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Secondary carbonates (calcretes) in coastal outcrops as archives for paleoenvironmental reconstruction- a case study from Yucatan Peninsula, Mexico

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In the Yucatan Peninsula (southeast of Mexico), several coastal outcrops with different layers of calcareous sand and compacted carbonated crusts were observed. In this work, we studied geochemistry and mineralogy of this primary and secondary carbonates. The primary lithogenic carbonates are represented by calcarenites, while the secondary carbonates are of pedogenic origin, particularly forming calcretes. In the study area, two layers of calcrete are found, separated by a thick laminated calcarenite, representing different marine facies. The calcretes have been interpreted in the sedimentary record, as evidences of subaerial exposure during periods of emersion of the carbonated platform. Calcretes are directly influenced by soil formation processes (pedogenesis), which makes them geochemically and mineralogically different to the lithogenic ones. Geochemically, calcretes are depleted in δ13C, with values between -2‰ and -10‰Ṫhe stable isotope signatures (δ13C) also point to the formation of this calcretes under a C3/C4 mix vegetation. Micromorphological observations indicate the dominance of secondary structures, with a decrease in porosity and greater compaction. Microgranular structure, acicular carbonates and roots traces are a common observed feature. Calcarenites have a quite different geochemical signature, with more enriched values of δ13C. Their micromorphology shows a dominance of bioclast and oolites. Uranium-series dating indicate that the calcretes are formed more than 100,000 years BP, during previous interglacial and glacial episodes (marine isotope stage (MIS) 5 and 6). This chronology denoted that the calcrete formation occurs during low sea levels, indicating subaerial exposure conditions, while the calcarenites are developed during the arise of the sea level.