Appendix DR2. Analytical procedures.

1. Carbonate rocks

Major and trace elements were analysed by X-ray fluorescence spectrometry at the Geological Survey of Norway (NGU), Trondheim, using a Philips PW1480 254 ray spectrometer. The precision (1σ) is typically around 2% of the major oxide present. Oxygen and carbon isotope analyses were performed at the Scottish Universities Environmental Research Centre (SUERC), Glasgow, using the phosphoric acid method (McCrea, 1950) as modified by Rosenbaum and Sheppard (1986) for operation at 70 °C. Isotope ratios in carbonate constituents of the whole-rock samples were measured on an AP 2003 mass spectrometer. Analyses were calibrated against NBS 19, and precision (1σ) for both isotope ratios is better than ± 0.2‰. The carbon isotope data are reported relative to V-PDB whereas the oxygen isotope data are relative to V-SMOW. Oxygen isotope data for dolomites were corrected using the fractionation factor 1.0099 (Rosenbaum and Sheppard, 1986).

2. Geochronology

Samples for zircon separation were about 0.5-1 kg in weight and were collected from both surface outcrops and drillcores. Mineral separation was performed at NGU from fine-crushed material by hand washing, heavy liquids and magnetic separation. The final concentrate was handpicked under a binocular microscope. Zircons were mounted in epoxy together with 91500 zircon. Grains were then sectioned approximately in half, polished and photographed. Back-scattered electron imaging was carried out prior to dating to aid in the selection of the best target areas for the analyses.

Zircons were analysed using the Cameca IMS 1270 at the Swedish Museum of Natural History, Stockholm (the NORDSIM facility). The spot diameter for the 8-10nA primary O^{2-} ion beam was ca. 20 μm and oxygen flooding in the sample chamber was used to increase the production of Pb^{+} ions. For further details of the analytical procedures see footnotes to Table DR4 and Whitehouse et al. (1997, 1999).

A subset of ten zircons from one sample was selected for analysis by conventional isotope dilution-thermal ionisation mass spectrometry (ID-TIMS) at the Radiogenic Isotope Laboratory, Massachusetts Institute of Technology (MIT). Zircons underwent annealing and leaching pre-treatment (Mattinson, 2005) in order to minimise the effects of post-crystallisation Pb-loss prior to HF dissolution with a ^{205}Pb-^{233}U-^{235}U spike. For further details of the analytical procedures at MIT see footnotes to Table DR5 and Schoene et al. (2006). All age dates are calculated using the decay constants of (Steiger and Jäger, 1977) and their associated uncertainties. Concordia plots were generated using the Isoplot program (Ludwig, 2001).

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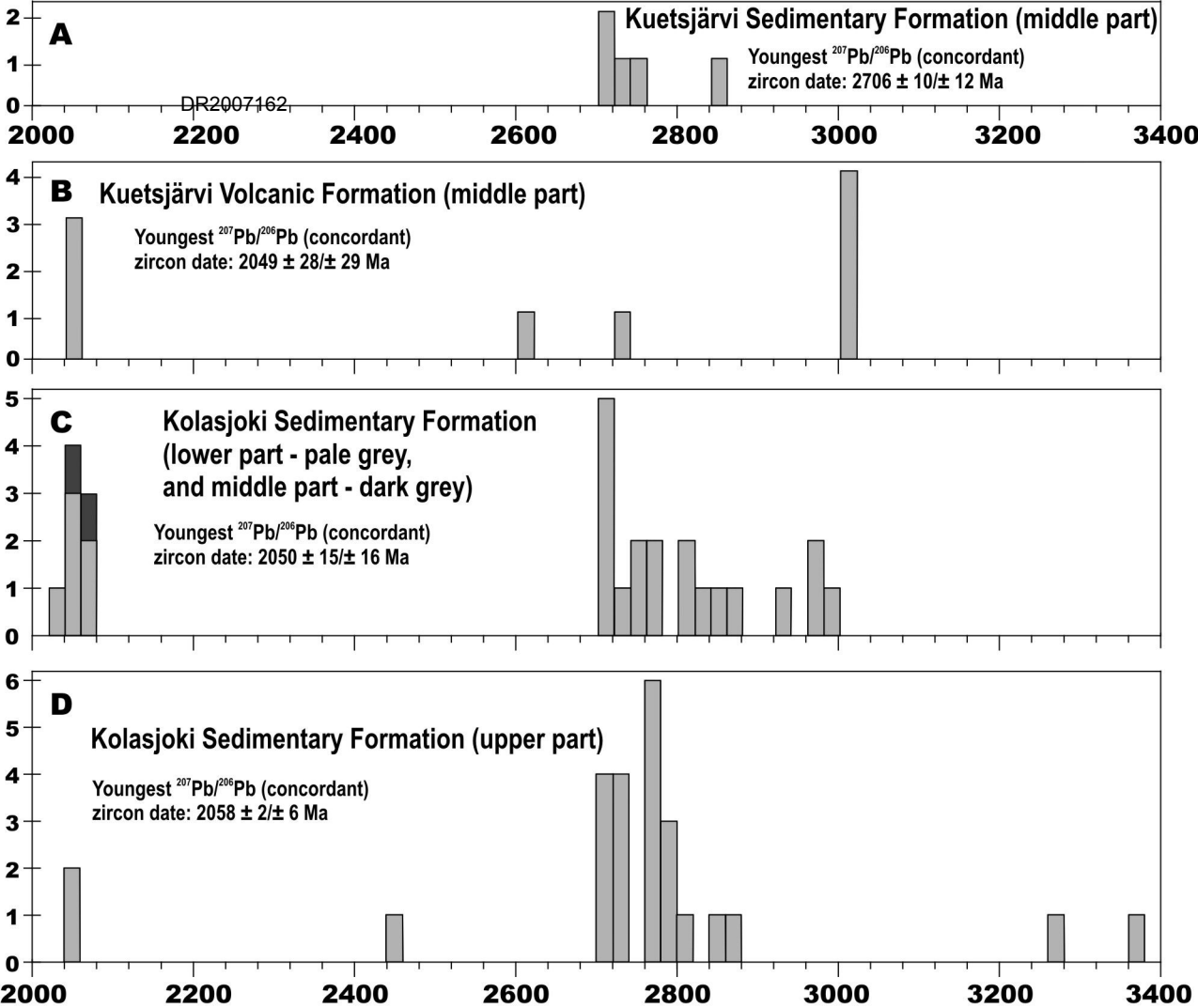

