

A Perfect Play of Salt, Bamboo and Gas: The First Petroleum Well (Breakthrough) in the World*

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Abstract

Although petroleum's current status as the key component of politics, society, and technology has its roots in the early 20th century, the petroleum industry is not of recent origin. More than three thousand years ago, petroleum was known as burning water by ancient Chinese people. Especially in the book Dream Pool Essays written in A.D. 1088, some detailed records on the nature, possible use, exploitation techniques, and origins of oil and gas were made. The first discovery and exploitation of oil and gas is actually a wonderful play of salt, bamboo, and gas. Salt is always playing significant roles in people's everyday life, and therefore, in the economy and politics of a region or country for thousands of years. Ancient China is no exception. Early in 347 AD, to produce enough salt, salt wells were drilled in Sichuan province in the southwest of China, to pump brine to be evaporated. During this process, collecting enough fuel is a big problem. Some careful people found lots of gas and oil coming out together with brine and fortunately they can be burned. So people drilled some new oil and gas wells (over 240 meters) nearby and carried them to salt springs through certain pipes. The local light and hollow bamboo pole is also a key point during these processes, because it can act as not only drill pipe but also pipelines to connect gas wells with salt springs. Some great gas fields are found in this place in recent decades. In this play, salt, bamboo, and gas are all indispensable, and the lack of every element would lead to the failure of that first great petroleum well or breakthrough in petroleum history. But it is just the power of nature that dramatically grants this place with salt mine, petroleum resource, and good climate for bamboo all at the same time. Techniques on drilling wells and choosing well sites were recorded and spread quickly around the world. The initiative knowledge of exploration and development of petroleum soon plays great roles in the dawn of modern petroleum industry.

The perfect play of salt, bamboo and gas

—the first petroleum well (breakthrough) in the world

Song Suihong

2016.6.19

Outline

- **1. Significance of table salt for human**
- **2. Discovery of gas**
- **3. Important role of bamboo**
- **4. Perfect play of salt, bamboo and gas**

1. Significance of table salt



- The role of salt in people's daily life

(1) Food seasoning



What if no salt in food?



(2) Food preservation



What if no salt to preserve food in ancient time?

1. Significance of table salt

(1) Used as payment or currency

Roman Legions were paid by salt

In Africa, salt was used as currency or coins



Equal in weight



Word “salary” comes from the Latin word for salt

1. Significance of table salt

(2) Strictly controlled by governments

Anyone buying salt from illegal businessman or concerned with illegal salt trading would be punished severely.

For government, salt tax and trading is a very important income, and salt is an efficient way to control its people.

In ancient China (770 BC. -453BC.), **Qi country became prosperous because of salt trading and salt tax** and defeated many neighbour countries and became one of the 5 giant countries

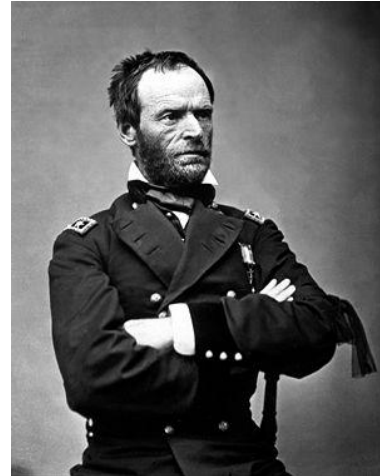


1. Significance of table salt

(3) Salt & war

Salt played an important role in the American Civil War.

One of the important reasons that the south failed is lacking enough salt supply for soldiers to eat and sterilize wounds.



