

Institute of Chemical Processes Fundamentals

Academy of Sciences of the Czech Republic, Prague



Jiří Vejražka

(please, pronounce as “**Yirgi Veyrageka**”)



Department of Multiphase Reactors

Head of the department: Marek Ruzicka

Responsible for COST participation: Jiří Vejražka

Staff:

- 2 senior, 3 regular researcher, 2 post-doc, 4 Ph.D., +2 on maternity leave
- 1 mechanical engineer
- 10 chemical engineers
- 2 numerical

Field of interest:

- bubbles, (bubble columns), drops
- rheology
- electrodiffusion technique for flow measurements
- granular flows - sedimentation (we are novices)
- foams and surfactants (we are novices)



Laboratory

High-speed imaging (bubbles, bubbles, bubbles, drops):

- Photron SA1.1 camera (1MPx @ 5400 fps, 0.25MPx @ 20 000 fps)
- Redlake X3 color camera: 1.2 MPx @ 1000 fps

High-speed PIV:

- laser 25mJ, 10 kHz, 2 cavities
- inverted microscope for μ PIV

Image processing:

- Matlab
- home-made software for PIV



Laboratory

Electrodiffusion technique

- if ferro/ferricyanide can be added, it can measure e.g. shear on walls

Rheology

- Haake RS-100
- detection of wall slip

Tensiometers:

- Krüss K11 (ring & plate)
- Krüss BP100 (bubble-pressure)

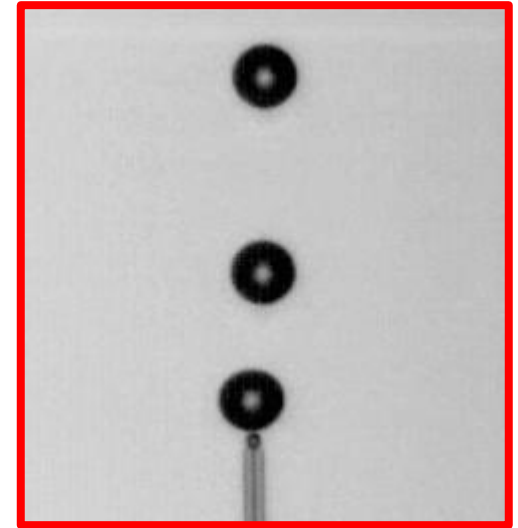
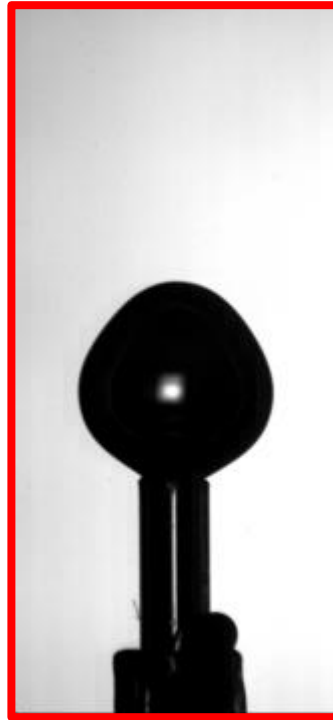
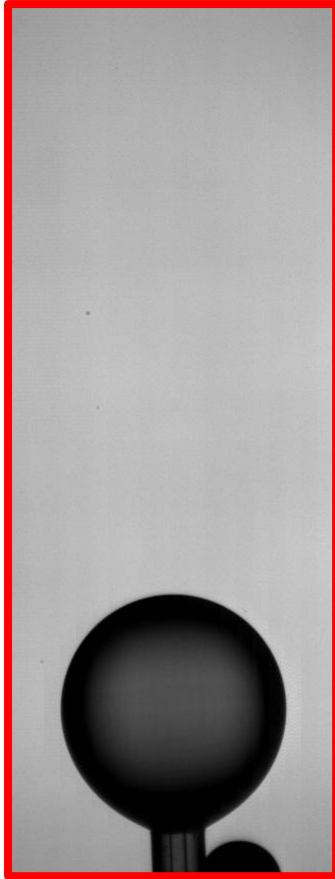
Powder flow properties and flowability:

