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Detrital Zircons U-Pb Age and Hf Isotope from the Western Side of the Taiwan Strait: Implications for Sediment Provenance and Crustal Evolution of the Northeast Cathaysia Block

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ABSTRACT

In situ detrital zircons U-Pb and Hf isotope analyses from the Min and Jiulong River of Southeast China were carried out to identify sediment provenance and crustal evolution of the northeast Cathaysia Block. Detrital zircons from both rivers displayed similar spectrum peaks at 236, 155, and 110 Ma, but samples from the Min River displayed a distinct Caledonian peak (ca. 460 Ma) and contained more Precambrian particles (ca. 1.8 Ga), which likely stemmed from the upstream area of the Wuyishan terrain. Interestingly, because Taiwan Island cannot supply Caledonian and Paleoproterozoic detrital materials and because the Ou and Jiulong River also lack components from these two populations, it is highly likely that the sediment in the western Taiwan coast partially originates from the Min River. The sediments from the Min River in Fujian are also considered the most likely source of the beach sands of western Taiwan (Chen et al. 2006). However, we stress that the ~1.8 Ga age source in the western Taiwan sediments was found and recognized. Combining U-Pb dating and Hf-isotope suggests that the northeast Cathaysia Block contains some Neoarchean detrital zircons, which derived from the incorporation of juvenile mantle materials and re-melting of ancient crustal substances. The wide ranges of $\varepsilon_{Hf}(t)$ value in the Paleoproterozoic and Neoproterozoic demonstrate the re-melting of ancient crustal materials with minor juvenile mantle materials. Phanerozoic zircons stemmed from re-melting and recycling of Proterozoic crustal materials with or without the invasion of juvenile mantle-derived magmas.

Key words: Detrital zircon, U-Pb age, Hf isotope, Provenance, Crustal evolution, Cathaysia Block

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1. INTRODUCTION

The Taiwan Strait connects the East China Sea and South China Sea, which are two major marginal seas of the western Pacific. This region serves as a canonical area in investigating terrigenous detrital materials transported into the sea, including the provenance and flux, as well as their distribution, transport and dispersion in continental shelves (Liu et al. 2002; Dadson et al. 2003; Xu et al. 2009). Detrital sediments from exposed continental crust across drainage basins may provide a record of the paleogeographic setting and their surrounding source regions (Cawood et al. 2003; Veevers et al. 2005).

Detrital zircons are resistant to chemical weathering and mechanical abrasion, and thus survive weathering from their provenance and subsequent transportation in fluvial systems. Therefore, *in situ* zircon U-Pb dating and Hf-isotope analysis has proven to be a useful tool in assessing the distribution of source rocks in the provenance and reconstructing tectonic evolution of continental blocks (Condie et al. 2005; Iizuka et al. 2005; Veevers et al. 2005; Yang et al. 2009; Wang et al. 2011).

Chen et al. (2006) proposed that sediments from the

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Min River in Fujian, Southeast China, are considered the most likely source of the beach sands of W Taiwan. However, ca. 1.8 Ga monazites have not been discovered in the Min River estuary and Wuyishan area (Chen et al. 2006, 2008). The Min River and Jiulong River are the major waterways flowing into the Taiwan Strait from the west and supply the strait with large amounts of terrigenous detrital materials (Xu 1994; Liu et al. 2001). In this study, we present U-Pb and Hf-isotope analyses of detrital zircons from the Min and Jiulong Rivers. The isotopic data are used to decipher identify sediment provenance and reveal the crustal evolution of the northeast Cathaysia Block.

2. GENERAL GEOLOGY OF THE DRAINAGE BASINS

The South China continent is composed of the Yangtze Block in the northwest and the Cathaysia Block in the southeast, along the Jiangshao-Pingyu Fault (Fig. 1a). The Min River flows across northern Fujian (Fig. 1b). As the largest river in the province it has a drainage basin area of 61000 km^2, an average flow of 1750 m^3 s^{-1} and annual average sediment loads of 715.5 × 10^4 t (Liu et al. 2001). The Jiulong River is situated in southern Fujian and is the second largest river in the province. The river has a drainage basin area of 14700 km^2 and annual average sediment loads of 223 × 10^4 t (Xu 1994). Because both drainage basins are mainly characterised by mountains and hills and concentrated rainfall, large quantities of terrigenous detrital materials are expected to be transported into the Taiwan Strait.

Precambrian basement rocks in the Cathaysia Block are sparsely exposed in the Chen Cai, Badu, Wuyishan, Nanling, Yunkai and Hainan areas (Zhao and Cawood 2012). The Min River originates from the Wuyishan region, which is a major Precambrian outcropping area of the Cathaysia Block (Fig. 1b). The headstream of the Jiulong River is located in the Longyan region (eastern Nanling). The Cathaysia Block has no exposed Archean rocks, but numerous Archean detrital zircons and minor inherited or xenocrystic zircons, implying the existence of Archean crust underlying the block or adjacent regions (Wan et al. 2007; Yu et al. 2009, 2012). The Cathaysia Block basement is composed mainly of Neoproterozoic basement rocks (~90%) with a minor outcrop of Paleoproterozoic rocks (Badu Group) in Wuyishan, and Mesoproterozoic rocks (Baoban, Shilu Group) in Hainan Island (Yu et al. 2010; Zhao and Cawood 2012). This composition is exemplified by ancient rock outcrops, which have been dated to approximately 1.8 Ga, in the Badu Group of southwestern Zhejiang and northwestern Fujian (Li et al. 1998; Yu et al. 2009, 2012). The Cathaysia Block has been bear strong overprinting of middle Paleozoic (Caledonian), Triassic (Indosinian) and Jurassic-Cretaceous (Yanshanian) (Chen and Jahn 1998; Zhou 2003; Wang et al. 2013). Early Palaeozoic granites are widespread in the eastern South China Block. Late Mesozoic granites from the Jurassic to Cretaceous display a migratory pattern from inland to coast

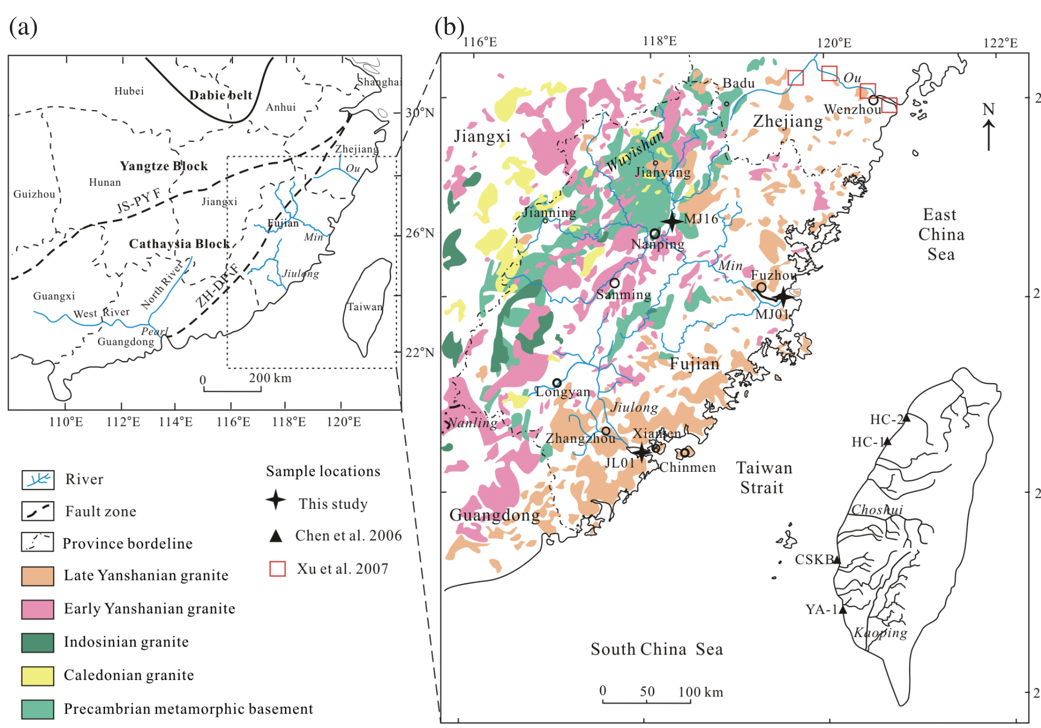

Fig. 1. Simplified map of major tectonic units in the South China (a) and geological map of the drainage basins of the Min River and Jiulong River in Fujian Province (b) revised from Sun (2006) .Abbreviation: JS-PY F, Jiangshao-Pingyu Fault; ZH-DP F, Zhenghe-Dapu Fault.

(Zhou et al. 2006; Li and Li 2007; Xu 2008; Wang et al. 2013). The drainage basins of both rivers are approximately perpendicular to the orientation of the Cathaysia granite-volcanic belts flowing into the Taiwan Strait (Fig. 1b).

3. SAMPLE AND ANALYSIS

Two surface sediment samples were collected from the Min River and one from Jiulong River (Fig. 1b). Three samples were all dominated by medium-coarse-grained feldspars and quartz sand. After washing, magnetic sorting and heavy liquid separation, zircon grains were glued to one side of double-sided tape and mounted with epoxy resin to form targets. The cathodoluminesence (CL) emission images have been widely used to distinguish igneous zircons from metamorphic zircons. In order to investigate the internal structures of zircon particles, zircon CL imaging was taken using a scanning electron microprobe at the Guangzhou Institute of Geochemistry, Chinese Academy of Sciences.

An Agilent 7500a quadruple (Q)-ICPMS and a Neptune multi-collector (MC) -ICPMS were used for simultaneous determination of zircon U-Pb age, trace elements and Lu-Hf isotopes with a 193 nm excimer ArF laser-ablation system (GeoLas Plus) attached. Experiments were carried out at the MC-ICPMS laboratory of the Institute of Geology and Geophysics, Chinese Academy of Sciences. The analytic methods and equipment parameters were similar to those of Xie et al. (2008).

