

PGE geochemistry used to determine magma fertility in Lihir and Feni islands, Papua New Guinea

ZHIJIE HUANG^{1,2*}, IAN H. CAMPBELL¹, RICHARD J. ARCULUS¹, WEI TIAN²

¹Research School of Earth Sciences, ANU, Canberra, 2601, Australia (*correspondence: Zhijie.Huang1@anu.edu.au)

²School of Earth and Space Sciences, PKU, Beijing, 100871, China

Lihir and Feni are groups of Plio-Pleistocene alkaline volcanic islands located off the northern coast of Papua New Guinea. Lihir hosts the Landolm epithermal gold deposit, but no deposit has been found on Feni. The question is why?

We hypothesize that if the evolving magma reaches sulfide saturation in early stage, all the chalcophiles will be locked within sufficient sulfides and prevented from entering the hydrothermal fluid. Alternatively, if the magma reaches volatile saturation before sulfide saturation, Au and Cu are available, which may lead to a economic deposit.

We analysed the platinum group elements (PGE) in both suites. The chalcophiles show clear trends in Feni. Pt decreases with decreasing MgO until 3.0 wt.%, where it drops more abruptly. Pd first increase until MgO falls to 3.0 wt.%, then starts to decrease. Cu follows the same trend as Pd. In Lihir, however, chalcophile data are more scattered, which obscures variation trends. Pd increases with decreasing MgO to 6.1 wt.% and then start to decrease. Pt also initially decreases, but becomes flat or may even increase with decreasing MgO. Cu increases slightly with decreasing MgO but the data then become scattered, which is attributed to hydrothermal alteration. The change in gradient on the plots of PGE against MgO is used to identify the timing of sulfide saturation. Modeling using rhyolite-Melts [1] suggests that this occurs after about 60% fractionation in both Feni and Lihir.

We suggest volatile saturation occurs close to sulfide saturation in Lihir. The result is a Au deposit. However, Feni also has a hydrothermal system, and may have reached volatile saturation before sulfide saturation. It is classified as Au-Cu in the chalcophile element fertility diagram [2]. We suggest that Feni is highly prospective for Au.

[1]Ghiorso and Gualda (2015) *Contrib. Mineral. Petrol.* **169(6)**, 53;

[2] Park et al. (2019) *Miner. Deposita* **54(5)**, 657-670.