

The relationship between:

$x$       salinity

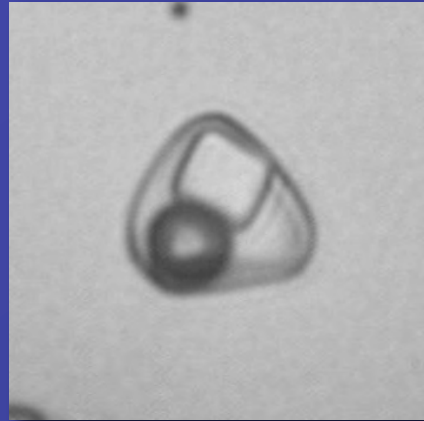
$T_m$       dissolution temperatures of halite

$\varphi^{\text{vap}}$       volume fraction of the vapour phase

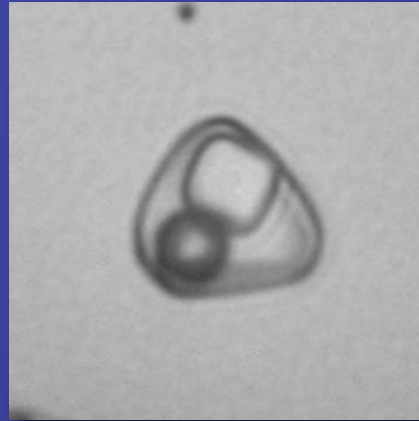
in the binary  $\text{H}_2\text{O}$ -NaCl system

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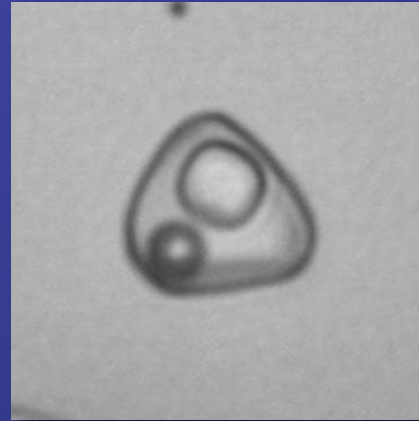
# Microthermometry



