

Chemostratigraphy of Continental Flood basalts: architecture, duration, and sulfur budget

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The diversity in scale, duration, and petrology of continental flood basalts is discussed in the context of the chemostratigraphic record of conformable sequences of flows. These data support an understanding of temporal and spatial changes in the style of volcanic activity and the depocenters of accumulation. The 66 Ma Deccan Trap of India comprises >1 million km³ of bimodal picritic and tholeiitic lavas erupted in <1Ma which progressively young from north to south as the Indian plate migrated over the Reunion hotspot (and approximately antipodal to the Chicxulub impact event). The flow tops are often weathered, but erosion and sedimentation are exceptionally rare, and the chemostratigraphic signals provide a remarkable record of variations due to source geochemistry, differentiation, and sulfide saturation history. The details help to compare the S budget of the erupted rocks with that of comagmatic intrusions, and this in-turn anchors estimates of volatile flux into the atmosphere.

The 250Ma Siberian Trap in the Noril'sk Region is part of a >3.8 million km³ large igneous province. It also records a progression from picritic basalts through to tholeiites over <1Ma with few examples of erosion or sedimentation between successive flows. On a regional basis the igneous rocks comprise 35% basalt, 26% tuff and 39% mafic intrusive rock. In contrast to the Deccan Trap, the stratigraphy in the Noril'sk Region contains >5% tuffaceous units include thick accumulations like the Khakanchasky Formation. The distribution of the volcanic eruptive centers of the Noril'sk Region are mapped out with chemostratigraphy, and the data provide strong evidence for the migration of volcanic centers in response to the structural framework of the crust.

The volume of phreatic volcanic products increases to the southeast where volcanic diatremes are developed, and likely contribute to the volcanic package in the Noril'sk Region. The chemostratigraphy of boreholes at Noril'sk provide a comparison between the comagmatic intrusive and eruptive products of this magmatic event. The West Greenland flood basalts provide yet another case study of short-lived magmatism where the S budget of volcanic rocks can be related to comagmatic intrusions. This information helps anchor studies of eruption rates of lavas, and provides a foundation on which to view the impact of flood basalt events on changing atmospheric compositions and their possible relationship to mass extinction events.