



## Strain partitioning in transpressive shears zones in the southern branch of the Variscan Ibero-Armorican arc

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### Abstract

The Torre de Moncorvo region (NE Portugal) is a key-sector of the Autochthon Domain of the Iberian Terrane. The region experienced Variscan deformation in the southern branch of the Ibero-Armorican Arc wherein the early structures (of Upper Devonian age—D<sub>1</sub>) denotes the establishment of a heterogeneous sinistral transpressive regime. This regime was also responsible for the development of large-scale left-lateral shear zones whose direction is subparallel to major folds. Finite strains analyses were carried out in the Torre de Moncorvo region using the normalised Fry method on different strain markers: (1) distribution of detrital quartz grains in quartzite rocks of Arenigian–Lanvirnian age; (2) arrangement of oolites in discontinuous Ordovician–Silurian ironstone horizons; (3) the rotation experienced by *Skolithos* preserved in Lower Ordovician metasedimentary clastic rocks. The results obtained indicate the predominance of slightly prolate strain ellipsoids. Nevertheless, the variation of their orientation around mesoscopic folds emphasises the role of strain partitioning in a transpressive regime, suggesting that different folding mechanisms were active in the course of the same deformation phase. For the studied cases, tangential longitudinal strain and flexural shear combined with regional sinistral shear seem to be the most common mechanisms of folding. Some of these three-dimensional theoretical models for strain patterns in folds could be used in other regions, where a transpressive regime is inferred.

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### 1. Introduction

Since the pioneering work of Harland [17], transpression has been recognised as a widespread deformation regime in fold belts. From homogeneous transpression [40], field data soon led to more elaborate theoretical models where the strain partitioning proved to be a common situation (e.g. [5,21,42,44]). Although these models allow for a good prediction of the bulk strain related with these regimes, little work has been produced in order to understand the highly heterogeneous strain that should be induced by the folding in such regimes [20,46].

In northern Portugal the main autochthonous Variscan structures have been produced by a heterogeneous transpressive regime [9,10,37]. Comprehensive geometrical and kinematical analyses of these structures were performed in Or-

dovician and Silurian metasediments in two sectors near Torre de Moncorvo. These studies were combined with finite strain estimations, since the knowledge of the strain pattern is fundamental to the understanding of any deformed regime [19,32].

The obtained data enable a better understanding of the D<sub>1</sub> sinistral transpressive regime, emphasising both the importance of strain partitioning and of distinct folding mechanisms in the course of the first phase of Variscan deformation. This will also contribute to the knowledge of the geodynamic evolution of the Ibero-Armorican Arc.

### 2. Geological setting

Previous works [6,36,37] have shown that the Torre de Moncorvo region (Fig. 1) is fundamental to the understanding of the early Variscan deformation in the Autochthon Domain of the Iberian Terrane in Portugal. Here, the most conspicuous structures are attributed to the first Variscan

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