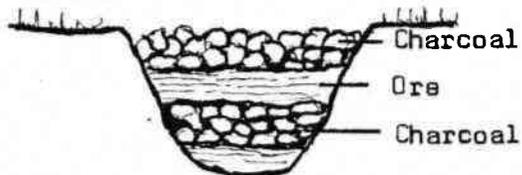


How man discovered metal we don't know. Probably it was by accident and equally probably it took an extremely long time to develop. We divide the remote past into three periods, the Stone Age, the Bronze Age and the Iron Age. We mean by this that man used stone tools first of all, made from flint, chert and other rocks, then he made tools of bronze and finally of iron. The Iron Age, in fact, continued until the Industrial Revolution of the 18th century when steel was developed.

Metal doesn't exist in the pure form except for gold and silver and occasionally copper. Normally it is found as ore, a solid mixture of iron and rock particles. This ore has to be treated to extremely high temperatures to separate out the metal from rock. The easiest metal to extract



from its ore is lead which has a very low melting point. In smelting operations, the separation of metal from ore, dangerous gasses are given off and great care must be taken at all times.

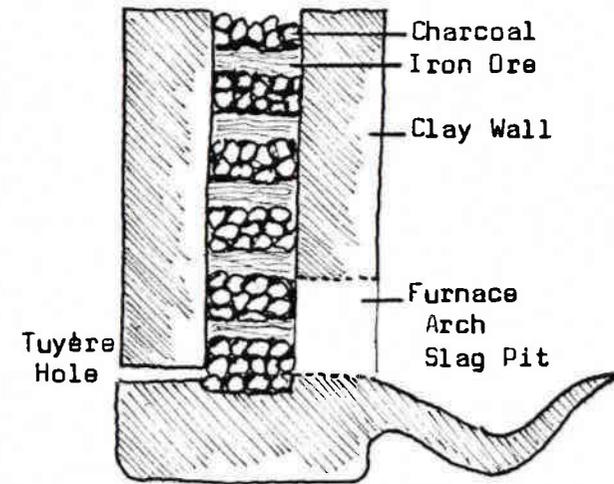


Evidence of smelting in the Bronze Age usually comprises a shallow clay lined bowl furnace with tiny remains of metal and slag, the melted rock waste, and charcoal.

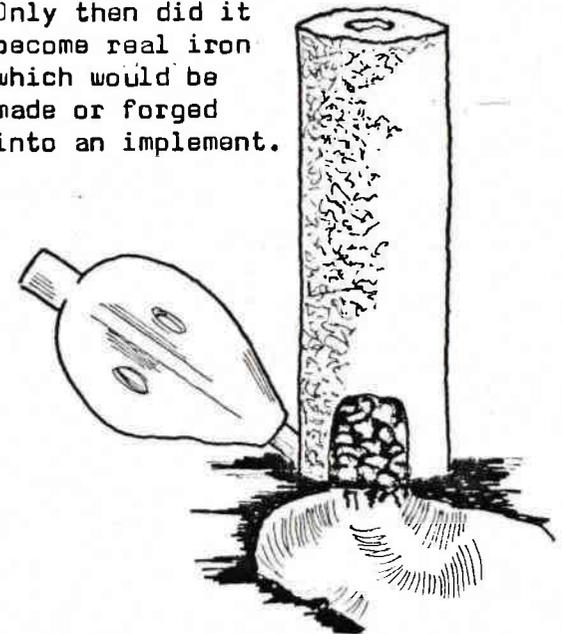
The first metalworker discovered that only charcoal would burn at a high enough temperature to smelt metal. To extract copper from the ore the furnace must have been at over 1000°C and iron at c. 1200°C . Even with charcoal it was necessary to force a draught into the furnace to make it burn hotter. This was done with bellows made from animal skin pushing the air down a thin pottery tube, called a tuyère, into the furnace.

The actual process of smelting was achieved by putting into the furnace layers of charcoal and fragments of copper ore called malachite and then pumping the furnace with the bellows. Gradually the right temperature is reached and tiny droplets of copper bubble out of the malachite and fall to the bottom of the bowl furnace. These are collected when the furnace cools and put into a special clay pot called a crucible. Putting the crucible back in the furnace and again pumping up the temperature these copper droplets melt into liquid copper which can then be poured into a mould. Bronze is made by mixing tin with copper. Tin is smelted in the same way as copper from an ore called cassiterite.

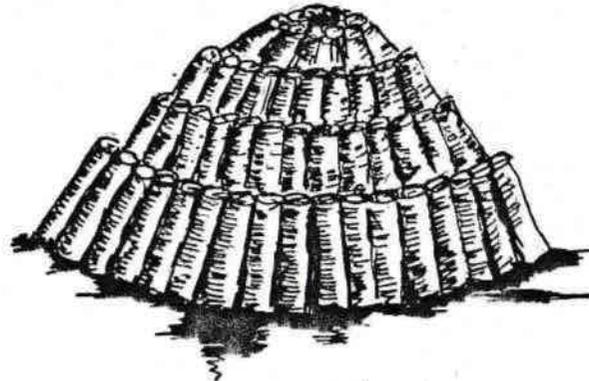
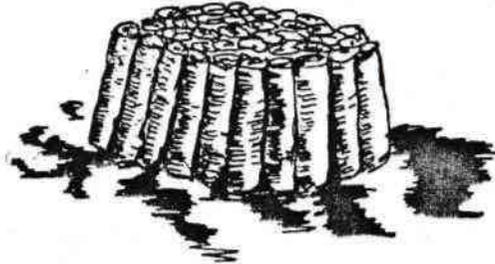
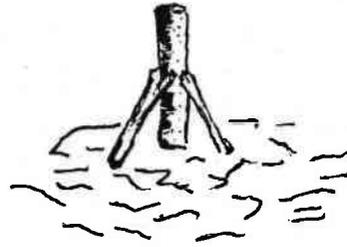
Iron was made in a different kind of furnace. This was a tall clay shaft again powered by a set of bellows. The Iron ore was crushed into small fragments and then roasted in an open wood fire to remove impurities. Afterwards the roasted ore was loaded into the shaft furnace with layers of charcoal and then heated for several hours. Once the right temperature



was reached the melted slag trickled out from the opening at the base of the shaft. The iron, a sponge-like mass, was left in the shaft. This had to be removed and reheated in an open bowl furnace and then hammered on an anvil. Only then did it become real iron which would be made or forged into an implement.



Charcoal is made by burning wood in a turf covered stack. The process takes many days to complete and must be left a long time before the stack is opened up and the charcoal removed.



Making Metal

