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Archaeological Investigations on the Beginning of Blast Furnace-Technology in Central Europe

Prof. Dr. Albrecht JOCKENHÖVEL, Dr. Christoph WILLMS, Thorsten ABDINGHOFF,
Michael OVERBECK

Seminar für Ur- und Frühgeschichte, Westfälische Wilhelms-Universität, Domplatz 20-22,
D-48143 Münster, Germany, e-mail: jockenh@uni-muenster.de

In the last four years the project "Iron and Steel Production in the Märkische Sauerland. A Process of Production from the Bloomery Furnace to the Early Osemundfinery", sponsored by the Volkswagen-Foundation, has excavated three blast furnaces, including two dated as early as the 13/14th century. These finds are important for the knowledge of the transition process from bloomery to blast furnace taking place during that time in Europe.

From the beginning of iron metallurgy (c. 1000 B.C.) in Central Europe iron was produced in bloomery furnaces in a direct, discontinuous process. During the Middle Ages the furnaces became larger, so called "Stücköfen". Water-powered bellows were already in use, while the process itself remained unchanged. The use of water-power was also crucial for the blast furnace. When and where in Europe the first water-powered blast furnaces were employed is still not clear. With the use of these furnaces pig-iron was produced in an indirect but continuous process. As the pig-iron contained too much carbon, it had to be transformed wrought iron by the finery process that required a finery-hearth.

Up to now there are only three European regions where early blast furnaces (13th-15th century) have been discovered: Lapphyttan in Sweden (Magnusson 1995), Dürstel in Switzerland (Tauber/Serneels 1997) and the Märkische Sauerland in Germany (Jockenhövel/Willms 1997). In an additional region, the Schwäbische Alb, Germany (Kempa/Yalcin 1995) mainly slags have indicated the indirect process in the 12th century so far. The remains of the furnaces in this region are not sufficient enough to allow more specific descriptions.

Years of archaeological prospection in the Märkische Sauerland (Fig. 1) have shown that this region has a very rich tradition of iron-metallurgy. Besides a large number of bloomery furnaces about 100 blast furnace sites have been discovered. Therefore two of these sites were picked for scientific archaeological excavations.

First of all both places were detected with geophysical methods to get an impression of the over all structure of the sites. With this technology it was possible to locate the furnaces so that they could be excavated without further search.

Two blast furnaces were excavated in the basin of the Kerspe-Dam (Nr. 105; Fig. 2 and 3). The older furnace was radiocarbon-dated back to cal AD 1205-1300, the younger one back to cal AD 1290-1395 (Fig. 4). So they are the oldest known blast furnaces in Central Europe. Both were built of loam and only a few stones, in the tradition of the construction of bloomery furnaces. They had an outer diameter of c. 3 m and an inner diameter of c. 0,8 m. For the first time it was possible to examine the hearth ("Gestell") of the furnaces. Both furnaces were built with their backsides into the slope of the basin, so that the slope could be used as a natural charging-platform. In the wall of the younger furnace the hole for the water-powered bellows was still intact. Furthermore a mill race, a wheel pit, depots for ore and charcoal, post-holes and stone-built drainage-trenches were found. A special drainage had been built of stones beneath the younger furnace to protect it from water. It is called the "Abzucht" by Georg Agricola.

The second site (Nr. 90) is located on the north slope of the Wipper-Valley (Fig. 2). Ceramic-finds date the blast furnace back to the 14/15th century. It was mainly built of stones and measures c. 3,5 x 3,5 m on the outside and c. 1,25 x 1,25 m on the inside. The breast was

