SUPPLEMENTARY METHODS

Sediment accumulation rates and ages were constrained by analysing for unsupported (excess) ^{210}Pb. ^{210}Pb occurs naturally as a radionuclide in the ^{238}U decay series. Supported ^{210}Pb results from the decay of ^{226}Ra within the sediment and is in equilibrium with its precursors in the ^{238}U decay chain. Unsupported ^{210}Pb is derived from decay of atmospheric ^{222}Rn to ^{210}Pb, and accumulates in sediments through adsorption on suspended matter (Appleby and Oldfield, 1983). ^{210}Pb has a half-life of 22.3 years and thus can be used to establish sediment accumulation rates over the past 100 to 150 years.

The ^{210}Pb activity of samples was measured using a combination of alpha and gamma spectrometry (see Table A3 for method used on specific samples) at the GAU Radioanalytical Laboratories at the University of Southampton. Samples were prepared for alpha spectrometry by freeze drying and crushing 3g sediment samples and spiking with ^{209}Po to monitor the chemical yield. The sample was then digested and the Po plated onto silver discs and counted using an alpha spectrometer. Samples were prepared for gamma spectrometry by freeze drying the sediment samples and pressing into ~16g pellets which were then sealed in petris dishes for at least 30 days to allow secular equilibrium of the uranium-series daughter products. The ^{210}Pb activity of the samples was measured using a low energy gamma spectrometer with a counting time of 3 days.

Where several samples were taken at different depths within a core, sedimentation rates were calculated using a Constant Sedimentation Rate model (Appleby, 2001). This model assumes that $C_m=C_0e^{-\lambda m/r}$, where C_m is the activity of ^{210}Pb at depth m, C_0 is the activity of ^{210}Pb at the core top, λ is the decay constant for ^{210}Pb (0.031), and r is the sedimentation rate. Least squares linear regression was used to establish the sedimentation rate of $\ln(^{210}Pb_{excess})$ as a function of depth in cores 4MC, 11MC and 12MC (Fig. A1). Standard errors were used to calculate the range of sedimentation rates and this information was used to calculate the age range of turbidites at a given core depth.

