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Iron First Came From Space

Humans were using iron well before they learnt to produce it, says S.Ananthanarayanan

Early human history is divided into the ***Stone Age***, the ***Bronze Age*** and the ***Iron Age*** – depending on what material tools and weapons were made of. But archeological evidence shows that iron as a material, although scarce, was known even in the Stone Age.

Dr Thilo Rehren

In the ***Journal of Archaeological Sciences***, Prof. Thilo Rehren of ***University College, London, at Qatar***, and colleagues describe their studies on iron beads strung in Egyptian necklaces all of 5000 years ago. The iron beads were strung along with gold and precious stones, which shows that iron was considered rare and valuable too. The source of iron before smelting iron became possible, around 1200 BCE, is the remains of iron rich meteorites which separate the metal from the ore during their formation or in their descent to the earth.

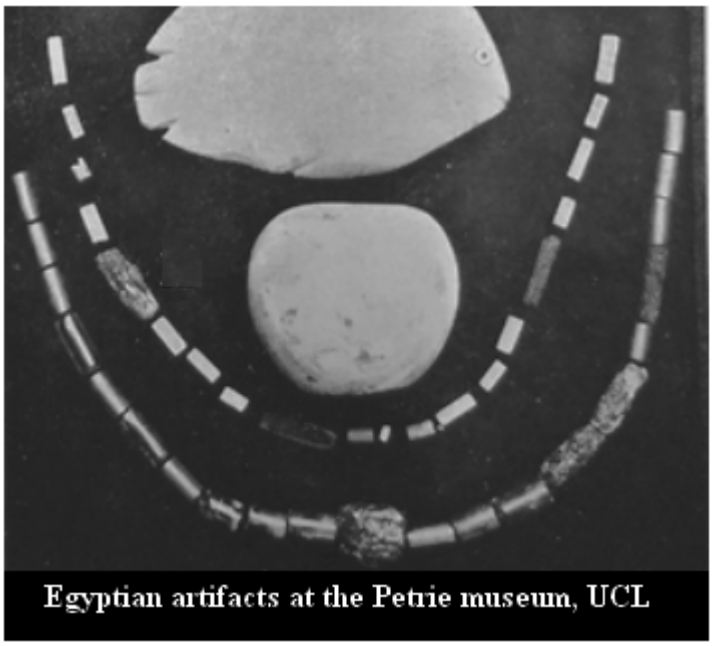
On the surface of the earth, iron cannot remain iron for long. All the iron is thus in the form of the oxides, and found in rocks and minerals of iron ore. Something like is true of other metals too. Copper, for example, is found very occasionally as the metal, but mostly in combination with sulphur, or carbon or as the oxide. Tin is also mostly found as the oxide. In the case of these ores, the metal can be extracted by driving out the oxygen, or sulphur, using reducing agents like carbon, at relatively lower temperatures. The oxides of iron, on the other hand, need high temperatures to be reduced.

This is the reason that copper was the first metal to be extracted in reasonable quantities, and alloyed with addition of tin, it formed the basis for the Bronze Age. The use of metal tools marks the end of the Stone Age and the use of bronze is placed at around 3000 BCE. Copper ore could be easily reduced in earthenware furnaces and the use of bronze became widespread, Bronze could be readily shaped and sharpened and artisans and craftsmen discovered new trades with the new tools that no longer needed to be fashioned from stone.

And then came the Iron Age. Extraction of Iron takes higher temperatures and materials for smelting. The Iron Age had hence to wait till the technology was available. A period of scarcity of tin, copper, which is easily deformed, needed to become firm, is thought to have accelerated the advent of iron. Once iron production started, the efficiency and economy of the process and the superior qualities of the metal greatly changed the industrial landscape. The start of the Iron Age is placed at around 1200 BCE, but there is now evidence of iron production having started as early as 1800 or 2000 BCE.

Iron before its time

The remarkable thing is that in small quantities, iron is still found in artifacts that predate the Iron or even the Bronze Age. These samples of iron are thought of as originating in meteorites, where the ores are reduced by high temperatures attained without the help of human made furnaces. Ancient people hence found craps of iron when meteorites reached the earth and discovered that the material could be deformed or shaped when worked on. The material, always in small quantities, was then used for ornamental purposes.