“Soldiers can not survive without salt” insisted by Sherman

1. Significance of table salt

(4) Communities were built where salt was available

In Britain, the suffix “-wich” in a placename means it was once a source of salt, as in Sandwich and Norwich



Sandwich

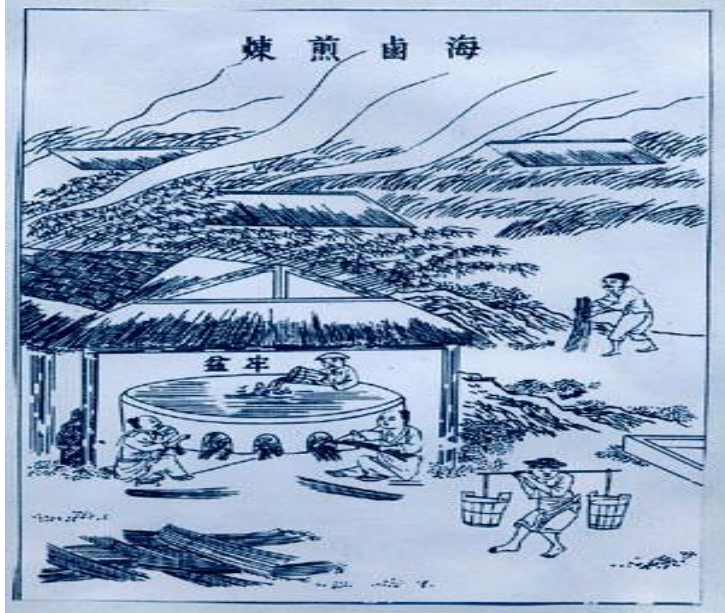


Norwich

1. Significance of table salt

How was salt collected?

(1) In areas near sea, salt is processed from sea water



Salt was obtained from evaporating salty sea water.

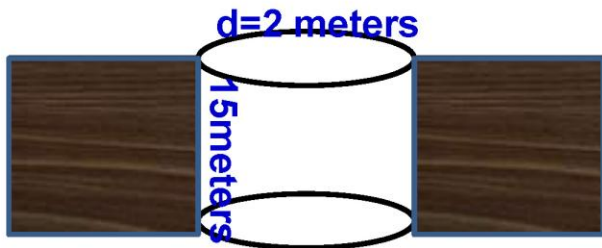
From the book *Tiangongkaiwu* (1637 AC.)

1. Significance of table salt

How was salt collected?

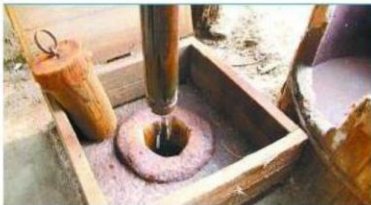
(2) In inland areas, salt wells are dug

Stage 1: Early shallow-well period (250 BC.-):



Bin Li arranged people to dig such shallow salt wells, solving the problem of lacking salt

Stage 2: Deep well (Zhuotong well) period (1000 AC.-):



**Zhuotong well
D=30cm
Deep=130meters
More production**

Some illegal salt businessmen drill such deep well with smaller diameter to avoid being found by government.

Presenter's notes: Deep wells are also called Zhuotong wells. Zhuotong means hollow bamboo, because one of the crucial materials is bamboo, working as casing. The invention of the Zhuotong well is an interesting story. In ancient time, salt was strictly controlled by the government, including the above shallow wells. Some illegal businessmen wanted to produce their own salt to make big money, but only on condition that they would not be found by the government, so they have to drill wells with a very small well head. This way, salt wells are very easy to hide from the government. And the invention of the Zhuotong well became an important milestone in the long history of salt wells and also gas wells.

1. Significance of table salt

How were Zhuotong wells drilled?

Step 1 Well location investigation

Experienced specialist surveys the surface geographical situation, including mountain and river trends.

The drilling results of nearby wells are also used for reference.



1. Significance of table salt

How were Zhuotong wells drilled?

Step 2 Digging well head

Bigger hole is
dug, until
subsurface stone
is met.

The soil is moved
out by people.



From the book *Tiangongkaiwu* (1637 AC.)

1. Significance of table salt

How were Zhuotong wells drilled?

Step 3 Placing stone circles

When subsurface stone is met, digging is finished.

Quadrature stones with hollow circles is placed to avoid wellhead collapse and allow drilling instrument to get through down to well.



