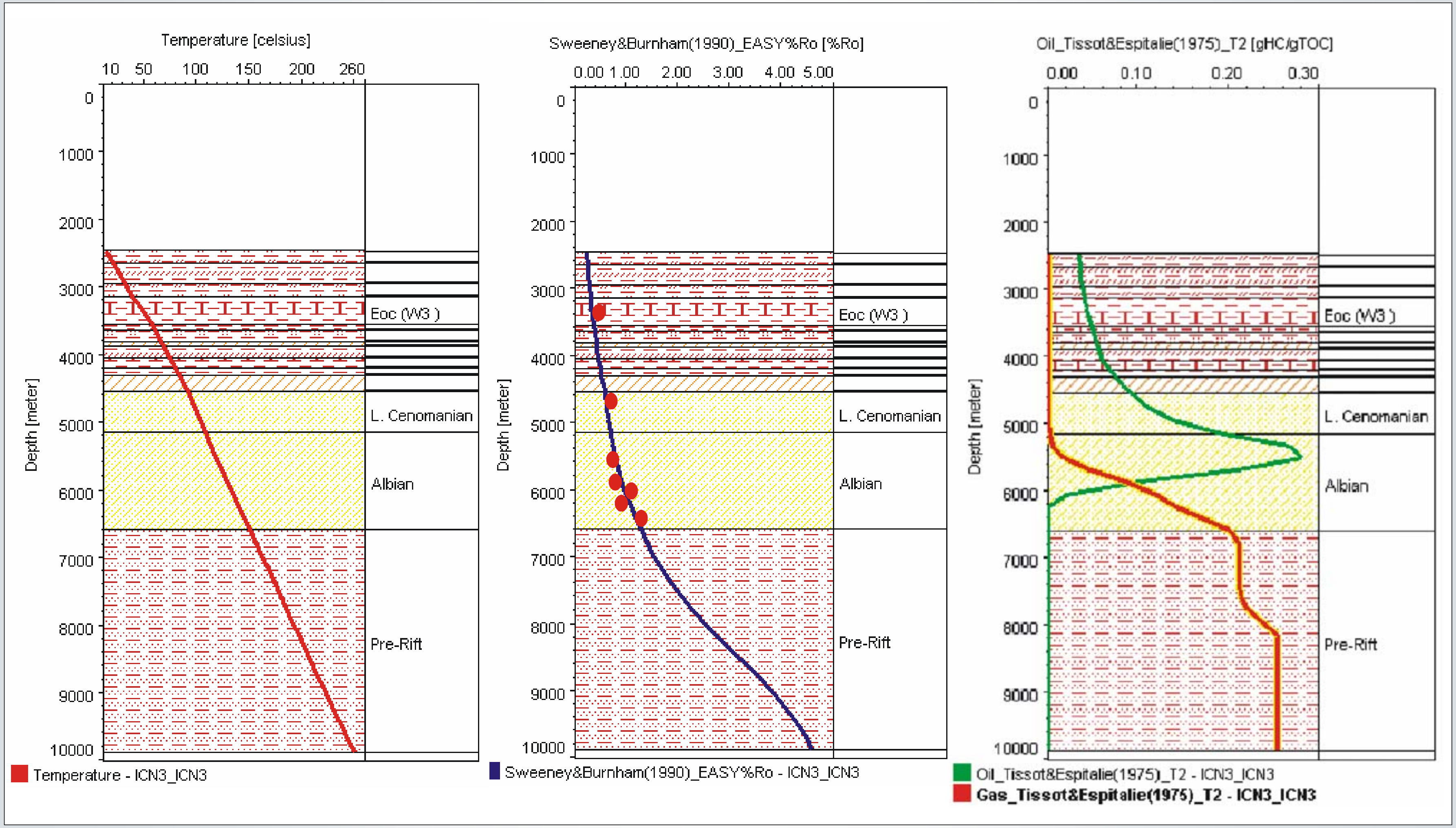
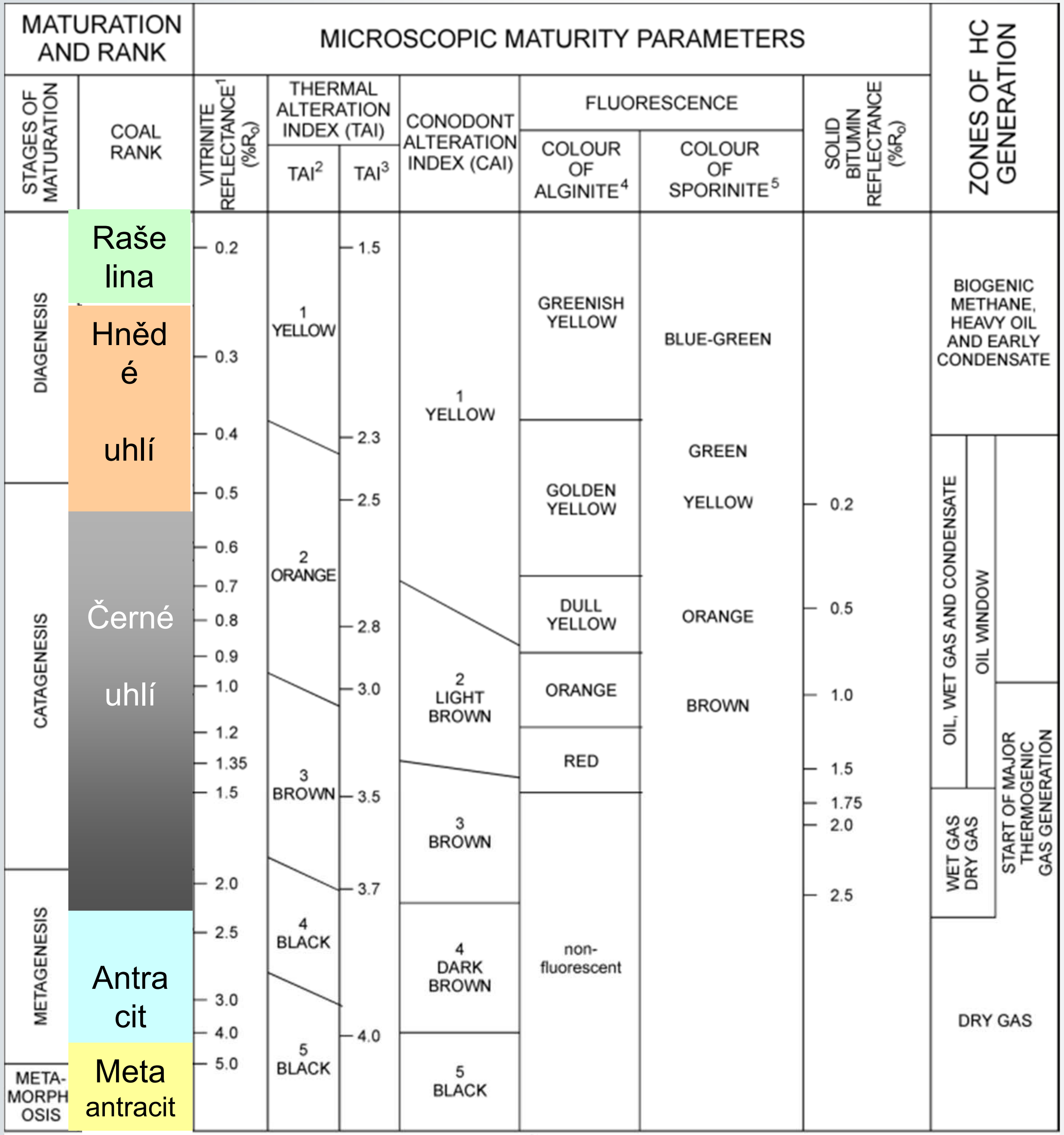
Temperature

Vitrinite Reflectance R_o(%)

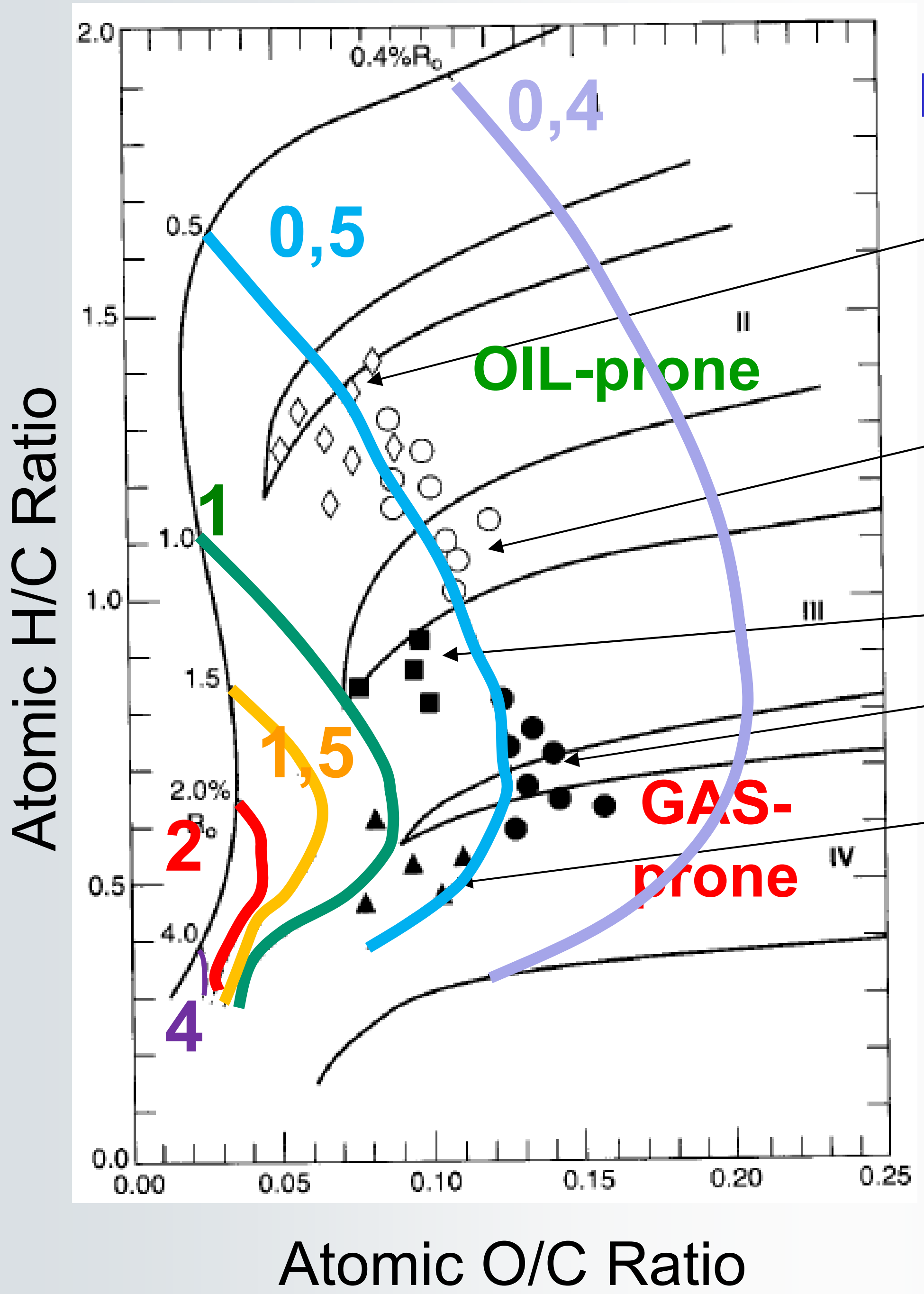
Hydrocarbon generation



Tepelné zrání kerogenu a uhlí



[1] from Teichmüller and Teichmüller (1982)
[2] from Staplin (1969)
[3] from Jones and Edison (1978)
[4] from Mukhopadhyay and Rullkötter (1986)



Kerogen Types - North Sea

II Kimmeridge Shale

(restricted marine U. Jur.)

