PETROLOGY, GEOCHEMISTRY AND STRUCTURAL CONTROL OF A LATE VARISCAN RING PLUTON: THE SANTA EULÁLIA PLUTONIC COMPLEX (ALENTEJO, PORTUGAL)

LOPES, Luís[1]; LOPES, José Carrilho[2]; SANT'OVAIA, Helena[3]; NOGUEIRA, Pedro[4]; RIBEIRO, Maria dos Anjos[3]

(1) University of Evora, School of Sciences and Technology, Department of Geosciences, Geophysics Center of Evora, Universidade de Evora - Departamento de Geociências, Rua Romão Ramalho, 59, Évora, 7002 554, Portugal, lopes@uevora.pt
(2) University of Evora, School of Sciences and Technology, Department of Geosciences, Geology Center of Lisbon, IDL, Universidade de Évora - Departamento de Geociencias, Rua Romão Ramalho, 59, Évora, 7002 554, Portugal,
(3) DGAOT, Centro de Geologia, Faculdade de Ciências, Universidade do Porto, R. Campo Alegre, Porto, 4169 007, Portugal,
(4) University of Evora, School of Sciences and Technology, Department of Geosciences, Centro de Geologia, UP, Universidade de Évora - Departamento de Geociencias, Rua Romão Ramalho, 59, Évora, 7002 554, Portugal

Abstract

The Santa Eulália Plutonic Complex (SEPC) is a 400 km^2 late variscan granitic pluton in the SW sector of the Iberian Variscides which cross-cuts the regional NW-SE Upper Proterozoic to Lower Palaeozoic lithological units. Isotopic dating of the massif refers to 290 ± 5 M.a. (Rb/Sr, Mendes 67/68 *in* Pinto 1984).

From the rim to the core, SEPC shows a medium to coarse-grained pink granite (G0 group) involving large elongated masses of mafic to intermediate rocks (M group) and a central grey monzonitic granite (G1 group) mainly represented by medium-grained textures. Elemental geochemistry shows that the peripheral G0 facies represent more evolved magmatic liquids with calc-alkaline to alkali-calcic character and metaluminous tendency. Instead, the G1 monzonitic facies are typically calc-alkaline and show peraluminous tendency. G2 and G3 represents fine grain texture of this grey monzonitic granite.

Magnetic Susceptibility analysis sustains major genetic differences between pink and gray granites. Sr and Nd isotopic analysis suggest petrogenetic processes involving crustal melts and primary magmas strongly contaminated by crustal fractions.

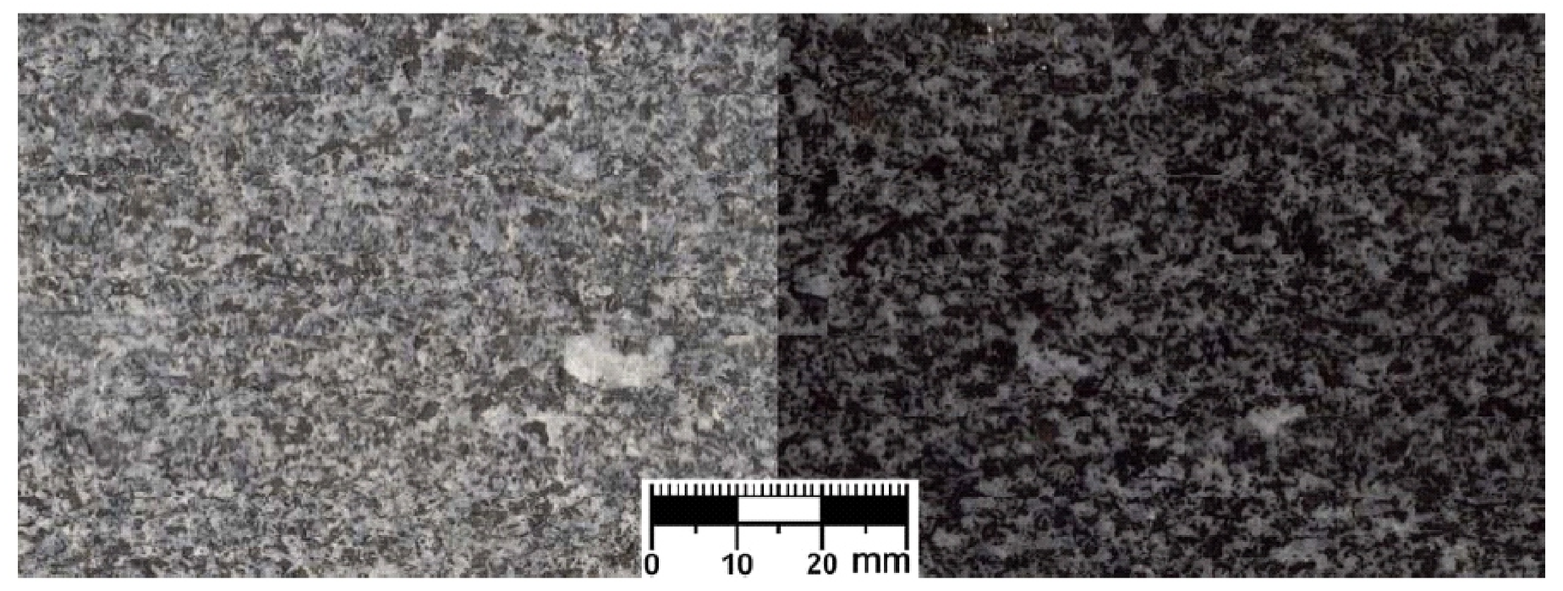
The thermal effects are restricted to the roof pendants and the metasomatic effects are constrained by the carbonate rocks. The shape of the pluton, absence of lateral thermal effects, smooth bend of the vertical host rocks around the pluton in eastern border suggest a small thickness of the massif in the western border, and a deep rooting in the major vertical shear zone at the eastern border (Ribeiro, M.A., et al., 2013). Complementary, a sub-volcanic concentric structure, whose implantation is also regional and structurally controlled by a late variscan N-S compression tension fields is proposed. This is suggested by E-W major axis SEPC orientation and pointed by fracturing studies in dimension stone quarries.