Figure DR6. Histogram plots (20 Myr bin-width starting at 2000 Ma until 3400 Ma) of $^{207}Pb/^{206}Pb$ concordant dates for the three stratigraphic intervals, namely the Kuetsjärvi Sedimentary and Volcanic formations and the Kolasjoki Sedimentary Formation.

Table DR1. Carbon isotope composition of Early Palaeoproterozoic carbonates from formations whose age have been constrained by high-precision U-Pb and Re-Os techniques, and their stratigraphic relationship to the dated unit is clear.

Stratigraphic unit	$\delta^{13}C$ (‰, V-PDB)	n	Age (Ma)[1]	Technique	Rock dated	Source of data	Reference to age
1. Seidorechka Sedimentary Formation	-5.4 to -1.8	6	>2442 ± 1.7	U-Pb	Overlying lava	Melezhik and Fallick, 1996	Amelin et al., 1995
2. Duitschland Formation	-3.7 to +10.1	70	>2316 ± 4(7)	Re-Os	Overlying schist	Buick et al., 1998; Bekker et al., 2001	Hannah et al., 2004
3. Sericite Schist Formation	+8.1 to +8.2	3	>2206 ± 9	U-Pb	Intruding sill	Karhu, 1993	Silvennoinen, 1991
4. Dunphy and Portage formations	+6.1 to +15.4	5	2169 ± 2	U-Pb	Interbedded lava	Melezhik et al., 1997	Rohon et al., 1993
5. Pistolet Subgroup	+5.3 to +10.4	18	>2142 +4/-2	U-Pb	Overlying lava	Melezhik et al., 1997	Clark, 1984
6. Lower Vistola Formation	+9.6 to +11.2	5	<2113 ± 4	U-Pb	Dyke truncated by formation	Karhu, 1993	Pekkarinen and Lukkarinen, 1991
7. Siltstone Formation	+12.1	1	<2078 ± 8	U-Pb	Dyke cutting lower part of the formation	Karhu, 1993	Silvennoinen, 1991
8. Kuetsjärvi Sedimentary Formation	+5.8 to +8.9	95	>2058 ± 2(6)	U-Pb	Overlying lava	Melezhik et al., 2005	This study
9. Houtenbek Formation	-3.3 to -0.6	3	>2061 ± 2.5	Pb-Pb evaporation	Overlying lava??	Buick et al., 1998; Bekker et al., 2004	Walraven, 1997
10. Kolasjoki Sedimentary Formation	+1.2 to +2.4	28	<2058 ± 2/6	U-Pb	Underlying lava	This study	This study

[1]. Number in parenthesis indicates age uncertainty including decay constant uncertainties.

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Table DR3. Chemical and isotopic composition of the Kolasjoki dolostones, drillhole # IX.

