DR2009219

ANALYTICAL METHODS

U-Pb isotopic analysis

Zircon and apatite were concentrated by standard crushing, Wilfley table, heavy-liquid and magnetic separation. Zircon was pre-treated with the chemical-abrasion technique (Mattinson, 2003, 2005). Zircons were placed in a muffle furnace at 900 ± 20˚C for ~60 hours in quartz beakers before being transferred to 300 µl Teflon FEP microcapsules and leached in ~120 µl 29M HF + ~25 µl 30% HNO_3 for 12-14 hours at ~180 ˚C. The acid was removed from the capsules and the fractions were then rinsed in ultrapure H_2O, fluxed on a hotplate at ~80 ˚C for an hour in 6M HCl, ultrasonically cleaned for an hour, placed back on the hotplate for an additional 30 minutes, and rinsed in the capsules in ultrapure H_2O and 30% HNO_3. Fractions were spiked with a mixed ^{233}U-^{235}U-^{205}Pb tracer and fully dissolved in ~120 µl 29M HF with ~25 µl 30% HNO_3 at ~210˚C for 48 hours, dried to fluorides, and then re-dissolved in 6M HCl at ~180˚C overnight. Single grains of apatite were hand-picked from non-magnetic separates, rinsed and ultrasonically cleaned in ultrapure H_2O and acetone prior to loading into single 300 µl FEP teflon microcapsules. Apatite was then spiked with the mixed ^{233}U-^{235}U-^{205}Pb tracer and dissolved in 12N HCl overnight, dried down and redissolved in 6N HCl overnight.

U and Pb were separated using an HCl-based single-column (zircon) or an HBr-based two-column (apatite) anion exchange chemistry modified after (Krogh, 1973). U and Pb isotopic measurements were performed on a VG Sector-54 multi-collector thermal-ionization mass spectrometer at MIT. Pb and U were either loaded together (HCl-based chemistry) or on separate (HBr-based chemistry) Re filaments in a silica-gel/phosphoric acid mixture (Gerstenberger and Haase, 1997). Pb was measured by either 1) peak-hopping on a single Daly detector (for smaller beams), or 2) a dynamic Faraday-Daly routine (F-D) that cycles between placing mass 204 in the axial Daly collector and masses 205-208 on the H1-H4 Faraday detectors to placing mass 205 in the axial Daly and masses 206-208 in the H1-H3 Faradays, providing real-time Daly gain correction. U isotopic measurements were made in static Faraday mode. Mass fractionation on the Daly detector was determined to be 0.25 ± 0.04 %/a.m.u. over a wide temperature range based on analysis of the NBS-981 common Pb standard and spiked aliquots of NBS-983. Mass fractionation and detector bias on the F-D routine was determined to be 0.07 ± 0.04 %/a.m.u. U mass fractionation is calculated in real-time using the ^{233}U-^{235}U tracer. All common Pb for the zircon analyses was attributed to procedural blank. Total procedural Pb blanks for the HBr-based chemistry were determined to be 1.2 ± 0.4 pg, which was used in the reduction of apatite data. U blanks are assigned a value of 0.10 ± 0.05 pg. All samples were spiked with a ^{205}Pb-^{233}U-^{235}U tracer, whose calibration is detailed in (Schoene et al., 2006), and an error of ± 0.05% is assigned to the $^{205}Pb/^{235}U$ of the tracer. Tracer uncertainties are not included in age estimates, though should be if comparing to other U-Pb data using a different tracer. Decay constant errors (±0.11% for ^{238}U and 0.13% for ^{235}U) are also not included in age estimates, but need to be if comparing to data from another decay scheme (e.g. $^{40}Ar/^{39}Ar$ dates). Data reduction was done using the algorithms of Schmitz and Schoene (2007).

Whole-rock geochemistry

Whole-rock samples were sawed into slabs using a diamond tipped blade. Sawed surfaces were polished on a lapidary wheel using silica carbide grit to remove saw marks. Resulting slabs were crushed with a hammer in a plastic bag and bits were handpicked to be free of weathered surfaces. Rock chips were then boiled in water, soaked in acetone and again hand picked before being powdered in a Spex alumina shatterbox. Powders were sent to Activation Laboratories, Inc., where major and trace element analyses were performed on fused powders using inductively coupled plasma mass spectrometry. Data for samples, replicate analyses and analytical standards are provided in Table A2.

SAMPLE DESCRIPTIONS AND GEOCHRONOLOGIC INTERPRETATIONS

The Malolotja inlier - NW Swaziland

EKC03-23 and BS04-3.

These samples were collected from one of the western-most exposures of Usutu rocks, where medium- to fine-grained tonalite is cut by a series of aplitic dikes. The dikes are oriented parallel to the host rock foliation and are foliated and boudinaged. A sample of the host rock (EKC03-23) and one dike (BS04-3) were collected. EKC03-23 yielded abundant euhedral elongate prismatic zircon. Seven zircon analyses from the host rock EKC03-23 yielded four near concordant analyses that yield a weighted mean $^{207}Pb/^{206}Pb$ date of 3230.3±0.4 Ma (MSWD = 0.4; Fig. 3C). The dike, BS04-3, yielded a small population of grains <100 μm long ranging in morphology from elongate and euhedral to nearly spherical, and many of these dissolved after a short period of chemical abrasion. Nine grains were successfully analyzed, and only one is concordant. However, four near concordant grains yield identical 207Pb/206Pb dates, and the five together yield a weighted mean $^{207}Pb/^{206}Pb$ date of 3224.4±0.4 Ma (MSWD = 1.5; Fig. 2B). Two other grains are discordant and give $^{207}Pb/^{206}Pb$ dates of ca. 3160 Ma, although it is possible these represent Pb-loss from an older population. Whether the older or younger population records the crystallization of the dike is thus unclear, although shearing certainly occurred at this outcrop after ca. 3224 Ma.

EKC03-33.

This sample was collected from within a relatively homogeneous low-strain zone ~1.5 km from the contact with the quartzites. It contains 1-6 cm megacrysts of K-feldspar within a tonalitic to granodioritic matrix. This sample yielded abundant elongate euhedral prismatic zircons. Out of six zircon analyses, three were concordant, giving $^{207}Pb/^{206}Pb$ dates that range between ~3232 and 3227 Ma. It likely that either these data represent mixing between differently aged domains of zircon or inheritance of slightly older grains within a 3227 Ma rock. It is also possible that ancient Pb-loss occurred at a single moment in time within such that a Pb-loss trajectory parallels the concordia curve. So it is likely that the rock crystallized between ca. 3232 and 3227 Ma, although a more precise estimate is precluded (Fig. 3C).

The Mbuluzi river section

EKC02-23.

This is a very fresh sample of granodioritic to granitic composition with large K-feldspar megacrysts, from the eastern crossing of the Mbuluzi river. It contains abundant stubby euhedral zircons ranging in size from 50-150 µm. Six zircons from this rock were analyzed, of which three were near concordant and yield a weighted mean $^{207}Pb/^{206}Pb$ date of 3229.8±0.5 Ma (MSWD = 1.9; Fig. 4B), which is interpreted to be the timing of crystallization of the rock.

EKC02-24.

This is a sample of very fresh biotite tonalite to diorite from the eastern crossing of the Mbuluzi river. It contained abundant zircon, ranging in morphology from elongate and prismatic to tabular, although each morphology had sharp crystal terminations. Five of six zircon analyses were concordant and yield a weighted mean $^{207}Pb/^{206}Pb$ date of 3227.5±0.3 Ma (MSWD = 0.4; Fig. 4B), interpreted to be the crystallization age of the rock.

EKC02-32.

This is a sample of homogeneous massive leucotonalite from the western outcrop. Biotite in this sample has been replaced by chlorite, although plagioclase remains largely unaltered. This rock yielded abundant euhedral elongate prismatic zircon. Of five zircon analyses, three yielded a concordant cluster, one is slightly negatively discordant and 1 Ma older, and one is slightly positively discordant. The younger analysis can easily be explained by Pb-loss. The older is either inherited from slightly older magma, or represents the true crystallization age while the cluster of three represent Pb-loss. Because it is unlikely that three grains will lose lead of identical amount, we prefer the interpretation that the older grain is inherited. A weighted mean $^{207}Pb/^{206}Pb$ date of the three equivalent analyses is 3231.3±0.5 Ma (MSWD = 0.8; Fig. 5A), and we think this represents the crystallization of at least a portion of the leucotonalite in the area. Alternatively, if the 5 grains were in fact from a single population which underwent Pb-loss, an upper intercept age yields 3232.4±0.8/9.3 Ma (MSWD = 0.1; without/with decay constant uncertainties) and within the error of the other estimate.

EKC03-18.

This is a sample of a fine-grained granitic plug that cross-cuts the other lithologies in the western outcrop. It resembles in texture and composition the granite mapped as Mpuluzi batholith several kilometers north and west of this outcrop. It yielded abundant zircons that were either elongate euhedral prisms or rounded prisms. Four rounded grains are interpreted to be inherited, with concordant $^{207}Pb/^{206}Pb$ dates of either ca. 3280 or 3224 Ma (Fig. 5A). Five grains with sharp crystal terminations were variably discordant with $^{207}Pb/^{206}Pb$ dates of ca. 3180-3190 Ma. A single concordant grain gave a $^{207}Pb/^{206}Pb$ date of 3186.8±2.1 Ma. This may most accurately represent the crystallization age of the rock and clearly post-dates the intrusion and deformation of other rocks in the area.

A2.3. Central Swaziland

EKC02-35.

