DATA REPOSITORY: SUPPLEMENTARY RESULTS

Potential Age Reversals in Radiocarbon Age Estimates

Several pairs of sample ages appear to indicate age reversals, i.e., places where older samples appear to overlie younger samples. Three cases of apparent age reversal are confirmed by stratigraphic data at the Golden Ridge Creek site, but the differences are smaller than expected uncertainties. In GR1119R, younger samples are stratigraphically lower than older samples at 33.8 m and 34.4 m distance from the mainstem (weighted mean calibrated ages 5,750 and 5,818 BP, respectively) and at 15.4 m and 16.1 m (141 and 169 BP, respectively) from the tributary outlet on the left bank (Table DR1, Fig. 4). In both cases, differences in mean calibrated ages are less than the 2-σ calibrated age uncertainties (Table DR1). In mainstem Golden Ridge Creek, younger and older samples appear inverted at 17.0 m and 18.8 m distance from the GR1119L confluence (148 and 168 BP, respectively; Table DR1, Fig. DR3), but the age difference is much less than the 1-σ calibrated age uncertainties (Table DR1). The older samples in these cases are therefore not excluded.

The left bank T2 riser at GR1119L contains two cases of apparent reversals that have age differences greater than the uncertainties attributable to radiocarbon dating but are separated by inferred buttress unconformities (Figs. 4 and 5). For the samples at 19.0 and 19.6 m distance (Fig. 4), the older deposit's exposure plane projects from the plane of the younger deposit, and we infer a buttress unconformity at the intersection of those planes. The uppermost debris flow deposit (19.6 m, left bank in Fig. 4) forms a higher bank than the uppermost fluvial gravel deposit (19.0 m, left bank in Fig. 4), and the topographic break separating the two surfaces continues from the line of the inferred buttress unconformity. The samples at 3.2 and 4.1 m distance (Fig. 5) both overlie an older sample (872 BP) from fluvial gravels at 2.9 m (Fig. 4).

Fluvial fines with backset bedding (i.e., dip upstream) determine two other cases, both in the right bank of T1 at GR1119L. In one case, an older sample at 12.5 m distance from the mainstem (weighted mean calibrated age 771 BP; Table DR1, Fig. 4) stratigraphically underlies a slightly lower younger sample at 14.4 m (518 BP) due to backset bedding. In the other case, a younger sample at 24.4 m (923 BP; Table DR1, Fig. 4) and an older sample at 26.6 m (1899 BP) are stratigraphically inverted. The older sample, likely exhumed from an older deposit, is therefore excluded from further analyses.

In the right bank of the debris flow fan (DF) at C1282R, an older sample at 62 m distance from the mainstem (weighted mean calibrated age 3132 BP; Table DR1, Fig. 3) is flanked at 57 m and 68 m by much younger samples (332 BP and 590 BP, respectively) at similar or lower elevations, and all samples are from debris flow deposits (Fig. 3). As dense vegetation and sloughed material covered the intervening stratigraphy, an age reversal cannot be ruled out, but descriptions of the facies' relative induration are consistent with the radiocarbon ages (i.e., older samples are from more indurated deposits). Also, while the sample ages at 57 m and 62 m appear inverted according to elevation and height above the bed (Table DR1), the older, at 0.8 m below the fan surface, appears stratigraphically lower than the younger, at 0.2 m below the fan surface (Fig. 3). Finally, given the significant distances separating the samples in the context of this debris flow fan (Figs. 2 and 3), we do not exclude this sample.

In the left bank of the debris flow fan (DF) at C1282R, a younger sample at 24 m distance (weighted mean calibrated age 170 BP; Table DR1, Fig. 3) is lower than an older sample at 28 m (830 BP). The older sample comes from a lower bank height, 1.5 m below the top of a taller bank, than the younger sample, 0.4 m below a the top of a shorter bank. It is likely, then, that the younger sample's deposit was formed relatively recently by fluvial infilling of a previously evacuated part of the fan.

