



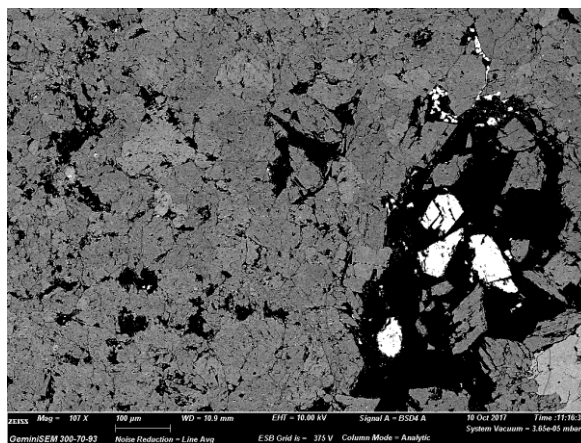
F-TRG newsletter October 2017-January 2018

This issue...

Ongoing F-TRG research in the Sawtooth Range (Montana) and the French Subalpine chains; recent fold-thrust related conferences; the F-TRG sponsor meeting and upcoming webinars.

Ongoing research and other work

Controls on fracture intensity in a carbonate anticline



Left: fracture carbonate bedding surface on the Swift Reservoir Anticline. Right: BSE (Back-Scatter Electron) image of a carbonate sample used for analysing compositional variation.

F-TRG have been using the Swift Reservoir Anticline in the Sawtooth Range of Montana to determine structural and lithological controls on fracture intensity in carbonates. SEM analysis of samples suggest the strongest controls on fracture intensity for this anticline are lithological attributes such as porosity and composition. Fracture intensities in the field area show correlations with porosity, quartz and clay percentages, indicating these factors influence fracture formation. Fracture intensities are only seen to consistently vary with structural position when lithology is constant, indicating lithology is a stronger control on fracture intensity than structural factors. An overview of this project will be presented to sponsors as a webinar on 30th January 2018.

Raman Spectroscopy to determine maximum burial temperature

As part of an ongoing project investigating the controls on along strike structural variation in the French Subalpine chains, we are using samples from the field area to determine maximum burial temperatures. The method we are using involves analysing crushed and decarbonised samples by Raman Spectroscopy, which analyses the structural order of organic carbon. As carbon within rocks is



heated it undergoes a reaction (thermal alteration), which involves both the formation and reordering of aromatic subunits towards stacked layers such as graphite. By analysing the relative proportions of disordered and graphite structure in the carbon we can estimate maximum burial temperature of the samples and determine if changes in temperature correlate to changes in structural style of folds. Sample preparation and analysis is ongoing; once complete results will be shared with sponsors. For further information on Raman Spectroscopy see the fact sheet on the F-TRG SharePoint site.

Conferences attended

'Fold and Thrust Belts: Structural Style, evolution and exploration' (October 31st-November 2nd 2017).

Rob and Hannah attended the Fold and Thrust Belts conference at the Geological Society, London (Rob also co-convened the meeting). The 3 day conference included sessions on the Zagros; South East Asia; Europe; Analogue Modelling; Fractures; Numerical Modelling; South America; Thermochronology; and Petroleum Systems. Several F-TRG presentations were given at the conference:

- *Rob Butler (keynote talk):* 'Interpreting structural geometry in fold-thrust belts: why style matters'.
- *Hannah Watkins:* 'Controls on fracture intensity in a carbonate anticline, Sawtooth Range, Montana'.
- *Hannah Watkins:* 'Along strike structural variation in the French Sub-Alpine chains'.
- *Reinaldo Ollarves (Santos):* 'Interaction between the folded structures of the PNG highland'.
- *Ruth Wightman (Oil Search):* 'Variation in Structural Style Between Two Complex, En-echelon Forelimb Structures in the Papua New Guinea Fold Belt'.

TSG and MSG Joint conference 2018 (January 3rd-5th).

Two Aberdeen PhD students presented work at the conference relevant to F-TRG. Lauren Kedar (first year student) presented an initial summary from her fieldwork in poster: 'The mechanical stratigraphy of a 3km-thick carbonate massif'.

Adam Cawood – who co-led the Pembrokeshire F-TRG field element of the F-TRG sponsor meeting in October 2017, presented a poster on: 'eRock: an online, open-access repository of virtual outcrops and geological samples in 3D'. Adam won the BP prize for 'Best Overall Student Contribution' at the conference for the poster and the eRock initiative. eRock is available on:

e-Rock.org

@eRocktweets

<https://sketchfab.com/e.Roc>



News and events

F-TRG sponsor meeting 2017

The 2017 F-TRG sponsor meeting was held in Pembrokeshire, Wales, 24th-28th October 2017. The trip included several field days exploring small-scale Variscan fold-thrust structures along the Pembrokeshire coastline and contrasting different deformation styles in limestones, sandstones and coal measures. The trip also included a knowledge exchange session with updates on F-TRG research; presentations were given on:

- 'Along strike structural variation in the French Sub-Alpine chains' – Hannah Watkins.
- 'Fracture attributes from a frontal anticline, NW Montana' – Adam Cawood.
- 'Interpretations of the Papuan Fold Belt subsurface structure' – Hannah Watkins.

