<Paper review>

“Lithological control on the deformation mechanism and the mode of fault slip on the Longitudinal Valley Fault, Taiwan”

Marion Y. Thomas, Jean-Philippe Avouac, Jean-Pierre Gratier, Jian-Cheng Lee, 2014, *Tectonophysics*, **632**, 48–63.

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Outline

- Introduction
- Objective
- Methodology
- Results & Discussion
- Conclusion

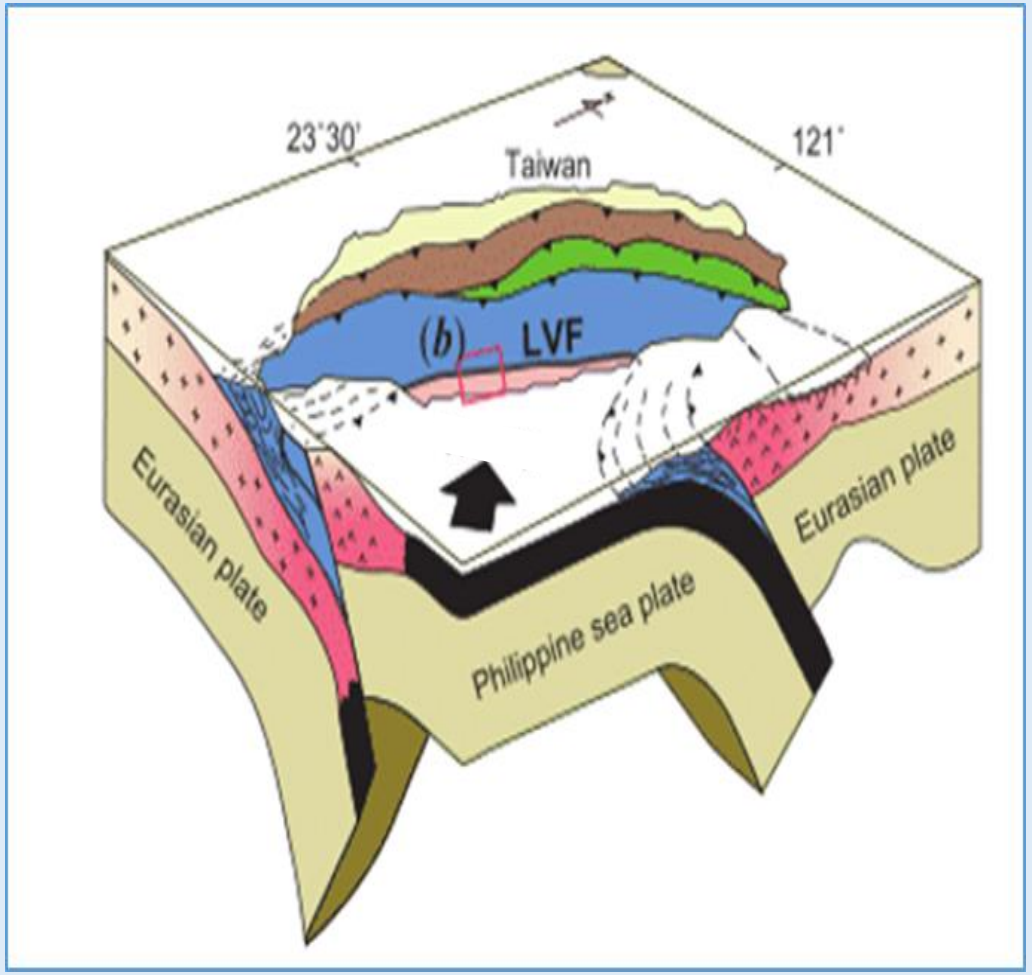
➢Introduction

- ✓The Longitudinal Valley Fault (LVF) in Taiwan is creeping at shallow depth.
- ✓LVF is bounded by the Lichi Mélange.
- ✓The LVF runs parallel to the East coast of Taiwan.
- ✓The LVF is an aseismic slip.
- ✓One of the major active faults.

The Longitudinal Valley fault is an east dipping, obliquely slipping reverse fault.

South China Sea Part of (Eurasian plate) beneath the Philippine Sea Plate.

9 cm/yr convergence rate between the Eurasian and the Philippine Sea Plate.



➢Objective

➢To investigate the potential factors that favor aseismic slip on the LVF.

- ✓Field investigations
- ✓Analysis of samples collected at the outcrops and from drill cores.
- ✓Based on structural and microstructural analysis of the various formations along the LVF and of rocks from the fault zone.