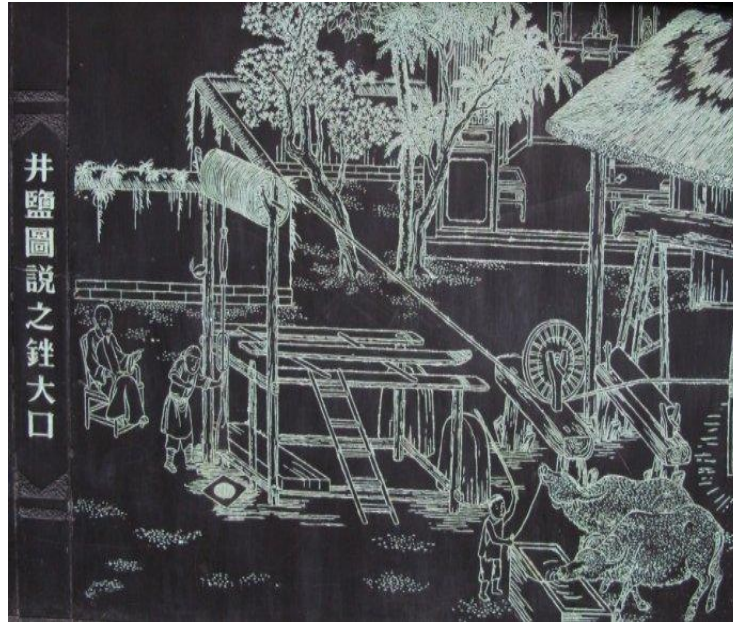
From the book *Tiangongkaiwu* (1637 AC.)

1. Significance of table salt

How were Zhuotong wells drilled?

Step 4 Drilling big hole

Big iron hammer is used to crush the subsurface stone. The heavy hammer can be dragged by people or later by cows. The mud and stone fragments are dragged out using special tool.



From the book *Tiangongkaiwu* (1637 AC.)



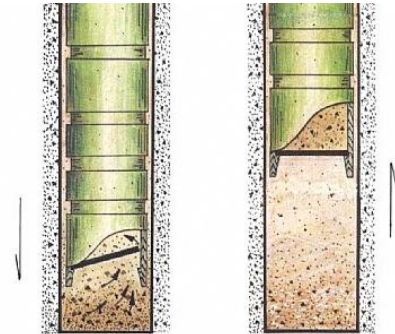
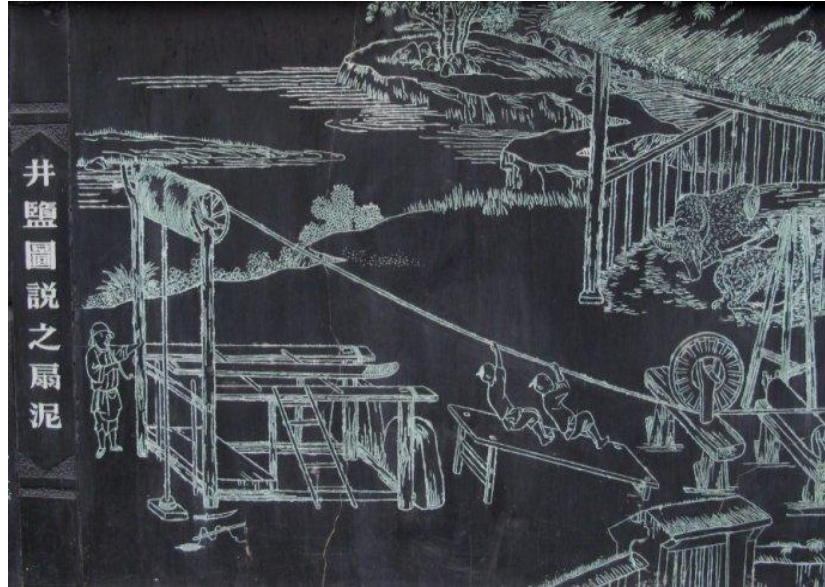
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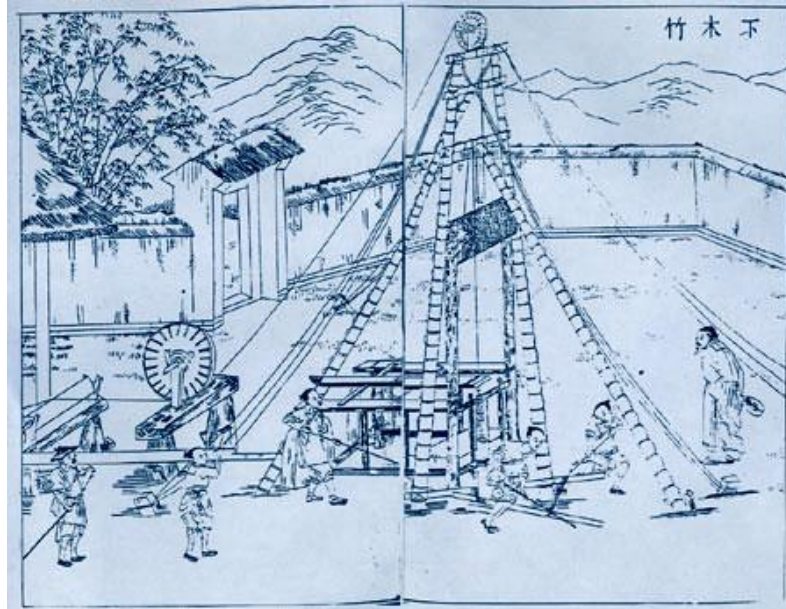
From the book *Tiangongkaiwu* (1637 AC.)