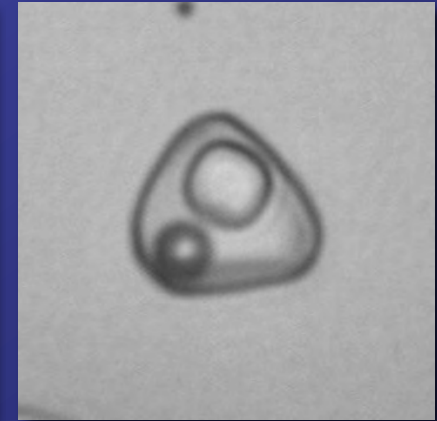
25 °C



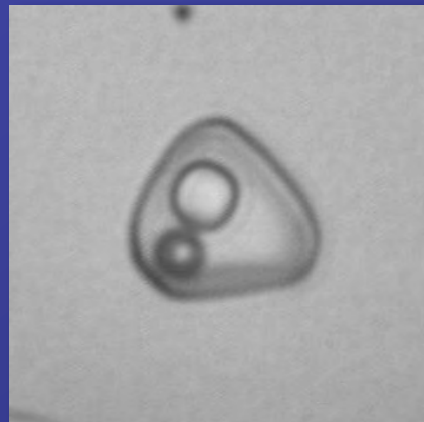
200 °C



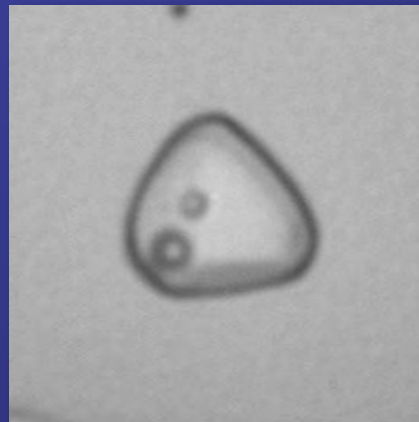
300 °C



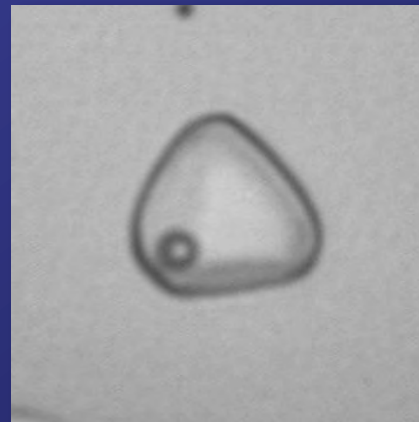
400 °C



500 °C

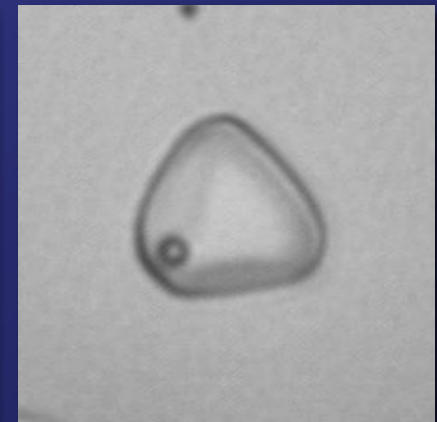


550 °C



553 °C

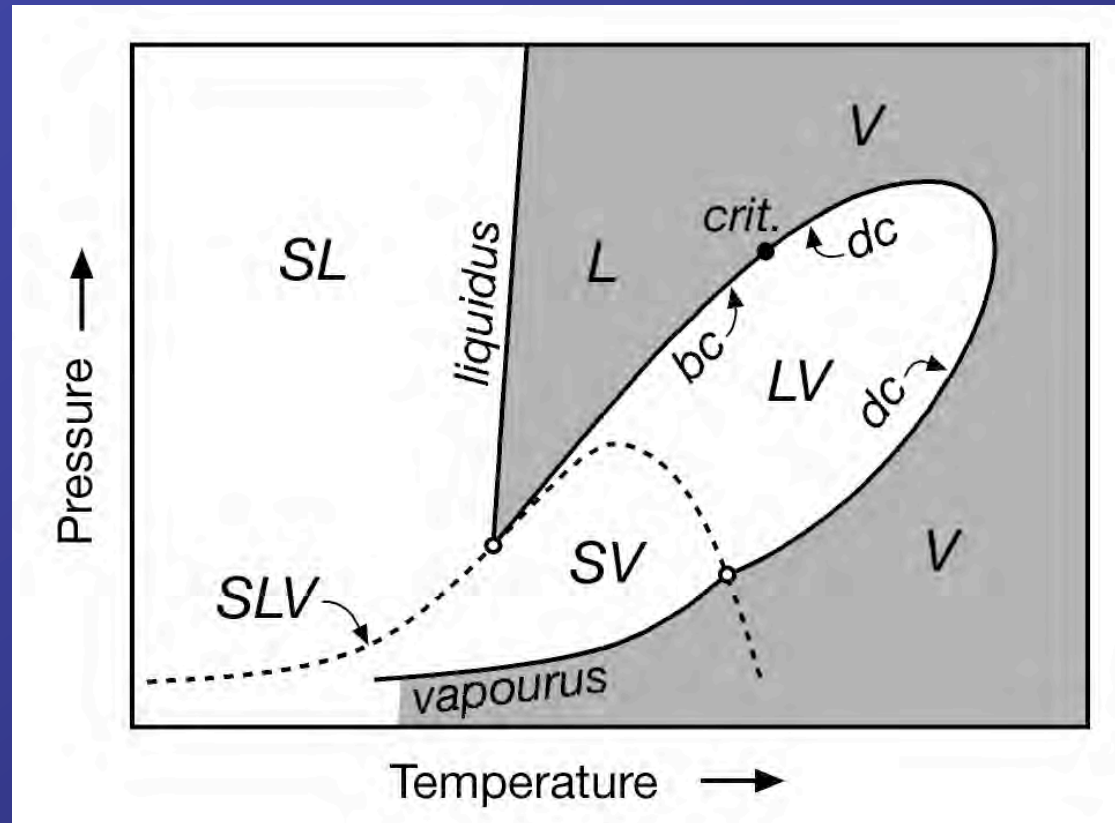
$T_m$  (SLV→LV)



> 600 °C

$T_h$  (LV→L)

# H<sub>2</sub>O-NaCl fluid/solid system



dissolution of halite = liquidus

# Modelling of V-x properties

## Equation of State H<sub>2</sub>O-NaCl

### 1. Anderko and Pitzer (1993)

isochores

liquid-vapour equilibria

limits: 300 - 925 °C

up to 500 MPa

lower limit 20 MPa ?

### 2. Solid-Liquid-Vapour curve

# Equation of State: Anderko and Pitzer (1993)

modified Benedict-Webb-Rubin equation

$$a^{residual} = a^{reference} + a^{perturbation}$$

$$a^{reference}(T, v, x) = a^{repulsive}(v, x) + a^{dipolar}(T, v, x)$$

$$\frac{a^{repulsive}}{RT} = \frac{\frac{3DE}{F} \cdot \eta - \frac{E^3}{F^2}}{1 - \eta} + \frac{\frac{E^3}{F^2}}{(1 - \eta)^2} + \left( \frac{E^3}{F^2} - 1 \right) \cdot \ln(1 - \eta)$$

$$\frac{a^{dipolar}}{RT} = \frac{A_2}{1 - \frac{A_3}{A_2}}$$

$$\frac{a^{perturbation}}{RT} = -\frac{4a}{RTb} \eta \cdot (1 + c\eta + d\eta^2 + e\eta^3)$$

Anderko and Pitzer (1993)

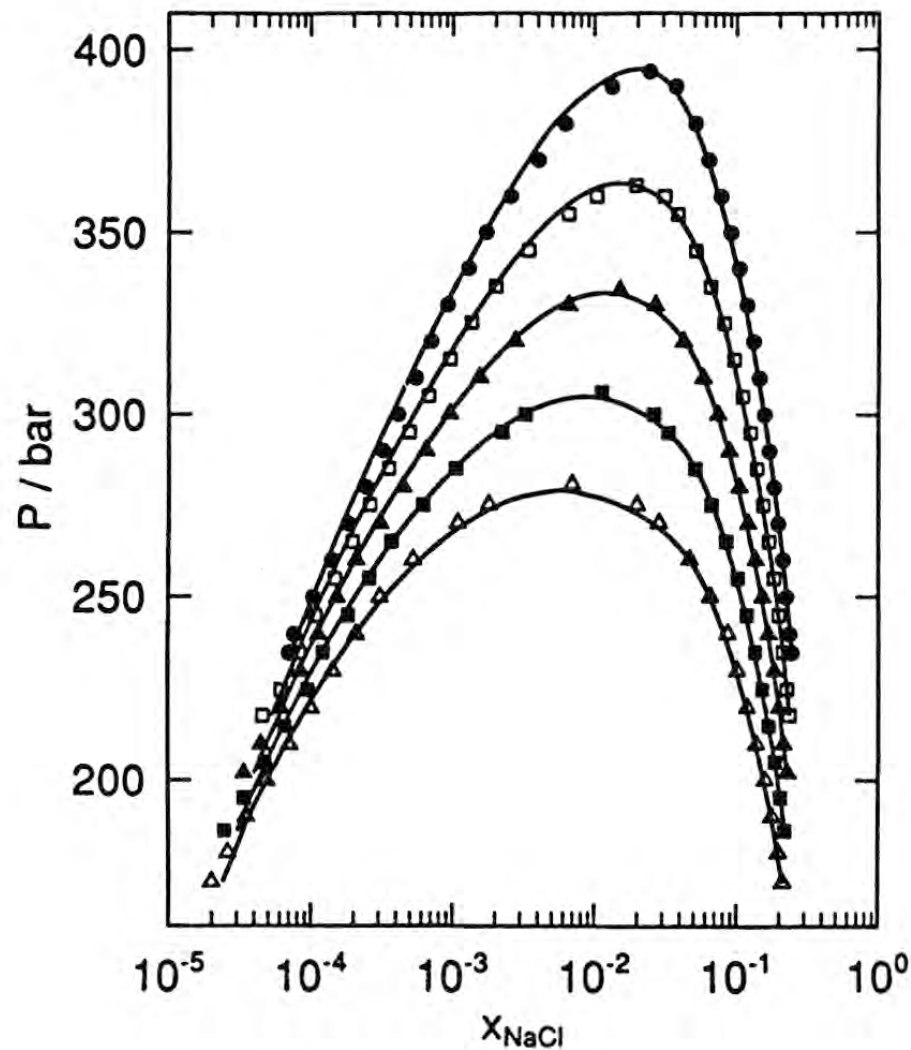


FIG. 5. Comparison of vapor-liquid equilibria calculated from the equation of state (lines) with the smoothed data reported by BISCHOFF and PITZER (1989) at  $T = 673.15$  K ( $\Delta$ ),  $683.15$  K ( $\blacksquare$ ),  $693.15$  K ( $\blacktriangle$ ),  $703.15$  K ( $\square$ ), and  $713.15$  K ( $\bullet$ ).

