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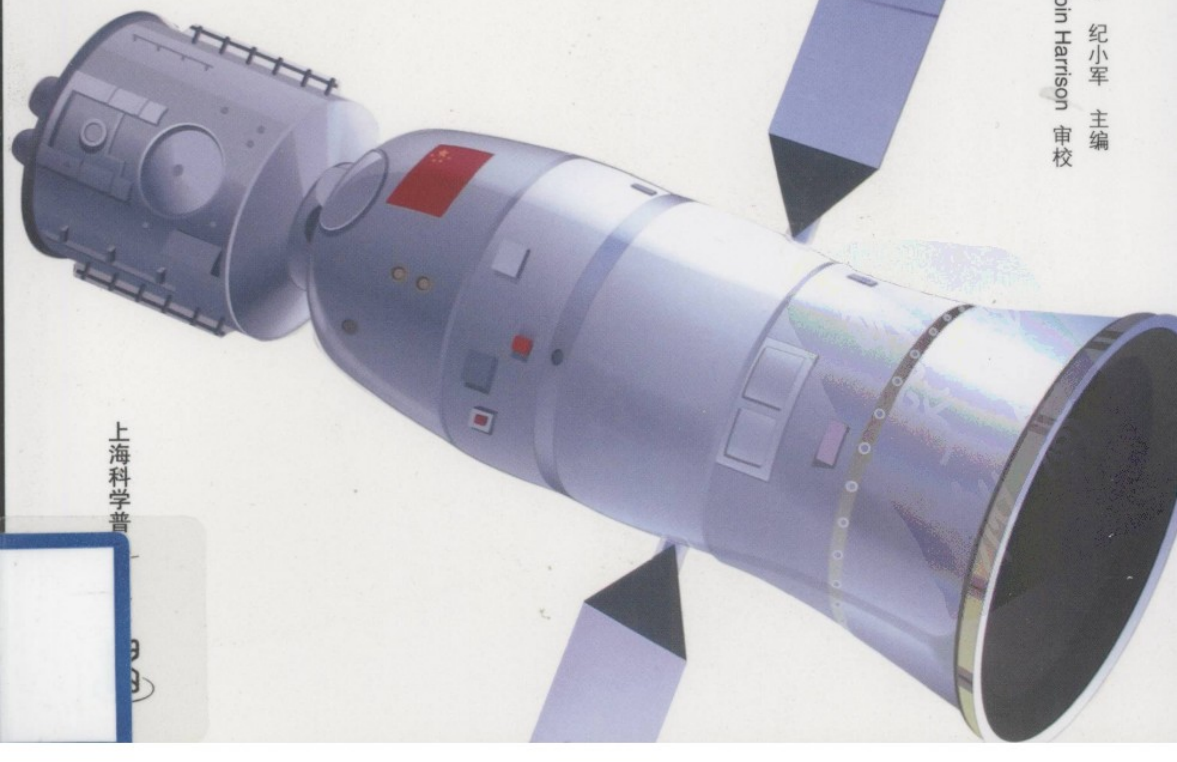
用英语说中国

Talk About China in English

中国第一部双语百科全书

科技 Science and Technology

王德军 纪小军 主编
[美] Robin Harrison 审校



上海科学普

教育资源 www.222b.com 公众号：铅笔钥匙

用英语说中国

Talk About China in English



ISBN 978-7-5427-4420-3

浩瀚英语沟通热线：
010-88116531 88119278
bookinfo@126.com

图书上架建议：英语学习

定价：36.00元

教育资源 www.222b.com 公众号：铅笔钥匙

活潮英语

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上海科学普及出版社

教育资源 www.222b.com 公众号：铅笔钥匙

图书在版编目(CIP)数据

用英语说中国. 科技：汉英对照/王德军，纪小军主编. —上海：上海科学普及出版社，2009.10

ISBN 978-7-5427-4420-3

Ⅰ.用… Ⅱ.①王…②纪… Ⅲ.①中国—概况—汉、英②科学技术—概况—中国—汉、英 Ⅳ.K92

中国版本图书馆 CIP 数据核字(2009)第 133453 号

责任编辑 徐丽萍

用英语说中国——科技

王德军 纪小军 主编

上海科学普及出版社出版发行

（上海中山北路 832 号 邮政编码 200070）

http://www.pspsh.com

各地新华书店经销 三河市德利印刷有限公司

开本 700×1000 1/16 印张 18.25 字数 357000

2009 年 10 月第 1 版 2009 年 10 月第 1 次印刷

ISBN 978-7-5427-4420-3 **定价：36.00 元**

教育资源 www.222b.com 公众号：铅笔钥匙

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前　言

随着我国改革开放的不断加速，旅游事业也越来越兴旺地发达起来。尤其是近几年来，来自世界各地的客人涌向中国，他们试图揭开这块辽阔土地的神秘面纱，发掘这段悠久历史的根源，以满足其难以诠释的好奇和幻想。

具有悠久而又丰富历史的中国一直为自己无数的历史遗迹和文化遗产感到自豪。几乎在中国的每一个地方，人们都能欣赏到神奇的景观或自然风光及其世代相传的故事和神话。

此外，在中国人民的辛勤努力下，国家在各个方面都有了翻天覆地的变化。从经济、文化、教育，到生活、娱乐和消遣，人们都在尽情地享受着国泰民安、和谐安睦的生活。国家的建设和发展日新月异，人们的思想、观点、生活方式也有了很大的变化。

在这种形势下，我们觉得有必要给来中国工作和旅游的外国友人——尤其是给那些将来参加2010年上海世博会的各国朋友提供一些帮助，把他们可能感兴趣的事情、人物和地方简单地作一些介绍，让他们对中国有个大致的了解。由此，我们编写了《用英语说中国》这套丛书。丛书共有12部，分别是：

1.《用英语说中国——历史》
2.《用英语说中国——民俗》
3.《用英语说中国——艺术》
4.《用英语说中国——文化》
5.《用英语说中国——名城》
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11.《用英语说中国——科技》
12.《用英语说中国——经济》

《用英语说中国——科技》由上篇（古代成就）和下篇（现代成就）构成。上下篇涵盖天文、地理、数学、物理、化学、农业、医学、手工业、工程建筑等九大领域的成就，使读者对中国的科技成就有一个基本了解。

参编这套丛书的作者都是来自高等院校的英语教授、副教授和硕士研究生，大家都为能参与此项有意义的活动而感到兴奋和激动，都乐意为宣传中国和振兴中

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华贡献自己的一份力量。

《**用英语说中国**》这套丛书从策划到构思，从设计到编写，都是站在较高的角度，本着较新的水准，创造性地把中国的上上下下、东西南北、方方面面以简洁流畅的语言娓娓叙述的。这必将令广大读者体验一种全新的感受。

《**用英语说中国**》这套丛书对于所有英语爱好者，包括中学生、中学教师、大学生、办公室职员和政府工作人员提高英语学习兴趣和英语水平都能有所帮助。丛书信息量庞大，涉及面广泛，古往今来，东南西北，犹如一部中国百科全书。丛书中的英文叙述和中文译述都严格遵循语言简练、结构明晰、形式活泼的宗旨，我们衷心希望这套丛书能够受到广大读者的喜爱和信赖。

王德军和纪小军任本书主编。纪小军承担本书上篇的主要编写工作，共编写近十万字，张军编写八万余字。

把中国介绍给世界，让世界上更多的人了解中国，是每个中国人的愿望。

限于编著者的水平和第一手资料的缺乏，丛书中有些地方的内容和信息可能存在着一些出入和欠缺，恳请广大读者予以批评指正。

《用英语说中国》丛书编者

2009 年 10 月

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Preface

With the rapid development of China's reform and opening-up, tourism is on the rise, esp. in recent years. More and more people from all over the world come to China, hoping to unveil the mystery of the vast land, to discover the origins of the long history in China and to satisfy their own curiosities and fantasies as well.

China, with a long and rich history, is always proud of her countless historical sites and cultural relics. Almost everywhere people encounter amazing miracles or natural beauties together with their everlasting legends and myths.

Furthermore, with the strenuous work of the whole nation, China has witnessed fundamental changes in every field. From national economy, culture and education to people's living standard, recreation and entertainments, everywhere and every soul is enjoying a peaceful and comfortable life in a friendly and harmonious atmosphere. The nation's construction and development are changing with each passing day while people's views and points are also keeping pace with the times.

Under such circumstances, we feel obliged to offer some help to those foreign visitors, esp. those who are coming to the 2010 Shanghai Expo, by giving them a brief introduction of the things, the people and the places they might be interested in. The series "***Talk About China in English***", therefore, come into being. The series consist of 12 books in all. They are:

1. **Talk About China in English—History**
2. **Talk About China in English—Folklore**
3. **Talk About China in English—Arts**
4. **Talk About China in English—Culture**
5. **Talk About China in English—Famous Cities**
6. **Talk About China in English—Celebrities**
7. **Talk About China in English—Tourism**
8. **Talk About China in English—Sports**
9. **Talk About China in English—Famous Colleges and Universities**
10. **Talk About China in English—Films and TV Series**
11. **Talk About China in English—Science and Technology**
12. **Talk About China in English—Economy**

Talk About China in English—Science and Technology consists of Part One (ancient achievements) and Part Two (modern achievements), which cover the great

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achievements in the nine fields of astronomy, geography, mathematics, physics, chemistry, agriculture, medicine, handicraft, and engineering construction. Through reading the book, readers will get a basic knowledge of scientific and technological achievements in China.

All the writers of the collection are professors, associate professors and graduate-students of English from military colleges and universities. We all feel happy and proud to have the chance to do our bit for the publicity of our motherland as well as her promotion.

From making plans to hatching plots, from working out schemes to carrying out the writings, the authors have been diligent and conscientious. Through our work, we want to provide readers with a rich and colorful introduction of an encyclopedic manner. The books are new and creative, and sure enough, they will bring fresh feelings and experiences to all readers.

The series are also helpful for all English lovers, including secondary school students and teachers, college students, office clerks and public servants.

Both the English and Chinese versions in the collection are made in simple language, clear structure and lively style. We hope they will find popularity upon publication.

Wang De-Jun and Ji Xiao-Jun are the co-editors of the book. And Ji Xiao-Jun has compiled several chapters in part one, amounting to over 100,000 words in all. Zhang Jun has compiled over 80,000 words.

We are extremely grateful to the authors and publishers of all the materials we have chosen here in the book. We apologize for the insufficient information in some cases due to lack of resources. We intend to show every respect for intellectual property rights, but we hope our pleading of the permission to use these materials for the purpose of letting more foreign friends know China better will receive kind and generous consideration.

Authors

October 2009

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古代成就

Ancient Achievements

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Chapter 1 Astronomy 天文



万物起源
The Origin of Things

The Theory of Five Elements

The ancient Chinese people tended to refer to supernatural power for an explanation of any natural phenomena that they could not understand or control. Such supernatural power had different names in different periods in Chinese history, such as Shang di (God) in the Shang Dynasty (1600BC ~ 1046) and Tian (Heaven) in the Zhou Dynasty (1046BC ~ 256 BC). The *Tian Zi* (Emperor) therefore was designated by the heaven to govern the world.

After the Zhou Dynasty, the five elements—metal, wood, water, fire, and earth—were thought to be the basic substance in the natural world, constituting various things, leading to the creation of the Theory of Five Elements.

The Theory of Vitality

In the middle of the Warring States Period (475BC ~ 221BC), Song Xing and Yin Wen, two famous philosophers at that time, brought forward the theory of vitality, explaining the world with the tiny primitive substance of Yuan Qi (vitality). According to them, Yuan Qi, invisible and untouchable, existed everywhere, and when combined, gave rise to all things in the world.

By the Three Kingdoms Period (220 ~ 280), Yang Quan, a philosopher, further developed the issue, saying that the heaven as well as all the stars in the Milky Way galaxy was composed of Yuan Qi.

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The Theory of Chaos

As early as in the Warring States Period, there already existed philosophers who believed the heaven and earth came into being as a result of the mutual effects of *Yin* and *Yang*. The book *Huai Nan Zi*, written by Liu An and so on during the Western Han Dynasty (206BC ~ AD24), was the earliest to elaborate on the origin and evolvement of the heaven, earth, and celestial bodies.



万物起源
The Origin of Things

五行说

中国古代先民对于无法理解和控制的自然现象，归诸于主宰万物的超自然力，此超自然力量，商代（前 1600 ~ 前 1046）叫“上帝”，周代改为“天”，而所谓的“天子”则受天之命来统治人间。从周代（前 1046 ~ 前 256）起，有了金、木、水、火、土为自然界最基本物质的想法，各种事物由此结合而成，“五行说”随即成型。

精气说

战国（前 475 ~ 前 221）中期，宋钘、尹文两位哲学家提出“精气”学说，以无法直接感受的精微原始物质“元气”解释世界。元气看不见、摸不着，但存在于任何地方，聚集起来即可成万物。三国时期（220 ~ 280），哲学家杨泉更进一步认为，天是元气构成的，银河众星也是元气精华构成。

浑沌阴阳说

战国时期，认为天和地是在浑沌中阴阳作用而诞生的见解已经存在。而最早明确论述天地和日月星辰起源和演化的，应推溯至西汉（前 206 ~ 公元 24）时期淮南王刘安等人写成的《淮南子》。

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古人观天
Heaven in the Eyes of Ancient Chinese People

It is said in the ancient times, Gong Gong (a half man and half snake monster) and Zhuan Xu (a god) had a hard fight for control of the heaven, with Zhuan Xu emerging as the victor. Exasperated by failure, Gong Gong went to the northwest corner of the earth and knocked down the Buzhou Mountain, which was one of the eight pillars supporting the sky. As a result, the northwest sky collapsed and the southeast earth sank. Subsequently, the sun, moon, and stars in the sky all slid to the northwest, while the water and silt on the earth flowed to the southeast.

Whenever encountered with natural phenomena they could not explain, the ancient Chinese people tended to create various legends with their imagination to show their conjectures. The abovementioned is a legend vividly showing their speculation on the cosmic structure.

The period between the 3rd and 6th centuries witnessed enormous development in China's astronomy, with the rise of many theories on the cosmic structure. The most important of these were the theory of canopy-heavens, the theory of sphere heavens, and the theory of expounding appearance in the night sky.

The Theory of Canopy-Heavens

The oldest theory on cosmic structure, the early school of canopy-heavens claimed that the heaven, shaped like a big pan, covered the earth, shaped like a chessboard.

According to the theory, the sun moves all year round along seven paths, called Qi Heng, and the innermost one was called Nei Heng (Inner Path), along which the sun moved on the Summer Solstice (around June 22 ~ 23). The outermost one was called Wai Heng (Outer Path), and the sun moved along on the Winter Solstice (around December 22 ~ 23). During other solar terms, the sun moved along the middle five paths. Advocators of this school also claimed the sunlight could only reach a maximum distance of 167,000 li (83,500 km), and nothing could be seen beyond. Therefore, they said, the sun moved within the said distance during the day, and beyond during the night.

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The Theory of Sphere-Heavens

In his book *Note to the Armillary Sphere*, Zhang Heng(78 ~ 139), a famous astronomer in the Eastern Han Dynasty, wrote that the heaven was like an egg, with the earth as the yolk inside, and that the heaven wrapped up the earth just as the eggshell did the yolk. This represents a classic elaboration on the theory of sphere-heavens.

According to the theory, the heaven was higher in the north and lower in the south, revolving around a north-south axis. The east-west axis, vertical to the north-south one, was the heavenly equator. The plane to which the equator is tilted 24°was the ecliptic, and the sun moved along the plane.

The theory of sphere-heavens played an important part in the history of Chinese astronomy, exerting significant influence on the design and manufacture of ancient astronomic instruments, as well as on the explanation of relevant astronomic theories.

The Theory of Expounding Appearance in the Night Sky

As a legend goes, during the Warring States Period, a man from the Qi State, having known that the heaven was constituted of gas, in which the moon and stars floated, feared the heaven might collapse one day. Thinking that he would have nowhere to go by then, the man became deeply worried, and lost his appetite. One of his friends brought him to a wise man that helped him to put the things in the right perspective by saying, "The sun, the moon, and the stars are also composed of gas. Even if they drop from the heaven, it would mean a collision between gas, and no harm will be caused."

In the previously two cosmic theories, the sun, the moon, and the stars all had a shell, meaning there was no reason for them to fall from the heaven. Later, however, the ancient people found the celestial bodies moved freely from one place to another at a fast or slow speed, and sometimes, they might not move at all, hence giving rise to the new theory of expounding appearance in the night sky.

The advocators claimed the heaven was composed of boundless gas with no shape. They said the reason that people felt themselves so small was that the heaven was too far away from earth. The celestial bodies floated in the gas with no support, following their own movement rules. The theory broke the boundary of heaven, exhibiting a boundless universe.

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古人观天
Heaven in the Eyes of Ancient Chinese People

相传在远古时候，共工和颛顼两人为了争夺天下发生了争战。共工失败后，一气之下跑到了大地的西北角，撞倒了那里的不周山。不周山原是八根擎天柱之一，撞倒之后，西北方的天就塌了，东南方的地也陷了下去。于是，天上的日月星辰都滑向西北方，地上的流水泥沙都流向了东南方。

当古人对自然现象的成因不能理解时，他们往往会借助想象，创造出各种各样的神话传说，以表达他们对自然界发生的各种现象的揣测。这则神话生动地反映了古人对于天地结构的推测。

公元3到6世纪是中国天文学快速发展的时代。在这段时期内，涌现了许多讨论天地结构的学说，其中最重要的是盖天说、浑天说和宣夜说。

盖天说

盖天说是中国最古老的讨论天地结构的体系。早期的盖天说认为：天就像一个扣着的大锅覆盖着棋盘一样的大地。

盖天说认为，太阳在天盖上的周日运动一年中有七条道路，称为“七衡”。最内一道叫“内衡”，夏至日太阳就沿内衡走一圈；最外一圈叫“外衡”，是冬至日太阳的路径；其他节气里，太阳沿中间的五道运行。他们还主张，太阳只能照射16.7万里（83500千米），超过这个距离就什么也看不见了。因此白天就是太阳走到距离我们16.7万里以内的范围，而晚上则在该范围之外。

浑天说

东汉著名天文学家张衡（78～139）在《浑天仪注》一文中写道：“浑天如鸡子，天体圆如弹丸。地如鸡子中黄，孤居于内，天大地小……天之包地如壳之裹黄”。天就像一个鸡蛋，大地像其中的蛋黄，天包着地如同蛋壳包着蛋黄一样。这是对浑天说的经典论述之一。

浑天说还认为，天球北高南低，通过南北天极的轴旋转。垂直于南北极轴把天球平分成南北两半的大圆就是天赤道。与赤道斜交成大约24°角的大圆是黄道，太阳在黄道上运行。

浑天说在中国天文学史上占有重要的地位，对中国古代天文仪器的设计与制造产生了重大的影响，对天文学的有关理论问题的解释也产生了重大影响。

宣夜说

传说战国时期，杞国有一个人听说天是由气体形成的，日月星辰就漂浮其中之

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后，他非常担心天体会掉下来，让他无处躲藏，于是整日忧心忡忡，茶饭不思。朋友把他拉到一位智者那里，智者开导他说："日月星辰也是气体形成的，即使它们掉下来，也是气体落入气体中，不会造成任何损伤。"

盖天说和浑天说中的日月星辰都有一个可供附着的天壳，都不用担心会掉下来。但是后来人们观测到日月星辰的运动各自不同，有的快、有的慢，有的甚至在一段时间中停滞不前。所以就又产生了一种新的理论"宣夜说"。

宣夜说主张：天是无边无涯的气体，没有任何形质，我们之所以看天有一种苍苍然的感觉，是因为它离我们太深远了。日月星辰漂浮在空气中，不需要任何依托，因此它们各自遵循自己的运动规律。宣夜说打破了天的边界，为我们展示了一个无边无际的宇宙空间。



中国古星象图
Star Maps

In ancient China, the star charts mainly fall into two groups in nature: the first were illustrative star charts which served for decorative and religious purposes, and the second were scientific ones which were drawn by ancient astronomic observers in books, painting rolls and stone carvings for educational or recording purposes.

Many of the star charts with a high scientific research value have been lost, and most of those passed down to date exist in the form of stone records:

Stone Planisphere of the Southern Song Dynasty in Suzhou

The stone planisphere kept in Suzhou today is China's earliest and most complete star map still extant. On the map are 1,434 stars, the ecliptic, the equator, the Milky Way and the twenty-eight constellations. The lower part of the planisphere is occupied by explanations totaling over 2000 characters, which constitute a general introduction to the astronomical knowledge that man had grasped by that time.

Stone Planisphere of the Five Dynasties

The stone planisphere is believed to be built between 941 and 960, precisely

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recording the positions of stars. It is 300 years earlier than the one in Suzhou, and one time bigger in diameter.

The Dunhuang Star Map

In 1899, the Dunhuang Star Map was found in the Dunhuang Mogao Grotto in a cache of manuscripts in a covered alcove. In 1907, a British man named Aurel Stein and a French man Paul Pelliot stole 9000 historical relics and artwork rolls, among which was a star chart numbered MS3326 with over 1350 stars painted on it. The map is now preserved in the British Museum.

Believed to be drawn as far back as 705 to 710 AD approximately, during the reign of Emperor Zhongzong of the Tang Dynasty, the star chart is recognized as the most important extant in the world, boasting of the most stars, and as one of the most valuable treasures in astronomy.

Beginning in December, the chart depicted the constellations near the equator in 12 sects based on the position of the sun. Besides, the Purple Forbidden Enclosure was drawn on the round plane projection map centered at the North Pole. This approach served as the predecessor of drawing star maps scientifically in China. And it is noteworthy that the method did not appear in foreign countries until 600 years later.

The Dunhuang Star Map contains over 1350 stars, among which are many very faint stars that are extremely difficult to find with the naked eye. The stars on the map are categorized into three schools with three colors, white, black and yellow representing stars of Wu Xian, Gan De and Shi Shen respectively. Though ancient Babylonians and Greeks also observed the sky and catalogued stars, no such complete record of the stars may exist or survive.

In ancient China, star maps would usually be found in imperial archives. What was the Star Map doing in Dunhuang remains unknown. It is speculation but it could be used to guide travelers along the Silk Road. Dunhuang was the last major resting place before starting on the journey on the north or south routes across the Taklamakan desert to the west.

The Sun, Moon and Stars in Western Han Frescoes in Luoyang

The Sun, moon and stars have found in the frescoes of the Wetern Han Dynasty excavated in Luoyang. Among 12 colored paintings, the first, from the east to west, depicted the sun, the seventh the moon and the other ten the stars.

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Shi Shi Star Chart

The star chart is a systematic collection of the stars in coordinates, usually compiled by the astronomic observers after long-term observation. It is an important reference tool for astronomers. The earliest star chart in China is compiled by Shi Shen(about 4th century BC), who lived in the Warring Stated Period. In his book *Astronomy*, later known as *Shi Shi Star Chart*, he records the determinative stars of the 28 constellations and the positions of over 100 stars in the equatorial coordinate system. *Shi Shi Star Chart* is one of the oldest star chart known in the world today.



中国古星象图
Star Maps

中国古星象图大致可分为两类，一类是为装饰或宗教目的制作的示意性星象图；另一类是常出现在书籍、画卷、石刻仪器等上面具科学性的星图，是古代天文观测者为认知教学和记录天空星星位置而绘制的。

历史上有非常多具有高科学研究价值的古星图都已经失传，得以流传至今的大多是以石刻记载的方式留下的：

苏州南宋石刻

南宋时在苏州雕刻的天文图碑，是中国现存最早且最完整的一块天文图石刻。碑石上部共刻恒星 1434 颗，还刻有黄道、赤道、银河及二十八星宿。碑石下方有 2000 多字的说明，概括地叙述了当时所知的一些天文知识。

五代吴越文穆王墓石刻星象图

五代吴越文穆王墓石刻星象图是公元 941 至 960 年间建造的，星象位置相当准确，比苏州石刻天文图早了 300 多年，尺寸约比苏州天文图直径大一倍。

敦煌星图

1899 年，敦煌莫高窟藏经洞中发现敦煌星图。1907 年被英国人斯坦因和法国人伯希和盗走了 9000 种敦煌历史文物及艺术品卷子，其中有一卷编号 MS3326 的星图，上绘有 1350 多颗星。该图现收藏于大英博物馆。

学者普遍认为敦煌星图绘于唐中宗时公元 705 ~ 710 年前后，是世上现存古星图中记载星数最多、最古老的重要星图，在天文史上具有重要价值。

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这卷图的画法是以十二月为开始，按照每月太阳位置的所在，分十二段把赤道附近的星座绘出；最后，再把紫微垣画在以北极为中心的圆形平面投影图上。这种画法开创了中国星图的科学绘制法。在此应该特别提出，国外使用类似的画法要比敦煌星图晚600多年。

星图绘制的1350多颗恒星，其中许多仅凭肉眼难以辨别。这1350多颗恒星被分为三系，以白色、黑色及黄色三种颜色绘成，分别代表巫咸星表、甘德星表和石申星表中的星。

古巴比伦人和古埃及人也曾观测过天空，并对恒星作了分类，然而，像敦煌星图这样完整地记录星体并且保留下来的星图是绝无仅有的。

在中国古代，星图通常藏于皇家档案中。敦煌星图何以出现在敦煌尚未知晓。人们推测，敦煌星图的作用可能在于为行人指路。敦煌是丝绸之路上经北线或南线穿越塔克拉玛干沙漠西行的最后一个重要驿站。

洛阳西汉壁画墓中的日、月、星象图

洛阳西汉壁画墓中的日、月、星象图。12块长方砖上的彩绘，由东而西，第一幅是太阳，第七幅是月亮，其余10幅都是星象图。

《石氏星表》

星表者，乃是天文观测者长期观察后，将大量测得的恒星以坐标系统性地汇编而成，它是天文学家们的重要参考工具。我国古代最早的星表编制人是战国时代的石申（约在公元前4世纪），他编的《天文》一书共八卷，被后人誉为《石氏星表》。其中明列二十八宿距星和100余颗恒星的赤道坐标位置。《石氏星表》是现知世界上最古老的星表之一。



《甘石星经》
The Ganshi Classic of the Constellation

The Chinese people have paid great attention to astronomical phenomena since very early times. Meteor showers and solar eclipses which occurred as far back as in the Xia Dynasty(2070BC ~ 1600BC) are recorded in ancient books, and are thought to be the earliest astronomical accounts in the world. By the Spring and Autumn and Warring States periods, astronomy had reached quite a

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high level of sophistication. Astronomers of the State of Lu observed 37 solar eclipses, among which 33 have been proved accurate. The earliest record of an appearance by Halley's Comet (613 BC) is contained in the chronicle of Lu known as *The Spring and Autumn Annals*.



During this period there appeared specialized works on astronomy. Based on their long-time observation of the celestial phenomena, Gan De of the State of Chu wrote a work titled *Astronomy and Astrology* in eight volumes, and Shi Shen of the State of Wei wrote his Astronomy, also in eight volumes. The two works were combined later generations as *The Ganshi Classic of the Constellations*. The earliest astronomical work extant in the world, it recorded the motions of Mercury, Jupiter, Venus, Mars and Saturn, and the rules dictating their appearances. It also recorded the names of 800 stars, of which the positions of 121 have been pinpointed. Gan De discovered Jupiter's moon with the naked eye, 2,000 years earlier than the Italian astronomer Galileo, who discovered it with an astronomical telescope in 1609. Shi Shen discovered the reason for solar and lunar eclipses. A crater on the moon has been named after Shi Shen.

《甘石星经》
The Ganshi Classic of the Constellation

中国人很早就注意观察天象。古书上关于夏朝(前2070年~前1600年)时流星雨和日食的记载,是世界天文史上最早的记录。春秋战国时期,天文学已取得了相当高的成就。鲁国的天文学家在对天象的观测中,观测到37次日食,其中33次被证明是可靠的。哈雷彗星早在公元前613年鲁国的史书《春秋》就有记载,这是世界上关于哈雷彗星的最早的记录。

这一时期还出现了天文学专著。在长期观测天象的基础上,楚国人甘德著《天文星占》八卷,魏国人石申撰写《天文》八卷,后人将它们合为一部,称《甘石星经》,这是世界上现存最早的天文学著作。书中记录了水、木、金、火、土五大行星的

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运行情况以及它们的出没规律。书中还记录了800个恒星的名字,有121个的位置现在已经被测定。甘德还用肉眼发现了木星的卫星,比意大利天文学家伽利略在1609年用天文望远镜发现该星早2000多年。为了纪念石申,月球上有一座环形山就是用他的名字命名的。



彗星
Comet

Chinese records of comets *dated back to a long time ago*. During the Spring and Autumn Period, some 2,200 years ago, Chinese documents already had records of comets, among which the most verifiable one is the record of a comet, which appeared in 613 BC, in *Spring and Autumn Annals*. It is recognized as the earliest mention of Halley's Comet in the world, 670 years earlier than the Western Europe, where the earliest record of Halley's Comet was in AD 66.



Since Halley's Comet visits the earth once every 76 years, it came back to the earth 29 times during a period of 2,149 years from 240 BC (the 7th year of the reign of the First Emperor of Qin) to 1910 (the 2nd year of the reign of Emperor Xuantong of Qing). Each of these visits was clearly recorded by Chinese scholars. J. R. Hind, a British astronomer, once used these continuous data to calculate the orbit of Halley's Comet, and discovered that the angle of the orbit showed a narrowing trend. In the Han Dynasty, it was 170 degrees, but it narrowed down to 161 degrees in the mid-9th century.

From 1600 BC to AD 1600, China recorded comets 581 times, leaving behind valuable materials. In 635 BC, Chinese astronomers pointed out that the comet always traveled with its back to the sun. Without these repeated observations, the

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detailed descriptions of the comet tails could not have been made, nor could the relationship between the sun and comets have been correctly deduced.



彗星
Comet

中国古代关于彗星的纪事很早。早在2200多年前春秋时期的古文献中已有关于彗星的记录。最可靠的是《春秋》对出现于公元前613年的彗星记录。这是世界上关于哈雷彗星的最早记录。西欧对哈雷彗星的最早记载是公元66年，这比中国最早的记载晚了670余年。

哈雷彗星大约每隔76年出现一次，从公元前240年到公元1910年的2149年期间，史书对哈雷彗星出现的记载多达29次，且记述详尽。英国天文学家J. R. 海德曾经使用这些数据计算哈雷彗星的运行轨道，他发现，彗星运行轨道角度呈变小趋势：在汉代，角度为170°，到19世纪中叶，则减至161°。

从公元前1600年到公元1600年，中国古代对彗星的记载多达581次，留下了极为珍贵的资料。公元前635年，中国古代天文学家指出，彗星总是背对太阳运行。没有上述有关彗星的反复观察，关于彗尾的描述则不可能详尽，也不可能对太阳和彗星之间的关系做出正确的分析。



新星和超新星
Novas and Supernovas

Novas and supernovas are all variable stars created by nova outbursts. During a nova outburst, the brightness may increase over the course of a few days by several thousand or even dozens of thousands of times. Then it will gradually dim, eventually returning to its original brightness after several or dozens of years.

The outbursts of supernovas are even more spectacular, increasing their

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brightness by up to hundreds of millions of times. The ancient Chinese people named such celestial bodies "guest stars". The earliest record on guest stars in China dates back to as early as in the 14th century BC, about a nova near the α Star on the Scorpio Constellation.

During the period between the Shang Dynasty and the end of the 17th century, 78 novas and especially 12 supernovas were recorded in China's historic books. Such a rich and systematic record of supernovas is unique in the world.

Of all the recorded novas and supernovas, the most brilliant was the supernova near the Tianguan Star in the Taurus constellation, which lasted two years after its outburst.

After the birth of the radio telescope in the 1930s, many scholars in the world, in an effort to search for the correspondence between the radio source in the Milky Way galaxy and the supernova, carried out detailed research on the ancient records on novas and supernovas. It turned out seven of the twelve supernovas recorded by ancient Chinese astronomers correspond to the radio source, which shows the importance of China's records on guest stars to modern astronomic research.



新星和超新星
Novas and Supernovas

新星和超新星都是由新星的爆发而产生的变星。新星的爆发有时能在几天时间内将这颗星的亮度增强几千到几万倍，随后它又会渐渐暗弱下去，几年或十几年之后最终回到原来的亮度。

超新星的爆发更加壮观，可以将这颗星的亮度增强到几百万倍，中国古人称这类天体为"客星"。中国最早的客星记载是大约公元前 14 世纪出现于天蝎座 α 星（心宿二）附近的一颗新星。

自商代至 17 世纪末，中国史书共记载了 78 颗新星、12 颗超新星，这么丰富而又系统的超新星纪事，在世界上是独一无二的。

在中国史书中所记载的新星、超新星中，最精彩的要算宋至和元年（1054 年）出现在金牛座天关星附近的超新星，这颗超新星爆发后达两年之久才变暗。

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20世纪30年代射电望远镜问世后，世界上许多学者为了寻找银河系中射电源和超新星的对应关系，无不对中国古代的新星、超新星记录做详细研究。研究证明，在中国古代的12次超新星记录中，有7颗以上对应着射电源。这充分说明中国古代的客星纪事对现代天文学的研究所起的重要作用。



日食
Solar Eclipse

A long time ago, people noticed that the sun and the moon sometimes suddenly lost their brightness. People could not figure out the reason and feared that, once gone, the brightness would not return and would mean the end of the world. Because of this, the ancient Chinese began to observe solar and lunar eclipses, recording the time and size of the eclipse, and searching for the causes of eclipses.



Solar eclipses, especially total solar eclipses, are eye-catching celestial events. As early as 3,000 years ago, the ancient Chinese people had made records on such astronomic phenomena. The earliest solar eclipse record that can be verified appears in *The Classic of History* (The Punitive Expedition of Yin in Shang Shu), about an eclipse took place around 2043BC during the Xia Dynasty.

Excavated bone and tortoise shell inscriptions of the Shang Dynasty recorded five solar eclipses that took place between the 14th and 12th centuries BC.

In *The Book of Songs*, a solar eclipse was also recorded. It was verified that the solar eclipse took place on September 6, 776BC.

By the Han Dynasty, records on solar eclipse were no longer limited to the time of an eclipse, but also covered the sun's position, the starting and ending times of eclipses, and the coverage size.

Statistics show that during the Spring and Autumn Period (770BC ~ 446BC) a-

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lone, there were 37 solar eclipse records, among which 33 have been proven to be reliable. By the time of Emperor Qianlong's reign in the Qing Dynasty (1644 ~ 1911), the total number of records had reached 1000. This number represents the world's most complete solar eclipse record, which is of great value to the astronomic research.



日食
Solar Eclipse

很久以前,人们注意到太阳和月亮有时会突然间丧失光芒。人们找不出原因,害怕太阳和月亮光芒一去不返,世界末日来临。于是,中国古人开始观察日月食,记录日月食发生的时间、食分,探索产生日月食的原因。

日食,尤其是日全食是最引人注目的天象之一。我国古人早在3000多年以前就对日食现象做了记载。最早的记载是《尚书·胤征》,据考证,这次日食大概发生于夏代仲康元年。

在出土的商代甲骨卜辞中,被认定的日食纪事有5次。这是发生在公元前14世纪至12世纪之间的日食纪事。

《诗经》中也有日食纪事。据考证,这次日食发生在公元前776年9月6日。

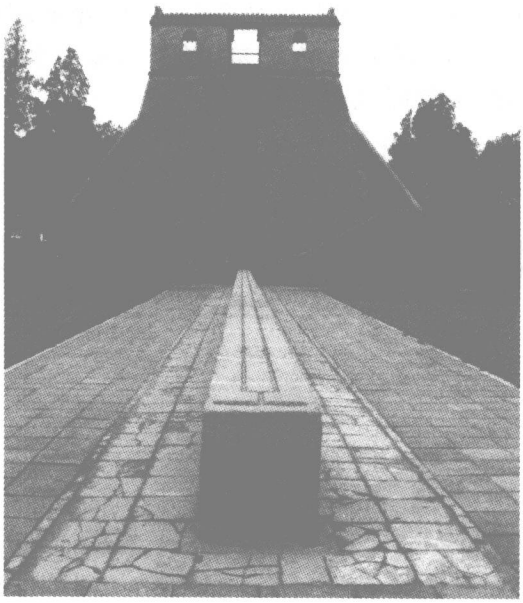
到了汉代,不仅有日食发生时间记录,还有对日食时的太阳位置、起止时刻、食分等的记录。

据统计,仅春秋时代(770BC ~ 446BC)记载的日食就有37次,其中33次已经被证明是完全可靠的。从春秋时代起到清代(1644 ~ 1911)乾隆年间为止,我国记录了大约有1000次左右,算得上是世界上最完整的日食记录,对天文研究具有很大的价值。

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登封观星台
Dengfeng Astro Observatory

Dengfeng Astro Observatory is located at Gaocheng Town, 15 kilometers southeast of Dengfeng City, Henan Province. It is the most ancient astronomical observatory extant in China. Performing the functions of measuring the shadow cast by the sun, observing celestial bodies, and telling time, the Astro Observatory is an ancient scientific heritage with significant research value. It was built in the 13th year of the Emperor Zhiyuan (AD 1276), (in the Yuan) by Guo Shoujing and Wang Xun as directed by the emperor, and was among the 27 astronomical observatories in the country at that time.



The observatory, of masonry construction, consists of the platform body and the stone gnomon (commonly named as heaven measuring ruler). With a square plane, the observatory is narrow in the top and large at the bottom. It is 12.62m in overall height. At the north of the observatory are two symmetrical step entrances for observation. The center of the northern wall is built into a hollow groove that is perforated through from top to bottom, so the higher gnomon at the groove's straight wall and the stone gnomon at the bottom constitute a series of gnomon apparatus for measuring the length of the shadow cast by the sun. The stone gnomon at the bottom of the groove is connected with 36 blocks of blue stone from south to north, and is 31.2m in length and 0.58m in width. The gnomon is carved with two parallel two-

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way watercourses. To the south of the watercourses is a suction sump, and to the north a discharge sump. Each sump has scales for measuring the levelness.

登封观星台
Dengfeng Astro Observatory

登封观星台位于河南省登封市城东南15千米的告城镇,是中国现存最古老的天文台。该观星台具有测影、观星和记时等功能,是具有重要研究价值的古代科学遗产。该台为至元十三年(1276年)郭守敬、王恂等人奉敕所建,是当时全国修建的27个天文观测站之一。

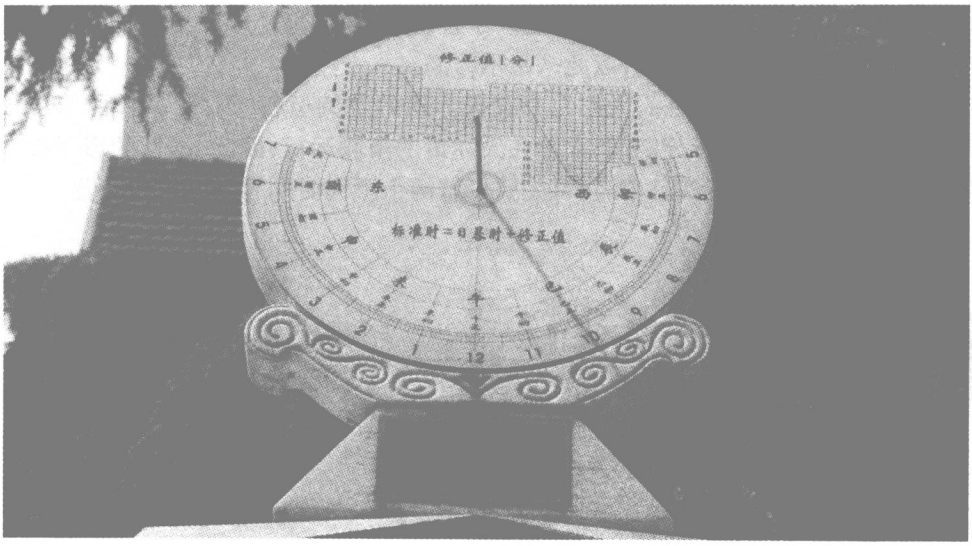
台为砖石混合结构,由台身和石圭(俗称量天尺)两部分组成。台的平面呈方形,台体上小下大,通高12.62米。台北设有两个对称的踏道口可以登台眺望。北壁中间砌成一个上下直通的凹形直槽,凹槽直壁与横梁组成的高表与台下石圭形成一组测量日影长度的圭表装置。槽底石圭自南向北由36方青石连接而成,长31.2米,宽0.58米,上刻两条平行双股水道。水道南端有注水池,北端有泄水池,池中有刻度,用以测量水准。

日晷
The Sundial

The sundial, an ancient Chinese timekeeping instrument consisting of a bronze needle and a stone dial, measures the time by taking advantage of the shadow of the sun. The needle crosses the center of the dial vertically, just like the pole of the gnomon, and the stone dial is placed onto a stone platform, higher in the south and lower in the north. The sundial surface is therefore parallel to the equatorial plane. The upper end of the sundial points right to the North Pole, and the lower end to the South. Both sides of the dial are divided into 12 parts, each part representing two hours. When the sunlight beams down on the

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sundial, the shadow of the needle falls on the surface and moves as the sun moves. Therefore, the needle's shadow resembles the needle of a modern watch or clock, and the stone dial is like the watch or clock's dial plate, indicating time.



From the vernal equinox (about March 20) to the autumn equinox (about September 22), the sun moves in the northern side of the equator, casting the needle's shadow on the upper part of the stone dial. Likewise, since the sun moves in the southern side of the equator from the autumn equinox to the vernal equinox, the shadow is cast on the lower part. Therefore, when observing the sundial, it is important to first find out the projection position in the two different periods.

日晷
The Sundial

日晷又称“日规”,中国古代利用日影测得时刻的一种计时仪器。通常由铜制的指针和石制的圆盘组成。铜制的指针叫做“晷针”,垂直地穿过

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圆盘中心，起着圭表中立竿的作用，因此，晷针又叫“表”，石制的圆盘叫做“晷面”，安放在石台上，呈南高北低，使晷面平行于天赤道面。这样，晷针的上端正好指向北天极，下端正好指向南天极。在晷面的正反两面刻划出 12 个大格，每个大格代表两个小时。当太阳光照在日晷上时，晷针的影子就会投向晷面，太阳由东向西移动，投向晷面的晷针影子也慢慢地移动。于是，移动着的晷针影子相当于现代钟表的指针，晷面则是钟表的表面，以此来指示时间。

由于从春分到秋分期间，太阳总是在天赤道的北侧运行，因此，晷针的影子投向晷面上方；从秋分到春分期间，太阳在天赤道的南侧运行，因此，晷针的影子投向晷面的下方。所以在观察日晷时，首先要了解两个不同时期晷针的投影位置。



张衡和地动仪
Zhang Heng and the Seismograph

In the Exhibition Hall of the Museum of Chinese History in Beijing, there is a restored model of the first seismograph, which was called Houfeng Didong Yi (lit. an instrument for measuring the seasonal winds and the movements of the Earth). The inventor was Zhang Heng, a famous scientist in the Eastern Han Dynasty.

Zhang Heng was from Nanyang of Henan Province. He studied diligently, and was especially fond of astronomy, calendar and mathematics.

During the Eastern Han period, earthquakes occurred frequently. Contrary to the popular belief at that time, Zhang Heng maintained that earthquakes were not signs of Heaven's anger but natural disasters. As a result of careful observations of earthquakes, he invented a seismograph in the then national capital of Luoyang in 132 AD, which was the world's first instrument to identify and ascertain the direction of earthquakes. The seismograph was made of fine copper, and was ingeniously constructed. Inside, there was a balanced post and eight rods. Outside, it was cast with eight dragons on the surface (whose heads pointed in eight directions-east, south, west, north, southeast, northeast, southwest, and northwest), and each dragon had a copper ball in the mouth. On the ground below the dragons there were eight copper toads raising their heads and opening their mouths oppo-

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site the dragons' mouths. When an earthquake occurred, the balanced post would tilt in the direction of the quake and push a rod. The dragon facing that direction would open its mouth, and the ball would fall into the mouth of the toad below, automatically indicating the direction of the earthquake. One day in 138 AD, the dragon in the west expelled its ball. As expected, an earthquake had occurred that day in Longxi (present-day Western Gansu Province) a thousand kilometers away. It was the first time that mankind had used an instrument to detect an earthquake. It was over 1,700 years later that a similar instrument was invented in Europe.



Unfortunately, the seismograph has not been handed down. It may have been lost after the Yongjia Turbulence in Western Jin Dynasty (307~312). Its original shape can only be inferred from documents like *Eastern Han Dynasty Records* and *History of East Han Dynasty*.

Zhang Heng was also a mechanical engineer. He ever made a flying "wooden eagle" and a "mileage-counting drum-cart".

People highly esteem Zhang Heng, a great scientist living more than 1,800 years ago, and they often hold commemorative activities to show respect for him. A ring of hills on the moon was named after him.

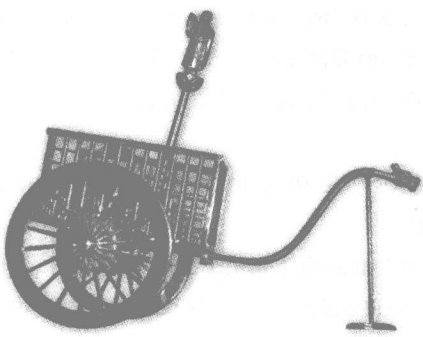
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张衡和地动仪
Zhang Heng and the Seismograph

在北京中国历史博物馆的展览大厅里，陈列着世界上第一架地动仪的复原模型。这架地动仪的发明者是中国东汉时著名的科学家张衡。

张衡，河南南阳人。他勤学好问，博览群书，特别爱好天文、历法和数学，是一位博学多才的科学家。

东汉时期，地震很活跃。当时的人们不懂科学，以为地震是鬼神发怒。张衡认为地震是一种自然灾害，他根据自己对于地震现象的观测，于公元 132 年在京城洛阳制成了“候风地动仪”，这台仪器成为世界上第一台观测地震方向的仪器。地动仪全部用精铜铸成，结构非常精细巧妙。仪器内部竖有一根铜柱，周围有 8 根杆子。仪器表面铸有八条垂直向下的龙，龙头分别对准东、南、西、北、东南、东北、西南、西北八个方向，每条龙的嘴里都含着一个铜球。在对着龙嘴的地上，蹲着八个仰着头、张着嘴的铜蟾蜍。当某个方向发生地震时，柱子就倒向那个方向，触动杆子，仪器上对着那个方向的龙嘴就会张开，铜球就会掉进铜蟾蜍的嘴里，自动报告发生地震的方向。公元 138 年的一天，地动仪西边的龙嘴吐出了铜球。果然，远在千里之外的陇西（今甘肃西部一带）在这一天发生了地震。这是人类第一次用仪器测报地震。在欧洲，直到 1700 多年后，才发明了同类的仪器。



遗憾的是，地动仪未能流传下来，可能是在西晋永嘉之乱（307 ~ 312）之后失落的，现在只能从《后汉记》、《后汉书》等文献中推测它的原貌。

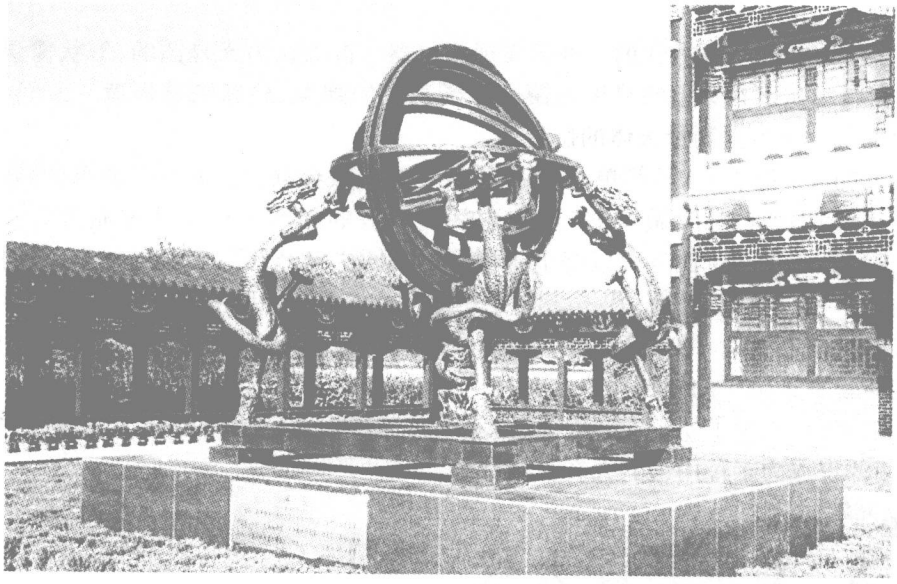
张衡还是一位机械工程师，制造过能飞的“木雕”和能计算里程的“计里鼓车”。

人们非常敬重张衡这位 1800 多年前的大科学家，经常举行纪念活动，表示对他的敬意。月球上有一座环形山是以他的名字命名的。

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浑仪
The Armillary Sphere

The Armillary Sphere was an astronomic observatory instrument in ancient China. The ancient people believed the heaven was round, just like an egg, with the stars in the sky resembling the round pills beset in the shell and the earth like the yolk. People used the armillary sphere to examine the position of celestial bodies from the earth.



The armillary sphere's structure was very simple at the very beginning, with three rings and a metal axis. The outermost ring—meridian ring—was fixed in the north-south direction, the middle ring—equator ring—was parallel to the earth's equatorial plane, and the innermost one—Chijing ring—could revolve around the metal axis. The Chijing ring and the metal axis intersected at two points, with one pointing to the North Pole and the other to the South Pole. An observatory tube was fixed on the Chijing ring and could rotate around the center of the ring.

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When used for examining the position of stars, the tube was first aimed at a certain star; then the graduation on the equator and Chijing rings was used to pinpoint the star's position in the sky.

Later, in order to facilitate the observation of more celestial bodies, such as the sun, the planets, and the moon, more rings were added inside the armillary sphere, making it a multi-purpose astronomic instrument.



浑仪
The Armillary Sphere

浑仪是中国古代的一种天文观测仪器。古人认为天是圆的，形状像蛋壳，出现在天上的星星是镶嵌在蛋壳上的弹丸，地球则是蛋黄。人们使用浑仪在这个蛋黄上测量天体的位置。

最初，浑仪的结构很简单，只有三个圆环和一根金属轴。最外面的那个圆环固定在正南北方向上，叫做“子午环”；中间固定着的圆环平行于地球赤道面，叫做“赤道环”；最里面的圆环可以绕金属轴旋转，叫做“赤经环”；赤经环与金属轴相交于两点，一点指向北天极，另一点指向南天极。在赤经环面上装着一根望筒，可以绕赤经环中心转动，用望筒对准某颗星星，然后，根据赤道环和赤经环上的刻度来确定该星在天空中的位置。

后来，古人为了便于观测太阳、行星和月球等天体，在浑仪内又添置了几个圆环，使浑仪成为多种用途的天文观测仪器。



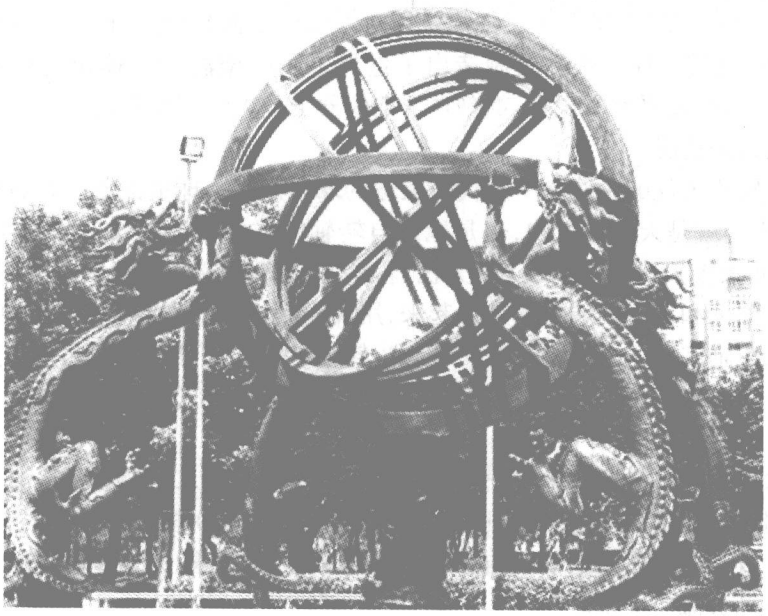
漏水转浑天仪
The Water-driven Armillary Sphere

In the middle of the Eastern Han Dynasty, Zhang Heng, an outstanding astronomer, made bold innovations to the armillary sphere, and designed and made the first water-driven armillary sphere in the world to measure the

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position of celestial bodies, which was carved with known important astronomical phenomena. People could observe the movement of the sun, the moon and the stars.

The major part of the water-driven armillary sphere was a spherical model, representing the celestial globe. Inside the globe there was a metal axis going through the center, with the sphere and the axis intersecting at two points: the north and south celestial points. The direction of the globe represented the direction of the earth's axial rotation.



To enable the armillary sphere to rotate, Zhang employed the gear system, linking the celestial globe with the kettle clepsydra. Powered by the water leaked out of the kettle, the gear drove the celestial globe to rotate around the axis, one day per circuit, in synchronization with the celestial body (sun). In this way, the celestial changes were presented accurately. By observing the instrument, one could know when a star rose in the east and set in the west.

The world's first water-driven astronomic instrument with explicit historical records, the new armillary sphere employed an extremely complex gear system. It was a proud achievement for ancient Chinese people to work out such a complex

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instrument. Unfortunately, the driving system was not handed down, as it was made in the remote past.



漏水转浑天仪
The Water-driven Armillary Sphere

东汉中期,杰出的天文学家张衡对浑仪作了大胆创新,设计并制作了漏水转浑天仪。张衡还制造出了世界上第一架测量天体位置的水运浑天仪,凡是已知的重要天文现象,都刻在这架仪器上。人们可以通过浑天仪观测到日月星辰运行的情况。

漏水转浑天仪的主体是一个代表天球的球体模型。球里面有一根铁轴贯穿球心,轴的方向就是天球的方向,也是地球自转轴的方向。轴和球有两个交点,一个是北极(北天极),一个是南极(南天极)。为了让浑天仪能自己转动,张衡采用齿轮系统把浑象和记时用的漏壶联系起来,用漏壶滴出来的水的力量带动齿轮,齿轮带动浑象绕轴旋转,一天一周,与天球同步转动,这样,就可以准确地把天象的变化表示出来。人在屋子里看着仪器,就可以知道某星正从东方升起,某星就要从西方落下。

漏水转浑天仪是有明确历史记载的世界上第一架用水力驱动的天文仪器。浑天仪应用到的齿轮机构和凸轮机构十分复杂。远在1800多年前,中国古人就可以造出这样复杂的仪器是很值得自豪的。可惜的是,这套复杂的传动系统因为年代久远没有能够流传下来。

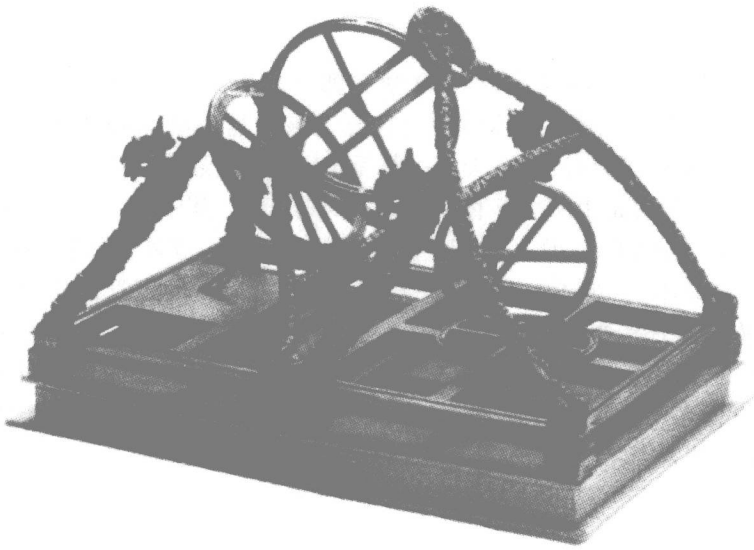


简仪
Abridged Armilla

The Abridged or simplified Armilla was invented in 1276 by Guo Shoujing (1231 ~ 1316), an astronomer in the Yuan Dynasty(1271 ~ 1368), for

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measuring positions of celestial bodies. The apparatus is simpler than the armillary sphere in terms of structure and application, and it gives a panorama of the celestial sphere except the part around Polaris, so it is called Abridged Armilla.



The primary structure of Abridged Armilla contains two large rings that are perpendicular to each other, of which one is parallel with the equatorial plane and is accordingly called "equatorial ring", and the other is a double-ring which is perpendicular to the center of the equatorial ring, revolving around a metallic shaft, and is called "right ascension double-ring". The double-ring holds within itself a sighting tube with crosshairs, which equals to a monocular and revolves around the center of the right ascension double-ring. During observation, the sighting tube is targeted at a certain star, thus the positional value can be read out at the dials of the equatorial ring and the right ascension double-ring. Two stands are supporting the metallic shaft that exactly directs at the south and the north, bracing the entire observing unit to a position in which the north part is higher than the south part. The equatorial mounting, invented by the Chinese, was somewhat 500 years earlier than like devices created in Europe.

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简仪
Abridged Armilla

简仪为元代(1271～1368)天文学家郭守敬(1231～1316)于公元1276年创制的一种测量天体位置的仪器。该仪器的结构和使用都比浑仪简单,而且除北极星附近以外,整个天空一览无余,故称简仪。

简仪的主要装置是由两个互相垂直的大圆环组成,其中的一个环面平行于地球赤道面,叫做"赤道环";另一个是直立在赤道环中心的双环,能绕一根金属轴转动,叫做"赤经双环"。双环中间夹着一根装有十字丝装置的窥管,相当于单镜筒望远镜,能绕赤经双环的中心转动。观测时,将窥管对准某颗待测星,然后在赤道环和赤经双环的刻度盘上直接读出这颗星星的位置值。有两个支架托着正南北方向的金属轴,支撑着整个观测装置,使这个装置保持着北高南低的形状。这是我国首先发明的赤道装置,要比欧洲人使用的赤道装置早500年左右。



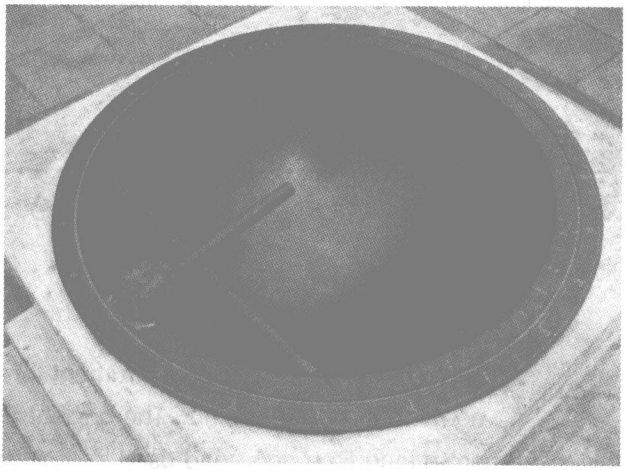
仰仪
The Projection Semi-sphere

An ancient astronomic instrument for observation, the projection semi-sphere was a creation by Guo Shoujing, an astronomer of the Yuan Dynasty.

The main body of the projection sphere is a bronze semi-sphere with a diameter of three meters, like an upturned pot, hence its name "Yang Yi" (Upturned Sphere). Inside the spherical surface, there are drawings of many orderly grids that are used for measuring the position of celestial bodies. Along the pot's mouth is carved a groove, which is used to contain water to see whether the sphere is in a horizontal position. At the edge of the groove are orderly carved 24 lines, indicating directions. Above the reticle (network of lines) in the south direction is in-

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stalled a cross, which extends along the south-north direction until it reaches the center of the instrument, where a small wooden plate with a hole in the center is placed at the end of the cross, evolving around the center of the projection semi-sphere.



Employing projection, the instrument is simple and convenient for observation. For example, when the sunlight goes through the hole, it will project the image of the sun onto the internal spherical surface. Then the observer can read the sun's position from the grids. Particularly, during a total solar eclipse, the whole process of the solar eclipse can be observed with the instrument. Moreover, both the exact position and size of the eclipse at different times can also be measured. Therefore, the projection semi-sphere was greatly loved by astronomy lovers.

仰仪
The Projection Semi-sphere

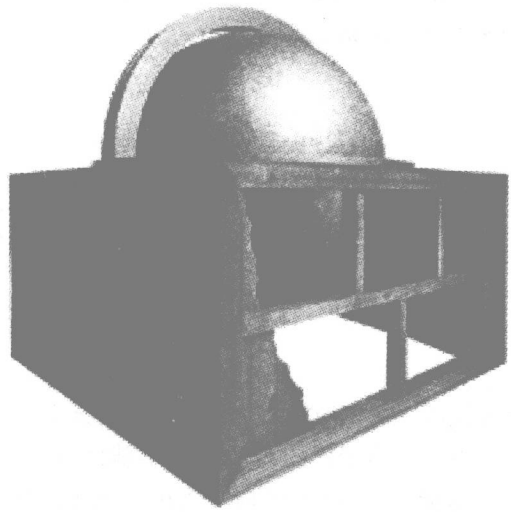
仰仪是中国古代的一种天文观测仪器，由元朝天文学家郭守敬设计制造。仰仪的主体是一只直径约三米的铜质半球面，好像一口仰放着的大锅，因而得名。仰仪的内部球面上，纵横交错地刻划出一些规则网格，用来量度天体的位置。在仰仪的锅口上刻有一圈水槽，用来注水校正锅口的水平，使其保持水平设置；在水槽边缘均匀地刻划出 24 条线，以示方向。在正南方的刻线上安置着两根十字交叉的竿子，呈正南北方向，一直延伸到仰仪的中心，把一块凿有中心小孔的小方板装在竿子的北端，并且小方板可以绕着仰仪中心旋转。

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仰仪是采用直接投影方法的观测仪器，非常直观、方便。例如，当太阳光透过中心小孔时，在仰仪的内部球面上就会投影出太阳的映像，观测者便可以从网格中直接读出太阳的位置了。尤其在日全食时，利用仰仪能清楚地观看日食的全过程，连同每一个时刻，日面亏损的位置、大小都能比较准确地测量出来。因此，仰仪是一种很受古代天文爱好者喜爱的天文观测仪器。

浑象
The Celestial Globe

The celestial globe was an instrument for demonstrating astronomic phenomena in ancient China. The ancient Chinese people learned to make this instrument a long time ago, and used it to pinpoint the position of the sun, the moon, and the stars with respect to each other and to know their movement. The celestial globe is seen as the ancestor of the modern celestial globe.



The one placed in the Ancient Beijing Observatory, with a weight of 3,850 kilograms, is the oldest celestial globe extant in China and was made during the reign (1661 ~ 1722) of Emperor Kangxi during the Qing Dynasty.

The main component of the celestial globe is a hollow bronze globe, with

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crisscross grids on the spherical surface, which are used to delineate the exact position of celestial bodies. A number of stars are marked on the sphere, representing their positions with respect to each other in the sky.

The sphere is mounted by its poles (corresponding to the celestial poles) on a metal axis, and can rotate around it. It takes a night to finish a circle. The globe is placed in a standing hoop, which is beset into a horizontally placed hoop, supported by four pillars decorated with dragonhead patterns.

With the celestial globe, people can figure out the star atlas even during daytime or on a cloudy night.



浑象
The Celestial Globe

天体仪，古称“浑象”，是中国古代一种用于演示天象的仪器。中国古人很早就会制造这种仪器，它可以用来直观、形象地了解日、月、星辰的相互位置和运动规律，可以说天体仪是现代天球仪的直接祖先。北京古观象台上安置的天体仪（如图），是中国现存最早的天体仪，制于清康熙年间，重3850千克。

天体仪的主要组成部分是一个空心铜球，球面上刻有纵横交错的网格，用于量度天体的具体位置；球面上凸出的小圆点代表天上的亮星，它们严格地按照亮星之间的相互位置标刻。

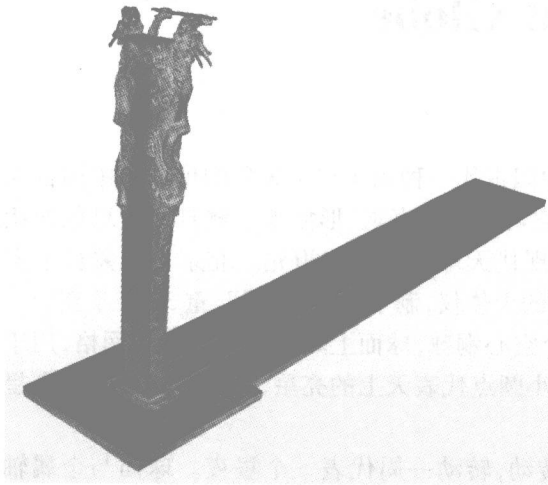
整个铜球可以绕一根金属轴转动，转动一周代表一个昼夜。球面与金属轴相交于两点：北天极和南天极。两个极点的指尖，固定在一个正立着的大圆环上，大圆环嵌入水平大圈内，下面四根雕有龙头的立柱支撑着水平大圈，托着整个天体仪。

利用浑象，无论是白天还是阴天的夜晚，人们都可以随时了解当时应该出现在天空的星空图案。

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圭表
The Gnomon

A simple and important astronomic instrument, the gnomon (an instrument used to calculate the time, season, and so on) is composed of a vertical gnomon (about eight *chi*, or 2.6 meters high) and a horizontal ruler. It is designed to determine the length of a tropical year and the 24 Solar Terms. The ruler has lines to indicate the months of the year.