Sample # (depth, m)	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	Na_2O %	K_2O %	Mg %	Ca %	Mn ppm	Sr ppm	Mg/Ca	Mn/Sr	$\delta^{13}C$ ‰	$\delta^{18}O$ ‰
170	26.9	6.94	2.71	0.32	0.62	1.97	7.7	14.5	1750	95	0.53	18.4	+2.2	17.3
170.8	17.6	5.07	1.95	0.24	0.32	1.45	9.3	17.6	1835	105	0.53	17.5	+2.3	18.0
171.5	8.49	2.11	0.8	0.09	-	0.68	10.5	20.7	1390	98	0.51	14.2	+2.1	18.7
172.1	14.6	5.61	2.21	0.29	0.37	1.60	9.3	17.8	1853	104	0.52	17.8	+2.4	19.5
173.9	35.9	1.14	0.54	0.03	-	0.46	6.9	13.9	575	62	0.50	9.3	+2.3	17.6
174.3	25.5	1.81	0.72	0.06	-	0.59	8.3	16.6	695	75	0.50	9.3	+1.9	17.1
175.7	12.6	1.72	0.69	0.08	0.11	0.50	10.1	19.6	985	72	0.52	13.7	+2.0	18.3
176.7	23.2	6.97	2.15	0.27	-	2.25	7.9	15.9	810	51	0.50	15.9	+2.1	19.3
177.7	26.8	7.74	2.15	0.28	0.1	2.41	7.1	15.0	695	63	0.47	11.0	+1.9	18.1
178.2	2.43	0.77	0.42	0.03	-	0.27	11.2	23.4	1083	61	0.48	17.8	+2.2	19.3
178.4	2.06	0.69	0.36	0.03	-	0.30	10.4	24.7	1249	76	0.42	16.4	+2.0	18.7
179.2	12.1	0.6	0.5	0.03	-	0.19	9.1	20.3	915	57	0.45	16.1	+2.0	19.2
180.6	3.41	0.6	0.48	0.02	-	0.24	11.8	22.5	769	58	0.53	13.3	+2.0	18.8
180.9	8.17	0.29	0.35	0.02	-	0.13	12.1	20.8	572	57	0.58	10.0	+1.7	18.8
182.2	3.38	0.37	0.45	0.03	-	0.24	9.2	25.9	1761	124	0.36	14.2	+1.5	17.3
183.1	0.63	0.43	0.49	0.05	-	0.08	10.8	25.1	1428	99	0.43	14.4	+1.8	18.2
183.4	1.58	0.17	0.4	0.01	-	0.05	9.7	26.3	1654	99	0.37	16.7	+1.7	18.2
183.45	3.34	0.28	0.4	0.02	-	0.11	9.4	25.5	1745	91	0.37	19.2	+1.7	17.9
184.5	8.71	-	0.15	-	-	-	10.7	21.4	761	43	0.50	17.7	+1.9	19.1
187.2	0.21	0.19	0.32	0.03	-	0.08	11.2	24.5	1193	66	0.45	18.1	+1.2	19.2
187.7	1.60	-	0.19	-	-	0.03	11.4	23.4	905	50	0.49	18.1	+2.0	19.5
188.2	1.14	-	0.17	-	-	-	11.6	23.8	983	48	0.49	20.5	+1.9	19.3
188.8	1.05	-	0.2	-	-	-	10.6	25.0	1300	66	0.42	19.7	+2.0	18.5
189.1	10.6	-	0.2	-	-	-	9.7	21.3	983	44	0.46	22.3	+1.8	18.0
191.25	-	0.05	0.4	0.01	-	0.02	10.6	25.8	1876	62	0.41	30.3	+1.7	18.4
192.4	1.55	0.86	0.96	0.09	-	0.14	10.6	23.5	1498	72	0.45	20.8	+1.2	17.9
193.1	1.99	0.78	0.67	0.03	-	0.19	10.8	23.4	1264	70	0.46	18.1	+1.5	17.3
196.7	3.60	-	0.38	-	-	-	10.7	23.3	1210	46	0.46	26.3	+1.6	18.5

'*Dashes'* – below detection limits: 0.01% for SiO_2, Na_2O; 0.01 for Al_2O_3 and TiO_2.

Table DR4. U-Th-Pb SIMS zircon analytical data for Kuetsjärvi and Kolasjoki formations.

