

Institute of Earth Sciences
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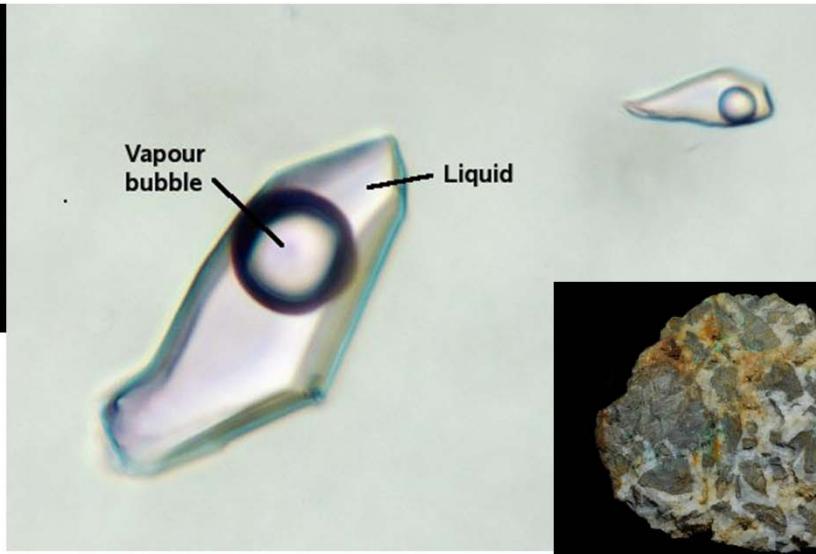
Fluid inclusions in Archaean quartz as window to the early evolution of organic molecules on Earth GC-MS and GC-IRMS measurements

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Fluid Inclusions (FIs)



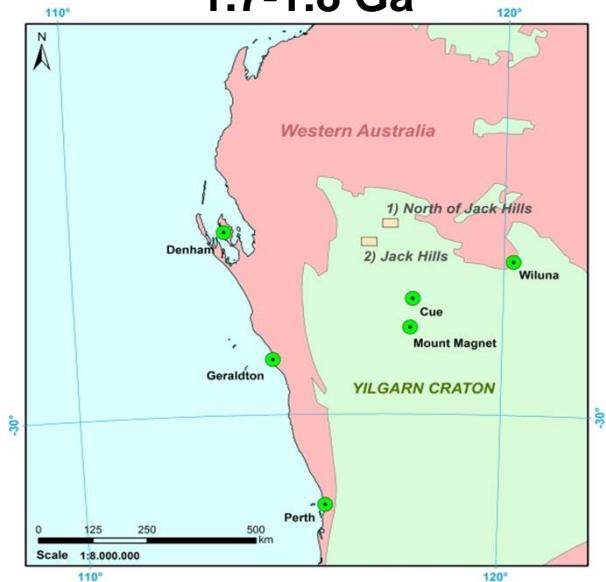
Fluid Inclusions (FIs)

- FIs contain organic matter of the initial fluid, be it of biotic or abiotic origin.
- The occurrence of hydrocarbons within FIs of rocks of sedimentary and diagenetic systems is obvious.
- Little is known about halogenated organic species in FIs. Investigations on **halogenated** organic compounds are not part of petrological and industrial analysis
- Hydrocarbons observed are suitable to serve as precursors for potential **halogenation** reactions in highly saline environments.

