Characterization and Modeling Study of Karst Networks in the Ordovician Carbonate Reservoirs

Feng Shen[1]
[1]**GeoReservoir Research, Stafford, TX**
Duoming Zheng[2] **and Wenqing Pan**[2]
[2]**PetroChina, Wulumuqi, China**
fshen@georeservoir.com

Ordovician age karst and collapse disturbances were observed from drilling data and seismic interpretation in the Tarim oil field. The seismic evidences of karst features are characterized with 3D seismic data processed with structure orientated and fault enhancement filter, from which volumetric seismic geometric attributes are computed. The reservoir architectures and karst features such as channels, caves, circular features and fractures/ conduits are detected with dip, curvature and amplitude gradient volumes. The quantified geometric attributes with seismic facies analysis allow precisely locating the main karst features (paleocaves and fractures) in 3D. The geological model was built keeping the same resolution as in the seismic cube, which allows karst features in the geological model being thus precisely modeled. The connectivity between the karst features is quantified which is the basis on understanding the karst network geometries in the collapsed paleocave systems. The karst network geometries are associated with channeling system and are located at different reservoir depth.

Log electrofacies analysis and calibration with core data and borehole imaging logs lead to the definition of reservoir rock types at wells. The sequential indicator simulation is used to generate 3D reservoir rock type model constrained with rock type logs and seismic impedance. The reservoir effective properties in the geological model are then modeled by integrating well data, seismic impedances and the reservoir rock type model. Karst network geometries are subsequently incorporated into rock type and effective property models. The 3D organization of karst networks is assessed from the integration of model properties and reservoir dynamic data. With the case study, we demonstrate the appli-

cation of our new integrated approach to the characterization and modeling of karst networks in the Ordovician carbonate reservoirs. Our results show that quantitative integrated characterization of karst networks and effective properties can provide a new understanding of paleocave reservoir modeling and underlying geological controls.