The 2017 F-TRG business meeting was also held in Pembrokeshire on 28th October. Documents from the sponsor meeting (field guide, presentations and business meeting documents are available on the F-TRG SharePoint site - <https://www.abdn.ac.uk/geosciences/departments/geology/ftrg-knowledge-exchange-1116.php>).



Above left: complex folding in the Carboniferous coal measures, Saundersfoot, Pembrokeshire. Above right: discussing classification of breccia in faulted Carboniferous limestones, St Govans, Pembrokeshire.

In-house visits

Hannah Watkins will be visiting Adelaide and Sydney to discuss PNG-specific fold-thrust belt uncertainty. She will visit Santos on 26th and 27th February, and Oil Search on 28th February and 1st March; please come along for a chat!

F-TRG webinars

Rob Butler presented a webinar titled 'When imaging is good – using deepwater examples to interpret fold-thrust structures' to Oil Search and Santos on 6th December 2018. The webinar used case studies from the submarine fold-thrust belt offshore NW Borneo (Malaysia) to explore and interpret structural geometry. In 2018 F-TRG will be presenting more webinars to sponsors. The preliminary programme is as follows:



- 30th January: 'Controls on fracture intensity in a carbonate anticline, Sawtooth Range, Montana' & 'An overview of the F-TRG SharePoint site' – Hannah Watkins.
- February (date TBC): 'The use of photogrammetry for building 3D models and extracting geological data from fold-thrust structures' – Adam Cawood.
- March (date TBC): 'Buckle folding' – Rob Butler.
- April/May (date TBC): 'Uncertainty and biases in interpreting data' – Clare Bond.

Other news and event information

The Fold-Thrust Research Group is on Twitter! Follow us ([@FoldThrust](#)) for updates on F-TRG activities and relevant fold-thrust information.

Recent/relevant publications

Borderie, S., Graveleau, F., Witt, C. & Vendeville, B. C., 2018. Impact of an interbedded viscous décollement on the structural and kinematic coupling in fold-and-thrust belts: Insights from analogue modeling. *Tectonophysics*, 722, 118-137.

Cortés-Aranda, J., Mugnier, J.-L., Jouanne, F., Vassallo, R., Carcaillet, J. & Alam Awan, A., 2017. Holocene shortening rates and seismic hazard assessment for the frontal Potwar Plateau, NW Himalaya of Pakistan: Insights from ¹⁰Be concentrations on fluvial terraces of the Mahesian Anticline. *Quaternary International*, 462, 75-89.

Karim, K., H. & Khanaqa, P. A., 2017. Syncline contribution to mountain peak building: examples from Western Zagros, Kurdistan Region, Northeastern Iraq. *Arabian Journal of Geoscience*, 10, 375.

Moreira Bersan, S., Danderfer, A., Lagoeiro, L. & Fernanda de Oliveira Costa, A., 2017. The kinematic evolution of the Serra Central Salient, Eastern Brazil: A Neoproterozoic progressive arc in northern Espinhaço fold-thrust belt. *Journal of South American Earth Sciences*, 80, 131-148.

Nakapelyukh, M., Bubniak, I., Bubniak, A., Jonckheere, R. & Ratschbacher, L., 2018. Cenozoic structural evolution, thermal history, and erosion of the Ukrainian Carpathians fold-thrust belt. *Tectonophysics*, 722, 197-209.

Rak, A. J., McQuarrie, N & Ehlers, T. A., 2017. Kinematics, Exhumation, and Sedimentation of the North Central Andes (Bolivia): An Integrated Thermochronometer and Thermokinematic Modeling Approach. *Tectonics*, 36, 2524-2554.

Tavani, S., Granado, P., Arbués, P., Corradetti, A. & Muñoz, J. A., 2017. Syn-thrusting, near-surface flexural-slipping and stress deflection along folded sedimentary layers of the Sant Corneli-Bóixols anticline (Pyrenees, Spain). *Solid Earth*, 8, 405-419.

von Hagke, C. & Malz, A., 2018. Triangle zones – Geometry, kinematics, mechanics, and the need for appreciation of uncertainties. *Earth Science Reviews*, 177, 24-42.



Wang, W., Yin, H., Jia, D., Wu, Z., Wu, C. & Zhou, P., 2018. Calculating detachment depth and dip angle in sedimentary wedges using the area-depth graph. *Journal of Structural Geology*, 107, 1-11.

Next issue...

The next issue of the F-TRG newsletter will be issued in April 2018 and will include an update on F-TRG activities to date and ongoing research.