SUPPLEMENTAL INFORMATION

Analytical details.

Hf is purified using 1 ml of Ln-Spec 100-150μ resin in BioRad poly-prep columns. Samples are loaded in 3M HCl and eluted following Munker et al. (2002) where major elements are first removed in 3M HCl, Ti-Nb in weak nitric and citric acid, Zr in (6M HCl + 0.06M HF), and finally Hf in (6M HCl + 0.4N HF). Hf isotopes are measured by solution MC-ICPMS in static mode. Solutions are 2% HNO_3 with trace HF which contain 50-100 ppb Hf. Sensitivity is ~200V per ppm Hf in solution. Solutions are introduced using an MCN 6000 desolvating spray chamber and free aspiration with an uptake rate of 50microL/min. Sweep gas and nitrogen flow rates are ~3.5 L/min and 10-20 mL/min, respectively. Rinse time is 5 min. Total data collection time per analysis is 20 minutes, and the total sample consumed is ~1 ml. Data are collected as a single block of 100 8-second integrations. On-peak backgrounds are measured immediately prior to each analysis and automatically subtracted from all peaks. Mass bias is corrected exponentially using $^{179}Hf/^{177}Hf = 0.7325$, and small (<<1%) isobaric interferences of Yb and Lu on 176Hf are corrected using $^{176}Lu/^{175}Lu = 0.2656$ and $^{176}Yb/^{173}Yb = 0.7876$. JMC 475 is run 4-5 times during each analytical session and results are reproducible within one session to <0.000004 (2σ). Daily average values during 2003-4 are $^{176}Hf/^{177}Hf$ = 0.282146 +/- 0.000006 (2σ). Results for each analytical session are normalized to JMC 475 = 0.282160 for that session. JMC-normalized values for unknowns agree between sessions to within 0.000005, which we take as our external reproducibility.

Model details from Figure 3.

For lines 1 and 3, a 25% non-modal batch melt of either clay-free (line 1) or volcaniclastic (line 3) sediment was extracted from a metasedimentary eclogite (60:40, Cpx:Gt mode; 40:60, Cpx:Gt melt mode), and added to depleted mantle. Results for sediment-derived fluid do not differ at the scale of this figure (see text). Lines 2 and 4 differ from lines 1 and 3 in that rutile, zircon, and monazite, in addition to garnet and clinopyroxene, are residual phases during batch partial melting (60:39, Cpx:Gt, +1%rutile, 0.003% zircon, 0.0001% monazite). The same lines apply for 0.0025% zircon and no monazite, or to any process in which Nd/Hf of the sediment component is increased sixfold. Tick marks on line 4 show the percent of sediment melt added. The depleted mantle for the Philippine Sea Plate has an Indian isotopic affinity (Woodhead et al., 2003). Mineral/melt partition coefficients for Nd, Sm, and Hf are 0.052, 0.25, 0.255 for garnet (Chauvel and Blichert-Toft, 2001); 0.36, 0.67, 0.55 for clinopyroxene (Blundy et al., 1998); 0.0003, 0.0009, 40 for rutile (Tatsumi and Hanyu, 2003), 0.022, 0.242, 64600 for zircon (Rubatto and Hermann, 2003); and 76400, 75300, 1 for monazite (Bea and Montero, 1999).

Figure comparisons.

Careful readers may wonder about subtle differences between Figures 3 and 4 of this paper and Figures 8a and 8b of Wade et al. (2004)[W04]. The two pairs were created at about the same time but use slightly different assumptions.

1. Type of sediment. Lines 1 and 2 in this paper assume the same clay-free sediment as the two lines labeled "bulk sed minus clay" in W04. This sediment was calculated from the weighted average of the remaining sediments in ODP Site 801. It lies on the chert-VC join in the inset to Figure 3. Lines 3 and 4 in this paper (volcaniclastic sediment) were not addressed in W04. Similarly, the lines labeled "bulk sed" in W04 are not repeated in this paper. They originate from "Avg" in Figure 3.
2. Enhanced Nd/Hf ratio of the sediment component. Lines 2 and 4 in this paper show the effect of adding a sediment component in which the Nd/Hf ratio is 6 times that of bulk sediment. This enhancement reflects the residual mineralogy during sediment melting or dehydration, which is quantitatively modeled in this paper. The lines labeled "(Nd/Hf) = 3*something" in W04 show the effect of adding a component with a Nd/Hf ratio 3 times that of bulk sediment.
3. Sediment addition contours. In this paper, tickmarks show the percent of *sediment melt* added to depleted mantle. In W04, lines connect tickmarks showing the effect of 1% and 2% *sediment* added to the same mantle. These lines are horizontal in Fig. 8a and vertical in Fig. 8b, whereas lines connecting the 1% and 2% values of Figures 3 and 4 of this paper are inclined. The difference reflects the differential effects of melting on the two axes. A certain percent of a sediment has the same effect on εHf whatever the Hf/Nd ratio of the component which adds it [W04 figures]. In contrast, when both elements partition differently during melting, all parameters vary with the percent of melt added [this paper]. Finally, any given percent lies closer to the mantle end member in W04 because concentrations in the sediment-derived component are ~4 times higher in the 25% sediment melt [this paper] than in its source [W04]

