

DOWN-HOLE GAMMA-RAY LOGGING AND THE CHEMOSTRATIGRAPHY OF BASIC VOLCANICS FROM THE CENTRAL-NORTHERN SUBPROVINCE OF THE PARANÁ IGNEOUS PROVINCE

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Researches have shown that the Paraná Igneous Province comprises two subprovinces (Southern and Central-Northern subprovinces), each with their own chemostratigraphic peculiarities. This study focus solely on the Central-Northern Subprovince (CNSP), whose thickness is up to 1,722.5 meters in borehole 2-CB-001-PR, Cuiabá Paulista, State of São Paulo. Multi-element geochemical analyses (63 elements) on 876 chip samples collected from seven deep boreholes, which are aligned along a 538 km NE-SW section that goes from Foz do Iguaçu to Bandeirantes (State of Paraná), were used in order to establish a high-resolution chemostratigraphy for LSi (Low-silica) volcanics. The base of the sequence is mainly characterized by a group of LSi-LZr-HTi-HP (Type 4) volcanics enriched in incompatible elements (e.g., K₂O, Nb, Th, U and REE) that is up to 700 meters thick. They gradually change to LSi-LZr-LTi-LP (Central-Northern Type 1) rocks enriched in compatible elements (e.g., Cr, Ni, Pd and Pt) that are up to 600 meters thick. Also, gamma-ray logs obtained from the continuous logging of five oil and gas exploration boreholes (digital .LAS files provided by ANP) and six groundwater exploration boreholes (provided by Hidroingá, Hidropel and Hydrolog) were used for this research. Total count measurements are expressed in API units. However, as these logs were produced in the past 40 years by different sensors with different sensitivities, there may be some divergences in measuring scales, which precludes the parametrization and quantification of gamma-spectrometric attributes for each geochemical type. Despite this restriction, the patterns observed in these down-hole gamma logs match the chemostratigraphy of the volcanic sequence and, therefore, allow the correlation between nearby boreholes that only have multi-element geochemical data, down-hole gamma-ray logs or both. Thus, since Type 4 and Type 2 (LSi-LZr-LTi-HP) rocks usually have relatively high concentrations of K₂O, U and Th, gamma-ray logs show an increase in measured radioactivity. On the other hand, since Central-Northern Type 1 and Type 3 (LSi-LZr-HTi-LP) volcanics generally have low concentrations of these elements, the gamma-ray signal is considerably lower. Down-hole gamma-ray log may also be used to identify the clear geochemical boundary between basic and Guarapuava acid volcanics (Type 13 – HSi-HZr-LTi-LP). Furthermore, when the boundaries determined by down-hole gamma-ray logs are projected to the ground surface, they match the boundaries determined by geological mapping and surface geochemistry. The results presented herein indicate that down-hole gamma-ray logs might be used in those areas that lack geochemical data. They might also contribute to the sharp delimitation of geochemical boundaries and to the construction of a three-dimensional model of the chemostratigraphy of the Paraná Igneous Province volcanics.

KEYWORDS: GAMMASPECTROMETRY, CHEMOSTRATIGRAPHY, SERRA GERAL VOLCANICS, PARANA IGNEOUS PROVINCE