Table S1 Core Geophysics and Age Control Methods

Core Geophysics

The cores collected offshore Sumatra (**Fig. S3**) were scanned at sea with a GEOTEK Multi Sensor Core Logger (MSCL), obtaining P-wave velocity, gamma ray density, resistivity, and loop magnetic susceptibility (MS) at 0.5 cm spaced intervals in 1.5-m length sections. Split cores were imaged with a high resolution line-scan digital camera and the lithostratigraphy was described. High resolution point MS data were collected using a Bartington MS2E point sensor at 0.5 cm spacing. The cores were imaged with the Oregon State University Aquilion 64 slice X-ray Computed Tomography (CT) system with a nominal voxel size of 0.5 mm.

Age Control Methods

Age control for stratigraphy is provided by Accelerator Mass Spectrometer (AMS) ^{14}C and ^{210}Pb radiometric techniques. ^{14}C data is based on decay with a half-life of 5,730 years and is useful for strata between ~300 - ~35,000 years old (Stuiver and Braziunes, 1993). ^{210}Pb data, based on a shorter half-life of 22 years (Noller, 2000), provides information about sedimentary deposition for the past ~150 years. We use ^{210}Pb age data to constrain the timing of deposition for the most recently deposited sediments.

To estimate ages of the turbidites using radiocarbon, we extract the calcium carbonate shells of planktic foraminifers preserved in the hemipelagic sediment below each turbidite to provide a maximum limiting age. We utilized planktic foraminiferid species as they most closely represent the age of the youngest sea water, the surface water that is most closely in ^{14}C equilibrium with the atmosphere. We sample below each turbidite because this is the sediment closest in age to the turbidite. We do not use the age of the sediment above the turbidite because the boundary between the top of the turbidite tail and the hemipelagic sediment is difficult to identify reliably and bioturbation is concentrated at this boundary. These methods are outlined in Goldfinger et al. (2012).

Trench core sites were deeper than the Carbonate Compensation Depth (CCD), the depth below which foraminiferid $CaCO_3$ tests dissolve faster than they are deposited. Therefore foraminiferid abundance was nil in trench core sediments, so ^{14}C age control applies only to the slope cores.

Sediment samples were removed from the cores while avoiding the 0.5 cm of material nearest the core walls to avoid visible or undetected deformation and friction drag along the core walls. In some cases, highly irregular turbidite bases resulted in sampling an interval below the basal irregularities, and applying a correction to the hemipelagic thickness called the "gap." Hemipelagic sediment samples were freeze dried to separate clay particles to improve rinsing through a sieve, washed in a dilute sodium hexametaphosphate solution to keep the fine particles in suspension, sieved through a 125 µm stainless steel sieve, then dried in a warm oven. Typically 25-50 individual planktic foraminifers (depending on size/weight) were identified then removed from this dried > 125 µm size fraction using a fine sable brush moistened with distilled water. Foraminiferal sample ages were determined using Accelerator Mass Spectrometry (AMS) methods at the Keck AMS facility at University of California, Irvine in collaboration with John Southon.

The primary sources of radiocarbon error include variation of the age in surface and near surface sea water, the sedimentation rate, the level of atmospheric radiocarbon in the atmosphere, and the basal erosion during turbidite emplacement. There does not yet exist sufficient prehistoric benthic-planktic age pairs with which to construct an age model in this region, so the reservoir correction is probably the largest source of error in this study and we have no way to evaluate this source of epistemic error. Because of the small number of cores collected at any given core site, we cannot evaluate basal erosion, and there will likely be undetected erosion in these data. Sedimentation rates are calculated using ^{14}C age estimates and thickness of hemipelagic sediment. Sedimentation rates are used to calculate ages for turbidites that have no direct age.

The "lab" radiocarbon ages are reported in years before present (BP, measured from 1950) with a 2 standard deviation lab error (Stuiver et al., 1998). ^{14}C ages are calibrated (Stuiver and Polach, 1977) and a marine reservoir correction of 16±11 years is made using the Marine09 database (Reimer et al., 2009). Only two delta R values are available for the Sumatra area, and while constraints are few on this correction, we here are correlating marine sites to other nearby marine sites, thus the local correlations are valid while absolute ages may contain additional uncertainty. One additional correction we make to the calibrated age is the sediment gap thickness correction (thickness of sediment between the turbidite and the sample; see OxCal code below). For individual ages, we propagate these uncertainties using RMS (root mean square) calculations using estimates of the uncertainties at each step. This calculation includes the lab uncertainties and results in the final reported 2σ range for each radiocarbon age. In later sections of the paper, we calculate region wide mean event ages. For these, we average the ages (using the combine function in OxCal), and again apply RMS calculations to the averaged error ranges to produce 95% RMS error range for each averaged age. No lab multipliers were applied to the data.

Some stratigraphy in trench cores has been correlated with deposits in slope cores. Based on these correlations (turbidites and a tephra deposit), the ages from the slope cores are plotted on the trench core figures (**Figure 8 and 10**). The turbidites in cores 03PC, 05PC, and 107TC are correlated using geophysical wiggle matching (techniques in Goldfinger et al., 2012) with turbidites in core 108PC, 104PC, and 103PC. The tephra in 38GC and 41GC is correlated using electron microprobe and Inductively Coupled Plasma Mass Spectrometry, ICPMS (Salisbury et al., 2012)

Supplemental Table 1.