This is a sample of coarse grained hornblende tonalite, collected along the Usutu river in the western portion of the map area (Fig. 6). It is undeformed and has no visible magmatic fabric, though rocks with fabrics defined by alignment of hornblende and tabular feldspar occur nearby. Some outcrops appear to have weak flattening in quartz as well, possibly indicating solid-state strain. This rock yielded abundant euhedral elongate to stubby prismatic zircons. Five zircons were analyzed and three near concordant grains yield a weighted mean $^{207}Pb/^{206}Pb$ date of 3236.1±0.5 Ma (MSWD = 0.6), interpreted to reflect crystallization of the rock (Fig. 8B).

Two apatite grains were analyzed from this rock, and they are ≤1% discordant and give $^{207}Pb/^{206}Pb$ dates between ca. 2865 and 2790 Ma, possibly reflecting partial resetting by the intrusion of the ca. 2.7 Ga Ngwempisi pluton, which crops out ~2 km to the SW (Fig. 10).

EKC02-36.

This is a sample of medium to fine grained foliated hornblende biotite leucotonalite collected along the Usushwana river in the NW portion of the map area (Fig. 6). Foliation in this sample is defined by fine-grained elongated bands of hornblende and biotite and flattened quartz and feldspar. Zircon from this sample is elongate and subhedral, with well-rounded crystal terminations, either indicative of metamorphic overgrowths or post-crystallization resorption. Three grains were analyzed and are nearly concordant with $^{207}Pb/^{206}Pb$ dates between ca. 3428 and 3436 Ma, with the most concordant giving the youngest $^{207}Pb/^{206}Pb$ date (Fig. 8). Thus, determining a precise crystallization age for this rock requires a more detailed investigation of zircon textures in addition to more U-Pb analyses. However, it is clear based on the geochronology and composition of this rock that it is associated with the Tsawela gneiss, whose type locality is in the Mankayane inlier in western Swaziland (Jackson, 1984; Jackson et al., 1987; Kröner and Tegtmeyer, 1994).

Two apatite grains were analyzed from this sample, and they are both >4% discordant and have $^{207}Pb/^{206}Pb$ dates between ca. 2893 and 2790 Ma, reflecting partial resetting by the intrusion of the Mbabane pluton, which crops out <2 km to the north (Fig. 10).

EKC03-21.

This sample came from an outcrop of compositionally layered hornblende tonalite, tonalite, and granodiorite from the Usushwana river directly south of Matsapha (Fig. 6). EKC03-21 is a coarse grained biotite tonalite with minor hornblende. Zircon from this sample is elongate to stubby and prismatic with slightly rounded crystal terminations. Of four analyses, three were nearly concordant and give a weighted mean $^{207}Pb/^{206}Pb$ date of 3232.1±0.5 Ma (MSWD = 0.8), which is interpreted to be the crystallization age of the rock (Fig. 8A). The other grain that is positively discordant is also ca. 3232 Ma.

One concordant apatite analysis gave a $^{207}Pb/^{206}Pb$ date of ca. 3190 Ma, which is interpreted to reflect cooling of the rock through the closure temperature of apatite (Fig. 8A).

BS04-7.

This is a fine-grained foliated tonalite with foliation defined by flattened quartz and feldspar and alignment of hornblende and biotite. It was sampled from a large body of banded tonalite along the Usushwana river where BS04-8 intruded synchronous with deformation. Zircon from BS04-7 varies from tabular ellipsoids to knobby subhedral elongate prisms to small euhedral elongate prisms. Seven zircons were successfully analyzed from a range of morphologies, though the most euhedral grains tended to dissolve during leaching and only two were recovered for analysis. Near concordant grains from the slightly rounded population of zircons give $^{207}Pb/^{206}Pb$ dates that range from 3411-3440 Ma (Fig. 8B). One small euhedral grain is discordant and gives a $^{207}Pb/^{206}Pb$ date of ca. 3315 Ma. The youngest discordant grain is a minimum age for the crystallization age of the rock but may be a result of Pb-loss or mixing of older and younger domans. Therefore, the concordant ca. 3.4 dates are likely a more accurate representation of crystallization.

BS04-8.

This sample is a medium-grained hornblende tonalite that was collected adjacent to BS04-7, where it is observed to intrude the banded gneiss. Biotite and hornblende occur in bands several cm in length that define a magmatic fabric whose orientation is highly dependent on its proximity to and geometry of the adjacent banded gneiss. Zircon from BS04-8 is euhedral and varies from elongate prisms at smaller grain widths (<100 μm) to stubby prisms or ellipsoids in large grains. All five zircons analyzed were concordant, and three yield a weighted mean $^{207}Pb/^{206}Pb$ date of 3232.1±0.4 Ma (MSWD = 0.7), interpreted to be the crystallization age of the rock (Fig. 8B). Two inherited grains give $^{207}Pb/^{206}Pb$ dates of ca. 3411 and 3541 Ma (not shown in Fig. 8), the former of which was the only analysis from the ellipsoidal population of zircon.

BS04-6.

This sample is an undeformed medium to coarse-grained granite that cuts all the magmatic fabric and foliation in the outcrop where BS04-7 and BS04-8 were collected. It yielded abundant euhedral elongate to stubby prismatic zircon in addition to a large, very clear blocky population that is euhedral but often broken. Six zircon analyses were all concordant and three from the blocky population yield a weighted mean $^{207}Pb/^{206}Pb$ date of 3219.9±1.0 Ma (MSWD = 1.5), interpreted to be the crystallization age of the rock (Fig. 8A). The other three prismatic grains give $^{207}Pb/^{206}Pb$ dates from ca. 3256-3260 Ma, and are interpreted as inherited.

Five grains of apatite were also analyzed for U-Pb analysis. All analyses are concordant except for one, which is -1.1% discordant, though all give $^{207}Pb/^{206}Pb$ dates between ~3180-3200 Ma. In addition, there is a strong correlation between date and grain size, suggesting that these data record cooling through the closure of apatite 20-40 Ma after intrusion of BS04-6 (Fig. 8A).

BSO4-11, BS04-12.

These samples were collected from an exposure along the Usutu river, about two kilometers upstream from its confluence with the Ngwempisi river. BS04-12 is a foliated granodioritic augen gneiss, with mantled porphyroclasts that give a dextral strike-slip shear sense (Fig. 9). BS04-11 is a sample of an ~0.5 m wide aplitic dike that cross-cuts the local foliation, and is lightly foliated itself, but shows no folding or offset, suggesting it post dates simple shear in the outcrop. Both samples yielded abundant large blocky to elongate zircons as well as a population of stubby to elongate prismatic zircons. Four of the large blocky grains from BS04-12 were analyzed, three of which are concordant and yield a weighted mean $^{207}Pb/^{206}Pb$ date of 3221.8±0.4 Ma (MSWD = 0.5), interpreted to be the crystallization age of the rock (Fig. 9B). Two blocky grains and one small prismatic grain were analyzed from BS04-11. The two blocky grains are concordant and yield a weighted mean date of 3221.6±0.4 Ma (MSWD = 0.2), interpreted to represent crystallization of the dike (Fig. 9B). The prismatic grain is concordant, but inherited with a $^{207}Pb/^{206}Pb$ date of ca. 3235 Ma. Because the two samples yield identical dates, it suggests that intrusion and shearing of sample BS04-12 occurred in a short period of time.

Nhlangano gneiss geochronology

EKC02-64.

This sample is a well-foliated porphyritic granitic orthogneiss and was collected from a good exposure along the Usutu river ~2 km downstream of the confluence with the Ngwempisi river (Fig. 6). This outcrop contains several phases of deformed gneiss, of which EKC02-64 is the oldest. This sample yielded abundant zircons, many with rounded grain boundaries, though a population with well developed terminations also was found. Three concordant grains from EKC02-64 give a weighted mean $^{207}Pb/^{206}Pb$ date of 3265.6±0.5 Ma (MSWD = 0.1), interpreted to be the crystallization age of that rock (Fig. 10B). One discordant grain gave a $^{207}Pb/^{206}Pb$ date of ca. 3329 Ma.

EKC02-66.

This is a well foliated yes relatively homogeneous tonalitic gneiss collected from an outcrop near the road that follows the Mkhondvo river (Fig. 10). It yielded abundant zircons, though only three did not totally dissolve during chemical abrasion. These three were between ~2 and 16% discordant with $^{207}Pb/^{206}Pb$ dates between ca. 3253 and 3216 Ma, respectively. An upper intercept date of the oldest two samples is 3286±17 Ma (decay constants errors included), which provides a lower estimate for the crystallization age of this sample.

EKC03-35.

This is a sample of tonalitic gneiss from a section of banded gneisses (Fig. 10C) several hundred meters from the contact between the Nhlangano gneiss and the Mkhondvo metamorphic suite, located a few hundred meters upstream along a small drainage that enters the Mkhondvo river in the mapping area of Condie et al. (1996). It contains abundant zircons of several morphologies, of which one population is prismatic with slightly rounded crystal terminations. Despite dozens of attempts, all but one zircon dissolved during even short periods of chemical abrasion. This one grain is ~1% discordant with a $^{207}Pb/^{206}Pb$ date of ~3330 Ma. Because of the limited sampling, we cannot decipher if this grain is inherited or represents igneous crystallization of the rock, though it clearly approximates an upper age for this sample. Seven apatite grains were analyzed, which yield $^{207}Pb/^{206}Pb$ dates between ~2719 and 2796 Ma, and exhibit variable amounts of positive and negative discordance. These dates likely represent partial resetting during ca. 2.73 Ga magmatic/metamorphic event associated with the intrusion of the Hlatikulu granite, which crops out within 1 km of the sample locality.

EKC03-36.

