Cement timing and distribution in Lower Cretaceous sandstones: Glenelg, Thebaud and Chebucto fields, offshore Scotian Basin

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Diagenetic cements have been studied in conventional core of Lower Cretaceous sandstone from the Glenelg, Chebucto and Thebaud fields in the Sable Subbasin, offshore Nova Scotia. The spatial and temporal distribution of diagenetic cements and para-sequences has been constrained in relationship to lithofacies, depth and the well position in both the distal (Glenelg and Chebucto) and proximal (Thebaud) parts of the basin.

Clay minerals in the sandstones include early grain-coating clays, kaolin, illite and chlorite. Grain-coating illitic clays occur in Glenelg N-49 forming coated grains cemented, initially, by Fe-rich calcite (CI), then low Fe-calcite (CII). Kaolinite occurs as booklets and vermicular stacking textures. It fills large intergranular pores in the Chebucto well and in some samples from Thebaud I-93 and Thebaud #3. Kaolinitized mica exhibits expanded texture that inflates into adjacent intergranular pores. Illite occurs also as fibrous crystals, which in the Chebucto K-90 well are included by ankerite. Fe-rich chlorite (chamosite) rims are found only in the Thebaud samples examined and demonstrably have developed from earlier Fe-rich clay. Early pore-filling chlorite occurs in contact with detrital quartz and lithoclast grains and is often associated with illite. Both this chlorite and chlorite rims are formed around quartz grains lacking quartz overgrowths. Quartz cement (overgrowths) is well developed principally in medium and coarse sandstones. It postdates kaolinite cement and predates most of the other cements.

Carbonate cements (calcite, Fe-calcite, Mg-calcite, ankerite and siderite) are the major cementing minerals filling the large intergranular pores in Glenelg, Chebucto and Thebeaud wells. In Glenelg H-59, two siderite cements were defined; the earliest one is formed by large and corroded crystals and it is low in Mg. The late microcrystalline siderite (< 10 μm) is Mg-rich (8 to 9%). It forms the tiny crystals that fringe detrital grains and fill intercrystalline micropores between quartz and Fe-calcite cement. In Thebaud I-93 siderite nodules contain less Mg than the siderite cement (1%, 8.5% respectively).

The neo-formation of framboidal pyrite in carbonate cement indicates a burial under both reducing and alkaline conditions. In samples from the Glenelg field, perthite is partially replaced by Fe-calcite, with only K-feldspar patches and albite left. Rare traces of francolite (samples with 1 to 6 wt.% P_2O_5) are found in the Glenelg wells associated with illite and calcite cements.

These observations on diagenetic minerals are related to the position of host sediments within parasequences. Coated grains are restricted to transgressive system tracts. Abundant early kaolinite and siderite are found principally in sandstones immediately beneath transgressive system tracts, particularly in cross-bedded coarse channel sandstones.Early calcite cement, predating quartz overgrowths, is found principally in bioturbated sandstones and mudstones with bioclasts, typical of the HST.

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