Analysis of the behavior of migration of neptune in fractured medium in four types of matrices rocks

L. S. S, de Sá[1], C. S. da Silveira[2], Z. R. de Lima[3]
e-mail: ludimilasalles.md@gmail.com , siqueira_claudia@yahoo.com.br , zrlima@ien.gov.br

[1]*COPPE/UFRJ,*[2]*ELETRONUCLEAR*
[3]*SETER/IEN*

Keywords: Radioactive waste, migration of radionuclides.

In geological repositories is relevant to analyze the groundwater movement process, because the mechanism by which the radionuclides in a repository with fractures could return to the surface would be through the groundwater circulation system. A common problem encountered is the modeling of the migration of radionuclides in a fractured medium. The objective of this work is to evaluate the behavior of the migration of radionuclides in for types of rock matrix, considering the following properties: volumetric density, porosity, distribution coefficient and molecular diffusion coefficient. In previous work it was simulated for two types of matrices rocks [1]. The physical system adopted consists of the matrix rock containing a discrete fracture in a porous medium saturated with water. The partial differential equations that describe the radionuclide movement were discretized by finite differences, and the Implicit Euler method was adopted. While the numerical scheme of progressive differences was used for the convective term. A complete description of the physical and mathematical model can be found in [2].
To simulate the model, two cases of matrix rocks were considered: granite and basalt. The radionuclide considered was ^{237}Np which is one of the most important actinides in nuclear waste, due to its long half-life and high dose factor. Table 1 lists some of the data used to describe the physical model and the properties of the parent rocks. The values adopted in spatial and temporal discretization in finite differences were: $\Delta z = 1m$, $\Delta y = 0.1m$ and $\Delta t = 0.1$ years.
The behavior of ^{237}Np in the different media is in Figures 1 and 2.

Table 1 - Properties of Rocks and Fracture.

Rock Matrix	θ	$D_p(m^2/year)$	R_p	$\rho_p(Kg/m^2)$
Granite	0.01	0.01	1.0	2.7×10^3
Rhyolite	0.05	5.68×10^{-3}	18	2.4×10^3
Basalt	0.059	8.84×10^{-6}	442	2.8×10^3
Volcanic Tuff	0,10	2.99×10^{-3}	206	2.3×10^3
	$b = 0.0005\ m;\ v = 1m/year.$			

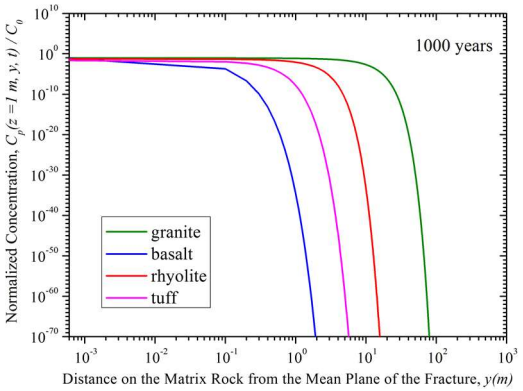

Figure1. Concentration of ^{237}Np in matrix rock as a function of the distance from the middle of the fracture.

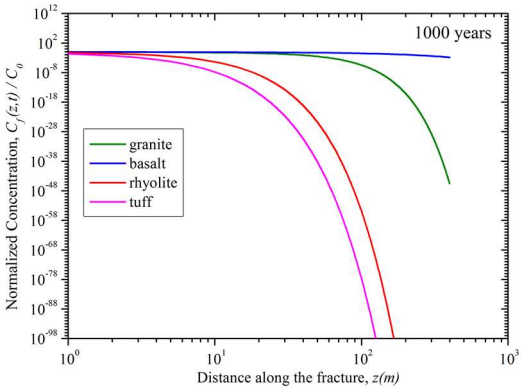

Figure 2. Concentration of ^{237}Np along the fracture.

With the results we can conclude that the granite presents a greater retention of ^{237}Np and the basalt the lesser retention, presenting a greater concentration of ^{237}Np in the fracture. Thus, the amount of ^{237}Np that can be released into the biosphere, due to the presence of a geological lineament [2], should be less in the case of granite.

The authors are grateful for the financial support of CNPq and CNEN.

References

[1] DE SÁ, L. S. S; DA SILVEIRA, C. S.; DE LIMA, Z. R. Analysis of the behavior of radionuclide migration in fractured medium in different types of matrix rocky, Progress Report - IEN, 2018, n.3.
[2] SILVEIRA, C. S. Avaliação Numérica do Transporte de Radionuclídeos em Rocha Fraturada, Tese de Doutorado. COPPE/UFRJ, (2013).