The spot size of laser ablation was 44μm in diameter. U, Th and Pb concentrations were calibrated using ^{29}Si as an internal standard and NIST 610 as the reference standard (Pearce et al. 1997). $^{207}Pb/^{206}Pb$, $^{206}Pb/^{238}U$, $^{207}Pb/^{235}U$ ($^{235}U = ^{238}U/137.88$) ratios were corrected using the 91500 external standard. GJ-1 and 91500 yielded weighted $^{206}Pb/^{238}U$ ages of 603 ± 8 and 1063 ± 17 Ma, respectively. The fractionation correction and results were calculated using GLITTER 4.0 (Jackson et al. 2004). Subsequently, common Pb was corrected according to the method proposed by Andersen (2002). The weighted mean U-Pb ages and concordia plots were processed using ISOPLOT 3.0 (Ludwig 2003).

In situ determination of zircon Lu-Hf isotopes was performed using a Neptune MC-ICPMS, which used a Geolas 193 ArF laser ablation system. In this study, the mean $^{173}Yb/^{171}Yb$ ratio of the individual spot is used to calculate the fractionation coefficient (β_{Yb}), and then derive the contribution of ^{176}Yb to ^{176}Hf (Iizuka et al. 2005). Detailed test procedures and equipment operating conditions were previously described (Wu et al. 2006). Interference corrections were facilitated using $^{175}Lu/^{176}Lu = 0.02655$ and $^{176}Yb/^{172}Yb = 0.5887$ (Wu et al. 2007). The ^{176}Lu decay constant required for the calculation of $\varepsilon_{Hf}(t)$ was 1.867×10^{-11} y^{-1} (Söderlund et al. 2004). The $^{176}Hf/^{177}Hf$ and $^{176}Lu/^{177}Hf$ ratios of chondrite at the present day are 0.282785 and 0.0336, respectively (Bouvier et al. 2008). To calculate model ages based on a depleted-mantle source, we have adopted a model with $^{176}Hf/^{177}Hf = 0.28325$ (Griffin et al. 2002) and $^{176}Lu/^{177}Hf$ ratio of 0.0384 (Griffin et al. 2000). GJ-1 and Mud Tank zircons give weighted $^{176}Hf/^{177}Hf$ ratios of 0.282009 ± 20 (2σ) and 0.282504 ± 15 (2σ), respectively. Hf isotopic composition is calculated using the following equations:

$$
\begin{aligned}
\varepsilon_{Hf}(0) &= [(^{176}Hf/^{177}Hf)_S/(^{176}Hf/^{177}Hf)_{CHUR,0} - 1] \times 10000 \\
\varepsilon_{Hf}(t) &= \{[(^{176}Hf/^{177}Hf)_S - (^{176}Lu/^{177}Hf)_S \times (e^{\lambda t} - 1)]/ \\
&\quad [(^{176}Hf/^{177}Hf)_{CHUR,0} - (^{176}Lu/^{177}Hf)_{CHUR} \times \\
&\quad (e^{\lambda t} - 1)] - 1\} \times 10000 \\
T_{DM} &= 1/\lambda \times \ln\{1 + [(^{176}Hf/^{177}Hf)_S - (^{176}Hf/^{177}Hf)_{DM}]/ \\
&\quad [(^{176}Lu/^{177}Hf)_S - (^{176}Lu/^{177}Hf)_{DM}]\} \\
T_{DM2} &= T_{DM} - (T_{DM} - t) \times [(f_{CC} - f_S)/(f_{CC} - f_{DM})] \\
f_{Lu/Hf} &= (^{176}Lu/^{177}Hf)_S/(^{176}Lu/^{177}Hf)_{CHUR} - 1
\end{aligned}
\tag{1}
$$

4. RESULTS

Detrital zircons are characterized by euhedral, short prismatic shapes, with oscillatory bands in the CL images (Fig. 2). A few zircons display unzoned or cloudy-zoned CL image patterns. Most zircons had Th/U ratios greater than 0.10 (only five particles Th/U ratios less than 0.10). More than 60 zircons were conducted for each sample to satisfy statistical requirements (Vermeesch 2004; Andersen 2005).

4.1 U-Pb Ages Results

We used $^{207}Pb/^{206}Pb$ ages for zircons of age ≥ 1.0 Ga and $^{206}Pb/^{238}U$ ages for zircons of age < 1.0 Ga (Compston et al. 1992). It is worth noting that only analyses with less than 10% discordance were included in the following discussion.

4.1.1 Min River (MJ01)

A total of 146 analyses of 146 grains from the Min River estuary were made, of which 126 analyses are concordant with ages ranging from 2765 ± 12 to 97 ± 2 Ma (Appendix 1). The age distributions of detrital zircon exhibited four major groups (Figs. 3a and b): 1.6 - 1.9 Ga (16.7%), 351 - 498 Ma (27.8%), 224 - 259 Ma (7.9%), and 97 - 182 Ma (27.8%). In addition, two zircon grains with magmatic internal zoning structures show Neoarchean ages of 2506 ± 10 and 2765 ± 12 Ma, and nine detrital zircons belong to the Neoproterozoic (613 - 919 Ma).

4.1.2 Min River (MJ16)

A total of 97 analyses of 97 grains from the upstream Min River were undertaken, of which 10 analyses were

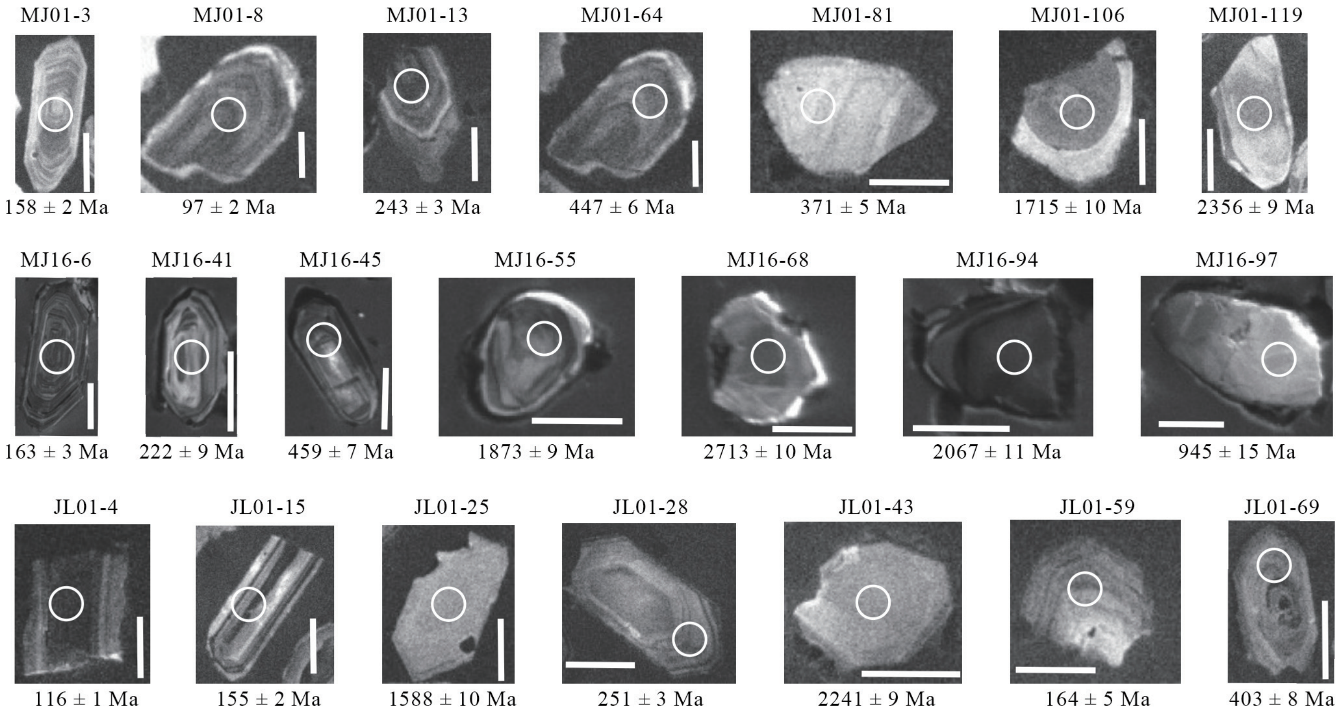

Fig. 2. Cathodoluminescence images of representative zircons (scale bar = 100 μm). Circles (44 μm) show U-Pb age analytical sites.