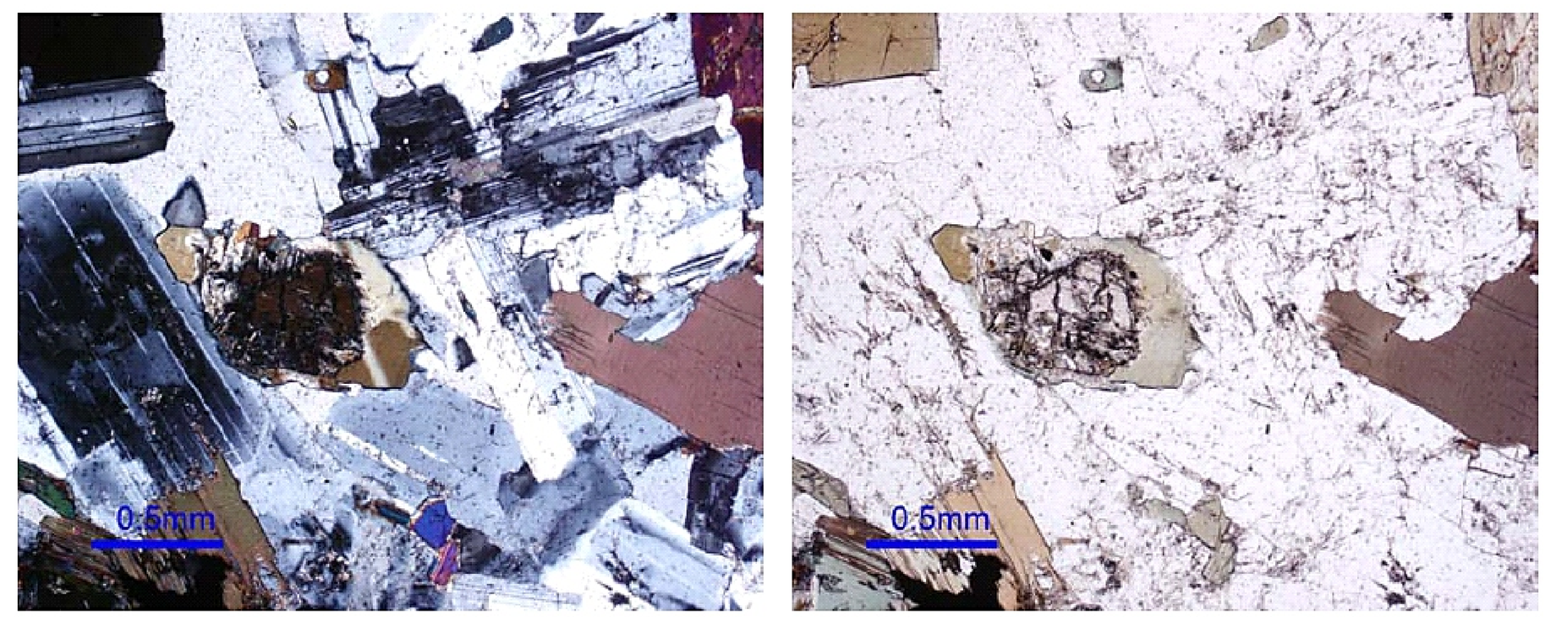
This work aims to contribute for a better understanding of the tectonic and magmatic events that promote the genesis and intrusion of this igneous body, as a representative unit of the late variscan magmatism.

Vertical fault contact between mafic rocks and G0 pink granite.

