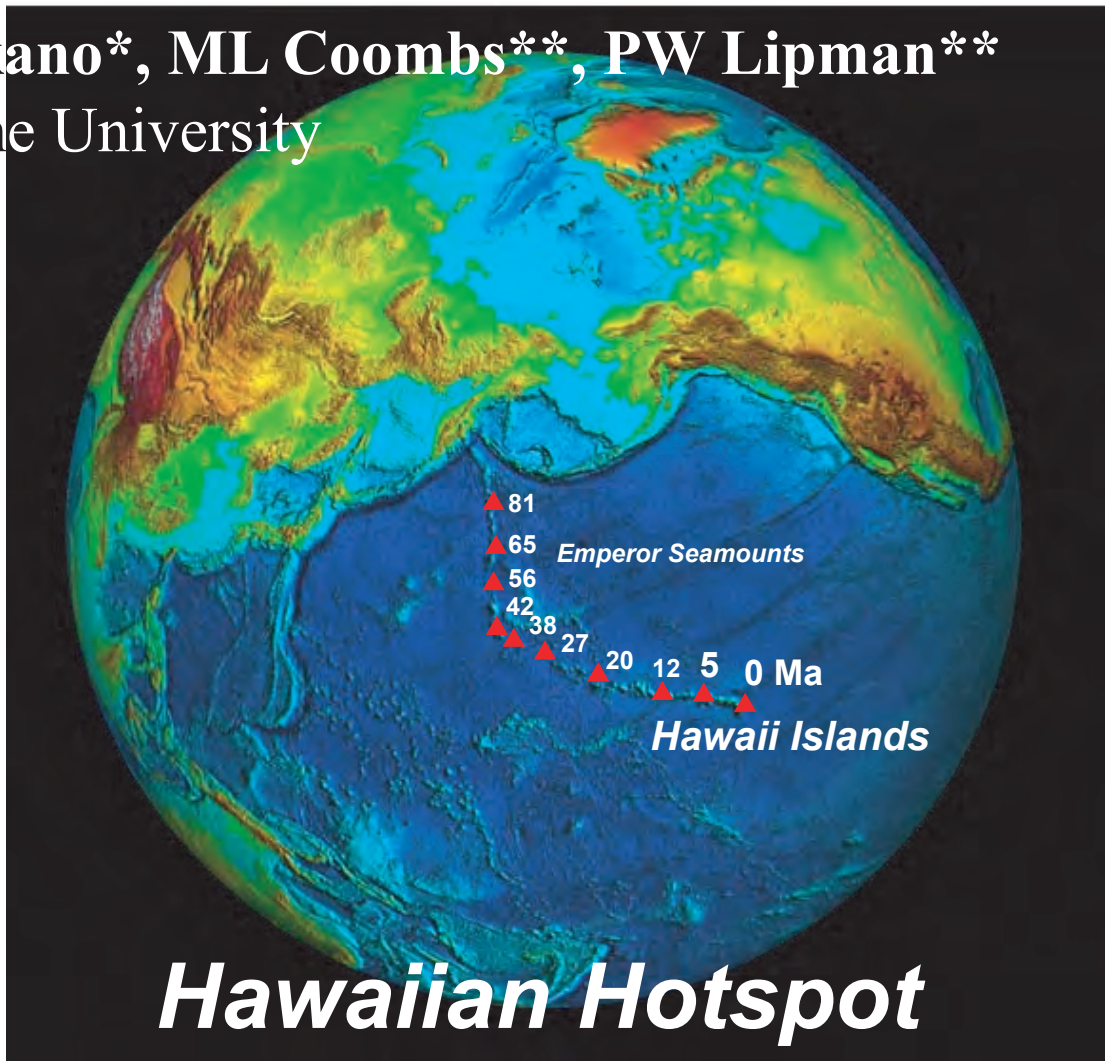
V51B-0546 (AGU Fall Meeting)

High precision Pb, Sr, and Nd isotope geochemistry of alkalic early Kilauea magmas from the submarine Hilina bench region, and the nature of the Hilina/Kea mantle component

