Compound specific sulfur isotope analysis of petroleum gases

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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 H_2S. 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 methanthiol or dimethyl sulfides in the presence of percent levels of H_2S is challenging because of: 1. the high reactivity of these compounds with surfaces and other compounds 2. the severe tailing of H_2S in the GC column and 3. sulfur saturation of the ICPMS. We used a modified GC with pasivated linens that is equipped with a gas inlet and a special valve that can transfer the H_2S 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% H_2S. We prepared several gas mixtures that simulated sour gas with variable concentrations of methane (65-95%), H_2S (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 H_2S (20%) was cut out. We are now applying this new method to natural sour gas samples from basins around the world.