Geotectonic development of British Isles

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The model of geotectonic development of British Isles is newly proposed on our recent new studies of the British Isles. In the first plate tectonic synthesis of the geotectonic development of the British Isles, Dewey (1971) considered that the Caledonian and Hercynian (Variscan) collisional orogenies were the most important events responsible for formation of the orogenic structures. The micro-continent of Avalonia is thought to play a unilateral continent in those collisional orogenies, and it represents the widest area in British Isles, however, the origin of Avalonia was not enough evaluated. Recently, we described two ancient subduction-related Pacific-type orogens in central Britain, and in southern Scotland and Ireland, and proposed the geotectonic development of Avalonia.

Neoproterozoic to Cambrian Pacific-type orogen in central Britan composed of high P/T bluescshist belt, accretionary complex and coeval arc complex. A 200 km long and 200 km wide, 680-450 Ma calc-alkaline volcano-plutonic belt extends southeastwards from the c. 560 Ma blueschist belt in Anglesey via northern Wales to central England, suggesting that the paleo-subduction of oceanic lithosphere was to the southeast. The blueschist belt has the shape of a shallow-dipping slab or sheet up to a few km thick that was exhumed from the subduction zone and emplaced into the accretionary complex to the northwest. Cambrian to Ordovician Pacific type orogen in southern Scotland and Ireland also show the north to the south subduction polarity till continental collision with southern margin of Laurentia craton. The Cambro-Ordovician Ballantrae ophiolite in Southern Scotland contains the bluescshit fragment in the serpentinite mélange. The mafic schist in the serpentinite mélange show the high-pressure intermediate-type metamorphic facies series, suggesting that they were exhumed from around 25 km depth within a cold subducted slab, and were juxtaposed with the bottom of a low-pressure MORB-like ophiolite in the hanging wall of a trench. This is consistent with early to middle Ordovician southward subduction responsible for the equivalent Clew Bay accretionary complex, c. 460 Ma blueschist and associated arc almost along-strike in western Ireland (Clift et al., 2004).

On the basis of these new observations and numerous studies of previous workers, their tectonic evolution is summarized in the following stages; (1) breaking up the Rodinia supercontinent, and birth of Iapetus ocean; (2) tectonic inversion from passive margin to active margin along the northern margin of ancient Avalonia; (3) successive north to the south oceanic subduction creating Avalonia Pacific-type orogens from c. 680 Ma till continental collision; (4) Caledonian continental collision between northern margin of Avalonia and southern margin of Laurentia craton; (5) collisional compression creating the back thrust within a Avalonia; (6) Hercynian continental collision between southern margin of Avalonia and northern margin of Armorica craton, forming Pangea supercontinent; (7) breaking up the Pangea supercontinent and birth of Atlantic ocean.