Hoernle, K., et al., 2021, Hikurangi Plateau subduction a trigger for Vitiaz arc splitting and Havre Trough opening (southwestern Pacific): Geology, v. 49, https://doi.org/10.1130/G48436.1

Supplemental Material

Samples and Analytical Methods

Sample preparation and locations

The cruise SO255 sample sites (see Figure below) and a detailed description of the recovered rocks are reported in Hoernle et al. (2017). The altered outer rinds of the samples were sawed off of the lavas. The remaining sample was cleaned with distilled water and then dried at 50°C. Then it was crushed in a steel jaw crusher, dry sieved and cleaned again with distilled water in an ultrasonic bath to remove dust. The freshest possible material was carefully handpicked in the 0.5-1 mm size fraction under a binocular microscope for the geochemical analyses. Half of the rock chips were ground to a fine powder using an agate mortar grinder and an agate planetary ball mill. This powder was used for trace element analysis. The remaining half of the rock chips were used for Sr-Nd-Pb isotopic analysis.

Trace element and isotope analytical methods

Trace element compositions were analyzed by solution inductively coupled plasma mass spectrometry (ICP-MS) at the Institute of Geosciences (IfG) at Kiel University, Germany using an Agilent 7500cs ICP-MS. 100 mg of sample powder was dissolved by acid-pressure digestion and measured following the method of Garbe-Schönberg (1993). BHVO-2 and AGV-2 generally replicate better than 4% 1SD. Our results for reference materials are within uncertainties of the compiled recommended values (Jochum et al., 2016). Replicate analysis of three samples deviate within 2% for the vast majority of elements.

Radiogenic isotope analyses (Sr-Nd-Pb-Hf) were conducted at the GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany by thermal ionization mass spectrometry (TIMS, Sr-Nd-Pb) and MC-ICPMS (Hf) following the methods outlined in Jacques et al. (2019) and Dausmann et al., (2019), respectively. Sr-Nd-Pb ion chromatography followed established standard procedures of Hoernle et al. (2008) for Sr-Nd-Pb and Geldmacher et al. (2006) for Hf.

Approximately 100-200 mg hand-picked whole-rock chips (500-1000 μm) were leached in 2N HCl at 70°C for 1 hour prior to dissolution. Ion chromatography followed established standard procedures. Sr and Nd isotope ratios were determined on a Thermo Scientific TRITON

Plus TIMS operating in static multi-collection mode and normalized within run to $^{86}Sr/^{88}Sr$ = 0.1194 and $^{146}Nd/^{144}Nd$ = 0.7219, respectively. Measurement errors are reported as a 2σ standard error (2SE). Reference materials were measured 4 to 5 times along with the samples on each turret and the average ratio of the standard subtracted from the preferred reference values to obtain a delta value to be added to the sample and standard data of each turret. This procedure ensures long-term comparability of data generated at different times and different instruments. Accordingly, NBS987 gave $^{87}Sr/^{86}Sr$ = 0.710250 ± 0.000008 (n = 101; 2σ standard deviation (2SD) and La Jolla gave $^{143}Nd/^{144}Nd$ = 0.511850 ± 0.000005 (n = 95; 2SD). Possible mass interferences by ^{87}Rb and ^{144}Sm were monitored by ^{85}Rb and ^{147}Sm but none were detected. Pb isotope analyses were carried out in static multi-collection mode on the TRITON *Plus* TIMS using Pb double-spike (Pb-DS) after Hoernle et al. (2011). Pb-DS corrected NBS981values are $^{206}Pb/^{204}Pb$ = 16.9408 ± 0.0018, $^{207}Pb/^{204}Pb$ = 15.4975 ± 0.0018 and $^{208}Pb/^{204}Pb$ = 36.7207 ± 0.0047 (n = 173; 2SD since installation of the instrument in 2014). Hafnium isotopic analyses were performed statically on a Thermo Scientific NEPTUNE *Plus* MC-ICP-MS at GEOMAR following . Drift corrected $^{176}Hf/^{177}Hf$ yielded = 0.282170 ± 6 (n= 110) for our in-house Hf SPEX CertiPrep™ solution which corresponds to $^{176}Hf/^{177}Hf$ = 0.282163 for JMC-475 Blichert-Toft et al. (1997). Total chemistry blanks were typically <30pg Pb, < 100pg Sr, < 50pg Nd & Hf and are therefore considered negligible relative to the amounts of sample used. Sr-Nd-Pb isotopes were replicated by means of separate digests and element separation on eight samples and one samples for Hf. In most cases data was reproduced within 2SD of the reference materials mentioned above. In addition, reference materials BCR-2 and AGV-2 were processed multiple times for Sr-Nd-Pb-Hf isotope ratio analysis similar to the samples. The results compare well with the high precision data of Fourny et al (2016) and Todd et al. (2015). We note that in contrast to unleached $^{87}Sr/^{87}Sr$ in BCR-2 of Fourny et al (2016) leached $^{87}Sr/^{87}Sr$ of BCR-2 is slightly more variable in the study presented here and may reflect a combination of sample heterogeneity and leaching effects. All sample data and relevant meta data along with the quality control data can be found in Appendix_DR3_Reference Materials and Replicates.