A long time ago, the ancient people found that things, like houses and woods under the sunshine, would cast shadows on the earth, the changes of which followed a certain rule. In order to observe the shadow's changes, the people erected on the flat ground a straight pole or stone column, which was called a "gnomon", and used a ruler to measure the length and direction of the gnomon's shadow, hence calculating the time (like a sundial).

Later, after noticing the gnomon's shadow always pointed north at midday, the ancient people laid a ruler made of stone plate on the ground, vertical to the gnomon and pointing to the north. In the midday, when the gnomon's shadow was cast over the stone plate, they could read the length of the shadow directly from the ruler.

After a long-time observation, the ancient people not only figured out that at mid-noon the length of the gnomon's shadow was the shortest within a day, but also that at mid-noon of the summer solstice and the winter solstice the gnomon's

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shadow was the shortest and longest respectively within a year. Therefore, they used the midday length of the shadow to measure the solar terms and the length of a year.



圭表
The Gnomon

圭表是一种既简单又重要的测天仪器，它由垂直的表（一般高八尺）和水平的圭组成。圭表的主要功能是测定冬至日所在，并进而确定回归年长度，此外，通过观测表影的变化可确定方向和节气。

很早以前，人们发现房屋、树木等物在太阳光照射下会投出影子，这些影子的变化有一定的规律。于是便在平地上直立一根竿子或石柱来观察影子的变化，这根立竿或立柱就叫做“表”；用一把尺子测量表影的长度和方向，则可知道时辰（如日晷）。

后来，发现正午时的表影总是投向正北方向，就把石板制成的尺子平铺在地面上，与立表垂直，尺子的一头连着表基，另一头则伸向正北方向。正午时，表影投在石板上，古人就能直接读出表影的长度值。

经过长期观测，古人不仅了解到一天中表影在正午最短，而且得出一年内夏至日的正午，表影最短；冬至日的正午，表影则最长。于是，古人就以正午时的表影长度来确定节气和一年的长度。



《灵宪》
Ling Xian (*Mystical Laws*)

A monumental astronomic works, *Ling Xian*, translated as *Mystical Laws*, is a distillation of the years of practice and theoretical research by Zhang Heng, a famous astronomer of the Eastern Han Dynasty. Dealing with such topics as the formation and structure of the heaven and earth and the cosmic

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evolvement as well as the nature and movement of celestial bodies, the book promoted the level of ancient China's astronomical level to a new high and cast a profound impact on the following generations.

The astronomical achievements of *Ling Xian* are as follows:

First, *Ling Xian* discusses the origin and structure of the cosmos. In terms of the formation of the heaven and earth, *Ling Xian* believes that the heaven, the earth, and all the other things have their origins in primitive and chaotic *yuanqi* (vitality). It further holds that, instead of staying permanently unchanged, the structure of the cosmos is constantly developing. These views, basically, are similar to modern theories on the evolution of the cosmos.

Second, based on the theory of sphere heavens, the book scientifically elaborates on the lunar eclipse. As an explanation of the phenomenon, Zhang Heng wrote in the book, "The moon itself is not luminescent, but rather reflecting the sunlight. The part of the moon where the sunlight fails to reach will not give out light. If the moon moves into the shadow of the earth, a lunar eclipse occurs."

Third, in relation of the finity and infinity of the cosmos, Zhang Heng compared the heaven to an eggshell, and the earth to the egg yolk. Zhang Heng, however, did not believe the eggshell to be the boundary of the cosmos. He viewed the cosmos that people could see with the naked eye as limited while the part that could not be seen as infinite.

Fourth, Zhang recorded his measurement of both the sun and the moon's angular diameter, which is 1/736 of the celestial sphere, or rather 29° 21″ (or 29′21″), an absolute difference of 2°from the modern average value of 31°5″ (or 31′5″). Considering the scientific level and observatory conditions of over 2000 years ago, the number is fairly precise.

Fifth, based on his careful observation of the celestial bodies, Zhang Heng sorted out the various star charts made by his predecessors and re-established a new chart, recording the position of over 3,000 stars.

The last but not the least, concerning the movement of the five planets, Zhang wrote: "The sun, the moon and the five planets all move in-between the heaven and earth, rather than on the wall of the celestial sphere. Moreover, the seven celestial bodies move at different speeds."

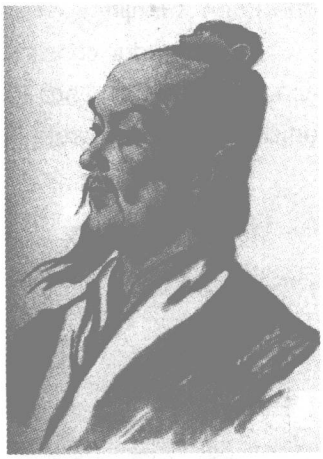
Ling Xian, is one of the most outstanding astronomic works in the history of ancient Chinese astronomy, represents a milestone in the development of Chinese astronomy. Its importance in the astronomical history is not lessened at all by its

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mistakes and shortcomings.

《灵宪》
Ling Xian (Mystical Laws)

《灵宪》是东汉著名天文学家张衡积多年的实践与理论研究写成的一部天文巨著。该书全面阐述了天地的生成、宇宙的演化、天地的结构、日月星辰的本质及其运动等诸多重大问题，将中国古代的天文学水平提升到了一个新阶段，并对后世产生了深远的影响。



《灵宪》的天文学成就如下：

第一，论述了宇宙的起源和宇宙的结构。关于天地的生成问题，《灵宪》认为天地万物是从原始的浑沌未分的元气发展来的。这种天体演化思想，是从物质运动的本身来说明宇宙的形成，认为宇宙结构不是亘古不变的，而是不断发展变化的。这些观点，与现代宇宙演化学说在基本原理上是相通的。

第二，在浑天说的基础上，科学地阐述了月食的原因。张衡在《灵宪》中写道："月光生于日之所照；魄生于日之所蔽。当日则光盈，就日则光尽也。"（大意为：月亮本身是不发光的，而是太阳光照射到月亮上，月亮才折射出光，太阳光照不到的地方则出现亏缺。如果月亮进入地影，就会发生"月食"。）

第三，宇宙的有限性和无限性。张衡把天比作一个鸡蛋壳，把地比作蛋壳中的鸡蛋黄，但他并不认为硬壳是宇宙的边界。张衡认为，人们目之所及的宇宙世界是有限的，但在人们目之所及之外的宇宙世界则是无限的。

第四，张衡实测出日、月的角直径是整个周天的1/736，即29°21′，这与近代天文测量所得的日和月的平均角直径值31°5″相比，绝对误差仅有2′。由于2000多年前的科学技术水平及观测条件，这个数值可以说是相当精确的。

第五，张衡在认真观察天体的基础上，对前人留传下来的好几种星表作了整理、汇总，建立了恒星多达三千的新星表。

第六，关于五星的运动问题，张衡提出：日、月、五星是在天地之间运行，而非在

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天球壁上运行。并且,这七个天体运动的速度各不相同。

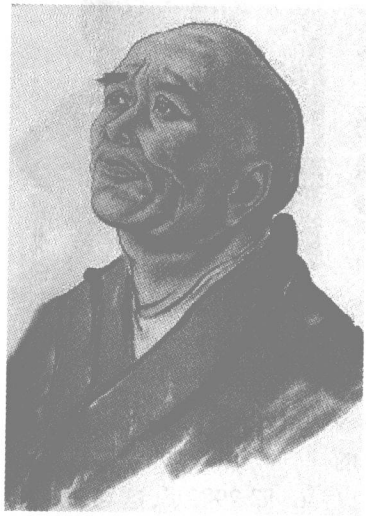
《灵宪》是中国古代天文学史上最杰出的天文学著作之一,也是中国天文学发展的一个里程碑。虽然其中还有一些错误和不足,但在天文学史上的意义并不因此而逊色。



《大衍历》
Da Yan Calendar

Da Yan Calendar was drafted by Zhang Sui (683 ~ 727, also named Seng Yixing) in 727, and was later sorted out by Zhang Shuo (667 ~ 730) and Chen Xuanjing.

The calendar consists of seven parts that elaborate on a variety of computation. There are another 12 articles dealing with some theoretical issues, mainly the articles Zhang Sui wrote in the calendar.



At the beginning of calendar making, in order to measure the position of stars in their orbits and get the law of movement, Zhang, in cooperation with his colleagues, made the bronze armillary sphere and ecliptic sphere, with which they gathered lots of astronomic data through practical observation, and carried out effective astronomic research. For instance, they remeasured the position of over 150 stars and the degree between the 28 constellations and the celestial North Pole, hence concluding the stars were always in motion. Based on this fact, Zhang inferred other stars on the celestial bodies were also movable, overthrowing the conclusion reached by his predecessors. Halley (1656 ~ 1742), a British astronomer, also put forward a similar viewpoint, but was over a thousand years later.

In revising the calendar, Zhang attached huge importance to practice. Together with Nan Gongshuo, he used a post to measure the shadow cast by the sun,

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and calculated the relations between the sun's positions and the solar terms. Besides, Zhang also designed an astronomic instrument called *Fujuyi* for measuring the altitude of the North Pole in different places throughout the country.

Between 724 ~ 725, Zhang led a large-scale project to identify the astro-geodetic measurement of 13 places and, based on the results, concluded that the length of a degree of the meridian line was 351.27 *li* (131.3 kilometers) by the Tang measurement. This was the first measurement of the meridian ever done in the world.

Beginning in 725, Zhang set out to revise the calendar, and finished the draft, namely the *Da Yan Calendar*, before his death in 727. The new calendar was implemented in 728.

An innovative calendar in Chinese history, *Da Yan Calendar* inherited the strong points of calendars of the previous dynasties, while making improvement on the shortcomings and defects, making a significant breakthrough in the calendar-making field. The calendar provided a deep insight into the asymmetrical movement of the sun and the moon. The most prominent point about it lies in the correct calculation with a new formula of the speed of the sun's movement along the ecliptic.

Well organized and logically deducted, *Da Yan Calendar* was more precise than its predecessors, and it served as a benchmark for calendar makers for many dynasties afterwards.

Da Yan Calendar was a leading calendar in the world at that time. In 717, Japan sent Kibi Makibi to China to study astronomy, and when he went back to Japan in 735, he brought with himself manuscripts of *Da Yan Calendar*, and the calendar was spread to Japan and used there for over a hundred years.



《大衍历》
Da Yan Calendar

《大衍历》,公元727年唐朝天文学家张遂(683 ~ 727,又名僧一行)修订,后经张说(667 ~ 730)和陈玄景整理成文。

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《大衍历》分七章，详细介绍了各种计算方法。此外，张遂还在《大衍历》中写了12篇相关理论问题的文章。

在《大衍历》修订初期，为了测量日、月、星辰在其轨道上的位置和掌握其运动规律，张遂等人制造了观测天象的“浑天铜仪”和“黄道游仪”。借助天文仪，通过实际观测，他们搜集了许多天文数据，有效地进行了对天文学的研究。例如，通过重新测定150多颗恒星的位置，多次测定二十八星宿距天体北极的度数，发现恒星是运动的。根据这个事实，张遂推断出天体上的恒星肯定也是移动的，于是推翻了前人的恒星不运动的结论。英国天文学家哈雷(1656～1742)也提出了恒星自己移动的观点，但比张遂的发现晚1000多年。

在历法修订过程中，张遂非常重视实践。张遂和南宫说等人一起，用标竿测量日影，推算出太阳位置与节气的关系。张遂设计制造了“复矩仪”，用于测量全国各地北极的高度。

公元724～725年，张遂组织了全国13个点的天文大地测量。从测量数据中，张遂得出了北极高度相差一度，南北距离就相差351里80步(合现代131.3千米)的结论。这个数据就是地球子午线一度的弧长。唐朝测出子午线的长度，在当时的世界上还是第一次。

公元725年，张遂开始编订历法，至逝世前完成《大衍历》草稿。公元728年《大衍历》颁行。

《大衍历》是一部具有创新精神的历法，它继承了前朝历法的优点和长处，对不足之处和缺点作了修正，因此，在历法制定领域取得了重要突破。《大衍历》对太阳和月亮的不均匀运动有很深见解，最突出的表现在，它运用新的公式比较正确地计算出太阳在黄道上运行的速度。

《大衍历》结构合理、逻辑严密，比以往各朝代历法更精确，成为后世历法编制的经典模式。

《大衍历》是当时世界上先进的历法。公元717年，日本派吉备真备来中国学习天文学，735年，吉备真备回国时带走了《大衍历》。于是《大衍历》便在日本广泛流传起来，作为历法使用了100多年。



《授时历》
Shoushi Calendar

Shoushi Calendar, the most outstanding calendar in ancient China, was compiled by Guo Shoujing, a prominent scientist in the Yuan Dynasty, and his colleagues. Enforced in 1281, throughout the Ming Dynasty and the begin-

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ning of the Qing Dynasty, the calendar was used for over 360 years.

The reason why the calendar was used for such a long time has much to do with its accuracy in calculation. In the first place, it employed astronomical documents of the highest accuracy in its time. For instance, it set the tropical year at 365.2425 days, which was the exactly the same as that in the currently used Gregorian Calendar, 301 years preceding the latter though. Secondly, based on earlier scholars' finding that the length of the tropical year was gradually shortening, the *Shoushi Calendar* held that the tropical year shortened by 0.0001 day every 100 years, which was more accurate as compared with earlier researches.



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In addition, instead of the mathematical method of recording astronomical documents via complicated fractions, the calendar employed decimal fractions, which largely reduced calculation workload and guaranteed accuracy. It also made innovations in terms of calculation methods; for instance, the use of mathematical approaches like cubic interpolation, polynomial equations to the 4th order and spherical trigonometry.

Soon after its compilation, *the Shoushi Calendar* was spread to and adopted by Japan and Korea. In recent years, astronomers from Japan, European and North American countries are again showing interests in *the Shoushi Calendar*, and some broad and in-depth researches have been made. As an advanced and accurate calendar in the history of China, *the Shoushi Calendar* also occupies a distinct position in the history of world astronomy.



《授时历》
Shoushi Calendar

《授时历》是中国古代最优秀的历法。由元代著名科学家郭守敬等人编制，从1281年开始实行，历经整个明代，一直到清初，共用了360多年。

《授时历》之所以沿用这么长时间，和它的计算精度非常高有很大关系。首先，它使用了当时最为精确的天文资料。例如，它确定了回归年的长度为365.2425日，与现今通行的公历值完全一致，但是它比格里高利历早了301年。其次，它吸收了前人研究发现的回归年的长度在逐渐变小的观点，规定100年中回归年的长度减小0.0001日。与前人研究相比，这个数值要精确一些。

另外，《授时历》废除了用复杂分数表示天文资料的办法，使用小数制，不仅大大减少了计算量，也保证了计算精度。《授时历》在计算方法上也有创新，例如三次插内插法、四次多项式方程、球面三角法等数学方法的使用。

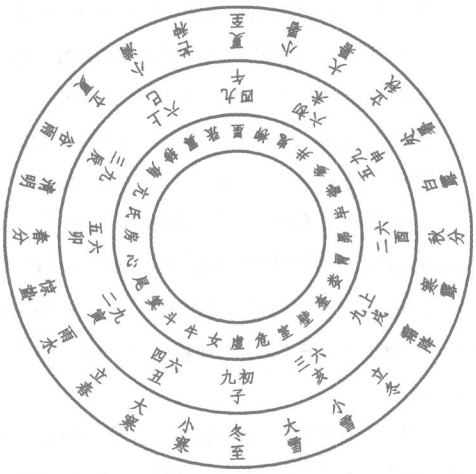
《授时历》编制不久即传播到日本、朝鲜，并被采用。近年来日本和欧美等国的天文学家对《授时历》产生了新的兴趣，进行了广泛而深入的研究。作为中国历史上一部先进的、精确的历法，《授时历》在世界天文学史上也占有突出的位置。

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二十四节气
The 24 Seasonal Division Points

According to the way of numbering the years in Chinese lunar calendar, there are two seasonal division points in each month, making 24 in a year.

The seasonal division points are peculiar to China's lunar calendar. In the long period of productive labor, ancient men gradually realized the rule of climate change. According to the relationship between the sun and the earth, they divided all the days in a year into 24 parts to indicate the change of seasons and climate. Thus, there is a seasonal divisional point about every 15 days and two seasonal divisional points within each month. The time of the 24 seasonal division points in the Gregorian calendar is almost fixed: those in the first half of the year (from January to June) all fall around the sixth or 21st day of the month, and those in the latter half of the year (from July to December), on about the eighth or 23rd day of the month.



The names for the 24 seasonal division points are: Beginning of Spring, Rain Water, Waking of Insects, Vernal Equinox, Pure Brightness, Grain Rain, Beginning of Summer, Grain Budding, Grain in Ear, Summer Solstice, Slight Heat, Great Heat, Beginning of Autumn, Limit of Heat, White Dew, Autumnal Equinox, Cold Dew, Frost's Descent, Beginning of Winter, Slight Snow, Great Snow, Winter Solstice, Slight Cold, and Great Cold, respectively.

The Beginning of Spring, Beginning of Summer, Beginning of Autumn and Be-

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ginning of Winter mark the start of four seasons. The Vernal Equinox and the Autumnal Equinox are the two points where the day and night are equal;

The Summer Solstice has the longest day and shortest night in a year, while the opposite is true for the Winter Solstice.

The Rain Water means the start of the spring rains. The Waking of Insects indicates that the spring thunder awakens hibernating insects.

The Pure Brightness means the onset of spring when a bright and clean spring scene replaces the cold, withered and yellow scene in winter.

The Grain Rain indicates that from that day, there will be more rainfall, which is beneficial to the growth of crops.

The Grain Budding shows that crops that will ripen in summer start to show plump seeds.

The Grain in Ear tells people that the wheat has ripened.

The Slight Heat and Great Heat indicate the full onset of summer, with the Great Heat being the hottest day of the year.

The Limit of Heat shows that scorching summer days will soon be gone.

The White Dew tells people that dew appears in the morning to show that the weather is turning cold, and, as this intensifies, we move on to the Cold Dew.

The Frost's Descent means the appearance of the first frost of the season.

The Slight Snow and Great Snow mean the arrival of the snowy season.

The Slight Cold and Great Cold indicate the degree of coldness in winter, with the Great Cold being the coldest day of the season.

The 24 seasonal division points have great influence on China's farming. For the convenience of memory, people compiled The Song for the 24 Seasonal Division Points:

Following the Beginning of Spring and Rain Water, the Waking of Insects awakens the Vernal Equinox, and then come the Pure Brightness and Grain Rain,

After the Beginning of Summer, Grain Budding, Grain in Ear, and Summer Solstice, the Slight Heat is connected with Great Heat.

The Beginning of Autumn and Limit of Heat are followed by the White Dew, Autumnal Equinox, Cold Dew and then the Frost's Descent,

And the Beginning of Winter leads to the Slight Snow, Great Snow, Winter Solstice, Slight Cold and Great Cold.

In the first half of the year, the seasonal division points fall on the sixth or 21st day of the month,

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And those in the latter half year occur on the eighth or 23rd day of the month.



二十四节气
The 24 Seasonal Division Points

按照中国农历的纪年法，每个月都有两个节气，一年共有 24 个节气。节气是中国农历特有的。古人在长期的生产劳动中，逐渐认识了气候变化的规律，他们根据太阳和地球的相互关系，把一年的天数分成 24 等分，用来表示季节和气候的变化。这样，差不多每 15 天就有一个节气，每个月就有两个节气了。二十四节气在公历中的日期几乎是固定的，上半年（1～6 月）的节气都在每个月的 6 日和 21 日前后；下半年（7～12 月）的节气都在每个月的 8 日和 23 日前后。

二十四节气的名称分别是：立春、雨水、惊蛰、春分、清明、谷雨、立夏、小满、芒种、夏至、小暑、大暑、立秋、处暑、白露、秋分、寒露、霜降、立冬、小雪、大雪、冬至、小寒、大寒。

立春、立夏、立秋、立冬 表示四季的开始。

春分、秋分 是一年中昼夜一样长的两天。

夏至 是一年中白天最长、黑夜最短的一天。

冬至 是一年中白天最短、黑夜最长的一天。

雨水 是开始下雨的意思。

惊蛰 表示春雷响过以后，冬眠的昆虫被惊醒了。

清明 是说春天到了以后，明净的春色代替了冬季寒冷枯黄的景色。

谷雨 表示从此雨水增多，对五谷的生长很有好处。

小满 表示在夏季成熟的农作物籽粒开始饱满了。

芒种 告诉人们小麦已经成熟了。

小暑、大暑 表示天气炎热的程度，大暑是一年中最热的时候。

处暑 表示炎热的天气快要过去了。

白露 告诉人们开始下露水，天气就要冷了。

寒露 表明露水已重，天寒加剧。

霜降 是开始下霜的意思。

小雪、大雪 表示到了下雪的时节和雪量大小的差别。

小寒、大寒 表示冬天寒冷的程度，大寒是一年中最冷的时候。

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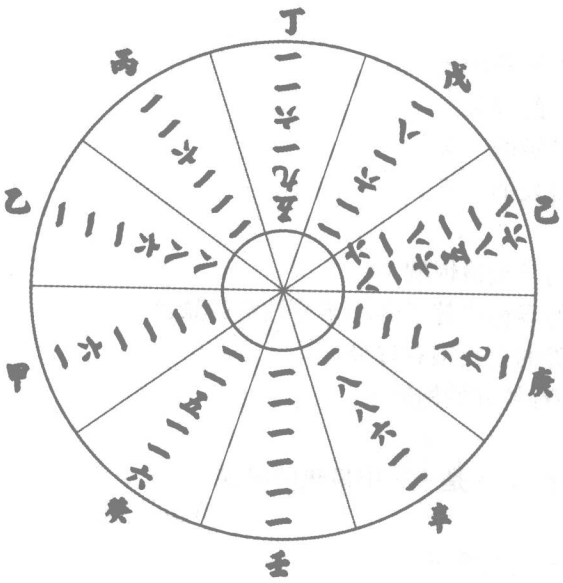
二十四节气对中国的农业生产起着很大的作用，人们为了方便记忆，还编出了《二十四节气歌》：

春雨惊春清谷天，夏满芒夏暑相连，
秋处露秋寒霜降，冬雪雪冬小大寒。
上半年是六、二一，下半年是八、二三。



天干地支
Heavenly Stems and Earthly Branches

Heavenly Stems, Earthly Branches and the Twelve Animal signs (shengxiaos) are brainchild of Chinese ancestors. Generally, the former are used in calculating hours while the latter numbering years.



In the calendar of ancient China, there were ten Heavenly Stems (tiangans) such as *jia*, *yi*, *bing*, *ding*, *wu*, *ji*, *geng*, *xin*, *ren* and *gui*; and twelve Earthly Branches (dizhis) such as *zi*, *chou*, *yin*, *mao*, *chen*, *si*, *wu*, *wei*, *shen*, *you*, *xu*, and *hai*. Each heavenly stem is paired with an earthly branch in a regular order to form a time-calculating method called *gan-zhi* (*Stem-Branch*), which was employed mainly to record days as well as hours, months and years, according to a study from the oracle bones inscriptions unearthed on the site of the ancient Yin State.

Each item of ganzhis has their meaningful names which were somewhat mentioned in the *Historical Records* (*Shih-Chi*) and the *History of the Eastern Han*

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Dynasty (*Hanshu*).

Jia means the moment of "tearing open", when the seals are torn open that block the embryos of life.

Yi suggests the moment of "breaking through", when lives break through and stick out of their envelopes.

Bing connotes "splendor"—lives appear to be visibly splendid at the moment.

Ding is indicative of the moment when the lives grow stronger.

Wu describes the phase when thriving lives are everywhere.

Ji alludes to "recognize"—everything has taken their shapes so as to be easily recognized.

Geng means "change"—everything is full-grown and has come to regulate their aggressive attitudes with the fruits.

Xin presents a new harvest.

Ren connotes "free"—under everything is an unrestrained nourishing power from the sun.

Gui means "estimate"—the prospect of lives can be estimated.

The heavenly stems are associated with the sun's revolution which affects lives on the earth.

The meanings of the twelve earthly branches

Zi means "accumulation"—life is about to happen under a cultivating power that is accumulating.

Chou means "undecided"—the power that cultivates life is still pending.

Yin connotes "transformation"— the moment when a life is born.

Mao is defined as "appropriate growth"—the stage when everything grows properly well.

Chen means "vibration"—a stage of growth when lives stretch after vibration.

Si means "rising"—at this stage the developing powers are so predominant that everything is inclined to grow and rise.

Wu means "luxuriance" —a stage when trees have luxuriant foliage.

Wei connotes "savour"—a stage when lives have attained distinctive traits.

Shen means "maturity"—at the moment lives are already full-grown.

You means "aging"—lives are on the decline at the moment.

Xu means "perish"—old things are all perished.

Hai means "seed"—new lives are hidden in the seeds.

Gan-Zhis were employed to designate the years before the reign of Wudi Em-

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peror of the Han Dynasty; and from Wudi to the end of the Qing Dynasty gan-zhis were grouped with the emperors' reign titles; during the ROC (Republic of China) period (1912 ~ 1949) years were calculated from the public's founding in 1912, and the Gregorian calendar was also used in some cases; since 1949 the Gregorian calendar has been widely accepted.

The order of the Sixty Jiazis

Jia-zi, Yi-chou, bing-yin, ding-mao, wu-chen, ji-si, geng-wu, xin-wei, ren-shen, gui-you;

Jia-xu, yi-hai, bing-zi, ding-chou, wu-yin, ji-mao, geng-chen, xin-si, ren-wu, gui-wei;

Jia-shen, yi-you, bing-xu, ding-hai, wu-zi, ji-chou, geng-yin, xin-mao, ren-chen, gui-si;

Jia-wu, yi-wei, bing-shen, ding-you, wu-xu, ji-hai, geng-zi, xin-chou, ren-yin, gui-mao;

Jia-chen, yi-si, bing-wu, ding-wei, wu-shen, ji-you, geng-xu, xin-hai, ren-zi, gui-chou;

Jia-yin, yin-mao, bing-chen, ding-si, wu-wu, ji-wei, geng-shen, xin-you, ren-xu, gui-hai.



天干地支
Heavenly Stems and Earthly Branches

天干地支与十二生肖，是中国古代历法研究的成果，一般来说，十二生肖用于纪年，天干地支纪时。

在中国古代的历法中，甲、乙、丙、丁、戊、己、庚、辛、壬、癸被称为“十天干”，子、丑、寅、卯、辰、巳、午、未、申、酉、戌、亥叫作“十二地支”。两者按固定的顺序互相配合，组成了干支纪法。从殷墟出土的甲骨文来看，天干地支在我国古代主要用于纪日，此外还曾用来纪月、纪年、纪时等。

天干地支的含义

在《史记》、《汉书》中均有部分记载，大体含义是：

甲是拆的意思，指万物剖符甲而出也。

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乙是轧的意思，指万物出生，抽轧而出。

丙是炳的意思，指万物炳然著见。

丁是强的意思，指万物丁壮。

戊是茂的意思，指万物茂盛。

己是纪的意思，指万物有形可纪识。

庚是更的意思，指万物收敛有实。

辛是新的意思，指万物初新皆收成。

壬是任的意思，指阳气任养万物之下。

癸是揆的意思，指万物可揆度。

由此可见，十天干与太阳出没有关，而太阳的循环往复周期，对万物产生着直接的影响。

十二地支的含义

子是兹的意思，指万物兹萌于既动之阳气下。

丑是纽，阳气在上未降。

寅是移，引的意思，指万物始生寅然也。

卯是茂，言万物茂也。

辰是震的意思，物经震动而长。

巳是起，指阳气之盛。

午是仵的意思，指万物盛大枝柯密布。

未是味，万物皆成有滋味也。

申是身的意思，指万物的身体都已成就。

酉是老的意思，万物之老也。

戌是灭的意思，万物尽灭。

亥是核的意思，万物收藏。

中国在汉武帝以前用天干地支纪年；从汉武帝到清末，用皇帝年号加天干地支纪年；民国时期用民国诞生时间来纪年兼或使用公元纪年，新中国以后广泛采用公元纪年。

六十甲子顺序

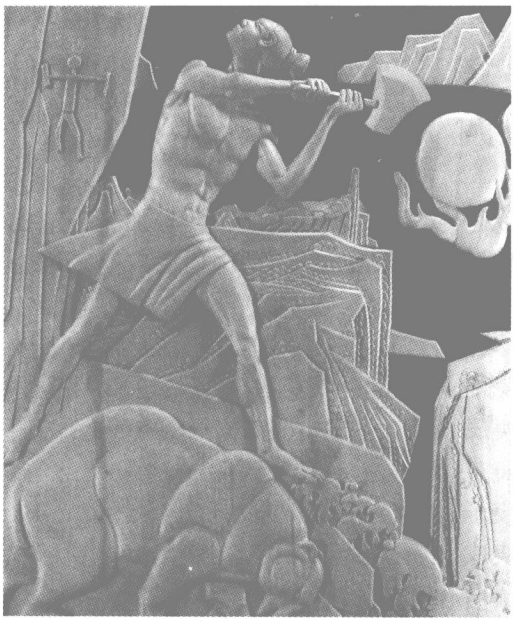
甲子、乙丑、丙寅、丁卯、戊辰、己巳、庚午、辛未、壬申、癸酉、
甲戌、乙亥、丙子、丁丑、戊寅、己卯、庚辰、辛巳、壬午、癸未、
甲申、乙酉、丙戌、丁亥、戊子、己丑、庚寅、辛卯、壬辰、癸巳、
甲午、乙未、丙申、丁酉、戊戌、己亥、庚子、辛丑、壬寅、癸卯、
甲辰、乙巳、丙午、丁未、戊申、己酉、庚戌、辛亥、壬子、癸丑、
甲寅、乙卯、丙辰、丁巳、戊午、己未、庚申、辛酉、壬戌、癸亥。

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Chapter 2 地 理 Geography

大禹治水
Yu the Great Harnesses the Flood

Yu the Great was the chieftain of the legendary Xiahou clan. He was originally called Yu or Xiayu. According to legend, the Yellow River flooded during the reign of Emperor Yao, and the people were forced to abandon their villages, and go to live in trees or on mountaintops. The flood brought great misery to the people. Emperor Yao, the chieftain of the Yan-Huang tribal alliance, appointed Gun to harness the flood. Gun built dikes to keep back the water, but failed. Shun, who succeeded Yao, killed Gun, and appointed Gun's son Yu to continue with the flood-harnessing work. Drawing a lesson from his father's failure, Yu adopted the dredging method to lead the flood waters to flow along river courses into the sea. Yu worked very hard. It was said that during the 13 years he spent taming the floods, he passed his



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home three times, but did not enter until his task was completed. As a result of his successful efforts, the people bestowed on him the title "Yu the Great" and with the approval of the tribal chieftains, Shun chose Yu as his successor.



大禹治水
Yu the Great Harnesses the Flood

大禹是传说中夏后氏部落的首领，原称"禹"，也称"夏禹"。传说尧的时候，黄河发大水，洪水冲毁了村庄和房屋，人们只能住到树上和山顶上。洪水给人民带来了极大的灾害。那时，炎黄部落联盟的首领尧任用鲧(gǔn)治理洪水，鲧采用筑堤堵水的办法治水，遭到了失败。尧之后，担任部落联盟首领的舜杀死了鲧，然后命令鲧的儿子禹继续治水。禹吸取了鲧的教训，改用疏导的方法治水，让洪水顺河道流向大海。禹辛勤地工作，传说他在外治水 13 年，三次经过家门都没有抽时间进去看看。最后，禹终于制服了水患。人们感谢禹，尊称他为"大禹"。由于禹治水成功，得到舜的"禅让"，舜征得各部落首领的同意，推举禹为自己的继承人。



《山海经》
Classic of Mountains and Seas

Shan Hai Jing (*Classic of Mountains and Seas*) was an important geographical literature on geography in ancient China. The currently available version includes 18 volumes, among which 5 volumes are *Shan Jing* (*Classic of Mountains*), 8 volumes are *Hai Jing* (*Classic of Seas*), 4 volumes are *Da Huang Jing* (*Classic of Big Land*) and 1 volume is *Hainei Jing* (*Classic of Mainland*). It is said that *Shan Hai Jing* was written by Yu, one of the forefathers of ancient China, but the saying is quite doubtful.

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In this book, *Shan Jing* and *Hai Jing* form their own specific systems accordingly, while they were finished in different periods, *Shan Jing* contains the description of famous mountains and great rivers, propagation and minerals on the mainland. It is estimated that this part of the book was finished in the early or mid period the Warring States Period. Hai Jing contains a great deal of alien legends, fairy tales home and abroad, and was written in the Qin Dynasty (221BC ~ 206BC) or at the beginning of the Western Han Dynasty.



Shan Hai Jing, containing rich legends and fairy tales, is very valuable for historical study, especially helpful for research on primitive society in China, and the primitive surname, tribes, and knowledge and understanding of the universe, nature and social development.

According to the records in *Shan Hai Jing*, the Yellow Emperors is the heavenly emperor of the west. He was the great grandfather of Zhuan Xu (a legendary ancient emperor), the grandfather of Guan. He was also the ancestor of many tribes inside and outside China. Di Jun has no records in other books and is not listed among San Huang Wu Di (Three Emperors and Five Gods), and is the only heavenly emperor in Shan Hai Jing.

In this book, he was the inventor of farming, craft, vehicle, boat, musical instruments, singing and dancing. Together with Xi (the legendary goddess), he gave birth to 10 suns and 12 moons, which relate to the astronomy and the calendar. There are still many legends about the water-control of the Great Yu, battle between the Great Yu and Gong Gong, and so on.

《山海经》
Classic of Mountains and Seas

《山海经》是中国古代的重要地理文献。现在的版本有十八卷，包括《山经》五卷、《海经》八卷、《大荒经》四卷、《海内经》一卷。传说是禹所作，不

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太可信。

《山海经》的《山经》和《海经》各成体系，成书的时代也不一样。《山经》涉及巫术较多，记载了海内名山大川、动植物产、祯祥怪异等内容。写作年代一般推测为战国初期或中期。《海经》则是方士用书，记载海内外怪异传闻，还有大量神话传说，写作时代是秦（前221～前206）或西汉初年。

《山海经》中有丰富的神话传说资料，具有重要的史学价值，这有助于研究中国的原始社会和上古的姓氏、部族，及上古人对宇宙、自然和社会历史的认识状况。

根据《山海经》的记载，黄帝是西方的天帝。他不仅是颛顼的曾祖、鲧的祖父，还是中国境内和四裔许多部族共同的祖先，这对研究中国民族史有着重要价值。帝俊在其他书中没有记载，也没有列入三皇五帝之中，他是《山海经》中独有的天帝。《山海经》把农、工、车、舟、琴瑟、歌舞的发明权都归于他，还说他和羲和生了十个太阳，又生了十二月，这又和天文历法有了关系。《山海经》中还有关于大禹治水、禹攻共工等神话传说。



都江堰
Dujiang Yan

Dujiang Yan (The Dujiang River Dyke) is a great ancient irrigation project situated about 50 kilometers northwest of Dujiang Yan City, Sichuan Province.

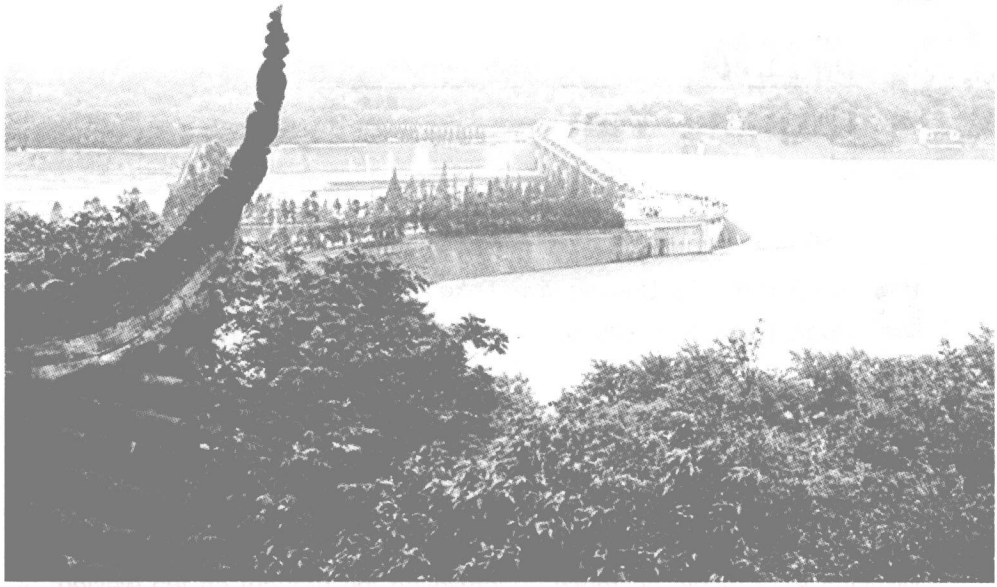
The Minjiang River is a major tributary of the Yangtze River in its upper reaches. Before Dujiang Yan was built, when torrential water rushed down the mountains in summer, the Minjiang River overflowed its banks and caused serious floods on the Cheng Du Plain. When the rainfall was not plentiful, the flow of water in the Minjiang River would decrease, aggravating the drought on the western Sichuan Plain.

In 256BC, Li Bing was appointed governor of Sichuan. To conquer the floods of the Minjiang River, he trekked upstream until he reached the area of the present-day Aba Tibetan Autonomous Prefecture. He got a lot of hydrological data on the Minjiang River. Then he began to build Dujiang Yan. Dujiang Yan system consists of the Fish Mouth, the Sand-flying Dyke and the Precious Bottle Neck.

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The Fish Mouth is a diversion dam built of pebbles. It divides the Minjiang River into the inner river and the outer river. The water of the inner river flows through the Precious Bottle Neck to irrigate 200,000 hectares of farmland around Cheng Du. The outer river was designed mainly to release floodwater. The Sand-flying Dyke between the Fish Mouth and the Precious Bottle Neck is an overflow dyke. When there is too much water in the inner river, the surplus water brims over the Sand-flying Dyke and flows into the outer river.

After Dujiang Yan was completed, Li Bing composed the rhyme easy for memory: "Dredge the riverbed when the water is deep and build low dykes when the water is low." It contains the guiding principle of dredging the waterways in ancient China.



Dujiang Yan serves the purposes of navigation, flood control, log floating and urban water supply. The trinity of the Fish Mouth, the Sand-flying Dyke and the Precious Bottle Neck keeps an effective control of water flowing into the inner river. In case of drought, Dujiang Yan channels water into the fields. If waterlogging occurs, the floodwater can be diverted. With the completion of Dujiang Yan, both

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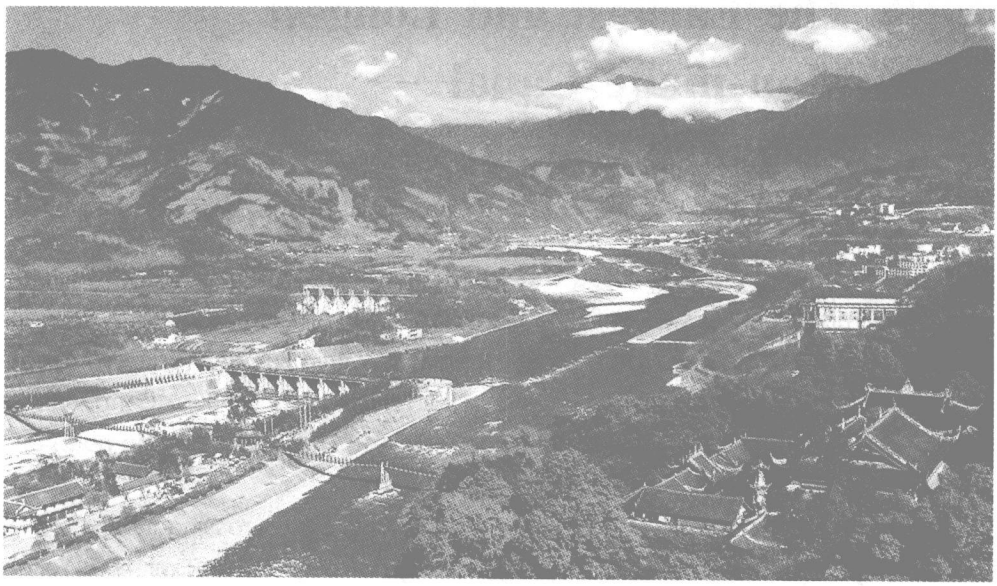
floods and droughts have been brought under control and famine years have gone. The Cheng Du Plain becomes "a land of abundance", with an irrigation area of 10 million *mu* (1 *mu* = 1/15 hectare).

Dujiang Yan has been in use for more than 2000 years. It is a miracle in the world history of water conservancy.

都江堰
Dujiang Yan

都江堰是一项伟大的古代水利工程,位于四川省成都市西北方向约 50 千米处的都江堰市。

岷江是长江上游的一条较大的支流,发源于四川省北部高山地区。在都江堰建成以前,每当春夏山洪暴发之时,江水奔腾而下,由于河道狭窄,常常引起洪灾,洪水一退,又是沙石千里,造成东旱西涝。



秦昭襄王五十一年(公元前 256 年),秦国蜀郡太守李冰沿岷江逆流而上,艰苦

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跋涉，亲自勘察岷江的水情、地势等情况，直至今日的西藏自治区的阿坝。他吸取前人的治水经验，率领当地人民，主持修建了著名的都江堰水利工程。都江堰的主体工程包括鱼嘴分水堤、飞沙堰溢洪道和宝瓶口进水口。

鱼嘴分水堤由鹅卵石修建而成，作用是将岷江水流分成内江和外江，其中内江水流经宝瓶口进水口引入成都平原，灌溉面积达20万公顷，而外江水流则将洪水引入内江水流，剩余的水经位处内江和外江之间的飞沙堰溢洪道溢出至外江水流。这样既可以分洪减灾，又可以引水灌田、变害为利。

为了观测和控制内江水量，李冰又雕刻了三个石桩人像，放于水中，以“枯水不淹足，洪水不过肩”来确定水位。他还凿制石马置于江心，以此作为每年最小水量时淘滩的标准。

都江堰一直发挥着航行、防洪、运木、供水等作用，它的三大部分，鱼嘴分水堤、飞沙堰溢洪道和宝瓶口进水口，有效地解决了江水自动分流、自动排沙、控制进水流量等问题，消除了水患。都江堰工程使成都平原从此沃野千里的天府之国。目前灌溉面积超过1000万亩。

2000多年来，都江堰一直发挥巨大效益。它是世界水利工程的奇迹。



京杭大运河
The Earliest and Longest Man-made Canal—Jinghang Canal

Jinghang Canal is called canal for short. It is known as the greatest china ancient project with the Great Wall. Since being founded in 5th century, the canal has had two large-scale expeditions within Sui and Yuan two dynasties. Having the length of 1794 kilometers, 15 times longer than Suez Canal and 32 times Panama Canal, Jinghang Canal is the main sea line combining the north and the south in our country.

The canal begins from Beijing and ends in Hang Zhou crossing Tianjing, Hebei, Shangdong, Jiangshu and Zhejiang, linking not only Haihe River, the Yellow River but also Huaihe River and Yangtze River. So it is the second prime channel only following Yangtze River in China.

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Though the canal cannot be wholly open to navigation currently, its seasonal navigation length has reached 1100 kilometers, mainly distributed in the south of Huanghe River. It reduces the burden of railway goods transportation, especially for the short and middle distance transportation of coal and building material, making a certain difference in promoting the district economic and enforcing the north-south communication. The canal continues to play an important role in ocean shipping.



The whole course of the Great Canal covers seven sections: the one from the city zone of Beijing to Tongxian County is called the Tonghui River, from Tongxian County to Tianjin called the North Canal, from Tianjin to Linqing called the South Canal, from Linqing to Tairzhuang called the Lu Canal, from Tairzhuang to Huaiyin called the Central Canal, from Huaiyin to Yangzhou called the Inner Canal, and across the Yangtze River the one from Zhenjiang to Hangzhou called the Jiangnan Canal.

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京杭大运河
The Earliest and Longest Man-made Canal—Jinghang Canal

京杭大运河简称运河，与万里长城并列为中国古代最伟大的工程之一。始建于公元前5世纪，后经隋、元两次大规模扩建。全长1794千米，是苏伊士运河的16倍，巴拿马运河的33倍，是中国重要的一条南北水上干线。

它北起北京，南至杭州，经过北京、天津、河北、山东、江苏、浙江六省市，沟通了海河、黄河、淮河、长江、钱塘江五大水系，是中国仅次于长江的第二条“黄金水道”。目前，大运河虽不能全程通航，但季节性通航里程已达1100千米，主要分布在黄河以南的山东、江苏和浙江三省。对分担铁路的货流，特别是承担煤炭、建材等的中短途运输任务，对发展地区经济，加强南北交流，起到了一定的作用。今天，大运河将继续发挥其重要的作用。

京杭大运河是由人工河道和部分河流、湖泊共同组成的，全程可分为七段：

(1)通惠河：北京市区至通县(今北京通州区)；(2)北运河：通县至天津市；(3)南运河：天津至临清；(4)鲁运河：临清至台儿庄；(5)中运河：台儿庄至清江；(6)里运河：清江至扬州，入长江；(7)江南运河：镇江至杭州。

郑白渠
Zheng Bai Qu

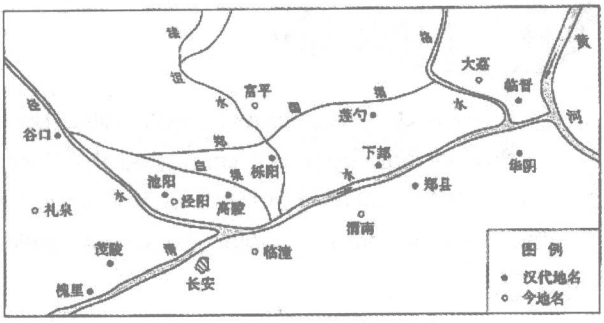
Zheng Bai Qu, a large irrigation project in the ancient Guanzhong Region (today's Shaanxin Province), was the combined name of Zhengguo Qu and Bai Qu. (Qu means canal.), now bore the name of Jinghui Qu.

In 246BC during the Qin Dynasty Warring States Period, Zheng Guo, a hydraulic engineer from the Han State, began the construction of Zhengguo Qu for the Qin

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State and finished the project in more than 10 years. The canal was 150 kilometers long, linking the Jingshui River and the Luoshui River. It could irrigate 40000 hectares of farmlands.

Thanks to the function of the canal, the production of the surrounding farmlands surged, providing enough funding for the Qin State which defeated the other six warring states and for the first time in China's history set up a unified country—the Qin Dynasty.



In 95BC, the Eastern Han Dynasty built Bai Qu, linking the Jingshui River and Weishui River. The new canal was 100 kilometers long and could irrigate 4,500 hectares of farmland.

Since then, the two canals were called by a joint name: Zheng Bai Qu. During the Tang Dynasty (618 ~ 907), Zheng Bai Qu had three branches: Tai Bai Qu, Zhong Bai Qu and Nan Bai Qu, with an irrigation area of over 10,000 hectares. In the later dynasties, Zheng Bai Qu was revamped several times.

郑白渠
Zheng Bai Qu

郑白渠是古代关中地区的大型水利灌溉工程,秦代郑国渠和汉代白渠的合称,近代陕西省泾惠渠的前身。

秦始皇元年(公元前 246 年)韩国水工郑国主持兴建郑国渠,十几年后完工。干渠西起泾阳,引泾水向东,下游进入洛水,全长 300 余里,灌溉面积 4 万顷。郑国渠的建成直接支持了秦国统一六国的战争。

西汉太始二年,赵中大夫白公建议增建新渠,引泾水向东,至栎阳(今西安临潼区东北)注于渭水,名叫白渠。干渠长 200 里,灌溉面积 4500 顷,此后灌区称郑白渠。唐代的郑白渠有三条干渠,即太白渠、中白渠和南白渠,灌溉面积超过 10000 顷,后来历经各个朝代,不断得到修复和发展。

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灵渠
Ling Qu

Ling Qu (Ling Canal), also called Dou River or Xing'an Canal, was an ancient canal that connected the Yangtze River system and Pearl River system. Ling Qu, located in the current Xing'an County in Southwest China's Guangxi Zhuang Autonomous Region, was the earliest canal with sluice gate in the world.



The canal was dug in 219BC at the order of Qin Shihuang (the First Emperor of China), to facilitate the transportation of grain for the military after he sent his troops south to conquer the territory south of the Meiling Mountain. It connected the Xiangjiang River and the Lijiang River. Later, every dynasty revamped the canal, making it the major water course that linked the Lingnan Region (current Guangdong Province and the Guangxi Zhuang Autonomous Region) and the central part of China.

After the People's Republic of China was founded in 1949, the canal undertook

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extensive repairs, turning into an important water resource for irrigation, drinking and industrial production, as well as a scenic spot. Currently, it is an important cultural relic of the country.



灵渠
Ling Qu

灵渠是中国沟通长江水系和珠江水系的古运河。又名陡河、兴安运河，在今广西壮族自治区兴安县境内。灵渠是世界最早的有闸运河。

秦国统一六国后，向岭南用兵，秦始皇二十八年（前219年），派监郡御史禄开凿灵渠运粮，沟通了湘江和漓江。由于历代不断增修改进，灵渠成为联接来岭南（今中国南部广东广西）与中原地区的主要交通线路。

中华人民共和国成立后，国家对灵渠全面整修，基本保留了传统工程面貌，使其成为灌溉、城市供水和风景游览综合利用的水利工程，是全国重点保护文物。



郦道元与《水经注》
Li Daoyuan and *Shui Jing Zhu*

Styled Shan Chang, Li Daoyuan was born in today's Zhuozhou County of North China's Hebei Province into an official family. As a small boy, Li set his heart on geological research. He loved traveling to the rivers and mountain, and especially took to the research on the hydrology and geology of various places. Later, taking advantage of being an official of different places, Li carried out field investigations, leaving footsteps in today's Henan (Central China), Shandong (East), Shanxi (North), and Jiangsu (East) provinces, and so on.

Whenever he went to a place, Li would visit the local places of interest and the rivers and mountains, conducting painstaking reconnaissance on the water flow and topography and visiting the elders for knowledge on the changes and the sources of the rivers. Through investigations on the local geography, history, and

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customs, he got large amounts of firsthand materials.

Besides, he read a great many ancient geological books, such as *Shan Hai Jing* (Classic of Mountains and Seas) and *Shui Jing* (River Classic), accumulating rich geographical knowledge, which laid a solid foundation for his geographical research and writing.



In comparing the geographical phenomena that he saw and what was written in geographical works, Li found many geographical conditions had changed over time. If the changes were not recorded in time, it would be even harder for the later generations to figure out the changes in history.

Li strongly felt it necessary to carry out a detailed inspection of the geographical conditions and write down the historical changes in respect to the ancient geographical literature. Therefore, Li decided to write a complete geographical book on the basis of *Shui Jing* in a commentary form.

A geographical book by Sang Qin of the Three Kingdoms Period, *Shui Jing* briefed on the watercourses of the country's 137 rivers. With a total of only 10,000 characters, the records of rivers were rather concise and non-systematic, providing no specific information on the geographical conditions of the areas where the rivers passed by.

With the rich firsthand materials he had got and on the basis of *Shui Jing*, Li finally finished a famous geographical book— *Shui Jing Zhu* (*Commentary to the River Classic*).

The 40-volume *Commentary to The River Classic*, with a total of 32,000 charac-

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ters, 20 times more than those in *Shui Jing* , records 1,252 rivers. With the rivers as the key links, the book gives detailed descriptions of the history, geography, economy, culture, and social customs, and so on of the areas where the rivers pass by. Hence, it is not simply a commentary, but rather, it is a recreation that boasts great importance and high scientific value in the history of ancient geography.

The book provides comprehensive information on the 1,252 rivers, large or small, including the river source, the size of the mainstreams, the distribution of tributaries, the width of river valleys, the depth of riverbeds, the length of the river flows, the direction, the seasonal changes in the volume of water, and the flood season, and so on. More detailed description of the northern rivers is provided, which shows the author Li Daoyuan's familiarity with these rivers. The book not only has records on rivers with water in them, but also 24 ancient rivers without water, providing clues in the search for underground water.

There are also accounts of floods in history in *The Commentary to the River Classic* , including information on the time and scale. Li Daoyuan collected most of the materials through field investigation, and some from ancient records in books or stone carvings. These records are of enormous reference value for today's flood prevention and disaster salvage. Besides, the book contains specific information on various types of lakes.

In terms of geology, Li Daoyuan elaborated on the effect of flowing water on geological formations, such as erosion, removal, and sediment, which is of great significance in the geological history. Also, many fossils are recorded in the book, including the fossils of both animal debris and relics.

Records can be found in the book of 31 hot springs, with comparatively detailed description of the features, the temperatures, the minerals, and the living things of different hot springs. Regarding the living things, records are provided of the animals and plants around the rivers mentioned in *The Commentary to the River Classic* .

There are comprehensive records of the agriculture geographical situation in the book, covering such areas as cultivation, pasturage, fishing, and hunting. Materials are also included on a great many farmland and irrigation projects, among which are 28 well-known projects, such as Dujiang Yan and Baiqu. The book provides more detailed and richer information on the construction reason, process, and scale than its predecessors.

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A famous geographical work in ancient China, *The Commentary to the River Classic cast tremendous impact on the later generations after its publication. Many* scholars, while carrying out geographical research, referred to the book.

Between 1735 and 1820 in the Qing Dynasty, some 20 scholars carried out a systematic research of the book, making it a specialized study—the study of Li (Li Xue). The research has been carried on to date, and spread to the foreign countries, giving rise to many international experts in "the study of Li".



郦道元与《水经注》
Li Daoyuan and Shui Jing Zhu

郦道元,字善长,范阳涿州(今河北涿州)人,生于官宦家庭。郦道元从少年时代起就有志于地理学的研究。他喜欢游览祖国的河流、山川,尤其喜欢研究各地的水文地理、自然风貌。他充分利用在各地做官的机会进行实地考察,足迹遍及今河北、河南、山东、山西、安徽、江苏、内蒙等广大地区。



每到一个地方,他都要游览名胜古迹、山川河流,悉心勘察水流地势,并访问当地长者,了解古今水道的变迁情况及河流的渊源所在、流经地区等。通过调查当地

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的地理、历史和风土人情等，掌握了大量的第一手资料。同时，他还阅读了大量古代地理学著作，如《山海经》、《水经》等，积累了丰富的地理学知识，为他的地理学研究和著述打下了基础。

通过把自己看到的地理现象同古代地理著作进行对照、比较，发现其中很多地理情况随着时间的流逝发生了很大变化。如果不及时把这些地理现象的变迁记录下来，后人就更难以弄明白历史上的地理变化。因此，应该对此时的地理情况进行详细的考察，同时查阅古代文献，与古代的地理学著作相印证，将地理面貌的历史变迁尽可能详细、准确地记载下来。为此，郦道元决定以《水经》为蓝本，以作注的形式写一本完整的地理学著作。郦道元利用自己掌握的丰富的第一手资料，在《水经》的基础上，终于完成了《水经注》这一地理学名著。

《水经注》全书共40卷，记载的河流水道1252条，文字则是《水经》的20余倍，达32万字。本书内容非常丰富，它以水道为纲，将河流流经地区的古今历史、地理、经济、政治、文化、社会风俗、古迹等作了尽可能详细的描述。因此此书已不是简单地注释《水经》，而是在《水经》的基础上独具匠心的再创作，在我国古代地理学史上占有重要地位，具有很高的科学价值。

《水经注》对1252条大小河流进行了全面记载，描述了各个河流的发源地点、干流大小、支流分布、河谷宽度、河床深度、流程长短、方向以及水量的季节变化、含沙量、汛期等情况。其中对北方一些河流的描述更为具体、详尽，说明郦道元对这些河流非常熟悉。他既引用了许多古书的记载，也有不少他自己实际调查的结果。《水经注》中不仅记载了有水河道，而且还记载了无水旧河道24条，这些记载为寻找地下水源提供了线索。

《水经注》记载了历史上和当时的洪水暴发的情况，这些记载包括洪水暴发时间、洪水大小等情况。这些历史水文资料大多为郦道元实地考察收集而来，有的得之于古书记载，有的则得之于许多河流上的石人或测水石铭的记录，非常珍贵，对于我们今天研究洪水的发展变化规律，防汛救灾具有重要参考价值。此外，《水经注》对各种类型湖泊的记载也颇为详细。

在地质学方面，郦道元在《水经注》中对于流水在地质形成中的作用进行了阐述，初步具备了流水侵蚀、搬运和沉积作用的思想，在中国古代地质学史上占有重要地位。《水经注》中还记载了许多化石，包括古生物残骸化石和遗迹化石。

《水经注》中记载有温泉31个，对各个温泉的特点、水温、矿物质、生物等情况进行了比较详细的叙述。在生物方面，《水经注》对各个河流周围的动植物情况进行了记载。

《水经注》对农业地理情况进行了全面记载，包括种植、畜牧、林业、渔业、打猎等许多方面。书中记载了大量农田水利建设工程的资料；其中较著名的水利工程就有28项，如都江堰、白渠等。书中对这些著名水利工程的兴建原因、经过、规模

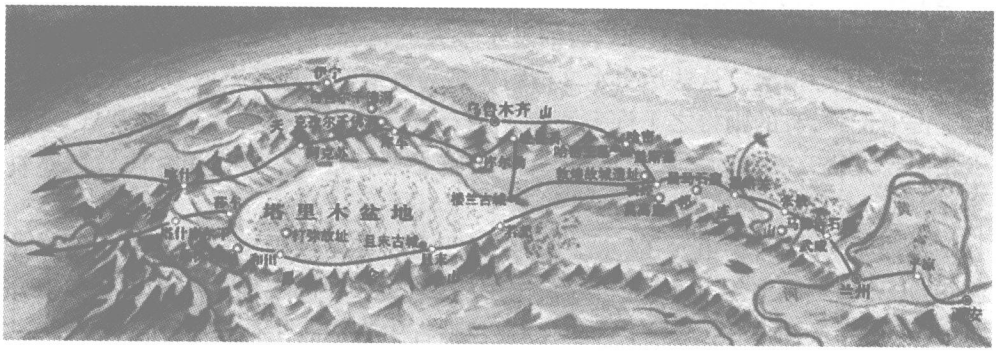
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大小及后代兴废情况的记载比前人要详细、丰富得多。同时，还顾及到动、植物资源的开发利用，湖泊旅游资源的开发利用。

《水经注》是我国古代地理学名著，内容异常丰富。出版发行以后，对后世有重大影响。许多学者进行地理学等方面的研究，均以《水经注》为主要参考书，从中汲取知识营养。到乾隆、嘉庆年间(1735～1820)，有20多名学者对《水经注》进行了系统研究，使研究《水经注》逐渐形成一种专门的学问："郦学"。直至今天，有关《水经注》的研究仍在不断发展，并且影响到国外，出现了不少有名的洋"郦学"家。

丝绸之路
The Silk Road

In the Han Dynasty, China established extensive contacts with various nationalities and kingdoms outside its domain through the Silk Road. Zhang Qian pioneered this route. During the reign of Emperor Wu, the Huns in the North often harassed the frontier of the Han Dynasty, and controlled dozens of small kingdoms in the Western Regions. In 138 BC., Emperor Wu sent Zhang Qian



with a delegation of over 100 people on a diplomatic mission to the Western Regions to seek allies against the Huns. Zhang Qian was captured by the Huns just as he left the Han territory, and was held prisoner for a dozen years. During this period, he learned the Hun language, and got to know well the geography of their territory. Escaping from the Hun encampment, Zhang Qian made his way back to

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Chang'an, with only one companion left of the 100 who had set out. In 119 BC, Emperor Wu sent Zhang Qian on a second diplomatic mission to the Western Regions. This time, he had an entourage of 300, with tens of thousands of cattle and sheep and a large amount of gifts. They visited many countries, and these countries sent envoys to return their visit to the Han court. From then on, the Han Dynasty had frequent contacts with the countries in the Western Regions, later setting up a Western Regions Frontier Command in today's Xinjiang Uygur Autonomous Region, which was under the administration of the central government. The Silk Road was another outcome of Zhang Qian's journeys. The Silk Road started from Chang'an in the east and stretched westward to reach the eastern shore of the Mediterranean Sea and the Roman Empire. Trade caravans from China carrying large amounts of silk fabrics exchanged merchandise with traders from Persia, India and Greece, and brought home walnuts, grapes and carrots from abroad. In the following several centuries, Sino-Western exchanges mainly characterized by the silk trade were mostly carried on through the Silk Road.

丝绸之路
The Silk Road

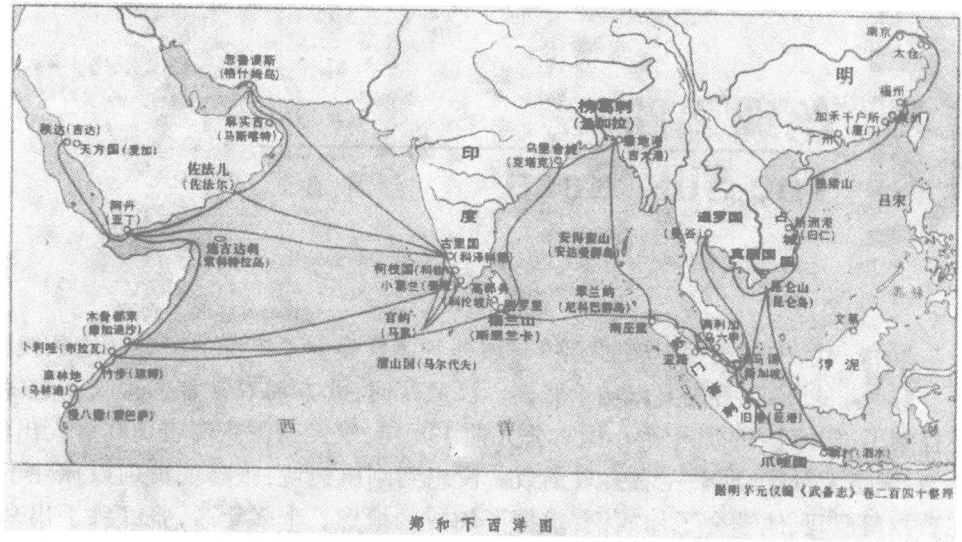
汉代,中国通过"丝绸之路"与域外各民族建立了广泛的交往。这条线路的开辟,首先要归功于张骞。汉武帝时,北方匈奴常常袭扰汉朝边境,还控制了当时西域的几十个小国。公元前 138 年,汉武帝派张骞带 100 多人出使西域,联络大月氏,准备左右夹攻匈奴。没想到刚出边境,张骞就被匈奴抓住了。在被扣留期间,他学会了匈奴语,掌握了匈奴的地形。十多年后,张骞逃了出来。当年与他同去的 100 多人,只剩下两人回到长安。公元前 119 年,汉武帝再次派张骞出使西域,这次随行的有 300 多人,带去了上万头牛羊和货物。他们访问了许多国家,这些国家也派了使臣带礼物回访。从此以后,汉朝和西域的往来越来越多。后来,汉还在今天新疆地区设了西域都护府,归中央政府管理。张骞出使西域,开辟了中西交流的"丝绸之路"。"丝绸之路"东起长安,向西到地中海东岸,转至罗马帝国。汉朝的商队,运大量的丝织品同波斯人、印度人、希腊人交换商品,同时带回了外国的核桃、葡萄、胡萝卜等。此后的许多世纪,以丝绸贸易为主的中西交流

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大多经过“丝绸之路”进行。

郑和下西洋
Envoy of Peace—Zheng He's Great Voyages

In the early days of the Ming Dynasty, that is, early in the 15th century, China was an advanced country in the world, with a booming economy and prosperous culture. In order to strength the relations with countries lying to the west of China as well as to flaunt the national power of the Great Ming Empire, Emperor Ming Chengzu launched a series of marine activities.



郑和下西洋图

Between 1405 and 1433, Zheng He was ordered seven times to act as an envoy to these countries, known as “Zheng He's voyages to the west seas”, as the main activities were carried out in the west sea area of today's Kalimantan Island, known as west seas in ancient times.

In 1405, a huge fleet of more than 300 ships manned by over 27, 800 men, including sailors, clerks, interpreters, officers and soldiers, artisans, medical men and meteorologists, set sail from Liujia Harbour near Suzhou on a distant voyage

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under the leadership of Zheng He. On board the ships were large quantities of cargo that could be broken down into over 40 different categories, including silk goods, porcelain, gold and silver ware, copper utensils, iron implements, cotton goods, mercury, umbrellas, and straw mats, etc. The fleet sailed along China's coast to Champa close to Vietnam and, after crossing the South China Sea, visited Java, Sumatra and reached Sri Lanka by passing through the Strait of Malacca.

On the way back it sailed along the west coast of India and returned home in 1407. Envoys from Calicut in India and several countries in Asia and the Middle East also boarded the ships to pay visits to China. Zheng He's second and third voyages taken shortly after, followed roughly the same route.

Each time he had under his command a big fleet and a staff of more than 20000 men. His fleets had sailed in the South China Sea and the Indian Ocean. They had gone further south to Java in today's Indonesia. Sailing then in a northwest direction, they had visited Yemen, Iran and the Holy City of Islam Mecca and further west to today's Somalia in East Africa. In all, he had made calls at more than 30 countries and territories. All this had taken place about half a century before the famous European sailor Columbus's voyage to America. For this reason, Zhen He's expeditions could rightfully be called "an unprecedented feat in mankind's history of navigation".

