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Stream sediments geochemistry in the Valongo anticline, northern Portugal: arsenic as a proxy to outline new exploration targets

Geoquímica de sedimentos de corrente no anticlinal de Valongo, norte de Portugal: arsénio como proxy para delinear novos alvos de exploração

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Resumo: O anticlinal de Valongo é conhecido pela ocorrência de vários depósitos minerais de Sb-Au e As-Au, muitos deles explorados desde os tempos romanos. Os depósitos de Sb-Au e As-Au ocorrem nos filões de quartzo com estrutura brechóide com direção predominante NE-SW, NNW-SSE, e ENE-WSW cortando formações do Câmbrico ao Carbónico. Uma campanha de 801 sedimentos de corrente foi obtida nesta área. A krigagem factorial foi aplicada como um método de interpolação, usando o arsénio (As) como proxy para delinear novos alvos de exploração. Os resultados permitem a identificação de alinhamentos NW-SE e NE-SW, como preferenciais para teores elevados de As. Estudos futuros irão usar informação estrutural e a distribuição das antigas escombreyras para obter uma maior precisão nas áreas para prospeção mineira.

Palavras-chave: Exploração, sedimentos de corrente, fundo geoquímico, depósitos de Au, arsénio.

Keywords: exploration, stream sediments, background, Au deposits, arsenic.

Introduction

The Valongo anticline is known for the occurrence of many mineral deposits, with a predominance of Sb-Au deposits, some exploited since Roman times, but especially in the late 19th century.

The definition of advanced-stage exploration targets has long resorted to the spatial patterns of trace elements (or indicator minerals) in stream sediments. It is key that the data analysis approach distinguishes between patterns related to local (delimited) sources, diffuse (background) sources or random distribution. This study aims 1) to identify and model the geochemical anomalies of arsenic; 2) to recognize possible spatial anisotropies and high significance As clusters in the Valongo anticline; 3) to discriminate the natural and anthropogenic sources.

Geology

Located 18 km from Oporto, the Valongo anticline includes Cambrian to Carboniferous formations. It is asymmetric and trends NW-SE, with a synclinal to the west. Cambrian phyllites with metagreywackes are overlapped, in angular unconformity, by Tremadocian-Floian metaconglomerates quartzites and graphitic phyllites. This sequence is followed by the Dapingian-Darriwilian black shales, and by

Hirnantian quartzites with metagraywacke intercalations (Medeiros et al., 1980). Silurian black shales and quartzites occur in both anticline flanks. Devonian is represented by clay shales, thin sandstone beds and quartzites, while Carboniferous by a sedimentary breccia, black clay shales with coal intercalations (Medeiros et al., 1980). Variscan granites surround the anticline. Sb-Au and As-Au deposits occur in brecciated quartz veins, with predominant NE-SW, N-S, NNW-SSE and ENE-WSW directions (Couto, 1993; Neiva et al., 2008), cutting Cambrian to Carboniferous formations. These deposits formed through the circulation of metamorphic fluids derived from the host metasediments. Variscan folding and thrusting generated shear zones with an anomalous crustal heat flow giving rise to hydrothermal activity (Couto, 1993; Neiva et al., 2008). The structural control is clear and the deposits have been associated with shear areas active since the Variscan D1 phase (Pereira et al., 1993).

Methodology

801 stream sediment samples were collected by the Baixo-Douro (EDM-ECD-BRGM) consortium (Viallefond, 1990) with a density of 4 samples/km².

Samples were sieved at 125 μm , digested by fusion with sodium peroxide and analyzed by ICP-AES, with an accuracy of 5-10%. The detection limit for As is 5 ppm. The BRGM laboratory (France) carried out the chemical analyses. Factorial kriging (FK) was applied as the interpolation method (Journel & Huijbregts, 1978) to define distribution patterns and identify spatial anisotropies. The selection of As is due to its presence in the mineral paragenesis of Sb-Au and As-Au deposits, as well as for being an element that replaces Sb in stibnite. Stibnite usually contains As (up to 1.39 wt.% As) in the Borralhal deposit, while in arsenopyrite Sb replaces As (Couto, 1993; Neiva et al., 2008).

Results and discussion

The results confirmed the method's efficiency in identifying the NW-SE and NE-SW directions as

preferential for the high As content (Fig. 1). Future work will explore the potential of other elements present in the mineral paragenesis as indicators of undiscovered mineral deposits. Other trace elements, such as Cu, Zn, Co, Pb, and Cd will be used to confirm and validate the identified As anomalies. Additional information, such as structural features and mine tailings dumps distribution will be analyzed to delineate exploration targets.

Conclusions

Factorial kriging proved to be effective in the definition of preferential As alignments. These high As zones match the area of known gold deposits and predict the most potential target zones for exploration. Closely related to the mineral paragenesis of Sb-Au and As-Au deposits, arsenic is a good proxy to predict potential mineralized zones.

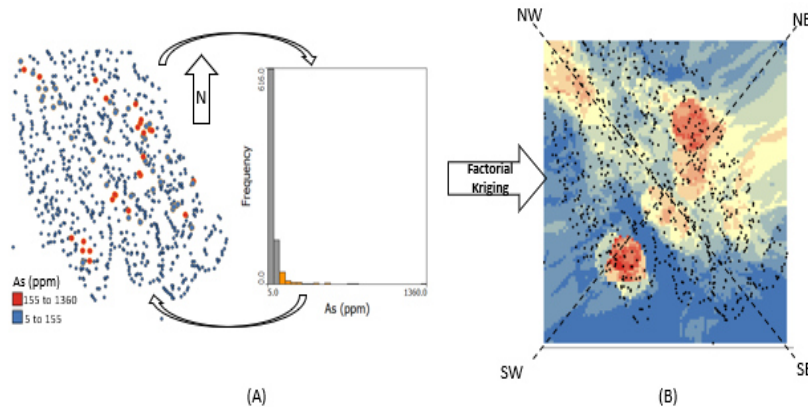


Fig. 1. a) Spatial distribution of As contents and As histogram; b) As spatial distribution (through FK) and probable spatial alignments.

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References

- Couto, H. (1993). As mineralizações de Sb-Au da região Dúrico-Beirã. Tese de Doutoramento. Faculdade de Ciências da Universidade do Porto, 607.
- Journel, A.G. & Huijbregts, C.J. (1978). Mining Geostatistics. Academic Press, London (UK). 600 pp.
- Medeiros, A.C., Pereira, E. & Moreira, A. (1980). Carta Geológica de Portugal. Notícia explicativa da folha 9-D. Serviços Geológicos de Portugal, Lisboa.
- Neiva, A. M. R, Andráš, P. & Ramos, J. M. F. (2008). Antimony quartz and antimony-gold quartz veins from northern Portugal. *Ore Geology Reviews*, 34, 533-546.
- Pereira, E., Ribeiro, A. & Meireles, C. (1993). Cisalhamentos hercínicos e controlado das mineralizações de Sn-W, Au e U da Zona Centro-Ibérica. *Cua. Lab. Xeol. Laxe* 18, 89-119 pp..
- Viallefond, L. (1990). Interpretation des resultats de la prospection geochimique tactique de la zone de Tapada-Baixo Douro (Portugal). Bureau de recherches geologiques et minieres. Orleans.