

Geo-Temas



Sociedad
Geológica
de
España

Volumen 18



5-7 julio 2021 Vitoria-Gasteiz

X Congreso Geológico de España

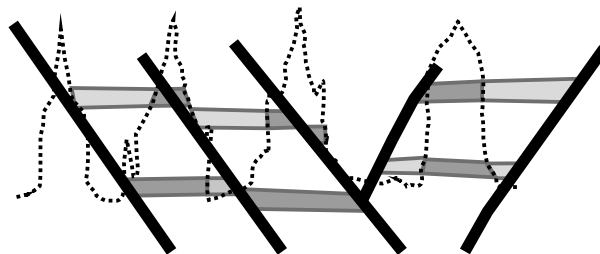
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X CONGRESO GEOLÓGICO DE ESPAÑA
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Vol. 18 (2021)

Cambrian-Ordovician Transition in the Northern Domains of Central-Iberian Zone; Tectonics Constrains

Transición Cámbrico-Ordovícico en los Dominios del Norte de la Zona Centro-Ibérica; Restricciones Tectónicas

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Abstract: *In the northern sectors of the Central-Iberian Zone the transition of the Lower Ordovician over the underlying sequences always shows evidence of the Toledanian phase. The effects of this pre-Armorican Quartzites deformation are highly heterogeneous. In most of the cases it is only shown by an important erosive level giving rise to a disconformity, while in other situations it corresponds to a strong angular unconformity where the older sequences could even present a reversal polarity. Such geometrical relations, that are common in the Central-Iberian Zone, could not be explained by the rotation of the layers in the vicinity of normal faults related to an extensional regime. This suggests that the Toledanian phase was a transient inversion in the general extensive regime that predominates in the northern margin of Iberia during most of the Lower Paleozoic.*

Keywords: *Toledanian phase, Central-Iberian Zone, Transient inversion.*

Resumen: En los sectores del norte de la Zona Centro-Ibérica, la transición del Ordovícico inferior sobre las secuencias subyacentes siempre muestra evidencia de la fase Toledana. Los efectos de esta deformación pre-Cuarzitas Armóricas son altamente heterogéneos. En la mayoría de los casos, solo se muestra por un nivel erosivo importante que da lugar a una disconformidad, mientras que en otras situaciones corresponde a una fuerte discordancia angular donde las secuencias más antiguas frecuentemente presentan inversión de polaridad. Estas relaciones geométricas, que son comunes en la Zona Centro-Ibérica, no podrían explicarse por la rotación de las capas próximo de fallas normales relacionadas con un régimen extensional. Esto sugiere que la fase Toledana fue una inversión transitoria en el régimen general extensivo que predominó en el margen norte de Iberia durante la mayor parte del Paleozoico Inferior.

Palabras clave: *Fase Toledana, Zona Centro Ibérica, Inversión transitoria*

INTRODUCTION

One of the main features of the Central-Iberian Zone (CIZ) is the so-called Toledanian unconformity of the basal Ordovician over the Cambrian or Upper Proterozoic rocks (Gutiérrez-Marco et al., 2002). The nature of this unconformity is important to understand, because it is related to a crucial moment in the northern Gondwana geodynamics, when a generalized stretching occurs (Ribeiro et al., 2007). Nevertheless the pre-Ordovician deformation is poorly known, not only due to the strong Variscan overprint, but also to the absence of related metamorphic foliations. This led to the coexistence of two opposed interpretations for this pre-Variscan event that try to explain the unconformity by:

– an Upper Cambrian extension along the northern Gondwana continental margin, leading to the rotation of the pre-Ordovician formations in the vicinity of normal faults (Dias da Silva, 2014);

– a transient inversion in the northern Gondwana margin probably related to the migration of the depocenter (Romão et al, 2005).

This work tries to contribute to the discussion of the nature of the Toledanian unconformity based on detailed structural mapping of chosen northern sectors of the CIZ enhancing its geometry and kinematics.