On each voyage Zheng He was acting as the envoy and commercial representative of the Ming court. No matter what country he visited, he called on the ruler of the land, presenting to him valuable gifts in token of China's sincere desire to develop friendly relations and inviting the host sovereign to send emissaries to China. Wherever he was, he made a careful study of the customs and habits of local residents. Showing them due respect, he bartered or dealt with them through consultation and negotiation on the basis of equality and mutual benefit. In this way, he obtained large quantities of pearls and precious stones, coral, ivory and dyestuffs for the Chinese emperor. He also brought back several kinds of rare and precious animals such as giraffe, lion, ostrich and leopard.

In ancient India, Chinese sailors made a good impression on the local people by observing local trading customs and practices. When he visited Sri Lanka on his third voyage, Zheng He offered a quantity of gold and silver Buddhist ceremonial vessels and silk-knit religious pennants to local temples on whose ground steles were set up to mark the occasion of his visit. Wherever he went, he was warmly received. At Zhancheng , the king of the land, in full royal regalia, came in person

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on elephant back with 500 cavalrymen to meet him at the wharf and then take him back to the palace. On the way they were greeted by local inhabitants who blew trumpets made of coconut shells and performed national dances at a solemn and joyous ceremony. Even today, people in Somalia and Tanzania look upon Ming China unearthed today as a symbol of the traditional friendship between their own country and China.

The countries Zheng He had visited later sent their emissaries and trade representatives to China from time to time. In 1419 when Zheng He was sailing back on his fifth voyage, 17 countries sent their envoys to China, including Philippines and Malaysia. While in China, these foreign emissaries were shown great hospitality by Emperor Chengzu of Ming. The voyages by Zheng He strengthened the friendly relations between China and other countries in Asia and Africa and gave an impetus to cultural and economic exchange between them.

Zheng He's voyages contributed a lot to the economic and cultural exchanges between China and other nations, and he opened up sea routes for East-West trade just as Zhang Qian and Xuan Zang had opened up land routes.



郑和下西洋
Envoy of Peace—Zheng He's Great Voyages

15世纪初的明朝，国力强盛，经济发达，文化兴旺。明成祖即位后，为了加强与东南亚国家的联系，也借此炫耀大明帝国的国威，开始了一连串大规模的海上活动。从公元1405到1433年，受明成祖派遣，郑和先后七次率领庞大的船队进行远航。因主要活动区域在今天的加里曼丹岛以西海域，旧称西洋，因此这些航海活动总称为“郑和下西洋”。

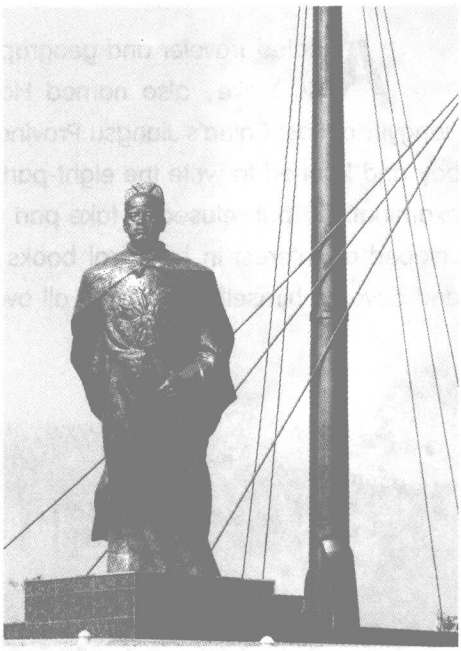
永乐三年(1405)，一支由水手、店员、翻译员、工匠、医生、气象学者、官兵共27800多人和300余艘船只组成的庞大船队，在郑和的指挥下，从苏州附近的刘家港出发，首次下西洋。船上装载着大量的货物，有丝绸、瓷器、金银首饰、铜器、铁具、棉花货物、水银、伞和稻草垫等40多个品种。船队沿中国海岸经过越南，穿越南中国海，拜访爪哇、苏门答腊，经过马六甲海峡到达斯里兰卡。

船队沿印度西海岸返航，于1407年返回中国。沿途中，印度古里的使臣以及

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亚洲数个国家和中东地区的使臣，纷纷登上郑和的船队拜访中国。郑和回国后不久又进行了第二、第三次西洋航行，基本沿着同一航线。

郑和每次远航都率领2万余人组成的庞大船队。船队穿越南海和印度洋，曾经到达今天印尼的爪哇南部，还沿着西北方向，先后拜访过也门、伊朗王国、伊斯兰教圣地麦加，以及继续向西到达东非今天的索马里。他总共拜访过30多个国家和地区，而且他所有的航行都比著名的欧洲水手哥伦布航行到美国早约半个世纪。基于此，郑和的远航毫无争议地被称为在人类的航行史上的一个空前的壮举。



郑和每次远航时，他的身份都是明朝的外交使节和贸易代表，他每到一个国家，都会拜访这个国家的元首，并通过赠送贵重的礼物来表达明政府愿意和其建立和发展友好关系的愿望，同时邀请东道国遣使来华。每到一处，郑和和他的船队都会入乡随俗，并在平等互利的基础上，通过友好协商进行贸易活动。他以这种方式为中国帝王获得了大量的珠宝、珊瑚、象牙和染料，他还把诸如长颈鹿、狮子、鸵鸟和豹子之类的珍稀动物引进了中国。

在古印度，这些中国使者的入乡随俗给当地留下了很好的印象。在郑和第三次远航拜访斯里兰卡时，他向当地的寺院捐赠了大量的金银佛教香炉和丝织经幡，该寺院为他举行了隆重的仪式，以记载这一重要活动。他每到一处，都受到热烈欢迎。

占城的国王身着皇室盛装，骑着大象，率领500骑兵，亲自到码头迎接他的到来，并且把郑和请到他的王宫。一路上，当地居民吹着椰子壳做成的号角，跳着民族舞蹈，以庄严而喜庆的仪式欢迎他。直到今天，索马里和坦桑尼亚仍然把当地出土的明代瓷器视为和中国传统友谊的象征。

郑和拜访过的国家纷纷派出使臣和贸易代表到中国。1419年，郑和第五次南洋远航期间，菲律宾和马来西亚等17个国家派遣外交使节到中国。这些使节在中国逗留期间，受到了明成祖皇帝的盛情款待。郑和的远航加强了中国与亚非等国家之间的友好关系，促进了与他们的经济文化交流。

郑和的航行为中国和其他国家的经济文化交往作出了重要贡献。正如张骞和玄奘打开了陆地往来的门户一样，郑和为东西方贸易往来打通了海上航线。

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徐霞客与《徐霞客游记》
Xu Xiake and *The Travel Diaries of Xu Xiake*

A noted traveler and geographer of the late Ming Dynasty (1368 ~ 1644), Xu Xiake, also named Hongzu (1587 ~ 1641), was born in today's Jiangyin of East China's Jiangsu Province. He studied the ancient classics as a small boy and learned to write the eight-part essay prescribed for the imperial civil service examination, but refused to take part in the imperial examination. Instead, he developed an interest in historical books, especially such books on different places, and devoted himself to traveling all over the country.



From the age of 21, Xu Xiake began to travel around and for thirty years he conducted surveys in 16 provinces, leaving his footsteps in virtually every part of the

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country. In conducting his surveys and investigations, he would never blindly embrace the conclusions recorded in previous documents. Instead, he discovered that the documentations made by his predecessors in their geographical studies were quite unreliable in many aspects.

To ensure that his reconnaissance were real and detailed, he seldom traveled by ship or by wagon. He climbed over mountains and hills and traveled long distances almost entirely on foot.

Xu's main contributions to geography include:

—A detailed scientific study of the karst landform. Xu visited over 270 caves in the (South China) Guangxi Autonomous Region and in (Southwest) Guizhou and (Southwest) Yunnan provinces, kept records of their directions, height, and depth, and elaborated on the cause of the formation. He was a pioneer in systematic karst studies in both China and the world.

—Correcting some mistakes of the records on the source and waterways of Chinese rivers.

—Observing and recording the species of many plants, explicitly putting forward the influences that landform, temperature, and wind speed might have on the distribution and blooming of plants.

—Conducting survey on the volcano relics of Tengchong Mountain in South China's Yunnan Province. Xu kept records of the shape and quality of the red pumice expelled from the volcano, and provided scientific explanation on the phenomenon.



—A detailed depiction of the phenomenon of terrestrial heat, the earliest of its kind in China.

—An excellent account of the people and places he had traveled.

Xu Xiake' contribution to the ancient Chinese geography was unprecedented, especially his detailed narration of the karst landform. His travel journal was compiled by the later generations into a book called *The Travel Diaries of Xu Xiake*, which is of high scientific and literary value.

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徐霞客与《徐霞客游记》
Xu Xiake and *The Travel Diaries of Xu Xiake*

徐霞客(1587～1641),原名弘祖,字振之,别号霞客,江苏江阴人,明代杰出的地理学家、旅行家。童年上私塾时,即听背经书,作八股文。但徐霞客偏偏没兴趣,有兴趣的是看古今史书,尤其是地方志并遍游名山大川。

21岁开始出游,30年间足迹遍及现在江苏、浙江、安徽、山东、河北、山西、陕西、河南、湖北、湖南、福建、广东、广西、江西、贵州、云南等16个省区。在他的调查研究中,他从不盲目轻信前人留下的文献总结。相反,他发现了前人在文献中记述的地理研究有很多谬误偏差。

为了使自己的勘察具体准确,他几乎舍弃了乘车或乘船,而是不畏艰险,徒步跋涉。

他在地理学上的重要贡献主要有:

对喀斯特地貌类型分布和差异,有详细的考察和科学的记述。仅在广西、贵州、云南三省,他亲自探察270多个洞穴,且有方向、高宽、深度之具体记载并初步论述成因,他是中国和世界广泛考察喀斯特地貌的卓越先驱;

纠正了文献记载的关于中国水道源流的一些错误;

观察记述了很多植物的生态品种,明确提出了地形、气温、风速对植物分布和开花早晚的各种影响;

调查了云南腾冲山的火山遗迹,科学记录与解释了喷发出来的红色浮石的形状、质地或成因;

对地热现象的详细描述在中国也是最早的;

对所到之处的人文地理情况作了不少精彩的记述。

他在中国古代地理学史上作出了超越前人的贡献,特别关于喀斯特地貌的详细记述。经后人编辑的《徐霞客游记》,不但具有极高的科学价值,而且具有很高的文学价值,被誉为"千古奇书"。

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Chapter 3 Mathematics 数学



十进制的使用
The Use of the Decimal System

According to the oracle inscription shown on tortoiseshells or animal bones, Chinese people in the Shang Dynasty was already able to use 13 words—one, two, three, four, five, six, seven, eight, nine, ten, hundred, thousand, and ten thousand—to denote any number within 100,000. However, the largest number that can be found is 30,000. The notions of odd, even, and multiple also appeared on the oracle inscriptions.

An example of how the ancient Chinese used the decimal system may be seen in an inscription from the thirteenth century BC, in which "547 days" is written "five hundred plus four decades plus seven of days." The Chinese wrote with characters instead of an alphabet. In the Western alphabet, when writing out numbers greater than nine, new words are used (for example, ten, eleven, and so on). With Chinese characters, ten is ten-blank and eleven is ten-one (zero was left as a blank space: 405 is "four blank five"). This was much easier than inventing a new character for each number. Having a decimal system from the beginning was a big advantage in making mathematical advances. The first evidence of decimals in Europe is in a Spanish manuscript of AD 976.

The decimal system, as a very important invention by the Chinese, boasts great significance in world mathematic history. Joseph Needham (1900 ~ 1995), a famous scientific historian who specialized in Chinese sciences, noted that it was virtually impossible for human beings to have a unified world without the decimal

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system, and the Chinese numeral system in the Shang Dynasty was basically more advanced and scientific than that of contemporary Babylon and Egypt.

十进制的使用
The Use of the Decimal System

据甲骨卜辞记载,商代的人们已经学会用一、二、三、四、五、六、七、八、九、十、百、千、万这13个单字记十万以内的任何数字,但是现在能够证实的当时最大的数字是三万。甲骨卜辞中还有奇数、偶数和倍数的概念。

根据公元前13世纪的甲骨文记载,"547天"被写作"500天加40天再加7天",从此例可以看出中国古人是如何使用十进制的。和别的语言不同,汉语用的是文字而不是字母。西方语言在记载大于9的数字时,使用新词(例如10,11,等)。汉语中,10为十,11为十一(零留作空位:405为"四百零五"),较西方语言中每个数字以一个单词来对应而言,这种写法容易得多。中国古人从最初就使用十进制进行运算,就数学发展而言,存在很大优势。而在欧洲,有关十进制的最早记载是在公元976年的一份西班牙手稿中。

十进制是中国人民的一项杰出创造,在世界数学史上有重要意义。著名的英国科学史学家李约瑟教授曾对中国商代记数法予以很高的评价,"如果没有这种十进制,就几乎不可能出现我们现在这个统一化的世界了"。李约瑟说,"总的说来,商代的数字系统比同一时代的古巴比伦和古埃及更为先进更为科学。"

九九乘法表
Multiplication Table

Chinese students are no strangers to the multiplication table. Known as jiujiu biao (Nine-nines rhyme), the multiplication table was already very popular as early as the seventh century BC in China according to historical very popular as early as the seventh century BC in China according to historical records. It was titled this because when it was taught one would start with "nine times nine (9x9)" and work his or her way down to "1x1". In today's schools in China,

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students start with "1x1" and work their way up.

九九乘法表和口诀

乘法表

1 × 1 = 1

1 × 2 = 2　2 × 2 = 4

1 × 3 = 3　2 × 3 = 6　3 × 3 = 9

1 × 4 = 4　2 × 4 = 8　3 × 4 = 12　4 × 4 = 16

1 × 5 = 5　2 × 5 = 10　3 × 5 = 15　4 × 5 = 20　5 × 5 = 25

1 × 6 = 6　2 × 6 = 12　3 × 6 = 18　4 × 6 = 24　5 × 6 = 30　6 × 6 = 36

1 × 7 = 7　2 × 7 = 14　3 × 7 = 21　4 × 7 = 28　5 × 7 = 35　6 × 7 = 42　7 × 7 = 49

1 × 8 = 8　2 × 8 = 16　3 × 8 = 24　4 × 8 = 32　5 × 8 = 40　6 × 8 = 48　7 × 8 = 56　8 × 8 = 64

1 × 9 = 9　2 × 9 = 18　3 × 9 = 27　4 × 9 = 36　5 × 9 = 45　6 × 9 = 54　7 × 9 = 63　8 × 9 = 72　9 × 9 = 81

乘法表

一一得一

一二得二　二二得四

一三得三　二三得六　三三得九

一四得四　二四得八　三四十二　四四十六

一五得五　二五一十　三五十五　四五二十　五五二十五

一六得六　二六十二　三六十八　四六二十四　五六三十　六六三十六

一七得七　二七十四　三七十二一　四七二十八　五七三十五　六七四十二　七七四十九

一八得八　二八十九　三八二十四　四八三十二　五八四十　六八四十八　七八五十六　八八六十四

一九得九　二九十八　三九二十七　四九三十六　五九四十五　六九五十四　七九六十三　八九七十二　九九八十一

Recent archeological finds shows that a multiplication table found at the Gurendi cultural relics of the Eastern Han Dynasty in Zhangjiajie of Central China's Hunan Province was amazingly consistent with the table of today, although the handwriting on the table is quite illegible. The table was discovered on a 22cm long wooden strip, which was broken when it was discovered. Previously, another 2,200-year-old bamboo strip from the Qin Dynasty with the carving of the multiplication table was found in the ancient Liye City in western Hunan Province, which is the earliest calculation table ever found in China.

Another multiplication table was discovered in documents from Loulan, which was written on two pieces of paper and discovered by Swedish explorer Sven Hedin a century ago.

Ancient Chinese were not the only people inventing multiplication tables as they have also been discovered on the clay tablets from ancient Babylon, but as the pronunciation of Chinese words is monosyllabic, the traditional Chinese multiplication table can be read smoothly and easily to be remembered and used.

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九九乘法表
Multiplication Table

中国的学生都背过九九乘法表。据史料记载，早在公元前7世纪，九九乘法表（亦称九九歌诀）在中国已广为人知。之所以称之为九九表，原因在于，古代的乘法口诀从“九九八十一”开始，一直到“一一得一”。今天则反其道而行之，从“一一得一”开始，一直到“九九八十一”。

根据考古专家在湖南张家界古人堤汉代遗址出土的简牍上发现的汉代“九九乘法表”，竟与现今生活中使用的乘法口诀表有着惊人的一致。这枚记载有“九九乘法表”的简牍是木质的，大约有22厘米长，残损比较严重。此前在湘西里耶古城出土的一枚秦简上也发现了距今2200多年的乘法口诀表，并被考证为中国现今发现的最早的乘法口诀表实物。

除了里耶秦简外，与张家界古人堤遗址发现的这枚简牍样式基本一致的“九九乘法表”还曾在楼兰文书中见到过，那是写在两张残纸上的九九乘法表，为瑞典探险家斯文赫定在上个世纪初期发掘。

乘法表在古代并非中国一家独有，古巴比伦的泥版书上也有乘法表。但汉字（包括数目字）单音节发声的特点，使之读起来朗朗上口，便于记忆、使用。



算盘和珠算
Abacus and Calculation with an Abacus

In 2007, the British newspaper *The Independent* listed 101 small inventions that changed the world, among which, the Chinese abacus, which has enjoyed a history of 2,000 years or so, ranked the first.

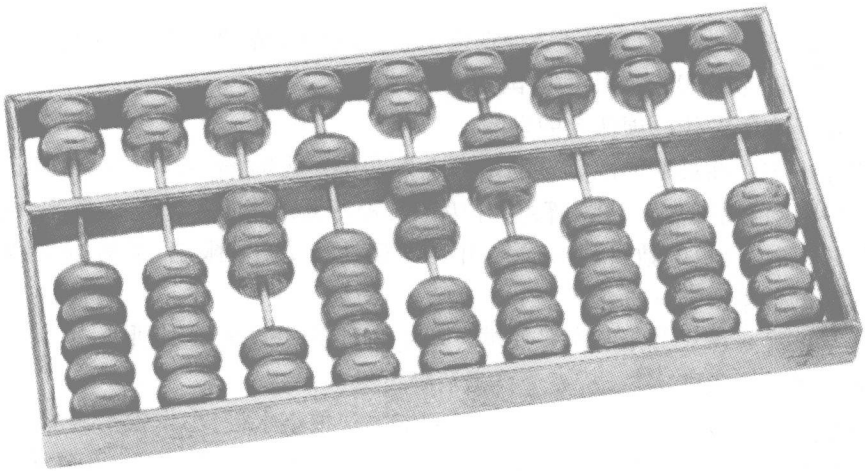
The abacus was a great invention in ancient China. The abacus was invented on the basis that Chinese used the counting-rod for a long period. In ancient times, people used small rods to count. Later, with the development of productivi-

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ty, the amount requiring calculation was greater, and calculation with counting-rods limited the calculation. Thus, people invented a more advanced counter—the abacus.

The earliest known painting of the Chinese abacus can be found in the famous long scroll Riverside Scene at Qingming Festival painted by Zhang Zeduan (1085 ~ 1145) during the Song Dynasty (960 ~ 1297). There, an abacus is clearly seen lying beside an account book on the counter of an apothecary's.

The abacus is rectangular with wooden frame on the four sides and small rods fixed inside strung with wooden beads; a girder across the middle separates the abacus into two parts: each rod has two beads on its upper part, each representing five, and five beads on the lower part, each representing one.



With the application of the abacus, people summarized many abacus rhymes, increasing the calculating speed. By the time of the Ming Dynasty, people could use the abacus in addition, subtraction, multiplication and division, which were widely used in calculating weight, amount, space and volume.

Since it is simple to make an abacus and cheap to buy one, and it is easy to remember abacus rhymes, simple and convenient to calculate with an abacus, it is widely used in China. There are many experts in the use of the abacus in all trades and professions, and some people can use an abacus with two hands at the same time.

Later the abacus was gradually spread into Japan, Korea, America, and

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countries and regions in Southeast Asia. People find that using an abacus can improve thinking and practical abilities in addition to providing convenient calculation. Since it requires cooperation of the mind, eyes and hand, it is a good way to improve the comprehensive reaction ability.



算盘和珠算
Abacus and Calculation with an Abacus

2007年,英国《独立报》评选出101款改变世界的小发明,排在第一位是有近2000年历史的中国算盘。

算盘是中国古代一项伟大的发明。

盘是中国人在长期使用算筹的基础上发明的。古时候,人们用小木棍进行计算,这些小木棍叫"算筹",用"算筹"作为工具进行的计算叫"筹算"。后来,随着生产的发展,需要计算的数目越来越大,用小木棍计算受到了限制,于是,人们又发明了更先进的计算器——算盘。

最早的算盘图见北宋画家张择端(1085~1145)的《清明上河图》长卷。画卷上一家药铺柜台上账本左边,一个算盘清晰可见。

算盘是长方形的,四周是木框,里面固定一根根小木棍,小木棍上穿着木珠,中间有一根横梁把算盘分成两部分:每根木棍的上半部有两个珠子,每个珠子代表五;下半部有五个珠子,每个珠子代表一。

随着算盘的使用,人们总结出许多计算口诀,使计算的速度更快了。这种用算盘计算的方法,叫珠算。到了明代,珠算已能进行加减乘除的运算,广泛用于计算物体的重量、数量、面积、体积等。

由于算盘制作简单,价格便宜,珠算口诀便于记忆,运算又简便,所以算盘在中国被广泛使用。中国各行各业都有一批打算盘的高手,而且有的人能用左右两只手同时打算盘。

算盘后来陆续流传到了日本、朝鲜、美国和东南亚等国家和地区。人们在使用过程中发现,使用算盘,除了运算方便以外,还有锻炼思维能力和动手能力的作用。因为打算盘需要脑、眼、手的密切配合,是训练综合反应能力的一种好方法。

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圆周率在中国
Pi in China

Pi, the ratio of the circumference of a circle to its diameter, is a very important constant in mathematics. The calculation of pi was an important criterion showing the development level of a nation's mathematics in ancient times. China attained some glaring achievements in this respect.

Pi was approximated in China as 3 at the beginning. Though very simple to use, the number was far from being precise.

On the journey of finding a precise pi, Liu Hui, a prominent mathematician of the Kingdom of Wei during the Three Kingdoms period, took the first crucial step by approximated pi. He did this by approximating circle polygons (plane structures, usually with three or more sides and angles that are used to help measure various aspects of shapes) via doubling the number of sides to get better approximations. He approximated pi as 3.14.

Green is born of blue, but beats blue; the student surpasses the teacher. Later, with Liu's method, Zu Chongzhi determined pi to 7 digits.

Zu Chongzhi (429 ~ 500) was a famous mathematician, astronomer and mechanic in the Southern and Northern dynasties (421 ~ 581). Smart and fond of learning since childhood, he liked natural science, literature and philosophy, and later became a world-famous scientist.

The achievements Zu Chongzhi made in mathematics have been universally acknowledged. Dated as far back as 1500 years ago, He worked out an accurate value of pi. Pi is usually represented by π, and it has always been a very important yet difficult research topic for mathematics to calculate the value of pi. Many mathematicians of ancient China made painstaking efforts in this research with satisfactory results. Based on earlier research, Zu Chongzhi continued to carry out systematic study. After calculating more than 1,000 times, he concluded that the value of pi falls between 3.1415926 and 3.1415927; and therefore he became the first scientist in the world who calculated the value of pi to seven decimal places. Zu Chongzhi also put forward the thesis that the approximate value of pi was 355/113,

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which was called milü(close ratio), pushing the calculation of pi to a new stage. The value was the most accurate in the world at that time, and Japanese mathematicians respectfully called it the "Zu Chongzhi Ratio". Not until more than 1,000 years later, did scientists in the West come up to and surpass the achievements of Zu Chongzhi.



圆周率在中国
Pi in China

圆周率,即圆的周长与其直径之比,是数学中最重要的常数之一。对它的计算,可以作为显示出一个国家古代数学发展的水平的尺度之一。而中国古代数学在这方面取得了令世人瞩目的成绩。

中国古代最初把圆周率取作3,这虽应用起来简便,但太不准确。在求准确圆周率值的征途中,首先迈出关键一步的是三国时期魏国杰出的数学家刘徽。他创立割圆术,用圆内接正多边形无限逼近圆而求取圆周率值。用这种方法他求得圆周率的近似值为3.14。

青出于蓝,而胜于蓝。后继者祖冲之利用割圆术得出了正确的小数点后七位。

祖冲之(429~500)是中国南北朝(421~581)时著名的数学家、天文学家和机械制造家。他从小聪明好学,爱好自然科学、文学和哲学,经过刻苦的学习钻研,终于成为一位享誉世界的科学家。

祖冲之在数学方面的成就为世界所公认。远在1500多年前,祖冲之就计算出了精确的圆周率α。圆周率通常用"π"来表示,求算圆周率的值是数学中一个非常重要也是非常困难的研究课题。中国古代许多数学家都为研究这个课题付出了心血,并取得了喜人的成果。祖冲之在前人研究的基础上,继续进行了深入系统的研究,经过1000多次的计算,得出圆周率在3.1415926和3.1415927之间,成为世界上第一个把圆周率推算到小数点后七位数字的科学家。祖冲之还提出π的近似值为355/113,称为"密率",把数学中关于圆周率的计算推进到一个新阶段,成为当时世界上最精确的圆周率。日本数学家尊称它为"祖率"。直到1000多年以后,西方的数学家才达到和超过了祖冲之的成就。

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分数和小数的最早运用
The Use of Fractional Number and Decimal Number

Fractional number

The first appearance of fractional numbers (*fen shu* in Chinese) was not a result of dividing two numbers. A fraction number was considered as a part of a whole number, and in Chinese, the word fen means to split or divide. Later, in the process of calculation, fractional numbers also appeared to denote the ratio of two whole numbers. Systematic fractional number algorithm appeared in the ancient math classic *Jiuzhang Suanshu* (*Nine Chapters on Mathematical Art*) in the Eastern Han Dynasty around the 1st century, which was about 1,400 years earlier than in Europe.

In the annotated version of *Jiuzhang Suanshu* by Liu Hui, it clearly shows the algorithm of the subtraction, addition, multiplication, and division of fractional numbers, which is identical to today's fractional calculations. Besides, other knowledge about fractions, including how to compare two fractions, and how to calculate the average of fractions, were also included in the book, making *Jiuzhang Suanshu* the earliest monograph that systematically discussed fractional numbers.

It was not until the 15th century that calculations with fractional numbers became popular in Europe. It is generally believed in Europe that the algorithm of fractional numbers originated in India, while the fact is the earliest Indian book on the algorithm of fractions appeared in the seventh century, in which were introduced the same rules as the those in *Jiuzhang Suanshu* . And even the annotated version of *Jiuzhang Suanshu* by Liu Hui was completed in 263 in the Wei Dynasty (220 ~ 265), which means that the algorithm of fractions is at least 400 years earlier than its counterpart in India.

Decimal number

Also in the annotated version of *Jiuzhang Suanshu* by Liu Hui, the notion of the decimal number was first raised up. Liu invented the decimal number to denote the approximate number value of root extractions. Around the

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year 1300, Liu Jin in the Yuan Dynasty wrote the number 106368.6312 as 〓 in his book *Lülü Chengshu*. The notion of decimal number appeared in the West in 1585 and the expression is rather difficult. For instance, the same number mentioned above would be expressed as ⓪ ① ② ③ ④ or 106368 ⓪6 ① 3 ② 1 ③ 2 ④

分数和小数的最早运用
The Use of Fractional Number and Decimal Number

分数

最初分数的出现，并非由除法而来。分数被看作一个整体的一部分。“分”在汉语中有“分开”“分割”之意。后来运算过程中也出现了分数，它表示两整数比。在中国古代，东汉时期的《九章算术》中有系统的分数运算方法，这比欧洲大约早1400年。

从后来刘徽所作的《九章算术注》可以知道，在《九章算术》中，讲到约分、合分（分数加法）、减分（分数减法）、乘分（分数乘法）、除分（分数除法）的法则，与我们现在的分数运算法则完全相同。另外，《九章算术》还记载了课分（比较分数大小）、平分（求分数的平均值）等关于分数的知识，是世界上最早的系统叙述分数的著作。

分数运算，大约在15世纪才在欧洲流行。欧洲人普遍认为，这种算法起源于印度。实际上，印度在7世纪的著作中才开始有分数运算法则，这些法则都与《九章算术》中介绍的法则相同。而刘徽的《九章算术注》成书于魏景元四年（263），所以，即使与刘徽的时代相比，印度也要晚400年左右才有分数运算法则。

小数

刘徽在《九章算术注》中介绍，开方不尽时用十进分数（徽数，即小数）去逼近，首先提出了关于十进小数的概念。到公元1300年前后，元代刘瑾（公元1271～1368年）所著《律吕成书》中，已将106368.6312写成：〓

而西方直到1585年才有十进小数的概念，且表示方法很复杂，如上述小数，写法为：⓪ ① ② ③ ④ 或106368 ⓪6 ① 3 ② 1 ③ 2 ④。

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负数的使用
The Use of Negative Numbers

The introduction of negative numbers is a great contribution to mathematics by ancient Chinese mathematicians. In *Nine Chapters on the Mathematical Art* (*Jiuzhang Suanshu*), negative numbers were used in the eighth chapter on solving systems of simultaneous equations. For instance, revenue numbers are considered positive, while expense numbers are deemed negative; or surplus amounts are viewed as positive, while deficit amounts are seen as negative. In a problem calculating grains, the increased grains are considered positive, and the lost grains, negative. At the time, calculation was done by the method of Suan Chou (counting rods). Red rods were used to denote positive coefficients, and black ones to denote negative ones. Or in another case, the normal position of Suan Chou denoted positive, while an inclined position denoted negative.

Rules for the calculation of signed numbers were also given in *Jiuzhang Suanshu*. According to the book, the deduction (or subtraction) of two numbers with the same sign (from another number) equals the deduction of the absolute values of the two numbers, while the deduction of two numbers with different signs equals the addition of the absolute values of the two numbers. Also, a positive number subtracted from zero gives a negative number, whereas a negative number subtracted from zero gives a positive number. The addition of two numbers with different signs equals the deduction of their absolute values, while the addition of two numbers with the same sign equals the addition of their absolute values. Zero plus a positive number is still a positive number, and zero plus a negative number is still a negative number. Until the 17th century, it was the most complete depiction on the rules for adding and subtracting positive and negative numbers in the world.

Negative numbers appeared very late in the West. Many noted mathematicians did not admit negative numbers, because they consider zero as "nothing" and could not understand that something could be even less than "nothing," and

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so considered negative numbers "absurd." It was only in the 17th century when Descartes invented the coordinate system, which gave a geometrical explanation and an actual meaning for negative numbers, that negative numbers began to be accepted gradually.

The introduction of negative numbers is an important contribution of Chinese mathematicians to world mathematics. With the introduction of negative numbers, the whole numbers and rational numbers became complete.



负数的使用
The Use of Negative Numbers

负数的引进,是中国古代数学家对数学的一个巨大贡献。在《九章算术》的第八章"方程"中,就引入了负数解联立方程组。如负数出现在方程的系数和常数项中,把"卖(收入钱)"作为正,则"买(付出钱)"作为负,把"余钱"作为正,则"不足钱"作为负。在关于粮谷计算的问题中,是以益实(增加粮谷)为正,损失(减少粮谷)为负等。当时是用算筹来进行计算的,以红筹为正,黑筹为负;或将算筹直列作正,斜置作负。

在《九章算术》中,除了引进正负数的概念外,还完整地记载了正负数的运算法则:同号两数相减,等于其绝对值相减;异号两数相减,等于其绝对值相加;零减正数得负数,零减负数得正数。异号两数相加,等于其绝对值相减;同号两数相加,等于其绝对值相加;零加正数得正数,零加负数得负数。直到公元17世纪以前,这还是正负数加减运算最完整的叙述。

在西方,负数出现得很晚。许多著名数学家一直不承认负数。他们把零看作"没有",他们不能理解比"没有"还要"少"的现象,因而认为负数是"荒谬的"。直到17世纪,笛卡儿创立了坐标系,负数获得了几何解释和实际意义,才逐渐得到了公认。

负数的引进,是中国古代数学家贡献给世界数学的一份宝贵财富。负数概念引进后,整数集和有理数集就完整地形成了。

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《周髀算经》
Zhoubi Suanjing

The oldest mathematical classic in China, *Zhoubi Suanjing* or The Arithmetical Classic of the Gnomon and the Circular Paths of Heaven, is an astronomy text as well. It is thought to have been compiled sometime between 500 BC and 200 AD. During the Tang Dynasty, the book was listed as the first of all the texts included in *the Ten Mathematical Classics*. It contains some important mathematical sections and measures the positions of the heavenly bodies. How a gnomon might be used is described in a conversation between Duke of Zhou and his as astrologer Shang Gao in the text:

Duke of Zhou: How great is the art of numbers? Tell me something about the application of the gnomon.

Shang Gao: Level up one leg of the gnomon and use the other leg as a plumb line. When the gnomon is turned up, it can measure height; when it is turned over, it can measure depth and when it lies horizontally it can measure distance. Revolve the gnomon about its vertex and it can draw a circle; combine two gnomons and they form a square.

Zhoubi Suanjing is a collection of 246 problems encountered during the conversations between the Duke of Zhou and Shang Gao. Each question has stated their numerical answer and corresponding arithmetic algorithm. The author of the Zhoubi Suanjing writes that Emperor Yu quells floods, deepens rivers and streams, surveys high places and low places by using the Gougu rule. And this book contains one of the first recorded proofs of the Gougu rule, or the Pythagorean Theorem in the world.

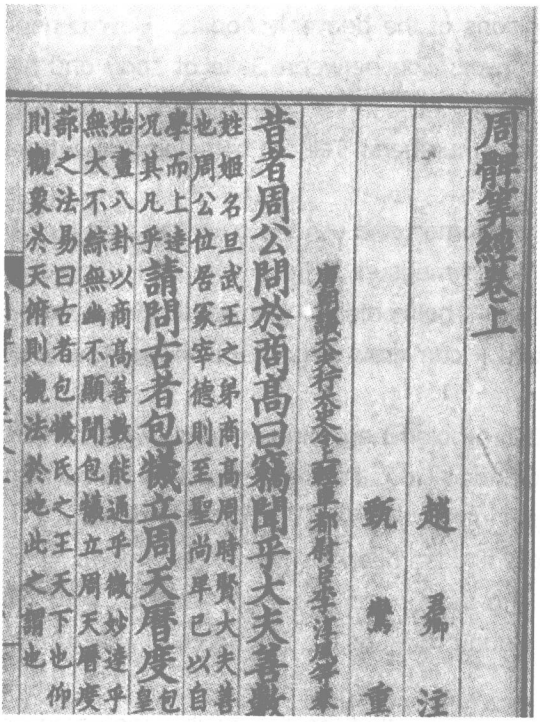
The text of *the Zhoubi Suanjing* also explains that the reason that mathematics can be applied to so many different cases is as a result of the way that mathematical reasoning allows one to pass from particular to general situations. This realization of the abstract nature of mathematics is important.

Zhoubi Suanjing contains calculations of the movement of the sun through the year as well as observations of the moon and the stars, particularly the pole star.

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《周髀算经》
Zhoubi Suanjing

《周髀算经》是中国历史上最早的一部数学典籍，也是一部天文学著作。成书时间大约在公元前5世纪与公元2世纪之间，唐代被收入《算经十书》，并被列为《十经》的第一部。该书包括许多重要的数学内容，还对天体方位作了测定。例如书中周公与商高的一段对话描述了如何用日圭标竿进行测量：


周髀算經卷上
趙爽注
甄鸾重
普者周公問於商高曰竊聞乎大夫善數
姓姬名旦武王之弟商高周時賢大夫善也周公位居冢宰德則至聖尚早已以自
孝而上達其凡乎請問古者包犧立周天曆度包
則觀象於天俯則觀法於地此之謂也昔包犧氏之王天下也仰
蔀之法易曰古者包犧氏始畫八卦以商高善數能通乎微妙達乎無大不綜無幽不顯開包犧立周天曆度

周公曰："大哉言数！请问用矩之道？"

商高曰："平矩以正绳，偃矩以望高，覆矩以测深，卧矩以知远，环矩以为圆，合矩以为方。"

《周髀算经》中周公与商高之间的对话涉及246个问题，每个问题都以相应数学算法得到解决。其中谈到了勾股定理（亦称毕达哥拉斯定理）及其在测量上的应用，记载了大禹如何运用勾股定理治理水灾、加深河床、测量高低。这是世界上关于勾股定理最早的文字记录之一。

《周髀算经》还解释了数学在各方面广泛应用的一个原因，即数学推理使人们能够从个别推及普遍，这是对抽象的数学性质的一个重要认识。

此外，《周髀算经》还计算了太阳在一年内的运动，并对月亮和星星，尤其是北极星作了观察。

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《九章算术》
Jiuzhang Suanshu

The Jiuzhang Suanshu (*Nine Chapters on the Mathematical Art*) is the longest surviving and one of the most important in the ten ancient Chinese mathematical books. The book was finished in the early Eastern Han Dynasty (about 1st century), indicating the formation of ancient Chinese mathematical system. It became the criterion of mathematical learning and research for mathematicians of later generations ever since then.

Afterwards, *the Jiuzhang Suanshu* have been annotated by many mathematicians, the most famous ones including Liu Hui (263) and Li Chunfeng (656). During the Tang Dynasty and Song Dynasty, it was officially declared to be the national mathematical textbook. The edition published by the Northern Song government in 1084 was the earliest mathematical book in the world. The book was introduced to Korea and Japan during the Sui and Tang dynasties. Now, it has been translated into several languages, including Japanese, Russian, German, English and French.

The book is broken up into nine chapters containing 246 questions with their solutions and procedures. Here is a brief description of each chapter:

Chapter I	Chapter II	Chapter III
Field measurement (Fang tian)	Cereals (Su mi)	Distribution by proportion (Cui fen)
Method for calculation of areas of land Deals with computation with fractions	Concerns with proportions (for exchange of cereals, millet, or rice)	Deals with problems on proportional distribution
Chapter IV	Chapter V	Chapter VI

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What width? (Shao guang)	Construction consultations(Shang gong)	Fair taxes (Jun shu)
Finds the length of a side when given the area or volume Finds the square root or cube root of a number	Concerns with calculation for constructions of solid figures Finds the volumes of various shapes of solid figures	Deals with calculation on how to distribute grain and labor fairly
Chapter VII	Chapter VIII	Chapter IX
Excess and deficiency (Ying bu zu)	Rectangular arrays (Fang cheng)	Right Triangles (Gou gu)
Uses of method of false position to solve difficult problems	Problems on simultaneous linear equations Introduces concept of positive and negative numbers Addition and subtraction of positive and negative numbers	Discusses the Gou gu theorem and properties of the right-angled triangle Problems on similar right-angled triangles Introduces general methods of solving quadratic equations

The book's major achievements are as follows:

1. Devising a systematic treatment of arithmetic operations with fractions, 1,400 years earlier than the Europeans.

2. Dealing with various types of problems on proportions, 1,400 years earlier than the Europeans.

3. Devising methods for extracting square root and cubic root, which is quite similar to today's method, several hundred years earlier than the Western mathematicians.

4. Developing solutions for a system of linear equations, about 1,600 years earlier than the Western mathematicians.

5. Introducing the concepts of positive and negative numbers, more than 600

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years earlier than the West.

6. Developing a general solution formula for the Pythagorean problems (problems of Gou gu), 300 years earlier than the West.

7. Putting forward theories of calculating areas and volumes of different shapes and figures.



《九章算术》
Jiuzhang Suanshu

《九章算术》是中国古代数学专著,是"算经十书"中最重要的一种。《九章算术》大约于东汉初年(公元1世纪)成书,它的出现标志着中国古代数学体系的形成。后世的古代数学家,大都是从《九章算术》开始学习和研究数学的,许多人曾为它作过注释,其中最著名的有刘徽(263)、李淳风(656)等人。唐宋两代都由国家明令规定为教科书。1084年由当时的北宋朝廷进行刊刻,是世界上最早的印刷本数学书。《九章算术》在隋唐时期就已传入朝鲜、日本. 现在它已被译成日、俄、德、英、法等多种文字。

《九章算术》分为九章,收有246个数学问题及解法与步骤。各章主要内容分别是:第一章"方田",研究田亩面积计算,用分数进行运算;第二章"粟米",研究谷物粮食的按比例折换;第三章"衰分",研究比例分配问题;第四章"少广",已知面积、体积、求其一边长和径长;求数的平方根、立方根;第五章"商功",研究土石工程、体积计算;第六章"均输",研究合理摊派赋税;第七章"盈不足",即双设法问题;第八章"方程",研究一次方程组问题,介绍正负数概念,进行正负数加减计算;第九章"勾股",探讨勾股定理、直角三角形属性,研究等边直角三角形问题,介绍二次方程的通解方法。

《九章算术》的数学成就如下:

(1)提出用分数进行运算的完整法则,比欧洲早1400多年;

(2)提出整套的比例理论,比欧洲早了1400多年;

(3)介绍了开平方、开立方的方法,其程序与现今程序基本一致,比西方早了数百年;

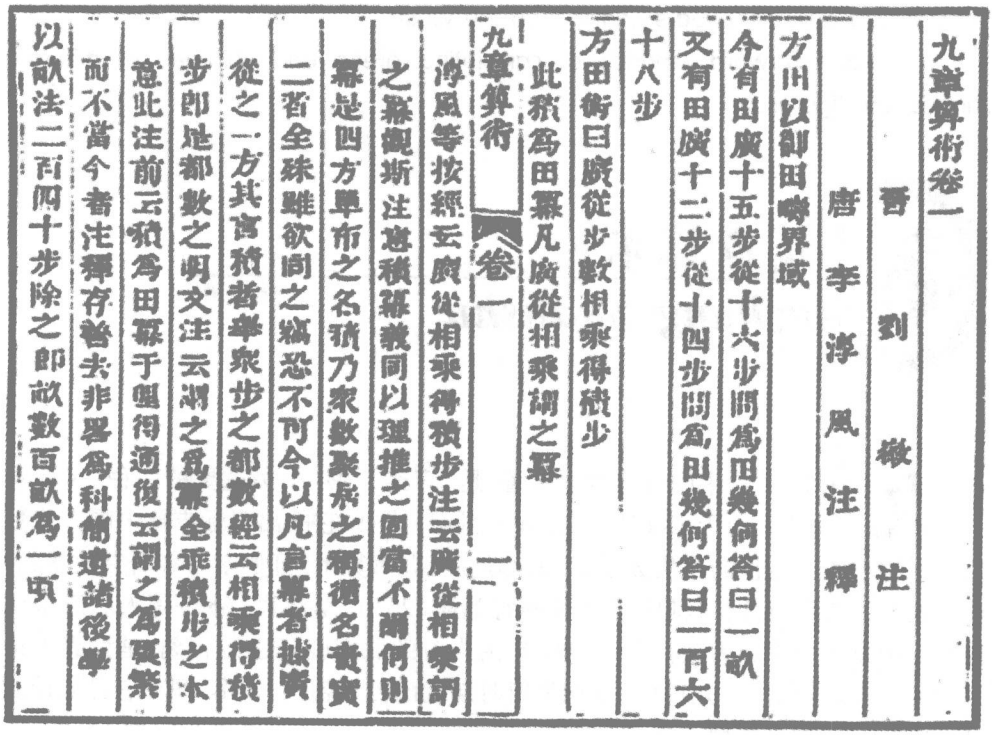
(4)采用分离系数的方法表示线性方程组,比西方早了1600年;

(5)提出了正负数,比西方早了6个世纪;

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(6)提出了勾股数问题的通解公式,比西方早了3个世纪。

(7)提出了各种多边形、圆、弓形等的面积公式。


九章算術卷一

晉劉徽注

唐李淳風注釋

方田以御田疇界域

今有田廣十五步從十六步問爲田幾何答曰一畝

又有田廣十二步從十四步問爲田幾何答曰一百六十八步

方田術曰廣從步數相乘得積步

此術爲田幂凡廣從相乘謂之幂

九章算術 卷一 一

淳風等按經云廣從相乘得積步注云廣從相乘即之幂觀斯注意積幂義同以理推之固當不謂何則幂是四方單布之名積乃衆數聚斉之稱猶名異實二者全殊雖欲同之竊恐不可今以凡言幂者皆積從之一方其言積者舉衆步之都數經云相乘得積步即是都數之明文注云謂之爲幂全乖積步之本意此注前云積爲田幂于理得通復云謂之爲幂而不當今者注釋存善去非器爲科條遺諸後學以啟法二百四十步除之即故數百畝爲一頃

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Chapter 4 Physics 物理



中国传入西方的机械技术
Chinese Mechanical Inventions that Contributed to the World

A common stereotype is that the Chinese have traditionally lacked scientific and technological ability, despite the four great revolutionary inventions of paper making, printing, gunpowder, and compass that have essentially changed the world. However, Chinese people have made a lot of other significant mechanical inventions besides the famous four, providing the source of many of the prerequisite technologies of modernity. From the 6th to the 15th century, China was the world's most technologically advanced society.

Here are some of the most celebrated mechanical inventions from China that have exerted profound influences on the development of other societies, especially when they were passed to the West:

Cast iron
The double-acting piston bellows
The crank handle (used for starting an engine)
The gimbals (as in the ancient Chinese Incense Burner)
Manufacture of steel from cast iron
The belt drive (or driving-belt)
Water power
The chain pump
Essentials of the steam engine
The chain drive (in which an endless wheel transmits power from an engine)

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The wheelbarrow
Sliding calipers (a kind of compass used for measuring diameters)
The fishing reel
The umbrella
The mechanical clock
"Permanent" lamps
The spinning wheel
Rudder



中国传入西方的机械技术
Chinese Mechanical Inventions that Contributed to the World

在很多人心目中,传统的中华文化似乎缺乏对科学技术的应用,可事实并非如此。除了对人类社会发展产生了巨大影响的四大发明之外,中国古代在科学技术方面也取得了辉煌的成就。中国古代的很多机械发明为人类社会的现代化提供了必要的条件。从公元6世纪到15世纪,中国一直是世界上科学技术最为发达的国家。从中国传往世界各地的技术发明中,最为显赫的还是活字印刷术、火药、指南针。

以下是一些由中国传入其他国家的重要机械技术,它们一经进入了西方,便对西方社会的发展,乃至人类历史的进程都产生了巨大的影响:

铸铁
活塞风箱
手摇曲柄
平衡环(被中香炉)
皮带传送
水力应用
方板链泵
蒸气机基本原理
链条传动
独轮车
滑动测径仪

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机械钟表装置
永明灯
纺车
轮式碾磨机
船尾舵
航海磁罗盘



杆秤
Chinese Steelyard—Gancheng

The steelyard is a Chinese invention. As early as 200 B. C., China began to make a scale of this type big enough to weigh several hundred pounds. The steelyard consisted of the following parts: an arm, a hook, lifting cords and a weight. The arm or beam measured about 1.5 metres long, graduated with the weight units—*jin* and *liang**. The hook, hanging from one end of the arm, was used to lift up the object to be weighed. Hanging from the other part of the arm was the freemoving weight, attached on a looped string. On the arm was fixed one, two or three lifting cords, placed much closer to the hook than to the other end. Anything to be weighed should be picked up by the hook, while the weigher lifted up the whole steelyard, holding one of the cords. He then slided the weight left or right until he found a perfect balance of the beam. He then read the weight from the graduation mark on which the weight-string rested.

This kind of steelyard is still in widespread use at market gatherings in China. They may be made in varying sizes working by the same principle, with the large ones to weigh food grain in bulk, pigs or sheep or their carcasses, and medium-sized ones for smaller transactions. There is also a miniature steelyard only about one third of a metre (about 1 foot) long, graduated with *liang* and *qian***. Used to weigh medicinal herbs and silver or gold, it first appeared about 1,000 years ago.

The steelyard is more convenient than the platform scale. Not only can it be carried around easily, but there is also no need for a whole set of weights. Corresponding to the lifting cords are different sets of graduation marks on the arm for

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different measuring ranges.

It is perhaps worthwhile to mention that the equal-armed platform scale appeared in China earlier than the steelyard with a sliding weight. A scale of the former description with a complete set of weights was discovered lately from a tomb near Changsha, Hunan Province, which dates back to the Warring States Period. It is in size similar to those in use today and its component parts are found to be in good proportions.

* One *Jin* equals 500 grams or about 1.1 pounds; it used to be divided into 16 *liang*, but now 10 *liang*.

* * A *qian* is one-tenth of a *liang*.



杆秤
Chinese Steelyard—Gancheng

杆秤是中国发明的历史最悠久的一种衡器。早在公元前200年前，已有了各种规格的杆秤砣，大的足以称重几百斤的物品。杆秤由木制的秤杆、金属秤砣、提绳等组成。秤杆长约1.5米，上面标有斤两刻度的星点。秤杆的一端悬挂着秤钩，用来吊起要称重的物品。秤杆上还挂有一个自由移动的秤砣。在靠近秤钩的一端固定了一到三个提绳。称重时必须用秤钩勾起物品，称重人提着提绳举起整杆秤，并将秤砣左右滑动直到完全平衡，然后根据秤砣上的绳子所在的星点位置读出重量即可。

至今在中国的集市上仍然广泛使用杆秤。尽管大小不同，原理都是一样的。大的用来称粮食、牲畜等，中等的用来称稍小的物件。还有一种只有普通杆秤的三分之一长的小杆秤，上面的星点刻度是“两”和“钱”，是用来称中草药或金银的。这种小杆秤最早出现于1000多年前。

杆秤和台秤相比更加方便，因为它易于携带，也不需要一整套的秤砣，不同的重量范围取决于秤杆上不同的提绳。

还值得一提的是，在中国天平秤比杆秤出现得更早。在湖南长沙出土的天平带有一整套的秤砣，据考为战国时期所造。它的大小和目前使用的天平大小接近，组件比例合适。

*一斤相当于500克或1.1镑，古代一斤是16两，而现在是10两。

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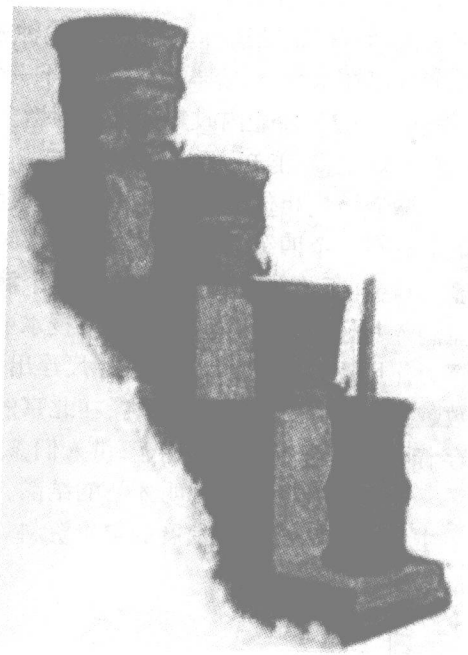
＊＊一钱为 1/10 两。

漏壶
The Clepsydra

The clepsydra is an instrument for time calculation in ancient China.

The ancient people, upon finding that water in a pottery often leaked out drop by drop, made a pottery kettle with a small hole. Water filling the kettle would leak out through the hole, and another kettle was used to collect the leaking water. A marked arrow, like the dial of today's watch, was placed inside the second kettle through the hole of the kettle lid, floating on top of the water with the support from a bamboo flake or a wooden plate. The kettle was known as an "arrow kettle". As the water level increased, the arrow also moved upwards, and people could know the exact time through looking at the marks on the arrow.

As the clepsydra was passed on from generation to generation, it gradually evolved into a set of four pots. These are placed in order on a four-level wooden stand, the one on the highest level called the Sun Pot, and below it the Moon Pot, Star Pot and Water-receiving Pot, respectively. The Sun Pot, Moon Pot and Star Pot all have an opening at the bottom for water to drop, and the Water-receiving Pot has a gauge inside. The water drops from the Sun Pot into the Moon Pot and then into the Star Pot and at last into the Water-receiving Pot. As more and more water drops into the Water-receiving Pot, the gauge gradually increases with the buoyancy of water. And



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thus people could tell the time through the scale above the water. The more levels the clepsydra has, the more accurate it is to measure time. Now, the four-level clepsydras of the Yuan and Qing dynasties are preserved respectively in the Museum of Chinese History and the Palace Museum in Beijing.

The copper clepsydra is the crystallization of ancient Chinese wisdom and creativeness. It not only tells us how ancient Chinese measured time, but also provides precious materials on the development of science and technology in ancient China.



漏壶
The Clepsydra

漏壶是中国古代的一种计时工具。最初，人们发现陶器中的水会从裂缝中一滴一滴地漏出来，于是专门制造出一种留有小孔的漏壶，把水注入漏壶内，水便从壶孔中流出来，另外再用一个容器收集漏下来的水。在这个容器内有一根刻有标记的箭杆，相当于现代钟表上显示时刻的钟面，用一个竹片或木块托着箭杆浮在水面上，容器盖的中心开一个小孔，箭杆从盖孔中穿出，这个容器叫做“箭壶”。随着箭壶内收集的水逐渐增多，箭杆也慢慢地往上浮，古人从盖孔处看箭杆上的标记，就能知道具体的时刻。

漏壶历代相传，由单只逐渐发展成为后来四只一套的漏壶。人们把四只漏壶依次放在一个四级木架上，上面的一只叫日壶，下面的三只分别叫月壶、星壶、授水壶。日壶、月壶、星壶的下面各有一个滴水的铜嘴，授水壶内有一个标尺。水从日壶滴入月壶，再到星壶，最后滴入授水壶。授水壶内的水越来越多，标尺受到水的浮力作用逐渐上升，人们通过标尺浮出水面的刻度，就可以知道时间了。漏壶的级数越多，计时就越准确。现在，在北京的中国历史博物馆和故宫博物院里还分别保存着元代和清代的四级漏壶，供人们参观。

漏壶是中国古人聪明才智的结晶，它不仅告诉了我们古人计时的方法，也留下了中国古代科学技术发展的宝贵资料。

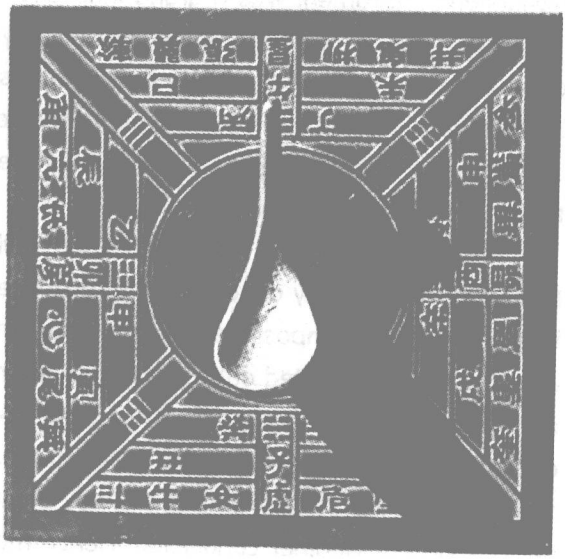
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指南针
The Compass

The compass is considered to be one of the four great inventions of ancient China.

Before the compass was invented, people depended upon the position of the sun and stars to tell them the direction when at sea, which only worked when it wasn't cloudy. The invention of compass solved the problem.

Over 2,000 years ago, in the Warring States Period, Chinese ancestors invented the earliest compass—Si Nan, also known as the South Pointer. Si Nan was composed of two parts: a spoon and a tray. The spoon was cut from an intact piece of natural loadstone, with its handle as the South Pole and its round, smooth bottom as the center of gravity. The tray, on the other hand, was made of bronze, and at the center, there was a round, smooth groove, carved with checks and words indicating the 24 directions. When the spoon was put into the groove, it would rotate flexibly. When the spoon stopped, its handle would point to the south. This instrument was the predecessor of the magnetic compass.



However, since it was easy for natural loadstone (magnetic iron oxide) to lose its magnetism, Si Nan could not be widely used. During the Northern Song Dynasty, artificial magnetization was discovered, giving rise to the Pointing-to-the-South Fish, which was made from a piece of thin iron sheet cut into the shape of a fish, magnetized in a geomagnetic field, and put into water, floating and lying

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north-to-south. However, due to its weak magnetic field, Pointing-to-the-South Fish was not of much practical value. On the basis of the Pointing-to-the-South Fish, people replaced the thin iron sheet with a magnetized steel needle, giving rise to the earliest artificially magnetic compass.

The compass was soon employed in navigation. The earliest record on using the compass in navigation was in Zhu Yu's *Ping Zhou Ke Tan* (written between 1119 ~ 1125), which recorded Zhu Yu's experiences in Guangzhou (South China's Guangdong Province), where navigation was highly developed. Zhu also wrote about some of the experienced sailors, "The sailors know how to pinpoint the ship's position; they watch the stars at night and the sun in the day, and when it is cloudy, they use the compass." This might be the earliest record on the use of the compass in the world's navigational history. Initiated by the Chinese people, this navigational instrument was a grand innovation in navigation technology.

Soon after, Arabian sea boats also employed the navigation device, and went on to introduce it to the European countries. As Friedrich Engels, pointed out in his book *Natural Dialectics*, "The magnetic needle arrived in Europe via the Arabs in around 1180." The statement shows the Europeans applied the compass in navigation 80 years after the Chinese.

The famous scientist Shen Kuo (the author of *Dream Creek Notes*) of the Northern Song Dynasty discovered the existence of magnetic declination (the angular deviation of a compass needle from true north), after performing many scientific experiments. He pointed out correctly that the magnetic poles of the earth were not in uniformity with the geographic poles. The use of marine compass and the theory of magnetic declination combined played a most important role in the long-distance sea voyages. For the first time in history, humans were able to navigate freely under any kind of weather conditions. Hence many new sea routes were opened to traffic, promoting the exchange of culture and trade among the people of the world. Words fail to describe the compass' importance to navigation.

Joseph Needham, a famous historian, once said to Chinese students: "In the realm of navigation, your ancestors were much more advanced than our ancestors. Far before Europe, the Chinese already harnessed the wind power, with the coordination of fore (front) and aft (rear) sails to navigate in any direction of the wind they encountered. Perhaps for this reason, in the history of navigation, China never used the galleys, which were rowed along by slaves as in ancient Greece or Rome."

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The invention of the compass had epochal influence on navigation, opening up a new chapter in the history of world navigation. With its help, Admiral Zheng He made seven voyages across seas to Southeast Asia and around Indian Ocean in the early Ming Dynasty (1368 ~ 1644), Christopher Columbus discovered the New World, and Ferdinand Magellan sailed round the world.



指南针
The Compass

指南针是中国古代“四大发明”之一。

在指南针发明以前，人们在茫茫大海上航行，只能靠太阳和星星的位置辨认方向，如果遇上阴雨天，就会迷失方向。而中国人发明的指南针则帮助人们解决了这个难题。

早在2000多年前的战国时期，我们祖先就发明了最早的指南针——司南。司南由一把“勺子”和一个“地盘”两部分组成。司南勺由整块磁石制成。它的磁南极那一头琢成长柄，圆圆的底部是它的重心，琢得非常光滑。地盘是个铜质的方盘，中央有个光滑的圆槽，四周刻着格线和表示24个方位的文字。司南勺放进了地盘就能灵活地转动，在它静止下来的时候，磁石的指极性使长柄总是指向南方。这种仪器就是指南针的前身。

由于天然磁石因打击受热容易失磁，磁性较弱，因而司南不能广泛流传。到宋朝时，有人发现了人造磁铁，进而发明了指南鱼。人们把经过磁化的薄片做成鱼的形状，将其放入水中即能浮在水面并指示正南北方向。后来，人们将指南鱼再加以改进，把带磁的薄片改成带磁的钢针，创造了人造磁体指南针。

指南针发明后很快就应用于航海。世界上最早记载指南针应用于航海导航的文献是北宋宣和年间(1119 ~ 1125)朱彧所著《萍洲可谈》。该书记录了他在广州时的见闻，还记载了中国海船上很有经验的水手：“舟师识地理，夜则观星，昼则观日，阴晦则观指南针。”这是全世界航海史上使用指南针的最早记载。我国人民首创的这种仪器导航方法，是航海技术的重大革新。

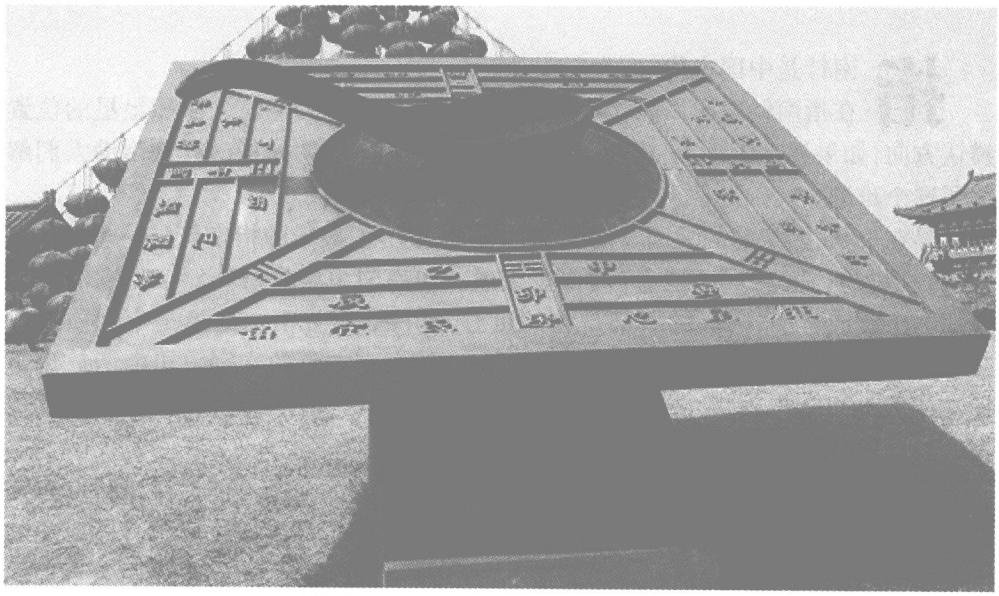
中国使用指南针导航不久，就被阿拉伯海船采用，并经阿拉伯人把这一伟大发明传到欧洲。恩格斯在《自然辩证法》中指出，“磁针从阿拉伯人传至欧洲人手中在1180年左右”。中国人首先将指南针应用于航海比欧洲人至少早80年。

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北宋著名科学家沈括(《梦溪笔谈》著者),在制作和应用指南针的科学实践中发现了磁偏角的存在。他精辟地指出,这是因为地球上的磁极不正好在南北两极的缘故。指南针及磁偏角理论在远洋航行中发挥了巨大的作用,人类第一次得到了在茫茫大海中航行的自由,从此开辟了许多新的航线,促进了各国人民之间的文化交流与贸易往来。指南针对航海事业的重要意义怎么说也不为过。

西方著名历史学家李约瑟曾对其中国学生说:"你们的祖先在航海方面远比我们的祖先来得先进。中国远在欧洲之前懂得用前、后帆的系统御风而行,或许就是这个原因,在中国航海史上从未用过多桨奴隶船。"

指南针的发明,给航海事业带来了划时代的影响,世界航运史也由此翻开了新的一页。明朝初期郑和率领船队七下西洋,15 世纪哥伦布发现新大陆和麦哲伦环绕地球航行等壮举,都是指南针用于航海事业的结果。



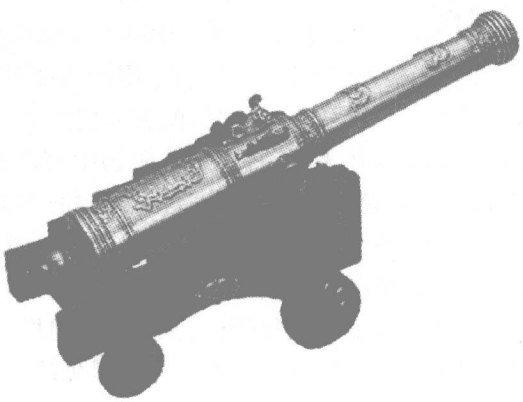
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Chapter 5 Chemistry 化学

火药 Gunpowder

Gunpowder is considered to be one of the four great inventions of ancient China.

The invention of gunpowder had a close relationship with the advanced ancient workmanship of smelting industry. People began to know a lot of chemistry knowledge about the nature of different mineral materials during the process of smelting operation. With the knowledge, ancient necromancers tried to seek the elixir of immortality from certain kinds of ores and fuel. Although they failed to get what they were looking for, they discovered that an explosive mixture could be produced by combining sulfur, charcoal, and saltpeter (potassium nitrate) in a certain proportion. This mixture finally led to the invention of gunpowder although its exact date of invention still remains unknown.



Many historical materials indicate that gunpowder first appeared before the

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Tang Dynasty. It was called "Black Gunpowder" because it's black in color. It was first used to make firecrackers and fireworks. The military applications of gunpowder began in the Tang Dynasty. The earliest weapon made from gunpowder was "Flying Fire", that is, rocket. During the Song and Yuan Dynasties, the military applications of gunpowder became common and some other weapons like "fire cannon", "rocket", "missile" and "fireball" were introduced.

Between 1225 and 1248, gunpowder and the related weapons spread to Europe via Arabia. Since the major raw material of gunpowder niter is as white as snow, Arabians called gunpowder "Chinese Snow" and "Chinese Salt". After gunpowder spread into Europe, it was not only used in weapons, and also for cutting through mountains, constructing roads, and digging rivers. The invention of gunpowder accelerated the coming of the Industrial Revolution.