II/III Mixed marine (Tertiary)

with Liptinite

III Coaly Shale (M. Jurassic)

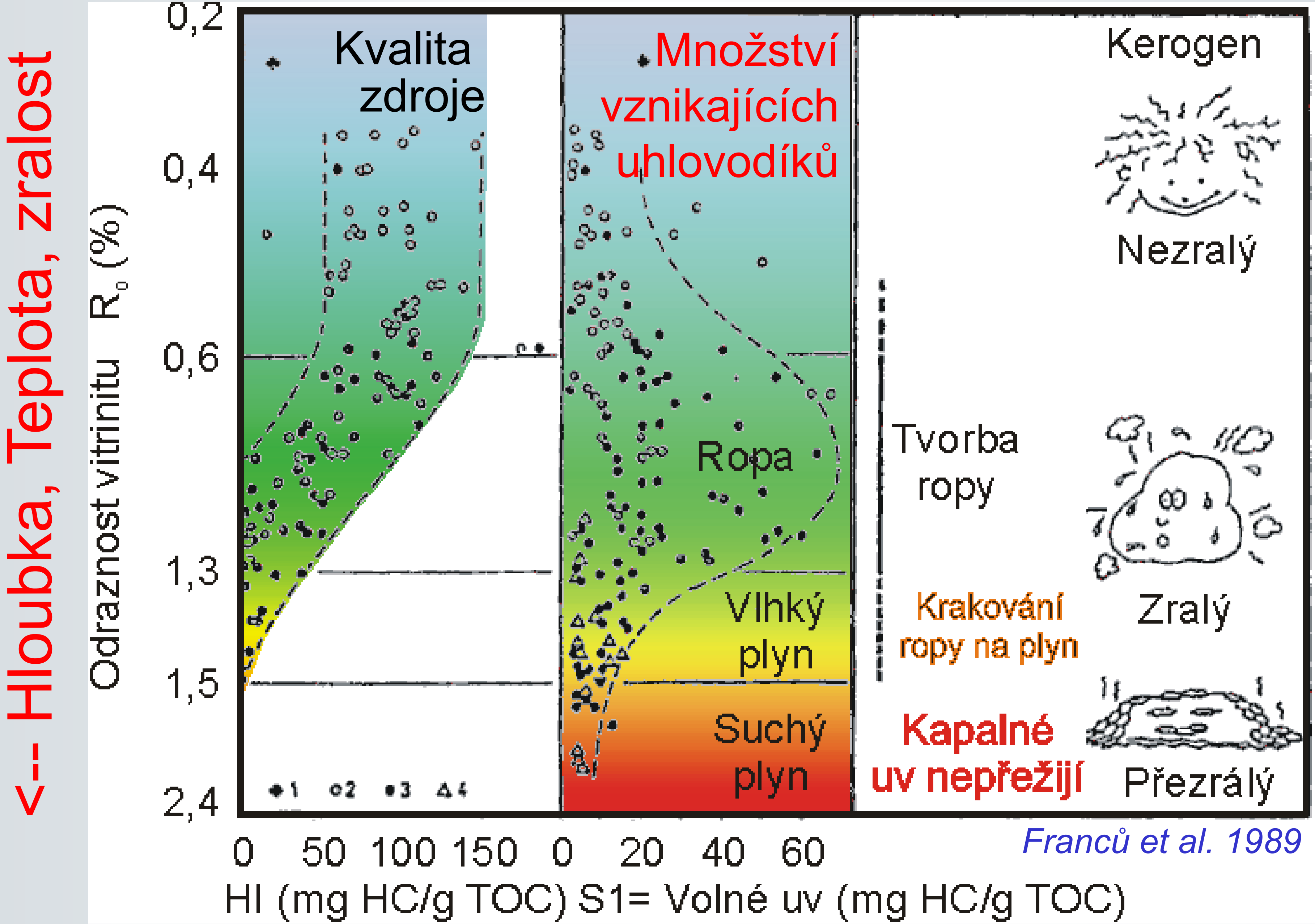
III/IV Open marine (Cretaceous)

IV Red beds (Triassic)

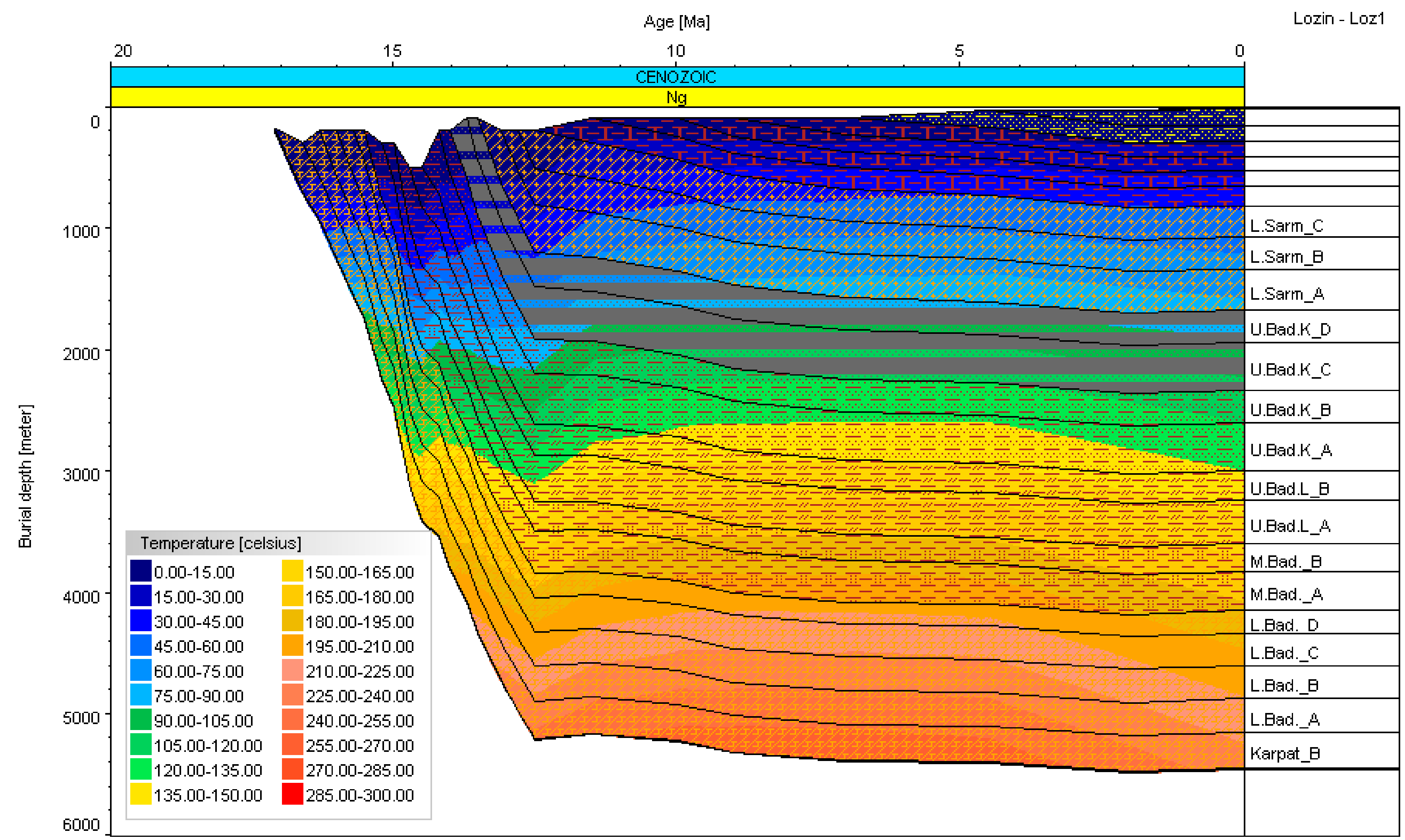
Vitrinite + inertinite

Jones (1987) in Hunt (1996)

