Formation and preservation of syntectonic sedimentary breccias in extensional environments (Crete and Pyrenees) and in-situ U-Pb constraints for the age of breccias in the Bas-Agly Basin

Tarik Kernif, Thierry Nalpas, Pierre Gautier, Sylvie Bourquin, and Marc Poujol
Univ Rennes, CNRS, Géoscience Rennes, UMR 6118, 35000 Rennes, France (tarik.kernif@univ-rennes1.fr)

A breccia is a rock made up of angular clasts. Its formation can be the result of several types of geological processes (sedimentary, tectonic, hydraulic, magmatic, etc.). The aim of this study is to understand the formation and the preservation of sedimentary breccias with a significant thickness (several tens to hundreds of meters) in extensional environments, by comparing the Bas-Agly Basin, in the eastern French Pyrenees, to a recent analogue (Pleistocene-Holocene deposits of the Chora Sfakion region, SW Crete). In both cases, the breccias mainly consist of carbonate elements.

Our preliminary results show that:

- Along the coast of the Chora Sfakion region, sedimentary breccias are preserved at the front of a major normal fault scarp over a distance of ca. 20 km. Their formation results from a destabilization of the topographic slope triggered by the activity of the fault. The breccias were preferentially developed at the expense of dolomitic layers that underwent intense fracturation during an older deformation phase. Breccia deposition was related to processes of aerial or subaquatic landslides. Relatively fine-grained unsorted breccias are found close to the main fault whereas larger blocks and olistoliths are found farther away and down-slope, attesting for large mass slides. Preservation of the breccias has been favoured by subsidence at the front of the fault.

- The sedimentary breccias of the Bas-Agly Basin bear characteristics that are broadly comparable to those of Crete. With respect to the Cretan case, the Bas-Agly deposits, which consist of breccias alternating with fine sediments, represent a more distal part of the system. However, the age of the breccias in the Bas-Agly Basin is widely debated, with estimates ranging from the Late Jurassic to the Eocene. Depending on the actual age, the tectonic environment could have been quite different, e.g. extensional or compressional. Thus, it is crucial to know the real age of these rocks. In order to solve this issue, we initiated a geochronological study, using in-situ U-Pb dating by LA-ICP-MS and focusing on the carbonate matrix of the breccias. This approach has proven successful and yielded ages consistent with the proposed extensional environment.

In summary, extensional tectonics appear to favour both the production and the preservation of large volumes of sedimentary breccias, which, therefore, may be considered as a marker of this tectonic regime. Whether compressional tectonics could produce a similar situation is a topic of
ongoing research.

Keywords: breccias, sedimentary, syntectonic, extension, Crete, Pyrenees, U-Pb dating