Sample Number	Lab Sample Number [1]	Sample Name	Core Number	Depth (cm)	Lab Age [2]	Lab Age Error	Cal. Age [3]	Cal. Age Error	Hemi Sed Rate (cm ka^{-1})[4]	Sed Rate Error
SUM-145	77175	RR0705_79PC_307_309_SUM-145	79PC	308	4650	20	4860	60	18	1
SUM-227	107808	RR0705_96PC_206_208_SUM-227	96PC	207	480	20	30	30	1	1
SUM-228	107806	RR0705_96PC_222_224_SUM-228	96PC	223	1150	20	670	40	11	1
SUM-089	65300	RR0705_96PC_287.5_289.5_SUM-089	96PC	288.5	5920	20	6280	60	18	1
SUM-090	65301	RR0705_96PC_374_376_SUM-090	96PC	375	2430	20	2040	80	22	1
SUM-232	107809	RR0705_96PC_399_401_SUM-232	96PC	400	2410	20	2010	90	18	1
SUM-177	76991	RR0705_103TC_012.5_014.5_SUM-177	103TC	13.5	1310	20	840	70	2	1
SUM-178	76992	RR0705_103TC_036_038_SUM-178	103TC	37	1890	20	1400	80	3	1
SUM-179	76993	RR0705_103TC_039_041_SUM-179	103TC	40	2070	20	1610	80	5	1
SUM-180	76994	RR0705_103TC_079_081_SUM-180	103TC	79.5	2990	20	2750	60	5	1
SUM-084	65297	RR0705_103PC_020_022_SUM-084	103PC	21	1230	20	740	70	11	1
SUM-054	54323	RR0705_103PC_049_051_SUM-054	103PC	50	1940	30	1450	80	24	1
SUM-085	65298	RR0705_103PC_092_094_SUM-085	103PC	93	2710	20	2350	70	11	1
SUM-055	54324	RR0705_103PC_111_113_SUM-055	103PC	112	2990	20	2720	60	8	1
SUM-087	65299	RR0705_103PC_174_176_SUM-087	103PC	175	3930	20	3770	90	11	1
SUM-050	54306	RR0705_103PC_209_211_SUM-050	103PC	210	4360	20	4480	80	11	1
SUM-052	54322	RR0705_103PC_277_279_SUM-052	103PC	278	5100	20	5430	110	16	1
SUM-053	65528	RR0705_103PC_300.5_302.5_SUM-053	103PC	301.5	5360	30	5720	110	13	1
SUM-224	107805	RR0705_103PC_324_326_SUM-224	103PC	325	5580	30	5890	80	20	1
SUM-253	107804	RR0705_103PC_383_385_SUM-253	103PC	384	6020	30	6350	90	26	1
SUM-176	77107	RR0705_104TC_011_013_SUM-176	104TC	12	710	20	290	70	2	1
SUM-175	77106	RR0705_104TC_047.5_049.5_SUM-175	104TC	48.5	1220	20	740	70	1	1
SUM-060	65529	RR0705_104PC_049.5_051.5_SUM-060	104PC	50.5	1070	20	600	60	11	1
SUM-062	54325	RR0705_104PC_067.5_069.5_SUM-062	104PC	68.25	1270	20	790	80	11	1
SUM-061	65530	RR0705_104PC_122_124_SUM-061	104PC	123	1630	50	1150	110	12	1
SUM-082	65531	RR0705_104PC_158_160_SUM-082	104PC	159	2040	20	1590	80	11	1
SUM-115	65532	RR0705_104PC_207_209_SUM-115	104PC	208	2420	220	2080	550	18	1
SUM-235	107807	RR0705_104PC_326_328_SUM-235	104PC	327	3000	40	2760	70	20	1
SUM-080	65294	RR0705_108PC_039_041_SUM-080	108PC	40	2020	20	1530	80	17	1
SUM-081	65295	RR0705_108PC_132.5_134.5_SUM-081	108PC	133.5	3040	20	2790	60	13	1

1. Radiocarbon samples were analyzed at the Keck Carbon Cycle Accelerator Mass Spectroscopy Facility at Earth System Science Dept., UC Irvine.
2. Lab-reported age errors reported to 2 standard deviations.
3. Calibrated age (in calendar years) ranges before A. D. 1950 according to Stuiver and Reimer [2] calculated using marine reserevior correction (ΔR = 16) errors reported with 95% error.
4. Hemipelagic Sedimentation rate is calculated from dividing unit thickness by the calibrated age.

- Radiocarbon concentrations are given as fractions of the Modern standard, D ^{14}C, and conventional radiocarbon age, following the conventions of Stuiver and Polach [1].
- Size-dependent sample preparation backgrounds have been subtracted, based on measurements of ^{14}C-free calcite.
- All results have been corrected for isotopic fractionation according to the conventions of Stuiver and Polach [1], with $\delta^{13}C$ values measured on prepared graphite using the AMS spectrometer. These can differ from $\delta^{13}C$ of the original material, if fractionation ocurred during sample graphitization or the AMS measurement, and are not shown.
- Inverted age in trigger core 104TC (in gray) represents repeated section not shown in Figure 2 nor in Supplemental Document 1.