

**Strontium isotope MC-ICP-MS
analysis of hair strands from human
mummies: transhumance
pastoralism of Early-Modern
individuals between Northern and
Central Italy**

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Mammal hair is formed by a scleroprotein, namely keratin, composed by some major elements (C, N, H, O, S), but including also trace elements such as Sr, Pb, Fe, K, Na and Ca. The latter are fixed through diet and exposure to exogenous sources, mainly water and air. Given that the average human scalp hair growth is ~1 cm/month, time-resolved hair sampling yields information about a specific period, reflecting the elemental and isotopic composition of the diet and environment at that time. The ⁸⁷Sr/⁸⁶Sr ratio of mammal tissues is generally directly correlated to the local bioavailable strontium, providing the chance to reconstruct the individual movements in a given time interval.

In this work, we developed our protocol to analyse low-Sr concentration mammal hairs for their ⁸⁷Sr/⁸⁶Sr ratio by Neptune MC-ICP-MS. We tested the method on a modern individual who traveled cyclically between Italy and Brazil. Hair strands were sampled with a time resolution of 1 to 2 months, yielding time resolved isotopic variations from the highest radiogenic ratios of the São Paulo area to the lower ones of Modena waters. Thus, the Sr analysis of hair has been applied to human mummies (Roccapelago, Modena, 16th-18th cent.). Hair strands were cut in several sub-samples with different length (time-resolution) in relation to the amount of available material. The best achieved time-resolution was of 3 months in a 12-cm-long strand. These samples revealed cyclical human movements from Roccapelago to the high radiogenic area of the Tuscan Magmatic Province. Historical documents attest a high frequency of human seasonal travels to Tuscany, up to the Grosseto area, likely linked to the exploitation of transhumance pastoralism.