Appendix C: Calculation of initial isotopic compositions and diagrams illustrating alteration effects.

Initial isotopic compositions for our samples were calculated using the $^{40}Ar/^{39}Ar$ ages determined in this study and an age of 85 Ma is assumed for samples where age data are not available. The reference data were also projected to a common age of 85 Ma to be able to compare them with our data. Exceptions are reference data, which are significantly younger (<50 Ma old) than the samples from the main CLIP phases, namely data of the Galápagos Islands and the younger Galápagos hotspot track. Since melting and differentiation processes can fractionate the parent/daughter ratios of the source, measured ratios cannot be applied to project the isotope ratios of these young rock samples correctly. Thus we assumed proposed source parent/daughter ratios for average depleted MORB mantle (DMM) from Workman and Hart (2005) for the Atlantic and Pacific MORB fields and for the depleted eastern domain of the Galápagos Islands with the following trace element concentrations in ppm: Pb = 0.018, U = 0.0032, Th = 0.0079, Rb = 0.05, Sr = 7.664, Sm = 0.239, Nd = 0.581, Lu = 0.058, Hf = 0.157. For the three more enriched domains, we used the concentrations in ppm for bulk subducted igneous crust from Stracke et al. (2003): Pb = 0.09, U = 0.027, Th = 0.088, Rb = 0.57, Sr = 81, Sm = 2.69, Nd = 7.45, Lu = 0.45, Hf = 1.78. For the Galápagos hotspot track, initial isotope ratios were first calculated using measured trace element concentrations and their ages and then projected to 85 Ma using the source parent/daughter ratios from Workman and Hart (2005) for tholeiites and those from Stracke et al. (2003) for alkali basalts.