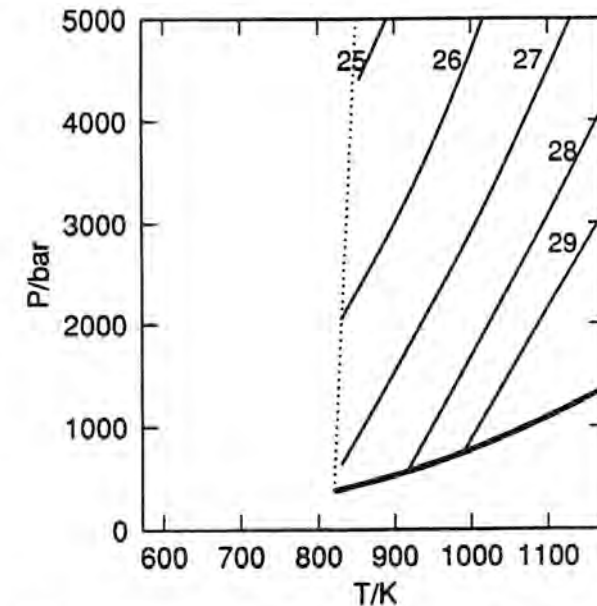
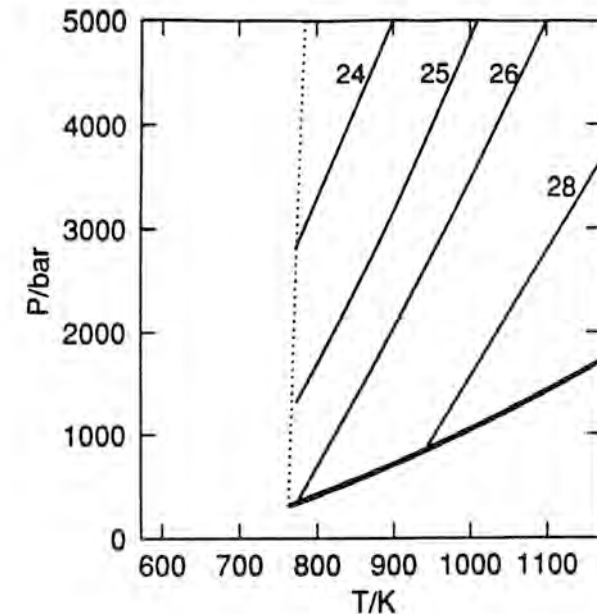
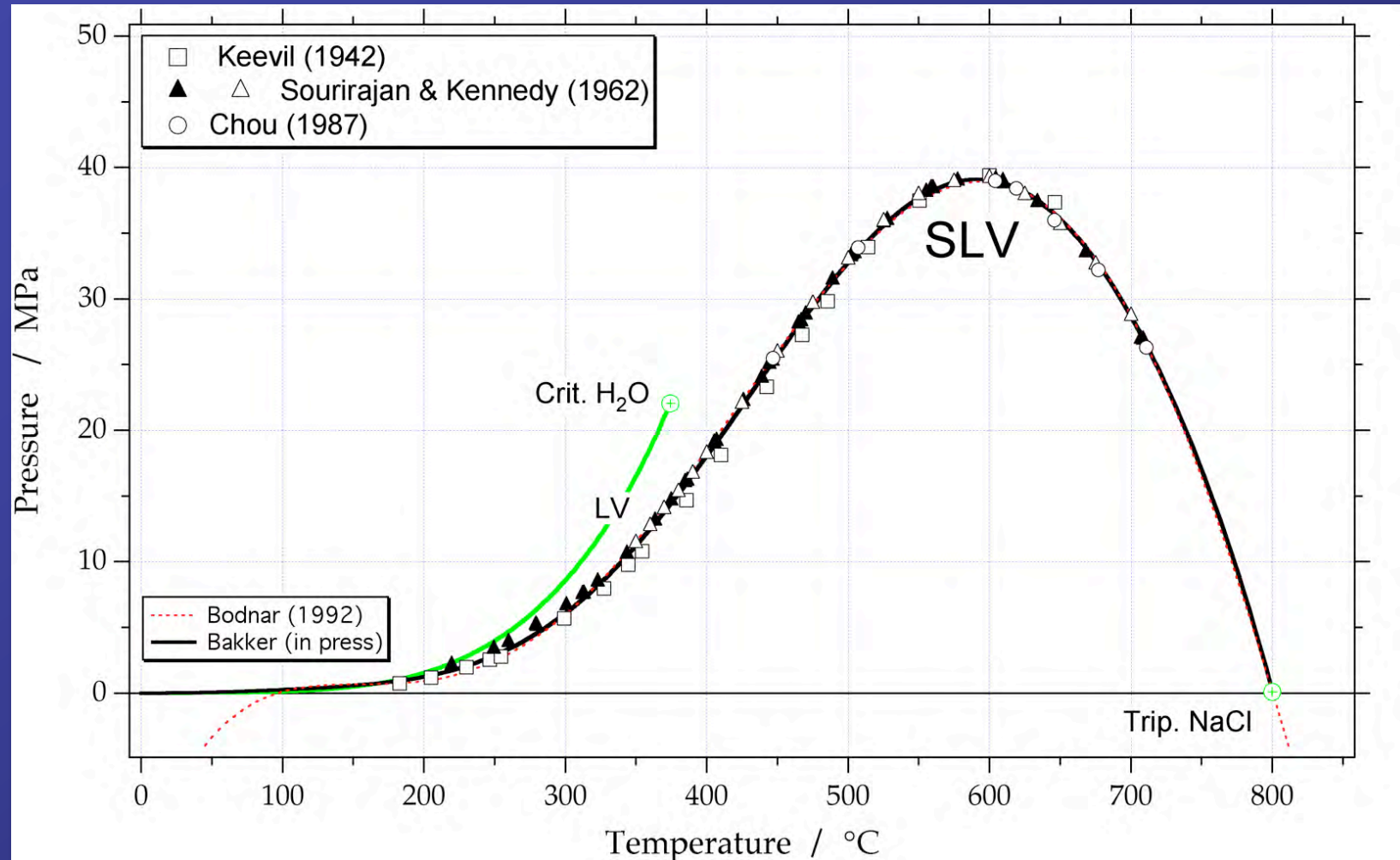


FIG. 17. Isochores calculated for  $x_{\text{NaCl}} = 0.3$  (upper figure) and  $0.4$  (lower figure) and different molar volumes ( $\text{cm}^3/\text{mol}$ ). The dotted line denotes solid-liquid saturation.