J-I Kimura*, TW Sisson, N Nakano*, ML Coombs**, PW Lipman****

*Department of Geoscience, Shimane University

**Volcano Hazard Team, USGS



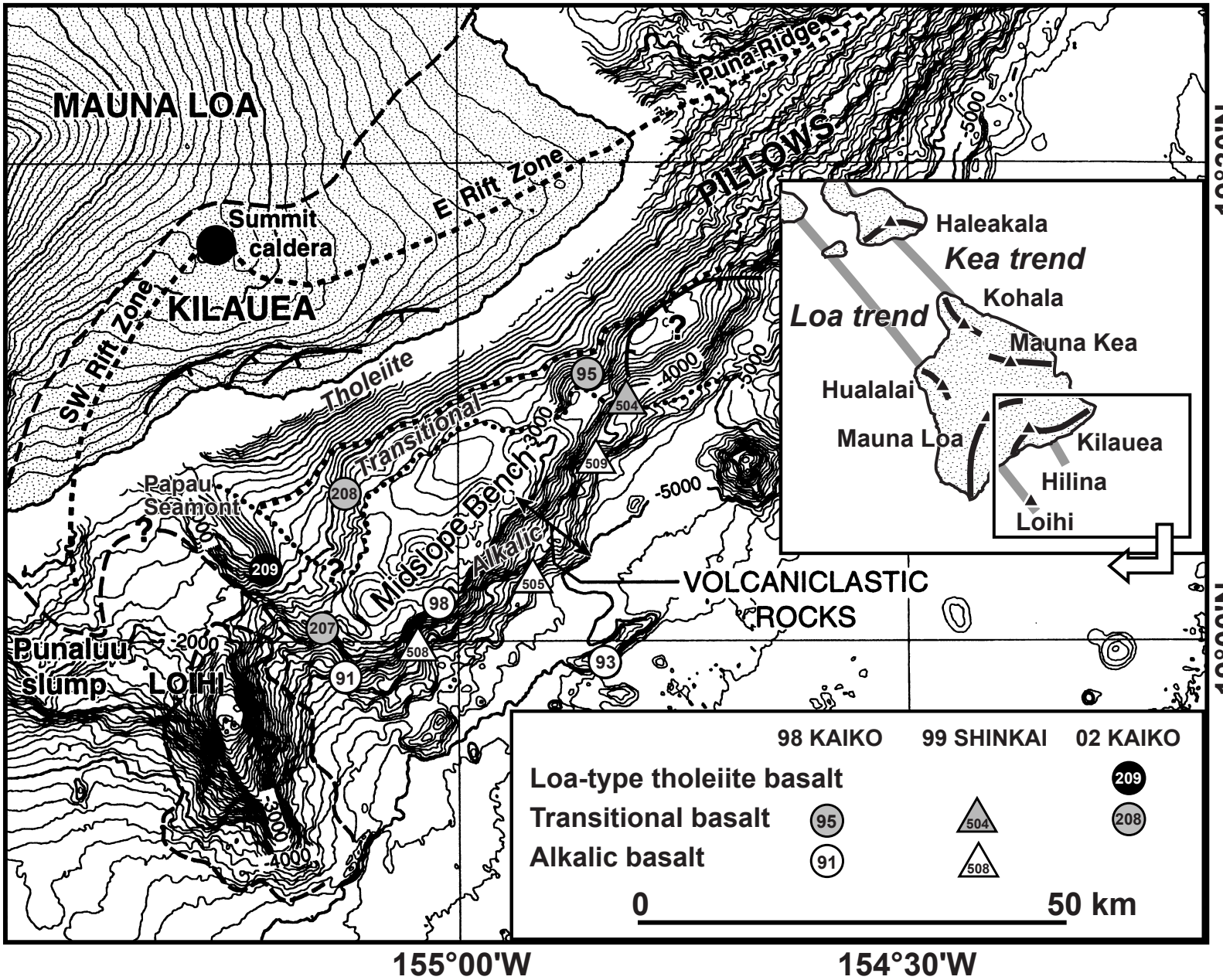


Fig. 1: Samples obtained by Shinkai 6500 and Kaiko dives in 1998-2002

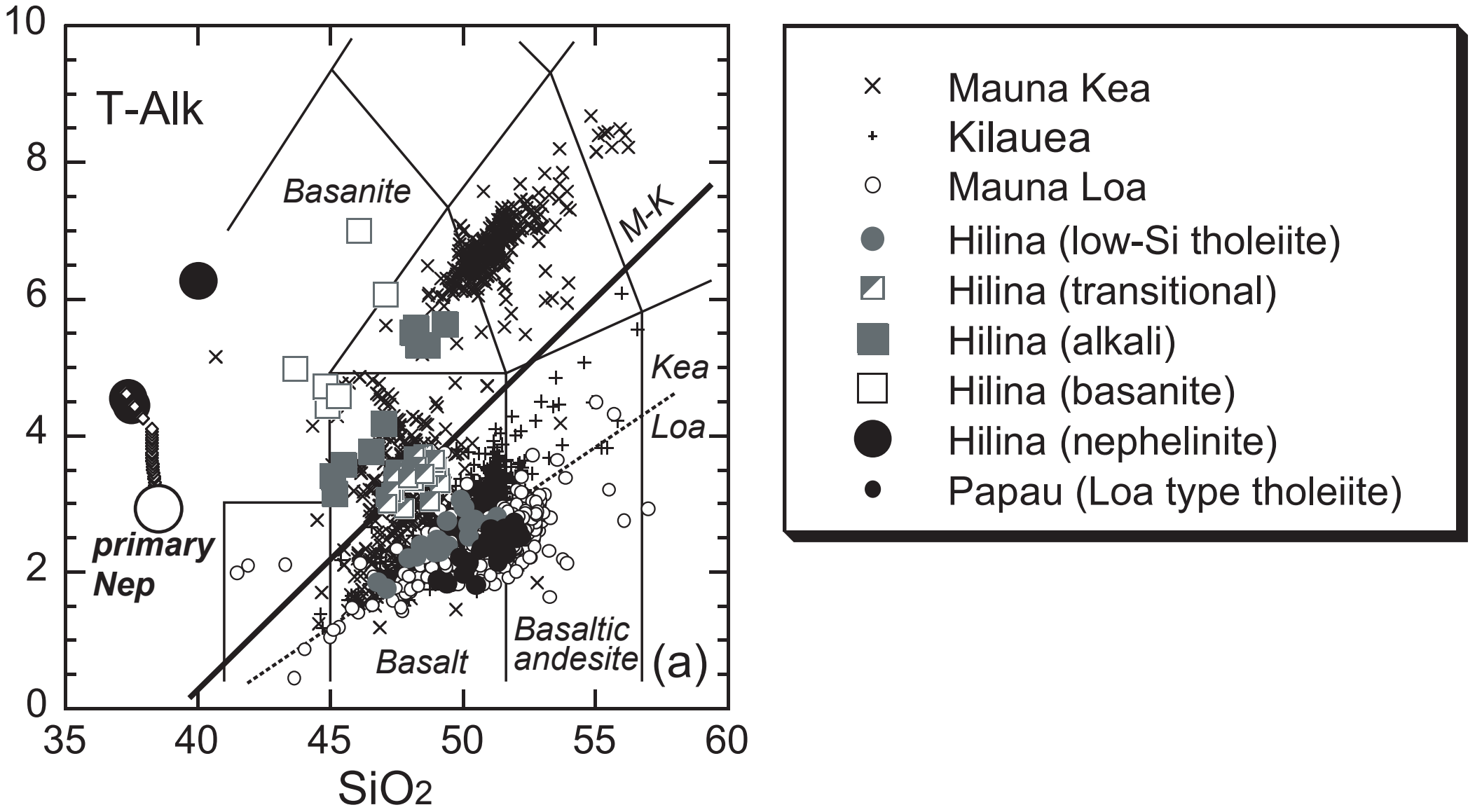


Fig. 2: TAS classification and comparison of the early Kilauea lavas to representative lavas from Hawaii Big Island. Kea-type tholeiite through transitional, alkali, basanite to nephelinite lavas were collected from Hilina bench. Loa-type tholeiite from Papau seamount

