

The origin of sulfur in shale oils, gases and spent matter as decoded by $\delta^{34}\text{S}$ monitoring and better knowledge gained on various pyrolysis driven processes

Zeev Aizenshtat¹, Ward Ahmed-Said¹ and Alon Amrani^{2,1}

¹ *Casali Institute and Chemistry Institute The Hebrew University of Jerusalem, Jerusalem, Israel*

² *Power, Environmental, and Energy Research Center, California Institute of Technology, Covina, CA, USA*

The recent rekindling of interest in thermally controlled processes for the utilization of bituminous rocks commonly called "oil shale" for the utilization of these as energy resource; stems from the hike in crude oil prices.

This presentation will focus on the role of sulfur during the thermal transformations in particular of bituminous rocks rich in organically bonded sulfur. Most of the organic matter is in the form of kerogen type-II S. However, some of the conclusions deduced from controlled experiments can be generalized for other deposits with different mineralogical character. We aim to explain the importance of the technological systems suggested such as the use of open or closed reactors. The presence of water and gases evolved during the pyrolysis change the chemical environment hence, complicate the role of the minerals.

In recent years, we have added the use of $\delta^{34}\text{S}$ monitoring as a useful tool to the arsenal of indices for the understanding of mechanisms of kerogen thermal degradation, thermal sulfate reduction (TSR) and isotope exchange during different processes. These data derived from *ex-situ* processes have also bearing on suggested *in-situ* projects. The pyroproducts migration through heated rocks that release water and gases may cause secondary and tertiary reactions leading to environmentally undesired effects.