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Levelling geochemical datasets as a tool to overcome boundary features in data applied to mineral exploration

Nivelamento de dados geoquímicos para ultrapassar efeitos de bordadura aplicado à prospecção mineral

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Resumo: *A existência de um elevado número de análises químicas produzidas durante as campanhas de prospeção geoquímica ao longo de décadas, deu origem a um elevado número de resultados analíticos produzidos com diferentes métodos analíticos, protocolos de amostragem e meios amostrais. Assim sendo, é necessário fazer o nivelamento destes resultados analíticos no sentido de os tornar comparáveis e, assim, aproveitar o potencial de informação geoquímica de áreas contíguas. Neste estudo foi utilizada uma técnica de nivelamento com base em bandas testadas com várias larguras entre as cartas de escala 1:25.000, respetivamente a 293/294 e 305/306, da região da Beira Baixa onde se amostraram sedimentos de corrente durante o projeto "Terras Raras". Estas amostras foram analizadas pelos mesmos métodos analíticos e no mesmo laboratório, mas observaram-se efeitos de bordadura de carta. Estas técnicas de nivelamento devem ser adaptadas aos dados que queremos comparar e no caso presente observou-se o desaparecimento do efeito de bordadura entre as cartas 293/294/305/306.*

Palavras-chave: *Lantânio, nivelamento de dados de geoquímica, prospeção mineral, sedimentos de corrente, cartografia geoquímica regional*

Key words: Lanthanum, geochemical datasets levelling, mineral exploration, stream sediments, regional geochemical mapping

Geochemical mapping is done in Portugal since the late 1950's . The method underwent a long period of developing analytical techniques and geochemical applications. Therefore, the amount of data produced since then for different purposes and with different analytical and sampling methods is enormous. To conduct geochemical exploration is important to map regional areas to observe regional anomalies before target studies. The first step is to map the existing data. Frequently the data existing served specific objectives, analyzed by different methods with a variety of chemical extractants resulting in different backgrounds and non-geological features. Features like the frontiers between countries and topographic sheets appear in the geochemical maps putting in evidence the different analytical or instrumental data. The use of levelling of different geochemical campaigns facilitate the mapping of old data in larger areas. The objective of this study is to apply a technique of levelling lanthanum results in two sampling phases in 1:25.000 topographic sheets 293/305 and 293/294/305/306 of the Beira Baixa in stream sediments collected during the Rare Earth Elements Exploration Project financed by the INTERREG Program in the 1990's. These stream sediments were analysed in the same laboratory and with the same method but in different periods, hence, shows differences between the map sheets. This study focuses on lathanum levelling, which is a REE element analysed by INAA in Actlabs, Ontario, Canada. The levelling is based on the Daneshfar and Cameron (1998) method. Fig. 1 shows the diferences of La data between 293/294/305 and 306 map sheets. The La results in the arcosic conglomerates of Cabeço do Infante formation (Beira Baixa; covering most of the area of 293 and 305 sheets), presented a different median result of 20.6 $mgkg^{-1}$ and 34.8 $mgkg^{-1}$ respectively for 293 south border band and 305 north border band and was the first to be leveled. The method consists in the selection of the best possible band width (e.g., Fig.2b-A1/A2-B1/B2) in the border of each sheet where geological formations are more or less the same. The quantiles (0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95) were calculated after log transforming the results in both bands. The next step is to calculate the equation of regression to a 95% level of confidence where Y is the levelling data and the X the data to be leveled. The regression equations calculated first 293/305 and after for the areas A2/B2 corresponding to 293/294 and 305/306 map sheets, are:

$\log_{10}La_{(305)}=0.5257+0.7621x\log_{10}La_{(293)}$.

