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Platinum group elemental and Re-Os isotopic geochemistry of Permian Emeishan flood basalts in Guizhou Province, SW China

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The Late Middle-Permian Emeishan continental flood basalts (ECFB) lie between the Lower Permian Maokou Formation and Upper Permian Xuanwei Formation, being part of the ~260 Ma Emeishan Large Igneous Province (ELIP) in SW China [1]. Basaltic samples systematically collected in a cross section in Guizhou Province, the easternmost part of the ELIP [2], were analyzed for platinum-group elements (PGE) and Re-Os isotopes, in addition to major element oxides and trace elements. The 550-m thick sequence in the cross section includes 12 basaltic flows whose thicknesses range from 10 to 140 m. The majority of the basalts are high-Ti variety ($TiO_2=1.9-4.4$ wt% and $Ti/Y=400-700$). In contrast to samples from Flows 9-12, those from Flows 1-8, the lower part of the sequence show depletion of Nb, Ta, P and Sr in the primitive mantle normalized trace elemental spider diagram and are relatively rich in Zr, La and Th, consistent with stronger crustal contamination. Gradual decrease of Zr/Nb, Th/Nb and Th/Ta ratios from the bottom to the top of the sequence, except Flow 9, indicate decreasing degrees of contamination.

Os, Ir and Ru range from 0.01 to 0.23 ppb and are low relative to Rh, Pt and Pd which range from 0.2 to 1.1, 6 to 17 and 5 to 18 ppb, respectively. Different lava flows have different primitive mantle-normalized PGE patterns, although samples from the same flow show similar PGE patterns. Pd/Ir and Pt/Pd, Ni/Pd and Pd/Cr and Ni/Pd and Cu/Ir ratios show negative correlation, suggest the result of crystal fractionation. Rocks from Flows 1-8 derived from magma show lower degrees of partial melting than rocks of Flows 9-12. The primitive mantle normalized pattern with clearly negative Ru anomaly for most of the Flows (except Flows 4 and 9) in the cross section can be interpreted by the fractionation of laurite or Os-Ir-Ru alloys in the primary magma and then coprecipitation with chromian spinel, olivine or sulfide fractionation. Thus the metal variations reflect variable extent of crystal fractionation and crustal contamination.

References

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