DIAGENESIS BY KOHOUT CONVECTION IN CARBONATE PLATFORM MARGINS

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ABSTRACT

Kohout convection is a large-scale and long-lived groundwater flow system in the margins of steep-sided active carbonate platforms. It was first postulated to occur in the subsurface of Florida by Francis Kohout in the 1960s. The flow is driven by buoyancy arising from subsurface differences in salinity or temperature. Temperature differences alone drive Kohout convection in isolated platforms. Cold, dense seawater surrounding a platform at depth migrates inward, displacing warmer pore waters at the same elevation. This inflowing density current is in turn warmed within the platform and is buoyed to discharge on the platform shelf or margin. The result is a giant convective half-cell of circulating seawater occupying the platform margin. In carbonate shelves, where regional meteoric groundwater flow may be present, the meteoric water mixes by dispersion with the convecting seawater, resulting in increased buoyancy which enhances the flow rate. Kohout convection may be modeled by systems of differential equations governing the fluid flow, heat transfer, and dispersive mass transfer. Approximate analytical and numerical solutions of these equations in the isolated platform setting are presented to show the effects of platform margin geometry and subsurface permeability on flow rates and flow patterns of Kohout convention.

Kohout convection may be an important agent of mesogenetic diagenesis — as it affects rocks deeply buried in a stratigraphic sense. Porosity may be developed and modified by dissolution by inflowing seawater undersaturated with respect to calcium carbonate phases, by cementation as the seawater warms and rises, and by dolomitization (if possible in these waters) — leading to reservoir conditions in platform margins.

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