PLUTONIC SALT GENESIS AND ITS ROLE IN HYDROCARBON GENERATION AND DISTRIBUTION

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ABSTRACT

A possibly significant geologic process may exist which creates a systematic genetic association between 1) global plate tectonics, 2) global salt distribution, and 3) the existence of major hydrocarbon bearing basins. The U. S. Gulf of Mexico region serves as a primary example of this predominantly empirical association, and a general hypothesis is presented which defines a dynamic genetic linkage between these three phenomenon. This hypothesis offers a systematic solution to many questions that remain unanswered and unrelated by conventional theory.

The general hypothesis, as applied to the Gulf of Mexico, states that diapiric salt structures have been formed primarily as a result of the cooling, degassification, and subsequent mineral crystallization of gaseous brine flows which have emanated from great depths as a direct result of dynamic thermal plume development within the Earth's mantle. These mineral-rich fluids were emitted in significant volumes following Gulf Coast area rifting and subsequent oceanic crustal emplacement in the Gulf of Mexico (Fig. 1). Carbonaceous sedimentary sequences surrounding growing salt plutons were conditionally affected by the increased heat flow emanating from the diapir. Due to this localized thermal kitchen phenomena, liquid hydrocarbons were generated and preferentially trapped near the salt diapir. Lighter more gaseous hydrocarbons were able to move through migration paths consisting of sedimentary reservoirs, fault planes, or the salt face itself to traps well beyond the source diapir (Fig. 2).

This hypothesis offers a systematic explanation for the following problematic phenomena and processes associated with the Gulf of Mexico area:

— The salt volume problem
— The salt sterility problem
— Gulf of Mexico source rock problem
— Salt dome mineral assemblages

Although this mechanism may account for a significant portion of the salt and hydrocarbons generated in the Gulf of Mexico, the plutonic hypothesis clearly does not preclude the formation of salt beds through evaporitic or deep water sedimentary processes. Additionally, the plutonic theory does not attempt to refute the concept that hydrocarbons can be generated through purely organic sedimentary mechanisms.

The plutonic salt generation hypothesis does, however, provide a genetic alternative to the concept that the world's massive salt distribution is exclusively a result of evaporitic processes. It also proposes an alternative mechanism to a purely sedimentary "source rock" theory of natural gas and oil generation. The strength of the plutonic hypothesis alternative lies in its ability to systematically explain and relate an expanding array of both large and small scale empirical phenomena. Further detailed physical and petrochemical examination of this hypothesis is encouraged in order to test its validity.

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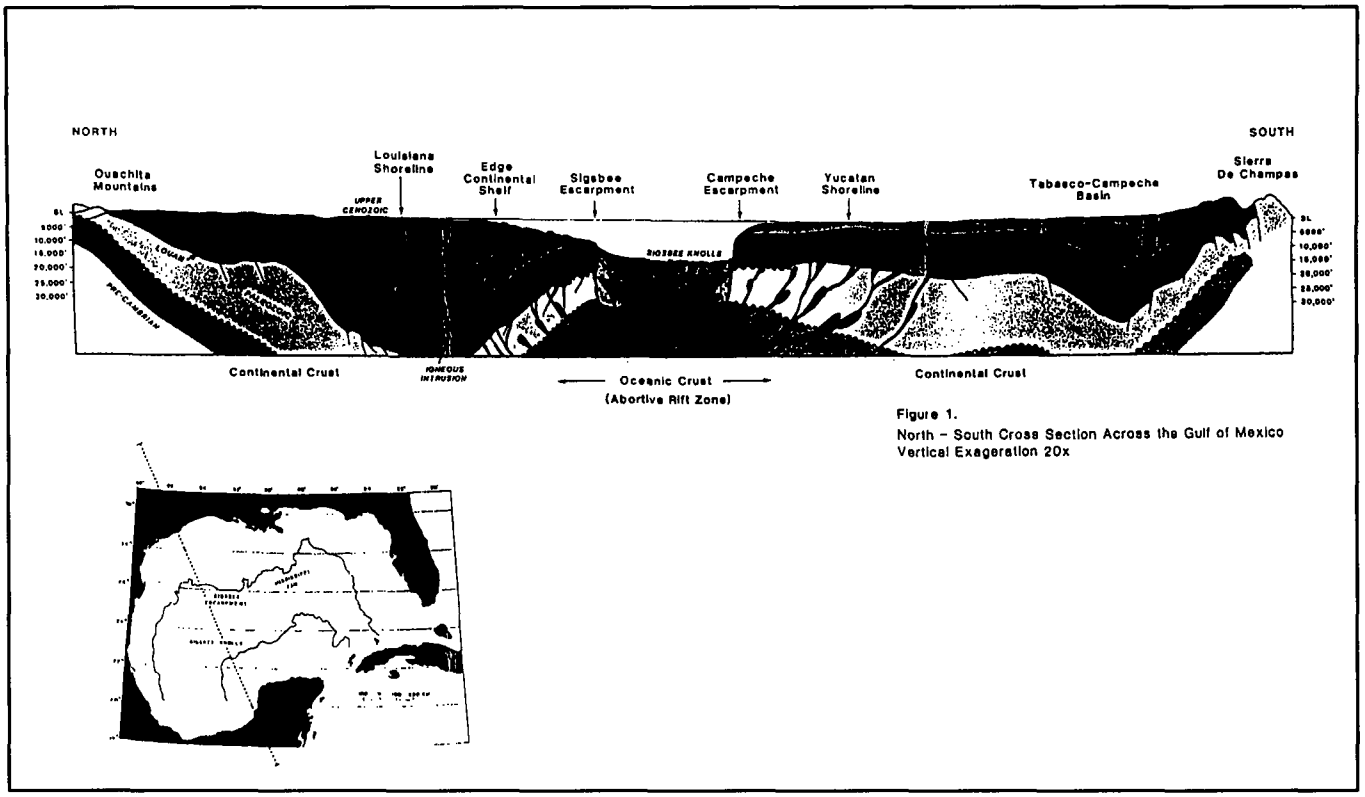