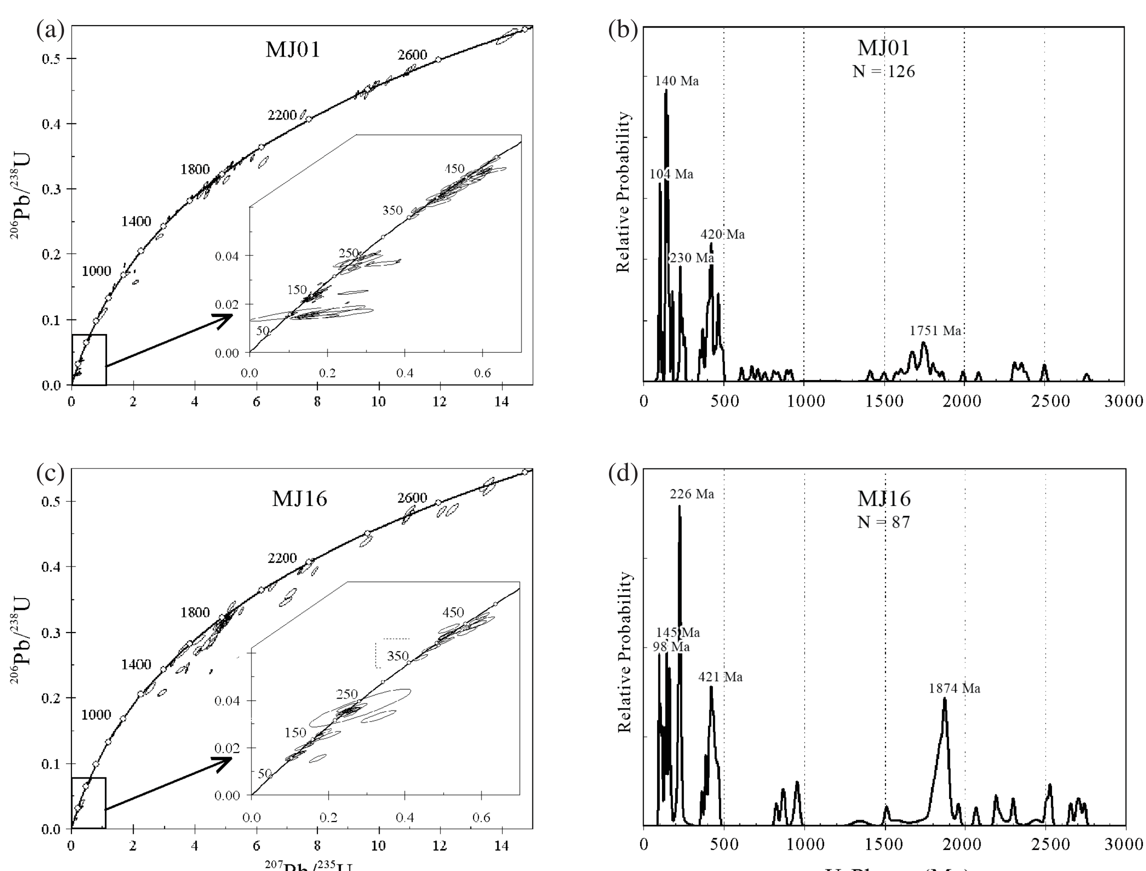

Fig. 3. Left panels show U-Pb concordia plots (a, c, e) of the detrital zircons from the Min River (MJ01 and MJ16) and Jiulong River (JL01). Insets show expanded plots for younger zircons. Right panels show corresponding relative probability plots of U-Pb ages for concordant detrital zircons (b, d, f).

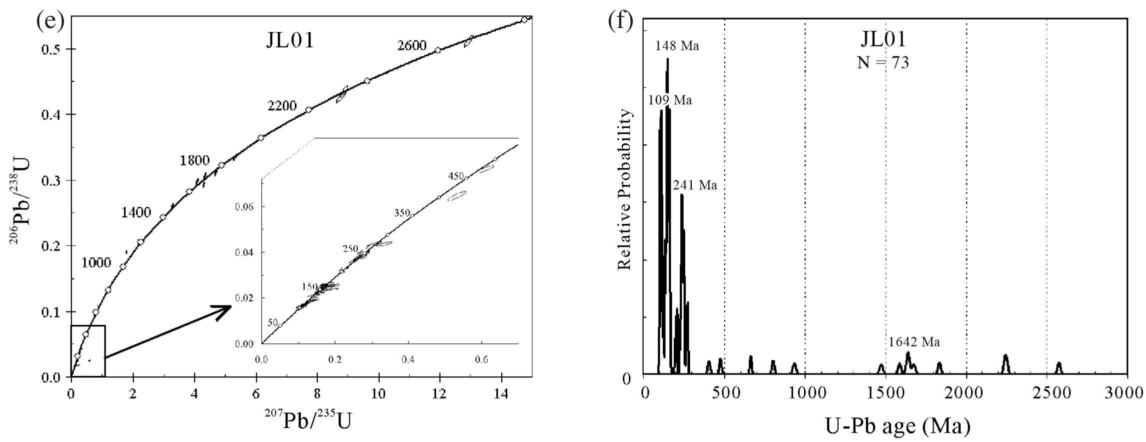

Fig. 3. (Continued)

discordant. The concordant zircons ranged in age from 2742 ± 9 to 97 ± 2 Ma (Appendix 1), and exhibited four major populations 1.6 - 1.9 Ga (24.1%), 363 - 469 Ma (18.4%), 210 - 233 Ma (13.8%) and 97 - 170 Ma (17.2%) (Figs. 3c and d). Seven zircon grains yielded the oldest $^{207}Pb/^{206}Pb$ ages of 2504 - 2742 Ma (8.0%). Six detrital zircons belong to the Neoproterozoic (826 - 964 Ma).

4.1.3 Jiulong River (JL01)

A total of 80 analyses of 80 grains from the Jiulong River estuary were undertaken, of which 73 analyses were concordant. The concordant zircons ranged in age from 2577 ± 9 to 101 ± 4 Ma (Appendix 1). Two major groups can be identified (Figs. 3e and f): 101 - 197 Ma (56.2%) and 207 - 254 Ma (20.5%). The third largest age population was made up of 5 grains with a range of 1474 - 1675 Ma. Few Caledonian and Paleoproterozoic zircons have been discovered in Jiulong River estuary.

4.2 Zircon Hf Isotopic Results

Almost all of the zircons had $^{176}Lu/^{177}Hf$ ratios of less than 0.002, indicating that the zircons had a minimal extent of radioactive Hf accumulation after their formation. Hence, the present-day $^{176}Hf/^{177}Hf$ ratios of the zircons are representative of the $^{176}Hf/^{177}Hf$ ratios upon formation of the zircons (Amelin et al. 1999). The analytical results are summarized in Appendix 2.

Detrital zircons from the Min River showed a large variation in Hf isotopic compositions (0.280856 - 0.282816), with $\varepsilon_{Hf}(t)$ values varying from +11.5 to -21.1 (Fig. 4a). Min River zircons chiefly fall in the negative epsilon space, but only 24 zircons (11%) with positive $\varepsilon_{Hf}(t)$. Figure 4b shows the distributions of the two-stage Hf (T_{DM2}) model ages. It can be seen that the crustal model age shows two prominent groups of 3.2 - 2.6 and 2.0 - 1.4 Ga from the two samples in Min River.

Detrital zircons from the Jiulong River estuary had $^{176}Hf/^{177}Hf$ ratios in the range of 0.280902 - 0.282842. The majority of particles had ratios greater than 0.282010, corresponding to an age range of 101 - 800 Ma and $\varepsilon_{Hf}(t)$ values between -12.7 and +6.1 (Fig. 4c). A few zircons had ratios less than 0.282010, corresponding to an age range of 932 - 2577 Ma and $\varepsilon_{Hf}(t)$ values between -5.5 and -15.8. The Jiulong River also shows a large abundance of negative and some positive $\varepsilon_{Hf}(t)$ values of 275 - 100 Ma (Fig. 4c). Zircons from the Jiulong River show a significant number of zircons with T_{DM2} between 1.2 and 1.8 Ga (Fig. 4d).

5. DISCUSSION

5.1 Provenance Tracing

U-Pb age analysis revealed that the detrital zircons from the Min River contained a large proportion of Precambrian particles (37%). In particular sample MJ16 has a clear peak age corresponding to the Paleoproterozoic (1874 Ma). This feature is related to the fact that the Badu Group with a Paleoproterozoic basement extensively outcrops in the Min River upstream basin (Li et al. 1998; Yu et al. 2009, 2012). In addition, nine Neoarchean detrital zircons are found in this study, which also have been identified in Wuyishan terrain as inherited or xenocrystic zircons (Wan et al. 2007; Yu et al. 2009, 2012). Recent SHRIMP U-Pb zircon dates demonstrated that northeast Cathaysia has undergone tectonothermal events in Neoproterozoic (Shu et al. 2011), which could provide Neoproterozoic material. In contrast, the Jiulong River estuary contains a sporadic number of Precambrian particles (Fig. 3f).

The Cathaysia Block was impacted by the Caledonian, Hercynian-Indosinian and Yanshanian (Jurassic-Cretaceous) orogenies (Zhou et al. 2006; Xu 2008), which are widespread in the eastern South China Block (Fig. 1b). The proportion of Phanerozoic detrital zircons in the mouth of the Min River is significantly higher than that ones in the upstream. The Caledonian granites are well developed throughout the Wuyishan terrain (Zhou 2003; Wan et al. 2007). Consequently, a considerable proportion (23%) of the detrital zircons in the Min River displayed prominent Caledonian traits.

A few Hercynian-Indosinian granites are exposed in Zhenghe, Mingxi and Liancheng in Fujian Province (Sun 2006) (Fig. 1b). The monazite age (Chen et al. 2008) and the zircons U-Pb age (Xu et al. 2007; Yu et al. 2012), were recently reported using sand samples from east of Wuyishan terrain, demonstrating the presence of Indosinian materials. The Indosinian granites are also exposed in the Longyan area (Zhao et al. 2006; Guo et al. 2012; Wang et al. 2013). These areas possibly provide the source of Indosinian components to the Min River and Jiulong River. From Jurassic to Cretaceous, this granite belt migrated from inland toward the coast (Zhou et al. 2006; Xu 2008). So, both the Min and Jiulong River contain a large number of Mesozoic zircons.

The detrital sediments in the Min River estuary mainly originate from the Jurassic-Cretaceous rocks in the middle-lower reaches. Those are also partially derived from the Indosinian and Caledonian components of its upstream region, together with Precambrian basement material from the headstream area. In contrast, the source of the detrital sediments in the Jiulong River estuary is mainly the Jurassic-Cretaceous rocks from the middle-lower reaches of the river, with a minor contribution from the Mesoproterozoic and Hercynian-Indosinian materials of the upstream region.

5.2 Re-Assessing the Provenance of Sediments From Western Coastal Areas of Taiwan Island

The Min River plays a prominent role in transport and supply of deposits to the western Taiwan, where large quantities of monazites that have been dated to ca. 1.8 Ga (Chen et al. 2006). However, Precambrian monazite has not been discovered in the Min River estuary and Wuyishan area (Chen et al. 2006, 2008). Chen et al. (2008) challenged the theory of an early Proterozoic provenance in Taiwan and suggested that coastal deposits of western Taiwan may be under the control of other river systems (e.g., the Ou River; Xu et al. 2007) or other orogenic belts (Sano et al. 2006).