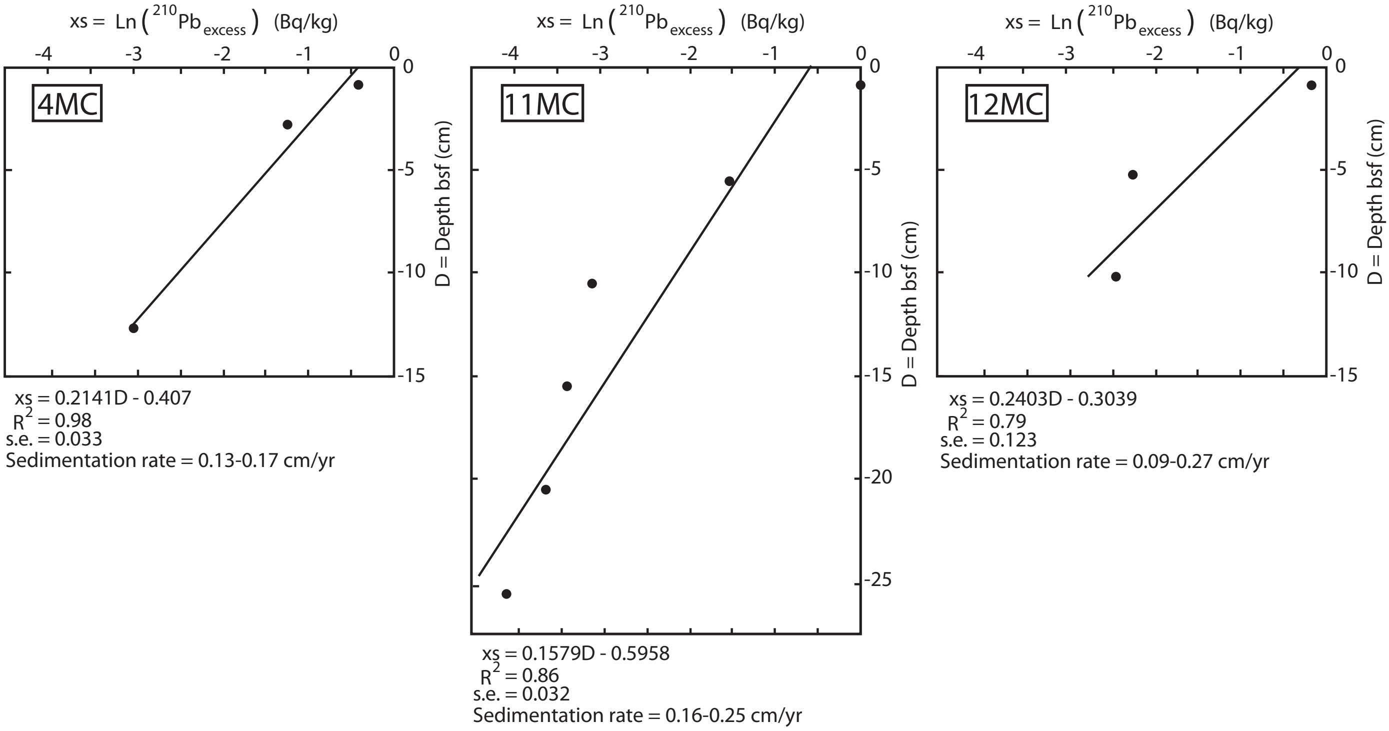
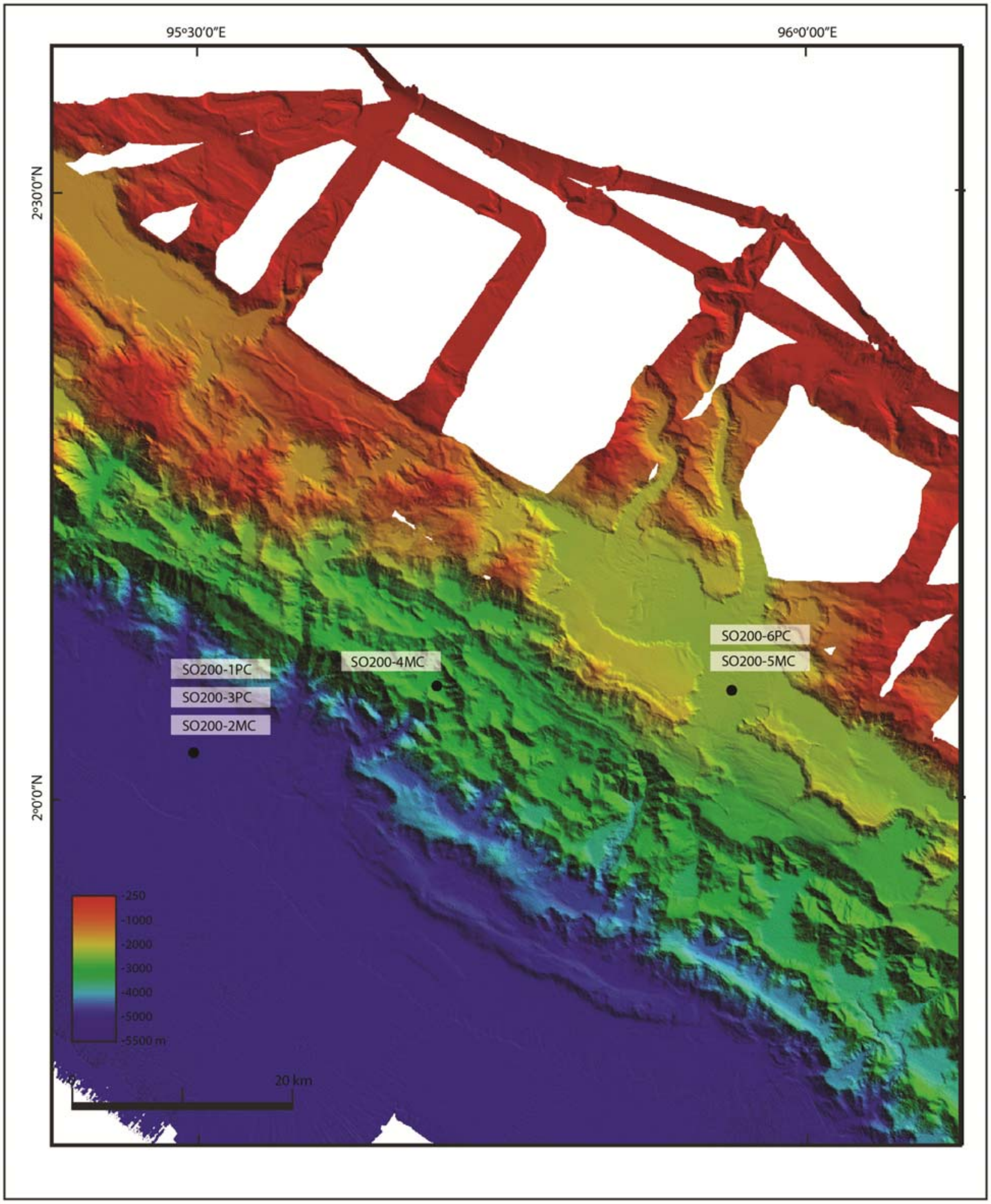

xs = Ln (210Pb excess) (Bq/kg)
4MC
D = Depth bsf (cm)
xs = 0.2141D - 0.407
R2 = 0.98
s.e. = 0.033
Sedimentation rate = 0.13-0.17 cm/yr
11MC
xs = 0.1579D - 0.5958
R2 = 0.86
s.e. = 0.032
Sedimentation rate = 0.16-0.25 cm/yr
12MC
xs = 0.2403D - 0.3039
R2 = 0.79
s.e. = 0.123
Sedimentation rate = 0.09-0.27 cm/yr