This rock is highly attenuated banded granodioritic augen gneiss sampled ~100 m downstream from sample EKC03-35 (Fig. 10D). Because this rock is strongly deformed, it's protolith is difficult to assess, though realtively massive nature, distinct feldspar megacrysts and lack of discernable lithic fragments leads us to conclude that it is an orthogneiss. It contains abundant prismatic zircons, of which only six did not dissolve during chemical abrasion and were successfully analyzed. These grains are between 0.9 and 3.8% discordant, with $^{207}Pb/^{206}Pb$ dates between 3224 and 3265 Ma (Fig. 10B). Because of the discordance, a single population of zircons cannot be identified, a precise crystallization age cannot be determined; an upper intercept of the two least discordant points yields a date of 3275±26 (decay constant errors included), and thus we are confident the sample crystallized before ~3240 Ma. Six apatite grains were also analyzed and yield $^{207}Pb/^{206}Pb$ dates between 2743 and 3099 Ma and are between 0 and ~13% discordant. We interpret these to represent partial resetting from the Hlatikulu granite, which crops out <1 km from the sample location.

Hlatikulu granite geochronology

BS04-20.

This is a fine-grained, undeformed tonalite that cross-cuts the northern margin of the Mkhondvo suite inlier and is cut by the Hlatikulu granite. This sample contained abundant euhedral stubby to elongate zircon, from which five were selected for analysis. Two highly discordant analyses from this sample give $^{207}Pb/^{206}Pb$ dates of ca. 3300 Ma. One near concordant grain gives a $^{207}Pb/^{206}Pb$ date of ca. 3206 Ma, and one concordant grain gives a $^{207}Pb/^{206}Pb$ date of ca. 2897 Ma. The youngest concordant grain has a $^{207}Pb/^{206}Pb$ date of 2733.9±0.7 Ma, and this date must closely approximate the timing of intrusion of this rock, because it is cut by samples BS04-21 and EKC02-65 (Fig. 11).

BS04-21.

This is an undeformed medium to fine-grained biotite granite that clearly cuts the Nhlangano gneiss ~500 m upstream from sample EKC03-35. It yielded abundant pristine stubby to prismatic zircons, and also a population of botryoidal and rounded zircons that appear resorbed or overgrown. Four analyses from BS04-21 yield a weighted mean $^{207}Pb/^{206}Pb$ date of 2729.8±0.4 Ma (MSWD = 1.3; Fig. 11). One analysis, picked from the rounded population of zircon gives a slightly younger $^{207}Pb/^{206}Pb$ date of ca. 2727.6 Ma, and therefore this grain may represent mixing of zircon associated with late magmatic fluids or later overgrowth.

EKC02-65.

This is a fine to medium grained biotite granite, taken from a roadside outcrop on the road following the Mkhondvo river near where it cross-cuts the Nhlangano gneiss and Usutu suite (Fig. 6). It yielded abundant pristine prismatic zircons and all three zircon analyses from EKC02-65 are concordant and yield a weighted mean $^{207}Pb/^{206}Pb$ date of 2728.9±0.5 Ma (MSWD = 0.5; Fig. 11). This is interpreted as the age of crystallization.

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Table 1. U-Pb isotopic data

				Isotopic ratios									Dates (Ma)						
Sample	$\frac{Pb^*}{Pb_c}$	Pb_c (pg)	$\frac{Th}{U}$	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{208}Pb}{^{206}Pb}$	$\frac{^{206}Pb}{^{238}U}$	% err	$\frac{^{207}Pb}{^{235}U}$	% err	$\frac{^{207}Pb}{^{206}Pb}$	% err	corr. coef.	$\frac{^{206}Pb}{^{238}U}$	±	$\frac{^{207}Pb}{^{235}U}$	±	$\frac{^{207}Pb}{^{206}Pb}$	±	% disc.
(a)	(b)	(c)	(d)	(e)	(f)	(f)	(g)	(f)	(g)	(f)	(g)		(h)	(i)	(h)	(i)	(h)	(i)	(j)
EKC03-33																			
za1	158	2.06	0.49	8357	0.133	0.640328	0.06	22.66600	0.07	0.25673	0.04	0.819	3190.3	1.5	3212.7	0.7	3226.7	0.7	1.43
za2	149	0.99	0.68	7577	0.183	0.647950	0.11	22.94236	0.13	0.25680	0.06	0.876	3220.2	2.8	3224.5	1.2	3227.2	1.0	0.27
za3	19	3.42	0.13	1084	0.036	0.643935	0.20	22.77134	0.21	0.25648	0.08	0.931	3204.5	5.0	3217.2	2.1	3225.2	1.2	0.82
za5	35	4.95	0.75	1512	0.201	0.651236	0.11	23.14377	0.12	0.25775	0.04	0.932	3233.0	2.9	3233.0	1.2	3233.0	0.7	0.00
za6	45	3.30	0.78	2267	0.208	0.649954	0.13	23.06746	0.14	0.25740	0.05	0.937	3228.0	3.2	3229.8	1.3	3230.9	0.7	0.11
za10	100	0.43	0.61	5173	0.166	0.640808	0.17	22.75386	0.19	0.25753	0.06	0.943	3192.2	4.4	3216.5	1.8	3231.7	1.0	1.55
EKC03-23																			
za1	267	0.89	0.54	12463	0.146	0.648127	0.07	22.96561	0.08	0.25699	0.05	0.819	3220.9	1.7	3225.5	0.8	3228.3	0.7	0.29
za2	450	0.58	0.48	22273	0.129	0.646029	0.08	22.90262	0.09	0.25712	0.04	0.880	3212.7	2.1	3222.8	0.9	3229.1	0.7	0.65
za3	399	0.49	0.55	19931	0.152	0.633685	0.08	22.36249	0.09	0.25594	0.06	0.802	3164.1	1.9	3199.6	0.9	3221.9	0.9	2.27
za4	198	0.63	0.54	9596	0.144	0.647845	0.09	22.98662	0.11	0.25734	0.05	0.883	3219.8	2.4	3226.4	1.0	3230.5	0.8	0.42
za6	385	0.56	1.06	17231	0.284	0.649095	0.10	23.03195	0.12	0.25735	0.07	0.841	3224.7	2.6	3228.3	1.2	3230.5	1.0	0.23
za8	206	0.90	0.18	10333	0.047	0.649736	0.06	23.04742	0.07	0.25727	0.04	0.808	3227.2	1.4	3228.9	0.7	3230.0	0.7	0.11
za9	61	0.62	0.24	3138	0.063	0.650487	0.22	23.07572	0.23	0.25729	0.07	0.946	3230.1	5.5	3230.1	2.2	3230.2	1.2	0.00
BS04-3																			
za1	3.6	1.19	0.55	206	0.148	0.646100	1.05	22.81694	1.08	0.25613	0.20	0.983	3212.9	26.7	3219.2	10.5	3223.0	3.1	0.40
za2	9.2	0.88	0.51	500	0.135	0.661636	0.42	23.45338	0.43	0.25709	0.09	0.980	3273.5	10.8	3245.9	4.2	3229.0	1.4	-1.76
za4	118	0.41	0.65	6050	0.179	0.621357	0.15	21.14940	0.18	0.24686	0.09	0.860	3115.3	3.8	3145.5	1.7	3164.8	1.4	1.97
za5	176	0.59	0.68	8980	0.187	0.623946	0.11	21.20527	0.12	0.24649	0.04	0.931	3125.6	2.7	3148.0	1.2	3162.4	0.7	1.47
za6	9.0	9.07	0.32	507	0.092	0.615914	0.48	21.59832	0.48	0.25433	0.07	0.990	3093.6	11.7	3165.8	4.7	3211.9	1.1	4.63
za8	172	0.70	0.29	9446	0.082	0.610397	0.15	21.56909	0.16	0.25628	0.05	0.957	3071.6	3.8	3164.5	1.6	3224.0	0.7	5.94
za9	49	0.86	0.90	2416	0.247	0.633518	0.14	22.39705	0.15	0.25641	0.06	0.927	3163.5	3.4	3201.1	1.4	3224.8	0.9	2.40
za10	395	0.70	0.56	20541	0.152	0.641493	0.10	22.68253	0.11	0.25645	0.05	0.895	3194.9	2.5	3213.4	1.1	3225.0	0.8	1.18
EKC02-23																			
za1	363	1.70	0.41	17816	0.113	0.628725	0.07	22.18403	0.08	0.25590	0.04	0.860	3144.5	1.7	3191.8	0.8	3221.7	0.6	3.02
za2	297	1.46	0.93	13474	0.255	0.632527	0.08	22.36934	0.09	0.25649	0.04	0.885	3159.6	2.0	3199.9	0.9	3225.3	0.7	2.58
za3	116	1.33	0.88	5376	0.239	0.644021	0.10	22.80293	0.12	0.25680	0.06	0.873	3204.8	2.6	3218.6	1.1	3227.2	0.9	0.88
za4	79	0.49	0.18	4461	0.048	0.647426	0.14	22.95164	0.15	0.25711	0.06	0.922	3218.1	3.5	3224.9	1.5	3229.1	0.9	0.43
za5	286	0.38	0.86	14054	0.232	0.647522	0.11	22.96889	0.12	0.25727	0.05	0.922	3218.5	2.8	3225.6	1.2	3230.0	0.7	0.45
za6	60	0.53	0.28	3339	0.075	0.648375	0.13	23.00213	0.14	0.25730	0.06	0.903	3221.9	3.2	3227.0	1.4	3230.3	1.0	0.33

Table 1.(cont.)

