

# An instrument for monitoring reactive silica in geothermal waters

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An instrument for the automatic colorimetric determination of reactive silica concentration in geothermal waters has been designed and a prototype has been assembled and successfully tested. Since high-temperature (250-300 °C) geothermal liquids have high silica concentrations (460-760 ppm under reservoir conditions), the yellow-colored silicomolybdate complex is preferable to the blue-colored complex due to its much lower absorbance (peak at 405 nm). The optimum working range is between 20 and 60 ppm SiO<sub>2</sub> approximately, which requires a dilution factor close to 20. The prototype comprises a light source, a spectrophotometer, and a flow cell (connected through optical fibers), as well as a reactor, three peristaltic pumps, five electrovalves, a membrane pump and a personal computer (PC). The peristaltic pumps and electrovalves are used both for transferring the solutions (i.e., either the water to be monitored or the standard silica solution, the acidified water used for dilution, and the molybdic acid) to the reactor and for conveying the yellow-colored solution from the reactor to the flow cell upon completion of the complexation reaction. Although the peristaltic pumps provide nominally constant fluxes, a high-precision balance is used to weigh the amounts of the acidified water, the sample or the standard, and the molybdic acid added to the reactor. Thus the dilution factor can be computed with the required precision. Acidified water is used as diluting agent since the silicomolybdate complex forms at pH 2, silica precipitation is prevented, and sulfide species are converted to H<sub>2</sub>S and eliminated through air stripping thus suppressing their interference [1]. The PC controls all the operations, including the calibration of the instrument by using 20, 40 and 60 ppm standards, and initiates a new cycle every 20-30 minutes. This time interval includes the time needed for silica analysis (color development occurs in 10 minutes) and for washing the pipelines and the other wetted parts of the instruments.

[1] Berro Jiménez *et al.* (2014) *Min Mag* **78**, 1417-1422.