GTK
Etelä-Suomen yksikkö
Isotooppigeologia
106/2012

15.3.2012

Zircon SIMS U-Pb ages for adakitoids from Iisalmi, Kianta, and Ranua terrains

Report to Tapio Ruotoistenmäki and Pentti Hölttä

Irmeli Mänttäri

March 2012

GEOLOGIAN TUTKIMUSKESKUS **KUVAILULEHTI**

Päivämäärä / Dnro

<table>
<tr><td colspan="2">Tekijät
I. Mänttäri</td><td colspan="2">Raportin laji</td></tr>
<tr><td colspan="2"></td><td colspan="2">Toimeksiantaja
T. Ruotoistenmäki ja P. Hölttä</td></tr>
<tr><td colspan="4">Raportin nimi
Zircon SIMS U-Pb ages for adakitoids from Iisalmi, Kianta, and Ranua terrains</td></tr>
<tr><td colspan="4">Tiivistelmä</td></tr>
<tr><td colspan="4">Asiasanat (kohde, menetelmät jne.)
U-Pb ages, zircon, sims, Archean, adakitic, plutonic rocks</td></tr>
<tr><td colspan="4">Maantieteellinen alue (maa, lääni, kunta, kylä, esiintymä)
Finland</td></tr>
<tr><td colspan="4">Karttalehdet</td></tr>
<tr><td colspan="4">Muut tiedot</td></tr>
<tr><td colspan="2">Arkistosarjan nimi</td><td colspan="2">Arkistotunnus
106/2012</td></tr>
<tr><td>Kokonaissivumäärä</td><td>Kieli</td><td>Hinta</td><td>Julkisuus
Ei julkinen / 5 v.</td></tr>
<tr><td colspan="2">Yksikkö ja vastuualue
VA 216</td><td colspan="2">Hanketunnus
7141000</td></tr>
<tr><td colspan="2">Allekirjoitus/nimen selvennys
 
Irmeli Mänttäri</td><td colspan="2">Allekirjoitus/nimen selvennys</td></tr>
</table>

CONTENTS

1. SAMPLES

The representative zircon grains were mounted in mount M823 (Appendix 2). The samples and NORDSIM sample numbers are summarized in table 1.

Table 1. Samples and NORDSIM analysis numbers. Mount M823 and corresponding rows there. For ε_{Nd} –values refer the report by Hannu Huhma.

Sample	Row	Nordsim analysis no	Number of analyses	Zircon types	OBS
A1958 tonalite, Iisalmi terrain	2	n3381	Merk 28	Fairly heterogeneous: fractured, zoning related alteration, centre domains often altered, dark and blurry CL, zoned, many inclusions	ε_{Nd} = +1.1
A1959 gneiss, Iisalmi terrain	3	n3382	Merk 30	Quite heterogeneous: long zoned zircon, many often CL-bright cores with thin darker rims	ε_{Nd} = +0.8
A1960 tonalite, Kuhmo, Kianta terrain	4	n3383	Merk 28	Rather heterogeneous: complex zircon with cores and thin rim domain. Some cores recrystallized.	ε_{Nd} = –1.5
A1962 grdr, Kuhmo, Kianta terrain	5	n3384	Merk 27	Fairly homogeneous: fractured zircon, normally CL-darker inner domain and paler rim zone, only few clear cores	ε_{Nd} = –4.6
A1963 grdr, Ilomantsi terrain	6	n3385	Merk 28	Rather homogeneous: healthy, oscillatory zoned zircon, generally CL-paler centre zones and dark outer zones, many inclusions (apatite?)	ε_{Nd} = –0.2
A1964 gr, Ilomantsi terrain	7	n3386	Merk 27	Quite homogeneous: complex zircons, commonly CL-dark zoned cores with zoning related alteration and structurally rather homogeneous rims	ε_{Nd} = –0.3
A1965 tonalite, Pudasjärvi block, Ranua terrain	8	n3387	Merk 25	Rather homogeneous: long/thin crystals and more stubby grains with supposed cores	ε_{Nd} = +2.1
A1966 grdr, Pudasjärvi block, Ranua terrain	1	n3388	Merk 21	Homogeneous, healthy oscillatory zoned zircon, only a few supposed cores	ε_{Nd} = +1.6

Abbreviations used: gr=granite; grdr=granodiorite

2. AGE RESULTS

1.1 Analytical methods

Zircon for U-Pb secondary ion microprobe dating was selected by hand-picking after heavy liquid and magnetic separation. The chosen zircon was mounted in epoxy, polished, and coated with gold. The U-Pb isotope analyses were made using the Nordic Cameca IMS 1270 at the Swedish Museum of Natural History, Stockholm, Sweden. The spot-diameter for the 8nA primary O_2^- ion beam was ~20 μm and oxygen flooding in the sample chamber was used to increase the production of Pb^+ ions. Three counting blocks, each including four cycles of the Zr, Pb, Th, and U species of interest were measured from each spot. The mass resolution (M/ΔM) was 5400 (10%). The raw data were calibrated against a zircon standard 91500, which has an age of 1065 Ma (Wiedenbeck et al., 1995) and corrected for modern common lead (T=0; Stacey and Kramers 1975). For the detailed analytical procedure see Whitehouse et al. (1999) and Whitehouse and Kamber (2005).

Plotting of the U-Pb isotopie data, fitting of the discordia lines, and calculating the ages were done using the Isoplot/Ex 3 program (Ludwig, 2003). Age errors are calculated at 2σ and decay constants errors ignored. Data-point error ellipses in figures are 2σ.

1.2 Zircon descriptions and U-Pb age results

1.2.1 A1958 – 93003031 tonalite, Iisalmi complex

The tonalite sample A1958 from the Iisalmi Complex contains abundant zircon with a fairly heterogeneous population in >4.2 g cm^{-3} density fraction. It is either prismatic euhedral or subheral, brown to colourless, transparent to translucent. The grains are rather small with somewhat varying grain-size. Grains with metamict (reddish, turbid) cores are frequent. Apatite and epidotite are common.

In BSE images, the zircon shows frequent fracturing and inclusions. The centre domains are often altered and zoning related alteration is common. In CL, the inner domains show a bit blurry zoning and many grains show rather structurally homogeneous outer zones/rims.

A total of 19 zircon domains were dated using SIMS (Table 2 and Fig. 2). One data point was ignored due to high common lead proportion. The U concentrations are moderate and generally 100-300 ppm. The U-Pb data on zoned zircon domains give either concordant or discordant ages, the concordant and equivalent ones determining an age of 2696 ± 4 Ma for the tonalite. Three analyses on texturally homogeneous rim and tip domains, yielded $^{207}Pb/^{206}Pb$ ages of 2.62−2.65 Ga for the later overprint.

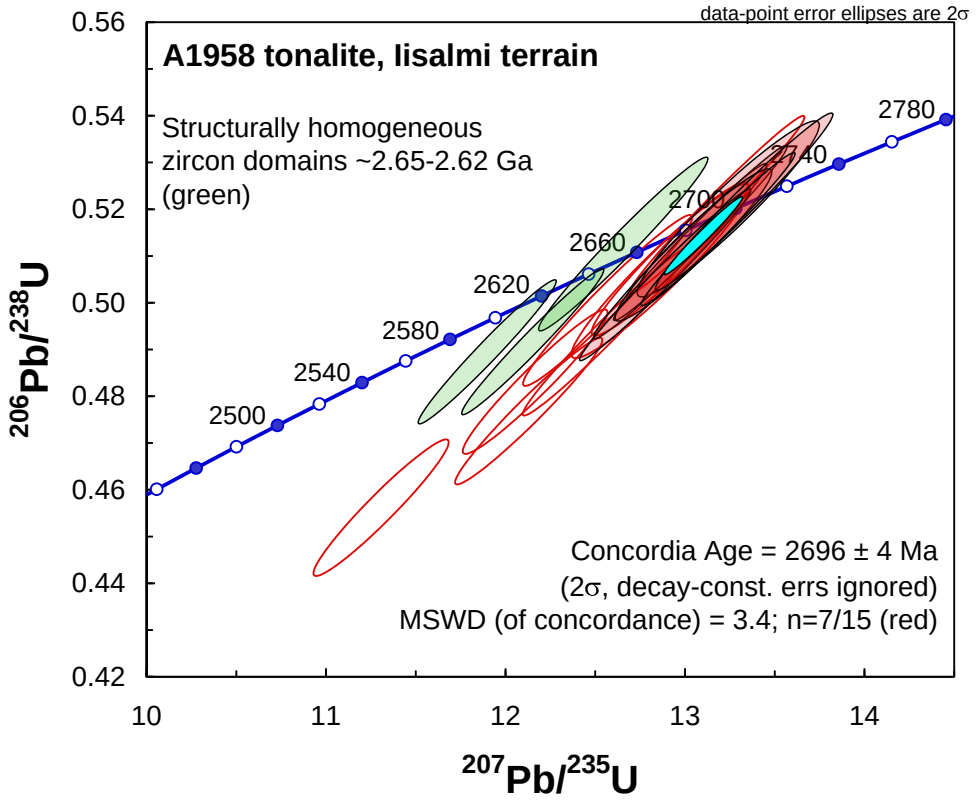


Fig. 2. Concordia plot showing SIMS U-Pb isotopic data, sample A1958 tonalite, Iisalmi terrain.

Table 2. SIMS U-Pb isotope data on zircon, samples from the Archaean terrains, E and N Finland.

		Derived ages						*Corrected ratios*								*Elemental data*					
Sample/ spot #	**Dated zircon domain**	**$^{207}Pb/^{206}Pb$**	**±s**	**$^{207}Pb/^{235}U$**	**±s**	**$^{206}Pb/^{238}U$**	**±s**	**$^{207}Pb/^{206}Pb$**	**±s %**	**$^{207}Pb/^{235}U$**	**±s %**	**$^{206}Pb/^{238}U$**	**±s %**	**r[1)]**	**Disc. %[2)]**	**[U] ppm**	**[Th] ppm**	**[Pb] ppm**	**Th/U meas**	**$^{206}Pb/^{204}Pb$ measured**	**f_{206} %[3)]**
A1958 tonalite, lisalmi terrain																					
n3381-01a	oscillatory zoned	2688	7	2673	13	2654	29	0.1839	0.4	12.915	1.4	0.5094	1.3	0.96		165	55	107	0.33	1.07E+05	0.0
n3381-01b	homog. tip domain	2647	4	2616	13	2577	28	0.1794	0.3	12.152	1.3	0.4914	1.3	0.98	-0.5	243	132	159	0.54	1.22E+05	0.0
n3381-02a	weakly zoned center domain	2651	6	2549	13	2423	26	0.1798	0.4	11.307	1.4	0.4562	1.3	0.96	-7.5	296	124	176	0.42	1.03E+03	1.8
n3381-02b	weakly zoned rim domain	2677	6	2617	13	2541	27	0.1826	0.4	12.166	1.4	0.4831	1.3	0.96	-3.3	205	96	130	0.47	2.51E+03	0.7
n3381-03a	weakly zoned	2696	7	2683	13	2666	29	0.1848	0.4	13.050	1.4	0.5123	1.3	0.96		115	40	76	0.35	4.37E+04	0.0
n3381-04a	homog. rim	2619	4	2597	13	2568	28	0.1764	0.3	11.901	1.3	0.4894	1.3	0.98		261	141	169	0.54	3.30E+04	0.1
n3381-05a	zoned	2694	5	2614	13	2513	28	0.1845	0.3	12.130	1.4	0.4768	1.3	0.97	-5.3	200	90	125	0.45	3.41E+03	0.6
~~*n3381-06a*~~	~~*zoned*~~	~~*2651*~~	~~*10*~~	~~*2376*~~	~~*14*~~	~~*2068*~~	~~*24*~~	~~*0.1798*~~	~~*0.6*~~	~~*9.380*~~	~~*1.5*~~	~~*0.3783*~~	~~*1.3*~~	~~*0.90*~~	~~*-22.5*~~	~~*308*~~	~~*215*~~	~~*161*~~	~~*0.70*~~	~~*2.68E+02*~~	~~*7.0*~~
n3381-07a	zoned	2702	4	2693	13	2681	29	0.1854	0.2	13.185	1.3	0.5157	1.3	0.98		304	154	207	0.51	4.46E+04	0.0
n3381-08a	weakly zoned	2694	5	2647	14	2588	32	0.1845	0.3	12.563	1.5	0.4939	1.5	0.98	-1.7	280	117	181	0.42	1.69E+03	1.1
n3381-09a	homog. center domain	2690	8	2670	15	2643	33	0.1841	0.5	12.865	1.6	0.5068	1.5	0.95		264	133	178	0.51	3.61E+03	0.5
n3381-10a	fairly homog. rim domain	2645	5	2654	14	2667	33	0.1791	0.3	12.656	1.5	0.5125	1.5	0.98		176	95	120	0.54	1.92E+04	0.1
n3381-11a	weakly zoned	2702	5	2704	14	2706	33	0.1854	0.3	13.333	1.5	0.5216	1.5	0.98		197	74	133	0.38	1.04E+04	0.2
n3381-12a	weakly zoned	2684	4	2693	14	2703	33	0.1835	0.2	13.179	1.5	0.5210	1.5	0.99		269	119	183	0.44	4.96E+03	0.4
n3381-13a	weakly zoned	2693	4	2686	14	2677	33	0.1844	0.3	13.087	1.5	0.5148	1.5	0.99		246	62	159	0.25	3.94E+04	0.1
n3381-14a	zoned	2696	8	2697	15	2699	33	0.1847	0.5	13.243	1.6	0.5200	1.5	0.95		133	116	99	0.87	2.27E+03	0.8
n3381-15a	zoned	2697	4	2672	14	2639	32	0.1849	0.2	12.892	1.5	0.5058	1.5	0.99		342	214	236	0.63	1.01E+04	0.2
n3381-16a	zoned	2691	4	2678	15	2660	33	0.1842	0.3	12.975	1.5	0.5109	1.5	0.98		223	84	146	0.38	1.47E+05	0.0
n3381-17a	weakly zoned	2672	6	2648	15	2616	32	0.1821	0.4	12.570	1.5	0.5005	1.5	0.97		215	121	144	0.57	3.12E+03	0.6
A1959 gneiss, lisalmi terrain																					
n3382-01a	zoned, CL pale	2742	6	2715	13	2679	30	0.1899	0.4	13.494	1.4	0.5153	1.3	0.96		89	25	58	0.28	4.99E+04	0.0
n3382-02a	zoned, CL pale	2888	8	2883	14	2875	31	0.2078	0.5	16.103	1.4	0.5621	1.3	0.94		49	24	37	0.49	2.69E+04	0.1
n3382-03a	weakly zoned	2790	6	2771	13	2745	30	0.1957	0.4	14.321	1.4	0.5309	1.3	0.97		99	18	66	0.18	8.76E+04	0.0
n3382-04a	zoned, CL pale	2884	6	2870	13	2850	30	0.2072	0.4	15.885	1.4	0.5559	1.3	0.97		90	42	67	0.46	1.08E+05	0.0
n3382-05a	zoned, CL pale	2838	8	2707	14	2535	28	0.2015	0.5	13.385	1.4	0.4819	1.4	0.94	-9.9	78	35	49	0.44	2.77E+03	0.7
n3382-06a	CL-bright zoned core	2672	9	2606	15	2522	30	0.1821	0.6	12.018	1.5	0.4788	1.4	0.93	-3.3	52	19	32	0.36	1.37E+04	0.1
n3382-06b	CL-dark homog. rim	2613	4	2641	13	2678	29	0.1757	0.2	12.479	1.4	0.5150	1.3	0.98	0.1	469	32	288	0.07	1.70E+03	1.1
n3382-07a	zoned tip	2745	5	2727	13	2704	29	0.1903	0.3	13.669	1.4	0.5210	1.3	0.97		216	85	138	0.39	6.17E+03	0.3
n3382-08a	weakly zoned	2784	7	2753	14	2710	30	0.1949	0.4	14.049	1.4	0.5227	1.4	0.95	-0.1	80	50	57	0.62	1.90E+04	0.1
n3382-09a	zoned	2887	6	2883	15	2877	35	0.2076	0.4	16.099	1.5	0.5625	1.5	0.97		85	29	62	0.34	3.79E+04	0.1
n3382-10a	zoned core	2899	12	2897	17	2895	36	0.2092	0.8	16.347	1.7	0.5668	1.5	0.89		20	8	15	0.41	4.08E+04	{0.05}
n3382-10b	zoned rim	2732	4	2719	14	2702	33	0.1888	0.3	13.550	1.5	0.5206	1.5	0.98		234	40	145	0.17	5.24E+03	0.4
n3382-11a	zoned (+thin rim)	2836	14	2824	17	2807	35	0.2012	0.9	15.136	1.7	0.5455	1.5	0.87		27	12	20	0.44	1.39E+04	0.1
n3382-12a	zoned	2888	5	2862	15	2825	34	0.2077	0.3	15.750	1.5	0.5499	1.5	0.98		133	72	99	0.54	5.63E+04	0.0
n3382-13a	zoned	2742	7	2734	15	2722	33	0.1900	0.4	13.763	1.6	0.5254	1.5	0.96		146	53	99	0.36	5.53E+03	0.3

