The beginning of copper mass production in the western Alps: the Saint-Véran mining area reconsidered

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ABSTRACT: In the Early Bronze Age copper production increases dramatically, yet in Western Europe little data is available on linked mining and smelting activity. In the area of Saint-Véran, Hautes-Alpes, ancient mining works testify to large-scale production, estimated at some seven tons of metallic copper per year. The associated smelting site, dated to the end of the 3rd millennium BC, shows particularly advanced technological skill. The mineralogy at Saint-Véran is an exceptionally massive and virtually single-phase deposit. As a consequence, very little beneficiation is required to achieve high-grade ore. The exploited ore is mainly bornite, Cu₅FeS₄, which is a particularly copper-rich mineral, compared to the more usual chalcopyrite, CuFeS₂. Recent surveys have found large amounts of native copper in the ancient mine spoil heaps so native copper was probably exploited, maybe before the Early Bronze Age. The slag morphology and composition is also discussed. Saint-Véran has thin, homogenous low-viscosity slags, similar to the Plattenschlacke recorded during the Middle to Late Bronze Age in the Eastern Alps. This combination of factors must surely have influenced the early start of copper mass production.

Introduction

In the Saint-Véran copper mining district in the southern part of the Western Alps (Fig 1), Early Bronze Age mining works and smelting areas have been investigated. Both provide evidence of a dramatic increase in copper production when compared to the preceding Chalcolithic period. Ancient mining remains reveal large-scale copper production which may have reached seven tons per year (Rostan and Rossi 2002; Rossi et al 1997; Rostan et al 1997), relying exclusively on the exploitation of bornite, a copper sulphide (Cu₅FeS₄). In order to roughly estimate the production rate, Rostan and Rossi (2002) have made the following calculation: the total volume of ore plus host rock being extracted from the mine is estimated at ~10,000m³. Given a ratio of ore to host rock of 1/25 by volume, this would have led to some 2000t of bornite, and consequently 1400t of metallic copper, being extracted. At a mining rate of roughly 4m³/month, this would have taken 200 years, assuming continuous exploitation without any seasonal interruptions. During the Neolithic and Chalcolithic periods, copper mining generally suggests much lower