunnan]” (Dianlüe): “Only the Shundang [Well] is [a spring that] gushes out from a rock cavity. It has a pond to store [the brine] which is boiled [down to salt] in the form of plates of pure white colour.”28 In the “Local Gazetteer of Yunlong Department” (Yunlongzhou zhi 雲龍州志) from the Kangxi reign-period (1661-1722) there is also a record on the Shundang Well:

The brine flows out from a crevice of a cliff, a stream as thick as a vein. A silver pipe is placed in it [to capture the spring] and they use a wooden barrel to form the well. If there is no brine, production is stopped.29

When we examined the Shundang Well during our field research trip in 2001 brine still flowed out of it. In the left part of the scroll’s section on the Black Well salt works we can see that at the Repeating-prosperity Well (Fulongjing 復隆井), also called Cliff Spring (Yaquan 崖泉), brine flows through bamboo pipelines and in wooden channels down from the mountains directly into a brine pool at the lower reaches. The descriptive label on the wall of the building reads: “[This is] the brine pool of the Repeating-prosperity Well.” The “New Words about Yunnan” (Diannan xinyu 滇南新語) from the Qing period also provides information about the Black Well’s use of natural brine:

28 Xie Zhaozhe, Dianlüe, chap. 3, “Chanlüe” 産略 (Brief Account of Production).
29 Wang Fu 王符, Yunlongzhou zhi 雲龍州志 (Local Gazetteer of Yunlong Department), edition of the Kangxi reign-period (1662-1722), chap. “Yanzheng” 盐政 (Salt Administration).
The Dripping-water Bamboo Grove (Dishuiqing 滴水箐) is located twenty li [ca. 11.92 km] south of the Repeating-prosperity Well (Fulongjing). There is no well. Two mountains [are protruding up] like double walls, just leaving a narrow strip of sky [at the top]. Between [the walls] there is an upright rock cliff with small interspersed holes into which brine seeps and crystallises. Below there is a mountain rivulet in which a channel is set. The locals take out water [from the rivulet] and splash it on the rock cliff from where it flows down into the channel as salty [water]. Thereafter they fill the hearth [pans] with it and boil it down to salt. This is another example for the exploitation of natural brine springs in Yunnan. For the different ethnic groups of Yunnan such springs as well as artesian wells were not only endowments provided by nature, but they also constituted the basis for the construction and development of different kinds of salt wells.

2.2 Wells on Land
The “Illustrations on the Salt Production Methods of Yunnan” makes clear that the Yunnan salt wells are all relatively shallow shaft wells, with a diameter at the well opening from several chi 尺 to several zhang 丈. This kind of well is also called a “leather bag well” (pidaijing 皮袋井), as its brine is hoisted with leather bags. This is, undoubtedly, the most common and most productive type of salt well in Yunnan. The “Explanation to the Illustration of the Cloud-dragon Well [Salt Works]” states:

One of them is called the Gold Fountain (Jinquan 金泉), which oozes out to the left of the departmental capital at the river side, with a width of one zhang and five chi [ca. 4.8 m] and a depth of six zhang [ca. 19.2 m]. One uses a windlass (chepan 車盤), ropes and leather bags (pi’nang 皮囊) to hoist the brine.

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30 Mark Elvin’s study of the Erhai catchment geography suggests that the character箐 (qing, but sometimes also read jing) can be often translated as “ravine stream”, and not as “bamboo grove”. The local pronunciation heard in his field trips was indeed more like qing. See also Mark Elvin, Darren Crook, Shen Ji, Richard Jones, and John Dearing, “The Impact of Clearance and Irrigation on the Environment in the Lake Erhai Catchment from the Ninth to the Nineteenth Century”, East Asian History 23 (2002): 6. [ME]


32 1 chi = ca. 32 cm; 1 zhang = ca. 3.2 m. See Qiu Long et al., Zhongguo gudai du-liangheng tuji, 1984. [Transl.]
The “Explanation to the Illustration of the Alou-Hou Wells [Salt Works]” comments: “Ten wells are operating presently. … They all bring up the brine with leather bags (pidai 皮袋) hoisted by windlasses.” The Mowai Well (Mowaijing 磨外井) of the Jingdong Well salt works is three chi [ca. 0.96 m] wide and two zhang [ca. 6.4 m] deep, and the Anning Well, a riverine well, has only a depth of one zhang and two chi [ca. 3.84 m]. In the “Rhapsody of the Anfeng Well Salt” (Anfeng jingyan fu 安豐井鹽賦), in the “Local Gazetteer of the White Salt Well” (Baiyanjing zhi 白鹽井志) of 1758, it is stated that the well has “a length of three zhang [ca. 9.6 m], a width of one zhang and two chi [ca. 3.84 m], and a depth of one zhang and five chi [ca. 4.8 m].”\(^{33}\) In our scroll some of the salt wells are covered by a roof to prevent the intrusion of rain water, but others are located in open area. Some wells are big, others small, and some are square, others round. But none of them is particularly large. Before the Kangxi reign-period (1662-1722) of the Qing Dynasty salt wells in Yunnan almost exclusively belonged to the type of shallow shaft wells with big openings, and this continued until the Republican period (1912-1949). When, during the Kangxi reign-period, Zhou Wei 周蔚 was appointed Salt Control Official (tiju 提舉) in Yunnan Province, he gave a detailed description of the excavation process of Yunnan’s shallow shaft wells in his “Record about the Financing of the Well Pagoda” (Chou jinglou ji 筹井樓記):

After having inspected the strengths and weaknesses as well as the workers’ capacities in order to evaluate the costs, work started. First we enlarged [the wells’] four corners, each to [a depth of] more than three zhang [ca. 9.6 m]. Then we took care of the middle part, which we dug down to [a depth of] more than three zhang and six chi [ca. 11.52 m] in order to capture the spring and to manage its flows. [When we saw that] the salty part flowed out from the middle while the sweet waters came out on the sides, we then built another well within the four corners, with a diameter of more than one zhang and five chi [ca. 4.8 m]. This well was divided into two areas, the outer one for the salty part, the inner for the sweet water. The brine was hoisted to be boiled, whereas the sweet water was likewise hoisted, but to be discarded. 500 zhang [ca. 1,600 m] of wooden stems had to be inserted, each zhang amounting to somewhat more than three qian 錢 [ca. 11.16 g]\(^{34}\) of silver. One

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\(^{33}\) Zhao Chun 趙淳, Baiyanjing zhi 白鹽井志 (Local Gazetteer of White Salt Well), manuscript of 1758, chap. 2, “Anfeng jingyan fu 安豐井鹽賦” (Rhapsody of the Anfeng Well Salt).

\(^{34}\) 1 qian = ca. 3.72 g. See Qiu Long et al., Zhongguo gudai duliangheng tuji, 1984. [Transl.]
thousand dan 石 [ca. 50,000 kg]\(^{35}\) of “mine concrete” (kuanghuì 矿灰) were applied, each dan amounting to three qian [ca. 11.16 g] of silver. Two thousand stone and water workers were employed, each with a wage of seven fen 分 [ca. 2.6 g].\(^{36}\) Moreover, three thousand miscellaneous workers were hired, each for five fen [ca. 1.86 g]. In addition, about one hundred liang 两 [i.e. taels of silver, ca. 3,720 g]\(^{37}\) were spent for bricks, tiles, the earthen groundwork, and sundry expenses.\(^{38}\)

From Zhou Wei’s account we can figure out that the excavation of the salt well started from the four corners, from where a well pit was dug with a length and width of three zhang [ca. 9.6 m] in order to determine the position of the vein of the spring. The digging procedure involved a process of “capturing the spring and managing its flows”. Only after the discovery that the brine spring flowed out in the middle and the fresh water current emerged at the side did the well builders narrow the well diameter to 1.5 zhang [ca. 4.8 m]. At the same time they separated the brine from the fresh water, the latter being discarded after hoisting. The excavation of such shaft wells was carried out with the usual digging tools, and required large inputs of manpower and financial resources. In the case of the Carnelian Well mentioned above, more than 5,000 workers were employed, and up to 1,000 taels of silver spent.

