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Westhues, et al., 2017, Evidence for hydrothermal alteration and source regions for the Kiruna iron oxide–apatite ore (northern Sweden) from zircon Hf and O isotopes: Geology, doi:10.1130/G38894.1.

Samples, Sample Preparation, and Detailed Results

Samples were collected in collaboration with the operating mining company LKAB (Luossavaara-Kiirunavaara Aktiebolag) from three different ore bodies (e.g., Kiirunavaara, Rektorn, Nukutus) within the vicinity of Kiruna (see Fig. 1, main text), the metavolcanic host rocks of those deposits, and igneous intrusions spatially and temporally related to the Kiirunavaara ore body (see Table DR1 for locations and mineralogy).

Zircon grains were separated from the samples in this study using standard crushing and separation techniques and were then mounted in epoxy and polished to reveal the crystal centers. Zircon grains were imaged by back-scattered electrons (BSE) and cathodoluminescence (CL) using a FEI Quanta 400 secondary electron microscope (SEM) at Memorial University of Newfoundland (MUN) prior to the in situ analyses. Subsequent CL images were taken with a JEOL JSM-7100F field emission SEM at MUN after all analyses were completed to precisely verify where in situ analyses were done. Representative CL and BSE images can be found in Figure DR1.

Determination of the zircon oxygen isotopic compositions ($^{18}O/^{16}O$) was done at the NordSIM facility of the Swedish Museum for Natural History, using a Cameca IMS1280 ion microprobe, after the zircon grains had been previously dated with the same instrument. The methodology follows that of Whitehouse and Nemchin (2009) and Heinonen et al. (2015), using a rastered 20 keV Cs+ primary beam (ca. 1.5 nA) in Gaussian focussed mode to sputter a ca. 15 µm sample area. Charge compensation was provided by a normal incidence electron gun. Runs were fully automated and included a 60 s pre-sputter period (rastered area 20 µm), and within-run centering of the field aperture, entrance slit, and mass, using the ^{16}O signal. Data were acquired for 64 s using two Faraday detectors in the multicollector system. The mounts were gently repolished to remove spots from prior U-Th-Pb analyses to then the oxygen analyses were made in the same locations where concordant ages were previously obtained. The oxygen isotope data were normalized to reference zircon samples Temora-2 and 91500 that were measured repeatedly throughout the sessions, assuming a $\delta^{18}O$ value of 8.20‰ and 9.86‰, respectively (Black et al., 2004; Wiedenbeck et al., 2004). Temora-2 was used as primary standard in the 2013 session, because the 91500 piece used showed impurities (see Fig. DR2 and Table DR2). Minor linear drift corrections (0.004 and 0.001 %/run in 2013 and 2014, respectively) were applied to the data sets where applicable based on minimising the external error on the standards. $\delta^{18}O$ compositions are reported relative to **V**ienna **s**tandard **m**ean **o**cean **w**ater (V-SMOW). Errors for $\delta^{18}O$ represent the sum of counting statistics error for individual spot and the external error obtained based on all standards analysed during the session, which were added in quadrature.

Hf isotopes were later measured at MUN by laser ablation multi-collector inductively coupled mass spectrometry (LA-MC-ICPMS) using a Thermo Finnigan Neptune MC-ICPMS and a Geolas 193nm excimer laser system, following the methods of Fisher et al. (2011). Helium was used as the carrier gas in the ablation cell and flowed at a rate of 1 litre/min with an auxiliary Ar gas flow of 0.8-0.9 litres/min and Ar make up gas flow of 0.825 litres/min. The laser spot size used was 40 µm, except for standard zircon Plešovice (49 µm), with a repetition rate of 10 Hz and fluence of 5 J/cm^2. The cup configuration for the MC-ICPMS can be found in Table DR3. The total analysis time of 150 seconds was integrated into acquisition cycles of approximately 1 second each. The gas background (blank) was measured for 30 seconds (~30 cycles), and then the laser fired for approximately 60 seconds resulting in ~600 pulses and ~60 cycles. Hf data reduction was done following the methods of Fisher et al. (2011) and is summarized in the following. The Lu-Hf isotope data was processed using the Excel macro MCTool-Hf, which is based on macros from "LAMTOOL-Hf", provided by Jan Košler of the University of Bergen. Mass bias effects for Hf and Yb were corrected using $^{179}Hf/^{177}Hf$ and $^{173}Yb/^{171}Yb$ (1.1302, Segal et al., 2003), respectively, with β_{Yb} being calculated ratio-by-ratio during single analysis. The $^{176}Yb/^{173}Yb$ ratio (Segal et al., 2003) and ^{173}Yb mass were used for the interference correction of ^{176}Yb on ^{176}Hf. The second interference on ^{176}Hf by ^{176}Lu was corrected using the measured ^{175}Lu mass, assuming $\beta_{Lu} = \beta_{Yb}$, and using $^{176}Lu/^{175}Lu$ of 0.02656 by Chu et al. (2002). Outliers for the Hf ratios were rejected based on the 2SD criteria with uncertainties based on the 2SD of the mean and only analyses with a minimum of 20 valid cycles (~1 cycle integrated per second) were used. Analyses with less than 20 cycles (laser drilled through the zircon grain) and where the invariant $^{178}Hf/^{177}Hf$ ratio, which monitors the effectiveness of mass bias correction, is different from natural Hf isotopic composition, were not used in the interpretation of the results. Standards used were the synthetic zircon MUNZirc-3 (B-142) and MUNZirc-4 (B-144) (Fisher et al., 2011) and natural zircon samples FC-1 and Temora-2 (Woodhead and Hergt, 2005). These were monitored throughout the measurement sessions and compared to accepted Hf isotopic ratios as found in Table DR4. LA-MC-ICPMS results of the zircon standards from this study can be found in Figure DR3 and Table DR5. Epsilon Hf (εHf) values are reported as deviation from the **ch**ondritic **u**niform **r**eservoir (CHUR) using the values from Bouvier et al. (2008) of $^{176}Hf/^{177}Hf = 0.282785$ and $^{176}Lu/^{177}Hf = 0.0336$. Initial $^{176}Hf/^{177}Hf$ ($^{176}Hf/^{177}Hf_i$) have been calculated at the best age estimate for each sample, using the decay constant of Söderlund et al. (2004). Initial εHf (εHf_i) and uncertainties have been calculated following the algorithm of Ickert (2013).

Three-hundred and nine U-Pb analyses were done on the zircon grains from the ten samples in this study, over three measurement sessions in 2011, 2013 and 2014 on four different grain mounts (Westhues et al., 2016). While measuring the oxygen isotopic composition in 2013, the primary Cs^+ beam became charged (probably due to minute amounts of water vapor caught in bubbles in the epoxy) and the electron gun drilled explosively into and across the epoxy mount. During this unfortunate event, 87 zircon grains were destroyed, and 59 grains were not measured following the explosion due to their proximity to the damaged region in the epoxy mount. Of the remaining 163 zircon grains, 99 oxygen analyses were done on the most concordant grains (Table DR6). Lu-Hf ratios were determined in the same spots as oxygen analyses, but also in other dated spots to identify differences between concordant and discordant areas of the zircon, totaling 128 Lu/Hf analyses (Table DR7). Table DR8 gives a comprehensive summary of SIMS U-Pb dates, oxygen analyses, and LA-MC-ICPMS Lu-Hf ratios for the individual grains.

Tables DR9 and DR10 show details about calculations with zircon oxygen analyses from this study together with magnetite and whole rock oxygen data from previous studies. Analyses for Hf isotopic composition of samples placed in discordant areas of the dated zircon grains overlap with those done in concordant areas for samples KRN-11-05, KRN-12-02, -03, -05 and NUK-12-02. The highest εHf_i values from K-1 are obtained from analyses with U-Pb results with a discordance of greater than 5%.

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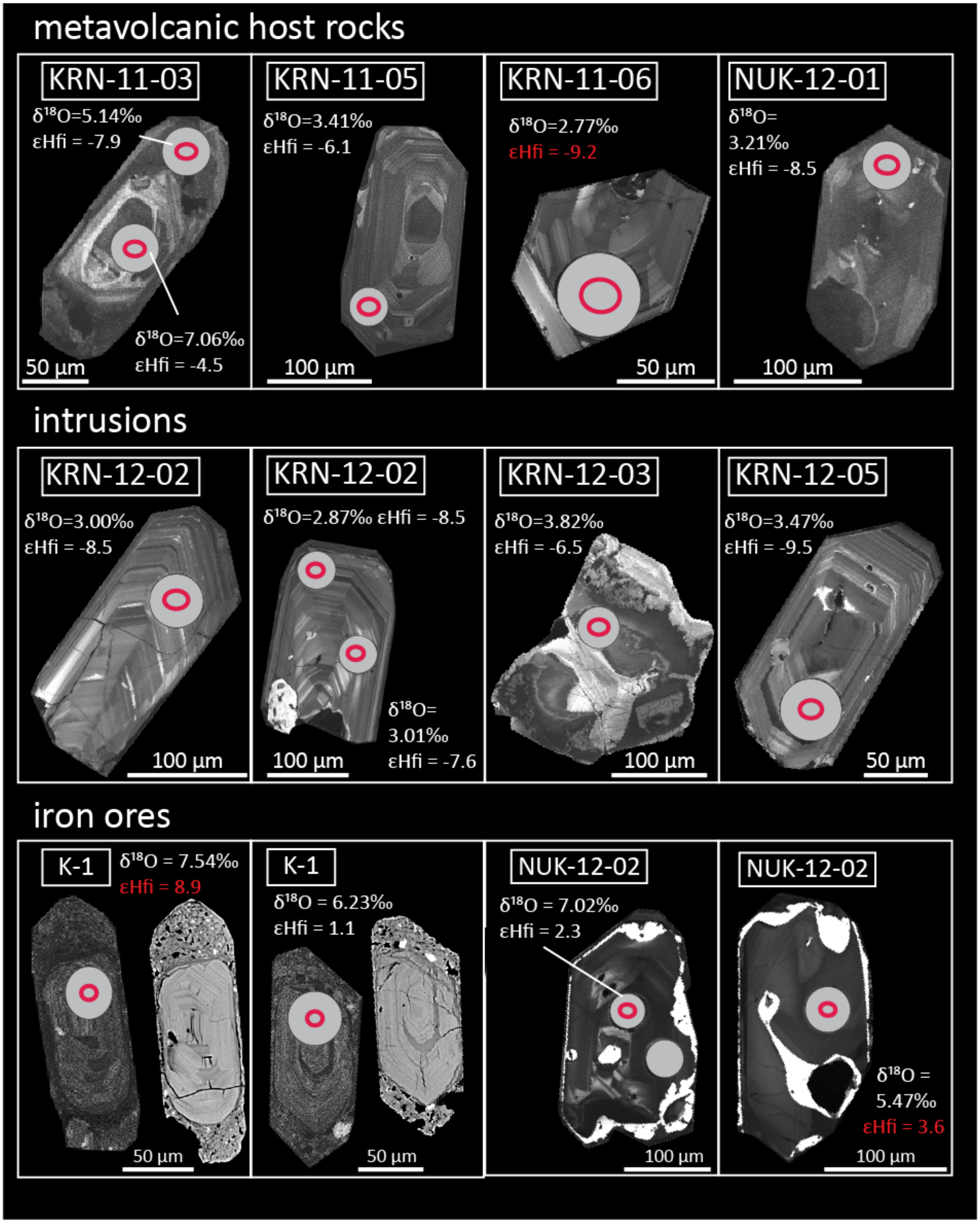


Fig. DR1. Representative CL and BSE images of zircon grains with oxygen (as $\delta^{18}O$ V-SMOW) and Lu-Hf (as initial εHf) isotopic compositions; εHf_i values in red have not been used (see Table DR-11). Red ellipses in CL images show locations of NordSIM oxygen analyses, grey spots in CL images show subsequent Lu-Hf LA-MC-ICPMS analyses. For ore sample K-1, BSE images have been included, since they show the differences between core and rims regions particularly well.

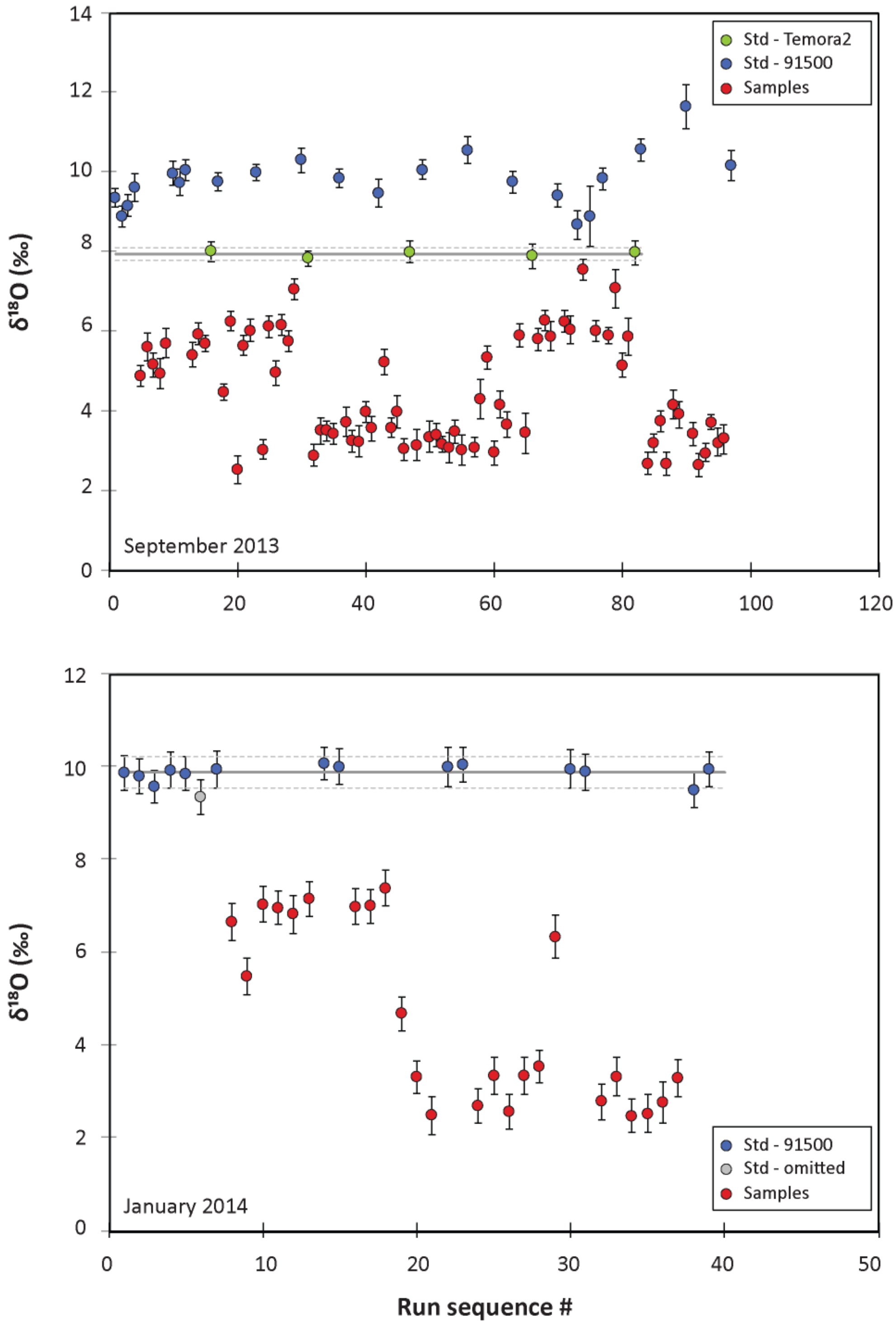
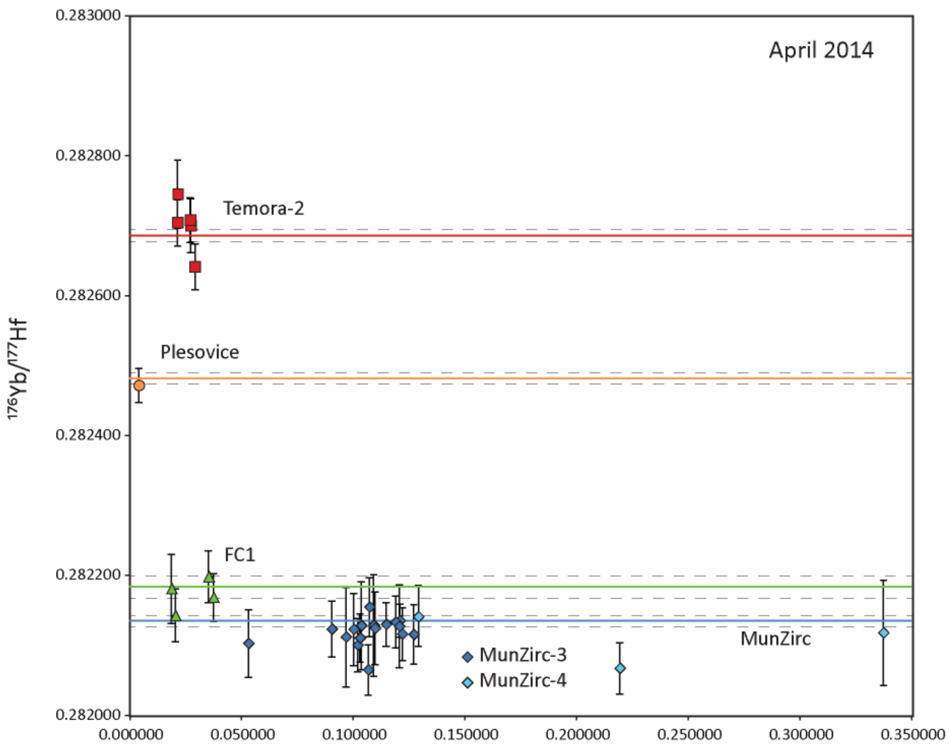


