



F-TRG newsletter January-March 2016

This issue...

This newsletter outlines recent F-TRG fieldwork in the French Sub-Alpine Chains, recent F-TRG research, masters projects, interns, F-TRG attendance at the Tectonic Studies Group (TSG) meeting, as well as recent publications relevant for fold-thrust belts.

Fieldwork

In March 2016 Hannah spent a week in the Vercors region of the French Sub-Alpine Chains. The aim of the fieldwork was to build upon pre-existing structural data from the region. More detailed bedding data from the frontal fold-thrust structure was collected along transects to develop closely spaced cross sections to analyse along-strike structural variation of a single fold-thrust structure. Structural damage was also recorded, mostly from the fold forelimb. Initial field observations suggest damage style and intensity vary significantly within forelimbs. Data will be analysed, firstly to determine how damage might vary along strike as structural geometry changes, and secondly to identify whether damage intensity varies systematically with minor changes in lithology. Once analysis has been completed, the results from this fieldwork will be shared with consortium members and prepared as a journal article during the second quarter of 2016.

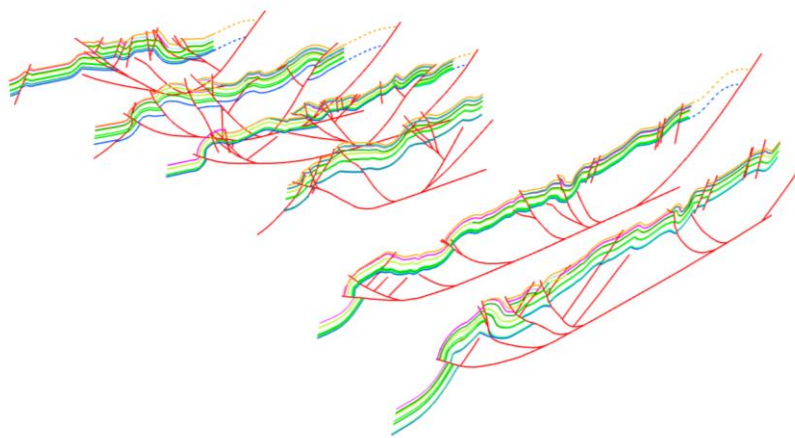


Fieldwork in the Vercors region of the French Sub-Alpine Chains. Fieldwork focussed on characterising forelimb geometry (top left and top right) and damage (bottom left).



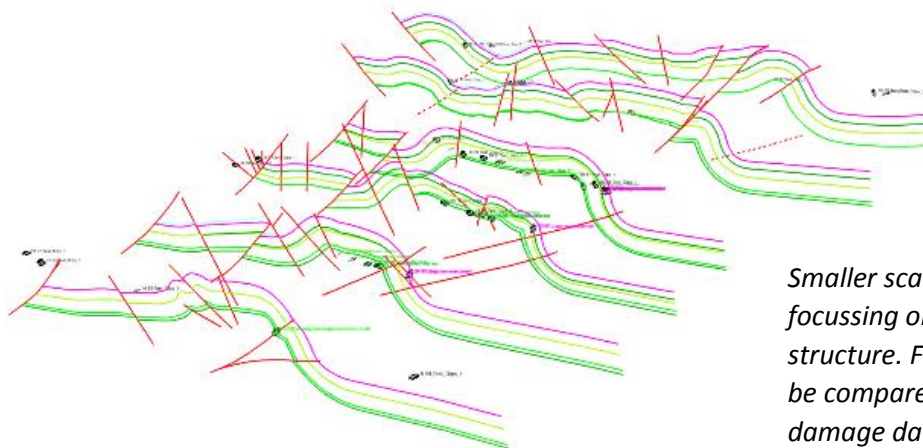
Ongoing research and other work

Research: Our main research focus has been characterising deformation styles in the Vercors (French Sub-Alpine Chains) and investigating large-scale variations in structural geometry in fold-thrust belts. Field data collected in July 2015 from the Vercors has been used to build a series of regional-scale (22-40 km) parallel cross sections. These have been restored and analysed to determine how structural geometry, thrust characteristics and fault displacements vary along strike. The results will be made available on the web portal shortly and are being written up as a journal article to be submitted to the Journal of Structural Geology.



Regional scale cross sections of the Vercors. Sections are analysed to determine along strike variation in structural style, geometry and fault displacements.

Research has also been focussed on smaller scale structural variation. Detailed, parallel cross sections have been constructed and restored from a single fold structure (the frontal fold structure of the Vercors). These cross sections were created to analyse how fold geometry might vary along strike for a plunging anticline; initial results suggest that instead of gradually decreasing bedding dips towards the tip of the fold, forelimb dips are consistently steep along most of the length of the anticline, decreasing rapidly at the plunging fold tip. Reasons for this observation are not yet clear; possible explanations include pre-existing structure, sudden and dramatic change in lithology and rapid decrease in thrust displacement. These geometric observations are being compared to the forelimb damage data collected in March 2016.



Smaller scale cross sections focussing on a single fold structure. Fold geometry to be compared with forelimb damage data.



Masters students: Daniel Warren, an MGeol student at the University of Aberdeen has been working on seismic data from Papua New Guinea, provided by Oil Search. Working on the Juha section line, Daniel has focussed on producing alternative seismic interpretations and 2D kinematic restorations to derive alternative structural evolution models for the Juha section, as well as looking into the effect of restoration workflows on uncertainty in the final model. Daniel is currently writing up his results in the style of a journal article for submission as his MGeol dissertation.

