Using Elemental Chemostratigraphy for Improved Zonation and Correlation of the Cretaceous Mishrif Carbonate Reservoir, Arabian Gulf

***Razik Shaikh**, Dubai Petroleum Company, PO Box 2222, Dubai, United Arab Emirates, phone: +971 4 310 2328, fax: +971 4 301 2360, razik.shaikh@conocophillips.com, Tim Pearce, Chemostrat Limited, Chemostrat Limited, Llanfyllin Ent Park, Llanfyllin, SY22 5DD, United Kingdom, and Mike Dix, Global Product Champion - LaserStrat, Halliburton Sperry-Sun, 3000 North Sam Houston Parkway East, Building J, First Floor, Houston, TX 77032.*

The Cenomanian Mishrif carbonate reservoir consists almost entirely of limestone grainstones, packstones, and wackestones, with little interbedded shale or dolomitization. The top of the reservoir is variably truncated by a significant unconformity. As biostratigraphic zonation of the Mishrif is hampered by a lack of high-resolution faunal assemblages, a chemostratigraphic study was undertaken on three cored wells to better characterize this important reservoir.

Cored well A, located downdip on the field structure, has the most complete Mishrif section. Four ascending chemostratigraphic units (M-1 through M-4) were recognized, primarily from changes in MnO, Sr, Ca/Sr, and Sr/Y with depth, and various crossplots. In addition, each unit can be subdivided, based on changes in Ca, Sr, Mn, Mg, P, Y, Fe, Al, Si, and K. These reflect subtle changes, both primary and diagenetic, in carbonate, phosphate, and siliciclastic content.

The Mishrif zonation from well A can be readily correlated to well B, higher on the structure's flank, and to well C, on the structure's crest. Episodes of localized erosion or non-deposition are suggested by the absence of two chemostratigraphic subunits in well B.

All cored sections display a karsted and mineralized alteration zone (unit M-T) related to the top-Mishrif unconformity. This zone extends downward as much as 16 feet below the unconformity surface, and is best developed in crest well C, where all of unit M-4 is missing (eroded?).

The improved, high-resolution, core-based zonation of the Mishrif was extended over a wider area by analyzing cuttings samples from two sub-vertical wells and one horizontal well. While the resolution with cuttings was predictably not as sharp, chemostratigraphic correlations to the subunit level could still be made with some confidence.