In recent years the author of this paper made two field research trips to the Nuodeng Well 諾敦井 in Yunlong District 雲龍縣 in order to reach a deeper understanding of the construction of land-based brine wells in Yunnan Province. The Nuodeng Well was dug more than 1,200 years ago in the Tang period, but no historical records exist that describe its structure during that time. In 1996 the well was closed and production stopped. The “Local Gazetteer of Yunlong Department” (Yunlongzhou zhi 雲龍州志) of the Kangxi reign-period (1661-1722) remarks that the Nuodeng Well “has a depth of seven zhang [ca. 22.4 m] and a diameter of more than two zhang [ca. 6.4 m].” Based on information and drawings obtained from elderly people, we were able to reconstruct the underground structure of this well. The shaft had a depth of 22 metres, with a gallery at its bottom. The gallery was supported with wood and plastered with clay in order to prevent the intrusion of water. The two conduits for brine and fresh water were strictly separated. In the well there were two strictly separated

\(^{35}\) 1 dan = ca. 50 kg. See Qiu Long et al., ibid. [Transl.]
\(^{36}\) 1 fen = ca. 0.372 g. See Qiu Long et al., ibid. [Transl.]
\(^{37}\) 1 liang = ca. 37.2 g. See Qiu Long et al., ibid. [Transl.]
\(^{38}\) Zhou Wei 周蔚, “Chou jinglou ji” 諸井樓記 (Record about the Financing of the Well Pagoda), in Langyanjing zhi 琅鹽井志 (Local Gazetteer of Carnelian Salt Well), manuscript of the Kangxi reign-period (1662-1722), chap. 3.
pipelines for salty and sweet water. The conduit for fresh water was composed of an open ditch and a covered drain. A slanted open circle was dug out, with elevations on both sides and a depression in the middle. Thus, the fresh water flowed from the higher parts to the low part of this circle, and was finally collected in a fresh water pool measuring six square metres. From there the fresh water was hoisted and released into a river. Just beside the fresh water pool was the brine pool, separated by two wooden boards plastered with clay to prevent leakage. The brine source was located at the deepest spot of the well, where it oozed out from a high-lying rock crevice. Between the brine spring and brine pool a brine store was set up. The workers operating the pumps (longgong 竕工) lifted the brine from the brine spring to the high-lying brine store from where it flowed in a conduit down to the salt pool. From this salt pool, which had a surface area of four square metres, the brine was hoisted out of the well and then boiled down to salt. All this makes clear that the separation between brine and fresh water constituted the key element of the underground well structure.

The salt wells of Yunnan show some similarities with the early shallow shaft wells (dakou qianjing 大口浅井) in Sichuan. In his article on “An Investigation of Ancient Chinese Salt Wells” published in 1985, Bai Guangmei points out three phases of salt well development. The first phase was that of the shallow shaft wells, as represented by the famous Well of [Zhang Dao]ling 張道陵, the Lingjing 陵井. The second phase was the “lofty tube wells” (zhuotongjing 卓筒井), that is, the deep-drilled wells invented during the Northern Song period (960-1127) in the mid-eleventh century. Finally, the third phase was characterised by the wells drilled to even greater depths (xiaokou shenjing 小口深井) from the late eighteenth to the mid-twentieth centuries.39

Until the Republican period (1912-1949), salt production in Yunnan with its relatively backward techniques remained in the first phase of shallow shaft wells and never developed to the second phase. This was probably related to the natural conditions there. Brine deposits in Yunnan were plentiful in the upper strata, so that sources never dried up, and there was thus no motivation to explore the deeper layers of the earth. According to Bai Guangmei’s survey, during the Eastern Han period (25-220) the depth of the Ling Well in Sichuan had already reached 80 zhang (ca. 256 m), and other known shaft wells showed a considerable depth, too. In contrast, the majority of Yunnan’s shaft wells were relatively shallow, reaching to a depth of only several zhang or 80 chi (ca. 25.6 m) at the most, while nonetheless never drying up. For example, the ancient

Nuodeng Well only was 22 metres deep, but produced salt continuously from the Tang Dynasty (618-907) right up until 1996. Zhao Kuanghua and Zhou Jiahua assume that the invention of Sichuan’s “lofty tube wells” was prompted by the drying up of the upper-strata yellow brines (huanglu 黃卤). Therefore people had to develop the technique of deep-drilling to exploit the black brines (heilu 黑卤) in the deeper layers of the earth.⁴⁰

In 1987, Bai Guangmei investigated a shallow shaft well dating from the Western Han period (202 BC-9 AD) in Sichuan, namely the White Rabbit Well (Baitujing 白兎井) in Yunyang 雲陽. He found that in Sichuan also shaft wells exist from the first phase that have continued to be used until the present day. Moreover, he claims that the White Rabbit Well’s brine is abundant and has not decreased over a period of two thousand years.⁴¹ This shows that even in Sichuan, where deep-drilled wells had become more and more widespread, people did not deem it necessary to abandon the old production techniques as long as brine in the upper strata showed no signs of becoming exhausted. Hence, shaft wells were never completely given up. Thus, we have reason to believe that the fact of Yunnan’s perpetual use of shaft wells is closely related to the constant supply of upper-strata brine, resulting in a lack of incentive to develop technical innovations. Certainly, though, there were also other factors inhibiting further evolution in Yunnan’s salt production techniques, like, for instance, the difficult transport conditions in these remote regions, the underdevelopment of its salt economy, as well as its deficiencies in overall salt supply.

2.3 Brine Wells in the Middle of Rivers

From the “Illustrations on the Salt Production Methods of Yunnan” we can see that there are also wells set up in the midst of rivers. This special type of well has not yet received full attention from scholars in the field. Three illustrations in our scroll – the “Illustration of the Black Well”, “Illustration of the Jingdong Well”, and “Illustration of the Anning Well” – prominently depict this particular feature, thus highlighting the unique and representative character of the Yunnan riverine salt wells.

The Eastern Well (Dongjing 東井) in the illustration of the Black Well salt works is located on a round platform high above the river, protected


by large blocks of stone upstream. Two men stand upright on the platform hoisting brine, while another, carrying brine on his back, walks down a bridge. The “Explanation to the Illustration of the Black Well [Salt Works]” says: “The Eastern Well gushes forth in the midst of a creek and is completely surrounded by its waters. [Therefore it is protected] with stone masonry, [and the well] has a width of two chi 尺 and five cun 寸 [ca. 0.8 m]\(^1\) and a depth of about three zhang and two chi [ca. 10.24 m].” The “New Words about Yunnan” (Diannan xinyu) of Zhang Hong from the Qing period also give a relatively detailed account:

The Big Well (Dajing 大井), Eastern Well (Dongjing), Bridge Well (Qiaojing 橋井), New Well (Xinjing 新井), Repeating[prosperity] Well (Fu[long]jing 福[龍]井), and Sand Well (Shajing 沙井) are six wells, but the general name is Black Well [salt works]. The Eastern Well and the Sand Well are located in a creek. The Eastern Well is protected against the current by a natural rock cliff to which embankments are added. This [structure] is popularly called “pig muzzle” (zhuzui 猪嘴). During the four seasons there are no concerns about over-flooding and weak brine. Moreover, in times of high water the brine is even more salty, a situation totally different to that of other wells, which regard the rainy season as their enemy. The Sand Well, however, is flooded by huge waters during summer and autumn. When [the area around the well] becomes dry [again], the brine used for boiling is very weak, so that according to the regulations it serves as surplus salt (yuyan 呑鹽) only.\(^2\)

Apparently the Black Well salt works had not only one riverine well, but two. It is obvious that our scroll only shows the Eastern Well, because text and picture are totally in agreement. Yet the Sand Well is also described in another historical document, namely, the “Local Gazetteer of the White Salt Well” (Baiyanjing zhi 白鹽井志) of 1758:

All the so called “sand wells” are located on sandy places along rivers. During winter and spring, when the weather is fine and clear, people dig into the sand to get to them. Their brine is weak. ... During the transition from summer to autumn, in periods of long-lasting rain, the water of the river swells and rises, flooding the area within one day. One has to wait until

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\(^1\) 1 chi = ca. 32 cm; 1 cun = ca. 3.2 cm. See See Qiu Long et al., Zhongguo gudai duliangheng tuji, 1984. [Transl.]

\(^2\) Zhang Hong, Diannan xinyu, p. 214.
The so-called “sand wells” were an important step from the construction of wells built on land to those set up in rivers. People probably first dug wells into the shallows by rivers, and then proceeded to try this in the rivers themselves after having accumulated some experience and knowledge. The riverine well on the “Illustration of the Jingdong Well [Salt Works]” is apparently the Mowai Well. This well, constructed in layers of cobblestone, is located on a square-shaped platform. Some parts of the platform are already covered by the rapid current of the river. Two men bend over the well hoisting brine. The “Explanation” reads:

One hundred and sixty li [ca. 92 km] to the south of the governmental seat of Jingdong Prefecture 華東府 lays the Mowai Well (Mowai 磨外 井), measuring three chi [ca. 0.96 m] in width and two zhang [ca. 6.4 m] in depth and built in layers of cobblestone. Another one, the MoIa Well (Mola 磨 lui 井), consists actually of two pits (keng 坑), with a width of three [ca. 0.96 m] and a depth of two chi [ca. 0.64 m]. It is located thirty-five li [ca. 20 km] away from the Mowai Well. The source of the brine spills out quickly and abundantly, and flows uninterruptedly. During the winter and spring seasons, the water level drops so much that the [cobble]stones protrude. [The brine] tastes then twice as salty and can be easily boiled [into salt]. During the transition from summer to autumn, however, [the water level rises sharply and the well] is submerged by billows and waves, and nobody can tell its location.

The well depicted on the “Explanation to the Illustration of the Anning Well” is a riverine well, too. It is set up on a comparatively large circular platform, with a brine-inspection house (jilufang 樂浦房) joined to it. Two men are standing upright hoisting brine. The “Explanation” reads:

That which the advantageous [component] of the natural functioning of Heaven and Earth brings forth [here] is extremely miraculous (tiandi ziran zhi li suo chan shen qi 天地自然之利所產甚奇), like in the case of the Anning Well which is located outside the city walls of the departmental capital amidst huge waves of waters. Fences are embedded into the heart of the river, which make [the salt works] rise [up between the] roaring

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44 Zhao Chun, Baiyanjing zhi, chap. 2.
45 We would like to thank Mark Elvin for having discussed the translation of this phrase with us. [Transl.]
The prominent place occupied by these three riverine wells on the scroll as well as the corroboration of such wells by other historical sources makes clear that this unusual phenomenon was not uncommon among the salt wells of Yunnan.