Fig. DR2. Oxygen analyses session overview for September 2013 (upper part) and January 2014 (lower part). While the piece of reference zircon 91500 (Wiedenbeck et al., 2004) used in 2014 has very consistent results, the piece used in 2013 showed impurities in the oxygen composition. Therefore, the reference zircon Temora-2 (Black et al., 2004) was used instead a primary standard.



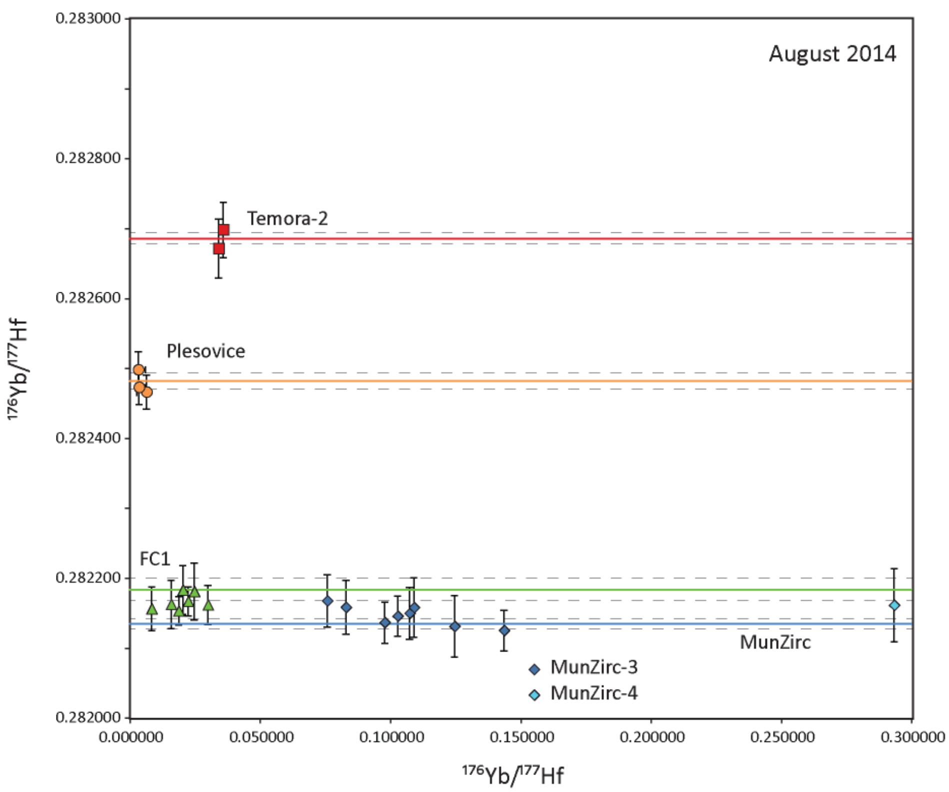


Fig. DR3. Plot of ^{176}Hf/^{177}Hf vs. ^{176}Yb/^{177}Hf for zircon standard measurements from this study. Bold lines represent accepted values and dashed lines the reported uncertainties as found in Table DR-9**.**

Table DR1. Sample list with GPS locations, rock types, and mineralogy; sorted by location.

Sample	Latitude	Longitude	Underground level	Rock type + mineralogy
K-1	N 67° 51' 0.6"	E 20° 12' 23.8"	767 m	D-ore*: mag, ap, act ±fsp-qz*
KRN-11-03	N 67° 50' 13.1"	E 20° 12' 17.4"	1365 m	(trachy-) andesite(FW): *Ab, Kfs ±act-tt-qz*
KRN-11-05	N 67° 50' 35.6"	E 20° 12' 37.4"	1065 m	rhyodacite (HW): *Kfs, qz ±hbl-tt*
Drill core end	N 67° 50' 35.6"	E 20° 12' 36.9"	1066 m	
KRN-11-06	N 67° 50' 35.8"	E 20° 12' 32.4"	1076 m	rhyodacite (HW): *Kfs (ser, Fe incl.), qz ±hbl-tit*
Drill core end	N 67° 50' 35.7"	E 20° 12' 34.2"	1077 m	
KRN-12-02	N 67° 50' 57.8"	E 20° 10' 24.7"	Surface	aplite: *qz, Kfs, Ab ±hbl-tt-mag*
KRN-12-03	N 67° 50' 23.4"	E 20° 10' 49.7"	Surface	syenite: *Kfs (Fe incl.), act, tt ± Ab-qz*
KRN-12-05	N 67° 50' 30.1"	E 20° 10' 50.1"	1365 m	granite: *kfs, qz ±Ab-bt-tt*
NUK-12-02	N 67° 53' 50.8"	E 20° 15' 33.9"	Surface	ore + host: *mag, ap – qz, ser ±ap, mag*
NUK-12-01	N 67° 53' 53.1"	E 20° 15' 31.1"	Surface	rhyodacite (FW): *qz, Kfs, ±bt-rt-act-mag*
REK-12-01	N 67° 52' 17.8"	E 20° 14' 13.6"	Surface	Rektorn porphyry (HW) K*fs (Fe incl., ser), qz, Fe ox*

Notes: KRN/K: Kiirunavaara, REK: Rektorn, NUK: Nukutusvaara, TUV: Tuolluvaara; FW: footwall; HW: hanging wall, ser: seritization
Mineral abbreviations: Ab: albite, act: actinolite, ap: apatite, bt: biotite, cal: calcite, fsp: feldspar, hm: hematite, Kfs: K-feldspar, mag: magnetite, qz: quartz, rt: rutile, tt: titanite.

Table DR2. SIMS oxygen ratio analyses for zircon standards.

Sample ID	Seq # run	^{16}O cps (x 10^9)	$^{16}O_{samp/av.std}$	$^{18}O/^{16}O$ *drift corrected*	± abs	$\delta^{18}O$ *standards*	± ‰	$\delta^{18}O$ *rejected**	± ‰
a) Session September 2013: chosen standard Temora-2, δ18O (std., ‰) = 7.93, ext. error (‰, 1SD) = 0.08, drift corr. (‰/run) = 0.004									
915ox_AW-mt4_@1	1	2.63	1.00	0.00201930	0.00000018			9.35	0.12
915ox_AW-mt4_@02	2	2.66	1.01	0.00201834	0.00000021			8.87	0.13
915ox_AW-mt4_@03	3	2.68	1.02	0.00201888	0.00000023			9.14	0.14
915ox_AW-mt4_@04	4	2.68	1.02	0.00201978	0.00000032			9.59	0.18
915ox_AW-mt4_@05	10	2.68	1.02	0.00202051	0.00000026			9.96	0.15
915ox_AW-mt4_@06	11	2.68	1.02	0.00202005	0.00000030			9.73	0.17
915ox_AW-mt4_@07	12	2.69	1.02	0.00202070	0.00000021			10.05	0.13
Tem_ox_AW-mt4_@1	16	2.70		0.00201660	0.00000019	8.00	0.12		
915ox_AW-mt4_@08	17	2.68	1.02	0.00202009	0.00000019			9.74	0.12
915ox_AW-mt4_@09	23	2.66	1.01	0.00202055	0.00000015			9.97	0.11
915ox_AW-mt4_@10	30	2.65	1.01	0.00202117	0.00000027			10.28	0.15
Tem_ox_AW-mt4_@2	31	2.65		0.00201624	0.00000013	7.82	0.10		
915ox_AW-mt4_@11	36	2.62	1.00	0.00202028	0.00000017			9.84	0.11
915ox_AW-mt4_@12	42	2.58	0.98	0.00201949	0.00000032			9.44	0.18
Tem_ox_AW-mt4_@3	47	2.63		0.00201657	0.00000022	7.98	0.13		
915ox_AW-mt4_@13	49	2.61	1.00	0.00202070	0.00000020			10.05	0.13
915ox_AW-mt4_@14	56	2.72	1.04	0.00202168	0.00000029			10.54	0.16
915ox_AW-mt4_@15	63	2.78	1.06	0.00202009	0.00000023			9.74	0.14
Tem_ox_AW-mt4_@4	66	2.66		0.00201637	0.00000027	7.88	0.15		
915ox_AW-mt4_@16	70	2.60	0.99	0.00201940	0.00000025			9.40	0.15
915ox_AW-mt4_@17	77	2.50	0.95	0.00202024	0.00000023			9.82	0.14
Tem_ox_AW-mt4_@5	82	2.48		0.00201653	0.00000026	7.97	0.15		
915ox_AW-mt4_@18	83	2.49	0.95	0.00202169	0.00000024			10.55	0.14
915ox_AW-mt4_@19	90	2.65	1.01	0.00202388	0.00000054			11.64	0.28
915ox_AW-mt4_@20	97	2.51	0.96	0.00202092	0.00000035			10.16	0.19
b) Session January 2014 a: chosen standard 91500, δ18O (std., ‰) = 9.86, ext. error (‰, 1SD) = 0.17, drift corr. (‰/run) = 0.001									
915ox_mt-Kiruna6_@1	1	2.67		0.00202018	0.00000017	9.84	0.19		
915ox_mt-Kiruna6_@2	2	2.63		0.00202004	0.00000016	9.77	0.18		
915ox_mt-Kiruna6_@3	3	2.60		0.00201960	0.00000013	9.55	0.18		
915ox_mt-Kiruna6_@4	4	2.52		0.00202031	0.00000019	9.90	0.19		
915ox_mt-Kiruna6_@5	5	2.69		0.00202016	0.00000013	9.83	0.18		
915ox_mt-Kiruna6_@06	6	2.78	1.15	0.00201915	0.00000017			9.32	0.19
915ox_mt-Kiruna6_@07	7	2.63		0.00202037	0.00000022	9.93	0.20		
915ox_mt-Kiruna6_@08	14	2.55		0.00202061	0.00000012	10.06	0.18		
915ox_mt-Kiruna6_@09	15	2.55		0.00202046	0.00000021	9.98	0.20		
915ox_mt-Kiruna6_@10	22	2.42		0.00202046	0.00000027	9.98	0.21		
915ox_mt-Kiruna6_@11	23	2.41		0.00202053	0.00000016	10.01	0.18		
915ox_mt-Kiruna6_@12	30	2.23		0.00202035	0.00000025	9.93	0.21		
915ox_mt-Kiruna6_@13	31	2.19		0.00202023	0.00000019	9.86	0.19		
915ox_mt-Kiruna6_@14	38	1.95		0.00201944	0.00000018	9.47	0.19		
915ox_mt-Kiruna6_@15	39	1.92		0.00202035	0.00000019	9.92	0.19		
c) Session January 2014 b: chosen standard 91500, δ18O (std., ‰) = 9.86, ext. error (‰, 1SD) = 0.18, drift corr. (‰/run) = 0.001									
915ox_mt-Kiruna6_@14-b	1	1.95		0.00201952	0.00000018	9.53	0.20		
915ox_mt-Kiruna6_@15-b	2	1.92		0.00202048	0.00000019	10.01	0.21		
915ox_mt-Kiruna6_@16	9	1.71		0.00202017	0.00000017	9.86	0.20		
915ox_mt-Kiruna6_@17	10	1.68		0.00202059	0.00000016	10.07	0.20		
915ox_mt-Kiruna6_@18	17	1.53		0.00202030	0.00000029	9.93	0.23		
915ox_mt-Kiruna6_@19	18	1.46		0.00202050	0.00000021	10.03	0.21		
915ox_mt-Kiruna6_@20	23	1.19		0.00201996	0.00000023	9.76	0.22		
915ox_mt-Kiruna6_@21	24	1.15		0.00201986	0.00000029	9.71	0.23		

* all 91500 analyses for session a) were rejected due to impurities in the oxygen isotopic value of the used standard piece.

Table DR3. Neptune MC-ICPMS cup configuration.

L4	L3	L2	L1	C	H1	H2	H3	H4
^{171}Yb	^{173}Yb	^{174}Hf+Yb	^{175}Lu	^{176}Hf+Yb+Lu	177Hf	^{178}Hf	^{179}Hf	empty

Table DR4. Accepted $^{176}Hf/^{177}Hf$ isotopic composition of zircon standards used in this study.

