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A new mechanism for producing cleavage in preexisting folds: the translation mechanism. An example in the Burela section (Variscan belt, NW Spain)

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Abstract

An outcrop on the Cantabrian coast (Burela section) shows a long train of tight meter-scale folds developed in Cambrian siliciclastic rocks. These folds have been shortened in the axial trace direction on the fold profile, developing a cleavage in the incompetent layers which obliterates the primary cleavage and crosscuts the folds. Several mechanisms have been analyzed to explain the development and attitude of this cleavage, some of them being the same as those that have previously been proposed to form folds but operating in a reverse sense. They are: anti-flexural flow, anti-reverse tangential longitudinal strain and homogeneous strain. The sole operation of these mechanisms cannot explain this cleavage and a new one has been defined with this aim. This mechanism consists of deformation of the incompetent layers by translation of the competent ones (translation mechanism), and it involves an area decrease within the incompetent layers in the fold profile plane and, if there is no important volume decrease, a stretching in the hinge direction that must affect both competent and incompetent layers. The geometrical properties of this mechanism have been analyzed in detail and it is concluded that, combined with a small amount of homogeneous flattening, this mechanism can explain the distribution of the cleavage through the folds.

Keywords: folds; cleavage; strain; kinematical modeling; Variscan belt.

1. Introduction

Cleavage development involves a rock deformation by flattening combined with microstructural and mineralogical changes. Hence, cleavage is a combined result of deformation and metamorphism. Its development is usually associated with that of