AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

Jacques Pironon[1], Stéphane Teinturier[2], Frédéric Walgenwitz[3] (1) CREGU - UMR G2R, Vandoeuvre-lès-Nancy, France (2) CREGU - H. Poincaré University, Vandoeuvre-les-Nancy, France (3) Totalfinaelf, Pau, France

Experimental Quartz Growth: Implications to the Study of Reservoirs Using Fluid Inclusions and Oxygen Isotopes

Quartz diagenesis is frequently associated with petroleum emplacement in sandstone reservoirs. In order to decipher the geochemical messages of fluid inclusion and isotope analyses, an experimental study of quartz growth has been developed in laboratory. Synthetic and natural Brazilian quartz have been used as equivalents of detrital natural quartz grains. Experiments were carried out in a gas-pressure autoclave under CH4 pressure control, up to 250ºC and 212 bar and in a fluid-pressure autoclave up to 350ºC and 400 bar. Petroleum and aqueous inclusions in quartz microfractures and quartz overgrowths have been created in variable W/O proportions (0, 5, 10, 20, 50 and 100%) when the quartz grains are water-wet. Synthesized petroleum inclusions are representative of the parent oil up to 250ºC. At 350ºC, evidence of cracking process have been observed with the release of methane from the dead oil added to the autoclave.

Comparison has been made between overgrowths created with and without the presence of oil. The recent application of FT-IR imaging shows the high hydration rate of the newly formed quartz. SIMS measurements show an enrichment in $\delta^{18}O$ of the quartz precipitating in the presence of petroleum. Overgrowths created in a water-salt system from a water solution with a $\delta^{18}O$ of -7.8‰ have an average δ18O of –2‰ whereas overgrowths created in a water-salt-oil system have a $\delta^{18}O$ of +9‰. This experimental approach shows that an oil saturation of a reservoir should not prevent quartz diagenesis. Fluid inclusions can be representative of quartz precipitation and the oil invasion of a reservoir can be marked in the isotope signature of the quartz.