## 10th International Conference on High Level Environmental Radiation Areas (ICHLERA 2022)



ID de Contribution: 145

Type: ORAL

## Influence of Initial poisons and clays on the criticality of Oklo natural nuclear reactors

mardi 28 juin 2022 15:20 (20 minutes)

In the aim to assess more the Oklo phenomenon through the numerical modelling and simulation, within the geological context based on field observations and measurements, a Python-based code is developed to automate the criticality research for a given configuration among a specific parameter, considered as the main variable of investigation. The home-made python program interacts with dedicated code for nuclear reactor criticality calculation, namely MCNP. This allowed us to investigate the asymptotical criticality occurrence, which corresponds to infinite multiplication factor  $k_{\infty}$  as a function of Uraninite fraction volume and total saturated porosity:  $k_{\infty}$  (V\_UO2, $\Phi_{C}$ )  $\cong$ 1 for different situation defined with relevant parameters, namely: Initial Poisons (Gd, Sm and Nd) and Clay fraction in the Gangue part of the U-rich ore. Indeed, in the first step of the present work, a generic U-rich ore was simulated over a given interval of Uraninite volume fraction and the corresponding porosities needed (Critical Porosity  $\Phi_{C}$ ) to reach criticality were obtained. It shows that an optimal point can be defined as the minimal one on the isocritical curve  $k_{\infty}$  (V\_UO2, $\Phi_{C}$ )  $\cong$ 1. This point, called "Inception point", is the most likely configuration to occur with low Uranium and less water defined by totally saturated porosity.

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Classification de Session: A. Oklo, from Natural core breeding to the Oklo discovery