							Ratios (corrected for common Pb)							Ages							
Spot #	[U] ppm	[Th] ppm	[Pb] ppm	Th/U calc	$^{206}Pb/^{204}Pb$ measured	f_{206}%	207 Pb / 206 Pb	±s %	207 Pb / 235 U	±s %	206 Pb / 238 U	±s %	corr. coef.	206 Pb / 238 U	±s	207 Pb / 235 U	±s	207 Pb / 206 Pb	err (2s abs) (a)	% disc-ordance (b)	con-cordant (c)
Sample 1, Kuetsjärvi Sedimentary Formation, middle part, arkosic sandstone from surface outcrop																					
n1937-01	142	43	100	0.29	46446	0.04	0.2017	0.34	15.24	1.1	0.5482	1.1	0.95	2818	24	2831	11	2840	11	0.8	yes
n1937-02	595	154	310	0.32	1384	1.35	0.1753	0.77	9.81	2.4	0.4059	2.3	0.95	2196	43	2417	22	2609	26	15.8	
n1937-03	167	80	114	0.46	113162	0.02	0.1866	0.30	13.44	1.1	0.5223	1.1	0.96	2709	24	2711	11	2713	10	0.1	yes
n1937-04	241	122	169	0.36	4235	0.44	0.2249	0.46	16.27	1.3	0.5247	1.2	0.93	2719	26	2893	12	3016	15	9.8	
n1937-05	248	382	209	1.58	7410	0.25	0.1859	0.29	13.27	1.2	0.5176	1.1	0.97	2689	25	2699	11	2706	10	0.6	yes
n1937-06	199	241	156	1.17	101475	0.02	0.1883	0.31	13.43	1.2	0.5173	1.1	0.96	2688	25	2710	11	2727	10	1.4	yes
n1937-09	233	168	163	0.72	6320	0.30	0.1892	0.40	13.01	1.2	0.4988	1.2	0.95	2608	25	2681	12	2736	13	4.6	
n1937-10	239	108	171	0.48	8325	0.22	0.1914	0.28	14.28	1.2	0.5410	1.2	0.97	2788	27	2768	12	2755	9	-1.2	yes
Sample 2, Kuetsjärvi Volcanic Formation, middle part, volcanoclastic pebble conglomerate from surface outcrop																					
n1938-01	64	27	51	0.43	134987	{0.01}	0.2236	0.43	18.26	1.2	0.5924	1.1	0.93	2999	26	3004	11	3007	14	0.2	yes
n1938-02	99	217	65	2.19	64179	{0.03}	0.1266	0.50	6.52	1.2	0.3739	1.2	0.92	2048	20	2049	11	2051	18	0.1	yes
n1938-03	597	150	231	0.13	3389	0.55	0.1743	0.51	7.54	1.2	0.3139	1.1	0.91	1760	17	2178	11	2600	17	32.3	
n1938-04	432	243	239	0.38	9135	0.20	0.1890	0.29	10.91	1.1	0.4187	1.1	0.97	2255	20	2516	10	2734	10	17.5	
n1938-05	72	57	62	0.80	98377	{0.02}	0.2230	0.38	18.33	1.1	0.5960	1.1	0.94	3014	26	3007	11	3003	12	-0.4	yes
n1938-06	74	46	36	0.64	21909	0.09	0.1267	0.66	6.51	1.3	0.3729	1.1	0.86	2043	20	2048	11	2053	23	0.5	yes
n1938-07	63	43	31	0.68	15845	0.12	0.1264	0.81	6.53	1.4	0.3744	1.1	0.81	2050	20	2050	12	2049	28	0.0	yes
n1938-08	68	22	52	0.32	45481	0.04	0.2247	0.44	18.23	1.3	0.5884	1.2	0.94	2983	29	3002	12	3015	14	1.0	yes
Sample 4, Kolasjoki Sedimentary Formation, lower part, sandstone from surface outcrop																					
n1942-01	369	70	241	0.19	102009	0.02	0.1913	0.22	13.84	1.2	0.5247	1.1	0.98	2719	25	2739	11	2754	7	1.2	yes
n1942-04	494	166	274	0.05	5419	0.35	0.1866	0.18	11.86	1.1	0.4609	1.1	0.99	2444	22	2593	10	2713	6	9.9	

Table DR4 (continued).