				Isotopic ratios									Dates (Ma)						
Sample (a)	Pb*/Pb_c (b)	Pb_c (pg) (c)	Th/U (d)	$^{206}Pb/^{204}Pb$ (e)	$^{208}Pb/^{206}Pb$ (f)	$^{206}Pb/^{238}U$ (f)	% err (g)	$^{207}Pb/^{235}U$ (f)	% err (g)	$^{207}Pb/^{206}Pb$ (f)	% err (g)	corr. coef.	$^{206}Pb/^{238}U$ (h)	± (i)	$^{207}Pb/^{235}U$ (h)	± (i)	$^{207}Pb/^{206}Pb$ (h)	± (i)	% disc. (j)
EKC02-24																			
za1	158	5.29	0.51	7052	0.138	0.640987	0.25	22.67971	0.25	0.25662	0.05	0.981	3192.9	6.3	3213.3	2.5	3226.1	0.8	1.30
za2	244	1.41	0.42	12294	0.114	0.648141	0.08	22.95173	0.09	0.25683	0.04	0.882	3220.9	2.0	3224.9	0.9	3227.4	0.7	0.25
za3	298	1.01	0.46	15829	0.123	0.647645	0.09	22.93653	0.10	0.25686	0.04	0.906	3219.0	2.3	3224.3	1.0	3227.5	0.7	0.34
za4	522	0.92	0.39	28117	0.105	0.648655	0.08	22.97330	0.09	0.25687	0.04	0.877	3222.9	2.0	3225.8	0.9	3227.6	0.7	0.18
za5	523	0.4	0.50	27509	0.135	0.648709	0.11	22.96981	0.12	0.25681	0.04	0.932	3223.2	2.9	3225.7	1.2	3227.2	0.7	0.16
za6	73	0.7	0.51	3852	0.138	0.650700	0.17	23.05023	0.18	0.25692	0.06	0.951	3230.9	4.4	3229.1	1.8	3227.9	0.9	-0.12
EKC02-32																			
za1	813	0.38	0.67	41355	0.181	0.646782	0.17	22.93444	0.18	0.25718	0.05	0.957	3215.6	4.4	3224.2	1.8	3229.5	0.8	0.55
za2	329	0.58	0.77	16474	0.206	0.649801	0.07	23.07298	0.09	0.25753	0.05	0.817	3227.4	1.8	3230.0	0.8	3231.6	0.8	0.17
za3	84	1.33	0.57	4161	0.153	0.649086	0.17	23.03476	0.19	0.25738	0.09	0.892	3224.6	4.4	3228.4	1.9	3230.8	1.4	0.24
za4	234	1.06	0.74	11664	0.198	0.649281	0.08	23.04677	0.09	0.25744	0.04	0.882	3225.4	2.1	3228.9	0.9	3231.1	0.7	0.22
za5	71	2.06	0.88	3149	0.237	0.651217	0.11	23.13505	0.12	0.25766	0.05	0.925	3233.0	2.8	3232.6	1.2	3232.4	0.7	-0.02
EKC03-18																			
za1	168	1.47	0.33	8602	0.089	0.635250	0.09	21.89261	0.10	0.24995	0.04	0.904	3170.3	2.3	3179.0	1.0	3184.4	0.7	0.56
za2	201	1.02	0.53	10777	0.142	0.647275	0.08	22.87535	0.09	0.25632	0.04	0.878	3217.5	2.1	3221.7	0.9	3224.2	0.7	0.26
za3	58	1.13	0.67	3056	0.179	0.647900	0.12	22.89320	0.13	0.25627	0.05	0.932	3220.0	3.0	3222.4	1.2	3223.9	0.7	0.15
za4	62	0.39	0.52	3326	0.147	0.610052	0.07	21.03869	0.08	0.25012	0.04	0.871	3070.2	1.8	3140.4	0.8	3185.5	0.6	4.55
za5	41	0.42	0.21	2333	0.059	0.622626	0.10	21.53464	0.10	0.25085	0.04	0.917	3120.4	2.4	3163.0	1.0	3190.1	0.7	2.76
za6	47	0.86	0.45	2550	0.123	0.633262	0.09	21.88420	0.10	0.25064	0.04	0.907	3162.5	2.2	3178.6	1.0	3188.8	0.7	1.04
za7	8.6	1.70	0.48	485	0.130	0.639214	0.49	22.06263	0.51	0.25033	0.13	0.965	3185.9	12.2	3186.5	5.0	3186.8	2.1	0.04
za8	90	0.56	0.55	4751	0.148	0.661031	0.12	24.18776	0.14	0.26538	0.06	0.906	3271.2	3.2	3276.0	1.3	3279.0	0.9	0.30
za9	151	0.78	0.95	7297	0.253	0.663830	0.07	24.33020	0.08	0.26582	0.05	0.829	3282.0	1.7	3281.7	0.8	3281.5	0.7	-0.02

Table 1.(cont.)

				Isotopic ratios									Dates (Ma)						
Sample (a)	Pb*/Pb$_c$ (b)	Pb$_c$ (pg) (c)	Th/U (d)	^{206}Pb/^{204}Pb (e)	^{208}Pb/^{206}Pb (f)	^{206}Pb/^{238}U (f)	% err (g)	^{207}Pb/^{235}U (f)	% err (g)	^{207}Pb/^{206}Pb (f)	% err (g)	corr. coef.	^{206}Pb/^{238}U (h)	± (i)	^{207}Pb/^{235}U (h)	± (i)	^{207}Pb/^{206}Pb (h)	± (i)	% disc. (j)
EKC02-35																			
za1	998	0.63	0.31	54457	0.084	0.642547	0.06	22.82544	0.07	0.25764	0.04	0.834	3199.0	1.6	3219.5	0.7	3232.3	0.7	1.31
za2	488	0.44	0.46	25888	0.123	0.651484	0.07	23.20128	0.09	0.25829	0.05	0.804	3234.0	1.9	3235.4	0.9	3236.3	0.9	0.09
za3	260	0.57	0.69	13177	0.190	0.634383	0.06	22.38022	0.08	0.25587	0.05	0.787	3166.9	1.5	3200.4	0.8	3221.4	0.8	2.14
za4	82	0.43	0.33	4460	0.088	0.648080	0.14	23.07343	0.14	0.25822	0.05	0.945	3220.7	3.4	3230.0	1.4	3235.9	0.7	0.60
za5	265	0.35	0.38	14279	0.102	0.651244	0.18	23.19488	0.19	0.25831	0.07	0.937	3233.1	4.5	3235.2	1.8	3236.4	1.0	0.13
a1 (95)	1.1	11.41	2.77	47	0.767	0.554014	0.99	15.65022	1.15	0.20488	0.45	0.923	2841.8	22.7	2855.7	11.0	2865.5	7.3	1.02
a2 (135)	2.4	17.06	1.46	104	0.404	0.540211	0.30	14.56589	0.34	0.19556	0.13	0.927	2784.3	6.7	2787.3	3.2	2789.5	2.1	0.23
EKC02-36																			
za1	1119	0.47	0.54	56963	0.145	0.698353	0.06	28.22418	0.07	0.29312	0.04	0.818	3414.4	1.5	3426.9	0.7	3434.2	0.6	0.74
za2	878	0.68	0.53	44866	0.141	0.699788	0.07	28.18293	0.08	0.29209	0.04	0.845	3419.8	1.8	3425.5	0.8	3428.8	0.7	0.34
za3	369	0.49	0.45	19107	0.122	0.691326	0.40	27.98202	0.40	0.29356	0.04	0.994	3387.7	10.6	3418.5	4.0	3436.6	0.7	1.83
a3 (95)	0.8	5.00	0.23	55	0.065	0.541610	1.73	15.56971	1.84	0.20849	0.36	0.982	2790.2	39.2	2850.8	17.5	2893.9	5.8	4.41
a4 (150)	2.5	16.02	0.37	127	0.117	0.473944	0.29	12.78543	0.34	0.19565	0.14	0.910	2500.8	6.0	2664.0	3.2	2790.3	2.3	12.50
EKC03-21																			
za1	629	0.49	0.73	31662	0.196	0.650279	0.06	23.09430	0.07	0.25758	0.04	0.800	3229.3	1.4	3230.9	0.7	3231.9	0.7	0.10
za3	133	2.19	0.64	5777	0.171	0.649724	0.07	23.07645	0.08	0.25760	0.05	0.826	3227.1	1.7	3230.2	0.8	3232.1	0.7	0.19
za5	106	0.56	0.57	5524	0.154	0.648190	0.11	23.03382	0.14	0.25773	0.09	0.800	3221.1	2.9	3228.4	1.4	3232.9	1.3	0.46
za6	89	0.41	0.49	4697	0.135	0.638878	0.21	22.69538	0.21	0.25764	0.04	0.978	3184.6	5.3	3214.0	2.1	3232.4	0.7	1.87
a1 (55)	5.9	2.77	4.13	173	1.106	0.642698	0.94	22.17495	0.96	0.25024	0.13	0.990	3199.6	23.8	3191.4	9.3	3186.3	2.1	-0.53