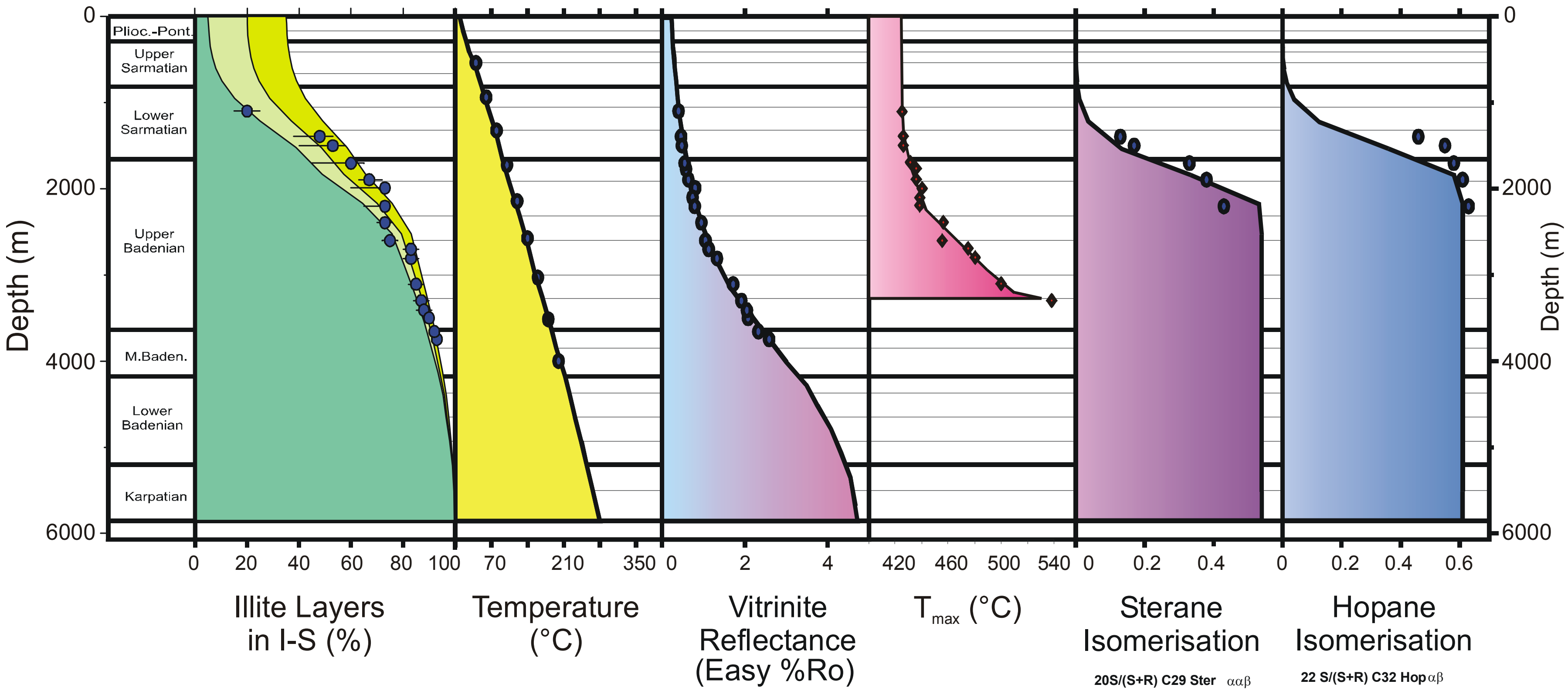
6. Zdrojové horniny - Tepelná zralost



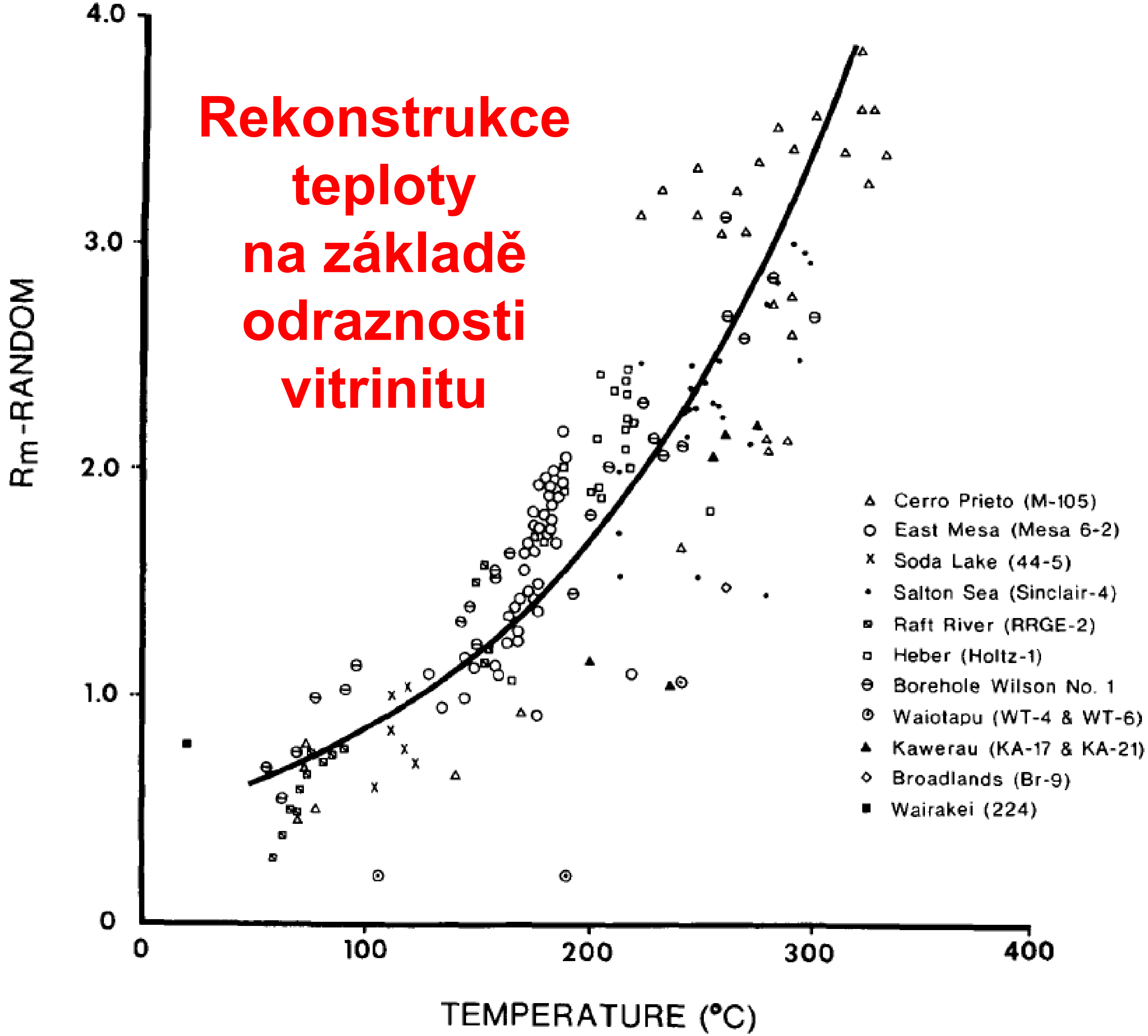
Continuous Deposition Model



Calibration by
I-S clays, Present Temperature, Ro, Tmax and Biomarkers

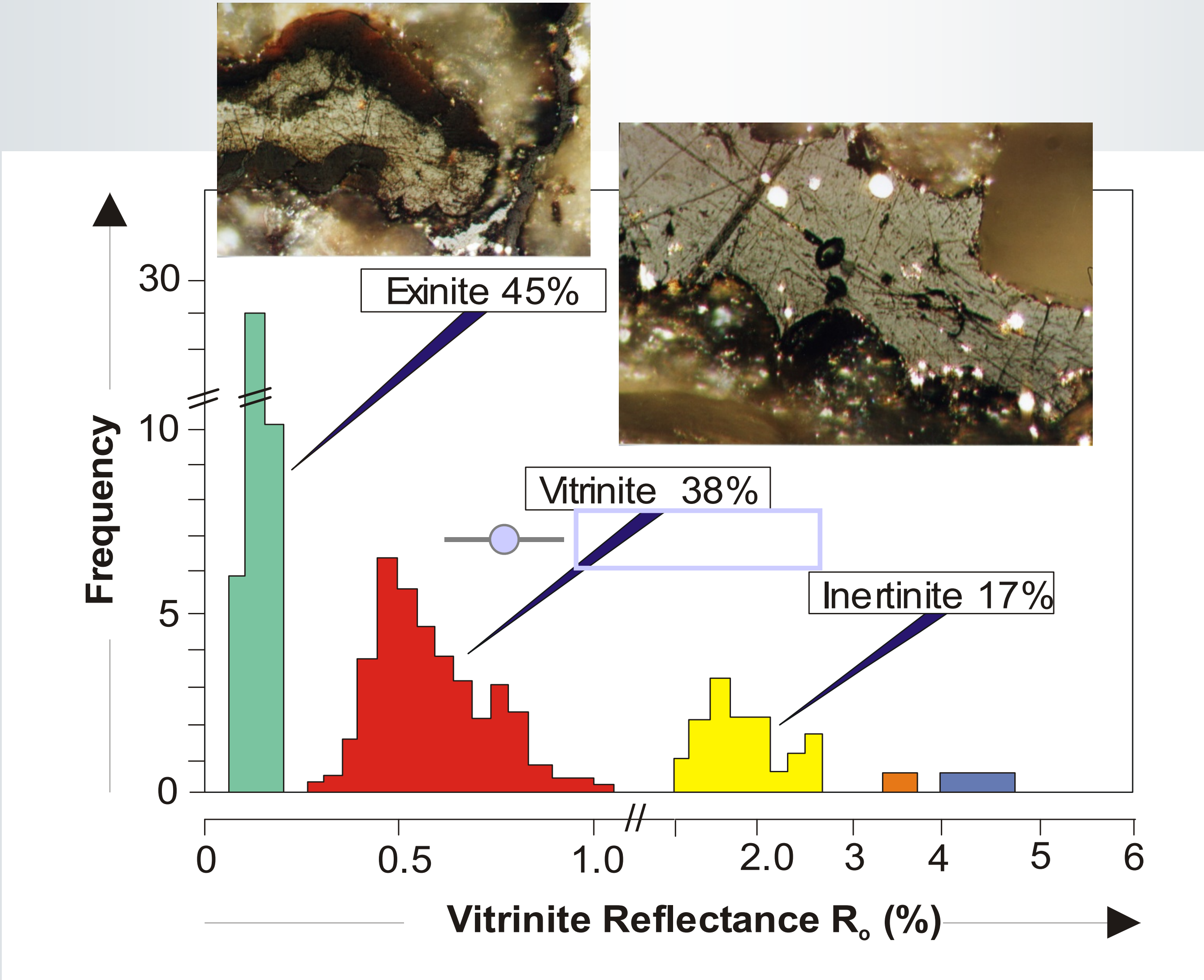


Rekonstrukce teploty na základě odraznosti vitrinitu



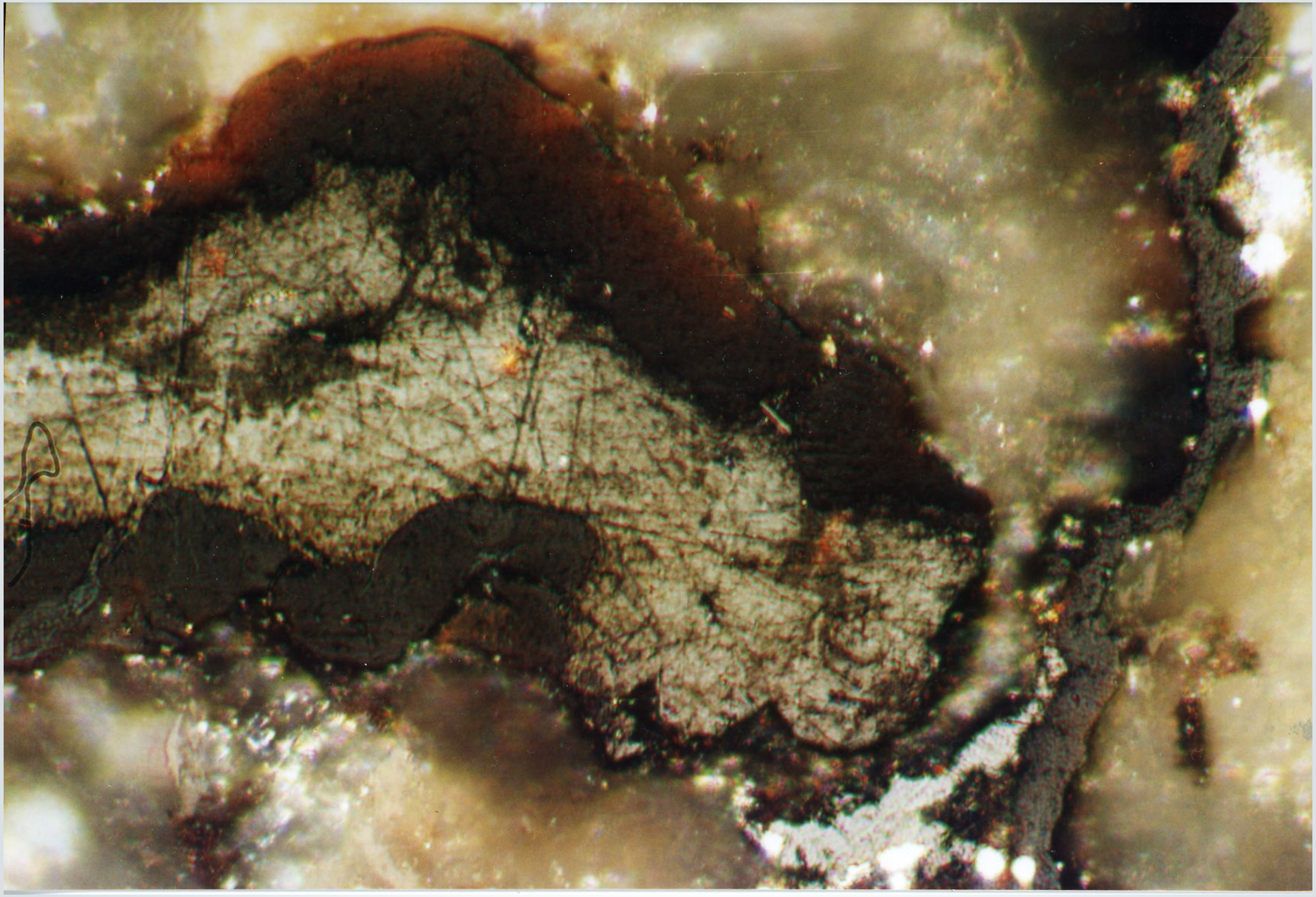
Barker 1983

Calibration Parameters - Vitrinite Reflectance



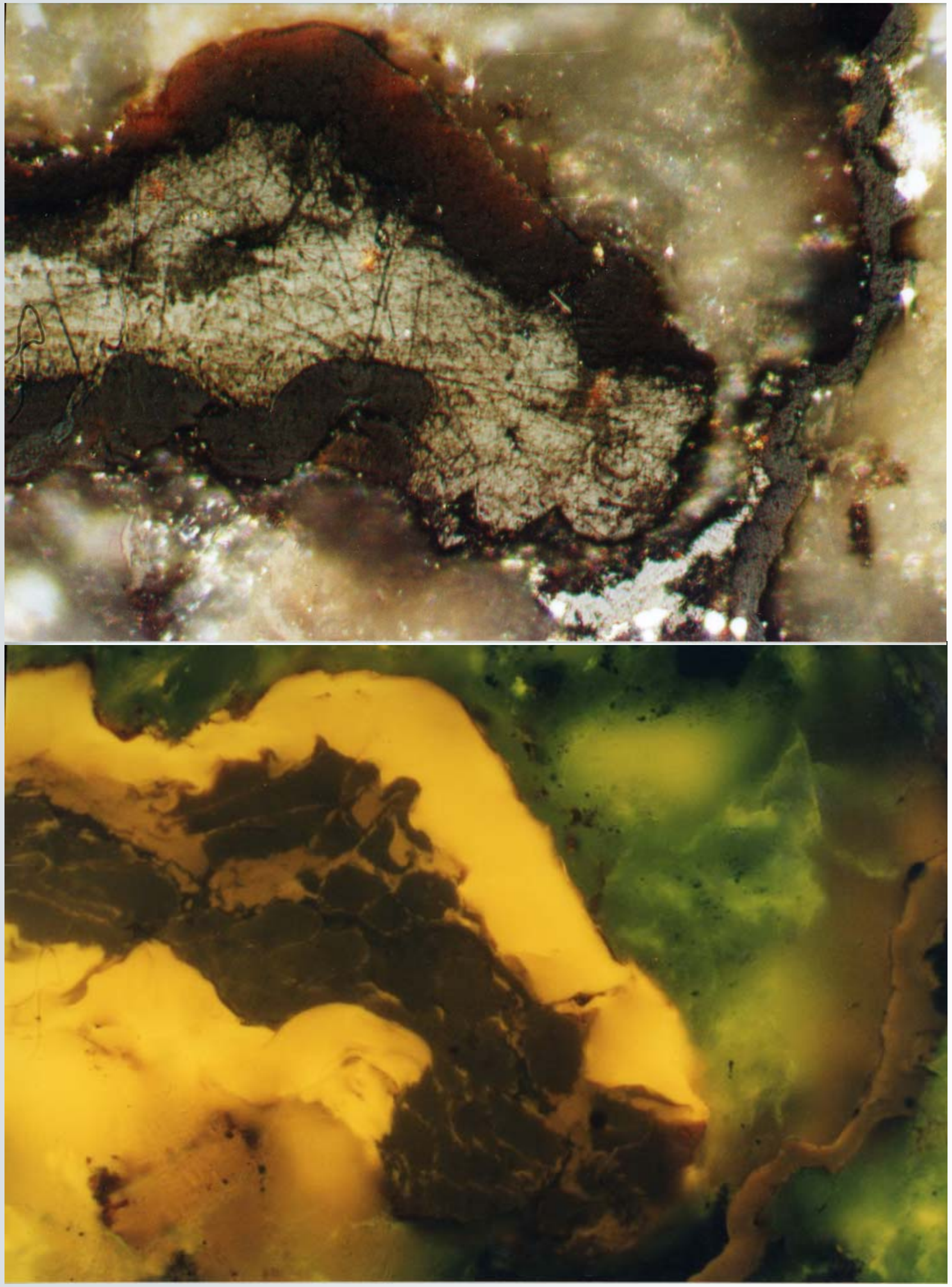
Only vitrinite indicates the thermal history