1. Significance of table salt

How were Zhuotong wells drilled?

Step 5 Placing bamboo casing

When drilling to 50 meters deep, casing made from bamboo is placed in well, to isolate strata water and avoid well collapse.



From the book *Tiangongkaiwu* (1637 AC.)



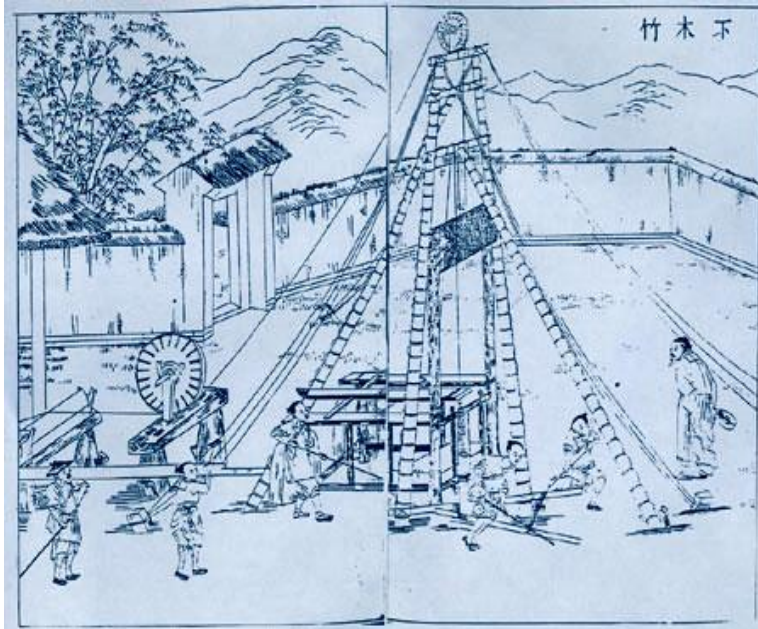
1. Significance of table salt

How were Zhuotong wells drilled?

Step 6 Drilling small hole

Smaller hammer is then put down through hollow bamboo casing, to crush the deeper stratum.

A typical 130 meters is drilled in 1000 AC.



From the book *Tiangongkaiwu* (1637 AC.)