The Taiwan crust experienced five major tectonic-thermal events (Lan et al. 2008), which occurred in the early

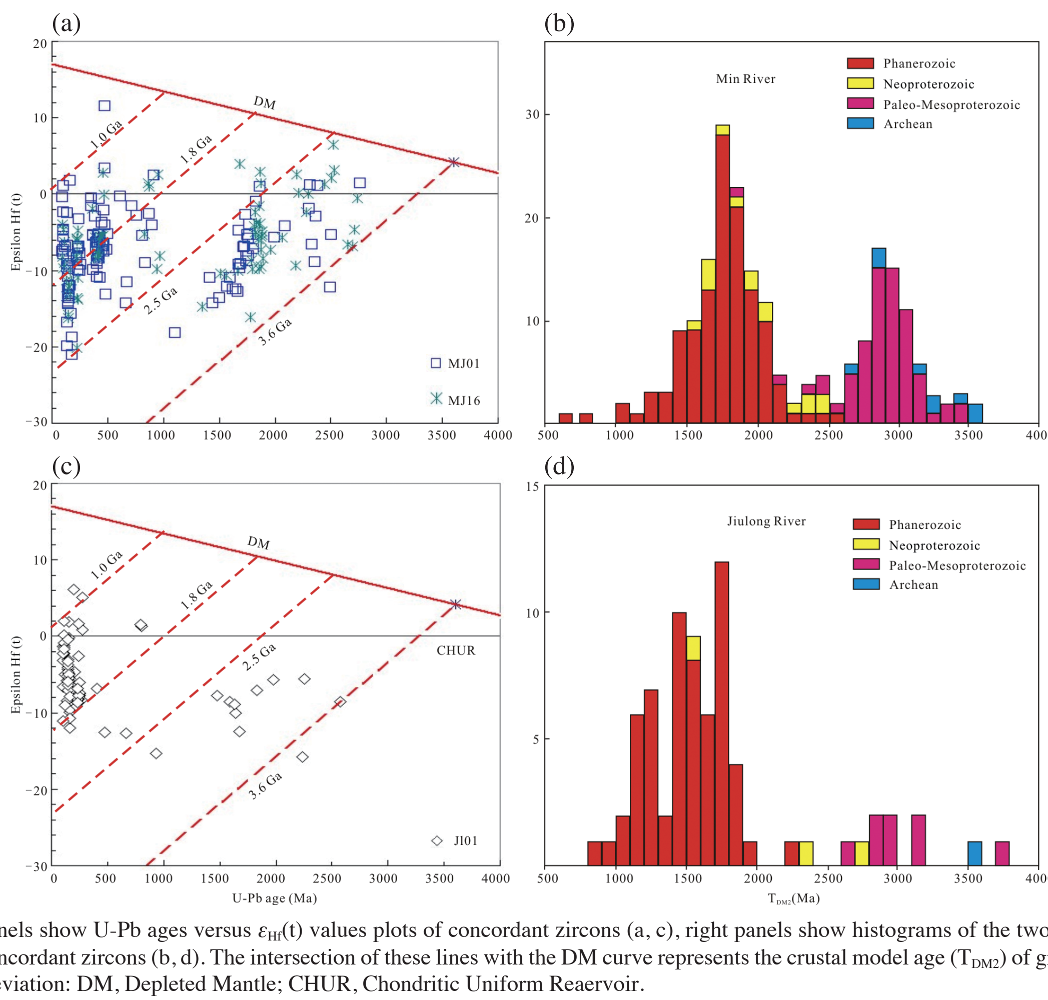

Fig. 4. Left panels show U-Pb ages versus $\varepsilon_{Hf}(t)$ values plots of concordant zircons (a, c), right panels show histograms of the two-stage Hf model ages for the concordant zircons (b, d). The intersection of these lines with the DM curve represents the crustal model age (T_{DM2}) of grains lying along the line. Abbreviation: DM, Depleted Mantle; CHUR, Chondritic Uniform Reaervoir.

Jurassic (200 - 175 Ma), late Jurassic (~153 Ma), late Cretaceous (97 - 77 Ma) and prior to (56 - 9 Ma) and after (< 5 Ma) the Pliocene, but no one in the Caledonian (360 - 540 Ma). In contrast, monazites in beaches of western Taiwan (Miaoli-Hsinchu area) and southern Taiwan (Chiayi-Tainan area) show prominent Caledonian (430 Ma) features (Chen et al. 2006), suggesting that these materials are unlikely to have originated from the island of Taiwan.

Further constraints on provenance can be gained by various potential sources (Fig. 5). The Paleoproterozoic peak at ~1.8 Ga is ubiquitous in the Yangtze, Ou River and Min River (Figs. 5a, b, and c), but the ~2.5 Ga and 700 - 900 Ma peaks are unique to the Yangtze (Yang et al. 2012). Neoproterozoic was an important period for the crust of the South China Block accretion and reworking (Li et al. 1995, 2002; Wang et al. 2007). However, a ~420 Ma population appears to be distinctive of the Min River (Fig. 5c). Not surprisingly, the Yangtze clay mineral (< 2 μm) can be transported southward to Taiwan Strait by the China Coastal Current (Xu et al. 2009), but heavy minerals (i.e., monazite, zircon) to western Taiwan Island are limited. Zircons from the Ou River show the Paleoproterozoic and Cretaceous ages (Fig. 5b), but very few grains of the Paleoproterozoic and Caledonian were found in its estuary (Xu et al. 2007).

Our work broadly supports Chen et al. (2008), showing that the main sources of Taiwan sediment came from the Min River. According to Fig. 5, higher age probability and more populations of the Min River grains are centred

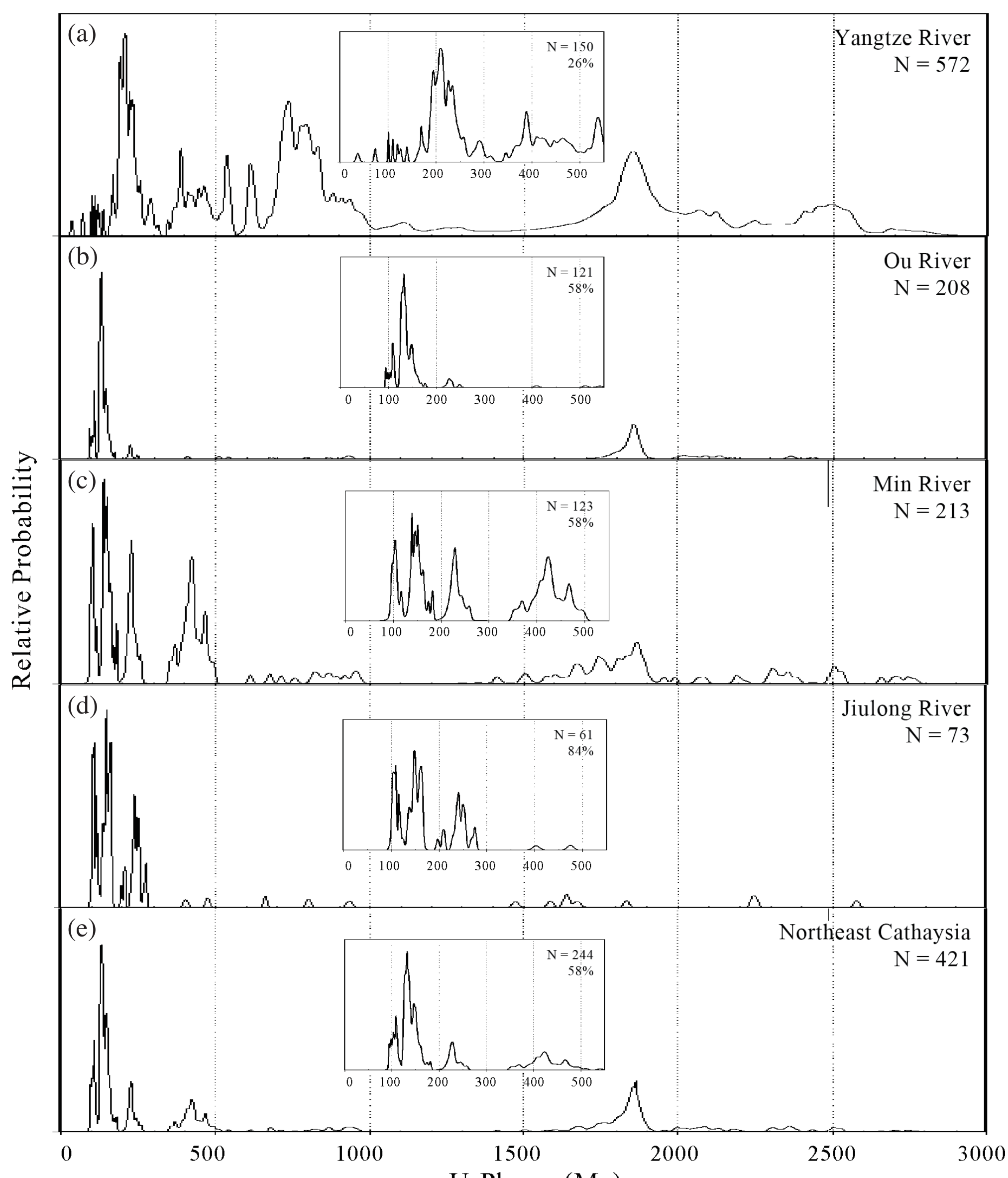

Fig. 5. U-Pb zircon age spectrum of the major potential sources. Data sources: (a) Yang et al. 2012; (b) Xu et al. 2007; (c) and (d): this study; (e): (b) + (c).

at ~1.8 Ga and ~420 Ma, which appear to be distinctive of the western Taiwan Island. Thus, the Min River likely supplies a portion of the detrital materials to western Taiwan beaches. Nevertheless, U-Pb ages revealed that the detrital zircons of the Jiulong River estuary do not have characteristic Precambrian and Caledonian peaks, indicating that this river is unlikely to provide materials to beaches of western Taiwan. Furthermore, based on the U-Pb ages and Hf isotopes of the detrital zircons of central Taiwan and compared the data with the U-Pb and $\varepsilon_{Hf}(t)$ data of the zircons in the Cathaysia Block (Lan et al. 2009), it was also clear that they have the same origin. Hence, the authors reasoned that the Min River plays a crucial role in the transportation and supply of detrital sediments to western Taiwan.

