

Interactive comment on “Seismic imaging of dyke swarms within the Sorgenfrei Tornquist Zone (Sweden) and implications for thermal energy storage” by Alireza Malehmir et al.

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I found this a very interesting read, partly because the combination of techniques and disciplines is novel to me. I have three comments, one slightly pedantic and two key observations that I think has been overlooked.

1) On page 4, Line 27 you state:

"Although a matter of a debate, Phillips et al. (2017) claim the first dyke swarm images observed in reflection seismic data in the world."

In Phillips et al (2017) [for transparency I should clarify I'm an author on this paper], it

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is stated:

"While previous seismic-based studies have imaged or contain evidence of one or several dikes, which may or may not be part of a dike swarm (e.g., Zaleski et al., 1997; Malehmir and Bellefleur, 2010; Wall et al., 2010), we present the first seismic data set that images and constrains the geometry of a dike swarm."

To clarify our sentence construction here, we agree that other seismic-based studies have clearly identified individual dykes with a dyke swarm (e.g. Wall et al. 2010 image three or four dykes). The orientation of these dykes does provide information on the orientation of the dyke swarm, but it does not constrain other geometrical properties (e.g. width, changes in height) of the dyke swarm. As such, and after an extensive literature search, we think the data presented in Phillips et al. (2017) are the only data that images the entire width of a dyke swarm and does so for >100 km along-strike; thus providing a novel insight into the 3D geometry of a dyke swarm. However, please clarify why you consider this a matter of debate. If we have missed pieces of literature that seismically image the structure of dyke swarms (not just individual intrusions) then we would be very grateful if you could cite them to bring this work to light and make up for any oversight in Phillips et al. (2017).

2) A key observation when considering whether dykes intersect storage sites will be spacing between dykes. You clearly highlight that dip and thickness are important. From your images I think you could also say something about spacing. Bunger et al. (2013) [Bunger, A.P., Menand, T., Cruden, A., Zhang, X. and Halls, H., 2013. Analytical predictions for a natural spacing within dyke swarms. *Earth and Planetary Science Letters*, 375, pp.270-27] show that dyke spacing should be systematic. The size of the storage site relative to the spacing between dykes could thus be a determining factor in its placement. From all your different data sources, it should be possible to put some quantitative constraints on dyke spacing.

3) There seems to be no mention of what the resolution of the data is. You mention

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it is 'high-resolution' but there should be some consideration of what this means; in other words, what are you missing? E.g. are <5 m thick dykes imaged and, if not, what could their importance be? There should also be an explanation about tuned reflection packages.

Kind regards, Craig Magee

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