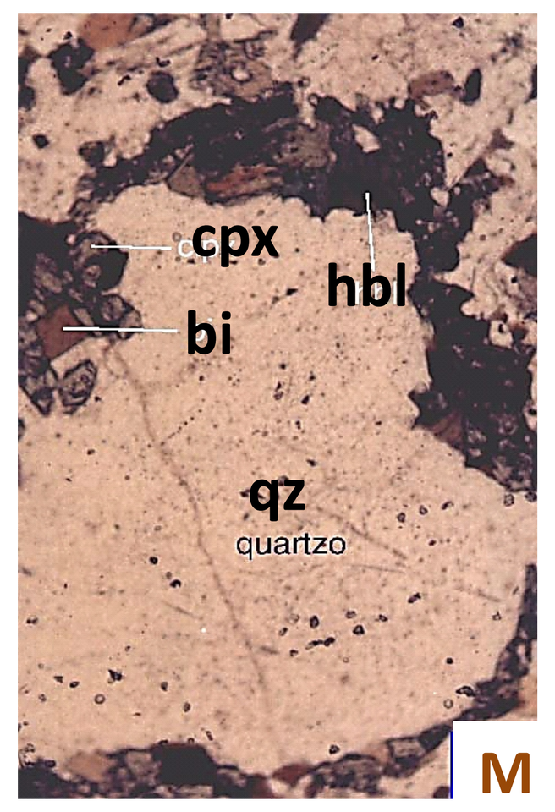
G1 grey granite fracturing patterns close to pink G0.

