Transfer of S from the oxidized sub-arc mantle to the atmosphere: Evidence from Mount Pinatubo, Phillippines

J.C.M. (CEES-JAN) DE HOOG, KÉIKO H. HATTORI

[1.]Department of Earth Sciences, University of Ottawa,
K1N 6N5, Canada (cees-jan@gvc.gu.se)

The 1991 eruption of Mount Pinatubo discharged ~ 20 Mt of SO_2 into the stratosphere. The ultimate source of S is considered to be underlying mafic magma, but the exact processes leading to the release of S is in debate partly due to the paucity of basaltic samples.

We examined mafic fragments in andesitic eruption products, that were discharged before the eruption. They contain abundant Mg-rich olivine (Fo: 86-88) surrounded by amphibole. The least-evolved melt inclusions contain high S, >1700ppm with 85% as sulfate. Oxygeobarometry using the olivine and enclosed chromite (X_{Cr}~0.64) yielded log fO2=NNO+1.4, suggesting the intrinsically oxidized nature of the mafic magma. The values are comparable with the fO2 of dacitic magma in the shallow crustal chamber.

The results indicate that the excessive release of S to the atmosphere is not related to a redox change during mixing of injected mafic magma with dacite. Instead, the S likely originated from S in immiscible aqueous fluids in the felsic chamber. This study confirms that the oxidation condition of sub-arc mantle is heterogeneous and locally oxidized. The occurrence of S-rich mafic melt in Mt. Iraya, north of Pinatubo (Metrich et al., 1999), and the abundant porphyry Cu deposits in the arc suggests that the underlying mantle may be regionally oxidized so that mafic magma is capable of transfering large quantities of S from the mantle to upper crust and the atmosphere. Furthermore, oxidized nature of felsic igneous rocks, that are common in arcs, is likely inherited from oxidized mafic magmas and also underlying sub-arc mantle.

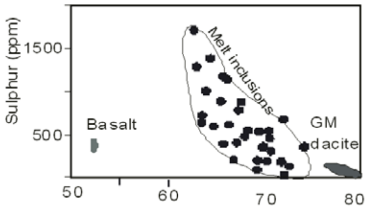

Figure 1. Sulphur contents of melt inclusions

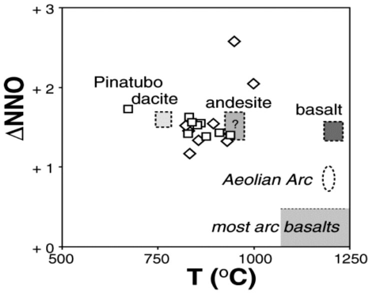

Figure 2. Redox conditions of basaltic fragments and dacite based on the composition of olivine and chromite.

Photodegradation Kinetics of Fenitrothion in Various Aqueous Media and Its Effect on Steroid Hormones Biosynthesis

A. S. DERBALAH[1], T.YAMAZAKI[2] AND H. SAKUGAWA[3]

Hiroshima University, 1-7-1 Kagamiyama, Higashi-Hiroshima
739-8521, Japan. [1] aly@hiroshima-u.ac.jp,
[2] takey@hiroshima-u.ac.jp , [3] hsakuga@hiroshima-u.ac.jp

Introduction and Methodology

Comparative photodegradation kinetics study of fenitrothion in various water media was carried out under both direct and indirect photolysis using nitrate as a OH radical generation reagent. To estimate degradation rate and half-life time of fenitrothion, irradiation by a solar simulator followed by HPLC analysis were employed. To study phototransformation kinetics of fenitrothion, samples were irradiated for 7 h and then conducted to solid phase extraction followed by GC-MS analysis. The mineralization rate of fenitrothion was evaluated by measuring the losses of dissloved organic carbon and inorganic ions formation using TOC analyzer and ion chromatography, respectively. The toxicity of fenitrothion and its metabolites on steroid hormones biosynthesis were also investigated.

Type of Sample	Rate constant (h^{-1})	Half-life $t_{1/2}$ (h)
MilliQ water	0.12± 0.007	5.66 ± 0.30
MilliQ water + 200 μM nitrate	0.15 ± 0.01	4.58 ± 0.36
River water	0.19± 0.01	3.58 ± 0.28
River water + 200 μM nitrate	0.26 ± 0.02	2.67 ± 0.16

Results and Discussion

Part of these study results are presented in the Table above. Both the degradation and mineralization rate of fenitrothion under indirect photolysis was faster than that of direct photolysis. The phototransformation kinetics of fenitrothion showed the same identified photoproducts under both direct and indirect photolysis. This reveals that there is no specific attach of the hydroxyl radicals in fenitrothion transformation. The results suggest that both fenitrothion and its photoproducts(fenitrooxon and 3-methyl-4-nitrophenol) are suspected of being endocrine disruptor compounds.

Conclusion

Fenitrothion photodegradation kinetics was grealty enhanced by indirect photolysis.

References

Durand, G., Mansour, M., Barcelo, D., 1992. Anal. Chemica. Acta. 262, 167-178.

Mikami, N., Imanishi, K., Yamada, H., Miyamoto, J., 1985. J. Pestic. Sci. 10, 263-272.