火药
Gunpowder

火药是中国古代的"四大发明"之一。

火药的发明与中国古代发达的冶炼技术有密切的关系。在冶炼金属的过程中,人们不断总结经验,逐渐接触和熟悉了许多矿物的性能,积累了丰富的化学知识。从战国时代起,就有人把冶金技术运用到炼制矿物药方面,梦想能炼出长生不老的药来,也有人想从矿物中炼出金银来。虽然没有炼出长生不老的丹药或金银,但是炼丹工匠们在炼丹的过程中发现,硝石、硫磺与含碳物质在一起加热后会发生剧烈的化学反应。在一次次爆炸中,人们逐渐认识到硝石、硫磺、木炭按一定比例配制,将会制成会能爆炸的火药。

火药发明的具体年代已无从查考,但根据资料可以推断,火药发明的时间应在唐代以前。由于这种火药的颜色是黑色的,所以叫做"黑火药"。火药发明后,先是被制成了爆竹和焰火。唐朝末年,火药开始用于军事。最早的火药武器是"飞火",即火箭。宋、元时期,军事上广泛应用火药,出现了许多火药武器,主要有火箭、火铳、突火枪、火炮等。

公元 1225 ~ 1248 年之间,火药和火药武器经由阿拉伯传到欧洲。因为制造火药的主要原料硝石洁白如雪,所以火药被阿拉伯人称为"中国雪"和"中国盐"。火

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药传到欧洲后，被各国用来制造兵器，还在开山、修路、挖河等工程中广泛使用，火药的使用促进了工业革命的到来。

造纸术
Papermaking

Papermaking is considered to be one of the four great inventions of ancient China. Before the papermaking technology was invented, people carved or wrote Chinese characters on tortoise shells, animal bones, bamboo slices, wooden plates, and thin tough silks. Tortoise shells, animal bones and wooden plates were too heavy to use while silks were too expensive. Around the early period of the Western Han Dynasty, people made paper from hemp and ramie. Initially, this was very rough and not suitable for writing.

During the Eastern Han Dynasty, an official named Cai Lun improved the technique after years of experimentation. He used many plant fibers such as barks, rags, torn fishing nets as raw materials, steamed and cooked them with water, then pounded them into pulp, and then spread the pulp evenly on a fine screen and dried it into a kind of thin paper. The paper was suitable for writing and also very cheap so it became very popular. Papermaking technology gradually improved so that various types of paper were created for different uses. For example, the Xuan paper made in Xuanzhou of Anhui Province is a high quality paper adapted for use in Chinese calligraphy and painting.



The technology spread to Korea and Japan in the late Sui and early Tang Dy-

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nasties, and later to Arabia and other countries. The invention of paper made it more convenient for information storage and communication and had a great significance in promoting the development of international civilization.

造纸术
Papermaking

造纸术是中国古代“四大发明”之一。在造纸术发明以前，人们把字刻写在龟甲、兽骨、竹片、木片和绢帛上。甲骨、木片很笨重，用起来不方便；绢帛太贵，一般人用不起。大约在西汉初期，人们用大麻和苎麻造出了纸。这种早期的纸比较粗糙，不太适合写字。

到了东汉时期，在朝廷做官的蔡伦，经过长期的试验，改进了造纸方法。他用树皮、破布、破鱼网等多种植物纤维作原料，加水蒸煮，捣烂成浆，再均匀地摊在细帘子上晾干，造成了一种薄薄的纸。这种纸便于写字，而且便宜，受到了人们的欢迎。造纸技术得到不断的改进，因为原料不同，纸也有了各种不同的种类和用途。安徽省宣州生产的宣纸，就是闻名中外的上等纸张，是用于中国书法、绘画的珍品。

中国的造纸术于隋末唐初传到朝鲜和日本，后来又传到阿拉伯地区和其他国家。纸的发明，极大地方便了信息的储存和交流，对于推动世界文明的发展具有划时代的意义。

漆器
Lacquerware

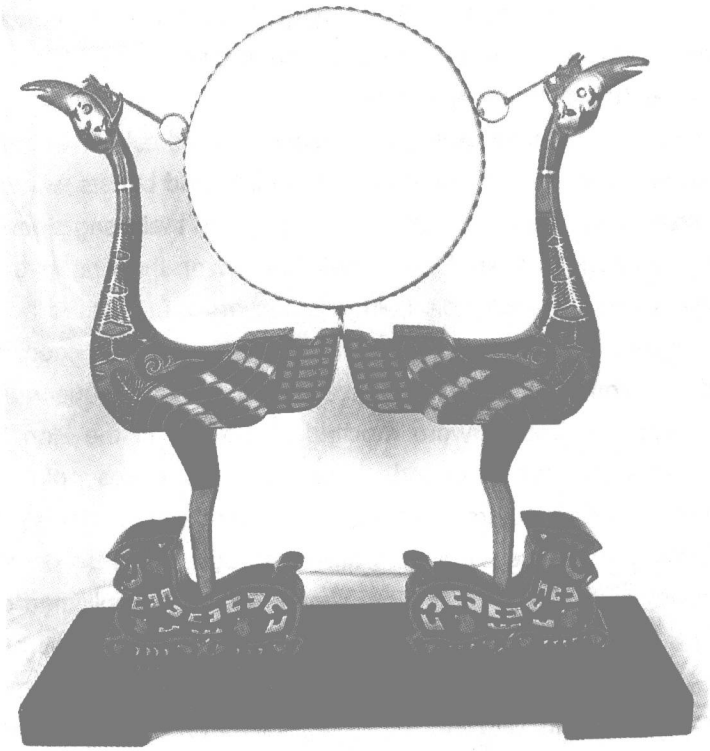
Chinese ancestors began to make lacquerware about 7,000 years ago. In 1978, red lacquer bowls and tubes of the Hemudu Culture were found in Yuyao, Zhejiang Province. According to scientific analysis, the coatings are natural lacquers.

After the Xia Dynasty, the variety of lacquerware increased, and the craft flou-

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rished for five centuries starting in the Warring States Period from 475 B. C. to 221 B. C. The scale of lacquerware production had already become very large in the Warring States Period. Lacquerware was one of the main economic resources of the time, and there were specific officials in charge of its production.

According to historical records, the ancient Chinese sage of Zhuang Zi used to be an officer in charge of lacquerware production. Lacquerware was very expensive. The production process was very complicated, necessitating a strong work force and long working hours. It came in many varied forms and was widely used for furniture, utensils, stationary, art works, musical instruments, funeral goods and weapons. The nobles moved their attention from bronzeware to lacquerware because the latter was bright, light, easy to clean, had heat insulation and corrosion resistant qualities and could be inlaid and painted with many colors.



Lacquerware was, however, usually coated black and decorated with red designs or coated red and decorated with black designs. About 220 lacquerware objects were unearthed in Zeng Houyi's Tomb in Hubei Province. They are the earliest and most superb lacquerware of the Chu Kingdom of the Warring States Period. Lacquerware items, including clothing storage boxes, which were unearthed in the

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tomb are richly varied, of large size and simple style; they reflect the charm of the culture of the Chu Kingdom. The designs on some of the boxes make them very valuable. In the center of one is a zhuan calligraphy character, meaning a star, surrounded by the names, also in zhuan characters, of the phases of the moon in a circle. On the two ends are designs of a blue dragon and a white tiger. This box is a rare relic of great value for research into ancient Chinese astronomy as it is the earliest written record of the moon phases yet found in China.

Some lacquerware was painted with fairy tales. For example, the ancient Chinese tale of *Hou Yi Shooting the Sun* was painted on a black coated and red design clothing box. Mushroom-shaped and colored clouds and two twisting double headed snakes with human faces form the background. On the two sides are two trees, the tall one with 11 branches and the short one with nine. On the tip of each branch is a circle radiating brilliant light, symbolizing the sun. Between the two trees, a man shoots an arrow at a bird on the tall tree. The story demonstrates mankind's successful battle against nature.

Han Dynasty lacquerware mainly used black and red colors. In the painted design of one piece, there are 90 immortals, and birds and beasts with different postures and expressions. The immortals are dancing with their long sleeves waving in the air, sitting quietly with their chins in their hands, or shooting arrows with concentrated expressions. The animals being hunted are turning their heads in panic and running swiftly away. Beautiful patterns of dragons, phoenixes, leaves, grass, cloud and various other things were drawn on the lacquerware objects to add to their elegance. Lacquerware reached its heyday in the Han Dynasty and more lacquerware products emerged. These included boxes, plates, earrings, bowls, baskets, trunks, rulers, kettles, chessboards and stools. Meanwhile, many new crafting techniques and decorative methods were also developed.

The patterns on the lacquerware are simple lines or complicated pictures, depending on the items' different functions. The contrast between the black and red colors creates a special artistic effect. The black and red pictures on the lacquerware present a mysterious and ever-changing fairy world inhabited by human beings and immortals.

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漆器
Lacquerware

中国人早在7000年前就开始制作漆器。1978年在距今7000年前的浙江余姚河姆渡文化遗址中发现了朱漆碗和朱漆筒，经过科学分析，其涂料为天然漆。

夏代之后，漆器品种渐多，在战国时期，漆器业独领风骚，形成长达5个世纪的空前繁荣。战国时漆器生产规模已经很大，被国家列入重要的经济收入来源，并设专人管理。据记载，庄子年轻时曾经做过管理漆业的小官。漆器生产工序复杂，耗工耗时，漆器品种又特别繁多，不仅用于装饰家具、器皿、文具和艺术品，而且还应用于乐器、丧葬用具、兵器等。这时的漆器很昂贵，新兴的诸侯不再热衷于青铜器，而把兴趣转向光亮、洁净、易洗、体轻、隔热、耐腐、嵌饰彩绘五光十色的漆器。



漆器一般髹朱饰黑，或髹黑饰朱，以优美的图案在器物表面构成一个绮丽的彩色世界。在湖北曾侯乙墓出土的漆器有220多件。这些漆器是楚墓中年代最早也是最为精彩的，而且品类全，器型大，风格古朴，这些精美的漆器体现了楚文化的神韵。其中有几件衣箱盖上所绘的图案非常有价值。一个箱盖的中心有一个篆文

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“斗”字,用粗笔写成。围绕“斗”字,是一圈二十八宿的古代名称,也是篆文,字迹清晰。箱盖两端绘有首尾对置的青龙、白虎的图像。这是研究我国古代天文学史的一件珍贵文物。

一些漆器上绘有一些有趣的神话故事。在一件刻有紫锦纹衣箱的箱盖上,绘有“后羿射日”的故事,黑地朱纹,有蘑菇状的彩云和两条双头人面蛇互相缠绕,两侧有一高一低的树,高树上有 11 个枝杈,矮树有 9 个枝杈,每个枝杈梢头都绘有一个放射光芒的圆圈,两树之间一人正用箭射下高树上的一只鸟。原来这是“后羿射日”的故事,是人与自进行斗争,以人最后胜利告终的美丽神话。

汉代漆器也是以黑红为主色。有一幅画面上出现 90 个形态各异、生动活泼的仙人和鸟兽。仙人之中,有的挥动着长袖翩翩起舞,有的托腮静坐,若有所思,有的拉弓射箭,千钧一发,猎物惊恐回首,匆忙飞奔。龙纹和凤纹都是装饰性的,并加以陶索纹、菱格纹、花瓣纹、草叶纹、云纹等。造型优美,图案华丽。汉代是漆器的鼎盛时期。漆器的品种又增加了盒、盘、耳环、碟、碗、筐、箱、尺、唾壶、棋盘、凳子。同时,还开创了多种新的工艺技法和装饰手法。

漆器图案根据不同的器物,以粗率简练的线条或繁褥复杂的构图表现,增强人或动物的动感与力度。黑红互置的色彩产生光亮、优美的特殊效果。在红与黑交织的画面上,形成富有音乐感的瑰丽多彩的艺术风格,展现了一个人神共在,奇伟谲诡、流动飞扬、变幻神奇的神话般的世界。



陶瓷
Ceramics

Ceramics, the general term for pottery and porcelain, refers to products made from plastic kaolin and porcelain clay, with quartz and feldspar as raw materials for glaze. The basic process includes molding, drying, and firing. Ceramics are mainly used for household, art, and architecture.

Ceramics began in China 6000 years ago during the New Stone Age. The earliest earthenware was moulded by hand; the potter's wheel came much later. At the beginning the clay was fired at a temperature of some 500℃ ~600℃. Painted pottery began to be known during the period of Yangshao and Longshan cultures.

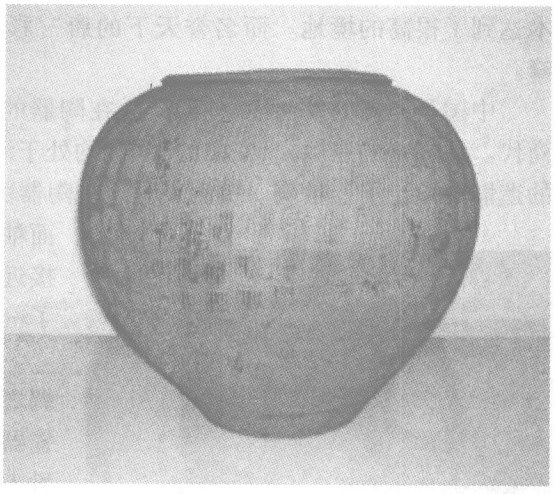
The large legion of terra-cotta soldiers and horses of the Qin Dynasty, discov-

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ered in Shaanxi Province in 1974, are eloquent proof of the high skills in kiln-firing and sculpture attained at that early age. The art of pottery reached another peak of development in the Tang Dynasty, as evidenced by the renowned "tri-coloured glaze."

On the basis of pottery developed porcelain, which emerged in China, homeland of the art, 3,000 years ago during the Shang Dynasty. From the remains of that period at Sanligang of Zhengzhou and Xiaotun of Anyang (both in Henan Province) and at Wucheng Village of Qingjiang County, Jiangxi Province vessels of blue-glazed ware have been unearthed. Upon examination, they proved to have been made of kaolin and fired and vitrified at the high temperature of 1,200°C. Their surface is coated with a glaze, whose chemical composition is already very close to that of their bodies. Certain porcelains of the Song and Ming dynasties were already celadon, though at its early stages.

Chinese ceramics became known to the world at large from the Tang Dynasty so much that the word "china" became the name of porcelain. Chinese porcelain, together with Chinese tea and silk flowed through the Silk Road and other land and sea routes to foreign countries.



Jingdezhen in southern China became a principal centre of the porcelain industry during the Song Dynasty. Dubbed the "Porcelain Metropolis," it still boasts important remains of ancient workshops and kilns.

A significant archaeological find was made when a porcelain kiln dating back to the Eastern Han Dynasty was brought to light a few years ago at Xiaoxiantan in Shangyu County, Zhejiang Province. This is the earliest porcelain-producing site ever discovered in China, and in the world as a whole.

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陶瓷
Ceramics

陶瓷是陶器和瓷器的总称。所谓陶器和瓷器是指用可塑性制瓷黏土和瓷石矿做胎体，用长石和石英等原料制釉，并且通过成型、干燥、烧制而成的制品，主要有日用、艺术和建筑陶器等三种。

中国陶器的出现大约在距今6000年左右的新石器时代。陶器起初是手制的，很久以后才出现了陶轮。早期的陶器将黏土加热至500℃～600℃烧制而成。彩陶起始于新石器时期的仰韶文化和龙山文化。

1974年在陕西省发现的秦汉时期的陶俑，表明中国当时的制陶技术和雕塑艺术达到了很高的境地。而名誉天下的唐三彩则标志着制陶业至唐代达到新的高峰。

中国是瓷器的发明地，瓷器产生在陶器的基础上，最早出现在3000多年前的商代。从郑州的三里岗、安阳的小屯（均处于河南省），以及江西省清江县的武城村的遗骸中出土了蓝釉陶。检测表明这些陶器由陶土经1200℃的高温烧制而成，表面釉质和陶体内部的化学成分已经非常接近。宋代和明代出土的陶瓷中就出现了一些青瓷器。



中国的瓷器、茶叶和丝绸在唐代经丝绸之路和其他水陆交通传到国外，而中国瓷器因其极高的实用性和艺术性而备受世人的推崇，因此它的名字和中国“China”同名。在宋朝，景德镇瓷窑成为中国制瓷中心，被称为“瓷都”，那里至今还保留着古代烧制瓷器的工房和烧窑。

几年前一个东汉时期的瓷器烧窑在浙江上虞县小仙坛出土，这是一个重大的考古发现，因为这是迄今为止在中国，也是在全世界发现的最早的瓷器烧制遗址。

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陶器的发展
Development of Pottery

The existence of pottery was a hallmark of the Neolithic Age in primitive society.

Pottery shards of more than 10000 years ago were discovered in the Fairy Cave site in Lishui County of East China's Jiangsu Province, and shards of sandy red pottery dating back 10000 years ago were found in the Nanzhuang Culture site in Xushui County of North China's Hebei Province.

The site of the Peiligang Culture in Xinzheng of Central China's Henan Province and the site of the Cishan Culture in Wu'an of Hebei Province are early Neolithic sites found in northern China, dating as far back as 7900 years ago. They were earlier than Yangshao Culture, and potteries of that period were mostly plain color without decorative designs.

The site of the Hemudu Culture in Yuyao County of East China's Zhejiang Province is another early Neolithic site that flourished 7000 years ago. Grey pottery, red pottery, charcoal-mixed black pottery, and even an occasional piece of painted pottery were found at all these ancient sites.

The site of the Yangshao Culture at Yangshao Village in Mianchi County of Henan Province, and at Banpo Village in Xi'an of North China's Shaanxi Province, inhabited by people who lived in prosperity in a matriarchal clan society, are more than 6000 years old. Large quantities of fine painted pottery were already made at that time.

With the development of the society, the quality of pottery steadily improved. By the Shang and Zhou Dynasties, a clear-cut division of labor had already appeared among potters. Elegant designs and pictures of flowers and birds were carved on pottery ware during the Warring States Period. Potters in this period introduced lead glaze, which made the surface of pottery smooth and fine and added luster to the vessels.

In the Western Han Dynasty the art of glazing pottery became widespread. Multi-colored glaze was also introduced in the Han Dynasty. The renowned Tang

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Dynasty tri-color pottery with lead glaze was the invention of potters who introduced white, yellow, blue, green, brown, and purple glazes and skillfully applied them in combination. The appearance of Tang tri-color glazed pottery marked the entry of pottery art into an era of greater variety and color.



陶器的发展
Development of Pottery

陶器的发明是原始社会新石器时代的一个重要标志。

我国已发现距今约10000年新石器时代早期的残陶片。河北徐水县南庄头遗址发现的陶器碎片经鉴定为10800～9700年的遗物。

河北武安发现的磁山文化和河南新郑发现的裴李岗文化，是黄河中游地区新石器时代的代表，距今7900年以上。它们早于仰韶文化，该文化的陶器以素面无文者居多。

浙江余姚河姆渡发现的河姆渡文化距今7000年左右，在该文化遗址也出土了大量的陶器。河姆渡文化的陶器为黑陶，造型简单，早期盛行刻画花纹。

在河南渑池仰韶村的新石器时代遗址，和陕西省西安市郊的半坡遗址都发现了大量做工精美，设计精巧的彩陶。这两个新石器时代遗址都属于母系社会遗址，有6000年以上的历史。

随着社会的不断进步，陶器的质量也逐步提高。到了商代和周代，已经出现了专门从事陶器生产的工种。在战国时期，陶器上已经出现了各种优雅的纹饰和花鸟。这时的陶器也开始应用铅釉，使得陶器的表面更为光滑，也有了一定的色泽。

到了西汉时期，上釉陶器工艺开始广泛流传起来。多种色彩的釉料也在汉代开始出现。有一种盛行于唐代的陶器，以黄、褐、绿为基本釉色，后来人们习惯地把这类陶器称为“唐三彩”。唐三彩是一种低温釉陶器，在色釉中加入不同的金属氧化物，经过焙烧，便形成浅黄、赭黄、浅绿、深绿、天蓝、褐红、茄紫等多种色彩，但多以黄、褐、绿三色为主。唐三彩的出现标志着陶器的种类和色彩已经开始更加丰富多彩。

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白陶
White Pottery

White pottery is a kind of pottery whose outside and inside are all white. The greenware is mostly made by hand. It uses porcelain clay or kaolinite, which contains less iron than figuline, and is fired at a temperature of about 1000 ℃. In the late Shang Dynasty, the emergence and application of white pottery with carved patterns marked the new achievement in the history of Chinese pottery. The hardness, fire resistance and water-absorbing capacity saw much improvement, so we consider the white pottery the indication of the leap from pottery to china.



A white pottery vase with geometrical patterns of the Shang Dynasty was excavated from the Yin Ruinsin Anyang of Henan Province, and it is the representative of white pottery with carved patterns in the Shang Dynasty. It is 20 centimeters tall in total with a caliber of 18. 5 centimeters, and was made by imitating the pattern of bronze ware. The body of the vase is spherical, the mouth becomes narrow, and the pitch at the shoulder part is large. The bottom is round with a ring foot. The whole work looks rounded and stately. The body of the vase is covered with patterns. The main patterns in relief and the detailed shadings form a florid design. The concave and protuberant, the distant and dense patterns were naturally combined to

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create a clear gradation. Now the vase is in the Palace Museum.

Due to the hardness, lustration, and fine craftsmanship, white potteries became the objects used exclusively by slaveholders. In the later period of the Shang Dynasty, white potteries tended to be more and more fussy and refined, so the top-notch white potteries were mostly from this period. After the Western Zhou Dynasty, white pottery was in decline due to the emergence of hard pottery with printed patterns and primitive china.



白陶
White Pottery

“白陶”是一种指器胎的表里都呈白色的陶器，器胚多以手工捏成，使用含铁量比陶土低的瓷土或高岭土，烧制温度在1000℃左右。商代晚期刻纹白陶的创制和使用，是中国制陶工艺发展史上的新成就。白陶的硬度、耐火度和吸水率都较以往的陶器有了大幅度提高，所以我们说白陶是陶器向瓷器的飞跃。

出土于中国中部河南省安阳殷墟的商代晚期几何纹白陶瓿，是商代刻纹白陶的代表作品。它通高20厘米，口径18.5厘米，模仿青铜器的式样制作而成。瓿体为球形，口部内敛，肩部斜度较大，底部为圆形，下有圈足，整体造型给人以端庄饱满的感觉。瓿体上布满纹饰，以凸雕的主纹和细密线刻的地纹组成绚丽的图案。颈部装饰有夔纹，腹部为曲折纹组成的兽面纹图案。纹饰构图谨严，主题突出，凹凸疏密结合自然，产生出强烈的层次感。此瓿现藏于北京故宫博物院。

白陶器因其质地坚硬，洁净美观，做工考究而成为奴隶主贵族的专有物品。商代后期的白陶制作过程更趋精细繁琐，所以白陶器的精品多集中于这一时期。西周以后，由于印纹硬陶和原始瓷器的兴起，白陶器逐渐消失。



瓷器的发展
Development of Porcelain

It's widely acknowledged that porcelain was invented by Chinese. After several thousand years of hard work, the early potters accumulated rich experience in their craft. The earliest porcelain appeared in the slave societies of the Shang and Zhou Dynasties.

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Porcelain as such was, in its initial stage, known now as the proto-celadon from which porcelain developed independently. Whereas pottery is porous and opaque and gives a dull sound when struck, porcelain, non-porous, translucent, and smooth-surfaced, is finer, harder, and closer-knit in texture and gives a metallic sound when struck.

A considerable number of Shang and Zhou proto-celadon vessels have been unearthed in many provinces in the Huanghe River (Yellow River) valley and the middle and lower reaches of the Yangtze River. These findings revealed basic characteristics of porcelain.

Proto-celadon used white china clay, or kaolin (an infusible white mineral earth produced in the area of Gaoling Village in Fuliang County in East China's Jiangxi Province), which is a fine, pure material suitable for making high quality porcelain. The firing temperature was at least 1,200 degrees Celsius-much higher than for firing pottery.

Porcelain making became steadily popular in the Warring States Period, when it began to step out of its primitive state.



Early in the Western Han Dynasty whole sets of celadon vessels were manufactured, according to specimens of Western Han vessels that were excavated in Peixian County, Jiangsu Province. The ewers, steamers, vases, jars, tripods and boxes have a hard paste and are smooth and lustrous compared with earlier wares. The frequent discovery of Han porcelain in

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archaeological digs indicates that large quantities of the ware were manufactured during the period.

White porcelain was invented during the Northern Dynasties (386 ~ 581), which laid a foundation for the invention of under glazed and on-glazed porcelain. It was in the Sui and Tang dynasties that porcelain became more varied and colorful. Glaze ingredients containing different metal oxides became available to produce brilliant underglaze (pre-glaze) colors via firing.

In the Song Dynasty, porcelain kilns mushroomed in different places, while porcelain schools representative of particular regions appeared. Before the Song Dynasty, porcelain was decorated by carved, incised, and impressed designs. That is, before the paste was dried, designs were carved or incised with a knife on the unglazed body or impressed with stamps for mass production and then glazed for firing. In the Song, Liao, and Jin Dynasties, decorative designs were painted over the glaze, with this painting on porcelain marking an entirely new stage in Chinese porcelain art.

The Yuan Dynasty saw continuous new developments in the art of porcelain making which contributed to different types of famous wares. Porcelain-manufacturing craft attained its acme in Chinese history in the Ming and Qing dynasties. This was shown in a tremendous variety of vessel shapes, lustrous colors, and splendid designs made possible by the fine texture of the paste, adequate firing, abundance of pigments, improvement of craftsmanship, and various social influences of the time. Apart from exquisite patterns, Ming porcelain decoration featured landscapes, portraits, and flower-and-bird and other paintings, while most of the Qing paintings on porcelain were works of famous contemporary artists or imitations of their works.

Jingdezhen in Jiangxi Province was the center of porcelain production in China during the Ming and Qing dynasties. Its kilns have contributed much to the perfection of porcelain and occupy a distinguished place in ceramic art.

China's various dynasties have seen a wealth of wares including the green Yue ware of Yuezhou, Xing white porcelain ware of Xingzhou, Ding ware in Hebei, Ru ware of Ruzhou, the celadon of Longquan in present-day Zhejiang Province, and Jingdezhen ware. The distinctive style of each is admired in different parts of the world, for Chinese pottery and porcelain went abroad as early as in the Han Dynasty, and was exported in large quantities by the late Tang Dynasty. From North China the wares went westward along the famous "Silk Road"; from the south

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they were shipped by sea to neighboring Asian countries and then to North Africa and Mediterranean countries. Not until the 15th century did they reach Europe and so have the worldwide impact that provided their brilliant page in the history of world civilization.

Today, every Chinese province or autonomous region turns out ceramics with local features or in the style of the ethnic group of the area. People in the business have inherited and carried forward the fine traditions of the ancient Chinese ceramic art, thereby creating a flourishing situation in pottery and porcelain production.



瓷器的发展
Development of Porcelain

瓷器是中国人发明的，这是举世公认的。瓷器的发明是在陶器技术不断发展和提高的基础上产生的。瓷器最早出现于商代和周代的奴隶制社会。

中国商周时期的原始瓷器称为“原始青瓷”，它们和陶器的区别在于：陶器渗水性强，不透明，敲击时发出厚重的声音；早期原始瓷器质地较陶器细腻坚硬，吸水性较弱，敲击时发出清脆的金属声。

在黄河流域和长江中下游沿岸的商代和西周遗址中发现的“原始青瓷”明显的具有瓷器的基本特征。它们由白色瓷土和高岭土（产于江西省浮梁县高岭村的一种矿物土）烧制，这些材料易于烧制出高质量的瓷器，烧结温度高达 1100℃ ~ 1200℃，比陶器的烧结温度高出许多。

瓷器业稳步发展，日益成熟，在战国时期已经非常普及。根据江苏省沛县出土的西汉早期的瓷器，当时已经开始生产成套的瓷器器皿了。耳杯、沙锅、花瓶、罐、三脚壶、盒等坚硬细腻，釉面有光泽。此外在考古中不断发现汉代瓷器，这说明当时瓷器已大批量生产了。

白瓷出现于北朝时期，白瓷的出现为釉下彩和釉上彩瓷器的发展打下基础。到了隋朝和唐朝，瓷器更有新的发展，颜色丰富、样式新颖。而且釉的成分含有多种金属氧化物，使釉底颜料烧制后异彩纷呈。

宋代制瓷业蓬勃发展，名窑涌现，形成了各具特色的地方瓷器派系。宋代以前，瓷器装饰主要靠雕刻印嵌，即在瓷糊变干之前用刀在瓷身上刻上花纹印章，然

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后上釉烧造。而到了宋、辽、金等时期，人们在瓷胎上直接绘画图案，这标志着中国瓷器艺术进入一个全新的发展阶段。

元代的瓷器业持续蓬勃发展，创造出很多著名的瓷器种类。明清两代是中国瓷器生产最鼎盛时期。由于瓷料质地精良、烧制考究、色料丰富、做工精湛，加上当时的各种社会影响，使瓷器生产的数量、造型、色彩、图案都达到了高峰。明代的瓷器不仅图案精美，还增加了自然景色、画像、花鸟等绘画，而清代的瓷器图案很多都是当代艺术大师的作品或对他们的临摹。

明清时期景德镇成为瓷器业的中心，“瓷都”的确立，使景德镇窑在瓷器行业中独占鳌头，为瓷器的进一步提高作出巨大贡献。

经过漫长的历史发展，中国出现了很多种名瓷，包括越州的青瓷，邢洲的白瓷，河北的定瓷，汝州的汝瓷，浙江省的龙泉青瓷和景德镇瓷器。这些名瓷各具特色，名扬四海。早在汉代，中国瓷器就开始走出国门，至晚唐时期大量出口。中国瓷器在中国北部由著名的“丝绸之路”运往西方，在中国南部经海运运往亚洲邻国，然后运至非洲和地中海沿岸各国。但中国瓷器直到15世纪才运到欧洲，也从此在世界的文明历史写下了辉煌的一页。今天，中国的各省市自治区都能生产出具有地方特色的陶瓷制品，从事陶瓷行业的人们也将古代陶瓷艺术的优良传统发扬光大，开创了陶瓷生产繁荣兴盛的新局面。



唐三彩
Tang Tri-colored Glazed Pottery

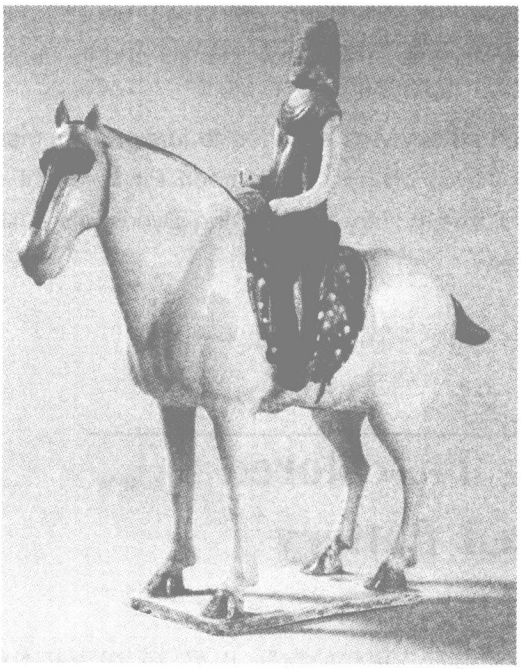
A type of glazed pottery with the dominant colors of yellow, brown and green was very popular in the Tang Dynasty. It was later called the tri-colored glazed pottery of the Tang Dynasty, or Tangsancai .

The Tang tri-colored glazed pottery is a low-melting glazed pottery. It was made by adding metallic oxides to the colored glaze and calcining the object to create different colors, namely the predominant yellow, brown and green. The chemicals in the glaze change gradually in the firing process, creating a variegated effect with a majestic and elegant artistic attraction. Tri-colored glazed pottery was usually used as burial objects. Its loose and brittle base and its low waterproofing properties meant it was not as practical as the blue and white porcelain that had already

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emerged at the time.

Tri-colored glazed pottery utensils of the Tang were usually rounded and full in shape in accordance with the aesthetic values of the time. The accurately proportioned human and animal figures have fluid lines, natural expressions and life-like movements. The soldier figures have strong muscles, big staring eyes and wield swords or arrows. The female figures have high hair buns and full sleeves; they stand gracefully erect, looking natural and elegant. The animal figures are mainly of horses and camels.



A tri-colored glazed pottery of a camel and a dance group was unearthed in a Tang general's tomb. The camel is brown and stands with its head raised high. The long hairs on its head, chest, stomach and upper parts of its two front legs were carefully executed. On the camel's back is a platform covered by a rug with two ethnic musicians seated on it with their backs to each other playing instruments. A third ethnic person dances between them. The three human figures have deep eyes, high-bridged noses and full beards; they are wearing long, green sweaters with turned-down collars and white boots. The figure in the front has a deep yellow coat. This piece of pottery is truly an exquisite handicraft.

Tri-colored glazed pottery of the Tang Dynasty was mostly produced in Xi'an, Luoyang and Yangzhou, which were important cities along the Silk Road. The cam-

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el was the major form of transport on the ancient trade route during the Tang. From these glazed potteries, we can imagine the travelers and camels making their hard journey across the desert, depending on one another for survival. The large figures and camels' resolute expressions represent the hardships associated with traveling on the long road.

Tri-colored glazed pottery is the crest of Tang pottery and it flourished during the dynasty's early and middle period. As the Tang Dynasty gradually lost power and its porcelain-producing technology developed, tri-colored glazed pottery declined. Though tri-colored glazed pottery was also produced during the Liao and Jin dynasties, it was not made in such great quantity and its quality was not as good as that of the Tang.

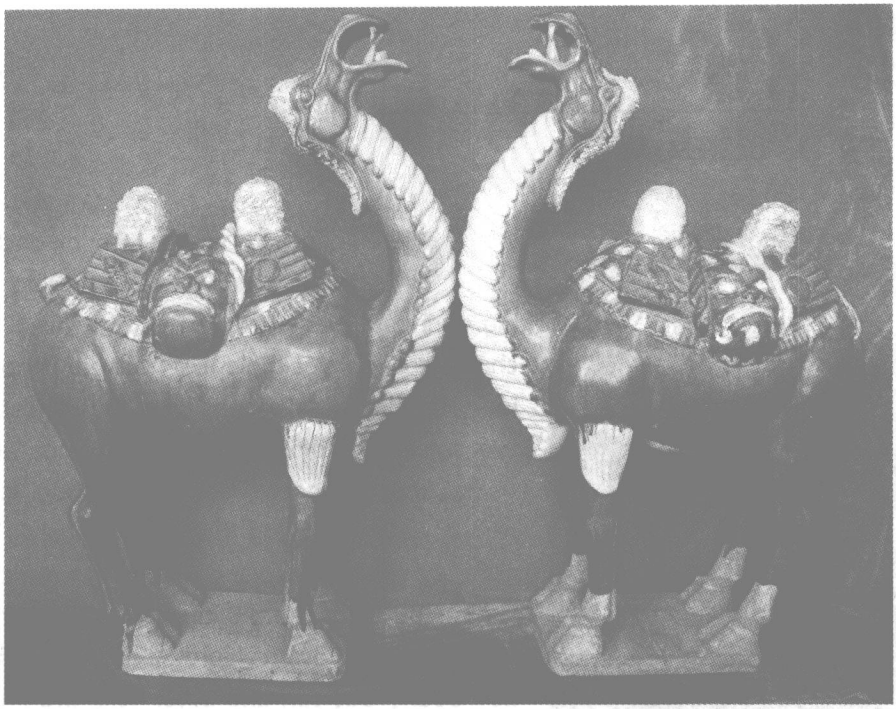
Tri-colored glazed pottery was exported to foreign countries in the early Tang, winning great favor. It was always been famed for its bright colors and pleasing shapes. Tri-colored glazed pottery of the Tang Dynasty is a shining pearl among ancient Chinese pottery.



唐三彩
Tang Tri-colored Glazed Pottery

唐三彩是一种盛行于唐代的陶器，以黄、褐、绿为基本釉色，后来人们习惯地把这类陶器称为“唐三彩”。唐三彩是一种低温釉陶器，在色釉中加入不同的金属氧化物，经过焙烧，便形成浅黄、赭黄、浅绿、深绿、天蓝、褐红、茄紫等多种色彩，但多以黄、褐、绿三色为主。唐三彩的色釉有浓淡变化、互相浸润、斑驳淋漓的效果。在色彩的相互辉映中，显出堂皇富丽的艺术魅力。唐三彩用于随葬，作为明器，因为它的胎质松脆，防水性能差，实用性远不如当时已经出现的青瓷和白瓷。唐三彩器物形体圆润、饱满，与唐代艺术的丰满、健美、阔硕的特征是一致的。它的种类繁多，主要有人物、动物和日常生活用具。三彩人物和动物的比例适度，形态自然，线条流畅，生动活泼。在人物俑中，武士肌肉发达，怒目圆睁，剑拔弩张；女俑则高髻广袖，亭亭立玉，悠然娴雅，十分丰满。动物以马和骆驼为多。

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在唐右卫大将军墓中出土了一件骆驼载乐俑。这匹骆驼昂首伫立，通体棕黄色，从头顶到颈部，由下颌到腹间以及两前肢上部都有下垂长毛，柔丽漂亮。驼背上架有平台并铺有毛毯。平台上左右各坐胡乐俑二人，而且是背对背而坐，正在吹打乐器，有一俑站在中央，翩翩起舞。这三个乐俑个个深目高鼻，络腮胡须，身穿绿色翻领长衣，白色毡靴，只有前面一人穿黄色通肩大衣。这件高大的驼载乐舞俑精美绝伦，令人赞叹！

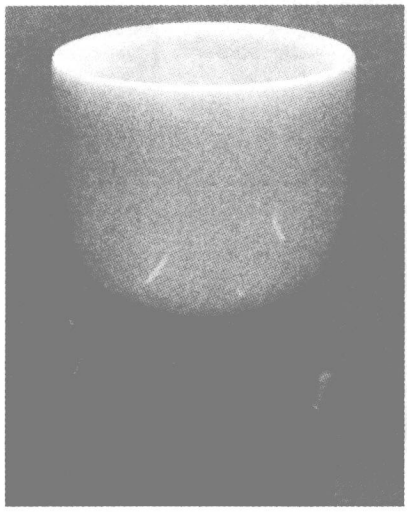
唐三彩的产地西安、洛阳、扬州是陆上和海上丝绸古道的联接点。在古丝绸之路上，唐代的交通工具主要是骆驼。可以想见，在沙漠中，人和骆驼艰难跋涉，相依为命，所以人和骆驼有一种亲密感。它那高大的形态和坚毅负重的神情，似乎还带着丝绸古道的万里风尘。

唐三彩是唐代陶器中的精华，在初唐、盛唐时达到高峰。安史之乱以后，随着唐王朝的逐步衰弱，由于瓷器的迅速发展，三彩器制作逐步衰退。后来又产生了“辽三彩”、“金三彩”，但在数量、质量以及艺术性方面，都远不及唐三彩。

唐三彩早在唐初就输出国外，深受异国人民的喜爱。这种多色釉的陶器以它斑斓釉彩，鲜丽明亮的光泽，优美精湛的造型著称于世，唐三彩是中国古代陶器中一颗璀璨的明珠。

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青瓷
Celadon



Celadon, a famous type of ancient Chinese stoneware, came into being during the period of the Five Dynasties. It is characterized by simple but refined shapes, jade-like glaze, solid substance and a distinctive style. Its prototype first emerged as early as the Shang Dynasty, gained the equal fame with white porcelain in the Tang Dynasty. The skills in celadon designing and firing were consummated in the Song Dynasty due to the contributions from five celebrated imperial kilns-Ru, Guan, Ge, Jun and Ding. With five imperial kilns paying tributes to the royal court with their fine celadon products, several plebeian kilns, best represented by Yaozhou kiln in North China and Longquan kiln in the south, also prospered with their unique designs in celadon making.

Celadon has long been highly appraised in China mainly due to its similarity with jade in coloring and composition. It is mainly colored with ferric oxides and its hardness is somewhere between china and porcelain, so it is usually classified as a type of stone ware.

青瓷
Celadon

青瓷是我国传统国瓷，始于五代。青瓷的特点是质坚胎薄、线条优美、光泽柔和，从商周的原始青瓷，到唐代“南青北白”，青瓷的技艺在宋代达

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到颠峰。宋代五大名窑“汝、官、哥、钧、定”，先后都以烧制青瓷而成为宫廷瓷器，形成官窑青瓷的流派；而民间青瓷也是异常繁荣，以北方的耀州窑和南方的龙泉窑为代表，形成独特风格的民窑青瓷的流派。

青瓷之所以在中国受推崇，是因为青瓷与玉石类似，它的成色成分和构成物质均与玉石相似，是以氧化铁为主要着色成分，而质地是属于陶与瓷之间的“炻器”状态，也就是常说的火石器。

元代青花瓷器
Blue and White Porcelain of Yuan Dynasty

The Yuan Dynasty is a key period for the development of the firing techniques of the Blue and White Porcelain in China. Its unique characteristics were based on the techniques of the former dynasties. The Blue and White Porcelain had become major porcelain product of China by the Ming and Qing Dynasties.

The Blue and White Porcelain of the Yuan Dynasty is large in size, with thick roughcast. Generally there are big bottle, big pot, big bowl and big plate, with the traditional flavor of the Tang and Song dynasties. Due to the underdeveloped techniques, there are two interfaces on the body and several veins inside the body. The roughcast is not as smooth as that of the Ming and Qing Dynasties, while the glaze of the Blue and White Porcelain



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of the Yuan Dynasty is thicker than that of the Ming and Qing Dynasties, due to more iron in the raw material of the glaze.

There are lines like bamboo on the foot of the porcelain. The body is connected with the foot when glaze has not been coated. The body is decorated with lines of lotus, clouds and lots of flowers. Dense decoration was not only applied to the blue and white porcelain but also to the picture weaving and stone carving, reflecting the unique characteristics of that time.

The major producer of the Blue and White Porcelain in the Yuan Dynasty was Jingdezhen. Besides, there were kilns for the blue and white porcelain production in Zhejiang Province, east of China and Yunnan Province, southwest of China.

元代青花瓷器
Blue and White Porcelain of Yuan Dynasty

元代是中国青花瓷器烧制工艺发展历史上的重要时期。这一时期在前代“釉下彩”等工艺的基础上逐步确立、完善了青花瓷器的烧制技术，并形成了自身的独特风格。到明清时期，青花瓷器已经发展成为中国瓷器中的主要产品。



元代青花瓷器在造型方面具有胎骨厚重，形制巨大的特点。常见的器形有大瓶、大罐、大碗、大盘等，这种造型继承了唐宋以来的传统风格。由于当时的旋削技术较差，瓷器身上常有两道接口，一般大罐内也多有旋纹。元代青花瓷器的胎质，在淘洗技术上不如明清时期细致。元代青花瓷器的釉层一般比明清时期略厚，白釉地子的闪青程度也较明清为重，可能是当时施釉较厚和釉料中含铁量较多

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的缘故。

在制作工艺上，元代青花瓷器的足部上下多有竹节状凸起的弦纹，器身与器足的接合部位，多采用胎接方式。在装饰上，元青花一般多装饰莲瓣纹，器物肩部绘有垂云纹，中间主题部分填以各种花卉，纹饰繁密，层次较多。这种繁密饰纹的手法，不仅表现在青花瓷器上，也表现在元代织锦和石雕工艺上，成为当时的独特风格。

元代青花瓷器的主要产地是中国中部江西省的景德镇。此外在中国东部的浙江省和西南部的云南省，也有烧制青花瓷器的瓷窑。

紫砂壶
Zisha Teapots

Zisha teapots, also known as "Yixing teapots", are made of purple clay specially produced in Yixing of Jiangsu Province. The first Zisha teapot could be traced back to the middle of Northern Song Dynasty, 900 years ago. As a non-glazed type, Zisha ware achieves its visual effect from its form and structure rather than the decorations of glazed, colored drawing. During the long development of Zisha art the potters have created many exquisite and unique patterns incorporating rich aesthetic thoughts.



The demand of stability is well met in the designing of its form. Stability means more than a teapot that pours clean and steady for the visual stability also counts. To make the Zisha teapot easy to handle and simplify the manufacturing process, round or a symmetrical form is usually the most favored shape of the teapot. The center of gravity lies in the axis, which is also the center line of whole structure and perpendicular to the center of the bottom. Thus the visual stability largely depends on the bottom size. Moreover, the changes in shoulder and waist also contribute to the position of gravity center and overall stability.

Boccaro art can be described as a type that is "from but beyond life". A good

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Zisha teapot is the combination of perfect form and proficient skill. Furthermore, it is crucial to select suitable patterns, texture of decorations, and the correct technique. Since Zisha art is an art of emotions, a relatively perfect work must be both convenient and have the function of cultivating, enlightening and generating the aesthetic feelings within.

紫砂壶
Zisha Teapots

紫砂壶又名“宜兴壶”,它是用江苏宜兴特有的紫砂泥烧制而成的一种茶具。紫砂壶创始年可追溯到北宋中期,距今有900年历史。紫砂器是一种无釉陶,它并非以釉彩绘画的装饰来达到陶瓷艺术中美的效果,而是通过造型结构来表达其外观美。紫砂壶艺经过长期的发展,陶工创制了不少精练别致的壶样,这些设计都蕴含着很多美学观念。



紫砂壶的造型基本上要符合稳的要求,“稳”除指使用时的稳定外,也要求视觉上具有安定感。紫砂壶为求使用及创作上的便利,多做成圆形或对称的形体,这种造型都以形体的中心线为轴,而造型的重心就落在中轴上,从造型重心下垂的中轴线,并落在壶底的中心点,所以壶底的大小就在视觉上影响壶的稳定性。此外,壶体的肩、腹部位的变化,也影响着整体造型的重心和稳定性。

紫砂艺术是一种“源于生活,高于生活”的艺术创作形式。一件好的紫砂壶,除了讲究形式的完美与制作技巧的精湛,还要审视纹样的适合,装饰的取材以及制作的手法。再说壶艺本身就是感情,所以一件较完美的作品,既要方便使用,又要能够陶冶性情,启迪心灵,给人油然而生的艺术感受。

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Chapter 6 农业 Agriculture

丝绸 The Silk

The silk is the symbol of the ancient Chinese culture and the old silk industry formed one of the glorious chapters in the history of the Chinese culture, making an indelible contribution to the development of the world civilization. The Chinese silk is known throughout the world for its excellent qualities, exquisite colors and rich cultural connotations. Several thousand years ago, when the silk trade first reached Europe via the Silk Road, it brought with it not only the gorgeous silk apparel and decorative items, but also the ancient and resplendent Oriental civilization. From then on, silk was regarded as the emissary and symbol of the Oriental civilization. The earliest silk article discovered to date is approximately 4700 years old, un-



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earthed from a tomb dating from China's Liangzhu Culture. According to an ancient Chinese legend, the Silkworm Goddess appeared to the Yellow Emperor, the legendary ancestor of the Chinese people, after he vanquished his adversary Chi You. She presented him with silk fibers spun from her own mouth as a sign of respect. The Yellow Emperor ordered the fibers woven into cloth and made into the silk apparel, which he found exceedingly soft and comfortable. His wife Lei Zu searched until she found a type of caterpillar capable of spinning silk fibers from its mouth. She raised these silkworms by feeding them mulberry leaves she picked herself. Later generations came to worship Lei Zu as the Silkworm Goddess, and the Yellow Emperor as the God of Weaving. Sericulture, including cultivating the mulberry plant, raising silkworms, and producing silk fabric, was a fundamental form of labor throughout thousands of years in ancient China. China is the birthplace of sericulture. Raising silkworms and reeling the silk from their cocoons was ancient China's greatest achievement in the utilization of natural fibers.



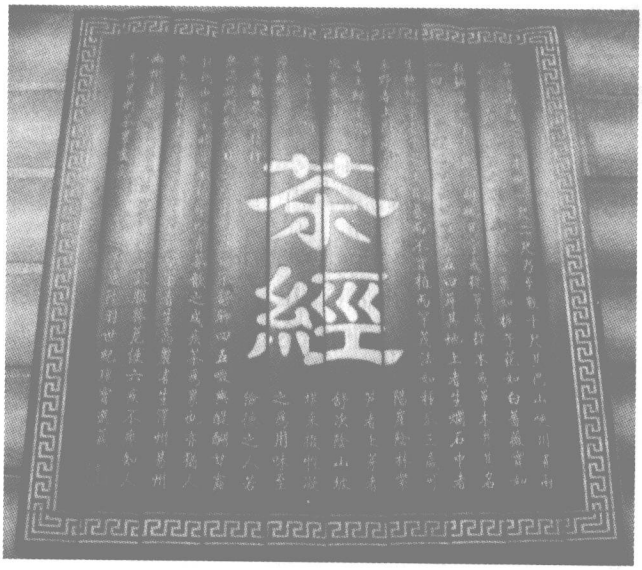
丝绸
The Silk

丝绸是中国古老文化的象征，中国古老的丝绸业为中华民族文化织绣了光辉的篇章，对促进世界人类文明的发展作出了不可磨灭的贡献。中国丝绸以其卓越的品质、精美的花色和丰富的文化内涵闻名于世。几千年前，当丝绸沿着古丝绸之路传向欧洲，它所带去的，不仅仅是一件件华美的服饰、饰品，更是东方古老灿烂的文明。丝绸从那时起，几乎就成为了东方文明的传播者和象征。目前已知的最早丝织物，是出土于距今约4700年良诸文化的遗址。关于丝绸中国有一个悠远的传说：远古时代，黄帝打败了蚩尤，“蚕神”亲自将她吐的丝奉献出来以示敬意。黄帝命人将丝织成了绢，以绢缝衣，穿着异常舒服。黄帝之妻嫘祖便去寻找能吐丝的蚕种，采桑饲蚕。后世民间崇奉嫘祖为养蚕的蚕神，黄帝为织丝的机神。采桑养蚕与制丝织绸，便成了中国古代社会几千年的基本劳作手段。中国是养蚕业的发源地，养蚕，缫丝是我国古代在纤维利用上最重要的成就。

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《茶经》
The Classic of Tea

The Classic of Tea is the first treatise on tea in the world, written by the Chinese writer Lu Yu between 760 and 780 in the Tang Dynasty. According to the popular legend, Lu Yu was an orphan of Jinling county (now Tianmen county in Hubei Province) who was adopted by a Buddhist monk of the Longgai Temple. At age 14, Lu Yu was discovered by the local governor Li Qiwu who offered Lu Yu the use of his library and the opportunity to study with a teacher. During the An Lushan and Shi Siming Rebellion period, Lu Yu lived in seclusion in Shaoxi (now Huzhou City, Zhejiang Province). During this period, Lu Yu made friends with many literati, including the calligrapher Yan Zhenqing, and wrote his masterpiece *The Classic of Tea*. For Lu Yu, tea symbolized the harmony and mysterious unity of the Universe. He invested *The Classic of Tea* with the concept of Buddhism, Taoism, or Confucianism that dominated the religious thought of his age. *The Classic of Tea* is divided into the following 10 chapters: 1. Origin; 2. Tea Tools; 3. Manufacture; 4. Tea Wares; 5. Brewing; 6. Drinking Tea; 7. Anecdotes; 8. Places; 9. Omission; 10. Diagrams. It covers a series of subjects ranging from tea culture, tea art, tea history, botany, biology, agriculture, medicine, geography, hydrology, pottery, tea farming machinery to tea production.



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《茶经》
The Classic of Tea

《茶经》是世界上第一部有关茶的专著，为中国唐朝文人陆羽在公元760～780年间所著。陆羽，唐竟陵（今湖北天门）人，传说从小是个孤儿，被当地龙盖寺和尚收养。14岁时被当地太守李齐物看中，带他到自己的书房读书，并给他请来一名老师。安史之乱爆发后，陆羽隐居苕溪（今浙江湖州），其间结交很多文人，其中包括书法家颜真卿，并完成了巨著《茶经》。在陆羽看来，茶象征着宇宙万物的和谐与神秘的统一。他将当时的主流宗教"儒释道"中的思想赋予到《茶经》之中。《茶经》共分为以下十章：一之源；二之具；三之造；四之器；五之煮；六之饮；七之事；八之出；九之就；十之图。共涉及茶文化、茶艺、茶史、植物学、生物学、农学、医学、地理、水文学、陶器工艺、农具、制茶等一系列的领域。

《齐民要术》
Qimin Yaoshu



Qimin Yaoshu (also *Main techniques for the Welfare of the People*) is the most completely preserved of the ancient Chinese agricultural texts, and was written by the Northern Wei Dynasty official Jia Sixie. The book is believed to have been completed in the second year of Wu Ding of Eastern Wei, namely in 544, while another account gives the completion between 533 and 544. The text of the book is divided into ten volumes and 92 chapters, and records 1500-year-old Chinese agronomy, horticulture, afforestation, sericulture, animal husbandry, veterinary medicine, breeding,

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brewing, cooking, storage, as well as remedies for barren land. The book quoted nearly 200 ancient books. Important agricultural books such as *Fansheng Zhishu* and *Simin Yueling* from the Han and Jin Dynasties are now lost, so future generations can only understand the operation of agriculture at the time from this book. Since the publication of the book, historical Chinese governments have long attached great importance to it. Since the book spread overseas, it has also often been considered a classic to study changes in the ancient species. When Charles Darwin was researching the theory of evolution, he made reference to an encyclopedia of ancient China. It is said that the book he referred to was in fact *Qimin Yaoshu* . The book's name *Qimin Yaoshu* can be explained as techniques by which common people make their livelihood, and also be explicated as techniques to harness the people's livelihood.

《齐民要术》
Qimin Yaoshu

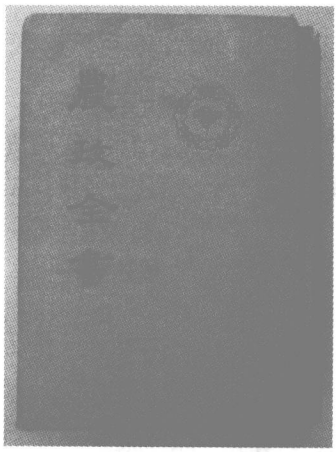
《齐民要术》是迄今保存最为完整的我国古代农学著作，由北魏时期官员贾思勰所著。有人认为《齐民要术》成书于东魏武定二年，即公元544年，还有记载说该书的完成时间在公元533和544年间。该书正文分十卷，共九十二篇，收录了中国1500年前农艺、园艺、造林、蚕桑、畜牧、兽医、配种、酿造、烹饪、贮藏以及治荒等方面的知识。书中援引古籍近200部，所引的重要农学著作如《泛胜之书》、《四民月令》等汉晋重要农书现已失传，因此后人只能从此书了解当时的农业运作。该书自出版后，长期受中国历朝政府重视，传遍海外后亦常被认为研究古物种变化的经典，达尔文研究进化论时曾参考一部中国古代百科全书，有说此书正是《齐民要术》。《齐民要术》可解作平民谋生方法，亦可解为治理民生的方法。



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《农政全书》
Nongzheng Quanshu

Nongzheng Quanshu (also Comprehensive Treatise on Agricultural Administration), was written by Xu Guangqi (1562 ~ 1633) in the late Ming Dynasty. Born in the Songjiang area in Jiangsu Province (now in Shanghai) where agriculture was very advanced, he was devoted to the agricultural development all his life. During the three-year period of mourning for his deceased father, he conducted in his hometown massive agricultural and ploughing experiments, and then went to Tianjing for similar experiments several times, the consequence of which was the completion of the agricultural encyclopedia. He died in his tenure of office, and it was his friend who helped publish the book in the 12th year of the reign of Emperor Chongzhen, i. e. in 1639. The book is divided into 60 volumes, including the agriculture-oriented thought, land policy, water conservancy, farm tools, arboriculture, sericulture, animal husbandry, relief policies and the like. Besides summarizing his experiences of succeeding in growing crops and cotton, he went into details about water conservancy and relief policies. He studied the lean years in the Chinese history, even delving into the concrete situations of the 111 locust plagues which ever happened in China. The most effective way of putting an end to the lean years, he believed, was to establish the water conservancy projects on a large scale. In the Northwest, as he instantiated his point, instead of delivering grain from Southeast with great efforts, people should learn to reclaim the wasteland and establish the water conservancy projects on a large scale, turning Northwest into a major grain yielding area. A great number of reference books written before or at the time were recorded in *Nongzheng Quanshu*, and the understandings and perspectives of the author presented. It



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was a great agricultural work of special importance in the Ming Dynasty.

《农政全书》
Nongzheng Quanshu

《农政全书》由晚明徐光启(1562～1633)著。徐光启生于农业发达的江苏松江地区,他一生热爱农业,在为父亲丁忧的三年间,在家乡进行了较大规模的农业耕种试验,后又几次赴天津进行农业试验,写出这部农业百科全书。他死在任上,是朋友帮助将这部书于崇祯十二年(1639)刊行的。全书60卷,分农本、田制、水利、农器、树艺、蚕桑、牧养、荒政等门,除总结自己种植粮食作物和棉花的成功经验外,还对水利和荒政以较大篇幅进行了研究。他研究了中国历代的荒年,甚至仔细研究了111次蝗灾的具体情况。他认为要彻底消灭荒年就要大兴水利,比如在大西北,与其耗费运力从东南运送粮食,不如开垦西北荒地,大兴水利,把大西北建成产粮基地。书中辑录了大量前代和当时的文献,也提出作者的心得和见解,是明代重要的农业科学巨著。

《天工开物》
Tiangong Kaiwu

Tiangong Kaiwu, as the representative work of the famous scientist in the Ming Dynasty Song Yingxing, was completed in 1637. It is an encyclopedia of agricultural and handicraft production technologies, summing up the knowledge of almost all the production areas. The work is divided into 18 volumes, containing planting, dyeing, grain processing, sugar refining, pottery firing, smelting and founding, vehicle and vessel manufacturing, forging, oil pressing, papermaking, mining, weaponry, pigment, liquor making, and so on. Song Yingxing tried to give accurate descriptions of the operating techniques and tools with specific data. *Tiangong Kaiwu* was a book in which the most abundant collection of scientif-

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ic and technological records was preserved. It was more oriented towards the handicraft industry, reflecting the productive forces in the late Ming Dynasty when capitalism began to emerge; it also indicated that the scientific technologies of our country at the time lagged behind Europe. The contemporary scientist Galileo discovered many important laws through the combination of the experiments and mathematics while China still stayed in the period of collecting and collating materials. Up to now, this work has already been published in 16 different versions in the world and printed for 38 times. It sold very well for a long time in some places, which was rarely seen in the ancient scientific works.

《天工开物》
Tiangong Kaiwu

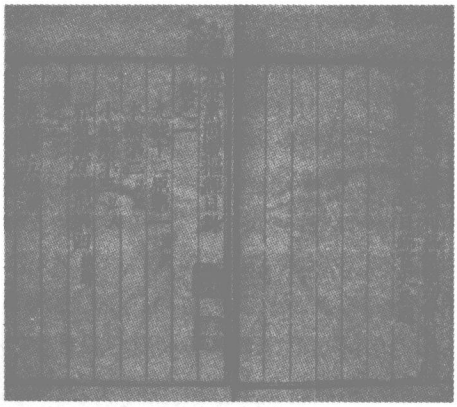


《天工开物》是我国明代著名科学家宋应星(1587～1663年)的代表作,完成于1637年。这是一部有关农业和手工业生产技术的百科全书,总结了各个生产领域的知识。全书共十八卷,包括种植、染色、粮食加工、制糖、烧制陶瓷、冶铸、车船制造、锤锻、榨油、造纸、采矿、兵器、颜料、酿酒等诸多内容。宋应星
无论是对操作技术还是对工具本身都尽可能用数字进行精确的描述。《天工开物》是保留我国科技史料最丰富的一部书,它更多地着眼于手工业,反映了我国明末出现资本主义萌芽时期的生产力状况。它也表明这个时期我国的科学技术已经比欧洲落后了。同一时期的伽利略已经用实验和数学相结合的方法发现了许多重要的定律,而中国还停留在以收集整理资料为主的阶段。《天工开物》一书在全世界发行了16个版本,印刷了38次之多。《天工开物》一书在一些地方长时期畅销不滞,这在古代科技著作中并不是经常看到的。

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Chapter 7 医学 Medicine

《黄帝内经》 *Huangdi Neijing*



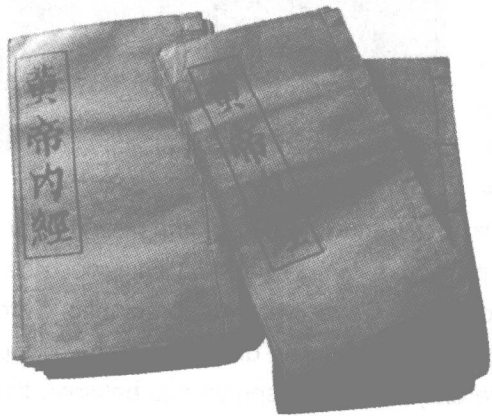
The four great classics of the traditional Chinese medicine are *Huangdi Neijing*, *Treatise on Exogenous Febrile Diseases*, *Jinkui Yaolue* and *Wenbing Tiaobian*, among which *Huangdi Neijing* is the first excellent work having the common ancestor of the Chinese nation Huangdi (or the Yellow Emperor) as its title, and also the oldest extant medical treatise in the Chinese medical works. It focuses on the study of human beings' physiology, pathology, diagnostics, principles of treatment and pharmaceutics. The work is comprised of two parts, i. e. *Suwen* and *Lingshu*, each being divided into 9 volumes and further 81 chapters respectively. In combination with the achievements made in philosophy and natural sciences at the time, it, taking such aspects as theory of Yinyang and five elements, correspondence between the nature and humans, internal organs and Meridians, pathogenesis, diagnostic methods therapeutical principles, and acupuncture as its point of departure, arrived at a systematic theoretical summary and understanding. Up to now, it still has had an important guiding meaning in diagnostics and therapeutics. In this book is not only medical science involved, but the scientific accomplishments made by humans

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in philosophy, anthropology, sociology, strategics, mathematics, ecology and so on. What astonishes us most is that some abstruse and penetrating elaborations in *Huangdi Neijing*, though made 2000 years ago, have revealed some achievements which are being or to be proved by the modern science. The most renowned medical specialists in ancient China such as Zhang Zhongjing, Huatuo, Sun Simiao and Li Shizhen were all deeply edified and influenced by the thoughts in *Huangdi Neijing*. They studied it assiduously and gained insight into its essence, thus becoming the well-known doctors in the Chinese history.

《黄帝内经》
Huangdi Neijing

我国传统医学四大经典著作是《黄帝内经》、《伤寒论》、《金匮要略》、《温病条辨》,《黄帝内经》也是第一部冠以中华民族先祖“黄帝”之名的传世巨著,是我国医学宝库中现存成书最早的一部医学典籍。是研究人的生理学、病理学、诊断学、治疗原则和药物学的医学巨著。《黄帝内经》包括《素问》八十一篇和《灵枢》八十一篇,各九卷。它分别从阴阳五行、天人相应、五运六气、脏腑经络、病机、诊法、治则、针灸等方面,结合当时哲学和自然科学的成就,作出了比较系统的理论概括和认识。迄今在诊治学上仍具有指导意义。不仅涉及医学,而且包罗天文学、地理学、哲学、人类学、社会学、军事学、数学、生态学等各项人类所获的科学成就。令人颇感惊讶的是,中华先祖们在《内经》里的一些深奥精辟的阐述,虽然早在2000年前,却揭示了许多现代科学正试图证实的与将要证实的成就。中国古代最著名的医学家张仲景、华佗、孙思邈、李时珍等均深受《内经》思想的熏陶和影响,无不刻苦研读之,深得其精要,而终成我国历史上的一代名医。



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望闻问切
Observation, Auscultation and Olfaction, Inquiry, Pulse Feeling and Palpation

The four methods of diagnosis are a general term used by the doctors of the traditional Chinese medicine for the basic methods of diagnosing illness, including diagnosis through observation, diagnosis through auscultation and olfaction, diagnosis through inquiry and diagnosis through pulse feeling and palpation, namely "observation, auscultation and olfaction, inquiry, and pulse feeling and palpation". The first method of diagnosis means that the doctors observe the physical conditions of the patients, the complexion and tongue coating included. Auscultation and olfaction refers to the situation, in which the doctors listen to the words, coughing and breathing of a patient, and sniff whether his mouth or body smells. The third method of diagnosis involves the inquiry into a patient's symptoms, medical history and so on. When it comes to the last method of diagnosis, it means that the doctors diagnose whether there is something wrong with a patient by feeling his pulse or palpating his abdomen. Through the four methods of diagnosis, the symptoms and physical signs of the illnesses manifested in various facets are diagnosed with a view to understanding the causes or nature of the illnesses as well as their connections with the internal organs, which provides a solid basis for the treatment of the illnesses. The four methods of diagnosis, each being of special significance, are interconnected and complementary; they cannot replace one another. In the clinical medicine, only with a combined application of the four diagnostic methods can a comprehensive and systematic understanding of the physical condition of a patient be gained; this is called "the combined use of the four methods of diagnosis"

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望闻问切
Observation, Auscultation and Olfaction, Inquiry, Pulse Feeling and Palpation

四诊是中医诊察疾病基本方法的合称，包括望诊、闻诊、问诊、切诊，即“望闻问切”。望是观察病人的身体状况，包括面色、舌苔等；闻是听病人的说话、咳嗽、呼息，并嗅其口中或身上是否有异味；问是询问病人症状，以及患病史等；切是用手把脉或按腹部诊察是否有异常。通过四诊，诊察疾病显现在各方面的症状和体征，以了解疾病的病因、性质及其与内脏的联系，为治疗疾病提供充分的依据。望、闻、问、切各有独特的作用，他们之间互相联系，互相补充，不能相互取代。临床必须结合运用，互相参证，才能全面系统的了解病情，称为四诊合参。

中药
Traditional Chinese Medicine

Traditional Chinese medicine (shortened as TCM), the origin of which could be traced back to the primitive society, boasts a history of thousands of years. It has been the result of a constant accumulation and summary of Chinese people in the long-term period of productive labor, living practices and medical practices. According to the written records in the ancient time, TCM originated in the primitive society; it was in the process of productive labor and living practices that people at the time gradually discovered TCM and

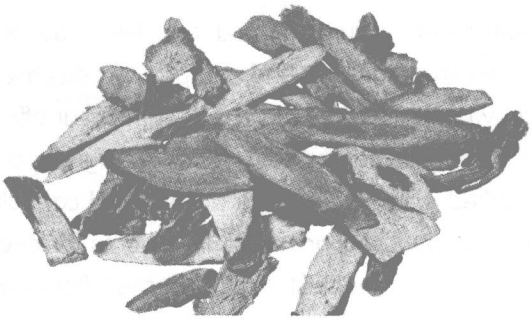


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then developed it. People in the primitive society, when collecting the edible plants, often ate some so-called poisonous ones by mistake, which would often result in the occurrence of vomiting and diarrhea, even coma and death. This forced people at the time to identify the plants scrupulously in case something unexpected occurred. When people felt sick, they might, however, think of using the plants to cure their illnesses, so the early medical practices were carried out. The Spring and Autumn and the Warring States Period witnessed a rapid development in the Chinese literature, philosophy, natural sciences, etc., and meanwhile, the medical science was then greatly developed. The publication of the TCM treatise which typified the period, namely *Huangdi Neijing*, marked the formation of the unique theoretical system of TCM. Not until the late Eastern Han Dynasty was the first TCM treatise *Shengnong Bencao Jing* (also *Shennong's Classic of Materia Medica*) published, which laid the theoretical foundation for TCM. Since the publication of the work, there have been hundreds of treatises on TCM, all of which have contributed a lot to its development. Among them, *Bencao Gangmu* (also *An Outline Treatise of Medical Herbs*) written by Li Shizhen in the Ming Dynasty was a world-renowned treatise on TCM.