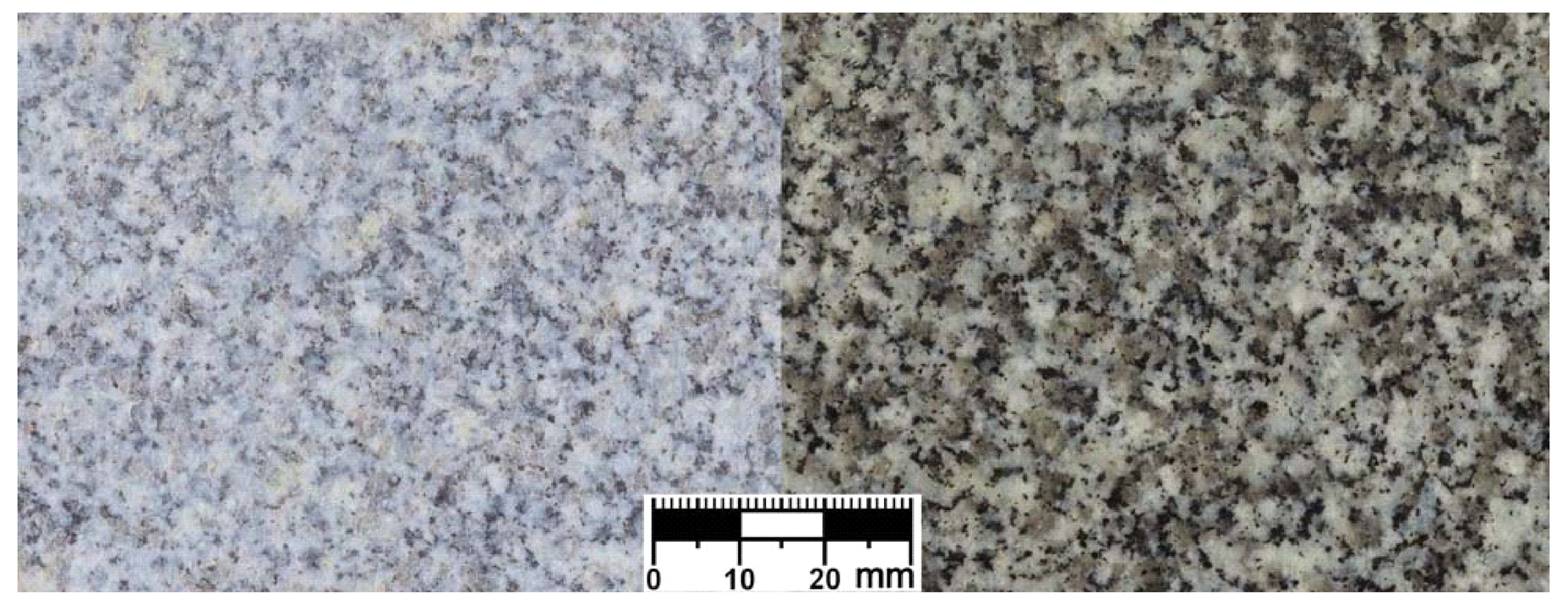
Petrology



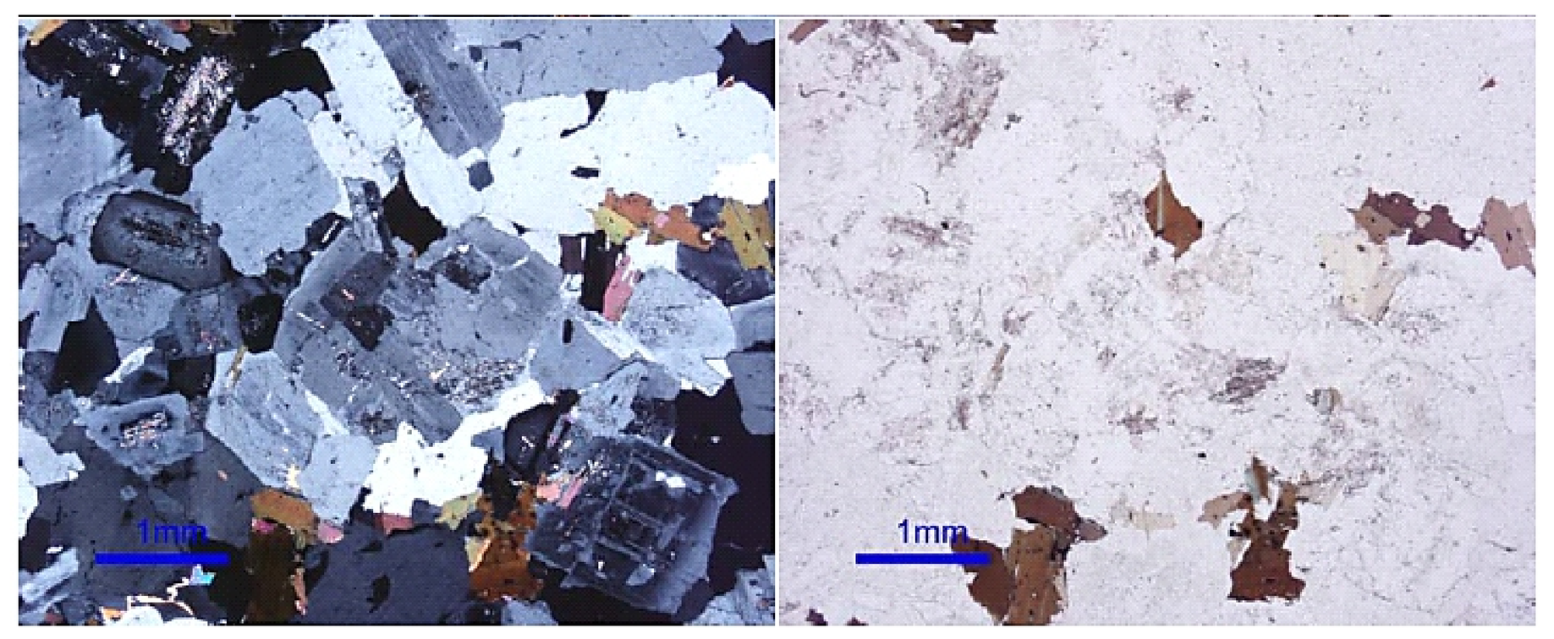


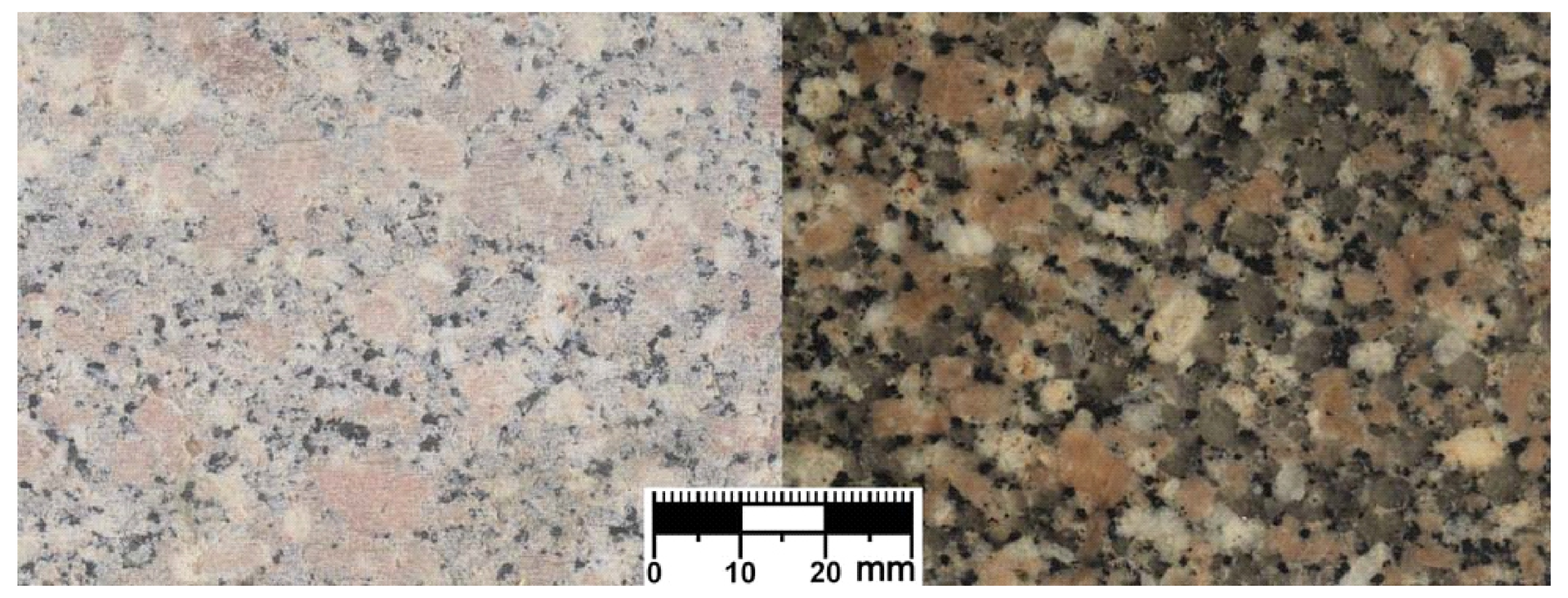
M-group:
(±ol ± opx + plg + cpx ± hbl ± bi)



