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

Craig B. Forster, Sangeetha M. Pasala, Milind D. Deo, and Siang J. Lim, University of Utah, Salt Lake City, UT

# Once it is Quantified, How Does Fault Architecture Affect Enhanced Oil Recovery?

Outcrop-based studies of faults, combined with in situ and laboratory testing, can yield quantitative maps of the detailed geometry of permeability and porosity heterogeneity in fault-affected rocks. Yet we often don't know which aspects of the detailed structures mapped by geoscientists must be preserved when reservoir engineers assign material properties in production-scale reservoir simulators. Furthermore, we lack practical approaches for upscaling the effects of the detailed features that must be preserved. We shed light on these issues by comparing, through simulation at an unusually detailed scale, the impact of fault permeability/porosity structures on enhanced oil recovery processes that involve carbon dioxide ($CO_2$) flooding. $CO_2$ flooding under miscible conditions is an important, and economical, process for enhanced oil recovery. Miscible displacement processes rely on multiple contacts of injected gas and reservoir oil to develop an in situ solvent that enhances oil recovery. Injecting $CO_2$ into a homogeneous oil reservoir causes a complicated series of interactions between $CO_2$, oil and water. Injecting $CO_2$ into a reservoir with fault-derived heterogeneity leads to more complicated fluid interactions that depend on whether the faults act as barriers, conduits or combined barrier-conduits. These fault-scale interactions can play an important role in determining ultimate recovery of oil and $CO_2$ breakthrough. The reservoir simulator is used to explore how different, 3-D, fault-related permeability/porosity structures might impact recovery, sweep efficiency and $CO_2$ breakthrough. The simulation results reveal how the geoscientists' ability to quantify and discriminate between high-permeability vs low-permeability faults in sandstone reservoirs can play an important role in designing enhanced oil recovery operations.