Standard	$^{176}Hf/^{177}Hf$	2SE	Source
Plesovice	0.282482	0.000012	Sláma et al. (2008)
MunZirc	0.282135	0.000007	Fisher et al. (2011)
FC-1	0.282184	0.000016	Woodhead and Hergt (2005)
Temora-2	0.282686	0.000008	Woodhead and Hergt (2005)

Table DR5. LA-MC-ICPMS Lu-Hf isotopic analyses of zircon standards measured in this study. Strike-through data were not used due to analytical problems (see comment and DR-1).

File name	Sample ID	$^{176}Hf/^{177}Hf$	2SE	$^{176}Lu/^{177}Hf$	2SE	$^{176}Yb/^{177}Hf$	2SE	$^{178}Hf/^{177}Hf$	2SE	Mean Hf (V)	spot size	comment
14ap02a01	Plesovice	0.282472	0.000016	0.000114	0.000001	0.003951	0.000025	1.467219	0.000029	4.56	49 µm	
14au11b01	Plesovice	0.282466	0.000024	0.000182	0.000010	0.006299	0.000206	1.467203	0.000033	4.15	49 µm	
14au11c01	Plesovice	0.282498	0.000026	0.000086	0.000000	0.003144	0.000014	1.467177	0.000041	3.86	49 µm	
14au11d01	Plesovice	0.282473	0.000024	0.000096	0.000002	0.003449	0.000074	1.467195	0.000045	4.14	49 µm	
	average	**0.282477**										
	2SD	0.000029										
	n	4										
14ap02a02	b142	0.282135	0.000024	0.005893	0.000051	0.120784	0.001161	1.467200	0.000038	3.05	40 µm	
14ap02a13	b142	0.282133	0.000037	0.006064	0.000166	0.118967	0.003733	1.467267	0.000047	2.42	40 µm	
14ap02a23	b142	0.282100	0.000038	0.005232	0.000023	0.101962	0.000553	1.467422	0.000055	2.72	40 µm	
14ap02a32	b142	0.282111	0.000034	0.005328	0.000044	0.102955	0.000800	1.467461	0.000056	2.36	40 µm	
14ap02a42	b142	0.282065	0.000036	0.005288	0.000058	0.106638	0.000999	1.467586	0.000041	2.66	40 µm	
14ap02a51	b142	0.282123	0.000040	0.004480	0.000228	0.090383	0.005342	1.467238	0.000044	3.46	40 µm	
14ap02a62	b142	0.282116	0.000042	0.006288	0.000016	0.127038	0.000153	1.467249	0.000045	2.66	40 µm	
~~14ap02b01~~	~~b142~~	~~0.280060~~	~~0.000089~~	~~0.005514~~	~~0.000058~~	~~0.106362~~	~~0.001488~~	~~1.474455~~	~~0.000410~~	~~2.58~~	40 µm	invariant ratio
14ap02b11	b142	0.282116	0.000038	0.006085	0.000107	0.121915	0.002331	1.467236	0.000050	2.51	40 µm	
14ap02c01	b142	0.282129	0.000073	0.005402	0.000112	0.109095	0.002107	1.467241	0.000055	2.38	40 µm	
14ap02c12	b142	0.282127	0.000059	0.005864	0.000075	0.120535	0.001403	1.467240	0.000055	2.72	40 µm	
14ap02c22	b142	0.282112	0.000071	0.004795	0.000072	0.096656	0.001232	1.467250	0.000050	2.65	40 µm	
14ap02c31	b142	0.282155	0.000042	0.005245	0.000070	0.107201	0.001432	1.467266	0.000060	2.43	40 µm	
14ap02c42	b142	0.282130	0.000031	0.005682	0.000015	0.114715	0.000634	1.467284	0.000051	2.48	40 µm	
14ap02c51	b142	0.282128	0.000063	0.005162	0.000109	0.103533	0.002156	1.467309	0.000056	2.55	40 µm	
14ap02c60	b142	0.282124	0.000052	0.005339	0.000036	0.109652	0.000325	1.467249	0.000046	2.39	40 µm	
14ap02c69	b142	0.282123	0.000052	0.004959	0.000068	0.100149	0.001335	1.467300	0.000040	2.88	40 µm	
14ap02c80	b142	0.282103	0.000048	0.002827	0.000153	0.053069	0.002790	1.467247	0.000067	3.35	40 µm	
14au11b02	b142	0.282150	0.000037	0.005509	0.000181	0.107322	0.004136	1.467180	0.000032	3.89	40 µm	
14au11b14	b142	0.282146	0.000029	0.005448	0.000036	0.102706	0.000725	1.467176	0.000053	1.99	40 µm	
14au11c02	b142	0.282158	0.000043	0.005372	0.000042	0.108964	0.000813	1.467203	0.000058	2.36	40 µm	
14au11c12	b142	0.282167	0.000037	0.004022	0.000029	0.075713	0.000604	1.467215	0.000050	2.13	40 µm	
14au11c18	b142	0.282131	0.000044	0.006085	0.000125	0.124507	0.002323	1.467201	0.000041	2.50	40 µm	
14au11d04	b142	0.282137	0.000030	0.004990	0.000022	0.097753	0.000343	1.467199	0.000033	3.91	40 µm	
14au11d30	b142	0.282125	0.000029	0.006928	0.000070	0.143510	0.001506	1.467192	0.000031	4.13	40 µm	
14au11b03	b142	0.282158	0.000039	0.004615	0.000005	0.082890	0.000306	1.467162	0.000047	2.58	40 µm	
	average	**0.282128**										
	2SD	0.000044										
	n	25										
14ap02a03	b144	0.282118	0.000075	0.017130	0.000100	0.337272	0.001766	1.467178	0.000076	2.08	40 µm	
14ap02c02	b144	0.282067	0.000037	0.011588	0.000022	0.219313	0.000108	1.467188	0.000042	2.56	40 µm	
14ap02c81	b144	0.282142	0.000044	0.006970	0.000368	0.129117	0.007390	1.467190	0.000059	2.85	40 µm	
14au11b04	b144	0.282161	0.000052	0.014605	0.000098	0.293235	0.002633	1.467205	0.000049	2.41	40 µm	
	average	**0.282122**										
	2SD	0.000082										
	n	4										
14ap02b13	FC1	0.282169	0.000034	0.001474	0.000058	0.037445	0.001561	1.467252	0.000048	2.01	40 µm	
~~14ap02c03~~	~~FC1~~	~~0.282221~~	~~0.000050~~	~~0.001292~~	~~0.000055~~	~~0.035390~~	~~0.001317~~	~~1.467232~~	~~0.000093~~	~~3.36~~	40 µm	< 20 cycles
~~14ap02c13~~	~~FC1~~	~~0.282222~~	~~0.000072~~	~~0.001442~~	~~0.000077~~	~~0.037735~~	~~0.002172~~	~~1.467288~~	~~0.000107~~	~~1.64~~	40 µm	< 20 cycles
14ap02c32	FC1	0.282198	0.000037	0.001333	0.000005	0.035174	0.000156	1.467224	0.000061	2.22	40 µm	
14ap02c52	FC1	0.282143	0.000038	0.000797	0.000020	0.020327	0.000529	1.467240	0.000052	1.79	40 µm	
14ap02c82	FC1	0.282181	0.000049	0.000735	0.000003	0.018566	0.000094	1.467192	0.000043	2.13	40 µm	
14au11b25	FC1	0.282181	0.000040	0.000957	0.000001	0.024664	0.000045	1.467164	0.000062	2.43	40 µm	
14au11c03	FC1	0.282157	0.000031	0.000326	0.000005	0.008283	0.000147	1.467250	0.000056	2.59	40 µm	

14au11c13	FC1	0.282163	0.000034	0.000593	0.000018	0.015808	0.000534	1.467185	0.000052	2.11	40 µm	
14au11c19	FC1	0.282183	0.000035	0.000749	0.000034	0.020283	0.000993	1.467200	0.000055	1.93	40 µm	
14au11d02	FC1	0.282162	0.000028	0.001105	0.000029	0.029904	0.000859	1.467211	0.000042	3.38	40 µm	
14au11d12	FC1	0.282167	0.000021	0.000872	0.000001	0.022303	0.000022	1.467163	0.000040	3.74	40 µm	
14au11d28	FC1	0.282154	0.000020	0.000722	0.000007	0.018701	0.000208	1.467209	0.000042	3.84	40 µm	
	average	**0.282169**										
	2SD	0.000042										
	n	11										
14ap02a04	Temora-2	0.282700	0.000039	0.001121	0.000027	0.027092	0.000908	1.467226	0.000051	2.03	40 µm	
14ap02a14	Temora-2	0.282708	0.000032	0.001118	0.000038	0.026914	0.000916	1.467389	0.000051	1.91	40 µm	
14ap02a33	Temora-2	0.282704	0.000033	0.000931	0.000013	0.021331	0.000362	1.467349	0.000053	2.15	40 µm	
14ap02a52	Temora-2	0.282745	0.000049	0.000864	0.000110	0.021358	0.002885	1.467287	0.000072	1.80	40 µm	
~~14ap02b02~~	~~Temora-2~~	~~0.282595~~	~~0.000038~~	~~0.001150~~	~~0.000036~~	~~0.028210~~	~~0.000966~~	~~1.467792~~	~~0.000076~~	~~1.81~~	40 µm	invariant ratio
14ap02b12	Temora-2	0.282641	0.000033	0.001195	0.000013	0.029107	0.000466	1.467252	0.000050	1.81	40 µm	
14au11b05	Temora-2	0.282698	0.000040	0.001439	0.000039	0.035829	0.001346	1.467210	0.000055	1.59	40 µm	
14au11b15	Temora-2	0.282671	0.000042	0.001383	0.000006	0.034008	0.000133	1.467217	0.000064	1.77	40 µm	
	average	**0.282696**										
	2SD	0.000065										
	n	7										

All ratios are corrected as described in DR-1; uncertainties are expressed at 95% confidence limit.

Table DR6. SIMS oxygen ratio analyses for zircon of Kiruna, northern Sweden. $\delta^{18}O$ calculated relative to V-SMOW.

sample + mount	**ox analyses**	**grain**	**^{16}O cps (x 10^9)**	**$^{16}O_{samp/av.std}$**	**$^{18}O/^{16}O$ *drift corrected***	**± abs**	**δ18O zrc**	**± ‰**
K-1 ore								
mount 4	n4721ox_K1_@4	R1G2 C	2.60	0.99	0.00201307	0.00000023	**6.23**	**0.14**
	n4721ox_K1_@6	R1G4 C	2.61	1.00	0.00201267	0.00000032	**6.04**	**0.18**
	n4721ox_K1_@10	R1G7	2.65	1.01	0.00201217	0.00000023	**5.79**	**0.14**
	n4721ox_K1_@13	R2G3	2.63	1.00	0.00201793	0.00000034	**8.66**	**0.18**
	n4721ox_K1_@16	R2G6	2.61	1.00	0.00201312	0.00000023	**6.26**	**0.14**
	n4721ox_K1_@17	R2G7	2.56	0.98	0.00201233	0.00000032	**5.87**	**0.18**
	n4721ox_K1_@18	R2G8	2.60	0.99	0.00201569	0.00000021	**7.54**	**0.13**
	n4721ox_K1_@21	R3G3	2.67	1.02	0.00201835	0.00000074	**8.88**	**0.37**
	n4721ox_K1_@22	R3G5 C	2.53	0.96	0.00201262	0.00000021	**6.01**	**0.13**
KRN-11-03 footwall								
mount 4	n4722ox_KRN11-03_@3	R2G1	2.49	0.95	0.00201236	0.00000015	**5.88**	**0.11**
	n4722ox_KRN11-03_@5	R2G3	2.54	0.97	0.00201232	0.00000044	**5.86**	**0.23**
	n4722ox_KRN11-03_@6	R3G2 C	2.69	1.02	0.00201472	0.00000046	**7.06**	**0.24**
	n4722ox_KRN11-03_@7	R3G2 C	2.45	0.93	0.00201087	0.00000026	**5.14**	**0.15**
KRN-11-05 hanging wall								
mount 4	n4723ox_KRN11-05_@6	R1G9	2.48	0.95	0.00200594	0.00000025	**2.67**	**0.14**
	n4723ox_KRN11-05_@7	R2G1	2.53	0.96	0.00200694	0.00000017	**3.17**	**0.11**
	n4723ox_KRN11-05_@9	R2G3	2.50	0.95	0.00200804	0.00000021	**3.72**	**0.13**
	n4723ox_KRN11-05_@10	R2G4	2.50	0.95	0.00200593	0.00000025	**2.67**	**0.14**
	n4723ox_KRN11-05_@13	R3G1	2.51	0.96	0.00200890	0.00000032	**4.15**	**0.18**
	n4723ox_KRN11-05_@14	R3G2	2.57	0.98	0.00200838	0.00000029	**3.89**	**0.16**
	n4723ox_KRN11-05_@16	R3G3 C	2.52	0.96	0.00200742	0.00000025	**3.41**	**0.15**
	n4723ox_KRN11-05_@17	R3G4	2.54	0.97	0.00200586	0.00000026	**2.63**	**0.15**
	n4723ox_KRN11-05_@18	R3G5	2.54	0.97	0.00200643	0.00000013	**2.92**	**0.10**
	n4723ox_KRN11-05_@19	R3G7	2.53	0.96	0.00200788	0.00000013	**3.64**	**0.10**
	n4723ox_KRN11-05_@20	R4G1	2.56	0.97	0.00200694	0.00000030	**3.17**	**0.16**
	n4723ox_KRN11-05_@21	R4G2	2.56	0.98	0.00200719	0.00000037	**3.30**	**0.20**
mount 6	n4900ox-R1-G3	R1-G3	2.52	1.04	0.00200982	0.00000016	**4.66**	**0.18**
	n4900ox-R2-G4	R2-G4	2.40	0.99	0.00200544	0.00000025	**2.47**	**0.21**
	n4900ox-R2-G5	R2-G5	2.43	1.00	0.00200708	0.00000012	**3.29**	**0.17**
	n4900ox-R3-G1	R3-G1	2.45	1.01	0.00200584	0.00000019	**2.67**	**0.19**
	n4900ox-R3-G2a	R3-G2 a	2.41	0.99	0.00200714	0.00000021	**3.32**	**0.20**
	n4900ox-R3-G2b	R3-G2 b	2.40	0.99	0.00200559	0.00000018	**2.54**	**0.19**
	n4900ox-R3-G3	R3-G3	2.37	0.98	0.00200716	0.00000022	**3.33**	**0.20**
	n4900ox-R4-G3	R4-G3	2.29	0.94	0.00201314	0.00000032	**6.32**	**0.23**
	n4900ox-R4-G4	R4-G4	2.34	0.97	0.00200756	0.00000013	**3.53**	**0.18**
KRN-11-06 altered hanging wall								
mount 6	n4901ox-R1-G2	R1G2	2.12	0.88	0.00200603	0.00000019	**2.77**	**0.19**

