爱上科学
Science

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爱上科学

INTRODUCING • 科技与发明系列

INTRODUCING TO INVENTION AND TECHNOLOGY

军事与安全

MILITARY AND SECURITY 双语版

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内容提要

《爱上科学》系列科普丛书为读者全面地讲述了科学知识和原理，以通俗的文字、生动的图表为特色，每本书介绍一个或几个主题。从日常生活中有趣的现象出发，引导和培养读者学习的兴趣，扩宽读者的视野，同时还可以帮助读者学习英语词汇、练习英语阅读。丛书涵盖物理、化学、生物、科技与发明4个系列。适合对科学知识感兴趣的广大科普爱好者阅读。

本书是科技与发明系列中的一本。科技与发明系列主要介绍各种科技成果以及相关发明，覆盖多个领域，包括建筑、交通、医学、军事、能源以及航空航天等，指导读者认知和学习各种科学技术，拓宽视野，引发思考，提高创新能力以及发明意识。

本书展示各种各样的军事武器，包括传统军事武器、现代军事武器、核武器、陆地装甲武器、海上军事武器、空间军事武器等，同时和介绍了各类锁和钥匙，详尽的介绍了它们的外观、原理以及各自的特点。书中含有“科学词汇”栏目，提取每章重点知识词汇。同时还有“试一试”栏目，包含丰富有趣的家庭小实验，有助于提高大家的动手能力。

丛书编委会

丛书序

这是一个科技新时代，我们曾经认为遥不可及的科学，时刻围绕在我们身边。你是否曾经怀疑过所谓的“2012，世界末日”，或者好奇过在地下高速飞驰的地铁，抑或每天都在关注着PM2.5……这说明科学已然走进了你的生活。学习科学，分享科学，爱上科学，让我们共同聆听来自科学的声音。

《爱上科学》系列科普丛书是一套引进版系列科普丛书，译自英国大型出版商棕熊图书（BROWN BEAR BOOKS）有限公司出版的著名科普图书《Facts At Your Fingertips》，其独特的科学解读视角、生动的科普画面、优美的图文设计，得到了欧洲读者的青睐，尤其是得到了欧洲青少年的极大欢迎。本丛书为读者全面地讲述了各个领域的基础科学知识和基本事实，以精彩的主题、通俗的文字、生动的画面为特色，从我们身边的素材和现象出发，激发和培养读者学习的兴趣。

丛书涵盖物理、化学、生物、科技与发明四大系列。物理系列阐释和说明了物理学知识及其发展史，包含对物理学发展史许多重大的物理发现以及著名的物理学家的介绍。化学系列主要阐释现代化学的基本概念，涵盖化学反应、有机化学、生物化学、金属、非金属、分子、原子、物态等多方面内容。生物系列主要阐释生命科学的基本概念，并探讨有关生物学的各个方面，包括植物学、微生物学、动物和人类、遗传学、细胞生物学以及生命形式等。科技与发明系列主要介绍各种科技成果以及相关发明，覆盖多个领域，包括建筑、交通、医学、军事、能源以及航空航天等，指导读者认知和学习各种科学技术，拓宽视野，引发思考，提升创新能力以及发明意识。

本丛书还具有中英双语的独特设计，让读者在阅读中文时，能对照性地阅读英语原文，为他们提高科学领域的英文阅读能力以及扩展科学类英语词汇量提供了很好的帮助。

丛书中还有“试一试”栏目，该栏目包含了丰富有趣的家庭小实验，为大家在生活实践中验证科学知识提供了更多的选择。

学无止境，让我们一起爱上科学！

目录 CONTENTS

WARFARE BEFORE THE CIVIL WAR

Wars have been fought over the control of land for as long as people have walked the Earth. In every battle, the ingenuity and effectiveness of a force 's weapons can make the difference between winning and losing.

The first battles were probably fought with hunting implements such as as spears and stone daggers. The earliest weapon to be designed specifically for the purpose of warfare is thought to be the club, or mace. The earliest maces, made at the beginning of the Bronze Age (10,000 B.C.), consisted of a stone attached to a wooden handle, and were designed to crush the skull of an enemy. In the third millennium B.C. advances in metalworking allowed some mace heads to be made of copper, and the greater density of the metal transformed the mace into a more effective weapon.

