

## CHAPTER 1

### From Stone to Metal

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At the end of the second ice age, 370,000 years ago, the mortal remains of a recognizable human were fortunately preserved for us in a cave near Pekin. The flakes of stone and burned bones which surrounded him show that fire and tools had been discovered. Fire enabled him to live in cold countries, prepare food, frighten animals away and lighten the gloom of his caves. In time he could use it to make pottery and stabilize his life. Its symbolic importance can be seen in the legend of Prometheus, who saved the human race from destruction and gave them fire stolen from heaven. Tools were no less important. As *homo faber*, man the maker, his first tools were of stone. Thus the multi-millennial stages of his existence before recorded history are called paleolithic, mesolithic and neolithic.

It is only in our own time, with the acquisition of recently discovered techniques, like radioactive carbon dating, aerial photography and pollen analysis, that the hidden tracts of man's history are being fitfully and intermittently illuminated. Recent discoveries in China should warn us against assuming that man's evolution is any other but a global matter. But since this book is basically concerned with Britain, revealing evidence from other lands must be omitted unless it is relevant to our story.

Consecutive phases of development in these early times are deceptive and confusing. Cultures described as paleolithic, mesolithic and neolithic flourished at different times and in different places. So for convenience it is perhaps best to begin our story in 3000 B.C.

#### THE URBAN REVOLUTION

By 3000 B.C. the communities cultivating the alluvial plains of the Nile, the Tigris-Euphrates and the Indus valleys were producing so

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much foodstuff that they could use labourers to dig canals, employ artisans to manufacture tools, and support merchants who bought other produce. They used sails to propel boats, oxen to draw ploughs, wheels to bear carriages and metals to fabricate tools and facilitate arduous manual operations. This conglomerate of skills enabled them to foregather in towns in Sumeria, Egypt and India.

The Sumerians who long before 3000 B.C. had drained marshes along the lower Euphrates near the Persian Gulf, irrigated land by canals and used animals to draw wheeled carts, foregathered in Ur, Kish, Erech and Nippur. Though conquered by Sargon (2637–2582 B.C.) their culture was strong enough to mould his Semitic followers. The great founder of Babylon, Hammurabi (1728–1686 B.C.), became the master of Mesopotamia and it is from his reign that most of our information comes, through the script of wedge-shaped signs which was developed from pictographs on clay. Sumerian mathematics was based on a sexagesimal system due to the fact that they thought there were 360 days in the year. We follow them in dividing a circle into 360 degrees. From their brick towers or ziggurat (the best known being the Ziggurat of Ur, excavated by Sir Leonard Woolley, and not unconnected with the Tower of Babel mentioned in *Genesis* ii, 1–9) priests could and did make astronomical observations.

The Egyptians erected even more impressive pyramids and obelisks in the Nile Valley. Beginning with King Zozer of the Third Dynasty (c. 3000 B.C.) whose 200-foot step-pyramid at Saggara near the old capital, Memphis was followed a century later by Khufu (c. 2900 B.C.) or Cheops of the Fourth Dynasty, who built one some 480 feet high. For this, the largest building up to that time, relays of 100,000 men were conscripted every three months by Cheops who was so obsessed that he sold his daughter's virtue for money to finish it. His daughter built a small pyramid of the stones given her by her lovers. His brother Chephren built another.

Fourteen centuries later, in the Eighteenth and Nineteenth Dynasties (1580–1205 B.C.) obelisks were cut from granite quarried at Aswan, just below the first cataract. In the quarry there lies an obelisk (rejected because of imperfections) some 137 feet long, weighing over a thousand tons. So stupendous was the task of building these that the engineer architects responsible for them were often given tombs in the necropolis and statues in the temple. We know the names of two of them, Senmut and Beknekhonsu. Senmut built the great temple of Deis-al-Bahari and several obelisks for Queen Hatshepsut (1495–1475 B.C.) and Beknekhonsu built, a century later, the obelisk

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that was taken from Luxor by the French naval engineer, J. B. A. Lebas, and reconstructed in Paris in A.D. 1836. Another obelisk from Heliopolis was re-erected on the London embankment in 1878, and a third in New York in 1881.