	n4901ox-R1-G4	R1G4	1.87	1.19	0.00200629	0.00000016	**2.92**	**0.20**
	n4901ox-R2-G1	R2G1	2.00	0.82	0.00200704	0.00000024	**3.27**	**0.20**
	n4901ox-R2-G4	R2G4	2.08	0.86	0.00200711	0.00000025	**3.31**	**0.21**
	n4901ox-R2-G5	R2G5	2.01	0.83	0.00200553	0.00000024	**2.51**	**0.20**
	n4901ox-R3-G5	R3G5	2.04	0.84	0.00200543	0.00000017	**2.46**	**0.19**
	n4901ox-R4-G2	R4G2	2.01	0.83	0.00200598	0.00000030	**2.74**	**0.22**
KRN-12-02 intrusion								
mount 6	n4899ox-R1-G1	R1G1	1.62	1.03	0.00200612	0.00000025	**2.84**	**0.22**
	n4899ox-R1-G4	R1G4	1.60	1.02	0.00200685	0.00000020	**3.20**	**0.21**
	n4899ox-R2-G1	R2G1	1.72	1.09	0.00200589	0.00000024	**2.72**	**0.22**
	n4899ox-R2-G2	R2G2	1.70	1.08	0.00200646	0.00000015	**3.00**	**0.20**
	n4899ox-R3-G5	R3G5	1.81	1.15	0.00200631	0.00000023	**2.93**	**0.21**
	n4899ox-R4-G1a	R4G1 a	1.75	1.11	0.00200619	0.00000019	**2.87**	**0.21**
	n4899ox-R4-G1b	R4G1 b	1.78	1.13	0.00200648	0.00000013	**3.01**	**0.19**
KRN-12-03 intrusion								
mount 6	n4898ox-R4-G2	R4G2	1.58	1.01	0.00200808	0.00000042	**3.82**	**0.28**
KRN-12-05 intrusion								
mount 6	n4897ox-R1-G1	R1G1	1.26	0.80	0.00200651	0.00000025	**3.03**	**0.22**
	n4897ox-R1-G5	R1G5	1.31	0.83	0.00200653	0.00000023	**3.04**	**0.21**
	n4897ox-R2-G1	R2G1	1.22	0.78	0.00200599	0.00000039	**2.77**	**0.26**
	n4897ox-R3-G7	R3G7	1.36	0.87	0.00200771	0.00000020	**3.63**	**0.21**
	n4897ox-R4-G1	R4G1	1.60	1.02	0.00200739	0.00000024	**3.47**	**0.22**
	n4897ox-R4-G2	R4G2	1.55	0.99	0.00200885	0.00000021	**4.20**	**0.21**
	n4897ox-R4-G5	R4G5	1.53	0.97	0.00200765	0.00000031	**3.60**	**0.24**

continued on next page. C: analyses in core, R: analyses in rim; a, b two analyses in similar zone of the same grain.

sample + mount	ox analyses	grain	^{16}O cps (x 10^9)	$^{16}O_{samp/av.std}$	$^{18}O/^{16}O$ *drift corrected*	± abs	δ18O zrc	± ‰
REK-12-01 altered host rock								
mount 4	n4732ox_REK12-1_@15	R1G2	2.71	1.03	0.00200953	0.00000014	**4.47**	**0.10**
	n4732ox_REK12-1_@18	R1G4 C	2.64	1.01	0.00201308	0.00000019	**6.24**	**0.12**
	n4732ox_REK12-1_@21	R2G1	2.65	1.01	0.00200562	0.00000031	**2.51**	**0.17**
	n4732ox_REK12-1_@22	R2G3	2.70	1.03	0.00201187	0.00000020	**5.63**	**0.13**
	n4732ox_REK12-1_@24	R2G5 C	2.58	0.99	0.00201262	0.00000023	**6.01**	**0.14**
	n4732ox_REK12-1_@27	R3G1	2.67	1.02	0.00200663	0.00000019	**3.02**	**0.12**
	n4732ox_REK12-1_@28	R3G4	2.67	1.02	0.00201280	0.00000023	**6.10**	**0.14**
	n4732ox_REK12-1_@29	R4G4	2.65	1.01	0.00201049	0.00000026	**4.94**	**0.15**
	n4732ox_REK12-1_@30	R4G6	2.59	0.99	0.00201288	0.00000021	**6.14**	**0.13**
	n4732ox_REK12-1_@33	R5G3	2.65	1.01	0.00201206	0.00000021	**5.73**	**0.13**
	n4732ox_REK12-1_@35	R5G5	2.67	1.02	0.00201470	0.00000021	**7.05**	**0.13**
NUK-12-01 footwall								
mount 4	n4719ox_NUK12-1_@8	R2G1	2.63	1.00	0.00200801	0.00000033	**3.71**	**0.18**
	n4719ox_NUK12-1_@11	R2G4	2.62	1.00	0.00200705	0.00000023	**3.23**	**0.13**
	n4719ox_NUK12-1_@16	R3G2	2.49	0.95	0.00200702	0.00000037	**3.21**	**0.20**
	n4719ox_NUK12-1_@17	R3G3	2.63	1.00	0.00200854	0.00000022	**3.97**	**0.13**
	n4719ox_NUK12-1_@19	R3G6	2.61	1.00	0.00200770	0.00000027	**3.55**	**0.15**
	n4719ox_NUK12-1_@21	R3G8	2.63	1.00	0.00201102	0.00000028	**5.21**	**0.16**
	n4719ox_NUK12-1_@22	R3G9	2.58	0.98	0.00200773	0.00000019	**3.57**	**0.12**
	n4719ox_NUK12-1_@27	R4G5	2.59	0.99	0.00200853	0.00000038	**3.97**	**0.21**
	n4719ox_NUK12-1_@29	R4G8	2.47	0.94	0.00200665	0.00000023	**3.03**	**0.14**
	n4719ox_NUK12-1_@39	R1G1	2.64	1.00	0.00200634	0.00000023	**2.87**	**0.14**
	n4719ox_NUK12-1_@41	R1G3	2.63	1.00	0.00200757	0.00000030	**3.49**	**0.17**
	n4719ox_NUK12-1_@42	R1G4	2.63	1.00	0.00200758	0.00000019	**3.49**	**0.12**
	n4719ox_NUK12-1_@43	R1G5	2.67	1.02	0.00200744	0.00000022	**3.42**	**0.13**
NUK-12-02 ore								
mount 6	n4896ox-R1-G3	R1G3	2.50	1.03	0.00201410	0.00000023	**6.80**	**0.20**
	n4896ox-R1-G5	R1G5	2.53	1.04	0.00201477	0.00000019	**7.13**	**0.19**
	n4896ox-R2-G2a	R2G2	2.57	1.06	0.00201453	0.00000020	**6.97**	**0.20**
	n4896ox-R2-G2b	R2G2 R	2.51	1.03	0.00201438	0.00000014	**6.64**	**0.20**
	n4896ox-R3-G1	R3G1	2.67	1.10	0.00201145	0.00000022	**7.02**	**0.19**
	n4896ox-R3-G3	R3G3	2.50	1.03	0.00201446	0.00000014	**6.94**	**0.18**
	n4896ox-R3-G6	R3G6	2.52	1.04	0.00201443	0.00000022	**5.47**	**0.20**
	n4896ox-R4-G1	R4G1	2.61	1.07	0.00201377	0.00000022	**6.98**	**0.18**
	n4896ox-R4-G5	R4G5	2.48	1.02	0.00201523	0.00000021	**7.37**	**0.19**

C: analyses in core, R: analyses in rim; a, b two analyses in similar zone of the same grain.

Table DR7. LA-MC-ICPMS Lu-Hf isotopic analyses of zircon from Kiruna, Sweden. Strike-through data were not used due to analytical problems (see DR-1).

sample	grain	analyses	$^{176}Hf/^{177}Hf$	2SE	$^{176}Lu/^{177}Hf$	2SE	$^{176}Yb/^{177}Hf$	2SE	$^{178}Hf/^{177}Hf$	2SE	ε_{Hf} (0)	2SE	$^{176}Hf/^{177}Hf_i$	ε_{Hf} (i)	2SE	Assigned age (Ma)	Mean Hf (V)	comment
K-1	**ore**																	
mount 2	R2G1	~~14ap02b03~~	~~0.281641~~	~~0.000034~~	~~0.000768~~	~~0.000021~~	~~0.017172~~	~~0.000438~~	~~1.467554~~	~~0.000058~~	~~-40.5~~	~~1.2~~	~~0.281613~~	~~0.9~~	~~1.2~~	~~1874.1~~	~~2.2~~	invariant ratio
	R1G3	~~14ap02b04~~	~~0.281517~~	~~0.000192~~	~~0.005458~~	~~0.001155~~	~~0.140501~~	~~0.029576~~	~~1.467707~~	~~0.000106~~	~~-44.8~~	~~6.8~~	~~0.281323~~	~~-9.4~~	~~7.0~~	~~1874.1~~	~~2.6~~	< 20 cycles
	R1G1, D	14ap02b05	0.281737	0.000045	0.003032	0.000068	0.083703	0.002437	1.467263	0.000065	-37.0	1.6	0.281630	1.5	1.6	1874.1	3.1	
	R3G1	14ap02b06	0.281493	0.000057	0.001408	0.000365	0.037606	0.010444	1.467307	0.000063	-45.7	2.0	0.281443	-5.2	2.1	1874.1	2.6	
	R3G3, D	~~14ap02b07~~	~~0.281713~~	~~0.000042~~	~~0.001542~~	~~0.000270~~	~~0.039188~~	~~0.007515~~	~~1.467233~~	~~0.000101~~	~~-37.9~~	~~1.5~~	~~0.281658~~	~~2.5~~	~~1.6~~	~~1874.1~~	~~2.8~~	< 20 cycles
	R5G2	14ap02b08	0.281547	0.000046	0.001873	0.000393	0.048459	0.010343	1.467223	0.000069	-43.8	1.6	0.281481	-3.8	1.7	1874.1	2.6	
	R6G1, D	14ap02b09	0.281706	0.000037	0.001878	0.000450	0.043268	0.010283	1.467223	0.000047	-38.2	1.3	0.281639	1.8	1.5	1874.1	2.4	
	R7G2	~~14ap02b10~~	~~0.281664~~	~~0.000105~~	~~0.001208~~	~~0.000388~~	~~0.031035~~	~~0.010299~~	~~1.467261~~	~~0.000097~~	~~-39.6~~	~~3.7~~	~~0.281621~~	~~1.1~~	~~3.8~~	~~1874.1~~	~~4.0~~	< 20 cycles
mount 4	R1G2C, D	14ap02c61	0.281700	0.000043	0.0022548	0.001104	0.061994	0.034377	1.467207	0.000081	-38.4	1.5	0.281619	1.1	2.1	1874.1	2.7	
	R1G4C, D	~~14ap02c62~~	~~0.281689~~	~~0.000050~~	~~0.001133~~	~~0.000243~~	~~0.028177~~	~~0.006368~~	~~1.467211~~	~~0.000106~~	~~-38.8~~	~~1.8~~	~~0.281648~~	~~2.1~~	~~1.8~~	~~1874.1~~	~~2.9~~	< 20 cycles
	R1G7	14ap02c63	0.281574	0.000047	0.000889	0.000019	0.023140	0.000535	1.467226	0.000059	-42.8	1.7	0.281543	-1.6	1.7	1874.1	2.8	
	R2G8, D	~~14ap02c64~~	~~0.281423~~	~~0.000215~~	~~0.002368~~	~~0.000972~~	~~0.061788~~	~~0.026720~~	~~1.467318~~	~~0.000101~~	~~-48.2~~	~~7.6~~	~~0.281339~~	~~-8.9~~	~~7.7~~	~~1874.1~~	~~3.1~~	< 20 cycles
	R2G7	~~14ap02c65~~	~~0.281525~~	~~0.000072~~	~~0.001922~~	~~0.000433~~	~~0.049978~~	~~0.011856~~	~~1.467314~~	~~0.000037~~	~~-44.6~~	~~2.6~~	~~0.281456~~	~~-4.7~~	~~2.6~~	~~1874.1~~	~~2.9~~	< 20 cycles
	R3G5C	~~14ap02c66~~	~~0.281709~~	~~0.000040~~	~~0.000688~~	~~0.000047~~	~~0.016992~~	~~0.001571~~	~~1.467250~~	~~0.000091~~	~~-38.1~~	~~1.4~~	~~0.281684~~	~~3.4~~	~~1.5~~	~~1874.1~~	~~3.1~~	< 20 cycles
	R3G3	~~14ap02c67~~	~~0.281662~~	~~0.000049~~	~~0.003577~~	~~0.000373~~	~~0.083593~~	~~0.008592~~	~~1.467288~~	~~0.000098~~	~~-39.7~~	~~1.7~~	~~0.281535~~	~~-1.9~~	~~1.8~~	~~1874.1~~	~~2.8~~	< 20 cycles
	R2G3, D	~~14ap02c68~~	~~0.281535~~	~~0.000076~~	~~0.002610~~	~~0.001605~~	~~0.069058~~	~~0.041860~~	~~1.467280~~	~~0.000034~~	~~-44.2~~	~~2.7~~	~~0.281442~~	~~-5.2~~	~~3.4~~	~~1874.1~~	~~2.7~~	< 20 cycles
	R1G2R, D	14au11c04	0.281796	0.000051	0.001973	0.000411	0.048079	0.009894	1.467175	0.000074	-35.0	1.8	0.281726	4.9	1.9	1874.1	2.3	
	R1G4R, D	~~14au11c05~~	~~0.281973~~	~~0.000108~~	~~0.008912~~	~~0.000639~~	~~0.216515~~	~~0.014856~~	~~1.467230~~	~~0.000095~~	~~-28.7~~	~~3.8~~	~~0.281656~~	~~2.4~~	~~3.9~~	~~1874.1~~	~~1.6~~	< 20 cycles
	R1G6, D	~~14au11c06~~	~~0.282064~~	~~0.000205~~	~~0.007507~~	~~0.000599~~	~~0.196103~~	~~0.013059~~	~~1.467191~~	~~0.000202~~	~~-25.5~~	~~7.3~~	~~0.281796~~	~~7.4~~	~~7.3~~	~~1874.1~~	~~1.6~~	< 20 cycles
	R1G8, D	~~14au11c07~~	~~0.281676~~	~~0.000080~~	~~0.001163~~	~~0.000161~~	~~0.028221~~	~~0.003605~~	~~1.467188~~	~~0.000078~~	~~-39.2~~	~~2.8~~	~~0.281635~~	~~1.6~~	~~2.9~~	~~1874.1~~	~~2.9~~	< 20 cycles
	R1G7b	14au11c08	0.281708	0.000056	0.002503	0.000167	0.067408	0.004532	1.467207	0.000093	-38.1	2.0	0.281618	1.1	2.0	1874.1	1.5	
	R2G6	14au11c09	0.281740	0.000066	0.002436	0.000911	0.063260	0.024041	1.467119	0.000134	-37.0	2.3	0.281653	2.3	2.6	1874.1	2.4	
	R2G4C, D	14au11c10	0.281875	0.000074	0.003076	0.000572	0.076833	0.014048	1.467148	0.000082	-32.2	2.6	0.281765	6.3	2.8	1874.1	2.2	inclusion?
	R2G4R, D	14au11c11	0.282191	0.000070	0.006440	0.000055	0.150980	0.001360	1.467177	0.000101	-21.0	2.5	0.281962	13.3	2.5	1874.1	1.6	
	R3G6, D	14au11c14	0.281701	0.000062	0.000987	0.000131	0.024324	0.003568	1.467263	0.000083	-38.3	2.2	0.281666	2.8	2.2	1874.1	1.9	
	mean		**0.281731**						**1.467212**					**2.0**				
	2SD		**0.000359**						**0.000104**					**9.6**				
KRN-11-03	**footwall**																	
mount 4	R2G1	~~14ap02c70~~	~~0.281705~~	~~0.000106~~	~~0.001262~~	~~0.000036~~	~~0.028687~~	~~0.002201~~	~~1.467115~~	~~0.000117~~	~~-38.2~~	~~3.7~~	~~0.281660~~	~~2.8~~	~~3.8~~	~~1884.1~~	~~2.5~~	< 20 cycles
	R1G2	~~14ap02c71~~	~~0.281501~~	~~0.000042~~	~~0.001256~~	~~0.000068~~	~~0.028598~~	~~0.001423~~	~~1.467234~~	~~0.000101~~	~~-45.4~~	~~1.5~~	~~0.281456~~	~~-4.5~~	~~1.5~~	~~1884.1~~	~~2.7~~	< 20 cycles
	R2G3	~~14ap02c72~~	~~0.281452~~	~~0.000047~~	~~0.000728~~	~~0.000013~~	~~0.015180~~	~~0.000243~~	~~1.467260~~	~~0.000133~~	~~-47.1~~	~~1.7~~	~~0.281426~~	~~-5.5~~	~~1.7~~	~~1884.1~~	~~3.7~~	< 20 cycles
	R3G2R	14ap02c73	0.281420	0.000035	0.000631	0.000014	0.013404	0.000268	1.467193	0.000044	-48.3	1.2	0.281398	-6.5	1.3	1884.1	2.4	
	R1G2	14au11c15	0.281539	0.000056	0.001304	0.000045	0.029385	0.000831	1.467155	0.000091	-44.1	2.0	0.281492	-3.2	2.0	1884.1	2.8	
	R3G2C	14au11c16	0.281492	0.000026	0.001052	0.000028	0.024630	0.000609	1.467189	0.000045	-45.7	0.9	0.281454	-4.5	1.0	1884.1	2.2	
	R4G1	14au11c17	0.281736	0.000042	0.001122	0.000163	0.024533	0.002869	1.467155	0.000074	-37.1	1.5	0.281696	4.1	1.5	1884.1	2.5	
	Mean		**0.281547**						**1.467173**					**-2.6**				
	2SD		**0.000271**						**0.000041**					**9.2**				
KRN-11-05	**hanging wall**																	
mount 4	R2G1	14ap02c74	0.281436	0.000041	0.001519	0.000056	0.037229	0.001257	1.467217	0.000062	-47.7	1.4	0.281382	-7.2	1.5	1880.5	1.7	
	R3G2	14ap02c75	0.281413	0.000052	0.001071	0.000108	0.026422	0.002850	1.467214	0.000056	-48.5	1.8	0.281375	-7.4	1.9	1880.5	1.9	
	R3G3R	14ap02c76	0.281451	0.000029	0.001035	0.000029	0.025593	0.000653	1.467206	0.000056	-47.2	1.0	0.281414	-6.1	1.1	1880.5	2.3	
	R4G2	14ap02c77	0.281430	0.000048	0.001470	0.000291	0.032545	0.005547	1.467241	0.000061	-47.9	1.7	0.281377	-7.4	1.8	1880.5	2.2	
mount 6	R1G3	~~14ap02a36~~	~~0.281435~~	~~0.000116~~	~~0.001028~~	~~0.000032~~	~~0.024502~~	~~0.000845~~	~~1.467875~~	~~0.000030~~	~~-47.7~~	~~4.1~~	~~0.281398~~	~~-6.6~~	~~4.1~~	~~1880.5~~	~~2.0~~	< 20 cycles
	R2G4	~~14ap02a37~~	~~0.281296~~	~~0.000022~~	~~0.000874~~	~~0.000063~~	~~0.021957~~	~~0.001713~~	~~1.467784~~	~~0.000109~~	~~-52.7~~	~~0.8~~	~~0.281264~~	~~-11.4~~	~~0.8~~	~~1880.5~~	~~2.6~~	< 20 cycles
	R2G4b	~~14ap02a38~~	~~0.281380~~	~~0.000051~~	~~0.001351~~	~~0.000023~~	~~0.034887~~	~~0.000525~~	~~1.467913~~	~~0.000139~~	~~-49.7~~	~~1.8~~	~~0.281332~~	~~-9.0~~	~~1.9~~	~~1880.5~~	~~2.1~~	< 20 cycles