- Freeman FT4



Special facilities

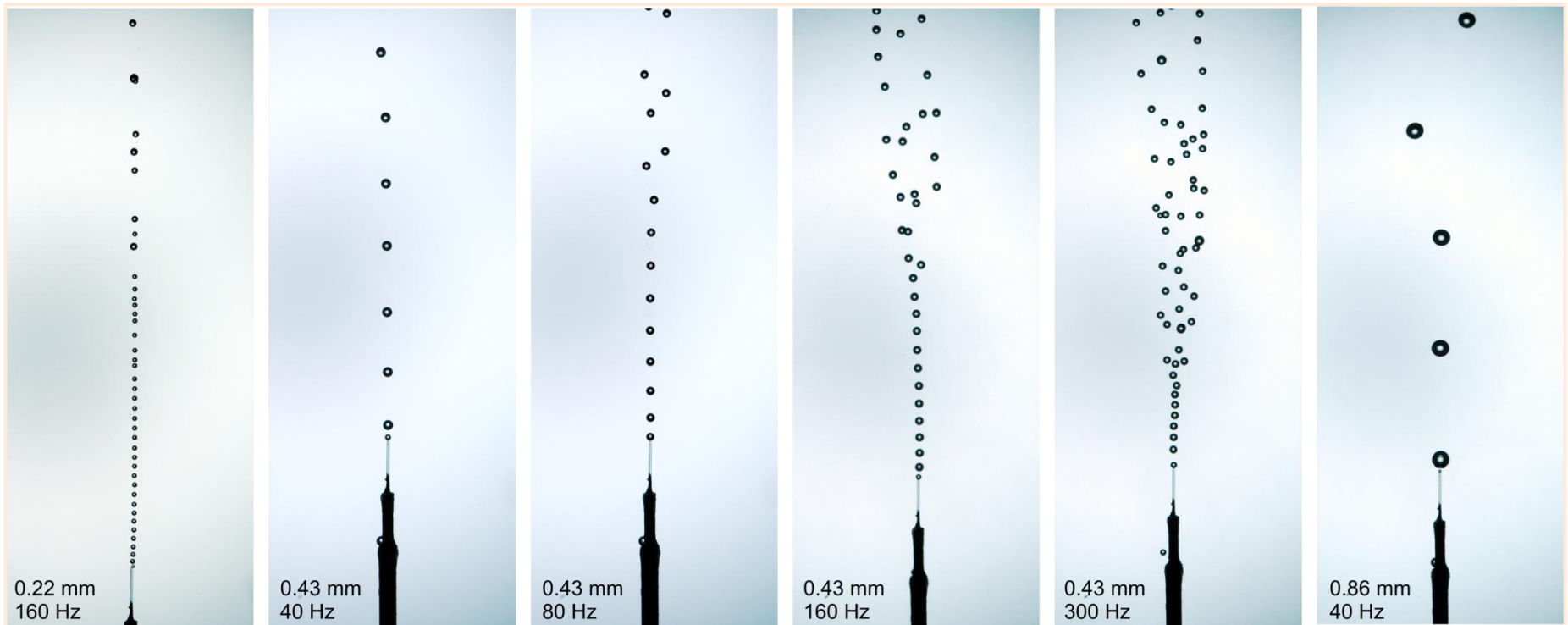
“Bubble generator”: bubble-on-demand generation (can do also drops)





Special facilities

“Bubble generator”: bubble-on-demand generation (can do also drops)

