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1 Strain partitioning in transpressive shears zones in the southern branch 2 of the Variscan Ibero-Armorican arc

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8 Abstract

9 The Torre de Moncorvo region (NE Portugal) is a key-sector of the Autochthon Domain of the Iberian Terrane. The region experienced
10 Variscan deformation in the southern branch of the Ibero-Armorican Arc wherein the early structures (of Upper Devonian age—D₁) denotes
11 the establishment of a heterogeneous sinistral transpressive regime. This regime was also responsible for the development of large-scale
12 left-lateral shear zones whose direction is subparallel to major folds. Finite strains analyses were carried out in the Torre de Moncorvo region
13 using the normalised Fry method on different strain markers: (1) distribution of detrital quartz grains in quartzite rocks of Arenigian–
14 Lanvirnian age; (2) arrangement of oolites in discontinuous Ordovician–Silurian ironstone horizons; (3) the rotation experienced by *Skolithos*
15 preserved in Lower Ordovician metasedimentary clastic rocks. The results obtained indicate the predominance of slightly prolate strain
16 ellipsoids. Nevertheless, the variation of their orientation around mesoscopic folds emphasises the role of strain partitioning in a transpressive
17 regime, suggesting that different folding mechanisms were active in the course of the same deformation phase. For the studied cases, tangential
18 longitudinal strain and flexural shear combined with regional sinistral shear seem to be the most common mechanisms of folding. Some of
19 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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22 *Keywords:* Transpression; Variscan; Folding mechanisms; Strain analysis

24 1. Introduction

25 Since the pioneering work of Harland [17], transpression
26 has been recognised as a widespread deformation regime in
27 fold belts. From homogeneous transpression [40], field data
28 soon led to more elaborate theoretical models where the
29 strain partitioning proved to be a common situation (e.g.
30 [5,21,42,44]). Although these models allow for a good pre-
31 diction of the bulk strain related with these regimes, little
32 work has been produced in order to understand the highly
33 heterogeneous strain that should be induced by the folding in
34 such regimes [20,46].

35 In northern Portugal the main autochthonous Variscan
36 structures have been produced by a heterogeneous transpres-
37 sive regime [9,10,37]. Comprehensive geometrical and kine-
38 matical analyses of these structures were performed in Or-

39 dovician and Silurian metasediments in two sectors near
40 Torre de Moncorvo. These studies were combined with finite
41 strain estimations, since the knowledge of the strain pattern is
42 fundamental to the understanding of any deformed regime
43 [19,32].

44 The obtained data enable a better understanding of the D₁
45 sinistral transpressive regime, emphasising both the impor-
46 tance of strain partitioning and of distinct folding mecha-
47 nisms in the course of the first phase of Variscan deformation.
48 This will also contribute to the knowledge of the geodynamic
49 evolution of the Ibero-Armorican Arc.

50 2. Geological setting

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

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