Figure 1. Gulf of Mexico Plutonic Salt Genesis. Salt diapir formation resulting from distal intrusive crystallization of deep sourced fluids which were expelled due to plate tectonic activity in the Gulf of Mexico.

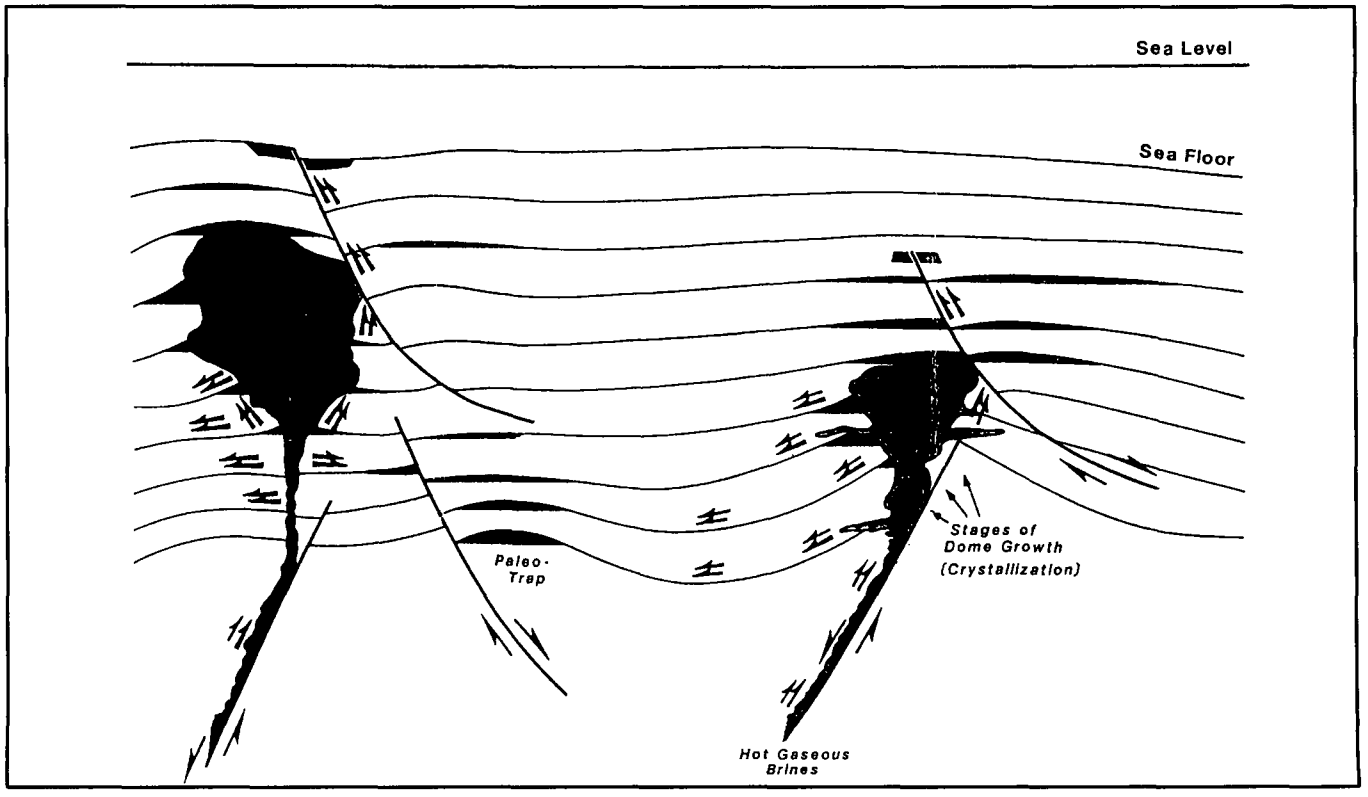

Figure 2. Plutonic Salt Hydrocarbon Generation Model