Macerals - Reflectance



Vitrinite & Cutinite (Exinite) – Reflected Light

Supressed Reflectance



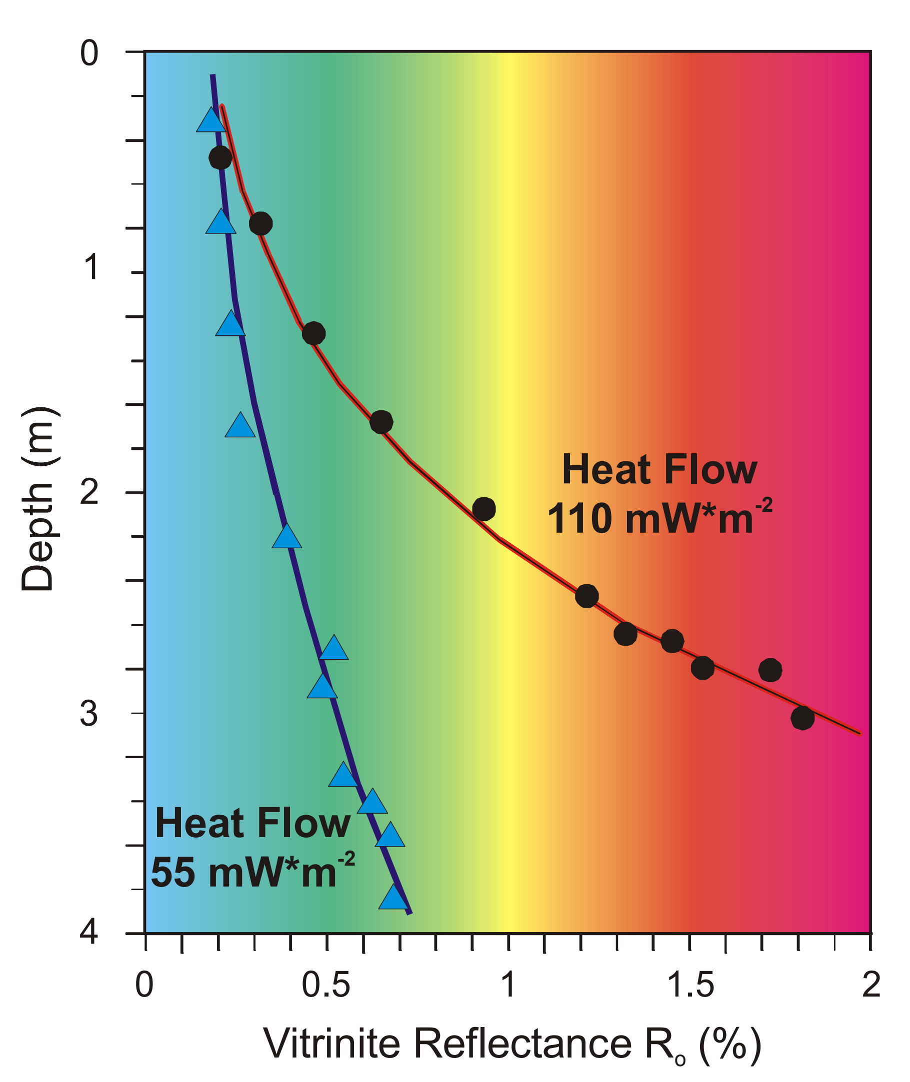
Vitrinite & Cutinite (Exinite)

– Supressed Vitrinite Reflectance due to oily Impregnation

Cutiniteis dark in reflected light

– Fluorescent Light Liptinite - yellow fluo.

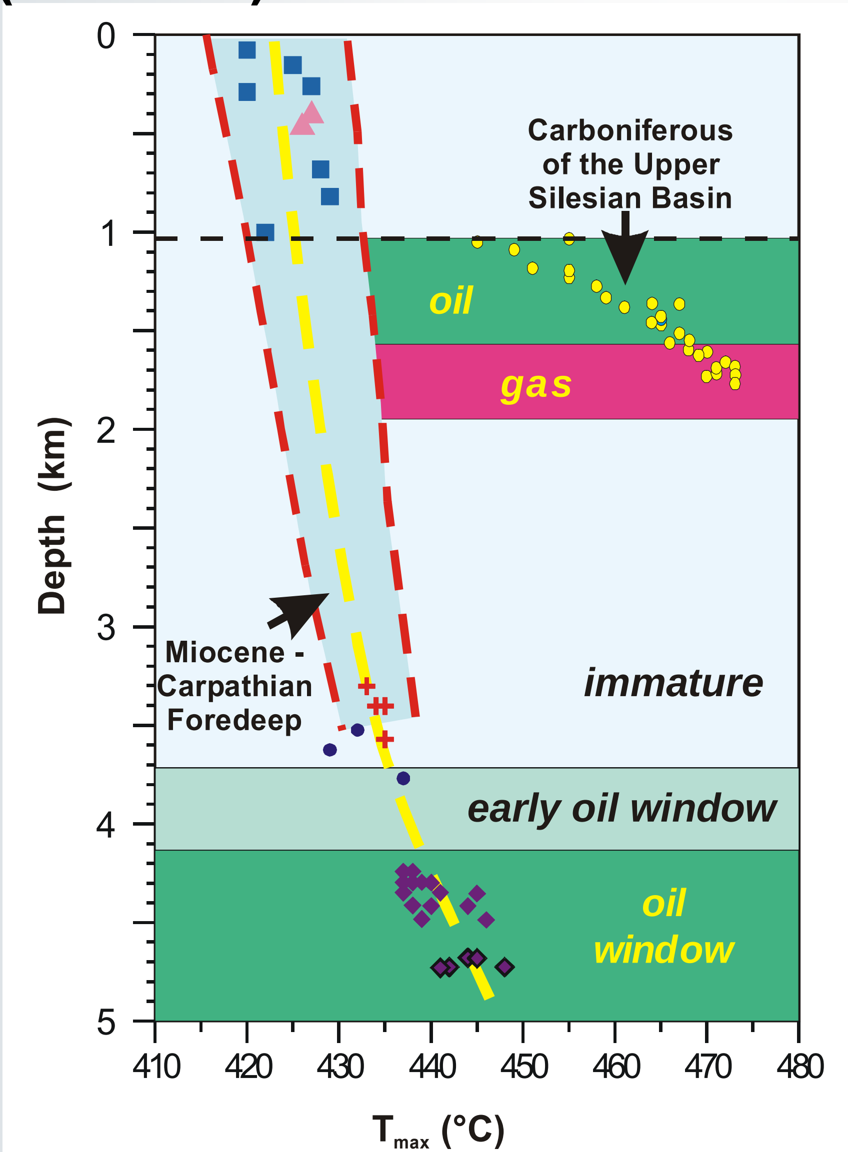
Maturity Trends



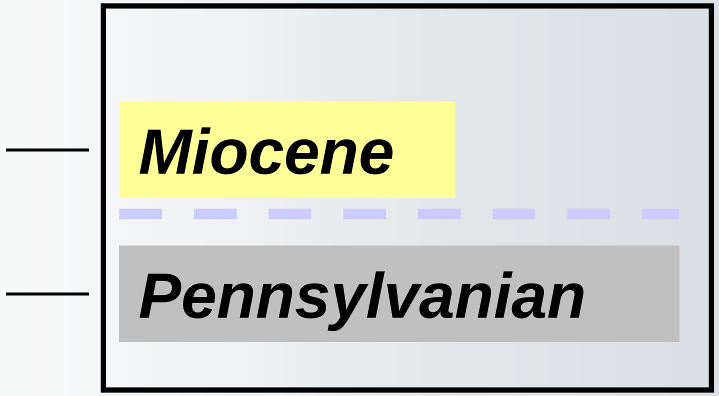
Maturity trends with depth in Mio-Pliocene basins "cold" Vienna and "hot" Pannonian

