ORIGIN AND CIRCULATION OF FLUIDS IN SUBDUCTION ZONES

K. Rajic[1,2*], H. Raimbourg[1], V. Famin[3], C. Lerouge[2], S. Scaillet[1], D. M. Fisher[4], K. Morell[5]

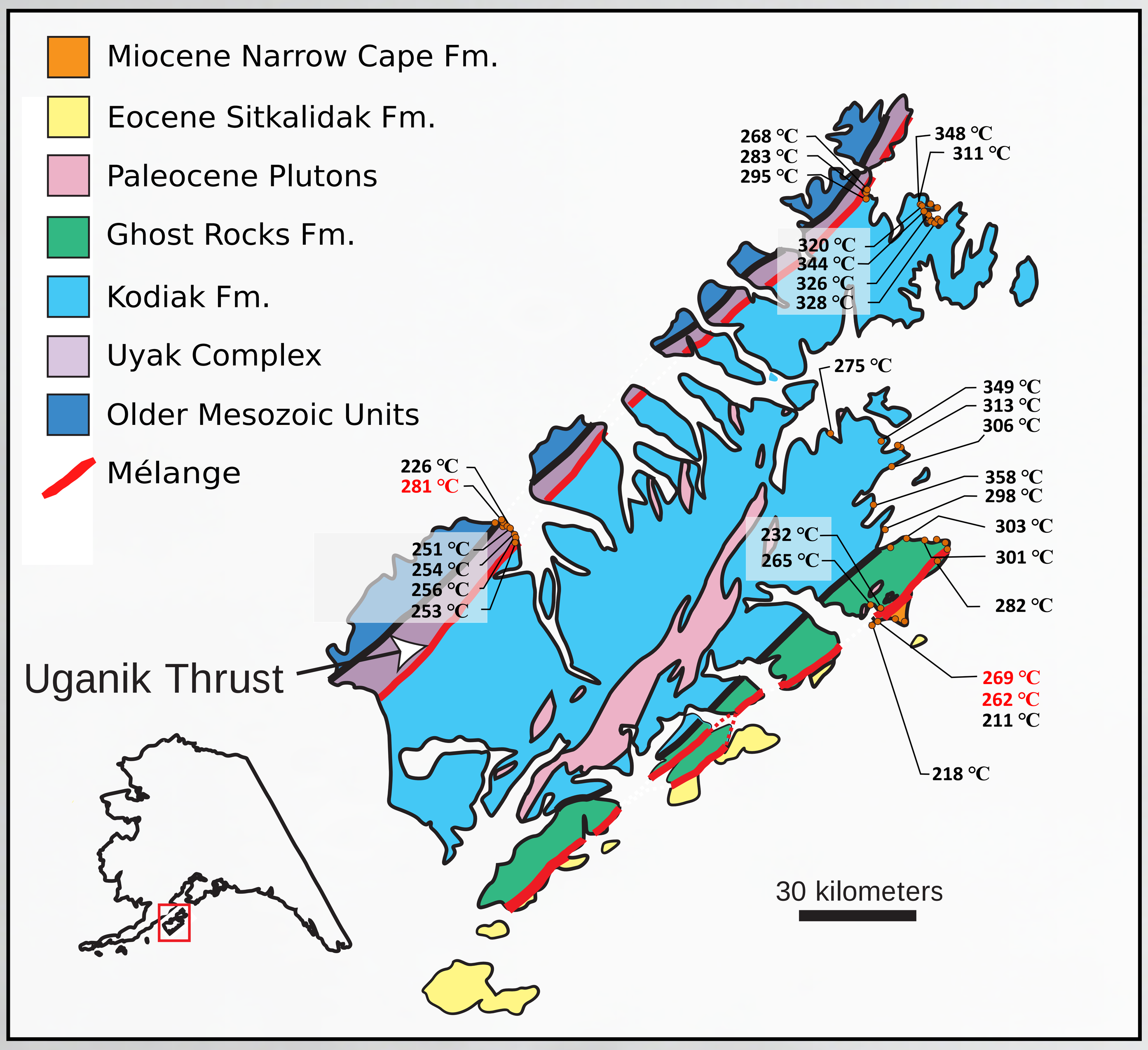
[1]*Institut des Science de la Terre d'Orléans (ISTO), 1a rue de la F érollerie, 45071 Orléans Cedex 1, France*
[2]*Bureau de recherche géologiqueet miniére (BRGM), 3 Avenue Claude Guillemin, 45100 Orléans, France*
[3]*Laboratoire Géosciences Réunion, Université de La Réunion, IPGP, Sorbonne Paris Cité, UMR 7154 CNRS, Saint-Denis, La Réunion, France*
[4]*Department of Geosciences, Pennsylvania State University, University Park, PA 16801, USA*
[5]*Department of Earth Science, University of California, Santa Barbara, CA 93106, USA*