	R2G5	~~14ap02a39~~	~~0.281368~~	~~0.000087~~	~~0.001175~~	~~0.000065~~	~~0.028889~~	~~0.001534~~	~~1.467903~~	~~0.000088~~	~~-50.1~~	~~3.1~~	~~0.281326~~	~~-9.2~~	~~3.1~~	~~1880.5~~	~~3.1~~	< 20 cycles
	R3G1	~~14ap02a40~~	~~0.281382~~	~~0.000040~~	~~0.001767~~	~~0.000028~~	~~0.045535~~	~~0.000755~~	~~1.467877~~	~~0.000082~~	~~-49.6~~	~~1.4~~	~~0.281319~~	~~-9.4~~	~~1.4~~	~~1880.5~~	~~2.2~~	invariant ratio
	R3G1b	~~14ap02a41~~	~~0.281368~~	~~0.000033~~	~~0.000793~~	~~0.000023~~	~~0.019888~~	~~0.000657~~	~~1.467538~~	~~0.000093~~	~~-50.1~~	~~1.2~~	~~0.281340~~	~~-8.7~~	~~1.2~~	~~1880.5~~	~~2.8~~	< 20 cycles
	R3G2a, D	14ap02a43	0.281436	0.000042	0.000808	0.000079	0.019782	0.002037	1.467403	0.000063	-47.7	1.5	0.281407	-6.3	1.5	1880.5	2.1	
	R3G2b	14ap02a44	0.281441	0.000035	0.001363	0.000082	0.034848	0.002180	1.467334	0.000050	-47.5	1.3	0.281392	-6.8	1.3	1880.5	2.2	
	R3G3	~~14ap02a45~~	~~0.281509~~	~~0.000110~~	~~0.003450~~	~~0.000177~~	~~0.090653~~	~~0.004616~~	~~1.467334~~	~~0.000088~~	~~-45.1~~	~~3.9~~	~~0.281386~~	~~-7.0~~	~~3.9~~	~~1880.5~~	~~2.4~~	< 20 cycles
	R4G1	~~14ap02a46~~	~~0.281474~~	~~0.000050~~	~~0.001333~~	~~0.000007~~	~~0.034725~~	~~0.000160~~	~~1.467338~~	~~0.000091~~	~~-46.4~~	~~1.8~~	~~0.281427~~	~~-5.6~~	~~1.8~~	~~1880.5~~	~~3.3~~	< 20 cycles

continued on next pages. C: analyses in core, R: analyses in rim; a, b two analyses in similar zone of the same grain; D: > 5% discordant at 2σ level. All data are corrected as described in DR-1.

sample	grain	analyses	$^{176}Hf/^{177}Hf$	2SE	$^{176}Lu/^{177}Hf$	2SE	$^{176}Yb/^{177}Hf$	2SE	$^{178}Hf/^{177}Hf$	2SE	ε_{Hf} (0)	2SE	$^{176}Hf/^{177}Hf_i$	ε_{Hf} (i)	2SE	Assigned age (Ma)	Mean Hf (V)	comment
KRN-11-05	**hanging wall - continued**																	
mount 6	*R4G3*	*14ap02a47*	*0.282141*	*0.000024*	*0.000413*	*0.000095*	*0.009971*	*0.002132*	*1.467266*	*0.000055*	*-22.8*	*0.8*	*0.282126*	*7.2*	*0.9*	*1349.0*	*3.7*	*contamination?*
	R4G4	14ap02a48	0.281410	0.000046	0.001155	0.000060	0.029634	0.001616	1.467318	0.000052	-48.6	1.6	0.281368	-7.7	1.6	1880.5	2.7	
	mean		**0.281431**						**1.467276**					**-7.0**				
	2SD		**0.000030**						**0.000152**					**1.2**				
KRN-11-06	**altered hanging wall**																	
	R1G2	~~14ap02a28~~	~~0.281367~~	~~0.000035~~	~~0.001118~~	~~0.000052~~	~~0.027630~~	~~0.001427~~	~~1.467502~~	~~0.000074~~	~~-50.2~~	~~1.2~~	~~0.281327~~	~~-9.2~~	~~1.3~~	~~1880.1~~	~~2.7~~	< 20 cycles
	R1G4	~~14ap02a29~~	~~0.281559~~	~~0.000097~~	~~0.002816~~	~~0.000150~~	~~0.073717~~	~~0.004129~~	~~1.467478~~	~~0.000045~~	~~-43.3~~	~~3.4~~	~~0.281459~~	~~-4.5~~	~~3.5~~	~~1880.1~~	~~2.8~~	< 20 cycles
	R2G4	~~14ap02a30~~	~~0.281432~~	~~0.000042~~	~~0.001123~~	~~0.000043~~	~~0.028141~~	~~0.001144~~	~~1.467466~~	~~0.000060~~	~~-47.9~~	~~1.5~~	~~0.281392~~	~~-6.9~~	~~1.5~~	~~1880.1~~	~~2.9~~	< 20 cycles
	R2G1	14ap02a31	0.281434	0.000048	0.000953	0.000073	0.023822	0.001910	1.467413	0.000051	-47.8	1.7	0.281400	-6.6	1.7	1880.1	2.2	
	R3G5	~~14ap02a34~~	~~0.281442~~	~~0.000044~~	~~0.000769~~	~~0.000012~~	~~0.018952~~	~~0.000343~~	~~1.467408~~	~~0.000090~~	~~-47.5~~	~~1.6~~	~~0.281415~~	~~-6.0~~	~~1.6~~	~~1880.1~~	~~2.9~~	< 20 cycles
	R4G2	~~14ap02a35~~	~~0.281387~~	~~0.000031~~	~~0.000723~~	~~0.000027~~	~~0.017377~~	~~0.000651~~	~~1.467618~~	~~0.000068~~	~~-49.4~~	~~1.1~~	~~0.281362~~	~~-7.9~~	~~1.2~~	~~1880.1~~	~~2.5~~	invariant ratio
	R2G4b	~~14au11b16~~	~~0.281560~~	~~0.000061~~	~~0.001419~~	~~0.000127~~	~~0.036837~~	~~0.003490~~	~~1.467216~~	~~0.000117~~	~~-43.3~~	~~2.2~~	~~0.281510~~	~~-2.7~~	~~2.2~~	~~1880.1~~	~~2.3~~	< 20 cycles
	R2G5	~~14au11b17~~	~~0.281563~~	~~0.000100~~	~~0.000913~~	~~0.000033~~	~~0.023044~~	~~0.000945~~	~~1.467306~~	~~0.000180~~	~~-43.2~~	~~3.6~~	~~0.281530~~	~~-1.9~~	~~3.6~~	~~1880.1~~	~~1.4~~	< 20 cycles
	R4G2b	14au11b18	0.281393	0.000050	0.001009	0.000041	0.024671	0.001197	1.467165	0.000079	-49.2	1.8	0.281357	-8.1	1.8	1880.1	1.7	
	R2G1b	~~14au11b19~~	~~0.281388~~	~~0.000062~~	~~0.001071~~	~~0.000087~~	~~0.027665~~	~~0.002362~~	~~1.467176~~	~~0.000120~~	~~-49.4~~	~~2.2~~	~~0.281350~~	~~-8.3~~	~~2.2~~	~~1880.1~~	~~2.0~~	< 20 cycles
	Mean		**0.281413**						**1.467289**					**-7.3**				
	2SD		**0.000058**						**0.000350**					**2.2**				
KRN-12-02	**intrusion**																	
	R1G1	14ap02a49	0.281442	0.000067	0.001391	0.000025	0.035829	0.000697	1.467356	0.000057	-47.5	2.4	0.281392	-6.8	2.4	1880.6	2.0	
	R1G1b	~~14ap02a50~~	~~0.281401~~	~~0.000058~~	~~0.001893~~	~~0.000041~~	~~0.049115~~	~~0.001160~~	~~1.467356~~	~~0.000111~~	~~-49.0~~	~~2.1~~	~~0.281333~~	~~-8.9~~	~~2.1~~	~~1880.6~~	~~2.7~~	< 20 cycles
	R1G3, D	14ap02a53	0.281520	0.000040	0.002878	0.000161	0.081595	0.005294	1.467254	0.000063	-44.7	1.4	0.281417	-5.9	1.4	1880.6	2.3	
	R1G4	14ap02a54	0.281470	0.000043	0.001454	0.000036	0.037123	0.000935	1.467195	0.000060	-46.5	1.5	0.281419	-5.9	1.5	1880.6	2.0	
	R2G1	14ap02a55	0.281470	0.000035	0.002036	0.000052	0.053801	0.001615	1.467215	0.000074	-46.5	1.2	0.281397	-6.6	1.2	1880.6	1.9	
	R2G2	14ap02a56	0.281401	0.000041	0.001108	0.000016	0.028441	0.000404	1.467264	0.000057	-49.0	1.5	0.281361	-7.9	1.5	1880.6	2.2	
	R3G5	14ap02a57	0.281418	0.000032	0.001207	0.000015	0.030919	0.000331	1.467259	0.000054	-48.3	1.1	0.281375	-7.4	1.1	1880.6	2.3	
	R4G1a	14ap02a58	0.281399	0.000031	0.001546	0.000013	0.040923	0.000304	1.467204	0.000058	-49.0	1.1	0.281344	-8.5	1.1	1880.6	2.0	
	R4G b	14ap02a59	0.281419	0.000036	0.001358	0.000039	0.034606	0.001049	1.467177	0.000055	-48.3	1.3	0.281370	-7.6	1.3	1880.6	1.7	
	R4G4, D	~~14ap02a60~~	~~0.281669~~	~~0.000265~~	~~0.002167~~	~~0.000090~~	~~0.058502~~	~~0.002819~~	~~1.467071~~	~~0.000173~~	~~-39.5~~	~~9.4~~	~~0.281591~~	~~0.3~~	~~9.4~~	~~1880.6~~	~~4.1~~	< 20 cycles
	mean		**0.281443**						**1.467241**					**-7.1**				
	2SD		**0.000084**						**0.000135**					**2.1**				
KRN-12-03	**intrusion**																	
	R4G2	14ap02a61	0.281442	0.000053	0.001137	0.000054	0.031664	0.001740	1.467159	0.000067	-47.5	1.9	0.281401	-6.5	1.9	1880.6	1.7	
	R1G3, D	14au11b20	0.281479	0.000049	0.001726	0.000032	0.054684	0.001159	1.467180	0.000063	-46.2	1.7	0.281418	-5.9	1.8	1880.6	1.4	
	R2G2, D	14au11b21	0.281520	0.000040	0.002674	0.000130	0.088806	0.004302	1.467160	0.000071	-44.7	1.4	0.281425	-5.7	1.5	1880.6	1.7	
	R2G3, D	14au11b22	0.281628	0.000064	0.003676	0.000164	0.107500	0.008138	1.467125	0.000135	-40.9	2.3	0.281497	-3.1	2.3	1880.6	1.8	
	R3G2, D	14au11b23	0.281469	0.000041	0.002608	0.000149	0.082511	0.005406	1.467219	0.000074	-46.5	1.5	0.281376	-7.4	1.5	1880.6	1.6	
	mean		**0.281508**						**1.467169**					**-5.7**				
	2SD		**0.000146**						**0.000068**					**3.2**				
KRN-12-05	**intrusion**																	