At the Cedar Creek site, samples from inset deposits (from beneath the bed and from T1; Figs. DR1 and 3) are consistently younger than nearby samples from the higher banks adjoining the debris flow fan surface (DF in Figs. DR1 and 3), as expected. At the Golden Ridge Creek tributary (GR1119L), however, many samples from the right bank of T2 are younger than samples from T1 at similar distances from the tributary outlet (Fig. 4). Supporting these radiocarbon ages, geomorphic evidence indicates that T1 on the right bank was actually formed by fluvial exhumation of the higher T2 surface: while the tops of T2 on the right and left banks have similar elevations, the right bank T1 surface is higher than the left bank T1; and the right bank T2 riser is gradual, poorly defined, largely covered with loose fluvial gravels, and adjacent to a flood channel. Both surfaces have likely aggraded further. Even on the left bank, younger stratified fines, likely overbank deposits, are found near the top of T2 (cf. sample ages and stratigraphy at 15.4 m and 16.1 m; Figs. 2 and 4). Stratigraphy, geomorphology, and radiocarbon dates at both tributary sites, then, reveal complex assemblages formed through multiple episodes of deposition and partial evacuation.

One age from the Cedar Creek fan and two from the Golden Ridge Creek mainstem have weighted mean calibrated ages greater than 10 ka, all >3 ka greater than the next older sample. Of the latter two, one (right bank, at –14.9 m distance, i.e., downstream, from the GR1119L confluence, weighted mean calibrated age 12,522 BP; Table 2, Fig. DR3) came from fluvial gravels just upstream of rounded boulders at the base of a bank. The nearest younger right bank sample (at –6.6 m, 158 BP) came from a higher fluvial gravel stratum. The oldest Golden Ridge

Creek mainstem sample (left bank, at 15.1 m, 16,604 BP) came from a basal stratum of fluvial gravel. Nearby younger left bank samples from higher, apparently overlying strata had much younger ages (Fig. DR3). The oldest Cedar Creek tributary sample (right bank of C1282R, 18 m from the mainstem, 10,481 BP) came from debris flow sediment, likely of tributary origin, near bedrock at the distal end of the debris flow fan (Fig. 3, Table DR1). The nearest younger sample (left bank, at 24 m, 170 BP) came from a fluvial gravel deposit at a lower elevation in a shorter bank, probably from reworking by the mainstem or tributary, as noted above (Fig. 3). As fluvial gravels are absent in the column of the oldest deposit, these samples must be separated by an unconformity, either destroyed by the tributary channel or hidden beneath bank vegetation. Based on the evidence, we exclude none of the three oldest age estimates.

REFERENCES

Hua, Q., and Barbetti, M., 2004, Review of trophospheric bomb C-14 data for carbon cycle modeling and age calibration purposes: Radiocarbon, v. 46, p.1273-1298.

Reimer, P.J., Baillie, M.G.L., Bard, E., Bayliss, A., Beck, J.W., Bertrand, C.J.H., Blackwell, P.G., Buck, C.E., Burr, G.S., Cutler, K.B., Damon, P.E., Edwards, R.L., Fairbanks, R.G., Friedrich, M., Guilderson, T.P., Hogg, A.G., Hughen, K.A., Kromer, B., McCormac, G., Manning, S., Bronk Ramsey, C., Reimer, R.W., Remmele, S., Southon, J.R., Stuiver, M., Talamo, S., Taylor, F.W., van der Plicht, J., and Weyhenmeyer, C.E., 2004, IntCal04 terrestrial radiocarbon age calibration, 0-26 cal kyr BP: Radiocarbon, v. 46, p. 1029-1058.

