

## **The redox state of the arc mantle since the late Neoproterozoic**

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The oxygen fugacity ( $fO_2$ ) of the arc mantle exerts a first-order control on the recycling of redox-sensitive elements (e.g., S, C, and Fe) and the formation of ore deposits. Despite its significance, the secular evolution of arc mantle  $fO_2$  following the Neoproterozoic Oxygenation Event (NOE, ~800–400 million years ago) remains poorly constrained. In this study, we employed machine learning and statistical methods to calculate V/Sc ratios in arc basalts since the late Neoproterozoic era. Our results reveal that the V/Sc ratios of arc basalts have remained relatively invariant since the NOE, implying long-term stability in the oxidation state of the arc mantle source. This stability suggests that the elevated surface oxygen levels during the NOE may not have directly caused the oxidation of the arc mantle. Furthermore, the relatively oxidation of the arc mantle suggests that the arc mantle  $fO_2$  has controlled the oxidation of arc magmas since the NOE.