



## The Rheic Ocean Gondwana passive margin: insights from structural analysis and stratigraphic response

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The Cantabrian and West Austrain-Leonese Iberian Zones are situated in the North-West of Spain. These Zones consist of stratigraphic successions spanning from the Cambrian ( $\sim 542.0$  Ma) to the Carboniferous ( $\sim 299.0$  Ma) and are cross-cut by large and small scale extensional and thrust faults. These sedimentary successions remain variable in thickness across thrusted sections of these Zones. In addition, numerous unconformities are identifiable within these sedimentary sequences, the most notable during the Late Ordovician (Hirnantian  $\sim 445.6$  Ma to  $\sim 443.7$  Ma) as a result of widespread glaciations and eustatic sea level fall. Overall these Zones illustrate the Palaeozoic history of the northern Gondwana margin and its passive margin associated with the Rheic Ocean.

This work focuses on characterising the basin dynamics of the northern Gondwana margin and its subsequent peri-Gondwana terranes through analysis of associated rifted sedimentary basins during the Early Palaeozoic specifically from a Southern European perspective. The passive margin stratigraphy associated with the Rheic Ocean in North-West Spain comprises diachronous marine and terrigenous shallow-marine limestones, dolostones, sandstones and shale sequences. In addition, volcaniclastic sediments have been observed to be concordant with Cambro-Ordovician sandstone and shale units. This stratigraphy associated with the passive margin has been classified into pre-, syn- and post-rift megasequences. The thicknesses of these sequences vary across the extensional fault block systems and latter thrusted segments of North-West Spain.

Burial history modelling of stratigraphic data interpreted from measured sections and published log data from the Cantabrian Zone, the Montagne Noire and Sardinia provides a unique insight into the passive margin development and its associated stratigraphy. For each of the respective stratigraphic units lithology, thicknesses, predicted erosion and deposition, relative sea level and thermal parameters were input into burial history modelling software in order to analyse the stratigraphic development of the passive margin. Burial history modelling in the Cantabrian Zone shows two major periods of rift and thermal subsidence during the Late Cambrian and the Early Devonian. Burial history results from adjacent sections of the northern Gondwana margin, the Montagne Noire and Sardinia also display similar patterns of rift and thermal subsidence during the Late Cambrian. The subsidence displayed by these models is attributed to the growth of the Rheic Ocean and passive margin development during the Cambrian and Ordovician and the development of a Rheno-Hercynian seaway during the Lower Devonian.

Fieldwork-based investigations from North-West Spain have confirmed the two periods of extension at the Gondwana margin at the Cambrian-Ordovician boundary and during the Lower Devonian. The kinematics of these syn-sedimentary faults shows NW-SE to NE-SW extension from south to north around the Ibero-Armorican Arc. This work shows that within the Southern European Variscides a classical passive margin analogue similar to the present-day Brazilian wide margin rather than the narrow West African margin.