The browning phenomenon of medieval stained glass windows

J. FERRAND*1, S. ROSSANO1, C. LOISEL2, N. TRCERA3, F.FARGES4, E. VAN HULLEBUSCH1, F. BOUSTA2 AND I. PALLOT-FROSSARD7

1 Université Paris-Est, Laboratoire Géomatériaux et Environnement (EA 4508), UPEMLV, 77454 Marne-la-Vallée, France (*correspondence: ferrand@univ-mlv.fr )
2LRMH, 29 rue de Paris 77420 Champs sur Marne, France
3Synchrotron SOLEIL, l’Orme des Merisiers BP48 91192 Gif-sur-Yvette CEDEX, France
4LMCM, Musée National d’Histoire Naturelle, 61 rue Buffon 75005 Paris, France

In some ancient stained glass windows, the presence of manganese, coupled with the alteration by water and microorganisms [1], can induce a browning and, consequently, a loss of transparency in stained glass windows. Among the diverse alteration observed on stained glass windows, the browning phenomenon is still poorly documented and its occurrence among stained glass is not completely known.

Small pieces of ancient stained glass windows presenting brown zones at their surface have been collected mostly from French workshops. Samples have been characterized using optical microscopy, Scanning Electron Microscopy coupled with Energy Dispersive System (SEM- EDS) and microprobe analysis. In order to get insight into Mn environment by water and microorganisms [1], can induce a browning and, consequently, a loss of transparency in stained glass windows. Among the diverse alteration observed on stained glass windows, the browning phenomenon is still poorly documented and its occurrence among stained glass is not completely known.

Chemical maps recorded on historical samples show that the Mn-rich alteration phases develop in Ca- and K-depleted zones. The XANES spectra of the alteration zones show significant differences with the Mn K-edge of fresh glass ensuring that a modification of the Mn environment and oxidation state occurred.


The Pedregal granitoid: a peculiar diatexitic rock (?) in a granite-migmatite complex

FERREIRA, J.A.1, MARTINS, H.C.B.1, RIBEIRO, M.A.1, AND FERREIRA, P.1

1Centro Geologia, Faculdade de Ciências, Univ. Porto R. Campo Alegre, 4160-007 Porto, Portugal (*correspondence hhrites@fc.up.pt)

The Pedregal granitoid, exposed of an area with of ca 3 km², is located in the Central Iberian Zone, northern Portugal and belongs to a synorogenic variscan granite-migmatite complex sub-concordant with the regional structures. It has an elongated shape with NW-SE trending sub-concordant with country rocks, and is a fine-grained biotite-rich granitoid with abundant small biotitic nodules (1 to 2 cm) which exhibit a internal foliation, and also metasedimentary xenoliths. The country rocks are represented by a metapelitic sequence of Edicarian age, the “Complexo Xisto-Grauváquico” (CXG).

The Pedregal granitoid is an homogenous rock, without metamorphic differentiation, and has a isogranular texture without preferred orientation. Besides, the intergranular boundaries are consistent with a metamorphic texture marked by textural reequilibrium in solid state. Accordingly, this rock has peculiar structural/textural features, point out to a diatexitic character. The mineralogical composition of this granitoid is quartz + biotite + plagioclase + K-feldspar + zircon + apatite +titanite + rutile, and secondary muscovite.

It is noteworthy the presence of pegmatites veins both in the granite and in the host rocks which are concordant with the main foliation of the CXG (NW-SE to NNW-SSE).

Geochemically is a peraluminous granitoid, with low SiO₂ (65 to 69 wt%) and very high Zr (390 to 435 ppm) contents. The Pedregal granitoid REE patterns show LREE enrichment much higher than the associated synorogenic granites and pegmatites (fig. 1).

Figure 1 – REE normalized patterns.

This work has been supported by POCI 2010 (FCT-Portugal, COMPETE/FEDER).