

Predicting Bulk Petroleum Compositions

Demetrio Santamaria-Orozco, Exploration, Instituto Mexicano del Petroleo, Eje Central Lazaro Cardenas 152, Mexico, D.F, 07730, Mexico, phone: 52 (55) 3003 6447, fax: 52 (55) 3003 6496, dsantama@imp.mx and Brian Horsfield, Section 4.3, Geoforschungszentrum, Telegrafenberg, 14473 Potsdam, Germany.

In the Sonda de Campeche offshore region of Mexico, the Tithonian sedimentary sequence is the most important source of hydrocarbons that today occur in Cretaceous-Paleocene reservoirs. The maturity of both source rocks and reservoired petroleum is known to increase from northeast to southwest across the region. This is manifested at the molecular level and also in the bulk petroleum properties such as API gravity, sulfur content, and gas-oil ratio (GOR). We have used this natural laboratory to gain insights into predicting the bulk composition of petroleum and physicochemical properties, the goal being to develop pre-drill capabilities based on kinetic modeling from laboratory pyrolysis. The first step was to set up a compositional mass balance of petroleum generation using the natural maturity sequence of source rocks. The input data came from pyrolysis gas chromatography, the yields and compositions defining characteristics of yet-to-be-generated petroleum for each maturity stage. After correction for carbon loss associated with expulsion, cumulative changes in petroleum composition as a function of Transformation Ratio were calculated. Micro-Scale Sealed Vessel (MSSV) pyrolysis was also used to predict petroleum compositions in the same format, and the two datasets were then compared. An excellent correlation was observed between compositional predictions from the laboratory with those calculated by the mass balance model. Applying the pyrolysis results to regional GOR trends; it was observed that traps appear to have been filled by instantaneous charging rather than by cumulative filling. The results support the notion (Santamaria et al., 1998) of mainly localized vertical migration avenues in association with a late timing of trap formation.