5.3 Implications for Crustal Evolution

The Ou River and the Min River in northeast Cathaysia Block both have a large number of Paleoproterozoic zircons, which contain information of the Paleoproterozoic basement (Wuyishan). However, the zircon U-Pb age and $\varepsilon_{Hf}(t)$ from Jiulong River are significantly different from these from Min River. Yu et al. (2010) suggested that the Cathaysia Block can be roughly divided into the Wuyishan area in the northeast and the Nanling-Yunkai-Hainan area in the southwest. Here, we just discuss the crustal evolution of northeast Cathaysia Block.

Whether the Cathaysia Block contains ancient crystalline basement remains controversial. Recently, Archean detrital zircons and minor inherited or xenocrystic zircons have been found in Wuyishan regions (Wan et al. 2007; Yu et al. 2009, 2012). Yu et al. (2012) found a large proportion of Archaean zircons (3.7 - 3.6, 3.2 - 3.0, 2.7 - 2.6, and 2.5 Ga) in the Badu Group Complex. In addition, some Archean debris had been discovered in Paleoproterozoic amphibolite in Jianning, Fujian (Li et al. 1998). In this study, nine Neoarchean detrital zircons (2504 - 2765 Ma) in Min River were identified, with $\varepsilon_{Hf}(t)$ varying from +6.5 to -6.8. The two-stage Hf model age of the zircons in this age group is 2.6 - 3.6 Ga (Fig. 4b), which suggested the juvenile crust of the Badu area in north Cathaysia was mainly formed in 2.5 - 2.8 Ga (Yu et al. 2012). These data imply that the Neoarchean zircons include both juvenile mantle-derived components and the reworked crustal materials.

The $\varepsilon_{Hf}(t)$ values of Paleoproterozoic zircons exhibit a wide range from negative to positive (-16.1 to +3.9) (Fig. 4b), indicating that the northeast Cathaysia involved extensive reworking of older crust with litter juvenile crustal growth (Xu et al. 2007). Zircons with U-Pb ages of 1.5 - 1.0 Ga were extremely rare, reflecting that the northeast Cathaysia Block experienced long-term tectonic stability during that period. The wide ranges in $\varepsilon_{Hf}(t)$ values (-14.2 to +2.6) in the Neoproterozoic indicated re-melting of ancient crustal material with minor juvenile mantle input. The zircons of Neoproterozoic mafic rocks show positive $\varepsilon_{Hf}(t)$ values, suggesting that they originated from a depleted mantle source (Shu et al. 2011). In the groups spanning 100 - 500 Ma, the northeast Cathaysia Block has been influenced by the Caledonian, Hercynian-Indosinian and Yanshanian orogenies. Most of Phanerozoic zircons (93%) have negative $\varepsilon_{Hf}(t)$ values, and only twelve grains have positive $\varepsilon_{Hf}(t)$ values. Their T_{DM2} values were predominantly within the range of 0.7 - 2.5 Ga with wide ranges in Hf-isotope composition, indicating that the Phanerozoic zircons stemmed from re-melting and recycling of the Proterozoic crustal materials, with or without juvenile mantle-derived magmas (Liu et al. 2012; Wang et al. 2013).

6. CONCLUSIONS

(1) Detrital zircons from the Min River and Jiulong River display Indosinian and Jurassic-Cretaceous characteristic peaks indicating that the detrital sediments were mainly supplied by Indosinian material of the upstream regions as well as Jurassic-Cretaceous materials from the middle and lower reaches. In addition, the detrital zircons from the Min River estuary display a prominent Caledonian peak and contain greater proportion of Precambrian particles, implying that these detrital substances originated from the upstream area of Wuyishan.

(2) Given that Taiwan Island cannot supply the Caledonian and Paleoproterozoic detrital material, and that the Ou and Jiulong River estuary lack components from these two periods, it is highly likely that the beach debris in western Taiwan coast partially originates from the Min River. Our study of zircons from Min River confirms the finding of Chen et al. (2006) that the sediments from the Min River in Fujian are considered the most likely source of the beach sands of the western Taiwan. However, we stress that the ~1.8 Ga age source in the western Taiwan sediments was founded and recognized.

(3) The northeast Cathaysia Block contains some Neoarchean detrital zircons, which derived from incorporation between juvenile mantle material and re-melt ancient crustal substances. Wide ranges in $\varepsilon_{Hf}(t)$ values in the Paleoproterozoic and Neoproterozoic indicated re-melting of ancient crustal material with minor juvenile mantle materials. Phanerozoic zircons stemmed from re-melting and recycling of the Proterozoic crustal materials with or without juvenile mantle-derived magmas.

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APPENDIX 1

U-Th-Pb isotope data for detrital zircons from Min River, Jiulong River and standard zircons.

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ01-1	0.45	0.04921	0.0009	0.14853	0.0025	0.022	0.00026	0.00631	0.00013	158	19	141	2	140	2	127	3	101
MJ01-2	0.53	0.0476	0.00063	0.23621	0.00287	0.03618	0.00038	0.00985	0.00014	79	13	215	2	229	2	198	3	94
MJ01-3	1.16	0.0456	0.00031	0.15591	0.00102	0.02481	0.00024	0.00705	0.00006	23	12	147	1	158	2	142	1	93
MJ01-4	0.44	0.08858	0.00134	0.25048	0.0035	0.02052	0.00023	0.00579	0.00005	1395	12	227	3	131	1	117	1	173
MJ01-5	1.04	0.05888	0.00173	0.59556	0.01673	0.0734	0.001	0.02136	0.00043	563	38	474	11	457	6	427	7	104
MJ01-6	1.51	0.07384	0.00083	0.3836	0.00384	0.03787	0.0004	0.01123	0.00011	1037	10	330	3	240	2	226	2	138
MJ01-7	0.54	0.05882	0.00095	0.61233	0.00903	0.07588	0.0009	0.02256	0.0004	560	15	485	6	471	5	451	8	103
MJ01-8	0.63	0.04965	0.00303	0.1036	0.006	0.01521	0.00033	0.00452	0.0002	179	93	100	6	97	2	91	4	103
MJ01-9	0.75	0.04682	0.00039	0.1523	0.00117	0.02371	0.00023	0.00682	0.00006	40	11	144	1	151	1	137	1	95
MJ01-10	0.99	0.07092	0.00904	0.14967	0.01851	0.01531	0.00047	0.00464	0.00011	955	275	142	16	98	3	94	2	145
MJ01-11	0.80	0.05734	0.00109	0.16475	0.00284	0.02094	0.00026	0.00633	0.0001	505	18	155	2	134	2	128	2	116

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ01-12	1.21	0.04823	0.00165	0.14463	0.00461	0.02185	0.00034	0.00607	0.00013	111	46	137	4	139	2	122	3	99
MJ01-13	1.44	0.05408	0.0012	0.28522	0.00581	0.03843	0.0005	0.01106	0.00016	374	24	255	5	243	3	222	3	105
MJ01-14	0.60	0.05646	0.00229	0.26919	0.01033	0.03458	0.00045	0.01075	0.00012	471	92	242	8	219	3	216	2	111
MJ01-15	0.30	0.0663	0.00043	1.35596	0.00817	0.14901	0.00145	0.02378	0.00026	816	11	870	4	895	8	475	5	97
MJ01-16	0.44	0.14699	0.0009	9.82299	0.05684	0.45691	0.00488	0.11793	0.00125	2311	10	2418	5	2327	21	2253	23	99
MJ01-17	0.39	0.05235	0.00064	0.42294	0.00475	0.05886	0.00063	0.01733	0.00026	301	12	358	3	369	4	347	5	97
MJ01-18	0.63	0.05153	0.0007	0.52242	0.00654	0.06786	0.00081	0.02021	0.00029	265	13	427	4	409	5	404	6	104
MJ01-19	1.02	0.08689	0.01753	0.17601	0.03474	0.01469	0.00062	0.00435	0.00016	1358	432	165	30	94	4	88	3	176
MJ01-20	1.03	0.05546	0.00134	0.50927	0.01131	0.06689	0.00093	0.0187	0.00035	431	26	418	8	417	6	374	7	100
MJ01-21	0.89	0.09696	0.03422	0.21019	0.07191	0.01572	0.00136	0.00461	0.00033	1566	785	194	60	101	9	93	7	192
MJ01-22	0.48	0.13313	0.00256	6.22407	0.10931	0.34047	0.00579	0.087	0.00173	2140	14	2008	15	1889	28	1686	32	113
MJ01-23	0.30	0.05735	0.00115	0.53154	0.00908	0.06722	0.00071	0.02087	0.00021	505	45	433	6	419	4	417	4	103
MJ01-24	0.42	0.11384	0.00099	5.51058	0.04432	0.3425	0.00381	0.08328	0.00128	1862	9	1902	7	1887	18	1617	24	99
MJ01-25	0.36	0.16397	0.0009	10.97384	0.05686	0.48033	0.00478	0.12519	0.00126	2497	10	2521	5	2559	21	2384	23	98
MJ01-26	0.65	0.0532	0.00042	0.15898	0.00114	0.02176	0.00021	0.00622	0.00006	337	10	150	1	139	1	125	1	108
MJ01-27	0.86	0.05451	0.00107	0.20418	0.00364	0.02727	0.00034	0.00802	0.00013	392	20	189	3	173	2	161	3	109
MJ01-28	1.93	0.07748	0.00769	0.26492	0.02571	0.0248	0.00052	0.00744	0.00011	1134	205	239	21	158	3	150	2	151
MJ01-29	1.62	0.05592	0.00264	0.30535	0.01311	0.03975	0.00092	0.01109	0.00033	449	55	271	10	251	6	223	7	108
MJ01-30	0.44	0.06567	0.00037	1.3817	0.00719	0.15316	0.00147	0.04459	0.00038	796	12	881	3	919	8	882	7	96
MJ01-31	0.71	0.11052	0.00121	4.74259	0.04756	0.31238	0.00366	0.08805	0.0013	1808	10	1775	8	1752	18	1706	24	103
MJ01-32	0.09	0.05682	0.00086	0.60678	0.0084	0.07773	0.00089	0.03255	0.00108	485	14	482	5	483	5	647	21	100
MJ01-33	0.75	0.05047	0.00348	0.11077	0.00713	0.01597	0.00043	0.0052	0.00025	217	99	107	7	102	3	105	5	105
MJ01-34	0.69	0.05123	0.00146	0.16471	0.00436	0.0234	0.00034	0.00697	0.00017	251	35	155	4	149	2	140	3	104
MJ01-35	0.82	0.0565	0.00124	0.55594	0.01123	0.07161	0.00095	0.02081	0.0004	472	23	449	7	446	6	416	8	101
MJ01-36	1.04	0.05048	0.00143	0.16619	0.00436	0.02395	0.00035	0.00756	0.00015	217	34	156	4	153	2	152	3	102
MJ01-37	0.62	0.06744	0.00611	0.34085	0.03009	0.03666	0.00075	0.01117	0.00025	851	195	298	23	232	5	225	5	128
MJ01-38	1.07	0.05803	0.00103	0.3299	0.00531	0.04135	0.00051	0.01221	0.00019	531	16	289	4	261	3	245	4	111
MJ01-39	1.07	0.05515	0.00178	0.17623	0.00524	0.02325	0.00037	0.00715	0.00016	418	39	165	5	148	2	144	3	111
MJ01-40	1.61	0.0613	0.00154	0.31063	0.00721	0.03686	0.00051	0.0109	0.00017	650	27	275	6	233	3	219	3	118
MJ01-41	0.35	0.04914	0.00075	0.1932	0.0027	0.02859	0.00032	0.00888	0.00018	155	15	179	2	182	2	179	4	98