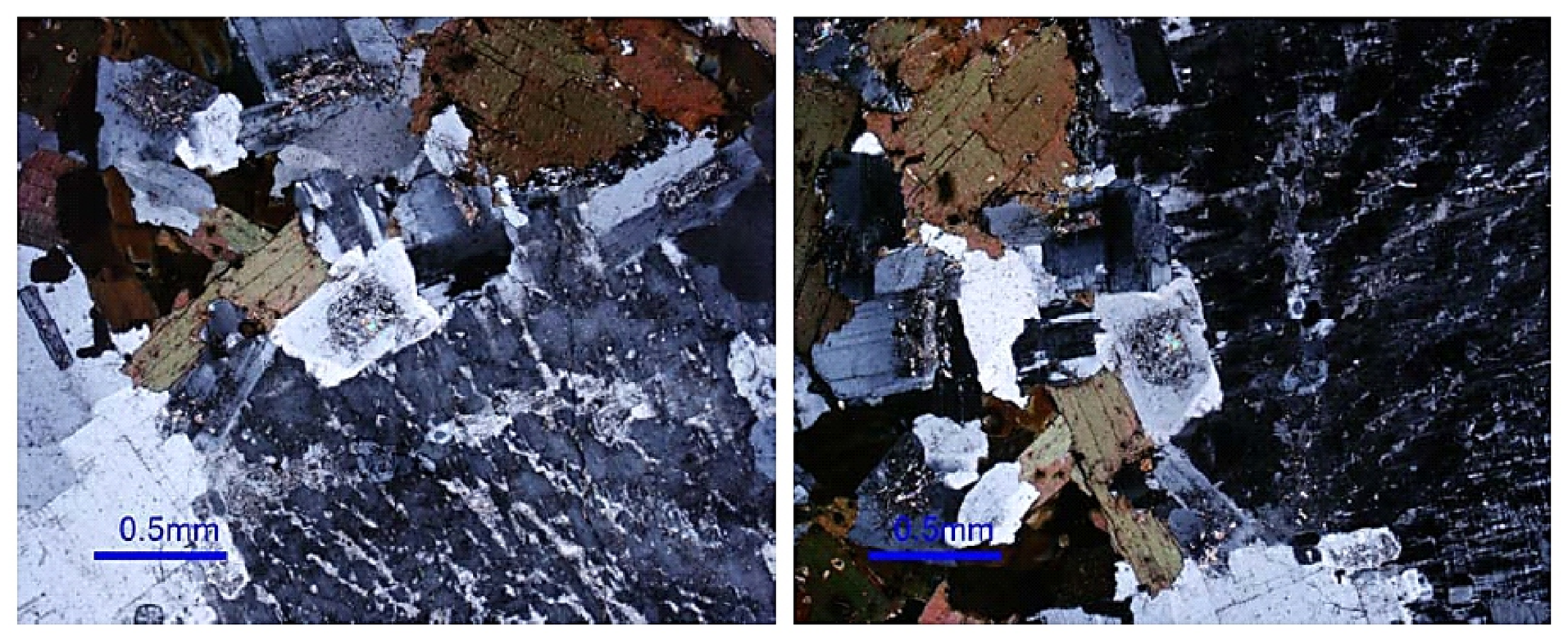


G1-group : (plg ± bi + fel-K + qz)