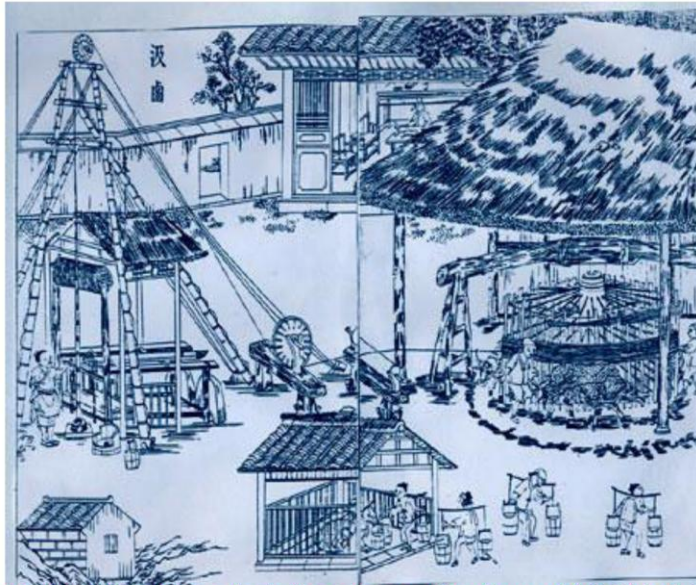


1. Significance of table salt

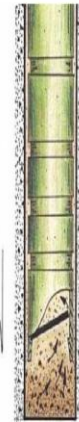
How were Zhuotong wells drilled?

Step 7 Carrying out salt water

Salt water in deep well is carried out using special tool.



From the book *Tiangongkaiwu* (1637 AC.)



Presenter's notes: When the Zhuotong well is finished, the next step is to carry out the salt water from the bottom of well with a special tool. The tool is made of hollow bamboo, with cattle hide at the bottom. When this tool is hung down to the bottom of the well, the cattle hide is open. When the tool is dragged up, it closes, holding the salt water from the well.

1. Significance of table salt

How were Zhuotong wells drilled?

Step 8 salt water evaporation

Salt is collected by evaporating salt water from well.



2. Discovery of gas/oil

In China, petroleum was first found to be recorded in The Book of Changes (1000 BC.).

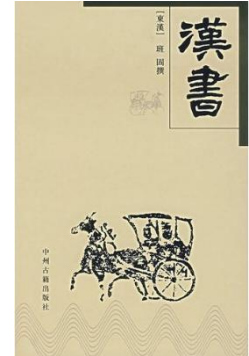
Its characteristics and uses are described in some very old books:

- (1) used for lighting
- (2) Lubricant
- (3) Medicine
- (4) Military affairs
- (5) Ink material

However, in earlier time, **before invention of Zhuotong well**, only oil or gas oozing from subsurface is used. **People don't positively acquire petroleum.**



The Book of Changes (1000 BC.)



Hanshu(32 AC.)



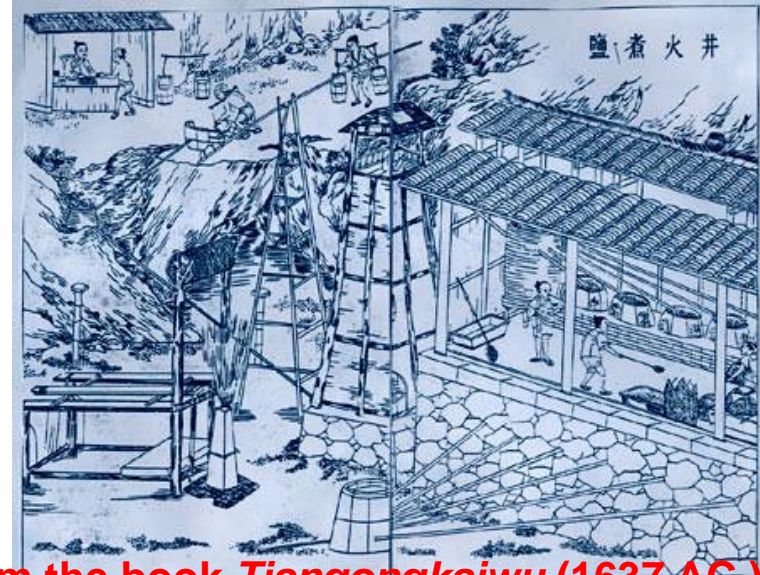
Dream Brook Sketchbook(1031 AC.)
A famous ancient China encyclopedia

