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Stylolites and fluid circulation: how many questions are still open?

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Carbonate reservoirs are important for the storage water and hydrocarbons, indispensable resources for the economy of our planet. Consequently, it is important to understand the accumulation modalities, porosity and permeability of different reservoirs rocks and their evolution in the course of time. Karst reservoirs in carbonates are still incompletely understood: the dissolution process and pattern in the formation of karst porosity in carbonate rocks, and fluid circulation in karst is usually considered to proceed along faults or joints while not much consideration is given to stylolites in this context. Stylolites are planes of dissolution enriched in insolvable particles that commonly form a distinct indentation (Park & Schot 1968; Gratier 2005) and which play an important role in fluid circulation during carbonate deformation (Rawling et al 2001). Stylolites mostly form in a compressional setting, probably by migration of large volumes of water that dissolve the carbonate and leave relict material along the indented stylolites planes. However, stylolites may also play a role as nucleation sites for karst porosity when deformation conditions change. There are few previous studies that investigate the dissolution/precipitation process along stylolites as sites of karst cavity formation (Alsharhan & Sadd 2000) and their role in deformation and permeability change (Renard et al 2004; Koehn et al 2007; Ebner et al 2009, 2010).

This study focuses on the role of stylolites in fluid circulation and karst dissolution, trying to answer the following questions:

1.What is the origin of the filling material in stylolites?

2.How does the shape of stylolites influence fluid flow in and around it?

3.Do fluid flow patterns also affect the shape change over time along the same stylolites?

4.How does the shape and size of mineral grains in stylolites influence the porosity and permeability path?

5 . When do stylolites reduce porosity and permeability, and when do they enhance these?

Presently, we are carrying out chemical and petrographic analysis using SEM, FTIR and TEM to understand the origin of the filling material in stylolites and its behaviour in fluid circulation. We are also setting up a database for classification of the diversity in shape and composition of stylolites. Irrespective of initial lithological diversity, clay minerals (mostly kaolinite and montmorillonite) are always present in all stylolites, compatible with the pressure-solution process that forms them.

We present first results of the chemical / petrographic analyses carried out and of first attempts to classify 3D stylolites.

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