

The 2021, 2022 and 2023 eruptions of Fagradalsfjall Fires, Reykjanes Peninsula Iceland

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On March 19, 2021, eruptive activity resumed on the Reykjanes Peninsula (RP) after 871 years of quiescence with an eruption within the Geldingadalir within valley. A year later this event was followed by the 3-18 August 2022 Meradalir eruption and now the third event has begun on 10 July 2023 Litli-Hrútur eruption, and ongoing at the time of writing. Past activity on the RP, has occurred as a series of centuries-long Eruption Periods, known as ‘fires’. We suggest this recent activity within the Fagradalsfjall volcanic system (FVS) demarcates the onset of a new Eruption Period on the RP, we term the Fagradalsfjall Fires. The 19 March to 18 September 2021 Geldingadalir eruption, was preceded by 3 weeks of seismic unrest in the Fagradalsfjall region, initially associated with movements on the RP plate boundary and then emplacement of a 9 km-long regional dyke between Fagradalsfjall and Keilir. The eruption featured up to 12 small vents on 10s- of-meters-long NNE-trending en-echelon fractures. It produced minor cone-forming tephra and pahoehoe to ‘a’ lavas. By end of September 2021, the eruption had built a cone more than 100 m above the pre-eruption surface. The initial time-averaged eruption rate was $3.7 \pm 2.1 \text{ m}^3/\text{s}$ and at day 39 it rose to $\sim 8.2 \pm 3.9 \text{ m}^3/\text{s}$ and stayed at that level for the remainder (from day 183) of the eruption. The 2021 lava field covers $\sim 5 \text{ km}^2$ and its DRE rock volume is $\sim 0.1 \text{ km}^3$. The 2022 Meradalir eruption started with continuous 5-20 m-high curtain of fires along a 300 m-long fissure and a discharge of $25 \text{ m}^3/\text{s}$, dropping to $15 \text{ m}^3/\text{s}$ within 2 days. By the end of the eruption its lava had covered 1.3 km^2 and had a volume of $\sim 0.01 \text{ km}^3$. The 2023 event started on 10 July 2023 at 16:40 on a 200 m-long en echelon fissure system, which quickly developed a set of erupting fissures forming a 1 km-long vent system, discharging lava at a rate of $40 \text{ m}^3/\text{s}$ for the first 5 hours. By the end of day 1 the activity was confined to a 100 m-long fissure segment and the magma discharge had dropped to $16 \text{ m}^3/\text{s}$, by day 3 it had dropped further or to $9\text{-}10 \text{ m}^3/\text{s}$ and by day 15 it was at $5\text{-}6 \text{ m}^3/\text{s}$. At the time of writing the lava flow field covered $\sim 1.3 \text{ km}^2$ and had a volume of 0.012 km^3 .