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ01-42	0.77	0.04772	0.00142	0.15146	0.00419	0.02308	0.00034	0.00685	0.00016	85	38	143	4	147	2	138	3	97
MJ01-43	0.43	0.05403	0.00066	0.54391	0.00614	0.07021	0.00079	0.0222	0.00033	372	11	441	4	425	5	444	7	104
MJ01-44	0.07	0.05704	0.00061	0.62973	0.00618	0.08029	0.00085	0.04745	0.0011	493	10	496	4	498	5	937	21	100
MJ01-45	0.54	0.15364	0.00088	9.59458	0.05171	0.44406	0.0045	0.13086	0.00124	2387	10	2397	5	2313	20	2486	22	103
MJ01-46	1.05	0.05515	0.00166	0.27671	0.00772	0.03648	0.00055	0.01105	0.00023	418	36	248	6	231	3	222	5	107
MJ01-47	1.17	0.04995	0.00046	0.28215	0.00239	0.04106	0.00041	0.01241	0.00012	193	10	252	2	259	3	249	2	97
MJ01-48	1.05	0.05853	0.00128	0.60185	0.01213	0.07474	0.001	0.02204	0.00038	550	22	478	8	465	6	441	8	103
MJ01-49	0.74	0.05332	0.00098	0.5215	0.00885	0.06509	0.00087	0.02116	0.00036	342	19	426	6	403	5	423	7	106
MJ01-50	0.94	0.06714	0.001	1.24341	0.01691	0.1346	0.0016	0.03901	0.00056	842	13	820	8	814	9	773	11	101
MJ01-51	0.30	0.06819	0.00054	1.72181	0.01254	0.18351	0.00186	0.05163	0.00066	874	10	1017	5	1086	10	1018	13	80
MJ01-52	0.39	0.05353	0.00072	0.5419	0.00668	0.07056	0.00081	0.0222	0.00037	351	12	440	4	428	5	444	7	103
MJ01-53	1.10	0.06018	0.00253	0.62241	0.02502	0.07501	0.00091	0.02316	0.00023	610	93	491	16	466	5	463	4	105
MJ01-54	0.32	0.10754	0.00066	4.65855	0.02733	0.31451	0.00308	0.08571	0.00084	1758	10	1760	5	1763	15	1662	16	100
MJ01-55	0.83	0.05154	0.00248	0.17018	0.0079	0.02397	0.00039	0.00771	0.0002	265	77	160	7	153	2	155	4	105
MJ01-56	0.40	0.10848	0.00079	5.17967	0.03616	0.33666	0.00348	0.09554	0.00104	1774	9	1849	6	1919	17	1844	19	92
MJ01-57	0.44	0.11201	0.00077	5.30017	0.03422	0.33368	0.00351	0.08948	0.00105	1832	10	1869	6	1804	17	1732	19	102
MJ01-58	0.26	0.10648	0.00084	4.45512	0.03265	0.30384	0.00319	0.09078	0.00138	1740	9	1723	6	1710	16	1756	26	102
MJ01-59	1.07	0.05849	0.00097	0.80377	0.01231	0.09979	0.0012	0.02881	0.00041	548	15	599	7	613	7	574	8	98
MJ01-60	0.11	0.05938	0.00086	0.61395	0.00647	0.07499	0.00075	0.02319	0.00026	581	32	486	4	466	4	463	5	104
MJ01-61	0.18	0.15155	0.00079	9.27764	0.04616	0.44433	0.00434	0.12191	0.00128	2363	10	2366	5	2370	19	2325	23	100
MJ01-62	0.72	0.05244	0.00267	0.18532	0.0088	0.02565	0.00055	0.00825	0.00033	305	69	173	8	163	3	166	7	106
MJ01-63	0.88	0.0509	0.00314	0.17034	0.01018	0.02427	0.00037	0.00764	0.00009	236	143	160	9	155	2	154	2	103
MJ01-64	0.82	0.05948	0.00126	0.5887	0.01145	0.07181	0.00095	0.02287	0.00044	585	21	470	7	447	6	457	9	105
MJ01-65	1.29	0.05196	0.00237	0.156	0.00683	0.0218	0.00035	0.00665	0.00014	284	71	147	6	139	2	134	3	106
MJ01-66	0.54	0.0468	0.00111	0.14551	0.00316	0.02265	0.0003	0.0055	0.00013	39	28	138	3	144	2	111	3	96
MJ01-67	0.80	0.04953	0.00383	0.15602	0.01166	0.02289	0.00052	0.00621	0.00023	173	126	147	10	146	3	125	5	101
MJ01-68	0.40	0.05147	0.00144	0.5098	0.01297	0.06717	0.00116	0.02083	0.00071	262	31	418	9	429	7	417	14	97
MJ01-69	0.79	0.14736	0.00169	9.54373	0.10544	0.45057	0.00563	0.1127	0.00158	2316	9	2392	10	2286	25	2158	29	101
MJ01-70	0.83	0.04929	0.00204	0.11408	0.00441	0.01681	0.00029	0.0042	0.00011	163	55	112	3	107	2	86	2	105
MJ01-71	0.93	0.09736	0.00116	4.14521	0.04713	0.29434	0.00349	0.07404	0.00088	1574	10	1663	9	1607	17	1444	17	98

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ01-72	0.80	0.09187	0.0245	0.21556	0.05426	0.01709	0.00154	0.00575	0.00114	1465	360	198	45	109	10	116	23	182
MJ01-73	1.87	0.04836	0.00179	0.24001	0.00833	0.03516	0.00061	0.00811	0.00015	117	50	218	7	229	4	163	3	95
MJ01-74	1.35	0.10327	0.00177	4.23906	0.06922	0.29824	0.00386	0.07991	0.00108	1684	14	1682	13	1683	19	1554	20	100
MJ01-75	1.13	0.07545	0.00402	0.16623	0.00786	0.01605	0.00043	0.00466	0.00018	1081	53	156	7	103	3	94	4	151
MJ01-76	1.09	0.05756	0.00105	0.62878	0.01088	0.07936	0.00091	0.02043	0.00025	513	19	495	7	492	5	409	5	101
MJ01-77	0.34	0.12933	0.00116	7.5236	0.06311	0.41376	0.00488	0.09618	0.0017	2089	10	2176	8	2178	22	1856	31	96
MJ01-78	0.70	0.04998	0.002	0.12584	0.00471	0.0185	0.00033	0.00464	0.00015	147	50	119	4	117	2	96	3	102
MJ01-79	0.97	0.0459	0.00178	0.1028	0.00374	0.01613	0.00024	0.00389	0.0001	68	35	99	3	102	2	98	2	97
MJ01-80	0.46	0.05221	0.0022	0.15404	0.00606	0.02149	0.00039	0.0063	0.00025	295	57	145	5	137	2	127	5	106
MJ01-81	0.48	0.05295	0.00105	0.43758	0.00802	0.0592	0.00076	0.01472	0.00031	327	21	369	6	371	5	295	6	99
MJ01-82	1.48	0.05764	0.00252	0.53173	0.02087	0.06719	0.00156	0.01648	0.00049	516	47	433	14	419	9	330	10	103
MJ01-83	0.76	0.16485	0.00211	10.98406	0.1355	0.48102	0.00618	0.12695	0.00202	2506	10	2522	11	2545	27	2416	36	98
MJ01-84	0.65	0.10259	0.00142	4.38555	0.05557	0.29138	0.00418	0.0718	0.00137	1672	11	1710	10	1567	21	1402	26	107
MJ01-85	1.24	0.10219	0.00105	4.78547	0.04698	0.32014	0.00371	0.08423	0.00085	1664	9	1782	8	1757	18	1635	16	95
MJ01-86	2.77	0.05361	0.00841	0.27867	0.04218	0.03786	0.00168	0.0085	0.0004	355	259	250	33	240	10	171	8	104
MJ01-87	0.57	0.04848	0.00253	0.10752	0.00522	0.01615	0.00035	0.00447	0.0002	123	72	104	5	103	2	90	4	101
MJ01-88	0.65	0.05246	0.00173	0.49395	0.01563	0.06439	0.00097	0.01956	0.00044	306	46	408	11	426	6	392	9	96
MJ01-89	1.28	0.05019	0.00337	0.25491	0.01556	0.03399	0.00116	0.00772	0.00033	204	85	231	13	224	7	155	7	103
MJ01-90	0.67	0.09985	0.00196	4.46982	0.0837	0.30513	0.00447	0.08281	0.0017	1621	17	1725	16	1705	22	1608	32	95
MJ01-91	1.76	0.05012	0.03338	0.10791	0.07072	0.01568	0.00189	0.00458	0.00067	201	964	104	65	100	12	92	13	104
MJ01-92	0.95	0.04987	0.00133	0.43699	0.01111	0.05863	0.00082	0.01654	0.00028	189	36	368	8	358	5	332	6	103
MJ01-93	0.93	0.05591	0.00168	0.48291	0.01331	0.06289	0.00102	0.01473	0.00037	449	34	400	9	393	6	296	7	102
MJ01-94	0.84	0.05133	0.0023	0.4867	0.02106	0.06186	0.00111	0.0183	0.00049	256	70	403	14	395	7	367	10	102
MJ01-95	0.60	0.05012	0.00175	0.48015	0.01614	0.06457	0.00101	0.01828	0.00047	201	51	398	11	404	6	366	9	99
MJ01-96	0.38	0.05191	0.00123	0.48144	0.01088	0.06335	0.00083	0.01848	0.00042	281	30	399	7	410	5	370	8	97
MJ01-97	0.93	0.10662	0.00123	4.78098	0.05281	0.31561	0.00368	0.087	0.00103	1742	9	1782	9	1717	18	1686	19	101
MJ01-98	0.26	0.14911	0.00167	9.84863	0.10659	0.45662	0.00568	0.11601	0.00261	2336	9	2421	10	2426	25	2218	47	96
MJ01-99	0.75	0.04853	0.0038	0.10211	0.00761	0.01532	0.0004	0.00395	0.00021	125	118	99	7	98	3	80	4	101
MJ01-100	1.29	0.04951	0.00102	0.42329	0.00838	0.05608	0.00072	0.01665	0.0002	172	25	358	6	351	4	334	4	102
MJ01-101	1.07	0.10779	0.00137	4.73494	0.05716	0.31897	0.00371	0.07955	0.00099	1762	10	1773	10	1785	18	1547	19	99

