chapter four

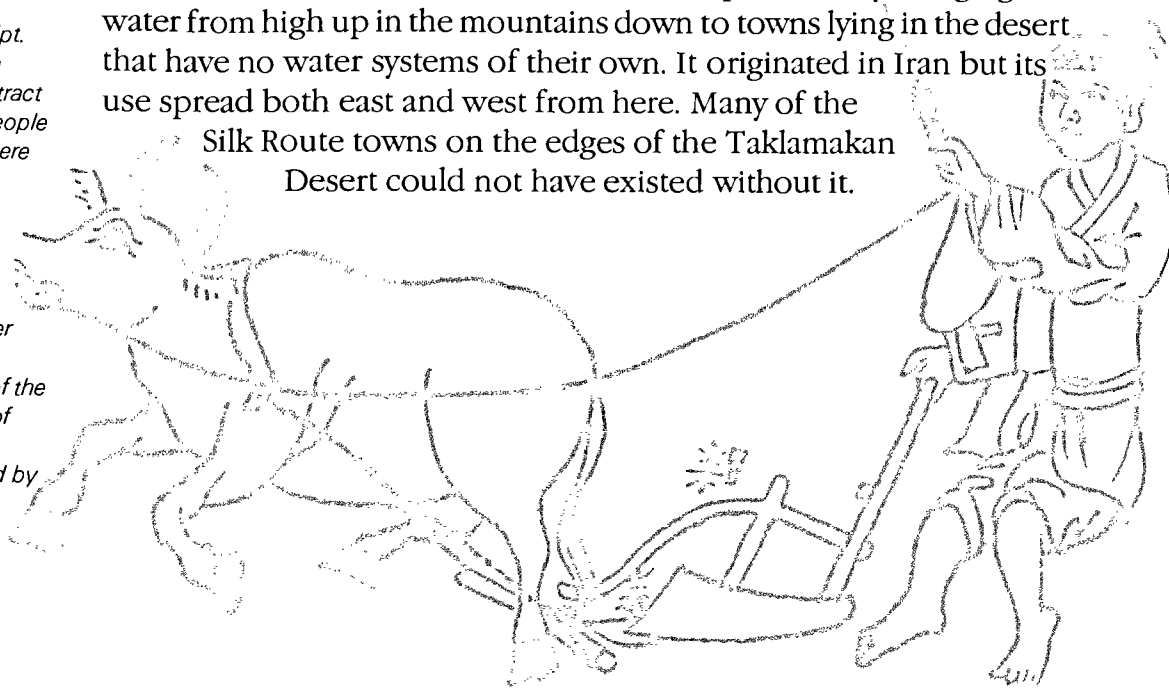
Producing the Goods

Food for All

However safe the routes the merchants travelled, trade would have been impossible without the goods to sell. On both a local and international scale, farming produce, that is, food, formed a core part of the trade and alongside this there was exchange in agricultural knowledge and techniques. By way of the trade routes, China gained new crops, such as grapes, cucumbers and tea, while to the West came rice, pears and even roses.

The dry climatic conditions of many parts of Asia have always demanded every conceivable means of making the maximum use of the available water. This is particularly true of much of the Islamic world and water irrigation is one of the most developed technologies in the whole of Muslim civilization. In this, the Muslims were heirs to the experience and techniques of the Sasanians, ancient Egyptians and Romans. Ancient methods of raising, storing and distributing water were developed and extended by the Muslims, old irrigation systems were repaired and new ones built. They made use of the ancient *qanat* system, still in use today in Iran, Syria, Oman and the Xinjiang region of western China. This is an extremely sophisticated underground canal system which avoids evaporation by bringing water from high up in the mountains down to towns lying in the desert that have no water systems of their own. It originated in Iran but its use spread both east and west from here. Many of the Silk Route towns on the edges of the Taklamakan Desert could not have existed without it.

