

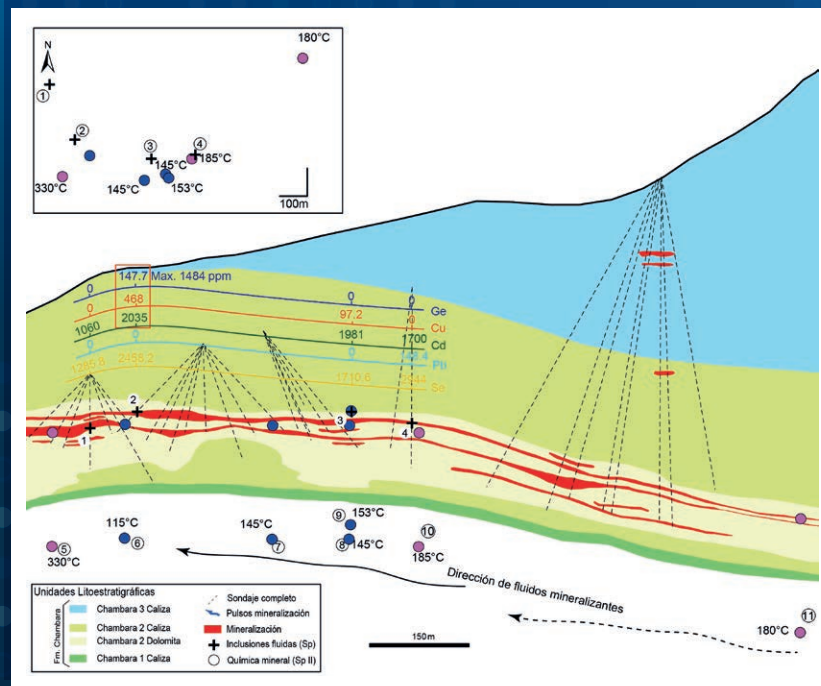
STUDIES OF STRATEGIC ELEMENTS

INGEMMET has been developing various projects aimed at determining the prospective potential of Peru through strategic elements.

For this it is necessary to determine the spatial, temporal and genetic relationship of the mineral deposits of mining importance and in current exploitation, which are associated with strategic elements.

Among the latter we have the **MVT type lead and zinc deposits in the North and Center of Peru**, which have contents of those elements of interest such as Ga, Ge, In, Cd, which have been studied establishing their relationship with geotectonic and magmatic events.

Among the results obtained we have the identification of high values of germanium, which exceed 1500 ppm, associated with zinc mineralization (sphalerites) and which have great prospective potential.

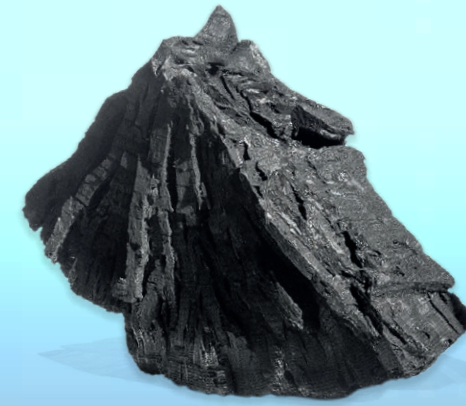


Direction of mineralizing fluids in Floryda Canyon, a zinc project in the Amazon region, where the distribution of germanium in sphalerites can be seen. Higher germanium concentration values are directly associated with lower homogenization temperatures of the mineralizing flow.

GRAPHITE RESOURCES

Natural graphite is one of the critical minerals of importance for the energy transition, used as a component for the production of electrical generators, chips, cables and for the battery supply chain of the automotive industry.

In Peru, graphite occurrences are located northwest of the Ancash region, in the horizons of the clastic and pelitic sedimentary sequences of Jurassic and Cretaceous age, in geological units that show an ancient depression known as the "Santa Basin". Currently, one of our research projects seeks to determine this potential in graphite and characterize its typology, generating areas of prospective interest with values between 72.4 to 75% of graphitic carbon.