**Corresponding author: kristijan.rajic@univ-orleans.fr*

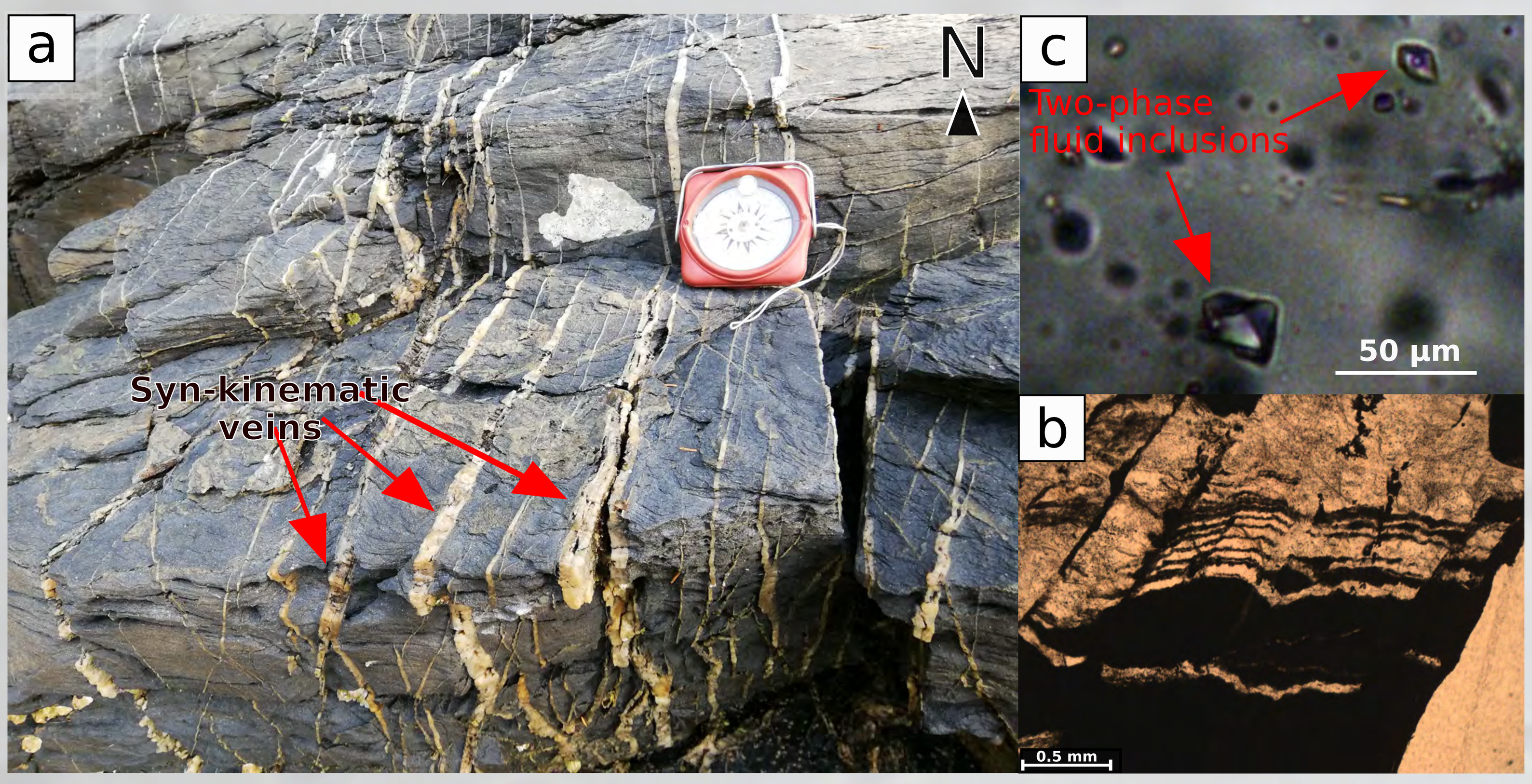
Introduction:

To understand deformation processes and geochemical cycling in subduction zones is a main interest in geosciences because of high seismic risks in these zones. The fluids play a major role in deformation mechanisms and consequently in the last few decades the role of fluids has been studied intensively. Three different paleo-accreted terraines: Kodiak archipelago, Shimanto belt in Japan and internal domains in the Alps are characterized by high fluid flow recorded in syn-kinematic quartz veins which provide an opportunity to study circulated fluids entrapped within fluid inclusions (FI).