中药
Traditional Chinese Medicine

中药起源很早，可以追溯到原始社会，有数千年的悠久历史。中医药是我国人民在长期的生产劳动，生活实践与医疗实践中不断地进行积累总结的结果。根据古代文字的记载，中药起源于原始社会，是当时的人们在从事生产活动、生活实践过程中逐渐发现和发展起来的。在原始社会时期，人们在采集可食用性植物时，常会误食一些所谓的“毒物”，而引起呕吐、腹泻，



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甚至昏迷、死亡等情况，这就迫使人们不得不小心翼翼地去辨认这些植物，以防发生意外。但是，当人们发生疾病时，可能又想到利用这些植物治疗某些疾病，于是便开展了早期的医疗实践活动。春秋战国时期是我国文学、哲学及自然科学等各方面迅速发展的时期，同时也带动了医学的发展，此时期具有代表性的中医典籍《黄帝内经》问世，标志着中医学独特理论体系已经形成。至东汉末年，我国的第一部中药学专著《神农本草经》出版，奠定了中药学的理论基础。自《神农本草经》问世至今，历代有关中药学的专著有数百种之多，均对我国中药学的发展作出了较大的贡献，其中明代李时珍的《本草纲目》更是誉满全球的中药学专著。



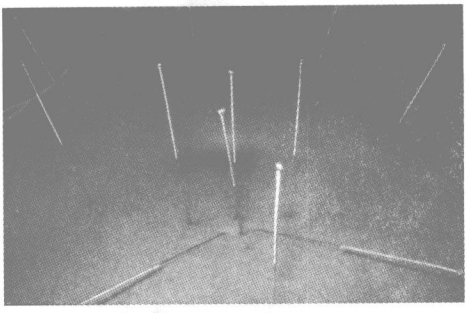
针灸
Acupuncture and Moxibustion

Acupuncture and moxibustion, with a history of thousands of years in China, is at the core of Chinese medicine; it includes two old therapeutic methods, i. e. acupuncture therapy and moxibustion therapy. Acupuncture therapy involves jabbing specially made metal needles of different lengths into the patient's body at certain acupuncture points, treating the patient by twirling or lifting the needles. Moxibustion therapy requires the placement of burning crushed dry moxa near or on the skin at certain acupuncture points, treating the diseases by the irritation of heat. In ancient China, there were many well-known doctors using acupuncture and moxibustion therapy to treat the patients, such as Bian Que of the Spring and Autumn Period and Hua Tuo of the Eastern Han Dynasty, who had cured some difficult and complicated diseases, and thus were acclaimed as miracle-working doctors. In 1027, a medical official of acupuncture and moxibustion of the Song Dynasty Wang Weiyi designed and made two bronze human figures marked with acupuncture points, and carefully carved 12 channels and vessels and 354 acupuncture points on the figures for people to use when learning the therapy. This was the earliest bronze human figure for medical use in China. Nowadays, acupuncture and moxibustion therapy is not only widely used in China to relieve people of their diseases, but it has also spread around the world.

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针灸
Acupuncture and Moxibustion

针灸在中国已有几千年的历史，是中国医学宝库中一颗璀璨的明珠。针灸术包括中国两种古老的治病方法：针法和灸法。针法是用特制的不同长度的金属针，按一定穴位，刺入病人体内，用捻、提等手法治疗疾病。灸法是把烧着的艾绒按一定的穴位，靠近皮肤或放在皮肤上，利用热的刺激来治疗疾病。中国古代有很多用针灸术为人治病的名医，像春秋时的扁鹊、东汉时的华佗等，他们治过不少疑难杂症，被誉为能使人起死回生的“神医”。公元 1027 年，宋代针灸医官王惟一，创造了针灸史上一大奇迹。他设计铸造了两具针灸铜人模型，在铜人体上精细地刻了十二经脉和 354 个穴位，供人学习针灸时使用。这是中国最早的医用铜人模型，也是中国针灸教育事业上的一个创举。今天，古老的针灸术不但在中国广泛使用，为人们解除病痛，而且还漂洋过海，传到了全世界各个地方。

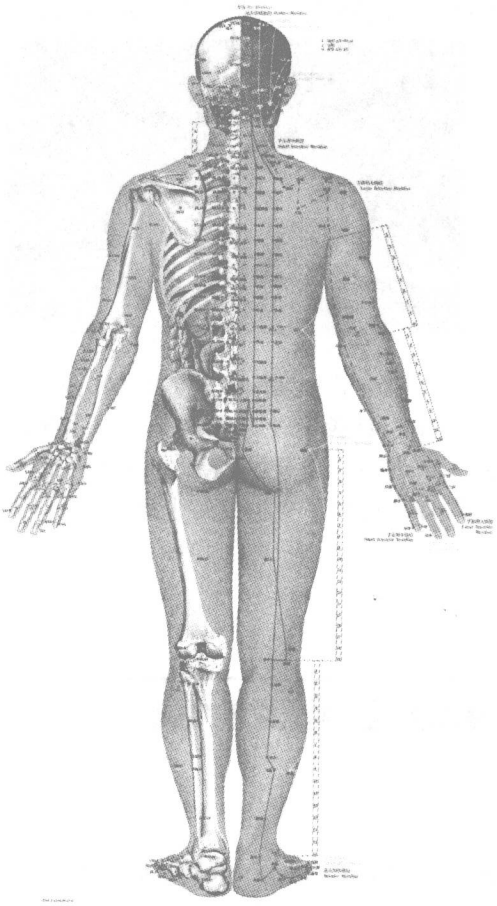


经络
The Meridians and Collaterals

The meridian-collateral theory is concerned with the physiological functions and pathological changes of the meridian-collateral system, and their relationships with zang-fu organs. It is an important component of the theoretical system of TCM. Andit is considered as a theoretical basis of all clinical subjects of TCM, especially that of acupuncture and moxibustion, tuina, and qigong. Besides, it guides the clinical practice of other branches of TCM. The meridians and collaterals are pathways along which qi and blood circulate through the whole

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body. The meridians are the major trunks of the meridian-collateral system and run longitudinally within the body, while the collaterals are the branches of the meridians and are reticularly distributed over the whole body. Hence, the meridians and collaterals, connecting the zang-fu organs with extremities, the upper with the lower and the internal with the external portions of the body, make all the body's organs and tissues an organic whole. The meridian-collateral system consists of meridians and collaterals as well as their subsidiary parts. This system, internally, links the zang-fu organs and, externally, joins the tendons, muscles and skin. The meridians are classified into three categories, i. e. the regular meridians, the extra meridians and the divergent meridians. There are twelve regular meridians, namely the three yin meridians as well as the three yang meridians of the hands and feet. They are known collectively as "the twelve regular meridians", which are the main passages for qi and blood circulation; they start and terminate at given points, run along fixed routes, and meet in certain orders. They are directly connected with the relevant zang-fu organs. The eight extra meridians are composed of Du, Ren, Chong, Dai, Yinqiao, Yangqiao, Yinwei and Yangwei meridians. They are interrelated with the twelve regular meridians and perform the functions of dominating, connecting and adjusting the twelve regular meridians. In addition, they are not directly related to the zang-fu organs. The twelve divergent meridians, as the extensions of the twelve meridians, originate from the limbs, run deeper into the zang-fu organs and emerge from the shallow neck. Their role is to enhance the links between every pair of meridians exteriorly-interiorly related in the twelve meridians and complement the organs and



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bodily areas to which the regular meridians cannot get. The collaterals are the branches of the meridians. They are divided into three groups, namely the divergent collaterals, superficial collaterals and tertiary collaterals. The divergent collaterals are the larger and main collaterals. The divergent collaterals originate from the twelve regular meridians as well as Du and Ren meridians respectively. Together with a large splenic collateral, they are generally called "the fifteen divergent collaterals". Their chief task is to strengthen the links between every pair of meridians exteriorly-interiorly related on the body surface. The superficial collaterals are ones that run through the surface layer of the human body, and often emerge on the surface. And the tertiary collaterals refer to the smallest and the thinnest ones of the whole body.



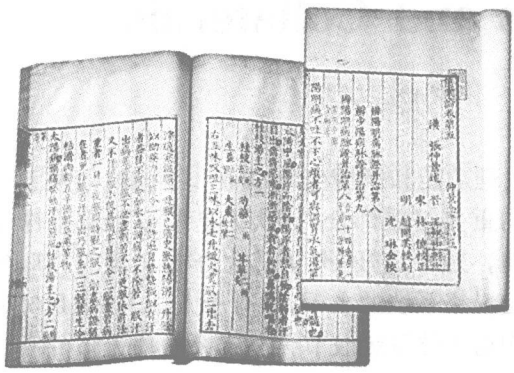
经络
The Meridians and Collaterals

经络理论是有关经络系统的生理功能和病理变化以及和脏腑之间关系的理论。它是中医理论系统的重要组成部分，被认为是所有中医临床学科特别是针灸、推拿和气功的理论基础。另外，它还指导其他分支学科的临床实践。经络是气血循行全身的通道。经是经络系统的主干，纵行于人体，而络是经的分支，呈网状分布于全身。因此，经络沟通人体脏腑肢节，上下内外，使人体的脏腑组织成为一个有机整体。经络系统由经和络互补而成。这个系统在内联络脏腑组织，在外沟通筋骨肌肤。经可以分为三类：正经、奇经和经别。有十二正经即手足三阴三阳经。它们被总称为"十二正经"，是气血循行的主要通道，有固定的起止点，按照一定的路径循行并按一定顺序交接。它们与相对应的脏腑直接相连。奇经八脉由督、任、冲、带、阴跻、阳跻、阴维和阳维脉组成。它们与十二正经相互联系，并行使控制、联系和调节十二正经的功能。另外，它们不与脏腑直接相关。十二经别是十二正经的延续。它们起于四肢，深入脏腑，浅出于项部。它们的作用是加强十二正经表里两经的联系，并补充十二正经所不能到达的脏腑和身体区域。络是经的分支，可分为三类：别络、浮络和孙络。起源于十二正经和任督二脉的别络和脾之大络统称为"十五别络"。它们的作用是加强表里两经在体表上的联系。浮络循行于人体的表层并常出于体表。孙络是整个人体中最细小的络脉。

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《伤寒杂病论》
Treatise on Cold Pathogenic and Miscellaneous Diseases

Treatise on Cold Pathogenic and Miscellaneous Diseases is one of the most significant books in the history of traditional Chinese medical science, written by Zhang Zhongjing (150 ~ 215) in the Eastern Han Dynasty, who was called the miracle-working doctor by the descendants. During his time, with warlords fighting for their own territories, many people were infected with febrile disease. Zhang's family was no exception. He learned medicine by studying from his townsfellow Zhang Bozu, assimilating from previous medicinal literature, and collecting many prescriptions elsewhere, finally writing the medical masterpiece. Shortly after its publication the book was lost during the wars that ravaged China during the period of the Three Kingdoms. It was collected by later people and compiled into two books, namely *Treatise on Cold Pathogenic Diseases*, which was a discourse on how to treat the epidemic infectious diseases causing fevers prevalent during his era, and the other, *Jingui Yaolue*, a compendium of his clinical experiences. This medical masterpiece was the greatest achievement of the medical theory since the Qin and Han Dynasties, which was applied broadly in the medical practice. It is also considered to be a monumental work for the school of febrile diseases by cold injury in traditional Chinese medicine.



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《伤寒杂病论》
Treatise on Cold Pathogenic and Miscellaneous Diseases

《伤寒杂病论》是中医历史上影响最大的古典医著之一。作者张仲景(150~215),东汉人,被后世称为“医圣”。他所处年代天下割据混战、兵戈扰攘,很多人染上了疫病,张仲景自己宗族中的人也有死于疫病的。他拜同乡张伯祖为师,钻研医学,吸收古代医学典籍里的知识,四处收集大量的药方,最终完成了这本医学名著。这本书成书后不久,便在之后全国战局动荡的三国时期失散。经后人收集整理,编成《伤寒论》和《金匮要略》两本书,前一本书论述对张仲景所处年代蔓延的传染病的治疗方法,后一本书是他临床经验的概要。这本医学名著集秦汉以来医药理论之大成,并被广泛应用于医疗实践。该书也被认为是中医“伤寒学派”的奠基之作。



人痘接种
Smallpox Inoculation

Smallpox inoculation or variolation was a great invention of medicine in ancient China. Inoculation against smallpox using material from smallpox patients was probably first practiced by the Chinese in the 10th century. A story was recorded that a Song Dynasty (960~1279) chancellor of China, Wang Dan, summoned physicians from all over the country to try to find some remedy for smallpox. From Mount Emei in Sichuan, a Taoist hermit, known as a “miracle-working doctor” brought the technique of inoculation and introduced it to him. However, the first clear and credible reference to smallpox inoculation in China comes from *Douzhen Xinfa* written in 1549 by Wan Quan. Inoculation, according to the historical records, was not widely practiced in China until the reign of Emperor Longqing (1567~1572) during the Ming Dynasty. Powdered smallpox scabs were

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blown into the noses of the healthy, and they would then develop a mild case of the disease and from then on were immune to it. During the seventeenth century, the practice spread to the Turkish regions, and then to the European countries. The French philosopher Voltaire once praised, "I am informed that the Chinese have practised inoculation in the past hundred years; this is a great precedent and example set by the Chinese nation considered to be the most intelligent and courteous in the world."



人痘接种
Smallpox Inoculation

人痘接种预防天花是中国古代医学家的伟大发明。中国人可能早在10世纪已懂得利用天花患者的病毒来接种的人痘接种法。有史书记载了一个故事:宋朝宰相王旦曾召集全国各地医师商议防治天花的方法,随后有一个被称为"神医"的四川峨眉山道教隐士将人痘接种术传给了王旦。不过,中国关于人痘接种最早的明确可信的记载来自明代医学家万全1549年的《痘疹心法》一书。据史料记载,人痘接种被广泛应用是在明朝隆庆年间(1567~1572)。将天花痘痂粉末吹入健康者的鼻孔,使其染病但症状较轻,痊愈之后便会终身对天花具有免疫力。17世纪,这一方法流传至土耳其一带,后又传至欧洲各国。法国哲学家伏尔泰这样赞扬人痘接种:"我听说一百年来,中国人一直就施用人痘接种法;这是被认为全世界最聪明、最讲礼貌的一个民族的伟大先例和榜样。"



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麻沸散
Ma Fei San



Ma Fei San is the first anesthetic in the world and was invented by Hua Tuo, an outstanding doctor in the late Eastern Han Dynasty. Although Hua Tuo's ancient prescriptions were lost, the ingredients are thought to have included cannabis and datura, which is a hallucinogenic plant and was later recorded as an anesthetic during the Song Dynasty. Some specific cases of abdominal operations were dilated upon in Hua Tuo's biography: A patient who suffered from abdominal pain for more than 10 days and had depilation of his beard and eyebrows beseeched Hua Tuo for treatment. The doctor diagnosed him as having deterioration in the abdomen, asked him to drink Ma Fei San, and then cut open and explored his abdomen. The doctor removed the deteriorated part, sutured and plastered the abdomen, and finally prescribed some herbs. The patient recovered after 100 days. This story is believed to be a treatment of acute appendicitis. There is a historical book, in which the excellent medical skills of Hua Tuo were reflected vividly. It read, "Provided that there was deterioration in the intestines, he would cut the deteriorated part out, wash the remaining part, sew up the abdomen, and rub it with ointment. In four to five days, the illness would remit and the patient would not wake due to pain; in a month or so, the patient would recover." There is also the story of General Guan Yu among the people, whose arm was pierced by a poisoned ar-

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row during a battle. Hua Tuo advised Guan to drink Ma Fei San so that he could do the surgery, yet Guan would not agree. Hua secured his wounded arm into the iron hoop of the wood frame and administered a strong anesthesia for it; then he scraped from Guan's arm all the necrotic flesh and periosteum, sutured the wound with silk threads, and dressed it with ointment. As a result, the life and arm of Guan Yu were saved.



麻沸散
Ma Fei San

麻沸散是世界上最早被发明和使用的麻醉剂，由东汉末年名医华佗发明。华佗的古老配方尽管已失传，但人们认为麻沸散的成分应包括大麻和曼陀罗花，后者是一种可使人产生幻觉的植物，在后来的宋时期被记载为一种麻醉药物。在华佗的传记中详细记述着其实施腹部手术的一些具体案例。有一个病人腹痛十余日，胡须和眉毛均有脱落，他恳求华佗给自己治病。经诊断，华佗认为病人腹部有病变，于是给他服用了些麻沸散，然后用刀剖开其腹部一查究竟。华佗从其腹部摘除病变部位，然后用针缝合伤口，敷上膏药，最后再给病人开一些药草服用。一百日之后，病人身体痊愈。有人认为这则故事讲述的是急性阑尾炎的治疗。有一部史书生动地放映了华佗的精湛医术，是这样写的："病若在肠中，便断肠湔洗，缝腹膏摩，四五日差，不痛，人亦不自寤，一月之间，即平复矣。"民间还流传一个关羽将军的故事，在一次战斗中，关羽的胳膊被一支毒箭射中。华佗建议关羽服麻沸散以便实施手术，但关羽不肯，华佗便把他的病臂缚在木架上的铁环中，在局部实施强烈的麻醉，拿出尖刀刮尽了腐肉和受损的骨膜，用丝线把伤口缝好，搽上了药，使关羽保存了性命和手臂。

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五禽戏
The Five-animal Exercise



The Five-animal Exercise, as a means of physical training in ancient China, was created by Hua Tuo, an eminent doctor in the late Eastern Han Dynasty. He summarized the traditional practice of our predecessors' building up their physical strength by imitating the animal movements, and created a set of healthcare gymnastics, i. e. the Five-animal Exercise, which consisted of five groups of actions imitating the movements and manners of the tigers, deer, bears, apes and birds. It is a thousand years earlier than the medical gymnastics contrived by the Swedish. At one time, seeing a kid playing with the door-latch, Hua Tuo immediately thought of a wise saying "Running water is never stale and a door-hinge never gets worm-eaten", which further reminded him of the fact that most of the illnesses were actually caused by the circulation hindrance and stagnation of Qi and blood, and people, if doing exercises regularly like a door-hinge, would improve their health and immunize themselves from illness. As a result, Hua Tuo was absorbed in researching into the ways for the physical buildup once he had time. He, referring to the "Physical and Breathing Exercise" used by people at the time when doing physical training, thought about making improvements constantly in accordance with the movements of various animals, the result of which was the creation of a set of fist

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techniques imitating the movements and manners of the tigers, deer, apes, bears and birds. This set of fist techniques, by imitating the quick pouncing of the tigers, light galloping of the deer, nimble jumping of the apes, slow-paced walking of the bears and wing-spreading flying of the birds, can clear your head and brighten your eyes, improve your heart and lung functions, strengthen your waist and kidney, and lubricate your joints, thus contributing to the overall buildup of your body. It is simple and easy to learn; anyone, whether men or women, old or young, can choose part of it for physical training at first, and then practice the whole set of actions as their physical buildup is gradually improved. Not only is the Five-animal Exercise good for your health and longevity, but for the eradication of your illnesses. Just as Hua Tuo said, "If feeling uncomfortable, you can do the Five-animal Exercise; as you perspire, you will get relaxed and feel like eating." In recent years, the Five-animal Exercise, as a means of rehabilitation treatment, has been widely used as an auxiliary treatment of people suffering from such illnesses as stroke sequelae, rheumarthritis, rheumatoid arthritis and osseous hyperplasia.



五禽戏
The Five-animal Exercise

五禽戏是我国古代体育锻炼的一种方法，创始人是东汉末年名医华佗。华佗总结了前人模仿鸟兽动作以锻炼身体的传统做法，创编了一套保健体操，包括虎、鹿、熊、猿、鸟的动作和姿态，也就是五禽戏。它比瑞典发明的医疗体操要早1000多年。一次，华佗看到一个小孩抓着门闩来回荡着玩耍，便联想起"户枢不蠹，流水不腐"的道理，于是想到人的大多疾病都是由于气血不畅和瘀寒停滞而造成的，如果人体也像"户枢"那样经常活动，让气血畅通，就会增进健康，不易生病了。于是，华佗有时间就专心致志地研究锻炼身体的方法，参照当时古人锻炼身体的"导引术"，不断琢磨改进，根据各种动物的动作，创造一套模仿虎、鹿、猿、熊、鸟五种动物的拳法。这套拳，模仿猛虎猛扑呼啸，模仿小鹿愉快飞奔，模仿猿猴左右跳跃，模仿黑熊慢步行走，以及模仿鸟儿展翅飞翔等动作，通过这一系列的运作，能清利头目，增强心肺功能，强壮腰肾，滑利关节，促进身体素质的全面增强，简便易学，故不论男女老幼均可选练，待体质逐渐增强后再练全套动作。五禽戏不仅具强身延年之功，还有祛疾除病之效。正如华佗所说："体有不快，起作禽之戏，怡而汗出，身体轻便而欲食。"近年来五禽戏作为康复医疗的一种手段，已广泛应用于

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中风后遗症，风湿性关节炎，类风湿性关节炎，骨质增生症等患者的辅助治疗。

《千金要方》
Qianjin Yaofang

Beiji Qianjin Yaofang (*Prescriptions Worth a Thousand Pieces of Gold for Emergencies*), also called *Qianjin Fang* or *Qianjin Yaofang* , was written by the well-known medical scientist in the Tang Dynasty Sun Simiao in the year 652. As he said, "Human life is of paramount importance, more precious than a thousand pieces of gold, and one prescription which can save it is even more precious; hence *Qianjin Yaofang* as the name of the book." From the Tang Dynasty to the modern times, *Beiji Qianjin Yaofang* has had more than 40 versions at home and abroad, which are roughly divided into two categories. The book is composed of 30 volumes. Volume 1 is the pandect of medical science, including medical ethics, materia medica, pharmacy and the like, Volumes 2 ~ 4 are on gynecological diseases, Volume 5 on pediatrics, Volume 6 on diseases of the seven orifices, Volumes 7 ~ 8 on dermatophytosis of all kinds, Volumes 9 ~ 10 on febrile diseases caused by cold, Volumes 11 ~ 20 on viscera diseases, Volume 21 on diabetes and similar diseases, Volume 22 on skin and external diseases, Volume 23 on hemorrhoid, Volume 24 on disintoxicating and various treatments, Volume 25 on techniques for emergencies, Volumes 26 ~ 27 on dietetic therapy and cultivation of mental poise, Volume 28 on normal pulse, and Volumes 29 ~ 30 on acupuncture and moxibustion. There are totally 233 categories, containing more than 5,300 articles. It has set up the format for compilation of prescriptions. The book gives a sys-


孫真人備急千金要方序 校一
孫真人備急千金要方
昔神農偏嘗百藥以辨五苦六辛之味逮伊
尹而湯液之劑備黃帝欲創九針以治三陰
三陽之疾得岐伯而砭艾之法精雖大聖人
有意於拯民之瘼必待賢明博通之臣或為
之先或為之後然後聖人之所為得行於永
久也醫家之務經是二聖二賢而能事畢矣
後之留意於方術者苟知藥而不知灸未足
以盡治療之體知灸而不知針未足以極表
裏之要如能兼是聖賢之旨者其名醫之走

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tematic summing-up of the accomplishments in medical science prior to the Tang Dynasty. Its sources are extensive, and its contents are rich, covering all clinical sectors and many aspects such as acupuncture and moxibustion, dietetic therapy, medicament, prevention, and hygiene. It contains both discussions and descriptions, having both proved recipes and classical prescriptions. It is the first comprehensive monumental work of medical science in China, another summing-up of Chinese medicine after *Treatise on Cold Pathogenic and Miscellaneous Diseases* by Zhang Zhongjing, and is acclaimed as the earliest encyclopedia of clinical medicine in the Chinese history.



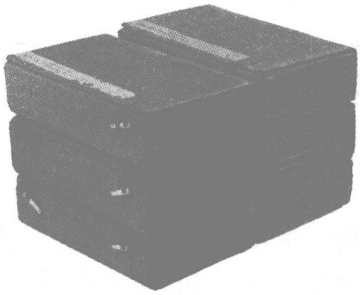
《千金要方》
Qianjin Yaofang

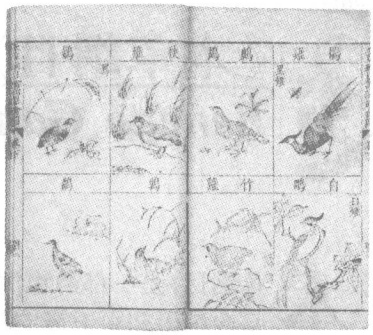
《备急千金要方》，又称《千金方》或《千金要方》，成书于652年，作者为唐代著名医学家孙思邈。正如他所言：生命的价值贵于千金，而一个处方能救人于危殆，价值更当胜于此，因而用《千金要方》作为书名。《备急千金要方》自唐代到现代，中外翻刻版本有40余种，大致可分为两类。此书30卷本内容，卷一为医学总论，包括医学伦理、本草、制药等；卷二～四为妇科病；卷五为儿科病；卷六为七窍病；卷七～八论诸风脚气；卷九～十为伤寒；卷十一～二十为脏腑病论；卷二十一论消渴淋闭诸症；卷二十二为疮肿痛疽；卷二十三系痔漏；卷二十四论解毒并杂治；卷二十五为备急诸术；卷二十六～二十七系食治并养性；卷二十八平脉；卷二十九～三十针灸孔穴主治，总计233门，含方论5300余首，创分症列方的编写体例。书中系统总结了唐代以前的医学成就，取材广泛，内容丰富，遍涉临床各科及针灸、食疗、药物、预防、卫生保健等。该书有述有作，验方经方兼备，是中国第一部理法方药俱全的医学巨著，是继张仲景《伤寒杂病论》后，中国医学的又一次总结，被誉为中国历史上最早的临床医学百科全书。

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《本草纲目》
Bencao Gangmu

Bencao Gangmu, also known as *The Compendium of Materia Medica* (a book on Chinese herbal medicine), is a materia medica work written by the great medical and pharmaceutical expert in the Ming Dynasty, Li Shizhen. It is regarded as the most complete and comprehensive medical book ever written in the history of traditional Chinese medicine in China. It almost lists all the plants, animals, minerals, and other objects that were believed to have medicinal properties. Li Shizhen completed the first draft of the book in 1578, after conducting readings of 800 other medical reference books and carrying out 30 years of field study. For this and many other achievements Li Shizhen has often been compared to Shennong, a great man in the Chinese mythology who taught people about agriculture and herbal medicine. *Bencao Gangmu* has 52 volumes in total. At the very beginning is the table of contents and 1,160 hand-drawn illustrations. Volumes 1 to 4 are an index and a comprehensive list of herbs that would treat the most common illnesses. Volumes 5 to 52 form the main content of the text, recording 1,892 distinct medicines, of which 374 were added by Li himself. There are some 11,096 prescriptions to treat the common illnesses, of which 8,160 were compiled or collected by Li. The text is written in almost 2 million Chinese characters, classified into 16 divisions and 60 orders. For every medicine there are explanations of the names, detailed descriptions of the odor, medical function,





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effects, side recipes etc. *Bencao Gangmu* improved the classification of traditional Chinese medicine, complying with a uniform format, and the language was comparatively scientific and precise; besides, it played a very significant role in promoting the credibility and scientific values of the biological classification of both plants and animals. The work corrected many false understandings of the nature of the medicines and illnesses. Li also included many new herbs and added his own discovery in certain drugs. *Bencao Gangmu* is more than a pharmaceutical work, for it contains information covering the topics in biology, chemistry, geography, mineralogy, geology, history, astronomy etc. It has been translated into more than 20 languages and spread all over the world. Even now it is still in print and used as a great medical work.



《本草纲目》
Bencao Gangmu

《本草纲目》是一部药物学著作，作者为明代伟大的医药学家李时珍。该书是我国中药史上最完整最全面的一部医学书籍，几乎列出了所有人们认为有医疗功效的植物、动物、矿物及其他物质。经过参阅 800 余部医学著作以及 30 年的实地考察学习，李时珍最终于 1578 年完成该书第一稿。神农氏是我国神话中的一位伟人，他教会了人民农耕及使用草药，李时珍因这部医学著作和其他众多成就常被后人比作神农。《本草纲目》共五十二卷，开篇为目录及 1160 幅手工插图，第一卷到第四卷是序例和用于治疗最常见疾病的药草清单，第五卷到第五十二卷是该书的主要部分，记载了 1892 种不同种类的药物，其中 374 种是李自己新增加的。该书收录了约 11096 首治疗普通疾病的方剂，其中 8160 首由李时珍自己拟定或收集。全书近 200 万字，分为 16 部、60 类。每种药物分列释名、气味、主治、疗效和附方等。《本草纲目》改进了中药的分类方法，格式比较统一，叙述也比较科学和缜密，此外，对提高动植物生物学分类的可靠性和科学价值也具有很大意义。该书纠正了前人对药物和疾病性质的很多错误理解。他还增加了很多新药，在某些药物中加入自己的发现。《本草纲目》不仅是一部药物学著作，还涉及生物学、化学、地理、矿物学、地质学、历史和天文学等方面内容。该书先后被翻译成 20 多种语言，在世界范围内广为流传，直至现在仍在作为一部重要的医学著作刊印使用。

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Chapter 8 手工业 Handicraft Industry



活字印刷 Moveable Type Printing

The block printing technology in our country was probably invented in the seventh century, and reached its climax in the tenth century in the Song Dynasty. With the block printing technology, such procedures as writing samples, carving blocks, spraying the ink and printing were involved in the process of publishing a book, and it was always time-consuming and costly in the use of the material resources and manpower to print a work of great length. The procedures would have to be repeated if other books were to be published; hence our ancestors conducted active explorations and strived for improvements, which led to the eventual invention of the moveable clay-type printing technology by an ordinary man called Bi Sheng during the period of Qingli of the Northern Song Dynasty, as can be proved by the account of the book *Dream Pool Essays* by Bi Sheng's contemporary, Shen Kuo. From then on, the moveable type printing technology was applied, and it was 400 years earlier than that used in Europe when the German Gutenburg, for the first time, printed the *Holy Bible* with this very technology. During the period of Dade of the Yuan Dynasty, Wang Zhen learned to use the moveable wood types to print books, of which none has come down to the present day. The oldest moveable-type printed book in existence in China is *Yushice* in the Yuan Dynasty, which is now collected in the National Library of China. There are, because of the differences of the times and materials, different names for the moveable type printing, such as the moveable clay-type printing, magnetic printing, moveable wood-type plate, moveable copper-type printing, moveable lead-type printing and moveable

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zinc-type printing. In the years of Hongzhi of the Ming Dynasty, the moveable copper-type printing became prevalent in Wuxi, Suzhou, Changshu and Nanjing, Jiangsu Province, but in the years between Tianqi and Congzhen of the Ming Dynasty when a social and economic decline was pervasive, lapsed into a low ebb due to its great economic cost, the corollary of which was that there were few moveable copper-type printed books handed down to the present day. There are over 100 kinds of books in existence which were printed with the cheap moveable wood types in the Ming Dynasty. In the late Ming Dynasty, the moveable wood-type printing gradually replaced the copper-type printing for the printing of the books. People at the time also learned to use the moveable zinc types to print books; unfortunately, there was not any book of this kind left to the present day. The moveable wood-type printing was the mainstream in the Qing Dynasty, and a great number of books of this kind have been properly preserved. After the Opium War, the moveable zinc-type printing technology originating in the west was introduced into China. The new printing technology, given its great advantages over the traditional block printing and moveable type printing, replaced them gradually as the major type of printing books, and has been used to the modern times.



活字印刷
Moveable Type Printing

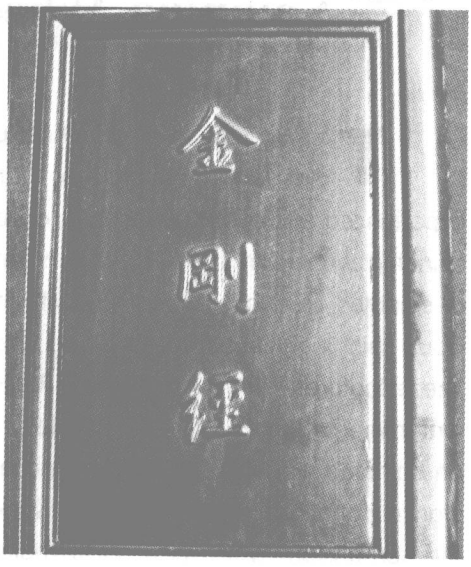
我国雕版印刷技术大约发明于公元7世纪，到了10世纪的宋代达到鼎盛。使用这种技术出版一套书籍须经过写样刻版、涂墨印刷等多道工序，如果是要印一部大著作，往往要花费大量的物力、人力和时间。假如要再出版其他书籍，这些工序又得重新来过，因此我们的祖先积极探索，力求改进，终于在北宋庆历年间，平民毕昇发明了用胶泥活字印刷技术。此事记载于与毕昇同时期的沈括的《梦溪笔谈》一书中，从此活字印刷术开始使用了。它比欧洲最先用活字印《圣经》的德国谷腾堡要早400年。到了元代大德年间，王桢发明了用木活字印书，可惜这些都没有传本，国内现存最早的活字印刷实物是国家图书馆藏元朝的《御试策》。活字版因时代、材料不同而有不同的名称，有“泥活字版”、“磁板”、“木活字版”、“铜活字版”、“铅活字版”、“锡活字版”等等。明代弘治年间，在江苏的无锡、

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苏州、常熟、南京一带，铜活字印刷开始流行起来。到了天启、崇祯时期，由于社会经济的衰落，铜活字印刷因经济成本太大进入低潮，很少有传本面世了。明代用木活字这种成本价廉的印刷方式印制的书籍现存有100多种，到了明代晚期，木活字逐步取代了铜活字印书。同时在明代还发明了用锡活字印书，可惜无实物传世。木活字是清代活字印刷的主流，且有大量的木活字书籍保存下来。鸦片战争以后，西方的铅活字印刷术传入我国，这种新型的印刷术比传统的雕版印刷和活字印刷有着较大的优势，逐步取代了雕版印刷和活字印刷的地位，成为印刷书籍的最主要的方式，并一直沿用到现代。

《金刚经》
The Diamond Sutra

The oldest extant printed book with a specific date in our country as well as in the world is *the Diamond Sutra*. The block-printed *Diamond Sutra*, printed in the ninth year of Xiantong of the Tang Dynasty (868), is a Buddhist scripture scroll which is some 16 meters long and made up of 6 bonded equal-sized pieces of paper with the Buddhist scripture on them. At the beginning of the scroll is a picture entitled the *Garden of the Benefactor of the Orphans and Solitary*, in which Gautama Buddha gives Dharma teachings in the Jetavana Vihara; on the rest of the scroll is written the text of *the Diamond Sutra* with an inscription which reads "On 15, April in the ninth year of Xiantong, Wang Jie printed the book for the sake of beseeching blessings for his parents". The world-renowned *Diamond Sutra*, initially hidden in the Qianfo Cave of Dunhuang Grottos in Gansu Province, was discovered in 1899 and then purchased illegally by an Eng-



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lishman Stein in 1907. It is now collected in the British Museum in London.



《金刚经》
The Diamond Sutra

我国及世界现存最早的有明确日期的印刷书是《金刚经》。《金刚经》是雕版印刷，印成于唐咸通九年（868），它是一部长约16米的佛教经卷，由6张尺寸一致的印有经文的纸张粘接而成。卷首有一幅题为《祇树给孤独园》的图画，画着释迦牟尼佛在祇园精舍说法的故事，其余为《金刚经》全文，题有“咸通九年四月十五日王玠为二亲敬造普施”一行。这卷举世闻名的《金刚经》，原藏甘肃敦煌千佛洞，1899年发现，1907年被英人斯坦因盗去，现藏伦敦不列颠博物馆。



水力大纺车
The Large Water-driven Spinning Wheel

The ancient spinning wheel usually had two to three, or even five, spindles. At the juncture of the Song and Yuan Dynasties when the society experienced substantial economic development, on the basis of various kinds of spinning wheels at the time, a new kind of large-size spinning wheel with dozens of spindles gradually appeared, with the prominent features different from the previous spinning wheels in that it had dozens of spindles and was powered by water. These features, which resembled those of modern spinning machines, made the waterwheels suitable for large-scale professional production. The large water-driven spinning wheel also greatly improved the efficiency of the textile industry. For instance, one hand-driven spinning wheel could weave 1.5 kilos of hemp (fiber from the hemp plant which is used to make textiles) at most each day, while a large water-driven one could weave more than 50 kilos daily. In this way, once the

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wheel began to work, there had to be enough hemp for constant production. The large water-driven spinning wheel was an important invention that applied natural power in textile manufacturing in ancient China. The water-driven spinning wheel in China precedes its Western counterpart by more than four centuries.

水力大纺车
The Large Water-driven Spinning Wheel

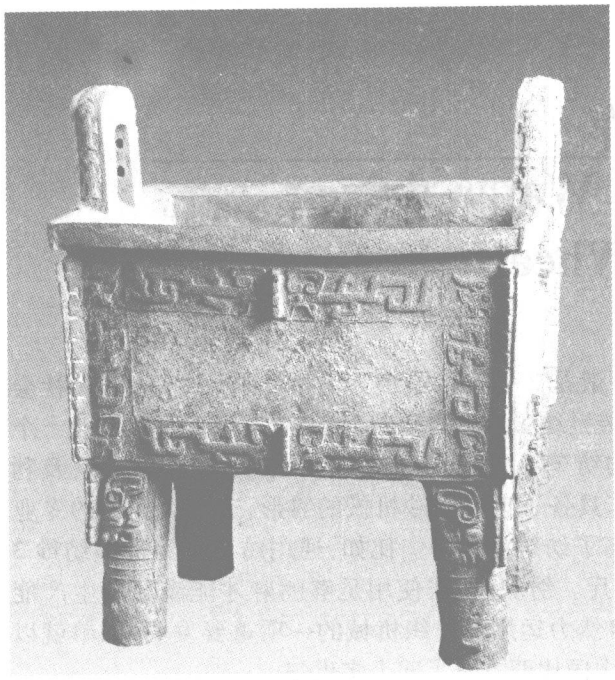
古代纺车的锭子数目一般是2~3枚,最多为5枚。宋元之际,随着社会经济的发展,在各种传世纺车机具的基础上,逐渐产生了一种有几十个锭子的大纺车。大纺车与原有的纺车不同,其特点是:锭子数目多达几十枚,及利用水力驱动。这些特点使大纺车具备了近代纺纱机械的雏形,适应大规模的专业化生产。水力大纺车还大大提高了纺织业效率。比如,通用纺车每天最多纺纱3斤,而大纺车一昼夜可纺100多斤。纺织时,需使用足够的麻才能满足其生产能力。水力大纺车是中国古代将自然力运用于纺织机械的一项重要发明,如单就以水力作原动力的纺纱机具而论,中国比西方早了四个多世纪。

司母戊大方鼎
The Simuwu Rectangle Ding

In 1939, a bronze ding which is an ancient cooking vessel with two loop handles and four legs was unearthed in Anyang, Henan Province. This four-legged ding known as the Simuwu Rectangle Ding was so big and heavy that it could not be moved after it was unearthed. The Japanese invaders tried several times to plunder it. To protect this rare cultural relic, the local people reburied it and then unearthed it again after China won the Anti-Japanese War in 1945. The Simuwu Rectangle Ding is now collected in the National Museum of Chinese History. The opening of the Simuwu Rectangle Ding is 110cm long and 78cm wide, its sides are 6cm thick and the loop handles are 133cm high. The whole ding weighs 875 kilograms and is the heaviest bronze ware in the world. The casting of this

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huge bronze vessel used over 1,000 kilograms of metal and needed 70 to 80 craftsmen to work on it. It is the biggest bronze ware unearthed in China and also a treasure in the world's bronze ware collection. Though the ding is big and heavy, its workmanship is exquisite.



Relief of Kui (a one-legged mythical animal) was carved on the four sides of the body of the ding. The animal figures are portrayed with artistic exaggeration and create a ferocious, mysterious and dignified atmosphere. Dings were used in the primitive society in China as cooking utensils. At first they were made of pottery clay. Then, as metallurgy emerged and developed, the material was changed to bronze at the end of the Shang Dynasty some 3,000 years ago. By that time, dings had changed function to become sacrificial vessels and the symbol of their owners' power and wealth. The Simuwu Rectangle Ding reveals a high level of casting technique and artistry. It represents the highest casting achievement of the Shang Dynasty. According to the archeologists, the King of the Shang Dynasty had the Simuwu Rectangle Ding made to commemorate his mother.

司母戊大方鼎
The Simuwu Rectangle Ding

1939年,在河南省安阳市出土了一件青铜鼎,该鼎为我国古代一种炊食器,有两个立耳和四足。这件被称为司母戊大方鼎的四足方鼎出土后,因为又大又重,一时无法搬运。日本侵略者多次强索该鼎,为避免这件珍稀文物惨遭掠夺,当地人们再次把它埋入地下,直到1945年抗战胜利后,才重新将其出土。

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司母戊大方鼎现收藏于中国历史博物馆。司母戊大方鼎口长 110 厘米，宽 78 厘米，壁厚 6 厘米，立耳高 133 厘米。整尊鼎重达 875 公斤，是世界上最重的青铜器。铸造这件大型的青铜器皿使用金属原料 1000 多公斤，需要七八十名工匠操作完成。它是中国出土的最大一件青铜器，也是世界青铜器收藏中的一件珍品。大方鼎虽然形大体重，但制作工艺非常精美，鼎身四周用浮雕刻出夔龙（想象中的一种单足动物）纹样。这些动物纹样是经过艺术夸张而刻划出来的，纹样衬托出一种狰狞、神秘、威严的气氛。鼎在原始社会时期的中国用作炊食器，最先由陶土烧制。随着冶金技术的出现和发展，在约 3000 年前的商代后期鼎改用青铜浇铸而成，而且，这时的鼎已经改变用途，成为一种礼器，是权力和财富的象征。司母戊大方鼎展现出一种高超的铸造工艺和艺术水平，代表了商代铸造技术的最高成就。据考古专家考证，商王铸造这尊司母戊大方鼎是为了纪念自己的母亲。

秦始皇陵铜车马
The Bronze Chariots and Horses of Emperor Qin Shihuang's Mausoleum

In December 1980, two sets of large painted bronze chariots and horses were unearthed 20 meters west of the mount of Emperor Qin Shihuang's Mausoleum. They were listed as No. 1 and No. 2 respectively according to their discovery. They were then enclosed in a wooden coffin and buried in a pit seven meters deep. When excavated, the chariots and horses were seriously damaged due to the decayed wooden coffin and the collapse of earthen layers. No. 2 bronze chariot and horses were found broken into 1,555 pieces when excavated. After two and a half years of careful and painstaking restoration by archaeologists and other experts, they were formally open to the public on October 1, 1983. No. 1 bronze chariot and horses were also open to the public in 1988. The bronze chariots drawn by four horses, with a single shaft, were placed one before the other vertically. The front chariot, i. e. No. 1 Chariot, was supposed to be "High Chariot" in the ancient time. The back chariot, i. e. No. 2 Chariot, was named "Security Chariot". It has a front room and a rear room, between which there is a partition. The

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front room is for the charioteer and the rear one for the master. In the rear compartment, there is a window on either side of the carriage as well as in the front with a door at the back. The windows and doors could close and open easily. The small holes on the windows were used for ventilation. On top of the chariot, there was an elliptical umbrella-like canopy. The chariot was colour-painted against a white background. No. 2 Chariot was fitted with more than 1,500 pieces of silver and gold and other ornaments, looking luxurious, splendid and graceful. Probably it was used for Emperor Qin Shihuang's soul to go out on inspection. No. 1 Chariot was equipped with crossbows, arrow heads, shields and the charioteer wore a hat, which shows that this chariot was employed to protect the No. 2 Chariot behind. The bronze chariots and horses were the earliest and most exquisitely made bronze valuables. They enjoy the highest class and have the most complete harnessing wares. They are also the largest bronze ware discovered in the history of world archaeology. The excavation of the bronze chariots and horses provides extremely valuable material and data for the textual research of the metallurgical technique, mechanism of chariots and technological modeling of the Qin Dynasty.

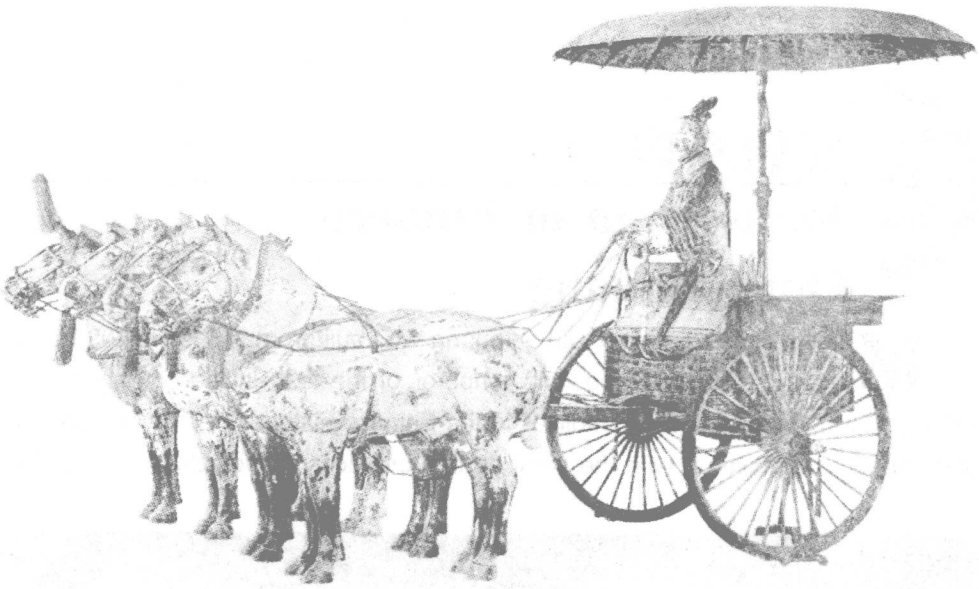


秦始皇陵铜车马
The Bronze Chariots and Horses of Emperor Qin Shihuang's Mausoleum

1980年12月在秦始皇陵西侧20米处，发掘出土了两乘大型彩绘铜车马，按照发现的顺序，被编为一号和二号铜车马。当时皆被埋在7米深的坑里，外面用一个木椁装着。出土时，因木椁腐朽，土层塌陷，两辆铜车马都残破严重，其中二号铜车马已碎成1555片，经过考古工作者和各方面专家两年半细心艰苦的修复，二号铜车马于1983年10月1日正式对外展出，一号铜车马也于1988年正式展出。这两乘车都是四马单辕，呈前后纵向排列，前面的一号车应为古代的"高车"。二号车叫"安车"，分为前御室和后乘室。两室之间隔以车墙。赶车的人坐在前御室，主人坐在后乘室。乘室前面及左右两侧有三个车窗，后面留门，门窗都可以灵活启闭，窗上的小孔可以调节空气。车上有椭圆形伞状车盖。此车通体

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施以白色为底色的彩绘，二号车配有 1500 余件金银构件和饰物，显得华丽富贵。它可能是供秦始皇出游时乘坐的。一号车上配备有弓弩、箭头、盾牌，驾车者带有官帽，这说明此车是用来保护后面二号车的安全的。铜车马是我国时代最早，驾具最全，级别最高，制作最精的青铜器珍品，也是世界考古发现的最大青铜器。它的出土，为考证秦代冶金技术、车辆结构、工艺造型等提供了极为珍贵的实物资料。

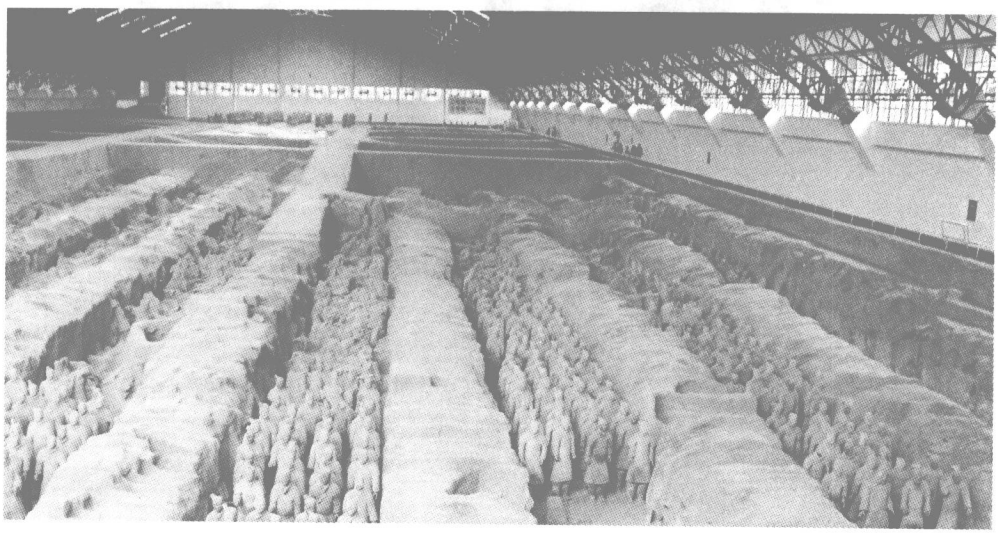


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Chapter 9 工程建筑 Engineering and Building

秦始皇陵 Mausoleum of Emperor Qin Shihuang

Mausoleum of Emperor Qin Shihuang was built from 246 BC to 208 BC, by order of Qin Shihuang, the emperor of the first unified country of centralized power and various nationalities in the Chinese history. It is the first and largest imperial mausoleum with the most numerous sacrificial objects in China. The



mausoleum is square in shape, with a flat top and ladder-shaped profile. It is 76 metres high, 345 metres long from east to west and 350 metres long from north to

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south. The total area of the mausoleum and its accompanying building relics is 120,750 square meters. The grand accompanying sacrificial Terra Cotta pits, with a total area of 25,380 square metres, were constructed from 221 BC to 209 BC. The pottery warriors and horses in the pits were organized in groups according to the army formation in the Qin Dynasty, which provided vivid materials for researching into the military establishment, fighting modes and army supplies in the Qin Dynasty. The excavation of the Terra Cotta Warriors and Horses is considered "the eighth wonder of the world" and "one of the most spectacular archaeological discoveries of the twentieth century". The realistic style of the Terra Cotta Warriors and Horses, which serves as a transitional art style in China's history of sculpture, has aroused the worldwide interest.

秦始皇陵
Mausoleum of Emperor Qin Shihuang

秦始皇陵是中国历史上第一个多民族的中央集权国家的皇帝秦始皇于公元前246年至公元前208年营建的,也是中国历史上第一个皇帝陵园。其巨大的规模、丰富的陪葬物居历代帝王陵之首。陵墓近似方形,顶部平坦,腰略呈阶梯形。现存高76米,东西长345米,南北宽350米,占地120750平方米的陵墓及大量地面建筑遗迹和陪葬物。兵马俑坑为秦始皇陵的一组大型陪葬坑,建造于公元前221至前209年,总面积25380平方米。这些按当时军阵编组的陶俑、陶马为秦代军事编制、作战方式、骑步卒装备的研究提供了形象的实物资料。兵马俑的发现被誉为"世界第八大奇迹","20世纪考古史上的伟大发现之一"。秦俑的写实手法作为中国雕塑史上的承前启后艺术为世界瞩目。

秦始皇陵兵马俑
The Terra Cotta Warriors and Horses

The Terra Cotta Warriors and Horses are one of the most significant archeological discoveries in the 20th century. The excavation work is ongoing at this site, which is around 1.5 kilometers east of Emperor Qin Shihuang's

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missed by any visitor to China. Upon ascending the throne at the age of 13 in 246 BC, Qin Shihuang, later the first feudal emperor in the Chinese history, began to work for his mausoleum. It took 11 years to finish. It is speculated that many buried treasures and sacrificial objects had accompanied the emperor in his afterlife. A group of peasants uncovered some pottery while digging for a well nearby the royal tomb in 1974. It caught the attention of archeologists immediately, who, after massive on-site excavations, claimed that the Terra Cotta Warriors and Horses had been associated with the Qin Dynasty. The museum covers an area of 16,300 square meters, divided into three sections, i. e. No. 1 Pit, No. 2 Pit, and No. 3 Pit respectively. No. 1 Pit, the largest of the three, was first opened to the public on China's National Day, 1979. No. 2 Pit, found in 1976, is 20 meters northeast of No. 1 Pit. It contained over one thousand warriors and 90 chariots. It was unveiled to the public in 1994. Archeologists came upon No. 3 Pit also in 1976, 25 meters northwest of No. 1 Pit. It looked like the command center of the armed forces. It went on display in 1989, with 68 warriors, a war chariot and four horses. Up to now, over 7,000 pottery soldiers and horses, chariots, and weapons have been unearthed from these pits. Most of them have been restored to their former gran-

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deur. The Terra Cotta Warriors and Horses were listed by UNESCO in 1987 as one of the world cultural heritages.

秦始皇陵兵马俑
The Terra Cotta Warriors and Horses

秦始皇陵兵马俑是20世纪最重要的考古发现之一。在陕西西安市临潼区秦始皇陵以东约1.5千米处,考古发掘工作正在进行。到中国的游客都不会错过参观这一景点。秦始皇后来成为中国历史上首位封建帝王。13岁的他于公元前246年继承王位之后就着手营造自己的陵墓,历时11年方修建完成。有人猜测,始皇帝死后有大量的宝物和陪葬品埋入陵墓陪伴这位帝王。1974年,几个农民在帝王陵寝附近打井时发掘出一些陶制品,这立即引起了考古学家们的注意,他们在经过大量的现场发掘后认为兵马俑和秦代关系密切。兵马俑博物馆占地16300平方米,由三部分组成,即分别是1号俑坑、2号俑坑和3号俑坑。一号坑在三个坑中最大,首先于1979年中国的国庆节当天向公众开放。1976年发现的2号坑,在一号坑东北方向20米处,有1000多个陶俑和90乘马车。2号坑于1994年向公众开放。3号坑也是考古学家在1976年发现的,在1号坑西北方向25米处,该俑坑看上去像是军队的指挥中心。1989年公开展览的3号坑,由68个陶俑、一乘战车和四个马俑。迄今从这些俑坑中共发掘出7000余件陶俑、陶马、战车和兵器,大部分经过修复都已重获了昔日的威武和庄严。秦始皇陵兵马俑于1987年被联合国教科文组织列为世界文化遗产之一。

长城
The Great Wall

Construction of the Great Wall began during the Spring and Autumn Period to the Warring States Period. Several vassal states built wall fortifications successively along the precipitous mountain ridges to ward off the plunder of nomadic people and the invasion of each other. In 221 B. C. when Qin Shihuang united China, he ordered to link the walls up. During the following dynasties, the

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Great Wall was destroyed continuously by natural disasters and human beings.



Among the remaining broken pieces of walls, those constructed in the Ming Dynasty are the most well-preserved and splendid ones. The Great Wall stretches some 6,300km from Jiayuguan Pass in the west to the Yalujiang River in the east, traversing 11 provinces, municipalities and autonomous regions. Not only is it the most magnificent ancient military defense work, but one of the most remarkable ancient buildings in the world.

长城
The Great Wall

长城始建于春秋战国时期。各诸侯国为互相防御和抵御北方游牧部落的侵扰,在地形险要之处相继兴筑长城。公元前 221 年,秦始皇统一中国后,将从前的长城连接起来。在以后的几个历史时期,由于自然和人为因素的毁

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坏，保存到今天的大都已是断断续续的遗迹。而在这些遗迹中保存最完整、最坚固、最雄伟的是明代长城。长城绵亘中国的11个省、市、自治区，西起嘉峪关，东到鸭绿江，全长约12600华里。它不仅是古代最雄伟的军事防御工程，也是世界上最非凡最伟大的古老建筑之一。

嵩岳寺塔
Songyue Pagoda

Songyue Pagoda is situated in Songyue Temple in the south of Mount Song and at the foot of Taishi Mountain, where all is nestling among the mountains and in the folds of the forests and mountains , the spring water



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streams, and the birds twitter, making people there bathed in the scenery of serenity and grace as if in the paradise. Initially built in the year 509 and the Summer Palace of Emperor Xuangwu of Northern Wei, Songyue Temple was later transformed into a buddhist temple. At the time, it was very large in size and at its heyday, as could be proved by the fact that Emperor Wu Zetian in the Tang Dynasty once took it as her temporary dwelling place when visiting Mount Song. Songyue Pagoda, built in the first year of Zhengguang of Northern Wei, namely in the year 520, was, among the existing pagodas with the dense-eaves types, the earliest one. The whole pagoda, assuming a graceful parabola shape, is exquisite in design and considered to be the classic of the pagodas with the dense-eaves types. With a height of 39.8 meters, a circumference of 33.7 meters and a thickness of 2.45 meters, it has 15 tiers equilateral-dodecagoned dense eaves as the body and is the only example of its kind among the various kinds of ancient pagodas extant in our country. The pagoda, composed of the base, the body, the dense eaves and the finial, was built with the bluish bricks; it is hollow inside and tube-shaped. There are between the tiers such things as the doors, mullion windows and carved animals, the design of which is ingenious, unique and spectacular. Songyue Pagoda, boasting a height of almost 40 meters and a history of over 1400 years, can be considered one of the extremely fine craftsmanships. The modern scientific principles in geology, geometry, physics and chemistry were applied, and the building materials, namely the small bluish bricks and glutinous rice juice, firmly agglutinated together. Songyue Pagoda, given its unique shape, became a masterpiece in the ancient Chinese architectural history, and is of great research value in the architecture.



嵩岳寺塔
Songyue Pagoda

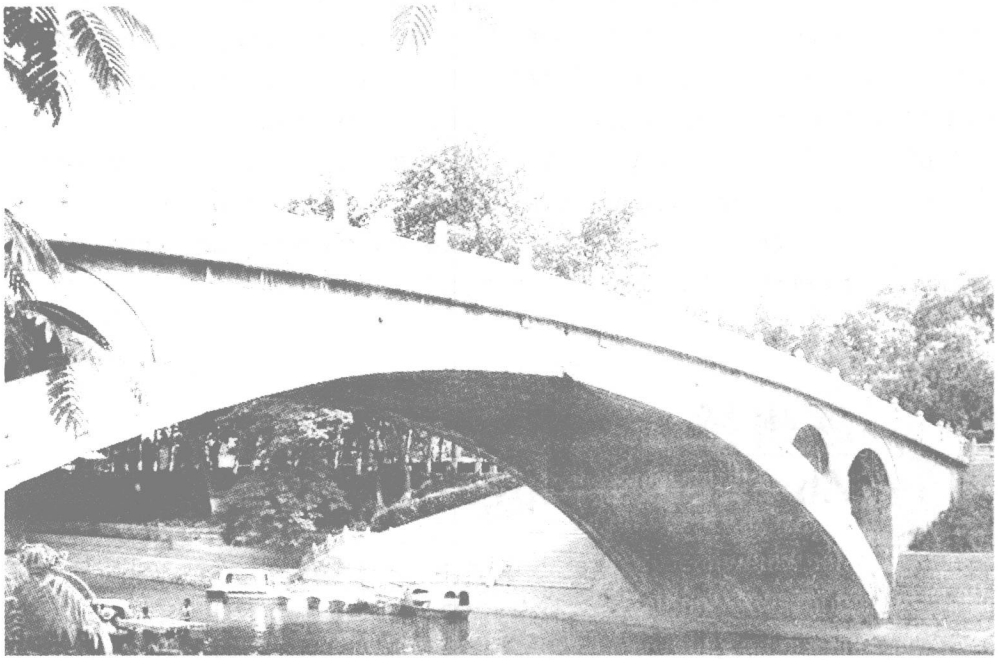
嵩岳寺塔位于嵩山南麓，太室山脚下的嵩岳寺内，这里群山环抱、山林掩映、泉水淙淙、鸟语和鸣、景色清幽雅致，一派人间仙景。嵩岳寺始建于公元509年，原来是宣武帝的离宫，后改为佛教寺院。当时的嵩岳寺规模宏大，盛极一时，武则天游嵩山时，曾把这里作为行宫。嵩岳寺塔建于北魏正光元年，公元520年，是我国现存年代最早的密檐式砖塔，大塔整个外形呈现出优美的抛物线

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形，设计绝妙，堪称密檐式塔的经典之作。大塔高 39.8 米，周长 33.7 米，壁厚 2.45 米，塔身平面为等边十二角形 15 层密檐，是我国现存各类古塔中的孤例，全塔由基台，塔身，密檐和塔刹四部分组成，用青灰条砖垒砌，塔身中空，呈筒状。各塔层之间均有壶门，棂窗，雕兽等，精巧独特，雄伟壮观，形制独特。嵩岳寺塔高近 40 米，历经 1400 多年，气势高危的古塔可谓鬼斧神工，整座大塔运用了地质、几何、物理、化学等现代科学原理，所用的建筑材料系小青砖、糯米汁、粘结牢固，嵩岳寺塔以它独有的造型成为中国古建筑史上的千古绝唱，在建筑学上有着极高的研究价值。

赵州桥
Zhaozhou Bridge

Zhaozhou Bridge is also called Anji Bridge. It is on the Jiaohe River to the south of Zhaoxian County town, 45 kilometers southeast of Shijiazhuang, Hebei Province. Because the whole bridge was made of stone materials, it was called Big Stone Bridge by the local people. It was first built between 595 ~ 605 and the construction was supervised by Li Chun, a famous craftsman in the



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Sui Dynasty. The structure of Zhaozhou Bridge is original, and the appearance is beautiful. The ancient people said that "The architecture is so novel that nobody knows how it was constructed." The bridge is 64.4 meters long, 9.6 meters wide and the span is 37.2 meters. It is a single-hole arc bridge made up of 28 comparatively separate arches. The greatest scientific contribution of Zhaozhou Bridge is its pioneering work of "open spandrel". At each shoulder of the main arch, there are 2 small parallel arches. This not only increases passages for the running water, decreases the weight of the bridge, and saves stone materials, but also enhances the stability of the bridge. Therefore, though 1,400 years has passed, having undergone many floods, eight earthquakes, and heavy traffic, it is still standing firm over the Jiaohe River. There are many beautiful legends about the construction of Zhaozhou Bridge. In the past, the Jiaohe River overflowed, and the local people could only ferry across by boat. Lu Ban, the carpenters' ancestor, turned the sheep into stones overnight to make the bridge. Zhang Guolao and Chai Wangye, two immortals, came to test the solidity of the bridge. Zhang Guolao rode on the donkey-back, facing backward. In the long bag on the donkey-back, there were the sun and the moon. Chai Wangye pushed a one-wheeled cart, on which there were the five famous mountains in China. When they came to the middle of the bridge, it began to shake and was likely to fall down. Seeing the situation was unfavorable, Lu Ban jumped into the water, and held up the bridge with his hands. Luckily, the bridge was safe and sound. So there left on the surface of the bridge clear hoof prints of the donkey and a rut. Lu Ban's fingerprints were also left on the arch of the bridge. Just like what was sung in the folk song "Child Cowherd", "Zhaozhou Bridge was built by Lu Ban, and the boulder railings were left by sages. Zhang Guolao passed the bridge on the donkey-back, and Chai Wangye made a rut by pushing the cart on the bridge."



