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Krafla Magma Testbed: an International In-situ Magma Laboratory for the Future

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The Krafla Magma Testbed (KMT) initiative has the aim to establish an international in-situ magma laboratory at Krafla volcano in North-Iceland, utilizing known target rhyolitic magma body at 2.1 km depth discovered accidentally by geothermal drilling in 2009 (IDDP-1 drill hole). The initial phase, KMT-1, has goals to drill a new well to the magma, and obtain continuous core from the deep hydrothermal system, through the brittle/ductile boundary, through the solidus and roof zone of the magma body and penetrate the magma. The core will be used to test hypotheses on the origin and nature of the magma body and to measure material properties of the deep hydrothermal to magmatic zone in order to improve geophysical interpretation and system models. Of particular interest is to determine the cause of extremely high permeability just above magma found in IDDP-1, which is important for future geothermal exploration. KMT-1 includes important technological advances. On the geothermal front, the plan is to test innovative casing connections in the well that will accommodate thermal expansion and contraction, a requirement for future development of superhot geothermal energy and related science. On the volcanological front, the aim is to emplace a string of thermocouples designed to withstand the extreme environment through thermal recovery, and defining heat flux out of the magma and its evolution with time. KMT-1 will conduct surface monitoring during drilling to detect whether the perturbations to the magmatic and hydrothermal environments give rise to signals interpreted as “unrest” at volcanoes. This will also illuminate fractures within the hydrothermal zone, and, if present, the coupling zone. KMT-1 proposal, with the goals above, was submitted to ICDP in January 2018.