Egyptian artifacts at the Petrie museum, UCL

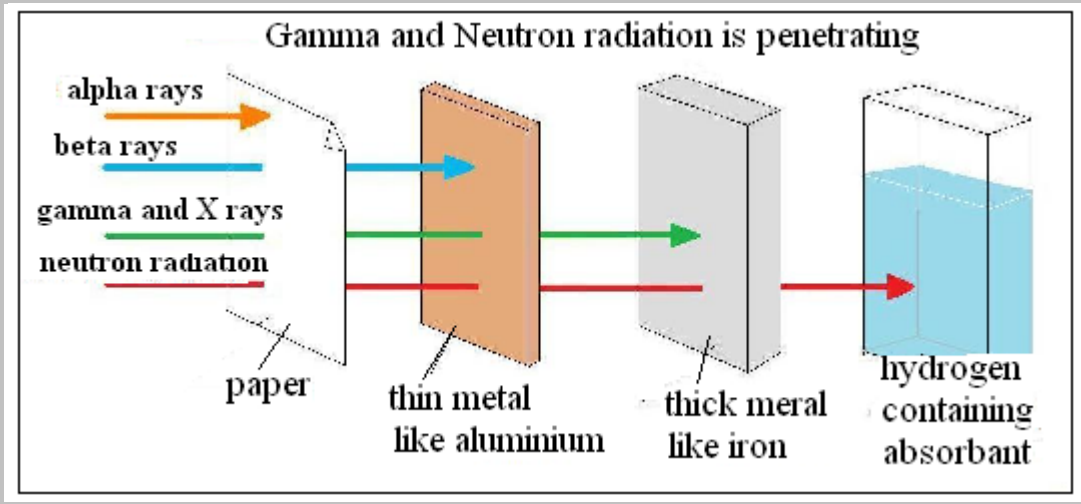
The ULC, Qatar team considered the case of iron beads that were found in an ancient Egyptian necklace that is now in the Petrie museum at UCL. The nine beads appear in the 5000 year old necklace along with gold and gemstones, which indicates that iron was rare and valuable. The beads are made from iron first beaten into sheets and then rolled into tubes, which indicates proficiency in metalworking. "The shape of the beads was obtained by smithing and rolling, most likely involving multiple cycles of hammering, and not by the traditional stone-working techniques such as carving or drilling which were used for the other beads found in the same tomb," says Professor Thilo Rehren.The nickel rich iron that is found in meteorites is harder than copper, which was used in the Bronze Age. Fourth millennium BC metalworkers, who worked with meteorite iron, hence already knew techniques which helped bring in the Iron Age after smelting of iron became possible.

The UCL team worked on the iron beads to show that they did indeed consist of meteorite iron. By the time the beads were discovered, in 1911, in excavations at a cemetery site at the village of el-Gerzeh in Lower Egypt, the beads were already completely corroded. Any attempt to analyse the material of the beads in the ordinary way would thus have destroyed the ancient find. The UCL scientists hence used a method of non-invasive scanning which is also used to scan cargo that is carried, for instance in goods containers, to peer, ‘without touching,’ into the delicate remains of ancient craftmanship.

Neutron and gamma ray scan

In neutron and gamma ray scanning, samples are bombards with high energy radiation, to observe both transmitted and scattered radiation with the use of detectors. In the case of cargo

scanning, the objective is to detect possible explosives, often hidden behind dense materials to prevent detection. Neutron and gamma ray beams are electrically neutral and manage easy passage through materials. The picture created by the transmitted and also the scattered particles enables the contents to be discovered, without any damage or the possibility of setting off explosions. The same method can equally analyse the internals of the scraps of artifact iron, without physical damage to the corroded filaments.



The analyses revealed that the samples were rich in nickel, cobalt, phosphorus and germanium – elements that are found in normal iron only in traces. "The really exciting outcome of this research is that we were for the first time able to demonstrate conclusively that there are typical trace elements such as cobalt and germanium present in these beads, at levels that only occur in meteoritic iron," says Prof Rehren. "We are also excited to be able to see the internal structure of the beads, revealing how they were rolled and hammered into form. This is very different technology from the usual stone bead drilling, and shows quite an advanced understanding of how the metal smiths worked this rather difficult material."