TABLE DR1. RADIOCARBON SAMPLE LOCATIONS AND AGES

Lab no.	Loc.[*]	Dis. (m)[†]	B[§]	Ht. (m)[#]	Elev. (m)[**]	Dep.[††]	^{14}C age (BP)[§§]	Calibrated age (BP)[##]			Sample des.[***]
								Mean	σ	2-σ range from - to	
AA71626	C1282R DF	18	R	1.42	34.84	DF	9,297 ± 56	10,481	91	10,654 - 10,286	c
AA71623	C1282R DF	24	L	0.45	34.34	FG	196 ± 38	170	93	307 - -4	c
AA71616	C1282R DF	28	L	0.26	34.85	FG	911 ± 60	830	61	932 - 699	c
AA71630	C1282R DF	30	R	0.35	35.08	DF	668 ± 39	619	40	681 - 555	c, *P.m.*
AA71608	C1282R DF	31	L	1.73	36.53	DF	194 ± 39	168	93	307 - -4	p.b.b.
AA71617	C1282R DF	37	R	0.88	36.35	FG	105 ± 36	133	79	270 - 11	c, *P.m.*
AA71624	C1282R DF	40	L	2.65	38.50	DF	2,500 ± 35	2,586	84	2,739 - 2,370	c
AA71599	C1282R DF	40	L	3.47	39.32	DF	1,537 ± 38	1,436	51	1,523 - 1,350	c
AA71602	C1282R DF	57	R	2.53	40.93	DF	269 ± 34	332	86	457 - -2	c, *P.m.*
AA71607	C1282R T1	62	L	1.36	40.02	DF	137 ± 36	143	82	282 - 5	c
AA71618	C1282R DF	62	R	2.75	41.41	DF	2,959 ± 36	3,132	66	3,253 - 3,000	c, *P.m.*
AA71605	C1282R T1	64	L	1.21	39.98	FG	234 ± 41	228	113	430 - -4	c, *P.m.*
AA71621	C1282R DF	64	L	1.73	40.50	DF	3,234 ± 40	3,458	50	3,559 - 3,380	c
AA71598	C1282R DF	66	L	0.68	40.70	DF	2,039 ± 39	2,003	56	2,115 - 1,899	c, *P.m.*
AA71625	C1282R B	67	R	-0.41	39.81	DF	179 ± 37	160	89	301 - -4	c
AA71619	C1282R DF	68	L	1.75	42.16	DF	429 ± 34	479	47	532 - 332	c, b.
AA71610	C1282R DF	68	L	2.04	42.45	DF	214 ± 33	185	98	310 - -4	w/c, ≠*P.m.*
AA71628	C1282R DF	68	L	2.30	42.71	DF	191 ± 36	166	92	305 - -4	c, *P.m.*
AA71615	C1282R DF	68	R	0.19	40.60	DF	959 ± 42	861	48	956 - 781	c
AA71609	C1282R DF	68	R	0.95	41.36	DF	574 ± 38	590	37	652 - 525	c
AA71620	C1282R DF	71	R	0.89	41.87	DF	521 ± 34	548	35	631 - 506	c, ≠*P.m.*
AA71606	C1282R DF	99	R	0.81	44.99	FG	131 ± 38	141	82	281 - 6	w/c, *P.m.*
AA71631	C1262R DF	5	R	0.03	33.66	FG	95 ± 39	131	79	270 - 11	p.b.b.
AA71601	C1262R B	9	L	-0.41	33.48	FG	697 ± 49	639	47	727 - 556	c, *P.m.*
AA71627	C1262R B	11	L	-0.49	33.59	FG	223 ± 32	198	100	312 - -4	w
AA71600	C1262R B	15	R	-0.05	34.44	FF	99 ± 39	132	79	270 - 11	c
AA71614	C1262R DF	16	L	3.56	38.15	DF	5,937 ± 48	6,768	62	6,888 - 6,664	c
AA71611	C1262R DF	23	L	3.07	38.87	DF	2,075 ± 39	2,048	57	2,146 - 1,947	c, *P.m.*
AA71603	C1262R B	26	R	-0.66	36.07	FG	256 ± 34	292	102	435 - -4	c, *P.m.*
AA71622	C1262R DF	50	L	0.55	42.72	FG	444 ± 33	497	34	538 - 339	c, ≠*P.m.*
AA71629	C MS	56	R	0.03	34.32	FG	223 ± 37	200	104	424 - -4	p.b.b.
AA71597	C MS	14	L	0.72	33.51	FG	1,345 ± 43	1,263	42	1,334 - 1,178	w/c, *P.m.*
AA71613	C MS	-17	L	0.19	30.94	DF	179 ± 33	161	89	299 - -4	c
AA71612	C MS	-15	L	0.69	31.44	DF	168 ± 33	156	87	291 - -4	c, *P.m.*
AA71604	C MS	-31	L	1.77	31.38	FF	154 ± 33	151	85	285 - -2	p.b.b.

