

Lower palaeozoic circum-Atlantic history from the Late Precambrian to the Middle Devonian

K.T. Pickering¹ and A.G. Smith²

¹*Department of Geological Sciences, University College London, Gower Street, London WC1E 6BT, United Kingdom*

²*Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, United Kingdom*

The *ca.* 620 to 570 Ma breakup of Gondwana led to the creation of a Mesozoic Tethys-like or Mediterranean-type ocean basin, the Western Iapetus Ocean between Laurentia and South America. At that time, the *ca.* 650 to 500 Ma subduction-related Cadomian and associated tectonothermal events occurred along an active, mainly Andean-type, convergent continental margin facing a much older and very wide Pacific-type ocean basin, here named the Eastern Iapetus Ocean. The main Lower Palaeozoic tectonothermal events were as follows: (1) 620 to 570 Ma breakup of Gondwana, with the Andean margin of South America rifting from the eastern margin of Laurentia to create the Western Iapetus Ocean. The Eastern Iapetus Ocean was already in existence, and Gondwana was associated with a landward-dipping subduction zone (Cadomian, Grampian, Penobscotian, Famantinian, and possibly some "Finnmarkian" events); (2) 490 to 470 Ma marginal basin development, followed by ophiolite obduction along northern/northwest margin of Laurentia (early or precursor stage of arc-continent collision between Laurentia and an outboard arc system [M'Clintock, Early Caledonian, Taconic]). During this time, there is no convincing evidence for continent-continent collision between Laurentia and South America; (3) 480 to 470 Ma second phase breakup of Gondwana, with Baltica, Eastern and Western

Avalonia, the Carolina slate belt, Piedmont, and other North American exotic continental blocks rifting from Gondwana; (4) 460 to 430 Ma, peak *ca.* 450 Ma, orogenic events involving continuing arc-continent collision/s; (5) 435 to 400 Ma destruction of remaining parts of the Iapetus Ocean (Scandian 430 to 400 Ma; Acadian Siluro-Devonian = Late Caledonian/Acadian, to 380 Ma; and Ligerian 390 to 370 Ma collision of Gondwana-derived Aquitaine-Cantabrian blocks with Eastern Avalonia-Baltica). Like the Pacific Ocean today, the Eastern Iapetus Ocean was many thousands of km wide, had a long and complex history of island arc development spanning at least 400 million years, and was associated with a phase of marginal basin formation which was of short duration (< 30 million years), particularly on its Laurentian margin side, together with major strike-slip tectonics, and therefore was similar to the Pacific Ocean basin. Also, like the Pacific, it was an essentially north-south elongated ocean. In contrast, the Western Iapetus Ocean appears to have been much narrower, shorter lived (probably < 100 million years), and associated with the rifting to form two opposing passive carbonate margins, analogous to the Mesozoic Tethys or the present-day Mediterranean. Also, like its Tethyan or Mediterranean counterparts, the Western Iapetus was an east-west oriented ocean basin.