Figure DR1

Figure DR2



95°30'0"E
96°0'00"E
2°30'0"N
2°0'0"N
SO200-6PC
SO200-5MC
SO200-4MC
SO200-1PC
SO200-3PC
SO200-2MC
-250
-1000
-2000
-3000
-4000
-5000
-5500 m
20 km

Figure DR3

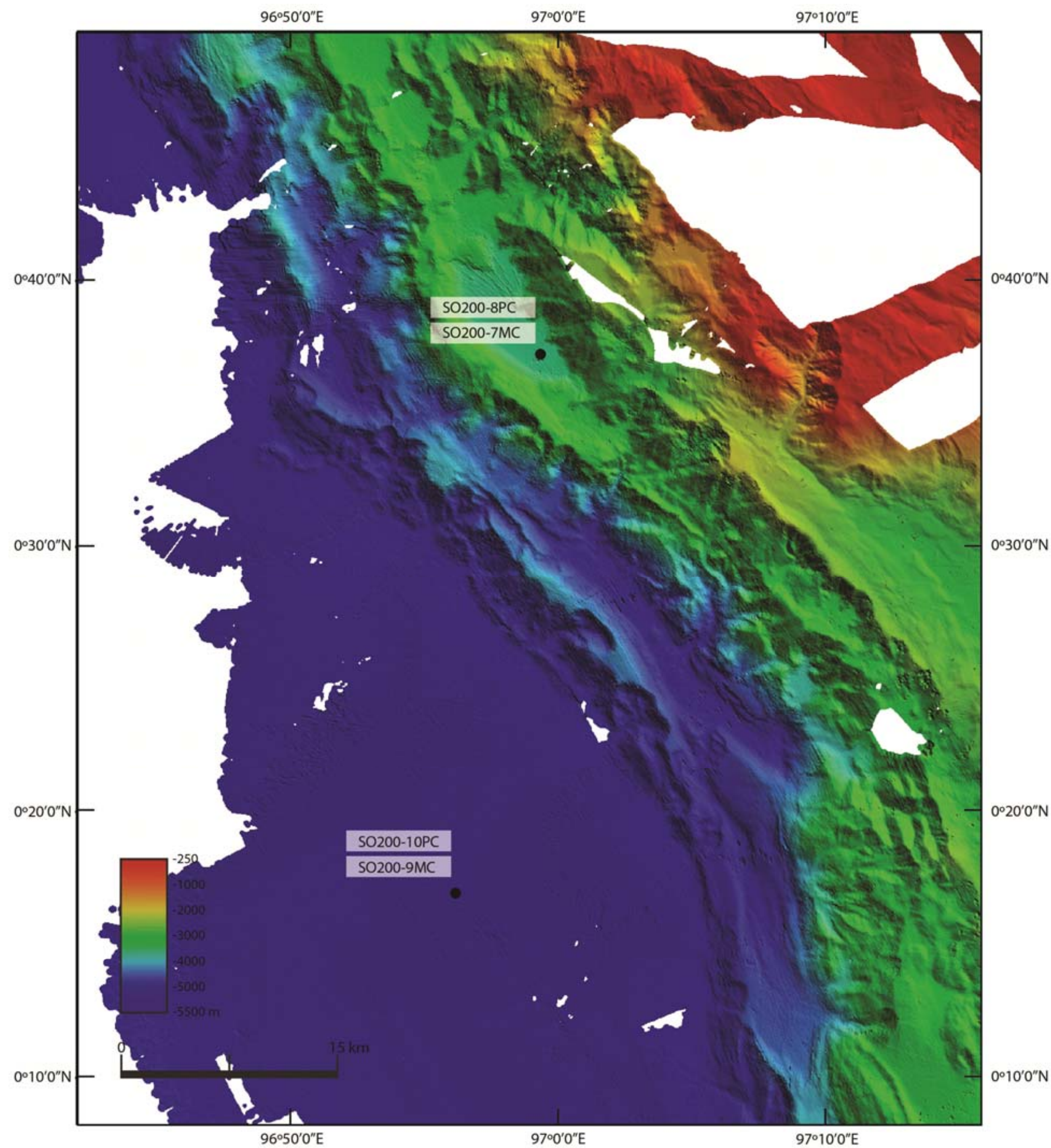

96°50'0"E
97°0'0"E
97°10'0"E
0°40'0"N
0°30'0"N
0°20'0"N
0°10'0"N
SO200-8PC
SO200-7MC
SO200-10PC
SO200-9MC
-250
-1000
-2000
-3000
-4000
-5000
-5500 m
0
15 km