THE GEOMETRY OF THE TOLEDANIAN UNCONFORMITY

The pre-Ordovician deformation in the northern sectors of the CIZ (Fig. 1A) is highly heterogeneous (Ribeiro et al., 1990). Such diversity is well expressed in the pattern of the Toledanian unconformity, which range from a disconformity to an angular unconformity, either of low or high angle (Coke et al., 2000). Thus, any model trying to

understand such complexity should be based in data from different key-sectors. Three main areas have been chosen due to their structural behaviour and well outcropping conditions: Marão (Fig. 1B), Southern Poiares (Fig. 2C) and Northwest Freixo de Espada-à-Cinta (Fig. 1D).

In the Marão Mountain it is possible to emphasize the coexistence of two main geometrical relations between the pre-Ordovician and the Ordovician formations:

- A disconformity relation, as in the Freitas sector (figure 1B1), with sub parallelism between both formations. Nevertheless the similar geometries of the layers, the transition between both periods is marked by an impor-

tant erosional surface related with a strong temporal gap, as proven by the presence in the Lower Ordovician basal conglomerates of pebbles of the Cambrian formation.

- A strong angular unconformity where the Cambrian layers have already been inverted by the Toledanian event before the deposition of the Ordovician basal layers, as happen in the Póvoas sector (figure 1B2).

In the southern limb of the Poiares syncline the situation is similar to the Marão one, with the angular unconformity restricted to localized domains (figure 1C). Also here the pre-Ordovician layers are usually reversed by the Toledanian deformation event.