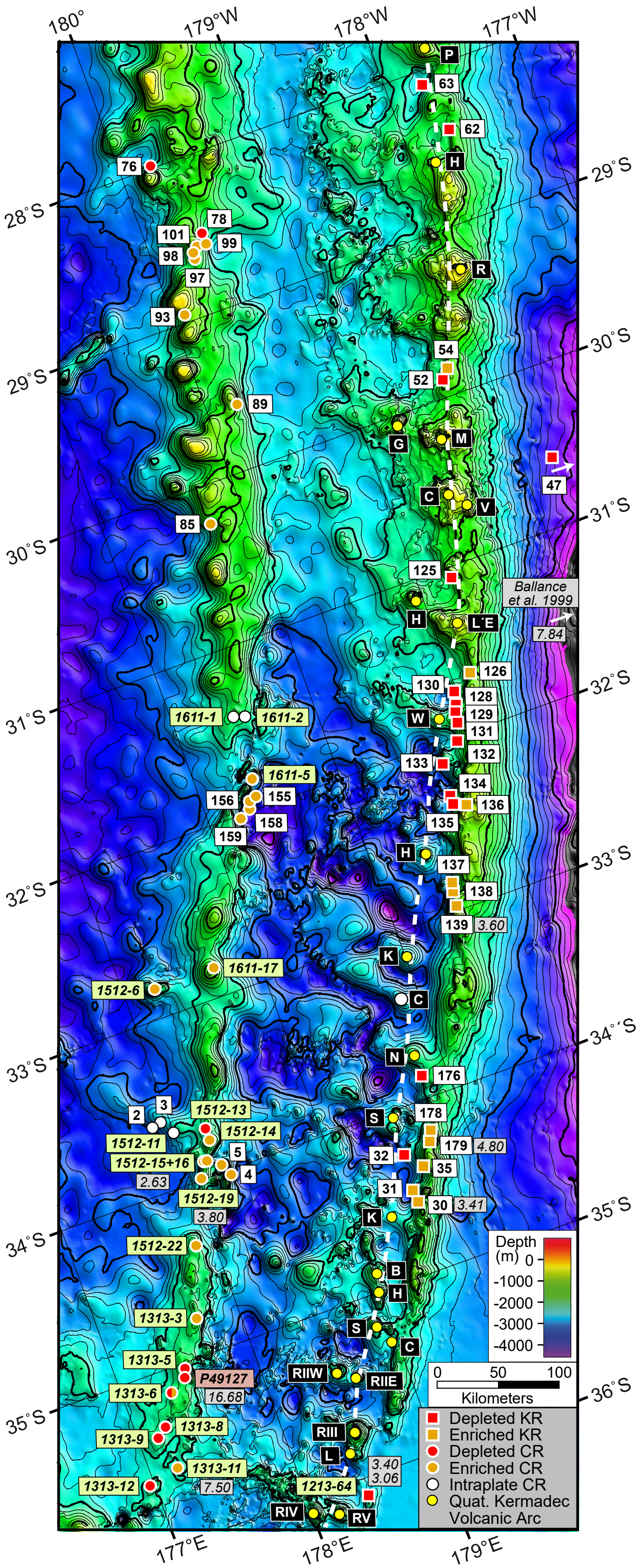

Figure S1: Map showing sample locations on the Kermadec Ridge (KR) and Colville Ridge (CR). The base map is from „The GEBCO_2014 Grid, version 20150318, http://www.gebco.net". Numbered symbols represent RV SONNE (white background), RV TANGAROA (yellow background), and RV VOLCANOLOG dredge sites (auburn background). Quaternary Volcanic Arc volcanoes are identified by numbers in black squares as follows, from south to north: RV, Rumble V; RIV, Rumble IV; L, Lille; RIII, Rumble III; RIIE, Rumble II East; RIIW, Rumble II West; C, Cotton; S, Silent; H, Healy; B, Brothers; K, Kibblewhite; S, Sonne; N, Ngatoroirangi; C, Cole; K, Kuiwai; H, Huanharoa; W, Wright; L'E, L'Esperance; H, Havre; V, Volcanolog; C, Curtis; M, Macauley; G, Giggenbach; R, Raoul; H, Hinetapeka; P, Putoto. Ar/Ar-ages (Ma, grey background) are from Balance et al., (1999), Mortimer et al. (2010) and Timm et al. (2019).

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