Figure DR4

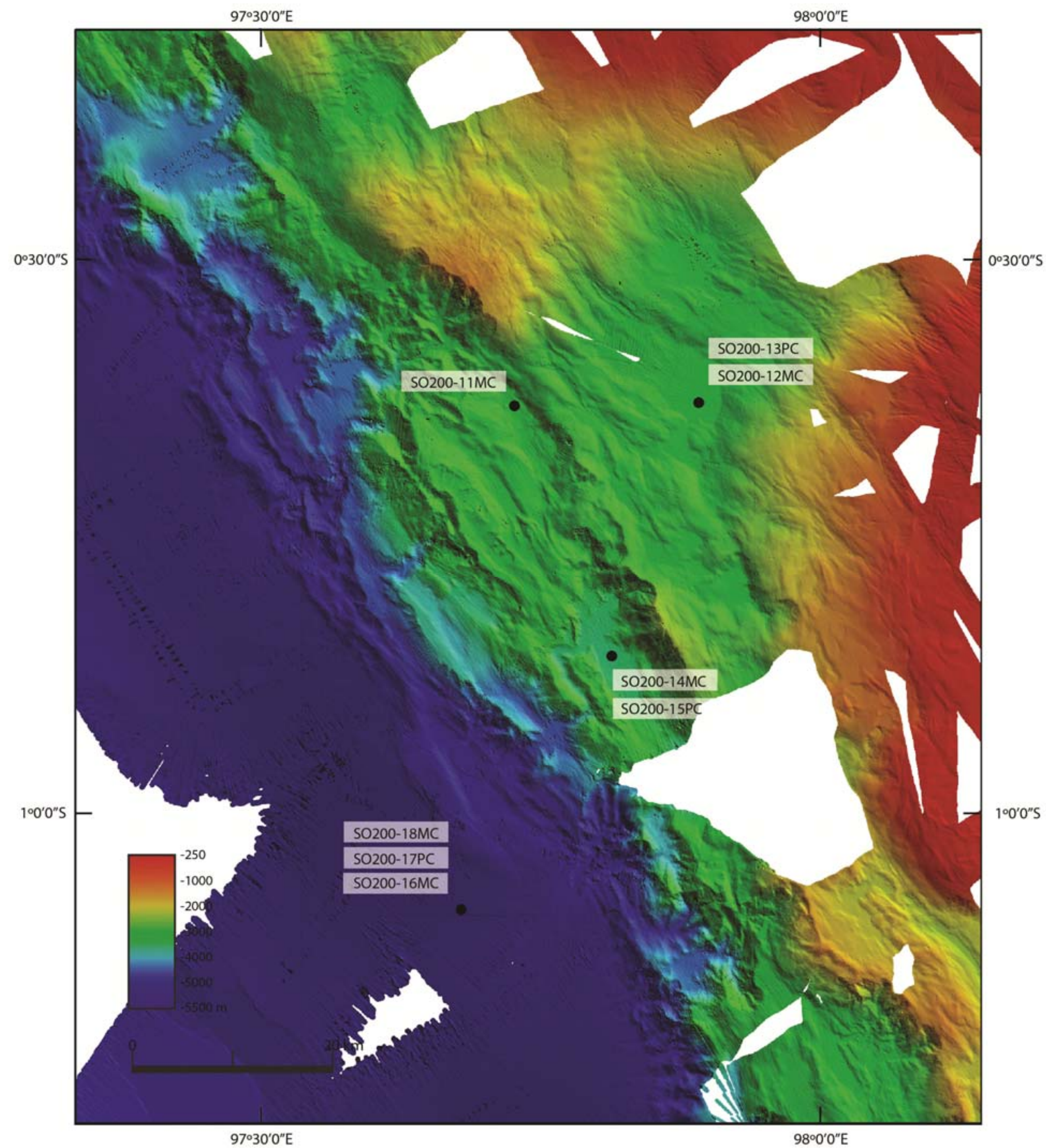

97°30'0"E
98°0'0"E
0°30'0"S
1°0'0"S
SO200-13PC
SO200-12MC
SO200-11MC
SO200-14MC
SO200-15PC
SO200-18MC
SO200-17PC
SO200-16MC
-250
-1000
-5500 m
0

Table DR1. Comparison of margin characteristics.

