Compound specific sulfur isotope analysis of petroleum gases

WARD SAID AHMAD1 KENNETH WONG2 MONACA MCNALL2 TRACEY JACKSHER2 COURTNEY TURICH ARTHUR STANKIEWICZ3 ALON AMRANI1*

1Earth Sciences Institute, Hebrew University, Jerusalem, Israel, alon.amrani@mail.huji.ac.il (*presenting author) 2Air Liquid America, Delaware Research & Technology center, Newark, DE, USA 3Schlumberger, Clamart, France and Houston, TX, USA

Since the development of compound specific sulfur isotope analysis (CSSIA) capabilities by GC coupled to MC-ICPMS for volatile sulfur compounds, this technique has been applied to several fields from petroleum geochemistry to oceanography. In the current study we have extended the capabilities of CSSIA to gases and more specifically petroleum gases, including sour gases, with high percentage of H2S. The analysis of trace sulfur compounds in natural gas is potentially informative for recognizing several reservoir processes which impact the quality and production of petroleum such as thermochemical and microbial sulfate reduction and thermal cracking of petroleum and source rocks. Other applications may include analysis of trace sulfur gases from the ocean, atmosphere, wetlands, sea ice and anoxic sediments. The analysis of ppm level sulfur compounds such as methanethiol or dimethyl sulfides in the presence of percent levels of H2S is challenging because of: 1. the high reactivity of these compounds with surfaces and other compounds 2. the severe tailing of H2S in the GC column and 3. sulfur saturation of the ICPMS. We used a modified GC with passivated linens that is equipped with a gas inlet and a special valve that can transfer the H2S away from the ICPMS and prevent its saturation. This valve transfers the gas to a thermal conductivity detector and thus enables a precise peak cut with no effect on the other sulfur peaks. This in turn enables analysis of sulfur compounds down to sub-ppm level in the presence of 30% H2S. We prepared several gas mixtures that simulated sour gas with variable concentrations of methane (65-95%), H2S (0.01 -30%) and organic sulfur compounds (0.1 – 20 ppm) to test the method. Precision and accuracy varied among the different sulfur compounds (2 ppm) and ranged from 0.1 to 0.6‰ after H2S (20%) was cut out. We are now applying this new method to natural sour gas samples from basins around the world.