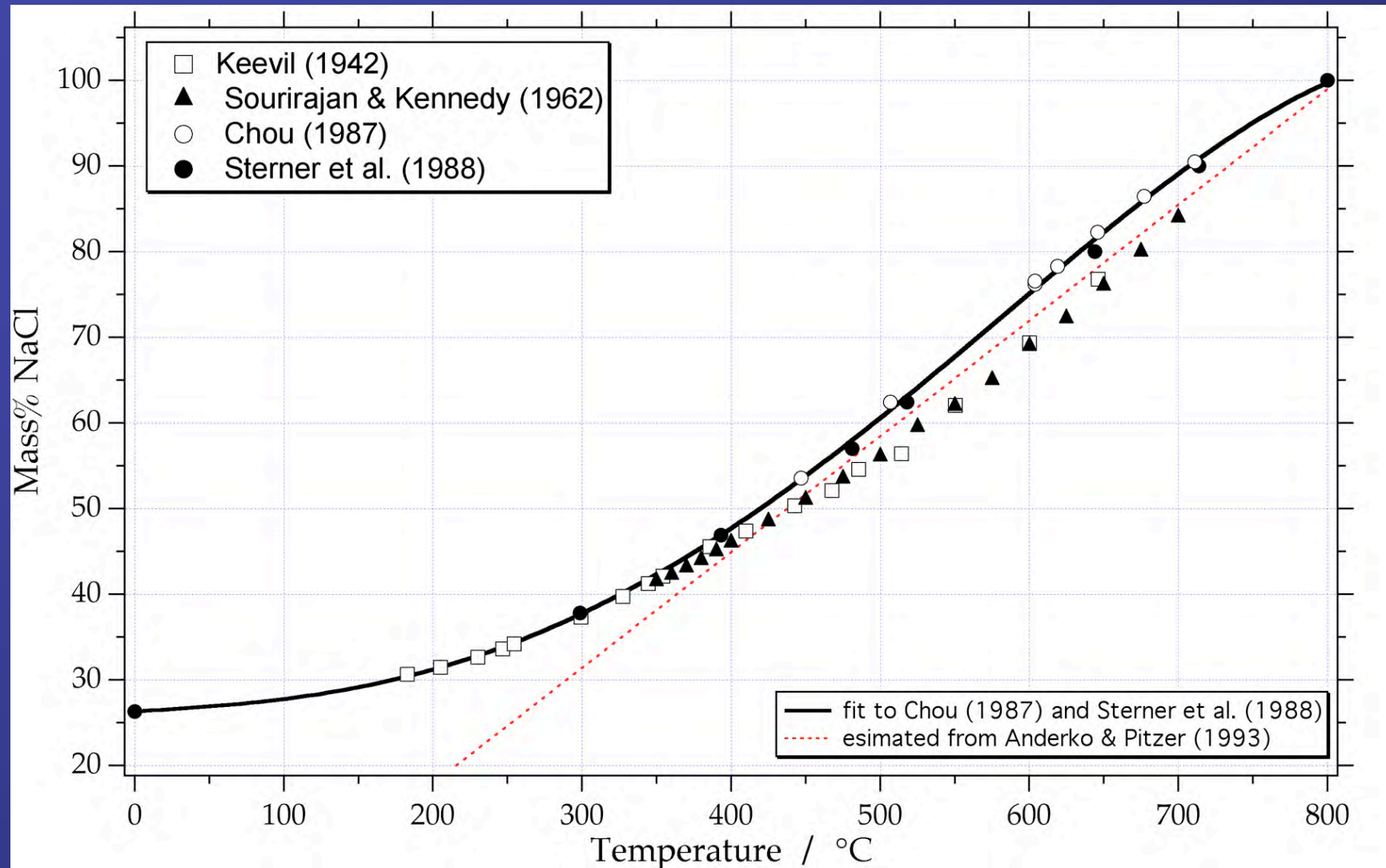
# Solid-Liquid-Vapour Curve

H<sub>2</sub>O-NaCl

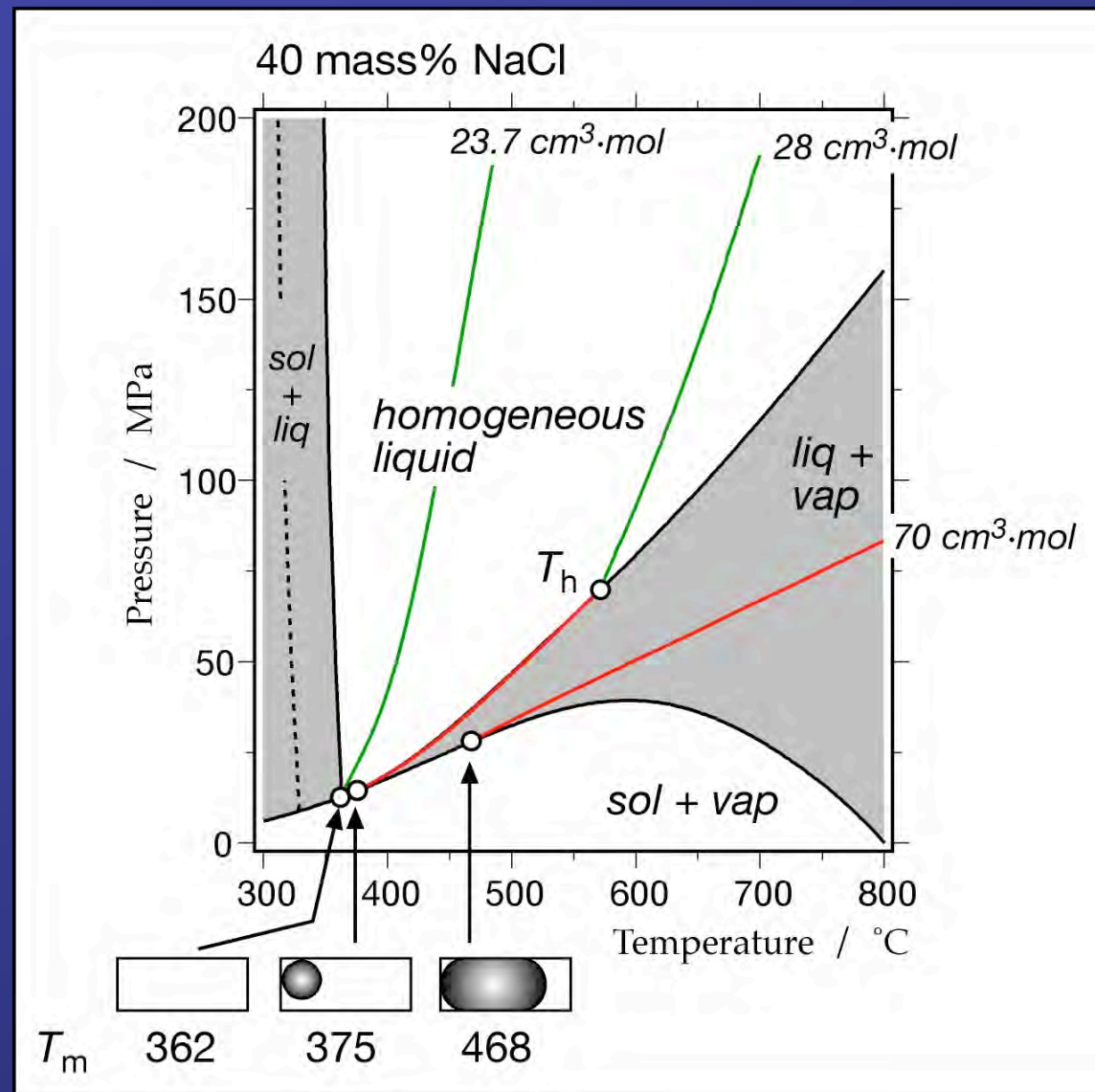