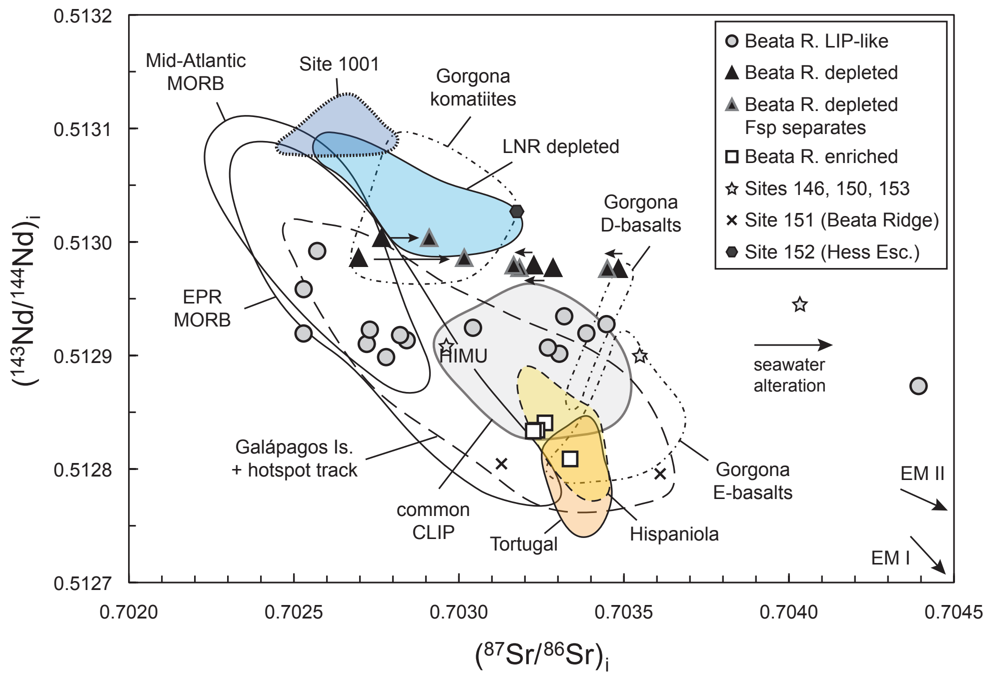

Fig. C.1. Initial $^{87}Sr/^{86}Sr$ versus $^{143}Nd/^{144}Nd$ diagram. Although many of the samples from the LIP-like and from the depleted group are shifted to higher $^{87}Sr^{86}Sr$ ratios, the division into the three distinct groups is visible. For the depleted group, Sr isotope data from whole rock samples as well as from plagioclase separates are shown. Data from DSDP Leg 15, Sites 146 and 150-153 are also included (Hauff et al., 2000a). Additionally shown are fields for common CLIP (Hastie et al., 2016; Hastie et al., 2008; Hauff et al., 2000a; Hauff et al., 2000b; Hoernle et al., 2004; White et al., 1999), Hispaniola (Escuder-Viruete et al., 2007; Lapierre et al., 1999; Lapierre et al., 1997), Tortugal (Hauff et al., 2000b; Trela et al., 2017), ODP Leg 165 Site 1001 (Kerr et al., 2009), depleted samples from the Lower Nicaraguan Rise (LNR; Dürkefälden et al., accepted), Galápagos Islands (Is.) (Blichert-Toft and White, 2001; White et al., 1993; GEOROC at http://georoc.mpch.gwdg.de/georoc/) and Galápagos hotspot track (Hauff et al., 2000a; Hauff et al., 2000b; Hoernle et al., 2002; Trela et al., 2015) and for Gorgona komatiites, depleted (D-) and enriched (E-)basalts (Aitken and Echeverría, 1984; Révillon et al., 2000; Révillon et al., 2002; Serrano et al., 2011). The Mid-Atlantic and East Pacific Rise (EPR) MORB fields comprise data from the PetDB database (http://www.earthchem.org/petdb). Initial isotopic compositions are calculated at 85 Ma. Analytical errors are smaller than the symbol size.