As offensive weapons grew more advanced, so did defensive armor. By 2500 B.C. smiths from Sumeria (modern-day Iraq) were able to craft fairly sophisticated helmets out of bronze, and their effectiveness forced changes in the design of the mace. In response, the head of the mace became more oval in shape, so that the force of a blow was concentrated on a specific point, causing greater damage to the helmet. Gradually the mace evolved into the battleax. Unlike the mace, the ax was not merely reliant on its weight to inflict damage but used a cutting edge as well.

THE SAMURAI SWORD

The first iron swords were made about 3,200 years ago. Swords have taken many forms since then, but many believe that the art of the swordsmith reached its high point in the *katana*, the weapon of the Japanese samurai warriors. Before it was placed in a furnace, the katana's blade was coated in clay apart from the cutting edge. This unique process allowed the sword to combine extreme flexibility with a razor-sharp blade.

A samurai sword had one cutting edge that had to be cleaned and oiled regularly to prevent it from rusting and becoming blunt.

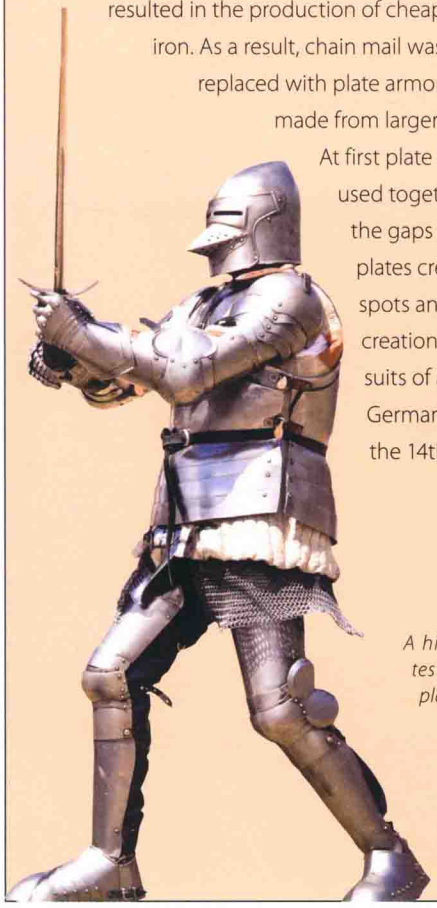
Primitive cutting blades were made from stone, such as this Native American arrowhead.

The ax remained the most important cutting-edge hand weapon until around 1200 B.C., when swords first began to be cast out of iron. While swords had been made before this date, they were cast from bronze, which could not be made into an effective strong, long, and sharp blade. It was only after the

Roman soldiers used the testudo—or tortoise—formation during sieges. The platoon is protected from attack from above and in front by the leather-covered shields.

ARMOR

As early as 1500 B.C. the Egyptians were making body armor by covering leather clothing with small pieces of bronze. The Assyrians were the first to use iron to make such armor. Greek artifacts from the 3rd century B.C. provide the earliest evidence of mail, flexible body armor made of small overlapping or linked metal pieces. There is some evidence that mail was used even earlier in Celtic Britain. By the 1100s A.D. suits of mail armor covered the entire body. Improvements in the metalworking skills of European armorers in the 13th century resulted in the production of cheaper and stronger iron. As a result, chain mail was gradually replaced with plate armor, which was made from larger pieces of metal. At first plate and mail were used together. However, the gaps between the plates created vulnerable spots and led to the creation of complete suits of armor in Germany and Italy in the 14th century.



A history enthusiast tests out fighting in plated armor.

