# Sr isotope exchange in bone apatite: an $^{84}$Sr-enrichment experiment

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Bone apatite is a form of calcium phosphate, $Ca_{8.3}\square_{1.7}(PO_4)_{4.3}(HPO_4$ and $CO_3)_{1.7}(OH$ and/or $CO_3)_{0.3}\square_{1.7,}$ where □ indicates a vacancy in the structure [1]. Strontium substitutes for Ca in bone apatite, and the Sr-uptake chain system enables $^{87}$Sr/$^{86}$Sr ratios to be used for many purposes such as the tracing of ancient human migration pattern. However, bone apatite is often poorly crystallized and prone to being recrystallized and isotopically exchanged with dissolved ions derived from burial soil. Meanwhile, cremated bone exposed to high temperatures is reported to contain highly crystalline apatite, which is not easily affected by exogenous contaminants [2]. Snoeck *et al.* [3] demonstrated that the calcined bone preserves original chemical composition, and are more resistant to diagenetic alteration than enamel, by an experiment exposing enamel fragments and calcined bone fragments to a $^{87}$Sr-enriched solution.

In this study, to examine the effect on susceptibility of bone to post-depositional contamination by the difference in crystalline of bone apatite, we conducted an experiment exposing modern boar bone fragments suffered from no-heat and heat at 300, 600, or 900ºC to a $^{84}$Sr-spiked solution (1.1 mg$SrCO_3$/L), which was made from $SrCO_3$ consisting of $^{84}$Sr (99.65%), $^{86}$Sr (0.14%), $^{87}$Sr (0.03%), and $^{88}$Sr (0.18%). The bones heated at 300 and 600ºC showed rapid changes in $^{84}$Sr/$^{86}$Sr and $^{87}$Sr/$^{86}$Sr ratios during the first 15 days of exposing and after that the increases became smaller, while the no-heated bones showed constant changes in $^{84}$Sr/$^{86}$Sr and $^{87}$Sr/$^{86}$Sr from 0.0565 to 1.9991 and from 0.70834 to 0.70781, respectively, during 12 months. Meanwhile, the bone heated at 900ºC showed little changes in $^{84}$Sr/$^{86}$Sr and $^{87}$Sr/$^{86}$Sr from 0.0565 to 0.0732 and from 0.70834 to 0.70829, respectively. The results indicate that bones heated at high temperature, having high crystalline, are resistant to post-mortem isotope exchange during burial, and can preserve original chemical composition. In the presentation, we will also show the result of carbon isotope change in bone apatite.

[1] Cazalbou *et al.* (2004) *J. Mater. Chem.* **14**, 2148-2153. [2] Lanting *et al.* (2001) *Radiocarbon* **43**, 249-254. [3] Snoeck *et al.* (2015) *Rapid Commun. Mass Spectrom.* **29**, 107-114.