

## Underground Structure of a *Tatara* Furnace

These dioramas show the process of building the underground structure of a *tatara* furnace. As larger and larger furnaces were developed, it became more challenging to maintain the high temperatures needed to smelt iron and steel. The furnace's underground section was devised to insulate the hearth and prevent heat from escaping. The basic design emerged in the fifteenth century, but the advanced version shown here was adopted in the 1700s.

To create the underground structure, workers first dug a pit between 3 and 5 meters deep that spanned a large area inside the *takadono* workshop. They built a narrow, stone-lined tunnel along the bottom of the pit to allow drainage, then covered the bottom with layers of gravel, clay, and charcoal. These components helped prevent underground moisture from reaching the furnace.

Next, workers constructed three stone-lined compartments: a deep trench in the center (directly below where the hearth would be built) with one smaller compartment on either side. These compartments were packed with wood, which was then burned to dry out the surrounding earth.

Once the fires died out, the trench was filled with charcoal and compacted ash to create a moisture barrier. The two smaller compartments were left empty to trap some of the escaping heat. Finally, workers filled in the remaining parts of the pit with clay to create a flat surface for the hearth and bellows.