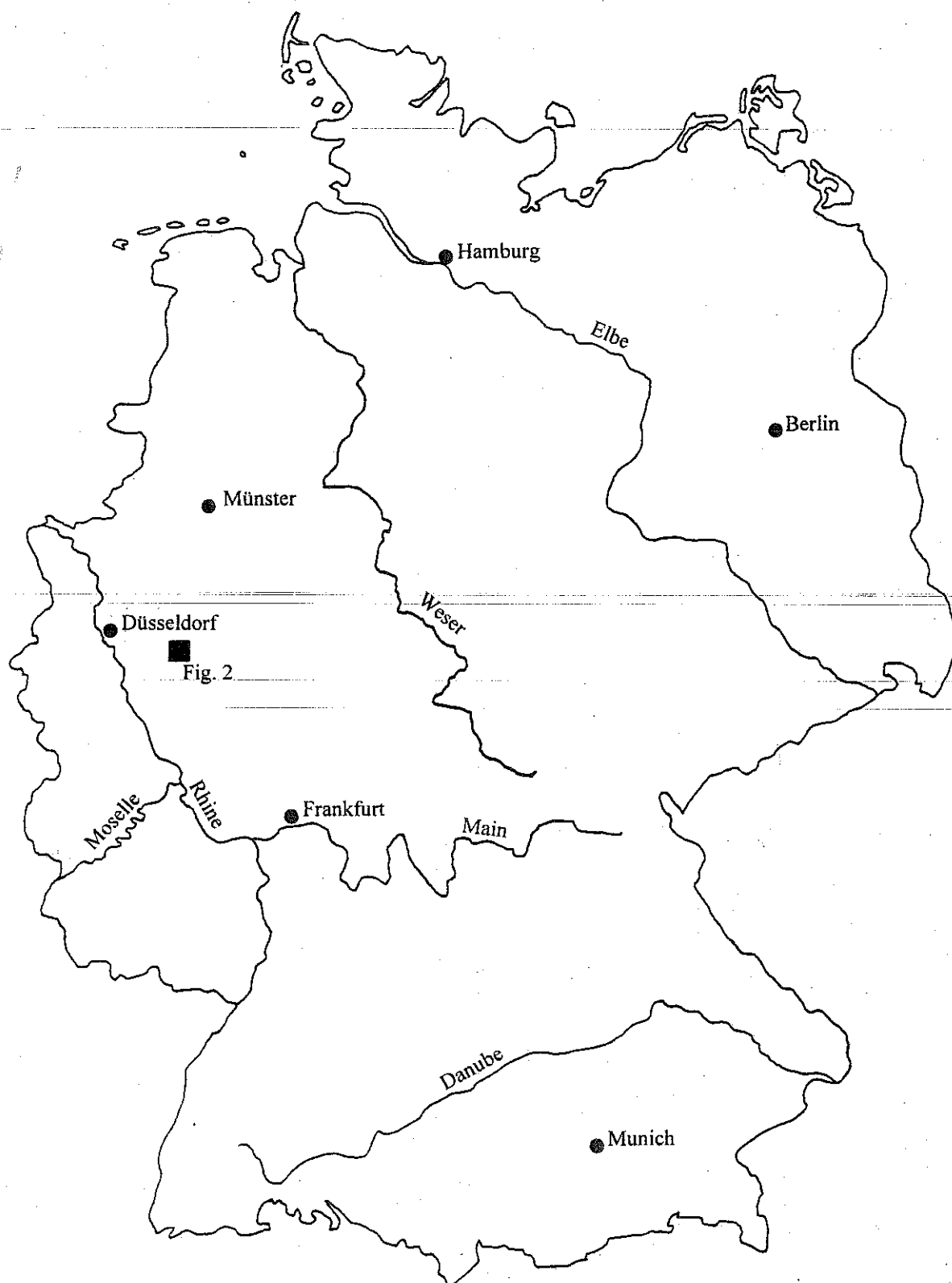


Fig. 1: Map of Germany showing the location of the project-area (cf. Fig. 2).

