



F-TRG newsletter July-October 2016

This issue...

This issue of the Fold-Thrust Research Group newsletter covers our recent field workshop and sponsor meeting in the French Alps. Ongoing research including along strike structural variation in fold-thrust belt geometry and forelimb damage styles in carbonate fold-thrust belts is highlighted. The newsletter also includes information on relevant upcoming conferences and recent journal publications.

F-TRG Sponsors Meeting 2016



Above: attendees of the F-TRG French Alps workshop at Fort du St-Eynard in the southern Chartreuse.



Above: folding in Eocene-Oligocene sands in the Eastern Champsaur basin, French Alps.

The 2016 F-TRG sponsor meeting and field workshop was held between 9th-13th October in the southern French Sub-Alpine chains. Based out of the village of Pont-en-Royans, delegates analysed along strike variation in fold-thrust belt structure by constructing cross sections through the Vercors and Chartreuse regions. The field component of the workshop also involved observing the variation in fold forelimb damage style on the frontal fold structure, by working along two gorge sections. Variation in structural style were discussed during evening sessions where delegates compared cross sections constructed in the field, and F-TRG members from Aberdeen University presented research from the past year on variation in along-strike fold geometry, thrust displacement and shortening in the Vercors region of the French Sub-Alpine chains. A new field area in the Sawtooth Range of Montana was also introduced. Aberdeen University PhD student Adam Cawood presented part of his



research on comparing methods for collecting structural data; directly from outcrop and from a variety of digital outcrop models. Aberdeen University PhD student Yuki Totake also presented part of his research, analysing along strike variation in thrust heave, fold geometry and thrust linkage in offshore Borneo.

As well as the field-based and knowledge exchange aspect of the sponsor meeting, the 2016 F-TRG business meeting was held in Pont-en-Royans on 13th October. Members of the research group from Aberdeen University, along with representatives from sponsor companies attended the meeting. A summary of research and other F-TRG activities since December 2015 was given. An overview of planned activities until October 2017 was delivered and discussed. It was agreed that F-TRG members would continue to focus on both the regional scale and field scale structures of chosen outcrop analogues (French Sub-Alpine chains and the Sawtooth Range of Montana), along with seismic interpretation of Papua New Guinea fold-thrust belt sections. It was also agreed that specific focus would be given to the role and interaction of different detachment levels in fold-thrust belt formation. Meeting attendees also agreed that the F-TRG would provide regular webinars to sponsors on a variety of relevant topics. The next meeting will be held in London in October 2017, with a field workshop in Pembrokeshire, SW Wales.

After the business meeting, the group spent an additional 3.5 days (13th-16th October) examining basin inversion and inherited structural controls on basement involvement and thrusting and structural styles in multilayer sandstone sequences in the Ecrins and Champsaur regions of the French Alps. Despite some bad weather, the group visited a number of outcrops, including the Ornon Fault at La Chalp; a large displacement normal fault bounding the Taillefer basement block and Ornon Basin. Folding in Jurassic sedimentary rocks in the hangingwall of the fault was observed on a well exposed, 700 m high vertical section, thought to be due to compression against the rigid Ornon Fault footwall. This location is where the process of buttressing was first described. The group made the most of the bad weather by hosting a doubles pool tournament, in which Oil Search team won! An improvement in the weather in the second half of the trip allowed the group to visit the eastern and western Champsaur basins, where they constructed a cross section through asymmetric folds in Eo-Oligocene turbidites, and visited a complex thrust zone on Le Palastre.

Ongoing research and other work

Recent F-TRG research has involved quantitative analysis of regional scale cross sections through the Vercors fold-thrust belt of the French Sub-Alpine chains. Cross sections are used to determine variation in shortening and total thrust displacement along strike; to analyse changes along strike in structural style and fold geometries; and to determine how thrust zones transfer displacement along strike to maintain constant thrust belt shortening. This research has been written up as a journal article titled 'Using laterally compatible cross sections to infer fault growth and linkage models in foreland thrust belts' and been submitted to the Journal of Structural Geology. The paper draft is available online to our sponsors.



We are currently working on field data collected from the frontal fold structure of the Vercors fold thrust belt that was collected in March 2016. The main aims of this current project is to use field observations to highlight and illustrate the range of deformation styles that might occur in carbonate fold forelimb regions. The frontal fold structure of the Vercors is well exposed, with several gorges cutting through the fold forelimb, meaning analysis of damage variation along strike and along strike-normal transects can be undertaken. The results of this project will be available to sponsors online, once complete.