However, some scholars [in the field] have been unaware of brine wells in the middle of rivers, and did not know of the possibility of building riverine wells. This is due to the fact that they have ignored relevant historical sources or have not been able to explain them sufficiently. In his “Miscellaneous Records of Guangyang” (Guangyang zaji 廣陽雜記), Liu Xianting 刘献廷 (Liu Jizhuang; 1648-1695) provides a succinct description of these riverine salt wells:

> The Carnelian Well in Kunyang Department, the White Well [salt works] in Yao Department, and the Black Well [salt works] in Chuxiong Prefecture all have their own Supervisors (tijusi 提舉司). The wells are all located at the lowest levels of the countless mountains and midst creeks and rivers. The brine gushes upwards, like the “Spurting Spring” (Baotuquan 趵突泉) in Jinan in Shandong Province. Wells are built of layers of stones, surrounded by railings, covered by pavilions, and connected [to the river bank] by bridges. There are thousands of [so-called] hearth households (zaohu 灶户) along the creeks. Each dan (擔) of brine pays a certain amount of tax.47

In “A Study of the Salt Economy in the Ming Period”, Liu Miao, when mentioning the well tower architecture of the Yunnan shaft wells, adds the following: “Liu Xianting’s record about the architectural features shows that the centres of the salt production facilities generally were the salt wells. Yet, the description about the so-called ‘pavilion’, i.e. the well

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46 We assume that a volume measure of ca. 107 litres is meant here. [Transl.]

Actually, Liu Miao had already touched upon these salt wells, which were “located at the lowest levels of the countless mountains and amidst creeks and rivers”, but as he did not know that brine wells could be built in the midst of rivers and thus did not understand why they were “surrounded by railings”, “covered by pavilions”, and “connected by bridges”, he felt Liu Xianting’s account to be “rather sketchy”. In fact, Liu Xianting’s main aim was not to demonstrate “that the centres of the salt production facilities generally were the salt wells”, but to point out the conditions and structures of riverine brine wells. Comparing Liu Xianting’s passage with the scroll and its explanations, we can conclude that they refer to exactly the same phenomenon, namely riverine salt wells.

Liu Xianting also mentions how people discovered the existence of brine springs in rivers: “The brine gushes upwards, like the ‘Spurting Spring’ in Ji’nan.” In other words, the locals found out that brine spouted up in certain places in rivers, from which they got the idea of setting up riverine wells for their exploitation.

Constructing a brine well in a river is a complex matter requiring specific knowledge and techniques and is definitely more difficult than building a well on land. Unfortunately the “Illustrations on the Salt Production Methods of Yunnan” provide only one sentence—“[it is protected] with stone masonry”—without further explaining the construction of riverine wells. Liu Xianting also merely says: “Wells are built of layers of stones.” Among the three wells in rivers depicted in our scroll, two are located in deep and broad rivers, while one is in relatively shallow water. I assume that no later than the forty-sixth year of the Kangxi reign-period, i.e. 1707, the minority peoples in Yunnan had already acquired the knowledge for building riverine wells. These wells were probably built during the low water season in winter. The locals first blocked the current upstream so that they could carry out well construction work downstream. In his “New Words about Yunnan” (Diannan xinyu) Zhang Hong says that “The Eastern Well (Dongjing 井) is protected against the current by a natural rock cliff to which embankments are added.” This suggests that the rivers were blocked and dams built for constructing these wells. Riverine wells therefore required more elaborate and high-

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49 Zhang Hong, Diannan xinyu, p. 214.
50 The blocking off of water upstream with a temporary dam to clear a river bed for dredging or to make possible repairs on a hydraulic installation seems to have been standard in Jiangnan since at least Ming times, and in all likelihood long before. [ME]
quality techniques of construction than those for land based wells. Otherwise, these wells would have been destroyed by flood-waters or endangered by fresh water seeping in. Riverine salt wells are an important achievement of Chinese well salt production and the result of the ingenuity demonstrated by all the various peoples in Yunnan province. Their existence shows that knowledge about geological and hydrological conditions as well as prospecting techniques and water management had already reached a considerable level.

3. Salt Production Techniques as Reflected in the “Illustrations on the Salt Production Methods of Yunnan”

The art of well salt production generally includes hoisting, transporting and boiling of brine as well as forming the salt, i.e. processes which are all depicted in the eight sections of the scroll. From these illustrations we can see that each salt works differed in its production process, demonstrating the diversity in the manufacture of salt by the various ethnic groups in the regions inhabited by them.

3.1 Hoisting and Transporting Brine

Our scroll shows that each of the salt works had its own method of hoisting and transporting brine, in accordance with local conditions and the experience accumulated by the salt makers. “Using windlasses that pull leather bags to hoist [the brine]” was one of the methods for bringing up the brine. In our scroll five wells of the Cloud-dragon Well salt works and ten wells of the Alou-Hou Wells salt works applied this technique. In the illustration of the Cloud-dragon Well salt works a cylindrical windlass is set on two posts, with many coils of hemp rope wound around it. A large kidney-shaped leather bag is fixed to the end of the rope. The windlass is equipped with four wooden handles and four pedals on each side, the first fixed to the inside windlass beam, the second to the outside axle. The windlass can be operated by four people, two at each side. The persons moving the handles are placed inside and move the handles downwards, whereas those placed outside are working the pedals, stabilizing themselves by leaning on a high frame. Thus, all four workers carry out the hoisting operation in a coordinated way. As the windlass rotates, the leather bag full of brine is pulled up to the surface. A fifth person is responsible for pouring the brine into a large wooden barrel.

Most of the windlasses shown on the scroll are, however, operated by only two workers, placed on each side and moving the windlass with the handles, while a third person empties the brine into the barrel. The “Explanation to the Illustration of the Alou-Hou Wells [Salt Works]” relates: “They all bring up the brine with leather bags hoisted by windlasses. It takes three days and nights to finish the [boiling of] the salt.” Xu Xiake’s
(1587-1641) “Travel Diary for Yunnan” (Dianyou riji) records with regard to the Anning Well “that there is a giant well on the east side of the city gate. Layers of beams are placed on it to build a bridge. On the railing a windlass is set up for hoisting [the brine]. This is the salt well.”

In general windlasses were used at relatively deep wells, as described in Fan Chuo’s “Records of Yunnan”, where the well in the walled city of Anning is reported to have had a depth of 80 chi [ca. 25.6 m]. Windlasses for hoisting brine in Yunnan were similar in design and technique to those used in Sichuan during the period of shallow shaft wells. The illustration on a tomb stone relief dating back to the Eastern Han period (25–220), unearthed at Yangzi Mountain (Yangzishan) in Chengdu, depicts how during the Han period brine was hoisted with the help of a pulley and, like in some cases in Yunnan, by four people pulling a long rope up and down in a coordinated way.

Another method for hoisting brine consisted in using a bamboo stick to which a leather bag was fixed. This method was generally used at shallow wells. From the scroll we know that this technique was adopted in the Black Well, White Well, Carnelian Well, Anning Well, Jingdong Well and Overflowing-sand Well salt works. In other words, the salt workers tied a leather bag to a bamboo stick, then lowered the stick into the well and pulled up the brine, which was then poured into a brine pool or a big barrel. In the “Local Gazetteer of the White Salt Well” (Baiyanjing zhi) of 1758 we can read the following:

The bags for hoisting the brine are made out of leather and tied to bamboo sticks. It takes two people to hoist the brine by crossing their hands. Compared to the use of a well sweep (jiegao) this is easy and convenient.

Zhang Hong’s “New Words about Yunnan” (Diannan xinyu) states: “Leather bags are used for hoisting the brine, and well sweeps for removing the sweet water.” In the illustrations of the eight salt works then in operation no well sweeps appear. It is only in the last section depicting the abandoned Zhijiu and Grass-creek Wells that we can see the remains of a well sweep. Well sweeps, working according to the principle of a lever, were simple machines not only used for hoisting of fresh water or for irrigation, but were also important in well salt production. Because brine and sweet water often occurred together, getting rid of sweet water was also an indispensable step in well salt production. It seems that square-pallet chain-pumps were used for this purpose. The illustration of

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51 Xu Xilke, Dianyou riji, chap. 4.
52 Zhao Chun, Baiyanjing zhi, chap. 2.
53 Zhang Hong, Diannan, p. 214.
the Black Well salt works show one of these machines on both sides of the large salt well compound. Each of them is powered by two men treading, thus causing the water to rise. On one side a descriptive label states the following: “Place of hoisting sweet water with square-pallet chain-pumps.”

