Analogue models testing the interaction between a propagating continental rift and inherited crustal fabrics

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Additional information:
This dataset provides supporting information to “Maestrelli, D., Montanari, D., Corti, G., Del Ventisette, C., Moratti, G., Bonini, M. (Submitted). *Exploring the interactions between rift propagation and inherited crustal fabrics through experimental modelling.*”

The models and the derived data have been elaborated at the *Tectonic Modelling Laboratory* of CNR-IGG and University of Florence, Italy.

1. Dataset description

This dataset presents the results of an experimental series of analogue models performed to investigate the interaction between a propagating continental rift and inherited crustal fabrics. Our experimental series was designed adopting a parametric approach, which consisted in the systematic variation of the orientation of various kinds of brittle discontinuities (e.g., faults, fractures, foliations, etc.). Structures of models have been analysed quantitatively by means of photogrammetric digital elevation model reconstruction and semi-automatic fault pattern quantification. In this dataset, we show the row data and specific elaborations supporting the interpretation of results.

2. List of supplied files

In this dataset we provide the following type of data:

- a separated synthetic list of provided files.
- movies obtained from high resolution top-view photos acquired during model deformation.

- input files for FracPaQ software used for semi-automatic fault pattern quantification.
- Digital Elevation Models (DEMs) for each analogue model.
- fully navigable 3D pdf files containing the final deformation stage for each analogue model.

3. Description of provided files

3.1. Movies of model deformation

Movies (supplied as .mp4 files) show the evolution of model deformation, and were created by editing high-resolution top-view photos (taken using a Canon EOS 1100D reflex camera) acquired with 120 seconds time-steps.

3.2. Input files FracPaQ

For each model, we supply the input file (Fig.1) (.svg format) to be opened with FracPaQ Software (Healy et al., 2017). This software can be freely downloaded at http://davehealy-aberdeen.github.io/FracPaQ/, and can be run using MATLAB®. Each input file consists of the digitized structural pattern of the area of interest, and can be used to quantitatively analyse the deformation pattern for each model. Models were digitized through Adobe Illustrator® software at the same magnification in order to avoid data bias.

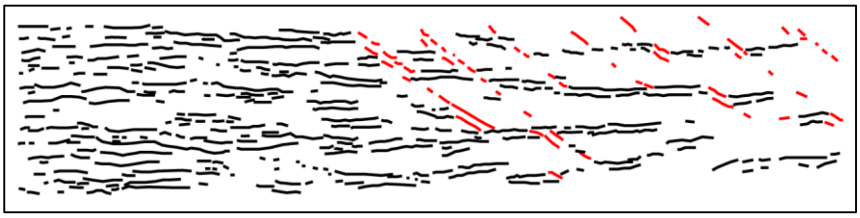

Figure 1. Example (Model RP-3) of input file generated for quantitative analysis of structures to be elaborated by FracPaQ software (Healy et al., 2017).

3.3. 3D Models

We obtained three-dimensional rendering of each models (Fig. 2) (provided as 3D .pdf files) basing on photogrammetric technique (e.g., Donnadieu et al., 2003) using Agisoft Photoscan® software. Each 3D model was obtained by photogrammetric interpolation of a minimum of 17 and a maximum of 28 high-resolution photos (acquired with a Canon EOS 1300D reflex camera).