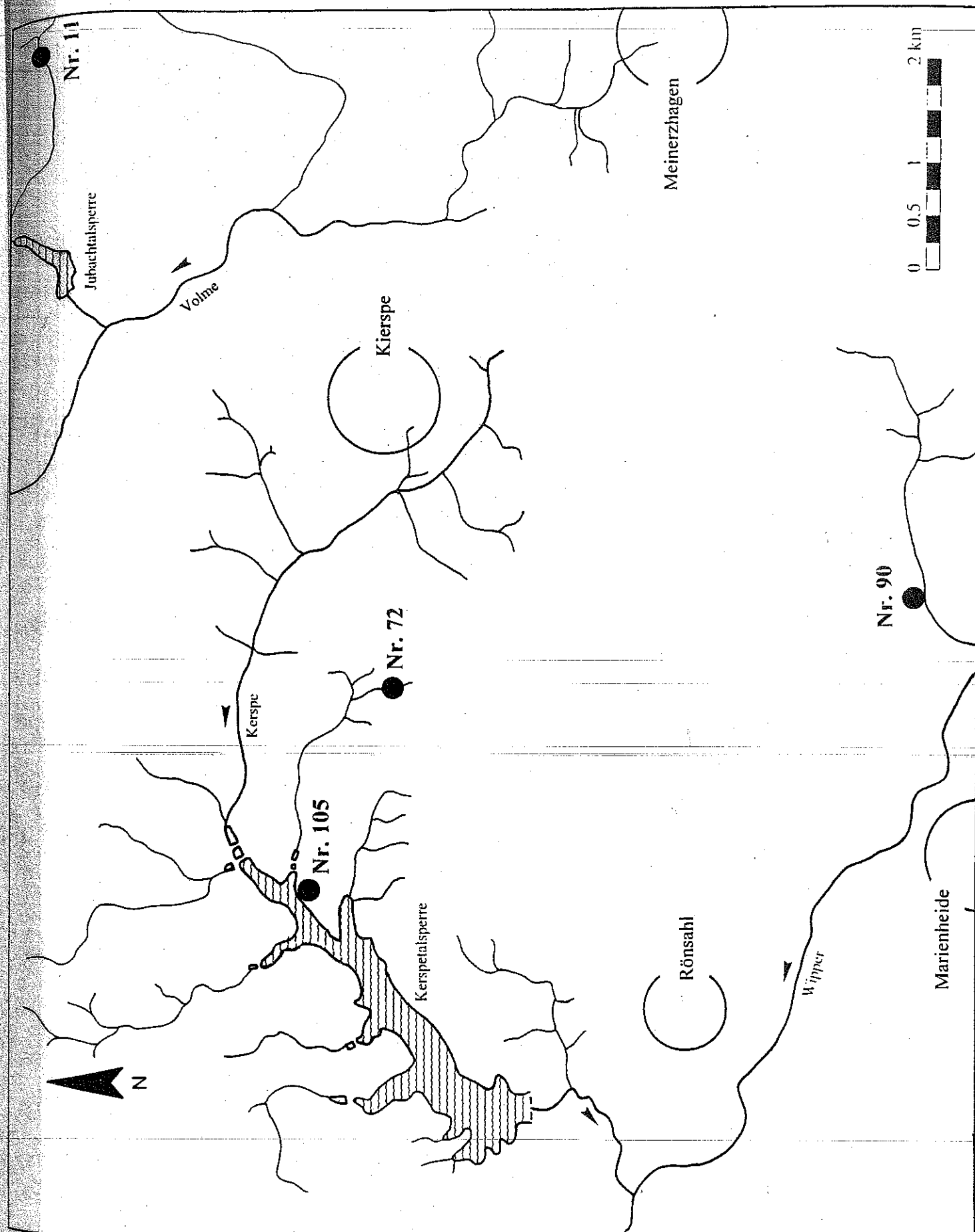


Fig. 2: Map of the project-area. Nr. 11 bloomery furnace site near Fernhagen, Märkisches Sauerland; Nr. 72 bloomery furnace site near Wienhagenerhaus, Märkisches Sauerland; Nr. 90 blast furnace site, Wipper-Valley near Marienheide, Bergisches Land; Nr. 105 blast furnace site in the Kerspe-Dam, Märkisches Sauerland.