赵州桥
Zhaozhou Bridge

赵州桥，又名安济桥，坐落在石家庄东南 45 千米赵县城南洨河之上，因桥体全部用石料建成，当地俗称大石桥。建于隋代开皇至大业年间（595

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~605)，由匠师李春监造。赵州桥结构新奇，造型美观，古人说它“制造奇特，人不知其所以为”。桥全长 64.4 米，宽 9.6 米，跨度 37.02 米，是一座由 28 道相对独立的拱券组成的单孔弧形大桥。赵州桥最大的科学贡献就是它“敞肩拱”的创举。在大拱两肩，砌了四个并列小孔，既增大流水通道，减轻桥身重量，节省石料，又增强了桥身稳定性。这就有力地保证了赵州桥在 1400 年的历史中，经受住了多次洪水冲击，8 次大地震摇撼，以及车辆重压，仍挺立在洨河之上。关于赵州桥的建造，有很多美丽的传说。昔日洨河水泛滥，百姓只靠木船摆渡。木匠祖师鲁班一夜之间把羊群化成石头建起大桥。张果老和柴王爷一同来试桥。张果老倒骑毛驴，驴背褡裢里装着日、月；柴王爷推小车，运载着五岳名山，他们行于桥中心，将桥压得摇摇欲坠。鲁班见势不妙，纵身跳入水中，用手将桥托住，石桥安然无恙。至今桥上面还留下了清晰的驴蹄印、车道沟和膝盖印；桥底保留着鲁班的手印。正如民歌《小放牛》所唱的：“赵州石桥鲁班爷修，玉石栏杆圣人留；张果老骑驴桥上走，柴王爷推车轧了一道沟。”

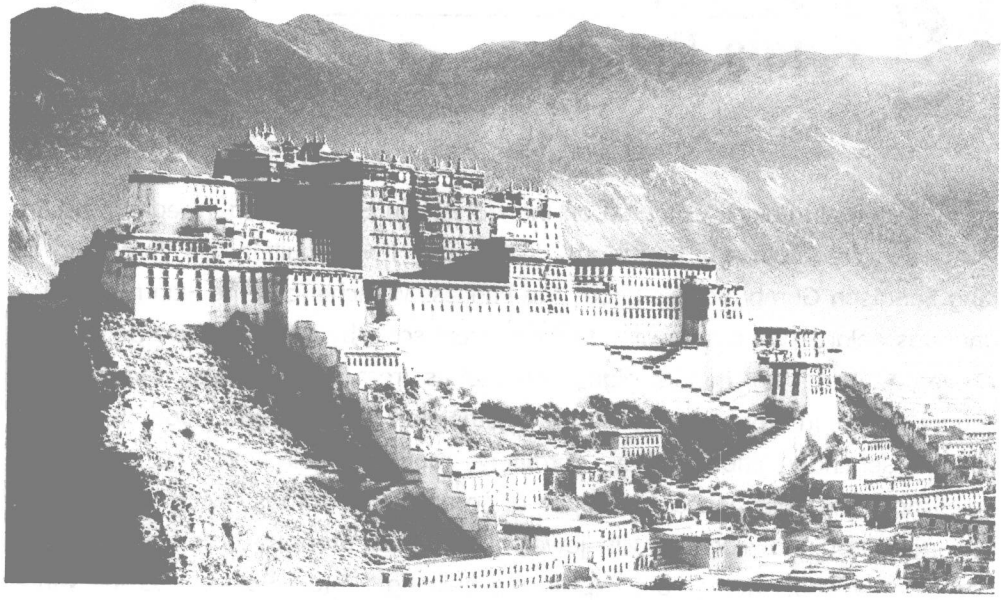
布达拉宫
Potala Palace

Potala Palace, situated on the Hongshan Hill in Lhasa, means “the Sacred Palace of Buddhism” in Sanskrit. It was built in the 7th century by King Songtsan Gambo for his bride, the Princess Wencheng of the Han nationality, and was enlarged and renovated to the present scale by the successive Dalais. The 13-story palace, 117 meters high, 360 meters from east to west and 130,000 square meters in area, was constructed completely by stone and wood. It includes temple, seminary, chanting hall, dormitory, mourning hall, yard and so on. The eight mourning halls house the stupas of several Dalai Lamas, which are covered with gold leaf and studded with jewels. Enormous precious historical relics and frescos on various themes are kept in the building. Potala Palace was the winter residence of Dalai Lamas. The imposing grand building was constructed on the slope of the hill, which demonstrates the characteristics of Tibetan archietcure and a combined style of Tibetan and Han cultures.

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布达拉宫
Potala Palace

布达拉宫位于拉萨市的玛布日山上。布达拉，梵语意为“佛教圣地”。始建于公元7世纪，为吐蕃赞普松赞干布迎娶文成公主而建。后经历世达赖的扩建和修筑，形成今日规模。布达拉宫主体楼房13层，高117米，东西长360米。建筑面积13万平方米、全部为石木结构。内有宫殿、佛堂、习经室、寝宫、灵堂殿、庭院等。有历代达赖喇嘛灵堂八座，塔身以金皮包裹，宝玉镶嵌，辉煌壮观。各殿墙壁绘有题材丰富的壁画，宫内还存有大量珍贵文物。布达拉宫为历代达赖喇嘛的冬宫。全部建筑依山势垒砌，体现了藏式建筑的特色和汉藏文化融合的风格。



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应县木塔
The Wooden Pagoda of Yingxian County



The real name of the Wooden Pagoda in Yingxian County, located in Fogong Temple in the northwestern corner of the county town of Yingxian, is Sakyamuni Pagoda. Since it was built completely of timber, it has been known popularly as the Wooden Pagoda of Yingxian County. It is the oldest wooden structure extant in China, and also the tallest among the ancient wooden buildings of the world. The pagoda was constructed during the Liao Dynasty. The Wooden Pagoda, nearly 70 meters high, is 30 meters in diameter and weighs over 2600 tons. Made up of at least 3,500 cubic meters of wood, the pagoda is octagonal in shape and contains nine floors, with four built-in stories not apparent from the outside. Built without the use of nails, the entire structure is solid, imposing,

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and elegant. Although built entirely with timber, the pagoda has weathered over 900 years of wind and rain, and withstood numerous strong earthquakes and wars. It's been recorded that there had occurred a strong earthquake with a magnitude of 6.5 on the Richter scale 300 years after the pagoda was built. All the buildings around collapsed but the quake merely shook out some shingles from the pagoda's eaves. All this is due to its unique structure. The pagoda's multi-storey structure has given it the kind of stability resembling those in the modern buildings. Its wood texture is very soft, which won't easily twist under the outside pressure. The many layers also reinforce the pagoda. Since the founding of New China in 1949, the government has dispatched many survey groups to conduct an on-site investigation into the pagoda and great efforts have been made to repair and reinforce the structure. During a repair project in 1974 a number of important and valuable cultural relics were found in the pagoda, including a picture of medicinal herbs and some Buddhist scriptures, all belonging to the Liao Dynasty. The scripture scrolls include both hand-written and block-printed ones, some of which are more than thirty meters long when spread out and can date back to as early as the year 990, 1003 or 1071. They are regarded as rare treasures both at home and abroad, and provide important data not only for the collating of the Buddhist scriptures but also for the research of development of the printing technology and cultural exchanges among different nationalities in China. The temple is also widely extolled as an outstanding example of Chinese architecture.



应县木塔
The Wooden Pagoda of Yingxian County

应县木塔地处应县县城西北的佛宫寺内，真名释迦塔。因完全由木料建造，人们一般习惯称其为应县木塔。它是我国现存年代最古老的一座木构建筑，在世界古代木构建筑中也是最高的。木塔建于辽代，近70米高，底层直径30米，总重为2600多吨。整个木塔至少使用木料3500立方米，呈八角形，共九层，其中内有四级暗层，从外部很难看出。整个木塔建筑没有使用一钉一铆，结构坚实、气势恢弘，样式别致。尽管完全由木制建造，该塔却经受住了900多年的风

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雨侵蚀，多次的强烈地震和战争。据记载，该塔建后300年，该地区曾发生里氏6.5级强震，震塌了周围所有建筑，但却仅仅震落了塔檐的几片木瓦。木塔的多层结构确保了其结构的稳固性，这堪与现代建筑相媲美。所选用的木料质地柔软，在外力作用下不易变形。木塔的多层结构也对其起到了稳固作用。1949年新中国成立后，政府多次派遣勘测组对该塔进行实地勘测，为修复和加固该塔做出了很大努力。在1974年的一次修复工程中于木塔中发现大量珍贵文物，其中包括一幅药草图以及一些佛教经卷，均属辽代。这些卷轴中有写经刻经，其中一些展开后有30多米长，历史可追溯到990年、1003年或1071年，在国内外堪称稀世珍品，不仅为佛教经卷的整理也为中国印刷技术和各民族间文化交流的发展研究提供了重要资料。应县木塔作为中国建筑的杰出典范广为世人称赞。

《营造法式》
Yingzao Fashi

Yingzao Fashi, the first official treatise on architecture and craftsmanship, plays an immeasurable role in the research on ancient architecture, the development of architecture in the Tang and Song Dynasties, and the probing into the architectural structures, project decoration methods and the construction organization and management in the Song and its ensuing Dynasties. The treatise was written by the well-known architect Li Jie in the third year of Yuanfu of the Song Dynasty, namely in 1100, and published and applied in the second year of Congning, i. e. in 1103. Various architectural criteria are standardized in the book, and the requirements of such aspects as the construction designs, materials, structures and quota of numerous kinds of architecture specified in detail. The book, with a total of 34 chapters, is divided into 5 sections, viz. the explanations of the architectural terms, regulations for various types of work, labor quota for various types of work, material quota for various types of work and drawings, along with one chapter of the illustrations of the theoretical or historical bases of some regulations and one chapter of the table of contents respectively at the beginning of the book. It is a collection and summary of the architectural designs and construction experiences at the time, exerting a far-reaching influence upon the later generations. The precursor of the book, *Yuanyou Fashi*, was written in the sixth year of Yuanyou (1091), but could not set strict regulations on the construction proportions

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and materials , owing to the lack of specifying the modular system , namely the



ways of using "cai" ; there was still great arbitrariness as to the architectural design and construction. Li Jie, under the order of the emperor, rewrote the book. He, based on the abundant experiences accumulated in his ten years of building projects, referred to a great number of relevant documents and old rules and regulations, and gleaned the operating specifications and hang of various types of work told by the craftsmen, thus completing *Yingzao Fashi* which has come down to the present day.

《营造法式》
Yinzao Fashi

《营造法式》是中国第一部详细论述建筑工艺的官方著作。对于古建筑研究,唐宋建筑的发展,考察宋及以后的建筑形制、工程装修做法、当时的

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施工组织管理,具有无可估量的作用。此书于宋元符三年(1100)编成,崇宁二年(1103)刊印施行。由著名建筑学家李诫所做。书中规范了各种建筑做法,详细规定了各种建筑施工设计、用料、结构、定额等方面的要求。全书共计34章分为5个部分:释名、各作制度、功限、料例和图样,前面还有"看样"和目录各一章。是当时建筑设计与施工经验的集合与总结,并对后世产生深远影响。原书《元祐法式》于元祐六年(1091)编成,但因为没有规定模数制,也就是"材"的用法,而不能对构建比例、用料做出严格的规定,建筑设计、施工仍具有很大的随意性。李诫奉皇帝命重新编著此书,他以个人十余年来修建工程之丰富经验为基础,参阅大量文献和旧有的规章制度,收集工匠讲述的各工种操作规程、技术要领等,终于编成流传至今的这本《营造法式》。

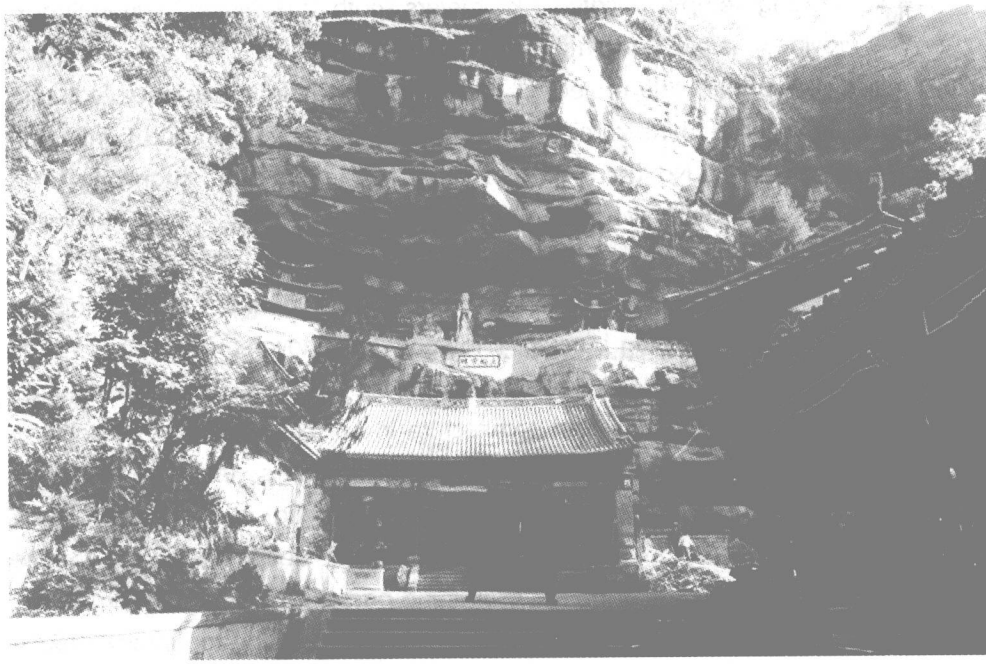


悬空寺
Xuankong Temple

Xuankong Temple, located 5 kilometers south of Hunyuan town in Shanxi Province, is perched on the cliff of Mount Hengshan. It is one of the key cultural relics sites under state protection and the only temple in existence featuring the cultures of the three Chinese religions, i. e. Buddhism, Taoism and Confucianism. First built in the late Northern Wei more than 1400 years ago, Xuankong Temple was taken as the Taoist altar when the Northen Wei Dynasty moved the initial Taoist altar in Pingcheng (now Datong City) southward there. The ancient craftsmen built this temple in accordance with the Taoist requirement of "not hearing the sound of cock crowing and dog barking". It was later renovated in the Jin, Yuan, Ming and Qing Dynasties. Xuankong Temple, about 50 meters above the ground, developed the traditions and styles of architecture in our country. The architectural features of the temple can be summarized in three characters, that is, "Qi" (surprising), "Xuan" (hanging) and "Qiao" (ingenious). What is "surprising" is its design and location selection. In a small basin in the deep valley, the temple hangs in the middle of the cliff, the top protruding part of which, like an umbrella, protects it from the erosion of the rain. Besides, the surrounding mountains reduce the time of sunshine streaming into the temple. The favorable geographical location

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is one of the important reasons Xuankong Temple can be well preserved. "Hanging" is another feature of the temple, which, with a total of 40 halls, was propped up by ten bowl-mouth-thick wooden beams on the surface. In fact, some of them do not bear any load at all. The temple, with its centre of gravity actually in the hard rocks, took as its base the beams partially inserted into the cliff in the light of the principle of mechanics. The "ingenuity" of the temple can be displayed in its corformity with the local conditions in the building process. The craftsmen, taking full advantage of the natural state of the cliff, arranged and built the various parts of the temple, making the layout and design of the plain architectural structure for the ordinary temples ingeniously realized in the three-dimensional space. There are in the temple over 80 Buddha statues. Xuankong Temple has gained for its mystery and ingenuity a reputation in the history of ancient and modern architecture. We could not help expressing our admiration and surprise for its audacity, ingenuity and dauntlessness, not only in the design methods but in the architectural conceptions. Li Bai, after visiting Xuankong Temple in the 23rd year of Kaiyuan of the Tang Dynasty (735), wrote the two characters "Zhuang Guan" (meaning magnificent and imposing) on the cliff. The great traveller in the Ming Dynasty, Xu Xiake, once called the temple "a great scenery in the world".



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悬空寺
Xuankong Temple

悬空寺座落在中国山西省浑源县城南5千米处，北岳恒山的绝壁之上。是全国重点文物保持单位，是国内仅存的佛、道、儒三教合一的独特寺庙。悬空寺始建于1400多年前的北魏晚期，北魏王朝将道家的道坛从平城，今大同南移到此，古代工匠根据道家“不闻鸡鸣犬吠之声”的要求建设了悬空寺。后金、元、明、清各代均有修缮。悬空寺距地面高约50米，悬空寺发展了我国的建筑传统和建筑风格，其建筑特色可以概括为“奇、悬、巧”三个字。值得称“奇”的是，建寺设计与选址，悬空寺处于深山峡谷的一个小盆地内全身悬挂于石崖中间，石崖顶峰突出部分好像一把伞，使古寺免受雨水冲刷。四周的大山也减少了阳光的照射时间。优越的地理位置是悬空寺能完好保存的重要原因之一。“悬”是悬空寺的另一特色，全寺共有殿阁40间，表面看上去支撑它们的是十几根碗口粗的木柱，其实有的木柱根本不受力，而真正的重心撑在坚硬岩石里，利用力学原理半插飞梁为基。悬空寺的“巧”体现在建寺时因地制宜，充分利用峭壁的自然状态布置和建造寺庙各部分建筑，将一般寺庙平面建筑的布局、形制等建造在立体的空间中，设计非常精巧。寺内有佛像80多尊。“悬空寺”以其玄妙的特点誉满古今建筑史。无论是从它的设计构思，还是它的建筑构想，它的大胆、它的奇巧、它的无畏都可以说是让人惊慕不已，慨叹不尽！唐开元二十三年(735)，李白游览悬空寺后，在石崖上书写了“壮观”二字，明代大旅行家徐霞客称悬空寺为“天下巨观”。



故宫
The Imperial Palace

The Imperial Palace, also known as the Forbidden City, was the imperial palace of emperors in the Ming and Qing Dynasties. Located at the centre of Beijing, it was built in the 4th year of the reign of Emperor Yongle (1406) in the Ming Dynasty, and completed 14 years later (1420); it boasts a history of

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more than 570 years. There were 14 emperors in the Ming Dynasty and 10 emperors in the Qing Dynasty who had been enthroned and ruled here. The Forbidden City, rectangular in shape and 720,000 square meters in size, owns 9,999 and a half rooms, the floor space of which is about 160,000 square meters. The palaces are surrounded by the purplish-red walls 3,400 meters long, and a moat 52 meters wide and 4.1 meters deep. At the middle of the four walls stands a gate tower respectively: the Meridian Gate in the south, the Godly Prowess Gate in the north,

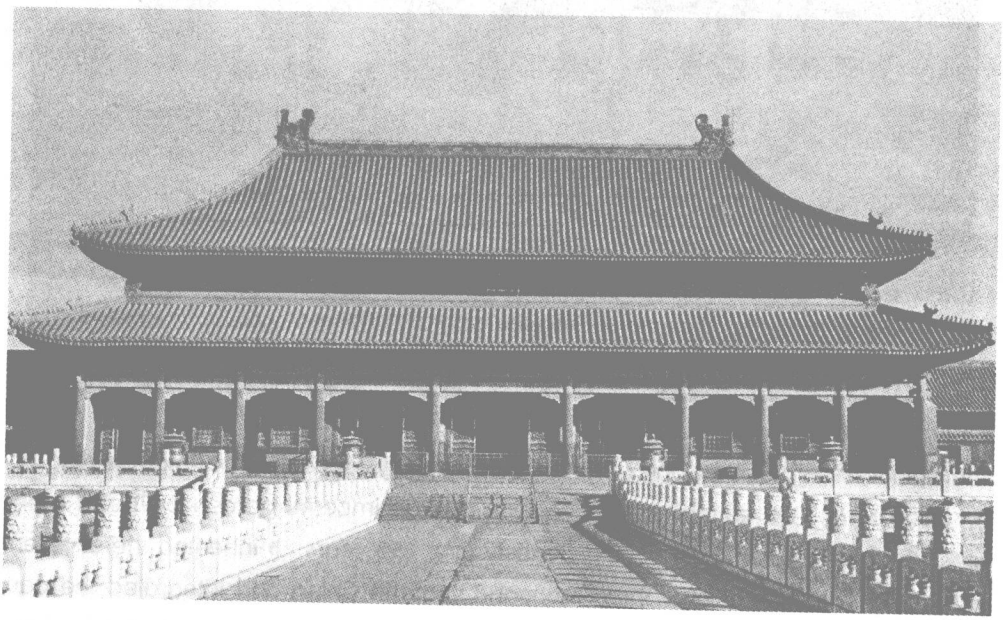


the Donghua Gate in the east and the Xihua Gate in the west, and at each of the four corners stands a tower. The whole Forbidden City looks like a strongly fortified castle. It is composed of two parts, the outer palace where the emperors held grand ceremonies, discussed state affairs with high-ranking officials and exercised their powers, and the inner palace where emperors conducted routine government affairs and empresses, concubines, princes, princesses resided, amused themselves and worshipped gods. There are over 920,000 pieces of valuable historical relics stored in the Imperial Palace. It is the largest and most complete ancient wooden architectural complex among the existing ones in China and in the world.

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故宫
The Imperial Palace

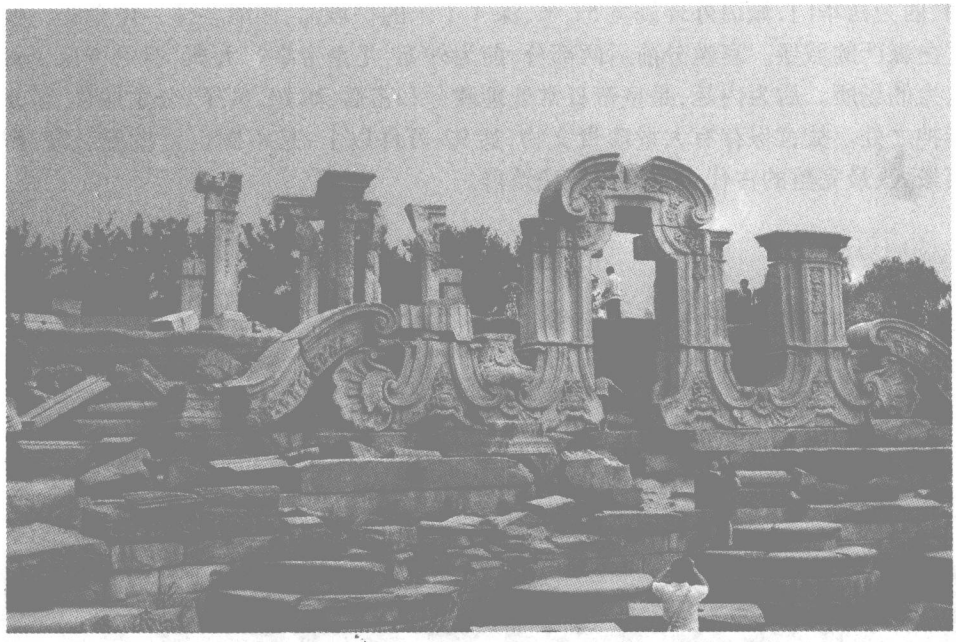
故宫是明清两代的皇宫，又称紫禁城。位于北京市中心，建于明永乐四年(1406)，完成于明永乐十八年(1420)，距今已有570多年的历史。先后有明代14位皇帝和清10位皇帝在此相继登基执政。紫禁城平面呈长方形，占地72万平方米，有殿宇楼阁9999间半。建筑面积约16万平方米。紫红色的宫墙长3400米。四面正中设城门四座，上建城门楼阁，南为午门，北为神午门、东为东华门、西为西华门，城垣外环绕宽52米、深4.1米的护城河，四隅各建一座角楼，犹如壁垒森严的城堡。宫殿分前后两部分，前为外朝，是皇帝举行大典，召见群臣，行使权力的场所。后为内廷，是皇帝日常处理政务和帝后、嫔妃、皇子、公主居住、游玩、奉神之处。故宫保存有大量珍贵文物，达92万件以上，是中国也是世界上现存规模最大、最完整的古代木结构宫殿建筑群。



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圆明园
Yuan Ming Yuan

Yuan Ming Yuan, located on the western outskirts of Beijing, is adjacent to the Summer Palace. First built in the 46th year of the reign of Emperor Kongxi (1707), it is composed of three gardens, i. e. Yuanmingyuan, Changchunyuan and Qichunyuan, with an area of 350 hectares, including a water area of



140 hectares. It has over one hundred landscape gardens, with a total building area of over 160,000 square meters. It was a large imperial garden built and managed by the emperors of the Qing Dynasty over 150 years. It inherited the excellent gardening traditions of over three thousand years in China and integrated the garden architecture of different styles, as can be reflected by the fact that it had the splendour and grandeur of the imperial structures and the serenity and gracefulness of gardens in the waterside towns in South China, and assimilated some elements

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from the European garden architecture. Yuan Ming Yuan used to be well-known in the world for its vast land scale, remarkable building techniques, elegant architectural groups, abundant cultural collections and profound national cultural connotations. It was reputated as "model of all gardening arts" and "Garden of Gardens". Unfortunately, this world-known garden was sacked and burned to the ground by the Anglo-French forces in October, 1860 and was later plundered and looted for many times. Consequently, the grand garden fell into ruins. Now, with the relics as the theme, Yuan Ming Yuan has formed a unique tourist scenery in combination with the history and vigorous atmosphere of the garden, having an important political and historical value as well as being a rare tourist resort.

圆明园
Yuan Ming Yuan

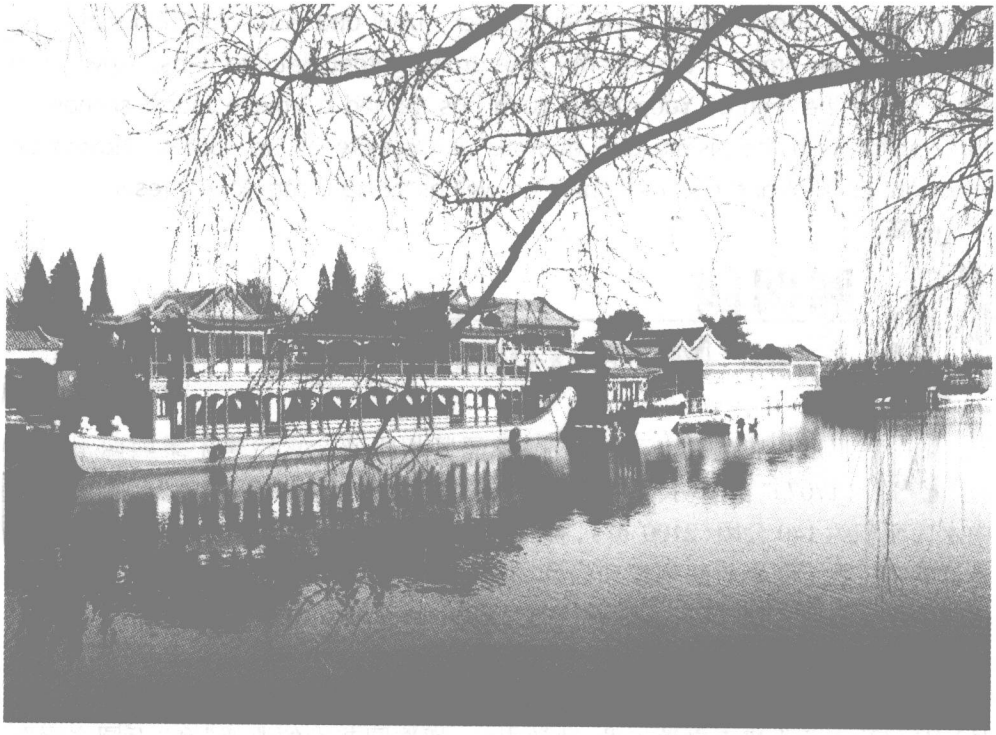
圆明园坐落在北京西郊，与颐和园紧相毗邻。它始建于康熙四十六年(1707)，由圆明、长春、绮春三园组成。占地350公顷(5200余亩)，其中水面面积约140公顷(2100亩)，有园林风景百余处，建筑面积逾16万平方米，是清朝帝王在150余年间创建和经营的一座大型皇家宫苑。它继承了中国3000多年的优秀造园传统，既有宫廷建筑的雍容华贵，又有江南水乡园林的委婉多姿，同时，又吸取了欧洲的园林建筑形式，把不同风格的园林建筑融为一体，圆明园曾以其宏大的地域规模、杰出的营造技艺、精美的建筑景群、丰富的文化收藏和博大精深的民族文化内涵而享誉于世，被誉为"一切造园艺术的典范"和"万园之园"。不幸的是，这一世界名园于1860年10月惨遭英法联军野蛮的劫掠焚毁，以后又经历了无数次毁灭和劫掠，这一恢弘的名园最终沦为一片废墟。如今的圆明园遗址公园，以遗址为主题，形成了凝固的历史与充满蓬勃生机的园林气氛相结合的独特的旅游景观，既具有重大的政治历史价值，又是一处难得的旅游胜地。

颐和园
The Summer Palace

Situated on the northwestern outskirts of Beijing with quiet and beautiful landscape, the Summer Palace was established in 1750 and used to be called the Garden of Clear Ripples. As an archetypal garden of the traditional gar-

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dening design, the Summer Palace, resorting to its surrounding mountains and water, radiates not only the gradeur of a Chinese imperial garden but also the beauty of nature in a seamless combination that best illustrates the guiding principle of the traditional Chinese gardening design: "The works of men should match the



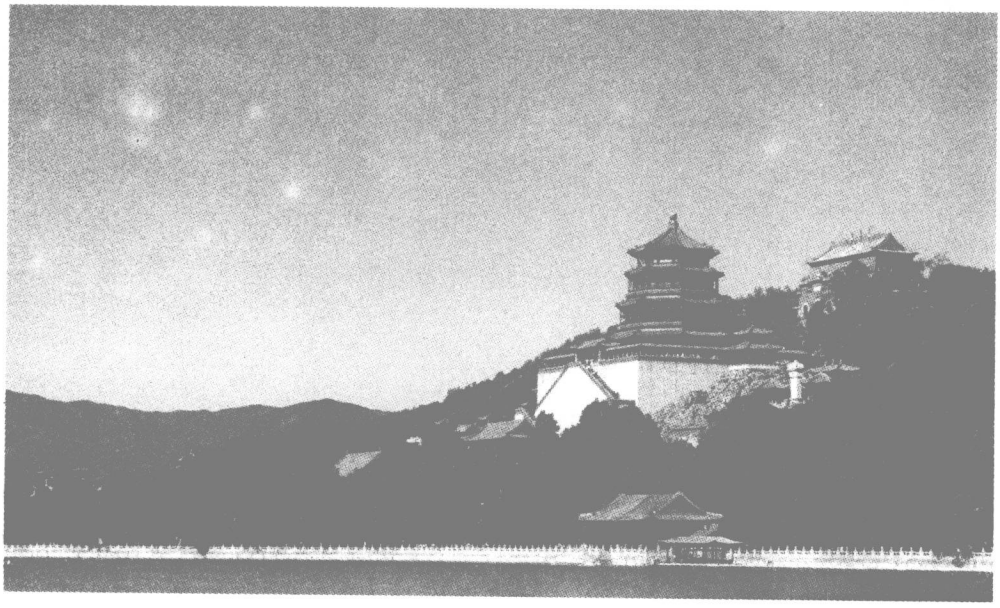
works of Heaven". Its Tower of Buddhist Incense, Long Corridor, Marble Boat, Suzhou Market Street, 17-Arch Bridge, Garden of Harmonious Interest and Great Pavilion have become the symbolic architecture known to every household. On the banks of the Kunming Lake, there are also the famous Marble Boat, Bronze Ox true to life, Zhichun Pavilion for spring sightseeing and other scenic spot architectures. In 1900, when the Eight-Power Allied Forces invaded Beijing, the Summer Palace was ravaged again. In 1902, the Qing Government ordered for its rehabilitation. In the late Qing Dynasty, the Summer Palace became the main dwelling place of the top dominators of China. It is the important witness to the modern history of China as well as the place where various major historical events took place. In 1924, the Summer Palace was opened to the public. On March 4, 1961, the Summer Palace was declared as one of the first group of historical and cultural heritage

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sites in China to be placed under special state protection. On December 2, 1998, with its profound historical and cultural background, beautiful natural environment and remarkable protection achievements, the Summer Palace was listed as one of the World Heritage Sites by UNESCO.

颐和园
The Summer Palace

颐和园，位于山水清幽、景色秀丽的北京西北郊，原名清漪园，始建于公元1750年，颐和园集传统造园艺术之大成，借景周围的山水环境，饱含中国皇家园林的恢弘富丽气势，又充满自然之趣，高度体现了“虽由人做，宛自天开”的造园准则。其中佛香阁、长廊、石舫、苏州街、十七孔桥、谐趣园、大戏台等都已成为家喻户晓的代表性建筑。在昆明湖畔岸边，还有著名的石舫，惟妙惟肖的铜牛，赏春观景的知春亭等景点建筑。1900年，八国联军侵入北京，颐和园再遭洗劫，1902年清政府又予重修；清朝末年，颐和园成为中国最高统治者的主要居住地，是中国近代历史的重要见证与诸多重大历史事件的发生地。1924年，颐和园辟为对外开放公园。1961年3月4日，颐和园被公布为第一批全国重点文物保护单位。1998年12月2日，颐和园以其丰厚的历史文化积淀，优美的自然环境景观，卓越的保护管理工作被联合国教科文组织列入《世界遗产名录》。



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近现代成就

Modern Achievements

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京张铁路
Beijing Zhangjiakou Railway

Beijing Zhangjiakou Railway is very famous in China, known to almost every household, because this railway was the first of its kind designed and built by us Chinese.

The chief engineer is Zhan Tianyou, a Yale graduate majoring in civil and railway engineering. He was born in 1861 in Guangdong Province, and he was very intelligent and interested in machinery at an early age. Upon graduation from the Yale University in 1881, he returned to China and became the chief engineer in 1905 for the first railway in China. He succeeded in overcoming the gradient problem by switching back the line, and he initially used two locomotives instead of one, one pulling, another pushing the train over this area. The railway was 201.2 kilometers long ,completed in 1909, two years ahead of time. It added a brilliant page in the history of the Chinese railway construction.



京张铁路
Beijing Zhangjiakou Railway

京张铁路在中国非常有名，几乎是家喻户晓。因为它是中国首条由中国人自行完成，投入营运的铁路。

担任这条铁路总工程师的詹天佑，毕业于美国耶鲁大学土木工程和铁路专业。詹天佑1861年出生于广东，自幼勤奋好学，对机械有着非常浓厚的兴趣。1881年詹天佑从耶鲁大学毕业后回国。1905年他被任为总工程师，负责修建中国第一条铁路。詹天佑成功采用列车折返攀斜的方式（“之”型铁路）解决了最困难的越岭

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问题，而且首次使用两部机车牵引，一部推，一部拉，使机车顺利行使。这条铁路全长约201.2千米，于1909年建成，比预定时间提前两年，在中国铁路建设史上增添了光辉的一页。



李四光和地质力学
Li Siguang and Geomechanics

In the 1920s, Li Siguang, a geologist and founder of geological mechanics of China, set up the subject of geological mechanics and made great contribution to the geological theory. He studied lithosphere with the mechanic theory, and established the tectonic system, one of the basic concepts of tectonic mechanics. He provided new ways to explore the natural phenomena and ushered in new ways of studying the lithosphere movement. His theory made great contribution to China's oil reconnaissance and survey.



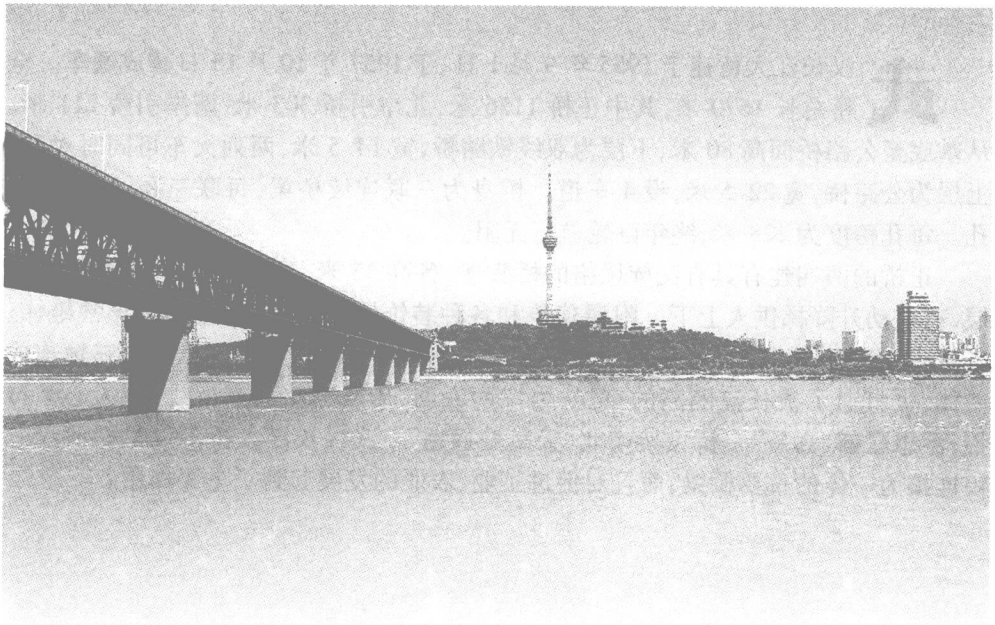
李四光和地质力学
Li Siguang and Geomechanics

20世纪20年代，地质学家，中国地质力学的奠基人李四光建立了新的边缘学科“地质力学”，为地质学理论作出了伟大贡献。倡导用力学观点研究地质，建立了“构造体系”概念——地质力学最基本的概念之一。为探索矿产分布的规律及其研究地壳运动提供了新方法。他的理论为中国石油的探索和发现作出了重要贡献。

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武汉长江大桥
First Bridge over the Yangtze River

Wuhan Changjiang River Bridge began to be built on September 1, 1955. It was opened to traffic October 13, 1957. The whole bridge is 1670 meters long. The main bridge is 1156 meters long. The bridge approach in the north end is 303 meters long. The bridge approach in the south end is 211 meters long. It is 80 meters high from the fundus to the surface of the highway bridge. The bridge has two storeys. The lower is the railway bridge. It is 14.5 meters wide. Two trains in the opposite direction can run across it at the same time. The upper is the highway bridge. It is 22.5 meters wide. Four cars can run across it side by side. The main bridge is a bridge with 3 continuous spans. Each span has 3 arches. There are 8 abutments and 9 arches in total. Every arch has a span of 128 meters. Large ships can sail across it all the year round.



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There is one bridge tower at each end of the bridge. They are in national architectural style. Each is 35 meters high. There are 7 storeys from the hall on the ground floor to the pavilion on the top floor. People can go up and come down by lift. The auxiliary buildings and all kinds of decorations are very compatible with the whole bridge. The whole bridge looks extremely magnificent. People can take the lift from the ground floor directly to arrive at the road surface of the highway bridge. When people stand on the bridge and look into the distance, they will find that the three towns of Wuhan combine into one whole. It makes people full of imagination. "One bridge is built spanning the river, which makes the traffic convenient." Wuhan Changjiang River Bridge not only unites the three towns of Wuhan into one body, but also greatly promotes the development of industry and agriculture.



武汉长江大桥
First Bridge over the Yangtze River

武汉长江大桥建于1955年9月1日,于1957年10月15日建成通车。全桥总长1670米,其中正桥1156米,北岸引桥303米,南岸引桥211米。从基底至公路桥面高80米,下层为双线铁路桥,宽14.5米,两列火车可同时对开。上层为公路桥,宽22.5米,设4车道。桥身为三联连续桥梁,每联三孔,共八墩九孔。每孔跨度为128米,终年巨轮航行无阻。

正桥的两端建有具有民族风格的桥头堡,各高35米,从底层大厅至顶亭,共7层,有电动升降梯供人上下。附属建筑和各种装饰协调精美,整座大桥异常雄伟。若从底层坐电动升降梯可直接上大桥公路桥面参观,眺望四周,整个武汉三镇连成一体,也打通了被长江隔断的京汉、粤汉两铁路,形成完整的京广线,使人心旷神怡,浮想联翩,真是"一桥飞架南北,天堑变通途"。武汉长江大桥不仅是把武汉三镇连接为一体的重要桥梁,而且对促进工业、农业的发展起到了重要作用。

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京广铁路
Jingguang Railway

Jingguang Railway is a major artery railway in China, connecting Beijing West Station in Beijing to Guangzhou Railway Station in Guangzhou, Guangdong.



The railway is jointed by two sections. The northern section, "Jinghan railway", is from Beijing to Hankou, and the southern section, "Wuguang railway", is from Wuchang to Guangzhou. Jinghan railway was finished in 1905 and Wuguang railway was finished in 1936. Between Hankou and Wuchang, there is the Yangtze River. The two sections were finally jointed together in 1957 when the Wuhan Yangtze River Bridge was built and it was renamed as Jingguang Railway.

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With a length of 2,324 kilometers, connecting the cities of Beijing and Guangzhou through 6 provinces, namely Beijing, Hebei, Henan, Hubei, Hunan and Guangdong, as well as dozens of large and medium-sized cities, and many other railways. Jingguang Railway has played an unusual role in the national economy of China. Even after the parallel Beijing-Kowloon railway is completed, the Jingguang Railway still plays a huge role.

The electric locomotive traction is mostly used in the whole railway passenger carriages and freight passenger carriages. Since the first railway speed lift in 1997 until the fifth in 2004, the travel time of the passenger carriage between Beijing and Guangzhou has been shortened from nearly 40 hours in the past to 22 hours. In the coming opening of the Wuhan-Guangzhou passenger line, it is expected to divert about 70% of the Jing-Guang Railroad passenger traffic. Electrification project began in the 1990s, the Zhengzhou-Wuchang section had been completed in 1992, the Beijing-Zhengzhou section began in 1993, completed in 1998, the Wuchang-Guangzhou section began in 1998, completed in 2001.



京广铁路
Jingguang Railway

京广铁路是中国一条从北京市通往广东省广州市的铁路，是中国最重要的一条南北铁路干线。

京广铁路原分为北南两段。北段从北京市到湖北省汉口，称为“京汉铁路”（1927 年～1949 年称“平汉铁路”），于 1897 年 4 月动工，1906 年 4 月建成。南段从广东广州到湖北武昌，称为“粤汉铁路”，于 1900 年 7 月动工，1936 年 4 月建成。在 1957 年武汉长江大桥通车后，两条铁路接轨，并改名为京广铁路。

京广铁路全长 2324 千米，连接了中国首都北京市和五座省会，分别是：河北、河南、湖北、湖南、广东，以及数十座大中城市保定市、邢台市、邯郸市、安阳市、鹤壁市、新乡市、许昌市、漯河市、驻马店市、信阳市、孝感市、咸宁市 、岳阳市、株洲市、衡阳市、郴州市 、韶关市，并与多条铁路相接，在中国的国民经济中起到了非同寻常的作用。即使在平行的京九铁路建成后，京广铁路也依然发挥着巨大的作用。

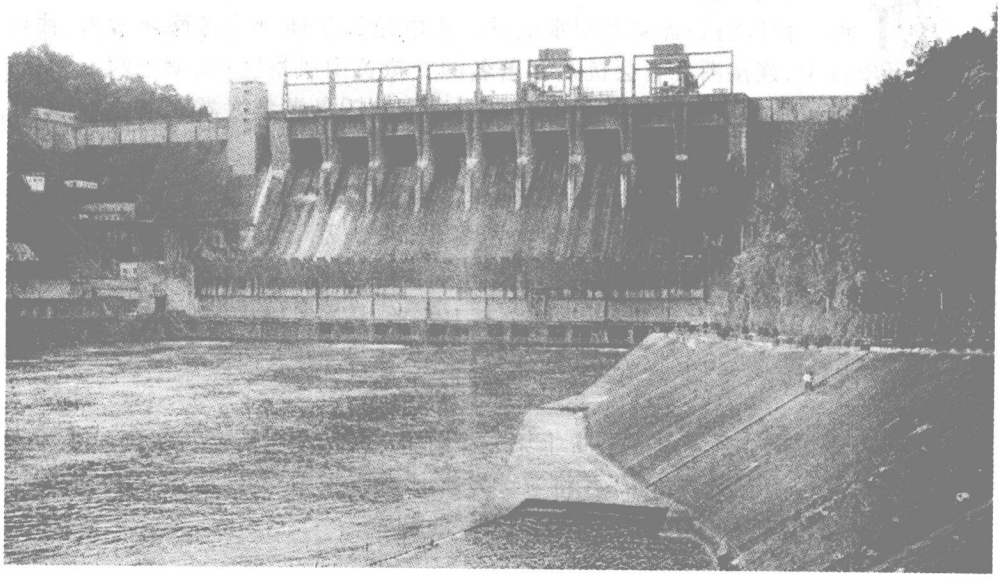
全路客运客车和货运客车大多采用电力机车牵引。自 1997 年第一次提速起

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至2004年第五次提速，北京往返广州间的客车的运行时间已由过去近40小时缩短到22小时。未来，武广客运专线启用后，预期可分流京广铁路约70%的客流。电气化工程于1990年代开始，其中郑州至武昌段先于1992年完成，北京至郑州段工程于1993年开始，1998年完成，武昌至广州段工程于1998年开始，2001年完成。

新安江水电站
Xin'anjiang Hydropower Station

The Xin'anjiang Hydropower Station, the country's first large-scale power plant designed and built by Chinese in the 1950s, is still the pride of the local people. It is on the Xin'an River in Jiande city of Zhejiang Province in east China. Moreover, it formed a huge reservoir (Qiandao Lake) with 1,078 islands, which is part of a golden tourist route linking Hangzhou, provincial capital of Zhejiang, and Mount Huangshan in neighboring Anhui Province.



Though squeezed out of China's top 50 power stations, the self-designed and

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self-built Xin'anjiang Hydropower Station was the country's first large-scale power plant after independence. The Xin'anjiang Hydropower Plant has 9 power generating units with a total installed capacity of 845,000 kw. and annual output of 1.86 billion kwh. As the first reinforced concrete dam in China, the Xinanjiang Dam is 105 meters high, also the first dam over 100 meters in China. The Dam is 466.5 meters long, with a total storage capacity of 22 billion m^3 and a maximum flood discharging capability of 14,000 m^3/s.

As the first landmark in hydropower development in new China, it has played and is still playing a major role in fueling the local economy, while acting as an example for hydropower development, station management, and resettlement of people in reservoir areas.



新安江水电站
Xin'anjiang Hydropower Station

新安江水电站建于1957年4月,是我国第一座自己勘测、自己设计、自行施工和自制设备的大型水电站。水电站位于浙江省建德市境内、钱塘江支流新安江上,连接浙江省会杭州和著名的安徽黄山风景区;大坝之西,就是筑坝蓄水建设新安江水电站而形成的著名的千岛湖。千岛湖集太湖之浩瀚、西湖之娟秀于一身,是理想的避暑胜地。

尽管早已不是中国最大最先进的水电站,但新安江水电站是建国后建成的第一座大型水电站。电站安装机组9台,总容量84.5万千瓦,多年平均年发电量18.6亿千瓦时。大坝坝型为国内首座混凝土宽缝重力坝,位于铜官峡谷上段两个大断层之间,岸坡陡峻,气势雄伟;最大坝高105米,是当时国内第一座百米以上高坝;水库总库容量为220亿立方米,坝顶全长466.5米,最大泄流量1.4万立方米每秒。

作为新中国成立后水利发展史上第一个标志性的建设,新安江水电站在繁荣当地经济方面扮演了主要角色,并将继续发挥其重要作用,同时为发展水利事业、建设水电站和帮助人民安居乐业树立了很好的榜样。

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中国第一台计算机的诞生
The Birth of the First Computer

In the mid-50th century, though the Chinese computing technology was only one or two years later than Japan, after all, but it has been a decade later from the emergence of world's first computer. The unanimous opinion is to learn and master the Soviet Union's technology first, on this basis, according to China's specific conditions, to carry out their own research, that is, "innovation after imitation, imitation for innovation."



In September 1956, China sent a delegation of computing technology to the Soviet Union. Min Naida is the head, deputy head Wang Zheng, fifteen members including Wu Jikang, Fan Xinbi, Xia Peisu, and so on. The former Soviet Union reception unit is the Soviet Academy of Sciences, Precision Machinery and Computing Technology Institute . In two months, computing technology research, production and education of Moscow, Leningrad were studied respectively, with an emphasis on the M-20 computer.

In April 1957, by the government, China ordered a M-3 computer and БЭСМ computer drawings information. On the basis of study and drawings information, the development work started. Led by Zhang Zichang and Mo Gensheng, M-3 (code 103) Computer Engineering Group was organized. Through the efforts of all staff, in close collaboration with Beijing cable plant, China's first digital computer successfully developed on August 1, 1958. This tube computer with computing speed of 30 times per second filled in our modern electronic computer blank.

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中国第一台计算机的诞生
The Birth of the First Computer

上个世纪50年代中期，中国的计算技术虽然只比日本晚一两年，但毕竟距世界上第一台电子计算机的出现已经晚了十年。大家一致的意见是：先学习掌握苏联已有的技术，在此基础上，再根据我国的具体条件，开展自己的研究工作，即“先仿制后创新，仿制为了创新”。

1956年9月，我国派出赴苏计算机技术考察团。团长闵乃大，副团长王正，团员有吴几康、范新弼、夏培肃等15人。前苏联方面的接待单位是苏联科学院精密机械与计算技术研究所。在两个多月的时间里，考察团分别对莫斯科、列宁格勒两地的计算技术的科研、生产与教育进行了考察，并重点对M-20计算机进行了学习。

1957年4月，我国政府订购了M-3计算机和БЭСМ计算机图纸资料。在考察和取得图纸资料的基础上，研制工作开始了。以张梓昌、莫根生为首，组织了M-3（代号103）计算机工程组。通过全体研制人员的努力和北京有线电厂的密切配合，于1958年8月1日研制成功了我国第一台数字电子计算机。这台运算速度为每秒30次的电子管计算机，填补了我国现代电子计算机的空白。

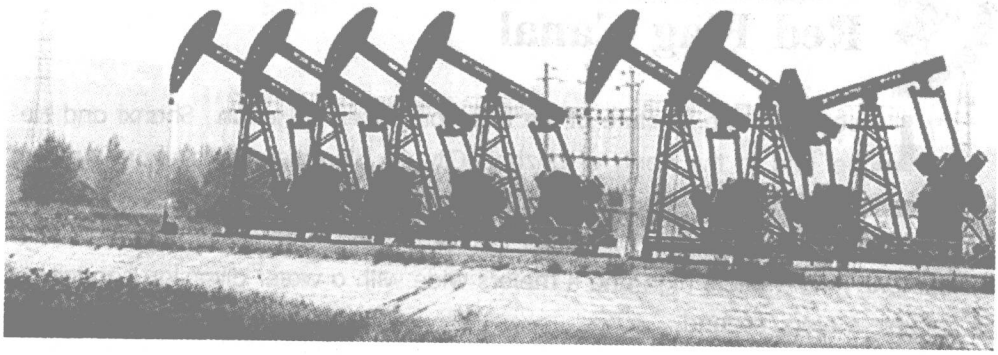


大庆油田的发现
Discovery of the Daqing Oil Field

Situated in a large plateau between the Songhua River and Nunjiang River in Heilongjiang Province, the Daqing Oil Field is the largest comprehensive oil production base in China. On September 26, 1959, a commercial oil flow was obtained from well Songji 3 in the Songliao Basin in Heilongjiang Province, marking the discovery of this world-class giant oil field. It was just before the 10th

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anniversary of the founding of new China. To commemorate the day, Datong Town was renamed Daqing (great celebration), and the whole oil deposit belt was named the Daqing Oil Field. To date it remains the largest oil field in China.



It was put into operation in May of 1960, soon producing two-thirds of the national total. By 1976, the output of its crude oil reached 50.3 million tons making it one of the 10 largest oil fields in the world. Since then on, it had well maintained an output of crude oil standing at 50 million tons or more. Statistics show that Daqing's proven recoverable reserves exceed 5.3 billion tons, and it has produced crude oil of 1.405 billon tons, accounting for 47.2 percent of the national total.

大庆油田的发现
Discovery of the Daqing Oil Field

位于黑龙江省松嫩平原中部的大庆油田，是中国最大的油区，1959 年 9 月 26 日 16 时许，在松嫩平原上一个叫大同的小镇附近，从一座名为“松基三井”的油井里喷射出的黑色油流标志着一个世界级大油田的发现。当时正值国庆 10 周年之际，为了纪念这一天，将大同改为大庆，整个石油探区被称为“大庆油

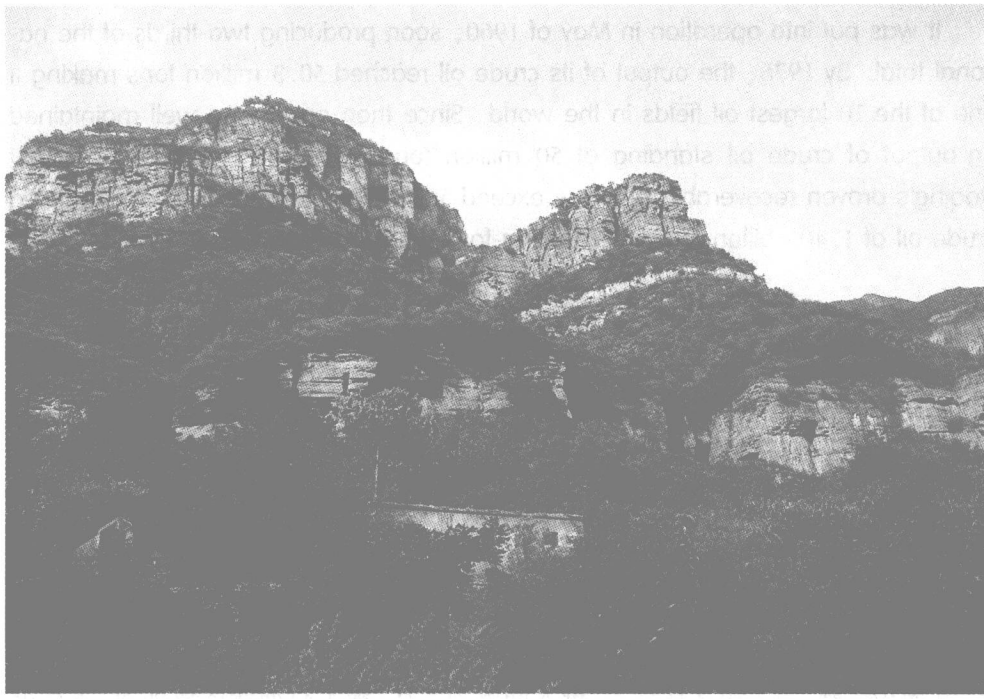
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田”。直到今天,它都是中国最大的油田,也是世界十大油田之一。

1960 年 5 月,大庆油田投入开发建设,原油产量很快占到全国总量的 2/3。1976 年,大庆油田原油年产量首次突破 5000 万吨大关,进入世界特大型油田的行列。自那以后,年产原油一直保持在 5000 万吨以上。累计探明石油地质储量超过 53 亿吨,现已累计生产原油 14.05 亿吨,占同期全国陆上石油总产量的 47.2% 。

红旗渠
Red Flag Canal

Located at the juncture of the three provinces of Henan, Shanxi and Hebei and in the north of Linzhou City 61 kilometers away from Anyang City, the Red Flag Canal was dug on precipitous rock faces and sheer cliffs in Taihang Mountains by people of Linxian County in 1960. Red Flag Canal is 70 kilometers long, 4.3 meters high and 8 meters wide with a water diversion capacity of 18.3 cubic meters/second.



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Red-Flag Canal is a monument to the industry and wisdom of Linzhou people created since the birth of PRC, valuable both in the material sense and the spiritual. Traditional Chinese virtues of cooperation, solidification, creation and sacrifice, manifested in this project by Linzhou people, were widely admired everywhere in China. "The new-born China has two wonders: the Yangtze River Bridge in Nanjing and the Red Flag Canal in Linxian County (now called Linzhou)", Chinese Premier Zhou Enlai told his foreign friends proudly in the 1970s. With a high reputation at home and abroad, it is known as "manmade river in heaven" and "today's Great Wall"

红旗渠
Red Flag Canal

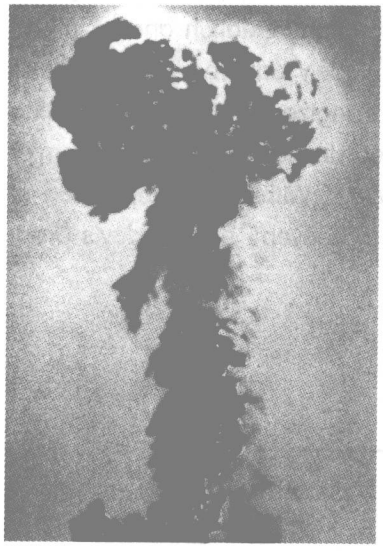
红旗渠构筑位于豫、晋、冀三省交界处,距安阳市林州县北部61千米远。红旗渠是1960年林县人民在太行山悬崖峭壁上盘山开凿的。长达70千米,渠高4.3米,宽8米,引水量18.3立方米/秒,是新中国林州人民勤劳与智慧的结晶,它不仅是一笔巨大的物质财富,而且是一笔巨大的精神财富。在此工程中,林州人民体现出的自力更生,艰苦创业,团结协作,无私奉献的优良传统美德和感人精神,受到世人的称赞而广为传颂。20世纪70年代周恩来总理曾自豪的告诉国际友人,"新中国有两大奇迹,一个是南京长江大桥,一个是林县(现名林州)红旗渠"。红旗渠在国内外享有很高的知名度,被誉为"人造天河"、"当代万里长城"。

中国第一颗原子弹
China's First Atomic Bomb

On October 16, 1964, China exploded the first nuclear bomb in Lop Nur of Xinjiang, becoming the third country to have atomic bomb in the

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world after the United States and Russia.



However, this brilliant success was achieved under extremely difficult conditions. When the People's Republic of China was founded in 1949, the Soviet Union agreed to aid China technologically in the development of nuclear industry. However, in June 1959, the USSR refused to provide relevant information as it had previously promised. Moreover, the Soviet Union recalled all technicians and advisers from China. In July 1960 Chairman Mao Zedong called on Chinese scientists to rely on their own efforts and develop China's atomic bomb within eight years.

On October 16, 1964, China successfully exploded its first atomic bomb. The Chinese people had finally developed their own nuclear technology. On the same day, the Chinese government made a solemn promise to the world that it developed nuclear weapons only for the purpose of self-defense and safeguarding national security. China would never at any time or under any circumstances be the first to use nuclear weapons.

中国第一颗原子弹
China's First Atomic Bomb

1964年10月16日,中国第一颗原子弹在新疆罗布泊爆炸成功,成为继美国、苏联之后世界上第三个拥有原子弹的国家。然而,这项伟大的成功是在当时极为困难的条件下取得的。1949年新中国刚刚成立时,苏联政府曾答应日后在技术方面帮助中国发展核工业。然而,1959年6月,苏联没有履行当时所做出的承诺,拒绝提供技术支持,并且撤走了在中国的专家和顾问。1960年7月,毛泽东主席号召中国的科学家们依靠自己的力量完成这项艰巨任务,准备用8年时间研制出原子弹。

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1964年10月16日，中国第一颗原子弹爆炸成功。中国人民最终拥有了自己的核武器。就在同一天，中国政府发表声明称，中国发展核武器，完全是为了保卫中国人民免受核战争的威胁；同时郑重宣布，中国在任何时候，任何情况下，都不会首先使用核武器。

我国早期激光技术的发展
China's Early Development of Laser Technology

In 1957, Wang Daheng and other scientists set up China's first professional optical Institute—the Chinese Academy of Sciences (Changchun) Optical Precision Instruments Machinery Research Institute ("MRI") in Changchun. Under the leadership of the older generation of experts, a number of young science and technology workers grew rapidly, Deng Ximing is one of the outstanding representatives. As early as in 1958, not long after the United States physicists Xiaoluo, Townes published their famous laser papers, he actively promoted this new technology research, then with the combination of the innovative spirit of the young and middle-aged research team proposed substantial increase brightness light source, color units, coherence of ideas and experimental programs in a short time. In 1960 the world's first laser come out. In the summer of 1961, under the auspices of Wang Zhijiang, China's first ruby laser developed. Within a short space of a few years, laser technology developed rapidly, and a number of advanced achievements were produced. Various types of solids, gases, chemicals and semiconductor lasers have been successfully developed. In the basic research and key technologies, a series of new concepts, new methods and new technologies (such as mutation and cavity Q-to-Q, traveling wave amplification, Re-use system, free electron oscillations radiation, etc.) have been put forward and implemented, many of which are unique.

At the same time, as a high-brightness, high-directional, high-quality, and other advanced features of the new light source, laser was used in various technical fields quickly, demonstrating a strong vitality and competitiveness. On communication, in September 1964, television pictures were transmitted by laser demon-

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stration, and in November 1964, calls were achieved in 3 km to 30 km. On industry, in May 1965, with laser drilling machine successfully used in Drawing Die Blanking production, significant economic benefits were acquired. On Medicine, in June 1965, retinal laser welding for the animals and clinical trials were conducted. On national defense, in December 1965, laser rangefinder Diffuse Reflectance (accuracy of 10m/10km) successfully developed, and in April 1966, remote control pulse laser Doppler velocimeter successfully developed.



我国早期激光技术的发展
China's Early Development of Laser Technology

1957年,王大珩等在长春建立了我国第一所光学专业研究所——中国科学院(长春)光学精密仪器机械研究所(简称"光机所")。在老一辈专家带领下,一批青年科技工作者迅速成长,邓锡铭是其中的突出代表。早在1958年美国物理学家肖洛、汤斯关于激光原理的著名论文发表不久,他便积极倡导开展这项新技术研究,在短时间内凝聚了富有创新精神的中青年研究 队伍,提出了大量提高光源亮度、单位色性、相干性的设想和实验方案。1960年世界第一台激光器问世。1961年夏,在王之江主持下,我国第一台红宝石激光器研制成功。此后短短几年内,激光技术迅速发展,产生了一批先进成果。各种类型的固体、气体、半导体和化学激 光器相继研制成功。在基础研究和关键技术方面、一系列新概念、新方法和新技术(如腔的Q突变及转镜调Q、行波放大、铼系离子的利用、自由电子振荡辐射等)纷纷提出并获得实施,其中不少具有独创性。

同时,作为具有高亮度、高方向性、高质量等优异特性的新光源,激光很快应用于各技术领域,显示出强大的生命力和竞争力。通信方面,1964年9月用激光演示传送电视图像,1964年11月实现3~30千米的通话。工业方面,1965年5月激光打孔机成功地用于拉丝模打孔生产,获得显著经济效益。医学方面,1965年6月激光视网膜焊接器进行了动物和临床实验 。国防方面,1965年12月研制成功激光漫反射测距机(精度为10米/10千米),1966年4月研制出遥控脉冲激光多普勒测速仪。

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第一个人工合成牛胰岛素
Synthesized Crystalline Bovine Insulin

Synthetic bovine insulin, which was fully developed in 1965 following 6 years of hard work by a group of Chinese scientists, was the first case of human beings synthesizing live proteins. This is the first time that zoetic protein has been synthesized by human in history. In the past it was a universal belief that man could by no means synthesize living body. The success made it possible for Chinese scientists to deflate the traditional concept. Synthetic bovine insulin marked a significant breakthrough in the field of life science and has substantially influenced human endeavors in finding out the secrets of life.

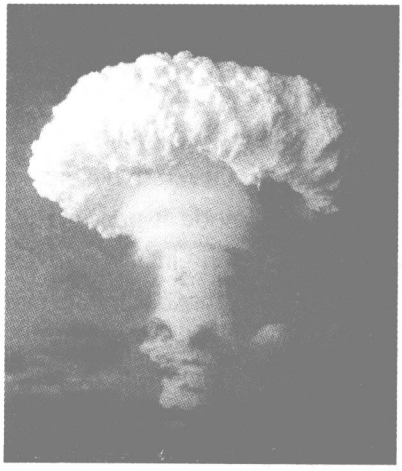


第一个人工合成牛胰岛素
Synthesized Crystalline Bovine Insulin

1965年,我国的科学工作者经过6年多坚持不懈的努力,获得了人工合成的牛胰岛素结晶。这是世界上第一个人工合成的蛋白质。过去世界普遍认为生命体是天然的,大都认为人工合成生命体是不可能的,是中国人首次让它变成可能。人工牛胰岛素的合成,是生命科学领域的重大突破,对于人类探索生命奥秘的影响是巨大的。

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中国第一颗氢弹
China's First Hydrogen Bomb



On June 17, 1967, China successfully exploded its first hydrogen bomb in western China. The explosive power is 150 times that of the A-bomb used by the United States in Hiroshima of Japan during the World War II. It marked a breakthrough in China's nuclear development, and indicated China's nuclear technology has entered a new era.

It took the United States more than seven years from its first A-bomb test to its first hydrogen bomb test, the USSR, four years, the UK, four and a half years and France, eight years and eight months. While in China, it only took two years and eight months, a surprise to the entire world!

