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Deformation bands in Neogene calcarenites (Leithakalk, St. Margarethen, Austria)

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In contrast to frictional faults and cataclasites in well consolidated and cemented sediments, lithologies with little or no diagenetic consolidation and high porosity develop deformation band type faults. Generally, deformation bands often form in well sorted fine to medium-grained sandstones before major porosity loss during diagenesis.

These structures were studied in Neogene (Badenian) calcarenites of the Leithakalk formation in a quarry near St. Margarethen at the Eastern border of the Eisenstadt Basin. This basin developed as a southeastern subbasin of the Vienna Basin during the middle Miocene along extensional nomal- and strike-slip fault systems at the Eastern edge of the Alps. This stone has been used for constructional purpose for a long time (e.g. at the famous St. Stephan´s Cathedral in Vienna) due to its relatively easy quarrying and sawing properties.

The Badenian Leithakalk in the quarry mainly comprises bioclasts dominated by corallinaceae debris and foraminifers, and is characterized by a high primary porosity, rather poor sorting and generally a medium grade of cementation. Within the deformation bands, the primary porosity of around 25% is reduced to ca. 1%, without any observable cataclastic grain size reduction. Additionally, the extent of carbonatic cementation is much lower within the deformation bands. We therefore conclude that the generation of these features occurred during a very early stage shortly prior to the main diagenetic overprint.

The orientation of the deformation bands indicates E-W directed extensional kinematics which can be correlated to large scale horst-and-graben structures within the

underlying basement and lower Miocene sedimentary rocks. Within the Leithakalk, classical brittle faults cross-cut both deformation bands and host rock, but frequently localize along the preexisting deformation bands.

The relative timing of the deformation bands formation with respect to the generation of cements and successive brittle faults provides crucial constraints on the deformation history of the normal faults bordering the Eisenstadt basin. Due to their low porosity, deformation bands may have strong influence on pathways for hydrocarbon and groundwater migration, with important implications on reservoir generation and exploration.