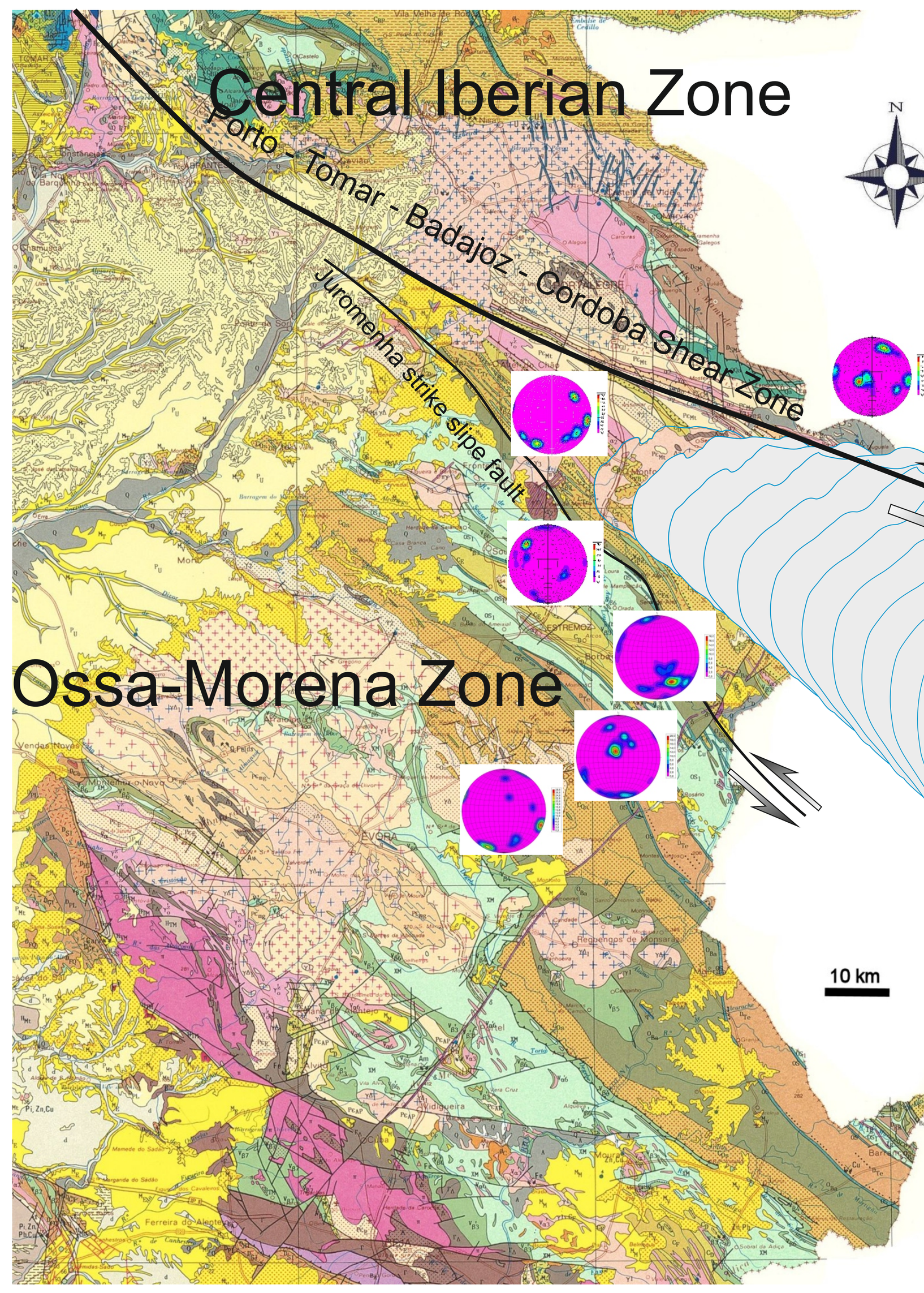


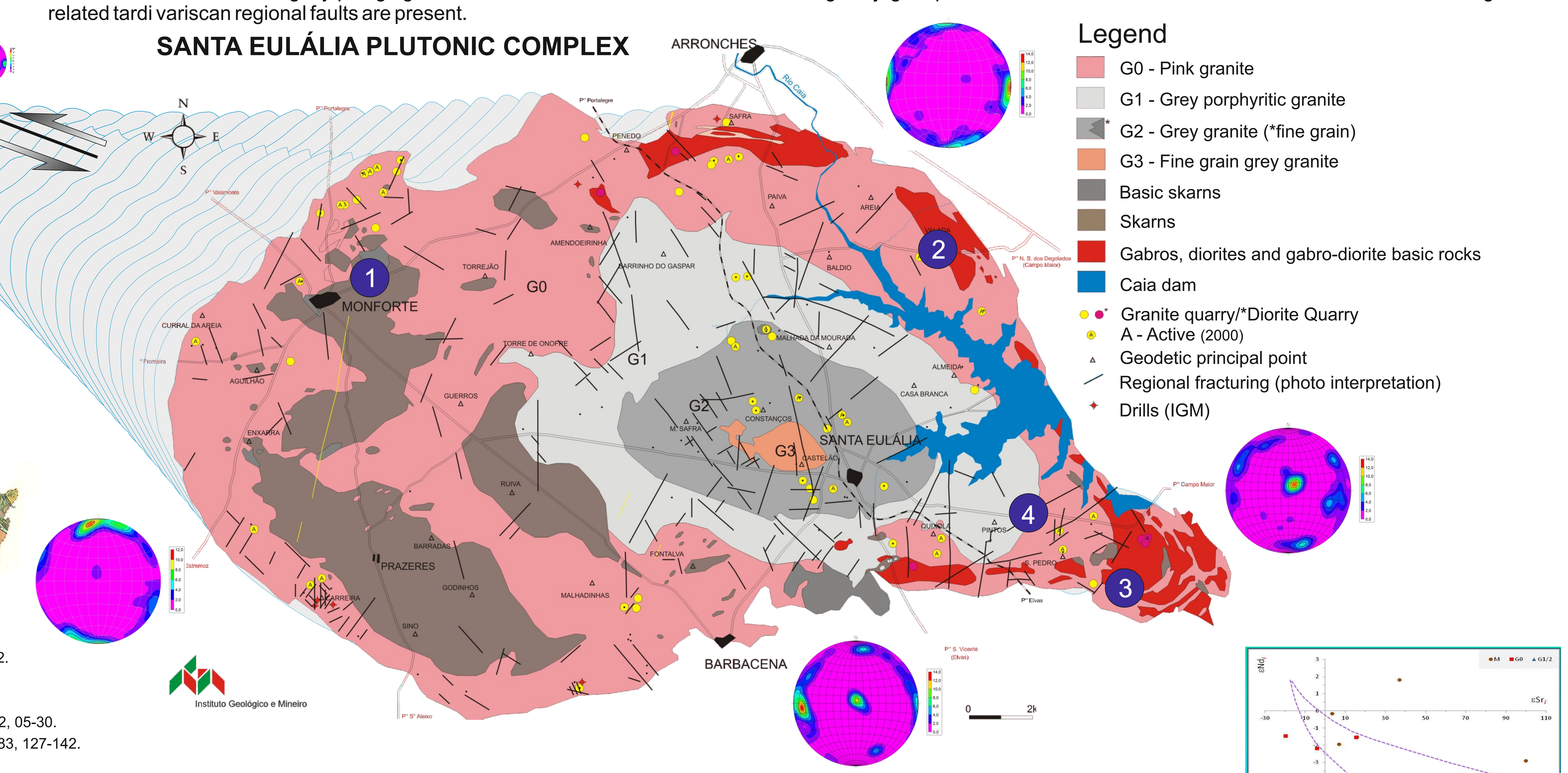
G0-group : (± bi ± hbl + plg + fel-K + qz)