Regional tectonic setting of the Longitudinal Valley Fault:

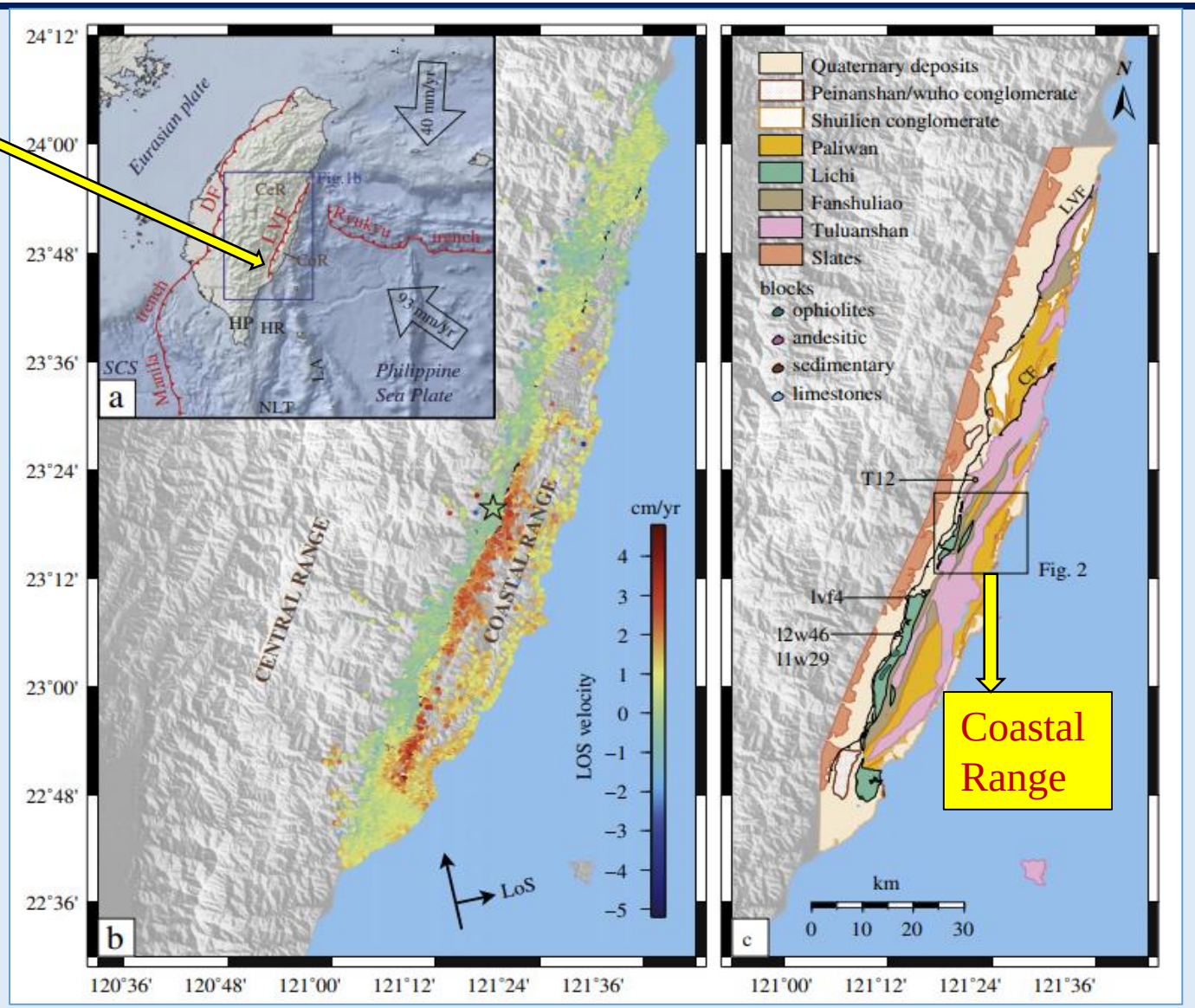
The LVF is an east dipping, obliquely slipping reverse fault.

LoS (Mean line of sight) Velocity (in cm/yr) Around LVF.

Persistent Scatter (PS) Technique

PALSAR Advanced Land Observing Satellite (ALOS) data acquired between 1/29/2007 and 6/2/2010.

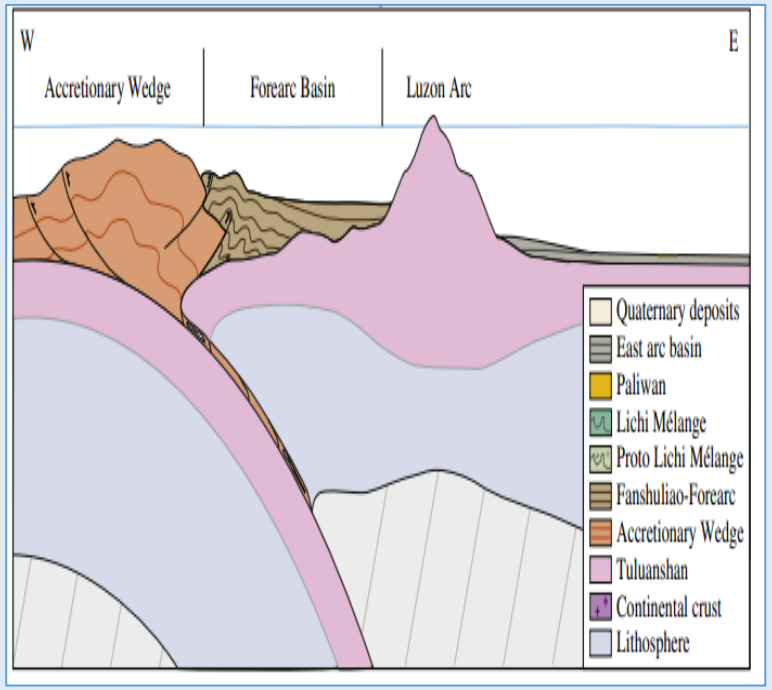
LoS velocity field (positive toward the satellite) along the LVF. The discontinuity is evidence of aseismic slip.



