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Kinematic reconstruction of the Caribbean region since the Early Jurassic

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The Caribbean region results from a complex tectonic history governed by the interplay of the North American, South American and (Paleo-)Pacific plates, between which the Caribbean plate evolved since the early Cretaceous. During its entire tectonic evolution, the Caribbean plate was largely surrounded by subduction and transform boundaries, which hampers a quantitative integration into the global circuit of plate motions. In addition, reconstructions of the region have so far not resulted in a first order kinematic description of the main tectonic units in terms of Euler poles and finite rotation angles. Here, we present an updated, quantitatively described kinematic reconstruction of the Caribbean region back to 200 Ma integrated into the global plate circuit, and implemented with GPlates free software. Our analysis of Caribbean tectonic evolution incorporates an extensive literature review. To constrain the Caribbean plate motion between the American continents, we use a novel approach that takes structural geological observations rather than marine magnetic anomalies as prime input, and uses regionally extensive metamorphic and magmatic phenomena such as the Great Arc of the Caribbean, the Caribbean Large Igneous Province (CLIP) and the Caribbean high-pressure belt as correlation markers. The resulting model restores the Caribbean plate back along the Cayman Trough and major strike-slip faults in Guatemala, offshore Nicaragua, offshore Belize and along the Northern Andes towards its position of origin, west of the North and South American continents in early Cretaceous time. We provide the paleomagnetic reference frame for the Caribbean region by rotating the Global Apparent Polar Wander Path into coordinates of the Caribbean plate interior, Cuba, and the Chortis Block. We conclude that a plate kinematic scenario for a Panthalassa/Pacific origin of Caribbean lithosphere leads to a much simpler explanation than a Proto-Caribbean/Atlantic origin. Placing our reconstruction in the most recent mantle reference frames shows that the CLIP erupted 2000-3000 km east of the modern Galápagos hotspot, and may not have been derived from the corresponding mantle plume. Finally, our reconstruction suggests that most if not all modern subduction zones surrounding the Caribbean plate initiated at transform faults, two of these (along the southern Mexican and NW South American margins) evolved diachronously as a result of migrating trench-trench-transform triple junctions.