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METALS AND THE MAKING OF THE ANCIENT WORLD: ENVIRONMENTAL AND ECONOMIC LEGACIES OF EURASIAN BRONZE AGE METALLURGY

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Abstract

The Bronze Age (c. 3500–1000 BCE) witnessed the emergence of large-scale metallurgy as a transformative force across Eurasia. This period saw the development of extensive mining and smelting networks that powered the production of vast quantities of copper and bronze artefacts—an industrial-scale endeavour often referred to as the 'Metal Road.' These networks connected remote ore-rich regions to far-flung consumer communities, laying the foundations for long-distance exchange that foreshadowed the later Silk Roads. Yet, behind this technological achievement lies a lesser-known environmental story.

This paper explores the environmental and economic impact of Bronze Age metallurgy by integrating archaeological, archaeometallurgical, and paleoenvironmental evidence. Through key case studies such as Kargaly in the Urals and Dzhezkazgan in Kazakhstan—where Late Bronze Age production alone may have exceeded 100,000 tonnes of copper—we reconstruct the scale of extraction and its ecological footprint. The production of just one kilogram of copper could require up to 94 kilograms of wood, highlighting the immense pressure on ancient forests and landscapes. Over generations, this resource demand likely led to deforestation, soil degradation, and early anthropogenic carbon emissions—impacts that are only beginning to be fully appreciated in archaeological discourse.

Simultaneously, metallurgy reshaped the economic and political terrain of Eurasian societies. With over half a million artefacts in circulation, metal became both a medium of value and a marker of power, innovation, and interconnection. This paper argues that metallurgy was not merely a technological achievement but a force of historical consequence—altering landscapes, economies, and human relationships to the environment in ways that resonate with today's challenges around sustainability, resource management, and ecological resilience.

***Keywords**: Bronze Age, archaeometallurgy, environment, carbon emission, First Industrial Age*