2. Discovery of gas/oil

why not drill a gas well ?

Key elements for gas wells drilling:

- (1) Salt boiling needs energy
- (2) Salt wells successes offer drilling techniques
- (3) Bamboo offer basic materials for drilling and transporting
- (4) Gas shows in salt wells indicate rich petroleum subsurface

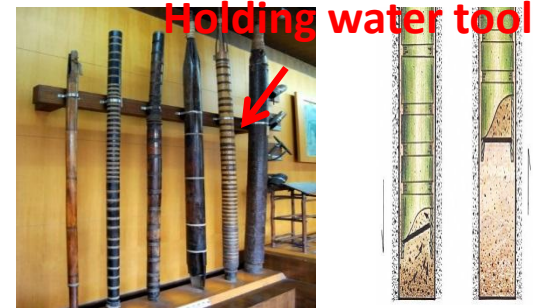
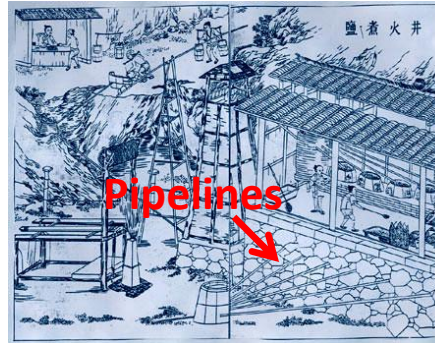
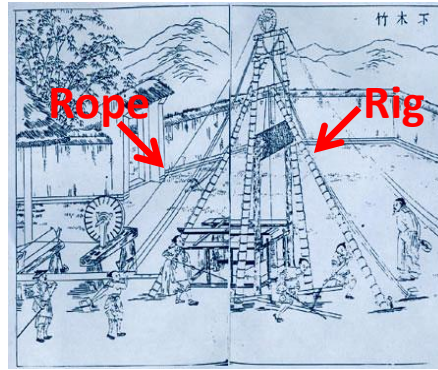


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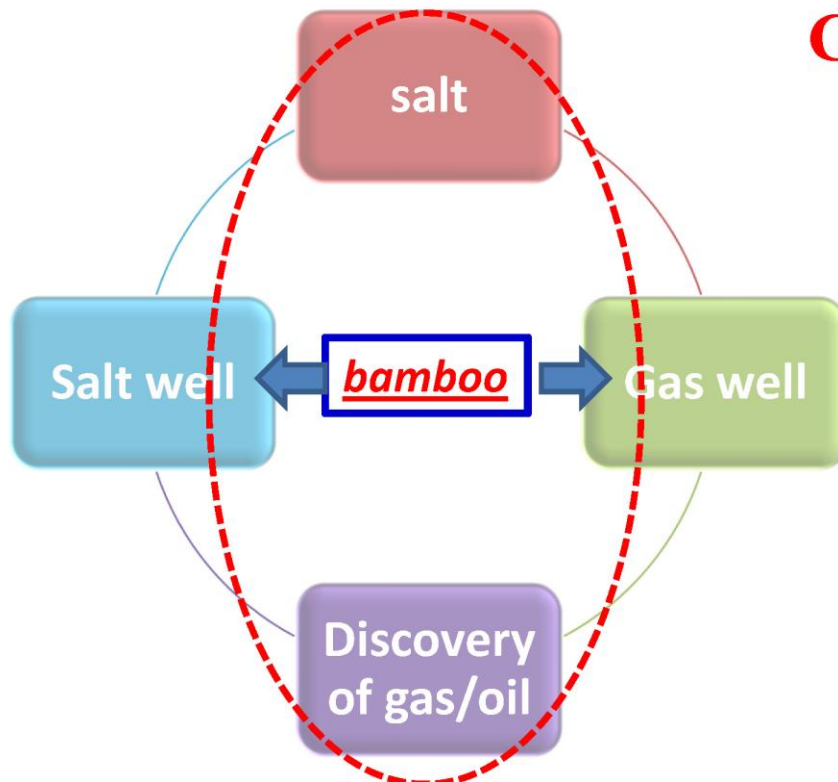
3. Role of bamboo