Table 1. U-Pb isotopic data

				Isotopic ratios									Dates (Ma)						
Sample	Pb*/Pb_c	Pb_c (pg)	Th/U	$^{206}Pb/^{204}Pb$	$^{208}Pb/^{206}Pb$	$^{206}Pb/^{238}U$	% err	$^{207}Pb/^{235}U$	% err	$^{207}Pb/^{206}Pb$	% err	corr. coef.	$^{206}Pb/^{238}U$	±	$^{207}Pb/^{235}U$	±	$^{207}Pb/^{206}Pb$	±	% disc.
(a)	(b)	(c)	(d)	(e)	(f)	(f)	(g)	(f)	(g)	(f)	(g)		(h)	(i)	(h)	(i)	(h)	(i)	(j)
BS04-7																			
za1	112	2.32	0.49	5796	0.131	0.703135	0.10	28.52495	0.11	0.29423	0.05	0.886	3432.5	2.7	3437.3	1.1	3440.1	0.8	0.28
za2	138	1.97	0.26	6747	0.070	0.694308	0.17	27.66153	0.18	0.28895	0.05	0.961	3399.0	4.5	3407.2	1.8	3412.0	0.8	0.49
za3	785	0.77	0.26	42260	0.068	0.702401	0.06	28.45518	0.07	0.29382	0.04	0.836	3429.7	1.6	3434.9	0.7	3437.9	0.6	0.31
za4	180	0.50	0.56	9268	0.151	0.665477	0.21	24.91872	0.22	0.27158	0.07	0.952	3288.4	5.4	3305.0	2.2	3315.2	1.1	1.03
za7	1110	0.19	0.27	59565	0.073	0.694396	0.17	27.78240	0.17	0.29018	0.05	0.960	3399.4	4.4	3411.4	1.7	3418.5	0.8	0.72
za8	136	10.44	0.29	6445	0.076	0.697804	0.07	27.89760	0.08	0.28996	0.04	0.871	3412.3	1.9	3415.5	0.8	3417.4	0.6	0.19
BS04-8																			
za1	2729	0.61	0.34	144966	0.090	0.695227	0.05	27.69521	0.06	0.28892	0.04	0.784	3402.5	1.3	3408.4	0.6	3411.8	0.6	0.35
za2	3133	0.69	0.68	159391	0.182	0.649825	0.07	23.07707	0.08	0.25756	0.04	0.851	3227.5	1.7	3230.2	0.7	3231.9	0.6	0.17
za3	580	0.60	0.60	29943	0.160	0.650089	0.09	23.09444	0.10	0.25765	0.04	0.894	3228.6	2.2	3230.9	1.0	3232.4	0.7	0.15
za4	600	0.56	0.71	29270	0.186	0.731132	0.07	31.66497	0.08	0.31411	0.04	0.846	3537.6	1.9	3539.9	0.8	3541.2	0.7	0.13
za5	178	0.40	0.61	9195	0.165	0.648247	0.16	23.02419	0.17	0.25760	0.07	0.920	3221.4	3.9	3228.0	1.6	3232.1	1.0	0.42
BS04-6																			
za2	231	0.54	0.52	12080	0.140	0.657275	0.21	23.76126	0.21	0.26219	0.04	0.978	3256.6	5.3	3258.6	2.0	3259.9	0.7	0.13
za3	164	0.68	0.39	8799	0.104	0.656805	0.09	23.68880	0.10	0.26158	0.05	0.902	3254.7	2.4	3255.7	1.0	3256.3	0.7	0.06
za4	159	0.76	0.46	8425	0.123	0.656046	0.11	23.65171	0.12	0.26147	0.06	0.879	3251.8	2.7	3254.1	1.2	3255.6	0.9	0.15
za6	743	1.14	0.63	38205	0.170	0.646775	0.07	22.79281	0.09	0.25559	0.04	0.876	3215.6	1.9	3218.1	0.8	3219.7	0.6	0.16
za7	1234	0.64	0.99	59380	0.265	0.646538	0.06	22.79307	0.07	0.25569	0.04	0.810	3214.7	1.5	3218.1	0.7	3220.3	0.7	0.22
za8	1095	0.27	0.54	57233	0.145	0.646147	0.08	22.76771	0.09	0.25556	0.04	0.888	3213.1	2.1	3217.1	0.9	3219.5	0.7	0.25
a1 (90)	3	23.28	3.54	95	0.953	0.636939	0.33	21.90784	0.63	0.24946	0.44	0.769	3177.0	8.2	3179.7	6.2	3181.3	6.9	0.17
a2 (145)	11	99.85	0.97	461	0.260	0.639883	0.06	22.16504	0.07	0.25123	0.05	0.781	3188.6	1.5	3191.0	0.7	3192.5	0.7	0.16
a4 (100)	7	11.40	1.23	288	0.328	0.646589	0.21	22.30274	0.23	0.25017	0.09	0.922	3214.9	5.4	3197.0	2.3	3185.8	1.4	-1.16
a5 (145)	6	18.26	1.25	253	0.337	0.640099	0.13	22.19352	0.15	0.25146	0.07	0.886	3189.4	3.3	3192.2	1.5	3194.0	1.1	0.18
a6 (170)	2	26.55	0.94	76	0.253	0.644193	0.30	22.44201	0.36	0.25266	0.19	0.856	3205.5	7.5	3203.1	3.5	3201.5	2.9	-0.16

Table 1. (cont.)

				Isotopic ratios									Dates (Ma)						
Sample (a)	Pb*/Pb_c (b)	Pb_c (pg) (c)	Th/U (d)	$^{206}Pb/^{204}Pb$ (e)	$^{208}Pb/^{206}Pb$ (f)	$^{206}Pb/^{238}U$ (f)	% err (g)	$^{207}Pb/^{235}U$ (f)	% err (g)	$^{207}Pb/^{206}Pb$ (f)	% err (g)	corr. coef.	$^{206}Pb/^{238}U$ (h)	± (i)	$^{207}Pb/^{235}U$ (h)	± (i)	$^{207}Pb/^{206}Pb$ (h)	± (i)	% disc. (j)
BS04-11																			
za1	5510	0.70	0.92	268112	0.248	0.647444	0.05	22.84301	0.06	0.25589	0.04	0.764	3218.2	1.2	3220.3	0.6	3221.6	0.6	0.13
za2	361	6.51	0.90	17645	0.242	0.647356	0.06	22.84259	0.07	0.25592	0.04	0.824	3217.9	1.5	3220.3	0.7	3221.8	0.6	0.15
za3	72	6.54	0.58	3756	0.154	0.651180	0.08	23.17491	0.09	0.25812	0.04	0.886	3232.8	2.0	3234.3	0.9	3235.2	0.7	0.10
BS04-12																			
za1	1256	0.34	0.89	61369	0.240	0.643876	0.09	22.69433	0.10	0.25563	0.04	0.905	3204.2	2.3	3213.9	1.0	3220.0	0.7	0.62
za2	2810	0.28	1.02	133952	0.276	0.646779	0.07	22.82349	0.09	0.25593	0.04	0.880	3215.6	1.9	3219.4	0.8	3221.8	0.6	0.25
za3	3742	0.40	1.10	176202	0.297	0.647034	0.07	22.82788	0.09	0.25588	0.04	0.881	3216.6	1.9	3219.6	0.8	3221.5	0.6	0.19
za4	5014	0.53	0.98	241146	0.265	0.647569	0.05	22.85273	0.06	0.25595	0.04	0.768	3218.7	1.2	3220.7	0.6	3221.9	0.6	0.13
EKC02-66																			
za1	77	0.69	0.36	4162.8	0.099	0.633011	0.14	22.58508	0.16	0.25877	0.07	0.887	3161.5	3.5	3209.2	1.6	3239.2	1.2	3.03
za2	63	1.09	0.32	3391.1	0.089	0.641958	0.16	23.10661	0.18	0.26105	0.07	0.925	3196.7	4.1	3231.4	1.7	3253.1	1.1	2.20
za3	49	0.85	0.14	2756.8	0.044	0.546016	0.08	19.19867	0.09	0.25501	0.04	0.891	2808.6	1.8	3051.9	0.9	3216.2	0.7	15.60
EKC02-64																			
za1	881	1.07	0.32	47223	0.085	0.657460	0.07	23.85223	0.08	0.26312	0.04	0.856	3257.3	1.8	3262.4	0.8	3265.5	0.7	0.32
za2	642	1.16	0.39	33383	0.105	0.657410	0.06	23.85243	0.08	0.26315	0.04	0.843	3257.1	1.7	3262.4	0.7	3265.6	0.7	0.33
za3	1570	0.12	0.34	82998	0.093	0.680006	0.07	27.32409	0.23	0.29143	0.22	0.299	3344.4	1.8	3395.1	2.3	3425.2	3.5	3.02
EKC03-35																			
za11	62	1.68	0.33	2958.0	0.090	0.668105	0.08	25.25509	0.12	0.27416	0.09	0.656	3298.6	2.1	3318.1	1.2	3330.0	1.4	1.21
a1 (72)	4.3	5.89	0.21	229.2	0.058	0.533515	0.51	13.96392	0.56	0.18983	0.15	0.963	2756.2	11.5	2747.3	5.3	2740.7	2.5	-0.70
a2 (190)	5.2	67.96	0.23	261.4	0.064	0.514442	0.07	13.38413	0.09	0.18869	0.06	0.763	2675.6	1.5	2707.1	0.9	2730.8	1.0	2.47
a4 (45)	1.5	7.39	0.23	94.1	0.063	0.536525	0.97	13.94658	1.06	0.18853	0.38	0.933	2768.9	21.8	2746.1	10.0	2729.4	6.3	-1.78
a5 (60)	1.5	6.85	0.39	84.5	0.105	0.558060	0.92	15.11220	0.99	0.19640	0.24	0.971	2858.6	21.3	2822.3	9.5	2796.5	3.9	-2.75
a6 (95)	1.9	13.59	0.36	101.9	0.100	0.535765	0.44	14.21527	0.48	0.19243	0.14	0.955	2765.7	10.0	2764.2	4.6	2763.1	2.4	-0.12
a7 (145)	4.3	29.51	0.28	227.9	0.078	0.523582	0.13	13.52635	0.16	0.18737	0.08	0.855	2714.4	3.0	2717.1	1.5	2719.2	1.4	0.22
a8 (120)	3.0	32.29	0.50	150.7	0.131	0.560401	0.15	14.79977	0.18	0.19154	0.09	0.855	2868.3	3.4	2802.5	1.7	2755.4	1.6	-5.08

Table 1. (cont.)

