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Marie-Camille Caumon, Jérôme Sterpenich, Aurélien Randi, Jacques Pironon. Experimental mutual solubilities of CO₂ and H₂O in pure water and NaCl solutions. GHGT-13, Nov 2016, Lausanne, Switzerland. 2016. hal-01409102

HAL Id: hal-01409102

<https://hal.science/hal-01409102>

Submitted on 5 Dec 2016

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Experimental mutual solubilities of CO₂ and H₂O in pure water and NaCl solutions.

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OBJECTIVES & METHODS

Context

Prevision of the effects of CO₂ injection in saline aquifers:

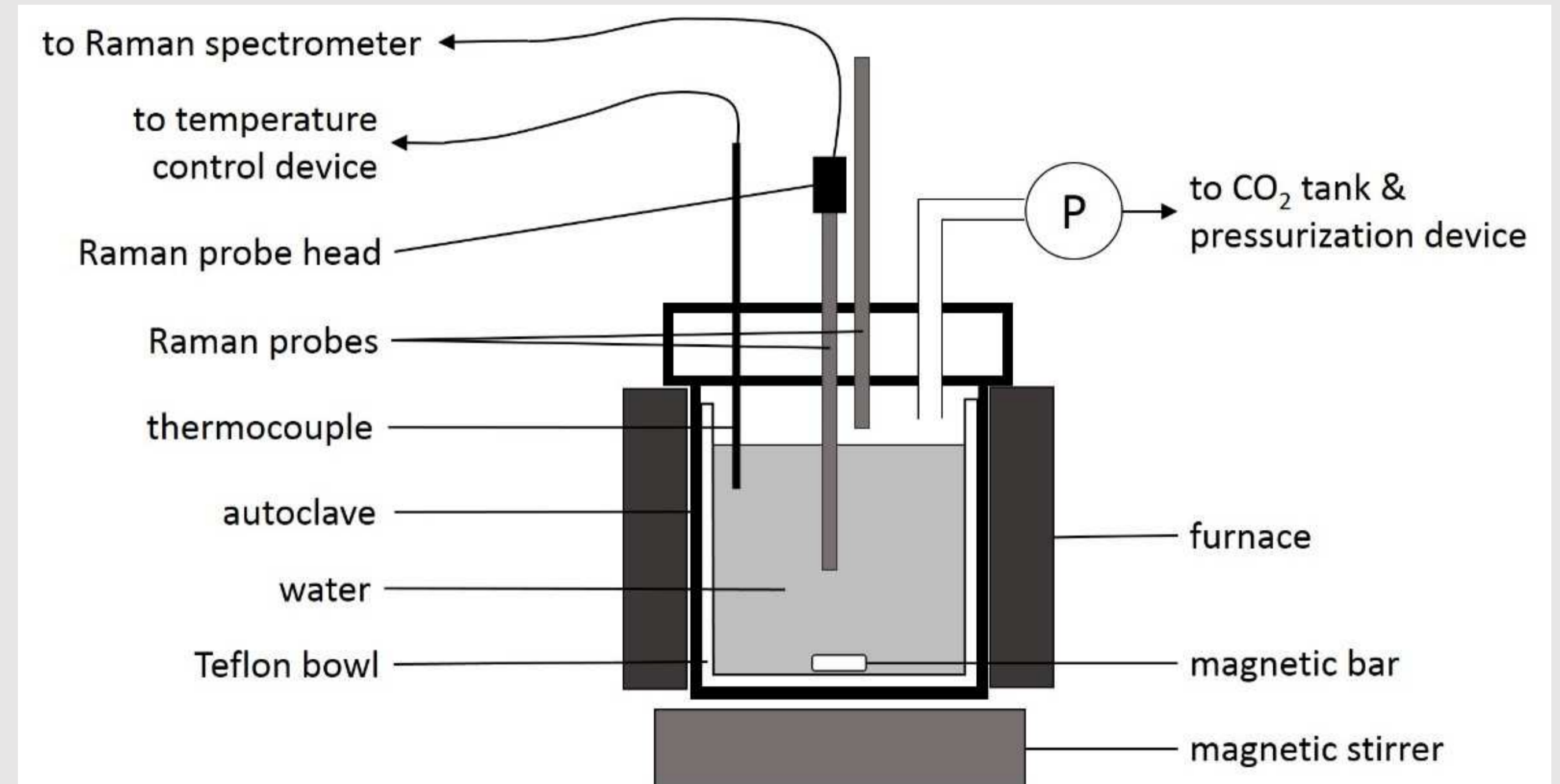
- Lack of solubility data in saline media at high *PT*.
- Lack of H₂O solubility data in the CO₂-rich phase.