Table 2. Continued.

		Derived ages						*Corrected ratios*								*Elemental data*					
Sample/ spot #	**Dated zircon domain**	**$^{207}Pb/^{206}Pb$**	**±s**	**$^{207}Pb/^{235}U$**	**±s**	**$^{206}Pb/^{238}U$**	**±s**	**$^{207}Pb/^{206}Pb$**	**±s %**	**$^{207}Pb/^{235}U$**	**±s %**	**$^{206}Pb/^{238}U$**	**±s %**	**r[1)]**	**Disc. %[2)]**	**[U] ppm**	**[Th] ppm**	**[Pb] ppm**	**Th/U meas**	**$^{206}Pb/^{204}Pb$ measured**	**f_{206} %[3)]**
n3382-14a	zoned core (+thin rim)	2849	9	2836	15	2818	34	0.2028	0.5	15.330	1.6	0.5484	1.5	0.94		45	14	32	0.31	2.08E+04	0.1
n3382-15a	zoned	2819	3	2805	14	2785	34	0.1991	0.2	14.837	1.5	0.5404	1.5	0.99		603	11	393	0.02	5.39E+04	0.0
n3382-16a	zoned core	2851	7	2848	15	2844	34	0.2030	0.4	15.524	1.6	0.5545	1.5	0.96		83	43	62	0.51	3.23E+04	0.1
n3382-16b	quite homog. rim	2759	7	2677	15	2571	32	0.1920	0.5	12.968	1.6	0.4900	1.5	0.96	-5.0	190	8	112	0.04	9.98E+02	1.9
n3382-17a	zoned (+thin rim)	2871	5	2882	15	2897	35	0.2056	0.3	16.082	1.5	0.5672	1.5	0.98		183	79	137	0.43	7.35E+04	0.0
n3382-18a	sector zoned core	2761	9	2752	15	2740	34	0.1922	0.6	14.034	1.6	0.5297	1.5	0.93		65.3	19	44	0.30	7.36E+03	0.3
n3382-19a	hazily zoned	2712	7	2684	15	2646	33	0.1866	0.4	13.060	1.6	0.5076	1.5	0.96		131	12	80.3	0.09	2.43E+04	0.1
n3382-20a	zoned	2889	11	2887	16	2884	36	0.2079	0.7	16.172	1.7	0.5643	1.5	0.92		44.1	20	32.9	0.44	2.95E+04	0.1
n3382-21a	weakly zoned	2754	7	2742	15	2726	33	0.1914	0.4	13.886	1.6	0.5263	1.5	0.96		114	32	76	0.28	5.99E+04	0.0
n3382-22a	fairly homog, CL-pale center	2753	10	2691	11	2609	21	0.1912	0.6	13.156	1.1	0.4990	1.0	0.85	-3.3	41	15	26	0.37	2.97E+04	0.1
n3382-22b	fairly homog, CL-dark tip	2746	6	2759	10	2777	21	0.1904	0.4	14.136	1.0	0.5384	0.9	0.93		137	5	88	0.04	3.56E+03	0.5
n3382-23a	fairly homog. Core (+thin rim)	2859	12	2857	11	2854	22	0.2041	0.7	15.668	1.2	0.5569	1.0	0.80		41	20	30	0.50	2.47E+04	0.1
n3382-24a	weakly zoned core	2809	5	2849	10	2907	22	0.1979	0.3	15.546	1.0	0.5698	0.9	0.95	2.0	215	14	149	0.07	6.71E+04	0.0
n3382-24b	zoned rim	2671	3	2660	9	2645	20	0.1819	0.2	12.725	1.0	0.5073	0.9	0.98		488	91	303	0.19	1.44E+04	0.1
A1960 tonalite, Kuhmo, Kianta terrain																					
n3383-01a	BSE-pale/CL-dark homog. core	2949	1	2986	13	3040	32	0.2157	0.0	17.923	1.3	0.6026	1.3	1.00	1.2	4403	229	3263	0.05	9.70E+05	0.0
n3383-01b	zoned rim	2630	6	2403	13	2145	24	0.1775	0.4	9.663	1.4	0.3947	1.3	0.96	-19.2	543	29	254	0.05	9.29E+03	0.2
n3383-02a	zoned	2820	5	2817	13	2813	30	0.1992	0.3	15.027	1.4	0.5470	1.3	0.97		130	42	90	0.32	1.37E+04	0.1
n3383-03a	zoned	2832	5	2809	13	2777	30	0.2008	0.3	14.904	1.4	0.5384	1.3	0.97		119	47	83	0.40	3.73E+04	0.1
n3383-04a	zoned center/core domain	2903	6	2865	13	2812	30	0.2097	0.4	15.811	1.4	0.5468	1.3	0.96	-0.9	107	49	78	0.46	5.30E+04	0.0
n3383-05a	CL-dark, hazily zoned	2793	3	2761	13	2717	29	0.1959	0.2	14.165	1.3	0.5243	1.3	0.99	-0.7	409	40	262	0.10	1.03E+05	0.0
n3383-06a	BSE-pale/CL-dark homog. core	2954	2	2915	13	2858	30	0.2164	0.1	16.644	1.3	0.5578	1.3	0.99	-1.5	696	224	505	0.32	3.78E+05	0.0
n3383-07a	weakly zoned tip domain	2848	5	2813	13	2763	29	0.2028	0.3	14.963	1.3	0.5352	1.3	0.97	-0.9	223	190	171	0.85	8.96E+04	0.0
n3383-07b	weakly zoned center domain	2837	7	2796	13	2739	29	0.2014	0.4	14.701	1.4	0.5294	1.3	0.95	-1.3	131	77	94	0.59	2.05E+04	0.1
n3383-08a	zoned	2834	4	2836	15	2841	35	0.2009	0.3	15.338	1.5	0.5537	1.5	0.99		214	165	167	0.77	2.31E+05	0.0
n3383-09a	weakly zoned	2853	5	2829	15	2795	34	0.2033	0.3	15.215	1.5	0.5427	1.5	0.98		124	80	93	0.64	5.77E+04	0.0
n3383-10a	weakly zoned	2841	5	2827	15	2808	34	0.2018	0.3	15.191	1.5	0.5459	1.5	0.98		135	114	105	0.85	4.17E+04	0.0
n3383-11a	weakly zoned	2820	8	2809	15	2792	34	0.1993	0.5	14.897	1.6	0.5421	1.5	0.95		92	37	64	0.40	7.37E+03	0.3
n3383-12a	zoned	2824	6	2782	15	2725	33	0.1997	0.3	14.491	1.5	0.5262	1.5	0.97	-1.1	110	32	74	0.29	1.98E+04	0.1
n3383-13a	BSE-pale/CL-dark homog. core	2938	1	2947	14	2960	35	0.2143	0.1	17.221	1.5	0.5829	1.5	1.00		1679	49	1196	0.03	3.53E+05	0.0
n3383-14a	zoned	2848	7	2835	15	2817	35	0.2027	0.4	15.315	1.6	0.5480	1.5	0.97		119	45	85	0.37	1.73E+04	0.1
n3383-15a	zoned center domain	2832	6	2798	15	2752	33	0.2007	0.4	14.735	1.5	0.5325	1.5	0.97	-0.2	180	146	128	0.81	1.56E+04	0.1

Table 2. Continued.

		Derived ages						*Corrected ratios*								*Elemental data*						
Sample/ spot #	**Dated zircon domain**	**$^{207}Pb/^{206}Pb$**	**±s**	**$^{207}Pb/^{235}U$**	**±s**	**$^{206}Pb/^{238}U$**	**±s**	**$^{207}Pb/^{206}Pb$**	**±s %**	**$^{207}Pb/^{235}U$**	**±s %**	**$^{206}Pb/^{238}U$**	**±s %**	**r[1)]**	**Disc. %[2)]**	**[U] ppm**	**[Th] ppm**	**[Pb] ppm**	**Th/U meas**	**$^{206}Pb/^{204}Pb$ measured**	**f_{206} %[3)]**
n3383-15b	CL-dark homog. outer domain	2781	3	2768	14	2749	33	0.1945	0.2	14.266	1.5	0.5319	1.5	0.99		541	49	346	0.09	1.68E+04	0.1
n3383-16a	zoned	2832	6	2804	15	2764	34	0.2007	0.4	14.818	1.5	0.5354	1.5	0.97		161	85	112	0.53	2.07E+04	0.1
n3383-17a	zoned	2785	6	2760	15	2727	33	0.1950	0.4	14.159	1.5	0.5265	1.5	0.97		162	31	105	0.19	1.59E+04	0.1
n3383-18a	zoned core	2803	8	2780	15	2750	34	0.1972	0.5	14.459	1.6	0.5319	1.5	0.94		87.5	51	58.9	0.58	2.04E+04	0.1
n3383-18b	weakly zoned rim domain	2774	7	2711	15	2627	32	0.1938	0.4	13.444	1.6	0.5032	1.5	0.96	-3.2	147	54	89.7	0.37	3.38E+03	0.6
n3383-18c	CL-bright core domain	2786	14	2712	17	2614	33	0.1951	0.8	13.454	1.7	0.5001	1.5	0.87	-3.1	46.8	28	28.1	0.59	7.09E+03	0.3
n3383-19a	weakly zoned core	2834	9	2850	15	2874	35	0.2010	0.6	15.565	1.6	0.5617	1.5	0.94		83.1	43	62.2	0.52	3.06E+04	0.1
n3383-19b	fairly homog. rim domain	2787	4	2754	14	2710	33	0.1953	0.2	14.071	1.5	0.5225	1.5	0.99	-0.4	473	41	299	0.09	1.53E+04	0.1
n3383-20a	fairly homog. center domain	2838	9	2838	11	2838	22	0.2014	0.5	15.359	1.1	0.5530	1.0	0.88		62	32	46	0.51	1.73E+04	0.1
n3383-21a	composite zoned center domain (+thin rim)	2842	5	2853	9	2869	22	0.2020	0.3	15.610	1.0	0.5605	0.9	0.95		198	33	138	0.17	4.40E+04	0.0
n3383-22a	zoned center domain	2830	5	2840	10	2855	22	0.2005	0.3	15.400	1.0	0.5571	0.9	0.94		159	139	126	0.87	4.19E+04	0.0
A1962 granodiorite, Kuhmo, Kianta terrain																					
n3384-01a	zoned	2923	4	2920	13	2915	31	0.2123	0.3	16.736	1.3	0.5718	1.3	0.98		136	25	99	0.18	5.52E+04	0.0
n3384-02a	CL-dark quite homog. center domain	2989	5	2980	13	2967	31	0.2211	0.3	17.822	1.3	0.5846	1.3	0.97		358	146	279	0.41	5.38E+04	0.0
n3384-03a	core	2988	6	2973	13	2951	31	0.2210	0.4	17.684	1.4	0.5805	1.3	0.96		144	71	113	0.49	1.09E+04	0.2
n3384-03b	Cl-dark rim	2708	19	2653	16	2582	28	0.1861	1.1	12.639	1.7	0.4926	1.3	0.75	-0.5	228	13	135	0.06	8.42E+02	2.2
n3384-04a	zoned core (+thin CL-paler rim)	2987	2	2972	13	2951	31	0.2208	0.1	17.677	1.3	0.5805	1.3	0.99		566	425	464	0.75	5.37E+03	0.4
n3384-05a	zoned core (+thin CL-dark rim)	2900	7	2857	13	2797	30	0.2093	0.4	15.675	1.4	0.5433	1.3	0.95	-1.3	99	91	78	0.92	1.65E+04	0.1
n3384-06a	zoned center domain	2988	4	2965	13	2931	31	0.2210	0.3	17.540	1.3	0.5756	1.3	0.98		183	156	152	0.85	2.25E+04	0.1
n3384-07a	CL-dark homog. core	2994	5	2961	13	2913	31	0.2218	0.3	17.466	1.3	0.5712	1.3	0.97	-0.5	1098	769	882	0.70	1.46E+05	0.0
n3384-07b	weakly zoned rim	2686	4	2656	13	2616	28	0.1837	0.3	12.672	1.3	0.5004	1.3	0.98	-0.5	523	56	316	0.11	1.07E+03	1.8
n3384-08a	CL-pale zoned core (+thin CL-dark rim)	2978	9	2943	16	2892	35	0.2197	0.6	17.152	1.6	0.5663	1.5	0.93		43	33	35	0.76	3.90E+03	0.5
n3384-09a	zoned	2931	6	2881	15	2809	34	0.2133	0.4	16.063	1.5	0.5461	1.5	0.97	-1.9	163	106	124	0.65	3.39E+03	0.6
n3384-10a	CL-dark hazily zoned	3003	1	3015	14	3033	36	0.2230	0.1	18.474	1.5	0.6007	1.5	1.00		1578	974	1320	0.62	2.49E+05	0.0
n3384-10b	zoned rim	2971	10	2956	16	2936	36	0.2186	0.6	17.387	1.6	0.5768	1.5	0.93		51	22	39	0.43	3.35E+04	0.1
n3384-11a	zoned	2977	9	2955	15	2923	35	0.2195	0.5	17.363	1.6	0.5736	1.5	0.94		70	54	57	0.78	4.18E+03	0.5
n3384-12a	homog. CL-dark/BSE-pale domain	2966	4	2968	15	2971	36	0.2180	0.2	17.601	1.5	0.5854	1.5	0.99		487	233	385	0.48	8.77E+04	0.0
n3384-13a	CL-bright core	2995	7	2987	15	2976	36	0.2219	0.4	17.952	1.6	0.5867	1.5	0.96		74	20	56	0.26	3.87E+04	0.1
n3384-13b	CL-darker rim	2686	5	2679	14	2670	33	0.1836	0.3	12.992	1.5	0.5131	1.5	0.98		163	4	100	0.02	4.39E+04	0.0
n3384-14a	weakly sector zoned center domain	2980	6	2932	15	2862	35	0.2198	0.4	16.944	1.5	0.5590	1.5	0.97	-1.7	90	53	69	0.59	1.52E+04	0.1

Table 2. Continued.

