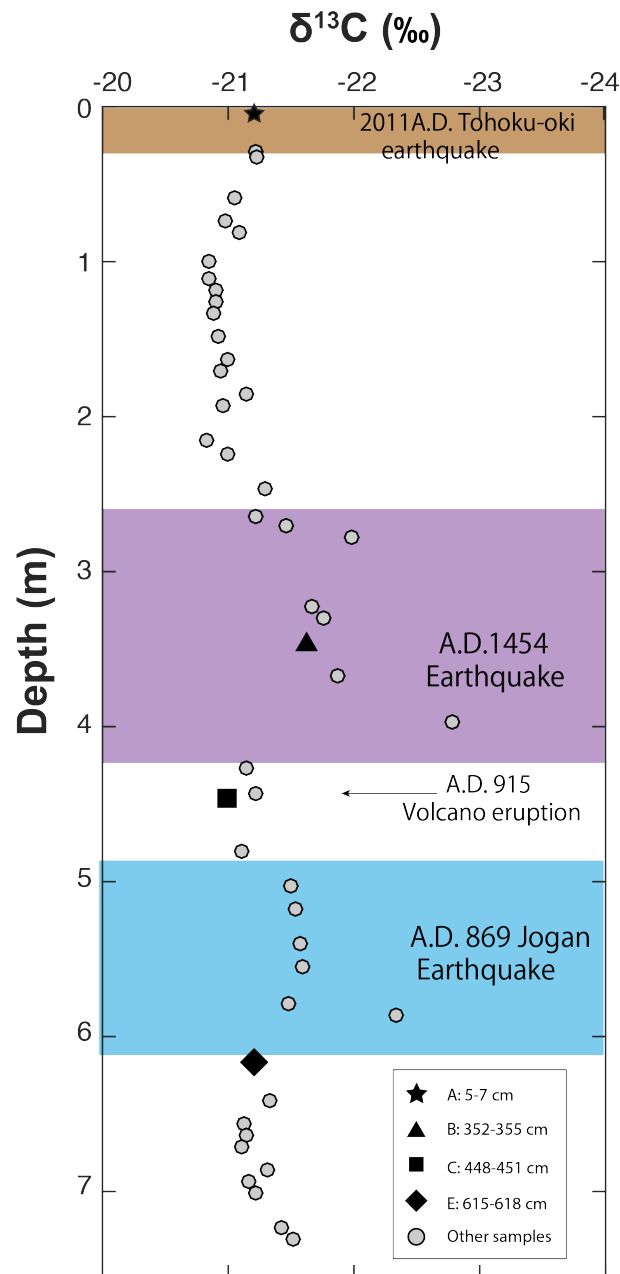


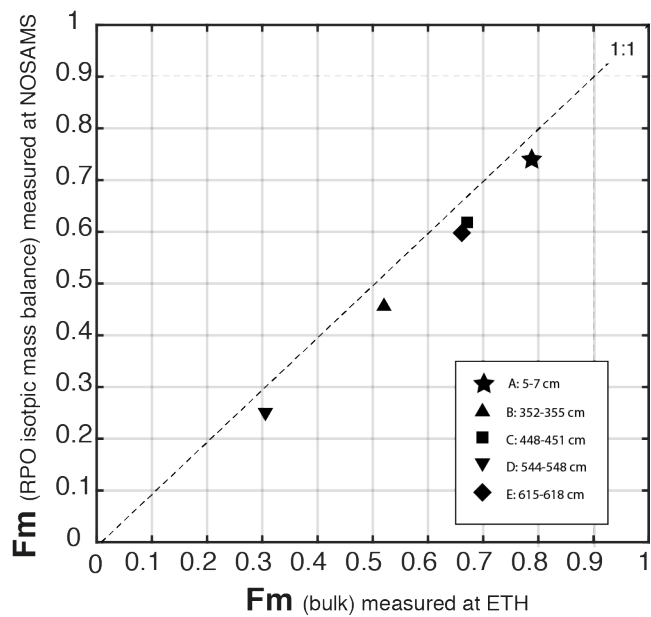
**Supplementary Table 1.** Bulk and RPO data (TOC content, radiocarbon, and stable carbon isotopic characteristics of bulk OC and thermochemical fractions) in selected samples (A – E) from core GeoB 16431-1.