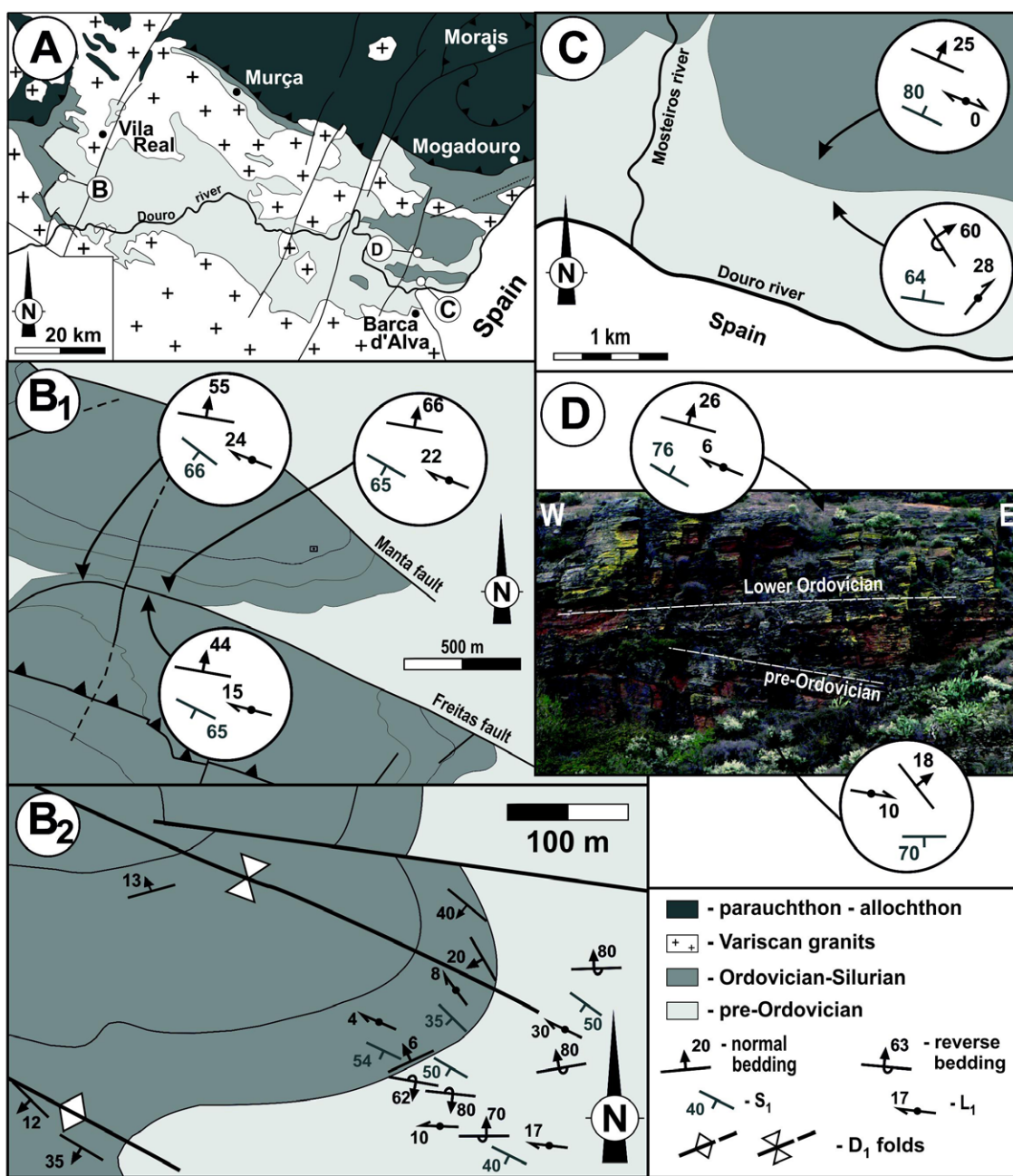


FIGURE 1- Toledanian unconformity in northern sectors of the Central-Iberian Zone: A- Simplified geological map with location of the studied domains; B- The Marão sectors of Freitas disconformity (B1) and Póvoa angular unconformity (B2); C- The southern Poiares syncline sector; D- The Toledanian unconformity in the southern limb of Moncorvo syncline.

W of Freixo de Espada-à-Cinta, in the Southern limb of the Moncorvo syncline (Dias et al., 2013), the Toledanian unconformity is well expressed as a very low angle unconformity (Fig. 1D), indicating a weak pre-Ordovician deformation. Such structural pattern make difficult to emphasize the Toledanian unconformity in situations of poor outcrop conditions.

When the observed Toledanian structures of the Douro basin are restored to their pre-Variscan geometry, the combination of the localized reverse limbs, with the flat lying pervasive sectors, indicates a SW vergence of the Toledanian structures. Such kinematics is compatible with the S facing of the major Sr^a do Viso thrust (Silva and Ribeiro, 1985), which is also been considered a major structure developed during the transient inversion (Romão et al., 2005).

GENETICAL MODELS FOR THE TOLEDANIAN UNCONFORMITY

The geometrical relation between the Pre-Ordovician and the Lower Ordovician formations is very heterogeneous, ranging from parallelism / very low obliquity (<10°) to high angular unconformity. The first situation is widespread in northern CIZ, showing that the Toledanian deformation is very weak in most of the Douro basin. However, it is possible to find narrow NW-SE to NNW-SSE bands where this deformation is very strong. Nevertheless, there was never the development of a coeval cleavage which indicates that the Toledanian deformation was achieved in a high structural level. As the strong deformation seems restricted to these narrow bands, it seems that the Toledanian event mostly results from the activity of faults with this trend. As in the more deformed sectors of Poiares and Marão the pre-Ordovician beds have been often overturned prior to the Lower Ordovician deposition, such strong rotation (>100°) could be difficult to explain by space problems in the vicinity of normal faults (e.g. rollover anticlines). This seems to indicate that the transient inversion has been the main process in the formation of the Toledanian unconformity and the high strain bands of Poiares and Marão are related to Toledanian thrusts with a SW facing.

ACKNOWLEDGEMENTS

Rui Dias acknowledges the funding provided by the Institute of Earth Sciences (ICT), under contract with FCT (the Portuguese Science and Technology Foundation; UID/GEO/04683/2013).

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