		Derived ages						*Corrected ratios*								*Elemental data*						
Sample/ spot #	**Dated zircon domain**	**$^{207}Pb/^{206}Pb$**	**±s**	**$^{207}Pb/^{235}U$**	**±s**	**$^{206}Pb/^{238}U$**	**±s**	**$^{207}Pb/^{206}Pb$**	**±s %**	**$^{207}Pb/^{235}U$**	**±s %**	**$^{206}Pb/^{238}U$**	**±s %**	**r[1)]**	**Disc. %[2)]**	**[U] ppm**	**[Th] ppm**	**[Pb] ppm**	**Th/U meas**	**$^{206}Pb/^{204}Pb$ measured**	**f_{206} %[3)]**
n3384-15a	CL-dark/BSE-pale core	2961	3	2951	15	2937	35	0.2174	0.2	17.294	1.5	0.5770	1.5	0.99		446	245	353	0.55	1.39E+04	0.1
n3384-16a	CL-pale zoned core (+thin CL-dark rim)	2976	6	2968	15	2956	36	0.2194	0.4	17.598	1.6	0.5819	1.5	0.97		87	80	74	0.91	9.26E+04	{0.02}
n3384-17a	zoned	2968	10	2959	16	2944	36	0.2183	0.6	17.425	1.6	0.5789	1.5	0.92		47	44	40	0.93	1.89E+03	1.0
n3384-18a	zoned	2965	8	2918	15	2850	35	0.2178	0.5	16.700	1.6	0.5560	1.5	0.95	-1.3	71	30	53	0.42	7.10E+03	0.3
n3384-19a	zoned	2991	6	2978	15	2958	36	0.2214	0.4	17.778	1.5	0.5824	1.5	0.97		196	103	155	0.52	2.18E+04	0.1
n3384-20a	fairly homog. CL-dark center domain	2990	4	2971	15	2942	35	0.2213	0.3	17.647	1.5	0.5783	1.5	0.98		219	195	183	0.89	2.73E+04	0.1
n3384-21a	zoned core (+thin CL-dark rim)	2973	7	2971	10	2968	23	0.2190	0.5	17.653	1.1	0.5847	1.0	0.90		71	30	55	0.43	7.82E+03	0.2
n3384-22a	core (+thin CL-dark rim)	2978	12	2967	12	2949	23	0.2197	0.8	17.572	1.3	0.5801	1.0	0.79		28	22	23	0.78	4.58E+03	0.4
A1963 granodiorite, Ilomantsi terrain																					
n3385-01a	oscillatory zoned	2729	6	2721	13	2710	29	0.1885	0.3	13.581	1.4	0.5225	1.3	0.97		102	65	73	0.64	5.95E+04	0.0
n3385-02a	oscillatory zoned	2724	6	2707	13	2683	29	0.1879	0.3	13.375	1.4	0.5161	1.3	0.97		105	67	74	0.63	7.44E+04	0.0
n3385-03a	oscillatory zoned	2719	6	2726	13	2735	30	0.1874	0.4	13.656	1.4	0.5285	1.3	0.96		84	60	62	0.71	7.48E+04	0.0
n3385-04a	oscillatory zoned	2739	6	2748	13	2760	30	0.1897	0.4	13.972	1.4	0.5343	1.3	0.96		94	62	69	0.65	6.08E+04	0.0
n3385-05a	oscillatory zoned	2740	6	2690	13	2625	29	0.1897	0.4	13.149	1.4	0.5027	1.3	0.96	-2.1	111	73	76	0.65	2.87E+04	0.1
n3385-07a	oscillatory zoned	2733	5	2719	15	2702	33	0.1889	0.3	13.560	1.5	0.5206	1.5	0.98		143	94	102	0.66	1.20E+05	0.0
n3385-08a	oscillatory zoned	2732	10	2722	15	2710	33	0.1888	0.6	13.603	1.6	0.5225	1.5	0.93		55	36	39	0.64	2.48E+04	0.1
n3385-09a	oscillatory zoned	2725	5	2739	14	2756	34	0.1881	0.3	13.836	1.5	0.5335	1.5	0.98		250	137	179	0.55	1.29E+05	0.0
n3385-09b	oscillatory zoned	2734	3	2775	14	2831	34	0.1891	0.2	14.373	1.5	0.5513	1.5	0.99	1.2	642	409	486	0.64	4.03E+03	0.5
n3385-10a	oscillatory zoned	2727	7	2734	15	2744	33	0.1883	0.4	13.774	1.6	0.5306	1.5	0.96		151	100	110	0.66	1.89E+04	0.1
n3385-11a	oscillatory zoned	2727	6	2713	15	2695	33	0.1883	0.4	13.474	1.5	0.5190	1.5	0.97		92	44	63	0.48	2.75E+04	0.1
n3385-12a	oscillatory zoned	2726	4	2719	14	2708	33	0.1882	0.3	13.546	1.5	0.5221	1.5	0.99		205	169	152	0.82	1.23E+05	0.0
n3385-13a	oscillatory zoned	2732	5	2721	15	2706	34	0.1888	0.3	13.580	1.6	0.5217	1.5	0.98		132	129	101	0.97	9.16E+04	0.0
n3385-14a	oscillatory zoned	2728	4	2720	14	2711	33	0.1883	0.3	13.572	1.5	0.5227	1.5	0.98		204	155	149	0.76	1.47E+05	0.0
A1964 granite, Ilomantsi terrain																					
n3386-01a	weakly zoned rim domain (+altered core)	2676	6	2607	13	2520	28	0.1825	0.4	12.039	1.4	0.4783	1.3	0.97	-4.2	125	73	80	0.59	4.34E+03	0.4
n3386-02a	hazily zoned	2791	6	2766	13	2732	29	0.1958	0.4	14.248	1.4	0.5279	1.3	0.96		225	86	154	0.38	5.10E+03	0.4
n3386-03a	CL-dark center domain	2663	6	2617	13	2559	28	0.1811	0.3	12.168	1.4	0.4873	1.3	0.97	-1.8	251	74	150	0.29	9.99E+02	1.9
n3386-03b	CL-paler, weakly zoned rim	2674	6	2563	13	2426	27	0.1823	0.4	11.480	1.4	0.4568	1.3	0.96	-8.3	139	116	84	0.83	2.20E+03	0.9
n3386-04a	core	2828	7	2788	15	2732	33	0.2003	0.5	14.571	1.6	0.5277	1.5	0.96	-0.8	63	24	43	0.38	6.90E+03	0.3
n3386-04b	fairly homog. rim	2684	8	2555	15	2395	30	0.1834	0.5	11.379	1.6	0.4499	1.5	0.95	-9.7	112	69	68	0.62	1.12E+03	1.7
~~*n3386-05a*~~	~~*zoned core*~~	~~*2682*~~	~~*49*~~	~~*1951*~~	~~*30*~~	~~*1339*~~	~~*18*~~	~~*0.1831*~~	~~*3.0*~~	~~*5.829*~~	~~*3.4*~~	~~*0.2308*~~	~~*1.5*~~	~~*0.45*~~	~~*-42.9*~~	~~*342*~~	~~*168*~~	~~*104*~~	~~*0.49*~~	~~*1.07E+02*~~	~~*17.5*~~
~~*n3386-05b*~~	~~*weakly zoned rim*~~	~~*2689*~~	~~*17*~~	~~*2647*~~	~~*17*~~	~~*2593*~~	~~*32*~~	~~*0.1839*~~	~~*1.0*~~	~~*12.560*~~	~~*1.8*~~	~~*0.4953*~~	~~*1.5*~~	~~*0.83*~~		~~*144*~~	~~*68*~~	~~*93*~~	~~*0.47*~~	~~*3.97E+02*~~	~~*4.7*~~

Table 2. Continued.

		Derived ages						*Corrected ratios*								*Elemental data*					
Sample/ spot #	**Dated zircon domain**	**$^{207}Pb/^{206}Pb$**	**±s**	**$^{207}Pb/^{235}U$**	**±s**	**$^{206}Pb/^{238}U$**	**±s**	**$^{207}Pb/^{206}Pb$**	**±s %**	**$^{207}Pb/^{235}U$**	**±s %**	**$^{206}Pb/^{238}U$**	**±s %**	**r[1)]**	**Disc. %[2)]**	**[U] ppm**	**[Th] ppm**	**[Pb] ppm**	**Th/U meas**	**$^{206}Pb/^{204}Pb$ measured**	**f_{206} %[3)]**
n3386-06a	zoned center domain (+rim)	2741	4	2695	14	2634	33	0.1899	0.3	13.214	1.5	0.5047	1.5	0.98	-1.7	209	76	136	0.37	6.17E+03	0.3
~~*n3386-07a*~~	~~*CL-pale, quite homog. core*~~	~~*2666*~~	~~*12*~~	~~*2550*~~	~~*16*~~	~~*2406*~~	~~*30*~~	~~*0.1814*~~	~~*0.7*~~	~~*11.319*~~	~~*1.7*~~	~~*0.4525*~~	~~*1.5*~~	~~*0.90*~~	~~*-7.7*~~	~~*83*~~	~~*22*~~	~~*45*~~	~~*0.26*~~	~~*6.97E+02*~~	~~*2.7*~~
n3386-08a	fairly homogeneous rim domain	2687	5	2675	15	2659	33	0.1837	0.3	12.932	1.5	0.5105	1.5	0.98		143	77	98	0.54	4.75E+04	0.0
~~*n3386-09a*~~	~~*weakly zoned rim*~~	~~*2665*~~	~~*11*~~	~~*2306*~~	~~*16*~~	~~*1923*~~	~~*26*~~	~~*0.1813*~~	~~*0.7*~~	~~*8.692*~~	~~*1.7*~~	~~*0.3477*~~	~~*1.6*~~	~~*0.92*~~	~~*-28.7*~~	~~*215*~~	~~*553*~~	~~*97*~~	~~*2.57*~~	~~*4.65E+02*~~	~~*4.0*~~
n3386-10a	zoned core (+thin rim)	2752	4	2673	14	2570	32	0.1912	0.2	12.913	1.5	0.4898	1.5	0.99	-5.1	373	127	235	0.34	1.03E+03	1.8
n3386-11a	hazily zoned center domain (+two thin rims)	2798	5	2754	15	2695	33	0.1965	0.3	14.062	1.5	0.5190	1.5	0.98	-1.4	193	135	138	0.70	6.11E+03	0.3
n3386-12a	fairly homog. rim domain	2672	6	2654	15	2630	32	0.1821	0.4	12.650	1.5	0.5038	1.5	0.97		131	75	88	0.58	5.68E+03	0.3
~~*n3386-13a*~~	~~*core*~~	~~*2812*~~	~~*11*~~	~~*2708*~~	~~*16*~~	~~*2570*~~	~~*32*~~	~~*0.1983*~~	~~*0.7*~~	~~*13.393*~~	~~*1.6*~~	~~*0.4898*~~	~~*1.5*~~	~~*0.91*~~	~~*-6.7*~~	~~*93*~~	~~*125*~~	~~*60*~~	~~*1.34*~~	~~*7.83E+02*~~	~~*2.4*~~
n3386-13b	homog. rim	2668	8	2568	15	2444	30	0.1817	0.5	11.546	1.6	0.4609	1.5	0.95	-6.9	152	410	94	2.70	1.13E+03	1.7
n3386-14a	CL-paler center domain (+thin rim)	2805	6	2752	15	2680	33	0.1975	0.4	14.035	1.5	0.5155	1.5	0.97	-2.2	116	45	77	0.39	3.00E+04	0.1
n3386-15a	zoned center domain (+thin rim)	2728	6	2725	15	2720	33	0.1884	0.3	13.635	1.5	0.5248	1.5	0.97		158	50	105	0.32	2.66E+04	0.1
n3386-16a	zoned center domain (+rim)	2738	8	2652	15	2540	32	0.1895	0.5	12.617	1.6	0.4829	1.5	0.96	-5.4	220	96	137	0.44	9.24E+02	2.0
n3386-16b	homog. rim	2691	6	2660	15	2620	32	0.1842	0.4	12.736	1.5	0.5014	1.5	0.97		142	87	95	0.62	1.07E+04	0.2
n3386-17a	hazily zoned center domain (+rim)	2713	5	2684	14	2646	33	0.1866	0.3	13.059	1.5	0.5075	1.5	0.98		384	157	251	0.41	5.73E+03	0.3
n3386-17b	homogeneous rim	2705	7	2695	15	2681	33	0.1858	0.4	13.207	1.6	0.5156	1.5	0.96		132	69	90	0.53	2.79E+03	0.7
~~*n3386-18a*~~	~~*CL-dark, weakly zoned center domain*~~	~~*2669*~~	~~*8*~~	~~*2109*~~	~~*9*~~	~~*1584*~~	~~*13*~~	~~*0.1818*~~	~~*0.5*~~	~~*6.980*~~	~~*1.1*~~	~~*0.2785*~~	~~*0.9*~~	~~*0.89*~~	~~*-43.5*~~	~~*413*~~	~~*158*~~	~~*146*~~	~~*0.38*~~	~~*3.85E+02*~~	~~*4.9*~~
~~*n3386-18b*~~	~~*CL-pale fairly homog. Rim*~~	~~*2652*~~	~~*23*~~	~~*2526*~~	~~*16*~~	~~*2371*~~	~~*19*~~	~~*0.1799*~~	~~*1.4*~~	~~*11.031*~~	~~*1.7*~~	~~*0.4446*~~	~~*0.9*~~	~~*0.56*~~	~~*-7.0*~~	~~*138*~~	~~*70*~~	~~*78*~~	~~*0.51*~~	~~*1.36E+02*~~	~~*13.8*~~
n3386-19a	CL-pale, zoned (+thin rim)	2822	8	2824	10	2826	22	0.1995	0.5	15.131	1.1	0.5502	1.0	0.88		73	42	55	0.58	1.30E+04	0.1
n3386-20a	fairly homogeneous core (+thin rim)	2837	6	2838	10	2840	22	0.2013	0.4	15.365	1.0	0.5535	0.9	0.94		130	62	95	0.48	1.81E+04	0.1
~~*n3386-21a*~~	~~*CL-pale zoned core*~~	~~*2709*~~	~~*9*~~	~~*2551*~~	~~*10*~~	~~*2357*~~	~~*19*~~	~~*0.1862*~~	~~*0.6*~~	~~*11.331*~~	~~*1.1*~~	~~*0.4414*~~	~~*1.0*~~	~~*0.86*~~	~~*-12.7*~~	~~*124*~~	~~*68*~~	~~*71*~~	~~*0.55*~~	~~*7.77E+02*~~	~~*2.4*~~
~~*n3386-21b*~~	~~*more homogeneous rim*~~	~~*2659*~~	~~*20*~~	~~*2578*~~	~~*15*~~	~~*2476*~~	~~*19*~~	~~*0.1807*~~	~~*1.2*~~	~~*11.667*~~	~~*1.5*~~	~~*0.4682*~~	~~*0.9*~~	~~*0.61*~~	~~*-3.2*~~	~~*104*~~	~~*49*~~	~~*63*~~	~~*0.47*~~	~~*2.15E+02*~~	~~*8.7*~~
n3386-22a	hazily zoned center domain (+thin rim)	2827	7	2801	10	2765	21	0.2001	0.4	14.777	1.0	0.5356	0.9	0.91	-0.2	158	103	116	0.65	6.43E+03	0.3
A1965 tonalite, Pudasjärvi block, Ranua terrain																					
n3387-01a	zoned	2817	6	2814	13	2810	30	0.1989	0.4	14.983	1.4	0.5464	1.3	0.96		109	32	77	0.30	4.34E+04	0.0
n3387-02a	CL-bright homogeneous core	2698	14	2694	16	2690	31	0.1849	0.9	13.205	1.6	0.5179	1.4	0.85		23	11	16	0.46	6.96E+04	{0.03}
n3387-02b	zoned, CL-darker rim	2712	5	2689	13	2658	29	0.1865	0.3	13.128	1.4	0.5104	1.3	0.98		170	14	105	0.08	3.01E+04	0.1