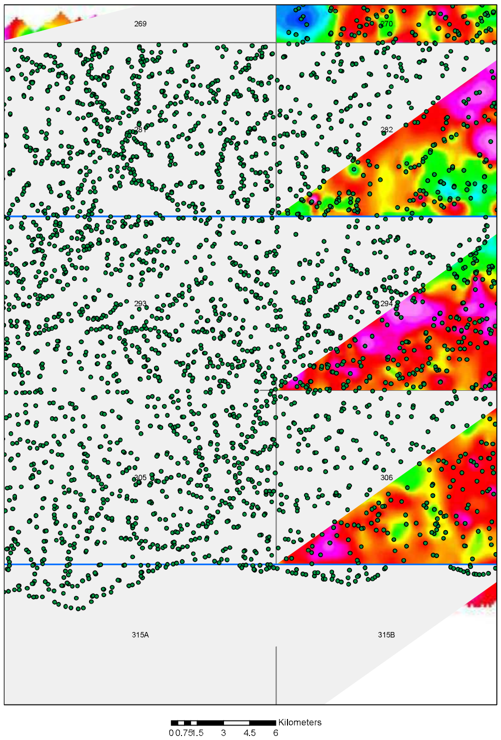

Fig. 1 – Lanthanum distribution in the boundary of two 1:25.000 topographic sheets of the Beira Baixa area, from the regional campaign of stream sediments geochemistry of the Rare Earth exploration Project.

$Log_{10}La_{(B2)}=0.627+0.6553xlog_{10}La_{(A2)}.$

After levelling both boudaries, all log(La) values were transformed from log scale into the original scale and projected as reflected in Fig. 2a, b. Multiple phases of levelling were necessary to remove the non-geological patterns evident on the raw geochemical images of a regional data compilation as stated in Agnew et al. (2004). Nevertheless, levelling needs to be a cautious exercise with a specific purpose of presenting a larger area of geochemical data taking in account that original data needs to be preserved and should be used whenever local targets are studied. Data with different sampling media, sampling protocols and analytical techniques result in different background levels and in some cases may not be possible to level the data.

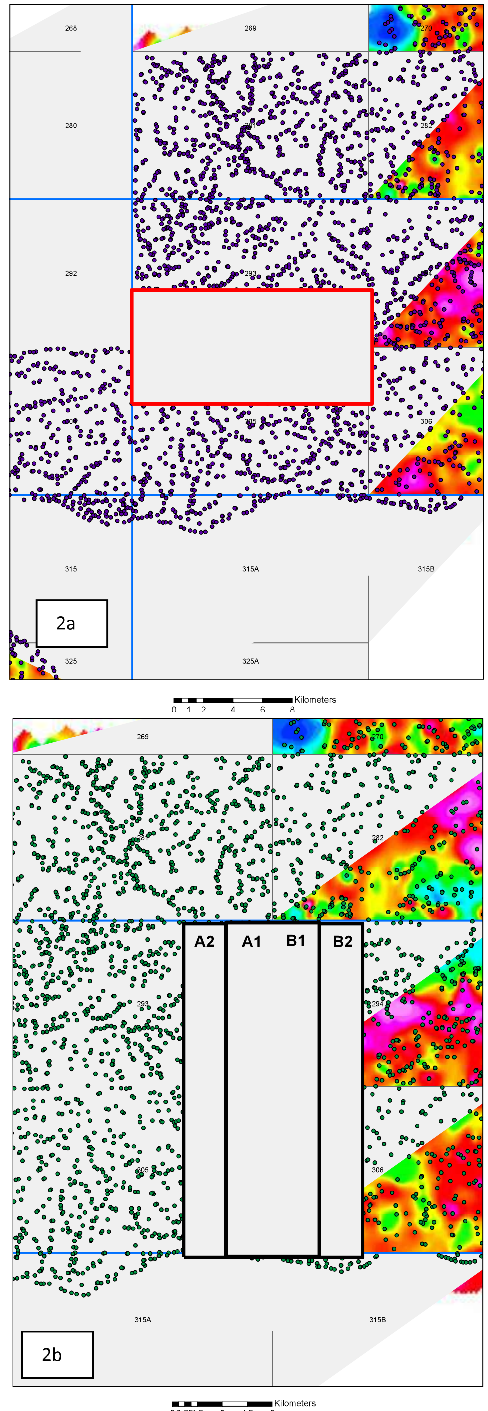

Fig. 2 - a. Leveled data for La in stream sediments of the 293 sheet by 305; b. Leveled data for La in stream sediments of the A2-293/294 sheet by B2-305/306 sheet based in Daneshfar and Cameron (1998).

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