

## ***Interactive comment on “Extrusion dynamics of deep-water volcanoes” by Qiliang Sun et al.***

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General comments on the manuscript: This paper presents an interesting dataset consisting of 3D seismic data from the South China Sea that images two volcanoes and their lava flows that are now buried beneath 10s of meters of sediment, and so not observable on the seafloor. Nevertheless, the seismic data provide remarkable views of the eruption deposits, both in map view and in cross-sections that provide information from which the style of eruption, sequence of events, and volume of eruption can be interpreted. The data are interesting, the figures are of very high quality, and they are explained well in the text. A weakness of the paper is that it tries to over-interpret the implications of the data in a few places, but I think this can be remedied with some rewording in revision. I have made editorial suggestions in an accompanying annotated manuscript file, and I include some of those comments below. I recommend minor revision to address these issues. After that I'm confident the paper will be a strong

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contribution.

Specific comments keyed to lines in the manuscript: Line 1: I think a better title for this paper would be something like “3D seismic imaging of Miocene volcanoes in the South China Sea” – something that is more informative to the reader about the real content of the paper. I don’t think this paper is a general discussion about “extrusion dynamics of deep-water volcanoes”.

Line 17 and throughout: What does “extrusion dynamics” mean here and throughout the manuscript? The authors need to explain what this means to them somewhere early in the paper. How can 3D (static) seismic images tell you about “dynamics”?

Lines 24-25: I suggest taking out "shallow sub-surface depths" because it is unnecessary and potentially confusing with the "deep-water" emplacement of the volcano as a whole. (water depths vs. subsurface depths within sediment)

Line 26: In my experience high hydrostatic pressure has little effect on eruption processes (1000 m vs 4000 m depth), so I’m skeptical about this sentence.

Line 49: It seems to me a distinction should be made here. With before-and-after bathymetric surveys, the volumes of individual eruptions CAN be well-constrained. It is only if you don’t have information on the pre-existing topography or bathymetry - or you are estimating over longer periods of time (multiple eruptions or an entire volcano’s history) that volume estimation is more difficult.

Line 51-58: The authors should mention these papers on seismic imaging of Axial Seamount (an active basaltic caldera with a summit depth of ~1400 m):

Arnulf, A. F., A. J. Harding, G. M. Kent, S. M. Carbotte, J. P. Canales, and M. R. Nedimovic (2014), Anatomy of an active submarine volcano, *Geology*, 42(8), 655-658, doi:10.1130/G35629.1.

Arnulf, A. F., A. J. Harding, G. M. Kent, and W. S. D. Wilcock (2018), Structure, seismicity, and accretionary processes at the hotspot-influenced Axial Seamount on the Juan

de Fuca Ridge, *J. Geophys. Res.*, 123, doi:10.1029/2017JB015131.

Line 68: Why would pressure have an effect on rheology? Observations from a recent eruption site at ~4000 m depth in the Mariana back-arc suggest that high hydrostatic pressure there had little or no effect on eruption dynamics and lava morphology, compared to submarine eruptions observed at shallower depths (for example Axial Seamount at ~1500 m):

Chadwick, W. W., Jr., S. G. Merle, E. T. Baker, S. L. Walker, J. A. Resing, D. A. Butterfield, M. O. Anderson, T. Baumberger, and A. M. Bobbitt (2018), A recent volcanic eruption discovered on the central Mariana back-arc spreading center, *Front. Earth Sci.*, 6:172, doi:10.3389/feart.2018.00172.

Line 71: This statement is inaccurate. Before-and-after multibeam bathymetry calculates depth changes from the shape of the pre-eruption seafloor to the post-eruption seafloor, so does NOT assume a smooth base. You should re-phrase this to something like: "Any eruption volume estimates that do not include pre-eruption topography may be grossly underestimated."

Line 331: I question whether any of the referenced papers here support the statement that "extensive lava flows in deep water... occur primarily because of high hydrostatic pressure...". In fact, I question that conclusion at all.

Line 344: You need to explain why you interpret that there are lava tubes (vs. just channels).

Line 385-386: These references do not support this statement (in the 2nd half of the sentence). The Caress et al. paper describes an eruption in which the largest volume was erupted after lateral intrusion (not transport on the surface), and the Carey et al paper describes an eruption for which the largest volume was erupted as a pumice raft that floated to the ocean surface.

Figure 1: If the contour lines are in ms what do they show? The twt to the seafloor? Or

some sub-surface horizon? Why not just use depth contours?

Figure 5: "Lava" is misspelled in the figure 5b legend.

Please also note the supplement to this comment:

<https://www.solid-earth-discuss.net/se-2019-87/se-2019-87-RC1-supplement.pdf>

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Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-87>, 2019.

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