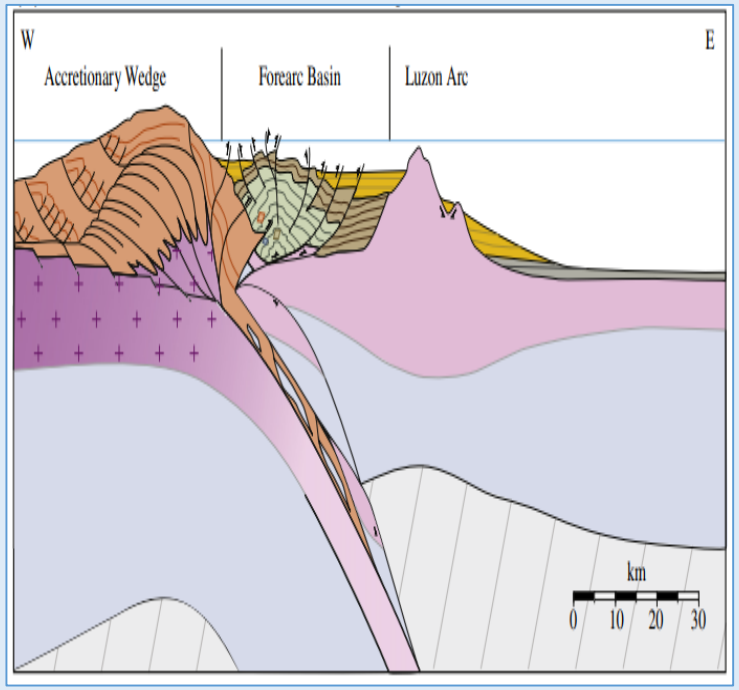
Different Collisional Stages:

- South China collided with the Luzon arc as a result of the subduction of the South China Sea beneath the Philippine Sea Plate.

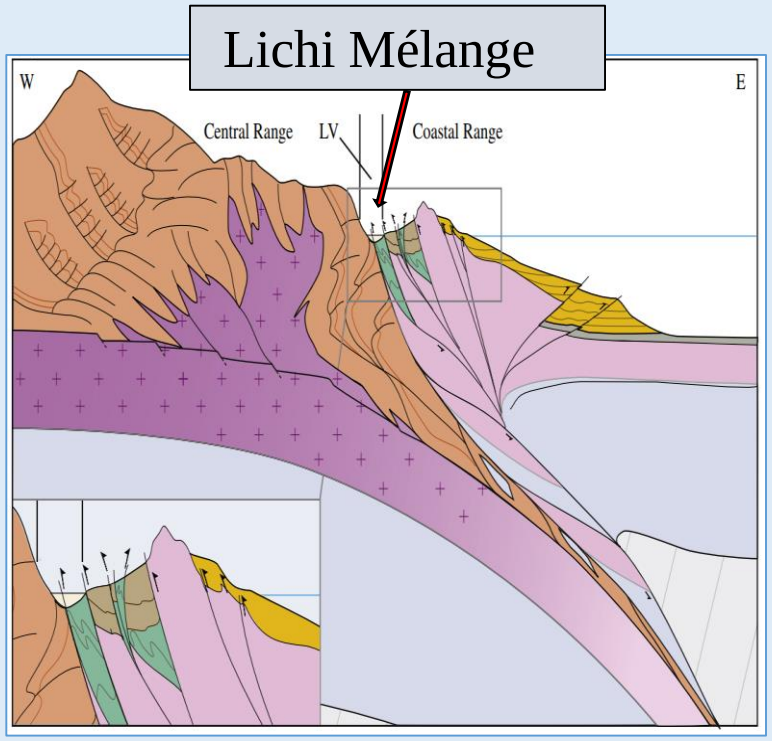
12 Ma : Intra-Oceanic Subduction Stage (or present south of 21° N).