▲ *Illustration from a 13th Century Persian manuscript. Cattle turn a wheel which works a mechanism to extract water from the ground. People gather round the pool where the water pours out.*



► *A Chinese farm labourer ploughing a field, from a Chinese farming manual of the 17th Century. A number of features from the Chinese plough were later adopted by the Europeans.*

◄ *Page from a Persian book on agriculture, dating to 1199. It shows various agricultural scenes, including plants being harvested and grain being winnowed.*

Later, in the Seventeenth Century, a great deal of technological information on China and Southeast Asia, including farm tools and agricultural books, was brought back to Europe by merchants and scientists. Of particular importance in this area were the Christian Jesuit missionaries who established their first mission in Beijing at this time. The Jesuits were keen observers of many things, apart from religion, and were scientifically trained, some in astronomy and others in engineering, botany and agriculture. They sent back much information on a wide range of subjects to European countries, including a series of albums illustrating Chinese agriculture and tea production.

This growing awareness of the farming methods and implements of the Far East inspired some of the innovations made in Northern Europe during the Seventeenth and Eighteenth Centuries in what has become known as the agricultural revolution. For example, it is very likely that the design of the modern European plough followed that of the Chinese plough, using a light wooden frame and iron to make the curved mouldboard. It was this tool that did so much to transform farming and food production in Northern Europe.

▼ *(right) Engraving of 1667 of a Jesuit priest called Father Adam Schall. The Jesuits were often trained in many sciences and passed much new information to the West.*

▼ *(left) Aerial view of a system of underground water channels* (qanats) *still in use in many Asian countries today. This is an ancient but very sophisticated method of irrigation.*

▲ *1st Century CE Roman stone relief. It shows workmen shaping metal vessels in their workshop.*