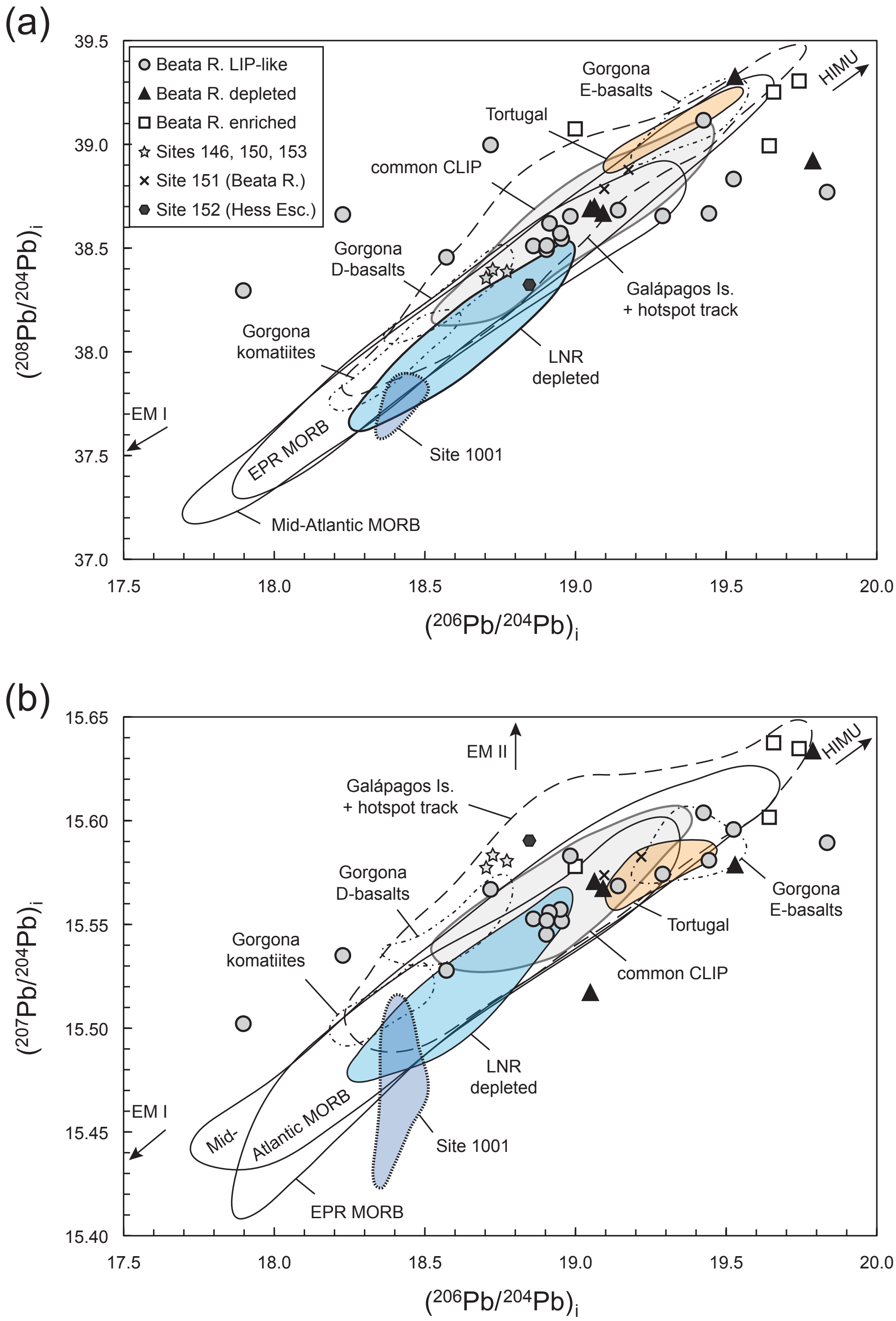

Fig. C.2. (a) Initial $^{206}Pb/^{204}Pb$ versus $^{208}Pb/^{204}Pb$ and (b) initial $^{206}Pb/^{204}Pb$ versus $^{207}Pb/^{204}Pb$ diagrams illustrating that the Pb isotope system is significantly affected by alteration processes. Data sources are the same as in Fig. C.1. Initial isotopic compositions are calculated at 85 Ma. Analytical errors are smaller than the symbol size.

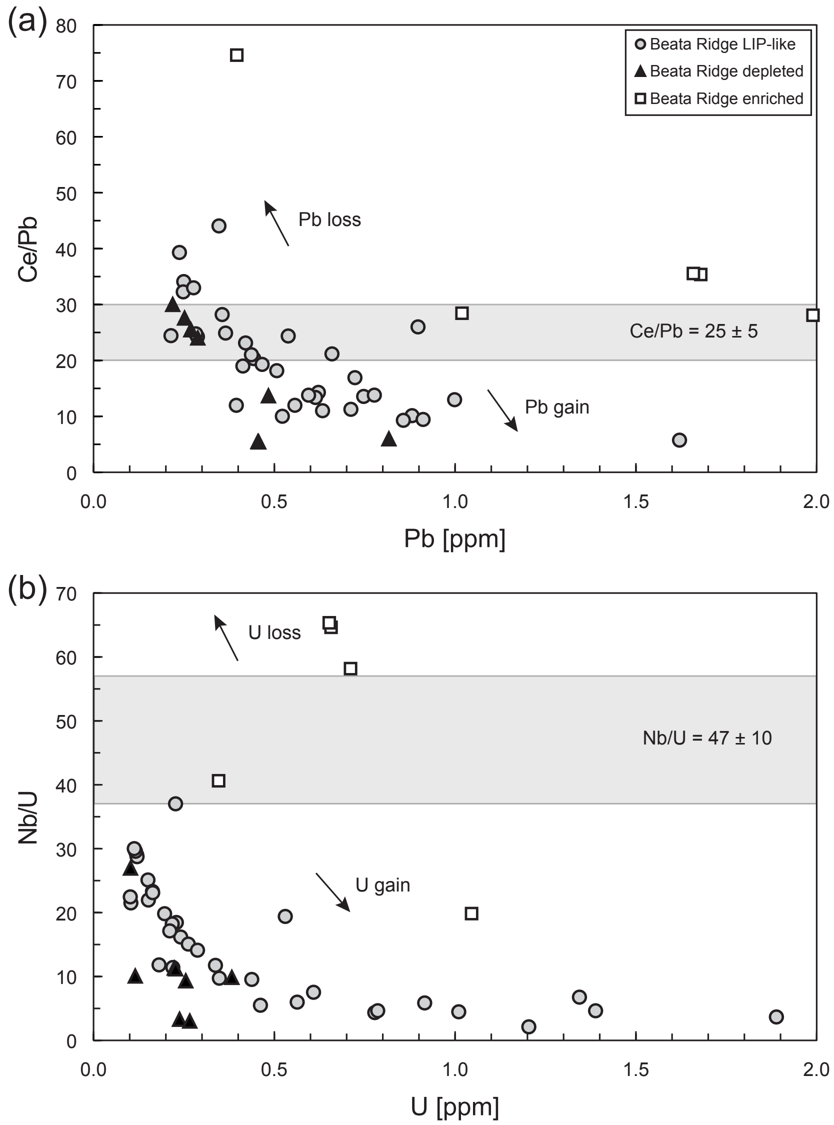

Fig. C.3. (a) Pb versus Ce/Pb diagram. The gray box shows a Ce/Pb ratio of 25 ± 5, which is typical for MORB and OIB (Hofmann et al., 1986), and the Pb concentrations of samples within this range are assumed to not have been significantly influenced by hydrothermal alteration. A few samples lie above this ratio and have lost Pb, whereas a large number of samples have Ce/Pb ratios lower than 20 and have gained Pb. (b) U versus Nb/U diagram demonstrating that most of the samples from the Beata Ridge are significantly affected by U gain during alteration processes. They lie below the Nb/U ratio of 47 ± 10 typical for MORB and OIB (gray box; Hofmann et al., 1986) and have high U concentrations.

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