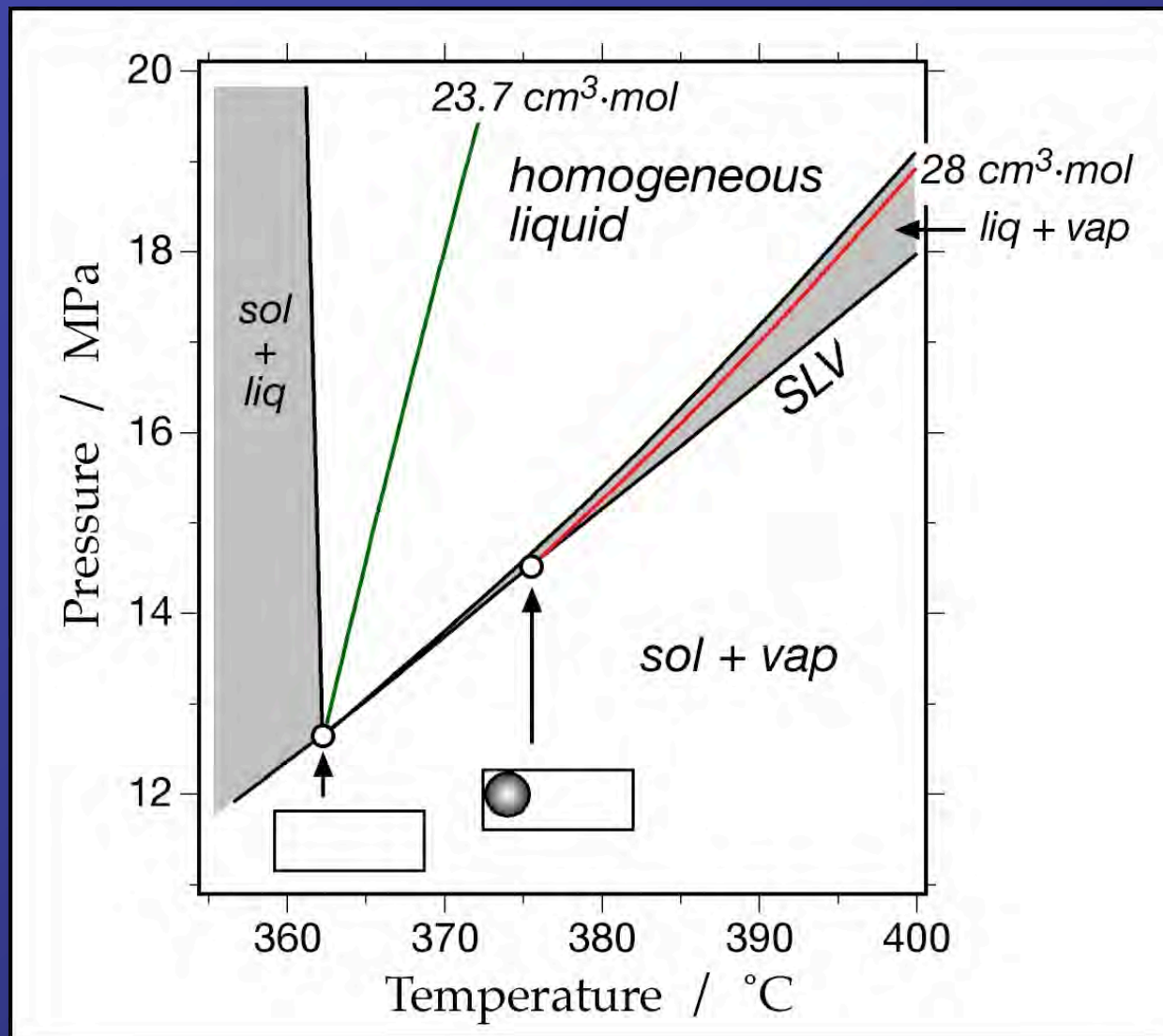
# Solid-Liquid-Vapour Curve

H<sub>2</sub>O-NaCl

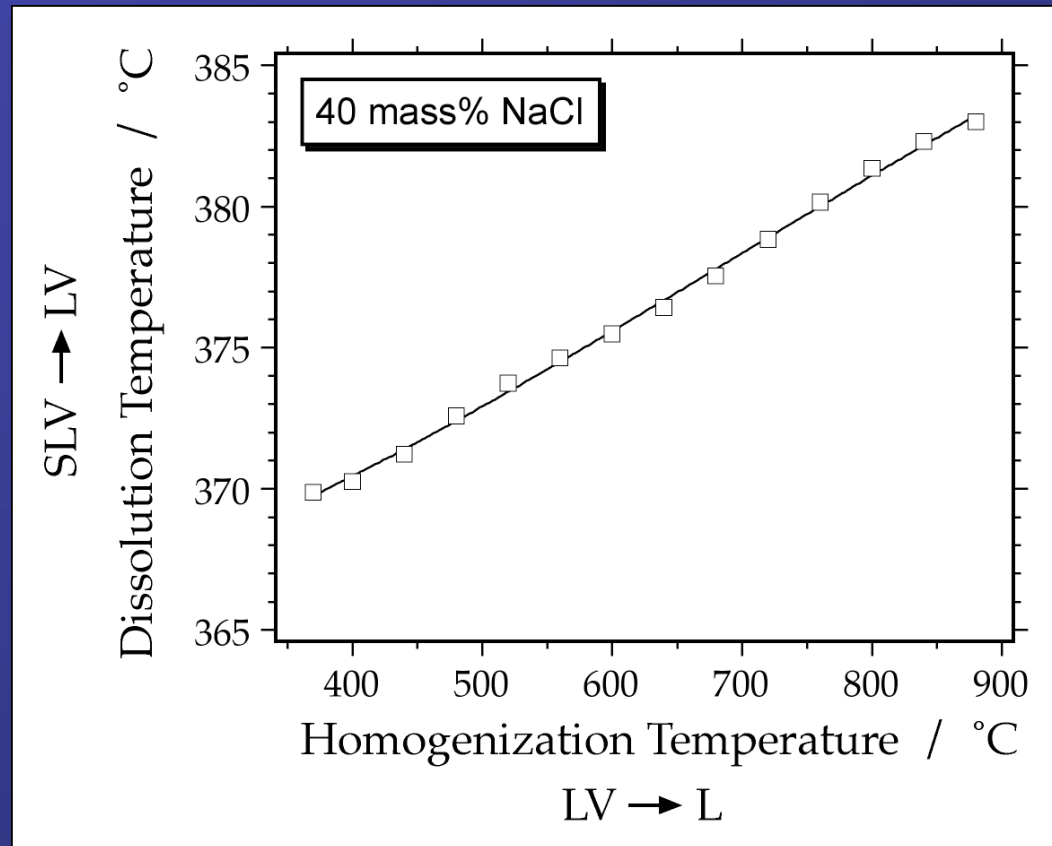






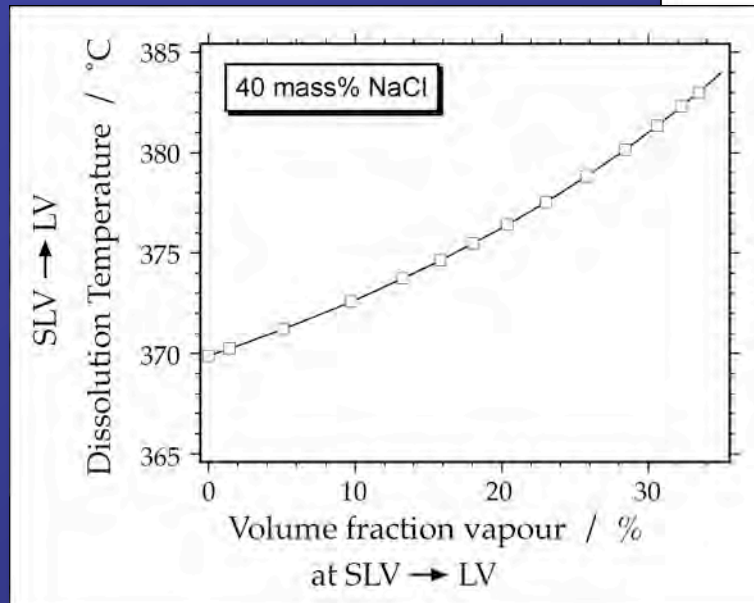