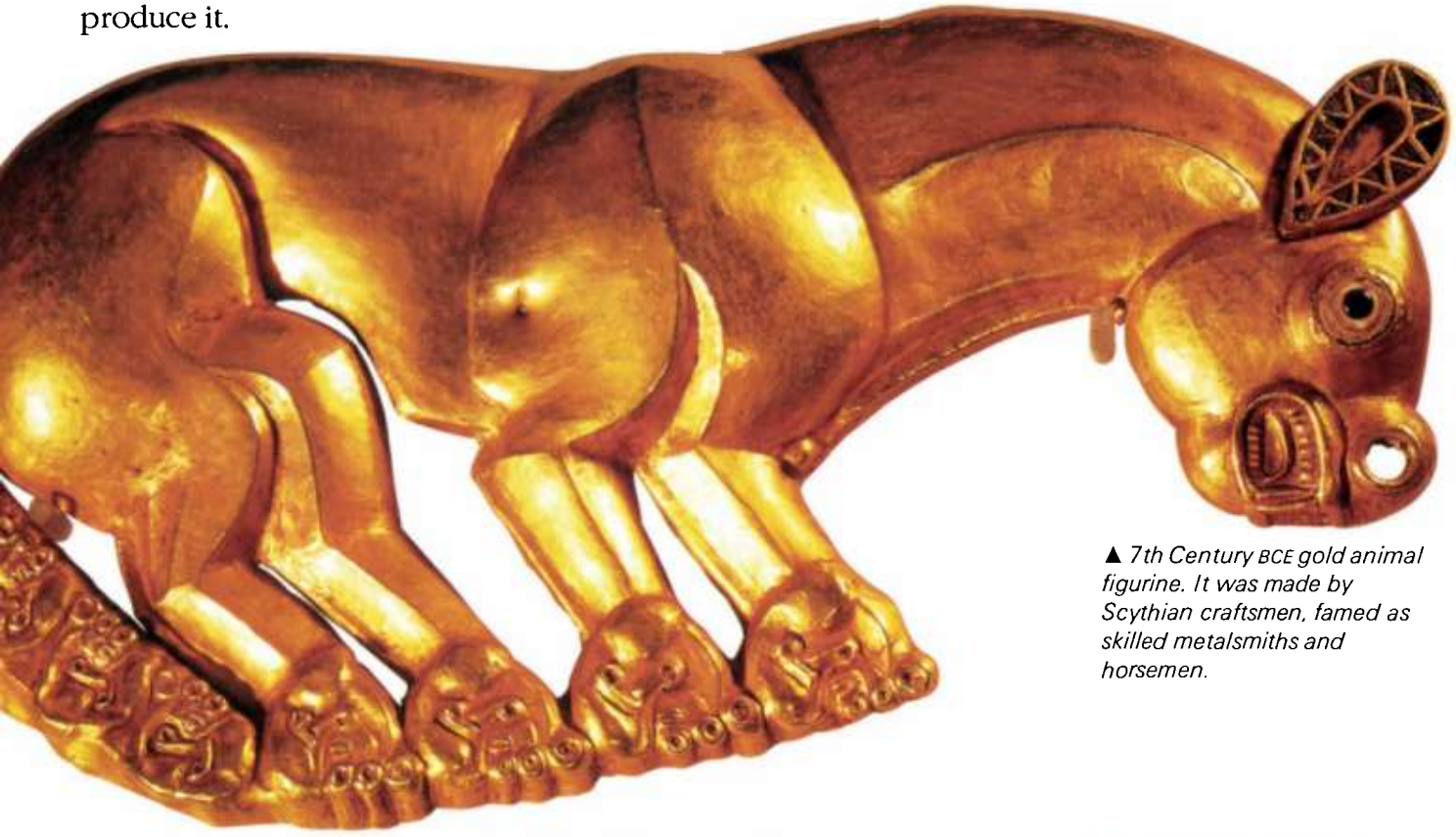
The Mystery of Metals

Metals, whether shaped into coins, jewellery or plates and bowls, were an important item of trade between East and West. The skills of the metalsmith were legendary and often associated with magic and alchemy (see page 38). Patiently and persistently he learned his art by trial and error, passing on his specialized knowledge over thousands of years by example and word of mouth. He was the possessor of a mysterious knowledge that could transform dull lumps of rock into dazzling metals.

▲ *Two illustrations from* De re metallica *by Georgius Agricola (1494-1555). This was a famous work on mining and metallurgy and these two scenes show the roasting of metal ores.*

Metals occur either on their own in an uncombined state, such as gold, or in a mixture of minerals called ores. Pure metals like gold probably attracted people's attentions first because of their glitter. They can be shaped simply with a hammer and an anvil. The ancient Egyptians regarded gold as the 'body of the gods' and had an insatiable appetite for it. Metals in ores, however, need to be processed in two stages. Firstly, the metal is extracted from its ore by smelting. Secondly, the metal needs to be worked up into objects that can be used. Molten or liquid metal can be poured into moulds and the cooled and hardened metal shape then finished by hammering.

The technology and skills needed to process metals first appeared in the Middle East at the beginning of the Fourth Millenium BCE. From there the knowledge of working metals spread westwards to Europe and eastwards to Afghanistan and then India. It is likely that it was passed on further eastwards to China and Southeast Asia. This spread east and west came about either through migrating peoples bringing with them the new skills, or through travelling metalsmiths and traders who introduced new metals and new techniques for working it. For example, during the Seventh Century CE, the Sogdians, a people of Central Asia heavily involved in trade, introduced to the Chinese finely-wrought chain mail armour along with the necessary skills to produce it.

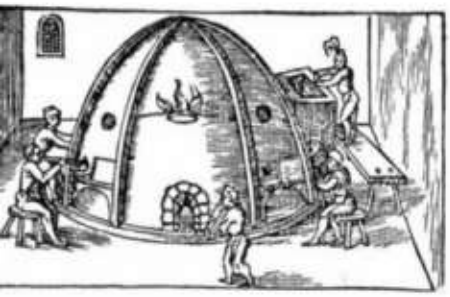


▲ *7th Century BCE gold animal figurine. It was made by Scythian craftsmen, famed as skilled metalsmiths and horsemen.*

Living on the northern paths of the Silk Route, the nomadic peoples of the Eurasian Steppe had a strong tradition of working metal. Their wealth needed to be easily portable so ornaments and jewellery made of precious metal were ideal forms for it to take. The style of this metalwork reflected their knowledge and interest in animals, particularly horses, and also those civilizations which they traded with, such as the Chinese, Persian and Greek. The Scythians, a nomadic people who occupied an area north of the Black Sea from the Eighth to Fourth Centuries BCE, are particularly famous for the spectacular gold ornaments and implements they made. It is possible that they achieved such remarkable standards of workmanship partly through contact with Greek traders around the Black Sea.

