X-RAY MICROTOMOGRAPHY: COMPARING RADIATION SOURCES AND RESOLUTIONS ON STUDY OF POROSITY IN VOLCANIC ROCKS

Vieira, L.D.[1]; Becker, M.[2]; Waichel, B.L.[1]; Mouro, L.D.[1,3]
[1]Universidade Federal de Santa Catarina, PFRH-PB 240; [2]Universidade Federal do Rio Grande do Sul;
[3]Universidade Federal do Rio de Janeiro

The X-ray microtomography (micro CT) is a non-destructive technique which has been used to generate 3D reconstructed models of samples and acquire microstructure informations from analysed materials. The technique is based on the emission of X-ray particles through a sample on a rotation stage. These particles reach a scintillator, converting the X-ray into visible light that is captured by a photodetector, generating tridimensional digital images of the sample. The result will be a series of projected images that can be tomographically reconstructed. The development of microtomographic imaging using the synchrotron radiation as X-ray source was a significant advent. The synchrotron emitted light is many orders brighter than the conventional X-ray source emitted light. Anothers advantages of synchrotron X-ray radiation includes the X-ray parallel beam configuration, which simplifies the tomographic reconstruction algorithm, and the use of a monochromatic X-ray that improves the accuracy of reconstructed images, eliminating the issue of energy dependence on X-ray absorption. Here we report the micro CT results of three samples using differents resolutions and radiation sources in order to compare these two analysis variables. The samples are from rubbly pahoehoe (SR and BG) and pahoehoe (GUA-P) lava flows of Serra Geral Formation (Early Cretaceous). The resolutions obtained in the analysis were approximately 50, 8 and 4 micrometers, with the two first using conventional X-ray radiation sources and the last one using the X-ray synchrotron radiation. As the SR sample is from a massive basalt, almost none porosity was identified by either resolutions, with a calculated value of approximately 1%, what means that the porosity is homogeneously and the microporosity is insignificant in this sample. Differently, the BG sample has a range of 6% in 50 micrometers to almost nothing in 4. This result could be explained by a “drusy” pore imaged in the higher resolution and by the microporosity in the lower. Resembling results were found in GUA-P sample, however the difference observed between porosity values in 50 and 4 micrometers resolutions were larger, with 26% and 2% respectively. In this case, the macroporosity is due to vesicular pores and the values on lower resolution can be explained by microvesicularity. Considering this informations, we can infer that volcanic samples can be imaged using different resolutions and radiation sources and, consequently, different porosity values can be obtained in the same sample. Furthermore, it was observed that the samples shows a threshold resolution value for microporosity, which means that any resolution below the threshold will be very similar to the threshold value.

PALAVRAS-CHAVE: X-ray microtomography, porosity, volcanic rocks.