EVALUATION OF POROSITY EVOLUTION IN VOLCANIC ROCKS USING X RAY COMPUTED MICROTOMOGRAPHY

Vieira, L.D.[1,2,3]; Fernandes, C.P. [1,2]; Waichel, B.L.[4]
[1]Universidade Federal de Santa Catarina – Programa de Pós-Graduação em Ciência e Engenharia de Materiais; [2]Laboratório de Meios Porosos e Propriedades Termosíficas; [3]Bolsista FAPESC/CAPES; [4]Universidade Federal de Santa Catarina – Departamento de Geociências

ABSTRACT: Based on the principle of attenuation produced as the radiation pass through a sample, the X ray computed tomography (µCT) has been widely applied for microstructural studies of several materials using image analysis, including varied rock types in order to obtain petrophysical properties, such as porosity and permeability, in addition to mineralogical studies. When compared with other lithologies, applications of the technique for microstructural studies in volcanic rocks are scarce, thus this work has the objective of evaluate primary and secondary porosity evolution in two volcanic rock samples from Serra Geral Group. The samples NP1B and S2 were collected in Rio Grande do Sul State, in the cities of Nova Pádua and São Marcos, respectively. In macroscopic and field analysis, the first sample were described as being from the top of an acid flow, with the presence of primary vesicles posteriorly filled in secondary process, promoting an negative effect on rock porosity; The S2 sample comes from an vesiculated basalt at the top of an pahoehoe flow, the porosity situation is similar from that observed in NP1B sample, with the decrease of primary porosity by secondary process. For microstructural analysis the sample were prepared in plugs with 8 millimeters in diameters and 30 millimeter in height, being possible to achieve the resolution of 4.33 µm using the microtomograph of sincrotron radiation from Argonne National Laboratory, in Chicago, Illinois. After the acquisition, the obtained images were reconstructed and posteriorly processed on Laboratório de Meios Porosos e Propriedades Termofísicas (LMPT-UFSC) using the software Avizo 7.1, going through the binarization process, wherein were determined the solid and fluidic (pore) phases of the samples. At first analysis, all the pores, filled and unfilled, were considered as part of samples' primary porosity and, posteriorly, only the unfilled pores were considered in fluidic phase. The results of porosity for NP1B sample varies from 1.94% in formation porosity to 0.04% in final porosity, with primary vesicles being majorly filled by secondary minerals. The S2 sample showed initial porosity values of 1.81% and finals of 0.10%, with secondary minerals filling most of its vesicles. However, secondary processes were also responsible for the pore formation in S2 sample, by plagioclase crystals dissolution. For NP1B sample, where there are predominance of primary pores and few produced by secondary processes, the technique were quite efficient. In other hand, situations where primary and secondary porosities are equally relevant for sample's total porosity, as viewed in S2 sample, some other cares must be taken in order to not to considerer secondary pores as part of sample's initial porosity.

KEYWORDS: X RAY MICROTOMOGRAPHY; VOLCANIC ROCKS; POROSITY.