中国第一颗氢弹
China's First Hydrogen Bomb

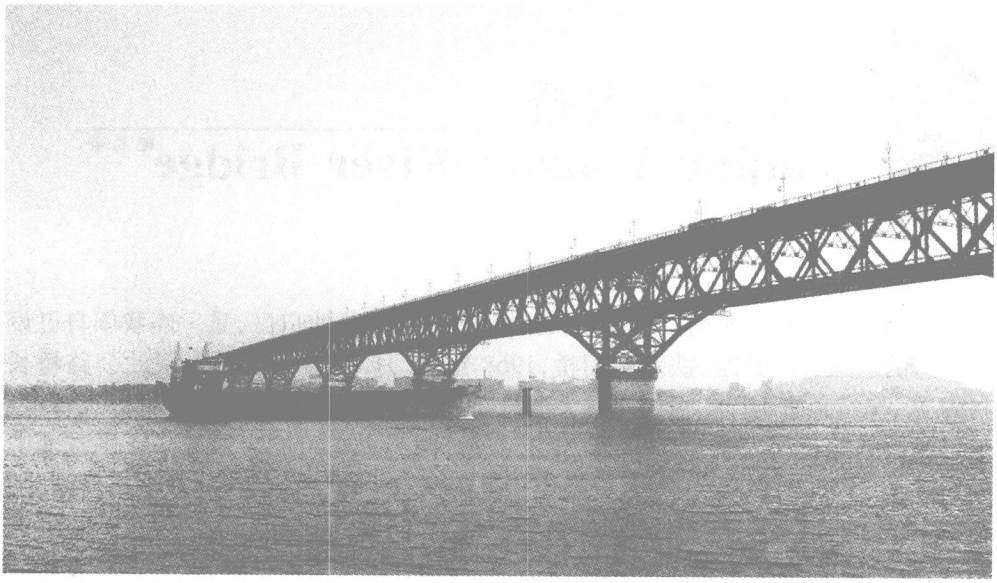
1967年6月17日，我国西部地区上空，第一颗氢弹爆炸试验获得完全的成功，其爆炸威力，相当于美国当年投到日本广岛那颗原子弹的150多倍。震惊世界的蘑菇云异常炫目耀眼。氢弹的爆炸成功，是中国核武器发展的又一个飞跃，标志着中国核武器的发展进入了一个新的阶段。

从原子弹到氢弹，美国用了7年4个月，苏联用了4年，英国用了4年7个月，法国用了8年8个月，而中国只用了两年8个月，在全世界引起了轰动。

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南京长江大桥
Nanjing Yangtze River Bridge

Nanjing Yangtze River Bridge in the north-west of the Yangtze River, connecting the urban areas with the Pukou District, is one of China's own design and construction of double-lane highways, railways dual-use bridge, completed on December 29, 1968.



Highway, on top of the bridge, is 4589 meters long with 15 meters wide carriageway, which can accommodate four large auto parallel. The two sides also have more than two meters wide sidewalks. The railway bridge is 6772 meters long, 14 meters wide, with the two-track shop. Two trains can be off at the same time. The bridge on surface of the river is 1577 meters long, and the remaining is for the highway bridge with the rich Chinese characteristics Double Arch Bridge hyperbolic form. 200 iron relieves are embedded into the highway bridge railings on

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both sides, besides, there are 150 pairs of magnolia flower-shaped lights on sidewalks. Each of two north-south ends of the bridge has a 70 meters high bridge tower. The lift in the tower will carry people reach the railroad bridge, the road bridge and the watch station on the tower. In front of each tower, it stands a 10-metre high sculpture of worker-peasant-soldier. Down the south tower, it is a beautiful park.

On December 18, 1968, China's own design and construction of the Nanjing Yangtze River Bridge was opened to traffic. It marks a leap of China's bridge construction. Nanjing Yangtze River Bridge is recorded by Guinness World Revenue.

The completion of the Nanjing Yangtze River Bridge, shortened one and a half hours by ferry from the river in the past to two minutes by train on the bridge, greatly facilitated cross-strait exchanges and the exchange of personnel, materials, promoting the economic development and people's lives.



南京长江大桥
Nanjing Yangtze River Bridge

南京长江大桥位于南京市西北长江上,连通市区与浦口区,是一座我国自己设计建造的双层双线公路、铁路两用桥,1968 年 12 月 29 日竣工。上层的公路桥长 4589 米,车行道宽 15 米,可容 4 辆大型汽车并行,两侧还各有 2 米多宽的人行道;下层的铁路桥长 6772 米,宽 14 米,铺有双轨,两列火车可同时对开。其中江面上的正桥长 1577 米,其余为引桥,公路引桥采用富有中国特色的双孔双曲拱桥形式。公路正桥两边的栏杆上嵌着 200 幅铸铁浮雕,人行道旁还有 150 对白玉兰花形的路灯,南北两端各有两座高 70 米的桥头堡,堡内有电梯可通铁路桥、公路桥及桥头堡上的瞭望台。堡前还各有一座高十余米的工农兵雕塑。南堡下是一个风景秀丽的公园。

1968 年 12 月 18 日,中国自行设计和施工的南京长江大桥建成通车。它标志着中国桥梁建设的一个飞跃。南京长江大桥被收入世界吉尼斯纪录。

南京长江大桥建成,使南来北往的火车由过去靠轮渡过江的一个半小时缩短为两分钟,大大方便了长江两岸的物资交流和人员来往,对促进经济发展和改善人民生活产生了积极的作用。

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第一颗人造卫星“东方红一号”
The First Chinese Satellite “Dong Fang Hong No. 1”

The first Chinese satellite “Dong Fang Hong No. 1” was launched on April 24th, 1970. It was notable in that, at 173kg, it was heavier than the first satellites of other countries. The satellite carried a radio transmitter. It broadcast the song of the same name, “The East Is Red”. With the successful launch of “Dong Fang Hong No. 1”, China became the fifth country after the Soviet Union, United States, France, and Japan to independently launch a satellite.



第一颗人造卫星“东方红一号”
The First Chinese Satellite “Dong Fang Hong No. 1”

1970年4月24日，中国第一颗人造卫星“东方红一号”发射成功。东方红一号重173公斤，比其他国家的第一颗人造卫星都要重。它携带了无线电广播发射机，播送《东方红》乐曲。东方红一号的发射成功使中国成为继苏联、美国、法国、日本之后第五个独立发射人造卫星的国家。



杂交水稻
Hybrid Rice

Since the foundation of the People's Republic of China, China has made one after another outstanding achievements in agriculture technology,

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one of which is the successful development of indica hybrid rice. With the application of this technology since 1976, China's total rice cultivation lands have grown such rice, which added rice output by some 240 billion kilograms up till 1994. What's more, this technology was exported to other countries.



The research of indica hybrid began in 1964, when a teacher from Hunan Province, Yuan Longping first put forward the idea of utilizing the heterosis in rice and initiated the research on hybrid rice in China. At the beginning, he discovered male-sterile rice. Then he brought forward the third hybriding paddy and carried out experiments on farmland. Yuan Longping made breakthrough in 1973. He was the first person to develop indica hybrid rice. The new technology was tested in many areas of South China in 1974 and 1975, and then extended to other areas. China became the first country that is capable of producing hybrid rice. Yuan Longping is the first scientist who successfully altered the self-pollinating characteristic of rice and realized large-scale farming of hybrid rice. This earned him the title "Father of Hybrid Rice". The achievements of Yuan Longping greatly solved the food shortage, and provided as a solution the worldwide starvation. It is regarded as the fifth invention after China's Four Major Inventions, and is acclaimed as the Second Green Revolution.

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杂交水稻
Hybrid Rice

新中国成立以来，中国在农业科技上的一项举世瞩目的成就是籼型杂交水稻的育成。这项技术自 1976 年在全国大面积推广以后，仅至 1994 年，就已使中国的稻谷累计增产达 2400 亿公斤。此外，该技术还被出口到美国等国家和地区。

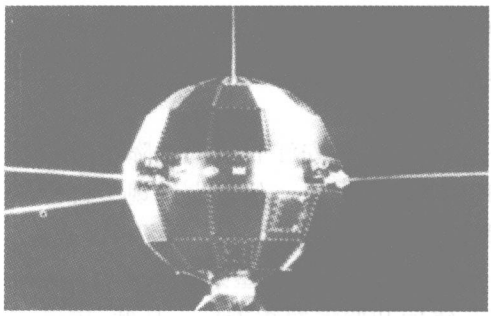
杂交水稻的研究始于 1964 年。当时任职于湖南省安江农校的袁隆平最先发现了水稻天然雄性不育株，便带领助手们开展了有关研究。他首先发现了雄性不育株，以后又率先提出了通过培育水稻三系进行杂交的设想，并进行了田间实验。1973 年终于获得突破性进展，在世界上第一个育成强优势灿型杂交水稻，1974 至 1975 年在中国南方多处试种效果良好，1976 年后开始大面积推广。从此，中国成为世界上第一个实现利用水稻杂交优势的国家。袁隆平也被誉为“杂交水稻之父”。他的成果不仅在很大程度上解决了中国人的吃饭问题，而且也被认为是解决世界性饥饿问题的法宝。国际上甚至把杂交稻当作中国继四大发明之后的第五大发明，誉为“第二次绿色革命”。

第一颗返回式遥感卫星
The First Recoverable Remote Sensing Satellite

On November 26, 1975, China launched a recoverable remote sensing satellite on a Long March launch vehicle. After three days of operation, the satellite returned as planned, making China becoming the 3rd country to have successfully developed satellite recoverable technology after the U. S and the former Soviet Union. Ever since then, information from the satellite has played a vital role in exploring resources, predicting disasters and mapping topography.

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第一颗返回式遥感卫星
The First Recoverable Remote Sensing Satellite



1975年11月26日，中国利用“长征号”火箭成功地发射了第一颗返回式遥感卫星。3天后，卫星按预定计划返回地面。至此，中国成为继美国、苏联之后世界上第三个掌握卫星返回技术的国家。自那以后，从卫星上传回的信息在中国资源调查、灾害预测、地图测绘研究方面扮演着至关重要的角色。

吴文俊及“吴方法”
Wu Wenjun and Wu's Method

Wu Wenjun, a well known mathematician, born in Shanghai in May 1919, graduated from Shanghai Jiaotong University in 1940. In 1947, he went to France for advanced study in University of Strassbourg. In 1949, he obtained his national doctor's degree of France. In 1957, he was elected as an academician of Chinese Academy of Sciences (CAS). In 1990, he was elected as an academician of the Third World Academy of Sciences.

His research work covered a wide area of mathematics. Its main achievements involved two areas of topology and mathematical mechanization. In the late 1970s, against the background of great development of computer technology, he has inherited and developed the tradition of ancient Chinese mathematics (that is, algorithm of thinking), and turned to study automated theorem proving, completely changed the face of this area. As a disciplinary precursor, Wu made monumental

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contributions to the field of topology by introducing Wu's imbedding and characteristic classes and establishing Wu's Formulae, well-known for Wu's Method, which have been widely accepted by his counterparts and had exerted worldwide influence. Wu's research has made a series of international leading results and has been applied internationally popular symbolic computation software.

吴文俊及"吴方法"
Wu Wenjun and Wu's Method

吴文俊,1919 年 5 月 12 日出生于中国上海,著名的数学家,1940 年毕业于上海交通大学,1949 年获得法国斯特拉斯堡大学博士学位。1957 年,他被选举为中国科学院(CAS)的院士。1990 年,被选举为第三世界科学院科学院士。



吴文俊的研究工作涉及数学的诸多领域,其主要成就表现在拓扑学和数学机械化两个领域。他为拓扑学做了奠基性的工作。20 世纪 70 年代后期,在计算机技术大发展的背景下,他继承和发展了中国古代数学的传统(即算法化思想),转而研究几何定理的机器证明,彻底改变了这个领域的面貌,是国际自动推理界先驱性的工作。他的示性类和示嵌类研究被国际数学界称为"吴公式","吴示性类","吴示嵌类",并在国际上产生了深远影响,被

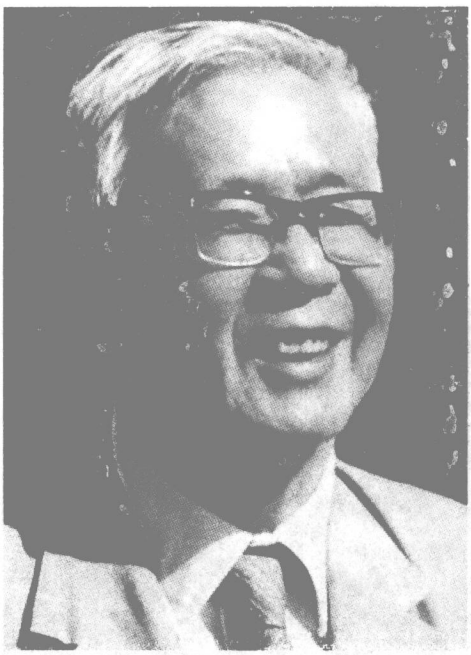
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称为“吴方法”。吴的研究取得了一系列国际领先成果并已应用于国际上当前流行的符号计算软件方面。



华罗庚:中国杰出的数学家
Hua Luogeng: An Outstanding Chinese Mathematician

Hua Luogeng (1910 ~ 1985) was a famous Chinese mathematician, and an academician of China Academy of Sciences. He was born on December 11, 1910 in Jintan, Jiangsu Province. After graduation from Jintan Junior High School, Hua Lougeng taught himself diligently. He began to teach in Tsinghua University from 1930. In 1936, Hua Luogeng visited and studied in Cambridge University in England. Back home, he continued teaching in the Southwest Associated University. In 1946, He went to the United States, beginning research work in universities such as Princeton. He went back to China in 1950. In the following years, he served as a professor in Tsinghua University, CAS Institute of Mathematics.



Hua was the founder and pioneer of many fields in new China's mathematics research. He wrote more than 200 thesis and monographs, many of which have become classic documents of immortal value.

Besides pure mathematics research, Hua also did a lot of work in the fields of mathematics applications. He made the mathematics serve the national economy and became the first Chinese scientist who closely combined the mathematics theoretic studies and practical production, and obtained enormous economic results in

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many fields.



华罗庚:中国杰出的数学家
Hua Luogeng: An Outstanding Chinese Mathematician

华罗庚(1910~1985)是中国著名数学家、中国科学院院士。1910年12月11日出生于江苏省金坛市。金坛中学初中毕业后刻苦自学。1930年开始在清华大学任教。1936年赴英国剑桥大学访问、学习,回国后任西南联合大学教授。1946年赴美国,在普林斯顿等大学从事研究工作。1950年回国。随后几年历任清华大学教授,中国科学院数学研究所所长等职。

华罗庚是新中国数学研究许多领域内的开拓者和奠基人,他撰写的论文和专著有200多篇,其中有很多已成为不朽经典。

除了纯数学研究,他在应用数学领域也做了很多工作。他的数学理论为国民经济服务,他是首位将数学理论研究和生产实践密切结合、并在许多领域取得巨大经济效益的华人科学家。



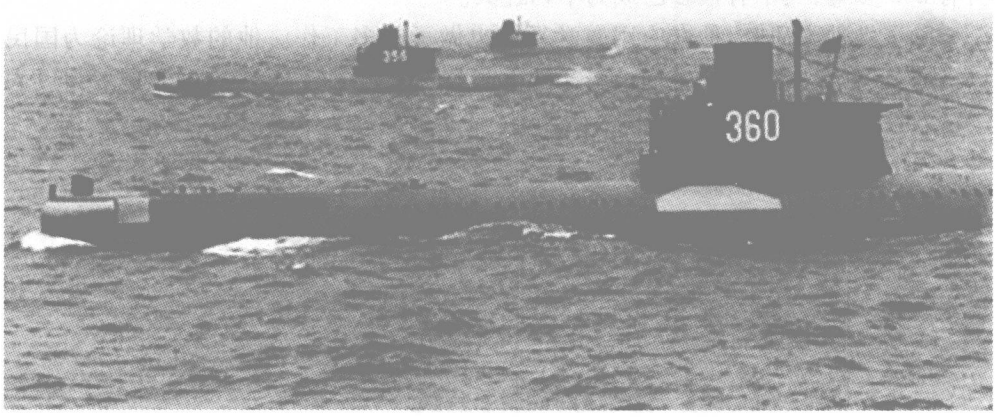
“长征一号”核潜艇
“Long March No. 1” Nuclear Submarine

On December 26, 1970, the Chinese launched the first nuclear-powered attack submarine, which is the first Han class nuclear-powered attack submarine. On August 1, 1974, the Central Military Commission issued an order to name the nuclear submarine “Long March No. 1” (hull number 401), and put it into the Navy commission.

The overall design of “Long March No. 1” began from 1966, and lasted a total of 5 years since the submarine was constructed while it was designed. The first

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shiplofting was set in the shipyard in May 1968 and the entity construction started in November. The first stage was to build each part of the boat as the whole boat is divided into 11 parts. In April 1970, the overall water test completed. The cross-way parallel operations were adopted in the second stage to install the equipments, from the host, cables, instruments to nuclear reactor components. The third stage was terminal mooring trial. In March 1971 fitting-out in water completed, followed by the reactor loading. In June, the reactor reached a critical state. The nuclear-powered submarine went to sea on August 23 for the first navigating experiment, carrying out the water surface navigation having been in progress successively navigates , the periscope's depth diving and the deep diving trial. The whole process of navigation was smooth and the function of the boat was fine. In January 1974, the nuclear-powered submarine joined the navy, carried out its trial flight, then took service in August in the same year.



The success of the first nuclear-powered submarine indicated Chinese naval ships and boats equipment technology having arrived at a new stage, showing Chinese People's determination of catching up with and surpassing the advanced world levels. Chinese navy has owned a nuclear-powered submarine, and China has become the fifth country who owns a nuclear-powered submarine in the world.

"Long March No. 1" (No. 401) is the first Han Class nuclear-powered attack submarine (Type 091) in China. Type 091 Han Class (SSN) submarines are first-generation nuclear-powered submarines of Chinese navy. All five units of this class were deployed with the North Sea Fleet of Qingdao. With a fully loaded displace-

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ment of 5000 tons, this class is armed with six 533mm torpedo tubes. Work started on the Type 091 Han Class nuclear-powered attack submarine in the late 1950s, though the first unit (No. 401 or "Long March No. 1") was not completed until 1974. The lead boats (401 &402), relatively noisy submarines based on 1950s and 1960s technology, suffered radiation problems, so from 403 onwards ("Long March-III, IV, V") the hull was extended 8 meters aft of the sail. The Xia Class submarines (SLBM) were based on the Han Class units. The first units of this class (401 &402) had certainly been withdrawn from service, possibly in 2005, while the three newest boats (403, 404, and 405) remained in service after their mid-life refits and renovations.



"长征一号"核潜艇
"Long March No. 1" Nuclear Submarine

1970年12月26日，中国人自行研制的第一艘核动力攻击型潜艇下水了，这是中国第一艘"汉"级攻击型核潜艇。1974年8月1日，中央军委发布命令，将这艘核潜艇命名为"长征一号"（舷号401），正式编入海军战斗序列。

"长征一号"的总体设计从1966年开始，边设计边建造，共历时5年。1968年5月，首制艇在造船厂放样，当年11月实体建造动工。第一阶段是分段建艇体，全艇共分成11段，1970年4月完成了总体试水。第二阶段是设备安装，从主机、电缆、仪表到核反应堆部件采取平行交叉的方式作业。第三阶段是码头系泊试验，1971年3月完成了水中舾装工作，紧接着是进行反应堆装料。6月，反应堆达到临界状态。8月23日，核潜艇首次出海进行航行试验，先后进行了水面航行，潜望镜深度潜水和深潜试航，一切顺利，潜艇航行性能良好。1974年1月，核潜艇加入海军，进行检验性试航，同年8月服役。

中国第一艘核潜艇研制成功，标志着中国舰艇装备技术已发展到了一个新阶段，表明了中国人民赶超世界先进水平的决心。中国海军从此拥有了自己的核潜艇，中国成为世界上第5个拥有核潜艇的国家。

长征一号核潜艇（401号）即中国第一艘汉级核动力潜艇（091型），建造于1967年，1974年开始服役。091型潜艇（北约代号汉级潜艇）是中国人民解放军海

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军的第一代核动力攻击潜艇(SSN),共制造了5艘,全配备于青岛北海舰队。配备6门533mm鱼雷发射管,潜航排水5000吨。中国的核子动力潜艇研发始于1950年代后期,除401号舰"长征一号"外,其他四艘分别是长征二号(402号)、长征三号(403号)、长征四号(404号)及长征五号(405号)。由于401号与402号舰经过多次改良和维修于航行时仍发现杂音,3号舰之后(长征三~五号)作出对应改良,船体增长8米。把汉级潜艇船体再加长、加上潜射弹道导弹(SLBM),就制成了夏级潜艇。401与402号舰已于2005年退役,其他三舰在作出了大量更新与改良后正在服役中。



"华光"激光照排系统
"Huaguang" Phototypesetting Laser System

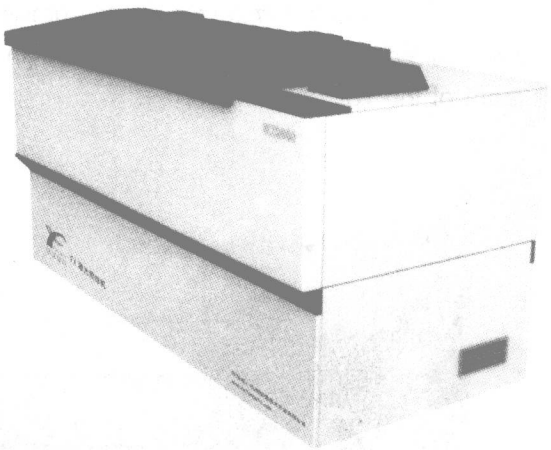
Traditional newspaper and books are printed in type. Therefore, it can not be separated from the "lead" and "fire." At that time, metallic lead was melt by fire, then cast into type. This labor-intensive process polluted the environment and did harm to typesetters' good health. With the development of computer technology, electronic laser technology had gradually replaced the "lead" and "fire." "Huaguang" Laser Phototypesetting System is China's pioneer in the field of electronic publishing.

"Huaguang" Laser Phototypesetting System began in August 1974. Beijing University in May 1975 began to develop Phototypesetting System, presided over by Professor Wang Xuan and other researchers. On July 27, 1979, in the university's Han Yu Information Processing Technology Research computer room, the researchers used their own Phototypesetting Developed Systems, in a very short period of time, output a sample layout octavo newspaper into a version, comprised of a wide variety of large and small fonts and complex layout, with six characters "Chinese information processing" as the masthead. This is the first Chinese newspaper output by Phototypesetting Laser System. The result opened up a clear road for the world's most voluminous text—Chinese characters bidding farewell to type printing. It is of great significance to realize the modernization of China's printing press and publishing areas. At that time, the whole world was astonished by this new print-

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ing industry, known as the second revolution of China's printing technology.

“华光”激光照排系统
“Huaguang” Phototypesetting Laser System



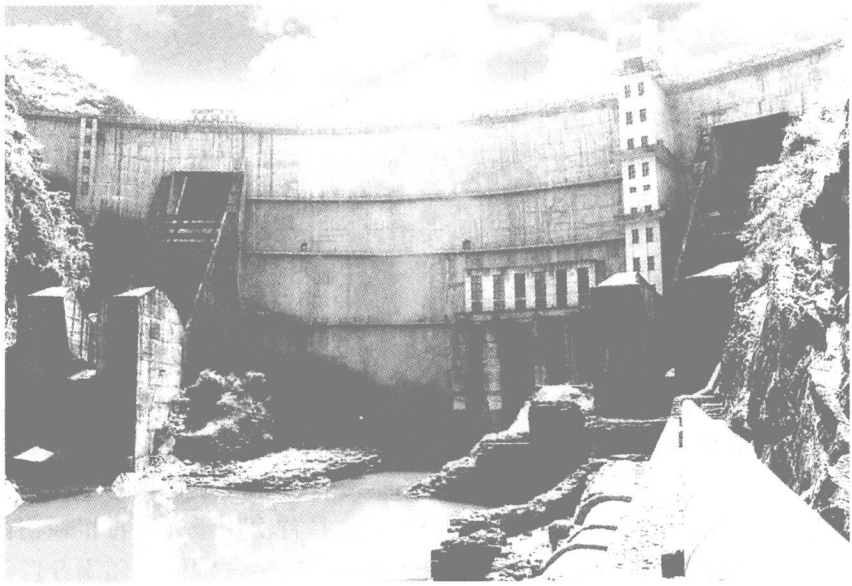
传统的报纸图书都是用铅字印刷。因此离不开“铅”与“火”。当时先用火熔化金属铅，尔后再铸成铅字。这种工艺劳动强度大，污染环境，危害排字工人身体健康。随着计算机技术的发展，电子激光技术逐步取代了“铅”与“火”。“华光”激光照排系统即是中国电子出版领域的先行者。

“华光”激光照排系统的研制工作始于1974年8月。1975年5月北京大学开始研制照排系统，由王选教授等主持这项工作。1979年7月27日，在北大汉字信息处理技术研究室的计算机房里，科研人员用自己研制的照排系统，在极短的时间内，一次成版地输出一张由各种大小字体组成、版面布局复杂的八开报纸样张，报头是“汉字信息处理”六个大字。这是首次用激光照排机输出的中文报纸版面。这项成果，为世界上最浩繁的文字——汉字告别铅字印刷开辟了通畅大道，对实现中国新闻出版印刷领域的现代化具有重大意义。它引起当代世界印刷界的惊叹，被誉为中国印刷技术的再次革命。

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葛洲坝水利枢纽工程
Gezhouba Water Control Project on Yangtze River

The experimental dam of the TGP(Three Gorges Project) Gezhouba Water Control Project is located at the lower end of the Three Gorges in the suburb of Yichang City, 2.3 km near Nanjin pass of Xiling Gorge, 38 km downstream of the TGP.



The Dam is 2595 meters long, with a total storage capacity of 1.58 billion m^3 and a maximum flood discharging capability of 110,000 m^3/s. The two hydro-electric plants have 21 generating units with a total installed capacity of 2.715 million kw. and annual output of 15.7 billion kwh. The annual one-way shipping capacity of the navigation facilities is 50 million tons.

The construction of the Gezhouba Project, including two stages, started in 1970. On January 3, 1981, the Yangtze River was completely blocked and the construction of the second stage of the project begun. The whole project ended in 1991.

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葛洲坝水利枢纽工程
Gezhouba Water Control Project on Yangtze River

葛洲坝水利枢纽工程是长江第一座水利枢纽工程，是三峡工程的实验坝，位于长江三峡出口，湖北省宜昌市区，距离西陵峡口南津关2.3千米，距上游的三峡大坝38千米。

大坝全长2595米，总库容量15.8亿立方米，最大泄洪量，为每秒11万立方米。水电站共两座，一在大江，装机14台；一在二江，装机7台，总容量271.5万千瓦。采用低水头径流发电，年均发电可达157亿度。三座船闸年单向通过能力为5000万吨。

葛洲坝水利枢纽工程于1970年动工，分两期进行建设。1981年1月3日大江截流，6月二、三江蓄水通航发电，一期工程基本完成。第二期大江工程于1982年开始施工，1986年大江电站第一台机组开始发电，1988年14台机组全部建成并网发电。1991年整个枢纽工程全部竣工。

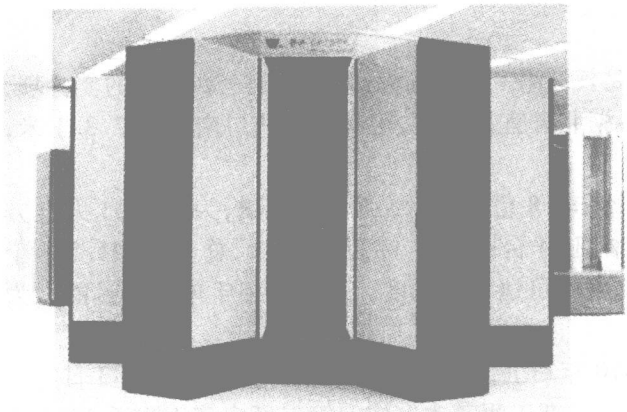
“银河”巨型计算机
The Yinhe Supercomputer

On November 21, 1981, “Yinhe Ⅰ” supercomputer, with a performance of 100 million Flops, was successfully developed by National University of Defense Technology and got by state verification in Changsha. Yinhe I was at that time the fastest and most powerful computer. Its birth filled in the gap in domestic supercomputer research and marked China entering the rank of international research of supercomputer. China had become the third country in the world which could develop large-scale computer after the US and Japan.

It was then used in the detection of oil and coal mines. Besides, it was also

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used for the satellite route analysis. At that time, only a few developed countries could develop supercomputer. The success of Yinhe brought Chinese computer industry into a very fast development. After *Yinhe one* , *the Yinhe Two* and *Yinhe Three* came out in 1992 and 1993 respectively.



In 1997, the large-scale computer "Galaxy-III" that could calculate 13 billion times in one second was developed in the University of National Defense Science and Technology.

Galaxy series large-scale computers developed by the University of National Defense Science and Technology have displayed its prowess fully in the weather forecasting, which not only enabled our country to rank among few countries that could make mid-term numerical weather forecast, but also remarkably improved the capability of forecasting serious natural calamities and yield enormous economic and social efficiencies.

"银河"巨型计算机
The Yinhe Supercomputer

1983年11月21日,由中国人民解放军国防科技大学研制成功的中国第一台亿次巨型计算机——"银河-Ⅰ"计算机在长沙通过国家鉴定。"银河-Ⅰ"巨型计算机是当时运行速度最快、功能最强的计算机,它的诞生,填补了国内巨型计算机研制的空白,标志着我国进入世界巨型计算机研制的行列。我国成为继美国和日本之后第三个能研制巨型机的国家。

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"银河-Ⅰ"计算机很快被用于石油和煤炭勘测,此外,也用在卫星运行路线的分析。在当时,只有少数几个发达国家掌握这项技术。此后,中国在巨型计算机研究领域不断进步,先后又两次取得重大突破:国防科技大学研制成功的"银河-Ⅱ"十亿次和"银河-Ⅲ"百亿次巨型计算机,分别于1992年和1997年通过国家鉴定。

1997,由国防科技大学计算机研究所研制的"银河-Ⅲ"百亿次巨型计算机系统,在北京通过了国家技术鉴定。

我国在设计研制巨型计算机的过程中,坚持研制生产与开发应用相结合,把"好用"、"实用"作为国产巨型机走向市场的生命线。比如,在首台巨型机研制时,就与国家气象部门探讨气象领域对巨型机的需求,突破了向量化并行算法等一系列关键技术,开发出了我国第一个全面向量化的大型应用软件——"高分辨率中期预报模式银河高效软件系统",使国产"银河"巨型机完成24小时天气预报的运行时间由过去的10700秒缩短为3900秒,一年就可为国家节省机时费300多万元。使我国成为世界上少数几个能发布5~7天中期数值天气预报的国家之一。如今,"银河"系列巨型机广泛应用于天气预报、空气动力实验、工程物理、石油勘探、地震数据处理等领域,产生了巨大的经济效益和社会效益。



星火计划
The Spark Program

At the end of the 1970s, the reform of economic institution first started in rural areas in China. The family output related contract responsibility system was established and has aroused the farmers' enthusiasm for getting rich through hard working and brought about a significant change to the production relations in the rural areas. Since the beginning of the 1980s, the township industries have developed rapidly and the rural economy has become unprecedented active. The specialization and commercialization of agricultural production have made the farmers more and more aware of the importance of science and technology, and hence the requirements for sciences have widely emerged in the rural areas. In March 1985, the Chinese government started the reform of scientific and technological institution in the whole country, further clarifying the policy for the development of science and technology, "Economic construction must rely on science and tech-

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nology and scientific and technological workers to be oriented toward rural economy", extend research achievements of science and technology to rural areas and help develop the rural economy. China is a large agricultural country with the rural population occupying 80% of the national total, and to solve the problems of agricultural, rural areas and farmers is needed by realizing the modernization of China and promoting the development of rural productive force. In May 1985, the Ministry of Science and Technology submitted to the State Council a suggestion to "implement a batch of scientific and technological projects of quick benefit so as to promote Local economy", in which the proverb "A single spark can start a prairie fire" was quoted, hence came the name of Spark Program, meaning that the spark of science and technology will extend over the vast rural areas of China. The Chinese government approved the implementation of this program in early 1986.

The Spark Program is the first program approved by the Chinese government to promote the development of rural economy by relying on science and technology and is an important component of plans for the national economic and scientific and technological development. The purpose of the program is to introduce advanced, appropriate technologies into the rural areas and lead the farmers to rely on science and technology in the rural areas, promote rural productivity, and expedite the sustainable, rapid and healthy development of agriculture and rural economy.



星火计划
The Spark Program

20世纪70年代末期，中国经济体制的改革率先在农村起步。家庭联产承包责任制的建立，激发了亿万农民劳动致富的热情，使中国农村生产关系发生了一次重大变革。进入80年代以后，乡镇工业发展迅猛，农业经济空前活跃。农业生产的专业化、商品化使农民越来越认识到科学技术的重要性，从而使农村普遍产生了对科学的需求和渴望。1985年3月，中国政府在全国实行科技体制改革，进一步明确了"经济建设必须依靠科学技术，科学技术工作必须面向经济建设"的科技发展方针，为广大科研院所和科技工作者面向农村经济主战场、向农

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村推广科技成果、帮助农村发展经济提供了契机。中国是一个农业大国，农村人口占80%，解决农业、农村和农民问题是实现中国现代化的关键，从这个基点出发，顺应全国经济体制改革的形势和农村生产力发展的需要，1985年5月，国家科委向国务院提出了“关于抓一批短、平、快科技项目促进地方经济振兴”的请示，引用了中国的一句谚语“星星之火，可以燎原”誉名为“星火计划”。寓意为科技的星星之火，必将燃遍中国的农村大地。1986年初中国政府批准实施这项计划。



星火计划是经中国政府批准实施的第一个依靠科学技术促进农村经济发展的计划，是我国国民经济和科技发展计划的重要组成部分。其宗旨是：把先进适用的技术引向农村，引导亿万农民依靠科技发展农村经济，引导乡镇企业的科技进步，促进农村劳动者整体素质的提高，推动农业和农村经济持续、快速、健康发展。

《高技术研究发展计划（863计划）纲要》
National High-Tech R&D Program (863 Program)

Since the 1980s new tides of technical development have produced a huge influence on the human beings and evoked a profound revolution in economy, society, culture, politics, military, etc. at the whole world. In 1983 the United States put forward the Strategic Defense Initiative (i. e. the Star Wars Initiative), then came the EURICA of Europe, the Comprehensive Outline of Science and Technology Progress in Year 2000 of the member countries of the Council of Mutual Economic Assistance (CMEA) at that time, the Policies for the Promotion of Science and Technology in the Next Ten Years of Japan, etc., which are all strate-

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gic plans aimed at the 21st century.

In March 1986, in view of the impacts of competition in the fields of high technologies in the world on China, four scientists, Wang Daheng, Wang Ganchang, Yang Jiachi and Chen Fanyun, submitted a letter to the central government to suggest that China adopt appropriate countermeasures to trace the development of high technologies in the world. This letter received great attention of Mr. Deng Xiaoping, who gave the written instruction "Quick decision should be made on this matter without any delay". In the following half year, the Program for Hi-Tech Research and Development (called Program 863 for short) was issued after extensive and in-depth study by hundreds of Chinese scientists. Since then the development of research on high technologies has entered a new stage in China. Because the letter of the scientists and the written instructions were both put forward in March 1986, hence came the name of "863" for the magnificent program.



《高技术研究发展计划（863计划）纲要》

National High-Tech R&D Program (863 Program)

1980年代以来，科学技术迅速发展，对人类产生了巨大的影响，引起了经济、社会、文化、政治、军事等各方面深刻的变革。1983年3月美国提出"星球大战"计划，欧洲的尤里卡计划、日本的"今后10年科学技术振兴政策"等着眼于21世纪的战略计划也先后应运而生。

1986年3月，王大珩、王淦昌、杨嘉墀、陈芳允四位老科学家联合向中央政府写了一封信，题为《关于跟踪世界战略性高科技发展的建议》，信中恳切地建议中国采取措施跟踪世界高科技发展，发展我国高技术的建议。这封信得到了邓小平同志的高度重视，小平同志亲自批示："这个建议十分重要"，"找些专家和有关负责同志讨论，提出意见，以凭决策，此事宜速作决断，不可拖延。"在随后的半年中，经过广泛、全面和极为严格的科学和技术论证后，中共中央、国务院批准了《高技术研究发展计划（863计划）纲要》。从此，中国的高技术研究发展进入了一个新阶段。由于计划的提出与邓小平同志的批示都是在1986年3月进行的，因此此计划被称为"863"。

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北京正负电子对撞机
Beijing Electron-Positron Collider (BEPC)

Beijing Electron-Positron Collider (BEPC) completed its first successful operation on October 16, 1988. It was hailed as another major scientific achievement next to China's successful development of man-made satellites, nuclear and hydrogen bombs and other achievements.

The construction of the positive and negative electron collider is the largest project in China's history. It was proposed by the Chinese American scientist Tsung-dao Lee when he first came back home in 1972, and was also the last project with instructions from Premier Zhou Enlai just before he passed away. The project broke ground in October 1984 and was completed in four years, marking major progress in Chinese science and technology.

The collider consists of five parts: accelerating electron and positive electron accelerator; high-speed electron and positive electron storage rings; detector for collision analysis; synchronized radiation experimental zone for research and use of the constant rays released by high-speed electrons and positive electrons; and computer center for analysis and calculation of the whole process with fast computer. As a complicated systematic engineering comprised of hundreds and thousands of sophisticated special equipments, its success indicated each equipment, the quality of components, the skill of installing and testing have entered the international advanced level of the 1980s.

The success of China's first high-energy accelerator Beijing electron-positron collider evoked strong repercussion in domestic science and technology circles and also created a stir in the international high-energy physics. Many renowned high-energy physicists in the world said that the success of Beijing electron-positron collider was a great progress in scientific development of China and also a milestone in the development of high-energy physics.

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北京正负电子对撞机
Beijing Electron-Positron Collider (BEPC)

1988年10月16日,我国第一座高能加速器——北京正负电子对撞机首次对撞成功。这是我国继原子弹、氢弹爆炸成功、人造卫星上天之后,在高科技领域又一重大突破性成就。

这项被认为是中国科学技术史上最大的科研工程,是在1972年由美籍华人李政道回国时首次提出,也是周恩来总理逝世前亲自主持的最后一个科研项目。1984年10月7日破土动工,仅用四年时间就完成了。

该对撞机由五个部分组成:加速电子和正电子加速器;高速电子和正电子储存环,探测器的碰撞分析;同步辐射实验区的研究和利用射线的不断释放的高速电子和正电子;计算机数据处理中心。是由数百种、上万台件高精尖专用设备组成的复杂的系统工程。它能一次对撞成功,表明对撞机的各种设备、部件的质量、安装调试的水平都达到世界一流。

我国第一台高能加速器北京正负电子对撞机一次对撞成功的消息,在我国科技界引起强烈反响,并在国际高能物理学界引起轰动。许多在世界上享有盛誉的高能物理学家说,北京正负电子对撞机对撞成功是中国科学发展的伟大进步,是高能物理发展的一个里程碑。



第一条高速公路——沪嘉高速公路
The First Highway—Hujia Express Way

On October 31, 1988, China has its own highway. Hujia Expressway is a section entering into Shanghai of 204 National Road (Shanghai to Yantai), from the Qilian Mountain Road of Shanghai suburb to the south gate of Jiading County, a full-Interchange closed equipment for the entire car dedicated high-grade highways.

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A total length of 20.5 kilometers highway occupies an area of 45 meters wide, with a 26.5 meters wide pavement, 3.5 meters medial strip, two lanes of each direction from upstream to downstream, and there are also 2.5 meters wide hardened verges on both sides for emergency vehicle use. The highway, for the first time, introduced a modern traffic control facilities, and three data acquisition systems set up on the whole road can collect data of speed, models and the passing cars. Emergency telephones are offered in very one kilometer, helping vehicle drivers, road managers keep in touch with the central control room. With a design speed of 120 km, the highway is open to 40000 vehicles day and night.

第一条高速公路——沪嘉高速公路

The First Highway—Hujia Express Way

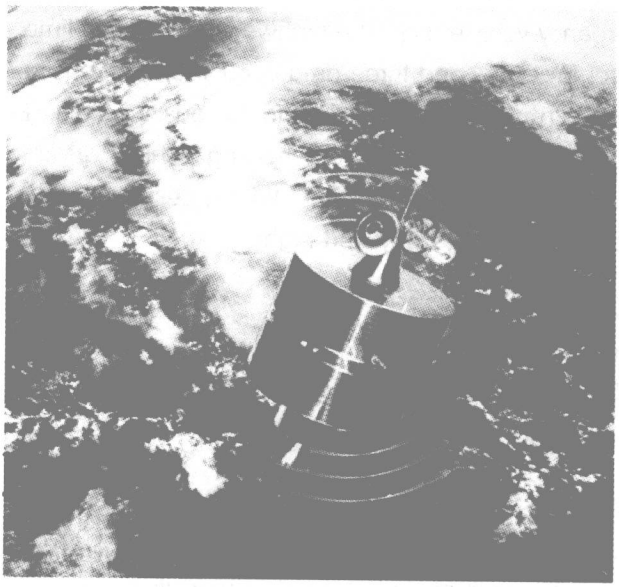
1988年10月31日，中国大陆拥有了自己的高速公路。沪嘉高速公路是204国道（上海至烟台）的入沪路段，从上海市区祁连山路至市郊嘉定县南门，是一条全立交全封闭设备全供汽车专用的高等级公路。

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公路全长20.5千米，占地宽45米，路面宽26.5米，中央有3.5米的分隔带，上下行各两个车道，两侧还有2.5米宽的硬路肩，供紧急停车用。这条公路首次采用了现代化的交通监控设施，全线设立了3个数据采集系统可采集到车速、车型和过路汽车数据。每一千米设有紧急电话，使汽车司机、公路管理人员和中央控制室保持联络。公路设计时速120千米，昼夜可通车4万余辆。

第一颗气象卫星“风云一号”
The First Meteorological Satellites “Feng Yun No. 1”

On September 7, 1988, China successfully launched an experimental weather satellite. The satellite smoothly entered into the nearly circular Sun-synchronous orbit, and all the equipments were in working order. Shortly after the satellite entering into the preset orbit, China's meteorological satellite ground station had received meteorological information from the satellite.



This named “Fengyun No. 1” meteorological satellite was launched by “Long March No. 4” carrier rocket at China's Taiyuan Satellite Launch Center. It is the first domestically developed and launched polar-orbiting meteorological satellite.

The satellite is equipped with two very high-resolution scanning radiometer, and a total of 5-channel detection can detect the cloud during day and night, the image of the earth surface, ocean col-

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or images, water boundaries, ocean surface temperature, snow cover and vegetation growth.

The main task of "FY-1" is to obtain global weather information and send weather data to meteorological satellite ground stations around the world. In addition, the satellite has the function to detect particles in the air component, in order to provide information on space physics research.

After "FY-1" satellite was put into the trial, it has been of great significance in raising the level of China's weather forecast, especially in severe weather monitoring and forecasting capabilities, offering better services for the construction of the national economy.



第一颗气象卫星"风云一号"
The First Meteorological Satellites "Feng Yun No. 1"

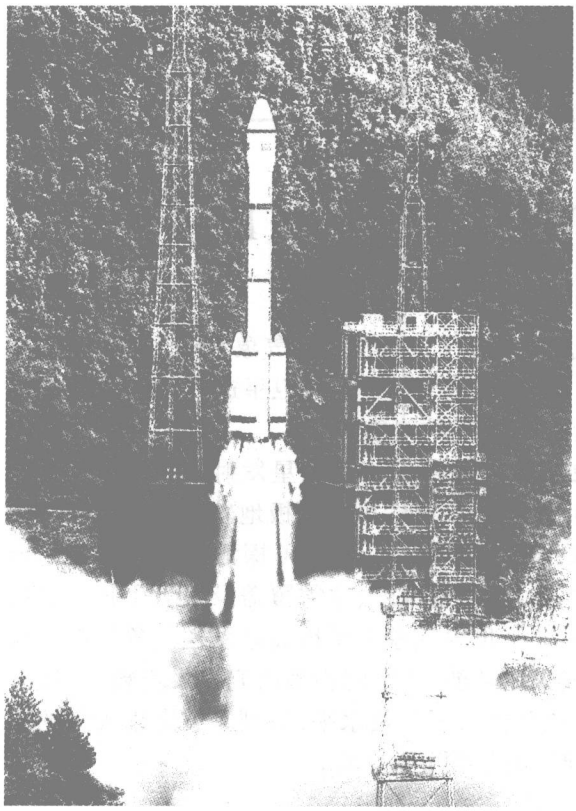
1988年9月7日,我国成功地发射了一颗试验性气象卫星。卫星顺利进入近圆形太阳同步轨道,星上仪器工作正常。卫星进入预定轨道后不久,我国的气象卫星地面站就收到了卫星发送的气象信息。

这颗命名为"风云一号"的气象卫星,是在我国太原卫星发射中心,用"长征四号"运载火箭发射的。它是我国自行研制和发射的第一颗极地轨道气象卫星。星上装有两台甚高分辨率扫描辐射仪,共有5个探测通道,可探测白天和夜间的云图、地表图像、海洋水色图像、水体边界、海洋面温度、冰雪覆盖及植被生长。卫星主要任务是获取全球的气象信息,并向全世界气象卫星地面站发送气象资料。此外,这颗卫星还具有探测空中粒子成分的功能,为空间物理研究提供资料。"风云一号"卫星正式投入试用后,对于提高我国天气预报水平,特别是灾害性天气的监测和预报能力,更好地为国民经济建设服务有重要意义。

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“长征三号”运载火箭
Long March 3 Launch Vehicle

Long March 3 (LM-3) is a three-stage launch vehicle, primarily intended for sending spacecraft into Geosynchronous Transfer Orbit with the GTO capacity of 1.5 metric tons and the length of 44.56m. The diameters of the first and second stages of LM-3 are the same, 3.35m and the third stage, 2.25m. The development of the first and second stages is based on the first and second stages of LM-2C. The first two stages burn UDMH/N2O4 as propellants, while the third stage of LM-3 is powered by a cryogenic engine, using liquid oxygen (LOX) and liquid hydrogen (LH2) as propellants. The launch site is Xichang Space Launch Center. The CZ-3 launch vehicle won a perfect success in April, 1984. The vehicle also marked the first use of a high technology upper stage. On April 7, 1990, LM-3 delivered the first foreign communication satellite, Asia Sat 1, made by the U.S. Hughes Corporation, into a predetermined GTO. It was a total success and marked the real entrance of Long March launch vehicles for China into the international commercial launch service market.



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“长征三号”运载火箭
Long March 3 Launch Vehicle

“长征三号”运载火箭是三级火箭，主要用于发射地球同步轨道有效载荷，运载能力为1.5吨。全长44.56米，一、二子级直径3.35米、三子级直径2.25米。其一、二级是在“长征二号丙”运载火箭的一、二子级的基础上研制的，使用偏二甲肼(UDMH)和四氧化二氮(N2O4)作为推进剂，其三子级采用了低温高能液氢(LH2)液氧(LOX)发动机。“长征三号”火箭在西昌卫星发射中心(XSLC)进行发射。“长征三号”运载火箭在1984年4月进行首次飞行，成功地将“东方红二号”试验通信卫星送入预定地球同步转移轨道，标志着中国运载火箭技术跨入世界先进行列。该火箭曾于1990年4月7日成功地将美国休斯公司制造的“亚洲1号”卫星送入地球同步转移轨道，是中国运载火箭发展上的一个重要里程碑。在此之后，“长征三号”运载火箭成功地发射了包括“亚太一号卫星”、“亚太一号甲卫星”、“风云二号卫星”等在内多颗国内外卫星。

秦山核电站
Qinshan Nuclear Power Plant

Qinshan Nuclear Power Plant—independently designed and built by China—is located in Haiyan County, beside the Hongzhou Bay, near the big cities of Shanghai and Hangzhou in Zhejiang Province, the first nuclear power station with a 300MW pressurized water reactor. Begun in 1982, it was connected to the grid on Dec. 15th, 1991. Its success ended the no-nuclear-power history in Chinese mainland, and it has acted as the important milestone in China's peaceful use of nuclear power. It made China the 7th nation after US, Britain, French, Soviet, Canada and Switzerland in self-designing and self-building power plants.

The second-phase project at Qinshan, including two reactors with a capacity of 600,000kw, joined the nation's electrical power grid and began generating power in 2002 and 2004. It still proved China's competence to design, construct, manage

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and operate a nuclear plant. The two reactors of the third-phase project, with a capacity of 700,000kw, jointly developed commercial-purpose heavy- water nuclear reactor power plant was completed and put into full-capacity operation in 2003.



秦山核电站
Qinshan Nuclear Power Plant

秦山核电站位于浙江省海盐县，濒临东海杭州湾，并且邻近上海、杭州等特大城市，是中国第一座依靠自己的力量设计、建造和运营管理的核电站。一期工程额定发电功率30万千瓦，采用国际上成熟的压水型反应堆。1982年选定站址，1984年开工，1991年12月首次并网发电。它的建成投产结束了祖国大陆无核电的历史，是我国和平利用核能的光辉典范，同时也使我国成为继美、英、法、前苏联、加拿大、瑞典之后世界上第七个能够自行设计、建造核电站的国家。

一期建成后不久，秦山核电站又先后开工建设了二期和三期工程，并引进国外技术力量和国内地方政府资本参与建造。二期工程依然由中国自主承担设计、建造和运营任务，采用压水型反应堆技术，安装两台60万千瓦发电机组，于2004年建成，并正在筹划继续扩建。三期工程由中国和加拿大政府合作，采用加拿大提供的重水型反应堆技术，建设两台70万千瓦发电机组，于2003年建成。



东方明珠
Oriental Pearl TV Tower

The Oriental Pearl Tower is a TV tower in Shanghai, China. The Oriental Pearl Tower is located at the tip of Lujiazui in the Pudong district. At 468 m (1,535 feet) high, it is the tallest tower in Asia, and the third tallest tower in the world after the CN Tower and the Ostankino Tower. Construction began in 1991 and the tower was completed in 1994. The tower features 11 spheres, big and small and the entire building is supported by three enormous columns that start underground. Visitors travel up and down the tower in double-decker elevators that can hold up to fifty people at the rate of seven meters per second. The design of the building is based on a verse of the Tang Dynasty poem *Pipa Song* by Bai Juyi a-

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bout the wonderful sprinkling sound of a pipa instrument, like pearls, big and small falling on a jade plate. As a symbol of the economic reform in Shanghai, it was also the tallest structure in China before it was surpassed by the Shanghai World Financial Center. Like the Statue of Liberty in N. Y., the Sydney Opera House and the Eiffel Tower in Paris, the Oriental Pearl Tower is also a landmark and a tourist attraction in Shanghai, which displays a spectacular view of an international metropolis with the Jin Mao Tower and the Shanghai World Financial Center. Seen from far, the Yangpu Bridge and the Nanpu Bridge seem like two Chinese dragons frolicking with the pearls of the Oriental Pearl Tower.



东方明珠
Oriental Pearl TV Tower

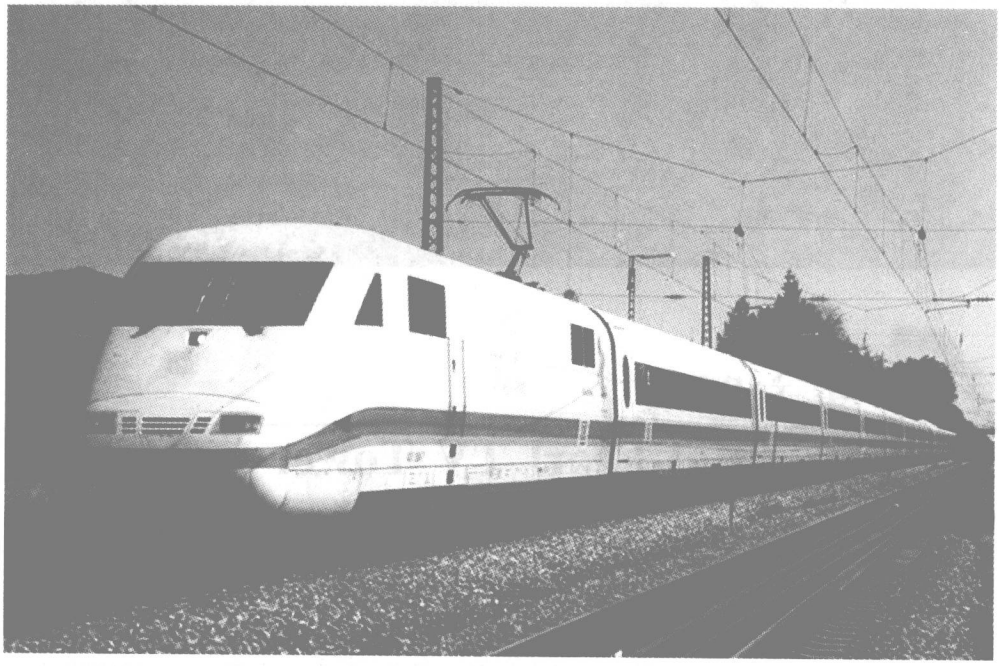
东方明珠广播电视塔，又名东方明珠塔，位于中国上海浦东陆家嘴金融贸易区，始建于1991年，1994年完工。东方明珠塔高467.9米，亚洲第一，世界第三，仅次于加拿大的加拿大国家电视塔(553.3米)及俄罗斯的奥斯坦金诺电视塔(540.1米)。东方明珠塔最有特色的是把11个大小不一、高低错落的球

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体串联在一起，整个建筑物的支撑完全靠三根深入地下的擎天立柱，内置可载50人的双层电梯和每秒7米的高速电梯。东方明珠塔的名字来源唐朝诗人白居易的《琵琶行》中关于琵琶的声音的描写，诗人把琵琶的声音比如成珍珠落到玉盘里时的发出美妙声音，“大珠小珠落玉盘”。东方明珠塔是上海改革开放的象征，曾是中国最高的建筑，现在已被上海环球金融中心取代。与纽约的自由女神、悉尼歌剧院、巴黎的埃菲尔铁塔一样，东方明珠塔成为上海标志性建筑和旅游热点之一，与后方新耸立而起的金茂大厦和环球金融中心交相辉映，展现了国际大都市的壮观景色。从远处看它与两边的杨浦大桥和南浦大桥巧妙地组合成一幅二龙戏珠的巨幅画卷。

京九铁路
Jingjiu Railway

Jingjiu Railway (also known as Beijing-Kowloon Railway) connects Beijing West Station in Beijing to Shenzhen Station in Shenzhen, Guangdong Province. It then follows the rail-link between Shenzhen to the special administrative region of Hong Kong to Hung Hom Station (Kowloon Station) in Kowloon.



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It is a dual-track railway. Construction began in February 1993. It was opened in 1996, connecting Beijing and Kowloon through Tianjin, Hebei, Shandong, Henan, Anhui, Hubei, Jiangxi and Guangdong, with a length of 2397 kilometers. Within Hong Kong, it shares the same pair of tracks with the East Rail Line (formerly British Section of the Kowloon-Canton Railway).

Located between Jinghu Railway (Beijing-Shanghai) and Jingguang Railway (Beijing-Guangzhou), it was built to alleviate the congested Jingguang Railway, and to foster development in the areas to the east of Jingguang Railway.

京九铁路
Jingjiu Railway

京九铁路(北京——九龙铁路)北起北京西站,跨越京、津、冀、鲁、豫、皖、鄂、赣、粤九省市的98个市县,南至深圳,连接香港九龙,全长2397千米。京九铁路1993年4月20日全线正式开工,于1995年11月16日全线铺通,1996年9月1日通车。京九铁路香港段,港称九广东铁,前称九广铁路(英段)。

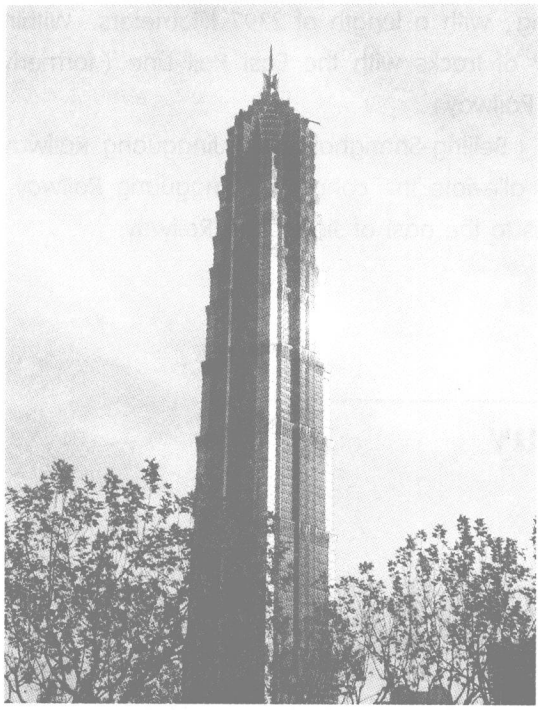
位于京沪、京广铁路之间的京九铁路的开通运营,不仅缓解了京九铁路的运输压力,也加快京广铁路沿线地区脱贫致富。

金茂大厦
Jin Mao Tower

The Jin Mao Tower is an 88-story landmark supertall skyscraper in the Lujiazui area of the Pudong district of Shanghai, People's Republic of China. It contains offices and the Shanghai Grand Hyatt hotel. Until August, 2008, it was the second tallest building in Shanghai, the third tallest in the PRC, the eighth tallest in the world. Construction began in 1994 and finished in 1998 with the total floor area of 278707 ㎡. The lower 50 floors are made up of offices and levels 51

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and 52 are mechanical floors, accessible only by service elevators. The building's anchor tenant is the five-star, 555-room Shanghai Grand Hyatt hotel which occupies floors 53 to 87. On Fifty-Six, a collection of restaurants including The Grill, the Italian Cucina, the Japanese Kobachi, and the Patio Lounge, which is located at the base of the atrium. The Hyatt's famous barrel-vaulted atrium starts at the 56th floor and extends upwards to the 87th. Lined with 28 annular corridors and staircases arrayed in a spiral, it is 27m in diameter with a clear height of approximately 115 m. Club Jin Mao is on the 86th floor. The 88th floor (not part of the hotel) houses the Skywalk, a 1520 m^2 indoor observation deck with a capacity of 1000 people. In addition to the panoramic views of Shanghai, it offers a topside view of the hotel atrium below. It also includes a small post office.



Designed by the Chicago office of Skidmore, Owings & Merrill, its postmodern form, whose complexity rises as it ascends, draws on traditional Chinese architecture such as the tiered pagoda, gently stepping back to create a rhythmic pattern as it rises.

金茂大厦
Jin Mao Tower

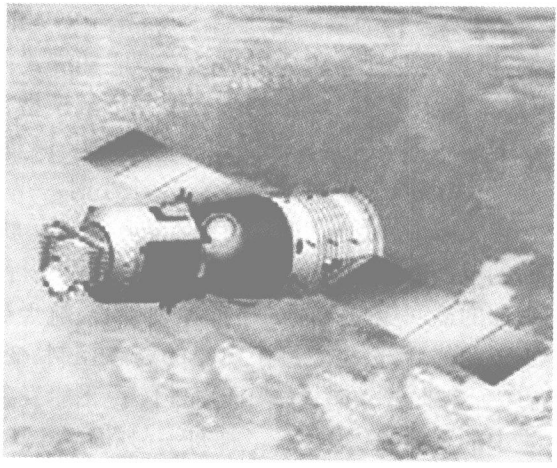
金茂大厦位于上海浦东新区黄浦江畔的陆家嘴金融贸易区，楼高420.5米，目前是上海第2高的摩天大楼（截至2008年8月）、中国大陆第3

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高楼、世界第 8 高楼。大厦于 1994 年开工,1998 年建成,有地上 88 层,楼面面积 278,707 平方米. 第 3 至第 50 层为办公室,第 51、52 层是机械和电子设备室,不开放。第 53 至第 87 层为拥有 555 个房间的金茂君悦大酒店,是世界上最高的五星级酒店。第 56 层有一个餐厅和一个中空的咖啡厅,特别是高 152 米,直径 27 米的酒店中庭,28 道环廊在霓红灯的照射下光彩迷人,仿佛置身在时空隧道,仰头便可以看到酒店中庭 31 个楼层的所有环行走道和 555 间客房。第 86 层是酒店会员俱乐部,只允许会员进入。第 88 层是一个能够容纳 1000 人的观景台,楼面高达 340.1 米,面积 1520 平方米,是中国最大和最高的大楼观景台。观景台还有一个小邮局。

金茂大厦由著名的美国芝加哥 SOM 设计事务所设计,是融汇了中国塔型风格与西方建筑技术元素的多功能型摩天大楼。金茂大厦集现代化办公楼、五星级酒店、会展中心、娱乐、商场等设施于一体,现已成为上海的一座地标。

“神舟一号”飞船
Shenzhou Ⅰ Experimental Spacecraft



Nov. 20, 1999, China successfully launched Shenzhou Ⅰ experimental spaceship on a LM-2F launch vehicle in Jiuquan Satellite Launch Center, which laid solid foundation for realizing the strategic target for manned space flight. Four orbital test flights of the Shenzhou spacecraft were conducted without crews. Remained in orbit for 21 hours, it made 14 orbits around the Earth carrying a dummy astronaut, experimental seeds, national flags and a banner with signatures of participating engineers and scientists and after that the descent module lands in central Inner Mongolia Autonomous Region the next day.

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The unmanned spacecraft consists of orbit, descent and propulsion modules. The orbit module is the place where astronauts live and work. The descent cabin lies in the middle of the spaceship, and is the astronaut's cabin and the command and control center. It is a airtight structure with a hatch on the top for astronaut to get in and out of the descent cabin and enter the orbital module, and it is the only landing part of the spaceship to return into the air and to land on the earth. In advancement spacecraft has two solar cell wings, attached to the outside of the instrument propulsion module below the descent cabin. The two solar cell wing total area of 24.48 m^2, which are deployed after launch and supply the power distribution. Shenzhou Ⅰ experimental spaceship is the important milestone in China's spaceflight history.



“神舟一号”飞船
Shenzhou Ⅰ Experimental Spacecraft

神舟一号飞船是中华人民共和国载人航天计划中发射的4艘无人飞船的第一艘实验飞船。飞船于1999年11月20日在酒泉航天发射场成功发射，承担发射任务的是在“长征2号”捆绑式火箭的基础上改进研制的“长征2号”F载人航天火箭。飞船携带一个飞行员模型、一些实验种子，国旗和一面带有航天工程师和科学家签名的横幅绕地球飞行14圈后，顺利降落在内蒙古中部地区的着陆场，飞船在太空中共飞行了21个小时。

飞船由轨道舱、返回舱和推进舱组成。轨道舱位于飞船的前段，通过舱口与后面的返回舱相通，轨道舱是宇航员在轨飞行期间的生活舱、试验舱和货舱。飞船中部的返回舱是飞船的指挥控制中心，航天员乘坐其上天和返回地面。推进舱位于飞船的后部，主要用于飞船的姿态控制、变轨和制动。除此之外，推进舱两侧装有20多平方米的主太阳能电池阵。飞船发射后两侧太阳能电池阵机翼打开为前进中的飞船提供电力。“神舟一号”无人试验飞船是中国载人航天工程的首次飞行，标志着中国在载人航天飞行技术上有了重大突破，是中国航天史上的重要里程碑。

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小浪底水利枢纽工程
Xiaolangdi Hydro Project

Xiaolangdi Hydro Project, a large modern water conservancy project, is located on the lower reaches of the Yellow River, 40km north of the ancient city of Luoyang in central China's Henan Province. As a key Chinese national project, Xiaolangdi Hydro Project is the largest of its kind on the Yellow River and second only to the Three Gorges project on the Yangtze River. It consists of a 1617m-long, 154m-high dam, silt-discharge channels and underground generating units. Preparatory work began in 1991. Main orders were placed in September 1994. One of the landmark events of the project involved diverting the Yellow River. This took place on 28 October 1997 and became a national occasion. The dam received state approval and started storing water in October 1999. It was connected to the grid in January in 2000 and the whole project was completed in 2001.



Xiaolangdi Project, designed to trap and flush sediments on the lower reaches

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of the Yellow River, could cope during the summer flood season. Xiaolangdi Hydro Project has been subjected to devastating Yellow River floods and has played an irreplaceable role in the agricultural area alongside. In addition, the 1,836mw Xiaolangdi Project is generating 5.1 billion kwh of electricity a year. Xiaolangdi is a multi-purpose project for dredging, flood control, ice control, industrial and municipal water supply and hydroelectric power. It is the key project of Yellow River Projects, considered as one of the most complicated and challenging hydroelectric projects in the world.



小浪底水利枢纽工程
Xiaolangdi Hydro Project

在河南省洛阳以北40千米处，一座现代化的特大型水利枢纽，小浪底水利枢纽工程，屹立在黄河最后一段峡谷之上。小浪底水利枢纽工程现为黄河上最大的水利工程，仅次于长江三峡水利枢纽工程，属中国国家重点项目。小浪底工程由拦河大坝（坝顶长度1617米，坝高154米）、泄洪建筑物和引水发电系统组成。小浪底工程1991年9月开始前期工程建设，1994年9月主体工程开工。1997年10月28号大坝顺利完成截流，1999年10月经政府许可开始蓄水。2000年元月首台机组并网发电，2001年底主体工程全面完工。

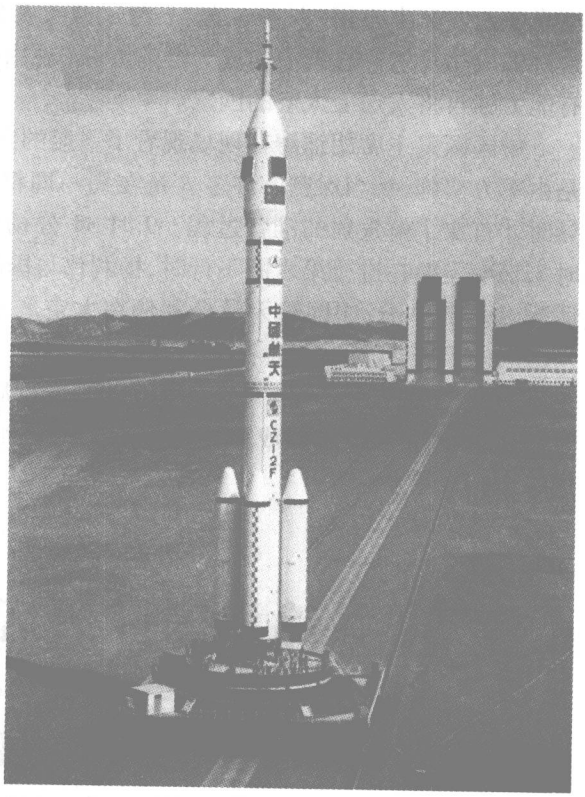
黄河小浪底水利枢纽工程的建成有效地控制了黄河下游沉积物，基本解除黄河下游凌汛威胁。小浪底水利枢纽工程不仅时刻保障着中国母亲河的岁岁安澜，也为沿线农业地区发挥着不可取代的关键性作用。除此之外，小浪底电站总装机183.6万千瓦，年平均发电量51亿千瓦时。小浪底水利枢纽工程是黄河干流上的一座集减淤、防洪、防凌、供水灌溉、发电等为一体的大型综合性水利工程，是治理开发黄河的关键性工程，被中外水利专家称为世界上最复杂的水利工程之一，是最具挑战性的工程。

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神舟五号载人飞船
Shenzhou V Spacecraft

Shenzhou V-atop a Long March 2F rocket—was successfully launched on October 15, 2003, at 09:00 Beijing time (UTC+8), carrying one astronaut, Yang Liwei. As the country's first manned space launch, the launch of the Shenzhou V space capsule, however, will mark China's entry to an exclusive club by becoming only the third nation in history to successfully place an astronaut into Earth's orbit after the United States and Russia.