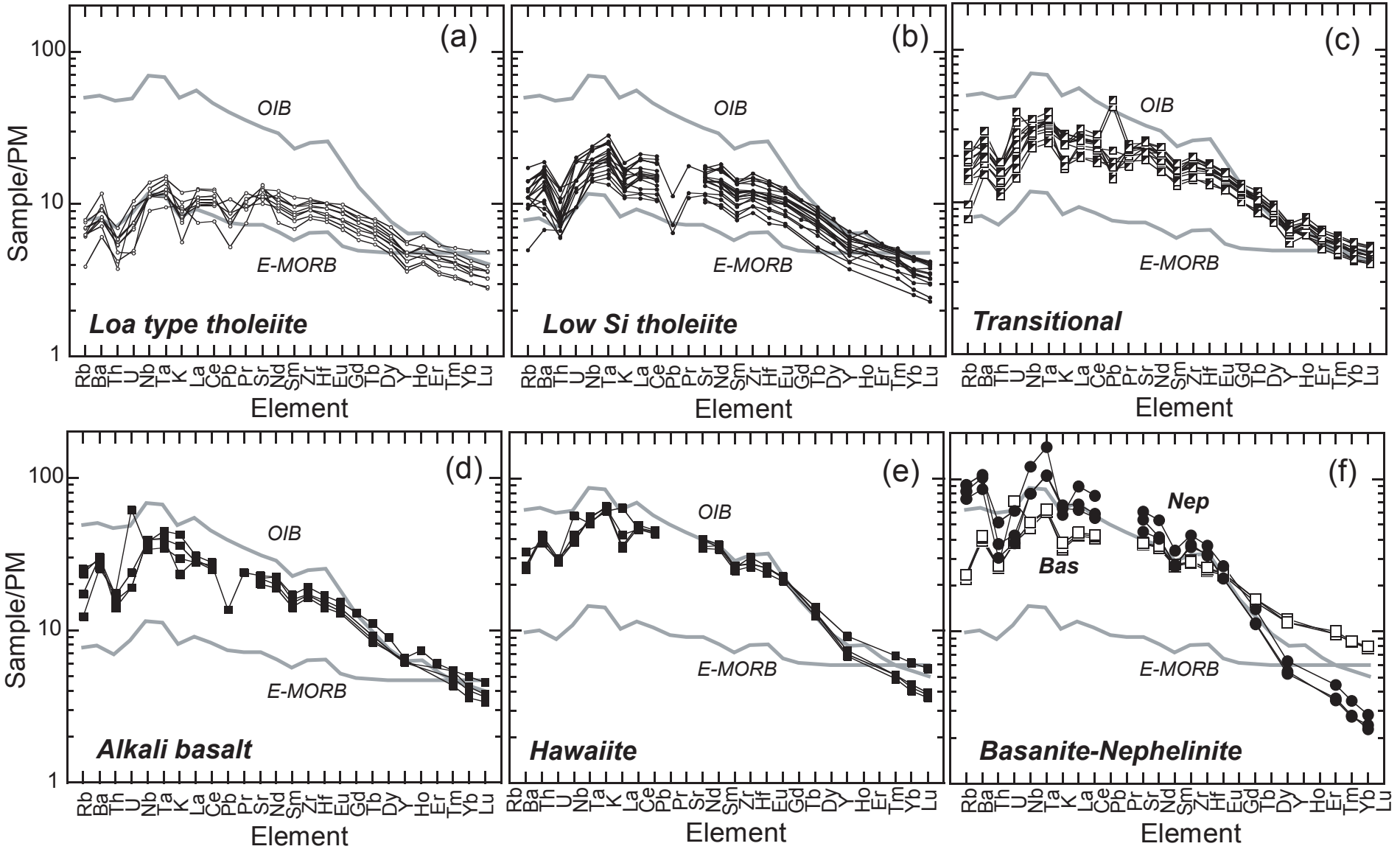


Fig. 3: Incompatible element spider diagrams for early Kilauea lavas
Compositions range from E-MORB to OIB types and more with
mid incompatible element humped and depletions in U, Th, K, and Pb

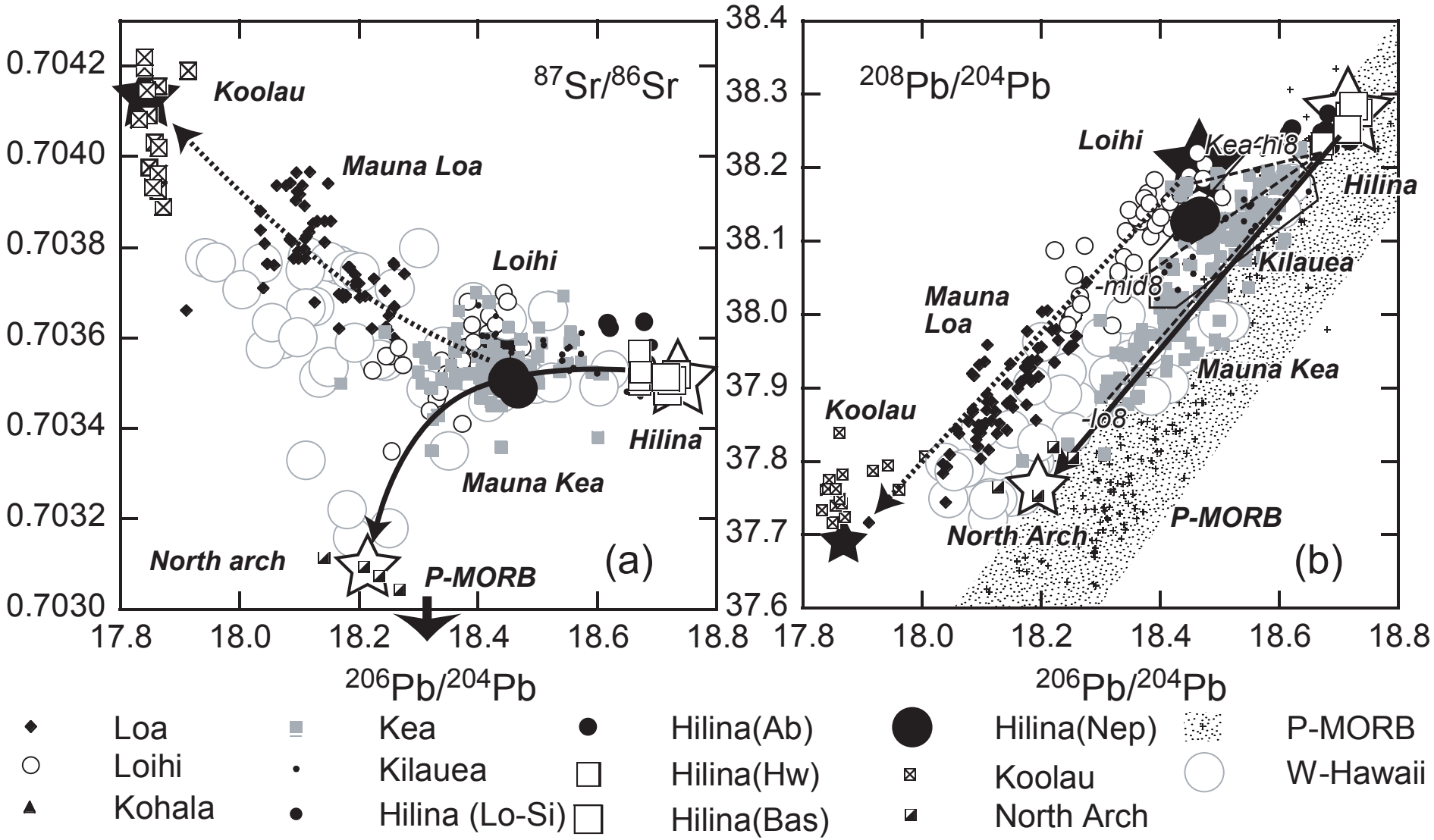


Fig.4: Figures showing isotopic characteristics of Hilina/Kea component with other endmembers (North arch, Loihi, Koolau) for Hawaiian hotspot.
Four discrete components are necessary for Hawaiian hotspot. These are spatially related and classified into Loihi-Loa-Koolau and Hilina-Lea-North arch trends