Structural Geology

The Santa Eulália Plutonic Complex fracturing systems can be explained by two main factors main: 1) The geometry of late variscan stress fields and 2) the three dimensional decompression suffered by the massive as result of erosion. Along the massif, a well develop fracturing system tend to be perpendicularly to the contact with the country rocks (stereographic projections). Nevertheless, local factors such as petrographic heterogeneities, proximity to basic rocks or skarns which result from the thermal effects of the massif, seems to affect the fracturing pattern exhibit by the granites. Locally there is variability in the main fracturing families resulting impossible to extrapolate these arrays for the whole massif. Regarding the dimension stone feasibility of chosen outcrops, local fracturing studies must ever be done. It must be pointed that almost joints and fractures observed have lateral or slightly plunging, movement criteria, much of the cases defining conjugate pairs from whom can infer the local stress field. Besides that, geometrical related tardi variscan regional faults are present.





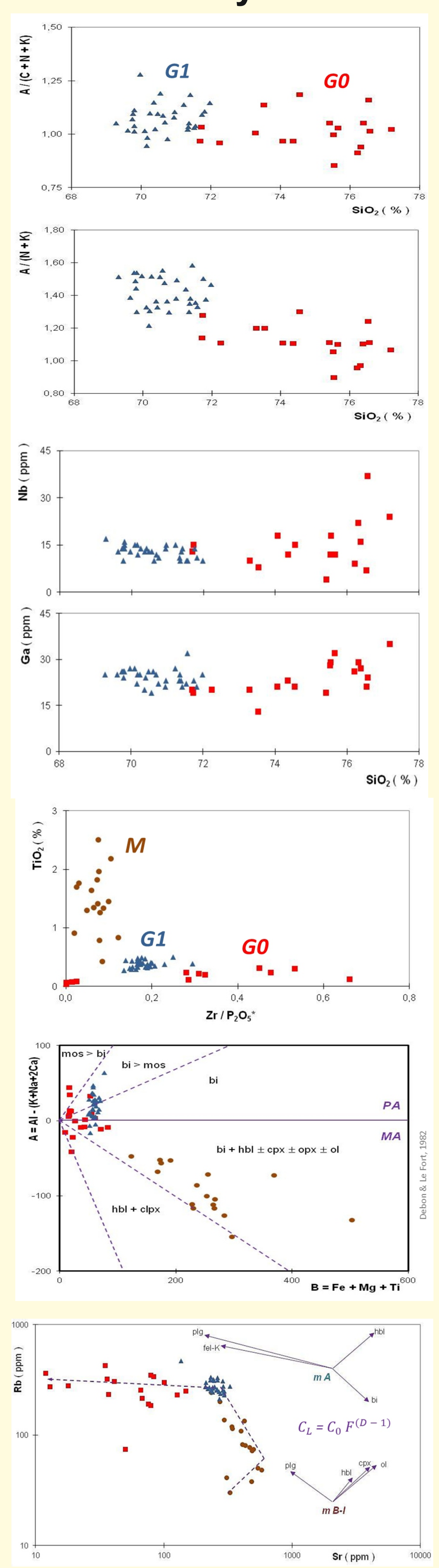
References
GONÇALVES, F. (1971) Memória nº 18. Serviços Geológicos de Portugal, pp. 62.
LOPES, J. C. & LOPES, J.L. & Lisboa, J.V. (1997) ENT, IGM, 39, pp. 141-156.
LOPES, J. C. (1989) PhD, Universidade de Évora, 138 pp.
LOPES, J. C.; MUNHÁ, J.M.; TASSINARI, C.C.G.; PIN, C. (2005) Com. Geol., 92, 05-30.
LOPES, J. C.; MUNHÁ, J.M.; WU, C.T.; OLIVEIRA, V.M.J. (1998) Comun. IGM, 83, 127-142.
LOPES, J. L. G. (2003) PhD Universidade de Évora, 568 p.

Carbonate skarns with large vesuvianite cristals.