Anther crucial element for the successes of salt well and gas well is bamboo.

- (1) Strong ropes to hang heavy hammer
- (2) Drilling casing
- (3) Special tool to hold salt water from subsurface
- (4) Pipelines to transport gas to salt-water evaporating place
- (5) Rig, wheel



4. Perfect play of salt, bamboo and gas

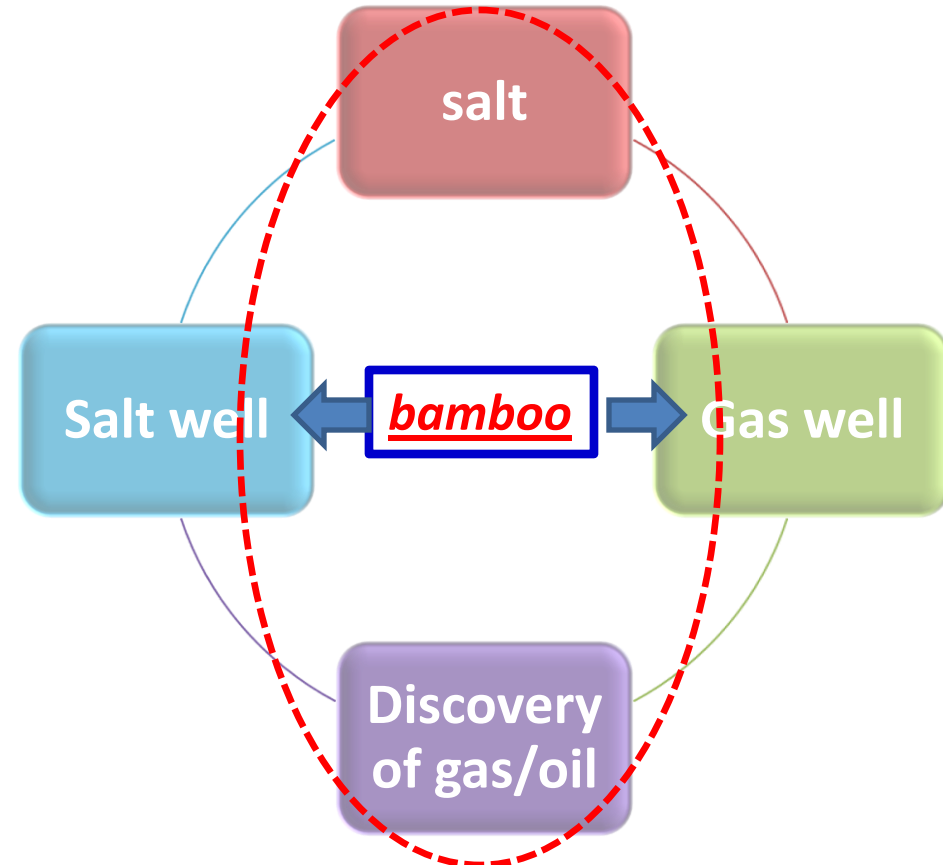


Compare to today's situation

- Salt—cars or other machines. Drive of gas well drilling
- Bamboo—steels for drilling and transporting
- Petroleum reserve—basic element

Presenter's notes: In these 3 stories, salt, bamboo, and gas; every element is indispensable. People need salt, so they drilled salt wells. Salt evaporation needs energy so people drilled gas wells for fire. The success of salt wells offer abundant experience and techniques to drill similar gas wells. Bamboo is also crucial. Without bamboo, the whole story would not be complete. Bamboo was used as rope, rig, casing, and special tools. Finally, abundant petroleum reserves is essential. Compared to today's situation, salt is like cars or other machines that needs petroleum and therefore drive the drilling of petroleum wells.