mount 6	R1G1	~~14ap02a05~~	~~0.281258~~	~~0.000022~~	~~0.001147~~	~~0.000044~~	~~0.028742~~	~~0.001087~~	~~1.467216~~	~~0.000077~~	~~-54.0~~	0.8	0.281218	~~-13.2~~	~~0.8~~	~~1874.2~~	~~3.7~~	< 20 cycles
	R1G1b	~~14ap02a06~~	~~0.281229~~	~~0.000057~~	~~0.001187~~	~~0.000026~~	~~0.029562~~	~~0.000711~~	~~1.467216~~	~~0.000068~~	~~-55.0~~	2.0	0.281186	~~-14.3~~	~~2.0~~	~~1874.2~~	~~3.8~~	< 20 cycles
	R1G5	14ap02a07	0.281448	0.000041	0.001037	0.000067	0.026366	0.001758	1.467209	0.000056	-47.3	1.5	0.281412	-6.3	1.5	1874.2	2.5	
	R2G1	14ap02a08	0.281423	0.000041	0.001452	0.000030	0.036464	0.000890	1.467166	0.000093	-48.2	1.4	0.281371	-7.7	1.5	1874.2	2.3	
	R3G7	14ap02a09	0.281419	0.000048	0.002651	0.000043	0.068219	0.001062	1.467246	0.000071	-48.3	1.7	0.281324	-9.4	1.7	1874.2	1.7	
	R4G5	14ap02a10	0.281216	0.000058	0.001447	0.000050	0.035168	0.001255	1.467857	0.000060	-55.5	2.1	0.281164	-9.5	1.3	1874.2	3.0	
	R4G4, D	14ap02a11	0.281383	0.000042	0.001738	0.000166	0.044915	0.004516	1.467345	0.000062	-49.6	1.5	0.281321	-7.5	1.1	1874.2	2.7	
	R4G1	14ap02a12	0.281371	0.000035	0.001372	0.000016	0.035381	0.000495	1.467343	0.000062	-50.0	1.2	0.281322	-9.5	1.5	1874.2	2.0	
	R4G2	~~14ap02a15~~	~~0.281423~~	~~0.000031~~	~~0.001269~~	~~0.000064~~	~~0.032198~~	~~0.001763~~	~~1.467356~~	~~0.000039~~	~~-48.2~~	~~1.1~~	~~0.281378~~	~~-15.1~~	~~2.1~~	~~1874.2~~	~~2.0~~	< 20 cycles
	R5G2, D	~~14ap02a16~~	~~0.281410~~	~~0.000056~~	~~0.001406~~	~~0.000041~~	~~0.035008~~	~~0.000980~~	~~1.467775~~	~~0.000076~~	~~-48.6~~	~~2.0~~	~~0.281360~~	~~-8.1~~	~~2.0~~	~~1874.2~~	~~2.8~~	< 20 cycles
	R5G6	~~14ap02a17~~	~~0.281403~~	~~0.000025~~	~~0.001047~~	~~0.000043~~	~~0.026762~~	~~0.001247~~	~~1.467690~~	~~0.000067~~	~~-48.9~~	~~0.9~~	~~0.281366~~	~~-7.9~~	~~0.9~~	~~1874.2~~	~~2.9~~	< 20 cycles
mount 4	R5G7	14ap02c78	0.281431	0.000044	0.001771	0.000038	0.045726	0.001170	1.467227	0.000058	-47.9	1.6	0.281368	-7.8	1.6	1874.2	1.5	
	R4G7	14ap02c79	0.281310	0.000041	0.001494	0.000104	0.036782	0.002516	1.467237	0.000082	-52.1	1.5	0.281257	-11.8	1.5	1874.2	1.9	
	mean		**0.281398**						**1.467253**					**-8.6**				
	2SD		**0.000094**						**0.000134**					**3.6**				

continued on next page. C: analyses in core, R: analyses in rim; a, b two analyses in similar zone of the same grain; D: > 5% discordant at 2σ level. All data are corrected as described in DR-1.

sample	grain	analyses	$^{176}Hf/^{177}Hf$	2SE	$^{176}Lu/^{177}Hf$	2SE	$^{176}Yb/^{177}Hf$	2SE	$^{178}Hf/^{177}Hf$	2SE	ε_{Hf} (0)	2SE	$^{176}Hf/^{177}Hf_i$	ε_{Hf} (i)	2SE	Assigned age (Ma)	Mean Hf (V)	comment
REK-12-01	**altered host rock**																	
	R1G2	14ap02c14	0.281637	0.000032	0.000792	0.000031	0.019527	0.000799	1.467280	0.000049	-40.6	1.1	0.281609	0.8	1.2	1876.2	1.8	
	R1G4C	14ap02c15	0.281635	0.000030	0.000702	0.000041	0.018700	0.001370	1.467245	0.000044	-40.7	1.1	0.281610	0.8	1.1	1876.2	1.9	
	R2G2	14ap02c16	0.281678	0.000041	0.001303	0.000060	0.035004	0.001517	1.467223	0.000061	-39.1	1.5	0.281632	1.6	1.5	1876.2	1.6	
	R2G3	14ap02c17	0.281635	0.000034	0.000890	0.000012	0.022096	0.000371	1.467192	0.000070	-40.7	1.2	0.281604	0.6	1.3	1876.2	2.4	
	R2G4, D	14ap02c18	0.281647	0.000038	0.000744	0.000020	0.018511	0.000492	1.467292	0.000057	-40.2	1.3	0.281621	1.2	1.4	1876.2	2.6	
	R2G5C	14ap02c19	0.281642	0.000043	0.001047	0.000056	0.026374	0.001631	1.467213	0.000061	-40.4	1.5	0.281605	0.6	1.6	1876.2	1.7	
	R4G6	~~14ap02c20~~	~~0.281668~~	~~0.000094~~	~~0.000994~~	~~0.000048~~	~~0.025007~~	~~0.001492~~	~~1.467191~~	~~0.000084~~	~~-39.5~~	~~3.4~~	~~0.281632~~	~~1.6~~	~~3.4~~	~~1876.2~~	~~3.7~~	< 20 cycles
	R4G4	14ap02c21	0.281579	0.000043	0.001012	0.000078	0.025609	0.002133	1.467247	0.000064	-42.6	1.5	0.281543	-1.6	1.6	1876.2	2.7	
	R3G4	14ap02c23	0.281257	0.000033	0.000627	0.000103	0.011971	0.001837	1.467509	0.000068	-54.0	1.2	0.281235	-12.5	1.2	1876.2	2.1	
	R3G1	14ap02c24	0.281389	0.000056	0.001670	0.000272	0.050002	0.009429	1.467913	0.000104	-49.4	2.0	0.281330	-9.2	2.0	1876.2	2.3	
	R5G3	~~14ap02c25~~	~~0.280703~~	~~0.000046~~	~~0.000903~~	~~0.000024~~	~~0.024051~~	~~0.000904~~	~~1.473333~~	~~0.000702~~	~~-73.6~~	~~1.6~~	~~0.280671~~	~~-32.6~~	~~1.7~~	~~1876.2~~	~~2.1~~	< 20 cycles
	R5G5	14ap02c26	0.281665	0.000026	0.000998	0.000006	0.026254	0.000230	1.467236	0.000062	-39.6	0.9	0.281630	1.5	1.0	1876.2	2.0	
	mean		**0.281577**						**1.467335**					**-1.6**				
	2SD		**0.000279**						**0.000443**					**10.0**				
NUK-12-01	**footwall**																	
	R1G1	~~14ap02c27~~	~~0.281557~~	~~0.000097~~	~~0.001600~~	~~0.000098~~	~~**0.040891**~~	~~0.002410~~	~~1.467220~~	~~0.000155~~	~~-43.4~~	~~3.4~~	~~0.281500~~	~~-3.0~~	~~3.5~~	~~1881.7~~	~~2.1~~	< 20 cycles
	R1G3	14ap02c28	0.281428	0.000050	0.001177	0.000114	0.029567	0.002929	1.467219	0.000070	-48.0	1.8	0.281387	-7.0	1.8	1881.7	2.2	
	R1G4	~~14ap02c29~~	~~0.281457~~	~~0.000055~~	~~0.001036~~	~~0.000076~~	~~0.025283~~	~~0.001692~~	~~1.467249~~	~~0.000106~~	~~-47.0~~	~~1.9~~	~~0.281420~~	~~-5.8~~	~~2.0~~	~~1881.7~~	~~2.6~~	< 20 cycles
	R1G5	14ap02c30	0.281420	0.000039	0.001092	0.000064	0.024596	0.001409	1.467242	0.000049	-48.3	1.4	0.281381	-7.2	1.4	1881.7	2.4	
	R2G1	~~14ap02c33~~	~~0.281435~~	~~0.000068~~	~~0.001121~~	~~0.000123~~	~~0.028118~~	~~0.003309~~	~~1.467229~~	~~0.000181~~	~~-47.7~~	~~2.4~~	~~0.281395~~	~~-6.7~~	~~2.4~~	~~1881.7~~	~~2.7~~	< 20 cycles
	R3G2	14ap02c34	0.281385	0.000031	0.001146	0.000012	0.028488	0.000382	1.467187	0.000060	-49.5	1.1	0.281344	-8.5	1.1	1881.7	2.3	
	R3G3	~~14ap02c35~~	~~0.281436~~	~~0.000036~~	~~0.001395~~	~~0.000189~~	~~0.034431~~	~~0.005721~~	~~1.467162~~	~~0.000077~~	~~-47.7~~	~~1.3~~	~~0.281386~~	~~-7.0~~	~~1.4~~	~~1881.7~~	~~2.5~~	< 20 cycles
	R3G6	14ap02c36	0.281442	0.000046	0.001054	0.000053	0.026136	0.001374	1.467205	0.000078	-47.5	1.6	0.281404	-6.4	1.7	1881.7	1.8	
	R2G4	~~14ap02c37~~	~~0.281462~~	~~0.000099~~	~~0.001636~~	~~0.000151~~	~~0.041077~~	~~0.004196~~	~~1.467181~~	~~0.000104~~	~~-46.8~~	~~3.5~~	~~0.281404~~	~~-6.4~~	~~3.5~~	~~1881.7~~	~~2.7~~	< 20 cycles
	R3G8	14ap02c38	0.281422	0.000025	0.001238	0.000039	0.026178	0.000904	1.467224	0.000068	-48.2	0.9	0.281378	-7.3	0.9	1881.7	3.4	
	R3G9	14ap02c39	0.281423	0.000045	0.001503	0.000157	0.039946	0.005488	1.467236	0.000056	-48.2	1.6	0.281369	-7.6	1.6	1881.7	1.8	
	R4G8	14ap02c40	0.281456	0.000045	0.001305	0.000094	0.032688	0.002353	1.467259	0.000068	-47.0	1.6	0.281409	-6.2	1.6	1881.7	2.1	
	R4G5	~~14ap02c41~~	~~0.281377~~	~~0.000037~~	~~0.001166~~	~~0.000011~~	~~0.029433~~	~~0.000363~~	~~1.467158~~	~~0.000061~~	~~-49.8~~	~~1.3~~	~~0.281336~~	~~-8.8~~	~~1.4~~	~~1881.7~~	~~2.7~~	< 20 cycles
	mean		**0.281425**						**1.467225**					**-7.2**				
	2SD		**0.000044**						**0.000048**					**1.6**				
NUK-12-02	**ore**																	
	R1G3	~~14ap02a18~~	~~0.281610~~	~~0.000025~~	~~0.000958~~	~~0.000128~~	~~0.024211~~	~~0.003351~~	~~1.467801~~	~~0.000048~~	~~-41.6~~	~~0.9~~	~~0.281575~~	~~-0.4~~	~~0.9~~	~~1877.1~~	~~2.6~~	invariant ratio

R1G5	14ap02a19	0.281604	0.000023	0.000593	0.000083	0.015572	0.002526	1.467560	0.000041	-41.8	0.8	0.281582	-0.2	0.8	1877.1	2.5	
R2G2	14ap02a20	0.281651	0.000037	0.001085	0.000114	0.030696	0.003495	1.467401	0.000047	-40.1	1.3	0.281613	0.9	1.3	1877.1	2.0	
R3G1	14ap02a21	0.281697	0.000030	0.001274	0.000089	0.032684	0.002392	1.467333	0.000049	-38.5	1.1	0.281651	2.3	1.1	1877.1	2.0	
R3G3	14ap02a22	0.281636	0.000036	0.000757	0.000011	0.019535	0.000276	1.467333	0.000054	-40.6	1.3	0.281609	0.8	1.3	1877.1	2.2	
R3G6	~~14ap02a24~~	~~0.281505~~	~~0.000030~~	~~0.000566~~	~~0.000038~~	~~0.014280~~	~~0.001047~~	~~1.468535~~	~~0.000126~~	~~-45.3~~	~~1.1~~	~~0.281484~~	~~-3.6~~	~~1.1~~	~~1877.1~~	~~2.5~~	invariant ratio
R4G5	~~14ap02a25~~	~~0.281477~~	~~0.000034~~	~~0.000569~~	~~0.000050~~	~~0.014658~~	~~0.001409~~	~~1.468710~~	~~0.000082~~	~~-46.2~~	~~1.2~~	~~0.281457~~	~~-4.6~~	~~1.2~~	~~1877.1~~	~~2.2~~	invariant ratio
R4G2a	~~14ap02a26~~	~~0.281576~~	~~0.000029~~	~~0.000475~~	~~0.000034~~	~~0.011545~~	~~0.000858~~	~~1.467801~~	~~0.000056~~	~~-42.8~~	~~1.0~~	~~0.281559~~	~~-1.0~~	~~1.1~~	~~1877.1~~	~~2.8~~	invariant ratio
R4G1	~~14ap02a27~~	~~0.281559~~	~~0.000031~~	~~0.000582~~	~~0.000051~~	~~0.015017~~	~~0.001621~~	~~1.467922~~	~~0.000049~~	~~-43.4~~	~~1.1~~	~~0.281538~~	~~-1.7~~	~~1.1~~	~~1877.1~~	~~2.3~~	invariant ratio
R1G1, D	14au11b06	0.281648	0.000028	0.001130	0.000033	0.030685	0.001138	1.467115	0.000053	-40.2	1.0	0.281608	0.7	1.0	1877.1	2.4	
R1G4, D	14au11b07	0.281673	0.000051	0.001749	0.000223	0.044623	0.005774	1.467137	0.000054	-39.3	1.8	0.281611	0.9	1.9	1877.1	2.1	
R2G6, D	14au11b08	0.281589	0.000033	0.000347	0.000015	0.008410	0.000448	1.467216	0.000071	-42.3	1.2	0.281576	-0.4	1.2	1877.1	1.8	
R2G2R	14au11b09	0.281651	0.000029	0.000528	0.000030	0.013397	0.000807	1.467196	0.000064	-40.1	1.0	0.281632	1.6	1.1	1877.1	2.4	
R3G1b	14au11b10	0.281707	0.000042	0.001790	0.000228	0.045977	0.006221	1.467181	0.000062	-38.1	1.5	0.281644	2.0	1.5	1877.1	2.0	inclusion?
R4G1b	14au11b11	0.281684	0.000027	0.000446	0.000006	0.011132	0.000162	1.467198	0.000072	-38.9	0.9	0.281668	2.9	1.0	1877.1	2.5	
R4G3	14au11b12	0.281673	0.000032	0.000794	0.000100	0.020716	0.002806	1.467166	0.000048	-39.3	1.1	0.281645	2.1	1.2	1877.1	2.0	
R4G4	14au11b13	0.281595	0.000042	0.001034	0.000108	0.030007	0.004795	1.467216	0.000056	-42.1	1.5	0.281558	-1.0	1.5	1877.1	2.0	inclusion?
mean		**0.281651**						**1.467254**					**1.1**				
2SD		**0.000078**						**0.000258**					**2.3**				

C: analyses in core, R: analyses in rim; a, b two analyses in similar zone of the same grain; D: > 5% discordant at 2σ level. All data are corrected as described in DR-1.