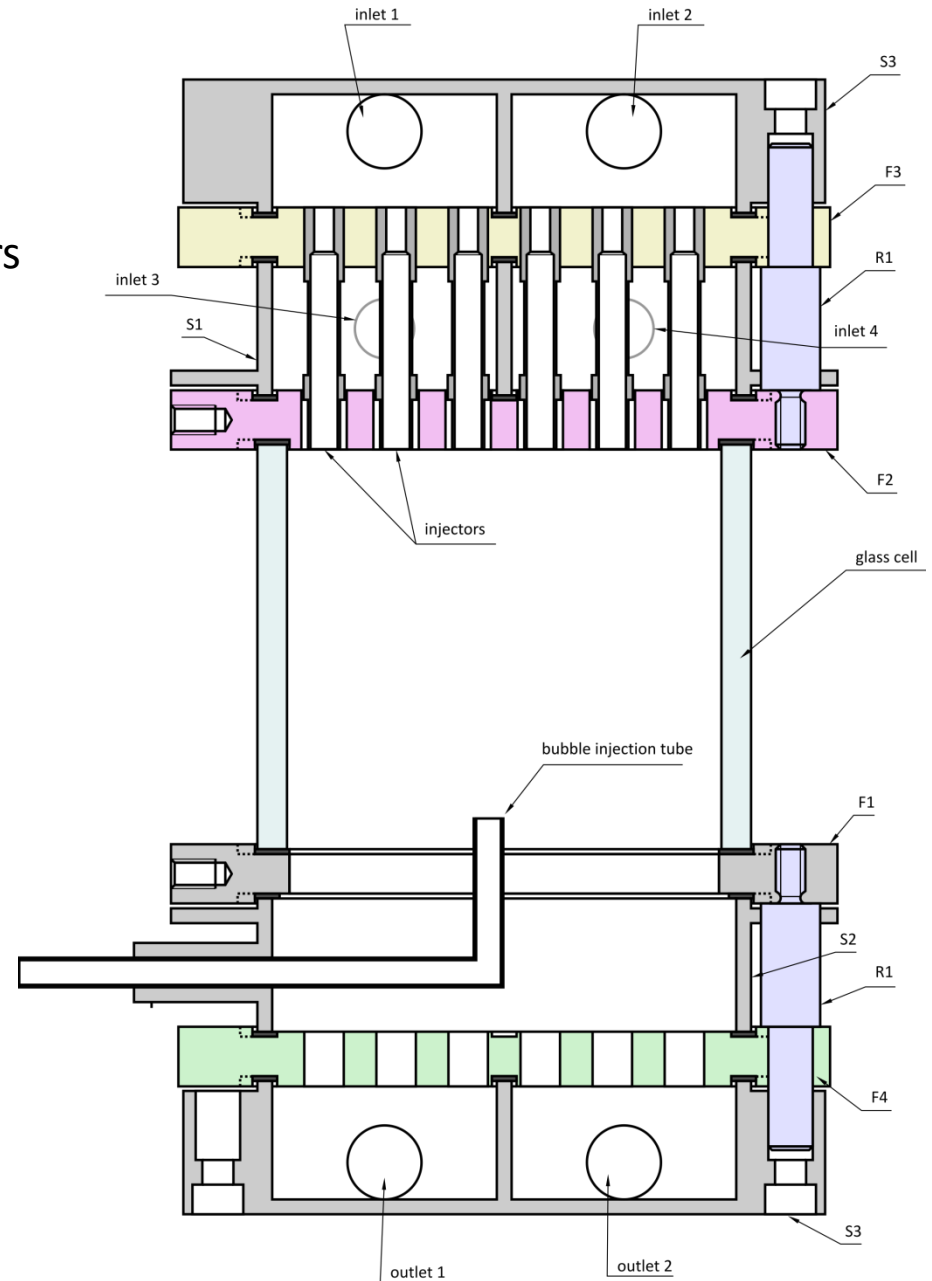




Special facilities

Turbulent channel:

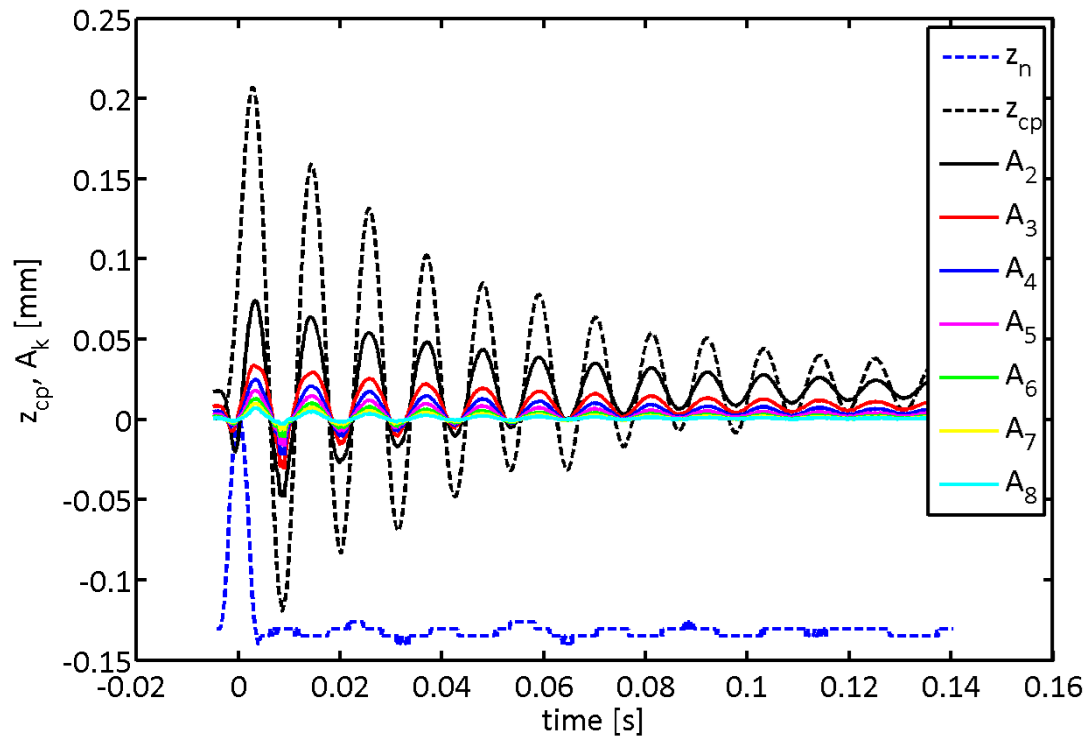
- allows to vary turbulence parameters while keeping same mean velocity
- study of bubble break-up
- (starting project, cooperation with NTNU Trondheim)





Running projects: bubble/drop oscillations

(Czech Science Foundation, Jiří Vejražka, 2 researcher + 1 PhD, 2011 - 2013)