REGION	STUDY	HEMIPELAGIC SED[N] RATE * (cm/ky)	NET SED[N] RATE [†] (cm/ky)	CONNECTIVITY [$]	MARGIN WIDTH[#] (km)	SEDIMENT SIZE **	ESTIMATED AVERAGE RECURRENCE INTERVAL OF LARGE[††] EARTHQUAKES (y) T – FROM TURBIDITES O – FROM OTHER METHODS	NUMBER OF SAMPLING LOCATIONS [$$]	STUDY AREA[##] (km^2)	SAMPLING DENSITY [***] ($cores/km^2$)	KEY OUTCOMES
Central Sumatra Convergent margin	This study	180	200	Poor (0.11)	Wide (70)	Fine	S. of Simeulue O ~150-200y (Sieh et al., 2008; Meltzner et al., 2012) N. of Simeulue ~400-700 y (Monecke et al., 2008; Jankaew et al., 2008)	9	24416	$3.7*10^{-4}$	Known large magnitude earthquakes do not always generate widespread turbidites.
Canada Intraplate	Grantz et al. (1996)	<1	120	NM	Narrow (40)	Fine	T 2000	3	6000	$5*10^{-4}$	Provenance of turbidites and proximity to zone of local seismicity suggests that turbidites emplaced during sea level high stand were seismically triggered.
Canada Intraplate	Doig (1998)	52	ND	NM	Lake	Very fine	T 350-1000	5	NM	NM	Earthquake recurrence interval inferred from turbidites distributed between multiple lakes along the Saguenay graben.
Cascadia Convergent margin	Adams (1990)	8.5	199	Moderate (0.37)	Wide (68)	Very coarse	T 590 +/-170	16	36176	$4.4*10^{-4}$	Presence of similar numbers of turbidites before and after channel confluences suggests widespread synchronous triggering of turbidites by earthquakes. 13 seismically generated turbidites emplaced since the Mazama tephra ~6845 +/- 50 y.
Cascadia/ British Columbia Convergent margin	Blais-Stevens and Claig (2001)	700	ND	NM	Fjords	Fine	T ~150	10	57	0.18	Varves provide high-resolution dates for debris flows in the fjord. Some turbidites correspond to known earthquakes. Recurrence interval is based on the assumption that most debris flows were earthquake triggered.
Cascadia/ British Columbia Convergent margin	Blais-Stevens et al. (2011)	950	ND	NM	Fjords	Very fine	T ~220	10	57	0.18	Reanalysis of the data presented in Blais-Stevens and Claig (2001). Nine debrites overlap in age with age ranges for plate-boundary earthquakes as determined from coastal subsidence or turbidite paleoseismology.
Cascadia Convergent	Goldfinger et al. (2003 a,b)	11.1	ND	Moderate (0.37)	Wide (70)	Very coarse	T ~600	32	72170	$4.4x10^{-4}$	Similar numbers of turbidites before and after channel confluences suggests

margin											widespread triggering of turbidity currents by earthquakes. Recurrence intervals for Cascadia and preliminary results from Northern California.
Cascadia (C) Convergent margin and Northern California (NC) transform	Goldfinger et al. (2008)	11.1 (C) 22 (NC)	ND ND	Moderate(C) (0.37) Very good (NC) (0.86)	Wide(C) (70) Narrow (NC) (47)	Very coarse(C) Fine/Medium (NC)	T ~520 (C) T ~200 (NC)	37 (C) 32 (NC)	61460(C) 17343 (NC)	6.0×10^{-4} (C) 1.8×10^{-3} (NC)	Refined dates for turbidites from the Cascadia and Northern California margin, combined with the onshore record is used to infer dynamic link between the Cascadia and San Andreas fault systems. Cascadia precedes most San Andreas events by 0-80 y.
Cascadia (C) Convergent margin and Northern California (NC) Transform	Gutierrez-Pastor et al. (2009)	11.1	ND	Moderate (0.37)	Wide (70)	Very coarse	T ~550 T ~200 (NC)	51 (C) 3 (N C)	72730	7.4×10^{-4}	Development of a more accurate age framework for Cascadian and Northern Californian turbidites, through a combination of radiometric dating and sedimentation rates.
Chile Convergent margin	Vargas et al. (2005)	ND	116	NM	Bay on continental shelf	Fine	O 111 +/- 33 (Comte and Pardo, 1991)	6	43	0.14	Stratigraphic record used to infer historical seismic events. Notably there is no sedimentological evidence for several known large historical earthquakes.
Chile Convergent margin	Blumberg et al. (2008)	Sea level highstand 10 cm/kyr Sea level lowstand 100 cm/ky	~ 10 cm/ky ~140 cm/ky	Good (0.5)	Moderate (60)	Fine	T 100-200	2	33898	5.9×10^{-5}	Long term changes in recurrence times of turbidites strongly influenced by climate and sea level. Recurrence intervals are higher during sea-level high stands (ie less frequent turbidites). This is attributed to reduced sediment availability and enhanced slope stability. A complete palaeoseismic turbidite record is probably only recorded during low stands.
Chile Convergent margin	Völker et al. (2008)	Sea level highstand 10 cm/kyr Sea level lowstand 100 cm/ky	~ 10 cm/ky ~140 cm/ky	Good (0.43)	Moderate (56)	Fine	O 100-350 (Cisternas et al.,2005)	6	67533	8.9×10^{-5}	Frequency of turbidite events may be linked to recurrence of giant earthquakes during phases of very high sedimentation rates on the continental shelf.
Chile Convergent margin	Völker et al. (2011)	ND	ND	Good (0.5)	Moderate (59)	Fine	O 150-200	3	45	0.067	Analysis of bathymetry suggests that the M_w 8.8 earthquake in 2010 did not generate landlides > 1 km across. Although there is evidence of small-scale landslides being generated by smaller aftershocks.
Chile (Ch) Convergent margin And East Canada (EC) Passive	St-Onge et al. (2012)	140 (Ch) 100-7000 (EC)	ND	NM	Fjords	Fine	ND	Chile – 1 Canada - 1	Chile – 152 Canada - 355	0.007 0.003	Seismic profiles and cores from an active and a passive margin. In both places turbidites found that correlate temporally with known earthquakes. These turbidites commonly display a homogeneous slightly fining mud cap. High sedimentation rates in fjords mean