Similar Age, Similar Lithology, No erosion just different heat flow

Miocene trend (23-5 Ma) based on 5 wells

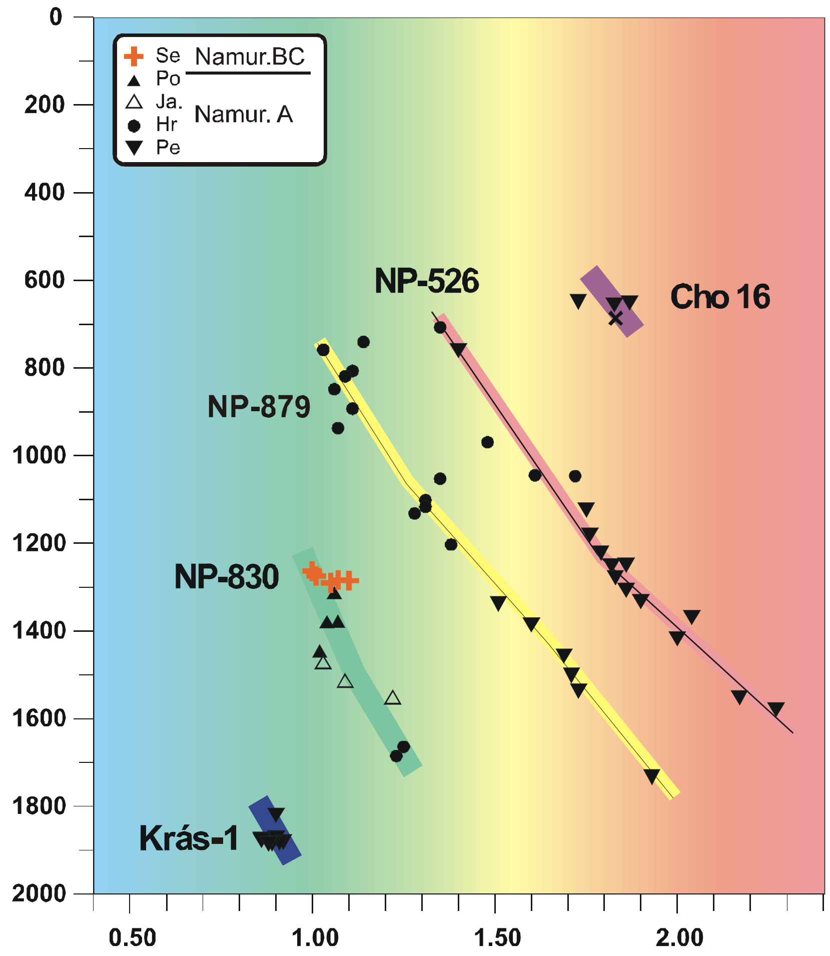


Single well



Heat flow during Neogene

Maturity Trends in Inverted (Uplifted) Basins



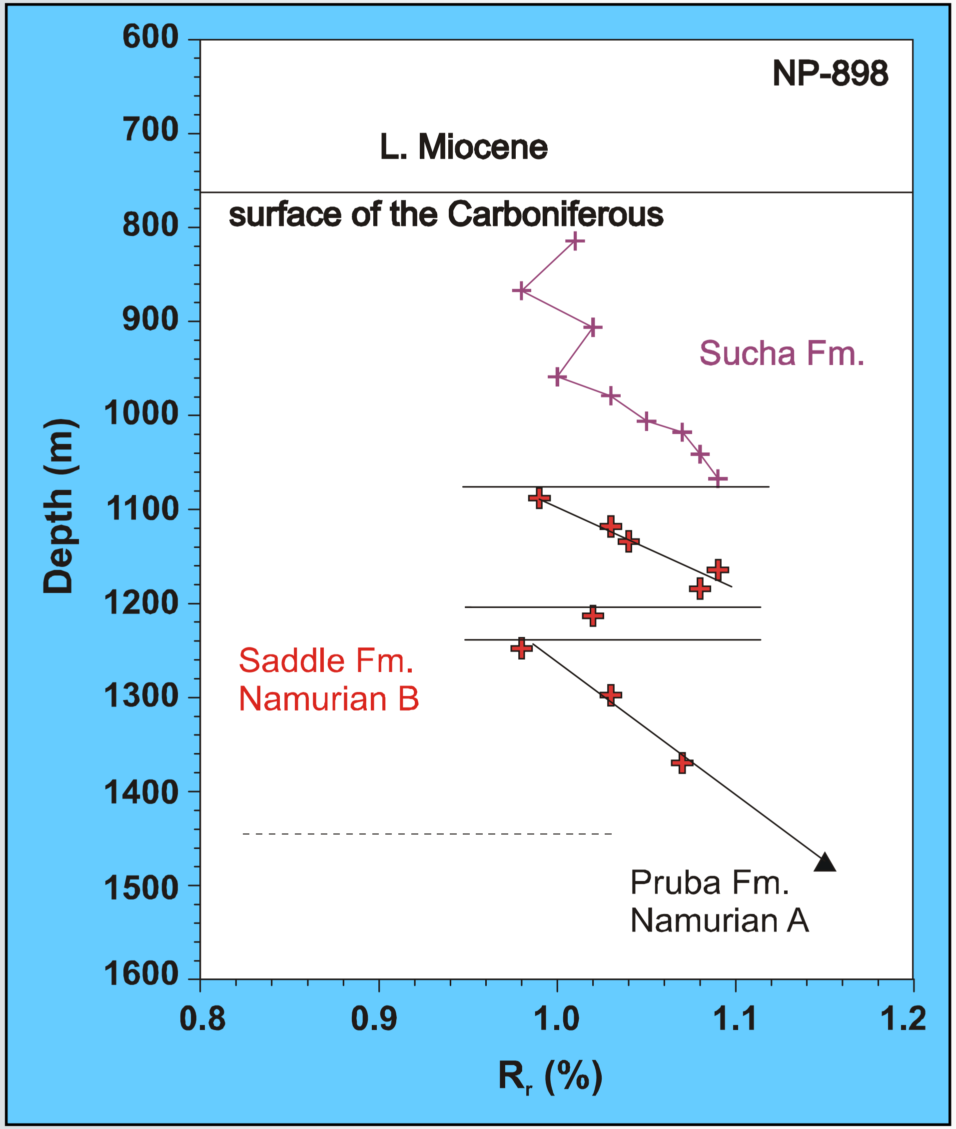
"Parallel" maturity trends with depth

show similar

paleo-heat flow / geothermal gradients

but different uplift and second burial

Maturity Trends in Overthrust Systems



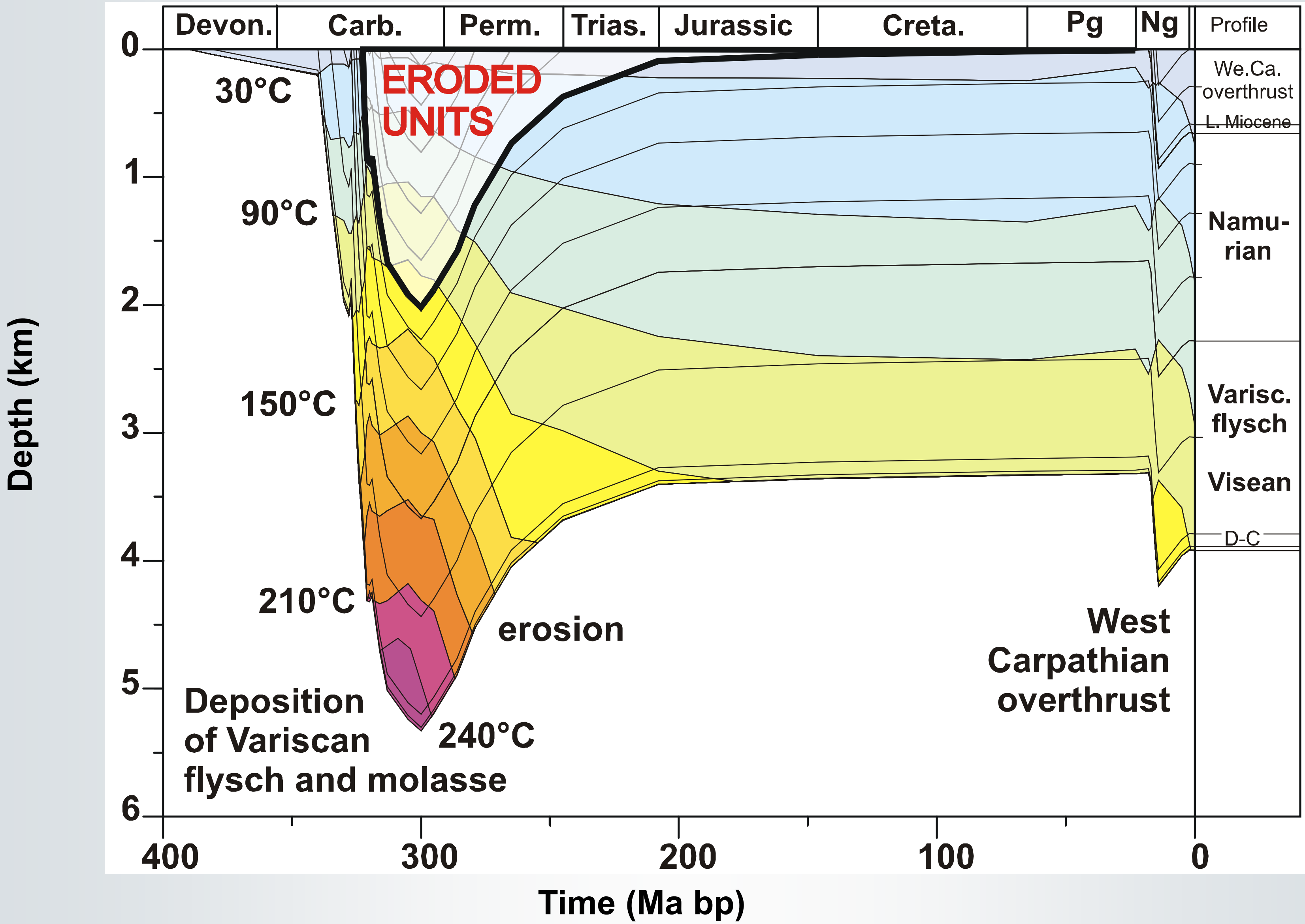
Vitrinite reflectance with depth

