ISOTOPIC SIGNATURE OF DIAGENETIC FLUIDS AND CEMENT IN THE LATE EOCENE TORTACHILLA LIMESTONE OF SOUTH AUSTRALIA

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Stable isotope analysis of carbonate rocks and fossils are employed for; reconstruction of the ancient sedimentary environments and their diagenetic history, estimation of the isotopic composition, origin and temperature of seawater and diagenetic fluids.The geochemical aspects of Tortachilla Limestone (Late Eocene) of St.Vincent Basin are considered in this study. The diagenetic setting, isotopic compositions and origin of diagenetic fluids and seawater are constrained using isotopic composition of dLMC meteoric cement and well-preserved calcareous marine fossils. The dLMC meteoric cement is resulted due to mineralogical stabilization of marine calcareous fossils by undersaturated meteoric fluids. Therefore, the isotopic signature of this cement is controlled by the isotopic composition of its precursors (calcareous fossils and diagenetic fluids). Accordingly, the isotopic composition of this meteoric cement is used to constrain the isotopic signature of diagenetic fluids. The isotopic composition of Tortachilla Limestone dLMC meteoric cement represents an isotopically light composition (highly depleted) relative to the isotopic composition of well-preserved marine fossils that their equilibrium precipitation is substantiated. This suggests that seawater had no significant contribution to the formation of this cement. On the contrary, the isotopic value of this cement is close to the values reported for the calcite precipitated from modern coastal and island meteoric water in similar latitude (51.5°). This cement also shows the inverted-J pattern, which is characterized by concomitant invariability in d18O and variability in its d13C signature. The isotopic composition of Tertiary seawater is also estimated by using the well-preserved fossil material and constraining relevant bottom water temperatures.