# GEOCHEMISTRY OF FLOWS, VOLCANICLASTIC DEPOSITS AND SLOPE MAPS: INPUTS FOR A LITHOFACIES MAP OF THE SERRA GERAL GROUP, STATE OF PARANÁ, BRAZIL

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The statistical analysis of lithogeochemical data from 5,974 surface and subsurface samples collected in the Paraná Igneous Province – PIP, identified gaps separating **H**igh and **L**ow contents of many elements, especially the discriminants $SiO_2$, Zr, $TiO_2$, and $P_2O_5$. The combination of these gaps allowed the classification of the igneous rocks into sixteen geochemical types, from which eight are major. Additionally, the 3D modeling of the geochemical types featured two sub-provinces: Southern (SSP) and Central-Northern (CNSP). Overall, the Serra Geral volcanics cover 100,000km² of the State of Paraná, comprising both sub-provinces. During the ongoing geological mapping, more than 3,700 locations have been visited, from which volcaniclastic rocks (breccias, tuff-breccias, and tuffs) interspersed to flows were identified in 680 sites. Their framework consists of angular to sub-round blocks and bombs (up to 1m in diameter) mostly of vesicular basalt, but also massive basalts are rarely found. Their matrix is composed of crystals and rock fragments of the Paleozoic sedimentary sequence (country rock), basaltic ash and abundant sideromelane shards, indicating the participation of external water. As the flows and volcaniclastic deposits dip towards the CNSP's SW-NE major axis which coincides roughly with the Paraná River valley, it is not feasible to use topographic contour lines to outline the units limits or the contacts among them. To bypass this obstacle, slope maps were drawn based on the 10m contours lines extracted from the 90m interpolated to 30m Shuttle Radar Terrain Model (SRTM), covering 14 map sheets in a 1:250,000 scale. Thus, lithogeochemistry, presence of volcaniclastics and slope maps were combined using hand selection techniques and native classification functions in a GIS environment. From the results, it follows: (1) neighboring volcaniclastic field stations located on a same >12° slope strip, characterize continuous Mafic Volcaniclastic Deposits (MVDs); (2) on the CNSP's base, MVDs are mainly associated with **Type 4** (LSi-LZr-HTi-HP) rocks, which are incompatible enriched and fall on the alkaline field; (3) from the transition to **Type 1 CN** (LSi-LZr-LTi-LP) until the top of the stratigraphic column, tholeiitic and compatible enriched rocks predominate over increasingly rare MVDs; (4) types **14** (HSi-HZr-LTi-HP) acidic flows are closely associated with **Type 4** basic flows; (5) the >12° slope strips have enough spatial resolution to delimit (a) **Types 4** and **1 CN** flows, (b) thin **Type 13** (HSi-HZr-LTi-LP) flows interspersed with the main **Type 14**, (c) interspersed flows of the **Types 4, 1 CN** and **13** and also their contacts with the Botucatu sandstones; (6) for the SSP, in the domains of **Types 1 S** (LSi-LZr-LTi-LP) and **9 CS** (HSi-LZr-LTi-LP) all these observations remain. The spatial structure of the shapefile allows the map to be easily improved as new geochemical data is added. The results validate this technique as an useful tool to draw lithofacies maps of the PIP, not only at a regional level but also in a detailed one. It also consolidates the evolutionary model proposed for the CNSP which considers hydrovolcanic events occurring in the initial and main phases, becoming reduced in the waning.

KEYWORDS: PARANA IGNEOUS PROVINCE; CHEMOSTRATIGRAPHY; LITHOFACIES MAP