

**MUD GAS LOGGING IN EXPLORATION WELLS.
DO WE NEED A MASS SPECTROMETRIC DETECTION OR ONLY A
TRADITIONAL GC/FID MUD GAS LOGGING?**

Arne S. STEEN¹, Jan H. AUGUSTSON² and Kristian A. ANGARD²

1. Norsk Hydro, Oil & Energy Research Centre, P.O. Box 7190, N-5020 Bergen, Norway.

2. Norsk Hydro, Oil & Energy, Global Exploration, Oslo, Norway

Mud gas logging is employed in most exploration wells as a screening tool for gas composition, hydrocarbon yields and safety aspects. The method is based on GC/FID detection (Gas Chromatography / Flame Ionization Detection) of typically C₁-C₅ hydrocarbons and CO₂. The compound separation and analytical selectivity is limited and restricted by the column resolution, selected cycle time and measurement density.

The quality of a GC/FID method depends on the resolution power of the separating column. A MS detector (Mass Spectrometer) will enhance the compound selectivity and thereby, report more accurate results. The technique is based on a sophisticated instrumentation, which may be more prone to malfunctions than a simple GC system.

The GC method is based on compound separation by using a capillary column. The compound specific fragmentation pattern by the mass spectrometry technique is unique and may expel the necessity of a GC separation. A stand-alone MS-technique benefits from a reduced cycle time (more rapid measurements) and increased carbon number detection range. An MS system is generally more sensitive than a FID system, in showing higher signal to noise ratio.

This study evaluates two different commercially available mud gas MS systems applied in two different exploration wells. The geochemical interpretations of the well profiles are provided and the MS datasets are compared methodwise as well as to the standard GC/FID mud gas data.

The GCMS instrumental setup was employed in a well comprising an almost 300 m thick interval of oil rich sediments whereas the stand-alone MS instrumental setup was employed in a well in part comprising gas-condensate bearing sediments. It will be shown that both techniques are feasible for characterizing the hydrocarbon type present while drilling, i.e. gas, condensate or oil.

In the case of wells containing rather dry gas, the MS also provides analyses of several inorganic compounds as helium, CO₂ and sulphur compounds. These may add important information in interpreting any potential differences in the gas bearing strata.

However, when secondary alteration effects in hydrocarbon mixtures were encountered in some zones (biodegradation and waterwashing) it was an advantage to run the GCMS instrument since both the iso and normal hydrocarbon compounds were more adequately analyzed in the C7(-) range and hence provided a better basis for more detailed follow-up sampling and analysis. In practice this advantage has to be weighed against the total costs, which were several times higher for the GCMS setup compared to the stand-alone MS setup.