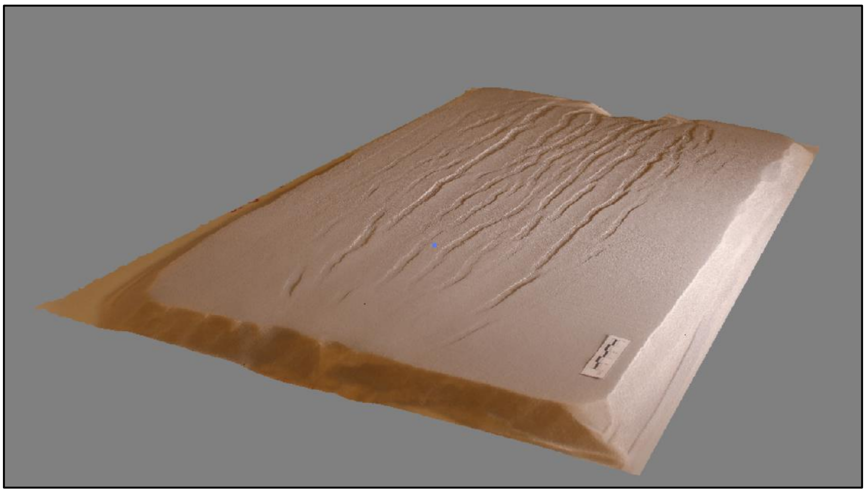

Figure 2. Example (Model RP-1) of 3D rendering obtained with Agisoft Photoscan® software.

The procedure for 3D model elaboration is summarized as follow:

- 3D perspective photos acquisition
- photos upload, alignment and consequent genesis of the sparse cloud (tie points)
- genesis of the dense cloud
- interpolation of model mesh
- genesis of model texture
- export of 3D pdf files with model rendering

3.4. DEMs

For each model, we supply a Digital Elevation Model (Fig. 3) (DEM; generated as .tif files). We have acquired perspective photos of the models to build up a 3D rendering and the consequent interpolated DEM, following the procedure described above for the creation of 3D models in Photoscan®. DEMs were interpolated directly from the sparse cloud. The use of markers placed at fixed, and locally geo-referenced positions on the model setup allowed an easy and equal scaling of all obtained DEMs.

DEM resolution ranges from a minimum of 0.463 mm/pix (Model RP-1) to a maximum of 0.315 mm/pix (Model RP-9) with an average resolution of 0.399 mm/pix.

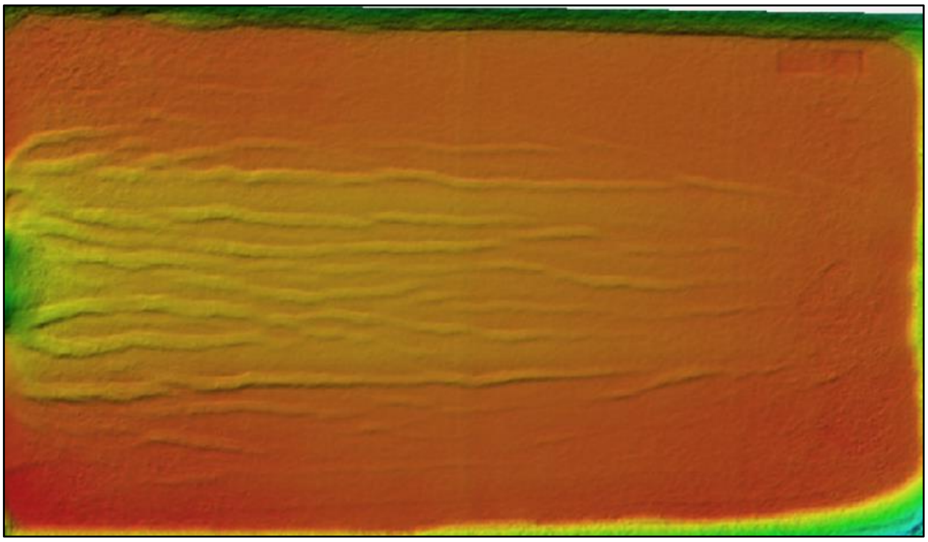

Figure 3. Example (Model RP-1) of Digital Elevation Model (DEM) generated with Agisoft Photoscan® software.

4. References

Donnadieu, F., Kelfoun, K., de Vries, B. V. W., Cecchi, E., & Merle, O. (2003). Digital photogrammetry as a tool in analogue modelling: applications to volcano instability. *Journal of Volcanology and Geothermal Research, 123(1-2),* 161-180. https://doi.org/10.1016/S0377-0273(03)00034-9

Healy, D., Rizzo, R. E., Cornwell, D. G., Farrell, N. J., Watkins, H., Timms, N. E., ... & Smith, M. (2017). FracPaQ: A MATLAB™ toolbox for the quantification of fracture patterns. *Journal of Structural Geology*, *95*, 1-16. https://doi.org/10.1016/j.jsg.2016.12.003