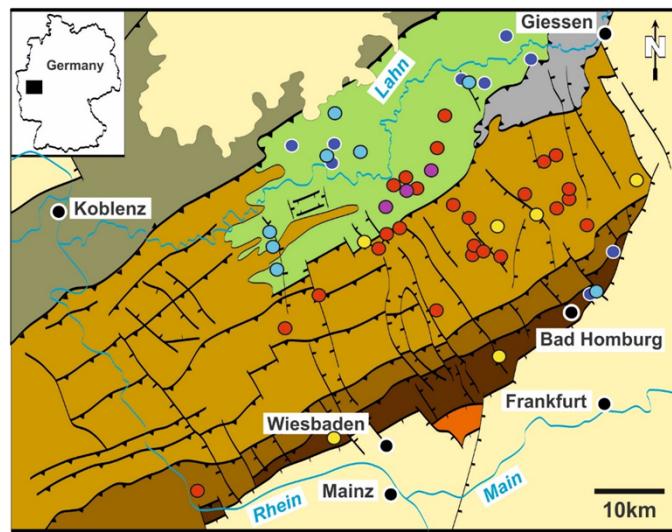
Fl samples from Western Australia



**Quartz sample
1.7-1.8 Ga**



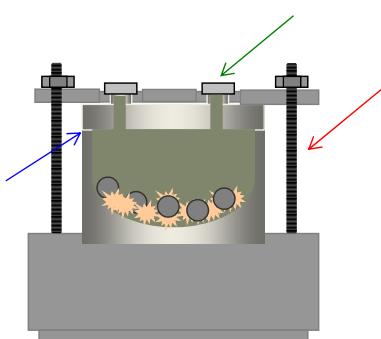
Fl samples from Taunus Mountains



Quartzite
sample
~260 Ma

Cenozoic cover	Vordertaunus unit	Tetrahedrite-tennantite bearing quartz-ankerite veins
Permian (Rotliegend)	Taunuskamm unit	Quartz veins with Pb-Zn-Cu ores
Giessener Grauwacke	Hintertaunus unit	Giant composite quartz veins
Lahn syncline	Fault	Metasomatic dolomite in Devonian reef complexes
Lower tectonic units	Thrust	Calcite-(quartz) mineralization in Devonian reef complexes

New gas-tight grinding device

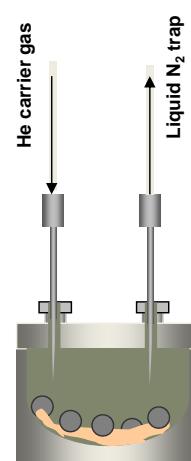


Grinding beaker and beads made of ZrO_2 with **clamping device** to fit in a planetary mill

