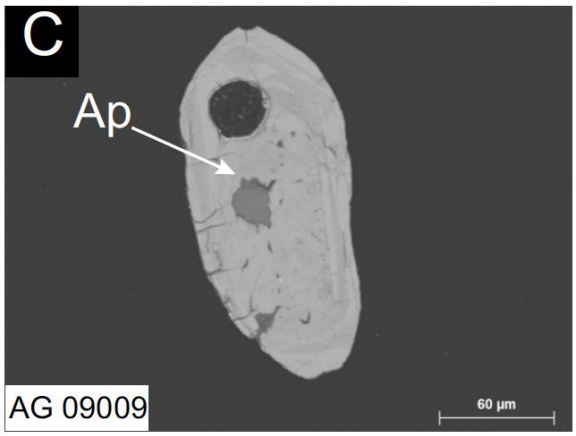
UNDERSTANDING PRESERVATION OF PRIMARY SIGNATURES IN APATITE BY COMPARING MATRIX AND ZIRCON-HOSTED CRYSTALS FROM THE EOARCHEAN ACASTA GNEISS COMPLEX (CANADA)

En Français:

Une nouvelle étude, sur des échantillons faisant partie des plus vieux de notre planète, montre comment le minéral zircon peut servir de capsule à d'autres minéraux et permettre de préserver les signatures originelles de la formation de terrains archéens. Cette étude développe une nouvelle méthode en analysant des inclusions d'apatite dans les zircons et montre que contrairement aux apatites présentent dans la matrice, les inclusions retiennent l'histoire primaire et la nature de leur roche hôte. En datant et analysant les signatures chimiques des apatites d'Acasta, cette étude démontre qu'il est possible de reconstituer l'histoire complexe de ces terrains anciens à l'échelle d'un grain de quelques centaines de microns. Cette découverte a fait l'objet d'un article publié dans *G-Cubed*.



In English:

A novel way to investigate the petrogenesis of ancient poly-metamorphosed terranes is to study zircon-hosted mineral inclusions, which are sensitive to melt evolution such as apatite. Recent contributions on such inclusions in unmetamorphosed granitoids can provide valuable petrogenetic information and, in turn, represent a way to circumvent effects of metamorphism. Yet, the impact of metamorphism on apatite inclusion has never been studied in detail. To address the issue of chemical and isotopic preservation of primary signals in apatite crystals both in the matrix and armored within zircons, researchers from the laboratoire magmas and volcans (LMV, Université Clermont-Auvergne / CNRS / IRD / Université Jean Monnet / OPGC), have studied apatite crystals from four 3.6-4.0 Ga TTG granitoids from the Acasta Gneiss Complex (Canada). The results demonstrate that U-Th-Pb isotope systematics in matrix apatite crystals were reset at 1.8-1.7 Ga (Wopmay orogen) whereas primary REE signatures were preserved in many crystals. In contrast, zircon-hosted apatite inclusions all preserved primary REE signatures despite variable ages between 1.7 and 4.0 Ga. The authors interpret these age resettings as a consequence of radiation damage accumulation in zircon lattice. Only the most pristine zircon crystal has an apatite inclusion with a concordant age consistent with the magmatic age of the zircon (4.0 Ga). In addition, the results show that apatite crystals from TTG have distinct REE composition from post-Archean granitoids apatites, that is preserved even in some apatites with reset ages. This capacity to retain primary information and discriminate granitoid types makes apatite a very valuable tool for reconstructing the nature and evolution of ancient crustal rocks through the use of detrital minerals.

Reference:

C. Antoine, E. Bruand, Guitreau, M., Devidal, J-L (2020). Understanding the preservation of primary signatures in apatite by comparing matrix and zircon-hosted crystals from Eoarchean Acasta gneiss complex (Canada); *G-Cubed*. https://doi.org/10.1029/2020GC008923