# Relationship $T_m - T_h$ at constant bulk composition

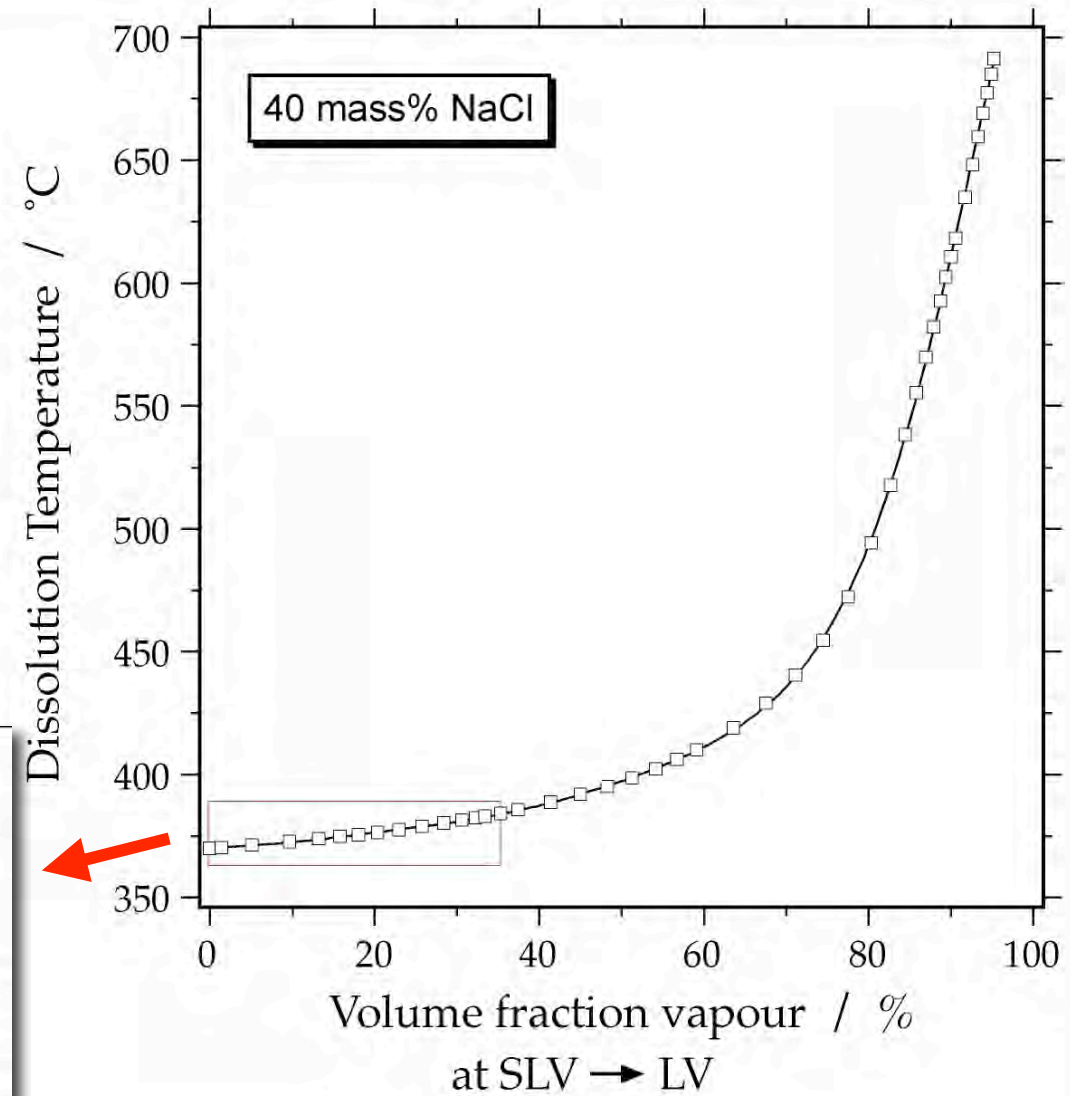


# Correlation

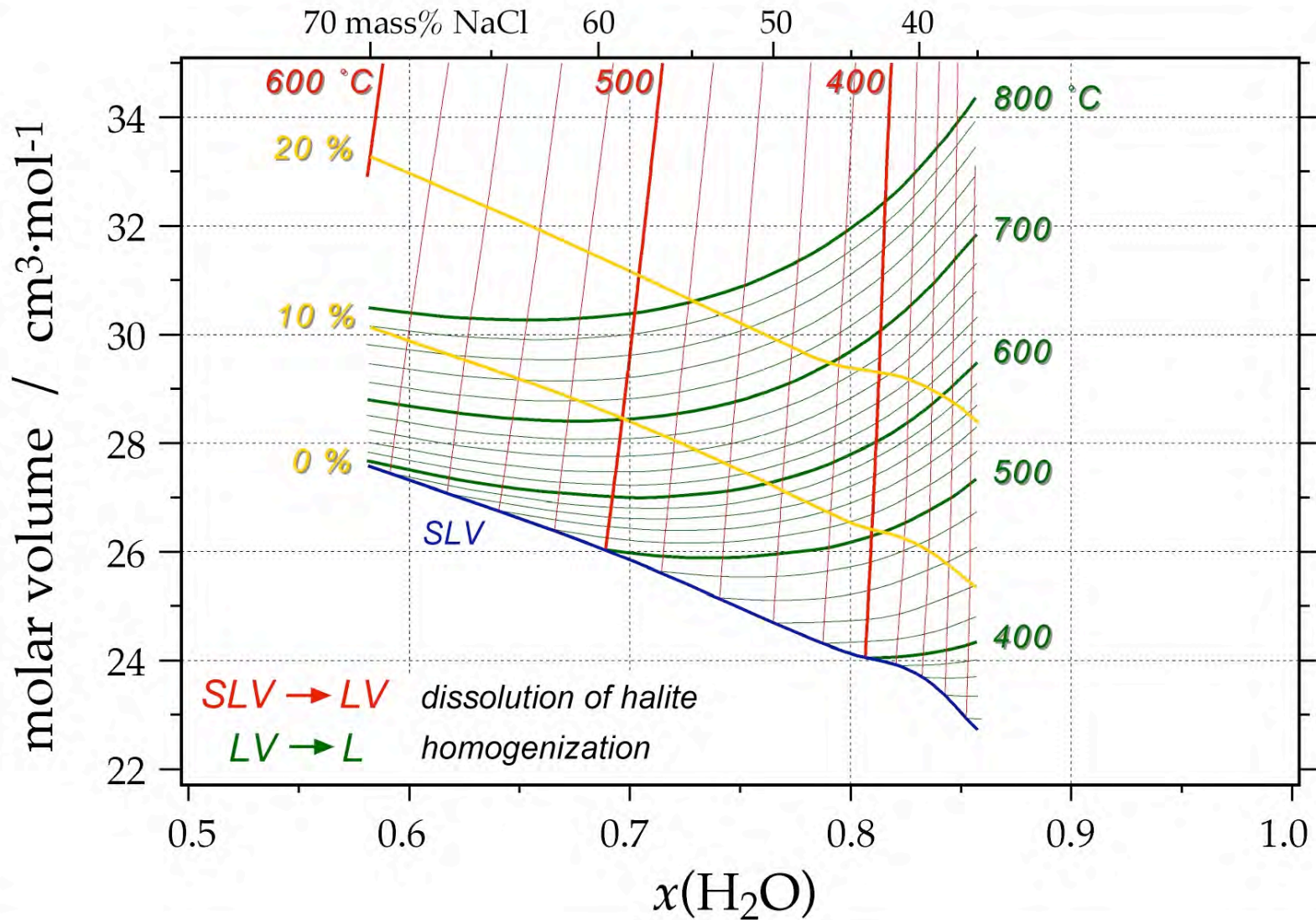