F-TRG are also working on a fracture dataset from the Achnashellach Culmination in the Moine Thrust Belt, collected as part of Hannah's PhD. The culmination exposes multiple fold-thrust structures in the Torridon Group sandstone, from which fracture data has been recorded. The aims of the project are to analyse the spatial distribution of the fracture sets and determine how certain fracture attributes, important in influencing fractured reservoir quality, vary with structural position and lithological variation.

News and events

Upcoming conference: Deformation, Rheology and Tectonics (DRT).

Clare, Rob and Hannah are part of the organising committee for the DRT conference to be held in Inverness, Scotland. The conference will be held between **30th April-4th May 2017** and will include a series of oral and poster sessions, as well as pre, mid and post conference field excursions to the Scottish Highlands. Conference topics will focus on small to large scale aspects of structural geology, including rock mechanics and physics of fractured rocks; interplay between fluid flow, deformation and mineral reactions; structural geology, tectonics and geophysics for exploration of production of energy resources; continental tectonics and mountain building: from deep to shallow; and 3D geometry and kinematics or tectonic structures.

For more information see <http://www.abdn.ac.uk/geosciences/events/drt2017-1091.php>.

Upcoming conference: Fold and Thrust Belts: Structural style, evolution and exploration.

Rob is involved with organising the 'Fold and Thrust Belts: Structural style, evolution and exploration' conference at the Geological Society, London. The conference is to be held **between 31st October-2nd November 2017**. Proposed themes for the conference include:

- Case studies documenting the temporal and spatial evolution of structural style.
- New techniques and approaches to understanding fold-thrust belts.
- New Exploration discoveries in fold and thrust belts, and their impact on understanding and prospectivity.
- Understanding and predicting fold-thrust belt geometry.
- Evolving stress fields and their impact on fault and fracture networks.
- Hydrocarbon modelling in fold and thrust belts.



For more information on the conference and abstract deadlines etc see the link below.
<http://www.geolsoc.org.uk/PG-Fold-and-Thrust-Belts-Structural-style-evolution-and-exploration>

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

Cheng, Chen, Lin, Yang, Chen, Zhang, Li & Liu, 2016. Deformation geometry and timing of the Wupoer thrust belt in the NE Pamir and its tectonic implications. *Frontiers of Earth Sciences*, doi:10.1007/s11707-016-0606-z.

Darnault, Callot, Ballard, Fraise, Mengus & Ringenbach, 2016. Control of syntectonic erosion on kinematic evolution of a multidecollement fold and thrust zone: Analogue modelling of folding in the southern subandean of Bolivia. *Journal of Structural Geology*, 89, 30-43.

Farzipour-Saein & Koyi, 2016. Intermediate decollement activation in response to the basal friction variation and its effect on folding style in the Zagros fold-thrust belt, an analogue modelling approach. *Tectonophysics*, 687, 56-65.

Ghanmi, Ghanmi, Aridhi, Salem & Zargouni, 2016. Role of tectonic inheritance in the instauration of Tunisian Atlassic fold-and-thrust belt: Case of Bouhedma-Boudouaou structures. *Journal of African Earth Sciences*, 119, 1-16.

Horton, Fuentes, Boll, Starck, Ramirez & Stockli, 2016. Andean stratigraphic record of the transition from backarc extension to orogenic shortening: A case study from the northern Neuquén Basin, Argentina. *Journal of South American Earth Sciences*, 71, 17-40.

Laubach, Fall, Copley, Marrett & Wilkins, 2016. Fracture porosity creation and persistence in a basement-involved Laramide fold, Upper Cretaceous Frontier Formation, Green River Basin, USA. *Geological Magazine*, doi:10.1017/S0016756816000157.

Oakley & Fisher, 2015. Inverse trishear modelling of bedding dip data using Markov chain Monte Carlo methods. *Journal of Structural Geology*, 80, 157-172.

Geological Magazine Thematic issue: Tectonic evolution and mechanics of basement-involved fold-and-thrust belts. Volume 153, issue 5-6, September 2016.

<https://www.cambridge.org/core/journals/geological-magazine/issue/D93951CB06E8266C5DEEC0D3EEDAE41>

Next issue...

The next issue of the F-TRG newsletter will be issued in January 2017 and will include an update on F-TRG activities and recent conferences attended.