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Collision-induced mantle flow as a driver of extrusion tectonics: a comparison of southeast Asia and the eastern Mediterranean

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Magmatic activity during plate collisions progresses from calcalkaline to potassic, ultrapotassic, and basaltic affinity, matching geodynamic responses such as crustal shortening and thickening, continental 'escape', and the propagation of marginal basins. In the case of the Arabian and Indian collisions potassic activity mostly predated the onset of (west- and SW-ward) Anatolian and (SE-ward) Indochina escape, accommodated respectively by the Bitlis and Red River faults. 'Post-extrusion' basalts reflect apparent intraplate stress reorientation associated with the slowing or cessation of marginal basin propagation. In considering the dynamic relationships involved, we address two critical problems: 1) evidence that basin opening began prior to the escape of 'conjugate' blocks, and 2) the presence of horizontal rather than vertically-disposed (plume-like) mantle thermal anomalies beneath 'post-extrusion' basalts. Comparison of Neogene-Quaternary (mantle-normalized) magmas from Anatolia and Indochina with parameterized experimental melts suggest the following: 1) Anatolian basalts segregated from spinel- to garnet-lherzolitic mantle between c. 2 and 3 GPa. (c. 70-100 km depth) under H_2O-undersaturated conditions, interpolated potential temperatures (T_p) ranging: 1) 1250-1450^{o}C in eastern Anatolia, 1300-1375^{o}C in Central Anatolia, and 1250 and 1330^{o}C in western Anatolia, lithospheric stretching factors (β) ranging between1.2 and 2.5; 2) Indochina basalts segregated under similar, H_2O-

undersaturated conditions, at pressures between 1.5 and 3.5 GPa, T_p ranging 1350-1450^{o}C, and β values 1.5-2.5. In both cases, H_2O-undersaturated conditions are indicated by: relatively high basalt H_2O contents (cf. MORB and OIB), melt segregation pressures consistent with shallow asthenospheric sources, and 3) interpolated mantle adiabats of 2 - 3^{o}C/km, cf. $< 1^o$C/km expected for anhydrous conditions. Small but significant differences in source composition and ambient melt fraction are indicated while Ce/Sm vs. Sm/Yb tcovariance is consistent with primitive melts segregation at the spinel-garnet lherzolite transition. In both regions, geochemical (major and trace element) and isotopic (Sr, Nd, and Pb) covariance suggests that ultrapotassic magmas tap convecting 'mantle wedge' sources contaminated via 'corner-flow' delamination by hydrated lithospheric mantle and lower crust. Post-extrusion basalts tap essentially uncontaminated, collision-displaced asthenospheric sources, in response to post-collision lithosphere transtension. Lastly, 'secondary' post-extrusion potassic and ultrapotassic activity reflects arc-continent collisions resulting from slab rollback, e.g. in the Isparta Angle (SW Turkey) – where the Hellenic arc has collided with the extinct Cyprian arc and an entrapped Gondwana microcontinent, and the Sunda-Banda arc, in collision with north-drifting Australia.