Geophysical Research Abstracts
Vol. 20, EGU2018-10759, 2018
EGU General Assembly 2018

Relationship between S and Sr isotopes provide evidence for multiple sources of contamination in the Rustenburg Layered Suite, Bushveld Complex

Nivea Magalhaes (1), Sarah Penniston-Dorland (1), James Farquhar (1), Edmond Mathez (2), and Allan Wilson (3)

(1) University of Maryland, College Park, United States (nivea@umd.edu), (2) American Museum of Natural History, United States, (3) University of the Witwatersrand, South Africa

The mafic-ultramafic Rustenburg Layered Suite (RLS) of the 2.06 Ga Bushveld Complex (BC), hosts the largest platinum group element (PGE) reserve of the world, occurring mainly as sulfide-rich layers.

The sulfur signature of this intrusion shows the presence of Archean surface-derived material (S-MIF, $\Delta 33S \neq 0$) that contaminated the parental magma, as it deviates from the expected $\Delta 33S$ value of the mantle of 0 ± 0.008‰Ṗrevious work suggested that the $\Delta 33S$ value was uniform throughout the intrusion (0.11‰± 0.02‰, but this signature is shown in this study to be variable, with the lowest values found in the Basal Ultramafic Sequence (most primitive, avg. 0.030‰, and the highest at the Marginal Zone (most contaminated, up to 0.301‰. The $\Delta 33S$ values vary with stratigraphic depth within the intrusion. Small-scale spikes in $\Delta 33S$ are sometimes associated to the PGE-rich layers, as for example a value of 0.157‰ found at the Merensky Reef. Textural analysis shows no evidence for late addition of hydrothermal sulfur.

Sulfur and strontium isotopes vary in the same stratigraphic levels within the intrusion. A positive correlation is observed in some levels, and in others there is a negative correlation. This observation suggests that different layers in the RLS assimilated different materials. This variability likely reflects distinct magma pulses, which either have assimilated sulfur from different sources, or in some cases, different amounts of contaminant from the same source. However, the data does not uniquely identify the source of sulfur.

It is unlikely that the Rustenburg Layered Suite existed as a single, big magma chamber, and these results are consistent with periodic or sill-like emplacement processes in an expanding chamber.