				Isotopic ratios									Dates (Ma)						
Sample (a)	$\frac{Pb^*}{Pb_c}$ (b)	Pb_c (pg) (c)	$\frac{Th}{U}$ (d)	$\frac{^{206}Pb}{^{204}Pb}$ (e)	$\frac{^{208}Pb}{^{206}Pb}$ (f)	$\frac{^{206}Pb}{^{238}U}$ (f)	% err (g)	$\frac{^{207}Pb}{^{235}U}$ (f)	% err (g)	$\frac{^{207}Pb}{^{206}Pb}$ (f)	% err (g)	corr. coef.	$\frac{^{206}Pb}{^{238}U}$ (h)	± (i)	$\frac{^{207}Pb}{^{235}U}$ (h)	± (i)	$\frac{^{207}Pb}{^{206}Pb}$ (h)	± (i)	% disc. (j)
EKC03-36																			
za1	247	0.54	0.42	13179	0.116	0.627896	0.10	22.40673	0.11	0.25881	0.05	0.902	3141.3	2.5	3201.5	1.1	3239.5	0.8	3.83
za2	149	0.68	0.53	7803.0	0.144	0.642513	0.21	22.92516	0.21	0.25878	0.05	0.977	3198.9	5.2	3223.8	2.1	3239.3	0.7	1.58
za8	65	3.85	0.26	3158	0.070	0.647439	0.08	23.10843	0.09	0.25886	0.04	0.877	3218.2	2.1	3231.5	0.9	3239.8	0.7	0.85
za9	389	0.49	0.29	21320	0.080	0.641473	0.07	22.67624	0.09	0.25638	0.04	0.861	3194.8	1.9	3213.2	0.8	3224.6	0.7	1.17
za10	33	0.60	0.65	1677	0.180	0.639608	0.15	23.20469	0.16	0.26312	0.08	0.887	3187.5	3.7	3235.6	1.6	3265.5	1.2	3.03
za11	71	0.43	0.34	3839.9	0.092	0.640505	0.31	22.88323	0.31	0.25912	0.07	0.977	3191.0	7.7	3222.0	3.1	3241.3	1.1	1.97
a1 (60)	3.9	6.99	0.27	202.8	0.076	0.529824	0.53	13.88913	0.56	0.19013	0.12	0.979	2740.7	11.9	2742.2	5.3	2743.3	1.9	0.11
a4 (35)	1.5	3.53	0.58	83.5	0.173	0.562936	1.98	18.39225	2.03	0.23696	0.25	0.993	2878.8	46.0	3010.5	19.5	3099.7	4.0	8.83
a5 (55)	2.9	5.10	0.43	148.7	0.120	0.554933	0.74	15.61655	0.78	0.20410	0.15	0.981	2845.7	17.1	2853.6	7.4	2859.3	2.5	0.59
a6 (72)	3.7	8.44	0.20	197.2	0.056	0.538031	0.33	14.36576	0.36	0.19365	0.11	0.956	2775.2	7.5	2774.2	3.4	2773.4	1.8	-0.08
a7 (105)	4.5	25.85	0.29	226.4	0.086	0.503824	0.10	13.32873	0.13	0.19187	0.08	0.811	2630.2	2.2	2703.2	1.2	2758.3	1.3	5.65
a8 (140)	4.9	61.25	0.37	235.3	0.117	0.476877	0.10	13.04429	0.12	0.19839	0.07	0.838	2513.6	2.1	2682.9	1.1	2813.0	1.1	12.83
EKC02-65																			
za1	176	1.19	0.80	8944.9	0.223	0.525437	0.08	13.65228	0.11	0.18844	0.07	0.744	2722.2	1.8	2725.9	1.0	2728.6	1.2	0.29
za2	166	1.92	1.47	7093	0.408	0.525635	0.07	13.65889	0.08	0.18846	0.05	0.838	2723.0	1.6	2726.4	0.8	2728.8	0.8	0.26
za3	32	3.42	0.79	1493	0.218	0.525122	0.31	13.64960	0.32	0.18852	0.06	0.983	2720.9	7.0	2725.7	3.0	2729.3	1.0	0.38

Table 1. (cont.)

				Isotopic ratios									Dates (Ma)						
Sample (a)	Pb*/Pb_c (b)	Pb_c (pg) (c)	Th/U (d)	$^{206}Pb/^{204}Pb$ (e)	$^{208}Pb/^{206}Pb$ (f)	$^{206}Pb/^{238}U$ (f)	% err (g)	$^{207}Pb/^{235}U$ (f)	% err (g)	$^{207}Pb/^{206}Pb$ (f)	% err (g)	corr. coef.	$^{206}Pb/^{238}U$ (h)	± (i)	$^{207}Pb/^{235}U$ (h)	± (i)	$^{207}Pb/^{206}Pb$ (h)	± (i)	% disc. (j)
BS04-20																			
za1	28	0.65	0.41	1488.4	0.115	0.644035	0.21	24.92600	0.23	0.28070	0.08	0.939	3204.9	5.4	3305.3	2.2	3366.8	1.2	6.10
za2	414	1.05	0.61	22353	0.168	0.528156	0.05	13.76746	0.07	0.18906	0.04	0.760	2733.7	1.1	2733.8	0.6	2734.0	0.7	0.01
za3	4.2	0.49	0.39	236.5	0.137	0.515480	0.95	19.80413	1.23	0.27864	0.78	0.773	2680.0	20.9	3081.8	11.9	3355.3	12.2	24.51
za4	1897	0.27	0.26	108360	0.072	0.564975	0.05	16.27296	0.07	0.20890	0.04	0.768	2887.2	1.2	2893.0	0.6	2897.0	0.7	0.42
za5	370	0.60	0.49	19535	0.133	0.640392	0.07	22.38542	0.09	0.25352	0.05	0.793	3190.6	1.7	3200.6	0.8	3206.9	0.8	0.65
BS04-21																			
za1	510	0.53	0.20	30051	0.056	0.524833	0.05	13.64586	0.07	0.18857	0.04	0.769	2719.6	1.1	2725.4	0.6	2729.8	0.7	0.45
za3	2.2	0.25	0.64	138.5	0.178	0.526586	1.68	13.67389	1.86	0.18833	0.52	0.963	2727.1	37.4	2727.4	17.6	2727.6	8.5	0.03
za4	108	0.29	0.14	6442.3	0.040	0.524939	0.10	13.64619	0.11	0.18854	0.05	0.903	2720.1	2.1	2725.5	1.0	2729.5	0.8	0.42
za5	122	1.09	0.20	7107.9	0.055	0.525893	0.11	13.67847	0.13	0.18864	0.05	0.912	2724.1	2.5	2727.7	1.2	2730.4	0.8	0.28

(a) za1, za2, a1, a2, etc. are fractions composed of single grains of zircon and apatite, respectively
numbers in parantheses following apatite fractions are the grain diameter, in µm

(b) Ratio of radiogenic Pb (including 208Pb) to common Pb.

(c) Total weight of common Pb.

(d) Model Th/U ratio calculated from radiogenic 208Pb/206Pb ratio and 207Pb/206Pb age.

(e) Measured ratio corrected for spike and fractionation only. Mass fractionation corrections were based on analysis of NBS-981 and NBS-983. Corrections of 0.25 ± 0.04%/amu (atomic mass unit) and 0.07 ± 0.04%/amu were applied to single-collector Daly analyses and dynamic Faraday-Daly analyses, respectively.

(f) Corrected for fractionation, spike, and blank. All common Pb was assumed to be procedural blank.

(g) Errors are 2 sigma, propagated using the algorithms of Schmitz and Schoene (2007)

(h) Calculations are based on the decay constants of Jaffey et al. (1971).

(i) Errors are 2 sigma.

(j) % discordance = 100 - (100 x 206Pb/238U date / 207Pb/206Pb date).

Table 2: Major and trace element data for selected samples

Oxide/Element	SiO2	Al2O3	Fe2O3(T	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	LOI	Total	Sc	Be	V	Cr
Unit Symbol	wgt %	wgt %	wgt %	wgt %	wgt %	wgt %	wgt %	wgt %	wgt %	wgt %	wgt %	wgt %	ppm	ppm	ppm	ppm
Detection Limit	0.01	0.01	0.01	0.001	0.01	0.01	0.01	0.01	0.001	0.01	0.01	0.01	1	1	5	20