Table 2. Continued.

		Derived ages						*Corrected ratios*							*Elemental data*						
Sample/ spot #	**Dated zircon domain**	**$^{207}Pb/^{206}Pb$**	**±s**	**$^{207}Pb/^{235}U$**	**±s**	**$^{206}Pb/^{238}U$**	**±s**	**$^{207}Pb/^{206}Pb$**	**±s %**	**$^{207}Pb/^{235}U$**	**±s %**	**$^{206}Pb/^{238}U$**	**±s %**	**r[1)]**	**Disc. %[2)]**	**[U] ppm**	**[Th] ppm**	**[Pb] ppm**	**Th/U meas**	**$^{206}Pb/^{204}Pb$ measured**	**f_{206} %[3)]**
n3387-03a	zoned long zr	2679	5	2666	13	2649	29	0.1828	0.3	12.812	1.4	0.5083	1.3	0.97		140	113	100	0.81	1.10E+04	0.2
n3387-04a	CL-pale, zoned center domain (+thin rim)	2709	9	2651	15	2576	32	0.1863	0.5	12.614	1.6	0.4912	1.5	0.94	-2.5	65	8	39	0.12	2.77E+04	0.1
n3387-05a	zoned	2776	5	2746	15	2706	33	0.1939	0.3	13.945	1.5	0.5215	1.5	0.98		192	102	135	0.53	6.90E+04	0.0
n3387-06a	zoned, CL-paler twin grain	2691	6	2659	15	2618	32	0.1842	0.4	12.720	1.5	0.5009	1.5	0.97	-0.1	139	12	84	0.09	7.25E+03	0.3
n3387-06b	CL-dark, homogeneous domain of the other twin grain	2640	3	2607	14	2564	32	0.1786	0.2	12.028	1.5	0.4885	1.5	0.99	-0.5	613	55	360	0.09	2.93E+04	0.1
n3387-07a	zoned long zr	2708	6	2694	15	2675	33	0.1861	0.4	13.198	1.5	0.5144	1.5	0.97		90	61	63	0.68	5.99E+04	0.0
n3387-08a	zoned long zr	2713	6	2711	15	2708	33	0.1866	0.3	13.434	1.5	0.5221	1.5	0.98		117	14	74	0.12	5.10E+04	0.0
n3387-09a	zoned center domain	2703	7	2675	15	2638	32	0.1855	0.4	12.938	1.6	0.5058	1.5	0.96		130	64	86	0.50	1.96E+04	0.1
n3387-09b	CL-darker, fairly homog. domain	2705	6	2700	15	2693	33	0.1858	0.4	13.283	1.5	0.5186	1.5	0.97		178	30	114	0.17	7.00E+04	0.0
n3387-10a	CL-bright core	2660	15	2620	17	2569	32	0.1808	0.9	12.202	1.8	0.4896	1.5	0.85		32	19	21	0.59	3.54E+03	0.5
n3387-10b	weakly zoned rim	2688	6	2695	15	2704	33	0.1838	0.3	13.210	1.5	0.5212	1.5	0.97		127	17	80	0.13	4.57E+03	0.4
n3387-11a	zoned	2685	6	2678	15	2668	33	0.1836	0.4	12.975	1.5	0.5127	1.5	0.97		156	107	110	0.69	3.25E+03	0.6
n3387-12a	CL-dark homog. outer domain (+ metamict core)	2665	5	2675	14	2688	33	0.1813	0.3	12.936	1.5	0.5174	1.5	0.98		352	247	250	0.70	2.63E+03	0.7
n3387-13a	CL-paler/BSE-darker core (+thin rim)	2779	8	2757	15	2726	33	0.1943	0.5	14.101	1.6	0.5263	1.5	0.95		84	60	61	0.71	2.05E+03	0.9
n3387-14a	zoned CL-pale	2877	8	2872	15	2865	35	0.2064	0.5	15.921	1.6	0.5595	1.5	0.95		72	30	53	0.41	5.17E+04	0.0
n3387-15a	zoned core	2850	5	2852	15	2855	35	0.2030	0.3	15.598	1.5	0.5573	1.5	0.98		132	76	100	0.58	2.27E+05	{0.01}
n3387-15b	CL-darker, weakly zoned rim	2732	5	2730	15	2729	33	0.1888	0.3	13.718	1.5	0.5269	1.5	0.98		182	40	120	0.22	1.32E+04	0.1
n3387-16a	weakly zoned long zr	2675	6	2663	15	2646	34	0.1824	0.4	12.769	1.6	0.5076	1.6	0.97		125	18	77	0.14	8.63E+03	0.2
n3387-17a	weakly zoned long zr	2697	8	2679	15	2655	33	0.1849	0.5	12.993	1.6	0.5096	1.5	0.95		72	11	45	0.15	3.90E+04	0.1
n3387-18a	weakly zoned long zr	2720	8	2714	15	2706	33	0.1875	0.5	13.484	1.6	0.5216	1.5	0.95		70	46	49	0.66	2.63E+04	0.1
n3387-19a	zoned (+thin rim?)	2698	5	2702	15	2706	33	0.1850	0.3	13.307	1.5	0.5217	1.5	0.98		258	322	205	1.25	5.75E+04	0.0
n3387-20a	zoned (+altered core)	2711	5	2695	9	2675	21	0.1864	0.3	13.219	1.0	0.5144	0.9	0.95		167	12	103	0.07	6.86E+04	0.0
n3387-21a	CL-bright core	2665	18	2583	18	2480	31	0.1813	1.1	11.729	1.9	0.4691	1.5	0.80	-3.2	16	10	10	0.63	3.35E+03	0.6
n3387-21b	weakly zoned CL-darker rim	2699	5	2770	10	2868	22	0.1850	0.3	14.298	1.0	0.5604	0.9	0.95	5.4	195	10	131	0.05	4.66E+03	0.4
n3387-22a	weakly zoned long zr	2710	7	2693	10	2670	21	0.1863	0.4	13.180	1.0	0.5131	0.9	0.91		107	9	67	0.09	1.06E+04	0.2
n3387-23a	zoned CL-pale core (+thin rim)	2861	8	2825	10	2775	22	0.2043	0.5	15.152	1.1	0.5379	1.0	0.90	-1.1	71	22	49	0.31	3.46E+04	0.1
n3387-24a	weakly zoned long zr	2713	6	2729	9	2751	21	0.1866	0.3	13.696	1.0	0.5322	0.9	0.94		235	123	163	0.52	1.55E+03	1.2
n3387-25a	Cl-pale core (+thin rim)	2838	8	2850	10	2867	22	0.2014	0.5	15.555	1.1	0.5601	1.0	0.90		66	42	50	0.64	3.15E+04	0.1

Table 2. Continued.

		Derived ages						*Corrected ratios*							*Elemental data*						
Sample/ spot #	**Dated zircon domain**	**$^{207}Pb/^{206}Pb$**	**±s**	**$^{207}Pb/^{235}U$**	**±s**	**$^{206}Pb/^{238}U$**	**±s**	**$^{207}Pb/^{206}Pb$**	**±s %**	**$^{207}Pb/^{235}U$**	**±s %**	**$^{206}Pb/^{238}U$**	**±s %**	**r[1)]**	**Disc. %[2)]**	**[U] ppm**	**[Th] ppm**	**[Pb] ppm**	**Th/U meas**	**$^{206}Pb/^{204}Pb$ measured**	**f_{206} %[3)]**
A1966 granodiorite, Pudasjärvi block, Ranua terrain																					
n3388-01a	oscillatory zoned	2724	6	2731	13	2741	30	0.1879	0.4	13.724	1.4	0.5298	1.3	0.97		110	57	77	0.52	1.27E+05	0.0
n3388-02a	oscillatory zoned	2719	7	2741	13	2770	30	0.1874	0.4	13.867	1.4	0.5368	1.3	0.96		102	30	69	0.30	1.20E+05	0.0
n3388-03a	oscillatory zoned	2715	6	2723	13	2733	30	0.1868	0.3	13.604	1.4	0.5280	1.3	0.97		141	118	105	0.84	5.56E+03	0.3
n3388-04a	oscillatory zoned	2716	7	2726	14	2740	30	0.1870	0.4	13.655	1.4	0.5296	1.4	0.96		84	48	60	0.56	1.37E+05	{0.01}
n3388-05a	oscillatory zoned	2727	9	2696	14	2654	30	0.1883	0.6	13.227	1.5	0.5095	1.4	0.92		44	44	33	0.98	1.73E+04	0.1
n3388-06a	oscillatory zoned	2727	9	2700	16	2664	33	0.1883	0.6	13.286	1.6	0.5118	1.5	0.94		45	40	33	0.89	2.57E+04	0.1
n3388-07a	oscillatory zoned	2731	5	2729	13	2726	30	0.1887	0.3	13.693	1.4	0.5262	1.3	0.97		135	92	97	0.68	3.91E+04	0.1
n3388-08a	oscillatory zoned	2727	5	2722	13	2716	29	0.1882	0.3	13.599	1.3	0.5240	1.3	0.98		198	106	138	0.53	8.10E+04	0.0
n3388-09a	oscillatory zoned	2712	7	2707	14	2700	31	0.1866	0.4	13.379	1.5	0.5201	1.4	0.96		86	47	60	0.54	1.04E+05	0.0

All the errors are in 1 sigma level. Data in italics and struck out are rejected mainly because of the high common lead contents. 1) Error correlation in conventional concordia space. 2) Age discordance at closest approach of error ellipse to concordia (2s level). 3) Percentage of common ^{206}Pb in measured ^{206}Pb, calculated from the ^{204}Pb signal assuming a present-day Stacey & Kramers (1975) model terrestrial Pb-isotope composition. Figures in parentheses are given when no correction has been applied.

1.2.2 A1959 – 94003640 Archaean gneiss, Iisalmi complex

The Archaen gneiss from the Iisalmi complex yielded a small amount of zircon in > 3.6 g cm^{-3} density fraction. The population looks fairly homogeneous with transparent to translucent, pale coloured, long prismatic zircon with varying grain-size. In addition, there are a few more equidimensional, usually larger grains and only some grains are turbid/metamict. The sample contains two phases of titanite; the dark brown and the paler, the latter one most probably being metamorphic.

In BSE and CL, the zircon population looks more heterogeneous. In general, the thin and long zoned zircon is mostly without cores and rims. The stubby ones show often CL-bright zoned cores and thin darker rims. Many zircon grains are badly fractured and altered and the others are fairly healthy/fresh.

A total of 29 zircon domains were dated using SIMS (Table 2 and Fig. 3). On the concordia diagram (Fig. 3A), most of the U-Pb data scatter between 2.70 Ga and 2.90 Ga. In the $^{207}Pb/^{206}Pb$ age histogram (Fig. 3B), there are two obvious frequency peaks at 2.74 Ga and 2.89 Ga and in the probability plot, the peaks are at ~2.67 Ga, ~2.74–2.75 Ga, ~2.82 Ga. ~2.85 Ga, and ~2.88–2.89 Ga. Unfortunately there is no correlation between the type of the analysed zircon domain and the age. However, one of the oldest cores (10a/2.90 Ga) is surrounded by a texturally zoned rim with an age of 2.73 Ga. Then, 2.74-2.75 Ga ages are the most common ones. Therefore it is supposed that the 2.74-2.75 Ga ages from the zoned zircon domains (grains, core, rims, tips) would give the best age estimate for the Iisalmi gneiss. Seven concordant data of the nine analyses determine an age of 2742 ± 7 Ma for the gneiss.

