



## Identification of the intrusive events Mosquito and Sardinha in the Parnaíba Basin based on wireline logs, detailed description of cuttings and x-ray fluorescence analysis.

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### Abstract

The igneous rocks can play different roles in a petroleum system. They can act as seal, reservoir, trap or heat supplier for hydrocarbon generation, justifying an interdisciplinary study to understand their function in this system. In the Parnaíba Basin these rocks function as traps and heat source for gas generation and is fundamental the understanding about the correct timing for these intrusions in the sedimentary column, as they function as critical moment. Two important events occur: Mosquito (Early Jurassic), and Sardinha (Early Cretaceous), and both can be act as trap or heat source. Our objective is identified and separate these two igneous events using wireline logs, detailed cuttings description and X-Ray Fluorescence (XRF) data. The integration of these data indicates two distinct sets of intrusions and variations in chemical and mineralogical composition along the intrusions. Nine wells were studied in the Parnaíba Basin, drilled in the Hawks Park Cluster, na important gas producing area. We individualized 60 intrusive igneous bodies using the Igneability Feature, with thicknesses ranging from 30cm to 185.3m. These intrusive bodies show two distinct features in the gamma-ray (GR) log, dividing them into “Barriguda” (Paunchy) and “Caixote” (Box) shapes. Wireline logs point to a rock with density between 2.9 and 3.1 g/cm<sup>3</sup>, characteristic of basalt/diabase by cross plot GRxRHOB, which compares with the GR values to infer the nature of igneous rocks. However, in the igneous rocks that present the “Barriguda” shape, the section with the highest GR values point to andesite and even dacite compositions, indicating that this section presented a complex differentiation of the magmatic fluid, probably being the last part that suffered crystallization. When comparing density and GR logs values, two distinct sets are observed. The first with a mean density of 2.96 g/cm<sup>3</sup> and mean GR of 27 gAPI, and the second with a mean density of 3.03 g/cm<sup>3</sup> and mean GR of 19 gAPI. This difference may indicate compositional variations related to distinct events. We observe a strong correlation between GR spectral values concentrations relate to the intrusions of the low-Ti Moquito Fm. and Sardinha Fm., respectively. When we used the geochemical data published by other authorsto calculate the gamma ray of both formations, Sardinha being low GR and Mosquito high GR. When we analyze the cuttings that were related to Mosquito Fm. we detected a higher olivine concentration in the basal portion and consequently higher Mg concentration, as well as higher values of K, Rb, Ga, Zr and P in the high GR shape, indicating the presence of minerals later in magma crystallization, such as feldspar slightly richer in Na and k, zircon and phosphates. We are proposing a workflow for a better characterization of igneous rocks using basic well-logs, and detailed description and XRF analysis of cuttings to understand chemical and mineralogical variations that affect the measurements of wireline logs along intrusions. This practical workflow provides an easy way to characterize igneous rocks in any environmental setting, included Paleozoic, Jurassic and Cretaceous events, included Pre-Salt ones.

**Keywords:** Mosquito and Sardinha intrusive events; Cuttings; X-Ray analysis; Wireline logs; Parnaíba Basin.