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Petroleum Geology of Mexico: A Futuristic Integrative Approach Based on 'Out of the Oil Box' Research

A recently completed 8-year research study using unconventional parameters, i.e. oxidation state, volatile content, and alkalinity of magmatism reveals a provocative tectonic pattern. Seven WNW-trending transcurrent fault zones may traverse the entire country of Mexico and connect with transform faults in the Gulf of Mexico and California. More than 3400 km of cumulative left-slip appears to have occurred along the zones since 200 Ma, as indicated by the systematic off-set of the Paleozoic edge of N. America in Mexico defined by a prominent NE-trending break in crustal oxidation state contours. Contoured water content of 5000 magma-metal models suggests the shears also act as permeable fluid-rich zones (5-15 miles wide). Sinistral kinematics along the zones induced lateral magma-metal fluid migration with arcuate paths. By analogy, similar fluid paths are probable for petroleum-rich fluids and may aid in petroleum drill hole targeting near production and in frontier areas. Arc alkalinity patterns since the Cretaceous indicate subducting slabs were segmented along ENE-trending slab tears. Time-slice reconstructions indicate the tears are fixed at the paleo-trench and connect with oceanic plate and onland fracture zones of the Mexico Shear System. Continental crust above segments are mini-geologic provinces. Oil-rich basin sweet spots may correlate with the tears, shear zones, and reduced crust. Magmatic arc timing within each slab segment may be associated with uplift, shoreline movement, sediment sources, and petroleum maturation within on- and off-shore basins.