

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

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The 1991 eruption of Mount Pinatubo discharged ~ 20 Mt of SO₂ 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 ($X_{Cr} \sim 0.64$) yielded $\log fO_2 = \text{NNO} + 1.4$, suggesting the intrinsically oxidized nature of the mafic magma. The values are comparable with the fO_2 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 transferring 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.

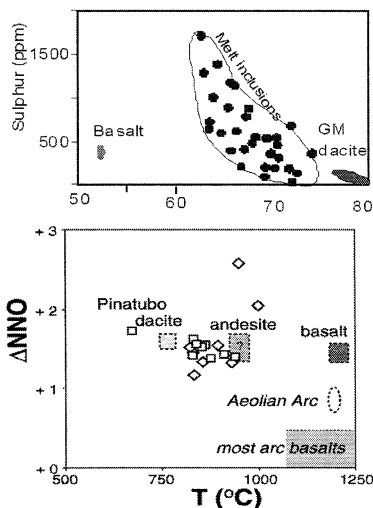


Figure 1. Sulphur contents of melt inclusions

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

Photochemistry of Fentirothion in Media and Hormones

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Introduction and Methods

Comparative photochemistry of fentirothion in various media under direct and indirect sunlight. The reaction was studied by HPLC and phototransformation products were identified by GC-MS. Fentirothion was irradiated for 7 h under direct sunlight followed by GC-MS analysis. The results show that fentirothion was transformed into several dissolved organic compounds. The TOC analyzer and the results show the toxicity of fentirothion and its photochemical products on hormones biosynthesis.

Results and Discussion

MilliQ water
MilliQ water + 200 ppm
River water
River water + 200 ppm

Results and Discussion

Part of these results are shown above. Both the direct and indirect photolysis of fentirothion under direct and indirect sunlight show both direct and indirect photolysis. The specific attachment of fentirothion to its photoproducts is suspected of being a direct photolysis.

Conclusion

Fentirothion is highly stable and its degradation is enhanced by indirect sunlight.

References

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