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From shale to slate: using High Resolution X-Ray Tomography to determine the lower boundary of metamorphism in pelitic rocks

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Metamorphism can be expressed as the readjustment of the chemico-mineralogical composition of a rock to new environmental conditions. The lower limit of the metamorphism, the boundary between diagenesis and low-grade metamorphism is characterized by the change of certain features. There are three main methods to delimit this boundary: Kübler Index (IK) or illite “crystallinity”, vitrinite reflectance, and mineral facies [1]. However, the metamorphic change is reflected in other features. In pelitic rocks, pyrite framboids are formed during the sedimentation and diagenetic stages. Framboids formed at this stage usually have mean sizes between 3 to 10 μm , depending on the oxygen availability of the depositional environment [2]. The distribution of their population follows a log-normal distribution. With the beginning of metamorphism, the framboids are affected by the new conditions. It is widely accepted that these new conditions induce an increase in size of the framboids [3], but until now no conclusive data have been presented.

In this work we present a new method to determine the transition from diagenesis to low-grade metamorphism, analysing the pyrite framboids using High Resolution X-ray Tomography (micro-CT). This technique is known for allowing 3D reconstruction of objects, and it is been widely used in Earth Sciences [4]. For this work, the micro-CT scans were used for the characterization of the populations of framboids present in the sample, combined with SEM observations and IK determination. The whole size distribution of pyrite framboids was statistically analysed, finding that for diagenetic rocks it is only composed by one population, while for rocks affected by metamorphism, several populations can be determined.

References:

[1] Arkai P, Sassi FP and Desmons J (2007) In: *Metamorphic Rocks. A classification and glossary terms*: Cambridge University Press, 36-42

[2] Bond DPG and Wignall PB (2010) *Geol Soc America Bull* 122: 1265-1279

[3] Craig JR, Vokes FM and Solberg TN (1998) *Mineralium Deposita* 34: 82-101

[4] Cnudde V and Boone MN (2013) *Earth-Sci Rev* 123: 1-17.