Table DR8. Summary SIMS U-Pb dates, oxygen analyses and LA-MC-ICPMS Lu-Hf ratios of zircon from Kiruna for individual grains.

sample	grain	Age zrc (Ma)	± 1σ	Disc. % 2σ limit	ox analyses #	$\delta^{18}O$ zrc	± ‰	Hf analyses #	$^{176}Hf/^{177}Hf$	2SE	$^{176}Lu/^{177}Hf$	2SE	ε_{Hf} (0)	2SE	$^{176}Hf/^{177}Hf$ (i)	ε_{Hf} (i)	2SE
K-1 ore		1874.1	7.1														
mount 4	R1G2 C	1852.3	3.1	-8.0	n4721ox_K1_@4	6.23	0.14	14ap02c61	0.281700	0.000043	0.002255	0.001104	-38.4	1.5	0.2816193	1.1	2.1
	R1G4 C	1863.4	4.0	-5.5	n4721ox_K1_@6	6.04	0.18	~~14ap02c62~~	~~0.281689~~	~~0.000050~~	~~0.001133~~	~~0.000243~~	~~-38.8~~	~~1.8~~	~~0.2816484~~	~~2.1~~	~~1.8~~
	R1G7	1877.0	3.1	-0.7	n4721ox_K1_@10	5.79	0.14	14ap02c63	0.281574	0.000047	0.000889	0.000019	-42.8	1.7	0.2815425	-1.6	1.7
	R2G3	1860.9	4.4	-7.4	n4721ox_K1_@13	8.66	0.18	~~14ap02c68~~	~~0.281535~~	~~0.000076~~	~~0.002610~~	~~0.001605~~	~~-44.2~~	~~2.7~~	~~0.2814421~~	~~-5.2~~	~~3.4~~
	R2G6	1876.5	3.2	-1.8	n4721ox_K1_@16	6.26	0.14	14au11c09	0.281740	0.000066	0.002436	0.000911	-37.0	2.3	0.2816533	2.3	2.6
	R2G7	1869.2	7.1	-0.3	n4721ox_K1_@17	5.87	0.18	~~14ap02c65~~	~~0.281525~~	~~0.000072~~	~~0.001922~~	~~0.000433~~	~~-44.6~~	~~2.6~~	~~0.2814564~~	~~-4.7~~	~~2.6~~
	R2G8	1850.9	3.4	-10.0	n4721ox_K1_@18	7.54	0.13	~~14ap02c64~~	~~0.281423~~	~~0.000215~~	~~0.002368~~	~~0.000972~~	~~-48.2~~	~~7.6~~	~~0.2813389~~	~~-8.9~~	~~7.7~~
	R3G3	1871.7	4.0	-2.0	n4721ox_K1_@21	8.88	0.37	~~14ap02c67~~	~~0.281662~~	~~0.000049~~	~~0.003577~~	~~0.000373~~	~~-39.7~~	~~1.7~~	~~0.2815351~~	~~-1.9~~	~~1.8~~
	R3G5 C	1883.5	2.7	-2.2	n4721ox_K1_@22	6.01	0.13	~~14ap02c66~~	~~0.281709~~	~~0.000040~~	~~0.000688~~	~~0.000047~~	~~-38.1~~	~~1.4~~	~~0.2816842~~	~~3.4~~	~~1.5~~
KRN-11-03 footwall		1884.1	3.7														
mount 4	R2G1	1885.7	4.2	-0.1	n4722ox_KRN11-03_@3	5.88	0.11	~~14ap02c70~~	~~0.281705~~	~~0.000106~~	~~0.001262~~	~~0.000036~~	~~-38.2~~	~~3.7~~	~~0.2816600~~	~~2.8~~	~~3.8~~
	R2G3	1881.5	3.2	-0.4	n4722ox_KRN11-03_@5	5.86	0.23	~~14ap02c72~~	~~0.281452~~	~~0.000047~~	~~0.000728~~	~~0.000013~~	~~-47.1~~	~~1.7~~	~~0.2814261~~	~~-5.5~~	~~1.7~~
	R3G2 C	1889.3	4.7	-0.2	n4722ox_KRN11-03_@6	7.06	0.24	14au11c16	0.281492	0.000026	0.001052	0.000028	-45.7	0.9	0.2814543	-4.5	1.0
	R3G2 R	1883.3	3.4	0.0	n4722ox_KRN11-03_@7	5.14	0.15	14ap02c73	0.281420	0.000035	0.000631	0.000014	-48.3	1.2	0.2813978	-6.5	1.3
KRN-11-05 hanging wall		1880.5	4.5														
mount 4	R2G1	1889.5	5.7	-0.5	n4723ox_KRN11-05_@7	3.17	0.11	14ap02c74	0.281436	0.000041	0.001519	0.000056	-47.7	1.4	0.2813818	-7.2	1.5
	R3G2	1891.4	7.7	-0.1	n4723ox_KRN11-05_@14	3.89	0.16	14ap02c75	0.281413	0.000052	0.001071	0.000108	-48.5	1.8	0.2813749	-7.4	1.9
	R3G3 R	1875.6	4.2	0.0	n4723ox_KRN11-05_@16	3.41	0.15	14ap02c76	0.281451	0.000029	0.001035	0.000029	-47.2	1.0	0.2814138	-6.1	1.1
	R4G2	1877.1	3.9	0.0	n4723ox_KRN11-05_@21	3.30	0.20	14ap02c77	0.281430	0.000048	0.001470	0.000291	-47.9	1.7	0.2813770	-7.4	1.8

mount 6	R1G3	1878.9	7.3	-0.7	n4900ox-R1-G3	4.66	0.18	~~14ap02a36~~	~~0.281435~~	~~0.000116~~	~~0.001028~~	~~0.000032~~	~~-47.7~~	~~4.1~~	~~0.2813982~~	~~-6.6~~	~~4.1~~
	R2G4	1883.3	7.3	0.0	n4900ox-R2-G4	2.47	0.21	~~14ap02a37~~	~~0.281296~~	~~0.000022~~	~~0.000874~~	~~0.000063~~	~~-52.7~~	~~0.8~~	~~0.2812644~~	~~-11.4~~	~~0.8~~
	R2G5	1871.0	8.4	0.0	n4900ox-R2-G5	3.29	0.17	~~14ap02a39~~	~~0.281368~~	~~0.000087~~	~~0.001175~~	~~0.000065~~	~~-50.1~~	~~3.1~~	~~0.2813259~~	~~-9.2~~	~~3.1~~
	R3G1	1871.7	6.4	0.0	n4900ox-R3-G1	2.67	0.19	~~14ap02a40~~	~~0.281382~~	~~0.000040~~	~~0.001767~~	~~0.000028~~	~~-49.6~~	~~1.4~~	~~0.2813193~~	~~-9.4~~	~~1.4~~
	R3G2 a	1840.6	9.5	-47.0	n4900ox-R3-G2a	3.32	0.20	14ap02a43	0.281436	0.000042	0.000808	0.000079	-47.7	1.5	0.2814070	-6.3	1.5
	R3G2 b	1885.8	8.5	0.0	n4900ox-R3-G2b	2.54	0.19	14ap02a44	0.281441	0.000035	0.001363	0.000082	-47.5	1.3	0.2813919	-6.8	1.3
	R3G3	1884.6	4.3	0.0	n4900ox-R3-G3	3.33	0.20	~~14ap02a45~~	~~0.281509~~	~~0.000110~~	~~0.003450~~	~~0.000177~~	~~-45.1~~	~~3.9~~	~~0.2813860~~	~~-7.0~~	~~3.9~~
	R4G3	1349.0	13.1	0.0	n4900ox-R4-G3	6.32	0.23	14ap02a47	0.282141	0.000024	0.000413	0.000095	-22.8	0.8	0.2821258	7.2	0.9
	R4G4	1880.1	5.4	0.0	n4900ox-R4-G4	3.53	0.18	14ap02a48	0.281410	0.000046	0.001155	0.000060	-48.6	1.6	0.2813684	-7.7	1.6
KRN-11-06 altered hanging wall		1880.1	2.7														
mount 6	R1G2	1885.4	6.3	0.0	n4901ox-R1-G2	2.77	0.19	~~14ap02a28~~	~~0.281367~~	~~0.000035~~	~~0.001118~~	~~0.000052~~	~~-50.2~~	~~1.2~~	~~0.2813269~~	~~-9.2~~	~~1.3~~
	R1G4	1888.0	5.3	-0.8	n4901ox-R1-G4	2.92	0.20	~~14ap02a29~~	~~0.281559~~	~~0.000097~~	~~0.002816~~	~~0.000150~~	~~-43.3~~	~~3.4~~	~~0.2814590~~	~~-4.5~~	~~3.5~~
	R2G1	1871.0	9.8	-1.3	n4901ox-R2-G1	3.27	0.20	14ap02a31	0.281434	0.000048	0.000953	0.000073	-47.8	1.7	0.2813997	-6.6	1.7
	R2G4	1890.9	7.1	0.0	n4901ox-R2-G4	3.31	0.21	~~14ap02a30~~	~~0.281432~~	~~0.000042~~	~~0.001123~~	~~0.000043~~	~~-47.9~~	~~1.5~~	~~0.2813916~~	~~-6.9~~	~~1.5~~
	R2G5	1880.4	9.6	0.0	n4901ox-R2-G5	2.51	0.20	~~14au11b17~~	~~0.281563~~	~~0.000100~~	~~0.000913~~	~~0.000033~~	~~-43.2~~	~~3.6~~	~~0.2815301~~	~~-1.9~~	~~3.6~~
	R3G5	1956.7	15.2	0.0	n4901ox-R3-G5	2.46	0.19	~~14ap02a34~~	~~0.281442~~	~~0.000044~~	~~0.000769~~	~~0.000012~~	~~-47.5~~	~~1.6~~	~~0.2814150~~	~~-6.0~~	~~1.6~~
	R4G2	1884.0	9.5	0.0	n4901ox-R4-G2	2.74	0.22	~~14ap02a35~~	~~0.281387~~	~~0.000031~~	~~0.000723~~	~~0.000027~~	~~-49.4~~	~~1.1~~	~~0.2813617~~	~~-7.9~~	~~1.2~~

continued on next pages. C: analyses in core, R: analyses in rim; a, b two analyses in similar zone of the same grain. All data are corrected as described in DR-1.

sample	grain	Age zrc (Ma)	± 1σ	Disc. % 2σ limit	ox analyses #	$\delta^{18}O$ zrc	± ‰	Hf analyses #	$^{176}Hf/^{177}Hf$	2SE	$^{176}Lu/^{177}Hf$	2SE	ε_{Hf} (0)	2SE	$^{176}Hf/^{177}Hf$ (i)	ε_{Hf} (i)	2SE
KRN-12-02 intrusion		1880.6	3.7														
mount 6	R1G1	1878.3	7.0	0.0	n4899ox-R1-G1	2.84	0.22	14ap02a49	0.281442	0.000067	0.001391	0.000025	-47.5	2.4	0.2813924	-6.8	2.4
	R1G4	1877.4	6.2	0.0	n4899ox-R1-G4	3.20	0.21	14ap02a54	0.281470	0.000043	0.001454	0.000036	-46.5	1.5	0.2814185	-5.9	1.5
	R2G1	1854.9	7.0	-1.0	n4899ox-R2-G1	2.72	0.22	14ap02a55	0.281470	0.000035	0.002036	0.000052	-46.5	1.2	0.2813974	-6.6	1.2
	R2G2	1880.9	7.1	0.0	n4899ox-R2-G2	3.00	0.20	14ap02a56	0.281401	0.000041	0.001108	0.000016	-49.0	1.5	0.2813610	-7.9	1.5
	R3G5	1876.4	6.7	0.0	n4899ox-R3-G5	2.93	0.21	14ap02a57	0.281418	0.000032	0.001207	0.000015	-48.3	1.1	0.2813751	-7.4	1.1
	R4G1 a	1878.7	5.6	0.0	n4899ox-R4-G1a	2.87	0.21	14ap02a58	0.281399	0.000031	0.001546	0.000013	-49.0	1.1	0.2813442	-8.5	1.1
	R4G1 b	1886.4	8.6	0.0	n4899ox-R4-G1b	3.01	0.19	14ap02a59	0.281419	0.000036	0.001358	0.000039	-48.3	1.3	0.2813705	-7.6	1.3
KRN-12-03 intrusion		1880.6	3.7														
mount 6	R4G2	1883.6	5.5	-0.4	n4898ox-R4-G2	3.82	0.28	14ap02a61	0.281442	0.000053	0.001137	0.000054	-47.5	1.9	0.2814015	-6.5	1.9
KRN-12-05 intrusion		1874.2	3.8														
mount 6	R1G1	1888.1	8.8	0.0	n4897ox-R1-G1	3.03	0.22	~~14ap02a05~~	~~0.281258~~	~~0.000022~~	~~0.001147~~	~~0.000044~~	~~-54.0~~	~~0.8~~	~~0.2812175~~	~~-13.2~~	~~0.8~~
	R1G5	1870.3	6.9	0.0	n4897ox-R1-G5	3.04	0.21	14ap02a07	0.281448	0.000041	0.001037	0.000067	-47.3	1.5	0.2814115	-6.3	1.5
	R2G1	1870.8	10.5	0.0	n4897ox-R2-G1	2.77	0.26	14ap02a08	0.281423	0.000041	0.001452	0.000030	-48.2	1.4	0.2813709	-7.7	1.5
	R3G7	1879.7	6.0	0.0	n4897ox-R3-G7	3.63	0.21	14ap02a09	0.281419	0.000048	0.002651	0.000043	-48.3	1.7	0.2813241	-9.4	1.7
	R4G1	1872.9	7.7	0.0	n4897ox-R4-G1	3.47	0.22	14ap02a12	0.281371	0.000035	0.001372	0.000016	-50.0	1.2	0.2813225	-9.5	1.5
	R4G2	1873.1	13.3	0.0	n4897ox-R4-G2	4.20	0.21	~~14ap02a15~~	~~0.281423~~	~~0.000031~~	~~0.001269~~	~~0.000064~~	~~-48.2~~	1.1	0.2813778	~~-15.1~~	~~2.1~~
	R4G5	1885.2	6.9	0.0	n4897ox-R4-G5	3.60	0.24	14ap02a10	~~0.281216~~	~~0.000058~~	~~0.001447~~	~~0.000050~~	~~-55.5~~	2.1	0.2811641	-9.5	1.3
REK-12-01 Rektorn porphyry		1876.2	6.8														
mount 4	R1G2	1885.5	4.9	0.0	n4732ox_REK12-1_@15	4.47	0.10	14ap02c14	0.281637	0.000032	0.000792	0.000031	-40.6	1.1	0.2816089	0.8	1.2
	R1G4 C	1883.6	3.1	0.0	n4732ox_REK12-1_@18	6.24	0.12	14ap02c15	0.281635	0.000030	0.000702	0.000041	-40.7	1.1	0.2816101	0.8	1.1
	R2G3	1890.9	3.0	0.0	n4732ox_REK12-1_@22	5.63	0.13	14ap02c17	0.281635	0.000034	0.000890	0.000012	-40.7	1.2	0.2816036	0.6	1.3

