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THE RB-SR METHOD APPLIED TO ACID - LEACHATES OF CLAY MINERALS : A POTENTIAL DATING METHOD OF LATE RECRYSTALLIZATION PROCESSES

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Examination of the possibilities of storage of long-life nuclear waste in geological formations, such as the Callovo-Oxfordian claystones of the Eastern Paris Basin, needs to evaluate as precisely as possible the potentials of such possible disposals in detailling precisely the history of the host rocks, and to decipher the effects of the successive events on their chemical and physical characteristics. In this context, the clay minerals can be used as indicators of the diagenetic evolution of sedimentary formations However, occurrence of detrital material together with authigenic soluble minerals in the finest clay fractions may bias the K-Ar and Rb-Sr isotopic dates, suggesting the use of leaching techniques to remove the elements adsorbed on and dissolve the soluble minerals mixed with the clay particles, into the leachates. Analyzed for their chemical compositions, these leachates can also provide information about the type of the crystalline phases intimately bound with the clay particles (e. g. carbonates or phosphates).

HCl-leaching was applied here to a smectite-rich bentonite layer occurring in the Callovo-Oxfordian claystones. A Rb-Sr age based on the leachate and residue data points of the finest clay fraction is identical to the K-Ar value of the same clay fraction (140 Ma), suggesting that: (1) both ages correspond to the crystallization time of the smectite, and (2) the HCl-soluble phase and the smectitic material were contemporaneous. These results allow to constrain an evolutionary model for the clay material of the bentonites which can be extended to the claystones despite systematic occurrence of detrital material.

The same leaching method was also applied to the <0.2µm clay fractions of the claystones. The REE patterns suggest the occurrence of apatite-like minerals dissolved in the leachates. Use of the Rb-Sr isochron method points to two types of leachates: those of the smectite-rich mixed-layers illite/smectite (I/S) giving meaningless Rb-Sr dates suggesting a mixture of non-contemporaneous soluble mineral phases, and those of the illite-rich I/S providing a value of about 90 Ma, indicating the crystallization of authigenic phosphates during late and probably limited fluid migrations that did not interact with the clay particles.

This new methodologic approach appears to have potentials to date mineral crystallizations or recrystallizations in sedimentary sequences, and to contribute to the knowledge of related, more or less extended, fluid circulations, leading to permeability decreases in the whole sedimentary sequences. In the Callovo-Oxfordian claystones, the results suggest a discrete recrystallization of mainly phosphates occurring about 50-60 Ma after deposition of the sediments, and which had no effect on the clay material.

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