5 Ma : Initial Arc-Continent Collision (or present 22º 2′N).



Present : Advanced Arc-Continent Collision (or present north of 23º N)

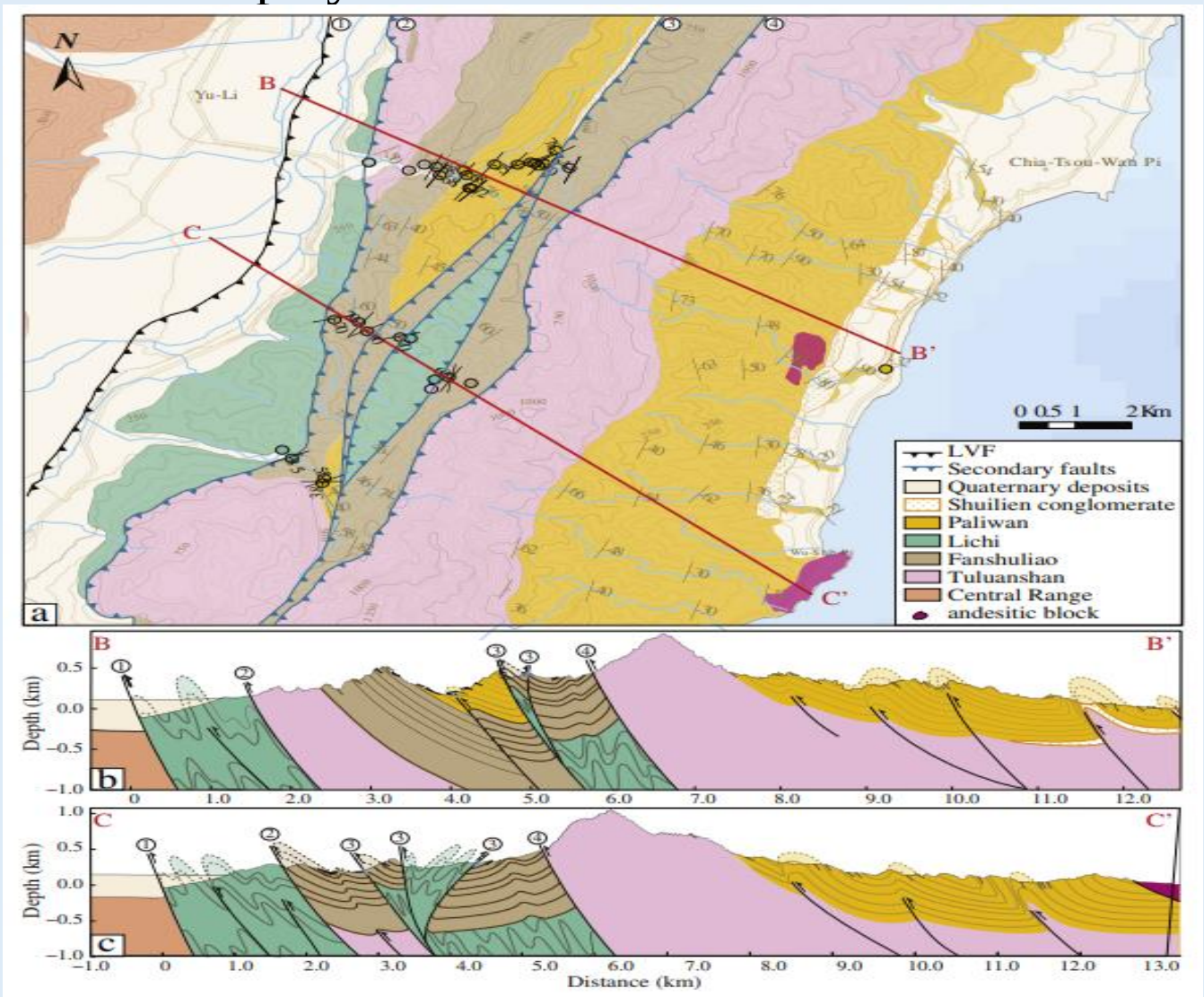


Geological map and cross-sections for the central part of the LV, Taiwan:

- ✓BB and CC show locations of cross-sections displayed.
- ✓ Subsurface Cross-sections.

Relationship of lichi mélange to other formation.

Collected samples (73 total) for chemical and micro-structural analysis (80 thin sections)



➢Methodology:

BSE is a microscopy technique that uses electrons reflected backward from a sample to create high-resolution images.

BSE (Backscattered Electron Imaging).

SEM (Scanning Electron Microscopy)

Energy-Dispersive X-ray Spectroscopy (EDS)

Electron Probe Micro-analyzer

It is used for imaging the microstructure of fault rocks and mineral phases.

BSE & EDS are techniques commonly used in SEM.

EDS is a Spectroscopic technique used in SEM.

Lichi Mélange formation:

✓Contact between the Lichi Mélange and the Fanshuliao formation, near Fuli.

