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Early Diagenesis of Lower Pliensbachian Sediments from the Algarve Basin (Portugal): Characterisation and Relation with Tectonic Evolution

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The Lower Jurassic (Lower Pliensbachian) sedimentary record of the western end of the Algarve Basin (Portugal) is made of decimetric thick layers of limestone and dolomitized limestone with chert nodules and inter-layered chert beds. Most of the observable lithologies are the product of an early diagenetic evolution and the original lithological content of the formation included limestones, marls and calciclastic limestones.
In this area the sedimentation was controlled by the tectonic stretching responsible for the evolution of the Algarve Basin, as well as by short-lived events of tectonic inversion. These episodes of tectonic inversion were responsible for the some uplift with the development of unconformities, sometimes with erosional surfaces separating the different sedimentary packages.
The early diagenesis affecting the Lower Pliensbachian sediments is characterized by: (i) a mechanical event controlled by the syn-sedimentary stretching, responsible for the development of calciclastic dikes and nodules alignements; (ii) the substitution of the carbonates from the most permeable calciclastic limestone layers by silica, leading to the development of the observed cherts; (iii) the dolomitization of the preserved limestones; and (iv) the infilling of joints and normal fault planes by silica-rich fluids leading to the development of quartz veins. This set of diagenetic transformations took place before the Upper Pliensbachian which lacks the evidences of their occurrence.
The whole-rock geochemical data of the carbonate and siliceous sediments of the Lower Pliensbachian revealed some affinities between both lithological types namely the lack of Ce anomalies and the presence of La anomalies in the REE patterns of all samples. The similarities between the carbonate lithologies which diagenetic evolution is marked by the replacement of calcite by dolomite and the siliceous sediments derived from the replacement of calcite by quartz establish a chemical connection between the two sets of rocks. This connection can be interpreted as a testimony of a common primary precursor for both lithological groups or as a testimony of a common character of the diagenetic fluids which interacted with the original sediments.
The dolomitization changed the Sr isotopic signature increasing the 87Sr/86Sr ratios from 0.7073 in the unchanged limestone to a maximum value of 0.7113 in the dolomitized samples. This strong increase together with the 13C/12C and 18O/16O values support an external origin for the dolomitizing fluids. A possible origin for the diagenesis is meteoric water coming into the basin after weathering the country rocks.
The hydrologic regime in the basin certainly underwent important changes during the uplift events associated to the mentioned tectonic inversion episodes and uplift allowing for input of water from land.