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Supplement of

Magnitude and source area estimations of severe prehistoric earthquakes in the western Austrian Alps

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Supplementary Table S1

All radiocarbon ages used for the age-depth models at Plansee, Piburgersee and Achensee (Oswald et al., 2021a; b; and this study)

Core ID	Sample no.	Core depth (cm)	Radiocarbon age (a BP ± 1σ)	95% calibrated age range (cal a BP)	Material	Reference
Plansee						
PLAN18-10	-	4.5	-	-36	137Cs peak	Oswald et al. (2021b)
PLAN18-10	-	8.5	-	-13	137Cs peak	Oswald et al. (2021b)
PLAN18-L1A-0-1.5	ETH-101431	52	595 ± 35	654-538	leaf and fir needle remains	Oswald et al. (2021b)
PLAN18-L1A-0-1.5	ETH-101432	81.5	2154 ± 24	2181-2058	leaf and fir needles	Oswald et al. (2021b)
PLAN18-10	ETH-94774	89	2591 ± 22	2756-2720	needle and fir cone piece	Oswald et al. (2021b)
PLAN18-L1A-0-1.5	ETH-101433	116.5	3136 ± 43	3449-3241	fir needle remains	Oswald et al. (2021b)
PLAN18-L1A-0-1.5	ETH-103730	129	3581 ± 26	3972-3831	fir needle	Oswald et al. (2021b)
PLAN18-L1B-1-2.5	ETH-103731	183.5	3782 ± 24	4236-4089	fir cone scale, needle remains	Oswald et al. (2021b)
PLAN18-L1A-1.5-3	ETH-101434	208	3915 ± 25	4423-4285	leaf and fir needles	Oswald et al. (2021b)
PLAN18-L1B-2.5-4	ETH-101435	309	5718 ± 56	6855-6403	leaf and fir needles	Oswald et al. (2021b)
PLAN18-L1A-3-4.5	ETH-101436	322.5	5869 ± 57	6800-6529	fir needle remains	Oswald et al. (2021b)
PLAN18-L1A-3-4.5	ETH-101437	399	7084 ± 65	8021-7783	fir needle remains	Oswald et al. (2021b)
PLAN18-L1A-4.5-6	ETH-103732	473	7739 ± 29	8589-8443	leaf and fir needle remains	Oswald et al. (2021b)
PLAN18-L1B-4-5.5	ETH-101438*	436.5	2595 ± 24	2759-2720	fir needles	Oswald et al. (2021b)
PLAN18-L1B-4-5.5	ETH-101439*	473.5	3934 ± 25	4440-4288	pair of fir needles	Oswald et al. (2021b)
PLAN18-L1A-4.5-6	ETH-101440	524	8278 ± 75	9460-9077	fir needle remains	Oswald et al. (2021b)
PLAN18-L1A-6-7.5	ETH-101441	660	9800 ± 87	11412-11068	betula fruit, fir needle remains	Oswald et al. (2021b)
PLAN18-L1A-9-10.5	ETH-103733	85	11509 ± 36	13461 - 13311	Conifer needle fragments	this study
Piburgersee						
PIBU18-01	-	10	-	83-73	210Pb/137Cs extrapolated age[4]	Thies et al. (2012)
PIBU18-01	ETH-94775	54.5	882 ± 21	903-733	fir needles	Oswald et al. (2021b)
PIBU18-01	ETH-94776	82.5	2493 ± 22	2720-2489	leaf and fir needles	Oswald et al. (2021b)
PIBU18-01*	ETH-92029	81.5	6457 ± 23	7427-7323	fir needles	Oswald et al. (2021b)
PIBU18-L1A-3-4.5	ETH-94777	353.5	3241 ± 22	3557-3395	fir needles, fir cone remains, betula fruit	Oswald et al. (2021b)
PIBU18-L1A_3-4.5	ETH-92030	370.5	3515 ± 23	3860-3705	leaf and fir needles	Oswald et al. (2021b)
PIBU18-L1A-3-4.5	ETH-94778	383.5	3983 ± 22	4519-4416	needles and Carpinus Betulus fruit	Oswald et al. (2021b)
PIBU18-L1A-4.5-6	ETH-92031	450	4060 ± 22	4784-4440	fir needles	Oswald et al. (2021b)
PIBU18-L1B-4-5.5	ETH-94779*	456	4519 ± 23	5302-5053	fir needles, betula fruit, tree leaf stalk	Oswald et al. (2021b)
PIBU18-L1B-4-5.5	ETH-94780	493.5	4828 ± 23	5605-5482	fir needles, tree leaf stalk	Oswald et al. (2021b)
PIBU18-L1B-4-5.5	ETH-94781	511	5244 ± 23	6174-5926	fir needles	Oswald et al. (2021b)
PIBU18-L1A-4.5-6	ETH-94782*	528	6005 ± 23	6925-6757	leaf remains, needles, betula fruit	Oswald et al. (2021b)
PIBU18-L1A-4.5-6	ETH-94783	551.5	5933 ± 23	6830 – 6675	needles, twig remains	Oswald et al. (2021b)
PIBU18-L1B-5.5-7	ETH-92032*	571.5	2499 ± 21	2724-2490	birch fruits, leafs, fir needles	Oswald et al. (2021b)
PIBU18-L1B-5.5-7	ETH-96886	638	8310 ± 24	9429-9260	leaf fragments, fir needles	Oswald et al. (2021b)
PIBU18-L1A-6-7.5	ETH-94784	650	8762 ± 25	9899-9634	leaf, twig, betula fruit	Oswald et al. (2021b)
PIBU18-L1A-6-7.5	ETH-96887	671	9299 ± 26	10575-10419	leaf stalk	Oswald et al. (2021b)
PIBU18-L1A-6-7.5	ETH-92033	691	10019 ± 26	11701-11335	twig and leaf remains, fir needle, birch fruits	Oswald et al. (2021b)
PIBU18-L1B-7-8.5	ETH-92034	743	11025 ± 27	13004-12784	fir needles and birch fruit	Oswald et al. (2021b)
Achensee						
ACH18-02	ACH18-02_10	7	-	CE 1986	137Cs peak	Oswald et al. (2021a)
ACH18-02	ACH18-02_18	15	-	CE 1963	137Cs peak	Oswald et al. (2021a)

