

***Kakuro* Blast Furnace**

This is a 1:10 scale model of a *kakuro* blast furnace that was used at Torikami Ironworks in Okuizumo. The actual furnace is 4.6 meters tall and was operated intermittently between 1918 and 1965. The original furnace still stands at the site of Torikami Ironworks, which is now the location of Nittōho Tatara.

Kakuro blast furnaces were developed to increase the efficiency of the *tatara* ironmaking method. Like their earlier versions, such furnaces were fed iron sand and charcoal, but the tall, square furnaces were built of brick, not clay. *Kakuro* furnaces could also be operated continuously, unlike the clay furnaces of prior centuries, which had to be demolished to retrieve the lumps of iron and steel that formed within them.

The machinery at the side of the furnace is a set of box bellows. Unlike the manpowered *tenbin* bellows of *tatara* furnaces from the early 1700s onward, these box bellows were powered by a waterwheel.

The design of the *kakuro* blast furnace eliminated the need for multiday shifts overseen by highly trained foremen. To operate the *kakuro* furnace, four workers on the upper level added iron sand and charcoal, while two workers on the lower level cleared away the pig iron and slag that flowed out. Each six-person crew worked a 12-hour shift.