1. **Location of the Well in relation to the Magma Chamber**

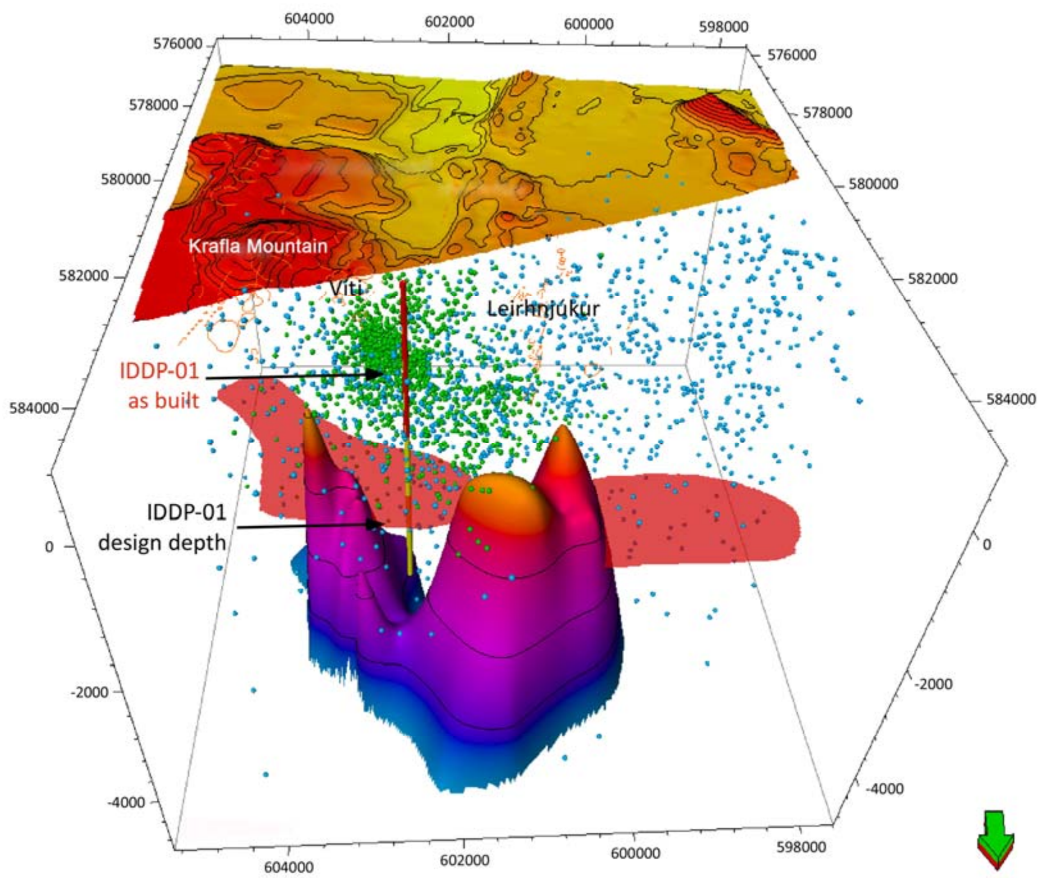

Figure DR1. Block diagram of the Krafla geothermal field, viewed towards the south. The vertical line shows the position of the well IDDP-01, the red section showing the depth as completed, and the yellow section the design depth of 4.5 km. The two red "shadows" show the extent of the magma chamber based on S-wave shadowing during the 1975-84 eruptions (Einarsson, 1978), while the red-blue contoured surfaces delineate the depth of the deep conductor based on recent TEM-MT surveys. Locations of earthquake hypocenters during the 1974-85 eruptions are shown as blue dots and those the period 2004-2007 as green dots. The site chosen for IDDP-01 was in a trough between two shallow lobes in the surface of the modelled conductive anomaly. After encountering magma at 2.1 km depth at this location, two lines of argument developed, (1) it is a minor sill or dike with dimensions below the level of resolution of the available geophysical surveys, or (2) the TEM-MT model needs revision. (Unpublished figure courtesy of ISOR, the Iceland GeoSurvey).

2. The Size of the Intrusion

A report on detailed quantitative modeling of the temperature conditions at the bottom of the IDDP-01 is being prepared for publication by the Iceland GeoSurvey, focusing on temperature conditions in the geothermal reservoir above the intrusion (Personal communication, Guðni Axelsson, 2010). As a first step, the report considers the temperatures in the intrusion and how they may have evolved since the emplacement of the magma. A major unknown is the time of that emplacement. One finding of the study is that, if the intrusion occurred at the time of the Krafla volcanic episode from 1975 to 1984 and at a temperature of 900-1000 ^{o}C, then its least dimension must be > 50-70 m.

3. Analytical Methods

FTIR. Volatiles analyses were done at USGS, Menlo Park, using a Nicolet Magna 750 spectrometer with an attached SpectraTech Analytical-IR microscope and a liquid-N_2-cooled MCT-A detector. Typically 512 scans were collected per analysis of doubly polished, bubble- and crystal-free, regions of glass. The measured infrared absorbance was adjusted for sample density and thickness. H_2O wt.% was calculated for the near IR peaks at 5200 and 4500 cm^{-1}, assuming a glass density of 2400 ±100 gL^{-1}. CO_2 was quantified with the 2350 cm^{-1} peak, using an extinction coefficient of 1077.