Spot #	[U] ppm	[Th] Ppm	[Pb] ppm	Th/U calc	$^{206}Pb/^{204}Pb$ measured	f_{206}%	Ratios (corrected for common Pb) 207 Pb / 206 Pb	±s %	207 Pb / 235 U	±s %	206 Pb / 238 U	±s %	corr. coef. -	Ages 206 Pb / 238 U	±s	207 Pb / 235 U	±s	207 Pb / 206 Pb	err (2s abs) (a)	% disc-ordance (b)	con-cordant (c)
Sample 4, Kolasjoki Sedimentary Formation, lower part, sandstone from surface outcrop																					
n1942-02	107	10	79	0.09	42483	0.04	0.2211	0.30	18.07	1.1	0.5928	1.1	0.96	3001	26	2994	11	2989	10	-0.4	yes
n1942-03	102	43	75	0.43	71054	0.03	0.2005	0.45	15.40	1.2	0.5570	1.1	0.92	2854	25	2840	11	2830	14	-0.8	yes
n1942-05	391	233	237	0.49	6171	0.30	0.1802	0.23	11.30	1.1	0.4549	1.1	0.98	2417	22	2549	10	2655	8	9.0	
n1942-06	160	85	113	0.54	133692	{0.01}	0.1894	0.27	13.78	1.1	0.5277	1.1	0.97	2732	25	2735	11	2737	9	0.2	yes
n1942-07	99	55	74	0.57	39851	0.05	0.2031	0.33	15.44	1.1	0.5516	1.1	0.96	2832	25	2843	11	2851	11	0.7	yes
n1942-08	294	210	148	0.72	226384	{0.01}	0.1275	0.27	6.62	1.2	0.3765	1.1	0.97	2060	20	2062	10	2064	10	0.2	yes
n1942-08b	233	137	108	0.51	11920	0.16	0.1254	0.43	6.27	1.2	0.3630	1.1	0.93	1997	19	2015	10	2034	15	1.8	yes
n1942-09	153	149	65	0.44	4680	0.40	0.1241	0.49	5.75	1.2	0.3362	1.1	0.91	1868	18	1939	10	2016	18	7.3	
n1942-10	159	95	77	0.54	31711	0.06	0.1271	0.46	6.65	1.3	0.3792	1.3	0.94	2073	22	2066	12	2059	16	-0.7	yes
n1942-11	281	40	181	0.13	93430	0.02	0.1863	0.24	13.53	1.1	0.5267	1.1	0.98	2727	25	2717	11	2710	8	-0.6	*
n1942-12	147	75	71	0.52	55740	0.03	0.1266	0.43	6.60	1.2	0.3783	1.1	0.93	2068	19	2060	10	2051	15	-0.8	yes
Sample 5, Kolasjoki Sedimentary Formation, lower part, sandstone from surface outcrop																					
n1941-01	140	108	106	0.79	75760	0.02	0.1940	0.30	14.35	1.1	0.5365	1.1	0.96	2769	24	2773	11	2776	10	0.3	yes
n1941-02	141	114	110	0.81	45283	0.04	0.1992	0.29	14.98	1.1	0.5454	1.1	0.97	2806	25	2814	11	2820	9	0.5	yes
n1941-03	229	119	97	0.43	3155	0.59	0.1277	0.53	5.92	1.2	0.3361	1.1	0.90	1868	17	1964	10	2067	19	9.6	
n1941-04	122	56	57	0.46	49942	0.04	0.1265	0.43	6.45	1.2	0.3699	1.1	0.93	2029	20	2039	11	2050	15	1.0	yes
n1941-04b	110	60	54	0.51	71884	{0.03}	0.1282	0.56	6.74	1.2	0.3815	1.1	0.89	2083	19	2078	11	2074	20	-0.5	yes
n1941-05	207	116	93	0.51	3647	0.51	0.1268	0.44	6.11	1.2	0.3493	1.1	0.93	1931	18	1991	10	2054	15	6.0	
n1939-01	141	96	100	0.68	161845	{0.01}	0.1861	0.44	13.22	1.2	0.5152	1.1	0.93	2679	25	2696	12	2708	14	1.1	yes
n1939-02	41	13	29	0.33	47644	{0.04}	0.1989	0.55	14.86	1.2	0.5422	1.1	0.89	2793	24	2807	12	2817	18	0.9	yes
n1939-03	119	68	96	0.59	53660	0.03	0.2187	0.41	17.65	1.2	0.5853	1.1	0.94	2970	26	2971	11	2971	13	0.0	yes

Table DR4 (continued).

