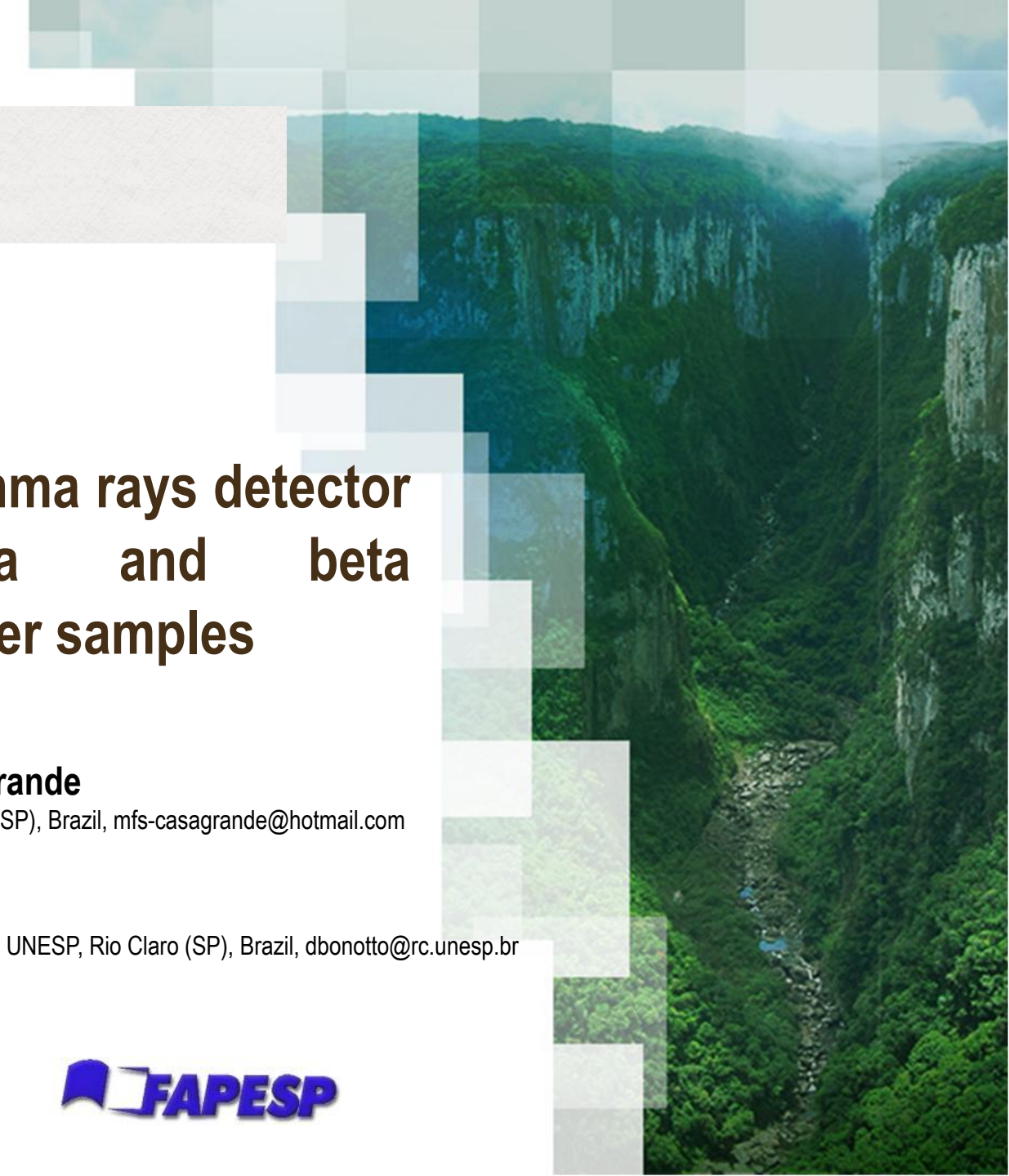
2016 Rio
norm VIII
Eighth International Symposium on Naturally Occurring Radioactive Material – NORM VIII
Rio de Janeiro, Brazil, October 18 -21, 2016



The use of HPGe gamma rays detector for gross alpha and beta measurements in water samples

Matheus Felipe Stanfoca Casagrande
Undergraduation in Geology, UNESP, Rio Claro (SP), Brazil, mfs-casagrande@hotmail.com

Daniel Marcos Bonotto
IGCE-Geosciences and Exacts Science Institute, UNESP, Rio Claro (SP), Brazil, dbonotto@rc.unesp.br

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1. Objectives

The aim of this project is the simultaneous characterization of gross alpha and beta radioactivity in waters through a coaxial Hyper-pure Germanium (HPGe) gamma ray detector and its use in the analysis of water samples from different aquifer systems located in the states of São Paulo, Minas Gerais and Mato Grosso do Sul.

2. Methodology

- Water sampling
- Calibration in Energy (keV)
- Calibration in Concentration (ppm)
- Calibration in Activity Concentration ($Bq.g^{-1}$)
- Efficiency Detection curve (%) generation
- Gross alpha and beta activity calculation

Radionuclide	Decay mode	Decay Series
^{214}Bi 1120,19 keV	beta	^{238}U
^{214}Bi 1764,49 keV	beta	^{238}U
^{226}Ra 186,1 keV	alpha	^{238}U
^{228}Ac 911,21 keV	beta	^{232}Th
^{228}Ac 968,27 keV	beta	^{232}Th
^{208}Tl 583,19 keV	beta	^{232}Th
^{208}Tl 2614,53 keV	beta	^{232}Th
^{224}Ra 240,9 keV	alpha	^{232}Th
^{40}K 1460,8 keV	beta	^{40}K

Table 1. Radionuclides used in the calibration of the spectrometric system.

3. Results

- Calibration and efficiency curves with significant correlation coefficients.

- Gross beta results were considerably higher with the use of ^{208}Tl when compared to the values generated by ^{228}Ac, with averages of 2,2 and 0,69 $Bq^{*}l^{-1}$, respectively.

- Water samples from fractured aquifers were the ones with the highest values of gross alpha and beta radioactivity (some springs from Caxambu, Lambari, Cambuquira, Poços de Caldas and Serra Negra, being lithologically associated with orthogneisses, migmatites, pegmatites veins, sienites and occurrences of traquites and alkaline breccias).

- Samples collected from porous aquifers belonging to Paraná Basin showed lower activity values compared to those observed in the fractured context.

-Possibility of analysis without the use of chemicals, sample destruction or even the use of more than one spectrometric system. The disadvantages can be resumed by the incapacity of alpha calibration through isolated and intense peaks.