Chinese President Hu Jintao watched the launch of the spaceship. The Shenzhou program, supported and run by the military, had been carried out under much secrecy. Most people got their first glimpse of the launch preparations on Monday, when Chinese state television began airing news stories and a documentary on the upcoming mission. At 09:34 Beijing time (UTC+8), the astronaut send the message of "I feel good." to the earth. And when it came to the sixth orbiting around the earth there was the first "sky-to-ground greeting" between Yang Liwei and Cao Gangchuan, the Defense Minister. At 18:40 Beijing time (UTC+8), Yang Liwei displayed the national flag of China and the flag of



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UN and gave the greetings to the Earth. Yang Liwei also had a communication with his families at 19:59 Beijing time (UTC +8).

The launch of Shenzhou V took place at the Jiuqian Space Center, in northwestern Gansu Province and landed after orbiting about the Earth 14 times during a 21-hour period in Inner Mongolia Autonomous Region. The orbital module remains in orbit for several months.



神舟五号载人飞船
Shenzhou V Spacecraft

“神舟五号”载人飞船是中国神舟号飞船系列之一，为中国首次发射的载人航天飞行器，于北京时间(UTC +8)2003 年 10 月 15 日 9 时在中国酒泉航天发射中心用“长征二号”F 型运载火箭发射，将航天员杨利伟送入太空。这次的成功发射标志着中国成为继前苏联(现由俄罗斯承继)和美国之后，第三个有能力独自将人送上太空的国家。

中国国家主席胡锦涛在现场观看了飞船的发射。“神舟五号”的研制和发射都是由军方实施，相当保密。许多人是在周一即将发射前官方媒体开始对此进行报导时才首次了解发射的准备过程。9 时 34 分杨利伟向地面表示“感觉良好”。17 时 32 分，飞船在进行第六圈飞行时，杨利伟与国防部长曹刚川进行第一次“天地对话”。18 时 40 分，中国航天员杨利伟在太空展示中国国旗和联合国旗，并向地球发出问候。19 时 59 分，杨利伟与家人通话。

“神舟五号”在完成了 14 圈绕地球的飞行后，返回舱于 2003 年 10 月 16 日 6 时 23 分在内蒙古着陆场成功着陆，离预定着陆地点仅差 4.8 千米。轨道舱继续绕地球运行半年左右。



电谷锦江国际酒店
Power Valley Jinjiang International Hotel

Power Valley Jin Jiang International Hotel, a 5-star business hotel located at the core area of the High-Tech Development Zone of Baoding, is 10

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km to the Beijing-Shijiazhuang Highway. The hotel is located on the city's major road-Chaoyangbei Street. The convenient location let you enjoy the very best of the city and the surrounding areas.



The hotel has installed photoelectric glasses, and a photovoltaic grid-connected system. It is the largest photoelectric mansion that has solar modules of 22638 ㎡ for powering up the building. At the same time, the hotel adopted the system that processes urban wastewater for hotel's cooling, heating and water usage. A truly remarkable recycling efficiency marks it an icon for energy conservation and environment protection.

Power Valley Jin Jiang International Hotel, with 23 floors above ground, is a landmark building of the city. The hotel boasts 291 rooms and suites including superior rooms, deluxe rooms, special view suites and presidential suite. The executive floors and Power Valley Prestige Club provide the most comfortable and luxurious living spaces. Each room or suite is uniquely designed and equipped with state of the art facilities including wide-screen LCD/TV and custom-made mattress. Jin

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Jiang Fu Chinese Restaurant offers Jin Jiang style Shanghai cuisine. The Sunshine Bar, located at the hotel lobby, is an excellent demonstration of contemporary style and chic design. Green Valley Café offers more than 200 Chinese and Western dishes in a comfortable and elegant setting. "Dae Jang Geum" Korean Restaurant provides authentic Korean cuisine; the genuine and friendly hospitality makes the dining experience ever enjoyable. Celebrity Club, an American style bar, will take you into an exotic and glaring world where you can fully relax and forget about the bustling city. Power Valley Hall is an international conference hall that can accommodate up to 400 people. More than 10 meeting rooms, equipped with high-tech facilities, are the places for high-end social gatherings and business meetings.



电谷锦江国际酒店
Power Valley Jinjiang International Hotel

电谷锦江国际酒店是一个以绿色环保为主题的现代化的五星级商务型酒店，酒店位于河北省保定市朝阳北大街北段，高新技术开发区的核心区域，距京石（津保）高速公路约 10 千米，交通非常便利。

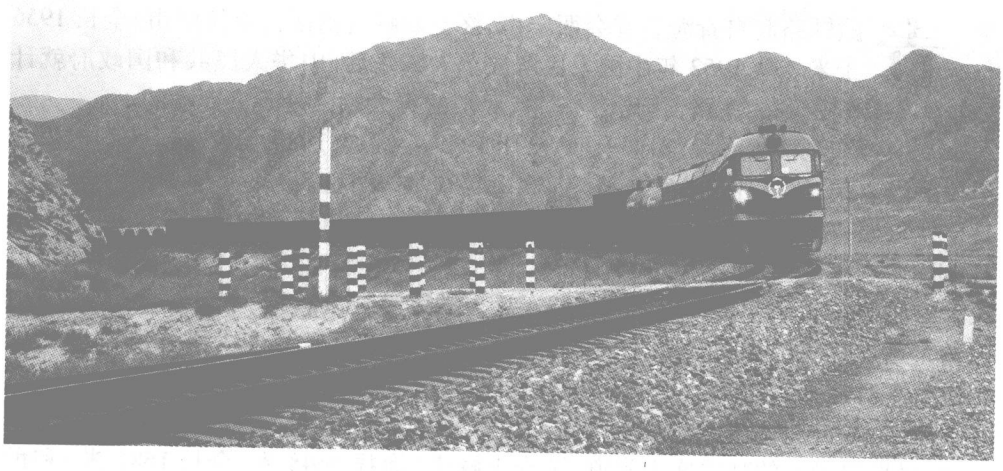
酒店利用太阳能光并网发电，太阳能玻璃幕墙安装面积 22638 平方米，是世界最大的太阳能大厦。同时，酒店采用了污水源热泵系统，将城市污水经过处理后用于整个酒店采暖、制冷、生活用水，使污水实现了循环利用，提供了可再生能源的利用效率，是国际上为数不多的节能环保型酒店。

电谷锦江国际酒店地上 23 层，是当地最豪华的酒店。拥有客房共 291 间，其中包括标准间、豪华间、总统套房等。还设有行政楼层及行政俱乐部，房间装饰典雅舒适，现代化设备完善，包括高速宽带网、48 频道卫星电视等，并提供对客人的一站式管家服务。"锦江府"餐厅经营上海锦江菜，提供精致、丰盛及富有创意的一流精品佳肴；酒店大堂的"阳光酒廊"，更是商谈小聚，独酌小憩之佳选；"绿谷咖啡厅"环境优美，恬静舒适；"大长今"餐厅，提供正宗韩国料理；四层"名人俱乐部"具有美式酒吧的火热风情；恢弘大气的"电谷堂"可同时容纳 400 余人举办大型国际会议，十余间配备高科技设施的多功能会议室，是高端商务会议及社交活动的理想选择。

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青藏铁路
The Qinghai-Tibet Railway

The Qinghai-Tibet Railway (also "Qingzang Railway") begins from Xining—the capital of Qinghai Province to Lhasa—the capital of Tibet self-governing province. Begun in 1958 and opened in 2006, it is 1956 km long.



The Xining-Golmud railway was finished in 1979 and put into operation in 1984. The Golmud-Lhasa railway was constructed from 2001 to 2005. The total Qinghai-Tibet Railway was officially opened on July 1st, 2006. And the Shanghai-Lhasa, Guangzhou-Lhasa, Lhasa-Shanghai and Lhasa-Guangzhou railways began to work in October that year. There are 45 stations along the Qinghai-Tibet Railway with the bridges and tunnels covering 8% of the total length. The train runs at a speed of 100km per hour on the permafrost zones and 120km per hour out of the permafrost zones. The whole journey costs 26 hours.

The Golmud-Lhasa railway is 1142 km, about 930 km of which would have an elevation of over 4,000 meters, with the highest point at 5,072 meters at Tanggula railway station. It also passes the longest plateau permafrost tunnel in the world,

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Kunlun Mountain Tunnel (1686 meters) with an elevation of 4648 meters. The completion and opening of Qingzang railway will play a large role in advancing the development of economy and society, improving the life of people, strengthening the solidarity of nations and promoting the communication of culture in the areas of Qinghai and Tibet.



青藏铁路
The Qinghai-Tibet Railway

青藏铁路起自青海省省会西宁市，终至西藏自治区首府拉萨市，全长1956千米。从1952年中国人民解放军入藏之后，中华人民共和国政府就计划修建一条到西藏的铁路，其政治、军事、经济的重大意义是不言而喻的。

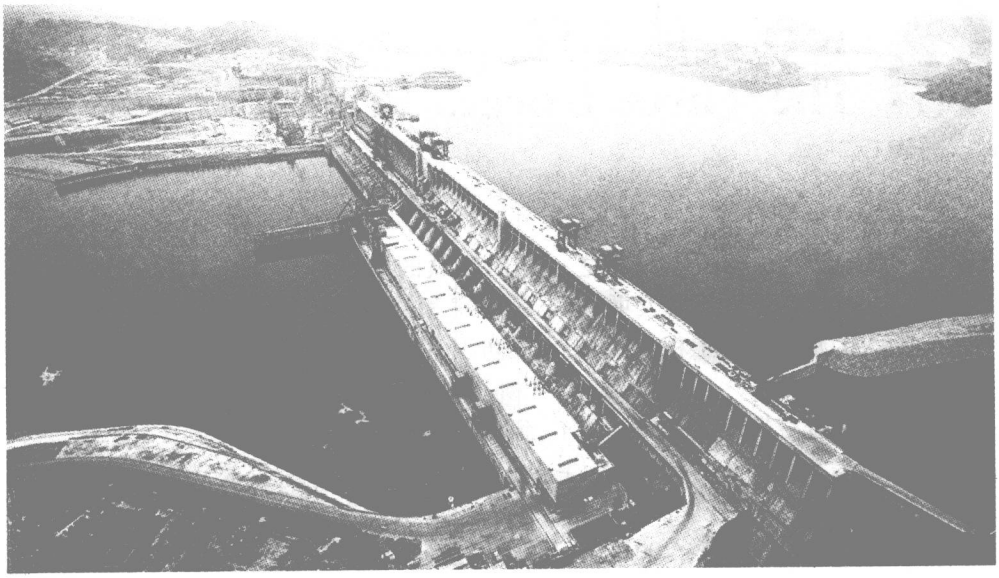
其中西宁至格尔木段(814千米)已于1979年铺通，1984年投入运营。格尔木至拉萨段2001年2月8日宣布修建，2001年6月29日正式开工，2005年10月12日全线贯通；2006年7月1日，青藏铁路正式通车。2006年10月1日和10月2日，上海—拉萨与广州—拉萨列车分别开始运行，2006年10月4日和10月5日，拉萨—海和拉萨—广州列车分别开始运行。铁路沿线设有45个车站，位于西藏境内的车站均充满了藏族特色，且无一相同。全线桥隧总长约占线路总长的8%，冻土层行车时速为100km，非冻土层时速为120千米，全程行车时间约为26小时。

格尔木—拉萨段全长1142千米，其中930千米的铁路线位于海拔4000米以上，穿过世界最长的高原冻土隧道：昆仑山隧道(海拔4648米，全长1686米)和世界海拔最高的火车站：唐古拉山火车站(海拔5072米)。青藏铁路的建成通车将对推进青海、西藏的经济社会发展、改善人民生活、加强民族团结、促进文化交流起到重要作用。

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长江三峡工程
The Three Gorges Project

The Three Gorges Project (TGP) is located in Sandouping of the Xiling Gorge, consisting of a large dam across a river, hydroelectric power station and navigation structures. It is an exceptionally large water conservancy scheme possessing enormous, comprehensive utilization benefits for flood control, power generation, navigation, breeding of aquatic products and water supply.



Initial Timetable:

1993 ~ 1997: The Yangtze River was diverted after four years in November 1997

1998 ~ 2003: The first group of generators began to generate power in 2003, and a permanent ship lock opened for navigation the same year.

2004 ~ 2009: The entire project is to be completed by 2009, when all 26 generators (with a combined generating capacity of 18.2 million kw) will be able to generate 84.7 billion kwh of electricity annually.

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May 20, 2006 was a historical day for the famous Three Gorges Hydro-electric Project on Yangtze River: the Three Gorges Dam was officially opened except the ship lift, nearly 10 months earlier than scheduled. As the largest reinforced concrete dam in the world, the main dam has concrete poured to 185 meters above sea level, and is 2309 meters long. The construction of the Three Gorges Project was begun in 1994 and the Yangtze River was completely blocked on Nov. 8, 1997 at the Three Gorges when the opening in the diversion canal of the Dam Project was closed. Hence the natural flow of the mighty river at the Three Gorges is cut. The construction of the Three Gorges Project entered the next stage: the construction of the Three Gorges Dam. The Three Gorges Project is the largest hydro-electric power station in the world, with a combined generating capacity of 18.2 million kw and an annual electricity generation of 84.7 billion kwh.



长江三峡工程
The Three Gorges Project

三峡工程位于长江三峡之一的西陵峡的中段，坝址在宜昌市的三斗坪。

三峡工程建筑由大坝、水电站厂房和通航建筑物三大部分组成。作为世界上最大的水利枢纽工程，三峡工程在防洪、发电、航运、养殖等方面均有巨大效益。

三峡工程分三期，从1992年开工，到2009年竣工，总工期17年。

一期工程5年(1992～1997)，主要工程除准备工作外，主要进行一期围堰填筑，导流明渠开挖。

二期工程6年(1998～2003)，工程主要任务是修筑二期围堰，左岸大坝的电站设施建设及机组安装，同时继续进行并完成永久特级船闸，升船机的施工。

三期工程6年(2003～2009)，本期进行的右岸大坝和电站的施工，并继续完成全部机组安装。届时，水电站总装机容量为1820万千瓦，年发电量847亿千瓦时。

2006年5月20日，举世瞩目的长江三峡水利枢纽工程迎来了历史性一刻：三峡大坝建成！三峡大坝全线浇筑达到海拔185米高程，比原计划提前近10个月。主体工程三峡大坝全长2309米，是世界上规模最大的混凝土重力坝。长江三峡水利枢纽工程于1994年底正式动工。1997年11月8日，长江三峡工程在湖北宜昌西陵峡江面顺利实施了大江截流，这标志着三峡工程在本世纪内走出了关键性的

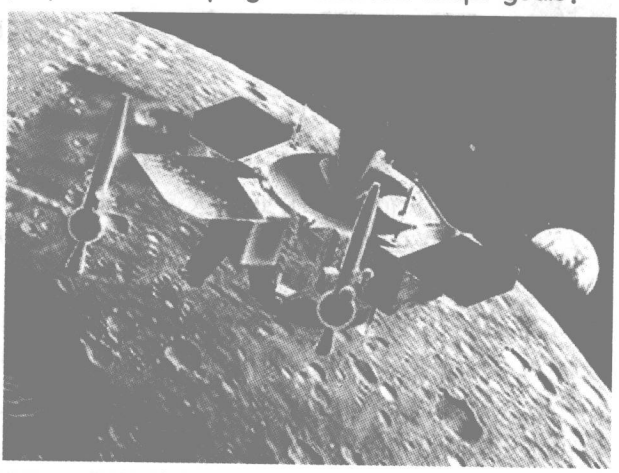
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一步，新一轮工程施工，主体工程三峡大坝，进入实质性阶段。建成后的三峡工程是迄今世界上最大的水利枢纽，其1820万千瓦的装机容量和847亿千瓦时的年发电量均居世界第一。

“嫦娥一号”
The Chang'e Ⅰ Lunar Probe

The Chang'e Ⅰ lunar probe is China's first lunar probe, successfully launched on LM-3A rocket on schedule at 6:05 p. m. local time (UTC + 8) from the Xichang Launch Center, on October 24, 2007.

The "Orbiting (Chang'e Ⅰ)" phase of the program has four major goals:



Drawing "pictures" of the Moon and obtaining three-dimensional images of the lunar surface. Dividing the basic landforms and structures of the lunar surface and initially making outline graphs of lunar geology and structures, so as to provide a reference and basis for later soft landings. The orbit of Chang'e Ⅰ around the Moon will provide complete coverage, including areas near the North and South Poles not covered by previous missions.

Probing useful elements on the Moon surface and analyzing the elements and materials, primarily making maps of the distribution of various elements on the Moon's surface. China hopes to expand the number of the useful elements to 14 previously probed by the NASA's Lunar Prospector, and will conduct an overall prospect evaluation on some useful resources on the Moon's surface.

Probing the features of lunar soil and evaluating its depth, as well as the amount of helium-3 (He) resources.

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Probing the space environment between the Moon and the Earth, recording data on the primitive solar wind and studying the impact of solar activity on the Earth and the Moon.

The first picture of the Moon was relayed on November 26, 2007. The mission is scheduled to continue for a year. At November 12, 2008, a map of whole lunar surface taken by Chang'e Ⅰ was shown to the public.

The launch of the 1.4 billion Yuan ($187 million) Chang'e Ⅰ, named after the Chinese goddess of the moon, is considered to be the first step in China's three-stage moon exploration campaign, with the second step being the delivery of a moon rover, and the third that of a recovery research vehicle to collect soil samples. The ultimate aim of the Chinese project is to put a man on the moon by 2020.



“嫦娥一号”
The Chang'e Ⅰ Lunar Probe

“嫦娥一号”是中国的首颗绕月人造卫星，以中国古代神话人物嫦娥命名。2007 年 10 月 24 日 18 时 05 分(UTC +8 时，下同)，在西昌卫星发射中心搭乘“长征三号”甲运载火箭顺利发射升空。卫星的总重量为 2350 千克左右，尺寸为 2000 毫米 ×1720 毫米 ×2200 毫米，太阳能电池帆板展开长度 18 米寿命大于一年。

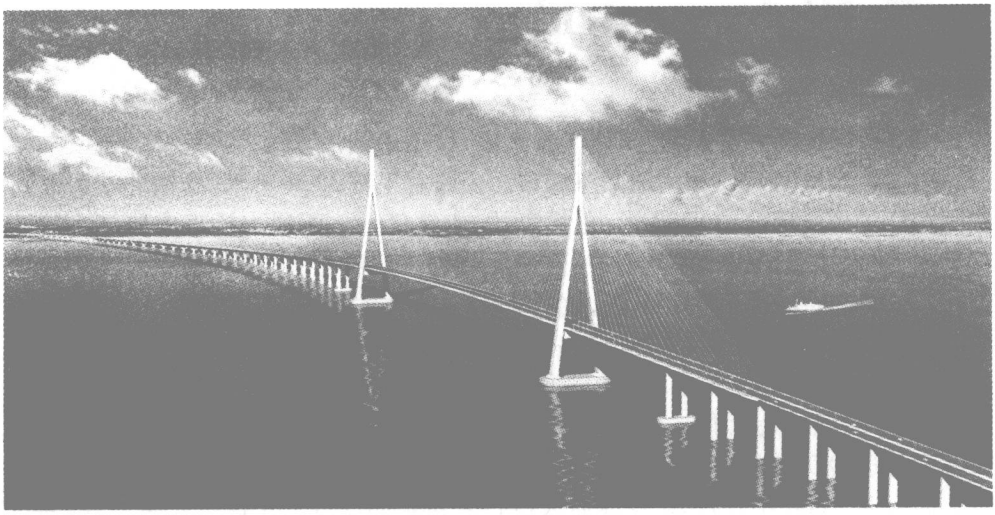
“嫦娥一号”的主要任务有：用 CCD 立体相机和激光高度计绘制完整的立体月球地图，从而获取覆盖全月面的地形图，有助于研究月球地质构造的演化，为未来登月地点的选择提供有用的参考数据；探测月球上的钛和铁等 14 种元素分布，并会利用成像光谱仪，测定造岩矿物，如橄榄石、辉石、斜长石等在月球表面的含量与分布情况；评估月球土壤厚度和氦-3 的资源量；监测月、地之间的空间环境，利用高能粒子探测器和太阳风探测器记录太阳风数据，以及太阳活动对月、地之间空间环境的影响。

2008 年 11 月 26 日，国家航天局正式发布经处理后的第一幅由“嫦娥一号”卫星传回的月面图像。2008 年 11 月 12 日，依据“嫦娥一号”卫星拍摄数据制作的中国第一幅全月球影像图正式公布。本次绕月任务将持续一年。

“嫦娥一号”是中国嫦娥工程的第一阶段任务，耗资 14 亿元人民币。第二阶段目标是研制和发射月球探测器。第三目标为发射月球采样返回器，嫦娥工程最终目标是在 2020 年实现载人登月。

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苏通长江公路大桥
Sutong Changjiang Highway Bridge



The Sutong Changjiang Highway Bridge (Sutong Bridge) is a cable-stayed bridge that spans the Yangtze River in the People's Republic of China between Nantong and Changshu, a satellite city of Suzhou, in Jiangsu Province. The highway is 32.4 kilometers long. Overall the bridge length is 8,206 metres (26,923 ft) and construction has been estimated to cost about 6.45 billion yuan RMB. Sutong Bridge can claim four worlds records. The largest main span (1088m): as far as main span is concerned, Sutong Bridge is 200m longer than that of Tatara Bridge in Japan; the highest pylon (over 300m); the deepest foundation (steel casing depth: 120m) and the longest stayed cable (580m). Construction began in June, 2003 and the bridge was linked up on June 18, 2007, one year ahead of schedule. The bridge was opened to traffic on May 25, 2008 and was officially opened on June 30, 2008. The completion of the bridge makes the commute between Shanghai and Nantong, originally completed through ferry route, shorten to about an hour. It brings Nantong one step closer to becoming an

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important part of the Yangtze River Delta economic zone, and has further attracted foreign investors into the city. The bridge is also pivotal in the development of poorer northern Jiangsu regions.



苏通长江公路大桥
Sutong Changjiang Highway Bridge

苏通长江公路大桥(简称苏通大桥)位于中国江苏省,该桥跨越长江,连接苏州(常熟)和南通两座城市。公路总里程32.4千米(含南北端引道),实际跨江的桥梁部分约8200米,总投资约64.5亿元。苏通大桥将由跨江大桥工程和南、北岸接线工程三部分组成,建成后将创造四项世界纪录:世界跨度最大的斜拉桥,斜拉桥主孔跨度1088米,比日本多多罗大桥还长200米;世界最高桥塔,塔高300.4米,相当于100层楼房的高度;最深基础,苏通大桥主墩基础由131根长约120米、直径2.5米至2.8米的群桩组成,在40米水深以下厚达300米的软土地基上建起来的,是世界上规模最大、入土最深的群桩基础;最长拉索,苏通大桥最长拉索长达580米,为世界上最长的斜拉索。2003年6月开工,于2007年6月18日提前合龙,2008年5月25日苏通大桥投入试运行,6月30日正式通车,南通进入上海的一小时都市圈之内,成为长江三角洲区域经济的重要组成部分。苏州大桥的建设,对于完善国家公路网,打通我国东部沿海大通道,促进长江三角洲区域经济社会的协调发展具有战略意义。

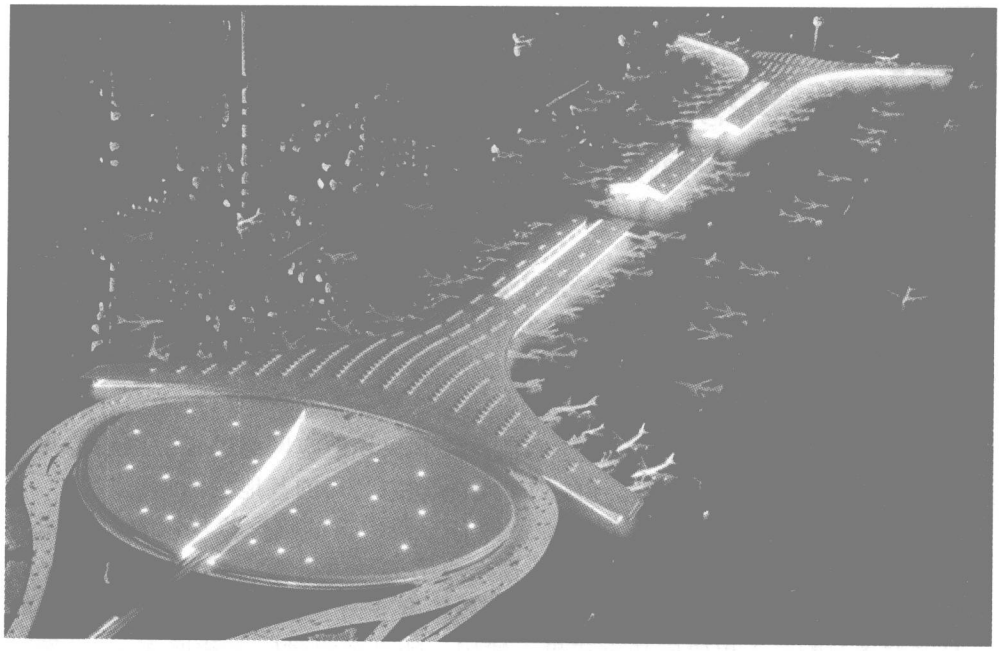


北京首都国际机场
Beijing Capital International Airport

Beijing Capital International Airport is located in northeast of Beijing, capital of the People's Republic of China, and 25.35km from the Tiananmen Square, to the north-east of the Beijing city-center. It is not only an aviation

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gateway of Beijing and a window for international communication, but also a radial center for China civil aviation network, featured in a large-scale international airport, with most important location, biggest scale, fullest facilities and busiest transportation in China.



Beijing Capital International Airport is the only airport that consists of three terminal buildings in China. Beijing Airport was opened on March 2, 1958. The airport then consisted of one small terminal building, which still stands to this day, apparently for the use of VIPs and charter flights. On January 1, 1980, a newer, larger building opened, with 60000 square meters of space. The terminal (T1) was larger than the one in the 1950s, but by the mid-1990s, it was too small. Terminal 2 (T2) was officially opened on November 1, 1999, with 336000 square meters of space. Terminal 1 was then closed for renovation after the opening of Terminal 2 and was reopened on September 20, 2004.

The third colossal expansion, including Terminal 3 (T3), a third runway and a rail link to the city-center, was completed before August, 2008, in time for the Beijing Olympics. At its opening with a south-to-north length of 2900 meters, Terminal 3 was the largest man-made structure in the world in terms of area covered (986, 000 ㎡), and a major landmark in Beijing representing the growing and developing

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Chinese city. Fresh from hosting the 2008 Olympic Games and completion of its new terminal building, the Beijing Capital International Airport has overtaken Tokyo Haneda to be the busiest airport in Asia based on scheduled seat capacity.



北京首都国际机场
Beijing Capital International Airport

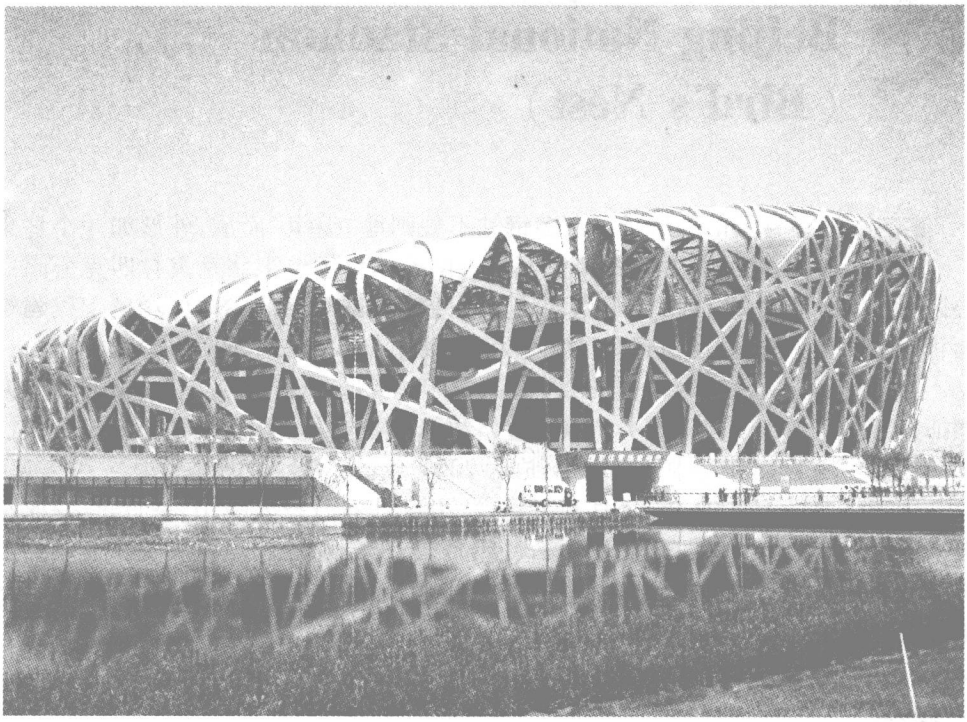
北京首都国际机场简称首都机场，是中华人民共和国北京市的主要的国际机场。北京首都国际机场位于北京市区东北方向，距离天安门广场25.35千米。中国地理位置最重要、规模最大、设备最齐全、运输任务最繁忙的大型国际航空港。北京首都国际机场不但是中国首都北京的空中门户和对外交往的窗口，而且是中国民航最重要的航空枢纽，是中国民用航空网络的辐射中心。并且是当前中国最繁忙的民用机场。也是中国国际航空公司的基地机场。

北京首都国际机场是中国国内唯一拥有三条跑道的国际机场。首都机场于1958年3月2日投入使用，是中国首个投入使用的民用机场。当时仅有一座小型候机楼，主要用于VIP乘客和包租的飞机。1980年1月1日，面积为6万平方米的一号航站楼及配套工程建成并正式投入使用。随着客流量的不断增大，一号楼客流量日趋饱和。重新规划的建筑面积达33.6万平方米，装备先进技术设备的二号航站楼于1995年10月开始建设，并于1999年11月1日正式投入使用。二号航站楼投入使用的同时，一号航站楼开始停用装修。2004年9月20日，整修一新的一号航站楼重新投入使用。

为迎接2008年北京奥运会的召开，首都机场进行了第三次扩建，包括3号航站楼、第三条跑道和机场到北京市区的北京机场轨道交通线。扩建工程于2008年8月之前全部建成投入使用。三号航站楼建成后是国内面积最大的单体建筑，总建筑面积98.6万平方米，南北向长2900米。扩建后的北京首都国际机场成为代表北京成长和发展的地标，北京奥运会的召开和3号航站楼的建设也使得北京首都国际机场取代东京国际机场（羽田）成为亚洲飞机起降最为繁忙的机场。

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北京国家体育场(鸟巢)
Beijing National Stadium (Bird's Nest)



Beijing National Stadium (the "Bird's Nest"), is the centerpiece of the Olympic Green in Beijing, China. The stadium was designed for use throughout the 2008 Summer Olympics and Paralympics. The "Bird's Nest", with the building area of 258,000 ㎡, has room for 91,000 spectators, but the capacity will be reduced to 80,000 after the Olympics. In 2001, after Beijing had been awarded the right to host the 2008 Summer Olympics, the city held a bidding process to select the best arena design. The "nest scheme" design, joint venture by architects Jacques Herzog and Pierre de Meuron of Herzog & de Meuron and Li Xinggang of China Architecture Design and Research (CADG), was approved by as the top design and became official in 2003.

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Ground was broken in December 2003 and the stadium officially opened in June 2008. Beijing National Stadium hosted the Opening and Closing Ceremonies, athletic events, and football final of the 2008 Summer Olympics and the 2008 Summer Paralympics. Though designed for track &field events of the Olympics, the stadium will continue to host sporting events, such as football, afterwards. It is one of the most important public space in Beijing and the landmark sports architecture.



北京国家体育场(鸟巢)
Beijing National Stadium (Bird's Nest)

国家体育场的外形是以众多钢铁不规则地"编织"而成,外形如一个鸟巢般,因此又称为"鸟巢"体育场。国家体育场位于北京奥林匹克公园中心区,为2008年第29届奥林匹克运动会和残疾人奥运会的主体育场。工程建筑面积258,000平方米,场内观众坐席约为91000个,其中临时坐席约11000个。

在2002年,北京市规划委员会举办了2008年北京市奥运会主场馆的全球方案征集活动。由瑞士建筑事务所赫尔佐格和德梅隆与中国建筑设计研究院合作设计的"鸟巢"在众多作品中脱颖而出,成为2008年北京奥运会的主场馆。

国家体育场于2003年12月开工建设,2008年6月投入使用,举行过2008年夏季奥运会和2008年残奥会的开幕式、闭幕式、田径及足球比赛决赛。奥运会后将成为北京市民广泛参与体育活动及享受体育娱乐的大型专业场所,并成为具有地标性的体育建筑和奥运遗产。

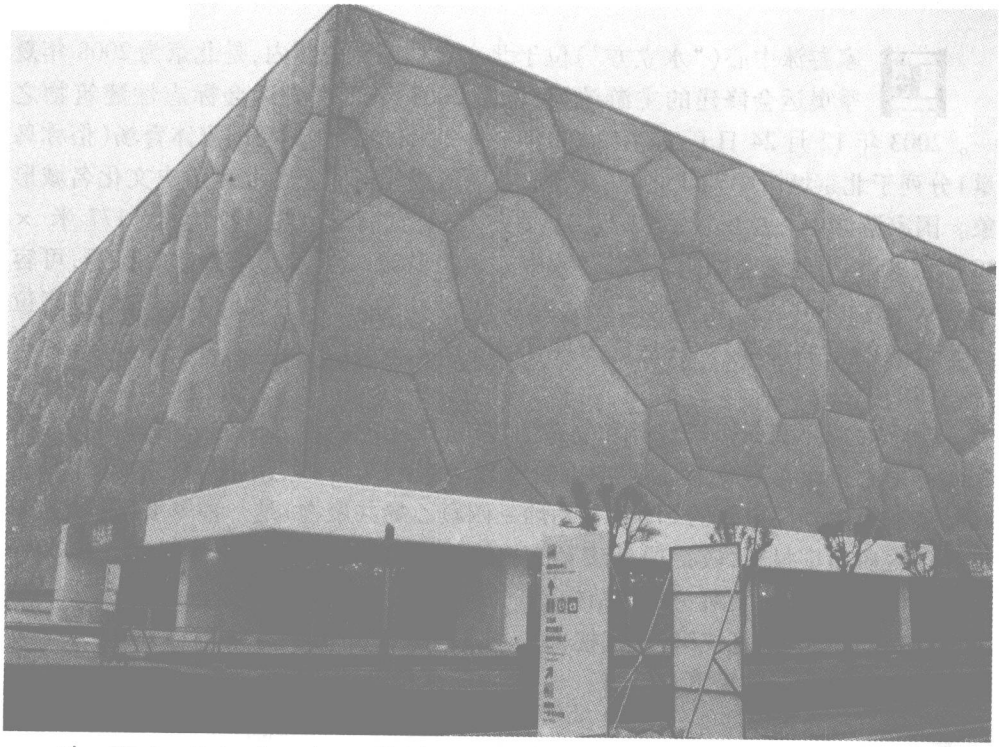


国家游泳中心(水立方)
National Aquatics Center (Water Cube)

The Beijing National Aquatics Center (the Water Cube), is an aquatics center that was built alongside Beijing National Stadium (the "Bird's Nest") in the Olympic Green for the swimming competitions of the 2008 Summer O-

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lympics. It is one of the landmark buildings in Beijing. Ground was broken on December 24, 2003, and the Center was completed and handed over for use on January 28, 2008. The Aquatics Center hosted the Swimming, Diving and Synchronized Swimming events during the 2008 Olympics with a capacity of 17000 seats that is being reduced to 6000. It also has a total land surface of 79532 ㎡. Although called the Water Cube, the aquatic center is really a rectangular box (cuboid) -177 meters square and 30 meters high.



The Water Cube is a beautiful but complex building that can give people inspiration and enthusiasm. The outer wall is based on the Weaire-Phelan structure, a structure devised from the natural formation of bubbles in soap foam. The complex Weaire-Phelan pattern was developed by slicing through bubbles in soap foam, resulting in more irregular, organic patterns than foam bubble structures. The ETFE cladding allows more light and heat penetration than traditional glass, resulting in a 30% decrease in energy costs. Comprising a steel space frame, it is the largest ETFE clad structure in the world with over 100000 m^2 of over 3000 ETFE pillows that are only 0.2 mm (1/125 of an inch) in total thickness. The Water Cube is really a magic architecture.

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国家游泳中心(水立方)
National Aquatics Center (Water Cube)

国家游泳中心("水立方")位于北京奥林匹克公园内,是北京为2008年夏季奥运会修建的主游泳馆,也是2008年北京奥运会标志性建筑物之一。2003年12月24日开工,在2008年1月28日竣工。其与国家体育场(俗称鸟巢)分列于北京城市中轴线北端的两侧,共同形成相对完整的北京历史文化名城形象。国家游泳中心总建筑面积79532平方米,长宽高分别为177米×177米×30米。2008年奥运会期间,国家游泳中心承担游泳、跳水、花样游泳等比赛,可容纳观众坐席17000座,其中永久观众坐席为6000座,奥运会期间增设临时性座位11000个(赛后将拆除)。赛后成为具有国际先进水平的、集游泳、运动、健身、休闲于一体的中心。

"水立方"不仅是一幢优美和复杂的建筑,她还能激发人们的灵感和热情。国家游泳中心表面看是一个三维立体结构,设计灵感来自肥皂泡的自然构造。采用在整个建筑内外层包裹的ETFE膜(乙烯-四氟乙烯共聚物)是一种厚度还不足0.2毫米的轻质新型材料,较普通玻璃具有更有效的热学性能和透光性,可节省30%的能源消耗,而且还会避免建筑结构受到游泳中心内部环境的侵蚀。"水立方"整体建筑由3000多个气枕组成,气枕大小不一、形状各异,覆盖面积达到10万平方米,堪称世界之最,创意真是奇特。

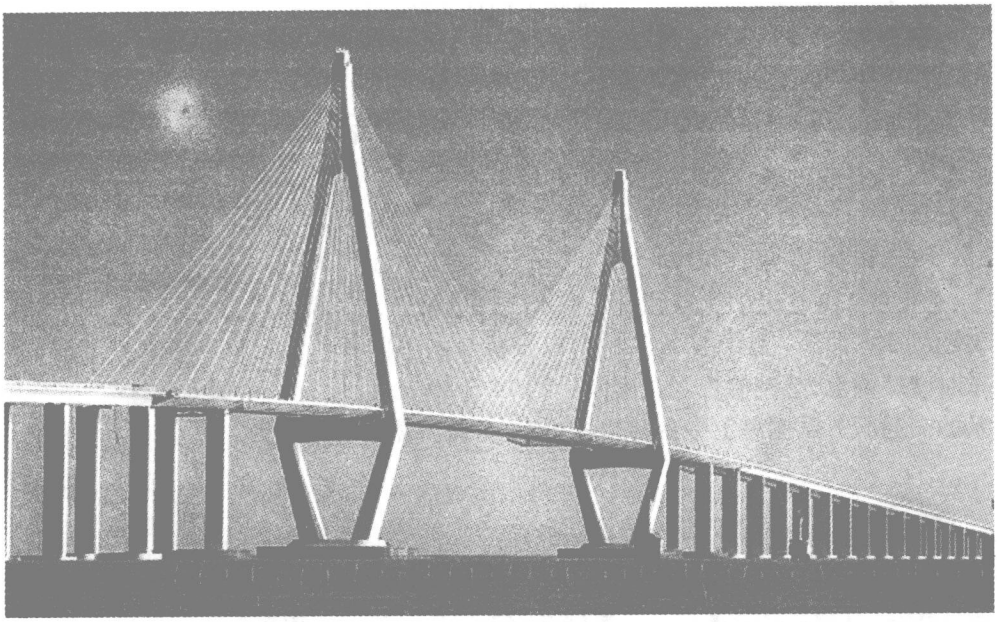
杭州湾跨海大桥
The Hangzhou Bay Bridge

Hangzhou Bay Bridge (36 kilometers' long) is a bridge across Hangzhou Bay off the eastern coast of China. It connects Haiyan in Jiaxing city and Cixi of Ningbo city in Zhejiang Province. The bridge is the longest trans-oceanic bridge in the world, one of the masterpieces of modern architecture.

The bridge underwent various feasibility studies for a decade before it was fi-

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nally approved in 2002. Construction of this bridge started on June 8, 2003. The opening ceremony was held on June 26, 2007 with great domestic media publicity, though after the opening ceremony, the bridge would only be used for test and evaluation purposes. It was opened to the public on May 1, 2008. The bridge reduces the previously trip from Ningbo to Shanghai by 120km and alleviates the congested Huhang Highway and Hangyong Highway.



The bridge has six expressway lanes in two directions. The designated speed is 100 kilometres per hour, and the designed longevity is more than 100 years. The total investment on the bridge was RMB 11.8 billion. The bridge is shaped in an "S", and the length of the bridge is decorated with flashing lights of different colors so that to distract from drowsiness, and keep attention on the road instead. This is also the real reason for "S" shape. There will be a service centre on this expressway. Mid-way through the bridge, a service island will be built for cars to turn off the road for rest, food, and a wide-range of services. The island is actually a platform resting on piers.

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杭州湾跨海大桥
The Hangzhou Bay Bridge

杭州湾跨海大桥是一座横跨中国杭州湾海域的跨海大桥，南起宁波慈溪，北至嘉兴海盐，全长36千米。杭州湾跨海大桥是世界上最长的跨海大桥，是世界建桥史上的一项创举和奇迹。

杭州湾跨海大桥2002年经国家计委批准立项，2003年6月8日奠基，2007年6月26日全线贯通，2008年5月1日建成通车。通车后从浙江宁波到上海的陆路距离缩短了120千米左右，大大缓解已经拥挤不堪的沪杭和杭甬高速公路的压力。

大桥桥宽33米，为双向六车道。设计时速100千米，设计使用寿命100年以上，总投资118亿元。为兼顾杭州湾水文环境特点，“长桥卧波”的设计将大桥平面勾勒成S形曲线，优美、活泼的桥型以及桥身的不同颜色让司机和乘客在驾车、乘车时减缓倦意，感到愉悦。在离南岸约14千米处，设计有一个面积达1.2万平方米的交通服务救援海上平台，同时也是一个旅游休闲观光平台。

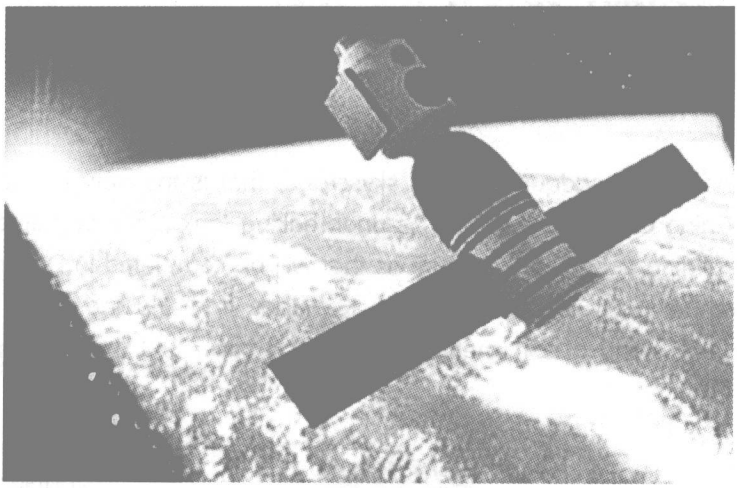


神舟七号载人航天飞船
Shenzhou VII Spacecraft

The Shenzhou VII spacecraft, as China's third manned mission, was launched on a LM-2F launch vehicle at 21:10 on September 25, 2008. It will be the first to carry a full complement of three astronauts, Zhai Zhigang, Liu Boming and Jing Haipeng. At 16:30 on September 27, 2008, Chinese astronaut Zhai Zhigang opened the hatch of the Shenzhou 7 spacecraft and went outside. Zhai, who became China's first-ever space walker, waved to the camera at this historic moment. For his 20 minute space walk, Zhai wore a Chinese-made Feitian suit, which is being highlighted as the first indigenous space suit. Liu Boming who did not actually exit the craft, wore a Russian-made Orlan space suit. With the successful space walk, China has become the third country, after the United States

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and Russia, to do so. At 17:37 September 28, 2008, the Shenzhou VII spacecraft landed in Inner Mongolia Autonomous Region.



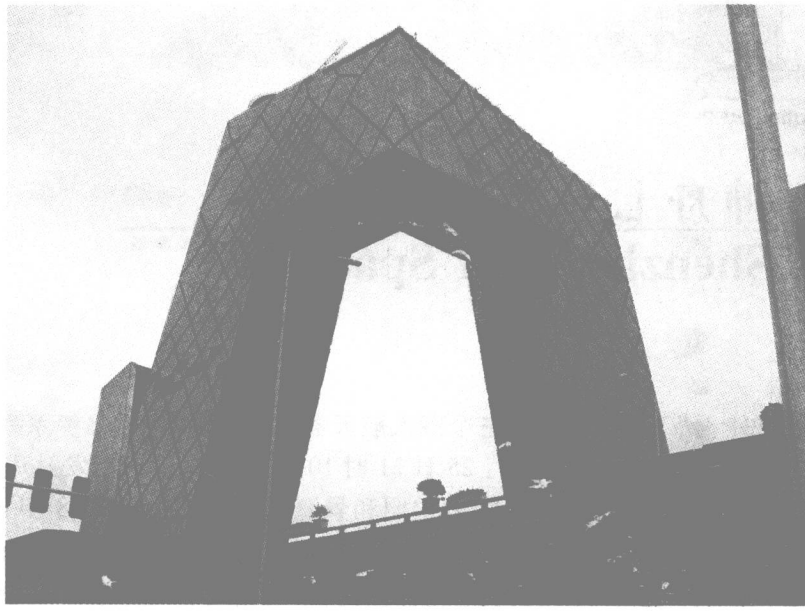
神舟七号载人航天飞船
Shenzhou VII Spacecraft

“神舟七号”飞船是中国第三个载人航天器，是中国神舟号飞船系列之一，在北京时间2008年9月25日21时10分由长征2F火箭发射升空。神七上载有三名宇航员分别为翟志刚、刘伯明和景海鹏。北京时间2008年9月27日16点30分，景海鹏留守返回舱，另外两人分别穿着中国制造的“飞天”舱外航天服和俄罗斯出品的“海鹰”舱外航天服进入“神舟七号”载人飞船兼任气闸舱的轨道舱。翟志刚出舱作业，刘伯明在轨道舱内协助，实现了中国历史上第一次的太空漫步，令中国成为第三个有能力把太空人送上太空并进行太空漫步的国家。飞船于北京时间2008年9月28日17点37分成功着陆于中国内蒙古四子王旗。

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央视大楼
CCTV Headquarters

The CCTV Headquarters is a skyscraper that is the new headquarters of China Central Television. Groundbreaking took place on September 22, 2004. The building is built in two sections that will be completed in December 2007 and in December 2008 respectively. Rem Koolhaas from Holand is the architect. The building will stand at 234 metres tall and will cover 550 thousand m^2 of floor space.



The main building is not a traditional tower, but a continuous loop of five horizontal and vertical sections, creating an irregular grid on the building's facade with an open center. Because of its radical shape, it has acquired the nickname dà kùchā, translated into English as "Big Underpants" or "Big Shorts". The construction of the building is considered to be a structural challenge.

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央视大楼
CCTV Headquarters

中央电视台总部大楼位于北京东部 CBD，设计师：雷姆·库哈斯（荷兰）。2004 年 10 月正式开工建设，此工程 B 标段将先一步于 2007 年年底前竣工，2008 年初交付使用，这亦将作为北京奥运转播中心和今后中央电视台节目制播中心。A 标段于 2008 年年底竣工，2009 年交付使用，此标段主要是电视文化中心、管理中心，地处中央商务区核心地带，总建筑面积约 55 万平方米，最高建筑 234 米。

主楼建筑外形就像是一只被扭曲的正方形油炸圈；两座竖立的塔楼向内倾斜，倾角很大；塔楼之间被横向的结构连接起来，总体形成一个闭合的环，有人称之为“大裤衩”。它被认为是世界上设计最激进的建筑。

南极考察
Antarctic Science Inspection

On November 19, 1984, the Chinese first Antarctic science inspection team started on a journey to Antarctica by the oceanographic research ship “Xiangyanghong-X” from the Port of Shanghai. The expedition consisting of 591 members from all over China, covered a voyage of 26433.7 sea miles and this journey lasted 142 days. The members of the Chinese Antarctic Expedition carried out scientific research on biology, geology, physiognomy, upper-atmospheric physics, seismology, meteorology, mapping and marine science as well as making routine observations on such subjects as human medicine and environmental science, etc. Chinese Antarctic Great Wall Station was built on Feb. 20, 1985, located at the southern tip of King George Island in the Shetland Islands of West Antarctica at 62°12′59″S, 58°57′52″W. Chinese Antarctic Zhongshan Station built on Feb. 26, 1989, is located at the Larsemann Hills of Princess Elizabeth Land, East Antarc-

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tica at 69°22′24″S, 76°22′40″E. China is planning to set up a third station at the summit of Dome A, Antarctica, during 2008 ~ 2010.



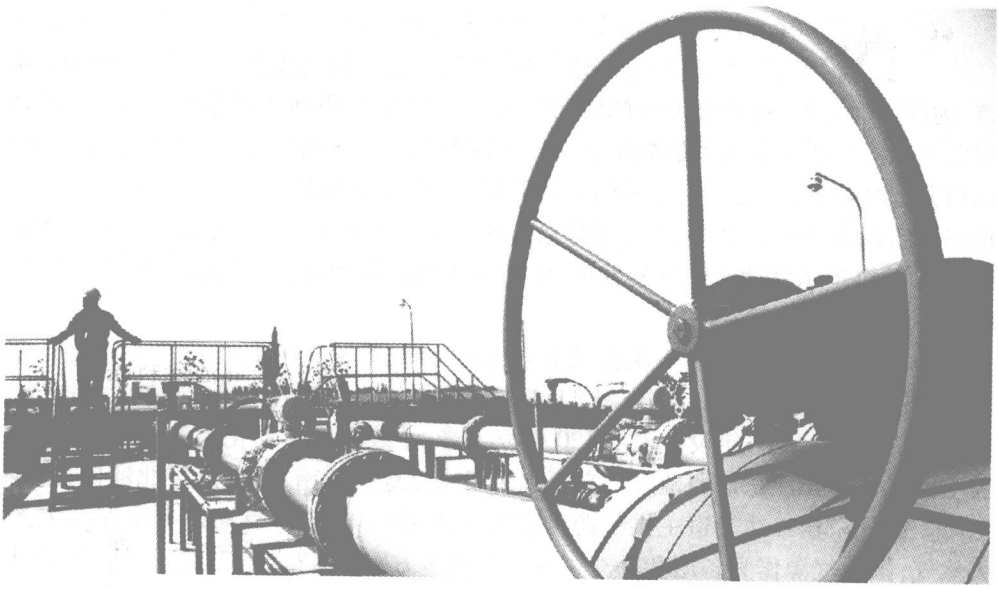
南极考察
Antarctic Science Inspection

1984 年 11 月 19 日，中国南极考察委员会派出的第一支南极考察队从上海乘“向阳红 10 号”出发，赴南极洲和南太平洋进行综合性科学考察。这支考察队由来自全国 591 人组成。考察活动历时 142 天，航程 26433.7 海里。考察队进行了生物、地质、地貌、高层大气物理、地震、气象、测绘和海洋科学等领域的考察及医药和环境状况的多学科调查。1985 年 2 月 20 日，中国首次在南极洲南端得兰群岛的乔治王岛上建成中国第一个南极科学考察基地——中国南极长城站，站址在南纬 62°12′59″，西经 58°57′52″处。1989 年 2 月 26 日，又在东南极大陆拉斯曼丘陵上建成中国第二个科学考察基地——中国南极中山站，其坐标为南纬 69°22′24″、东经 76° 22′40″。中国从 2008 年起开始在南极内陆冰盖建立第三个南极科学考察站，计划 2010 年建成。

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西气东输
West-to-East Gas Diversion Project

The West-to-East Gas Diversion Project, as well as the "West-to-East Electricity Transmission," and the "South-to-North Water Diversion" is the government's key national strategic project, aimed at realigning overall economic development and achieving rational distribution of national resources across China. There is a natural gas storage of 26,000 billion m^3, occupying 87% of the national storage, in Tarim Basin, Qaidam Basin, and Szechwan Basin, etc. gas fields in Western China, among which Tarim Basin in Xinjiang Uygur Autonomous Region has the capacity of 8,000 billion m^3, 22% of the national storage. The discovery of the natural gas reserves in Tarim Basin made China the fourth largest gas country after Russia, Qatar and Saudi Arabia.



The launch of the West-to-East Gas Diversion Project was passed in February,

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2000. It is the landmark project of the Great Western Development Strategy in China. The first phase of the West-to-East Gas Diversion Project includes a 4,200km trunk pipeline running from Lunnan in Tarim Basin to Shanghai, conveying natural gas to central China, Eastern China and the Yangtze River delta zone. Finished in 2004, it is expected to have a capacity of 12 billion m^3 annually. The second phase of the Project, operated by PetroChina, will have a designed gas capacity of 30 billion m^3 annually and the construction will begin in 2008. This second pipeline will be mainly supplied by Turkmenistan and Kazakstan, the Central Asia-China gas pipeline. The third pipeline is designed to convey a joint gas supply from Russia and Xinjiang to the Yangtze River Delta and the Pearl River Delta.



西气东输
West-to-East Gas Diversion Project

“西气东输”与“西电东送”、“南水北调”并称为中国三大国家重点建设工程。实施西气东输工程，有利于促进我国能源结构和产业结构调整，为西部大开发、将西部地区的资源优势变为经济优势创造了条件，对推动和加快西部经济发展具有重大的战略意义。我国西部地区的塔里木、柴达木、陕甘宁和四川盆地蕴藏着26万亿立方米的天然气资源，约占全国陆上天然气资源的87%。特别是新疆塔里木盆地，天然气资源量有8万多亿立方米，占全国天然气资源总量的22%。塔里木盆地天然气的发现，使我国成为继俄罗斯、卡塔尔、沙特阿拉伯等国之后的天然气大国。

2000年2月国务院第一次会议批准启动“西气东输”工程，是拉开西部大开发序幕的标志性建设工程。从新疆至上海的西气东输一线管道2004年建成投产，线路全长约4200千米，年设计输量120亿立方米；全线采用自动化控制，供气范围覆盖中原、华东、长江三角洲地区。它西起塔里木盆地的轮南，起点是塔北油田，东至上海。西气东输二线管道主供气源为引进土库曼斯坦、哈萨克斯坦等中亚国家的天然气，国内气源作为备用和补充气源。据初步方案，西气东输二线干线管道设计输气规模300亿立方米/年，计划2008年全线开工，拟由中国石油独资建设，2010年建成通气。规划中的第三条天然气管道，路线基本确定为从新疆通过江西抵达

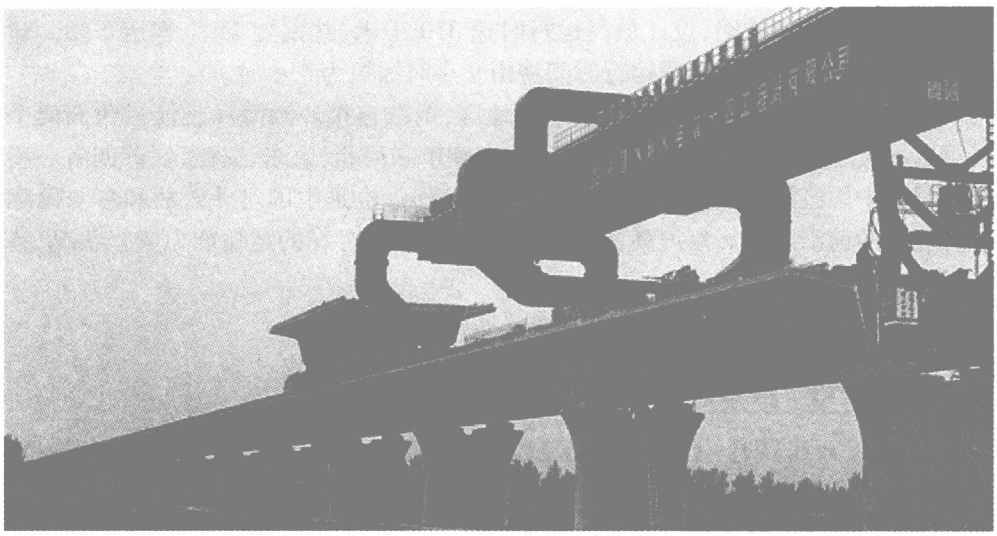
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福建，把俄罗斯和中国西北部的天然气输往能源需求量庞大的长江三角洲和珠江三角洲地区。



京沪高速铁路
Beijing-Shanghai High-speed Railway

The Beijing-Shanghai High-speed Railway is one of China's plans for high-speed trains. Construction started on April 18, 2008, and is planned to be finished in 2013. It will be 1,318 kilometers long and will be the longest single-phase high-speed railway ever built in the world. With 21 stops, its top speed is expected to be 350 km/h (220 mph), cutting Beijing to Shanghai travel time from 9 hours to 5 hours.



The high-speed railway between Beijing and Shanghai, running through the municipalities of Beijing, Tianjin and Shanghai and the four provinces of Hebei, Shandong, Anhui and Jiangsu, connects two large economic areas of China: the Bohai rim economic sphere and the Yangtze River economic zone. As growing eco-

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nomic bases with rapid development, these areas are not only the driving force for China's economic development, but are also at the forefront of China's opening-up and participation in international economic competition. When completed, the high-speed railway, to be devoted to passenger transport, will ease the traffic pressure between Beijing and Shanghai.



京沪高速铁路
Beijing-Shanghai High-speed Railway

京沪高速铁路是预定在中国北京市与上海市之间兴建的一条高速铁路客运专线，与现有京沪铁路大体平行，正线全长约 1318 千米。该工程已于 2008 年 4 月 18 日正式开工，预计 2013 年投入运营。京沪高速铁路是《中长期铁路网规划》中投资规模最大、技术含量最高的一项工程，也是我国第一条具有世界先进水平的高速铁路，设计最高运行时速 350 千米，共设置 21 个客运车站。建成后北京南－上海虹桥全程运行时间将由 9 小时缩短为 5 小时。

京沪客运专线位于中国华北和华东地区，两端连接环渤海和长江三角洲两个经济区域，全线纵贯北京、天津、上海三大直辖市和河北、山东、安徽、江苏四省。所经区域是中国经济发展最活跃和最具潜力的地区，也是中国对外开放和参与国际经济竞争的前沿阵地。京沪高铁建成后，京沪间长期存在的运输能力紧张状况，将在根本上得到解决。

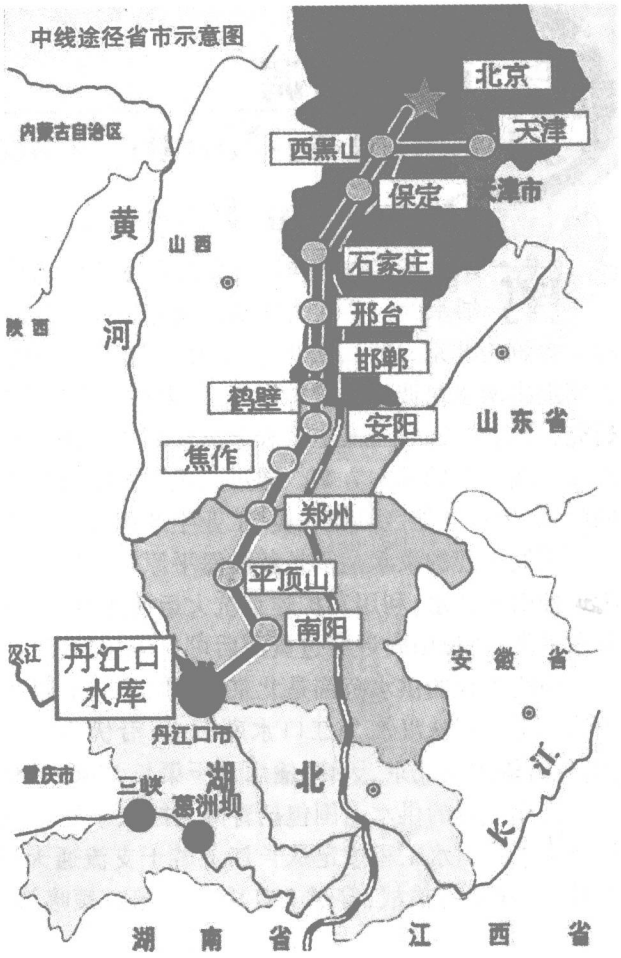


南水北调
South-to-North Water Diversion Project

China's south-to-north water diversion project, to bring relief to China's drought-ridden north by diverting water from the Yangtze River, is another mammoth water conservancy scheme larger even than the Three Gorges Pro-

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ject. The late chairman Mao Zedong first proposed the idea of the diversion project in 1952, intending the ambitious scheme to ease the growing water shortages in the cities of Beijing and Tianjin and the northern provinces of Hebei, Henan and Shandong. The south-to-north water diversion project, a result of 50 years of investigation and research, aims to divert water from the Yangtze River valley to the reaches of Yellow River, Huaihe River and Haihe River so as to ensure the water supply for farming, industry and life in northern China. The project will have three water diversion routes, namely the eastern route, middle route and western route.



The eastern route is expected to supply Shandong Province and the northern part of Jiangsu, linking Shandong with the Yangtze River and bringing water north to the Huang-Huai-Hai Plain via the Beijing-Hangzhou Grand Canal. Diverted from a major branch of Yangtze River, near Yangzhou city, the water will travel along existing river channels to the Weishan mountains of Shandong, before crossing the Yellow River via a tunnel and flowing to Tianjin.

The central route diverts water from the Danjiangkou reservoir on the Han River via new canals near the west edge of the Huanghuaihai Plain to flow through Henan and Hebei Provinces to Beijing-a diversion route totalling some 1,246km in length. The nearby city of Tianjin will also draw water from the trunk line near Xushui in Hebei Province.

Construction of the western route—which involves working on the Qinghai-Tibet

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Plateau-between 3,000m ~ 5,000m above sea level—will involve overcoming some major engineering and climatic challenges. Once completed in 2050, the project will bring water from three tributaries of the Yangtze— the Tongtian, Yalong and Dadu rivers-nearly 500km across the Bayankala Mountains and then on to northwest China.

The project was formally launched in 2002. Once it is completed in 2050, about 38 billion to 48 billion cubic meters of water will be transferred yearly to the areas with a population of 300 million.



南水北调
South-to-North Water Diversion Project

南水北调工程是我国优化配置水资源的重大举措，是解决华北、西北地区缺水的一项战略性基础设施工程。此工程的规模和难度都超过三峡工程。为解决北京、天津、河北、河南和山东日益严重的缺水状况，自 1952 年毛泽东主席提出南水北调工程设想以来，广大科技工作者持续进行了 50 年的勘测、规划、研究，分别在长江下游、中游和上游规划了三条调水线路，形成了南水北调东线、中线和西线调水的基本方案。通过三条调水线路与长江、黄河、淮河和海河四大江河的联系，为华北地区供应农业、工业生产用水及生活用水。

东线工程的供水范围是黄淮海平原东部地区。东线调水工程从长江下游扬州附近抽引长江水，利用和扩建京杭大运河逐级提水北送，经洪泽湖、骆马湖、南四湖和东平湖，在位山附近穿过黄河后可自流，经运河到天津。

中线工程的供水范围是北京、天津、华北平原及沿线湖北、河南两省部分地区。中线调水工程从汉江丹江口水库引水，沿伏牛山和太行山山前平原，京广铁路西侧，自流输水到北京、天津，输水总干渠长 1246 千米。

西线工程的供水范围包括青海、甘肃、宁夏、内蒙古、陕西和山西六省(区)。西线调水工程引水工程拟定从长江上游干支流通天河、雅砻江、大渡河调水，克服施工难、气候差的挑战，穿过 500 多千米的巴颜喀拉山进入位于黄河上游的西北地区。

南水北调工程在 2002 年正式开工，预计在 2050 年全部完工后每年可解决 3 亿人口 380 亿到 480 亿立方米的用水问题。

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[General Information]
书名=用英语说中国：科技
作者=王德军
页数=272
SS号=12364100
DX号=000006796126
出版日期=2009.10
出版社=上海科学普及出版社

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