margin											that there is sufficient sediment available for most earthquakes to trigger flows.
Dead Sea Transform	Niemi and Ben-Avraham (1994)	ND	400	NM	NM	ND	O 140-500	0	NM	NM	Slump deposits identified in seismic that correspond temporally with known earthquakes. Eight deposits have been emplaced in the last 22-30 ky. Assuming all deposits are seismically triggered a recurrence time for earthquakes can be estimated.
Haiti Transform	McHugh et al. (2011)	ND	ND	NM	Perched basin	Fine/medium	ND	23	1809	0.013	Deposit associated with the 2010 earthquake comprises coarse base overlain by complex cross bedding and contortions overlain by homogeneous mud.
Japan Convergent margin	Inouchi et al. (1996)	ND	ND	NM	Lake	Very coarse	ND	6	59	0.1	Turbidites are linked to the historical earthquake record, although there are several large historical earthquakes for which there is no turbidite present in the stratigraphic record.
Japan Convergent margin	Nakajima and Kanai (2000)	ND	ND	ND	Moderate (50)	Fine	T 160-330	4	10989	$3.6x10^{-4}$	Seismically triggered turbidites commonly show: amalgamated beds, irregular sequences of structures, grain-size breaks, abrupt changes in composition within a bed, variable composition between beds.
Japan Convergent margin	Shiki et al. (2000)	ND	ND	NM	Lake	Medium	ND	6	59	0.1	Seismic turbidites commonly comprise, lower sand and upper silty sub layers with a lack of tractional structures and coarse tail grading of sand.
Japan Convergent margin	Noda et al. (2008)	101	ND	ND	Moderate (59)	Fine	T <113	7	649	0.01	Comparison of turbidites with known historical earthquake record suggests that only half of all large earthquakes are recorded in the stratigraphic record.
Switzerland Intraplate	Scnhellmann et al. (2002)	ND	ND	NM	Lake	ND	T ~3000	8	116	$6.9x10^{-2}$	Presence of mass flow deposits of similar age in multiple lake sub-basins is used to infer seismic triggering. Events correlated using seismic stratigraphy calibrated with ^{14}C dates. There are 5 palaeoseismic events in the last 15 thousand years, with highly variable recurrence times.
Marmara Sea Transform	McHugh et al. (2006)	ND	570	NM	NM	Fine	ND	9	4831	$1.9x10^{-3}$	Turbidites correlated with historical earthquakes along the North Anatolian fault. Potential to use the different records in small basins along the transform to estimate recurrence intervals on different segments.
Mediterranean Convergent (Aegean arc)	Kastens (1984)	7.5	ND	NM	NM	Fine/Medium	T ~1500	22	NM	NM	Turbidites and debrites in basins close to Calabrian ridge most likely related to earthquakes as cut off from other sources and occur in multiple isolated basins. Estimated earthquake magnitude required to cause sufficient shaking to trigger an earthquake is ~Mw7.