example of deformation (imbrication and stacking) after maximum coalification

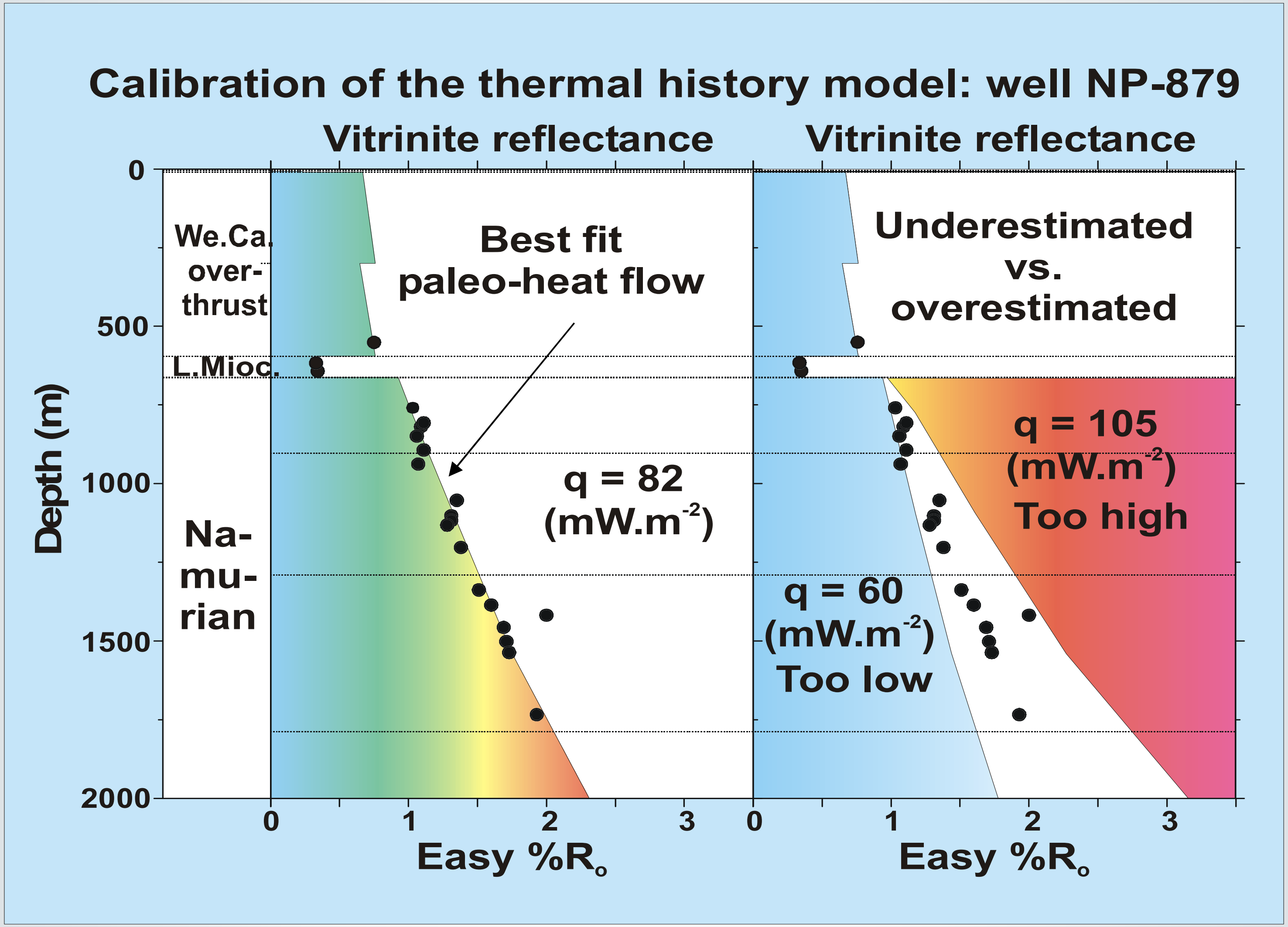
Variscan foreland b. U. Silesian Basin

Calibration

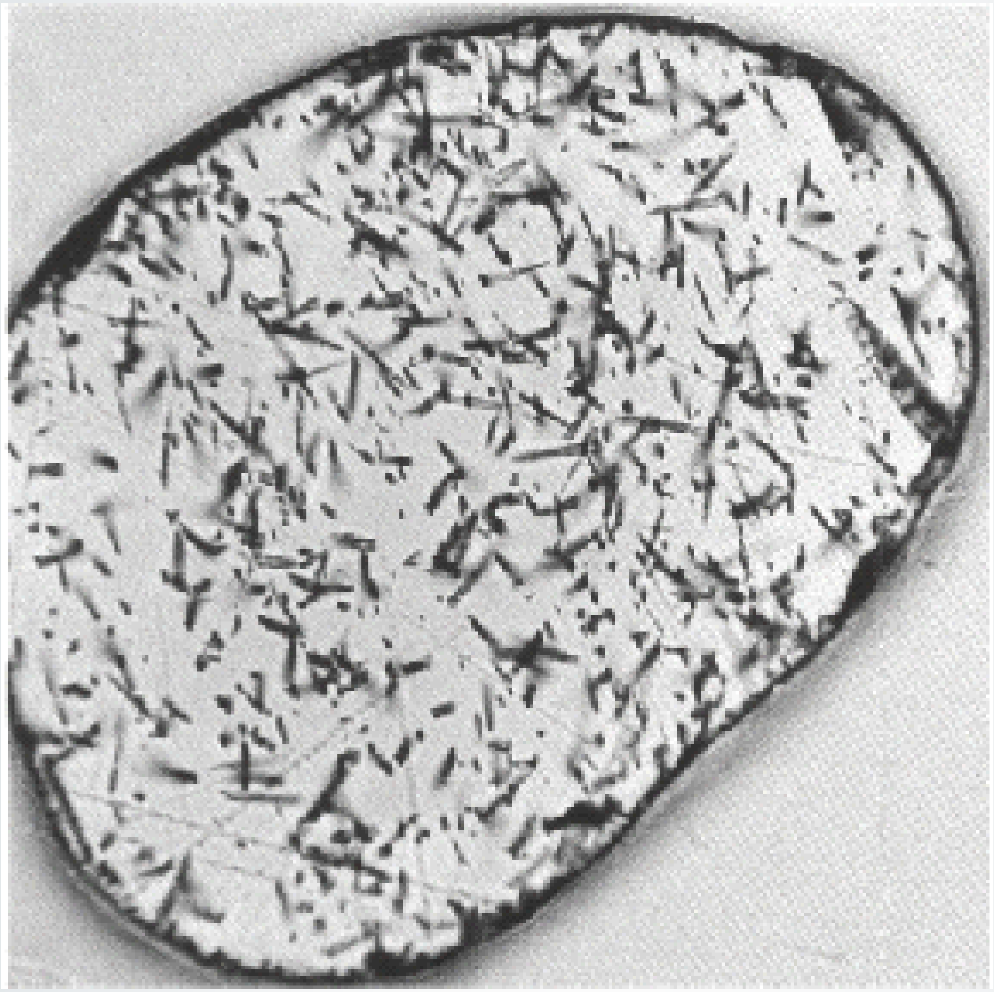
Burial History with Uplift and Erosion



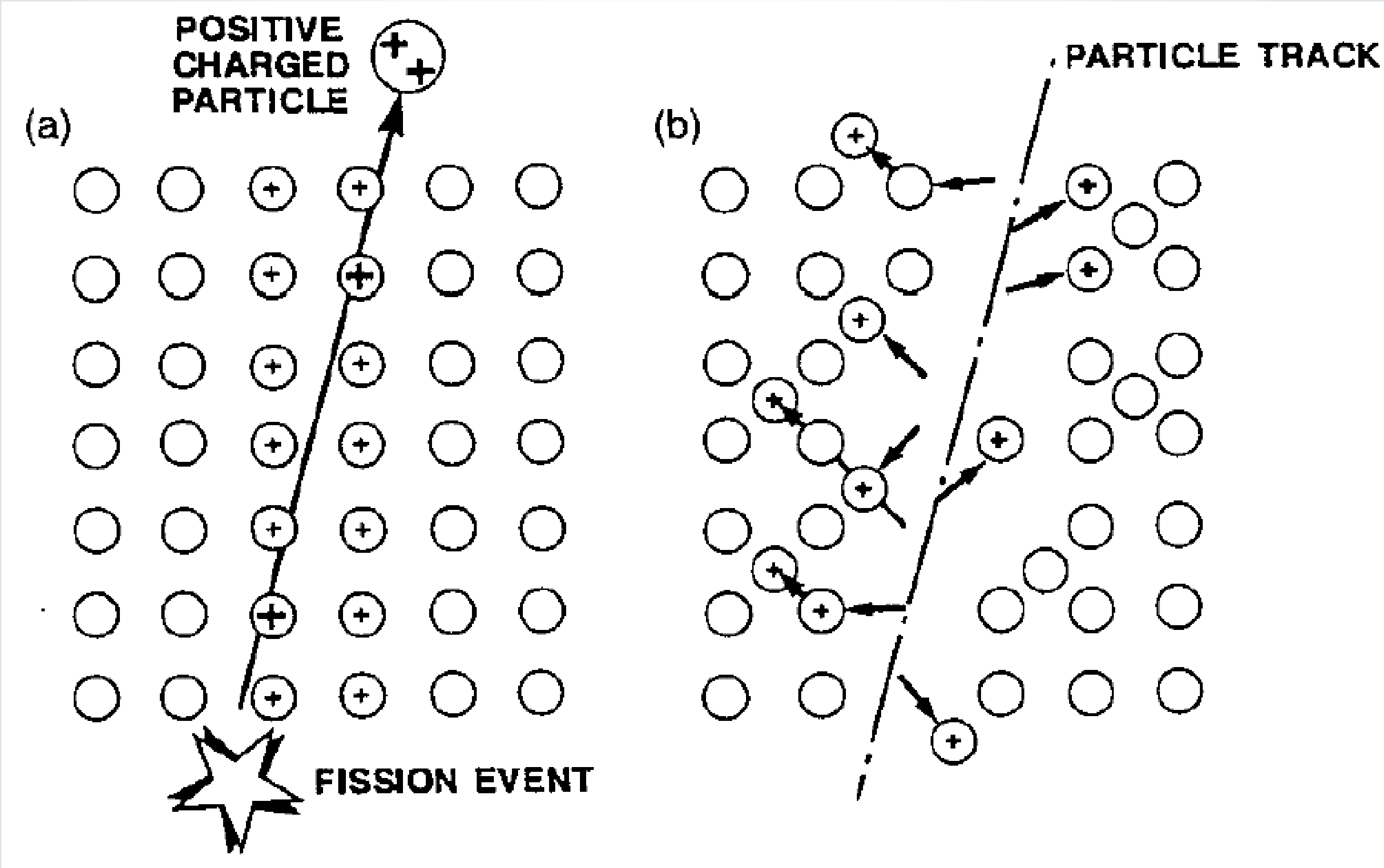
Testing Alternative Scenarios of Heat Flow History for the Late Paleozoic Phase (330-295 Ma)



Apatite Fission Tracks
Štěpné stopy uranu
v apatitech a zirkonech

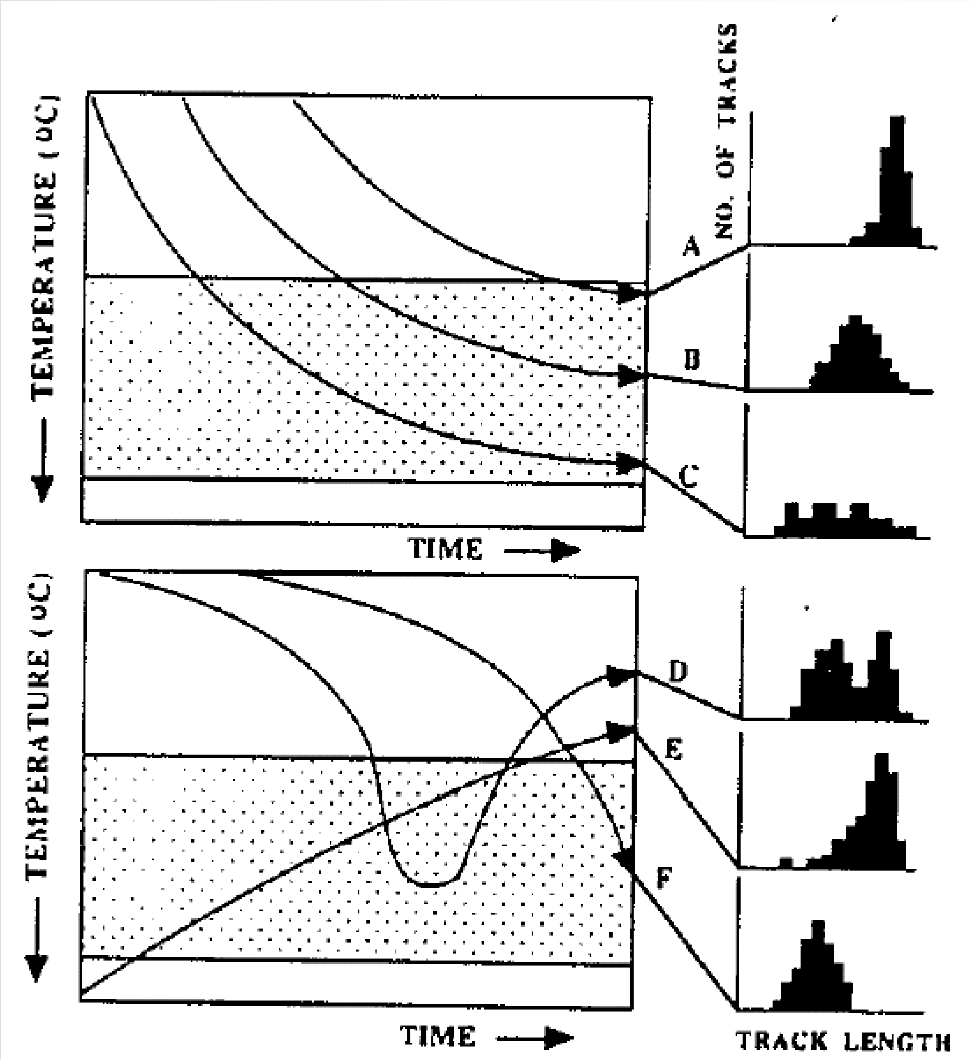


Radioaktivní rozpad uranu vyzařuje částice které proráží "tunely" v krystalové mřížce minerálů



