

«Petroleum Systems Conference 2023»

Source of Mercury in Petroleum

Sverre E. Ohm- University of Stavanger / Consultant, OPGIS

Mercury (Hg) is being reported from an increasing number of fields on the Norwegian Offshore Continental Shelf (NOCS). Wilhelm et al. (2007) report Hg concentrations of petroleum from 41 counties and 10 US states, which were processed at plants in the US. Of these, the Norwegian oils have the fourth highest Hg concentration (average 19.5 µg/kg). However, only oils from two Norwegian fields were included.

Why should Hg in petroleum be monitored? There is both a corrosion and a health issue related to Hg in petroleum. Hg corrosion takes place through amalgamation and liquid metal embrittlement. The Skida plant explosion in Algeria in 1973 raised awareness of these processes. The most toxic forms of mercury for humans are Hg⁰ vapor and methylmercury (MeHg).

To date, there is little information in the literature concerning the source and absorption mechanisms of Hg in crude oil. Several theories have been proposed, among others: mantle Hg degassing through deep-rooted faults, release of Hg from organic material during maturation, proximity to igneous provinces, dissolution of cinnabar (α-HgS) in contact with oil.

In this study source rock samples from the NOCS have been analyzed by inductively coupled plasma mass spectrometry for Hg and other heavy metals. Hg concentrations were compared to ditto in other heavy metals, to results of rock-eval and TOC, to sediment type from particle counting, and to source rock type (maceral composition). This made it possible to throw light on environments favoring accumulation of Hg. Samples with anomalous Hg values were compared to location of deep faults and known igneous provinces, which may have contributed with the excess Hg.

Lesson learned: What would the lecturer want the audience to be left with and take with them from this speech:

Zones with anomalously high Hg concentrations are present in some source rock sequences. Hg concentration generally decreases with increasing depth and maturity suggesting that it has “escaped” the source rock dissolved in generated and expelled petroleum. Hg correlates positively with clay minerals, anoxic depositional environment, sulfur, and the combined macerals sporinite + cutinite + resinite (terrestrial derived macerals).