In the “Illustrations on the Salt Production Methods of Yunnan” no bamboo pumps (lit. “bamboo dragons”, zhulong 竹龍) are shown. Taking other historical sources into account, bamboo pumps were apparently not yet applied in the production of Yunnan well salt during the Kangxi era (1662-1722). However, during the late Qing period the use of bamboo pumps was widespread in Yunnan. My field research at the Nuodeng Well made clear that brine and sweet water were separated by two channels down in the well. A line consisting of seven bamboo pumps was set up for discarding sweet water, each pump operated by one man pushing and pulling it. The deepest pump was called “first stage bamboo pump” (yidulong 一度龍), followed upwards by the “second stage” and the “third stage bamboo pump”. The brine had to pass from the underground brine pool through these seven stages to the well mouth before it could be dumped into the river. Such pumps were also used for lifting brine and thus were called “salt water dragons” (xianshuiulong 咸水龍). Three of them were employed, two long ones with a length of 8 chi [ca. 2.56 m] and a short one. The workers used these pumps to lift the brine out of the well’s deeper areas and to store it in an underground brine pool. From there it was lifted out of the well by means of a windlass and buckets. A bucket was fixed to each end of a rope coiled around the windlass, so that the two workers pulling the rope up and down had to coordinate their hoisting operations. Therefore, the locals have the pun “seven up eight down” (qi shang ba xia 七上八下).

In the “Illustrations on the Salt Production Methods of Yunnan” the most important method for transporting the brine is still manpower. This means that workers carried the brine to the boiling houses in wooden or bamboo buckets, with the help of carrying-poles or on their back. Of course, some of the salt works also made use of other methods. At the Jingdong Well salt works a salt well was located on a platform in the midst of a river. The brine hoisted from the well was poured into a channel made out of large bamboos, and from there flowed directly into the bamboo barrels at the covered boiling house set up near the river bank. This efficient device saved a considerable amount of manpower. The Repeating-prosperity Well of the Black Well salt works also used bamboo channels for transporting the brine. A different method was adopted at the Anning Well, where boats were used to ship the brine. The Anning Well was also set up on a platform in the middle of the river. Below the platform in the illustration two small boats wait to transport the brine. At
the upper reaches not far away, the brine of another small boat has been unloaded already. Two men carry the brine up a stone staircase to the boiling house. The explanation to the relevant illustration states: “Hoisting is carried out with leather bags bound to a bamboo pole, and [the brine] is shipped by boat to the boiling [facilities].”

### 3.2 Boiling and Forming the Salt

The process of boiling and forming the salt is an important stage in well salt production because it defines the shape of the salt, and, moreover, often influences its colour and quality. According to the different technological methods employed and local characteristics, the boiling and forming of salt in Yunnan can be divided into three categories: pan salt (guoyan 鍋鹽), such as the salt at the Black Well salt works; hand-kneaded salt (shounieyan 手捏鹽), such as at the White Well salt works; and the so-called “yeba salt” (yebayan 巴巴鹽), such as that produced at the Jingdong Well salt works.

Pan salt is mainly produced in the area settled by the Yi people in Chuxiong, including the salt works Black Well (Heijing 黑井), Carmelian Well (Langjing 琅井) and Alou Hou Wells (Alou-Houjing 阿陋猴井). As shown in the scroll’s illustrations, these salt works each had a number of boiling houses, one place for cutting the salt, a firewood storage place, and some other buildings. The hearths in the boiling houses have a height of about half that of a man, and look like either the form of the character yi 一, ding 丁, or shi 十, or of the letter “L”. Up to more than ten large pans are placed on a hearth, each of which had the capacity to boil some 120 jin 斤 [ca. 71.6 kg] of salt. Workers continuously feed firewood into the hearths to keep the fire burning, or pour more brine into the pans using small buckets. Some of the men use large ladles to transfer brine from one pan to another, while others remove scum from the pans. The “Explanation to the Illustration of the Black Well [Salt Works]” states:

[The Black Well salt works altogether] counts twenty-six hearths (zao 灶), each one being more than two zhang [ca. 6.4 m] long and about six chi wide [ca. 1.92 m]. [Each of them] is equipped with eleven big pans (daguo 大鍋) with twenty-two barrel pans (tongguo 桶鍋) attached alongside them. 59.4 barrels (tong 桶) of hoisted brine require somewhat more than seven hundred bundles (tong 駱) of firewood. From the mao-hour 閏 [from ca. 5 to 7 o’clock] to the xu-hour 西 [from ca. 19 to 21 o’clock], three pans of salt can be produced.

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54 1 jin = ca. 597 g. See Qiu Long et al., Zhongguo gudai duliangheng tuji, 1984. [Transl.]
From this illustration one can see that the barrel pans alongside the big pans are rather small. They are placed into the empty spaces between the big pans. This kind of arrangement makes full use of the available heat energy, and so increases efficiency and helps save fuel. Three batches of salt were produced each day, suggesting that the Black Well brine was strong and salt output high. In contrast, the brines of the Carnelian Well and the Alou-Hou Wells salt works seem rather weak. Salt was produced only once every three days.

The pan salt produced was very large. The illustration of the Carnelian Well shows four men who—by using two crossed bamboo poles—carry a large piece of salt just lifted from the pan and are heading to the place for cutting the salt. Once there, the pan salt is placed on a small table and sawn by two men into several pieces. The situation at the Anning Well is somewhat different. The relevant explanation in our scroll records the following: “[The piece of salt] resembles a fu 矩 pan and does not need to be sawn into pieces.” This also belongs to the category of pan salt.

Hand-kneaded salt was mainly produced in the settlement areas of the Bai 白 people in Dali 大理, including the White Well, Cloud-dragon Well and Overflowing-sand Well salt works. The illustrations of these three salt works show in each case a number of boiling houses, a place for shaping the salt, a firewood store and some other buildings. The big hearths of the Cloud-dragon Well and the Overflowing-sand Well salt works are similar to those of the Black Well salt works. The hearths for boiling at the White Well salt works, however, show special characteristics. From the illustration one can see that the salt hearths are placed underground, apparently in a similar way as the pit-style hearths (dikangshi 地 坑式 灶) made by some minority people. In the “Local Gazetteer of the White Salt Well” (Baiyanjing zhi) of 1758 the salt hearths are described as follows:

The hearths are remade once a month. ... After digging up the hearth they use the wet mud from within the hearth to fill up the [new hearth] bottom. Then they wait for the mud to become dry before they start [to build] the hearth structure. Hereafter, they wait for the mud of the hearth structure to become dry, before they begin [to construct] the pan holdings. Then they again wait for the mud of the pan holdings to become dry, before they start boiling, day and night without interruption.\footnote{55 Zhao Chun, 
Baiyanjing zhi, chap. 2.}
Both from text and illustration it becomes thus evident that the hearths of the White Well salt works belong to the pit-type hearths, with hearth chamber and smoke channels all underground and mounted with a large pan in the centre and ten small pans encircling it. This kind of hearth is called “henhouse hearth” (jiwozao 雞窩灶), because salt boiling has to be performed squatting and stooped.

The hand-kneaded salt of the White Well was produced in a totally different way to the pan salt of the Black Well salt works. The salt was not boiled dry, but was taken out from the pan [with a sieve] during the on-going process of crystallisation and—after most of the liquid had dripped out—kneaded by women into balls. At the same time the salt workers shovelled out hot ash from the pit-hearth and spread it on the ground. The salt balls were then placed on these hot ashes for drying. As the last step in the process, the salt producers roasted the salt in a fire so that it became dry and hard. The “Records of the Wilds of Yunnan” (Dianhai yuheng zhi) from the Qing period also gives a short account of the salt forms of the White Well salt works:

The salt of the White Well [salt works] is very white and called “head salt” (rentou yan 人頭鹽). This is “ball salt” (tuanyan 團鹽), which can only be made by female hands.36

The production of hand-kneaded salt was similar at the other two salt works. The “Explanation to the Illustration of the Cloud-dragon Well [Salt Works]” puts it like this:

Salt is produced within two days and nights, its colour resembling snow; thereafter it is kneaded into [elongated pointed pieces] in the shape of a jade rectangular tablet (gui 圭), and is popularly called “lampstand salt” (dengtaiyan 燈台鹽).

And the text to the Overflowing-sand Well salt works mentions:

It takes one day and one night to turn the brine into salt sand (yansha 盐沙), [and then] it is kneaded into lumps, shaped like bells. [Each] has a weight of two liang [ca. 75 g], and exhibits a greyish colour.

The most important advantages of the production of hand-kneaded salt lay in substantial abbreviation of boiling time, saving of firewood, and reduction of production costs. The salt produced at the Nuodeng Well, visited by me during my field research trips, also belonged to this type of salt form. The steps of the manufacturing process consisted in: boiling to salt—dispelling the water—returning to the pan—scooping out the salt—

36 Tan Cui, Dianhai yuheng zhi, p. 65.
training with water—pounding the salt—kneading the salt—roasting the salt.

“Yeba salt”, 57 such as that from the Jingdong Well salt works, was mainly manufactured in the settlement area of the Dai people in Simao. The salt boiling hearths of the Jingdong Well and White Well salt works were identical, all of them being of the pit-hearth type, requiring work to be performed while squatting, and being equipped with a large pan in the centre and ten small pans surrounding it. In the “Explanation to the Illustration of the Jingdong Well [Salt Works]” we can read the following:

The locals (turen) use bamboo buckets to scoop the brine. At each well six hearths are set up. After one day and night, the brine is boiled into salt, which is popularly called “yeba salt” (yebayan). It is formed in boxes made of woven bamboo strips and thus of square shape. When boiled [i.e. roasted], the salt is mixed with ash, so that the top becomes white and the bottom black. This is why it is also called “black salt” (heiyan). The weight of each square lump amounts to two to five liang [ca. 75-187 g].