Stopy se uchovají, rostou a množí při T < 60°C

Jak se teplota v zemských hlubinách zapíše do hornin v podobě histogramu AFT

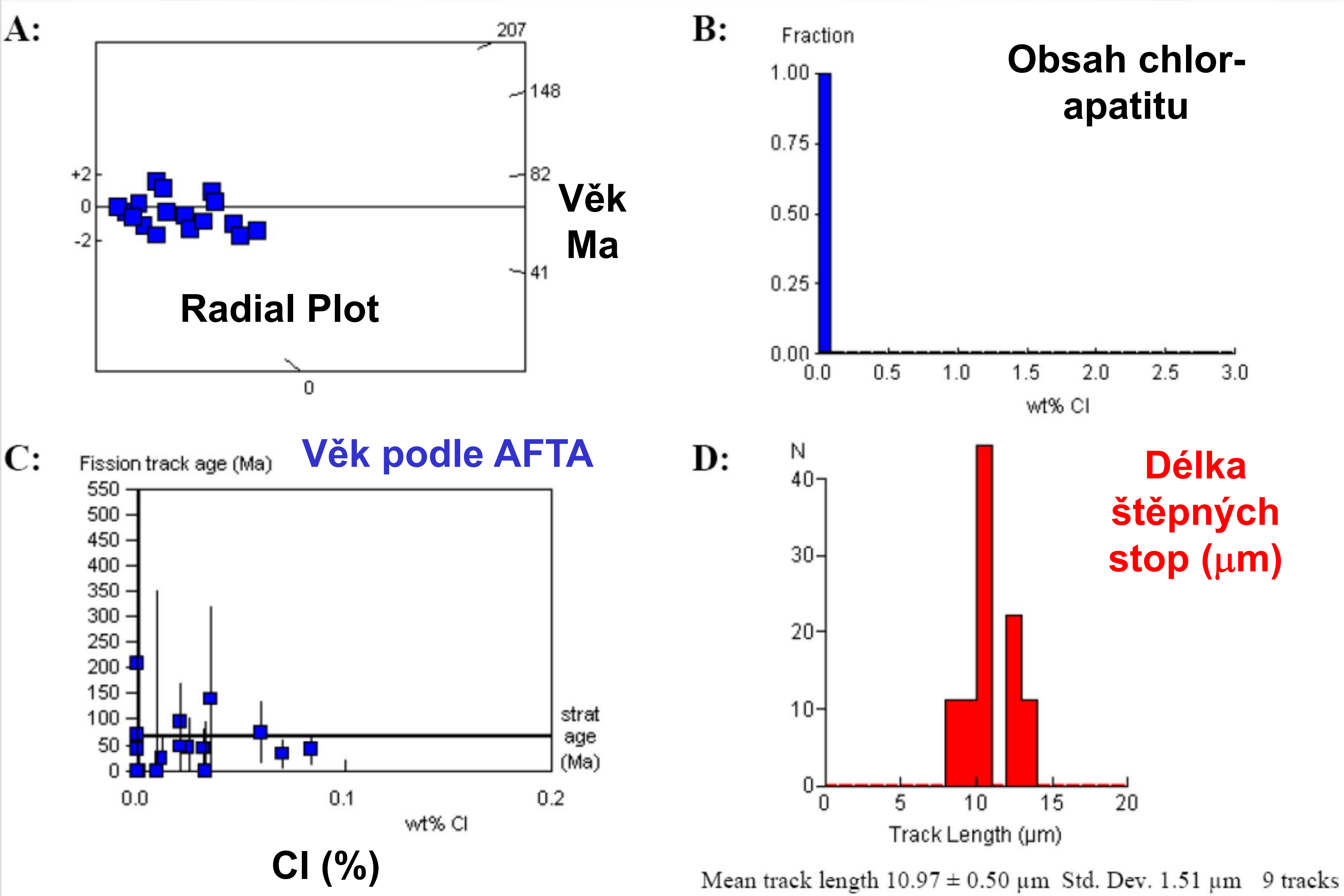


Monotonní pokles a překrytí

Výzdvih => E = ochlazování

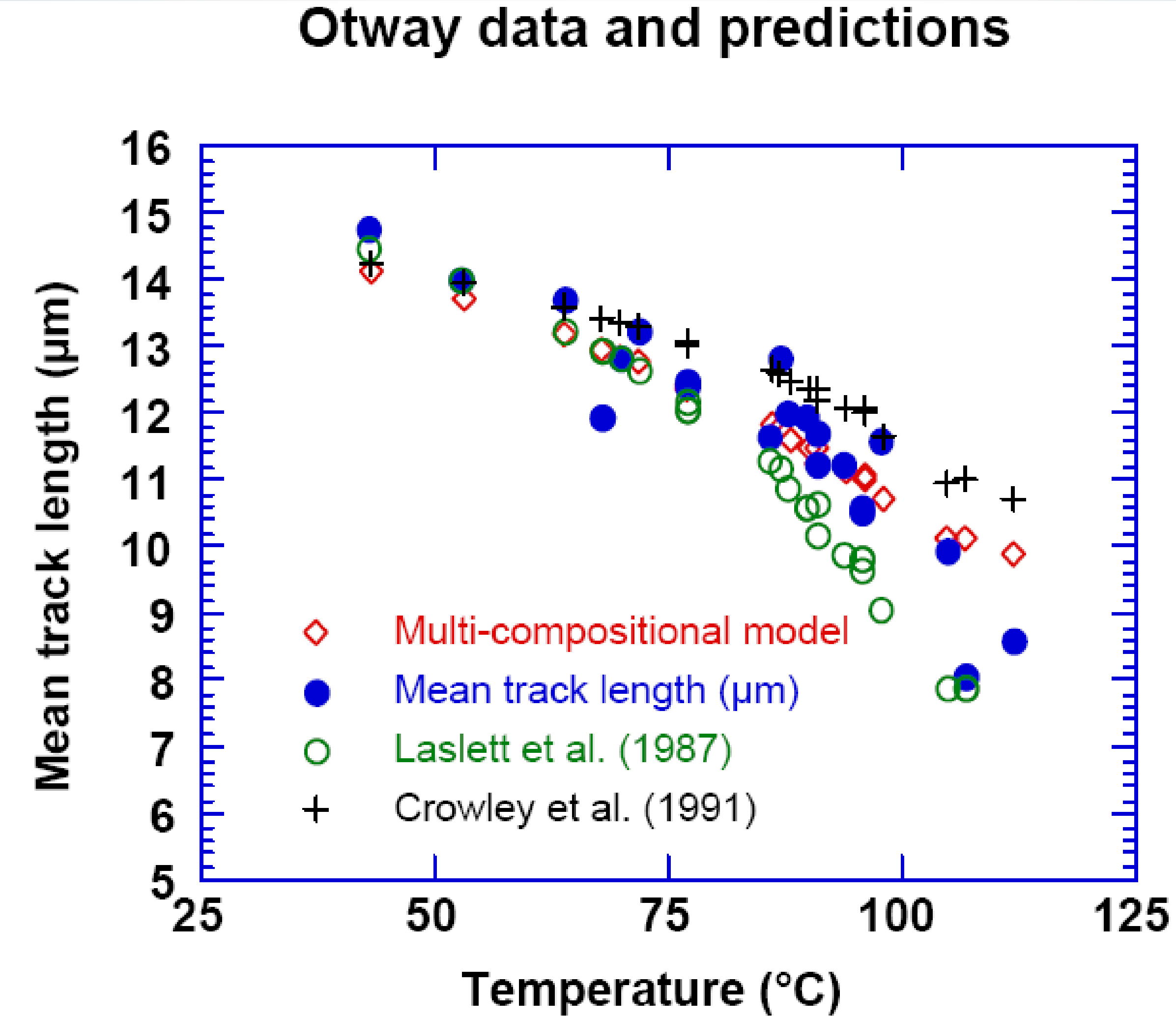
Green et al, 1989a

AFTA Diagramy

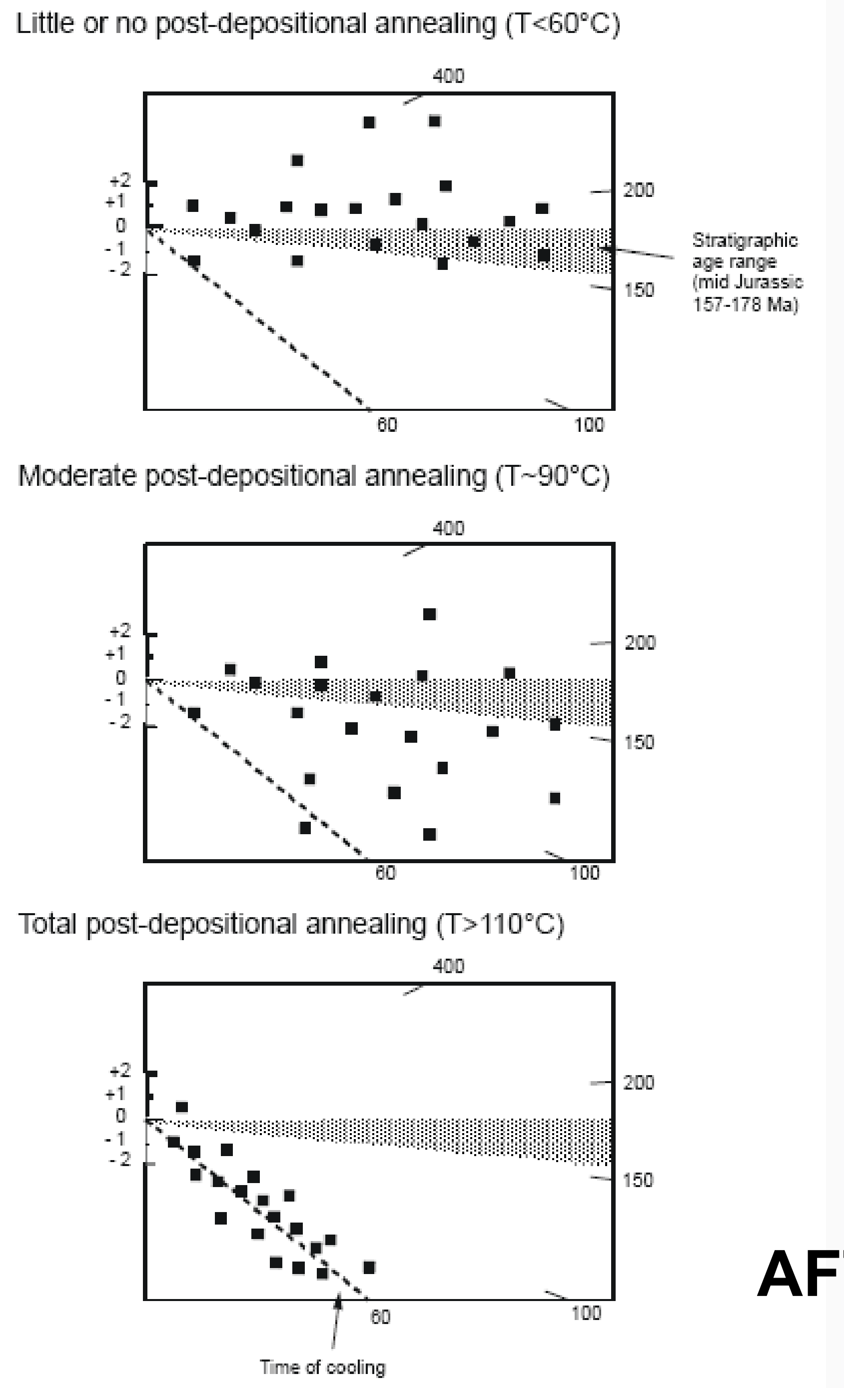


Délka štěpných stop AFT a Teplota vrstev
Otway Basin reference wells

AFTA



from Green et al, 1989a



AFTA

Radialní diagramy měření jednotlivých zrn

Chladné vrstvy

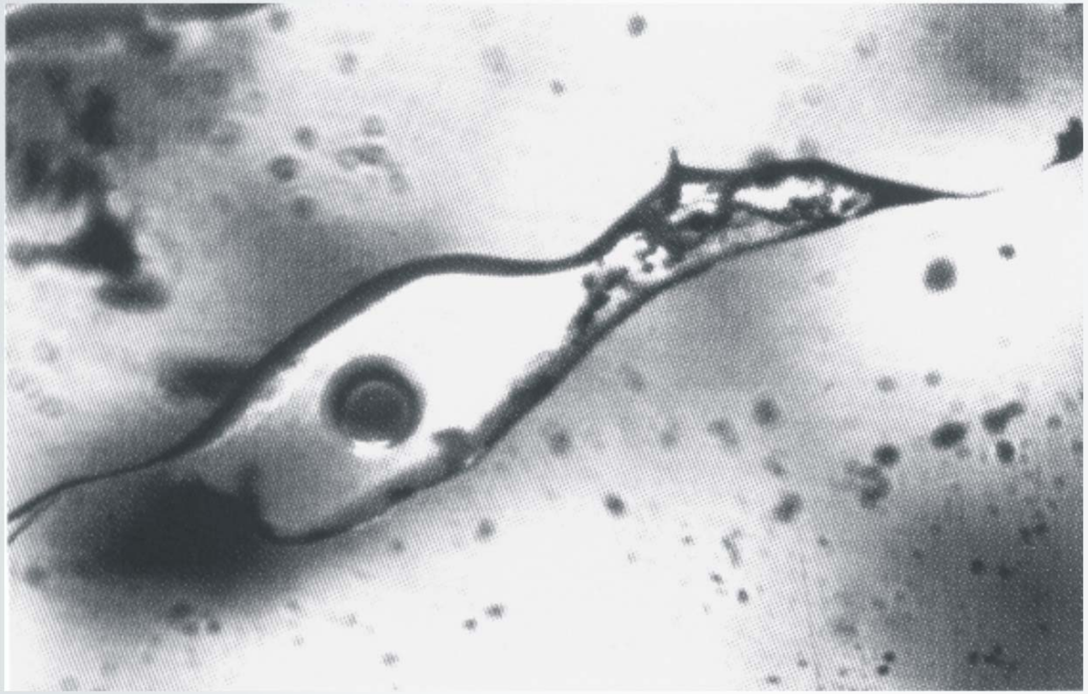
Středně pohřbené a prohřáté (90°C) horniny

Silně prohřáté horniny při hlubokém pohřbení

Green et al, 1989a

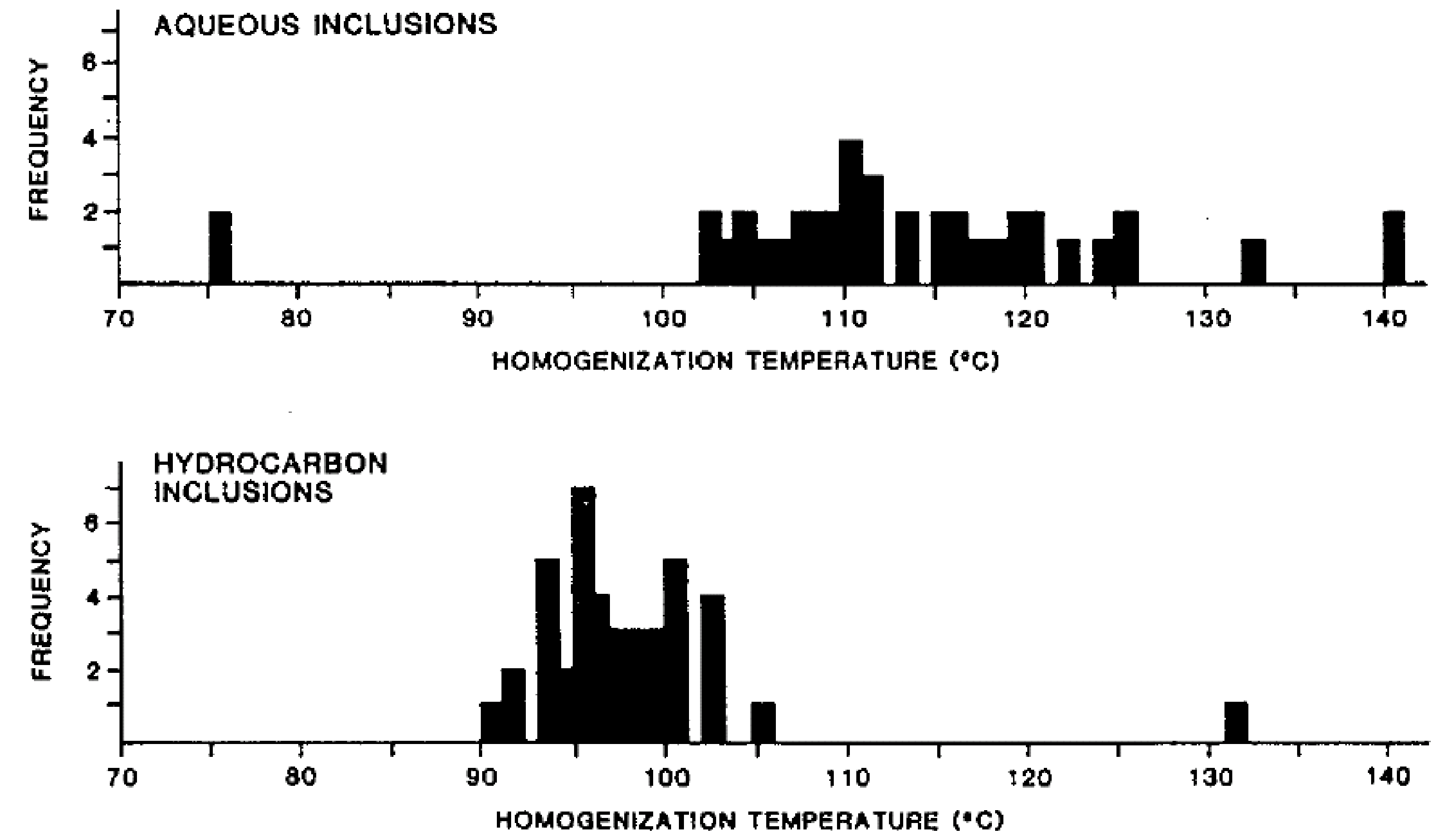