▲ *A smithy in Iran today. Two metalsmiths are hammering the heated metal before shaping it.*

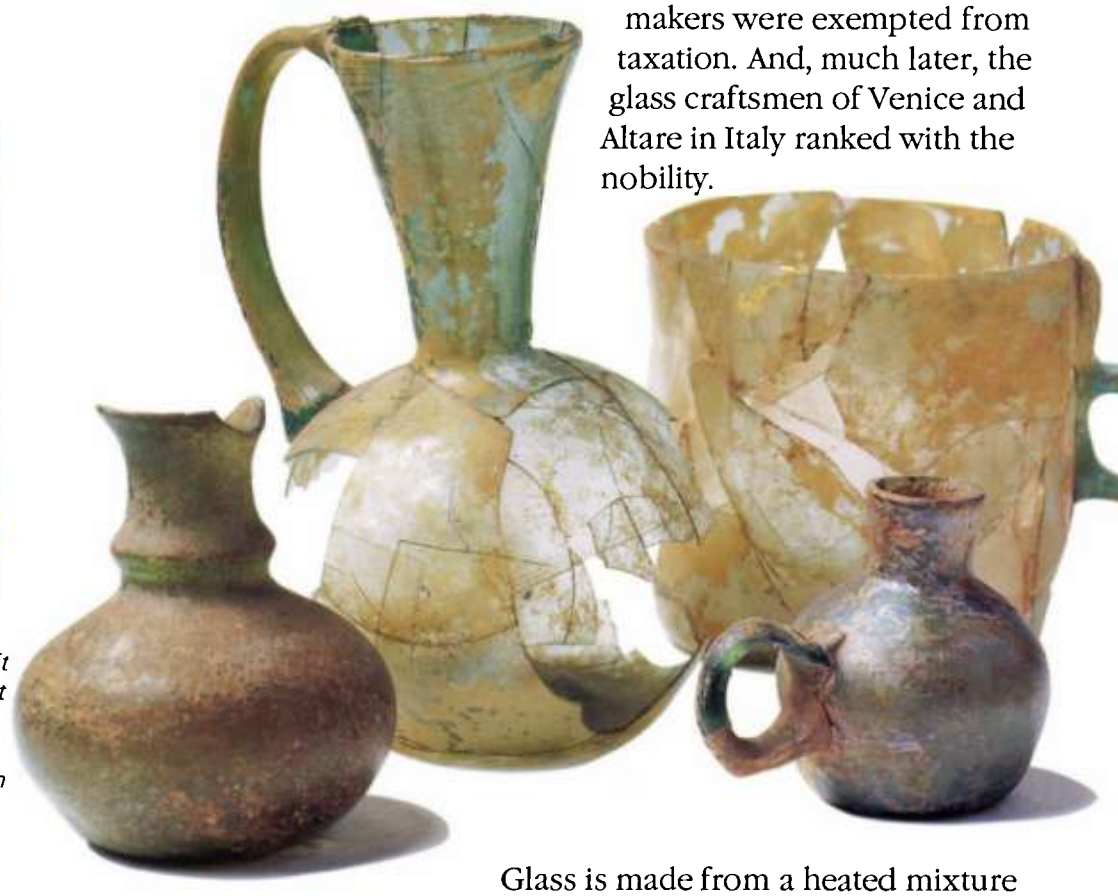
Glass and Ceramics



▲ *Engraving of a Venetian glass furnace. From* De la Pirotechnica *by Vannoccio Biringuccio, 1540. The ingredients are being heated until molten and then blown into shapes.*

'Glass is one of the most noble things which man hath at this day for his use upon the earth.' So wrote Antonio Neri, the author of the first modern book on glassmaking, published in Florence in 1612, and this opinion has been shared for thousands of years as glass was traded along the Silk and Spice Routes. For example, the glassmakers of Rome were given a special street where they could practise their art. In the Byzantine period glassmakers were exempted from taxation. And, much later, the glass craftsmen of Venice and Altare in Italy ranked with the nobility.

