

## **An Overview of Heavy Oil Carbonate Reservoirs in the Middle East**

Buza, John W.<sup>1</sup> (1) Chevron Corporation, Houston, TX.

Global heavy oil resources in carbonate rocks have been estimated to be on the order of 1.6 trillion barrels, of which about one-third may occur in the Middle East. Owing to its vast light oil reserves, documentation in the public domain on Middle Eastern heavy oil accumulations is not complete but enough information is available to assemble a reasonable picture of the geological setting, reservoir and oil quality issues and the status of cold and EOR production in the region. Productive heavy oil carbonate fields can be grouped into two categories: 1) low matrix permeability, fracture dependent and 2) matrix permeability dependent production. Fracture enhanced, low matrix permeability production is dominant and occurs in Oman, Iran, Iraq, Syria, Turkey and Egypt and includes producing fields such as Qarn Alam in Oman and Issaran and Bakr-Amer in Egypt. In Iran, several fractured carbonate fields have successfully cold tested oil qualities on the order of 10 degree API. Wafra, located in the Partitioned Neutral Zone (PNZ) of Kuwait and Saudi Arabia, is the most notable example of an accumulation that has ample matrix permeability to allow economic cold production without significant fracture enhancement. Ultimate recovery from these fields is heavily dependent on oil viscosity and the ability to lower it. EOR implemented in the region include a CO<sub>2</sub> flood at Bati-Raman in Turkey, a full-field crestal steam injection project that is underway at Qarn Alam and an ongoing pilot steam flood at Wafra that commenced in February 2006. These three fields, along with Issaran, where a CSS project began in 2006, constitute the bulk of carbonate heavy oil activity in the Middle East. Current carbonate heavy oil production is on the order of 100-150 TBD (0.5% of Middle East production) and will likely stay at that level until Wafra production is increased or fields with large potential, such as Ferdows in Iran, are brought onstream.