Objectives

Acquisition of solubility data in saline media by *in situ* Raman techniques at 100 °C, 0-200 bar, 0-2 M NaCl.

Methods

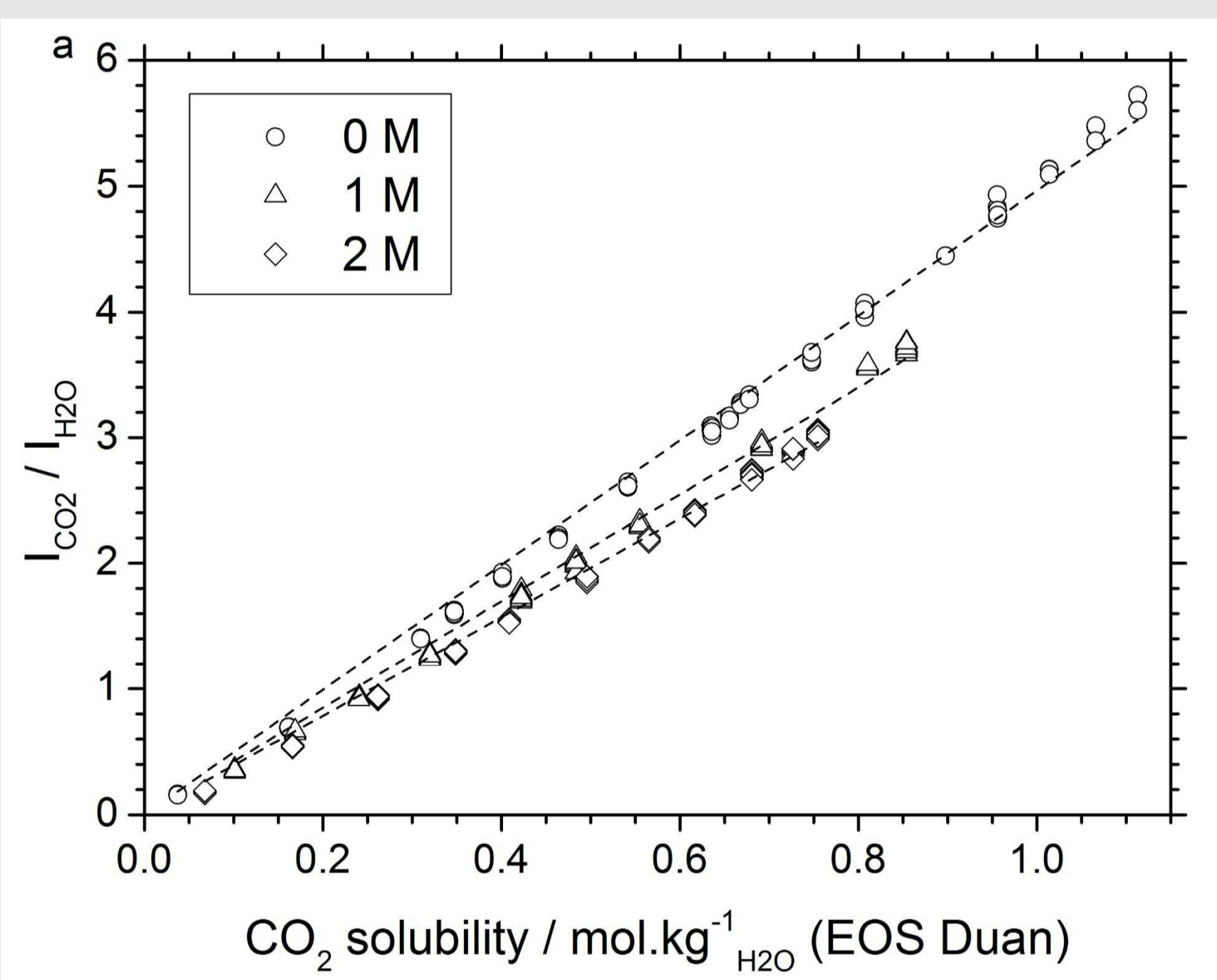
Two Raman probes are connected to a 2L autoclave. Raman spectra are continuously acquired in both vapor and liquid phases while CO₂ is injected.



