

CHALK DOLOMITIZATION BENEATH LOCALIZED SUBSIDING TERTIARY DEPRESSIONS IN A MARGINAL MARINE SETTING IN THE PARIS BASIN (FRANCE)

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ABSTRACT: Dolomitization of the Late Cretaceous chalk in the southeastern Paris Basin forms kilometer-size bodies that crosscut bedding. These diagenetic structures were first identified during petroleum exploration of intra-chalk seismic discordances and then they were cored down to 700 m. The high-velocity chalk forms kilometer-size hill-shaped structures between 150 and 600 m depth. Similarly, the top of the chalk shows kilometer-size domes and depressions with an average amplitude of 50 m and slopes over 3%, whereas the base of the chalk shows only very gentle dip.

Two drill cores, 2 km apart, intersecting the seismic discordances allowed us to establish that these structures correspond to dolomitized chalk and porosity reduction. Detailed biostratigraphic correlations between the two drill cores show that (1) the seismic discordances are not related to the stratigraphy, and (2) dolomitization of the chalk coincides with an apparent compaction of the whole unit.

The overlying Early and Middle Eocene formations vary spatially between 20 and 100 m thickness. The distribution of their sedimentary facies indicates that the dome and depression structures at the top of the chalk developed during the Middle Eocene. The depression structures and localized Middle Eocene depocenters directly overlie the dolomitized diagenetic structures in the chalk. Furthermore, the depressions commonly correspond to zones where sand channels are cut through the Early Eocene claystone, down to chalk.

Groundwater circulation within the chalk may have been linked to the Tertiary sand channels. Such circulation might have been responsible for the dolomitization of the chalk and concurrent dissolution and/or compaction leading to differential subsidence in the Tertiary deposits. The link between Tertiary localized depocenters and dolomitization constrains the chalk diagenesis to the Eocene and to nearsurface environments. Stable-isotope compositions of the dolomites indicate that sea water of normal salinity was likely the dolomitizing fluid. Dolomitization was apparently triggered by recharge of the chalk groundwater with sea water, entering the chalk in depression areas.

Lastly, the diagenetic processes result in sharp seismic reflectors that cut across stratigraphy. These seismic reflectors, first interpreted as deep intra-chalk erosional surfaces, do not follow any depositional stratigraphy at all. Consequently such structures cannot be interpreted in terms of sequence stratigraphy.