Spot #	[U] ppm	[Th] ppm	[Pb] ppm	Th/U calc	$^{206}Pb/^{204}Pb$ measured	f_{206}%	Ratios (corrected for common Pb) 207 Pb / 206 Pb	±s %	207 Pb / 235 U	±s %	206 Pb / 238 U	±s %	corr. coef.	Ages 206 Pb / 238 U	±s	207 Pb / 235 U	±s	207 Pb / 206 Pb	err (2s abs) (a)	% disc-ordance (b)	con-cordant (c)
Sample 6, Kolasjoki Sedimentary Formation, lower part, gritstone from surface outcrop																					
n1939-04	45	18	34	0.41	23738	0.08	0.2124	0.51	16.93	1.2	0.5781	1.1	0.90	2941	25	2931	12	2924	16	-0.6	yes
n1939-07	101	41	74	0.41	59743	0.03	0.2060	0.36	15.87	1.1	0.5586	1.1	0.95	2861	25	2869	11	2875	12	0.5	yes
n1939-11	175	129	126	0.74	55450	0.03	0.1854	0.32	13.18	1.2	0.5156	1.1	0.96	2681	24	2693	11	2702	11	0.8	yes
n1939-12	118	87	88	0.75	145261	{0.01}	0.1920	0.38	14.12	1.1	0.5337	1.1	0.94	2757	24	2758	11	2759	12	0.1	yes
n1939-13	513	257	343	0.47	32275	0.06	0.1893	0.26	13.17	1.1	0.5045	1.1	0.97	2633	24	2692	11	2736	8	3.8	
Sample 7, Kolasjoki Sedimentary Formation, lower part, hematite-rich gritstone from surface outcrop																					
n1940-01	114	129	91	1.13	65627	0.03	0.1935	0.50	14.20	1.2	0.5322	1.1	0.91	2750	24	2763	11	2772	16	0.8	yes
n1940-02	88	127	74	1.49	93975	{0.02}	0.1870	0.43	13.61	1.2	0.5281	1.1	0.93	2733	25	2723	11	2716	14	-0.6	yes
n1940-03	119	132	93	1.11	57553	0.03	0.1853	0.34	13.31	1.1	0.5209	1.1	0.95	2703	24	2702	11	2701	11	-0.1	yes
n1940-05	97	76	86	0.73	42723	0.04	0.2452	0.30	20.67	1.1	0.6113	1.1	0.96	3075	26	3123	11	3154	10	2.5	
n1940-06	46	98	48	2.10	109460	{0.02}	0.2180	0.51	17.16	1.2	0.5710	1.1	0.90	2912	25	2944	12	2966	16	1.8	yes
Sample 9, Kolasjoki Sedimentary Formation, middle part, sandstone from drillhole #3026, depth 449 m																					
n1943-01	414	202	384	0.51	26956	0.07	0.1913	0.23	18.89	1.2	0.7162	1.1	0.98	3482	31	3036	11	2753	7	-26.5	
n1943-02	100	50	83	0.52	40625	0.05	0.2232	0.34	18.64	1.2	0.6060	1.1	0.96	3054	27	3024	11	3004	11	-1.7	
n1943-03	153	83	73	0.52	61654	0.03	0.1278	0.38	6.62	1.3	0.3758	1.2	0.96	2057	22	2062	12	2068	14	0.5	yes
n1943-04	1298	682	169	0.26	1638	1.14	0.0824	2.63	1.18	4.4	0.1046	3.5	0.80	641.3	22	794.9	24	1254	103	48.9	
n1943-04b	1241	554	167	0.26	975	1.92	0.0800	1.06	1.21	1.6	0.1100	1.2	0.74	672.8	7.5	806.9	8.9	1197	42	43.8	
n1943-05	62	42	31	0.70	41024	{0.05}	0.1266	0.63	6.63	1.3	0.3798	1.1	0.87	2075	20	2063	11	2051	22	-1.2	yes
n1943-06	206	102	104	0.54	28788	0.06	0.1259	0.37	6.94	1.1	0.3997	1.1	0.95	2168	20	2103	10	2041	13	-6.2	
n1943-06b	312	128	129	0.36	34812	0.05	0.1246	0.33	5.73	1.1	0.3335	1.1	0.96	1855	18	1936	9.9	2024	12	8.3	

Table DR4 (continued).

Spot #	[U] ppm	[Th] ppm	[Pb] ppm	Th/U calc	$^{206}Pb/^{204}Pb$ measured	f_{206}%	Ratios (corrected for common Pb) 207 Pb / 206 Pb	±s %	207 Pb / 235 U	±s %	206 Pb / 238 U	±s %	corr. coef.	Ages 206 Pb / 238 U	±s	207 Pb / 235 U	±s	207 Pb / 206 Pb	err (2s abs) (a)	% disc-ordance (b)	con-cordant (c)
Sample 9, Kolasjoki Sedimentary Formation, middle part, sandstone from drillhole #3026, depth 449 m																					
n1943-07	56	21	46	0.37	23878	0.08	0.2221	0.41	19.11	1.2	0.6242	1.1	0.93	3127	27	3048	11	2996	13	-4.4	
Sample 10, Kolasjoki Sedimentary Formation, upper part, coarse-grained gritstone from drillhole #2817, depth 65 m																					
n1946-01	144	133	111	0.96	87325	0.02	0.1857	0.30	13.64	1.1	0.5328	1.1	0.96	2753	24	2725	11	2705	10	-1.8	yes
n1946-02	113	41	76	0.37	98109	{0.02}	0.1878	0.51	13.58	1.3	0.5245	1.2	0.92	2718	27	2721	12	2723	17	0.2	yes
n1946-03	99	66	73	0.67	32741	0.06	0.1943	0.32	14.27	1.2	0.5329	1.1	0.96	2754	26	2768	11	2779	11	0.9	yes
Sample 11, Kolasjoki Sedimentary Formation, upper part, fine-grained sandstone from drillhole #2817, depth 59 m																					
n1944-04	189	73	133	0.40	41016	0.05	0.1939	0.34	14.51	1.3	0.5426	1.2	0.96	2795	28	2784	12	2775	11	-0.7	yes
n1944-06	51	73	42	1.39	38846	0.05	0.1894	0.58	13.53	1.2	0.5197	1.1	0.88	2698	24	2720	12	2736	19	1.4	yes
Sample 12, Kolasjoki Sedimentary Formation, upper part, sandstone to gritstone from drillhole #2817, depth 56 m																					
n1948-01	286	173	196	0.59	31943	0.06	0.1866	0.39	13.16	1.2	0.5113	1.1	0.94	2662	24	2691	11	2713	13	1.9	yes
n1948-02	129	57	89	0.42	29432	0.06	0.1922	0.53	14.10	1.2	0.5321	1.1	0.90	2750	25	2756	12	2761	17	0.4	yes
n1948-03	42	19	40	0.41	11221	0.17	0.2802	0.58	26.61	1.3	0.6888	1.1	0.89	3378	29	3369	12	3364	19	-0.4	yes
n1948-04	351	36	228	0.094	60270	0.03	0.1843	0.31	13.62	1.1	0.5361	1.1	0.96	2767	25	2724	11	2692	10	-2.8	
n1948-05	82	110	67	1.26	28210	0.07	0.1873	0.68	13.81	1.3	0.5349	1.1	0.85	2762	25	2737	12	2719	22	-1.6	yes
n1948-06	259	168	185	0.61	51940	0.04	0.1858	0.40	13.56	1.2	0.5296	1.1	0.94	2740	24	2720	11	2705	13	-1.3	yes
n1948-07	23	6	16	0.24	20611	{0.09}	0.2023	0.93	15.51	1.4	0.5561	1.1	0.76	2850	25	2847	14	2845	30	-0.2	yes
n1948-08	508	285	204	0.34	17787	0.11	0.1731	0.27	7.21	1.1	0.3021	1.1	0.97	1702	16	2138	10	2588	9	34.2	
n1948-09	340	186	174	0.36	32736	0.06	0.1817	0.28	9.80	1.1	0.3914	1.1	0.97	2129	20	2416	10	2668	9	20.2	
n1948-10	338	84	231	0.24	72006	0.03	0.1874	0.23	14.12	1.2	0.5465	1.1	0.98	2810	26	2758	11	2720	8	-3.3	

