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GR Focus Review

Basalt geochemistry as a diagnostic indicator of tectonic setting

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ABSTRACT

Basalt geochemistry can be used as a diagnostic indicator for determining the tectonic setting of origin, because specific plate tectonic settings often impart distinctive geochemical characteristics. For example: (1) mid-ocean ridge basalts (MORB) and oceanic island basalts (OIB) have clearly distinguishable trace element and Sr-Nd isotope geochemical characteristics; (2) arc related basalts, including IOAB (intra-oceanic arc basalts), IAB (island arc basalts) and CAB (continental arc basalts), exhibit following distinguishing features: all are characterized by low Nb/La ratios (<0.85) and negative Nb, Ta and Ti anomalies; most exhibit low Nb concentrations (<8 ppm), high positive ϵ_{Nd} values and low enrichment of incompatible elements except the continental arc shoshonitic basalts that possess high concentrations of incompatible trace elements and lower to negative ϵ_{Nd} values; (3) although contamination by continental crust or lithosphere can impart subduction-like signature (e.g., low Nb, low Ta and low Ti) and lead to misidentification of contaminated continental intraplate basalts as arc related, there are still some essential differences between continental intraplate basalts and arc related ones; such as: uncontaminated continental intraplate basalts have high Nb concentrations, $\text{Nb/La} > 1$, “hump-shaped” OIB-like trace element patterns and moderate positive ϵ_{Nd} values that distinguish them from the arc related ones; whereas,

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