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## The 2020 volcano-tectonic unrest at Reykjanes Peninsula, Iceland: stress triggering and reactivation of several volcanic systems

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The Reykjanes Peninsula in south-west Iceland straddles the North-America - Eurasia plate boundary and hosts several active volcanic systems, including the Svartsengi volcanic system. The last eruption in this area took place around 1240 CE, with eruptive episodes recurring every 800-1000 years, affecting one volcanic system at a time, but spanning multiple systems with activity spaced ~100 to 200 years. In January 2020, unrest was identified in Svartsengi, characterized by intense seismicity and inflation at a rate of 3-4 mm per day. This area is located within 5 km of several important infrastructures: a) the town of Grindavík; b) the Svartsengi geothermal power plant; c) and the Blue Lagoon geothermal spa, which had over a million annual visits before the Covid pandemic.

Two continuously recording GNSS stations were installed in the Svartsengi geothermal area in 2013-2015 to monitor geothermally-induced subsidence. Coinciding with the onset of an earthquake swarm starting on January 21 ( $M < 4$ ), uplift of about 3-4 mm/day was noticed in automated GNSS and InSAR results. The uplift rates in this first inflation phase decreased after January 31 and reverted to slight subsidence in early February. Interestingly, the most intense seismicity was offset from the uplift center by about 2-4 km to the southeast. Geodetic source models from the initial two weeks indicate the deformation is the result of a sill intrusion at a depth of about 4 km with a volume change of approximately 3 million  $m^3$ . The resulting stress changes from this intrusion act to increase seismicity at the sill edges, thus offering an explanation for why the seismicity is offset from the center of uplift. The location of the sill coincides roughly with a crustal volume with a high  $V_p/V_s$  ratio.

Two more inflation-deflation episodes have occurred at Svartsengi in 2020 and the total uplift amounts to approximately 12 cm. Additionally, at least one inflation episode occurred in the

Reykjanes system, in February 2020, and inflation started in the Krýsuvík system in mid-July 2020, culminating in a M5.6 earthquake on October 20. The Fagradalsfjall system, between Krýsuvík and Svartsengi, has shown high seismicity in 2020, but does not display detectable inflation nor deflation. Therefore, the volcano-tectonic activity in 2020 spans the entire western part of the Reykjanes Peninsula. The stress changes for each of these events are too small to explain the cross-system activity, hence we suggest the entire unrest is by deep magma migration beneath the entire western Reykjanes Peninsula.