Mediterranean Transform (W. Greece)	Anastasakis and Piper (1991)	2.1	50.1	NM	Very narrow (15)	Fine	O 2222	6	2582	$2.3x10^{-3}$	Five turbidites can be correlated between two basins fed by separate drainage systems. The synchronicity of the turbidites suggests seismic triggering. Frequency of earthquakes inferred to be of sufficient strength to cause submarine failure is similar to frequency of turbidites. No unequivocal characteristics of seismically triggered turbidites could be distinguished.
New Zealand	Pouderoux et al. (2012)	36	62	NM	Narrow (46)	Medium	T 270-340	15	10856	$1.4x10^{-3}$	Earthquakes appear to be the dominant triggering mechanism for turbidity currents on this margin with volcanism and floods subsidiary triggers. Turbidites used to provide recurrence interval of large earthquakes.
Northern California	Goldfinger et al. (2007)	22	ND	Very good (0.86)	Narrow (47)	Fine/Medium	T ~200	32	100528	$3.1x10^{-4}$	Offshore turbidite record used to estimate recurrence interval of earthquakes on San Andreas Fault.
SW Iberia	Gracia et al. (2010)	14.4	ND	Very good (0.71)	Wide (78)	Medium	T 1800	4	11778	$3.4x10^{-4}$	First test of turbidite palaeoseismology on a low convergence margin. Some turbidites can be related to known earthquakes. Earthquake recurrence estimated based on all turbidites being earthquake triggered.
Taiwan	Huh et al. (2006)	ND	250	NM	NM	ND	ND	47	5906	$8.0x10^{-3}$	Turbidites in the basin are related to known earthquakes, although not all earthquakes have corresponding turbidites throughout the basin.
Washington Sound	Karlin et al. (2004)	ND	60	NM	NM	Coarse	T 300-500	35	92	0.38	Seismic activity is known to have caused mass failures in lake Washington. The Seattle fault cross cuts the lake. Assuming most turbidites are seismically triggered yields a recurrence interval of 300-500y.

* Average hemipelagic sedimentation rate as published, else average calculated from published values.
† Net sedimentation rates including hemipelagic sediment and mass flow deposits. Average as published, else average calculated from published values.
$ Connectivity – <0.25 poor connectivity, 0.25-0.4 moderate connectivity, 0.4-0.55 good connectivity, > 0.55 excellent connectivity. Connectivity calculated by dividing the length of the study area into $1/5^{th}$ degree intervals and assigning each section a value of 0 or 1 according to whether there is a continuous conduit from the slope break to the basin plain (1) The highest resolution bathymetry available was used either from publication, or geomapapp.
# Margin width - < 35 km very narrow, 35-49 km narrow, 50-64 km moderate, > 65 km wide. Average shelf break to basin floor distance based on nine equally spaced measurements.
** Sediment size – Based on the coarsest sizes found in turbidites: <63 µm very fine, 63-250 µm fine, 250-500 µm medium, 500-1000 µm coarse, >1000 µm very coarse.
†† Most studies in this table consider large earthquakes to be greater than ~M_w 7. Unless stated otherwise the recurrence interval provided is derived from the study of the source reference in column 2.
$$ Cores from the same location are counted as a single locality. Number of localities is based on localities shown on published map of study area.
The study area is calculated as the length of margin studied as measured from the maximum margin parallel distance between cores, multiplied by the margin width. For lakes and fjords the study area is the area of the lake or fjord.
***Number of sampling locations divided by the study area.
ND No data.
NM Not measurable.

Table DR2. Detailed core locations.

TABLE A2. DETAILED CORE LOCATIONS

Core	Core type	Location	Latitude	Longitude	Date/time recovered (UTC)	Water depth (m)	Core length (m)
SO200/1PC	Piston	Simeulue trench	2°2.280N	95°29.820	14/2/09 06:45	4895	0
SO200/2MC	Multi	Simeulue trench	2°2.279N	95°29.821	14/2/09 12:20	4894	0.25
SO200/3PC	Piston	Simeulue trench	2°2.269N	95°29.810	14/2/09 17:58	4886	1.5
SO200/4MC	Multi	Simeulue lower slope basin	2°5.538N	95°41.796	15/2/09 01:32	3512	0.43
SO200/5MC	Multi	Simeulue upper slope basin	2°5.19N	95°56.284	15/2/09 07:00	2150	0.33
SO200/6PC	Piston	Simeulue upper slope basin	2° 5.282N	95° 56.284	15/2/09 09:45	2198	3.51
SO200/7MC	Multi	Nias lower slope basin	0° 37.216N	96° 59.336	16/2/09 08:08	3875	0.44
SO200/8PC	Piston	Nias lower slope basin	0° 37.216N	96° 59.344	16/2/09 12:10	3874	3.28
SO200/9MC	Multi	Nias trench	0° 16.946N	96° 56.178	16/2/09 21:19	5299	0.53
SO200/10PC	Piston	Nias trench	0° 16.943N	96° 56.172	17/2/09 03:42	5301	5.40
SO200/11MC	Multi	Batu lower slope basin	0° 38.026S	97° 43.657	17/2/09 15:41	3456	0.38
SO200/12MC	Multi	Batu mid slope basin	0° 37.826S	97° 53.531	17/2/09 21:29	3209	0.26
SO200/13PC	Piston	Batu mid slope basin	0° 37.825S	97° 53.535	18/2/09 01:45	3214	3.82
SO200/14MC	Multi	Batu lower slope basin	0° 51.557S	97° 48.899	18/2/09 09:56	3839	0.38
SO200/15PC	Piston	Batu lower slope basin	0° 51.562S	97° 48.896	18/2/09 14:24	3840	1.39
SO200/16MC	Multi	Batu trench	1° 5.238S	97° 40.836	18/2/09 23:20	5450	0.2
SO200/17PC	Piston	Batu trench	1° 5.226S	97° 40.844	19/2/09 05:00	5449	0
SO200/18MC	Multi	Batu trench	1° 5.239S	97° 40.846	19/2/09 11:47	5449	0.29

