



A new model for the provenance of the Upper Devonian Old Red Sandstone (UORS) of southern Ireland

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The geology of Southern Ireland is dominated by the influence of both the Caledonian and Variscan orogenies which have shaped the landscape of today. The Old Red Sandstone (ORS) sequences of the Middle - Upper Devonian Munster Basin have traditionally been viewed as a post-orogenic molasse deposit sourced from the Caledonides (Friend et al. 2000 & references therein), which were subsequently deformed by the Late Carboniferous Variscan Orogeny. This model does not take into account the potential impact of the Acadian Orogeny, an Early to Mid Devonian transpressional tectonic event which culminated in Mid Emsian times and resulted in the deformation and inversion of Lower ORS (LORS) basins across Britain and Ireland (Soper & Woodcock 2003; Meere & Mulchrone 2006). Evidence of Acadian deformation in Southern Ireland is recorded in the LORS sequence of the Lower-Middle Devonian basin, the Dingle Basin. Meere & Mulchrone (2006) show that penetrative deformation visible in the LORS of the Dingle Basin has an Acadian signature and is not associated with Late Carboniferous Variscan compression (Parkin 1976; Todd 2000). The role of the Acadian Orogeny in the tectono-sedimentary evolution of Southern Ireland has been analyzed in this study using a multidisciplinary approach. Petrographic analysis of both the LORS and Upper ORS (UORS) of southern Ireland suggests an alternative provenance model in which there is a direct genetic link between the two Devonian deposits. There is a fining-up relationship between the two basins and the volcanic lithic fragments - while extremely limited in occurrence in the Munster Basin - are strikingly similar in both units. The absence of conglomeratic units at the base of the Munster Basin provide further evidence that the UORS does not represent a classic molasse deposit. This is supported by EMPA data from both basins which indicates identical mica chemistries in both the LORS and UORS. A comparison with the white mica chemistries from a variety of source areas suggests that the mica chemistry is similar to both the Irish Caledonides and also to the Scandian micas; therefore the ultimate source area of the ORS detritus remains ambiguous. This relationship is confirmed by the $40\text{Ar}/39\text{Ar}$ step-heating and total fusion age dating which yields Acadian apparent ages for the detrital white mica component in both basins; apparent ages for the Munster Basin micas are in the range 403 to 388 Ma. The Dingle Basin micas yield ages in the range 405 to 385 Ma. The presence of Acadian age micas in both basins and the similarity in mica chemistry suggest an alternative provenance model in which the LORS deposits of the Dingle Basin are inverted and recycled southwards into the UORS Munster Basin.

References:

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