4. Perfect play of salt, bamboo and gas

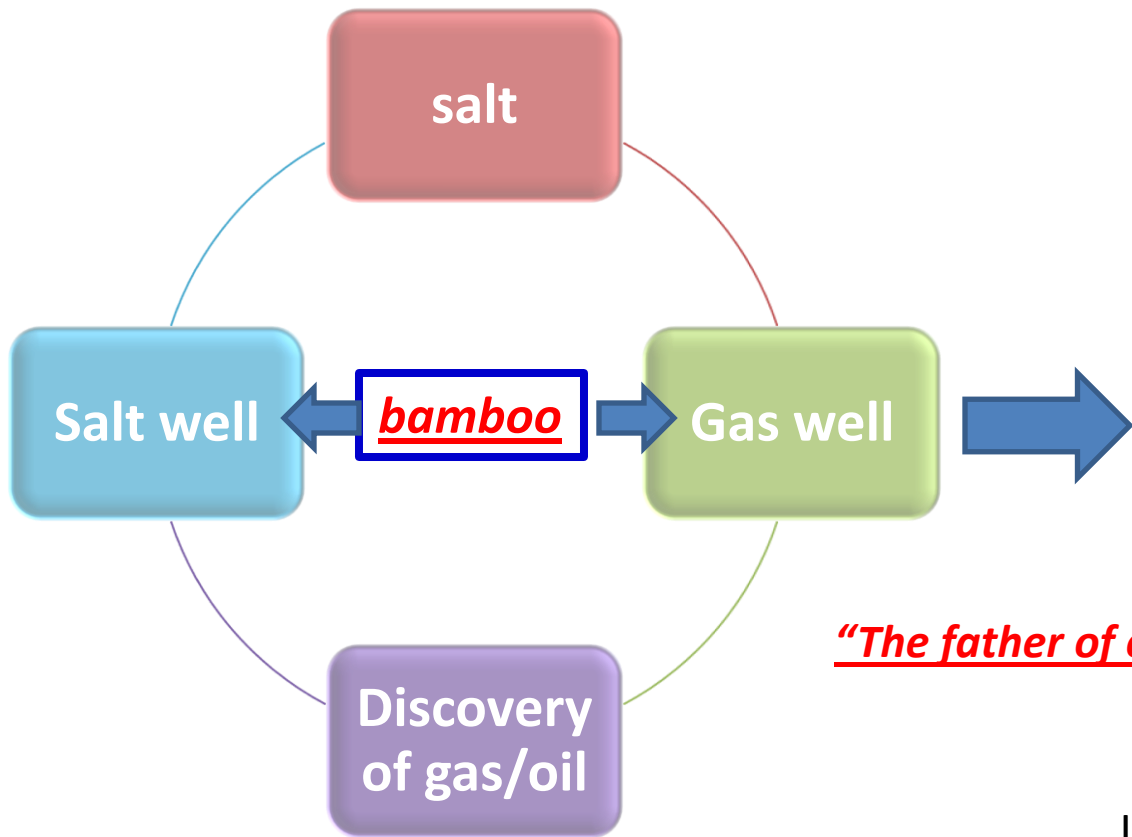


The power of nature grants this place with salt mine, perfect weather for bamboo and petroleum reserve

4. Perfect play of salt, bamboo and gas



**Experience and
techniques for
modern well
drilling**



"The father of oil drilling in the world"



Joseph Terence Montgomery Needham

THANK YOU

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A