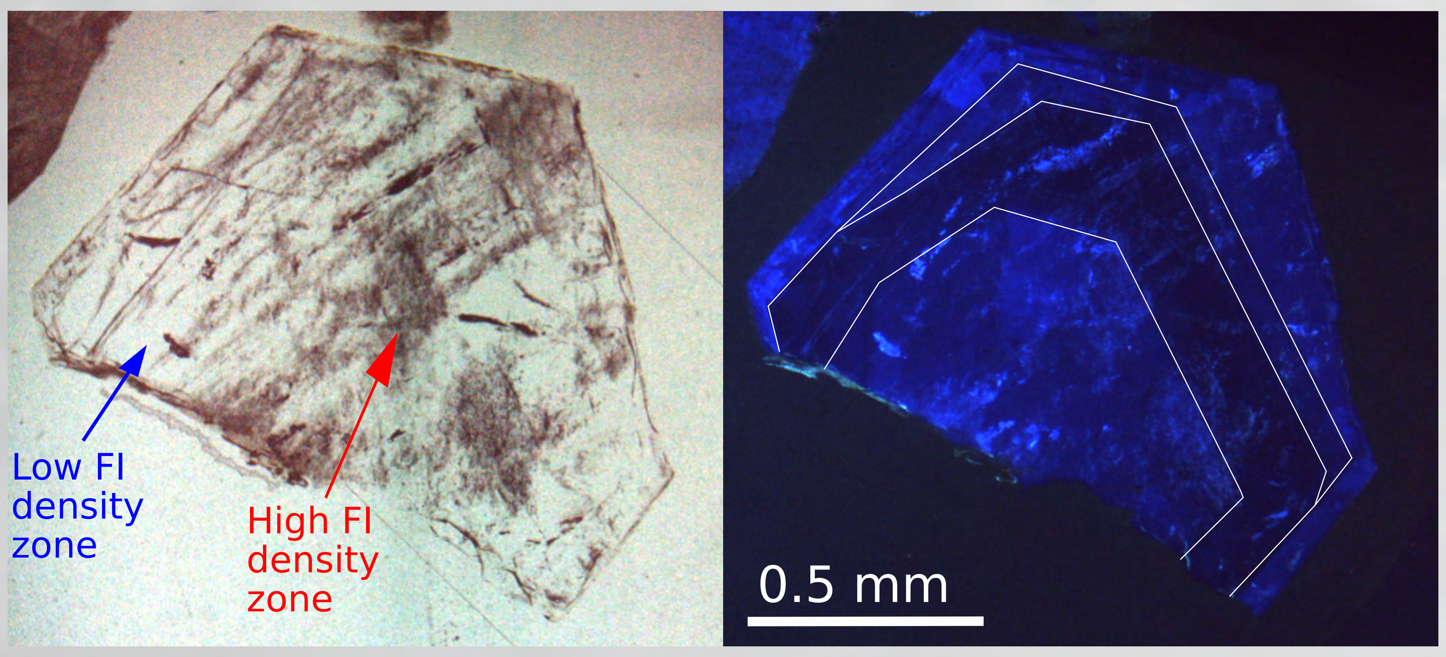
Main questions are:
(1) what is the composition of the circulating fluids;
(2) what is their source;
(3) the timing and spatial scale of circulation?