No.	Core depth (cm)	TOC (wt %)	Bulk			T <sub>1</sub> (170-320°C)			T <sub>2</sub> (320-391°C)			T <sub>3</sub> (391-476°C)			T <sub>4</sub> (476-570°C)			T <sub>5</sub> (570-915°C)		
			δ <sup>13</sup> C	Fm	<sup>14</sup> C age	δ <sup>13</sup> C	Fm	<sup>14</sup> C age	δ <sup>13</sup> C	Fm	<sup>14</sup> C age	δ <sup>13</sup> C	Fm	<sup>14</sup> C age	δ <sup>13</sup> C	Fm	<sup>14</sup> C age	δ <sup>13</sup> C	Fm	<sup>14</sup> C age
A	5-7	1.7	-25.1	0.7943 ±0.0105	1850 ±107	-23.8	0.8392 ±0.0018	1410 <sup>#</sup> ±15	-22.3	0.7747 ±0.0082	2050 ±85	-24.4	0.6856 ±0.0078	3032 ±91	-26.5	0.6874 ±0.0073	3011 ±85	-28.3	0.5649 ±0.0065	4588 ±93
B	352-355	1.2	-28.7	0.5222 ±0.0095	5218 ±146	-25.3	0.5426 ±0.0058	4912 ±85	-24.7	0.5042 ±0.0054	5501 ±87	-28.7	0.3962 ±0.0048	7437 ±97	-29.4	0.4147 ±0.0049	7071 ±95	-30.1	0.3352 ±0.0044	8780 ±104
C	448-451	1.5	-26.2	0.6766 ±0.0101	3139 ±120	-24.0	0.7032 ±0.0017	2830 <sup>#</sup> ±20	-23.2	0.6646 ±0.0087	3282 ±105	-21.9	0.5600 ±0.0057	4658 ±81	-27.7	0.6091 ±0.0067	3983 ±88	-33.2	0.4953 ± 0.0060	5644 ±98
D	544-548	0.6	-30.9	0.3093 ±0.0088	9425 ±228	-25.6	0.3132 ±0.0043	9326 ±111	-26.7	0.2656 ±0.0037	10648 ±113	-28.0	0.2200 ±0.0040	12164 ±145	-36.5	0.2319 ±0.0037	11740 ±127	-33.2	0.1850 ±0.0044	13553 ±193
E	615-618	1.6	-27.5	0.6691 ±0.0102	3228 ±122	-23.4	0.6929 ±0.0020	2950 <sup>#</sup> ±25	-21.9	0.6357 ±0.0063	3639 ±79	-25.2	0.5481 ±0.0056	4830 ±82	-25.6	0.5270 ±0.0057	5145 ±86	-25.2	0.4876 ±0.0059	5770 ±97

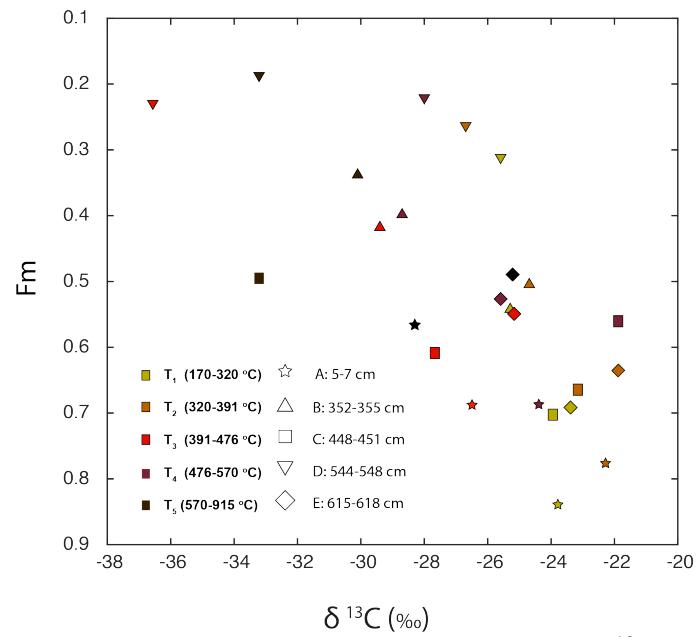
Note: # indicates that samples were measured at NOSAMS.



**Supplementary Figure 1.** Bulk OC  $\delta^{13}\text{C}$  profile of Core GeoB 16431-1 ( $n = 47$ ). The  $\delta^{13}\text{C}$  of sample D was not gained due to its measurement failure. The samples for OC  $^{13}\text{C}$  analysis in Ag capsules were first fumigated (37% HCl for 72 hrs) and measured with a  $\pm 0.2$  ‰ precision using a coupled elemental analyzer (EA) / IRMS / AMS online system at ETH Zürich (McIntyre et al., 2016).



**Supplementary Figure 2.** Isotopic relationship between calculated (from RPO isotopic mass balance) and measured bulk values for  $F_m$  values at NOSAMS and ETH, respectively.



**Supplementary Figure 3.** Cross-plot between Fm values and  $\delta^{13}\text{C}$  data of RPO fractions (T<sub>1</sub>-T<sub>5</sub>) among the five samples.

**Supplementary reference:**

1. McIntyre, C. P. et al. Online <sup>13</sup>C and <sup>14</sup>C gas measurements by EA-IRMS-AMS at ETH Zürich. *Radiocarbon* **58**, 1-7 (2016).