TABLE DR1. (CONTINUED)

Lab no.	Loc.[*]	Dis. (m)[†]	B[§]	Ht. (m)[#]	Elev. (m)[**]	Dep.[††]	^{14}C age (BP)[§§]	Calibrated age (BP)[##] Mean	σ	2-σ range from - to	Sample des.[***]
AA72005	GR1119L T2	2.9	L	0.68	96.33	FG	976 ± 34	872	47	953 - 795	c, *P.m.*
AA72004	GR1119L T2	3.2	L	1.93	97.68	FF	911 ± 36	837	50	918 - 742	c, *P.m.*
AA72008	GR1119L T2	4.1	L	1.58	97.61	FG	398 ± 34	441	60	515 - 319	c,b.
AA71992	GR1119L T1	4.3	R	0.40	96.50	FG	1,068 ± 35	985	39	1,056 - 928	c
AA71985	GR1119L T2	6.8	R	2.44	98.59	FG	386 ± 34	429	60	510 - 318	c, *P.m.*
AA71999	GR1119L T2	8.8	L	3.48	99.60	FG	4,702 ± 60	5440	83	5,584 - 5,316	c
AA72002	GR1119L T2	9.4	R	3.06	99.17	FG	479 ± 35	520	21	550 - 483	c
AA71993	GR1119L T2	10.7	L	1.49	97.67	FG	6,140 ± 41	7047	71	7,164 - 6,913	c, ≠*P.m.*
AA71986	GR1119L T2	12.4	R	2.56	99.02	FG	529 ± 33	554	37	631 - 509	c
AA71995	GR1119L T1	12.5	R	1.06	97.54	FF	855 ± 33	771	50	902 - 689	c
AA72007	GR1119L T1	14.4	R	0.77	97.56	FF	475 ± 35	518	21	549 - 480	c, *P.m.*
AA72003	GR1119L T2	15.4	L	2.88	99.64	FF	132 ± 34	141	82	280 - 7	c
AA71994	GR1119L T2	16.1	L	3.11	99.84	FF	195 ± 33	169	92	305 - -4	c
AA71987	GR1119L T0	17.4	R	0.05	96.71	FF	371 ± 33	416	58	505 - 316	c, *P.m.*
AA71996	GR1119L T2	19.0	L	2.38	98.95	FG	2,195 ± 35	2225	59	2,324 - 2,124	c, ≠*P.m.*
AA71997	GR1119L T2	19.6	L	2.11	98.77	FF	688 ± 46	632	44	698 - 553	c, ≠*P.m.*
AA71998	GR1119L T2	19.6	R	2.36	99.02	FG	231 ± 42	221	113	430 - -4	p.b.b.
AA72006	GR1119L T1	24.4	R	0.35	97.43	FF	1012 ± 34	923	48	1,048 - 797	c
AA71990	GR1119L T1	26.6	L	0.12	97.29	FF	210 ± 32	180	96	308 - -4	c, *P.m.*
AA71989	*GR1119L T1*	*26.6*	*R*	*0.48*	*97.65*	*FF*	*1,948 ± 34*	*1899*	*40*	*1,986 - 1,824*	*c*
AA71988	GR1119L T2	28.0	L	2.09	99.33	FG	847 ± 34	762	48	900 - 686	c, *P.m.*
AA72001	GR1119L T2	33.8	L	0.15	97.70	FG	5,000 ± 43	5750	75	5,893 - 5,620	c
AA71991	GR1119L T2	34.4	L	1.05	98.62	FG	5,070 ± 39	5818	54	5,912 - 5,731	c
AA72000	GR1119L T1	37.4	R	0.67	98.36	FF	1,268 ± 37	1208	49	1,287 - 1,086	c, *P.m.*
AA72011	GR MS	-29.0	R	0.49	95.00	FF	870 ± 34	792	55	906 - 698	c/w
AA72010	GR MS	-14.9	R	0.39	95.06	FG	10,760 ± 620	12,522	806	14,040 - 10,785	c, ≠*P.m.*
AA72012	GR MS	-6.6	R	0.83	95.84	FG	173 ± 33	158	88	297 - -4	c, *P.m.*
AA72016	GR MS	0.3	R	0.17	95.37	FG	181 ± 36	161	89	302 - -4	c
AA72014	GR MS	15.1	L	0.10	95.83	FG	13,790 ± 850	16,604	1,182	18,813 - 14,243	c
AA72013	GR MS	17.0	L	0.44	96.30	FG	148 ± 33	148	84	284 - 0	c
AA72015	GR MS	18.8	L	0.62	96.60	FF	216 ± 33	168	99	310 - -4	w/c
AA72009	GR MS	23.8	R	0.97	97.22	FG	1.0160 ± 0.0042	-5	1	-3 - -6	c

Note: All samples included for completeness. Sample shown in italics (AA71989) excluded from calculations.

