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Basin Scale Fluid Flow: Does It Occur and Does It Matter? A Case Study of the Paris Basin, France

Many historical models of burial diagenesis have been built using the assumption that basin scale fluid flow is the main control and driving force for cementation. However, some recent models of predictive diagenesis have used a simpler assumption that diagenesis is isochemical and that basin scale fluid flow is negligible. A basin-wide database including formation water geochemistry, petrographic, fluid inclusion, and isotope data have been collected from the Upper Triassic fluvial sandstones and Mid Jurassic shallow marine limestone from the Paris Basin to assess whether basin scale flow has occurred and its effects on the sandstone and limestone.

Analysis of Triassic sandstone data supports movement of water on a basin scale including an extensive flux of highly saline water from the halite-bearing eastern margin and localised influx of fresh water at the southern margin. Analysis of geochemical tracers and cement patterns suggests that water influx has not had a major impact on diagenetic processes.

The Mid Jurassic limestone has been an artesian system since the Oligocene despite being buried to >2000m at the basin center. However, the artesian, basin scale fluid flow has had little diagenetic impact on the limestone. Recorded by modern formation water geochemistry and geochemical tracers in cements, highly saline Triassic formation water has undergone episodic cross-formational flow into the Mid Jurassic limestone for the last 35 my. In contrast to the other types of basin scale flow that have occurred, cross-formational fluid flow has been important in causing carbonate cementation in the limestone.