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Effect of Radium mobility on the U-Pb systematic and age determination of uraninite.

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The U-Pb radio chronometer is commonly used to date the formation of uraninite, a major component of uranium deposit. Uraninite was first used in 1905, when Rutherford determines ages up to 500 Ma in using their He/U ratio, and in 1907 when Boltwood determine the first U-Pb ages (413-535 Ma). During the last decade, in situ U-Pb datation on Uraninite has been developed, either in using "chemical ages" with the determination by EMP of U and Pb contents, either in using "isotopic ages" with the determination of Pb and U isotopic ratios and contents by SIMS, providing a large amount of age from archean up to Cenozoic ages. It is noticeable that the determination of chemical age relies on the assumption that the U-Pb system stay closed over time. This assumption can be supported by many isotopic measurements providing concordant or close to concordance ^{238}U-^{206}Pb and ^{235}U-^{207}Pb ages.

However, during the last year, SIMS U-Pb age determination on Uraninite from the Imouraren (Niger) uranium deposit provides contrasted results. On one hand, samples provide concordant U-Pb ages with an average value of 99 $\pm$2 Ma. On the other hand, samples provide largely discordant ages, with ^{207}Pb/^{206}Pb ages up to 340 Ma. Duplicated measurements and careful data examination allowed us to discard any common lead contamination as a source of discordance. Therefore we set the in situ measurement of the U series nuclides ^{238}U - ^{234}U - ^{230}Th - ^{226}Ra. The high transmission at high mass resolution of the CRPG –Cameca IMS 1270 ion microprobe allowed us to get significant secondary beam intensities for the smaller isotopes and to determine the activity ratios with a few % precision. These measurements points out that ^{234}U and ^{230}Th are at equilibrium with ^{238}U, when ^{226}Ra may be largely depleted, up to 50%. This points out that in the geological context of the deposit, hydrothermal fluids may leach Ra. To explain the observed discordant ages, Ra should have been lost during a large amount of time since the deposit formation, suggesting a continuous rock fluid interaction in a stable geological context.