The three youngest ages comprise of a 2.67 Ga (24b) rim around a 2.81 Ga core and a 2.67 Ga (06a) CL-bright core with a 2.61 Ga (06b) texturally homogeneous rim. The low-U 2.67 Ga core is most probably recrystallized during the 2.67 Ga metamorphic event.

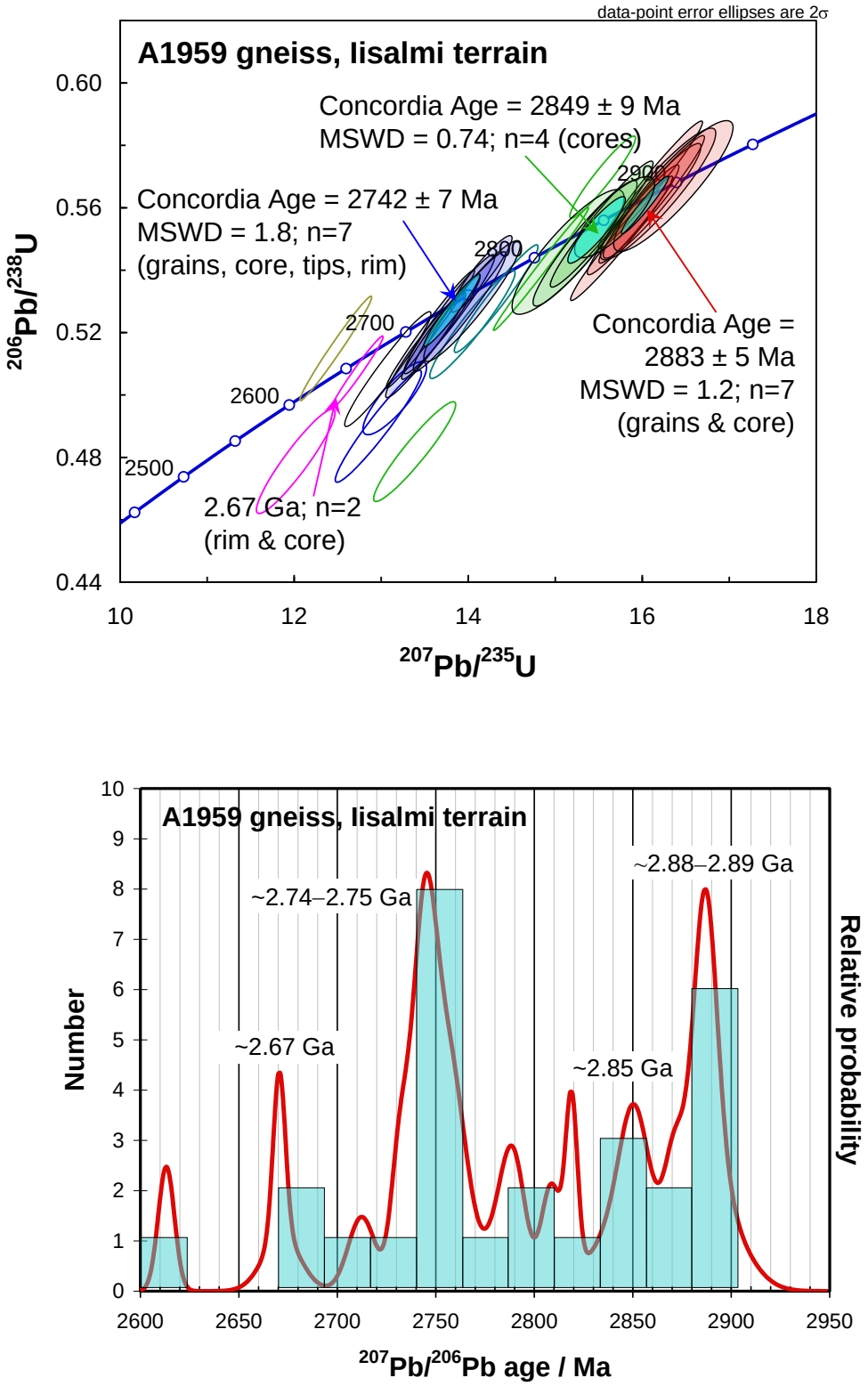


Fig. 3. SIMS U-Pb isotopic data, sample A1959 gneiss, Iisalmi terrain. A) Concordia plot. B) Probability plot with histograms. The most discordant data point n3382-05a is ignored.

1.2.3 A1960 – 94002667 tonalite, Kuhmo belt

The tonalite from Kuhmo area yielded abundant zircon in density fraction >4.0 g cm^{-3}. The population consisting of dark brown, euhedral prismatic and transparent to turbid zircon looks quite visually homogeneous. The grain-size varies from very fine to fairly coarse.

In BSE and CL images, the zircon shows zoning, homogenized/recrystallized cores (structurally homogeneous and pale in BSE) and cores with original zoning. Some zircon grains with alteration are seriously fractured and others are fairly healthy/fresh looking.

A total of 28 zircon domains were dated using SIMS (table 2 and Fig. 4). The U concentrations are mostly low but very high values were measured on texturally homogeneous and CL-dark cores. Both the old cores and younger rims show the lowest Th/U. The oldest ages of 2.94−2.95 Ga were measured on texturally homogeneous and CL-dark cores (homogenized, initial age even older?). On the concordia curve, most of the U-Pb data plot at 2.80−2.85 Ga. The 2836 ± 5 Ma age for the tonailite is determined by the mean $^{207}Pb/^{206}Pb$ ages of the zoned zircon grains. A few zircon rim domains yielded younger ages of ~2.78 Ga.

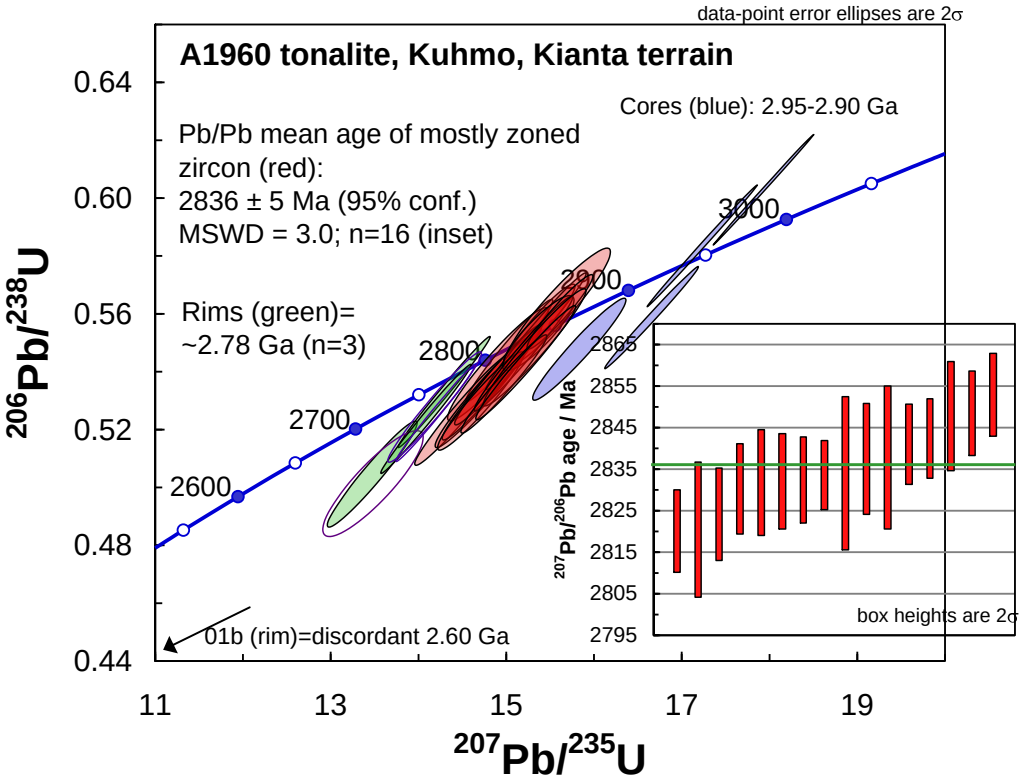


Fig. 4. Concordia plot showing SIMS U-Pb isotopic data, sample A1960 tonalite, Kuhmo, Kianta terrain.

1.2.4 A1962 – 95001782 granodiorite, Kuhmo belt

The granodiorite sample from the Kuhmo belt yielded a small amount of zircon in >4.0 g cm^{-3} density fraction. For the most part, it is long prismatic, brown, translucent to turbid, and the grain-size is varying.

In BSE and CL, the zircon population looks fairly homogeneous. It is generally fractured and has CL-darker inner domain with paler rim zone that can be further enveloped by a darker thin rim zone.

A total of 26 zircon domains were dated using SIMS (Table 2 and Fig. 5). The zircon U concentrations and Th/U are varying. The lowest Th/U ratios were measured from the young zircon rims with an approximate age of 2.69 Ga. On the concordia diagram, most of the U-Pb data plot at 2.95−3.0 Ga with a mean $^{207}Pb/^{206}Pb$ age of 2980 ± 6 Ma. As the three meaningfully younger data points at 2.90−2.93 Ga were measured from zoned zircon domains, they may originate from tiny felsic dykes or melting segregations. The oldest measured age was 3003 ± 2 Ma (Pb-Pb age).

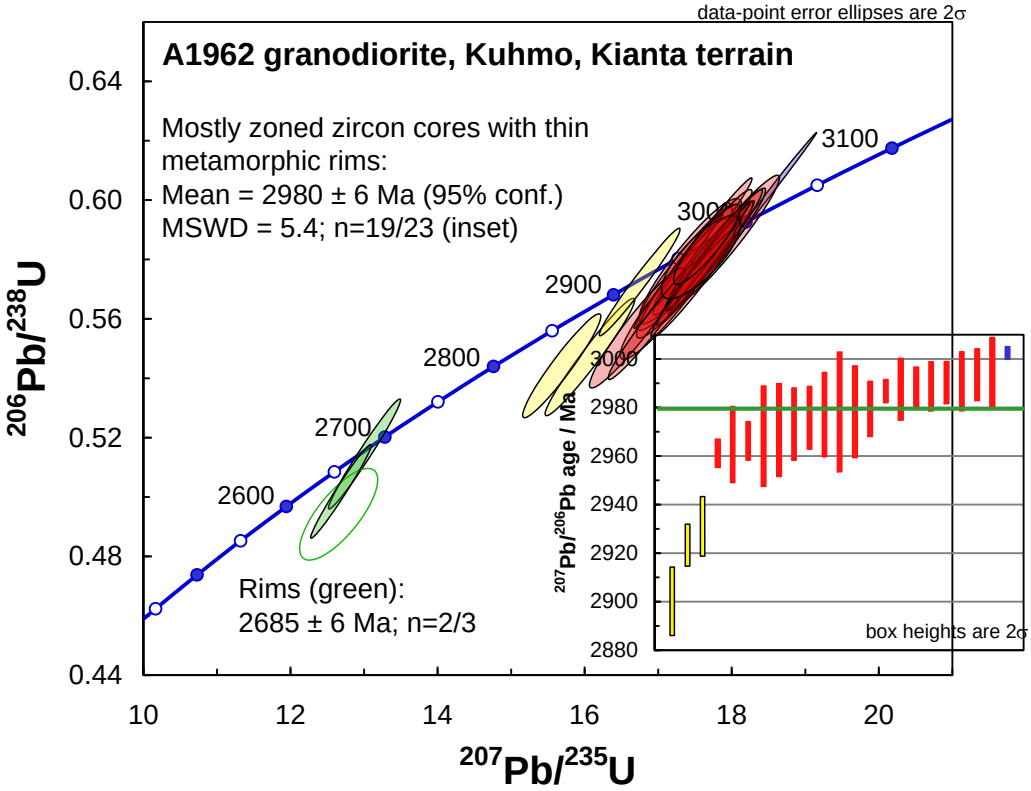


Fig. 5. Concordia plot showing SIMS U-Pb isotopic data, sample A1962 granodiorite, Kuhmo, Kianta terrain.

1.2.5 A1963 – 90010130 granodiorite, Ilomantsi belt

The granodiorite sample from the Ilomantsi area yielded a large amount of pale zircon with a rather homogeneous population. In density fraction >4.2 g $cm^{-3,}$ the zircon is fairly short=stubby, mainly fine to medium-grained and translucent. The finer grains are transparent. Fraction 3.6-4.2 g cm^{-3} contains a small amount of longer prismatic grains. Dark brown titanite is abundant.

In BSE and CL images, the zircon population looks fairly homogeneous. It principally consists of healthy/fresh, oscillatory zoned zircon. The generally CL-paler centre zones are followed by darker outer zones. Zircon has abundant inclusions (apatite?).

A total of 14 zircon domains were dated using SIMS (Table 2 and Fig. 6). The U concentrations and Th/U are generally 100−200 ppm and 0.6−0.7, respectively. All the measured U-Pb data plot in a tight cluster. 13 of the 14 analyses determine a concordia age of 2730 ± 3 Ma for the granodiorite.

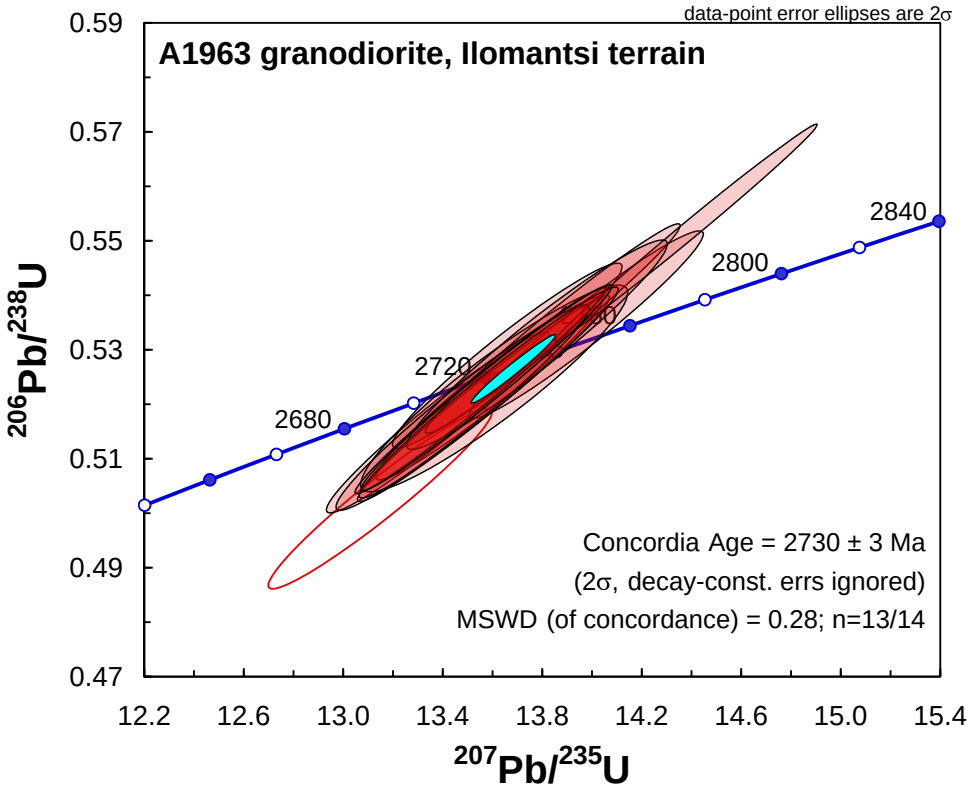


Fig. 6. Concordia plot showing SIMS U-Pb isotopic data, sample A1963 granodiorite, Ilomantsi terrain.

