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云南大理苦橄岩的Re-Os同位素特征:对峨眉山大火成岩省成因的制约

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摘要：

云南大理苦橄岩产出于峨眉山大火成岩省内带,位于峨眉山玄武岩系底部。岩石具斑状结构,斑晶占20%~40%左右,由自形-半自形的橄榄石和单斜辉石组成;基质约占60%~80%,主要由长条状斜长石和颗粒状单斜辉石组成,辉绿结构;含少量尖晶石。绝大部分样品全岩SiO_2低于47%,为45.94%~46.37%(1个样品达47.35%),MgO大于18%,介于19.01%~23.77%之间,Na_2O+K_2O低于2%,介于1.52%~1.97%之间,具典型苦橄岩的岩相学和岩石化学特征。全岩Re含量变化范围较小,介于0.349×10^{-9}~0.424×10^{-9}之间;Os含量变化范围较大,介于0.889×10^{-9}~4.276×10^{-9}之间;$^{187}Re/^{188}Os$=0.437±0.012~2.708±0.025,$^{187}Os/^{188}Os$=0.1283±0.0002~0.1354±0.0004;从中分选出的橄榄石的Re、Os含量分别为0.030×10^{-9}~0.049×10^{-9}、0.625×10^{-9}~0.757×10^{-9},$^{187}Re/^{188}Os$=0.191±0.038~0.377±0.062,$^{187}Os/^{188}Os$=0.1254±0.0005~0.1268±0.0005,均低于全岩;尖晶石的Os含量最高,为80.5×10^{-9},$^{187}Os/^{188}Os$最低,为0.1252±0.0003。经质量平衡计算,基质的$^{187}Os/^{188}Os$比值介于0.1380~0.1415之间,与原始上地幔相比,基质的Re-Os同位素组成具有壳层熔岩的特点,而橄榄石和尖晶石具有熔融残留相的特点,基质的γOs大于0,介于+2.0~+3.28之间,矿物的γOs均小于0,介于-2.01~-2.59之间,显示明显的亏损特征,无核-幔边界源区信息,而全岩的介于-1.11~-3.24之间,为基质和斑晶及尖晶石的混合结果,推测峨眉山大火成岩省是壳-幔相互作用的产物。

英文摘要：

Dali picrite in Yunnan Province occurs at the bottom of Emeishan basalt in the inner zone of Emeishan Large Igneous Province (ELIP). The picrite is highly porphyritic with 20%~40% euhedral-subhedral olivine and clinopyroxenite phenocrysts, and the groundmass with diabasic texture is composed of microcrystalline olivine, clinopyroxenite and plagioclase with minor spinel. SiO_2 content of most picrites ranges from 45.94% to 46.37%, lower than 47%, except for one sample, whose SiO_2 content is up to 47.35%. In all picrite samples, MgO is higher than 18%, varying between 19.01% and 23.77%, and total Na_2O+K_2O is lower than 2%, ranging narrowly from 1.52% to 1.97%, which indicates the features of typical picrites. Whole-rock Re content shows a narrow range from 0.349×10^{-9} to 0.424×10^{-9}, while Os has a wide range from 0.889×10^{-9} to 4.276×10^{-9}; in addition, the whole-rock $^{187}Re/^{188}Os$ and $^{187}Os/^{188}Os$ ratios vary from 0.437±0.012 to 2.708±0.025 and from 0.1283±0.0002 to 0.1354±0.0004, respectively. The estimated $^{187}Os/^{188}Os$ ratios of the matrix range from 0.1380 to 0.1415 by the Mass Balance Calculation. By contrast, all Re (0.030×10^{-9}~0.049×10^{-9}) and Os (0.625×10^{-9}~0.757×10^{-9}) values of the olivines separated from the picrites are lower than those of whole-rock data, and the $^{187}Os/^{188}Os$ ratio of the olivines ranges from 0.1254±0.0005 to 0.1268±0.0005, lower than that of the whole-rock. The spinel separated from the picrites has the highest Os content up to 80.6×10^{-9} and the lowest $^{187}Os/^{188}Os$ ratio down to 0.1252±0.0003. Compared with features of the Primitive Upper Mantle (PUM), the matrix Re-Os isotopes have the crust lava affinity, while the olivine and spinel show residual mantle features. γOs values of the separated minerals (olivine and spinel) are between -2.01 and -2.59, indicating that the rock-forming materials might have originated from the depleted sources instead of from such rich or fertile areas as the boundary of the core-mantle, while the γOs values of whole-rock vary from -1.11 to -3.24, obviously the mixing result of olivine, spinel and matrix. It is inferred that the formation of ELIP should be attributed to the interaction between the crust and the mantle.

关键词：苦橄岩 壳-幔作用 Re-Os同位素 峨眉山大火成岩省 大理

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