Silicification as the result of incongruent rock dissolution

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INTRODUCTION

We studied silicification mechanisms during acid water-rock interaction to unravel the sources and sinks of silica in active hydrothermal environments. We obtained geochemical signatures including silicon isotopes from altered/silicified volcanic rocks, their unaltered parents, chemical precipitates and the strongly acidic waters from Kawah Ijen volcano (Java).

SETTING + SAMPLES

Kawah Ijen is an active volcano with a large crater lake (3x10 m\(^2\)) (Fig 1a). A low pH (<0.5), strong mineralization (TDS~105 g/l) and high SO\(_4\), Cl and F contents (Table 1) reflect the continuous input of volcanic gasses and fluids at the bottom (e.g. [1], Fig. 1b). Seepage springs on the outer flank form the acidic Banyupahit stream.

The hyperacidic waters interact with andesitic and basaltic lavas and pyroclastics, leaving variably altered and silicified rocks behind. Samples (this study and [2]) come from the crater area and from the flanks where volcanics are in contact with seepage water.

CONCLUSIONS

- Silicification of volcanic rocks by hyperacidic waters occurs by incongruent rock dissolution as shown by two independent approaches
- Silicon isotope fractionation is limited during silification reactions
- The rate and mode of plagioclase dissolution is an important controlling factor in generating REE patterns of altered rocks
- Si isotope measurement procedures for highly altered rocks should take the possible presence of newly formed S-bearing minerals into account

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ACKNOWLEDGEMENT

Financial support from the Dr. Molengraaff Fonds is greatly appreciated.