Hydrogeochemistry of Petroleum Brines from Oil Wells on the Southeast Basin of Mexico

Carrillo-Chavez, Alex[1], Blanca Mendez-Ortiz[1], Jordi Tritlla[1], Gilles Levresse[2], Ernesto Caballero[3], Lourdes Clara[3], Miguel Varela[3], Jaime Patiño[3] (1) Geociencias-UNAM, Mexico, Queretaro, Mexico (2) Centro de Geociencias, UNAM Campus Juriquilla, Queretaro, Mexico
(3) Pemex Exploracion y Produccion, Villahermosa, Tabasco, Mexico

Formation waters (petroleum-brines) from 250 oil wells on the Tertiary and Mesozoic southeast basin of Mexico, were collected and analyzed for major and trace ions and stable isotopes (d18O, dD and ?13C). The results indicate strong differences between the Tertiary and the Mesozoic brines, and even within different oil-wells in the same oil field. The salinity of the brines ranges from 29,000 ppm to 330,000 ppm. The brines isotopic composition range from d18O = -1.5 ‰ to +13.5 ‰ (VSMOW) and dD = -22.98 ‰ to +2.10 ‰, which indicate a wide variation of processes (evaporated water in equilibrium with host rock (carbonate cement), water in siliciclastic host rock, mixing of brines, etc). Major elements and halogens chemistry indicate the main hydro-chemical processes: (1) precipitation of some sulfur minerals in the host rock, (2) mixing of highly evaporated brines, past the point of halite precipitation with brines with composition very similar to seawater; and (3) strong water/rock interactions between brines and carbonated rocks (dolostones). The differences and similarities between the brines indicate different pulses of fluids in the reservoir rocks prior to strong compartmentalization due to structural faulting. Cation geothermometer calculations and modeled equilibrium temperatures give results very similar to measured temperatures and fluid inclusions microthermometric measures. The overall results indicate a complex evolution for the brines with mixing of at least two end members (one with salinity close to sea water, and other with highly evaporated brine). The reservoirs seem to be isolated with no hydraulic conductivity since a major Miocene-Pliocene faulting event.