Samples

BS-04-6	73.22	13.61	1.52	0.015	0.21	0.61	2.69	7	0.161	0.03	0.5	99.56	< 1	< 1	< 5	< 20
BS-04-8	71.66	14.94	1.54	0.019	0.48	2.69	5.27	1.29	0.216	0.07	1	99.16	2	1	13	< 20
BS-04-12	75.47	13.73	1.17	0.014	0.38	1.7	3.51	3.45	0.19	0.09	0.55	100.3	2	1	14	< 20
KPV99-90	77.51	12.1	0.55	0.016	0.6	1.55	3.71	2.1	0.094	0.02	0.84	99.09	2	2	< 5	< 20
KPV99-94	70.62	15.99	1.95	0.022	0.78	3.13	5.1	1.02	0.261	0.1	1.5	100.5	1	1	19	< 20
EKC02-23	70.21	14.32	2.76	0.053	0.74	1.85	3.41	4.51	0.339	0.18	0.82	99.19	3	1	28	< 20
EKC02-24	55.87	19.74	7.4	0.106	2.15	4.97	4.79	2.38	1.057	0.45	1.48	100.4	9	7	60	< 20
EKC02-32	56.84	19.56	4.86	0.057	2.69	5.3	6.76	0.08	0.69	0.31	2.09	99.23	7	2	86	< 20
EKC02-35	65.31	16.68	5.37	0.077	1.51	4.33	4.64	1.22	0.717	0.29	0.81	100.9	6	1	70	< 20
EKC02-51	68.1	15.66	3.04	0.068	1.2	3.35	4.08	1.56	0.464	0.17	1.27	98.96	6	1	71	< 20
EKC02-64	71.78	14.52	1.83	0.017	0.57	2.07	4.26	2.98	0.307	0.1	0.95	99.39	2	< 1	14	< 20
EKC02-66	70.26	15.58	1.41	0.027	0.43	1.76	5.49	2.22	0.206	0.08	1.01	98.47	1	2	12	< 20
EKC03-18	60.84	18.95	3.27	0.049	2.77	1.22	8.38	0.78	0.755	0.24	1.88	99.13	4	2	37	< 20
EKC03-21	68.95	15.77	3.01	0.052	1.02	2.8	3.94	3.18	0.386	0.21	0.68	99.99	3	1	49	< 20
EKC03-23	63.56	15.83	5.41	0.083	1.76	4.01	3.69	2.47	0.741	0.47	0.91	98.94	9	2	81	20
EKC03-33	64.98	15.51	4.81	0.079	1.41	3.18	3.37	3.69	0.64	0.35	1.33	99.36	9	3	63	< 20
EKC03-35	67.26	15.93	3.63	0.046	1.44	3.24	4.34	2.18	0.722	0.2	0.61	99.61	8	3	57	40
EKC03-36	72.64	14.31	1.87	0.017	0.56	2.22	3.81	2.93	0.337	0.09	0.74	99.51	3	2	18	< 20

Standards and duplicate analyses

GXR-1 Meas																< 20
GXR-1 Cert																12
WMG-1 Meas																830
WMG-1 Cert																770
NIST 694 Meas	11.32	1.89	0.71	0.01	0.32	43.09	0.87	0.59	0.115	30.09					1678	
NIST 694 Cert	11.2	1.8	0.79	0.0116	0.33	43.6	0.86	0.51	0.11	30.2					1740	
DNC-1 Meas	46.88	18.49	9.82	0.149	10.17	11.33	1.89	0.26	0.488	0.09			31	< 1	155	290
DNC-1 Cert	47	18.3	9.93	0.149	10.1	11.3	1.87	0.234	0.48	0.09			31	1	148	285
BIR-1 Meas	47.67	15.62	11.26	0.174	9.65	13.29	1.8	0.04	0.978	0.04			44	1	337	390
BIR-1 Cert	47.8	15.4	11.3	0.171	9.68	13.2	1.75	0.03	0.96	0.05			44	0.58	313	382
MICA-FE Meas																90
MICA-FE Cert																90
GXR-2 Meas																30
GXR-2 Cert																36
FK-N Meas	57.85	18.09	0.17	0.002	< 0.01	0.1	2.39	12.51	0.004	0.02			< 1	1	< 5	
FK-N Cert	65	18.6	0.09	0.005	0.01	0.11	2.58	12.8	0.02	0.024			1	1	5	
LKSD-3 Meas																80
LKSD-3 Cert																87
MAG-1 Meas																80
MAG-1 Cert																97
NIST 1633b Meas	48.84	28.56	10.97	0.015	0.79	2.16	0.3	2.3	1.311	0.58			41		305	
NIST 1633b Cert	49.2	28.4	11.1	0.02	0.8	2.11	0.27	2.35	1.32	0.53			41		296	
SY-3 Meas	62.13	12.43	6.42	0.328	2.73	8.3	4.36	4.66	0.141	0.48			8	22	55	
SY-3 Cert	59.6	11.8	6.49	0.32	2.67	8.25	4.12	4.23	0.15	0.54			7	20	50	
W-2a Meas	74.69	9.67	4.1	0.139	1.13	0.56	0.41	1.95	0.404	0.09			11	10	75	90
W-2a Cert	52.4	15.4	10.7	0.163	6.37	10.9	2.14	0.626	1.06	0.13			36	1.3	262	92
NIST 696 Meas	3.78	54.48	8.55	0.005	0.01	0.02		0.02	2.636	0.04					408	
NIST 696 Cert	3.79	54.5	8.7	0.004	0.012	0.018		0.009	2.64	0.05					403	
CTA-AC-1 Meas																
CTA-AC-1 Cert																
BS-04-8 Orig	72.18	14.94	1.55	0.021	0.48	2.71	5.12	1.28	0.217	0.06	1	99.57	2	1	11	
BS-04-8 Dup	71.13	14.93	1.53	0.018	0.48	2.66	5.41	1.31	0.215	0.07	1	98.75	2	1	16	
Method Blank																< 20

Co	Ni	Cu	Zn	Ga	Ge	As	Rb	Sr	Y	Zr	Nb	Mo	Ag	In	Sn	Sb	Cs
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
1	20	10	30	1	0.5	5	1	2	0.5	1	0.2	2	0.5	0.1	1	0.2	0.1
1	< 20	< 10	< 30	13	0.5	< 5	97	308	1.9	49	1	< 2	< 0.5	< 0.1	< 1	< 0.2	0.4
3	< 20	< 10	< 30	18	0.6	< 5	26	421	3.2	75	1.9	< 2	< 0.5	< 0.1	< 1	< 0.2	0.1
3	< 20	< 10	< 30	15	< 0.5	< 5	71	272	3.4	211	3.9	< 2	< 0.5	< 0.1	< 1	< 0.2	0.6
< 1	< 20	< 10	< 30	14	1	< 5	59	42	25.9	87	8.5	< 2	< 0.5	< 0.1	2	< 0.2	5.6
4	< 20	10	30	18	0.6	< 5	30	591	3.6	119	1.7	< 2	< 0.5	< 0.1	< 1	0.4	0.8
5	< 20	< 10	40	17	0.9	< 5	103	393	12.5	163	4.4	< 2	< 0.5	< 0.1	< 1	< 0.2	0.7
12	< 20	60	160	29	1	< 5	150	680	27.2	531	17.5	< 2	< 0.5	< 0.1	14	< 0.2	13.5
9	< 20	< 10	40	34	3.3	< 5	2	761	18.3	296	11.8	< 2	< 0.5	< 0.1	< 1	< 0.2	< 0.1
12	< 20	60	90	20	0.7	< 5	21	643	10.6	275	6.3	< 2	< 0.5	< 0.1	1	< 0.2	1.1
8	20	20	90	20	0.6	< 5	51	516	8.9	106	2	< 2	< 0.5	< 0.1	< 1	< 0.2	1.5
4	< 20	< 10	40	17	< 0.5	< 5	64	292	4	204	4.7	< 2	< 0.5	< 0.1	< 1	< 0.2	0.5
3	< 20	< 10	80	21	< 0.5	< 5	64	504	4.2	126	2.7	< 2	< 0.5	< 0.1	2	< 0.2	0.8
13	< 20	< 10	60	15	< 0.5	< 5	15	170	9.4	290	6.3	< 2	< 0.5	< 0.1	1	< 0.2	< 0.1
7	< 20	30	40	17	0.7	< 5	43	740	6.6	182	3.6	< 2	< 0.5	< 0.1	2	< 0.2	0.2
10	< 20	20	70	19	1.1	< 5	128	543	28.4	180	10.3	< 2	< 0.5	< 0.1	3	0.6	36.9
9	< 20	20	90	19	1.1	< 5	161	590	35.2	298	14	< 2	< 0.5	< 0.1	4	< 0.2	12.4
10	20	20	70	21	0.9	< 5	99	249	16.6	243	17.7	< 2	< 0.5	< 0.1	2	< 0.2	1.8
3	< 20	20	40	20	0.7	< 5	80	215	11.4	178	12.5	< 2	< 0.5	< 0.1	2	< 0.2	0.7
8	40	1110	750	17		428	4		33	30	1.2	18	32.5	0.8	51	122	3.1
8.2	41	1110	760	13.8		427	14		32	38	0.8	18	31	0.77	54	122	3
195	2510	5590	110	10		7			15	54	4.6	< 2	1.4		2	2.3	0.5
200	2700	5900	110	10.3		7			12	43	6	1.4	2.7		2.2	1.8	0.48
55	250	100	90	14	1.3	< 5	4	143	18.6	34	1.4	< 2	< 0.5			5.5	0.2
54.7	247	96	66	15	1.3	0.2	4.5	145	18	41	3	0.7	0.027			0.96	0.34
50	170	120	90	16	1.4	< 5	< 1	108	16.8	13	0.5	< 2	< 0.5		< 1	0.4	< 0.1
51.4	166	126	71	16	1.5	0.44	0.25	108	16	16	0.6	0.5	0.036		0.65	0.58	0.005
24	50	< 10	1300	97	3.2	< 5	> 1000		49.8	846	270	< 2		0.6	72		180
23	35	5	1300	95	3.2	3	2200		48	800	270	1.2		0.6	70		180
8	< 20	80	570	31		15	78		16.7	168	5.9	< 2	14.3	< 0.1	2	21.2	5
8.6	21	76	530	37		25	78		17	269	11	2.1	17	0.252	1.7	49	5.2
								37									
								39									
32	50	40	150			20	89		31.6	169	7.7	< 2	1.7		2	< 0.2	3.1
30	47	35	152			27	78		30	178	8	2	2.7		3	1.3	2.3
20	40	30	140	20		5	143		22.6	59	5.5	< 2	< 0.5	< 0.1	3	< 0.2	8.2
20.4	53	30	130	20.4		9.2	149		28	126	12	1.6	0.08	0.18	3.6	0.96	8.6
								1035									
								1040									
								286									
								302									
42	80	120	90	18	1.5	< 5	21	55	21.8	86	6.3	< 2	< 0.5			< 0.2	0.9
43	70	110	80	17	1	1.2	21	190	24	94	7.9	0.6	0.046			0.79	0.99
< 1		70	40						355								
2.72		54	38						272								
3	< 20	< 10	< 30	18	0.6	< 5	26	438	3.2	75	1.8	< 2	< 0.5	< 0.1	< 1	< 0.2	0.1
3	< 20	< 10	< 30	19	0.6	< 5	26	403	3.3	76	2	< 2	< 0.5	< 0.1	< 1	< 0.2	0.1
< 1	< 20	< 10	< 30	< 1	< 0.5	< 5	< 1		< 0.5	< 1	< 0.2	< 2	< 0.5	< 0.1	< 1	< 0.2	< 0.1

Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
3	0.05	0.05	0.01	0.05	0.01	0.005	0.01	0.01	0.01	0.01	0.01	0.005	0.01	0.002	0.1	0.01	0.5
2735	13.4	21.7	2.21	6.1	0.84	1.12	0.56	0.07	0.36	0.06	0.18	0.026	0.16	0.023	1.4	0.09	< 0.5
393	35.6	61.7	6.52	18.3	2.61	0.992	1.57	0.19	0.77	0.12	0.29	0.037	0.22	0.033	2.5	0.06	< 0.5
1015	20.5	32.3	3.29	9.49	1.4	0.835	0.98	0.13	0.65	0.13	0.35	0.054	0.37	0.06	5.2	0.1	< 0.5
147	30	63.3	7.3	23.6	4.16	0.482	3.55	0.64	3.94	0.8	2.4	0.361	2.36	0.362	3.2	0.79	< 0.5
145	4.53	8.26	1	3.41	0.76	0.464	0.67	0.11	0.56	0.1	0.31	0.051	0.35	0.058	2.9	0.23	< 0.5
912	40.8	74	8.05	24.7	4.06	1.29	3.04	0.45	2.33	0.41	1.09	0.148	0.89	0.136	4.5	0.26	< 0.5
518	42.4	88.2	11.3	39	7.98	1.76	6.68	1.1	5.47	0.95	2.55	0.343	2.01	0.298	10.9	0.59	< 0.5
62	118	182	20.1	63.1	9.79	3.15	7.03	0.88	3.69	0.62	1.55	0.196	1.14	0.175	7.4	0.33	< 0.5
511	27.4	50.6	6	20.1	3.53	1.7	2.72	0.4	1.93	0.35	0.95	0.131	0.82	0.129	6.9	0.34	< 0.5
221	14.4	29.9	3.72	12.5	2.46	0.845	2.11	0.31	1.57	0.29	0.8	0.112	0.7	0.107	2.8	0.05	< 0.5
853	39.9	67.3	7.04	20.2	2.7	0.839	1.61	0.19	0.8	0.14	0.38	0.054	0.36	0.057	5	0.08	< 0.5
481	18.1	31.8	3.37	9.99	1.76	0.628	1.24	0.17	0.8	0.14	0.35	0.048	0.28	0.039	3.2	0.55	< 0.5
370	18.5	40.3	4.44	12.9	2.34	0.798	2.02	0.31	1.63	0.3	0.8	0.107	0.63	0.09	5.8	0.33	< 0.5
1948	24.4	42.9	4.81	15.3	2.69	1.87	2.22	0.28	1.3	0.23	0.61	0.082	0.52	0.081	4.2	0.17	< 0.5
572	40.6	84.8	10.6	36.8	7.48	1.79	6.85	1	4.91	0.85	2.39	0.346	2.06	0.297	4.7	0.82	0.9
1436	89.4	165	19.2	59.4	10.6	2.26	7.8	1.29	6.26	1.06	3.04	0.435	2.7	0.39	7.5	1.07	0.8
340	59.1	106	11.7	34.2	5.6	1.07	4.18	0.7	3.4	0.57	1.56	0.2	1.1	0.163	5.9	1.22	< 0.5
464	34.4	63.4	6.97	21.4	4.02	0.865	3.49	0.49	2.2	0.35	0.87	0.102	0.56	0.079	4.5	0.62	< 0.5
	7.69	15.3		8.17	2.87	0.641	4.17	0.89	5.16			0.429	2.24	0.309	0.8	0.08	165
	7.5	17		18	2.7	0.69	4.2	0.83	4.3			0.43	1.9	0.28	0.96	0.175	164
	7.9	16.7		8.91	2.29	0.744		0.47	2.66	0.48		0.229	1.31	0.197	1.5	0.33	0.6
	8.2	16		9	2.3	0.82		0.3	2.8	0.5		0.2	1.3	0.21	1.3	0.5	1.3
106	3.76	8.48	1.18	4.74	1.38	0.603	2.1	0.46	2.98	0.59	1.95	0.333	1.93	0.302	1	0.08	< 0.5
114	3.8	10.6	1.3	4.9	1.38	0.59	2	0.41	2.7	0.62	2	0.38	2.01	0.32	1.01	0.098	0.2
10	0.77	2.21	0.44	2.43	1.12	0.55	1.97	0.45	2.87	0.57	1.77	0.299	1.68	0.252	0.6	0.03	< 0.5
7	0.62	1.95	0.38	2.5	1.1	0.54	1.85	0.36	2.5	0.57	1.7	0.26	1.65	0.26	0.6	0.04	0.07
	192	426	54.4	171	32.8	0.609	23.4	2.93	11.4	1.39	3.77	0.572	3.29	0.472	26.9	35	8.3
	200	420	49	180	33	0.7	21	2.7	11	1.6	3.8	0.48	3.5	0.5	26	35	15
	22.1	45.7		16.6	3.13	0.673	2.89	0.5	2.7			0.253	1.51	0.231	4.6	0.68	1.2
	25.6	51.4		19	3.5	0.81	3.3	0.48	3.3			0.3	2.04	0.27	8.3	0.9	1.9
204																	
200																	
	47	89.7		40.4	7.53	1.43		1.01	5.19				2.67	0.406	4.6	0.67	1.3
	52	90		44	8	1.5		1	4.9				2.7	0.4	4.8	0.7	2
	34	71	8.72	29.1	5.67	1.14	5.29	0.84	4.27	0.7	2.13	0.335	1.94	0.277	1.7	0.74	0.9
	43	88	9.3	38	7.5	1.6	5.8	0.96	5.2	1.02	3	0.43	2.6	0.4	3.7	1.1	1.4
702																	
709																	
473																	
450																	
454	10.1	22.5		11.6	3.04	1.06		0.69	3.98	0.71	2.16	0.345	1.98	0.291	2.5	0.48	< 0.5
182	10	23		13	3.3	1		0.63	3.6	0.76	2.5	0.38	2.1	0.33	2.6	0.5	0.3
	> 2000	> 3000		1090	162	46.7	143	17.9					11.7	1.15	2.2	2.8	
	2176	3326		1087	162	46.7	124	13.9					11.4	1.08	1.13	2.65	
409	36	62.2	6.55	18.6	2.65	0.98	1.56	0.19	0.77	0.12	0.29	0.037	0.21	0.033	2.4	0.07	< 0.5
376	35.3	61.2	6.49	18.1	2.57	1	1.59	0.2	0.76	0.12	0.29	0.037	0.22	0.033	2.5	0.06	< 0.5
	< 0.05	< 0.05	< 0.01	< 0.05	< 0.01	< 0.005	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.005	< 0.01	< 0.002	< 0.1	< 0.01	< 0.5

Tl	Pb	Bi	Th	U
ppm	ppm	ppm	ppm	ppm
0.05	5	0.1	0.05	0.01
0.5	18	0.2	1.27	0.16
0.15	11	0.2	5.41	0.22
0.32	12	< 0.1	2.82	0.53
0.31	7	0.1	4.63	0.92
0.17	7	0.2	0.54	0.57
0.53	20	0.3	4.24	0.66
0.97	11	< 0.1	1.23	0.79
< 0.05	8	< 0.1	7.27	0.83
0.14	8	< 0.1	0.54	0.37
0.39	8	< 0.1	1.95	0.42
0.3	19	0.2	6.53	0.57
0.34	20	0.2	4.58	0.62
0.11	< 5	0.2	5.9	0.88
0.24	26	< 0.1	0.41	0.25
1.15	25	0.2	8.14	1.98
1.15	24	0.4	15.9	2.29
0.5	18	< 0.1	14.5	1.41
0.47	28	< 0.1	11.7	0.83
0.44	730	1380	2.64	35.8
0.39	730	1380	2.44	34.9
	17		1.16	0.68
	15		1.1	0.65
< 0.05	12	< 0.1	0.25	0.08
0.026	6.3	0.02	0.2	0.1
< 0.05	< 5	< 0.1	0.06	0.02
0.01	3	0.02	0.03	0.01
16	8	0.2	166	89.6
16	13	1.9	150	80
0.9	611	< 0.1	7.35	2.6
1.03	690	0.69	8.8	2.9
	19		11	4.91
	29		11.4	4.6
0.44	24	< 0.1	9.61	2.29
0.59	24	0.34	11.9	2.7
0.1	8	< 0.1	2.07	0.52
0.2	9.3	0.03	2.4	0.53
			23.8	4.53
			21.8	4.4
0.14	11	0.2	5.62	0.23
0.15	11	0.1	5.19	0.22
< 0.05	< 5	< 0.1	< 0.05	< 0.01