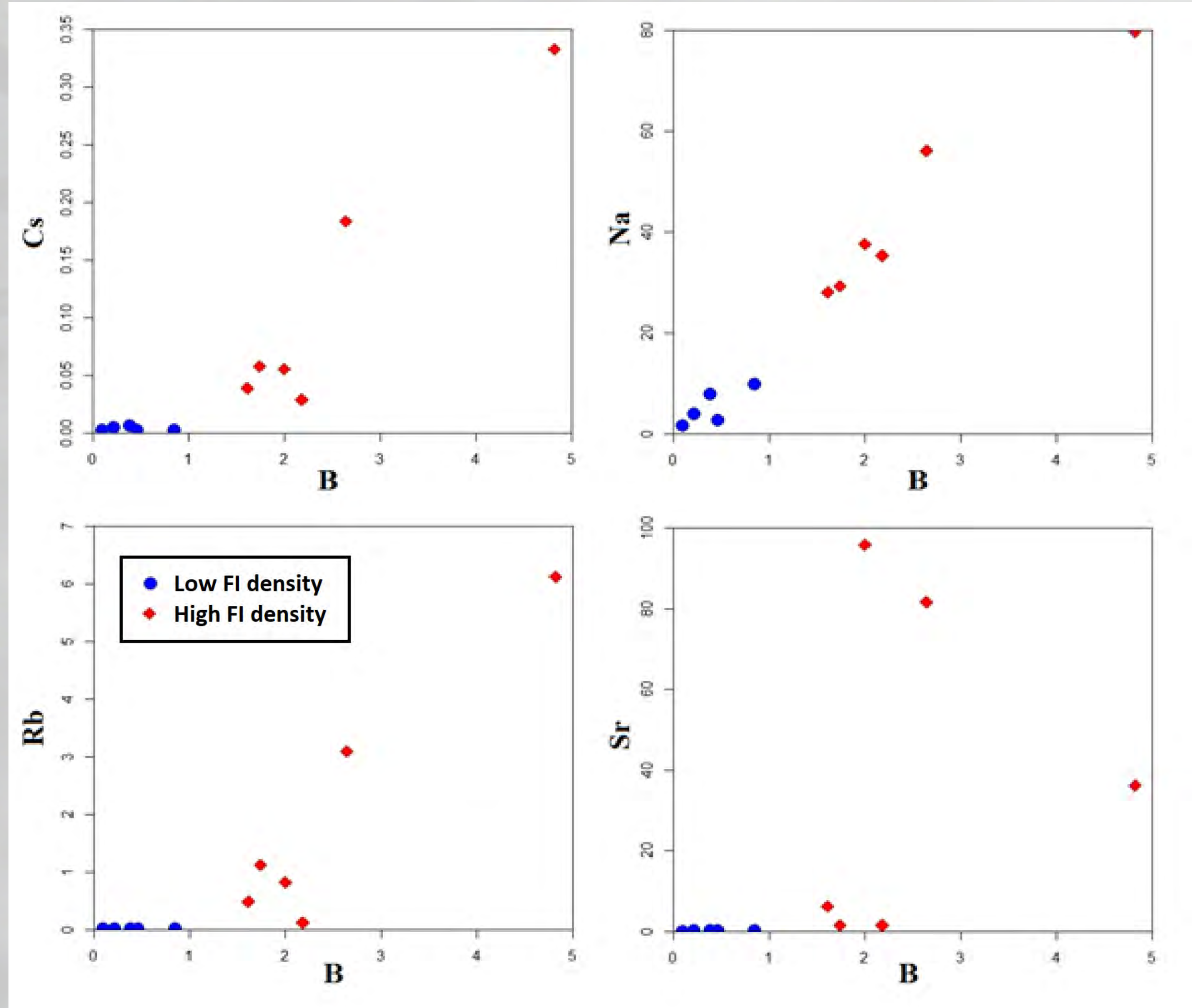
Simplified geological map of Kodiak AK with the temperature at which the samples have been exposed determinated by Raman spectroscopy of carbonaceous material (Beyssac, 2002).



