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MAPPING OF Fe2O3 , Nb and TiO2 , AS A SUPPORT TO CLASSIFY OUTCROPPING MATERIALS IN" MORRO DOS SEIS LAGOS" CARBONATITE COMPLEX, BRAZILIAN AMAZON

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The study goal was the preliminary mapping of Fe_2O_3, Nb and TiO_2 contents to support of the classification of outcropping materials (focused on laterite types), in "Morro dos Seis Lagos", in Brazilian Amazon. The methodological procedures were based on machine learning tools, gathering Sentinel-2 MSI and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) sensor data, numerical terrain models (all with 20 m spatial resolution), and geochemical legacy dataset from the Geological Survey of Brazil (CPRM). The input geochemical dataset was subdivided in training dataset (341 samples) and validation dataset (85 samples) to apply the Random Forest (RF), in 60 loops of iteration, and the model's performance were evaluated through the average values of the metrics (R^2, RMSE and MAE). Subsequently, the resulting average maps were combined using cluster analysis (k-means) via unsupervised classification, performed at the R environment through the Vegan package, where the number of resulting classes was optimized taking into account the "Simple Structure Index" (SSI) criterion. Different cluster grouping was tested considering classes number (6 to 10) and interactions (0 to 8000), and the resulting classes (zones) were contrasted with available geological map. The results showed the best performance in modeling via the Random Forest (RF) model associated with Recursive Feat Elimination (RFE) for the elements Nb (R^2=0.08, RMSE = 0.86, MAE = 0.66), TiO_2 (R^2=0.14, RMSE = 3.90, MAE= 2.56) and Fe_2O_3 (R^2=0.23, RMSE =19.77, MAE = 14.12). Based on the results obtained via preliminary cluster analysis, the best optimization was achieved grouping in 9 classes, according to SSI criterion. The results showed agreement when compared to the classes of the geological map available for the area, but with better detailing of the laterite facies. The conclusions of the preliminary study pointed out that advances regarding the scale detail provided better understanding the behavior of the variability in laterite and talus deposits with the support of machine-learning tools and covariates from remote sensing data. However, improvement in the cluster classification can be achieve by adding other geochemical compounds and testing different predictive models.