The IMAGES setup: a *PT*-controlled autoclave connected to two Raman probes and spectrometer (Kaiser Optical Sys.)

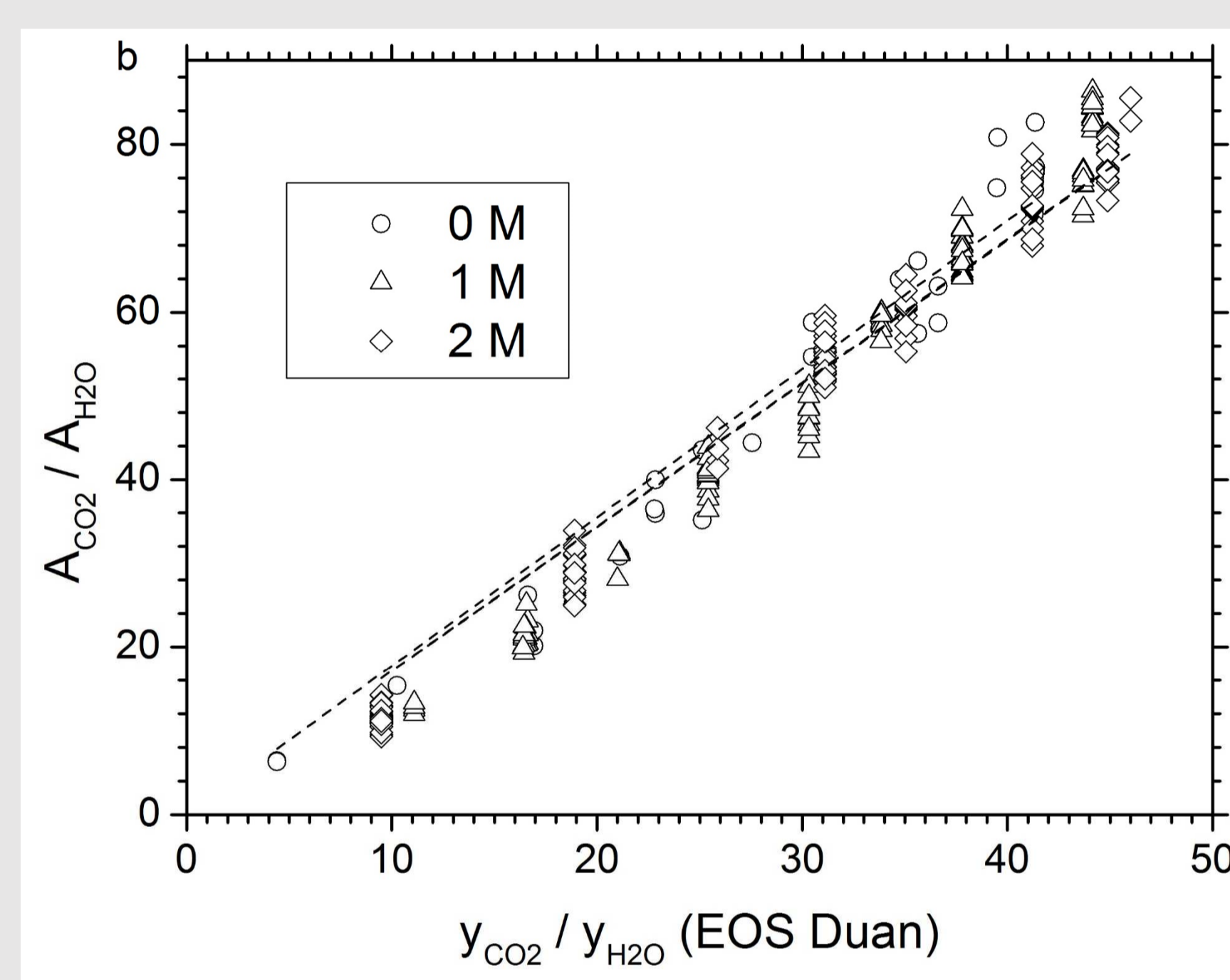
RESULTS

CO₂ solubility vs. salinity