Viton seal for gas-tightness

Crimped seal for gas sampling

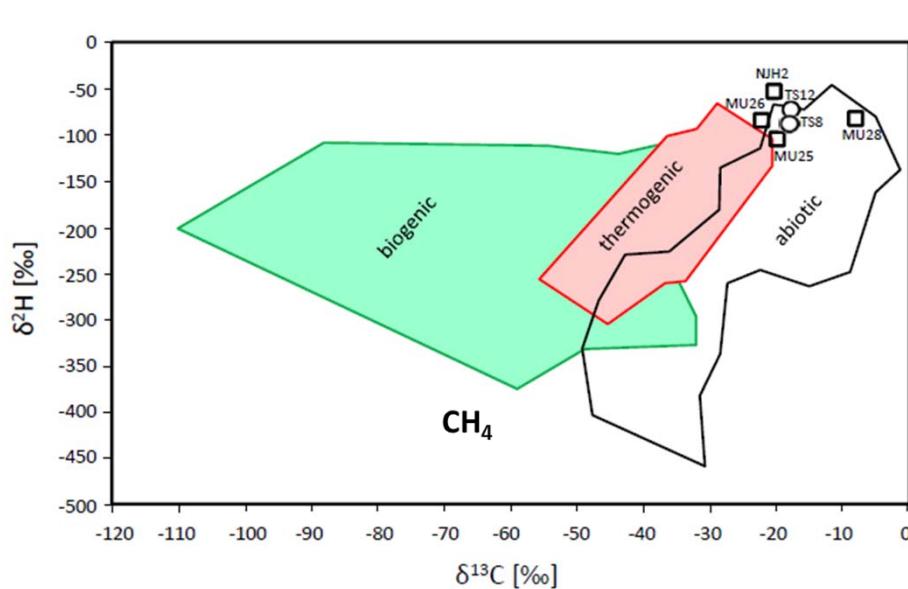
Gas-tight transport to GC-FID and GC-MS



Purge with He carrier gas from headspace and trap with liquid N_2

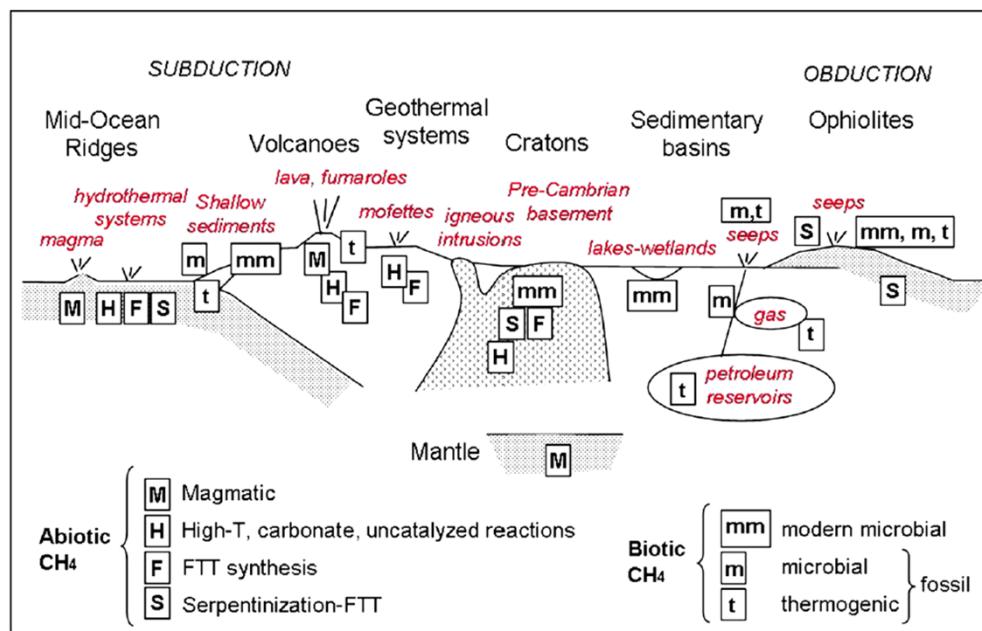
Mulder et al., Chem.Geol., 2013

$\delta^{13}\text{C}$ and $\delta^2\text{H}$ Isotopic Composition of Methane



Biotically formed CH_4 in subsoil petroleum systems (red: thermogenic; green: biogenic) and abiotically formed CH_4 (black-rimmed: abiotic). The results of CH_4 trapped in 4 Australian quartz samples (squares) and 2 quartzite samples from the Taunus mountain range (circles) are shown (adapted from Ethiope and Sherwood Lollar, 2013)

