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Application of Ag, Cu and Pb isotopes in determining the origin of the ore for metals from Castillo de Huarmey (Peru)

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Discovered in 2012 in Castillo de Huarmey (Peru), the unplanned tomb of the Wari culture elite and the artefacts contained in it allow learning about many aspects of the life of the Wari people. Analyzes of Ag, Cu and Pb isotopes of small fragments of metal monuments from this tomb were performed (5 samples of silver alloys and 10 samples of copper alloys). Ag (for silver alloys) and Cu (for copper alloys) isotopes were used to determine the type of ore. The obtained result for both isotope systems indicates the use of primary ore - hypogenic ore. The origin of the ore was determined using the lead isotope. The obtained results indicate that one sample has an isotope signature that matches Bolivian deposits (Potosi, Pulacayo) and Tiwanaku artefacts. This suggests an import from Bolivia. Two samples have a similar signature to the Castillo de Huarmey rock samples and match the Province I ranges. This may indicate a local product. Unfortunately, there is a visible similarity to the isotope signature of the ore samples from Peru, which may indicate an exchange from this region. The lead isotope signature of one of the samples is that of Province IV, indicating imports from southern Peru. The results for the remaining samples are the same as the results of the Conchopath artefacts. This indicates the origin of the ore from the Julcani mine. However, the linear nature of the results obtained for these samples may also indicate the mixing of ores from different mines (eg Cero de Pasco) or the smelting of metals. To be able to more accurately determine the origin of individual artefacts, more analyzes of Cu, Ag and Pb isotopes would be needed for many metal deposits used in ancient times. This would provide a better picture of the correlation or absence of Cu or Ag isotopes with Pb isotopes for different types of deposits and ores.

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