Bulletin of the National Museum of Japanese History
Vol. 256 March 2026

Iron Production at the End of the Yayoi Period in the Kinki Region: An Analysis of the Microscopic Artifacts

MANABE Seiji and SOUNOH Tamiyuki

This paper clarifies the changes in smithing techniques from the Yayoi period to the Kofun period by analyzing micro artifacts generated by smithing. We expect that the thickness of the iron oxide scale produced during the forging of ironware is mainly determined by the operating temperature of the furnace. To examine this, we measured and compared the thickness of iron oxide scale and the iron slag/fine iron fragments excavated from various settlement sites to clarify their temporal change. Prior to measurements, we attempted to collect micro artifacts from the Tanabe-tenjinyama and Nishikyogoku sites in Kyoto Prefecture. While we were unfortunately unable to collect micro artifacts from the Tanabe-tenjinyama site, we successfully acquired micro iron slag from the Nishikyogoku site. Analyzing micro artifacts we have collected so far, including micro iron slag from the Nishikyogoku site, we found that the presence of iron oxide scale and its thickness varied depending on the period. Additionally, settlement sites with thicker iron oxide scales tended to be ironware production sites with higher-temperature furnace facilities engaged in more advanced blacksmithing operations. We also found that the thickness of the excavated iron oxide was about 0.1 mm before the Late Yayoi Period, but after the Early Kofun Period, the thickness was more than 0.3 mm.

In order to explore the specific formation processes of these micro artifacts, we also conducted smithing experiments at Rekihaku. Comparing these results to prior experiments conducted by Katano City and the Boso Fudoki-no-oka Museum, We confirmed that an iron oxide scale always comes out when striking a hot iron. Furthermore, we confirmed that iron fragments are produced only when chisel cutting is performed. From these analyses, the thickness of the iron oxide scale is primarily related to the temperature of the furnace. This paper suggests that changes in blacksmithing operations from the Yayoi to the Kofun period can be confirmed based on analysis of micro artifacts. We argue that micro artifacts analysis is indispensable when considering the technological nature of ironworking at ancient settlement sites.

Key words: Iron oxide scale, micro artifact, ironware production, Yayoi period, Kofun period