We are also in the progress of setting-up a series of summer projects for students currently enrolled on Aberdeen Universities taught MSc programme in Integrated Petroleum Geology. The students' will complete a range of projects including using Raman spectroscopy to determine the thermal history of sections through the sub-alpine chain as well as working on seismic data.

F-TRG Interns: Through a scheme funded by NERC we have been able to offer an internship with the group to an engineering student over the summer. The student Russell will work on the creation of virtual field trips for the Vercors – supporting our knowledge exchange activity with you. Zuzanna Mycon will take an internship with us as well, looking at some more detailed petrography and linking her observations to virtual outcrop models.

Knowledge exchange: We have begun compiling a database of published journal articles relevant to the Fold-Thrust Research Group. We aim to search back through past articles systematically and add them to a group on Mendeley. Research group partners will be given instructions of how to access this database in the second quarter of 2016. The database will be continuously updated throughout the life of the consortium. Our internship students will also add to our virtual outcrop model library and create some virtual field trips that you will be able to share in house.

News and events

TSG conference: the Fold-Thrust Research Group attended the Tectonic Studies Group (TSG) annual conference, held at University College London (UCL) on 6th-8th January 2016. Clare presented two posters titled 'The Structural Geology of the Bongwana Natural CO₂ Release: an analogue for fracture controlled CO₂ migration' and 'Utilizing Drones, Virtual Outcrop and Digital Data Analysis to Input into Fracture Models'. Rob presented a talk titled 'Basement-cover tectonics, structural inheritance and deformation migration in the outer parts of orogenic belts: A view from the western Alps' and a poster titled 'Interpreting deformation structures formed beneath submarine gravity flows-a kinematic boundary layer approach'. Hannah presented a poster titled 'Discrete Fracture Network (DFN) modelling of a folded tight sandstone reservoir analogue'.

The conference covered a broad range of structural geology topics, including deformation characteristics in carbonates; structural controls on fluid flow in carbonate rocks; modelling dynamic growth of fold-and-thrust belts; cross section balancing; structural analysis of virtual outcrop models; the impact of seismic image quality on interpretation and 3D model building techniques.

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



Recent/relevant publications

Awdal, Healy & Alsop, 2016. Fracture patterns and petrophysical properties of carbonates undergoing regional folding: A case study from Kurdistan, N Iraq. *Marine and Petroleum Geology*, 71, 149-167.

Carminati, Aldega, Bigi, Minelli & Shaban, 2016. Not so simple 'simply-folded Zagros': The role of pre-collisional extensional faulting, salt tectonics and multi-stage thrusting in the Sarvestan transfer zone (Fars, Iran). *Tectonophysics*, 671, 235-248.

Deng, Koyi & Nilfouroushan, 2016. Superimposed folding and thrusting by two phases of mutually orthogonal or oblique shortening in analogue models. *Journal of Structural Geology*, 83, 28-45.

Ferrill, Morris, Wigginton, Smart, McGinnis & Lehrmann, 2016. Deciphering thrust fault nucleation and propagation and the importance of footwall synclines. *Journal of Structural Geology*, 85, 1-11.

Granado, Thöny, Carrera, Gratzner, Strauss & Muñoz, 2016. Basement-involved reactivation in foreland fold-and-thrust belts: the Alpine-Carpathian Junction (Austria). *Geological Magazine*, doi: 10.1017/S0016756816000066.

Malz, Madritsch, Meier & Kley, 2016. An unusual triangle zone in the external northern Alpine foreland (Switzerland): Structural inheritance, kinematics and implications for the development of the adjacent Jura fold-and-thrust belt. *Tectonophysics*, 670, 127-143.

Perez, Horton & Carlotto, 2016. Structural inheritance and selective reactivation in the central Andes: Cenozoic deformation guided by pre-Andean structures in southern Peru. *Tectonophysics*, 671, 264-280.

Qiu, Yan, Tang, Wang, Yang, Tang & Wang, 2016. Mesozoic geology of southwestern China: Indosinian foreland overthrusting and subsequent deformation. *Journal of Asian Earth Sciences*, 122, 91-105.

Tian, Sun, Windley, Zhang, Gong, Lin & Xiao, 2016. Cenozoic detachment folding in the southern Tianshan foreland, NW China: Shortening distances and rates. *Journal of Structural Geology*, 84, 142-161.

Vollgger & Cruden, 2016. Mapping folds and fractures in basement and cover rocks using UAV photogrammetry, Cape Liptrap and Cape Paterson, Victoria, Australia. *Journal of Structural Geology*, 85, 168-187.

Yan, Xu, Dong, Qiu, Zhang & Wells, 2016. Fault-related fold styles and progressions in fold-thrust belts: Insights from sandbox modeling. *Journal of Geophysical Research: Solid Earth*, 121, doi: 10.1002/2015JB012397.

Zhou, Zhang & Xu, 2016. Effects of lateral friction on the structural evolution of fold-and thrust belts: Insights from sandbox experiments with implications for the origin of landward-vergent thrust wedges in Cascadia. *GSA Bulletin*, 124, 3-4, 669-683.



Next issue...

The next F-TRG newsletter will be issued at the end of the second quarter of 2016. We will outline progress of F-TRG research, new fieldwork results, report on F-TRG attendance at the EGU conference 2016, outline more papers relevant for fold-thrust belts and more...