PRIMARY VESICLES, VESICLE-RICH SEGREGATION STRUCTURES AND RECOGNITION OF PRIMARY AND SECONDARY POROSITIES IN LAVA FLOWS FROM THE PARANÁ IGNEOUS PROVINCE, SOUTHERN BRAZIL

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RESUMO: This study focuses in the Santa Cruz do Sul-Herveiras road profile in southernmost Brazil where a volcanic succession from pahoehoe to rubbly lavas of the Paraná–Etendeka Province is exposed. Identification of the petrophysical properties of basaltic lava flows, including the various shapes, sizes, origins, and filling materials of the vesicles, can determine their suitability as possible unconventional volcanic reservoirs. This work provides an integrated approach for examining primary vesicles and vesicle-rich segregation structures in the mesoscopic scale as well as quantitatively analyze the pore types in thin section. This paper establishes distinct primary vesicle distribution patterns according to lava thickness. The V1 vesicles are ubiquitous in both lobes (up to 1 m thickness) and inflated pahoehoe lavas (2-6 m thickness). These vesicles also occur in both basal portion and top breccias of the rubbly lavas (30-50 m thickness). The V2 vesicles occur at the base of both P-type lobes and inflated pahoehoe lavas. V3 vesicles occur in the upper half of the core of both inflated pahoehoe and rubbly lavas.This study also highlighted that vesicle-rich segregation structures are preserved only in the inflated pahoehoe lavas. Proto-cylinders are typical of the base of these flows; cylinders, C-S cylinders and S2 sheets occur only at core of these lavas, while S1 sheets appear only in the top. Gas release process to lead to primary porosity, while alteration and tectonic fracturing are the main processes that generate the secondary porosities including intracrystalline sieve in plagioclase, intracrystalline in olivine, spongy, cavernous, lacy, intra-fragment, intra-matrix, intra-cement, quench and tectonic fractures. Despite of several porosities identified in the study area, the precipitation of secondary minerals within the developed open spaces strongly decreases the existing porosities. On the other side, the presence of fractures, dykes, and layers crossing the studied lava flows could represent an efficient channel network for hydrocarbon migration. However, these structures are sealed by sandstone and secondary minerals, which reduce the available space for hydrocarbon storage. Future studies should now focus on an integrated approach of quantitative analysis of porosity and permeability coupled with brittle tectonic studies in order to define the effective porosity degree of the basaltic lavas of the south hinge of TS, which could help to build predictive models of reservoir quality for hydrocarbon storage.

PALAVRAS-CHAVE: PARANÁ-ETENDEKA PROVINCE, VESICLE-RICH SEGREGATION STRUCTURES, VOLCANIC POROSITY.