Plyno-kapalné uzavřeniny (inkluze) v pískovcích a kalcitových nebo Q žilách

Teplota => Fázova koexistence



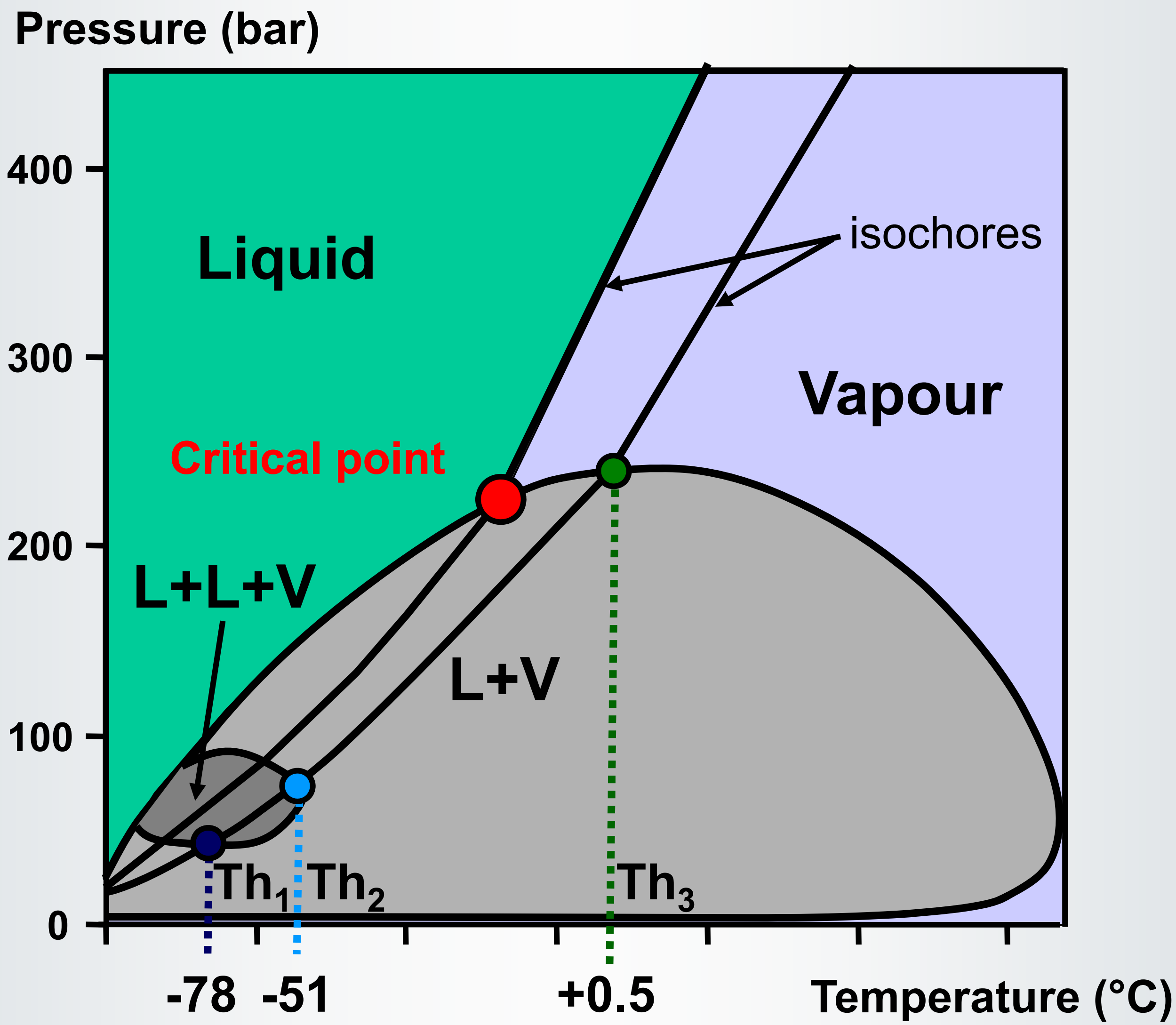
Plynová bublina
Kapalina
Krystalky soli

Výsledky měření plyno-kapalných uzavřenin



Homogenizační Teplota

Plyno-kapalné inkluze
P, T interpretace homogenizace



Shrnutí - plyno-kapalné inkluze

Z p T podmínek fázových změn (bublina - roztok - krystalek) lze vyčíst podmínky vzniku celého krystalu - teploty a hloubky pohřbení

6. Summary - Calibration

- Calibration make model closer to reality
- From maturity data we read the paleo-heat flow and estimate the amount of erosion
- Only calibrated models can provide reasonable calculation of generated oil and gas