

Anomalous sulfur of the Waterberg Project of the Bushveld Complex is not locally derived

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Informally called “Far Northern Limb”, the Waterberg Project (WP) is a newly described high-grade deposit of platinum group elements (PGE) in the Bushveld Complex (BC) that is located in the southern margin of the Limpopo Belt. Dating of this intrusion through U/Pb zircon age yielded values of 2.059 ± 3 Ga and 2.053 ± 5 Ga, which confirms association of this intrusion to the Bushveld magmatic event¹. Despite its geographical relationship to the Northern Limb of the BC, the different magmatic stratigraphy and mineralization style suggest that the WP was emplaced in a separate magma chamber².

We use multiple sulfur isotopes to understand the origin and evolution of the WP. The sulfur isotope composition is very similar to the Eastern and Western Limbs of the BC^{3,4}. Waterberg has a $\Delta^{33}\text{S}$ average of $0.088\text{‰} \pm 0.022\text{‰}$ (BC average = $0.112\text{‰} \pm 0.024\text{‰}$, 1 s.d.). The footwall, a sulfur-rich granofels, has $\Delta^{33}\text{S}$ equal to 0.013‰ . Therefore, it is not possible that the sulfur signature of WP is sourced from either assimilation of this material during the magmatic phase, or from post-magmatic hydrothermalism. The $\Delta^{33}\text{S}$ values are variable in the ultramafic sequence, which might result from assimilation of footwall (and subsequent lowering in the $\Delta^{33}\text{S}$ signature), but are uniform in the Main and Upper Zones.

The similarity in values between the WP and the other intrusions of the BC, and the fact that Waterberg crystallized in a separate magma chamber, shows that the large-scale contamination of the parental magma occurred at a deeper level, prior to emplacement of magma in the crust.

1 Huthmann et al., 2016. *Precambrian Research*, 280: 61-75.

2 Kinnaird et al., 2017. *Economic Geology*, 112: 1367-1394.

3 Penniston-Dorland et al., 2012. *EPSL*, 337-338: 236-242.

4 Magalhaes et al., 2018. *In press*.