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Magma dynamics at the Reykjanes peninsula (MaDRe) – an integrated geochemical and geophysical study

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Here we present our interdisciplinary research team which involves over 30 scientists at all carrier levels from five different countries. Our aim is to understand how volcanism operates on so called leaky transform faults on the example of the Reykjanes peninsula (RP), SW Iceland.

The RP undergoes periods of active rifting and associated volcanism at regular intervals [1]. The 2021 Fagradalsfjall and 2022 Meradalir eruptions might indicate the start of a new volcanic episode. Tectonic unrest started in January 2020 on the RP. Diffusion chronometry on minerals, however, revealed that deep magmatic unrest can precede geophysical eruption precursors by several years [2]. Seismic activity and ground deformation suggest the emplacement of a vertical, segmented dyke in the brittle crust following 24th of February 2021 along the central axis of the highly oblique plate boundary [3]. The composition of the eruption products showed that the eruption was derived from near-Moho (~15-18 km deep) reservoirs but stalled in a shallow dyke shortly before the eruption in accordance with the geophysical model [4]. In 2021 the chemical composition of the magma changed significantly in the first 50 days, suggesting a fast shift in the composition of the deep magma reservoirs tapped [4]. Although no major change in major and trace element composition was observed later, a jump in radiogenic isotope compositions were detected [5]. The 2022 lavas are more enriched than any of the 2021 products but follow the same radiogenic isotope mixing curves [5]). These suggest a dynamic interplay between multiple Moho-level sills [5] that store melt lenses of diverse compositions.

[1] Saemundsson et al (2020) JVJR, 391, 106501, [2] Kahl et al., (2023) Geology, 51/2: 184–188, [3] Sigmundsson et al (2022) Nature, 609, 523–529, [4] Halldórsson et al. (2022) Nature, 609, 529-534 [5], Marshall et al., (2023) this meeting.