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ACH18-02	ETH-89637 *	40	831 ± 26	778 - 683	5x needle fragments, 1 leaf part	Oswald et al. (2021a)
ACH18-02	ETH-89638 *	45	380 ± 24	501 - 322	3x needles	Oswald et al. (2021a)
ACh18-02	ETH-89639	91	157 ± 25	284 - rec.	3x needles, 3 leaf parts	Oswald et al. (2021a)
ACH17-01	ETH-85081 *	40	3333 ± 24	3636 - 3482	needles, leaf fragments	Oswald et al. (2021a)
ACH17-01	ETH-85080 *	87	1107 ± 24	1060 - 956	needles, leaf fragments	Oswald et al. (2021a)
ACH17-01	ETH-85079	125	1382 ± 23	1344 - 1278	needles, leaf fragments	Oswald et al. (2021a)
ACH19-L3D	ETH-108238	244	7336 ± 29	8189-8030	coating of fruit and leaf, needle fragments	Oswald et al. (2021a)
ACH19-L3C	ETH-108239	418	8200 ± 28	9275-9026	needle fragments + coating of fruit	Oswald et al. (2021a)
ACH19-L3B	ETH-108240	585	8396 ± 30	9523-8305	many small needle fragments	Oswald et al. (2021a)

* Samples excluded for age-depth modelling

Supplementary Figure S2:

Longcore data of core PLAN18-L1 at Plansee including histogram-equalized core image, CT image, bulk density, ^{14}C samples and interpreted event horizons.
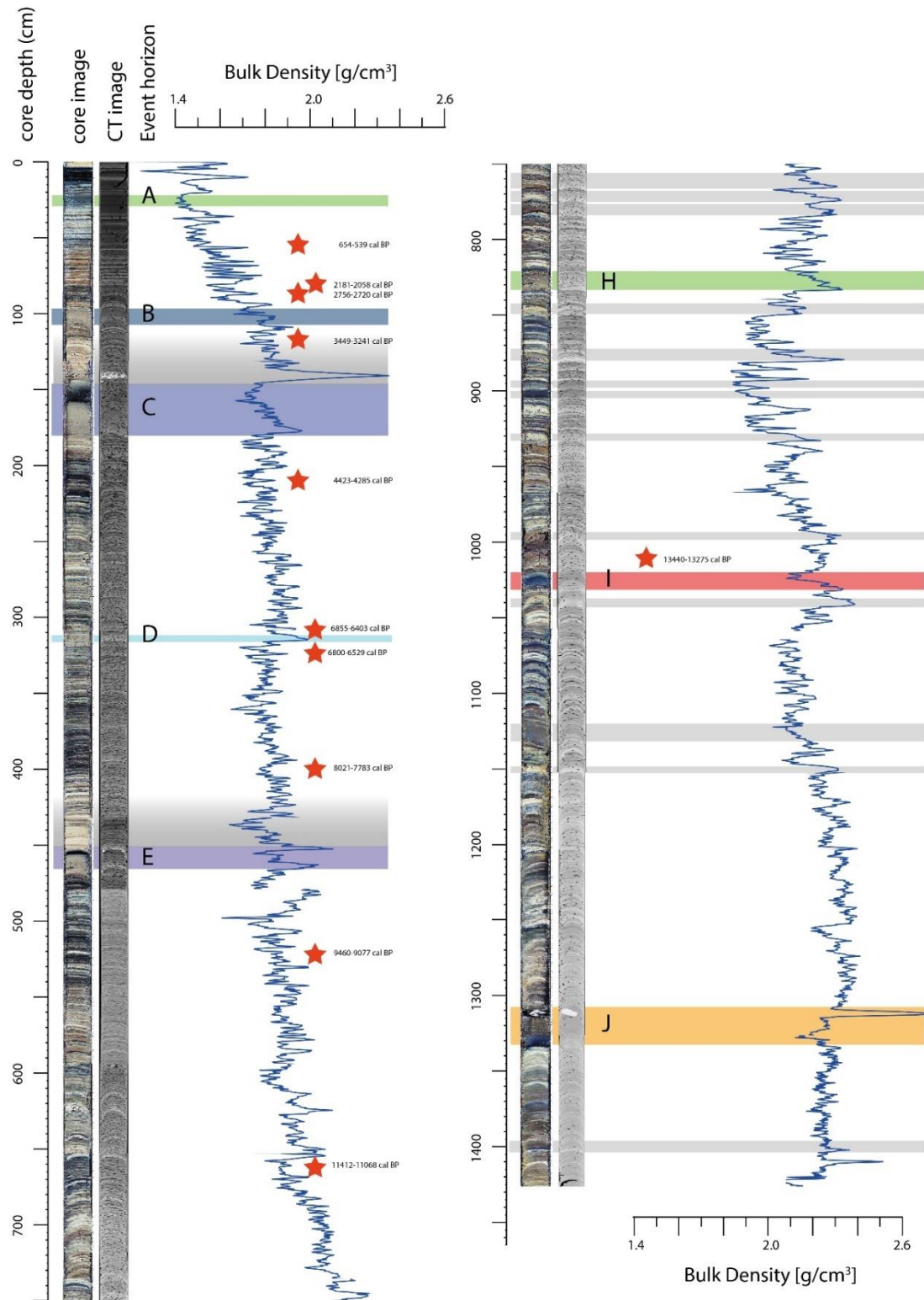
Supplementary Figure S3:

Evaluation of earthquake-related sedimentary imprints to represent a single event using the overlap of the 95% probability density functions of the individual event ages using the R software package 'overlapping' (Pastore and Calcagnì, 2019). We defined a PDF event age overlap >40% to indicate a single earthquake event with impact in multiple lakes. PDF event age overlaps < 40% are rejected to represent potential single events. PDF event age overlaps of the events at circa 3.0 and 4.1 ka BP are derived from Oswald *et al.*, (2021b).
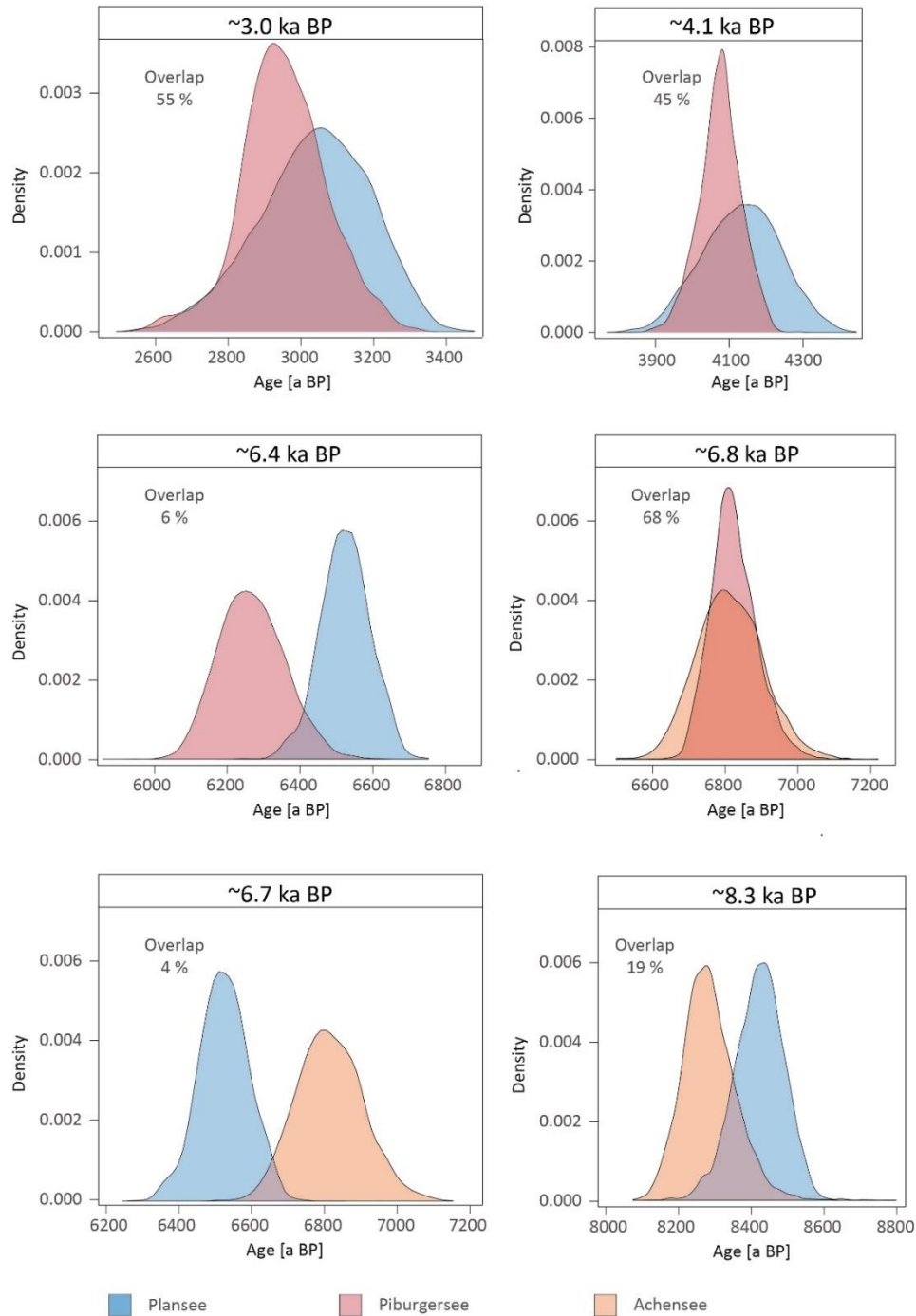
Supplementary Table S4:

Available geophysical and core data sets of the investigated lakes.

Lake	Geophysical data			Core data				
	Multibeam bathymetry	Seismics (km)		Long core	Short core	Measurements		
		Pinger source	Sparker source	Number	Number	MSCL	CT	XRF
Achensee	yes	133	99	2	3	yes	yes	no
Plansee	yes	45	-	1	4	yes	yes	no
Piburgersee	yes	no penetration	-	1	1	yes	yes	yes

References

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