



## **Discovery and description of gossans above amethyst deposits in altered volcanic rocks of the Paraná province, South America**

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We discovered a large number (probably thousands) of gossans in the intraplate volcanic rocks of the Paraná volcanic province, South America, based on observations of satellite images and field work associated with geochemistry and geophysics. We thus define a straightforward prospecting guide for agate and amethyst deposits. The study area is located on the border between Brazil and Uruguay, covering the Los Catalanes geological district and the Quaraí mining district. Anomalies in Google Earth satellite images were identified above six underground mines in the Los Catalanes geological district, characterized in the pampas of the region as irregular structures of intense green color and sometimes with brownish, rough texture. The vegetation, scintillometric and geochemical anomalies occur at several stratigraphic levels in the volcanic group. Three scintillometric profiles performed on the Maurício Mine in the Los Catalanes geological district indicate low emission rates near 55 cps (sd = 4.7) in the gossan compared with the regional average of colada Cordillera (63 cps). Whole rock geochemical analyses of three samples collected within the underground mine indicate high loss on ignition (4.5, 3.4, 4.5 wt.%). LOI higher than 2% is considered a strong indicator of intense hydrothermal alteration in the gossan. In the Quaraí mining district, gossans were studied in five areas, two in colada Catalán, two in colada Muralha, and one in colada Cordillera. The world-class deposits of amethyst and agate geodes are in coladas Catalán and Cordillera. Negative radiometric anomalies (higher than one standard deviation) occur in these gossans. The detailed study of one gossan included a geophysical grid spacing of 50 x 50 m (K, U, Th and total emission rate) and whole rock geochemical analyses (ACME, Canadá). The whole rock geochemical analyses of 17 samples collected within and outside the gossan classify the rocks as basaltic andesites, low-Ti, Gramado chemical type. The samples inside the gossan display high values of loss on ignition (2.3, 2.8, 2.9, 2.8, 2.9, 2.4, 2.6, 2.6, 2.3 and 2.3 wt.%), while outside the gossan the values are lower (0.8, 2.3, 0.5, 0.5, 1.6, 0.5, 0.6, 0.7, 1.1, 1.3 and 1.9 wt.%). SiO<sub>2</sub>, K<sub>2</sub>O and Rb show strong negative correlation with loss on ignition, while MgO has a slight enrichment. The low scintillometry in the gossan is defined primarily by the lower K<sub>2</sub>O of the altered rock. We thus report the discovery of gossans above amethyst geodes in the world-class deposits of the Paraná volcanic province and present a first description of the structure, a straightforward prospecting guide for additional deposits.