

***Interactive comment on* “Structure of massively dilatant faults in Iceland: lessons learned from high resolution UAV data” by Christopher Weismüller et al.**

Anonymous Referee #2

Received and published: 11 August 2019

Dear Editor, The manuscript by Weismüller et al., is focused on studying the geometry of the Icelandic rift related faults by means of high-resolution images (mainly drone images). By using their very nice dataset, they aim at classifying the faults according to their geometry (e.g. presence or absence of a tilted block in the hanging wall) and the R value (ratio between the opening with and the vertical offset). The main outcome is that all different fault geometries are not due to a different origin (which is not clarified in the text) but represent structural endmembers of a continuum in the evolution of the faults or fissures. I suggest the publication of this manuscript after some minor revisions. Below are my suggestions.

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Page 2, lines 8-9: I believe that in this case the “Campi Flegrei” example is not a very good one. Those you reported here- such as Icelandic and East African Rift - are the best examples of MDF that form on a rift, along the fissure swarm. As for the Hawaii example, I believe you are referring to the Koaie Fault Zone on Kilauea that is also belonging to a huge rift zone affecting the whole volcano and related to the extension and dike intrusions related to the flank seaward motion. The fault observed on Campi Flegrei does not show such a clear relationship with a rift zone and most of deformation is mostly due to the caldera collapse and the interaction with the Appennines structural trend. Here I suggest to remove the Campi Flegrei citation. If you want to see a good example of MDF related to the caldera collapse (and not directly to the rifting activity) I suggest you to have a look at Askja caldera in Iceland (Trippanera et al., 2018, Bulletin of Volcanology).

Page 2, line 14: I think that here and elsewhere citations should be listed in temporal and not in alphabetical order.

Page 2, line 29: I believe that it would be probably better to invert the sequence of Fig. 1 and 2.

Page 2, line 30: “Maximum horizontal stresses...” Why you refer to the maximum horizontal stress instead of the minimum one as usual (that can be easily related to GPS vectors)?

Page 4, line 27: Please cite Fig. 2a, b at the end of the first sentence.

Page 5, line 2: I would remove the words “remote sensing” here. In this case “remote sensing” is clearly referred to satellite images but then later at lines 8 and 10 this is referred to aerial images, therefore it is a bit misleading.

Page 5, line 11: Gudmundsson et al., 1992 is about the 1991 Hekla eruption not the 2000 eruption. Please adjust the sentence accordingly.

Page 5, line 18: Did you use aerial images to make Sfm-DEMs? Please spell Sfm the

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first time you use it in the manuscript.

Page 5, line 22: “. . .aid the mapping of faults and joints. . .” On this topic, I suggest to check also Trippanera et al., 2019 (Frontiers, Structural Geology and Tectonics).

Page 6, lines 3-4: “The photographs were sorted according to associated survey areas and reduced to only use sharp photographs with good image quality” This sentence could be deleted.

Page 6, line 16: “. . .significant error. . .” Could you indicate what is a significant error for you? (e.g. < 0.5 m)

Page 6, lines 25-26: “. . .With a mapping accuracy of a few mm in the DEM and ortho-mosaic at a 1:100 scale, the mapping error is in the same order of magnitude as our spatial resolution. . .” This is unclear. Please, revise it.

Page 6, line 27: “DF” You used MDF earlier. Please use MDF or spell it if you intend something different.

Page 7, sections 2.3.1 and 2.3.2 could be merged

Page 8, lines 17 to 19: from “The combination. . .” to “. . .during the processing.” These lines should go in the “methods” section.

Page 8, lines 22 to 25: from “To simplify. . .” to “. . .above (Fig. 7-11).” These lines should go in the “captions” section.

Page 8, line 28: what do you mean for “maximum elevation difference”? Is it the difference between the highest and the lowest points? Please, make sure the reader does not understand that 44 m is the maximum fault throw.

Page 8, line 23 “scanline count” What do you mean with this?

Page 9, lines 4-5: how is the cross-section geometry in the segments i – ii – iii? Both footwall and hanging wall are flat (it seems like this from the DEM)?

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Page 9, line 16: I believe you should describe the cross-section geometry of the fault before talking about TB vs opening. E.g. why not showing the variation of the tilt angle of the TB in the bottom diagram (Fig. 8) Do you have any idea about the relationship between the main fault and the fissures (in the DEM of Fig. 8) that seem to be oblique to the main fault?

Page 9, line 17: do you mean that the larger openings are associated with tilted hanging walls? If yes, I suggest to not use the word “slope” here and in line 18 but to directly refer to the tilt of the hanging wall (or TB).

Page 9, line 22-23: “Further trends of dipping surfaces are located on the hanging wall. . .” Do you mean the dip of the TB? It is not clear. It is better to describe the cross section geometry in one or more point, if different.

Page 9, line 26: “. . .bending ca. . .further north.” How far are you from the intersection with the Husavik – Flatey fault?

Page 10, lines 2-3: “since a horizontal hanging wall is not covered in the north and the south at the TBs” Unclear

Page 11, lines 8-9: Probably between Vogar and the other rift systems, there should be a difference in the opening direction. Do you have any info about this?

Page 11, line 12: You should recall figure 12a before 12b in the text.

Page 15, line 26: “The difference is a result of our definition for the cutoff of vertical offset (2 m)” This is a bit unclear.

Page 16, lines 3 (“...mapping error...”) and 10 (“...vertical offset are underestimated...”): Can you quantify the range of the errors for the vertical offset?

Page 16, lines 11 to 13: “Overlaps of DF and TB. . .no clear boundary is visible.” I believe that a block with a dip value $\ll 5^\circ$ cannot be classified as a TB in any case.

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Perhaps, there is an opening (or R value) threshold after which only TB develops and below this threshold one can have both DF and TB.

Page 16, lines 29-30: "This is because vertical offset is less influenced by surface 30 structures as the opening width and measured outside the influence area of TB." Not clear

Page 17, line 23: What is the meaning of "al.st."?

Page 17, line 32: Do you mean the location of drone surveys along the fault are spotted?

Figure 1: It could be better if you indicate the footwall and the hanging wall in each figure.

Figure 8 and elsewhere: I suggest to indicate the foot wall and the hanging wall in the DEM, for a more immediate understanding of the figure.

Figures 13 to 16: it could be nice to have also a topographic profile across the main features.

Figure 22: It would be useful to add a background reference (e.g. a light gray box) for the expected R values

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