



## **Shale: Geology, Gas and Oil, Environmental Considerations**

Visiting professor: Sally J. Sutton, (Colorado State University, USA)

### **Course description:**

The lectures to be given will focus on shales, particularly on aspects that may be of interest to environmental chemists, and will cover the basic nature of shales, the types of conditions under which they form, their chemical characteristics, and why they host the organic matter from which gas and oil develop. This will be followed by consideration of how gas and oil are extracted from shales and various environmental problems and questions related to the extraction. Typically shales have low permeability and block movement of oil, gas, and water in the Earth's shallow subsurface, so until recently technical difficulties generally prevented extraction of gas or oil from shales. Today, however, in the USA and Canada induced fracturing of shales increases permeability, resulting in profitable extraction of gas and oil in several regions. Globally there are many more shale deposits that have potential for development. There are, however, questions and concerns about possible environmental impacts of this potentially large-scale development, including concern about the amount of water utilized and the possibility of contamination of surface water and groundwater. The fluids used to fracture shales contain a variety of chemical additives, some toxic. In addition, the naturally-occurring brine trapped in shales that comes to the surface during gas and oil production may contain high levels of some metals and may be radioactive. So management of contaminated waste water is an important issue for shale development. There is also growing concern about shale development causing increased atmospheric contamination by methane, a potent greenhouse gas.

### **Syllabus of the lecture subjects (enlisted):**

1. Introduction to rock types, with emphasis on sedimentary rocks, particularly shales, and their constituents.
2. Introduction to plate tectonics and sedimentary basins.
3. Shale composition, including mineralogy, chemistry, and organic matter.
4. Origin of hydrocarbons.
5. Introduction to hydrocarbon sources, reservoirs, and seals.
6. Shales as unconventional hydrocarbon reservoirs.
7. Extraction of gas and oil from shales.
8. Water use during gas and oil extraction from shales.
9. Chemistry of hydraulic fracturing ("fracking") fluids.
10. Chemistry of produced water (naturally occurring pore water) brought to the surface during extraction of gas and oil from shale.
11. Disposal of used hydraulic fracturing fluids and of produced water.
12. Surface water and aquifer contamination related to hydraulic fracturing fluids or produced water from gas and oil extraction.
13. Water contamination by hydrocarbons related to gas and oil development.



14. Atmospheric contamination related to shale gas and oil development.
15. New developments in environmental protection during extraction of gas and oil from shales.

<b>TERMINY ZAJĘĆ</b>			
<b>Data</b>	<b>Dzień tyg.</b>	<b>Godz.</b>	<b>Sala</b>
25 maj 2015	poniedziałek	9.15-13.00	Luwr (Chemia A)
26 maj 2015	wtorek	9.15-13.00	Luwr (Chemia A)
27 maj 2015	środa	9.15-13.00	Luwr (Chemia A)
28 maj 2015	czwartek	9.15-12.00	Luwr (Chemia A)