$^{40}Ar/^{39}Ar$ age constraints for the D2 Variscan extension in the Porto-Viseu metamorphic belt (Portugal)

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The Porto-Viseu belt is located in the innermost zone of the Iberian Variscan Belt. During the Variscan continent – continent collision (370-290 Ma), this area was affected by three main deformation events (D1, D2 and D3). The earlier D_1 deformation phase affected all the pre-Carboniferous sedimentary sequences and induced prograde metamorphism of Barrovian type, characterized by a rapid increase of metamorphic grade from the chlorite and biotite zones to the staurolite, sillimanite and sillimanite+K-feldspar zones.

The D1 NW-SE trending contractional structures were variably overprinted by a major syn-collisional D2 extensional event attributed to a gravitational collapse of the thickened continental crust. The metamorphic climax, accompanied by intense migmatization is reached during this tectonic event. Late stage D3 deformation is related to crustal-scale transcurrent shear zones and marks the beginning of extensive plutonic activity represented by large volumes of syn- and late-D3 granitoids.

This work presents new geochronological $^{40}Ar/^{39}Ar$ data for D2. The data were obtained in muscovite concentrates from one metapelite sample (144-186) from the staurolite zone showing a strong S2 fabric. The muscovite concentrates yield a $^{40}Ar/^{39}Ar$ plateau age of 333.3±2.2 Ma (Figure 1). This age is coherent with regional structural contraints and with the avaliable U-Pb geochronological data for the syn-D3 granites from the area (308 Ma). The 333.3±2.2 Ma age appears therefore to date the D2 event.

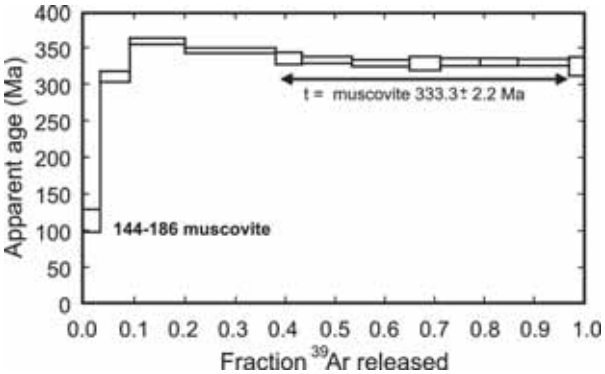

Figure 1: Muscovite $^{40}Ar/^{39}Ar$ analytical results.

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Imagery-correlated high precision stable isotope analysis

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The CAMECA IMS-1280 large radius, multicollector ion microprobe at the Wisc-SIMS National Facility is capable of high accuracy and precision for *in situ* analysis of isotope ratios. Spot size is variable from ~10 to sub-micron as dictated by counting statistics and desired precision, which can be as good as ±0.1‰ (1sd) for 10μm spots and better than ±1‰ for sub-μm spots on $\delta^{18}O$ [1]. Analysis is correlated to textures as seen by a range of imaging techniques. These new capabilities permit exciting and fundamental research where samples are small, precious, or zoned. For instance:

1. Laser confocal microscopy reveals annual layers in speleothems from Soreq Cave, Israel. Correlated analysis of $\delta^{18}O$ detects long term changes in seasonality at 0.1y resolution, vs. >10y by previous methods [2]. **2.** Igneous zircons with 1-70 ppm Li have growth zoning, imaged by CL and by maps of ppm [Li]. Values of $\delta^{7}Li$ (and total REE) correlate to growth bands demonstrating that values are magmatic [3]. **3.** Growth zones in single forams (SEM) analyzed for $\delta^{18}O$ with <3μm spots reveals up to 3‰ zoning between ontogenetic and gametogenetic calcite demonstrating two vital effect mechanisms that are opposite in sign [4]. **4.** Carbonate globules in the Mars meteorite, ALH84001, are concentrically zoned in Ca-Mg-Fe-Mn (EMPA). Values of $\delta^{18}O$ correlate with chemistry, while $\Delta^{17}O$ is constant at 0.8 for carbonates and 0.3±0.1 for opx [5]. **5.** In chondrules from Semarkona, $\delta^{18}O$ vs. $\delta^{17}O$ slopes of ~0.5 are resolved within apparently MIF arrays [6]. **6.** CL imaging of quartz overgrowths in St. Peter sandstone (SW Wisconsin) reveals multiple layers of finely banded cement. However, analysis of $\delta^{18}O$ shows that cements are homogeneous at 29.3‰ suggesting that these syntaxial overgrowths formed in the vadose zone as deep silcretes [7]. **7.** Analysis of 2mm bluegill otoliths resolves seasonal changes of $\delta^{13}C$ in daily growth layers (SEM). A sharp $\delta^{13}C$ increase of ~10‰ during a whole-lake ^{13}C labelling experiment shows that a larger proportion of otolith carbon is derived from DIC than diet (M~0.4) [8].

[1] Page *et al.* (2007) *Am Min* **92**, 1772-1775. [2] Orland *et al.* (2008) *GCA*, this vol. [3] Ushikubo *et al.* (2008) *GCA*, this vol. [4] Kozdon *et al.* (2008) *GCA*, this vol. [5] Valley *et al.* (2007) *Lun Sci Conf* **38**, #1147. [6] Kita *et al.* (2007) *Lun Sci Conf* 38, #1791. [7] Kelly *et al.* (2007) *GCA* **71**, 3812-3832. [8] Weidel *et al.* (2007) *Can J Fish Aquat Sci* **64**, 1641-1645.