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TABLE DR1. COMPILATION OF MAJOR AND TRACE ELEMENT AND ISOTOPE DATA FOR KASUGA SEAMOUNTS.

	2411	1885-4	1884-2	2404	2505	2511	2502	1880-5	1884-10	BCR-1	Ext. Error[2]
XRF[3]	**LKB**	**LKB**	**MKB**	**MKB**	**MKB**	**HKB**	**HKB**	**HKB**	**HKB**		
SiO2	49.77	52.48	51.08	50.64	52.19	48.72	49.14	52.1	49.75	54.25	1.6%
TiO2	0.61	0.72	0.85	0.72	0.71	0.7	0.67	0.79	0.64	2.29	0.9%
Al2O3	14.64	14.86	16.05	15.97	14.69	14.18	14.14	16.07	12.91	13.5	3.4%
Fe2O3*	9.62	8.43	8.4	8.91	8.41	9.05	9.2	7.91	7.64	12.53	2.9%
MnO	0.19	0.15	0.16	0.17	0.17	0.14	0.14	0.16	0.15	0.195	1.0%
MgO	8.13	9.82	7.82	8.38	8.69	11.02	10.89	7.03	11.7	3.7	2.1%
CaO	12.49	10.41	11.6	11.85	10.81	11.89	11.53	10.77	11.32	7.31	0.1%
Na2O	1.63	2.21	2.13	2.13	2.11	1.7	1.8	2.12	1.37	3.17	4.1%
K2O	0.63	0.68	0.85	0.97	1.59	2.13	2.1	2.12	2.75	1.81	4.6%
P2O5	0.15	0.15	0.21	0.2	0.33	0.46	0.44	0.43	0.59	0.361	13.6%
XRF[3]											
Ni	64	168	67	86		159	160	75	221	13	nd
Cr	189	556	225	297	312	562	580	200	973	10	nd
V	287	230	283	280	282	273	298	284	236	405	nd
ICPMS[4]											
Sc	37	33	37	39	34	33	37	36	36	32	nd
Rb	12.9	13.5	14.9	20	39	46	52	51	73	47	0.83%
Sr	388	343	484	494	445	516	591	620	562	326	0.71%
Y	17	17	19.5	20	22.5	21	24	26	26	37.86	0.83%
Zr	43.3	62.6	61.3	64.4	102	105	124	123	169	196	1.41%
Nb	2.36	2.93	3.37	4.26	5.88	3.87	6.07	5.06	3.84	13.35	1.85%
Cs	0.27	0.21	0.27	0.31	0.52	0.53	0.59	0.67	0.8	0.98	50 ppb
Ba	237	185	251	318	311	242	278	399	196	682	0.26%
La	11.7	12.6	16.4	19.7	22.3	23.4	26.8	31.6	30.3	25.19	0.73%
Ce	21.9	24.2	30.9	35.9	41.9	44.5	50.5	57.3	56.8	53.01	0.29%
Pr	2.88	3.1	3.97	4.46	5.25	5.52	6.29	7.12	6.94	6.89	0.58%
Nd	12.1	12.6	16.6	17.7	21.3	22.2	25.4	27.4	27.8	28.66	0.81%
Sm	2.81	2.88	3.7	3.81	4.63	4.88	5.58	5.77	6.26	6.56	0.77%
Eu	0.89	0.86	1.13	1.14	1.39	1.44	1.65	1.71	1.83	1.95	0.10%
Gd	3.18	3.15	4.06	4.14	4.36	5.17	5.91	6.3	6.68	6.76	1.05%
Tb	0.47	0.46	0.56	0.56	0.66	0.69	0.79	0.83	0.88	1.07	1.82%
Dy	2.78	2.76	3.25	3.27	3.83	3.71	4.25	4.58	4.7	6.33	1.09%
Ho	0.57	0.57	0.64	0.66	0.78	0.67	0.77	0.86	0.83	1.32	1.18%
Er	1.72	1.74	1.92	1.95	2.09	1.8	2.07	2.33	2.12	3.61	0.40%
Tm	0.24	0.25	0.27	0.28	0.31	0.24	0.28	0.33	0.28	0.53	1.32%
Yb	1.55	1.58	1.69	1.76	1.98	1.46	1.69	2.02	1.64	3.35	1.21%
Lu	0.24	0.25	0.26	0.27	0.3	0.22	0.25	0.3	0.25	0.50	1.05%
Hf	1.15	1.47	1.48	1.56	2.36	2.38	2.74	2.63	3.31	4.81	1.27%
Ta								0.15	0.1	0.73	50 ppb
Pb	1.92	1.62	2	2.56	3.51	1.88	2.29	3.82	1.74	13.50	1.61%
Th	1.46	1.97	2.19	2.62	2.75	2.53	2.57	3.52	2.7	5.96	1.30%
U	0.458	0.550	0.580	0.685	0.880	1.170	1.150	1.400	1.180	1.693	1.30%
Ce/Ce*	0.89	0.91	0.90	0.89	0.91	0.92	0.91	0.89	0.91		
Hf/Hf*	0.45	0.56	0.43	0.43	0.53	0.52	0.52	0.47	0.57		
$^{87}Sr/^{86}Sr$[3]	0.703550	0.703270	0.703450	0.703530	0.703610	0.703970	-	0.703930	0.704100		
$^{143}Nd/^{144}Nd$[3]	0.512880	0.512930	0.512870	0.512830	0.512840	0.512770	-	0.512790	0.512770		
eNd	4.68	5.66	4.49	3.71	3.90	2.54	-	2.93	2.54		
$^{176}Hf/^{177}Hf$[1]	0.283171	0.283171	0.283175	0.283119	0.283082	0.282977	0.282985	0.283016	0.282948		
eHf	14.11	14.11	14.24	12.27	10.97	7.25	7.54	8.62	6.22		
$^{206}Pb/^{204}Pb$[3]	18.883	18.850	18.853	18.817	18.912	18.909	-	18.946	19.122		
$^{207}Pb/^{204}Pb$[3]	15.616	15.597	15.606	15.614	15.625	15.591	-	15.623	15.680		
$^{208}Pb/^{204}Pb$[3]	38.694	38.606	38.661	38.681	38.718	38.621	-	38.730	38.838		
$d^{18}O$[3]	6.0	-	-	5.7	5.8	5.8	-	-	-		