The Egyptians probably opened up copper mines in the Sinai Peninsula as early as the third millennium B.C., whilst their quarries at Turra near Cairo show that they gave up open mining in favour of shafts. Shafts were also used for wells: Joseph's well at Cairo goes 300 feet into the earth. The beginning of civilization among peoples coincided with mining: a science which gradually evolved and spread. These mines were uniformly worked by slaves, obtained by war. Sometimes they worked with their bare hands, to judge by the clay which is found in ancient mines bearing the impress of thousands of fingers. More often they used hammers and wedges, bones and horns. They tunnelled and constructed galleries, often so narrow that children had to be used to squeeze through them. For blasting they used fire and vinegar: a technique which survived to Hannibal's time. The Egyptians also had windlasses to draw up the water in the mines.

The metals so obtained, gold, silver, lead, iron, and later copper and tin were used in various ways. Legend, in the person of Herodotus, had it that the Ethiopian kings bound their prisoners with gold chains. The Argonauts, who in about 1350 B.C. raided Colchis in Georgia, were looking for gold. Silver was used for handles on shields.

From before 1000 B.C. sixteen papyri on Egyptian mathematics are extant: Alimose the scribe, who compiled one of the most important of them in 700 B.C., began his work with the words 'Rules for enquiring into nature, and for knowing all that exists', and discusses fractions, division and easy equations with unknown quantities.

The papyrus on which it was written is itself a technological advance, for it is the root of our modern paper. In addition to this, glass making was practised with materials from the Caucasus, fabrics were woven, cisterns dug, mining practised and metals smelted with the aid of blowpipes and bellows.

Rivers are liable to flood and crops must be planted. To plan these things in advance a calendar is needed, and in Egypt one such exists—an official calendar of 365 days and a lunar calendar of 364. (In Mesopotamia they clung to the lunar calendar for all purposes.) To co-ordinate the two, careful observation of the moon and the sun were necessary and by 747 B.C. the Assyrians had managed to draw up tables. This in turn stimulated the study of mathematics, and the construction of time pieces like the water clock and the sundial.

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### BRITAIN ABOUT 2300–1400 B.C. AND THE WESSEX CULTURE

Whilst the riverine cultures were well advanced in the Bronze Age, Britain underwent a neolithic revolution. The neolithic culture took root in Britain on the Downs and uplands from Sussex to East Devon and is perhaps best typified by Windmill Hill at Avebury: a stable camp. Picks and rakers made of antlers and shovels from the shoulder blades of oxen enabled them to mine flints with success. These flint-miners of Norfolk, Sussex and Wessex were able to barter their products. Gordon Childe has called them 'the founders of British industrialism'.

About 2000 B.C., other small bands of colonists landed on the western coasts and left their mark in the form of large chambered tombs. They were followed about 1750 B.C. by a Megalithic religion which found expression in collective tombs—long pear-shaped barrows which are often 300 feet long and at Maiden Castle extend for a third of a mile.

These were in turn invaded about 1750 B.C. by the Beaker folk who imposed upon Great Britain and Ireland a remarkable uniformity of religion and culture. They brought the use of metals with them and beads of Egyptian design. Their great monuments Avebury and Stonehenge indicate this. Stonehenge is partially built of spotted dolerite brought from the Prescilly mountains in South Wales, a distance of 145 miles, even if brought overland.

This sarsen stone structure at Stonehenge is the major structural feat up to this time in Britain. The fact that the stones were brought from Wales is a further indication of the trade routes that existed between these Beaker folk. The skilful dressing of these stones, their erection, the mortising of the lintels and their raising have excited engineers and archaeologists and the reader is recommended to the masterly summary by R. J. C. Atkinson for the best account of their speculations and findings.

Not the least of the intriguing phenomena is the carving of what is virtually a Mycenaean dagger, which proves an interesting link with another culture where architectural progress was outstanding and deserves a brief mention.