The illustration of our scroll makes clear how salt was produced at the Jingdong Well salt works: the salt was boiled until it crystallized; then a long ladle was used to scoop out the crystallized salt. Thereafter, in the room for shaping the salt, the remaining liquid was kneaded out from the wet salt, which then was placed into boxes made of woven bamboo strips. Eventually, two men carried these boxes to the salt-roasting place, where it was roasted on a fire and thus took its final form. Thus, after it had dried, the salt turned out of the box was square-shaped. Because the back side was smoked and burned over the fire, “the top becomes white and the bottom black.” From a technical point of view, the production methods for “yeba salt” of the Jingdong Well and the salt balls of the White Well followed more or less the same track. The only difference was that the Jingdong Well salt works was located in a place rich in bamboo, and therefore the Dai people made efficient and creative use of this natural resource. “Yeba salt” was only sold to the local population, as is made clear by the text of the scroll:

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57 Yeba is probably a word of the Yi language and means “square”. See Yang Qiwei, Shengtai meixue jingxiang zhong de Sameiren fushi yishu (The Art and the Clothes and Ornaments of the Samei People Seen in the Mirror of Environmental Aesthetics), Minzu yishu yanjiu (Ethnic Art Studies), 24.1 (2011): 166. [Transl.]
[The “yeba salt”] only covers the needs of the population of the [surrounding] Jingdong Prefecture and is not distributed to other places.

There is another technological detail of Jingdong “yeba salt” worthy of mention, namely, that during brine boiling plant ash was added, apparently a method that resulted from the technical experience of the salt producers accumulated over long periods of time. Plant ashes are a type of alkali, which—when added during salt boiling—may have produced some reaction, though we presently do not know enough to explain this phenomenon in a scientific way.

Yunnan’s well salt production technology was substantially different to that used in Sichuan. As already mentioned above, one conspicuous difference concerned the wells themselves, in the case of Sichuan these being deep-drilled wells, in Yunnan shaft wells. Furthermore, there existed also a disparity in the scale and art of salt boiling. As Bai Guangmei’s investigation of the shaft well in Yunyang, Sichuan, has made clear, already during the Han Dynasty Sichuan’s shaft wells could produce as much as 20,000 jin [ca. 11,940 kg] of salt per day, and later, successive technical improvements in salt boiling were introduced, such as “ridge hearths” (longzao 壟灶), “field hearths” (tianzao 田灶) and “tower hearths” (taluzao 塔爐灶). No comparable developments took place in Yunnan.

The techniques of well salt manufacture in Yunnan undoubtedly lagged behind those of Sichuan for reasons directly related to the historical, political and economic conditions of this southwestern province. Limitations in space allow only one aspect to be mentioned here. Central to China’s salt monopoly history is the concept of salt zones, which stipulated that salt produced in a certain area could only be sold within a fixed region specified by the government. Salt that transgressed the borders of these salt zones was called contraband salt (siyan 私鹽).

The “History of the Chinese Salt Industry” (Zhongguo yanyeshi) remarks that the salt produced in Yunnan was only distributed in Yunnan province itself, while Sichuan salt, besides being sold in Sichuan itself, was also exported to most parts of Guizhou and Hunan and to some parts of Hubei. The system of salt zones resulted in the strengthening of the position of Sichuan salt in the salt markets and enhanced its development. For Yunnan, however, this meant that due to the restrictions caused by the salt monopoly its salt could not be sold in other provinces. This limitation in its

59 The key point determining illegality was not limited to salt crossing a salt zone, but also comprised salt being produced, transported or sold in a secret, non-authorized fashion within a zone. [ME]
60 Tang Renyue, Zhongguo yanyeshi: jindai dangdai bian, p. 17.
distribution possibilities was not advantageous for its well salt production, so that its salt industry never reached the level of Sichuan. Such a situation inevitably also did not provide any incentive for innovation of Yunnan’s well salt production techniques.

4. Concluding Remarks

The “Illustrations on the Salt Production Methods of Yunnan” (Diannan yanfa tu) gives us a vivid description of how Yunnan minorities used a variety of methods to develop and exploit a natural resource, i.e. brine, in response to different natural environments. These methods ranged from the direct use of easily accessible brine springs to the elaborate techniques required for constructing riverine wells, from hoisting brine in leather buckets operated manually to the lifting of brine with the help of windlasses, from carrying brine on the back or shipping it by boat to the installation of bamboo pipelines and wooden channels for brine transport, and from salt products shaped like pans, balls or squares to those in the form of a jade rectangular tablet (gui 鬆) or of bells. In other words, the salt production techniques of the nine salt works depicted in the “Illustrations” differ from one well to the next, each of them having its own characteristics. The illustrations demonstrate that during varying periods of history the different minority peoples in Yunnan used their own methods and techniques for salt manufacture. They did so on the basis of responding to existing conditions, thus creating varied modes of production. This scroll is testimony to the different stages and types of well salt production used in the past by various minority peoples in southwest China.

Translation of the Text of the Scroll

Explanation to the Illustration of the Black Well [Salt Works]

There are eight salt wells [i.e. salt works] in Yunnan, among which the Black Well (Heijing 咥 ѩ) [salt works] occupies the first place, because it covers more than one half of the [total salt] tax (ke 课) produced by the eight salt wells [i.e. salt works]. It is located 150 li [ca. 86.4 km] north of the governmental seat of Chuxiong Prefecture 楚雄府. [It is surrounded by] many steep and green mountains, and “a long [flat] bridge is set
across the bubbling [river] waters.”

Population there is dense and it is indeed an important place with respect to public finance and taxation. The general name [of the salt works] is Black [Well] (Hei 黑), but the individual wells are called Big [Well] (Da 大), Repeating-prosperity [Well] (Fulong 复 隆) and Eastern [Well] (Dong 東). The Big Well has been open since the end of the Yuan period. It is operated under a steep cliff, [and has] a width of eight chi [ca. 2.56 m] and a depth of about two zhang 大 and five chi [ca. 8 m]. The Repeating-prosperity Well is also called Cliff Spring (Yaquan 崖 泉) and has been open since the Jiajing reign-period [1522-1566]. Its source originates in deep bamboo forests, and by means of bamboo pipelines and wooden channels the [brine] flow is conducted to, and caught in, a pool. It was dredged in the fourth year of the Longqing reign-period (1570). The Eastern Well gushes forth in the midst of a creek and is completely surrounded by its waters. [Therefore it is protected] with stone masonry, [and the well] has a width of two chi and five cun [ca. 0.8 m] and a depth of about three zhang and two chi [ca. 10.24 m]. [The Black Well salt works altogether] counts twenty-six hearths (zao 陣), each one being more than two zhang [ca. 6.4 m] long and about six chi wide [ca. 1.92 m]. [Each of them] is equipped with eleven big pans (daguo 大 锅), with twenty-two barrel pans (tongguo 桶 锅) attached alongside them. 59.4 barrels (tong 桶) of hoisted brine require somewhat more than seven hundred bundles (tong 桶) of firewood. From the mao-hour 卯 [from ca. 5 to 7 o’clock] to the xu-hour 戌 [from ca. 19 to 21 o’clock], three pans of salt can be produced. One pan [block of salt] is sawed into four quarters. The colour [of the salt] is slightly black, hence the name. 

The corvée workers are all naked and with dirty faces, as ferocious as ghosts. Some of them are wrapped in sheepskins and carry half-cangues. It is almost unbearable to see them working in these wretched conditions.

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51 This phrase, changqiao wo bo 長 橋 臥 波, is a quotation from the prose poem Afanggong fu 阿 房 宮 賦 of the Tang poet Du Mu 杜 牧(803-852). See the many references in the electronic Siku quanshu version of the Crossasia project of the Staatsbibliothek zu Berlin. In the Illustrations three main types of bridges can be distinguished: (i) those with substructures in the water and slightly arched (3, 5,); (ii) those that go more or less level from one bank to another with no such substructure (1, 2 [7 examples], 3 [on the side-stream upper left], 4, 6 [3 out of a total of 4 cases]; and (iii) three somewhat in-between types (6 [middle bridge, strongly curved but without substructure], 8 [2 short flat bridges but with supports in the water]. [ME]

52 This is at odds with the illustration, which shows smaller L-shaped hearths with, apparently, three large pans and three small ones. [Transl.]