[*]Loc. = channel and deposit from which sample was removed. C1282R = Cedar Creek western tributary; C1262R = eastern Cedar Creek tributary; C MS = Cedar Creek mainstem; GR1119L = Golden Ridge Creek tributary; GR MS = Golden Ridge Creek mainstem; B = channel bed; T0, T1, T2 = terraces.

[†]Dis. = surveyed tape distance along channel.

[§]B = bank from which sample was removed, R = right bank, L = left bank.

[#]Ht. = height above surveyed channel centerline, negative heights indicate that sample was removed from below the channel bed.

[**]Elev. = elevation of sample location in meters height above ellipsoid (m.h.a.e.).

[††]Dep. = type of deposit from which sample was removed. DF = debris-flow deposits, FG = fluvial gravels, and FF = fluvial fines.

[§§]^{14}C age (BP) = Radiocarbon age in uncalibrated years before 1950 AD, except for AA7209 reported as fraction of modern radiocarbon.

[##]Calibrated age (BP) = age in calibrated years before 1950 AD using IntCal04 (Reimer et al., 2004) and BombNH04 (Hua and Barbetti, 2004) calibration curves; negative numbers indicate years after 1950 AD, e.g.,–5 BP is 1955 AD. Mean is weighted mean, σ is standard deviation due to both analytical and calibration uncertainties, and the probability of the actual age falling within the 2-σ range is 95.4%.

[***]Sample desc. = sample description; c = charcoal, w = wood, w/c = partially burnt wood, b. = bark, p.b.b. = partially burnt bark, *P.m.* = *Pseudotsuga menziesii*, ≠*P.m.* = not *Pseudotsuga menziesii*.

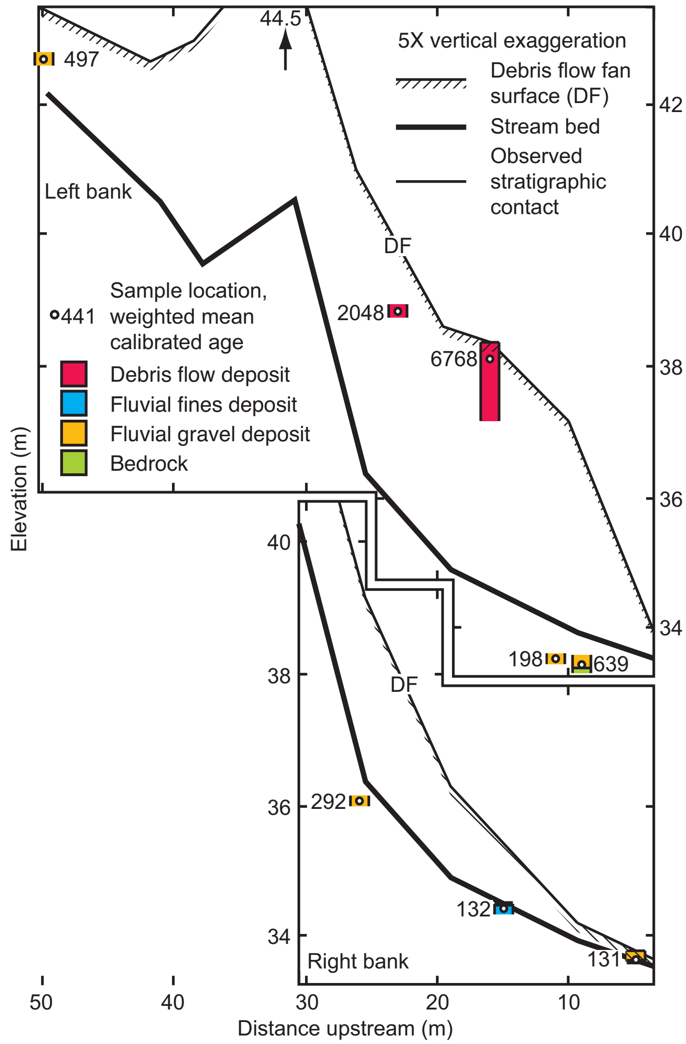

Figure DR1. For eastern tributary at Cedar Creek site (C1262R; Fig. 2), stratigraphy of channel banks; longitudinal profiles of channel bed and debris flow fan surfaces (DF); and radiocarbon sample locations (white circles), shown with weighted mean calibrated ages (BP). Elevations in meters height above ellipsoid (m.h.a.e.) shown with 5X vertical exaggeration on right axis for left bank (top) and left axis for right bank (bottom). Right bank is shown as mirror image to facilitate comparison of banks. Distances shown relative to mainstem centerline at confluence. Points projected into the plane of the cross-section.