Table DR4 (continued).

Spot #	[U] ppm	[Th] ppm	[Pb] ppm	Th/U calc	$^{206}Pb/^{204}Pb$ measured	f_{206}%	Ratios (corrected for common Pb) 207 Pb / 206 Pb	±s %	207 Pb / 235 U	±s %	206 Pb / 238 U	±s %	corr. coef. -	Ages 206 Pb / 238 U	±s	207 Pb / 235 U	±s	207 Pb / 206 Pb	err (2s abs) (a)	% discordance (b)	concordant (c)
Sample 13, Kolasjoki Sedimentary Formation, upper part, fine-grained sandstone from drillhole #2817, depth 55 m (see also Table 3 for ID-TIMS analyses)																					
n1945-01	1367	3391	376	0.72	5698	{0.33}	0.1399	0.56	3.24	1.3	0.1680	1.1	0.90	1001	11	1467	9.9	2226	20	55.0	
n1945-02	401	200	223	0.39	23363	{0.08}	0.1809	0.19	10.56	1.4	0.4233	1.4	0.99	2276	27	2485	13	2661	6	14.5	
n1945-03	265	95	177	0.34	38520	{0.05}	0.1876	0.23	13.48	1.1	0.5209	1.10	0.98	2703	24	2714	11	2722	8	0.7	yes
n1945-04	386	280	241	0.23	24167	{0.08}	0.1855	0.19	12.78	1.1	0.4997	1.1	0.99	2612	23	2664	10	2703	6	3.4	
n1945-05	139	91	87	0.68	64134	{0.03}	0.1589	0.46	10.21	1.2	0.4662	1.1	0.93	2467	23	2454	11	2444	16	-0.9	yes
n1945-06	86	51	63	0.59	20676	{0.09}	0.1992	0.42	14.88	1.2	0.5421	1.1	0.93	2792	25	2808	11	2819	14	1.0	yes
n1945-07	504	163	343	0.32	112628	{0.02}	0.1923	0.19	14.10	1.1	0.5318	1.1	0.99	2749	24	2756	11	2762	6	0.5	yes
n1945-08	166	84	116	0.52	51863	{0.04}	0.1876	0.35	13.61	1.2	0.5262	1.2	0.96	2725	26	2723	11	2721	11	-0.2	yes
n1945-09	236	74	135	0.32	6367	{0.29}	0.1737	0.24	10.81	1.2	0.4515	1.1	0.98	2402	23	2507	11	2593	8	7.4	
n1945-10	3314	2405	384	0.32	4019	{0.47}	0.0882	0.30	1.04	1.1	0.0857	1.1	0.96	530.1	5.6	724.8	5.9	1386	12	61.7	
n1945-11	471	92	307	0.20	138529	{0.01}	0.1885	0.18	13.60	1.2	0.5232	1.2	0.99	2713	26	2722	11	2729	6	0.6	yes
n1945-12	2249	964	1290	0.34	5431	{0.34}	0.1845	0.35	11.27	1.2	0.4428	1.2	0.96	2363	23	2545	11	2694	12	12.3	
n1945-13	1249	1097	325	0.28	5964	0.31	0.1426	0.52	3.91	1.3	0.1988	1.2	0.91	1169	12	1615	10	2259	18	48.2	

(a) Uncertainty (2σ level) includes internal errors only (e.g., common Pb correction, counting statistics).
(b) % discordance = 100 - (100*($^{206}Pb/^{238}U$ date/$^{207}Pb/^{206}Pb$ date)).
(c) Within 2σ error.