▲ *Glass-blowing follows the same methods today as when it was introduced in the mid-1st Century* BCE.



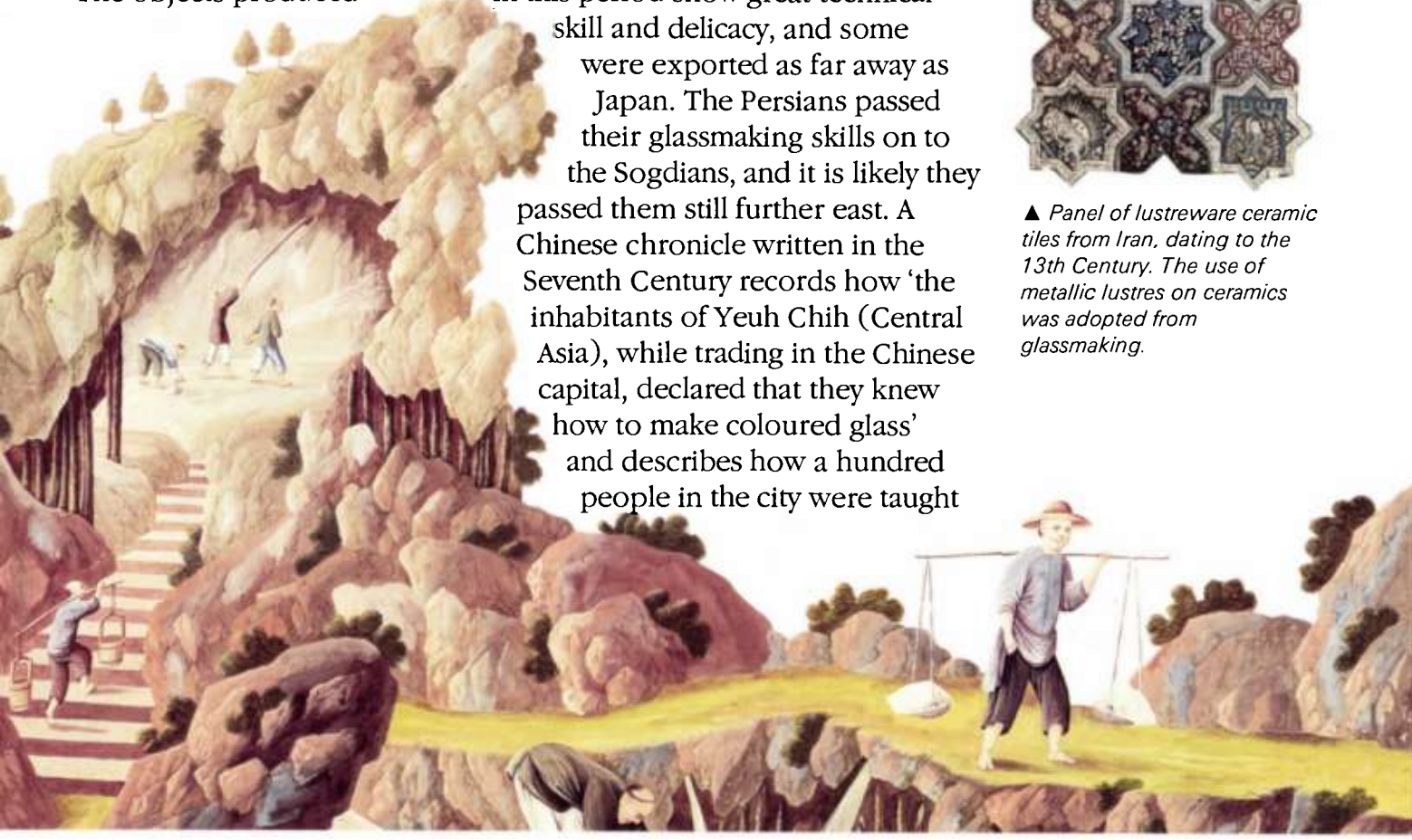
► *A selection of Sogdian blown glass vessels, dating from the 8th Century* CE.

