Data Repository Items

Luminescence methods

Luminescence dating of lake sediments was completed on the fine-grained (4-11 μm) polymineral and quartz fractions. All samples were dated by the multiple aliquot regeneration dose procedures, using the component-specific dose normalisation (CSDN) method (Jain et al., 2003). This method compensates for sensitivity changes from irradiation and subsequent preheating, rendering robust equivalent dose values. Initially, the CSDN procedure determined equivalent dose with infrared (IR) stimulation, and then subsequently with blue light excitation. This sequence of analysis (IR followed by blue excitation) preferentially measures feldspar-sourced and then quartz-sourced emissions. The resultant blue emissions were measured at ~ 25º C by a photomultiplier tube coupled with one 3-mm-thick Schott BG-39 and one 3-mm-thick Corning 7-59 glass filter; these emissions are the most suitable as a chronometer (e.g. Balescu and Lamothe, 1994; Lang et al., 2002). The background count rate for measuring emissions was <100 counts/s, with a signal-to-noise ratio of >20. A sample was excited for 90s, and the resulting emissions was recorded in 1s increments.

A critical analysis for luminescence dating is the dose rate, which is an estimate of the sediment exposure to ionizing radiation during the burial period. Most ionizing radiation in sediment is from the decay of isotopes in the U and Th decay chains and ^{40}K, which was measured by inductively coupled plasma-mass spectrometry. A small cosmic ray component is included in the estimated dose rate (Prescott and Hutton, 1994). Dose rate for each sample was adjusted for measured moisture, organic and biogenic silica content.

References

Balescu, S., and Lamothe, M., 1994, Comparison of TL and IRSL age estimates of feldspar coarse grains from waterlain sediments: Quaternary Science Reviews, v. 13, p. 437-444.

Jain, M., Botter-Jensen, L., and Singhvi, A.K., 2003, Dose evaluation using multiple-aliquot quartz OSL: test of methods and a new protocol for improved accuracy and precision: Radiation Measurements, v. 37, p. 67-80.

Lang, A., Hatte, C., Rousseau, D.D., Antoine, P., Fontugne, M., Zoller, L., and Hambach, U., 2003, High-resolution chronologies for loess: comparing AMS C-14 and optical dating results: Quaternary Science Reviews, v. 22, p. 953-959.

Prescott, J.R., and Hutton, J.T., 1994, Cosmic ray contributions to dose rates for luminescence and ESR dating: large depths and long-term time variations: Radiation Measurements, v. 23, p. 497-500.

Data Repository Table 1

Data Repository Table 1. Radiocarbon ages from Lake CF8.

Lab number[a]	Core name	Depth in core section (cm)	Stratigraphic unit	Material	$\delta^{13}C$	Fraction modern	^{14}C age (^{14}C yr B.P.)
AA60641	02-CF8	31	I	aquatic moss	-26.6	0.6766±0.0052	3140±60
AA60642	02-CF8	50	I	aquatic moss	-29.1	0.5596±0.0028	4660±40
CURL-6954	02-CF8	107	I	aquatic moss	-30.5	0.3133±0.0017	10490±190
NSRL-13843	04-CF8-02a	80	III	aquatic moss	-22.1	0.00474 ±0.00063	43000 ±1070
AA60649	04-CF8-02a	81	III	aquatic moss	-23.9	0.0140±0.0010	34290 ±570
NSRL-13322	02-CF8	164	III	aquatic moss	-22.3	0.00260 ±0.00020	47810 ±400

[a]NSRL/CURL = The INSTAAR Laboratory for AMS Radiocarbon Preparation and Research; AA = The NSF - Arizona Accelerator Mass Spectrometry (AMS) Laboratory.

Data Repository Table 2

Table 2: Optically stimulated luminescence ages from Lake CF8 sediments.

Sediment core ID and depth	Lab #	Equiv. dose (Gy)[d]	U (ppm)[e]	Th (ppm)[e]	K_20 (%)[e]	A-value	H_2O (%)	Organic & $BSiO_2$ (%)	Cosmic[e] dose (Gy/ka)	Dose rate (Gy/ka)	OSL age (ka)
02-CF8-01 40.5-50.5 cm	UIC1683BL[a]	7.14 ± 0.46	3.1 ± 0.1	54.7 ± 0.1	1.14 ± 0.01	0.13 ± 0.01	80 ± 10	32 ± 5	0.08 ± 0.01	4.82 ± 0.29	1.48 ± 0.14
02-CF8-01 108-118 cm	UIC1684BL	44.70 ± 0.66	3.5 ± 0.1	38.4 ± 0.1	2.79 ± 0.01	0.10 ± 0.01	70 ± 10	32 ± 5	0.07 ± 0.01	4.44 ± 0.28	10.07 ± 0.88
02-CF8-01 108-118 cm	UIC1684BL-IR[b]	45.62 ± 0.64	3.5 ± 0.1	38.4 ± 0.1	2.79 ± 0.01	0.10 ± 0.01	70 ± 10	32 ± 5	0.07 ± 0.01	4.44 ± 0.28	10.28 ± 0.89
02-CF8-01 108-118 cm	UIC1684IR[c]	47.03 ± 0.51	3.5 ± 0.1	38.4 ± 0.1	2.79 ± 0.01	0.10 ± 0.01	70 ± 10	32 ± 5	0.07 ± 0.01	4.44 ± 0.28	10.59 ± 0.92
05-CF8-01 90-95 cm	UIC1682BL	425.07 ± 2.40	2.0 ± 0.1	35.1 ± 0.1	2.23 ± 0.01	0.13 ± 0.01	60 ± 10	25 ± 5	0.05 ± 0.01	4.38 ± 0.28	97.15 ± 0.91
05-CF8-01 90-95 cm	UIC1682IR	460.94 ± 2.95	2.0 ± 0.1	35.1 ± 0.1	2.23 ± 0.01	0.13 ± 0.01	60 ± 10	25 ± 5	0.05 ± 0.01	4.38 ± 0.28	105.35 ± 9.85
05-CF8-01 140-145 cm	UIC1685BL	899.77 ± 8.28	3.8 ± 0.1	66.0 ± 0.1	1.97 ± 0.01	0.12 ± 0.01	60 ± 10	12 ± 3	0.04 ± 0.01	7.39 ± 0.41	121.71 ± 12.08
05-CF8-01 213-218 cm	UIC1681 BL	(>)1260.44 ± 7.45	2.4 ± 0.1	37.3 ± 0.1	3.78 ± 0.04	0.12 ± 0.01	50 ± 10	4 ± 2	0.04 ± 0.01	6.49 ± 0.35	(>)194.12 ± 18.92

[a]Excitation under blue light (470 nm).

[b]Excitation under infrared light (920 nm) with subsequent blue light excitation.

[c]Excitation under infrared light.

[d] Multiple aliquot regenerative dose method following normalization procedures of Jain et al. (2003)

[e]U, Th and K_20 content by ICP-MS; includes a cosmic ray dose rate from calculations of Prescott and Hutton (1994)

All errors are at one sigma. Analyses by the Luminescence Dating Research Laboratory, University of Illinois at Chicago.