1.2.6 A1964 – 94002572 granite, Ilomantsi belt

The granite from the Ilomantsi area, contains abundant zircon in >4.2 g cm^{-3} density fraction. It is either prismatic (l:w ≥2.5) euhedral or subheral, brown or reddish (altered/metamict) to colourless, transparent to translucent, with varying grain-size. The titanite in sample is largely medium-brown but also pale grains were detected.

In BSE and CL, the zircon commonly has CL-dark zoned cores with zoning related alteration and structurally rather homogeneous rims. A few CL-bright cores were also detected. The grains are occasionally strongly fractured.

A total of 30 zircon domains were dated using SIMS (Table 2 and Fig. 7). Nine analyses were rejected due to high common lead proportion and/or high degree of discordance. The U-Pb data divide into four apparent age groups. The analyses on four older zircon cores/centre domains give an upper intercept age of 2832 ± 10 Ma. Three U-Pb data points are approximately coeval at ~2.78 Ga and five zoned centre domains/cores plot approximately on a same reference line intercepting the concordia curve at ~2.73 Ga. Later overprinting at 2692 ± 16 Ma is manifested by analyses on eight texturally fairly homogeneous rim domains.

Zoned cores/centre domains with thin rims are supposed to give the age for the A1964 granite. The upper intercept age of 2728 ± 12 Ma determined by four of the five analyses is considered the best age estimate for the granite.

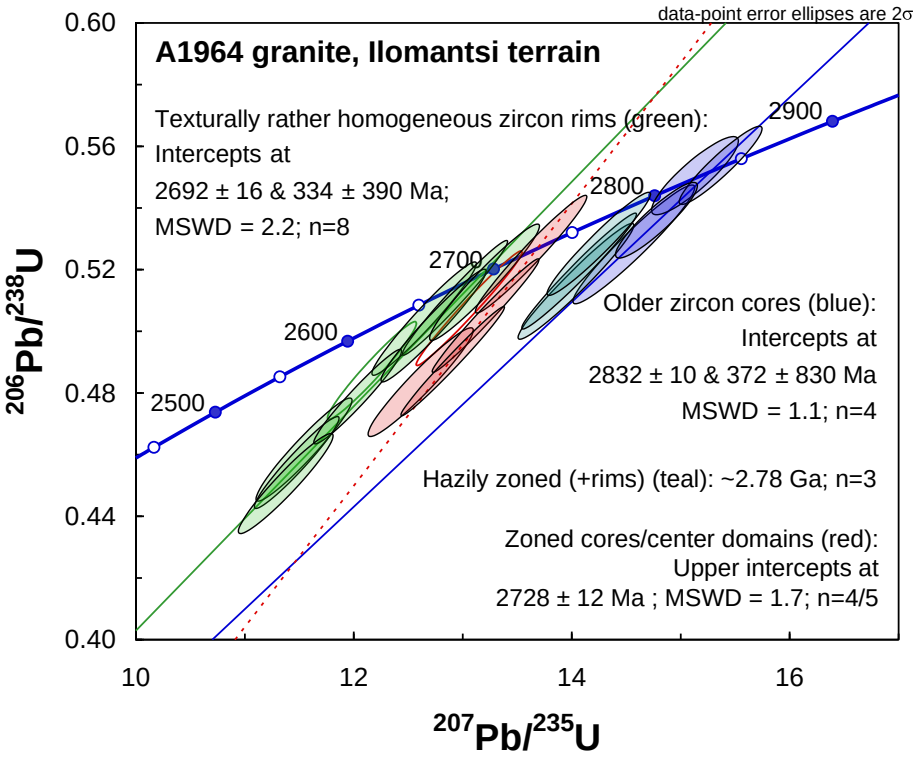


Fig. 7. Concordia plot showing SIMS U-Pb isotopic data, sample A1964 granite, Ilomantsi terrain.

1.2.7 A1965 – 94003693 gneissic tonalite, Pudasjärvi block

Tonalite form the Pudasjärvi block yielded a very small amount of zircon in >3.6 g cm^{-3} density fraction. The population consists mostly of fine-grained, long/thin prismatic, and transparent to translucent zircon. In addition, a few larger grains with apparent inherited origin were detected (subhedral elongated larger grains).

In BSE and CL images the thin zircon crystals show zoning. The more stubby grains show often zoned cores and thin rims.

A total of 31 zircon domains were dated using SIMS (Table 2 and Fig. 9). The U concentrations and Th/U vary, but mainly they are rather low to moderate. On the concordia diagram, the U-Pb data scatter between 2.65 Ga and 2.90 Ga. The supposedly inherited zircon grains and cores have ages of 2.82−2.88 Ga and 2.78 Ga. Two low-U CL-bright cores and two CL-dark texturally homogeneous zircon domains indicate overprinting at 2.64−2.67 Ga. Most of the zoned zircon domains/grains are ~2.70 Ga. The 2706 ± 4 Ma age for the tonalite is estimated using the mean of the $^{207}Pb/^{206}Pb$ ages. However, seeing that the Pb–Pb age trend is decreasing (Fig. 9 inset), it would be possible that the oldest ages of 2.73–2.71 Ga may better approach the real tonalite age.

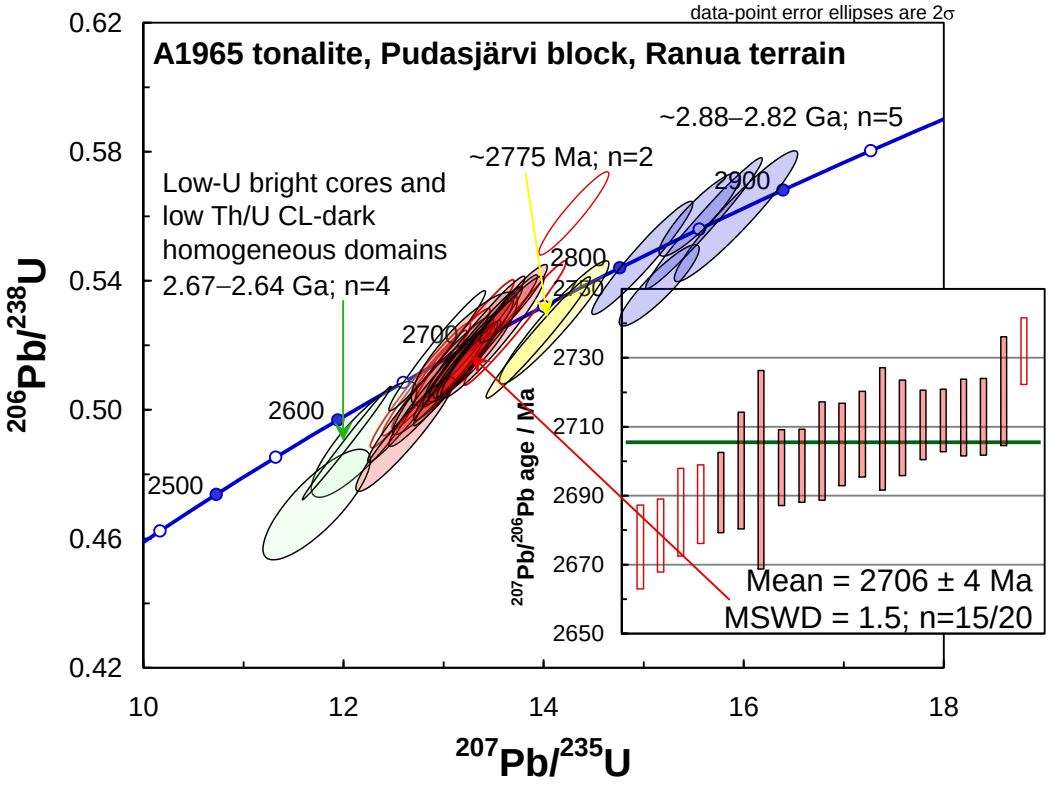


Fig. 9. Concordia plot showing SIMS U-Pb isotopic data, sample A1965 tonalite, Pudasjärvi block, Ranua terrain. Inset shows the mean of the $^{207}Pb/^{206}Pb$ ages of the ~2.70 Ga zoned zircon domains/grains.

A1966 – 93001908 granodiorite, Pudasjärvi block

The zircon in granodiorite from the Pudasjärvi block is mostly colourless and transparent, either short to long prismatic or subhedral oval shaped. The observed colour most probably is caused by the altered domains or pigmentation of the zircon grains. The grain-size varies but it is predominantly fine. In all, although the differences in zircon morphologies etc., the population looks fairly homogeneous. Dark brown titanite is abundant.

In BSE and CL images, the population shows extreme homogeneity consisting of healthy oscillatory zoned zircon. Only a few supposed cores were detected.

A total of 9 zircon domains were dated using SIMS (Table 2 and Fig. 10). The rather low-U zircon grains give univocal age result of 2722 ± 4 Ma for the granodiorite.

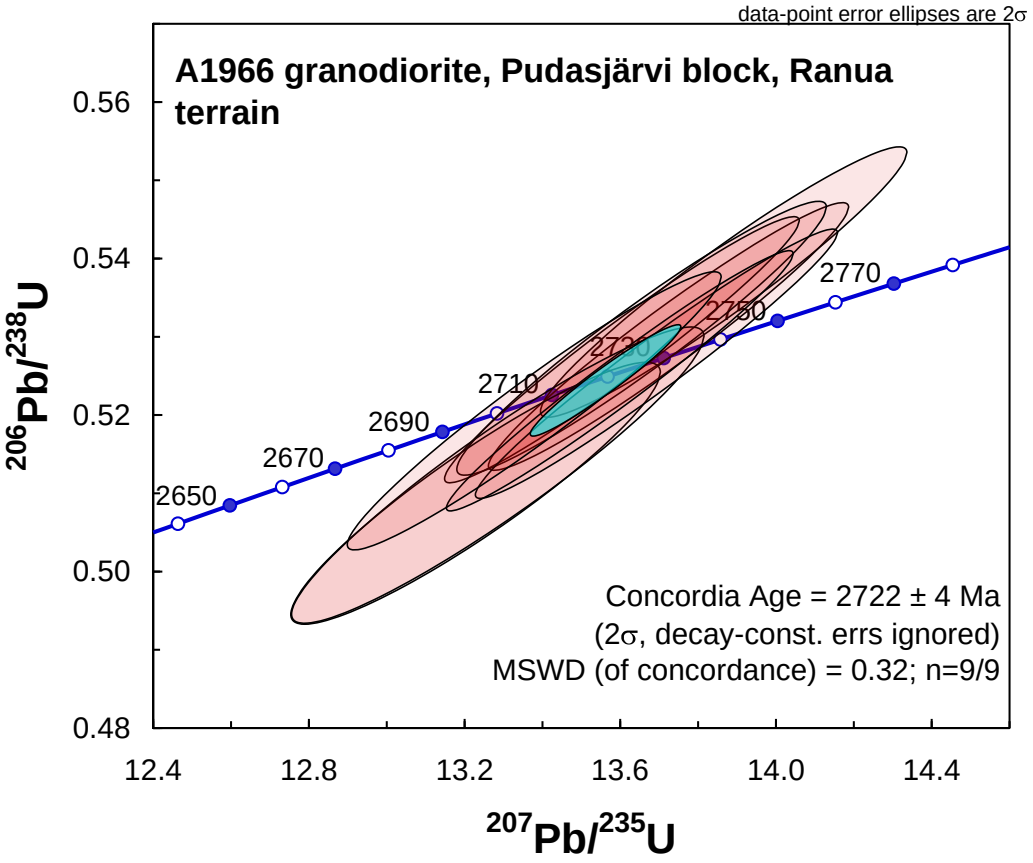


Fig. 10. Concordia plot showing SIMS U-Pb isotopic data, sample A1966 granodiorite, Pudasjärvi block, Ranua terrain.

3. SUMMARY

Table 2. Summary of the age results.

