Whole-rock geochemistry and Pb isotope compositions in metasediments of the Iberian Pyrite Belt; relevance to mineral exploration

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Metasedimentary sequences recording strong vertical and lateral facies variations form the main lithostratigraphic units of Iberian Pyrite Belt (IPB), a world-class metallogenic district of Palaeozoic age in SW Variscides. The lower unit (Phyllite-Quartzite Group, PQ) comprises metamorphosed shales/sandstones that gradually evolve to the overlying siliciclastic series (mostly shale-derived), often inter-bedded with tuffaceous pelites, included in the Volcano-Sedimentary Complex (VSC), which is the prime host of IPB ore-systems. Ordinary PQ and VSC metapelites are identical, but some geochemical ratios (*e.g.* Zr/Al_2O_3, Al_2O_3/TiO_2, As/Sc, Cu/Sc, Pb/Sc, Zn/Sc) tested in a wide (108) database allow to separate the main (clay- and sand-derived) recycled continental crust component, from other inputs related to: (i) volcanic sources, as in VSC tuffaceous metapelites; (ii) changes caused by mass-advection processes (particularly, hydrothermal alteration/mineralisation) prior to Variscan metamorphism. Signs of the latter processes are clear both in sequences surrounding the ore lenses, and in places where only faint signs of mineralisation are observed. Whole-rock Pb isotope compositions provide further evidence for this geochemical distinction, and may become a valuable tool in the design of future mineral exploration surveys. Indeed, results obtained for a set of 12 samples show that: (i) the radiogenic ordinary metapelites ($9.89 \leq \mu \leq 9.97$) should derive their Pb from upper crustal Pb reservoirs; (ii) similar μ values in tuffaceous metapelites coupled by distinct $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ranges denote inputs of components isotopically comparable with IPB volcanics; (iii) the slightly lower μ values along with lower Pb isotope ratios in altered/mineralised metapelites suggest mixing with a distinct (less radiogenic) Pb source, conceivably denoting interaction with deep hydrothermal fluids isotopically akin to those equilibrated with typical IPB sulphide ores.