

Mining originated in palaeolithic times tens of millennia ago with the collection from the surface of the ground of stones such as quartz, flint or obsidian for tools, of various types of earth for use as pigments or abrasives, and of rare deposits of gems or metals in their native form. By the later palaeolithic, in addition to a considerable trade in flint nodules, from such pits as those at Grime's Graves in Norfolk, mining for metallic ores or for the alluvial deposits of native metals (tin, copper, gold) called 'placers' was beginning. Certain areas became famous for their production of a particular metal. For example, gold came from Egypt, copper from the Sinai or from Cyprus (whose name itself indicates the importance of its copper mines), silver and tin from across the Caucasus, and later on, iron from Elba or Noricum.

Methods of extracting the ores from the ground were unsystematic and not very sophisticated until the later classical period. Surface outcrops were naturally the first deposits to be exploited, but pits and shafts and galleries soon had to be used to follow up the veins of metal or flint-bearing layers of chalk. Some of these shafts in certain areas have been found to be as much as 300 feet deep, although 30-40 feet is more usual. From a central shaft which might be no more than two to three feet wide a small chamber would be opened out (a 'bell-pit') or several galleries radiating outwards would be driven in search of the desired stones or metals. Repeated shafts were driven down from the surface, rather than using an access shaft with extensive or interconnecting underground galleries, until later times when the Romans attempted a more systematic and thorough search for ores.

One of the better known ancient mine-sites is Laurion, in the mountains of southern Attica about forty kilometres from Athens. More than 2,000 shafts up to 300 feet deep have been traced, in which Greek slave-miners toiled deeper and deeper in search of the lead-silver metalliferous ore known as galena until forced to halt digging in each shaft by the seepage of water into the tunnels at sea level. Most of the shafts are regular and rectangular in cross-section, approximately 6 feet by 4 feet, with access by ladders or tree-trunks with branch-stubs and pegs or with notches cut down one side. The centre of the shaft provided just enough space for hauling the ore to the surface in baskets by rope and pulley. Ventilation of the galleries which ran along the veins of ore was aided by parallel tunnels, doors across galleries to direct the draught, and special ventilation shafts which acted as chimneys. These were built with a small platform at the bottom on which a fire would be lighted. The resulting up-draught would help to pull the foul air out of the galleries to be discharged with the smoke above ground.

To prevent the all too common accident of collapse, the working galleries or 'stopes', which spread to the limits of each section of the ore deposit, were cut out leaving pillars of rock at frequent intervals to support the roof. Later on in the excavation of each stope, when the ores began to run out, the useless rock was not removed to the surface, but packed back into the open sections of the stope so that the support pillars could then be safely cut out for the ore each contained. The miners worked in conditions which would seem intolerable to us. In cramped and stinking holes, with smoky oil lamps guttering in alcoves in the walls, the slaves and criminals condemned to the mines worked to produce the silver on which the might of Athens depended. They wore no clothes or at most a leather breechclout, and every sack or basket of ore had to be dragged along to the foot of the main shaft.

Tools were not unlike those used even in comparatively recent times until the advent of machinery and power tools at the working surface underground. Hammers which resemble a modern geologist's hammer, picks with wooden handles, gads or cold chisels and wedges have all been found by archaeologists' investigations. Most of these at Laurion are made of iron and were produced on the spot. We know that the area was once heavily timbered, but that even by Hellenistic times the timber was entirely gone. A small amount was used to make props and ladders, much more to provide the fuel for smelting the ores and for the production of iron tools used underground. Haematite, an iron ore, was also extracted from the mines along with the galena to ensure an adequate supply of iron for the miners' and smelters' tools.

When the ores reached the surface, in the form of smallish lumps of metalliferous rock, they were subjected to a number of complicated treatments. Crushing, washing, grinding, sieving, or roasting all had a part to play in the production of the metal-rich fine powdery substance which would then be charged into furnaces between layers of charcoal to produce 'hard-lead', a lead-silver alloy with traces of tin, arsenic, antimony and so on. Cupellation, a complex process already well-known by classical times, was then employed to remove the unwanted base metals from the desired silver. The 'hard-lead' was melted in a cupel or crucible of special porous clay, which absorbed much of the base metals in the form of oxides. A strong blast of air was blown across the surface of the molten metal to aid in the oxidation process. After the cupellation was completed, a small lump of silver remained behind in the cupel.

Not until the end of the second century B.C. did mining operations cease at Laurion. In 102 B.C. the slave-miners revolted against the intolerable conditions and the mines fell into disuse. A few secretive and probably illicit operations continued into the Roman Empire, to enrich the pockets of 'pirate' entrepreneurs, but throughout the next eighteen hundred years the mines were forgotten. In the middle of the nineteenth century a French mining company resmelted all the ancient Greek slag heaps and rejected rock piles to recover the final traces of the lead and silver which ancient techniques could not release from the ores.