	R2G5 C	1883.7	3.6	0.0	n4732ox_REK12-1_@24	6.01	0.14	14ap02c19	0.281642	0.000043	0.001047	0.000056	-40.4	1.5	0.2816051	0.6	1.6
	R3G1	1884.4	5.3	0.0	n4732ox_REK12-1_@27	3.02	0.12	14ap02c24	0.281389	0.000056	0.001670	0.000272	-49.4	2.0	0.2813296	-9.2	2.0
	R3G4	1896.4	5.6	0.0	n4732ox_REK12-1_@28	6.10	0.14	14ap02c23	0.281257	0.000033	0.000627	0.000103	-54.0	1.2	0.2812347	-12.5	1.2
	R4G4	1886.2	3.9	0.0	n4732ox_REK12-1_@29	4.94	0.15	14ap02c21	0.281579	0.000043	0.001012	0.000078	-42.6	1.5	0.2815429	-1.6	1.6
	R4G6	1878.5	2.8	0.0	n4732ox_REK12-1_@30	6.14	0.13	~~14ap02c20~~	~~0.281668~~	~~0.000094~~	~~0.000994~~	~~0.000048~~	~~-39.5~~	~~3.4~~	~~0.2816321~~	~~1.6~~	~~3.4~~
	R5G3	1878.7	2.3	0.0	n4732ox_REK12-1_@33	5.73	0.13	~~14ap02c25~~	~~0.280703~~	~~0.000046~~	~~0.000903~~	~~0.000024~~	~~-73.6~~	~~1.6~~	~~0.2806707~~	~~-32.6~~	~~1.7~~
	R5G5	1874.6	3.6	0.0	n4732ox_REK12-1_@35	7.05	0.13	14ap02c26	0.281665	0.000026	0.000998	0.000006	-39.6	0.9	0.2816295	1.5	1.0
NUK-12-01 footwall		1881.7	2.3														
mount 4	R1G1	1885.0	4.4	0.0	n4719ox_NUK12-1_@39	2.87	0.14	~~14ap02c27~~	~~0.281557~~	~~0.000097~~	~~0.001600~~	~~0.000098~~	~~-43.4~~	~~3.4~~	~~0.2814997~~	~~-3.0~~	~~3.5~~
	R1G3	1874.6	5.4	0.0	n4719ox_NUK12-1_@41	3.49	0.17	14ap02c28	0.281428	0.000050	0.001177	0.000114	-48.0	1.8	0.2813866	-7.0	1.8
	R1G4	1878.2	4.7	0.0	n4719ox_NUK12-1_@42	3.49	0.12	~~14ap02c29~~	~~0.281457~~	~~0.000055~~	~~0.001036~~	~~0.000076~~	~~-47.0~~	~~1.9~~	~~0.2814197~~	~~-5.8~~	~~2.0~~
	R1G5	1875.8	4.7	-0.9	n4719ox_NUK12-1_@43	3.42	0.13	14ap02c30	0.281420	0.000039	0.001092	0.000064	-48.3	1.4	0.2813813	-7.2	1.4
	R2G1	1883.9	7.0	0.0	n4719ox_NUK12-1_@8	3.71	0.18	~~14ap02c33~~	~~0.281435~~	~~0.000068~~	~~0.001121~~	~~0.000123~~	~~-47.7~~	~~2.4~~	~~0.2813949~~	~~-6.7~~	~~2.4~~
	R2G4	1886.4	6.5	-0.1	n4719ox_NUK12-1_@11	3.23	0.13	~~14ap02c37~~	~~0.281462~~	~~0.000099~~	~~0.001636~~	~~0.000151~~	~~-46.8~~	~~3.5~~	~~0.2814041~~	~~-6.4~~	~~3.5~~
	R3G2	1881.3	4.9	-0.2	n4719ox_NUK12-1_@16	3.21	0.20	14ap02c34	0.281385	0.000031	0.001146	0.000012	-49.5	1.1	0.2813442	-8.5	1.1
	R3G3	1876.0	4.9	0.0	n4719ox_NUK12-1_@17	3.97	0.13	~~14ap02c35~~	~~0.281436~~	~~0.000036~~	~~0.001395~~	~~0.000189~~	~~-47.7~~	~~1.3~~	~~0.2813862~~	~~-7.0~~	~~1.4~~

continued on next page. C: analyses in core, R: analyses in rim; a, b two analyses in similar zone of the same grain. All data are corrected as described in DR-1.

sample	grain	Age zrc (Ma)	±	Disc. % 2σ limit	ox analyses #	$\delta^{18}O$ zrc	± ‰	Hf analyses #	$^{176}Hf/^{177}Hf$	2SE	$^{176}Lu/^{177}Hf$	2SE	ε_{Hf} (0)	2SE	$^{176}Hf/^{177}Hf$ (i)	ε_{Hf} (i)	2SE
NUK-12-01 continued																	
	R3G6	1883.9	6.6	0.0	n4719ox_NUK12-1_@19	3.55	0.15	14ap02c36	0.281442	0.000046	0.001054	0.000053	-47.5	1.6	0.2814041	-6.4	1.7
	R3G8	1888.0	3.6	-0.3	n4719ox_NUK12-1_@21	5.21	0.16	14ap02c38	0.281422	0.000025	0.001238	0.000039	-48.2	0.9	0.2813778	-7.3	0.9
	R3G9	1887.3	5.5	0.0	n4719ox_NUK12-1_@22	3.57	0.12	14ap02c39	0.281423	0.000045	0.001503	0.000157	-48.2	1.6	0.2813693	-7.6	1.6
	R4G5	1877.1	5.4	0.0	n4719ox_NUK12-1_@27	3.97	0.21	~~14ap02c41~~	~~0.281377~~	~~0.000037~~	~~0.001166~~	~~0.000011~~	~~-49.8~~	~~1.3~~	~~0.2813355~~	~~-8.8~~	~~1.4~~
	R4G8	1881.9	6.0	-3.3	n4719ox_NUK12-1_@29	3.03	0.14	14ap02c40	0.281456	0.000045	0.001305	0.000094	-47.0	1.6	0.2814093	-6.2	1.6
NUK-12-02 ore		1877.1	3.5														
mount 6	R1G3	1887.3	3.5	-0.7	n4896ox-R1-G3	6.80	0.20	~~14ap02a18~~	~~0.281610~~	~~0.000025~~	~~0.000958~~	~~0.000128~~	~~-41.6~~	~~0.9~~	~~0.2815753~~	~~-0.4~~	~~0.9~~
	R1G5	1890.3	4.8	-0.3	n4896ox-R1-G5	7.13	0.19	14ap02a19	0.281604	0.000023	0.000593	0.000083	-41.8	0.8	0.2815824	-0.2	0.8
	R2G2	1881.6	6.1	0.0	n4896ox-R2-G2a	6.97	0.20	14ap02a20	0.281651	0.000037	0.001085	0.000114	-40.1	1.3	0.2816125	0.9	1.3
	R2G2 R	1870.6	6.2	-1.3	n4896ox-R2-G2b	6.64	0.20	14au11b09	0.281651	0.000029	0.000528	0.000030	-40.1	1.0	0.2816321	1.6	1.1
	R3G1	1880.1	5.1	0.0	n4896ox-R3-G1	7.02	0.19	14ap02a21	0.281697	0.000030	0.001274	0.000089	-38.5	1.1	0.2816513	2.3	1.1
	R3G3	1881.2	5.4	0.0	n4896ox-R3-G3	6.94	0.18	14ap02a22	0.281636	0.000036	0.000757	0.000011	-40.6	1.3	0.2816089	0.8	1.3
	R3G6	1884.8	6.5	0.0	n4896ox-R3-G6	5.47	0.20	~~14ap02a24~~	~~0.281505~~	~~0.000030~~	~~0.000566~~	~~0.000038~~	~~-45.3~~	~~1.1~~	~~0.2814845~~	~~-3.6~~	~~1.1~~
	R4G1	1888.3	5.5	0.0	n4896ox-R4-G1	6.98	0.18	~~14ap02a27~~	~~0.281559~~	~~0.000031~~	~~0.000582~~	~~0.000051~~	~~-43.4~~	~~1.1~~	~~0.2815378~~	~~-1.7~~	~~1.1~~
	R4G5	1890.9	8.4	0.0	n4896ox-R4-G5	7.37	0.19	~~14ap02a25~~	~~0.281477~~	~~0.000034~~	~~0.000569~~	~~0.000050~~	~~-46.2~~	~~1.2~~	~~0.2814569~~	~~-4.6~~	~~1.2~~

C: analyses in core, R: analyses in rim; a, b two analyses in similar zone of the same grain. All data are corrected as described in DR-1.

Table. DR9. Calculation of theoretical oxygen isotopic compositions for rhyolite and dacite magmas in equilibrium with magnetite from Kiruna (values from Nyström et al., 2008). 1000lnα (magnetite-andesite) = -4.7 ‰, 1000lnα (mag-dacite) = -4.3 ‰ from Zhao and Zheng (2003), and values for 1000lnα (mag-water 800 ºC) = - 5.3 ‰ and 1000 ln a (mag-water 400 ºC) = - 7.9 ‰ from (Zheng, 1991).

sample	$\delta^{18}O$ (‰) measured	Sample type	Rhyolite $\delta^{18}O$	Dacite $\delta^{18}O$	Fluid at 800 ºC, $\delta^{18}O$	Fluid at 400 ºC, $\delta^{18}O$
PG-531	2.2	apatite bearing ore with apparent crossbedding	6.9	6.5	7.5	10.1
PG-235	1.7	Stratified ore rich in apatite	6.4	6	7.0	9.6
KIR-51	1.1	vesicular ore	5.8	5.4	6.4	9.0
PG-K9	1.8	ore with dendritic actinolite after pyroxene	6.5	6.1	7.1	9.7
PG-K14	0.9	ore with dendritic actinolite after pyroxene	5.6	5.2	6.2	8.8
PG-K8	2.1	skeleton ore	6.8	6.4	7.4	10.0
PG-37:6	0.7	skeleton ore	5.4	5	6.0	8.6
HjL-1	1.3	columnar magnetite	6.0	5.6	6.6	9.2
KUJ-3	1.1	columnar magnetite	5.8	5.4	6.4	9.0
PG-530	-0.2	columnar magnetite	4.5	4.1	5.1	7.7
PG-618	-0.7	magnetite-banded apatite rock	4.0	3.6	4.6	7.2
KIR-86	1	ore amgydule from footwall	5.7	5.3	6.3	8.9
4564:240	0.3	ore amgydule from footwall	5.3	4.6	5.6	8.2
4564:297	1.2	ore amgydule from footwall	5.9	5.5	6.5	9.1

Table. DR10. Calculation of theoretical oxygen isotopic compositions of fluids in equilibrium with metavolcanic and intrusive rocks from Kiruna (whole rock data from Blake, 1992) at different temperatures, 1000lnα (water-rock) from Zhao and Zheng (2003).

sample	$\delta^{18}O$ (‰) measured	Sample type	200 ºC	400 ºC	600 ºC	800 ºC
	1000lnα (andesite-water)		6.71	1.36	-0.11	-0.52
K90/26	6	footwall	-0.7	4.6	6.1	6.5
K89/23	6.4	footwall	-0.3	5.0	6.5	6.9
K89/17	6.7	footwall	0.0	5.3	6.8	7.2
K90/24	6.6	footwall	-0.1	5.2	6.7	7.1
K90/27	6	footwall	-0.7	4.6	6.1	6.5
K90/25	7.3	footwall	0.6	5.9	7.4	7.8
K89/21	7.2	footwall	0.5	5.8	7.3	7.7
K89/19	7.7	footwall	1.0	6.3	7.8	8.2
K89/24R	7.3	footwall	0.6	5.9	7.4	7.8
	1000lnα (syenite-water)		7.54	1.89	0.26	-0.24
K89/10	6.9	syenite	-0.6	5.0	6.6	7.1
K89/13	6.2	syenite	-1.3	4.3	5.9	6.4
K89/11	6.1	syenite	-1.4	4.2	5.8	6.3
K89/8	6.5	syenite	-1.0	4.6	6.2	6.7
K89/12	6.2	syenite	-1.3	4.3	5.9	6.4
	1000lnα (rhyolite-water)		8.80	2.69	0.84	0.19
K89/36	7.5	hanging wall	-1.3	4.8	6.7	7.3
K89/37	8	hanging wall	-0.8	5.3	7.2	7.8
K89/39	7.8	hanging wall	-1.0	5.1	7.0	7.6
	1000lnα (granite-water)		9.1	2.7	0.84	0.19
K90/CA1	6.8	granite	-2.0	4.1	6.0	6.6
K89/GP9	7.7	granophyre dike	-1.1	5.0	6.9	7.5