人类开始在地球上行走以后，为了争夺土地，他们之间的战争就一直在持续。战争中，哪一方能够机智而高效地使用武器，往往成为其致胜的关键。

早期的战争中，很可能人们使用的是狩猎武器，如长矛或石匕首。后来出现了棍棒和石锤，人们一般认为这是最早的专门用于战争的武器。硬头锤最早出现在青铜器时代（公元前10000年左右）早期，是由一块石头绑在木棍上做成，可以击碎敌人的头盖骨。到了公元前3000年，随着冶金技术的进步，有些战锤的锤头开始是铜制的。金属的密度比石头大，因此战锤也就成为一种更加有效的武器。

随着进攻性武器的发展，防御性的盔甲也在进步。公元前2500年，苏美尔地区（现代伊拉克所在区域）的工匠已经能够利用黄铜制造出相当精美的头盔。这种头盔非常有效，迫使对手不得不改进战锤的设计。结果，锤头的形状越来越接近椭圆形，这样一来，在进行击打的时候，力量可以作用于一个点上，对头盔的伤害更大。渐渐地，战锤发展成了战斧。与战锤不同的是，斧子的威力不仅在于重量，还因为有锋利的斧刃。

日本武士刀

3200年前铁刀开始出现。从那时起，刀的外形一直在变化，但是很多人相信，日本武士刀将铸刀术发展到了极致。武士刀是日本武士的兵器。武士刀在淬火之前，在刀身上刀刃以外的部分要裹上一层粘土。这种独特的工艺使得武士刀一方面弹性极佳，另一方面它的刀刃又像刮胡刀般锋利。

武士刀的刀刃需要经常清洁并上油才能保证其锐利及光芒。

原始人的刃具是用石头打出来的，比如这支美洲土著所用的箭头。

公元前1200年左右，用铁锻造的刀出现，在这之前斧子一直都是最重要的手持带刃武器。然而，在那之前也有刀，但都是用青铜锻造的，刀刃不够坚硬、锋利，刀身也不够长。

古罗马士兵在攻城时采用龟甲形方阵阵型。这样，步兵可以受到包裹皮革的盾牌保护，使他们身体的正面和顶部可以免受敌人的攻击。

盔甲

早在公元前1500年，埃及人就造出了护甲。他们的护甲是皮革制的衣服，外面镶嵌铜片。亚述人则首先在护甲上使用了铁。有证据表明，公元前3世纪的时候，古希腊就有了最早的铠甲，这是一种非常柔韧的护甲，用层层相连的小金属片制成。也有证据表明，更早些时候，不列颠的凯尔特人就已经开始使用铠甲。

到公元1100年前后，已经出现了能够覆盖全身的成套铠甲。13世纪，随着欧洲的金属加工技术的进步，人们可以生产更加坚硬的铁并且价格便宜。于是，人们开始使用大片的铁皮制造出板甲，并逐渐替代了链甲。起初铁板和铁链混合使用，但是铁板之间的缝隙易受攻击，于是，14世纪的德国人和意大利人制造出全身铠甲。

一名历史爱好者在尝试穿戴板甲进行作战。

development of iron smelting that the sword came into its own. While its design changed repeatedly over the next 3,000 years, it was used successfully in battle right up until the late 19th century.

Slings and arrows

The sword, ax, and mace are all shock weapons, which are used in hand-to-hand combat. Equally important were missile weapons, which were used to attack the enemy from afar. The simplest of these was the sling, which consisted of two thongs attached to a pouch. A small stone or lead shot was put in the pouch. The thrower whirled the sling around his head before letting go of one of the thongs and launching the stone toward the enemy.

The most important missile weapon was undoubtedly the bow, which was first used for hunting around 30,000 B.C. Several

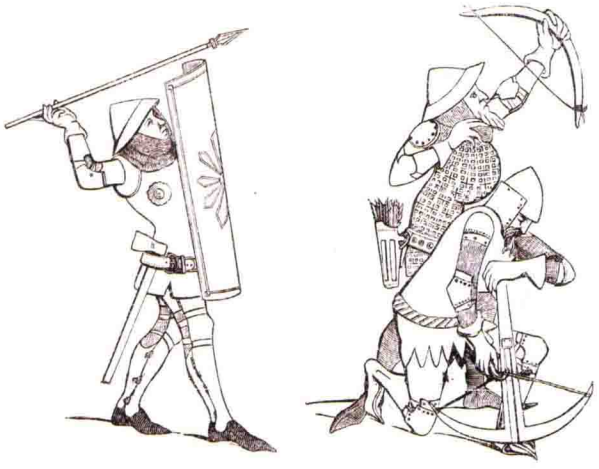
Although it is easy to construct, a slingshot was seldom deadly unless in the hands of an expert.