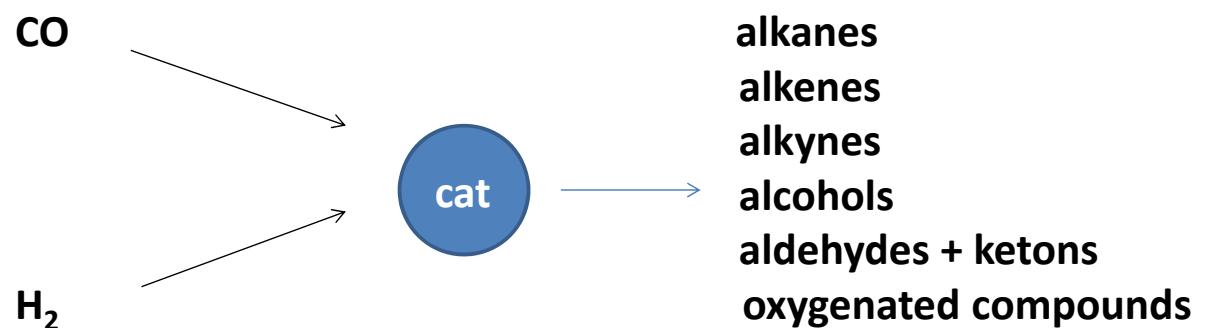
Geogenic Methane Formation



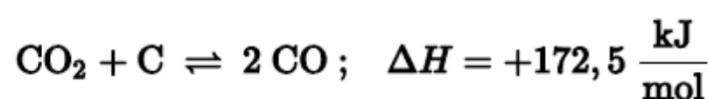
Abiotic Methane Formation on Earth

Etiope and Sherwood Lollar: Reviews of Geophysics, 2013

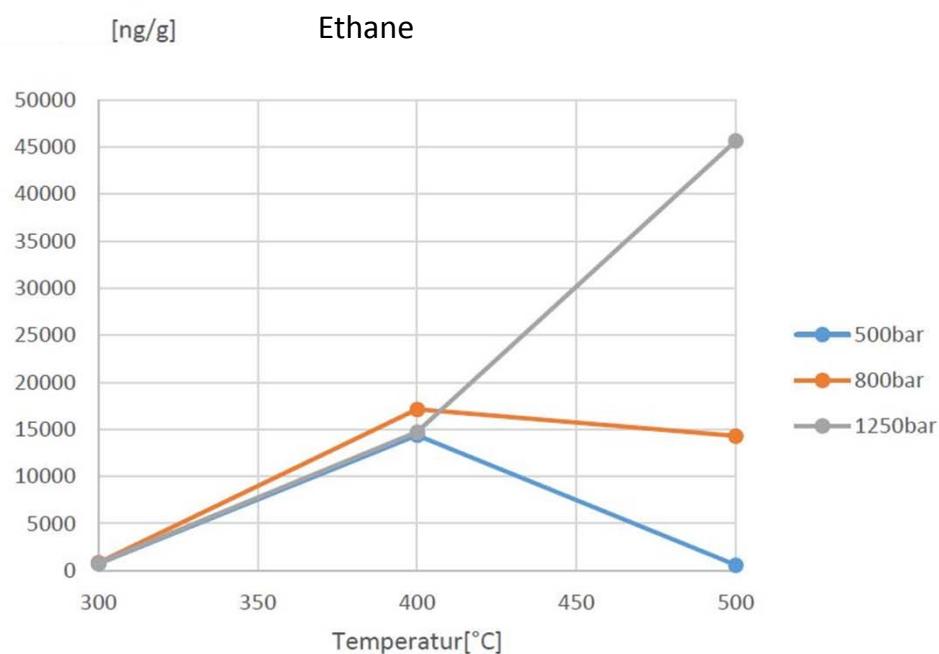
Fischer-Tropsch Synthesis



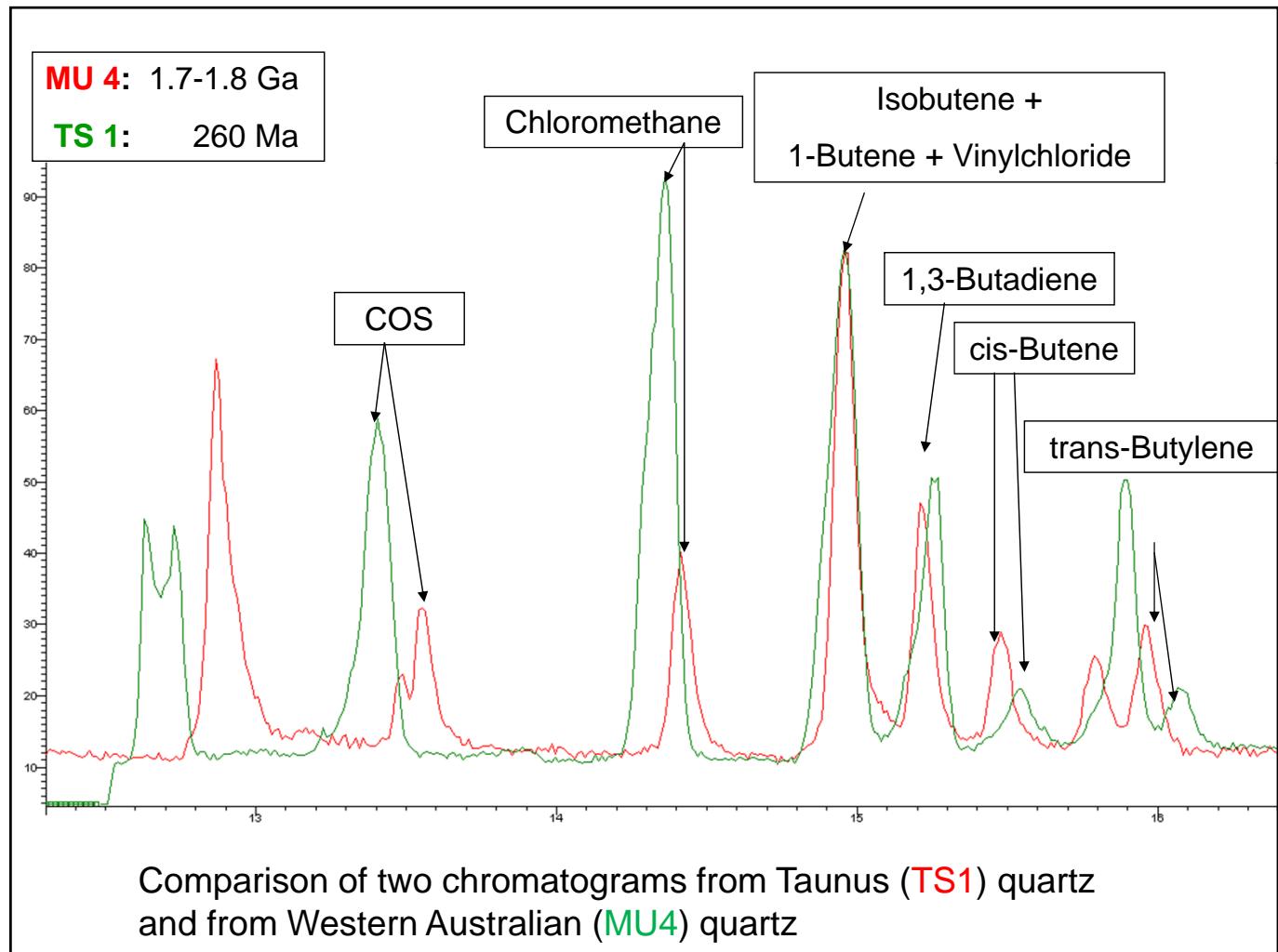
