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Precambrian to Ordovician sedimentary basins of Wales display contrasting histories across major NE-striking fault systems. Northeast of the Menai Strait Fault System the Monian Supergroup is a deformed succession of mainly metaclastic rocks. Within the fault system the Arfon Basin contains sandstone and slate overlying Neoproterozoic volcanic rocks. South of the fault system, in the Harlech Dome of the Welsh Basin, a distinctive succession of clastic rocks has been correlated with those of the Meguma Terrane in the northern Appalachian orogen, together comprising the domain Megumia. A detrital zircon analysis from Cambrian sandstone in the Harlech Dome is consistent with this correlation. However, the Early Ordovician Dol-cyn-afon Formation higher in the succession and the overlying Late Ordovician Conway Castle Sandstone show a more diverse provenance, consistent with derivation from the Monian Supergroup. Cambrian sandstone from the Llanberis Slates Formation in the Arfon Basin shows a distinct provenance dominated by a Neoproterozoic source. None of the samples analyzed contains Laurentian detritus. These results suggest that the Welsh Basin was juxtaposed with the Monian Supergroup and its Precambrian substrate along the Menai Strait Fault System by the Tremadocian, and indicate that the Iapetus Ocean remained open at least until the Silurian. The Cambrian detrital zircon record from the Arfon Basin does not show clear similarity to the Monian Supergroup, nor to the Welsh Basin and adjacent Midland Platform, indicating that the basin was isolated from these sedimentary sources within the fault system. The juxtaposition of these terranes probably took place during strike-slip to transpressional tectonism close to the northern margin of Gondwana during the Early Ordovician.