Electron microprobe. Glasses and minerals were analysed on a Cameca SX-100 microprobe equipped with 5 WDS spectrometers at 15 KeV accelerating potential and beam currents of 10 nA. Natural silicate minerals and natural glasses were used as standards. Net intensities were converted into concentrations using ZAF corrections and Cameca's Peaksite automation software.

Mass Spectrometry. Glass separates were combusted in a high-temperature conversion elemental analyzer (TC-EA) carbon reduction furnace, producing H_2 gas that was introduced into a Finnigan DeltaPlusXL mass spectrometer in a helium gas stream. Data were corrected relative to standards from the National Bureau of Standards and are correct within ±2.8‰. Oxygen gases, prepared by BrF_5 treatment, were analyzed in a dual-inlet Finnigan MAT 252 mass spectrometer. Values for standards were correct to within ±0.15‰ of published values.

4. **Glass Compositions**

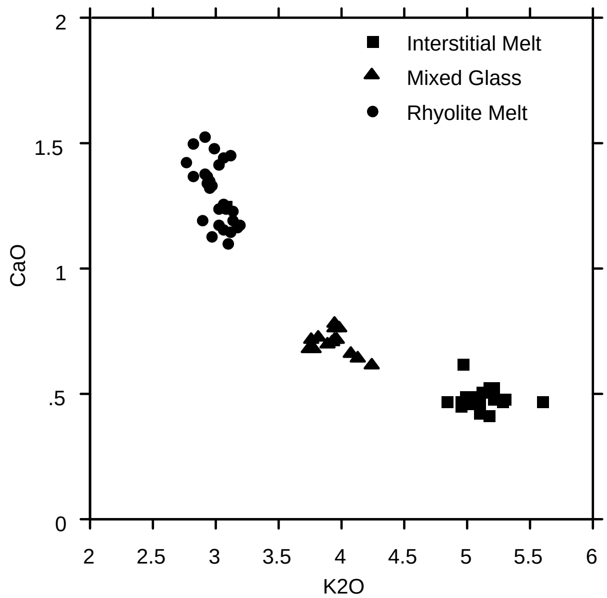

Figure DR2. Plot of K_2O versus CaO contents of quenched volcanic glasses. (Determined by electron microprobe analysis). Rhyolite melt refers to the sparsely phyric glass and includes both highly vesiculated glass (pumiceous) and the more common obsidian-like glass. Interstitial melt (squares) refers to the minor amounts of quenched glass interstitial in a mostly crystallized rhyolitic felsite. The mixed glass occurs in cuttings fragments that contain glomerocrysts of plagioclase, augite, and titanomagnetite with partially resorbed quartz and minor amounts of residual alkali feldspar. Both these glasses have major and minor element chemistry very different from the felsite (sample 24). One hypothesis is that they are different fractions of a partially melted felsite.

5. **The Future of the Well.**

In August 2009 after being cooled by injection of copious amounts of cold water at 30- 40 L/s during and after drilling, the IDDP-1 was allowed to heat. By January 2010 projections from repeated measurements of the rate of heating indicated that, by October 2010, undisturbed conductive heat transfer should increase temperatures to ~ 500 ^oC at the bottom of the casing at 2069 m (Egilson, Mortensen and Steingrimsson, 2010).

In March 2010 a staged series of flow tests began, planned to continue for some months. By August 2010 the well was still heating and was producing dry superheated steam at 380^o C at 18-19 bars, and at a flow rate of 25 to 30 kg s^{-1}. The temperature of the producing zone appears to be ~400 ^{o} C. Long-term tests at lower pressures could produce even hotter dry superheated steam with neutral pH, as long as liquid water is absent. The future of the well is still being evaluated depending both on the outcome of flow tests and the availability of the necessary funding (Elders et al, 2010). The most likely scenario initially will be to continue relying on production from the permeable zone above the intrusion, using natural recharge. Important issues include, (1) will acid gases cause excessive casing corrosion?, and (3) will there be excessive erosion or scaling? One possible strategy might be to use pH modification by injecting treated fluid into the nearby well K-25.

Developing it as the world's hottest Enhanced Geothermal System (EGS), by injecting water directly into the magma, would require significant new engineering. However it remains to be demonstrated that drilling into magma is technically and fiscally feasible and that it is possible to engineer a cracking front that propagates into the magma to enhance recharge and heat exchange at magmatic temperatures.

Supplementary References Cited

Egilson, Þ., Mortensen, A.K., and Steingrimsson, B., 2010, Well IDDP-1 at Krafla. Temperature and pressure logging after 170 days of heating: Iceland GeoSurvey: Report ISOR, No. 10014, p. 1–13.

Elders, W.A., Friðleifsson, G. Ó., Zierenberg, R. A., Pope, E. C., Ármannsson, H., Mortensen, A.K, Guðmundsson, Á, Lowenstern, J. B, Marks, N.E., Bird, D.K., Owens, L., Reed, M., Olsen, N.J., and Peter Schiffman, 2010, Rhyolite magma drilled in Iceland could power the world's hottest Enhanced Geothermal System: Transactions of the Geothermal Resources Council, Annual Meeting, Sacramento, October 24-27th, 2010, pp.19.