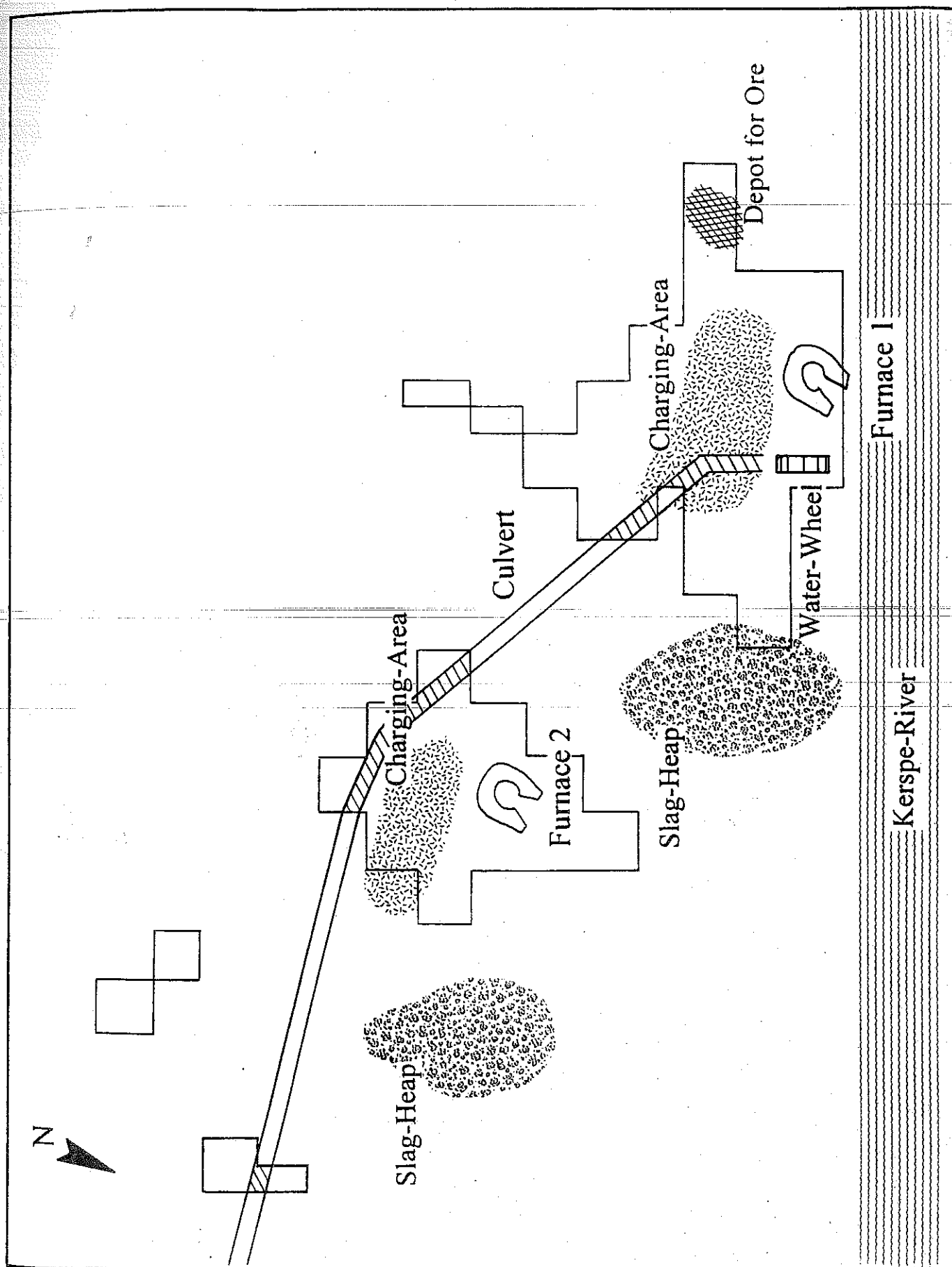


Fig. 3: Kerspe-Dam, Märkisches Sauerland (Nr. 105). Sketch showing the main features of the site.

open with a pig-iron(?) layer in front of it. The furnace was built into the slope so that it could be easily charged with ore and charcoal. Drainage-trenches were found uphill and on the sides of the furnace. About 3,5 m downhill a trench with wooden boards on the sides may have been the culvert of the water-wheel and/or the drainage. Near the blast furnace there was an older bloomery furnace, whose slag heaps may have been used for recycling the old iron-rich slags in the new furnace.

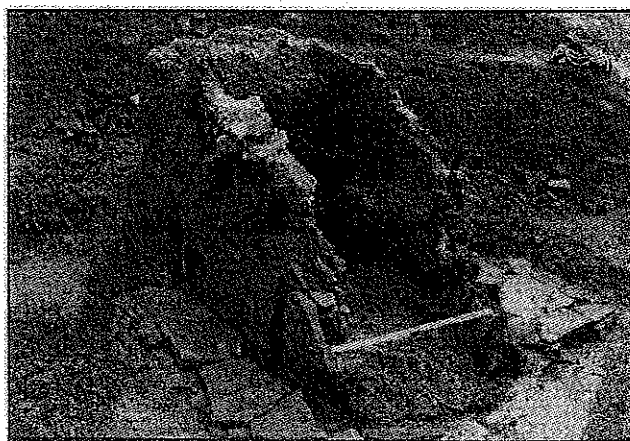


Fig. 4: Kerspe-Dam, Märkisches Sauerland (Nr. 105). The younger blast furnace (August 1996).

Both sites were situated in valleys near flowing water showing the change of places connected with the new indirect iron technology. The water-powered bellows required water as an important factor. The availability of wood/charcoal and ore was still important, but came in second place.

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