important technical developments have occurred during the course of its lengthy history. One of the most important of these was the introduction of the composite bow around 3000 B.C. The composite bow (made of a mixture of wood, animal

FACTS AND FIGURES

- The longbow was 6 ft (180 cm) long and could propel a 3-ft (90 cm) arrow 1,200 ft (365 m). A skilled archer could fire up to ten arrows in a minute. Arrows with hardened steel heads could penetrate plate armor and iron mail from 300 ft (90 m).
- The crossbow was 3 ft (90 cm) long and could propel a 1½-ft (45 cm) arrow 900 ft (270 m). A skilled archer could fire up to eight arrows in a minute.

Battleaxes could only inflict injuries when used in close combat—and within range of the opponent 's ax.



Missile weapons used in medieval warfare: the spear, bow, and crossbow.

sinew, and horn) continued to be a highly effective weapon until the Middle Ages, when it was used to devastating effect by the forces of Mongol conqueror Genghis Khan.

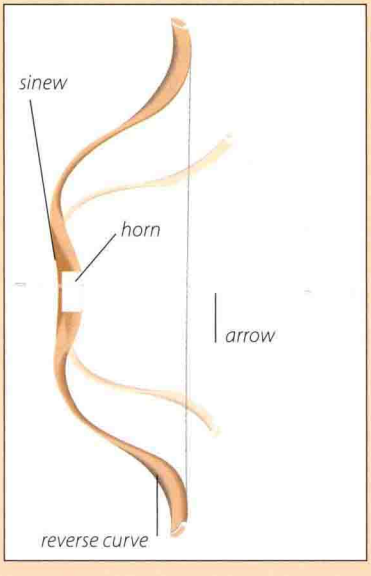
In the 12th century two further developments increased the potency of the bow as a weapon. The first was the rediscovery of the crossbow. The idea of placing a bow laterally across a wooden stock and fitting it with a mechanical winding mechanism and trigger was first explored by the Chinese in the sixth century B.C., but the design did not spread to Europe until 1,800 years later. The crossbow's winding system gave it enormous power, and its iron bolts were able to pierce even the strongest armor. However, the weapon did have its drawbacks, the most notable of which were a lack of accuracy and a limited range.

These problems were overcome by the Welsh longbow. The longbow was made from yew, a wood that possesses the qualities of a composite bow. Around 7 ft (2 m) in length, the longbow was extraordinarily powerful and extremely accurate. The use of the weapon by the English was a pivotal factor in their victory over the French at Agincourt in 1415.

THE COMPOSITE BOW

The effectiveness of the archer in battle was increased by the invention of the composite bow around 3000 B.C. This weapon had a long range and considerable penetration power.

Composite bows were made by binding animal sinews to the front and horn to the rear of a curved wooden stave. The outer arms of the bow bent away from the archer, forming a reverse curve. The power of the bow relied on stringing the bow so that the layers of horn and sinew were bent back toward the archer (stretching the sinews and compressing the horn); this built up extra tension, which propelled the arrow forward with a considerable amount of force.



Composite bows were small yet powerful and ideal for use on horseback.

只有后来随着冶铁技术的发展，刀才形成自己的风格。此后的3000多年里，尽管刀的外形一再变化，但一直到19世纪晚期刀还成功应用于各种战争中。

投石器和箭

刀、斧和长矛都是击打兵器，适用于肉搏战。还有一种重要的武器，那就是抛射兵器，主要用来袭击远处的敌人。最简单的抛射兵器是投石索，由两根绳子绑着一个小袋子构成。投郑人将小弹丸放入袋子里，抓住绳子绕头旋转，然后松开一根绳子，将石头投向敌人。

最重要的抛射武器无疑是弓，30000多年前，原始人进行狩猎的时候就开始使用弓了。在其漫长的使用过程中，人们对弓进行了好几次重要的技术革新，其中之一是在公元前3000年左右的时候制造出了复合材料的弓。