Glass is made from a heated mixture of silica (usually sand, flint or quartz), and a flux (usually potash or soda), with lime added to make the glass stronger. These ingredients are placed in crucibles in a furnace where they are heated so that they fuse and become a molten liquid. Coloured glass can be made by adding metallic oxides.

Inheriting skills from Syria and Egypt, Roman glass production became a major industry from the First Century BCE, as a result of the expansion of the Roman Empire and the growth of its trade network. This was partly the result of the discovery made in the

mid-First Century BCE in Syria that glass can be blown like a bubble. Before this, glass had always been moulded. The new method enabled craftsmen to produce a whole range of vessels of different shapes and sizes which before had only been possible in metal and clay.

For a time following the collapse of the Roman Empire the production of glassware in Europe went into decline. But under the Sasanian emperors of Persia (224-651), glass production improved. The objects produced in this period show great technical skill and delicacy, and some were exported as far away as Japan. The Persians passed their glassmaking skills on to the Sogdians, and it is likely they passed them still further east. A Chinese chronicle written in the Seventh Century records how 'the inhabitants of Yeuh Chih (Central Asia), while trading in the Chinese capital, declared that they knew how to make coloured glass' and describes how a hundred people in the city were taught how to manufacture it, leading to a great reduction in prices.



▲ *Panel of lustreware ceramic tiles from Iran, dating to the 13th Century. The use of metallic lustres on ceramics was adopted from glassmaking.*

▲ *Early 19th Century illustration showing the collection of kaolin clay in China. It was this fine white clay which enabled the Chinese to first produce porcelain.*

China's glass production may have owed a debt to the West, but in ceramics the situation was reversed. By 900 the Chinese had produced kilns where the temperature was high enough (1450°C) to make delicate porcelain and they were soon exporting it to Western Asia. The effect was dramatic and Islamic potters strove to produce such high quality ware. They did not succeed, but made other innovations instead: they developed the use of a tin glaze, which gives a good white background for painting, imitating Chinese porcelain. They also evolved the use of metallic lustres on pottery, a technique borrowed from the glassmaker. And it was the export of the blue pigment of cobalt from Iran to China in the Twelfth Century that enabled the Chinese to produce their famous blue and white porcelain ware.

Spinning and Weaving

▲ *Nomads from Uzbekistan in Central Asia proudly display one of their hand-embroidered cloths.*

Spinning fibres to produce yarn and then weaving it into cloth or carpets are basic processes that have been practised since the very earliest times. There does not seem to have been any particular pattern in the development of the equipment used in this craft. Availability of materials, population growth and the resulting increase in demand, many different climates and all the other factors which control the development of civilizations played their part.

Spinning is the process of drawing out and then winding or twisting the textile fibres into a continuous thread. Various types of hand-held spindle for doing this were developed among ancient civilizations. However, the spinning-wheel came into use as a development of the hand-spindle and represents a great step forward in textile

► *Illustration from the Luttrell Psalter of 1338. It shows the spinning and carding (combing) of wool, and is the earliest European record of a spinning wheel in use.*

manufacture. It provides a good example of the movement of textile technology from East to West. It probably had its origins in China and derived from the machinery used for processing silk fibres. A single continuous strand of silk runs for several hundred metres, and the silk-weaving industry in China obviously needed a silk-winding machine that could deal with these extremely long fibres.

The silk industry was operating in China from at least the Fourteenth Century BCE, although it was probably many centuries

after that date that the spinning-wheel was developed. It is possible that spinning-wheels were introduced to Europe by Italian merchants and missionaries who travelled to China during the rule of the Mongol Yuan dynasty (1280-1368 CE). The earliest picture of a spinning-wheel in Europe appears in the Luttrell Psalter in England, dated to 1338. But the spinning-wheel may have been introduced much earlier to Europe by the Arabs during their period in Sicily and Spain. They may have taken it along with their knowledge of silk manufacture.

