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Abstract Book

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Volume change in contractional kink bands; examples from the NNE-SSW Late Variscan kink bands of Portugal

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Kink bands are usually associated to the late deformation stages in polydeformed areas, being developed in rocks that present a strong planar mechanical anisotropy (e.g. layering or cleavage). In Portugal, the Late Variscan deformation episode generates in Almograve and Abrantes regions (SW Iberian Massif), brittle to brittle-ductile NNE-SSW sinistral kink bands, which deflects and deforms the NNW-SSE regional trend related to the earlier tectonic events. These defection induces a counterclockwise rotation of subvertical primary layering/foliation in inner domains of the kink bands. The rotation inevitably distort previous structures, generating a complex structural pattern in response to kink folding mechanism, but with particular features in each case. In Almograve, within metric to decametric sinistral kink bands, a wide spectrum of structures were developed, including distinct fold patterns (among which flexural slip folds) and brittle to brittle-ductile shear zones. In the inner domains of the Abrantes metric kink band, a high strain pattern composed by 2nd order conjugate kink bands, acting as "strain slip cleavage" is found.

The developed mesoscopic structures allows to calculate internal and external stress fields, showing a variation from the outer to inner domains of kink band. The stress field pattern also shows a rotation which is also similar to the exhibit rotation of structures within inner domains. This stress field variation should be related with the deformation mechanisms induced by rotation of primary layering. Indeed, the generated internal structures are clearly controlled by layer parallel shortening and layer parallel slip, which were the two main mechanisms responsible by accommodation of volume distortion within kink bands. This deformation was also conditioned by the rheology and heterogeneities of deformed sequence.

As mentioned, during the development of kink bands, the strain is localized within kink band due the internal rotation of primary layering and/or simple shear parallel to kink boundaries. There are no evidences of kink band boundary migration, allowing to classify the kink bands as fixed hinge type III kink bands.

In order to estimate the internal shortening parallel to layering during the rotation, it is proposed a new theoretical graphical method for type III kink bands, which allows an expedite shortening measurement based on angular parameters of kink bands. The proposal graphic shows that kink bands presents variable shortening ratio ranging between 5 to 25%. Some care should be used with such shortening values, because small variations in kink band angular values could occur, being induced either by slip in kink band boundaries or the layer parallel slip.

However, the new method presents itself as an excellent approach method, as proved by the similar shortening calculated for real structures. The correct geometric analysis also allows to determine that shortening component is dissipated in the other two orthogonal directions, i.e. perpendicular do layering and in vertical direction.

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