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Evidence of historical mining inferred from metal concentration of alluvial sediments in the Bernese Alps

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Metal pollution is normally associated with modern day industrialization. However, evidences of anthropogenic metal pollution date back to the Palaeolithic, were the domestication of fire contributed to an increase of trace metals released from the burning wood. Large-scale metal pollution started during the Roman period with the increase of mining and smelting activities. The production of metals during this period was quite rudimentary and highly polluting, contributing to a raise of metal concentrations in the atmosphere and subsequently in sediments and soils. Towards the modern period, production methods were improved, especially since the industrial revolution, but continued to release pollutants to the environment.

The aim of this study is to identify periods of increased mining activity though the analysis of sedimentary records. For this purpose, we study the geochemical response of trace metals in sedimentary cores from the Aare and Lütschine delta plains, located at the Bernese Alps. The focus of this analysis is the detection of metal concentration anomalies from the last 3000 years. The analysis is based on the X-Ray Fluorescence (AVATECH XRF core scanner) response of the chemical elements copper (Cu), zinc (Zn) and lead (Pb) contained in eight cores with depths down to 10 meter. All data was filtered in order to remove the noise from natural processes such as the increase of trace metal concentrations in organic rich horizons and to select the highest peaks of these metals.

Results show similar trends in all the analysed cores and indicate three major pulses of trace metal concentration during the Roman Period, Early Medieval Age and a general increase of metal concentration during the Modern era, which can evidence mining and smelting activities. Periods of lower trace metal concentrations and shifts in concentration trends relate accurately with central Europe social and economic transitions, migratory events and significant demographic variations. It is also possible to identify some trace metal peaks during the late Neolithic period. The findings of archaeological sites from this region support the assumption of these possible early pollution periods.