



**HAL**  
open science

# Micro-porosity found in quartz shear bands from Ikaria, Greece: insights from Hyperspectral Cathodoluminescence and High-Resolution Electron Backscatter Diffraction

Gina McGill, Jacques Précigout, Cécile Prigent, Laurent Arbaret, Laura Airaghi, David Wallis

## ► To cite this version:

Gina McGill, Jacques Précigout, Cécile Prigent, Laurent Arbaret, Laura Airaghi, et al.. Micro-porosity found in quartz shear bands from Ikaria, Greece: insights from Hyperspectral Cathodoluminescence and High-Resolution Electron Backscatter Diffraction. European Geosciences Union General Assembly 2024 (EGU24), 0000, à renseigner, Unknown Region. 372, pp. 1-12, 10.5194/egusphere-egu24-9750 . insu-04647679

**HAL Id: insu-04647679**

**<https://insu.hal.science/insu-04647679>**

Submitted on 15 Jul 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

EGU24-9750, updated on 15 Jul 2024

<https://doi.org/10.5194/egusphere-egu24-9750>

EGU General Assembly 2024

© Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.



## Micro-porosity found in quartz shear bands from Ikaria, Greece: insights from Hyperspectral Cathodoluminescence and High-Resolution Electron Backscatter Diffraction

Gina McGill<sup>1</sup>, Jacques Précigout<sup>1</sup>, Cécile Prigent<sup>2</sup>, Laurent Arbaret<sup>1</sup>, Laura Airaghi<sup>1</sup>, and David Wallis<sup>3</sup>

<sup>1</sup>Institut des Sciences de la Terre d'Orléans (ISTO), CNRS/BRGM, Université d'Orléans, 45071, France (gina-elizabeth.mcgill@univ-orleans.fr)

<sup>2</sup>Institut de Physique du Globe de Paris (IPGP), 1 rue Jussieu 75238 Paris, France

<sup>3</sup>Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge, CB2 3EQ, United Kingdom

Extensive micro-porosity can be found in numerous examples of quartz-rich mylonites deformed in crustal shear zones, but whether or not deformation is involved in the production of such pores remains a matter of active debate. The occurrence of syn-kinematic micro-scale porosity could result in overall changes in rock strength, as well as potentially generating a deep permeability. This would have major implications for fluid-rock interactions, earthquake nucleation and ore deposits. In this study, we focus on micro-pores occurring in quartz-rich shear bands from mylonitic granitoids which outcrop in Ikaria (Cyclades, Greece). Related to the back-arc geodynamics of the Aegean domain during the Miocene, this granitic body intruded the Cycladic basement during active detachment faulting, which has led to heterogeneous deformation of the pluton. While the granite exhibits large-scale levels of strain, increasing with proximity to the detachment fault, quartz-rich shear bands develop as a result of viscous strain localisation, giving rise to S-C structures. Micro- (to nano-) pores occur in pure quartz aggregates of these shear bands, where micro-structural features indicate dominant crystal plasticity, mostly recovering by subgrain rotation.

Based on five samples collected at different distances from the detachment fault, we performed microprobe-based hyperspectral cathodoluminescence and electron backscatter diffraction (EBSD) to characterise the micro-pores in pure quartz aggregates. In cathodoluminescence maps, parent and recrystallized quartz grains produce blue (420 nm wavelength) and yellow (650 nm wavelength) signals respectively. Furthermore, both parent and recrystallised grains exhibit a distinct increase in luminescence at 650 nm, which appear visually as very bright yellow rims/halos at their grain boundaries and, to a minor extent, at their subgrain boundaries. Using high-resolution and standard EBSD, we highlight high (to very high) geometrically necessary dislocation densities that partly coincide with such rims/halos, particularly where micro-pores are described. Most of the dislocations that may contribute to these high densities are related to the main dislocation slip system of quartz (prism  $\langle a \rangle$ ), as deduced from lattice preferred orientation and subgrain analyses. Our findings, therefore, suggest that highly luminescent "yellow"

boundaries of quartz grains result from dislocation accumulation, and hence, from crystal plasticity, which can be linked to the production of micro-porosity in these rocks.