Raman intensity ratios vs. predicted solubility

H₂O solubility in the CO₂-rich phase



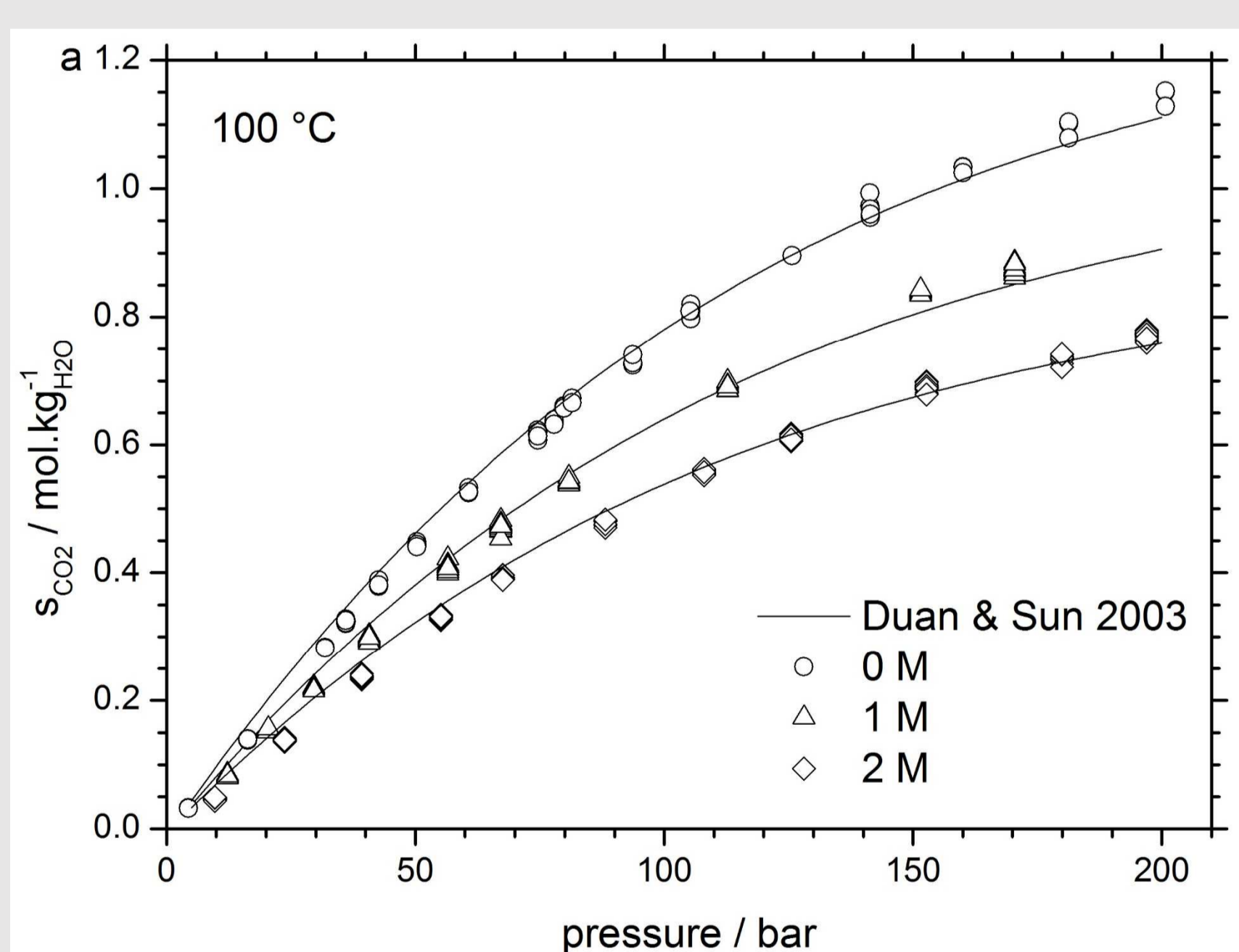
Raman area ratios vs. predicted molar fraction ratios