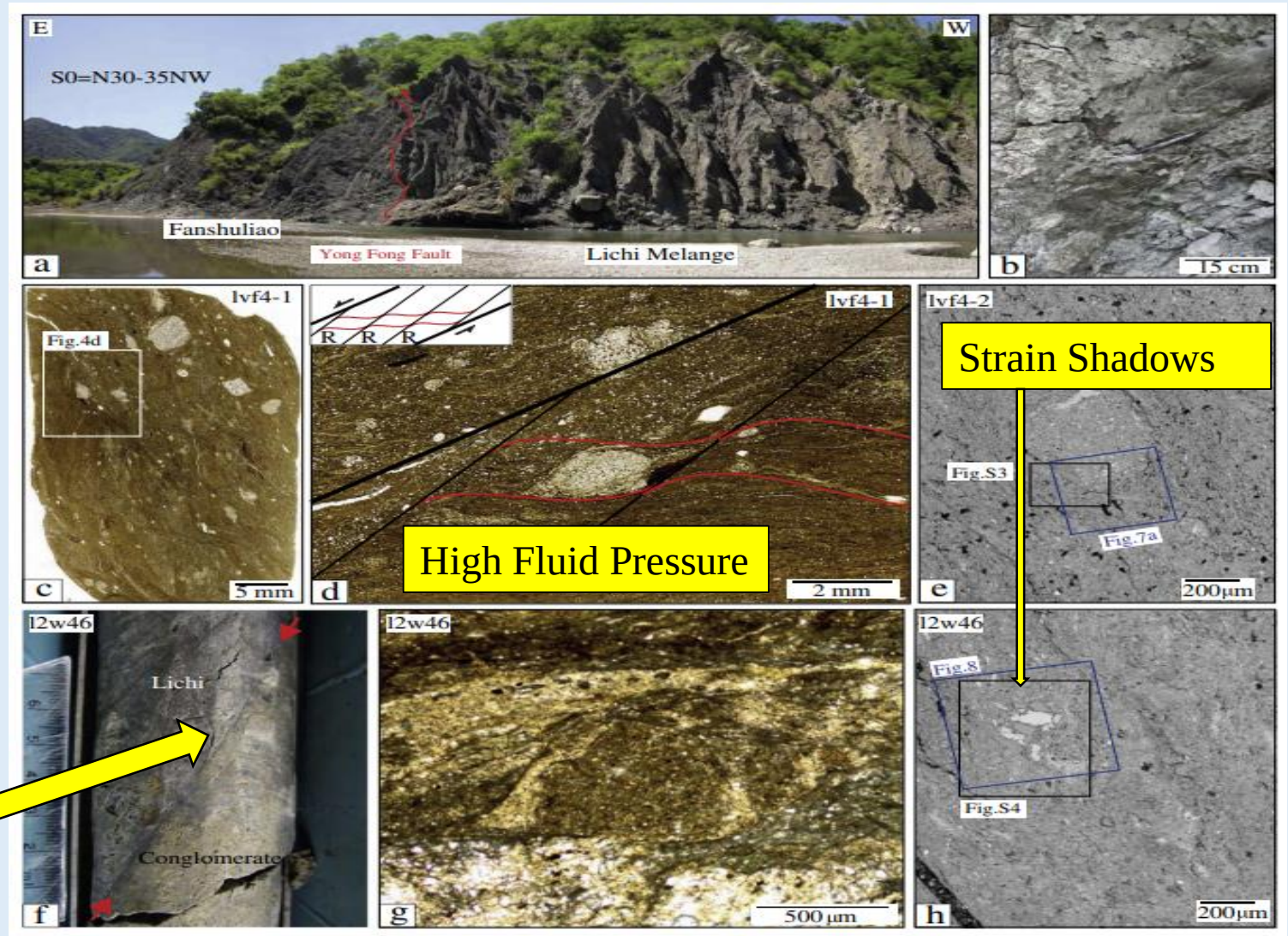
Scaly argillaceous matrix with slickensided surfaces.

Thin section of lvf4 sample show penetrative foliation.

Sigmoid-shaped microstructure with microlithons are embedded in a layer of clay-rich gouge. And oriented along R-type Riedel shear fractures.

Borehole core (46.4 m depth along the core section). BSE image from the SEM.

Calcite or breccia's are cemented in open fractures Sandstone.