Boudouard -Equilibrium



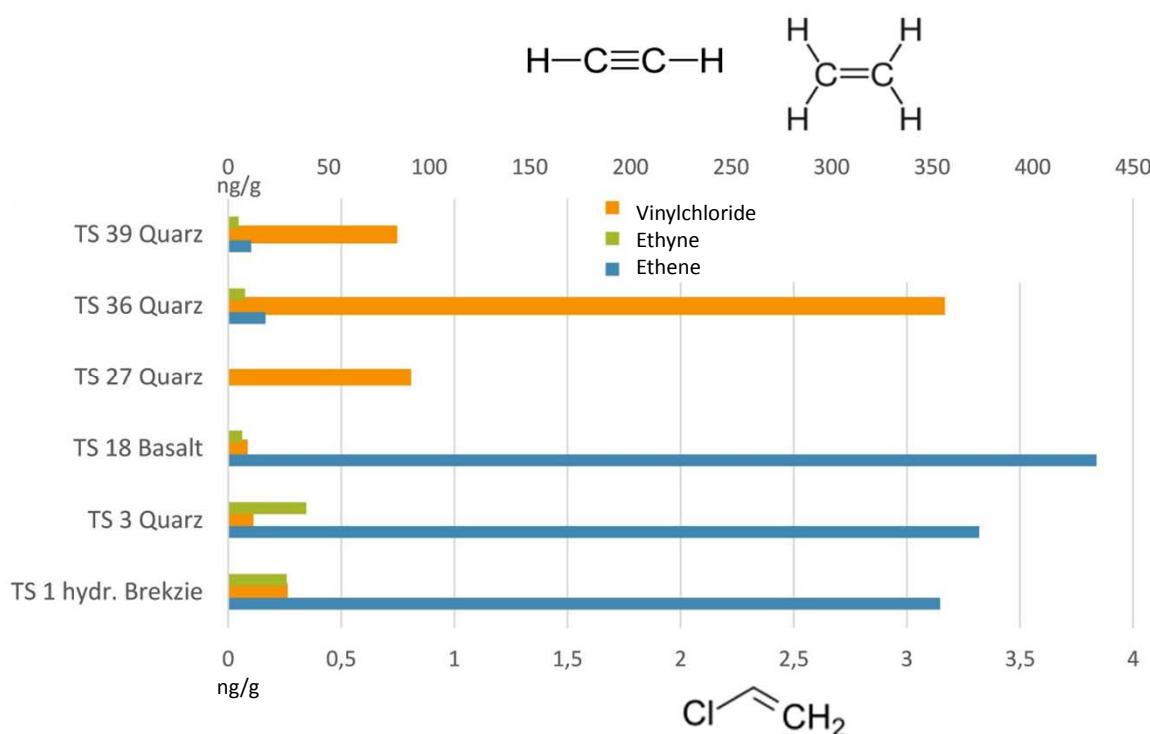
Abiotic Ethane formation - Experiments



Bachelor thesis, Schneider 2015



Organic compounds in FIs of Taunus Mountains



Master thesis, Krupp 2016

**Primordial soup (Bracher, Nature Chemistry, 2015)
with some new ingredients from fluid inclusions
measurements**