Sample	Rock type	Terrain	Age	Metamorphic/ recrystallized zircon domains/rims	Inherited zircon/core	Obs!	ε_{Nd}
A1958 – 93003031	tonalite	Iisalmi terrain	Concordia Age = 2696 ± 4 Ma MSWD (of concordance) = 3.4; n=7/15	2.65-2.62 Ga (texturally homogeneous zircon domains)			ε_{Nd} = +1.1
A1959 – 94003640	gneiss	Iisalmi terrain	Concordia Age = 2742 ± 7 Ma MSWD (of concordance) = 1.8; n=7 (grains, tips, core, rim)	2.67 Ga (n=2) 2.61 Ga (n=1)	2.85 Ga (n=4) 2.88–2.89 Ga (n=7)	Age data scatter at 2.90–2.70 Ga.	ε_{Nd} = +0.8
A1960 – 94002667	tonalite	Kianta terrain (Kuhmo)	Mostly zoned zircon: Pb-Pb mean = 2836 ± 5 Ma MSWD = 3.0; n=16	2.78 Ga (n=3)	2.95-2.90 Ga (n=4)		ε_{Nd} = –1.5 (~0; calc. at 2.8 Ga)
A1962 – 95001782	granodiorite	Kianta terrain (Kuhmo)	Mostly zoned zircon cores with thin metamorphic rims: Pb-Pb mean = 2980 ± 6 Ma MSWD = 5.4; n=19/23	2685 ± 6 Ma (n=2/3) (Younger zoned zircon domains; 2.90−2.93 Ga n=3)	3.0 Ga (n=1?)	Or, the rim age is the magmatic age?	ε_{Nd} = –4.6 (~0; calc. at 3.0 Ga)
A1963 – 90010130	Granodiorite	Ilomantsi terrain	Concordia Age = 2730 ± 3 Ma MSWD (of concordance) = 0.28; n=13/14				ε_{Nd} = –0.2
A1964 – 94002572	granite	Ilomantsi terrain	Upper intercept age 2728 ± 12 Ma MSWD=1.7; n=4/5 Zoned centre domains with thin rims	Intercepts at 2692 ± 16 & 334 ± 390 Ma; MSWD = 2.2; n=8	2.83 Ga (n=4) 2.78 Ga (n=3)	This is just an interpretation of the multiphase zircon age data	ε_{Nd} = –0.3
A1965 – 94003693	gneissic tonalite	Pudasjärvi block, Ranua terrain	2706 ± 4 Ma MSWD=1.5; n=15/20	2.67-2.64 Ga; n=4	2.88-2.82 Ga; n=5 2.78 Ga; n=2	Age data scatter at 2.64–2.90 Ga	ε_{Nd} = +2.1
A1966 – 93001908	granodiorite	Pudasjärvi block, Ranua terrain	Concordia Age = 2722 ± 4 Ma MSWD (of concordance) = 0.32; n=9/9				ε_{Nd} = +1.6

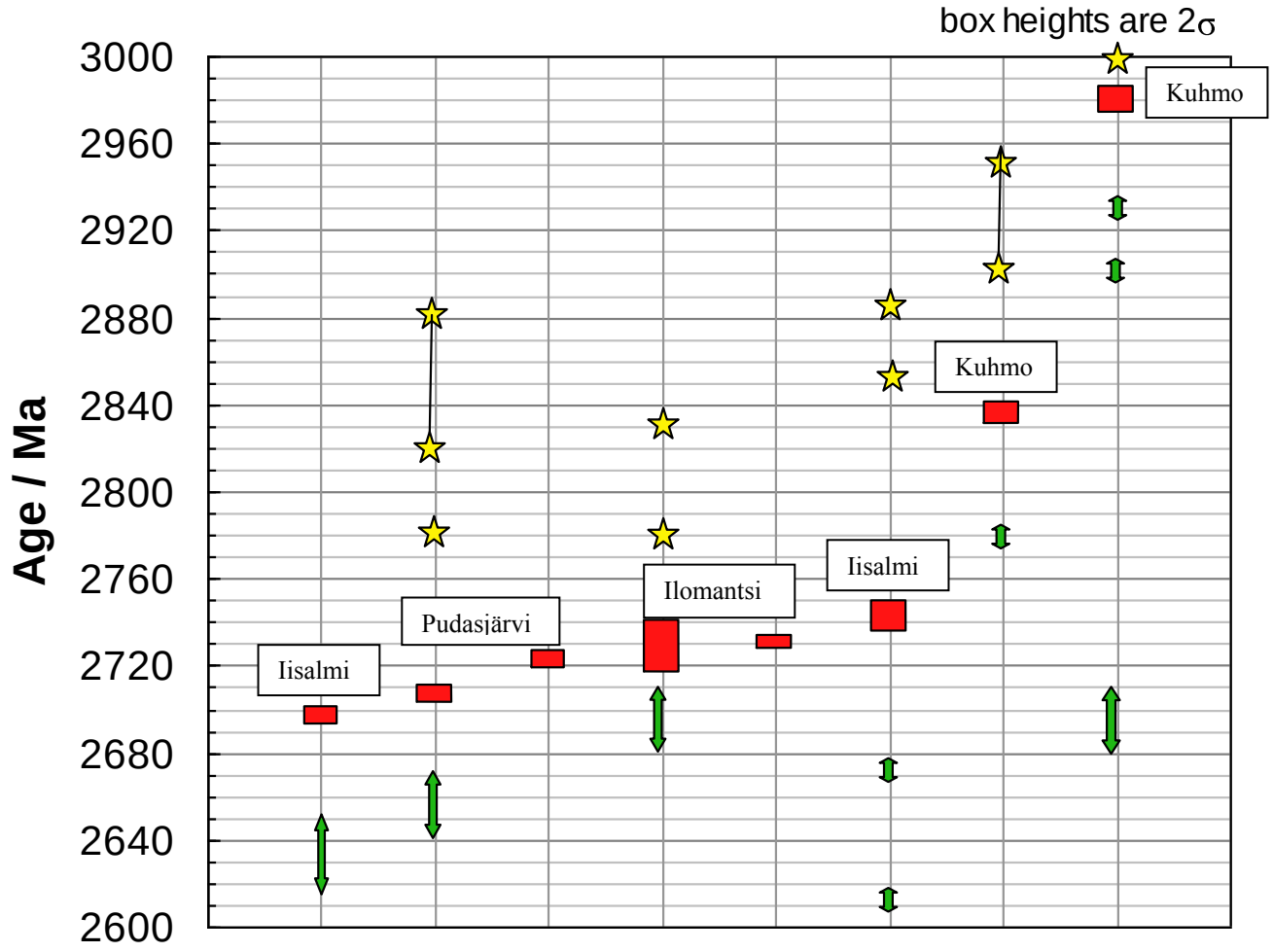


Fig. 11. Summary of the age results. Red boxes = crystallization age; Yellow stars=inherited zircon; Green arrows=overprinting ages. Note that the sample pairs from the different areas show samples with and without inherited zircon - genesis!

4. ACKNOWLEDGEMENTS

In manuscripts the personnel of the NORDSIM laboratory should be thanked (Martin Whitehouse, Lev Ilyinsky, and Kerstin Lindén). In addition, the following text should be added in the acknowledgements: ”The ion microprobe facility in Stockholm (Nordsims) is operated under an agreement between the joint Nordic research councils (NOS-N), the Geological Survey of Finland and the Swedish Museum of Natural History. And finally when the manuscript has bee accepted for publication you should ask a NORDSIM publication number from M.Whitehouse and put it into acknowledgements (“This paper is Nordsims publication XXX”).

Thanks also to Matti Karhunen for rock crushing and Leena Järvinen for mineral separation.

Ja sitten Hannun osuus jos ei tule kirjoittajaksi. Hannu on laskenut epsilonit kaikille näytteille T=2700 Ma eli Kuhmon näytteiden kohdalla epsiloinit lähestyvät nollaa kun käytetään niiden todellisia ikiä.

5. REFERENCES

Claesson, S., Huhma, H., Kinny, P.D., and Williams, I.S., 1993. Svecofennian detrital zircon ages—implications for the Precambrian evolution of the Baltic Shield. Precambrian Research 64, 109-130.

Huhma, H., Claesson, S., Kinny, P.D., and Williams, I.S., 1991. The gowth of Early Proterozoic crust: new evidence from Svecofennian detrital zircons. Terra Nova 3, 175-178.

Krogh, T.E., 1982. Improved accuracy of U-Pb zircon ages by the creation of more concordant systems using an air abrasion technique., Geochimica et Cosmochimica Acta 46, 637-649.

Krogh, T.E., 1973. A low-contamination method for hydrothermal decomposition of U and Pb for isotopic age determinations. Geochim. Cosmochim. Acta, 37, 485-494.

Ludwig, K.R., 1993. PbDat 1.24 for MS-dos: A computer program for IBM-PC Compatibles for processing raw Pb-U-Th isotope data.

Ludwig, K.R., 2003. Isoplot/Ex 3. A geochronological toolkit for Microsoft Excel. Berkeley Geochronology Center. Special publication No. 4.

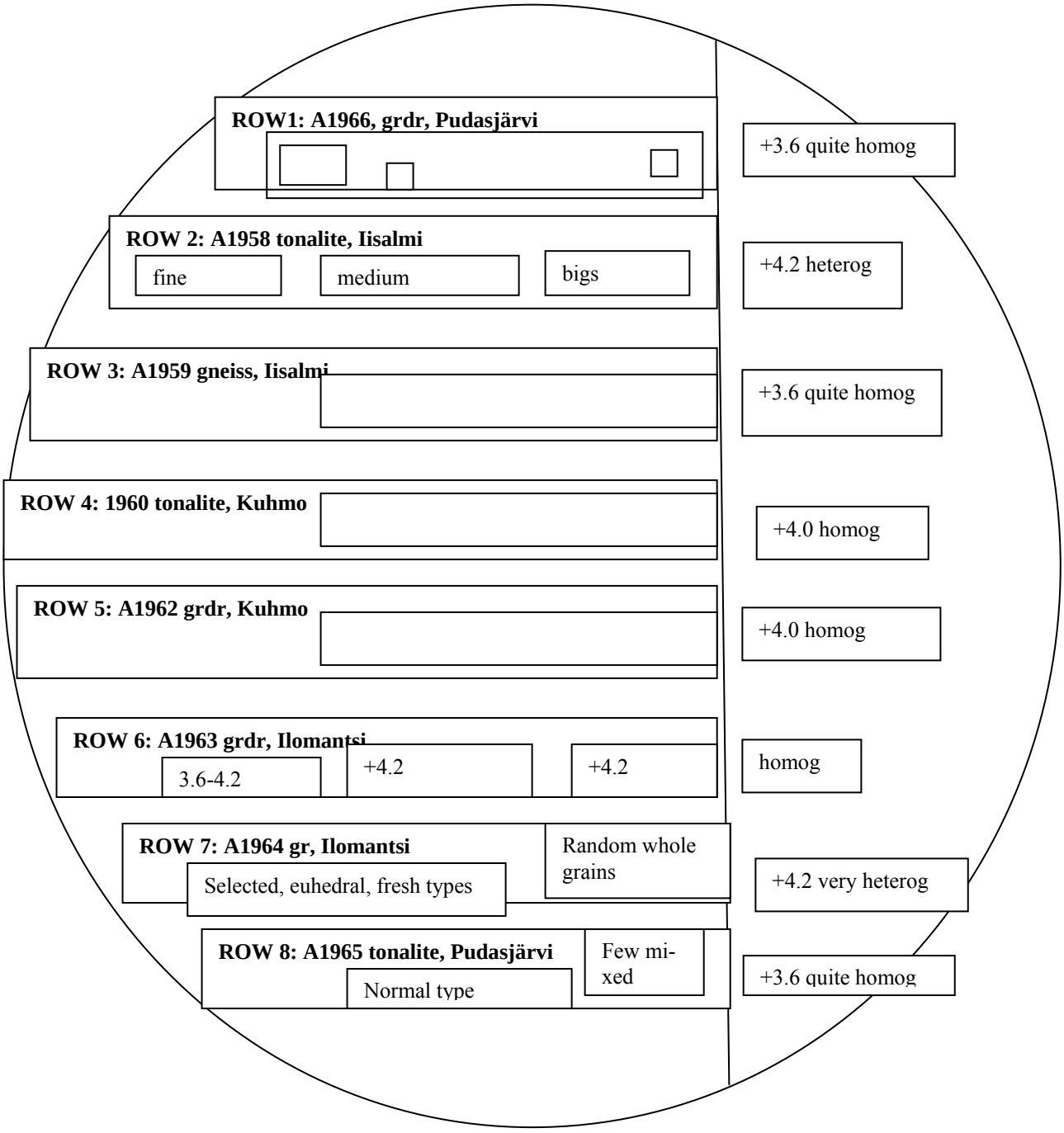
Stacey, J.S. & Kramers, J.D. 1975. Approximation of terrestrial lead isotope evolution by a two-stage model. Earth and Planetary Science Letters, 26, 207-221.

Whitehouse, M.J. and Kamber, B.S., 2005. Assigning Dates to Thin Gneissic Veins in High-Grade Metamorphic Terranes: A Cautionary Tale from Akilia, Southwest Greenland. Journal of Petrology 46, 291–318.

Whitehouse, M.J., Kamber, B. & Moorbath, S., 1999. Age significance of U-Th-Pb zircon data from early Archaean rocks of west Greenland – a reassessment based on combined ion-microprobe and imaging studies. Chemical Geology, 160, 201-224.

Wiedenbeck, M., Allé, P., Corfu, F., Griffin, W.L., Meier, M., Oberli, F., von Quadt, A., Roddick, J.C., & Spiegeln, W., 1995. Three natural zircon standards for U-Th-Pb, Lu-Hf, trace element and REE analysis. Geostandards Newsletter, 19, 1-23.

MOUNT 823, Adakitoids_SIMS project by T.Ruotoistenmäki



Geologian tutkimuskeskus/ Isotooppigeologia/HH 20.4.2009
CK41.23/2009/9

Arkeisten "adakiittisten" granitoidien Sm-Nd tuloksia

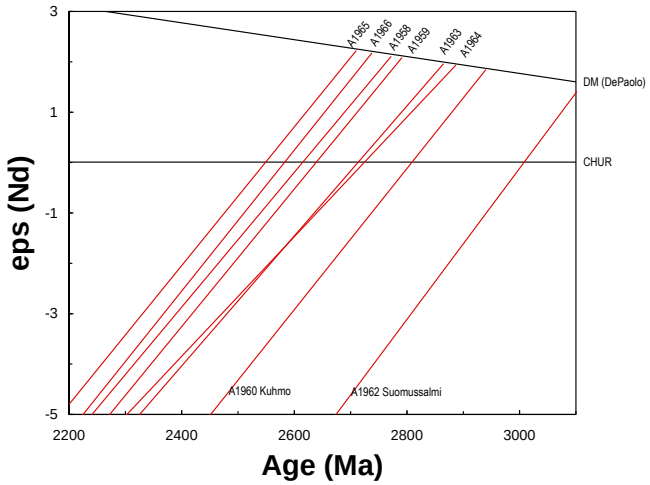
Raportti Tapio Ruotoistenmäelle

Felsisten kivien Sm-Nd analyyseillä voidaan arvioida keskimääräistä kuoren ikää, ns. "crustal residence age". Keskeinen kysymys etenkin arkeisten kivien tulosten tulkinnassa on kuitenkin mahdollinen Sm-Nd systeemin avoimuus. Mikäli metamorfista Sm/Nd fraktioitumista on tapahtunut, ovat lasketut initiaalisuhteet ja malli-iät virheellisiä. Epäilyttäviä ovat näytteet, joiden REE-taso on poikkeuksellisen alhainen ja $^{147}Sm/^{144}Nd$ selvästi kuoren keskikoostumusta korkeampi (> 0.13?). Graniittien syntyyn mahdollisesti liittyvä REE fraktioituminen voi toisaalta viedä Sm/Nd-suhteen hyvinkin pieneksi, jolloin laskennallinen malli-ikä on liian pieni kuvastamaan protoliittia. Initiaali-epsilon kuvaa tällöin paremmin keskimääräistä lähtömateriaalia, mikäli sula on ollut tasapainossa restiitin kanssa (Nd-isotooppikoostumuksen osalta)?