Table DR3. Radiocarbon sample data.

TABLE A2. RADIOCARBON SAMPLE DATA

Sample code*	Radiocarbon facility sample code	Depth in core† (cm)	Uncalibrated radiocarbon age (years BP)	Calibrated age range 2σ § (years BP)
SO200_5MC_C1	SUERC-31758	32	3132±37	2795-3037
SO200_11MC_C1	SUERC-31759	30	612±37	129-335
SO200_6PC_C1	SUERC-31762	82.5	6050±38	6373-6594
SO200_6PC_C2	SUERC-31763	173.5	8964±39	9517-9760
SO200_8PC_C1	SUERC-31764	89	6407±37	6772-6994
SO200_8PC_C2	SUERC-31765	180	7410±39	7781-7957
SO200_13PC_C1	SUERC-31766	15.5	1226±37	681-874
SO200_13PC_C2	SUERC-31767	91.5	3855±37	3687-3926
SO200_15PC_C1	SUERC-31768	39	1741±35	1224-1368
SO200_12MC_C1	BETA-296522	16.5	420±30	N.D. #
SO200_14MC_C1	BETA-296523	14	360±40	N.D. #

* The sample code contains the core number after the prefix SO200, this is followed by either MC - multi core or PC - piston core.

† This is equivalent to depth below seafloor for multi cores, in piston cores sediment may be missing from the top of the core.

§ Calib 6.0 was used with an open ocean 400 year marine reservoir correction ($\Delta R = 0$).

\# N.D. – no data: the age could not be calibrated because the uncalibrated age is younger than the reservoir correction.

Table DR4. ^{210}Pb sample data.

TABLE A3. ^{210}Pb SAMPLE DATA

Sample code*	Sample depth† (cm)	Analysis type	Excess ^{210}Pb (Bq/g) §
SO200_2MC_Pb1	0.2-1.5	Gamma	0.349
SO200_4MC_Pb1	0.2-1.5	Gamma	0.666
SO200_4MC_Pb2	2.5-3	Gamma	0.297
SO200_4MC_Pb3	11.7-13.2	Gamma	0.048
SO200_4MC_Pb4	21.5-22.5	Gamma	0.000
SO200_5MC_Pb1	0.2-1.5	Gamma	0.768
SO200_7MC_Pb1	0.2-1.5	Gamma	0.627
SO200_7MC_Pb2	21-22	Gamma	0.000
SO200_7MC_Pb3	33.2-34.2	Gamma	0.000
SO200_9MC_Pb1	0.2-1.2	Gamma	0.141
SO200_9MC_Pb2	4-5	Gamma	0.082
SO200_9MC_Pb3	32-33	Gamma	0.026
SO200_9MC_Pb4	41.7-42.7	Gamma	0.000
SO200_11MC_Pb1	0.2-1.5	Alpha	1.009
SO200_11MC_Pb2	5-6	Alpha	0.214
SO200_11MC_Pb3	10-11	Alpha	0.043
SO200_11MC_Pb4	15-16	Alpha	0.032
SO200_11MC_Pb5	20-21	Alpha	0.025
SO200_11MC_Pb6	25-26	Alpha	0.016
SO200_11MC_Pb7	27.5-28.5	Gamma	0.000
SO200_11MC_Pb8	37-38	Gamma	0.000
SO200_12MC_Pb1	0.2-1.5	Gamma	0.859
SO200_12MC_Pb2	4.5-6	Gamma	0.086
SO200_12MC_Pb3	9.5-11	Gamma	0.107
SO200_12MC_Pb4	13.5-15	Gamma	0.000
SO200_12MC_Pb5	19.5-21	Gamma	0.000
SO200_12MC_Pb6	23.5-25	Gamma	0.000
SO200_14MC_Pb1	0.2-1.5	Gamma	0.489
SO200_14MC_Pb2	15.5-16.5	Gamma	0.000
SO200_14MC_Pb3	32-33.5	Gamma	0.000
SO200_18MC_Pb1	0.2-1.5	Gamma	0.169

* The sample code contains the core number after the prefix SO200.

† This is equivalent to depth below seafloor.