53 Tong 陣 is probably an error for kun 框, “bundle”. [Transl.]

54 Banjia 半 椫, in the shape of a half-cangue, was a means of carrying a basket or another load on one’s back supported by a strap against a person’s forehead. For a reference see Ximan congxiang 溪 牠 曇 笑 (Funny Accounts from the Brook
conditions. "The Investigation of Yunnan Salt Administration" (Quandian yanzheng kao 全滇鹽政考) shows that during the Wanli reign-period [1573-1620] of the Ming the yearly quota [of the salt tax revenue] amounted to more than 22,600 [taels of silver]. When Our Dynasty was founded, the illegitimate Regional Commander (zongbingguan 总兵官) Shi Wen 史文, who was in control of the salt tax, deceitfully reported [a salt tax quota of] 96,000 taels, that is, almost four times as much as the [original] quota, with the intent to obtain merit by making contributions. Then, in the year with the cyclical signs yisi of the Kangxi reign-period [1665], the rebel Wu [Sangui 吴三桂] increased the tax by another 2,000 taels per month on the excuse that the population was numerous and thus the salt available for consumption insufficient. Until today governmental salt producers are truly troubled by heavy quota demands and high tax burdens.

黑井圖說

滇南鹽井有八,黑居第一,蓋八井課價,黑井過半焉。去楚雄府治北一百五十里,數峰青峙,長橋臥波,人煙稠密,洵為財賦重地。總名之曰黑,分言之曰大、曰復隆、曰東。大井開自元末,產危崖下,寛八尺,深二十五尺許。復隆一名崖泉,始於嘉靖年間,其源溢深箐,以梘槽接流入池。隆慶四年浚。東井湧於中流,環皆溪水,砌以石,寛二尺五寸,深三丈二尺許。計二十六灶,每灶一座,長丈餘,寛六尺許,駕大鍋十一口,傍附桶鍋二十二口,汲滷五十九桶四分。需柴七百餘捆。自卯至戍,成鹽三鍋。一鍋鋸分為四,色微黑,故名。為役之徒皆裸體垢面,猙獰似鬼,或披羊皮而戴半枷。勞瘁之狀,有不忍覩者。稽《全滇鹽政考》,明萬歷年間歲額二萬二千六百零。因本朝定鼎之初,偽管鹽課總兵官史文投獻邀功,佞報課額九萬六千兩,幾四倍其額矣。復於康熙乙巳吳逆稱家口眾多,鹽不敷食,每月加課二千兩,額重課繁,迄今官灶甚憊。
Explanation to the Illustration of the White Well [Salt Works]

Why is this well [i.e. salt works] named “White [Well]” (Bai [井])? This is because of the white colour of its salt. It is located in the Taohua and Yuxiang Mountains 桃花 玉象 山 of Yao’an 姚安, which with their broad rivers indeed provide a magnificent sight. During the Wanli reign-period [1573-1620] of the Ming Dynasty, the quota tax (eke 額課) was only some 10,500 taels, but was also reported deceitfully [in the early Qing period] by the illegitimate official Shi Wen 史文 to have amounted to more than 28,500 [taels], which is [over] one and a half times more than the original quota. [The White Well salt works] altogether counts seven wells, namely the Guanyin [Well] (Guanyin 観音), the Small Stone [Well] (Xiaoshi 小石), the Old Well (Jiujing 舊井), the Elevated Well (Qiaojing 喬井), the Boundary Well (Jiejing 界井), the Ash Well (Huijing 灰井), and the Tail Well (Weijing 尾井). The shape of [their positions] is similar to the Seven Stars [of the Dipper] or a constellation deployed on a [Chinese weiqi 囲棋] chess [board]. Some are north of the mountains, some on river banks, and they differ in width and depth. As they are similar to the wells of the Black Well [salt works], their conditions of salt boiling are comparable and do not need to be repeated here. The only difference is that for brine hoisting leather buckets (pitong 皮桶) are used. Moreover, “salt sand” (yansha 鹽沙) is produced within one day and night, and only women’s hands are able to knead it into the shape of kickballs (cuju 蹴踘), with a weight from 2 to 6 jin [ca. 1.2-3.6 kg]. It is told that once the Daughter of the Dragon King (longnü 龍女) in an elegant feather dress herded goats at the bank of a creek. When the goats licked the earth there the local peoples could trace and dredge [the brine well]. That is how the source [of brine] was found. Although it is a story which cannot be verified, we record it nonetheless, in order to display the uncanny characteristics of the salt [production] methods in the border regions.

白井圖說

井胡為而名白？因鹽之色白，故名。在姚安之桃花玉象山中，江流浩瀚，亦大觀也。明萬曆時，額課止一萬五百餘兩，亦被僞員史文佞報二百八千五百零，已增倍半矣。共計七井，如觀音、小石、舊井、界井、灰井、尾井、狀若七星，形如棋布，或在山之陰，或在水之涯，其大小、深淺不一。較黑井畧同，其煎煮事宜亦不甚相遠，無容贅述者，獨汲滷用皮桶。煎一晝夜成鹽沙，惟婦女手始能捏成團，狀如蹴踘，重五六觔、二三觔不等。或曰昔有龍女，羽衣翩翩，牧羊於溪水之畔，羊舐其土，土人跡而浚之，遂獲其源。雖屬無根之談，姑述之，以見邊徼鹽法之異耳。
Explanation to the Illustration of the Carnelian Well

The Carnelian Well (Langjing 琅井) was opened long ago. Its history from the Tang [618-709] to the Song [960-1279] Dynasties cannot be examined. In the Yuan period [1271-1368] a native, Jing shan 景善, was appointed as Superintendent of the Carnelian Well Cloister (Langjing siyuan 琅井寺院提点), hence its opening should date back to the Yuan period. It is at a distance of thirty li [ca. 17.3 km] away from the Black Well [salt works]. It produces a gush of brine, which is only slightly salty. Moreover, it is near the bed of a creek and is thus easily invaded by sweet [i.e. fresh] water. Salt is obtained only after three days and nights of boiling. Therefore, the costs of firewood and labour are several times higher [than those at other salt works], and the hearth workers (zaoding 灶丁) are reportedly destitute. The colour [of its salt] is slightly whiter than that from the Black [Well]. It has the form of an inverted pan, and is divided with a saw in the same manner as at the Black Well [salt works]. There are altogether thirty-two hearths contributing a yearly quota tax (efu 風賦) of no less than 10,000 strings of cash. It is without doubt an important place for salt [tax] policy (yance 盐筴). It belongs to Baoquan Community 堡泉鄉 [lit. “Fountain of Fortune”] in Dingyuan District 定遠縣. This community obtained its name because of the salt works, and the people there are famous for their pure and honest customs. With its combination of beautiful landscape and remarkable historical sites, [the Carnelian Well] occupies the first place among the eight salt wells [i.e. salt works]. The quota tax in the Wanli reign-period [1573-1620] of the Ming Dynasty was only some 2,400 taels, but was also reported deceitfully [in the early Qing period] by the illegitimate official Shi Wen 史文 to have amounted to 9,600 taels, which is exactly four times the old quota.
Cloud-dragon (Yunlong 雲龍) is the name of a department, which is located in a very remote border region, adjacent to the Lisu 傈僳 savages. It has no city walls. The governmental seat is surrounded by hills and rivers to the west of the Luoma Mountain 雲馬山. Two watercourses, namely the Langcang River 雲江 and the Luoma Stream 雲馬江, embrace the department boundary for a distance of several hundred li. The Cloud-dragon Well (Yunlongjing 雲龍井) is one of the eight wells [i.e. salt works], and people do not know that this one well [i.e. salt works] actually comprises eight wells. One of them is called the Gold Fountain (Jinquan 金泉), which oozes out to the left of the departmental capital at the river side, which has a width of one zhang [ca. 4.8 m] and a depth of six zhang [ca. 19.2 m]. One uses windlasses (chepan 車盤), ropes and leather bags (pi’nang 皮囊) to hoist the brine. The firewood comes from Lan Department 蘭州 in Lijiang [Prefecture] 麗江. It is logged by Bo Barbarians 僕蠻 and drifted downstream. Salt is produced within two days and nights, its colour resembling snow; thereafter it is kneaded into [elongated pointed pieces] in the shape of a jade rectangular tablet (gui 圭), popularly called “lampstand salt” (dengtaiyan 燈台鹽). From the Gold Fountain [Well], about thirty li [ca. 17.3 km] after leaving the mountains, there is the Stone Gate Well (Shimenjing 石門井) at the riverside, followed by the Big Well (Dajing 大井), the Heaven’s Ear Well (Tian’erjing 天耳井) and the Mountain Well (Shanjing 山井). Their conditions of salt boiling are all similar to the Gold Fountain [Well]. After another twenty li [ca. 11.5 km] of travel through the mountain region, one reaches a plateau amidst the mountains, where we find the Nuodeng Well 諾邓井. From the Nuodeng [Well] along the river another 100 li [ca. 57.6 km] or so, there is again a well, named Master Well (Shijing 師井). There is no difference in the boiling method between these two wells, only that their brine is a little bit less salty than that of the other wells, and that they are located in an area with unhealthy mists and miasmatic rains (manyan zhangyu 蠻煙瘴雨). From the Master Well going downstream in twists and turns for 150 li [ca. 86.4 km] we arrive at a well called Shundang 順荡, which is already more than 240 li [ca. 138.2 km] away from the departmental capital. The farther we get, the stranger the situation. The brine spring flows out from a hole in the rock, and there is no need for hoisting with a windlass. Its taste is more salty and its colour whiter, but compared with the other wells, it is just about the same.
雲龍井圖說