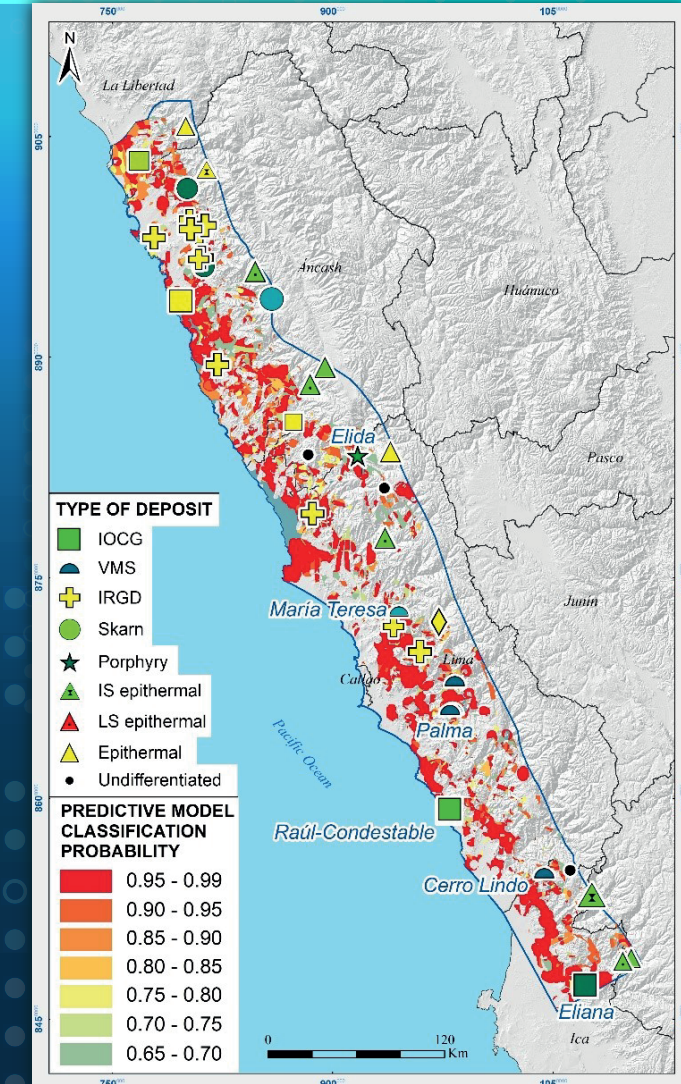
Graphite mantle in the Santa basin, Ancash region, where there are concentrations that exceed 70% of graphitic carbon.

NEW PROSPECTIVITY METHODOLOGIES USING MACHINE LEARNING and DEEP LEARNING

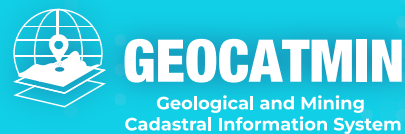
INGEMMET is developing Mineral Prospectivity Maps using Artificial Intelligence (AI) tools such as Machine Learning and Deep Learning,

1. Principal Component Analysis of Stream Sediments Geochemistry.
2. Geological units of felsic intrusive rocks, intermediate and mafic of different ages, as well as those related to the Casma Group.
3. Distance to north – south, east – west, northeast – southwest and northwest – southeast lineaments,
4. Spectral anomalies of clays, oxides
5. Mineral deposits.

A control of the model was developed using the Confusion Matrix, ROC curve and ROC - AUC parameter, among others, all within the framework of research projects that study mineralization in the Cretaceous belt of the central coast of Peru, for VMS and IOCG deposits, which have great potential to host strategic elements such as cobalt and nickel.



Mineral Prospectivity Map using Machine Learning and Deep Learning by Neural Network Classifier on the central Peruvian coast.



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Geological and mining cadastral information system of Peru, with more than 250 layers of information.

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