Method performance

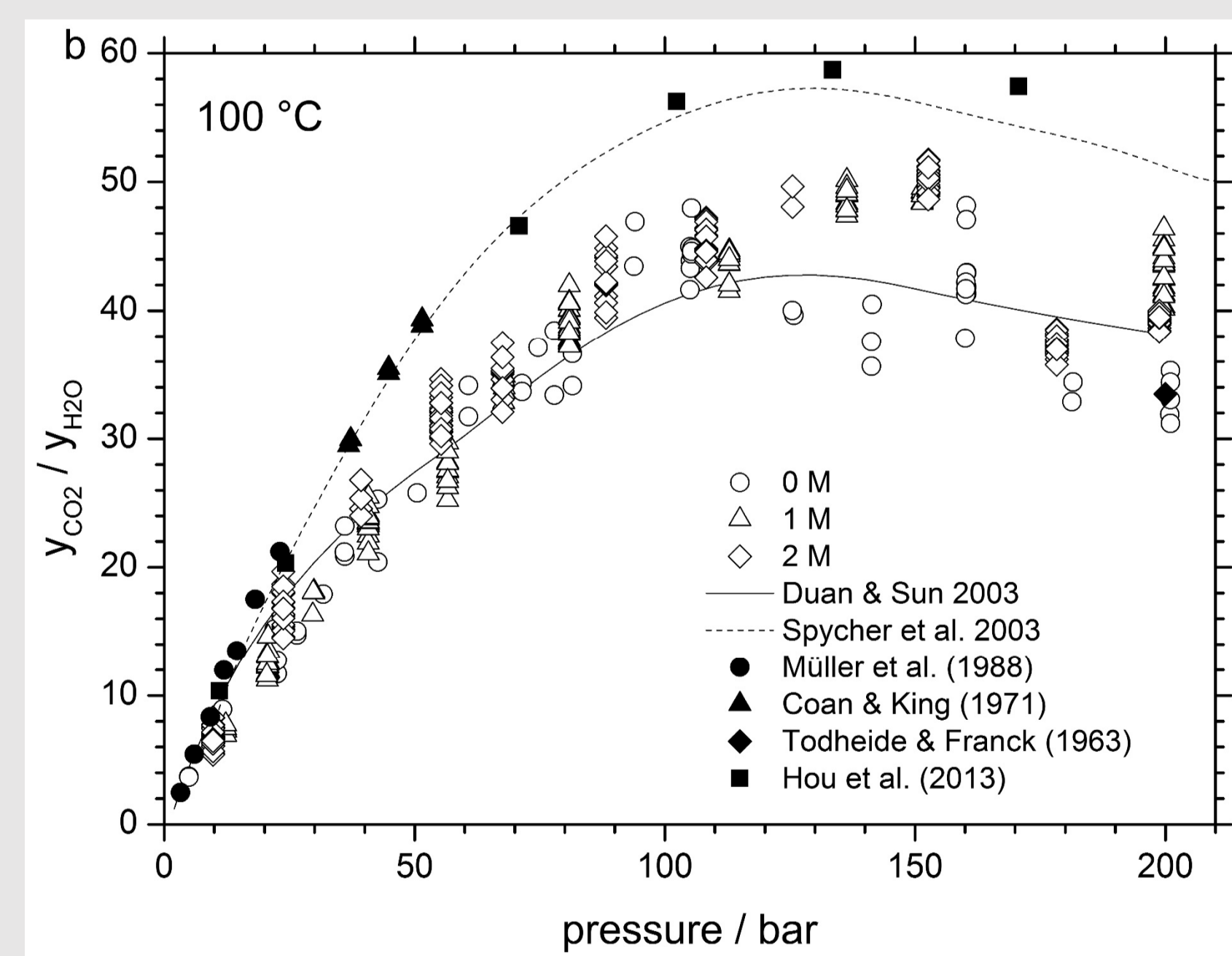
- A correlation is found between Raman data and CO₂ solubility in saline water.
- Salinity affects the calibration curves in the H₂O-rich phase.
- A correlation is found between Raman data and molar fraction ratios in the CO₂-rich phase.
- This correlation does not depend on salinity.

Comparison with thermodynamic models

- Experimental CO₂ solubility in saline water & calculated values (EOS Duan & Sun, 2003) perfectly fit.
- Measured H₂O solubility in CO₂ ranges between the two tested models (Duan & Sun, 2003 & Spycher et al., 2003) and other exp. data.



Experimental & modeled CO₂ solubility vs. pressure



Experimental & modeled molar fraction ratios vs. pressure

CONCLUSION

The determination of **mutual solubilities of H₂O and CO₂** is essential for the modelling and understanding of CO₂ geological storage in deep saline aquifer. Here it is demonstrated that the IMAGES experimental device, coupled to a Raman spectrometer, makes possible to produce **new solubility data at 100 °C up to 200 bar, in the presence of NaCl**. Moreover, it is now possible to measure **H₂O solubility data in the CO₂-rich phase** where data are very sparse. In this last case, previsions may be improved by the optimization of the experimental device.