投石索虽然容易使用，但只有在行家手里才能置人于死地。

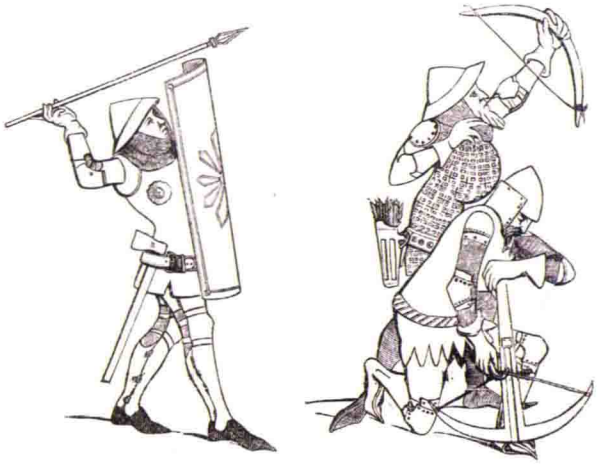
复合材料（木头、动物的筋和角材质的复合

事实与数据

长弓的长度可达6英尺（180厘米），能够将3英尺（90厘米）长的箭射出1200英尺（365米）。一名有经验的弓箭手可以在一分钟内射出十支箭。具有坚硬的铁箭头的箭能够从300英尺（90米）外穿透板甲和铁质链甲。

弩的长度为3英尺（90厘米），能够将一支1.5英尺（45厘米）的箭射出900英尺（270米）。一名有经验的弓弩手可以在一分钟内射出8支箭。

战斧只有在近身肉搏的时候才能造成杀伤，但这也在敌人战斧的攻击范围内。



中世纪战争中的抛射武器：投枪、弓和弩。

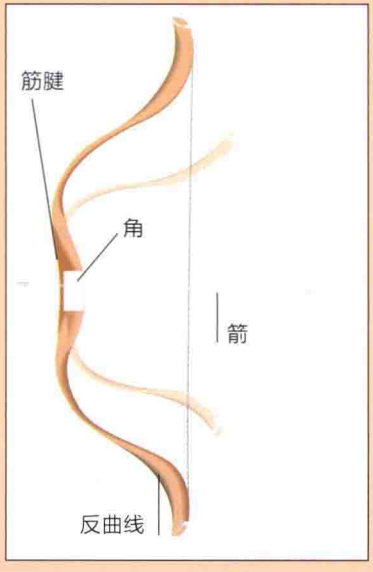
物）的弓直到中世纪都还是十分高效的武器，蒙古的成吉思汗的部队将这种弓的使用发挥到了极致。

12世纪的两项进步则进一步开发了弓的潜力。首先是弩的再次重视。公元前6世纪，中国人首先制造出一种武器，这种武器可以将弩弓固定在木质弩身上，并使用机械发条机构和扳机触发。但是直到1800年以后这种设计才在欧洲传播开来。弓弩的发条机构力量惊人，其铁质弩箭甚至能击穿最坚硬的盔甲。但是，这种武器也有缺点，最突出的就是准确度不高，射程也有限。