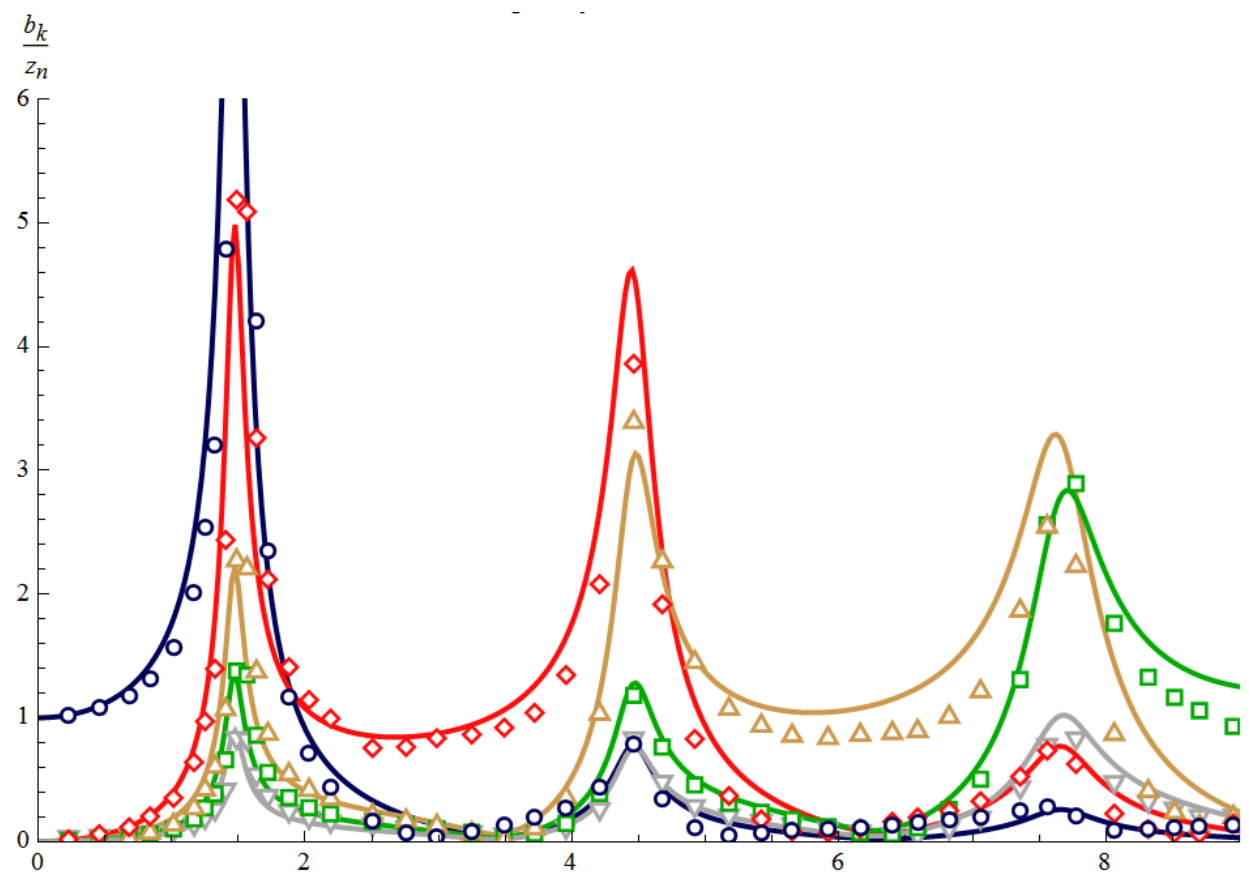


- probing at high frequencies? (mode 1: 140 Hz, mode 4: 1000 kHz)



Running projects: bubble/drop oscillations

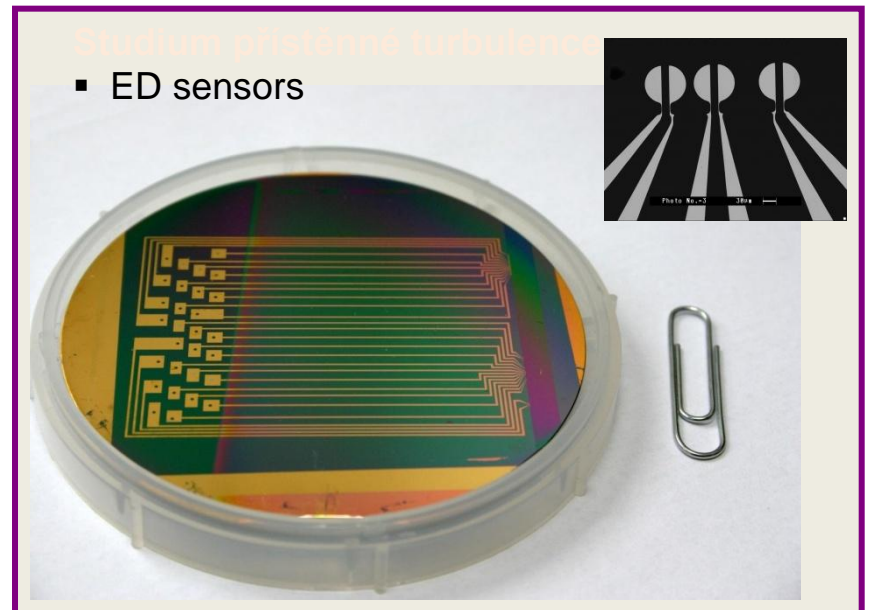
- theory (idealized) for response of shape to support motion and **volume variations**





Running projects: μ channels

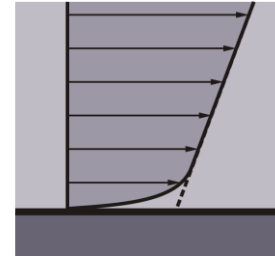
- Electrodiffusion sensors in μ channels (Czech Science Foundation, Jaroslav Tihon + 1 researcher, 2012-2014)



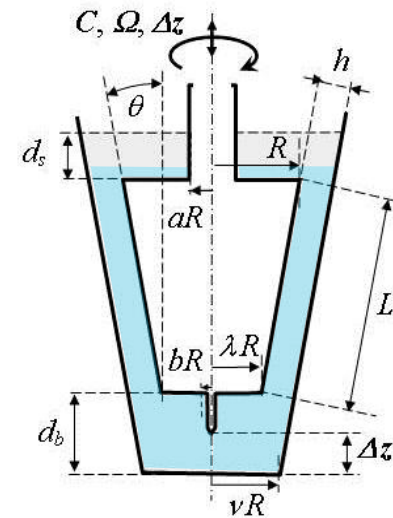


Running projects: Wall slip

- adapted techniques by standard rheometer + electrodiffusion (Czech Science Foundation, Ondřej Wein)



Rheostress RS 600 (HAAKE)