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ01-102	0.48	0.05238	0.00094	0.5052	0.00867	0.06803	0.00079	0.01961	0.00031	302	20	415	6	426	5	393	6	97
MJ01-103	0.40	0.05019	0.00099	0.49771	0.00943	0.065	0.00083	0.01986	0.00037	204	24	410	6	398	5	397	7	103
MJ01-104	0.30	0.08591	0.00061	2.05679	0.01325	0.17426	0.00178	0.04161	0.00051	1336	10	1135	4	1036	10	824	10	129
MJ01-105	0.30	0.04591	0.00104	0.17978	0.00393	0.02843	0.00033	0.00803	0.00017	7	24	168	3	181	2	162	3	93
MJ01-106	0.59	0.10502	0.00073	4.57663	0.03055	0.31038	0.00321	0.0819	0.00078	1715	10	1745	6	1772	16	1591	15	97
MJ01-107	1.90	0.04699	0.00082	0.15332	0.00245	0.02375	0.00028	0.00555	0.00006	49	18	145	2	151	2	112	1	96
MJ01-108	0.77	0.05261	0.00272	0.17456	0.00845	0.02415	0.00051	0.00607	0.00024	312	72	163	7	154	3	122	5	106
MJ01-109	0.60	0.05361	0.00145	0.54679	0.01423	0.07104	0.00096	0.02019	0.00042	355	36	443	9	420	6	404	8	105
MJ01-110	0.49	0.04725	0.00225	0.13894	0.00609	0.0214	0.00046	0.0054	0.00027	62	59	132	5	136	3	109	5	97
MJ01-111	0.65	0.08947	0.00092	3.12388	0.02926	0.25407	0.00288	0.0629	0.00085	1414	10	1439	7	1459	15	1233	16	97
MJ01-112	0.92	0.04897	0.00234	0.14482	0.00637	0.02152	0.00046	0.00536	0.00019	146	63	137	6	137	3	108	4	100
MJ01-113	0.34	0.05266	0.00075	0.52361	0.00712	0.06937	0.00078	0.02127	0.00032	314	14	428	5	429	5	425	6	100
MJ01-114	0.74	0.103	0.00138	4.34044	0.05535	0.30586	0.00358	0.07984	0.00115	1679	11	1701	11	1720	18	1553	22	98
MJ01-115	0.40	0.1036	0.00101	4.58066	0.04278	0.31092	0.00345	0.08366	0.00116	1690	9	1746	8	1594	17	1624	22	106
MJ01-116	1.15	0.06605	0.00843	0.14127	0.01673	0.01556	0.00077	0.00418	0.00034	808	166	134	15	100	5	84	7	134
MJ01-117	0.60	0.10575	0.00167	5.01329	0.07588	0.31403	0.00434	0.08961	0.00163	1727	13	1822	13	1706	21	1735	30	101
MJ01-118	0.80	0.05158	0.00237	0.16323	0.00721	0.02297	0.00037	0.00701	0.00018	267	72	154	6	146	2	141	4	105
MJ01-119	0.59	0.15087	0.00117	10.30263	0.07756	0.46552	0.00525	0.12364	0.00141	2356	9	2462	7	2495	23	2356	25	94
MJ01-120	0.78	0.05386	0.00204	0.56441	0.02056	0.07004	0.00116	0.02213	0.00053	365	55	454	13	422	7	442	10	108
MJ01-121	0.96	0.05256	0.00162	0.47933	0.01339	0.06334	0.00114	0.01651	0.00037	310	34	398	9	374	7	331	7	106
MJ01-122	0.88	0.10118	0.00182	4.16982	0.07166	0.29101	0.00392	0.08751	0.00145	1646	15	1668	14	1596	19	1696	27	103
MJ01-123	0.70	0.09085	0.00276	2.84058	0.07831	0.22678	0.00289	0.06689	0.00079	1443	59	1366	21	1318	15	1309	15	109
MJ01-124	0.85	0.06218	0.00133	1.21968	0.02501	0.1323	0.00176	0.03964	0.00064	680	24	810	11	758	10	786	12	107
MJ01-125	0.89	0.04828	0.00192	0.1511	0.0056	0.02276	0.0004	0.00588	0.00016	113	55	143	5	145	3	118	3	99
MJ01-126	1.17	0.04743	0.00158	0.1082	0.00334	0.01657	0.00025	0.00445	0.00009	78	45	105	3	106	2	92	2	99
MJ01-127	0.55	0.09616	0.00345	2.08254	0.06885	0.15707	0.0022	0.04605	0.00079	1551	69	1143	23	940	12	910	15	122
MJ01-128	0.69	0.05757	0.00265	0.17862	0.00761	0.02256	0.00046	0.00628	0.00024	513	58	167	7	144	3	127	5	116
MJ01-129	0.94	0.05467	0.00234	0.57994	0.02387	0.07394	0.00126	0.02242	0.00056	399	63	464	15	478	8	448	11	97
MJ01-130	0.94	0.05463	0.00389	0.29585	0.02011	0.03938	0.00097	0.01109	0.0005	397	108	263	16	249	6	223	10	106
MJ01-131	0.50	0.05274	0.00285	0.18499	0.00961	0.02544	0.00037	0.00798	0.00009	318	126	172	8	162	2	161	2	106