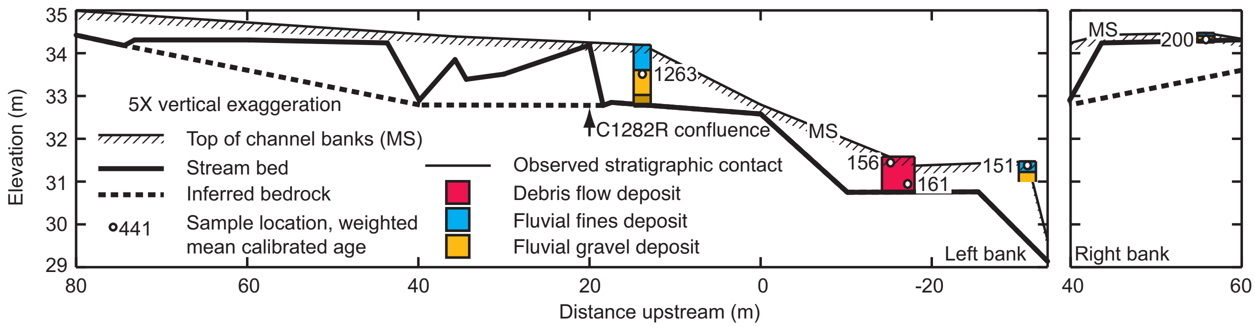

Figure DR2. For mainstem Cedar Creek (Fig. 2), stratigraphy of channel banks; longitudinal profiles of channel bed and valley floor deposit surfaces (MS); and radiocarbon sample locations (white circles), shown with weighted mean calibrated ages (BP). Elevations in meters height above ellipsoid (m.h.a.e.) shown with 5X vertical exaggeration. Distances shown relative to C1262R centerline at confluence. Points projected into the plane of the cross-section. Lighter and darker shades of yellow used to differentiate finer and coarser facies of fluvial gravel deposits, respectively.

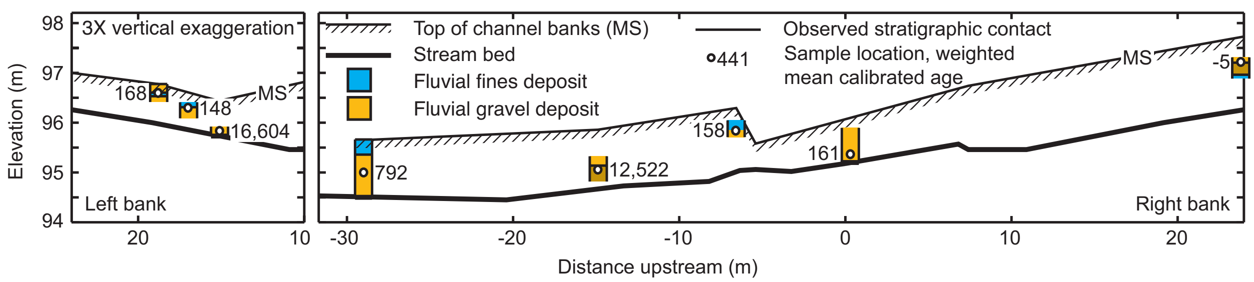

Figure DR3. For mainstem Golden Ridge Creek (Fig. 2), stratigraphy of channel banks; longitudinal profiles of channel bed and valley floor deposit surfaces (MS); and radiocarbon sample locations (white circles), shown with weighted mean calibrated ages (BP). Elevations in meters height above ellipsoid (m.h.a.e.) shown with 3X vertical exaggeration. Distances shown relative to mainstem centerline at confluence; positive values upstream of confluence, negative values downstream. Points projected into the plane of the cross-section. Lighter and darker shades of yellow used to differentiate finer and coarser facies of fluvial gravel deposits, respectively.