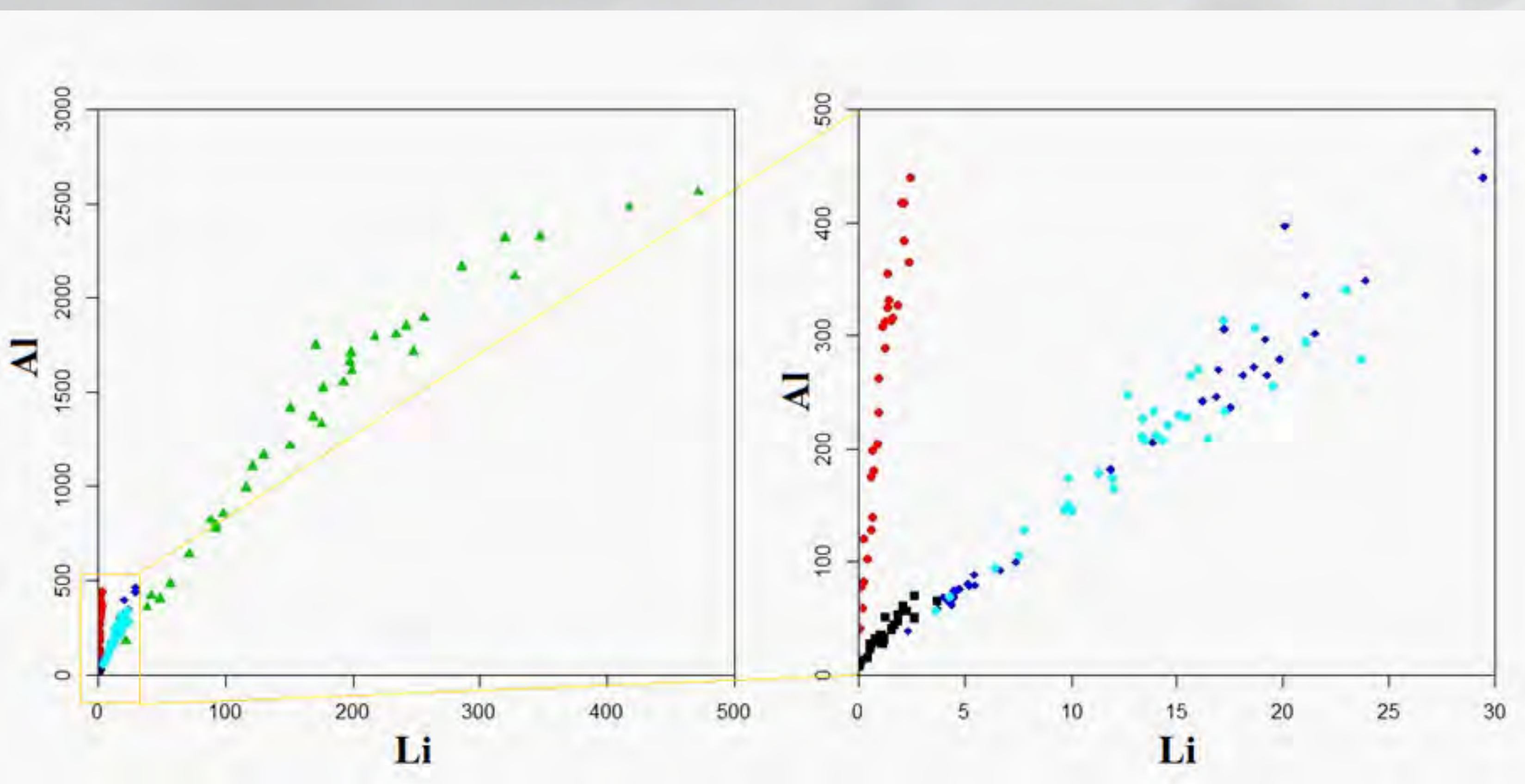
(a) *Syn-kinematic veins from Kodiak Formation.* **(b)** *Crack-seal texture, interpreted as the result of slow-slip events near the base of the seismogenic zone (Fisher and Brantley, 2014, Ujiie et al., 2018).* **(c)** *Two-phase fluid inclusions in quartz from syn-kinematic veins.*



Quartz microphotographs - on the left in transmitted light and on the right CL image. The grain shows different FI density zones which are not spatially associated with growth rims seen with CL color. The difference in CL color is associated with Al and Li concentrations. CL-blue quartz has higher concentrations than darker, CL-brown quartz.



LA-ICP-MS results for zones in quartz with different fluid inclusion density. Zones with high fluid inclusions density are enriched with B, Na and LILE (K, Cs, Sr, Rb).



Li vs. Al binary diagram for five different samples from the Flysch a Helminthoides show variations in Al/Li ratio, but very consistent ratios for each sample. Each color represents different sample.

Main focus of the work:

➡ Determination of the source and composition of the fluids which circulated through the prisms (internal vs. external)

➡ Determination of the timing of circulation by crush leaching *in vacuo* step heating technique combined with Ar-Ar noble gas method

➡ Fluid/rock interaction, mineral chemistry, mineral assemblages and their textures

➡ Compare results from all three studied prisms

➡ Constrain fluid circulation model combined with tectonic evolution of accretionary prism

Citing literature:

1. Beyssac, O., Goffe , B., Chopin, C. and Rouzaud, J. -N., (2002) Raman spectra of carbonaceous material in metasediments: a new geothermometer. J. Metamorph. Geol., 20, 859–871.
2. Fisher, D.M. and Brantley, S.L. (2014) The role of silica redistribution in the evolution of slipinstabilities along subduction interfaces: Constraints from the Kodiak accretionary complex, Alaska. J.Struct. Geol. 69B, 395-414.
3. Ujiie, K., Saishu, H., Fagereng, A., Nishiyama, N., Otsubo, M., Masuyama, H. and Kagi, H. (2018) Anexplanation of episodic tremor and slow slip constrained by crack -seal veins andviscous shear insubduction mélange. Geophys. Res. Lett. 45, 5371-5379.