Weaving is the main operation in the production of textiles and is carried out on a loom. The basic principle is to interlace one set of threads (known as the warp) at right angles through another set of threads (known as the weft). The framework of the loom holds taut the length-wise warp threads, while the cross-wise weft thread is woven in.

Silk, woollen and cotton cloth are woven in this way, with variations in technique to allow for the different qualities of threads, as are flat-woven rugs and carpets, such as the kilim. However, pile carpets are made by knotting lengths of yarn onto threads strung on a vertical loom. From the earliest times, weavers practised their craft along the trade routes, refining their art and developing their designs, as they compared their work to the cloth and carpets brought in by foreign trade.

► *A Turkoman woman spinning wool on a spindle. This is the simplest and most ancient method of spinning wool into threads and is still practised in parts of the world today.*

The Queen of Fibres

Of all the products of spinning and weaving, silk fabrics have always been regarded as the most luxurious. From the time of the Silk Route's opening around 100 BCE, silk formed the bulk of the trade exported west from China but, for several centuries to come, outside of China, its origins were shrouded in mystery, giving still greater value to the exotic cloth.

▼ *Early 19th Century illustration showing the selection of silkmoths for breeding. This was a very important early stage in the silk-making process and only the finest moths were chosen.*

► *Engraving from an 18th Century English book showing the various stages in the manufacture of silk. The silk moth cocoons are placed in hot water and the threads are then unwound.*

Silk thread is made by twisting together several of the long strands of fibre produced by a silkworm (the caterpillar of a specially-bred moth) when it spins its cocoon. Legend has it that the Chinese Empress Xiling Shi (see Foreword on page 2) first started to cultivate silkworms around 2600 BCE. Sericulture, as silk manufacture is called, seems to have started around this time and for many centuries the Chinese kept the production of silk a closely guarded secret.

Once the Silk Route was open, the techniques of weaving the silken thread did begin to spread, perhaps because they were similar to those used to weave other cloth. By 300 CE, silk cloth was being woven in Central and Western Asia using Chinese thread. However, at the start of the Fifth Century, Khotan, an oasis on the southern path of the Silk Route around the Taklamakan Desert, learnt the secret of silk production itself. The story goes that one of its kings married a Chinese princess, who smuggled silkworms and mulberry seeds (the silkworm feeds exclusively from the mulberry tree) out of China in her headdress.

Equally underhand practices appear to have been used in the progress of the secret further west. In 552 CE certain Persian Christians (probably from the heretical Nestorian sect) are said to have smuggled silkworms from Khotan to the court of the Byzantine emperor Justinian I (483-565), hidden in their hollow walking canes. The authenticity of this account is hard to establish, as is the story of the Chinese princess. However, silk began to be produced in Byzantium around this time and, significantly, trading contacts with Central Asia were improving.

In 568 a delegation arrived in Constantinople from the Turkish Empire, which, centred on Mongolia, had expanded west across the Eurasian Steppe as far as the Byzantine border. The aim of the Turks was to bypass Persia and establish direct trade in silk with Byzantium. A Byzantine embassy went in turn to visit the Turkish khan and, for a brief ten years, Europe had knowledge of Central Asia and access to Chinese silk outside the control of Persian middlemen.

From then onwards, sericulture gradually spread through Western Asia and Europe. By the Fifteenth Century, Italy and France had become the leading European producers of silk. However, in both the manufacture of silk and the weaving of fabric, the Chinese were hard to surpass. As late as 1837, a French silk expert, Camille Beauvais, wrote of 'the undeniable superiority of Chinese methods over European ones', noting that the Chinese 'lose scarcely one silkworm in a hundred, whereas with us the mortality rate is well over 50 per cent'.

▼ *Silk threads being woven into lengths of cloth in Central Asia today. Hand-operated looms are still used to make the best quality silk, although most silk is now produced on mechanized looms.*

▲ *(above and top left, page 32) Fragments of patterned silk, dating from the 7th-8th Century CE, found in the caves at Dunhuang, China.*

◀ *Silk worms feed on a rich diet of mulberry leaves before they spin their cocoons.*