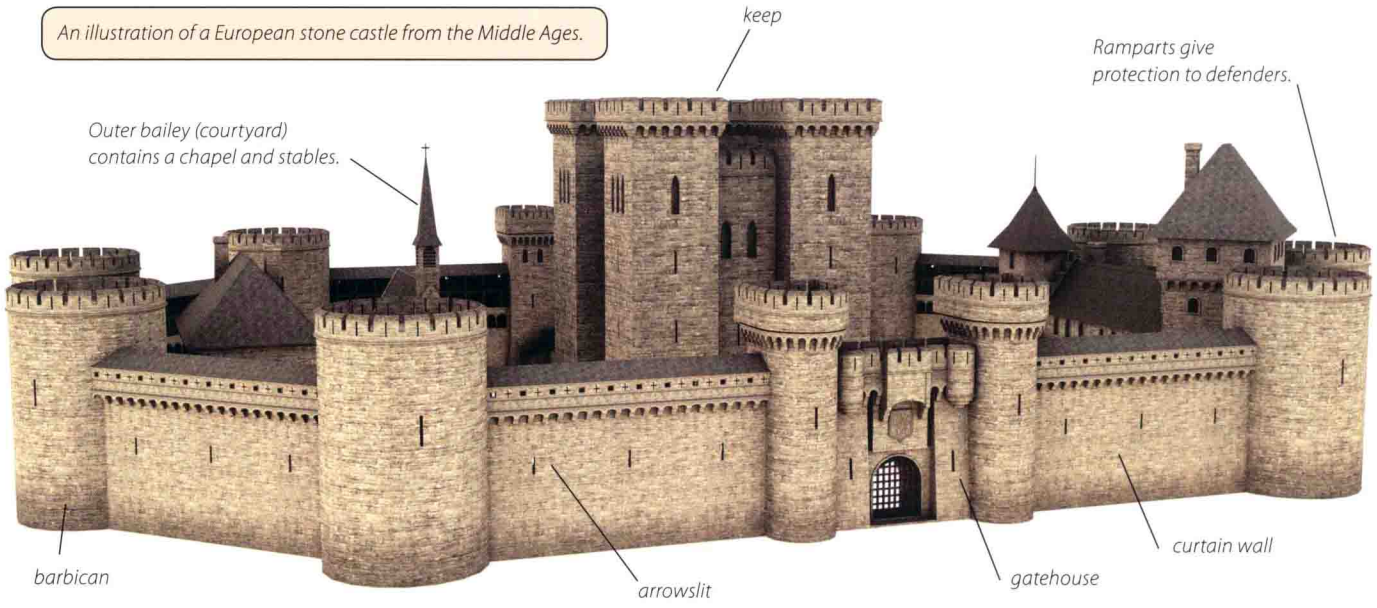
威尔士长弓则克服了这些缺点。这种长弓用紫杉木制造，这种木头具有复合弓的特质。弓长度约7英尺（2米），威力巨大而且极为准确。1415年的阿金库尔战役中，英国人之所以能够战胜法国人，就是因为使用了这种武器。

复合弓

复合弓发明于公元前3000年左右，此后弓箭手在战争中的作用大大提高。这种武器射程远，穿透力极强。复合弓的木条前面绑着动物的筋腱，后面则绑着动物的角。弓背向弓箭手反方向弯曲，呈反曲线形。弓箭的力量来源于弓箭手拉动弓弦的时候，动物的角和筋腱向弓箭手方向弯曲（扩张筋腱，挤压角）而产生的力。这样产生的额外张力，会以惊人的力量将箭射出。



复合弓尺寸不大但力道十足，是在马背上使用的理想武器。



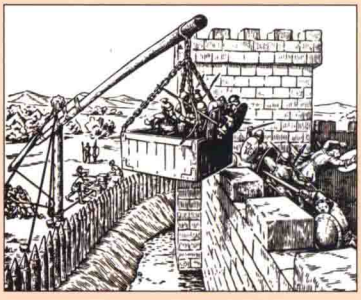
Fortifications and siege warfare

People began putting defensive walls around their homes and settlements tens of thousands of years ago—fortifications have been found at Jericho in the Middle East that date back to around 8000 B.C. Until 900 B.C. attacking armies lacked a reliable way of assaulting stone forts and surrounded them instead, forcing the occupants to come out fighting or surrender from starvation. Around that time, however, the Assyrians (from present-day Iraq) developed techniques to attack forts. They relied on machines such as the battering ram. Built on a six-wheeled wooden frame and covered by protective plates of leather, the Assyrian battering ram had a turret for observation and defensive fire.

The Assyrians were also prepared to go over the walls by using scaling ladders and by constructing ramps. Mantelets (large shields sometimes mounted on wheels) protected advancing soldiers from archers within the fort.

ATTACKING A CASTLE

When the Greek ruler Alexander the Great invaded Persia (now Iran) and India between 336 and 323 B.C., his engineer Diades invented a machine called the crow. This was a long, heavy bar suspended from a vertical frame that was used to knock down the upper parapets of a wall. Diades also invented another siege weapon called the telenon. It was a box large enough to hold a number of men that was slung from a boom suspended from a vertical frame. The basket could be raised or lowered and was used to place soldiers directly onto the enemy 's walls.



Attacking soldiers use a telenon to get over the castle ramparts.