

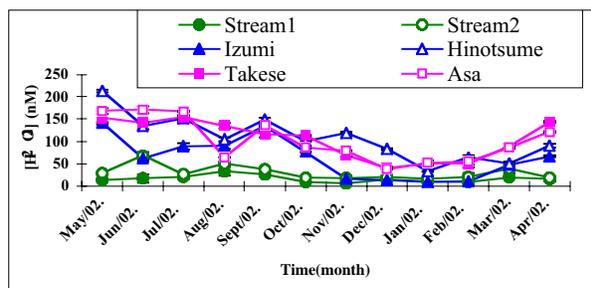
Spatial and temporal variation of hydrogen peroxide in stream and river waters: Effect of photo-bio-physio-chemical processes of aquatic matters

KHAN M. G. MOSTOFA AND HIROSHI SAKUGAWA

Hiroshima University, 1-7-1, Kagamiyama, Higashi-Hiroshima 739-8521, Japan mostofa@hiroshima-u.ac.jp
hsakug@hiroshima-u.ac.jp

Introduction and Methodology

Hydrogen peroxide (H_2O_2) is omnipresent in all natural waters and is an indicator of photochemical and biological processes of aquatic organic matters. The solar intensity, humic-like substances in dissolved organic matter (DOM), the iron concentration, particulate matter and microbial activities (PMMA) might have a significant role in regulating the concentration of H_2O_2 in natural waters. This study investigated the variation of H_2O_2 concentration in stream and river waters with reference to solar intensity, dissolved organic carbon (DOC), fluorescence properties of humic-like substances in DOM, photo-Fenton reaction, PMMA. Previous methods were followed for all analytical measurements.



Results and discussion

The results of H_2O_2 (Figure) showed that the concentration was significantly varied due to spatial and temporal effects. Generally, the H_2O_2 concentration was high in summer and low in winter and also the concentration was higher in downstream river (R.) sites compared to that of upstream sites, suggesting the significance of solar radiation and humic-like substances in DOM in waters. As the downstream rivers detected high fluorescence intensities of humic-like substances in DOM. The river waters, having high humic-like substances but high amount of PMMA and Fe concentration, was detected very low concentration of H_2O_2 , suggesting the effect of PMMA and photo-Fenton reaction in water.

Conclusion

H_2O_2 variation in stream and rivers was caused from the allied effect of solar intensity, humic-like substance in DOM, iron concentration and PMMA.

References

Yuan, J., Shiller, A. M. 2001. Deep-Sea Research II 48, 2947-2970 and references therein.

Metalliferous stromatolites from New Zealand hot springs

B. W. MOUNTAIN¹, L.G. BENNING² AND S. JACKSON³

¹ Geological and Nuclear Sciences, Wairakei Research Centre, Taupo, New Zealand (b.mountain@gns.cri.nz)

² School of Earth Sciences, University of Leeds, Leeds, United Kingdom (liane@earth.leeds.ac.uk)

³ Dept. of Earth and Planetary Sciences, Macquarie University, Sydney, Australia (sjackson@els.mq.edu.au)

Hot spring sinters are known for enrichments in metals such as Au, W, Tl, Hg, As and Sb. These deposits also show extensive microbial control on their textural development. In New Zealand, two areas that display both characteristics are Rotokawa and Champagne Pool. At Rotokawa, springs are surrounded by sinter that is overlain discontinuously by unconsolidated mud. Within the mud, siliceous stromatolites are found composed of light silica-rich and dark clay-rich laminations with fine Fe sulphides and organic material. At Champagne Pool, metal-rich sulphur crystals grow at the air-water interface and are covered by a biofilm of filamentous microbes. Subaerially, spicular stromatolites composed of vitreous, porous, and granular silica laminations rich in silicified microbes are present.

The coexistence of enriched heavy metals and microbes suggests the possibility that microbes influence metal contents on a local scale. To determine the finer scale distribution of metals, polished sections of natural and experimental sinters were analysed by LA-ICP-MS. At Rotokawa, stromatolites show high concentrations of As (<2.5%), Sb (<1.5%), W (<800 ppm), Tl (<110 ppm), Pb (<75 ppm) and Au (<6 ppm) in the darker layers. In the silica-rich layers, these metals are found at lower concentrations while Fe (<6%), Mn (<500 ppm) and Ge (<200 ppm) are elevated. Adjacent mud deposits also show anomalous metal contents, however, As, Sb, and Au are on average lower and Tl is higher. At Champagne Pool, sinter grown on glass slides was analysed. Sulphur crystals, covered by the filamentous biofilm, contained high concentrations of heavy metals. The results are semi-quantitative but median values include Sb (~3500 ppm), As (~1300 ppm), Pb (~230 ppm), Tl (~50 ppm), Au (~35 ppm), and W (~15 ppm). Subaqueous spicular stromatolites also contain anomalous heavy metal contents but at lower concentrations.

Although the initial control on relative metal contents is the composition of the thermal fluid entering each spring, it is clear that relative metal concentrations are effected by the substrate with which they co-precipitate. Correlations between Sb, As, Tl, W and Au suggest at similar mechanism of precipitation and inverse relationships between these metals and Fe and Mn indicate changing chemical conditions. This suggests that the stromatolites are providing a valuable record of spring chemistry over time. Whether microbes play a role in influencing metal contents remains uncertain but is an intriguing possibility that requires further study.