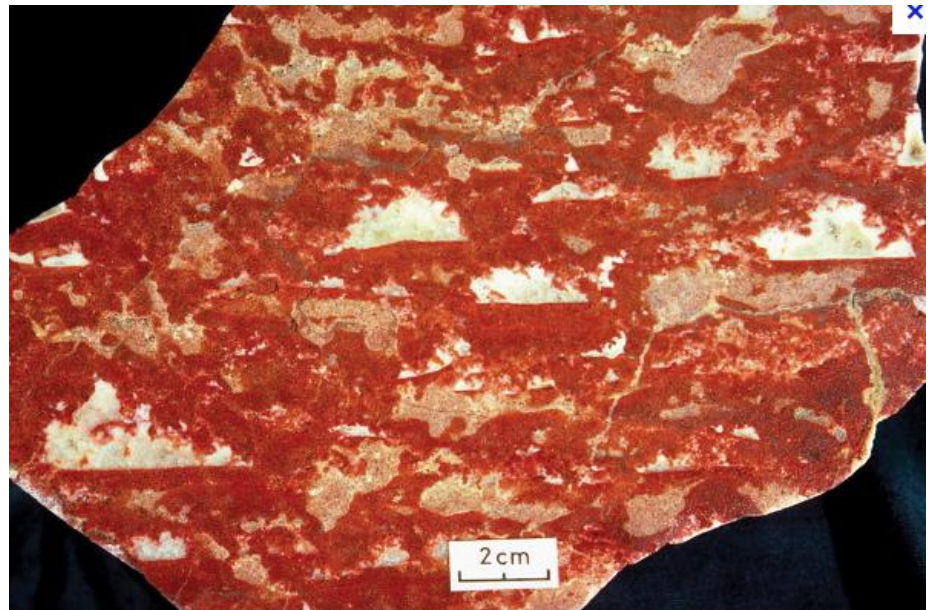


Other running projects

- beer foam (Marek Ruzicka, no founding)



- stromactactis formation (Marek Ruzicka, no founding)



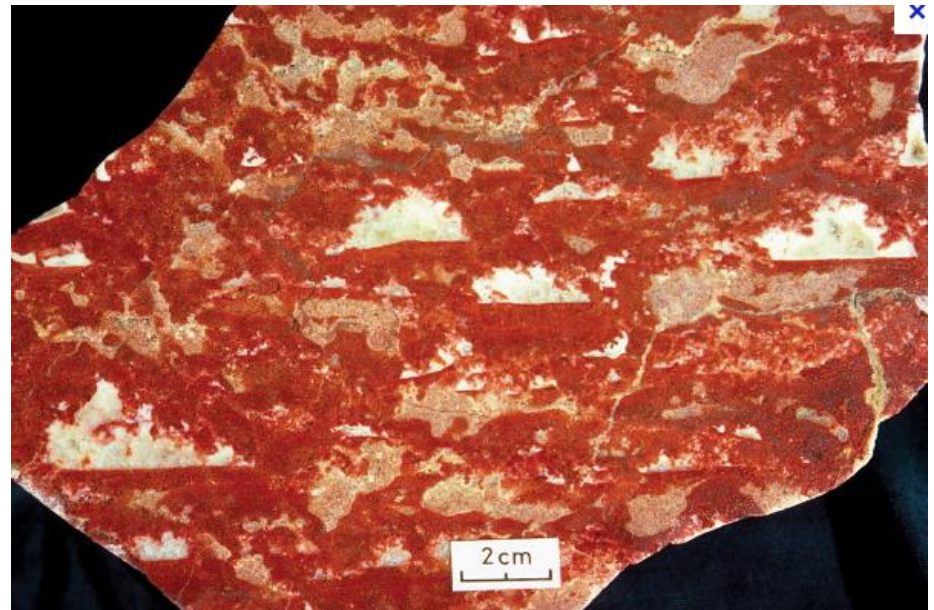


Other running projects

- biogas upgrade by a wet membrane (Pavel Izak with my participation, industry)



- stromactactis formation (Marek Ruzicka, no founding)





Topics for research proposal

- willing to join other projects
 - our strong points: bubble/drop dynamics, imaging, programming, test rigs

- Oscillating bubble: test-case for CFD?

- “interface” in “green application”: biogas upgrade = CO₂ / CH₄ separation

Thank you for your attention.