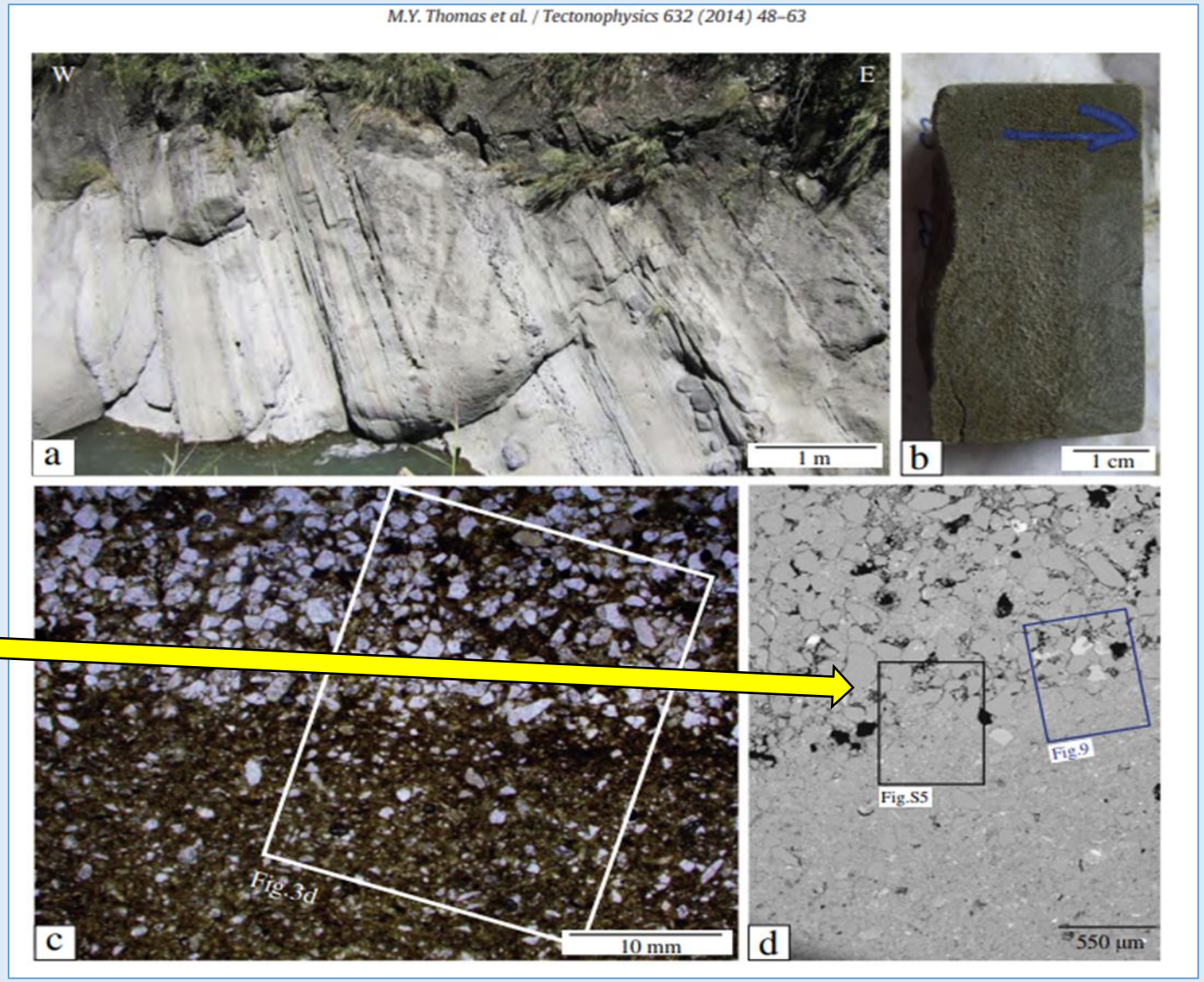
Fanshuliao formation:

- ✓Miocene to early Pliocene.
- ✓Turbiditic Bouma sequence.

Optical micrograph in plane polarized light. variation in granulometry, characteristics of turbiditic deposits. The white rectangle displays the location of subfigure d.

BSE image from the SEM. Black and blue boxes indicate location of pointshoot X-ray analysis with the SEM.

Calcarenoceous Volcaniclastic Sandstone and Quartz-Wacke Sandstone.



➢Results & Discussion

Deformation Mechanisms & Microstructural Features:

Cataclastic flow and pressure solution creep are primary processes.

Strong grain size reduction and foliation observed.