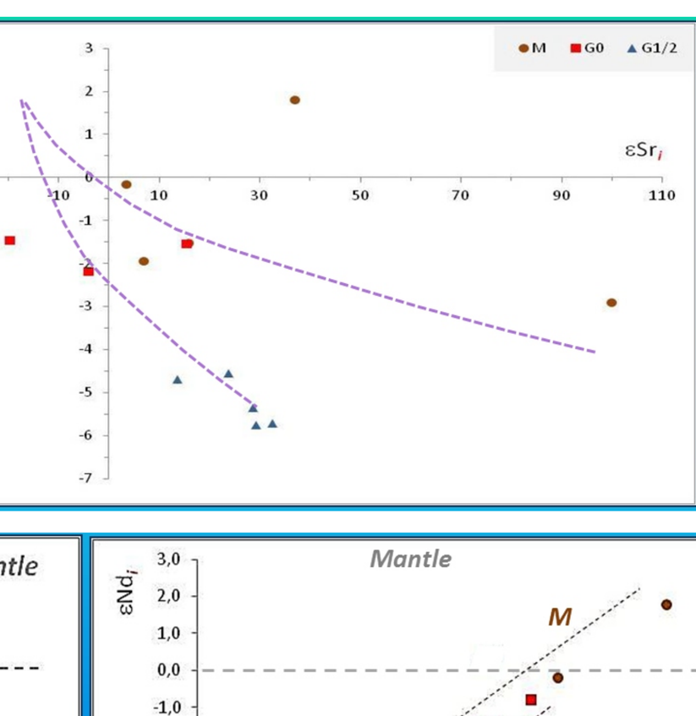
Mafic rocks with tipical alteration.

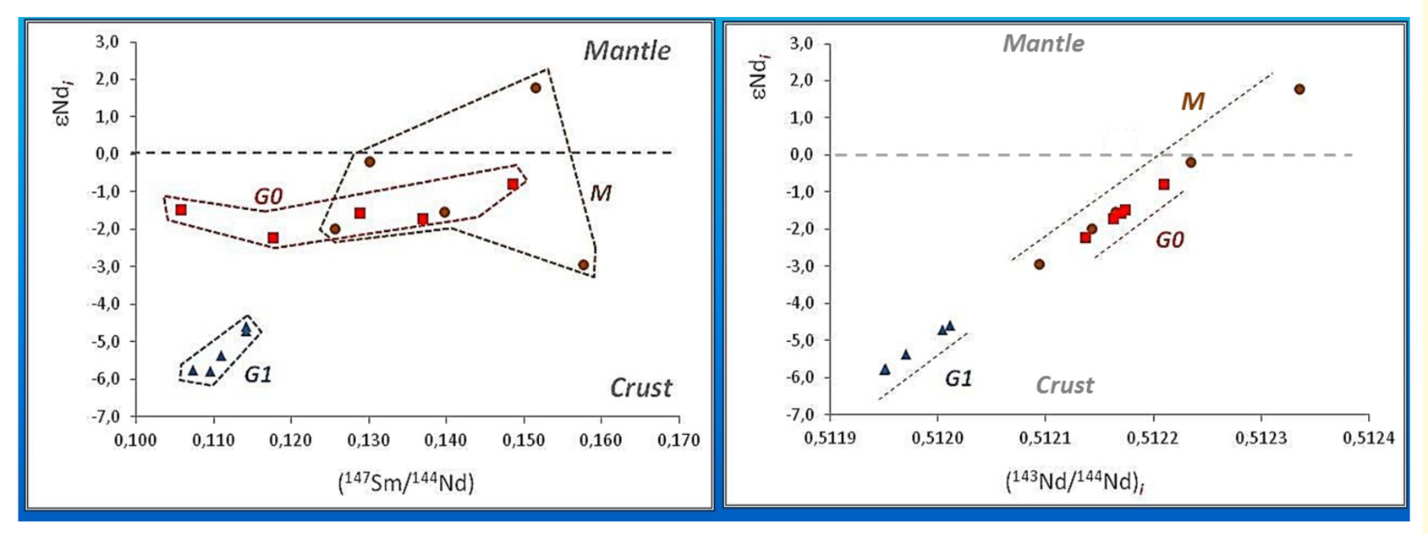
From the left to the right: G1, G0 and G2 granites.

Geochemistry



Petrogenesis





The least evolved gabbro of the M-group has a mantle Nd isotopic signature (εNd290=+1.7). The pink granite G0-group revealing (-2.3<εNd290<-0.9) plots in the mantle-crust εSri-εNdi alignment apparently defined by mafic rocks of M-group (-3.0 <εNd290<+1.7). The grey granites (G1-group) diverge from this trend (-5.9<εNd290<-4.7) suggesting petrogenetic processes involving dominant crustal melts and/or primary magmas strongly contaminated by crustal fractions. An ACF-type differentiation process could justify these isotopic data showing that crustal contribution were probably more important during the petrogenesis of the central G1 facies than in the magmatic event associated to the peripheral G0 granites.

Acknowledgements:
This work has been financially supported by PTDC/CTE-GIX/099447/2008 (FCT-Portugal, COMPETE/FEDER)