

Tectonics, islands and island hopping in the Early Palaeozoic benthos

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The Ordovician was characterized by extreme magmatic and tectonic activity that resulted from a period of rapid plate movements. The oceans were littered with microcontinents, volcanic arcs and archipelagos together with complex, mobile belts around many of the continents. Neuman (1972, 1984) suggested that Iapetus Ocean island environments could be identified in the displaced terranes of the Appalachian mountain belt, a model confirmed by parallel studies in the Scandinavian Caledonides (Bruton & Harper, 1981, 1985). Statistical analyses confirmed that in the Iapetus region such biotas, developed seaward of the continents, could be grouped into a low latitude Toquima-Table Head province and a high latitude Celtic province (Neuman & Harper, 1992; Harper *et al.*, 1996). Subsequent data refined the position of these and related provinces, and the placement of associated terranes (Harper *et al.*, 2008, 2009). A substantial new database including 65 sites globally and nearly 250 taxa covering the critical Dapingian-Darriwilian (late Early – early Mid Ordovician) interval has been constructed from existing datasets, but includes additional new data and GPS coordinates for all localities. The locality data have been plotted on predrift Ordovician palaeogeographic reconstructions by BugPlates and the data matrix analysed by a range of multivariate techniques including non-metric multidimensional scaling. The patterns broadly confirm previous reconstructions, but allow more accurate definitions of the main provinces. These analyses also confirm the roles of the oceanic provinces as both cradles and museums of evolution (Harper & Mac Niocaill, 2002), with reference to the development of the global brachiopod fauna through the Floian-Sandbian (mid Early – early Late Ordovician) interval. Moreover, groups of taxa with particularly widespread distributions during the Dapingian-Darriwilian were possible island hoppers, taking advantage of the spectrum of disparate terranes generated by the magmatic and tectonic activity of the period.

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