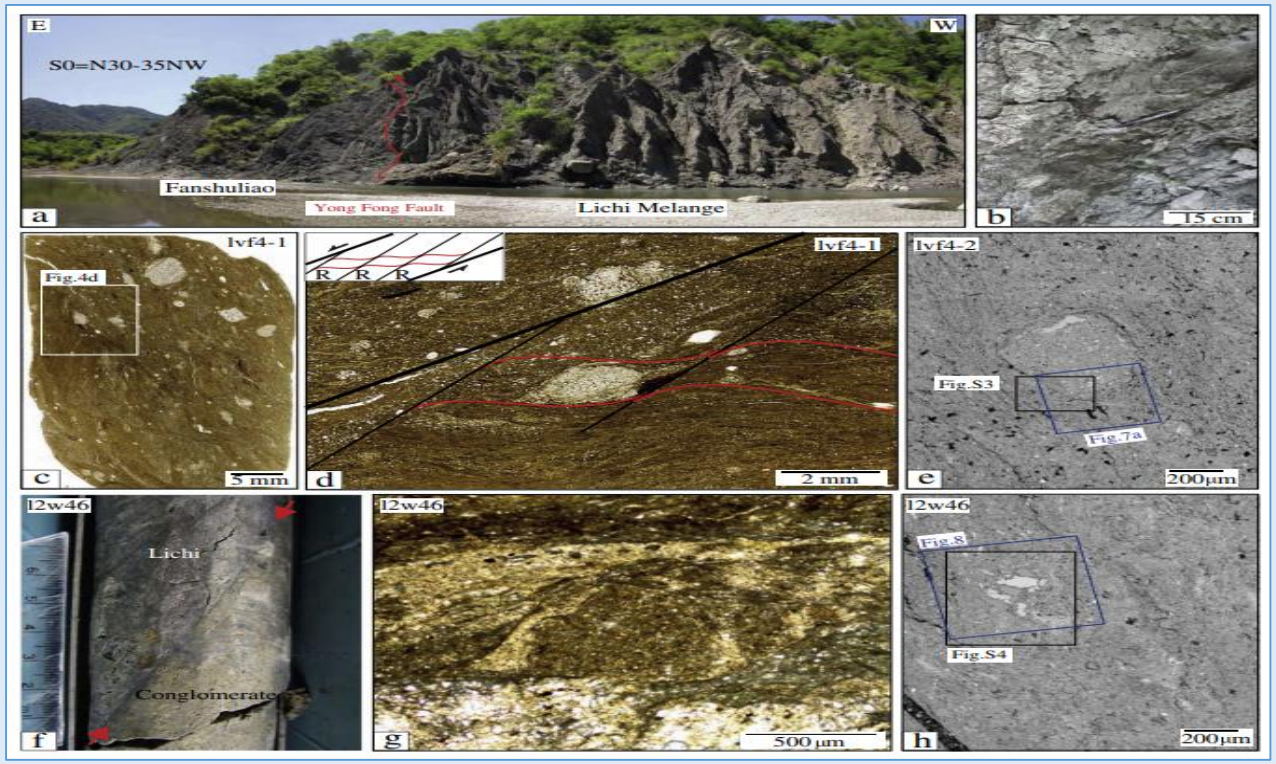
Grain boundary sliding accommodates strain in the shear zone.

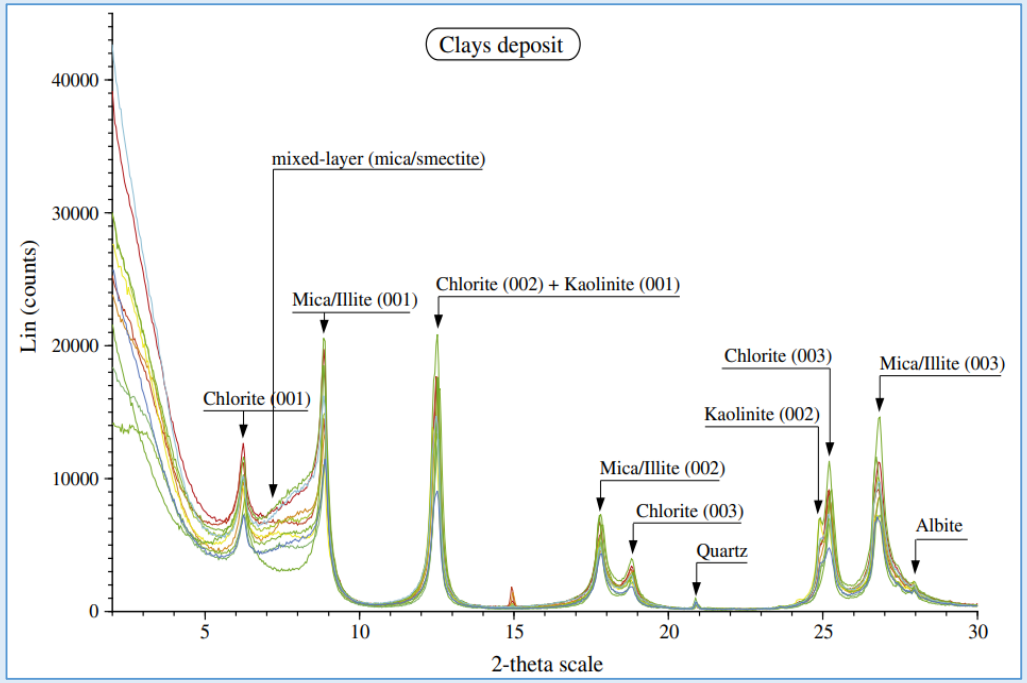
Presence of sigmoidal porphyroclasts, microlithons.

Mineralogical Changes:

Depletion in Ca–Na feldspar, quartz, and calcite in the foliated matrix.

