Analyzing alteration mineralogy in geothermal drill samples with infrared spectroscopy

Christoph Hecker, Mahid M. Ahmed, Ridwan P. Sidik, Marino C. Baroek, Herwin Azis, Freek D. van der Meer

Well site geologists at geothermal drill sites typically have a very limited arsenal of analytical methods to determine mineralogy at their disposal. Typically “Methylene Blue” to analyze the smectite clay content in the drill sample and binocular microscopes to optically determine some of the more distinct alteration minerals are the only methods currently available on site. Any more sophisticated methods (e.g. thin sections, XRD, microprobe …) are restricted to the laboratory and have long turn-around times, which can be several weeks, depending on distance and workflows of the laboratory involved. Any information gained from one well can only be used for decision making on the next well, but not to react to the mineralogy of the current well being drilled. Decisions of e.g. depth of the production casing shoe are difficult to be made on the spot.

With this research we want to work towards a mineral identification tool that can be operated at the drill site to help identify alteration minerals without long turn-around times. It should be operable by a geologist and with minimal sample preparation required. Infrared spectroscopy has the ability to identify alteration minerals. To cover all relevant geothermal alteration minerals, several parts of the electromagnetic infrared spectrum are needed, such as the near IR, the short-wave IR and the long-wave IR.

In this research we assess different wavelength ranges of the infrared spectrum as a potential tool to determine alteration mineralogy in geothermal wells. We use drill cuttings from 3 different wells of a geothermal field in Sumatra, Indonesia. The wells are positioned in the upflow and outflow of the system respectively and were taken from different depths to allow comparison of different environmental conditions and alteration mineralogy. The samples are measured in their original composition and after washing out of the drilling mud to determine the level of sample preparation needed to achieve useful results. We will show first results obtained with imaging and non-imaging spectrometers on the unwashed samples.