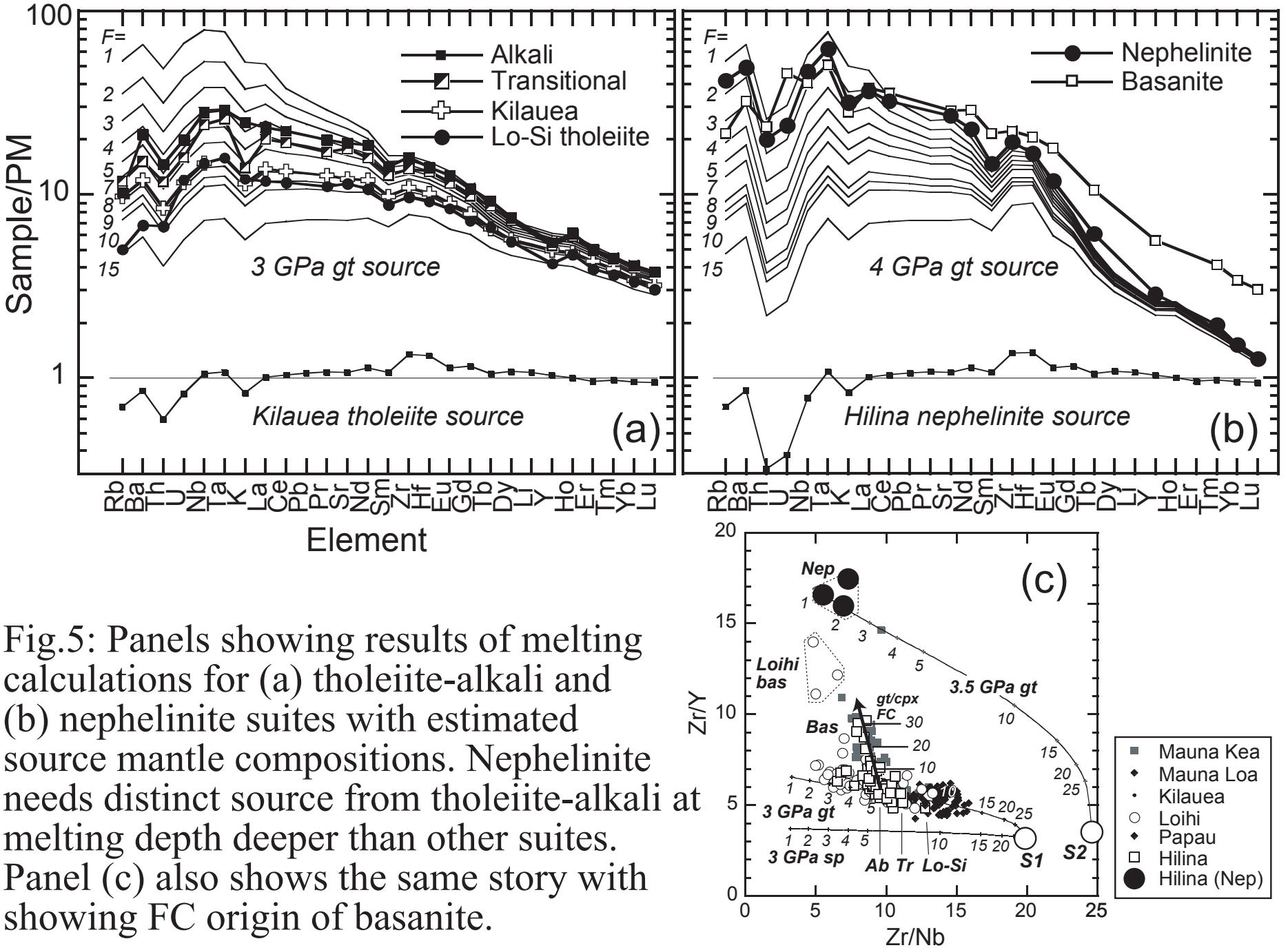


Fig.5: Panels showing results of melting calculations for (a) tholeiite-alkali and (b) nephelinite suites with estimated source mantle compositions. Nephelinite needs distinct source from tholeiite-alkali at melting depth deeper than other suites. Panel (c) also shows the same story with showing FC origin of basanite.