雲龍，州名也，地處極邊，與傈僳野人接壤，且無城廓。披山帶河而治，在雒馬山西。兩水夾流，環繞數百餘里，一名浪滄江，一即雒馬江也。雲井乃八井中之一，不知一井之中亦復有八。其一名金泉，出州治之左，江之辟，寬一丈五尺，深六丈，用車盤索牽皮囊以汲。薪出麗江蘭州，僰蠻伐木，泛流而下。煮經兩晝夜而成。鹽色似雪，捏柝成塊，狀如圭，俗謂之“燈臺鹽”。自金泉出山三十里許，江畔有石門井，其次大井，又天耳井及山井。其事宜形勢與金泉畧同。山行二十里，山之塢有諾鄧井焉。由諾鄧遵江行百餘里，復有師井。兩井煎煮之法無異，獨味較數井稍淡，地處蠻烟瘴雨之中。再自師井環流百五十里有井曰順盪，去州治已二百四十餘里，愈出愈奇，源從石孔中出，無事盤汲，味更鹹，色益白，較之各井，將毋同。

Explanation to the Illustration of the Anning Well

That which the advantageous [component] of the natural functioning of Heaven and Earth brings forth [here] is extremely miraculous (tiandi ziran zhi li suo chan shen qi 天地自然之利所産甚奇), like in the case of the Anning Well 安寧井, which is located outside the city walls of the departmental capital amidst huge waves of waters. Fences are embedded into the heart of the river, which make [the salt works] rise [up between the] roaring [floods]. A pavilion is built on [the platform], which, when looking upon it from afar, resembles hibiscus standing aloof of the water. The aperture of the well looks like a kidney; it is one zhang and two chi [ca. 3.8 m] deep and has a circumference of over 6 zhang [ca. 19.2 m]. Hoisting is carried out with leather bags bound to a bamboo pole, and [the brine] is shipped by boat to the boiling [facilities]. It takes two days and nights to finish the [boiling of] the salt, which is of blue-green and white colour of and of somewhat bitter taste. It resembles a fu 釜 pan and does not need to be sawn into pieces. The hearth workers (zaoding 灶丁) are all naked and barefooted, their hardships being twice that at other wells. The miraculous phenomenon is that the well is not invaded by river water, and that it neither decreases when being exploited for a long time, nor overflows when no [brine is] hoisted. This suffices to demonstrate the numinosity in [nature’s] processing of things (zu jian zaowu zhi shen 足見造物之神).
安寧井圖說

天地自然之利所產甚奇，如安寧井，在州治廓外，洪濤巨浸之中。嶽鬱江心，使之瀉然仰出，構亭其上，遙視之宛如芙蓉，亭亭水面耶。井口狀如腰子，深一丈二尺，週圍六丈餘。用竹竿繫皮袋提汲，舟運以煮，兩晝夜而成鹽，其色青白，味稍苦，形如釜，不用鋸解。灶丁皆裸體跣足，與他井之苦較倍。異者，江水弗浸，長汲弗減，不汲弗溢，足見造物之神。

Explanation to the Illustration of the Alou-Hou Wells [Salt Works]

The one with the most wells (jingyan 井 眼) among the eight [salt] wells [i.e. salt works] is without doubt Alou-[Hou] 阿陋 [陋]. The “Investigation of [Yunnan] Salt Administration” ([Quan Dian] yanzheng kao [全 滇 鹽政 考]) lists altogether 40 wells, some of which are named after people, others after places. Their generic name is “small old-quota wells” (gu'e 小井). Besides those [closed due to] disasters, caving-ins and abandonment, ten wells are operating presently, namely the Big Well (Dajing 大井), the Miraculous-rising [Well] (Qixing 奇 兴), the Bala [Well] (Bala 吧 啊), the Luomu [Well] (Luomu 羅 木), the Abundant Boundary [Well] (Fengji 萱 境), the Twelve Workers [Well] (Shi’erding 十 二 丁), the Yuan Chaofeng [Well] (Yuan Chaofeng 袁 朝 飛), the Yuan Xin [Well] (Yuan Xin 袁 信), the Nadian [Well] (Nadian 納 甸), and the Monkey Well (Houjing 猴 井). They are located amidst countless mountains and in deep bamboo forests, encircled by creeks. Although these are many wells, their sources are small and their streamlets thin, so that the value of the taxes is not much either. The depths of the wells vary, as do taste and quantity of their brines. They all bring up the brine with leather bags hoisted by windlasses. It takes three days and nights to finish the [boiling of] the salt, which is of blue-green and white colour and of not very salty taste. [The salt works] is fifty li [ca. 28.8 km] to the south-east of the governmental seat of Guangtong District 廣通 縣. The meaning of the name “Alou” is unknown. Although [the salt works contains the character] lou 陋 (“vulgar”), the conditions of the salt administration are worthy of praise.

阿陋猴井圖說

八井中之井眼最多者，莫如阿陋。《鹽政考》內共載四十井，或以人名，或以地名，總名為古額小井。除災傷、埋沒、棄廢外，現開計十井，曰大井、奇興、吧嘞、羅木、萱境、十二丁、袁朝飛、袁信、納甸、猴井，僻處叢山深箐，環溪上下左右，但井眼雖多而源微流細，故課價亦無幾也。井之深淺不等，瀉之濃淡多寡亦各相異。均系車運皮袋以汲。煎歷三晝夜
成鹽。色青白，味不甚鹹。距廣通縣治東南五十里。阿陋之名，不識何所取義，名雖“陋”，而鹽法事宜頗稱嘉焉。

Explanation to the Illustration of the Jingdong Well [Salt Works]

One hundred and sixty li [ca. 92 km] to the south of the governmental seat of Jingdong Prefecture 景東府 lies the Mowai Well 磨外井 measuring three chi [ca. 0.96 m] in width and two zhang [ca. 6.4 m] in depth and built in layers of cobbles. Another one, the Mola Well 磨脹井, consists actually of two pits (keng 坑), with a width of three [ca. 0.96 m] and a depth of two chi [ca. 0.64 m]. It is located thirty-five li [ca. 20 km] away from the Mowai Well. The source of the brine spills out quickly and abundantly, and flows uninterruptedly. During the winter and spring seasons, the water level drops so much that the [cobble]stones protrude. [The brine] tastes then twice as salty and can be easily boiled [into salt]. During the transition from summer to autumn, however, [the water level rises sharply and the well] is submerged by billows and waves, and nobody can tell its location. The locals (turen 土人) use bamboo buckets to scoop the brine. At each well six hearths are set up. After one day and night, the brine is boiled into salt, popularly called “yeba salt” (yeyuan 葉巴鹽). It is formed in boxes made of woven bamboo strips and thus of square shape. When boiled [i.e. roasted], the salt is mixed with ash, so that the top becomes white and the bottom black. This is why it is also called “black salt” (heiyan 黑鹽). The weight of each square lump amounts to two to five liang [ca. 75-187 g]. The tax value (kejia 課價) of the quota salt is not high, and this salt only covers the needs of the population of the [surrounding] Jingdong Prefecture and is not distributed to other places. Nonetheless, [the Jingdong Well salt works] is not unimportant, because it is only by depending on it that the flooding of the [prefecture’s salt zone] by [salt from] the two directly adjacent indigenous wells (tujing 土井), i.e. Anban 按板 and Baomu 抱母, can be prevented.
Explanation to the Illustration of the Overflowing-sand Well [Salt Works]

The Overflowing-sand Well (Mishajing 彌沙井) is the smallest of the eight wells [i.e. salt works]. On all four sides it is surrounded by mountains, with a meandering stream in the middle. The well [i.e. the spring] is located at the foot of the western mountains. Its brine, coloured like ambrosia (qiongjiang 琼漿), flows out of the rock, neither too fast nor too slow. The septa of a bamboo are removed to form a pipe which guides the brine to flow into the pool. It takes one day and one night to turn the brine into salt sand (yansha 盐沙), [and then] it is kneaded into lumps, shaped like bells. [Each] has a weight of two liang [ca. 75 g], and exhibits a greyish colour. Next to it there is one small well, with boiling and hoisting conditions not different from the big well. The hearth workers (zaoding 灶丁) all have dirty faces and wear [poor] hemp clothes. Its quota is very small, and, being located in the poorly inhabited territory of Jianchuan Department 剑川州, it is the salt works most distant from the provincial capital. When it is compared with the Black Well and the White Well [salt works], the disparity is even more far apart than clouds in the sky and soil! However, because even trifling coins matter for the state treasury, how could one look down on them and ignore them!

