Smelting: Three-Day Direct Method

The three-day direct method of smelting was only practiced in the Okuizumo region. Through years of trial and error, ironworkers were able to improve on the four-day method and develop a process that required only three days.

The direct smelting method used a superior iron sand called *masa* in combination with *akome* iron sand. *Masa* iron sand, which comes from acidic rock, has fewer impurities but melts at a much higher temperature. Unlike the indirect method, which produced molten pig iron that oozed out from the furnace, the main product of the direct method remained inside the furnace as a large, porous lump of iron and steel called a *kera*. At the end of an operation, the furnace would be dismantled and the *kera* smashed apart and sorted by grade. This was the only method capable of producing *tamahagane* steel, which is vital to the production of Japanese swords.

Records from the Kanna Ironworks (Okuizumo, Shimane Prefecture) show the materials consumed during a single instance of the three-day method in 1901: 13.5 metric tons of iron sand (*masa* and *akome*) and roughly 14 metric tons of charcoal were used to produce 2.1 metric tons of pig iron and a *kera* weighing 2 metric tons, meaning that about 30 percent of the iron sand was converted to usable metal.