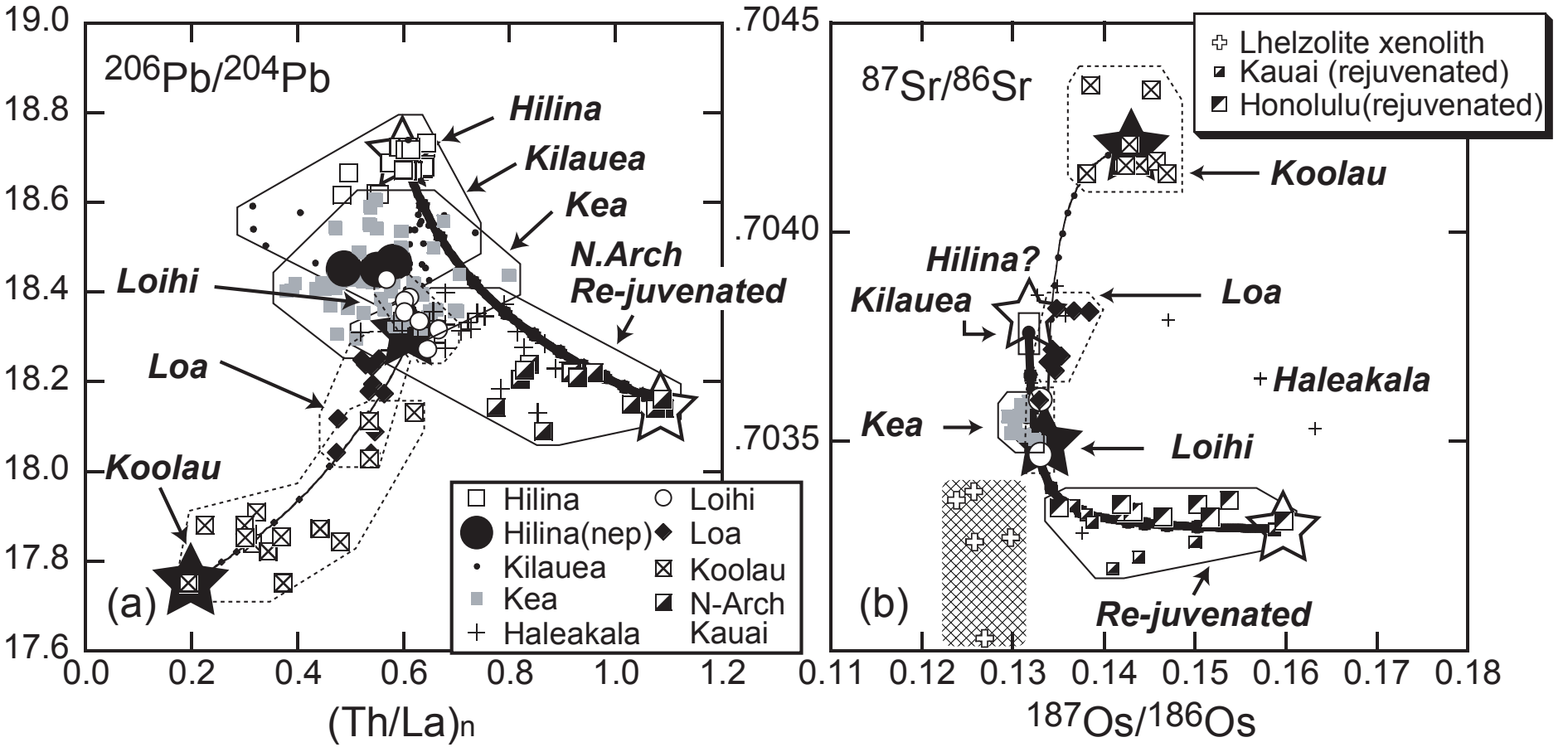


Fig. 6: Mixing models of lava sources with different element-isotope pairs Hilina-Kea-North arch (Re-juvenated) and Loihi-Loa-Koolau mixing trends are again identical, which is similar with Nd-Sr-Pb isotope plots in Fig. 4. Loihi and Hilina components are generally similar but $^{208}Pb/^{204}Pb$ ratios are systematically different. Note that degree of Th depletion $(Th/La)_n < 1$ is also important factor for Hawaiian lavas and this varies between different sources with Koolau endmember as lowest.

