

A long-term record of polythionates in the acid crater-lake of Poás volcano: Changes in the subaqueous input of fumarolic gases

M. Martínez^{1,2,5}; M.J. van Bergen¹; E. Fernández²; B. Takano³; E. Malavassi²; V. Barboza²; Y. Miura⁴; R. van der Laat²; E. Duarte²; J. Valdés⁵; W. Sáenz²

1. Department of Earth Sciences, Utrecht University, Budapestlaan 4, 3584 CD Utrecht, The Netherlands. (E-mail: vbergen@geo.uu.nl)
2. Volcanological and Seismological Observatory of Costa Rica (OVSICORI), Universidad Nacional, P.O. Box 86-3000 Heredia, Costa Rica. (E-mail: mmartine@una.ac.cr)
3. Department of Chemistry, University of Tokyo, 3-8-1 Komaba, Meguro-ku, Tokyo 153, Japan.
4. Department of Chemistry, Faculty of Science, Tokai University, Hiratsuka, Kanagawa 259-1292, Japan.
5. Laboratory of Atmospheric Chemistry (LAQAT), School of Chemistry, Universidad Nacional, P.O. Box 86-3000, Heredia, Costa Rica.

Polythionate concentrations have been regularly monitored in the hot ($T = 21-94^{\circ}\text{C}$) and acidic ($\text{pH}=0-1.8$) crater lake of Poás Volcano. Currently available data now provide a record over the last 25 years, during which the total concentration of tetrathionate, pentathionate, and hexathionate has ranged from below detection limits up to 4200 mg/L, reflecting three distinct periods of activity.

Between 1985 and mid-1987, when the fumarolic activity was centred around a pyroclastic cone at an on-shore location, the total concentration of polythionates was consistently very high (up to 4200 mg/L), marking a period of low activity. Mid-1987 was the start of a 7-years period of very vigorous fumarolic activity with sporadic phreatic explosions, centred in the lake and drying it out during significant time intervals. This period registers the lowest concentration of total polythionates, which, with few exceptions, remained below or close to detection limits. After mid-1994, when the lake reappeared, the total concentration returned to relatively stable intermediate levels (up to 2800 mg/L) that apparently mark more quiescent conditions in the lake area, since the main focus of fumarolic activity was shifted to the pyroclastic cone again. Since late 1994, numerous fumarole-opening events have occurred to the south of the pyroclastic cone and in the internal eastern crater wall. A particular event was observed between September 2001 and May 2002, when polythionates temporarily disappeared.

The observed behaviour of polythionates clearly record changes in the input and $\text{SO}_2/\text{H}_2\text{S}$ ratio of the subaqueous fumaroles. Seismic monitoring data suggest a possible relationship between peaks in tremor signals and the occasional disappearance of polythionates.