### MYCENAE

Mycenae was a famous Greek city, the golden town of the Cyclops, mythologically connected with the labours of Hercules and his

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taskmaster, Eurystheus, associated with Perseus and the House of Acresius and known, through Homer, as the stronghold of Agamemnon. Thanks to the excavations of Schliemann (in A.D. 1877) and subsequently of Tsountas and Wall, we know that the citadel was first occupied in the early Bronze Age, and it was growing in power at the time Stonehenge was being built. The Princes of Mycenae developed the copper mines, built a new palace, enlarged the citadel and exhaled an influence over the Greek mainland to Egypt.

They built an underground cistern outside the town with secret access from within so that the inhabitants could have a secure supply of water. The heyday of Mycenae, from 1400–1100, saw the construction of the galleries on a cantilever system with elaborate counterweights. The Treasury of Atreus shows evidence of having been planned beforehand with great care. Of its construction A. J. B. Wace remarked, 'The unknown master of the Bronze Age who designed and built the Treasury of Atreus deserves to rank with the great architects of the world.' Certainly the engineering skill which enabled these Mycenaeans in their Aegean fortress to control flood waters and divert streams which threatened their town leaves us with little doubt of the experimental skill that existed towards the end of the second millennium B.C.

## THE RISE OF THE SMITH

The next major event, about 1400 B.C., was the production of iron in a cheap economical manner by the Hittites in Asia Minor. They could write, and brought with them new wares and new gods from beyond the Black sea. In Anatolia they had copper, silver and lead, and built cities with stout masonry walls. Their power was at its height about 1350 B.C., controlling Syria and threatening Egypt. By 1200 B.C. iron technologies spread through the Euphrates valley, especially among the Assyrians who, beginning with Ashurnasipal II (884–859 B.C.), forged the empire of Ninevah. Under Ashur-bani-pal (668–625 B.C.) this reached its finest flower. This empire was destroyed in turn by the Chaldaeans, whose most notable ruler was Nebuchadnezzar (605–551 B.C.). In turn the Chaldaeans fell under Persian rule for two centuries (536–332 B.C.).

The march of man was punctuated by conquests, not only of his fellows, but of nature. The rotary hand mill, the use of horses and chariots, the chain of pots and the pulley are all characteristic of this Asian culture.

THE PHOENICIAN ALPHABET

Meanwhile along the eastern shores of the Mediterranean a subject race of the Egyptians achieved emancipation. The downfall of Mycenae (when the Dorians overran the Peloponnese and islands as far as Crete) enabled this emancipated race, the Phoenicians, to establish a trading network that soon straddled the Mediterranean with factories.

Centred at Tyre (*Ezekiel* 27: 13–25), their ‘factories’ or ‘colonies’ competed with the Greeks and later with the Romans. Carthage, their first settlement on the African coast, was established early in the first millennium B.C., and they settled on both the east and west coasts of Spain. From Egypt, Mesopotamia and Arabia they obtained goods which they sold. They also, by their ubiquity, established a consonantal alphabet, an indispensable corollary of trade.

Their greatest service was in the transmission of technological ideas. The half-legendary Cadmos, son of a Phoenician king, is said to have brought the art of mining to the Greeks, being the first to work the gold and silver mines of Pangaion in Macedonia. Thasos, another Phoenician prince, worked gold mines in an island of the North Aegean named after him. Cyprus became in Sarton’s words ‘the metallurgical centre of the Mediterranean’ where such engineers and builders as Eupalinus (c. 600 B.C.) made their names.

Before the Persians embarked on their conquests there was, in the Aegean coast of Asia Minor, the trading colony of Miletos in Ionia where Thales advised the Ionian cities to federate against the Persian threat. Thales (c. 624–548/5 B.C.) was a Phoenician by ancestry who had assimilated Egyptian learning. Sarton sees in him ‘the first man in any country to conceive the need for geometric proposition’. Thales was the founder of magnetism, for he knew of the properties of the lodestone. He held that water is the original substance. His friend Anaximander (610–545 B.C.), some fifteen years his junior, went on to write the first treatise on natural philosophy in the history of mankind, and also tried to define the primary substance which he called *apeiron* (or the undetermined). Anaximenes, who followed him, thought of the stars as situated on a rolling sphere.