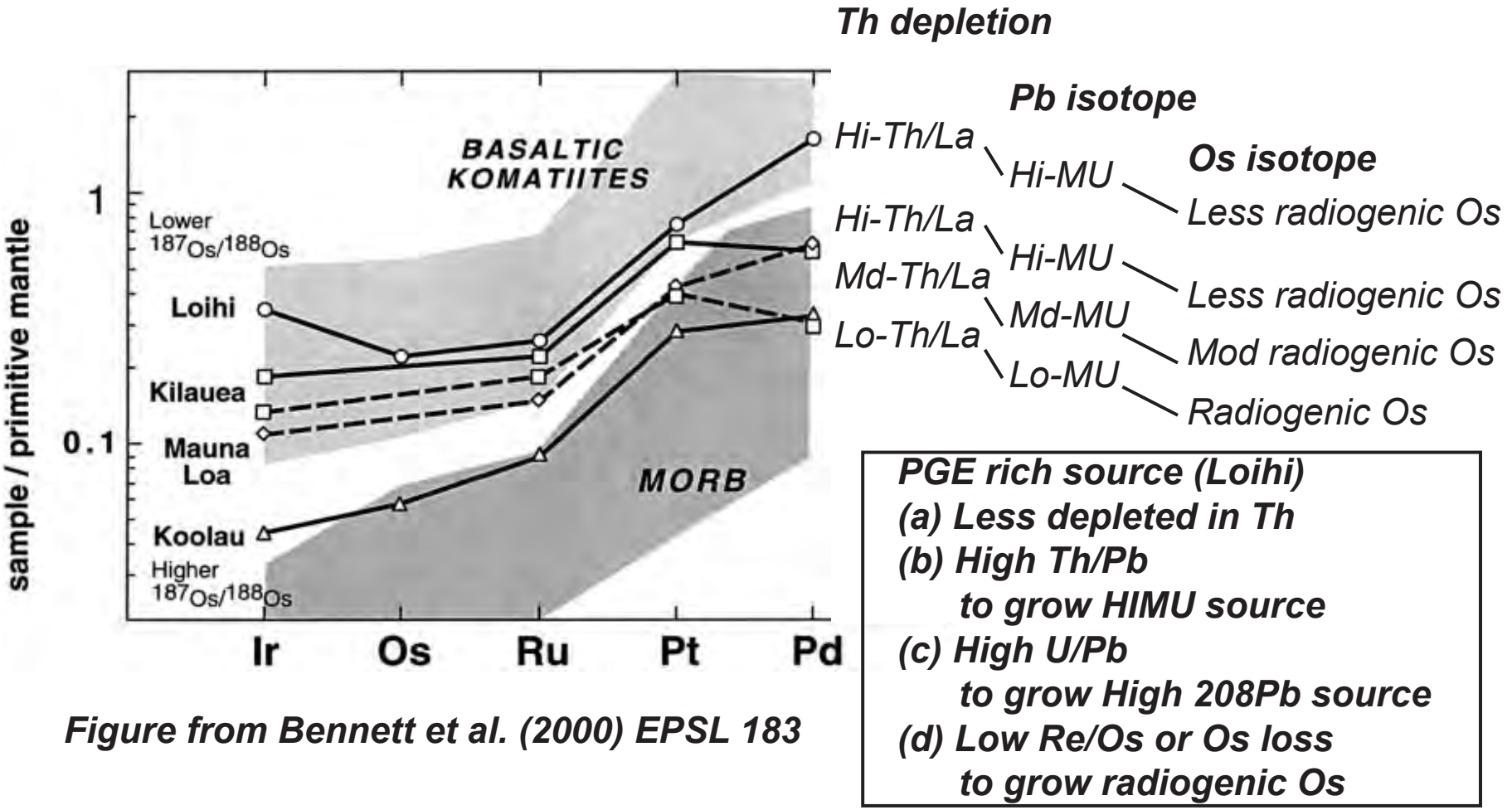


Figure from Bennett et al. (2000) EPSL 183

Fig. 7: PGE composition of Hawaiian lavas reported by Bennett et al. and its relation to Th-Pb depletions and Os isotope characteristics.
Loss in Th-Pb-PGEs and Os can be caused simultaneously by sulfide melt extraction in the source. Radiogenic Os istope found in the most PGE depleted Koolau lavas shows sulfide melt depletion occurred at an ancient time.

