Geophysical Research Abstracts
Vol. 18, EGU2016-3334, 2016
EGU General Assembly 2016

Geochronology and geochemistry of lithologies of the Tabuaço W-prospect area (Northern Portugal)

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This work is focussed on lithologies occurring at Quinta de São Pedro das Águias, which is located in the Tabuaço prospect (an area of 45 km2 where exploration for W-skarn deposits is taking place, in northern Portugal, close to the Douro valley). At Quinta de São Pedro das Águias several lithologies are recognized: "normal" phyllites, black phyllites (graphite-bearing), marbles, calcsilicate (s.s.) rocks and skarns (sometimes, scheelite-bearing), belonging to the Bateiras Formation, of the Douro Group (one of the two major subdivisions of the Neoproterozoic-Cambrian Dúrico-Beirão Supergroup); Paredes da Beira-Tabuaço granite; several aplitic and pegmatitic bodies. The studied area belongs to the Central Iberian Zone, a geotectonic unit of the Iberian Variscan Chain.
Rb-Sr isotope analyses done in the scope of this work, provided a 316 $\pm$ 7 Ma whole-rock isochron (MSWD = 1.7; initial 87Sr/86Sr = 0.7146) for the granitoids, using the 87Rb decay constant recently recommended by IUPAC-IUGS (Villa et al., 2015). This date is interpreted here as the emplacement age of those rocks, during a late stage of the Variscan D3.
The granite revealed a S-type nature, namely because it is a muscovite granite, it shows a peraluminous composition (average A/CNK = 1.28), and the Sr and Nd isotope fingerprints (-8.9 $\leq$ εNd(316Ma) $\leq$ -7.8; +0.7105 $\leq$ 87Sr/86Sr(316Ma) $\leq$ 0.7182) fit into the composition of metasedimentary crust. The analysed phyllites show the following isotopic compositions: -9.7 $\leq$ εNd(316Ma) $\leq$ -8.2; +0.7148 $\leq$ 87Sr/86Sr(316Ma) $\leq$ 0.7188. Therefore, the isotope signatures, at 316 Ma, of the granite and of the studied metapelites overlap, suggesting that the parental magma was generated by anatexis of Grupo do Douro metasediments. According to their petrographic, geochemical and isotopic features, aplites and pegmatites are viewed as extreme differentiates from the granite.
São Pedro das Águias metapelites show biotite zone parageneses. Geochemically, their REE normalized patterns are very similar to those displayed by NIBAS and by other upper crustal reference compositions. Isotopically, especially due to their lower εNd316, the studied metapelites are clearly distinct from the Grupo das Beiras metasediments (the other major division of the Dúrico-Beirão Supergroup), and, instead, they resemble other metasedimentary units of the Iberian Massif.
Several lines of evidence, namely the isotope data (-8.1 $\leq$ εNd(316Ma) $\leq$ -6.4; +0.7090 $\leq$ 87Sr/86Sr(316Ma) $\leq$ 0.7102) and the occurrence of fine intercalations of sub-mm layers enriched in phyllosilicates, suggest that calcsilicate (s.l.) rocks owe their composition not only to metasomatism that accompanied the granite intrusion, but also to an inheritance from their protoliths, which should have resulted from mixed sedimentation, both chemical and terrigenous.

This work was financially supported by:
- FEDER funds trough Operational Programme Competitiveness Factors – COMPETE and by national funds through FCT – Fundação para a Ciência e a Tecnologia in the scope of projects Petrochron (PTDC/CTE-GIX/112561/2009) and Geobiotec (UID/GEO/04035/2013);
- Colt Resources.

Reference:
Villa, I.M., De Bièvre, P., Holden, N.E., Renne, P.R., 2015. IUPAC-IUGS recommendation on the half life of 87Rb. Geochim. Cosmochim. Acta 164, 382-385.