Table DR5. U-Pb ID-TIMS zircon analytical data for sample #13, Kolasjoki Sedimentary Formation, upper part, fine-grained sandstone.

				Ratios										Age (Ma)							
	Pb(c)	Pb*	Th	206 Pb	208 Pb	207 Pb	err	206 Pb	err	207 Pb	err	corr.		206 Pb	err	207 Pb	err	207 Pb	err	err	% disc-
	(pg)	Pbc	U	204 Pb	206 Pb	235 U	(2s%)	238 U	(2s%)	206 Pb	(2s%)	coef.		238 U	(2s abs)	235 U	(2s abs)	206 Pb	(2s abs)	(2s abs)	ordance
(a)	(b)	(c)	(d)	(e)	(e)	(f)	(g)	(f)	(g)	(f)	(g)			(h)	(i)	(h)	(i)	(h)	(i)	(j)	(k)
z5	1.2	41	0.62	2141.2	0.165	23.9829	(.17)	0.662217	(.16)	0.26266	(.06)	0.94		3275.76	5.15	3267.70	5.50	3262.8	0.9	7.5	-0.4
z1	1.2	61	0.43	3417.9	0.117	15.9672	(.16)	0.561681	(.13)	0.20618	(.09)	0.82		2873.57	3.86	2874.84	4.71	2875.7	1.5	7.2	0.1
z7	0.8	202	0.35	11449.5	0.097	14.5920	(.07)	0.541003	(.06)	0.19562	(.05)	0.77		2787.64	1.55	2789.01	2.03	2790.0	0.8	6.9	0.1
z6	0.8	241	1.08	14835.9	0.299	14.4908	(.10)	0.538819	(.09)	0.19505	(.05)	0.90		2778.50	2.61	2782.40	2.91	2785.2	0.7	6.9	0.2
z4	0.5	166	0.81	8580.7	0.224	14.4360	(.13)	0.538651	(.11)	0.19437	(.06)	0.89		2777.80	3.19	2778.80	3.60	2779.5	1.0	6.9	0.1
z3	0.7	129	1.22	6201.0	0.337	14.3352	(.12)	0.536846	(.11)	0.19367	(.05)	0.90		2770.23	3.04	2772.15	3.39	2773.6	0.9	6.9	0.1
z9	1.2	7	0.40	396.0	0.111	14.3104	(.92)	0.532100	(.80)	0.19506	(.42)	0.89		2750.29	21.93	2770.51	25.41	2785.3	6.9	9.8	1.3
z8	1.3	45	0.59	1931.4	0.369	6.5938	(.21)	0.376271	(.18)	0.12710	(.11)	0.87		2058.84	3.74	2058.52	4.36	2058.2	1.9	6.3	0.0
z2	0.6	39	1.29	2584.5	0.169	6.5928	(.31)	0.375925	(.20)	0.12719	(.24)	0.65		2057.22	4.17	2058.38	6.45	2059.5	4.2	7.3	0.1
z11	0.8	13	0.58	761.6	0.171	6.4905	(.35)	0.369885	(.28)	0.12727	(.19)	0.84		2028.86	5.69	2044.61	7.07	2060.6	3.3	6.9	1.5

(a) z1, z2, z3 etc. are labels for fractions composed of single grains or fragments of zircon; All zircon fractions were subject to the chemical abrasion technique (Mattinson, 2005).
(b) Total weight of common Pb; (c) Ratio of radiogenic Pb to common Pb.
(d) Model Th/U ratio calculated from radiogenic 206/208 ratio and $^{207}Pb/^{206}Pb$ age.
(e) Measured ratio corrected for spike and fractionation only. Mass bias corrections were based upon long-term analyses of NBS-981. Corrections of 0.25 ± 0.04%/a.m.u (atomic mass unit) and 0.07 ± 0.04%/a.m.u were applied to single-collector Daly analyses and dynamic Faraday-Daly analyses respectively.
(f) Corrected for fractionation, spike, blank and initial common Pb. All common Pb was assumed to be procedural blank.
(g) Errors are at the 2 sigma level, propagated using the algorithms of Ludwig (2001).
(h) Calculations are based upon the decay constants of Jaffey et al. (1971).
(i) Uncertainty (2s level) includes internal errors only (e.g., common Pb correction, counting statistics)

(j) Uncertainty (2s level) includes internal errors and systematic external errors related to decay constant uncertainties of Jaffey et al. (1971).
(k) % discordance = 100 - (100*(^{206}Pb/^{238}U date/^{207}Pb/^{206}Pb date)).

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