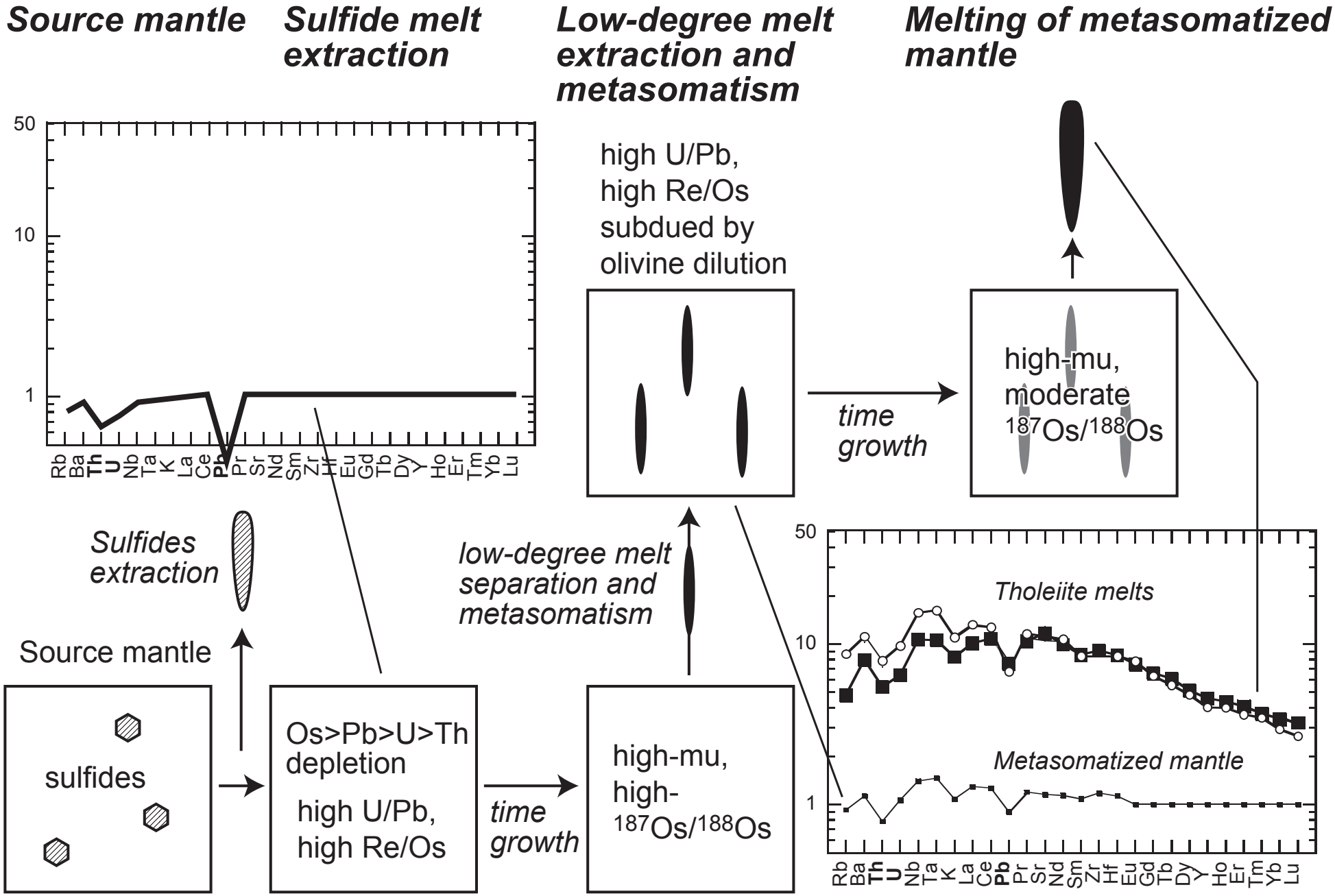


Fig. 8: Figure showing sulfide melt depletion - low degree melt metasomatism two stage model for the Hilina mantle source of Hawaiian volcano

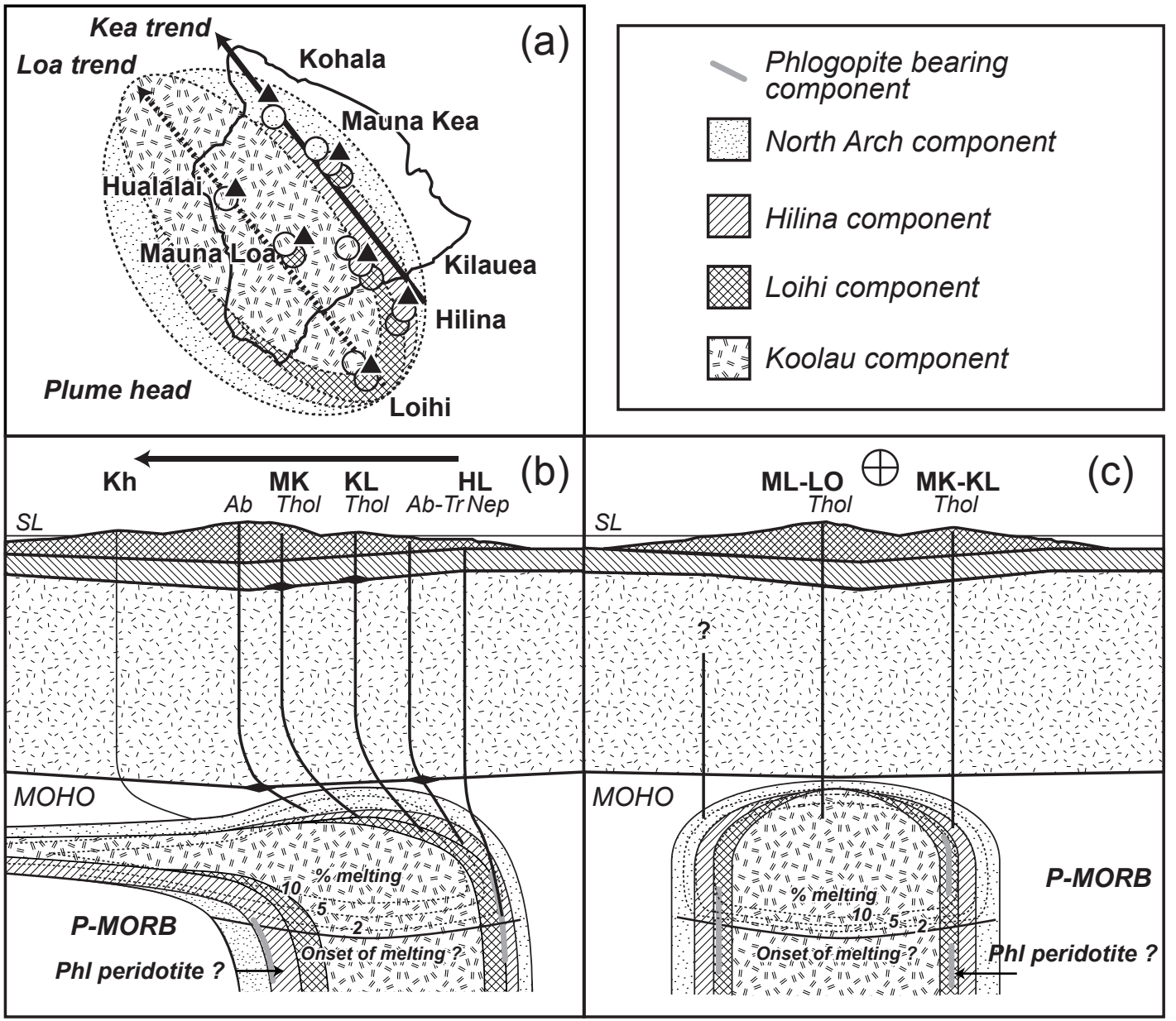


Fig. 9: A concentric structure model of source region of Hawaii hotspot suggesting plume origin of the hotspot.