X-ray powder diffraction:





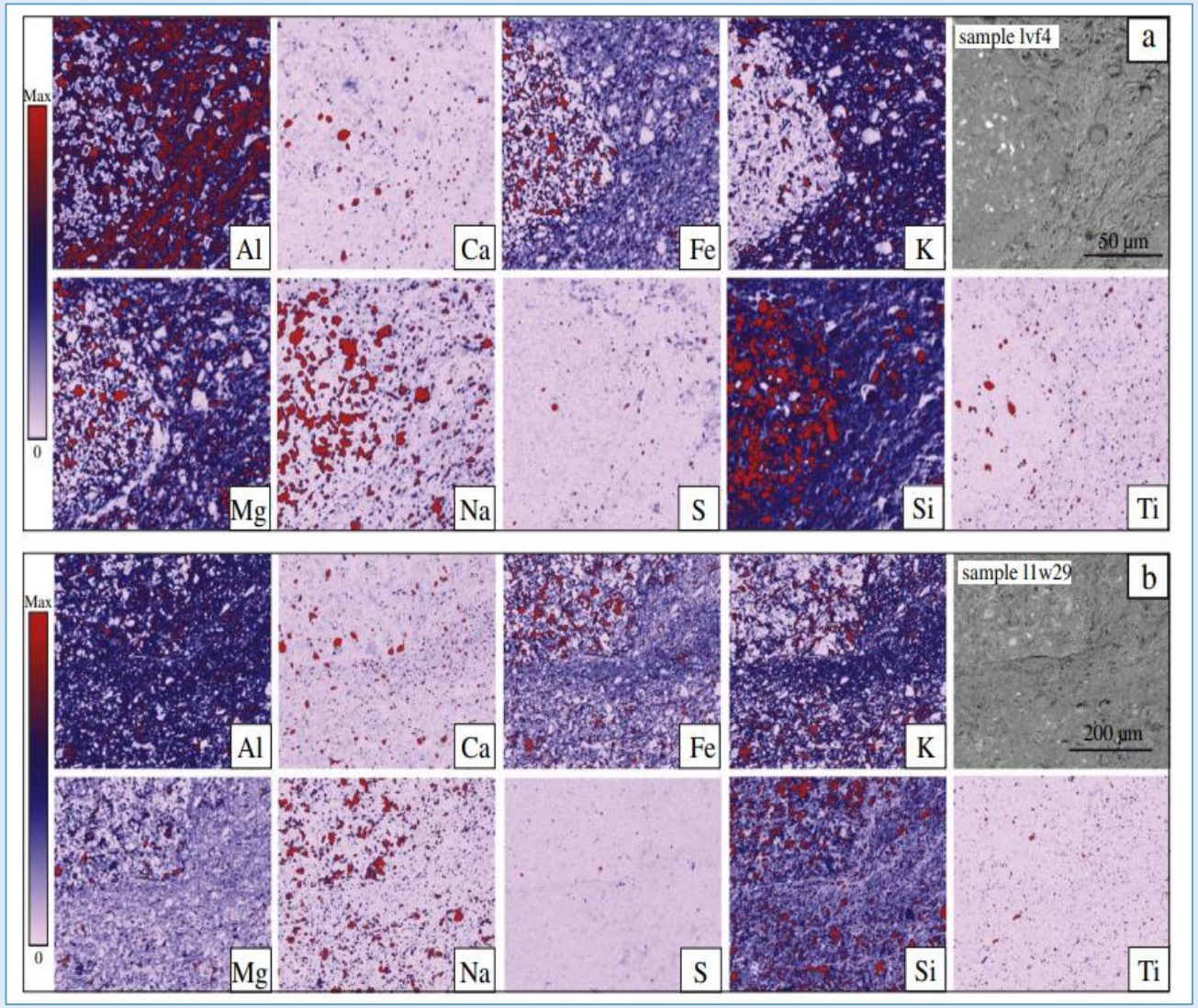
Electron probe micro-analyzer result:

Sample lvf4 was collected in the field, inside the LVF fault gouge, and sample l1w29 has been collected on the borehole core.

Evidence of slickensides in the Lichi Mélange suggest that frictional sliding must contribute to the creeping process.

Red, blue and white colors indicates high, intermediate and missing or low contents respectively. Aluminum indicates pervasive clay mineralization of the foliated matrix.

The foliated gouge is also clearly depleted in Si, Ca and Na and passively concentrated in K, Al, Fe, Mg, Ti, and S compared to the microlithon (initial state), showing a lack in soluble minerals that is likely related to pressure-solution diffusive mass transfer.



➢Conclusion

The LVF involves two key processes:

Frictional sliding & Pressure-solution creep

Pressure-solution creep, facilitate grain boundary sliding within the LVF gouge.

Within the Lichi Mélange, pressure-solution creep plays a key role in accommodating aseismic creep.

I value your time and attention. Thank You!