Tässä raportoidaan Sm-Nd analyysit kahdeksasta granitoidista, jotka liittyvät TR:n hankkeeseen "Characteristics of adakitic plutonites in Finland". Taulukossa (Ruotoistenmäki2009nd.xls) epsilon on laskettu käyttäen ikää 2700 Ma (taulukon algoritmi laskee epsilonin halutulla iällä, paina F9).

Tulokset ja tulkinnnat

On runsaasti esimerkkejä etenkin alhaisen asteen vulkaniiteista, että Sm-Nd systeemi ei ole pysynyt suljettuna kiven historian aikana. Toisaalta useat analyysit tietyn ryhmän kivistä antavat varsin yhtäpitäviä tuloksia, jolloin on hyvä syy uskoa että initiaalisuhteet edustavat todellista primääriä koostumusta (esim. Lieksan granitoidit, Halla 2002; tai Kaapinsalmen intruusiosta tehdyt analyysit, Heilimo et al., in prep.). Myös Sm-Nd malli-iät esim. Siuruan vanhoista gneisseistä ovat "vanhoja", mikä osoittaa että yleisesti ottaen Sm-Nd systeemin antamat ikäarviot ovat vähintäänkin suuntaa antavia. Yksittäisiin poikkeaviin tuloksiin on tietenkin syytä suhtautua varauksin.



Tämän hankkeen näytteet ovat REE-trendin suhteen tavanomaisia ja Sm-Nd tulokset hyvinkin antavat primääriä informaatiota. Tulokset osoittavat varsin suurta (systemaattista?) vaihtelua materiaalin iässä. Malli-iät ovat noin 2.72 -2.74 Ga (Pudasjärvi), 2.77 -2.79 Ga (Iisalmi), 2.87 -2.89 Ga (Ilomantsi), 2.94 Ga (Kuhmo) ja 3.1 Ga (Suomussalmi, A1962). Näyte A1962 on täsmälleen samasta paikasta kuin Mikkolan A1909-Kuikkavaara ja Sm-Nd tuloksetkin ovat identtiset. Tämän näytteen zirkonista heterogeeninen U-Pb tims-data viittaa yli 2.9 Ga ikään, mutta nuorempi (2.8 Ga?) metamorfinen efekti on myös näkyvissä (H:n raportti Mikkolalle 2009). Tässä kivessä kuten Suomussalmella muutenkin on merkkejä yli 3 Ga kuoresta, mutta suurin osa näytteistä edustaa siis varsin juveniilista Neoarkeista ainesta.

Espoossa 20.4.2009

Hannu Huhma

Liitteet: Ruotoistenmäki2009nd.xls

GTK/ Isotooppigeologia/ NäytelomakeTyön vastaanottaja ja pvm: eim 10.4.2008

A 1958 - 93003031
Päivämäärä 10.4.2008
Kivilaji: Tonaliitti Paikka, kunta: Iisalmi complex Ktl: 3343 2 X (kaistakoordinaatit): Y (kaistakoordinaatit): (yhtenäiskoordinaatit): X=7057160 Y=3547420 Kenttänumero: Labnum = 93003031 (viite: Rasilainen, Kalevi; Lahtinen, Raimo; Bornhorst, Theodore J. 2007. The Rock Geochemical Database of Finland Manual [Electronic resource]. Geologian tutkimuskeskus. Tutkimusraportti 164. Espoo: Geologian tutkimuskeskus. 38 p. Electronic publication (in: http://arkisto.gsf.fi/tr/tr164/tr164.pdf). Geologi: Tapio Ruotoistenmäki Hanke: 2801021
Kivilajikuvaus (hiekuvaus, paljastumakuvaus, geologinen yhteys): …
Geologinen ongelma (miksi isotooppityö tehdään?): Nordsim-Project #: Fi/2008/37 Characteristics of adakitic plutonites in Finland
Liittyy (näytteet
Ehdotetut toimenpiteet U-Pb mineraali~~, Sm-Nd mineraali/kokokivi, Rb-Sr mineraali/kokokivi, Pb-Pb mineraali/kokokivi, muu?~~ U-Pb zircon, ~~kokokivi~~
Kommentti:
Julkaisusuunnitelma: …

GTK/ Isotooppigeologia/ NäytelomakeTyön vastaanottaja ja pvm: eim 10.4.2008

A1959 - 94003640
Päivämäärä 10.4.2008
Kivilaji: Arkeinen gneissi Paikka, kunta: Iisalmi complex Ktl: 34311 X (kaistakoordinaatit): Y (kaistakoordinaatit): (yhtenäiskoordinaatit): X=7101160 Y=3500970 Kenttänumero: Labnum = 94003640 (viite: Rasilainen, Kalevi; Lahtinen, Raimo; Bornhorst, Theodore J. 2007. The Rock Geochemical Database of Finland Manual [Electronic resource]. Geologian tutkimuskeskus. Tutkimusraportti 164. Espoo: Geologian tutkimuskeskus. 38 p. Electronic publication (in: http://arkisto.gsf.fi/tr/tr164/tr164.pdf). Geologi: Tapio Ruotoistenmäki Hanke: 2801021
Kivilajikuvaus (hiekuvaus, paljastumakuvaus, geologinen yhteys):
Geologinen ongelma (miksi isotooppityö tehdään?): Nordsim-Project #: Fi/2008/37 Characteristics of adakitic plutonites in Finland
Liittyy (näytteet
Ehdotetut toimenpiteet U-Pb mineraali~~, Sm-Nd mineraali/kokokivi, Rb-Sr mineraali/kokokivi, Pb-Pb mineraali/kokokivi, muu?~~ U-Pb zircon, ~~kokokivi~~
Kommentti:
Julkaisusuunnitelma: …

GTK/ Isotooppigeologia/ Näytelomake Työn vastaanottaja ja pvm: eim 10.4.2008

A1960 - 94002667
Päivämäärä 10.4.2008
Kivilaji: Tonaliitti Paikka, kunta: Kuhmo Ktl: 4423 06 X (kaistakoordinaatit): Y (kaistakoordinaatit): (yhtenäiskoordinaatit): X X=7173438 Y=3618354 Kenttänumero: Labnum = 94002667 (viite: Rasilainen, Kalevi; Lahtinen, Raimo; Bornhorst, Theodore J. 2007. The Rock Geochemical Database of Finland Manual [Electronic resource]. Geologian tutkimuskeskus. Tutkimusraportti 164. Espoo: Geologian tutkimuskeskus. 38 p. Electronic publication (in: http://arkisto.gsf.fi/tr/tr164/tr164.pdf). Geologi: Tapio Ruotoistenmäki Hanke: 2801021
Kivilajikuvaus (hiekuvaus, paljastumakuvaus, geologinen yhteys): …
Geologinen ongelma (miksi isotooppityö tehdään?): Nordsim-Project #: Fi/2008/37 Characteristics of adakitic plutonites in Finland
Liittyy (näytteet
Ehdotetut toimenpiteet U-Pb mineraali~~, Sm-Nd mineraali/kokokivi, Rb-Sr mineraali/kokokivi, Pb-Pb mineraali/kokokivi, muu?~~ U-Pb zircon, ~~kokokivi~~
Kommentti:
Julkaisusuunnitelma: …

GTK/ Isotooppigeologia/ Näytelomake Työn vastaanottaja ja pvm: eim 10.4.2008

A1962 - 95001782
Päivämäärä 10.4.2008
Kivilaji: Granodioriitti Paikka, kunta: Kuhmo Ktl: 4511 07 X (kaistakoordinaatit): Y (kaistakoordinaatit): (yhtenäiskoordinaatit): X=7227560 Y=3583835 Kenttänumero: Labnum = 95001782 (viite: Rasilainen, Kalevi; Lahtinen, Raimo; Bornhorst, Theodore J. 2007. The Rock Geochemical Database of Finland Manual [Electronic resource]. Geologian tutkimuskeskus. Tutkimusraportti 164. Espoo: Geologian tutkimuskeskus. 38 p. Electronic publication (in: http://arkisto.gsf.fi/tr/tr164/tr164.pdf). Geologi: Tapio Ruotoistenmäki Hanke: 2801021
Kivilajikuvaus (hiekuvaus, paljastumakuvaus, geologinen yhteys): …
Geologinen ongelma (miksi isotooppityö tehdään?): Nordsim-Project #: Fi/2008/37 Characteristics of adakitic plutonites in Finland
Liittyy (näytteet
Ehdotetut toimenpiteet U-Pb mineraali~~, Sm-Nd mineraali/kokokivi, Rb-Sr mineraali/kokokivi, Pb-Pb mineraali/kokokivi, muu?~~ U-Pb zircon, ~~kokokivi~~
Kommentti:
Julkaisusuunnitelma: …

GTK/ Isotooppigeologia/ Näytelomake Työn vastaanottaja ja pvm: eim 10.4.2008

A 1963 - 90010130
Päivämäärä 10.4.2008
Kivilaji: Granodioriitti Paikka, kunta: Ilomantsi Ktl: 4244 04 X (kaistakoordinaatit): Y (kaistakoordinaatit): (yhtenäiskoordinaatit): X=6959880 Y=3708970 Kenttänumero: Labnum = 90010130 (viite: Rasilainen, Kalevi; Lahtinen, Raimo; Bornhorst, Theodore J. 2007. The Rock Geochemical Database of Finland Manual [Electronic resource]. Geologian tutkimuskeskus. Tutkimusraportti 164. Espoo: Geologian tutkimuskeskus. 38 p. Electronic publication (in: http://arkisto.gsf.fi/tr/tr164/tr164.pdf). Geologi: Tapio Ruotoistenmäki Hanke: 2801021
Kivilajikuvaus (hiekuvaus, paljastumakuvaus, geologinen yhteys): …
Geologinen ongelma (miksi isotooppityö tehdään?): Nordsim-Project #: Fi/2008/37 Characteristics of adakitic plutonites in Finland
Liittyy (näytteet
Ehdotetut toimenpiteet U-Pb mineraali~~, Sm-Nd mineraali/kokokivi, Rb-Sr mineraali/kokokivi, Pb-Pb mineraali/kokokivi, muu?~~ U-Pb zircon, ~~kokokivi~~
Kommentti:
Julkaisusuunnitelma: …

GTK/ Isotooppigeologia/ Näytelomake Työn vastaanottaja ja pvm: eim 10.4.2008

A1964 - 94002572
Päivämäärä 10.4.2008
Kivilaji: Graniitti Paikka, kunta: Ilomantsi Ktl: 4332 10 X (kaistakoordinaatit): Y (kaistakoordinaatit): (yhtenäiskoordinaatit): X=7021049 Y=3685422 Kenttänumero: Labnum = 94002572 (viite: Rasilainen, Kalevi; Lahtinen, Raimo; Bornhorst, Theodore J. 2007. The Rock Geochemical Database of Finland Manual [Electronic resource]. Geologian tutkimuskeskus. Tutkimusraportti 164. Espoo: Geologian tutkimuskeskus. 38 p. Electronic publication (in: http://arkisto.gsf.fi/tr/tr164/tr164.pdf). Geologi: Tapio Ruotoistenmäki Hanke: 2801021
Kivilajikuvaus (hiekuvaus, paljastumakuvaus, geologinen yhteys): …
Geologinen ongelma (miksi isotooppityö tehdään?): Nordsim-Project #: Fi/2008/37 Characteristics of adakitic plutonites in Finland
Liittyy (näytteet
Ehdotetut toimenpiteet U-Pb mineraali~~, Sm-Nd mineraali/kokokivi, Rb-Sr mineraali/kokokivi, Pb-Pb mineraali/kokokivi, muu?~~ U-Pb zircon, ~~kokokivi~~
Kommentti:
Julkaisusuunnitelma: …

GTK/ Isotooppigeologia/ Näytelomake Työn vastaanottaja ja pvm: eim 10.4.2008

A 1965 - 94003693
Päivämäärä 10.4.2008
Kivilaji: gneissitonaliitti Paikka, kunta: Pudasjärvi Ktl: 3442 02 X (kaistakoordinaatit): Y (kaistakoordinaatit): (yhtenäiskoordinaatit): X=7207930 Y=3505480 Kenttänumero: Labnum = 94003693 (viite: Rasilainen, Kalevi; Lahtinen, Raimo; Bornhorst, Theodore J. 2007. The Rock Geochemical Database of Finland Manual [Electronic resource]. Geologian tutkimuskeskus. Tutkimusraportti 164. Espoo: Geologian tutkimuskeskus. 38 p. Electronic publication (in: http://arkisto.gsf.fi/tr/tr164/tr164.pdf). Geologi: Tapio Ruotoistenmäki Hanke: 2801021
Kivilajikuvaus (hiekuvaus, paljastumakuvaus, geologinen yhteys): …
Geologinen ongelma (miksi isotooppityö tehdään?): Nordsim-Project #: Fi/2008/37 Characteristics of adakitic plutonites in Finland
Liittyy (näytteet
Ehdotetut toimenpiteet U-Pb mineraali~~, Sm-Nd mineraali/kokokivi, Rb-Sr mineraali/kokokivi, Pb-Pb mineraali/kokokivi, muu?~~ U-Pb zircon, ~~kokokivi~~
Kommentti:
Julkaisusuunnitelma:

A1966 - 93001908

Päivämäärä 10.4.2008

Kivilaji: granodioriitti
Paikka, kunta: Pudasjärvi
Ktl: 3514 3

X (kaistakoordinaatit): Y (kaistakoordinaatit):
(yhtenäiskoordinaatit):
X=7278860 Y=3462400

Kenttänumero: Labnum = 93001908
(viite: Rasilainen, Kalevi; Lahtinen, Raimo; Bornhorst, Theodore J. 2007. The Rock Geochemical Database of Finland Manual [Electronic resource]. Geologian tutkimuskeskus. Tutkimusraportti 164. Espoo: Geologian tutkimuskeskus. 38 p. Electronic publication (in: http://arkisto.gsf.fi/tr/tr164/tr164.pdf).

Geologi: Tapio Ruotoistenmäki
Hanke: 2801021

Kivilajikuvaus (hiekuvaus, paljastumakuvaus, geologinen yhteys):
…

Geologinen ongelma (miksi isotooppityö tehdään?):
Nordsim-Project #: Fi/2008/37

Characteristics of adakitic plutonites in Finland

Liittyy (näytteet

Ehdotetut toimenpiteet U-Pb mineraali~~, Sm-Nd mineraali/kokokivi, Rb-Sr mineraali/kokokivi, Pb-Pb mineraali/kokokivi, muu?~~ U-Pb zircon, ~~kokokivi~~

Kommentti:

Julkaisusuunnitelma:
…