Late Cretaceous to Early Paleocene Geological Evolution of Jamaica

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Abstract

The relationship between the rocks of Jamaica and the evolution of the Caribbean has always been difficult to explain. We have analysed and dated stratigraphic sequences and unconformities across Jamaica and the geochemistry and age of volcanic and metamorphic rocks. Two main terranes are recognized: a Western Jamaica Terrane (WJT) and an Eastern Jamaica Terrane (EJT). The WJT consists of an arc and basin succession with basaltic, andesitic and rhyolitic volcanics with IAT/CA affinity extruded from the Lower Cretaceous through to the Campanian. Arc volcanics are intercalated with thick units of volcaniclastics, rudist bearing limestones, and subsidiary deep-water shales, and indicate at least 60 My of island arc volcanism. The basinal succession includes shales and conglomerates. In the thicker and best preserved basinal successions, a regressive sequence extends from at least the Coniacian to the early late Campanian. Following a major unconformity, the transgressive-regressive Kellits Synthem represents the mid Maastrichtian-Paleocene but with volcanism (ignimbrites) now related to Jamaican-type adakites. A further uncoformity brings in the clastics and carbonates of the Yellow Limestone Group. The EJT of the Blue Mountains has a basement formed of CLIP basalts of late Turonian to Coniacian age overlain by deep-water limestones and an arc-derived sandstone-shale sequence of presumed Santonian age. Overlying are thick piles of Campanian volcanics (derived from a depleted plateau source) and volcanicalstics with rudist limestone intercalations in the mid (Back Rio Grand Lmst.) and upper (Rio Grande Lmst.) Campanian and the early Maastrichtian. Two rift basin successions are developed in eastern Jamaica: the late Maastrichtian-Paleocene John Crow Mountain Rift (JCMR) and the mid Paleocene to early Eocene Wagwater Rift (WR). Volcanics in the WR can be generated by partial melting of subducted CLIP rocks during rifting. Blueschists, with a CLIP geochemistry, amphibolites, with arc geochemistry, and a serpentinite melange record the presence of a Campanian subduction zone that subducted CLIP rocks (EJT protolith), which were returned to the surface before the mid Paleocene. The geology of Jamaica is most easily explained by north-easterly directed subduction of the Farallon Plate beneath WJT (and Cuba) as insufficient oceanic crust was present in the Proto-Caribbean to drive Jamaican island arc volcanism for 60 My. Following the eruption of the CLIP, the CLIP collided with the WJT and began subducting with the development of an unconformity and subsequent change in volcanism to CLIP derived source regions. The WJT was thrust onto the North American Plate and a strike-slip fault systems and two tears in the subduction slabs initiated allowing Cuba (and the EJT) to move to the NE and eventually collide with the Bahamas Platform in the Eocene. Subduction zone rocks were uplifted along the strike-slip fault systems and transtensional basins (JCMR followed by WR) developed progressively in the latest Maastrichtian to Paleocene. Decompressional melting resulted in the partial melting of the CLIP and the formation of Jamaican-type adakites what were erupted into the WG. The model explains the geology of Jamaica well, but still leaves the geological evolution of Jamaica disparate from other parts of the Caribbean.