Note:

[1] Precision of $^{176}Hf/^{177}Hf$ < 0.000008, based on replicate analyses of JMC 475 (0.282146 $\pm$ 0.000008; n = 18).
Accuracy of $^{176}Hf/^{177}Hf$ < 0.00001, based on replicate analyses of BCR-2 (0.282868 $\pm$ 0.000005; n = 4).
Results for rock unknowns are normalized to the average of JMC 475 analyses performed during analytical session.

[2] External error is % 2 std dev for four separate dissolutions of a UCSC in-house basalt standard with 8.6 ppm Nd, 2.6 ppm Sm, and 1.6 ppm Hf.

[3] Major element and XRF trace element data are from Fryer et al. (1997). Sr, Nd, Pb, and O isotopes are from Stern et al. (1993) and are consistent with 143Nd/144Nd = 0.51183 for La Jolla Nd.

[4] Trace element concentrations are by HR-ICPMS at UCSC using powders ground in WC except for 1880-5 and 1884-10 which were ground in agate.

TABLE 1. SELECT TRACE ELEMENT AND Nd-Hf ISOTOPE DATA FOR SAMPLES FROM KASUGA SEAMOUNTS.

Sample	2411 LKB	1885-4 LKB	1884-2 MKB	2404 MKB	2505 MKB	2511 HKB	2502 HKB	1880-5 HKB	1884-10 HKB
Nd	12.1	12.6	16.6	17.7	21.3	22.2	25.4	27.4	27.8
Sm	2.81	2.88	3.7	3.81	4.63	4.88	5.58	5.77	6.26
Hf	1.15	1.47	1.48	1.56	2.36	2.38	2.74	2.63	3.31
Hf/Hf*	0.45	0.56	0.43	0.43	0.53	0.52	0.52	0.47	0.57
$^{143}Nd/^{144}Nd$	0.512880	0.512930	0.512870	0.512830	0.512840	0.512770	-	0.512790	0.512770
εNd	4.68	5.66	4.49	3.71	3.90	2.54	-	2.93	2.54
$^{176}Hf/^{177}Hf$	0.283171	0.283171	0.283175	0.283119	0.283082	0.282977	0.282985	0.283016	0.282948
εHf	14.11	14.11	14.24	12.27	10.97	7.25	7.54	8.62	6.22