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A new model: Punctuated Chlorozoan Carbonates- biotic response to accretion tectonics and volcanism (Cretaceous-Cenozoic, Mid-America)

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We propose a new model for Punctuated Chlorozoan Carbonates (PCC) inspired by the model of punctuated equilibria in evolution. PCC are characterized by rapid appearance and disappearance of stable conditions for chlorozoan carbonate production, modest size and a geologically short life span (1-10 Ma). PCC located along the Late Mesozoic – Cenozoic intra-oceanic subduction zones of Central America and the Caribbean consist of small carbonate banks and buildups inter-stratified in overall deeper-water volcano-detrital series and bounded by unconformities and/or abrupt facies changes. Oceanic basements in isostatic equilibrium are usually deeply submerged. Their rise into the photic zone and eventual emergence was controlled by accretion tectonics, and/or intra-oceanic plateau or arc development. PCC formed in fore/back-arc areas, on uplifted accretionary prisms, oceanic plateaus and arcs, and on (later accreted) oceanic seamounts. PCC were mainly built by rock-forming LBF (larger benthic foraminifera) and rhodophycaean algae, while rudists (Upper Cretaceous) and corals (Oligocene-Miocene) produced some framework. PCC formed in overall unfavorable conditions, due to tropical weathering of emerged oceanic terranes and/or arc volcanism, producing high discharge of silt, clay and dissolved nutrients. The occurrence of PCC implies local/temporary cut-off from detrital input and stalling of explosive arc volcanism. Hence, age and facies evolution of PCC provide valuable markers of the geodynamic, tectonic and paleo-environmental evolution of active margins and the Caribbean Plate as a whole (see abstract by Andjic et al.). PCC are fundamentally different from long-lived (10-60 Ma) large carbonate shelves set along passive margins, where carbonate production is largely controlled by paleoclimate and eustatic sea-level change. Models developed for these carbonates do not apply to CCP.Based on case studies, the new model chronologically synthesizes the biotic/sedimentary record observed in PCC (O1-6)) and relates it primarily to endogenic processes (P1-6): (O1): Oldest sediments on oceanic basements are pelagic, or hemipelagic/turbiditic, formed below the photic zone. (P1): Basaltic basements normally form at sub-photic depths and subside thermally.(O2): Deep water sediments may be overlain by arc-derived, shelfal tempestites and mudstones formed above storm wave base. (P2): Tectonic uplift occurs due to accretion, underplating, or collision. (O3): Coarsening upwards tempestites, progressive unconformities and/or erosion of lithified and tilted sediments in the inter-tidal zone. (P3): Further tectonic uplift and land-ward tilting occurs as a consequence of collision or incorporation of accreted material into the upper plate. (O4): PCC encroach on an angular unconformity. Arc-derived material is rare. (P4): Accumulation due to relative se level rise, owing to tectonic subsidence and/or due to eustatic sea-level rise. Scarcity of volcanodetrital input implies bypassing and/or stalling of the nearby arc activity due to collision, underplating or back-stepping of the arc. (O5): PCC show often increasing water energy upsection;
topmost carbonate levels show interbedded ash layers. (P5): Continued subsidence produces accommodation space for carbonates. Renewed explosive arc activity starts to interfere with carbonate production. (O6): A sharp change to volcano-detrital offshore/deep water turbiditic facies marks the end of PCC ("drowning"). (P6): Increasing volcano-detrital

input causes low water transparency and eutrophication of surface waters, stopping the carbonate factory.