弥沙井圖說
彌沙井乃八井中之最小者，四面環山，中流九曲。井產西山之下，滷從石中出，色若瓊漿，不疾不徐，截竹為筒，引流入池。煎熬一晝夜而成鹽沙，捏為個，其形如鍾，重二兩，色似灰。傍有一小井，其煎汲事宜亦與大井無異。灶丁皆垢面麻衣。額鹽無幾，去省最遠，在劍川州轄，居民寥寥，較之黑白諸井，奚啻雲泥耶！但錙銖皆關國儲，豈可薄其少而忽之！

Explanation to the Illustration of the Zhijiu and Grass-creek Wells

The two wells, Zhijiu (Zhijiu 只舊) and Grass-creek (Caoxi 草溪), are located amidst deep mountains and secluded valleys to the south-west of the Hequ Department [Capital] 和曲州, and had been open since the Hongwu reign-period [1368-1398] of the Ming Dynasty. The Zhijiu [Well] is one hundred and sixty li [ca. 92 km] away from the departmental [capital], the Grass-creek [Well] two hundred li [ca. 115 km]. Their sources were shallow and their brines scanty. Their tax quota amounted to somewhat more than 250 taels. By imperial decree, [these two wells] were ordered to close down in the autumn of the xinhai year of the Kangxi reign-period [1671], and since then it is the Black Well [salt works] which
Zhu Xia: Production of Well Salt by Ethnic Minorities

pays the taxes (kefu 趙 賦) on their behalf. Only the remains of the salt works are still left between dangerous cliffs and winding mountain streams, deserted by men and infested by weeds. Although the salt works are closed, their taxes are still being covered, which is the reason that we attached them to the end of this scroll.

只舊草溪井圖說

和曲州之西南，深山窮谷中，產只舊、草溪二井，開自明洪武年間。只舊去州一百六十里，草溪去州二百里許，源淺滷微，額課二百五十餘兩，於康熙辛亥穐奉旨封閉。迄今課賦黑井代納。惟留故址於危巖曲澗、荒煙蔓草之中。但井雖閉，而賦猶代輸，故附之圖末。

Colophon to the Illustrations on the Salt Production Methods
[of Yunnan]

Old, indeed, is the expression “boiling sea [water]” (zhu hai 煮 海), but in Yunnan we only “boil mountains” (zhu shan 煮 山)! How can mountains be boiled? [This expression is used] because all the places where salt can be boiled are located in the midst of countless mountains. Some of them lie beside dangerous cliffs, some are adjacent to deep gullies, while others gush forth in the middle of swift currents. [Their sources] are inexhaustible in supply and always available for use. How enormous and marvellous are the benefits brought forth by Heaven and Earth’s spontaneity! Once I chanted the following commending verses: “Mountains and rivers rich and abundant, precious goods they contain; Heaven and Earth even and complete, [nature’s] ingenious operations they display.” Yet, different are the circumstances between mountains and seas, and hence salt production methods greatly vary. Moreover, even the conditions among the eight salt wells [i.e. salt works] are not the same, as, in general, boiling is difficult, costs of production (gongben 工 本) are high, and tools and facilities are complex. Besides, due to steep and towering mountains, transportation is troublesome, not like the Yangtze River or other great rivers on which one and the same boat can [easily] sail for a thousand li. Thus, the value of taxes is twice that of other provinces. Furthermore, there is a lack of rich merchants who can take over [salt] procurement. That is why the salt administration in Yunnan cannot by any means be compared with that in the provinces of Jiang[su] and Zhe[jiang]. Being of preposterous and simple-minded nature, I undeservedly was granted the Special Imperial Kindness to be appointed twice as Salt Supervisor (cuozheng 鹹 政) in this border region. After having received this order and having arrived in the tenth month of the year with the cyclical signs
jiashen [1704] as a single horseman riding alone, three years have passed, but how could I dare to claim that I am already up to my post, and that I enriched the national treasury as well as benefited the common people? The only thing which may not make me feel ashamed is that I—scratching my head in despair—inquire of Heaven until deep in the night and early in the morning. Somebody asked me: “You have been twice appointed Salt Commissioner, but you never went in person to these places to witness the conditions. How do you know about their hardship and ease?” I answered: “There is only hardship and no ease. I am very well acquainted with it. But how could I bear to disturb our destitute hearth [people]? Did you not hear about the saying, that ‘by entering Shaowen’s room, one can lay down and enjoy the luxuriously green mountains in the landscape paintings [just as well as by going there for sight-seeing]’? [Thus] I will use painting to display them here.” Hence I ordered a painter-craftsman to paint delicately the outlines of mountains and rivers, the circumstances of [salt] boiling, and the human conditions. And [I] warned [him]: “Do not concentrate so much on embellishments, and learn the lesson from the story of Zheng Xiu.”

First day of the fifth month in the year with the cyclical signs dinghai of the Kangxi reign-period [1707].

The Salt Distribution and Postal Service Commissioner (yanyishi 盐 驛 使) of Yunnan, Li Bi from Yanshan 燕 山, wrote this colophon as well as the explanations.

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65 Shaowen 少 文 is the style or adult name (zi 字) of Zong Bing 宗 彬 (375-443), a painter famous for his landscape paintings (shanshui hua 山 水 畫). [Transl.]

66 Zheng Xiu 鄭 袖 was the wife of King Huai of Chu 楚 懷 王. Her story is in Zhan qiu ce 战 国 策 (Strategies of the Warring States), in the fourth chapter of “Chu ce” 楚 策 (Strategies of Chu). Queen Zheng Xiu persuades a potential rival from Wei that the king does not like her nose. When the king asks Zheng Xiu why this lady always covers her nose, the queen answers that she does not like his smell. He then has her nose cut off. See Lisa Ann Raphals, Sharing the Light: Representations of Women and Virtue in Early China, Albany: State University of New York, 1998, p. 53. [Transl.]
大矣哉，亦異矣！余嘗嘆曰：山河賜福居奇貨，天地平成顯化工。但山海懸殊，而鹽法因之迥異。即八井之中，事宜亦復不同，大抵煎煮難，工本費，器具繁，且崇山峻嶺，輓運為勞，非若長江大河，可以片帆千里者。故課價倍於他省，故乏富商充辦，是滇南鹽法大非江浙諸省可同日語。余性本迂拙，謬膺特恩，復任邊徼鹺政，於甲申陽月，單騎啣命而至，今又三載矣，敢曰駕輕就熟，裕國儲、惠元元耶？惟清宵露照，搔首問天，似可告無愧。或曰："公兩任鹺使，未嘗親至其地，目擊其形狀，安知其勞逸何如耶？"余曰："有勞無逸，聞之熟矣。安忍擾吾窮灶？子不聞入少文之室，可以臥眺蒼巒乎？余將繪圖以覽焉。"因命畫工細繪其山川形勢、煎煮事宜、人物情狀。且戒曰："弗以粉飾為工，聊學鄭袖之故態雲爾。"

旹康熙歲次丁亥十月之吉
滇南鹽驛使者燕山李苾跋並說
Ill. 1: Illustration of the Black Well [Salt Works] (Heijing 黑井)

SOURCE for all illustrations: “Illustrations on the Salt Production Methods of Yunnan” (Diannan yanfa tu 滇南鹽法圖). Courtesy of the National History Museum of China.
III.2. Illustration of the White Well [Salt Works] (Baijing 白井)
Ill. 3: Illustration of the Carnelian Well (Langjing 琅井)
Ill. 4: Illustration of the Cloud-dragon Well [Salt Works] (Yunlong jing 雲龍井)
Illus. 5: Illustration of the Anning Well [Salt Works] (Anningjing 安寧井)
Ill: 7: Illustration of the Jingdong Well [Salt Works] (Jingdongjing)
III: 8. Illustration of the Overflowing-sand Well [Salt Works] (Mishajing 沙沙沙沙 井井井井)
Ill. 9: Illustration of the Zhujiu and Grass-creek Well [Salt Works] (Zhujiu caoxijing yuanshui井)
Research Note

Translating 宿 *sukh/xiu and 舍 *lhah/she—‘lunar lodges’, or just plain ‘lodges’?*

Christopher Cullen

In pre-modern China, people who made observations of the positions of heavenly bodies, or who did calculations about those positions, frequently used as a reference frame a system that sliced the heavens into twenty-eight unequal divisions, ranging in width from over 30 degrees to around 2 degrees. Each of these divisions shared its name with a particular asterism, whose westernmost star marked the start of the division in question. This system is first fully evidenced in quantitative form in the Western Han, although the asterisms themselves are attested as a complete set in a depiction from the fifth century BC: see Wang Jianmin 王健民, Liang Zhu 梁柱 et al. (1979). The Chinese phrase most commonly used to refer to this system of celestial divisions and asterisms is èr shí bā xiù 二十 八 宿, meaning ‘the twenty-eight xiù’ (when in this essay I use modern standard pronunciation, I do so purely for convenience of reference). In some texts the word shè 舍 is used where we might expect to find xiù. I shall however turn to the question of shè after discussing the more commonly used term.

So how should one render xiù in English, assuming that one feels unable to avoid the problem by transliterating rather than translating, and simply writing ‘the twenty-eight xiù’? Several prominent western scholars have chosen to translate this word using terms such as ‘lunar mansions’.

* While I use tone markings for modern readings of Chinese words in my main text, I have refrained from using them in my title or in references to published work, since this may cause problems with bibliographical search functions. The asterisk before a reconstructed ancient form is a conventional indication that it is not attested by actual usage. I am grateful to the two anonymous referees for their suggestions for improving this essay, which I have gladly adopted.