INTRODUCTION

The objective is to understand better the mechanisms of formation of the Naxos domes (Greece). Textures of zircon present successive dissolution and precipitation cycles. One idea to explain these cycles is a crustal scale convection followed by diapirism [1]. Which parameters drive this phenomenon? Can we use computational fluids dynamics (CFD) tools to confirm or deny this idea?

POLYDIAPIRS IN A THREE-LAYER SYSTEM

2D simulation of a three-layer system varying viscosity and density ratio:

⇒ Qualitative agreement with numerical results of Weinberg and Schmeling [5] (finite-difference)
⇒ Quantitative agreement with the linear stability approach [6]

- Case I: \( \rho_3 < \rho_1 < \rho_2 \), \( \mu_1 / \mu_2 = 100 \)
- Case II: \( \rho_3 < \rho_2 < \rho_1 \), \( \mu_1 / \mu_2 = 100 \)
- Case III: \( \rho_3 < \rho_2 < \rho_1 \), \( \mu_1 / \mu_2 = 200 \)

We use 2 parallel CFD softwares JADIM [3], Fortran, in-house code) and OpenFOAM [4], C++, open-source code) both based on a Finite-Volume and a Volume-Of-Fluid method.

Equations solved (mass (1), momentum (2), energy (3), phase fraction (4)) where \( \rho \) and \( \mu \) are a function of \( C_i \) and \( T \) (i : phase volume fraction):

\[
\nabla \cdot \mathbf{U} = 0 \tag{1}
\]

\[
\frac{\partial \rho \mathbf{U}}{\partial t} + \nabla \cdot (\rho \mathbf{U} \mathbf{U}) = -\nabla P + \rho \mathbf{g} + \nabla \cdot (\mu (\nabla \mathbf{U} + (\nabla \mathbf{U})^T)) \tag{2}
\]

\[
\frac{\partial C_i}{\partial t} + \mathbf{U} \cdot \nabla C_i = 0 \tag{4}
\]

CONCLUSION AND FUTURE WORK

⇒ CFD codes well suited
⇒ Work in progress:
  • Increasing the complexity of the fluids rheology
  • Convective vs. diapirism?
  • Comparison with a real case (Naxos domes)

REFERENCES