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AI oriented prospectivity mapping to study relationships between Sb mineralization and geological framework

Alex Vella[1,2], Charles Gumiaux[1], Guillaume Bertrand[1,2], Bruno Tourlière[2], Eric Gloaguen[1,2], and Stanislas Sizaret[1]

[1]Institut des Sciences de la Terre d'Orléans (ISTO – UMR 7327) – Orléans, France
[2]Bureau de Recherches Géologiques et Minières (BRGM) – Orléans, France

Prospectivity mapping aims at producing favorability maps, outlining areas with the highest likelihood to host mineralization. This process can be done using data-driven approaches, based on statistical and spatial analyses on geological features and known mineral occurences. Besides, such approach contributes to better understand metallogenic processes by highlighting specific and systematic associations between deposits and geological features (structures, lithologies, contacts, geophysical anomalies, etc).

As part of the AUREOLE project, prospectivity maps of Sb throughout the West European Variscan Range are being produced using CBA ("Cell-Based Associations"). CBA is a prospectivity tool developped for mineral prospectivity mapping by the French Geological Survey (BRGM). This method divide at first space into a regular cells grid. Inside each cell, the associations of geological factors, such as lithological, structural, geophysical or geochemical features, are grouped together and define the geological framework in the vicinity of the given cell. This project aims at developing and improving this method by the addition of new machine learning methods and statistical and spatial analysis tools for the automated classification and the calculation of favorability score.

Application of this approach to the Ibero-Armorican Arc, relying heavily on Artificial Intelligence to process the data, will highlight statistical relationships between the Sb deposits and their surrounding geological framework. Computations will be performed at multiple scales and in different areas trough the Arc, in order to observe the influence of scale in the consistency of the results and to bring out general laws from local specificities in the metallogenic models. Results from this almost purely data-driven approach will be compared to the metallogenical models traditionnaly proposed for Sb deposits in the studied areas. We infer this new multiscale and multidomains study would improve our understanding of the genetic processes resulting in Sb deposits through the Variscan Range and give new metallotects or specify the common ones, to be used for mineral exploration purpose.

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