THE EFFECTS OF FREEZING ON TRACER DISTRIBUTION IN CORES

June Gidman and Frank J. Conner
Chevron Oil Field Research Company, La Habra, California, USA

Abstract When oil fields are evaluated as candidates for enhanced recovery techniques, it is essential to have a realistic estimate of remaining oil in place. In some instances, especially heavy oil reservoirs with low salinity formation waters, oil saturations are measured by core analysis. In these cases it is necessary to determine the extent of mud filtrate invasion in the core, and the common practice is to add a tracer to the mud and analyze the core for the tracer. The usual wellsite procedure is then to freeze the core or core samples to prevent tracer diffusion, on the assumption that freezing immobilizes fluids.

We tested the assumption that freezing immobilizes fluids and found it to be false. For our experiments we used both cores and sandpacks saturated with brines of known composition and then froze them in either dry ice or liquid nitrogen. They were then subsampled, and the fluid composition of the subsamples was determined by geochemical techniques.

Freezing with dry ice causes more migration than freezing with liquid nitrogen. However, in all cases, fluid migration occurs and leads to incorrect assessment of the amount of mud filtrate invasion. The ultimate consequence is that oil saturations are in error. This miscalculation could significantly impact the economic viability of an enhanced recovery project. To avoid such miscalculations, we recommend that tracer analysis samples and subsamples be taken at the wellsite.