$$T_m - \varphi^{\text{vap}}$$



SLV → LV

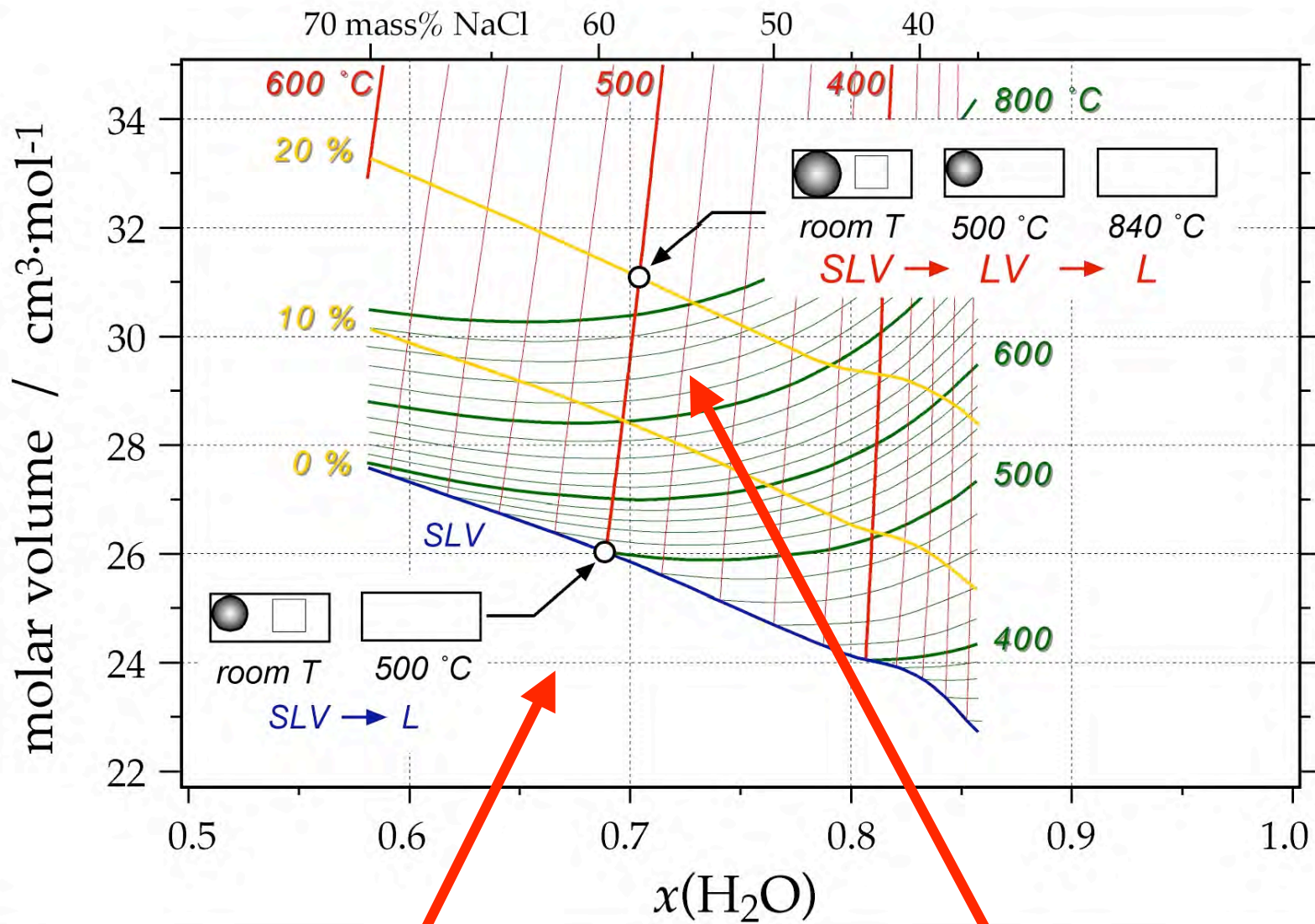


# The power of a V-x diagram



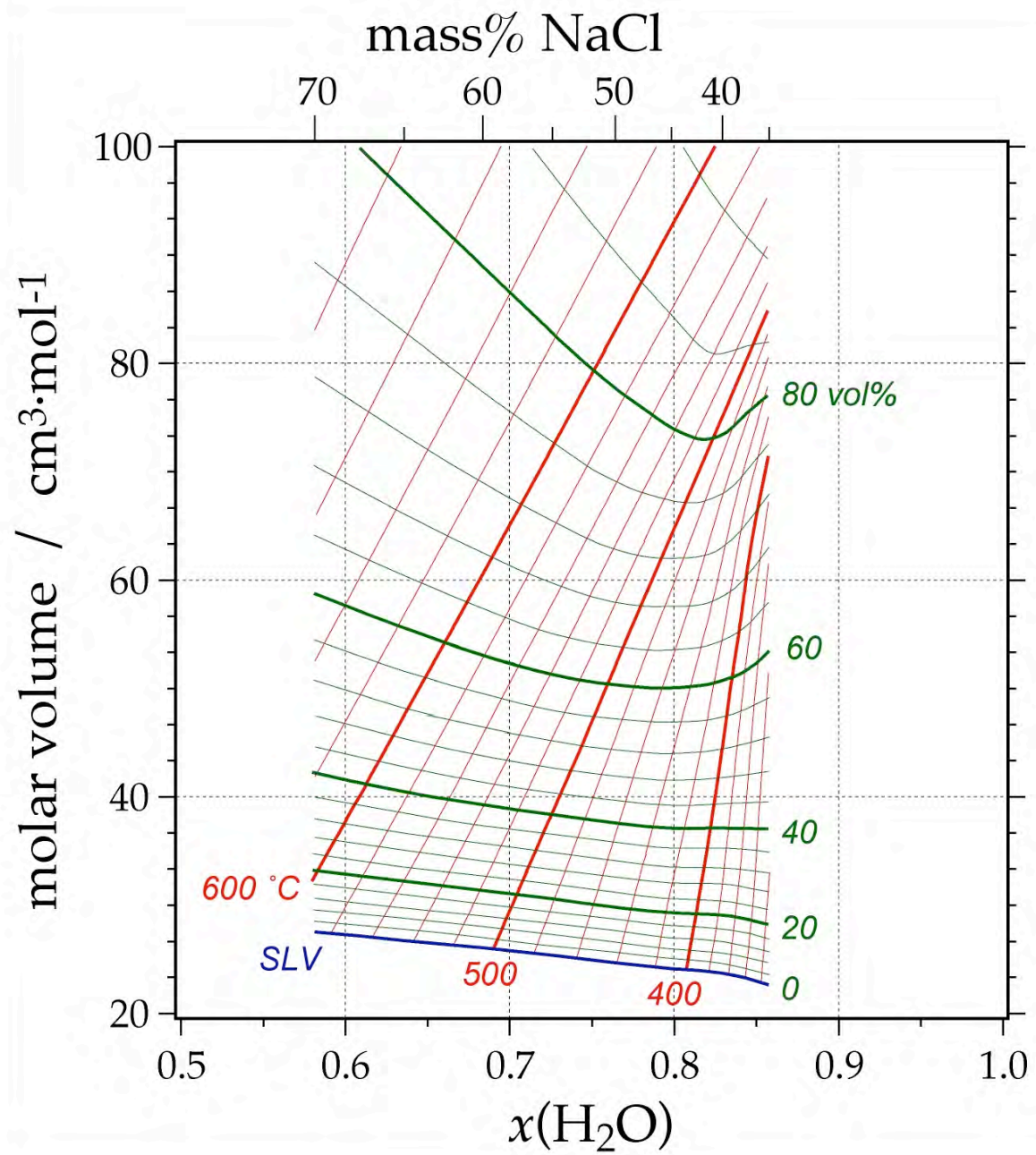


# Example



59.8 mass% NaCl

57.5 mass% NaCl



# Conclusions

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