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ01-132	0.84	0.05519	0.00145	0.57814	0.01459	0.07468	0.00097	0.02435	0.00041	420	34	463	9	472	6	486	8	98
MJ01-133	0.83	0.11023	0.00139	4.99651	0.06023	0.32878	0.0038	0.0984	0.00129	1803	10	1819	10	1832	18	1897	24	98
MJ01-134	0.70	0.06433	0.00151	1.23399	0.02782	0.13912	0.00179	0.04035	0.00075	752	27	816	13	840	10	800	15	97
MJ01-135	0.66	0.19262	0.00323	14.16046	0.2313	0.53319	0.00812	0.19816	0.00416	2765	12	2761	15	2755	34	3654	70	100
MJ01-136	0.99	0.06734	0.00768	1.00531	0.10452	0.10855	0.0061	0.03453	0.00295	848	126	707	53	664	35	686	58	106
MJ01-137	0.44	0.10757	0.0015	4.428	0.05874	0.2985	0.00355	0.08387	0.00153	1759	11	1718	11	1684	18	1628	29	104
MJ01-138	0.65	0.06205	0.00103	1.00275	0.01595	0.11719	0.00133	0.0346	0.00049	676	16	705	8	714	8	688	10	99
MJ01-139	0.80	0.09884	0.00103	3.87465	0.03704	0.28498	0.00332	0.07264	0.00096	1602	10	1608	8	1616	17	1417	18	99
MJ01-140	0.59	0.07628	0.00341	1.78441	0.07535	0.16967	0.00248	0.051	0.00069	1102	92	1040	27	1010	14	1005	13	109
MJ01-141	0.65	0.09361	0.00063	3.39695	0.021	0.26377	0.00271	0.05978	0.00057	1500	11	1504	5	1509	14	1174	11	99
MJ01-142	0.40	0.05986	0.0009	0.91377	0.01313	0.11068	0.00122	0.03659	0.00055	599	15	659	7	677	7	726	11	97
MJ01-143	1.43	0.05001	0.00204	0.11031	0.00419	0.01602	0.0003	0.00401	0.0001	189	54	107	4	104	2	85	2	103
MJ01-144	0.69	0.0478	0.00142	0.24623	0.00679	0.03744	0.00057	0.00953	0.00024	89	37	224	6	237	4	192	5	95
MJ01-145	0.25	0.1224	0.00093	5.87233	0.04297	0.34782	0.00359	0.13933	0.00167	1992	9	1957	6	1924	17	2636	30	104
MJ01-146	1.27	0.10662	0.00154	4.52855	0.06263	0.30793	0.00371	0.08563	0.00109	1742	11	1736	12	1731	18	1661	20	101
MJ16-01	0.51	0.05101	0.00401	0.18763	0.01353	0.02668	0.0009	0.00813	0.00068	241	104	175	12	170	6	164	14	103
MJ16-02	0.61	0.14554	0.00367	6.95792	0.14474	0.34674	0.00493	0.0975	0.00138	2294	44	2106	18	1919	24	1881	25	120
MJ16-03	0.48	0.05508	0.00123	0.47053	0.00963	0.06196	0.00084	0.01974	0.00047	415	23	392	7	388	5	395	9	101
MJ16-04	0.72	0.11352	0.00496	4.46416	0.1775	0.29826	0.00878	0.08627	0.00444	1857	33	1724	33	1718	44	1673	83	108
MJ16-05	0.65	0.04931	0.00263	0.15445	0.00757	0.02272	0.00054	0.00668	0.00034	163	71	146	7	145	3	135	7	101
MJ16-06	0.47	0.04949	0.00156	0.17441	0.00507	0.02556	0.0004	0.00806	0.00027	171	39	163	4	163	3	162	5	100
MJ16-07	0.79	0.04813	0.00605	0.13541	0.01594	0.02041	0.00095	0.00741	0.00061	106	176	129	14	130	6	149	12	99
MJ16-08	0.57	0.10226	0.00352	2.92715	0.08996	0.2076	0.00323	0.06048	0.00089	1666	65	1389	23	1216	17	1187	17	137
MJ16-09	0.71	0.11055	0.00173	4.1115	0.05864	0.26978	0.00367	0.08118	0.00165	1808	12	1657	12	1540	19	1578	31	117
MJ16-10	0.40	0.05704	0.00168	0.54989	0.01485	0.06993	0.00113	0.02223	0.0008	493	32	445	10	436	7	444	16	102
MJ16-11	0.73	0.10538	0.00316	3.52815	0.09401	0.24283	0.00334	0.07053	0.00092	1721	56	1534	21	1401	17	1378	17	123
MJ16-12	0.45	0.11194	0.00153	4.94376	0.06238	0.32035	0.00411	0.09022	0.00202	1831	11	1810	11	1791	20	1746	37	102
MJ16-13	1.50	0.18468	0.00211	12.38149	0.13445	0.48631	0.00632	0.12955	0.00185	2695	10	2634	10	2555	27	2462	33	105
MJ16-14	0.93	0.11525	0.00309	5.01546	0.12357	0.31568	0.00645	0.09236	0.00288	1884	20	1822	21	1769	32	1786	53	107
MJ16-15	0.69	0.05089	0.00359	0.15983	0.01032	0.02278	0.0007	0.00754	0.00046	236	93	151	9	145	4	152	9	104

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ16-16	0.20	0.10862	0.00294	4.07812	0.09128	0.2853	0.00414	0.07884	0.0012	1776	51	1650	18	1652	21	1534	23	108
MJ16-17	0.80	0.13711	0.00111	7.44001	0.05608	0.39362	0.00416	0.11441	0.00135	2191	9	2166	7	2140	19	2189	24	102
MJ16-18	0.49	0.11064	0.00202	5.17216	0.08774	0.33909	0.00517	0.09695	0.00279	1810	14	1848	14	1882	25	1870	51	96
MJ16-19	0.19	0.06897	0.00064	1.38184	0.01188	0.14534	0.00149	0.04347	0.0008	898	10	881	5	875	8	860	15	101
MJ16-20	0.17	0.06843	0.00114	1.34926	0.01756	0.143	0.0015	0.0435	0.00046	882	35	867	8	862	8	861	9	101
MJ16-21	0.79	0.1128	0.00125	5.00155	0.05111	0.32165	0.00373	0.08798	0.00135	1845	9	1820	9	1798	18	1704	25	103
MJ16-22	0.83	0.04786	0.00698	0.10975	0.01481	0.01663	0.00096	0.00501	0.00061	92	195	106	14	106	6	101	12	100
MJ16-23	0.52	0.05427	0.00105	0.50179	0.00892	0.06707	0.00084	0.02075	0.00044	382	20	413	6	418	5	415	9	99
MJ16-24	0.81	0.11144	0.00216	4.79243	0.08539	0.31194	0.00494	0.09311	0.00217	1823	14	1784	15	1750	24	1799	40	104
MJ16-25	0.68	0.05219	0.00319	0.13064	0.00729	0.01816	0.0005	0.00635	0.00032	294	78	125	7	116	3	128	6	108
MJ16-26	0.43	0.05484	0.00206	0.46841	0.01619	0.06196	0.00116	0.01969	0.00083	406	45	390	11	388	7	394	16	101
MJ16-27	2.02	0.07231	0.00765	0.33026	0.0311	0.03313	0.00171	0.01045	0.00066	995	110	290	24	210	11	210	13	138
MJ16-28	0.98	0.18031	0.00161	12.02926	0.10207	0.48394	0.00551	0.13308	0.00175	2656	9	2607	8	2544	24	2525	31	104
MJ16-29	0.61	0.10323	0.00383	4.10473	0.13508	0.28839	0.00493	0.08394	0.00135	1683	70	1655	27	1633	25	1629	25	103
MJ16-30	0.67	0.05096	0.00318	0.17172	0.00988	0.02444	0.00066	0.00754	0.00041	239	83	161	9	156	4	152	8	103
MJ16-31	0.38	0.05114	0.00124	0.24905	0.00513	0.03532	0.00045	0.01112	0.00018	247	57	226	4	224	3	223	4	101
MJ16-32	0.28	0.14421	0.00342	7.1162	0.12951	0.3849	0.00543	0.10073	0.00153	2278	42	2126	16	2092	26	1940	28	109
MJ16-33	1.12	0.05446	0.00247	0.25613	0.01062	0.03412	0.00073	0.01033	0.00034	390	55	232	9	216	5	208	7	107
MJ16-34	0.79	0.05548	0.00179	0.52387	0.01554	0.0685	0.00117	0.02098	0.0006	432	37	428	10	427	7	420	12	100
MJ16-35	0.46	0.05899	0.00194	0.56193	0.01691	0.0691	0.00121	0.02137	0.00083	567	36	453	11	431	7	427	16	105
MJ16-36	0.33	0.05479	0.00159	0.5075	0.01355	0.06719	0.00106	0.02063	0.00078	404	33	417	9	419	6	413	15	100
MJ16-37	0.32	0.05787	0.00128	0.60193	0.01216	0.07546	0.00103	0.024	0.00073	525	22	478	8	469	6	479	14	102
MJ16-38	0.55	0.13855	0.00322	7.66955	0.16654	0.40154	0.00789	0.117	0.00429	2209	17	2193	20	2176	36	2236	78	102
MJ16-39	0.27	0.11345	0.00283	4.94266	0.10006	0.31599	0.00462	0.09109	0.00133	1855	46	1810	17	1770	23	1762	25	105
MJ16-40	1.84	0.07198	0.00115	1.60025	0.02346	0.16128	0.002	0.04813	0.00062	985	13	970	9	964	11	950	12	101
MJ16-41	0.54	0.05218	0.0049	0.25224	0.02175	0.03506	0.00141	0.01165	0.00105	293	124	228	18	222	9	234	21	103
MJ16-42	0.30	0.12007	0.00141	5.50307	0.05954	0.33248	0.004	0.09991	0.00254	1957	10	1901	9	1850	19	1925	47	106
MJ16-43	0.73	0.05309	0.00449	0.26854	0.02106	0.03669	0.00129	0.0104	0.00077	333	115	242	17	232	8	209	15	104
MJ16-44	0.86	0.05037	0.00399	0.24548	0.01813	0.03535	0.00112	0.00987	0.00061	212	111	223	15	224	7	199	12	100
MJ16-45	0.26	0.05798	0.00153	0.58953	0.01429	0.07376	0.00112	0.02728	0.00105	529	28	471	9	459	7	544	21	103

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ16-46	0.54	0.11129	0.00317	4.76441	0.11572	0.31049	0.0046	0.08968	0.00128	1821	53	1779	20	1743	23	1736	24	104
MJ16-47	0.29	0.19	0.00202	13.58963	0.13829	0.51882	0.00653	0.14442	0.00368	2742	9	2722	10	2694	28	2727	65	102
MJ16-48	1.40	0.0504	0.00481	0.10533	0.00934	0.01516	0.00056	0.00453	0.00025	213	134	102	9	97	4	91	5	105
MJ16-49	0.84	0.11605	0.00247	4.50848	0.08723	0.28181	0.00476	0.08616	0.00236	1896	16	1733	16	1600	24	1671	44	119
MJ16-50	0.98	0.04969	0.00236	0.24564	0.01072	0.03586	0.00078	0.01069	0.00038	181	62	223	9	227	5	215	8	98
MJ16-51	0.72	0.11509	0.0026	5.19124	0.10802	0.3272	0.00586	0.09622	0.00279	1881	17	1851	18	1825	28	1857	51	103
MJ16-52	0.64	0.04997	0.00198	0.17464	0.00638	0.02535	0.00047	0.00802	0.00026	194	51	163	6	161	3	161	5	101
MJ16-53	0.11	0.10925	0.00151	3.76282	0.03478	0.2498	0.00257	0.07229	0.0008	1787	26	1585	7	1437	13	1411	15	124
MJ16-54	1.12	0.16468	0.00171	10.99873	0.10885	0.48447	0.00589	0.12783	0.0018	2504	9	2523	9	2547	26	2431	32	98
MJ16-55	0.36	0.11458	0.00119	4.97247	0.04767	0.31481	0.00356	0.09105	0.00164	1873	9	1815	8	1764	17	1761	30	106
MJ16-56	0.15	0.11575	0.00121	5.08204	0.04896	0.31848	0.00362	0.09016	0.00247	1892	9	1833	8	1782	18	1745	46	106
MJ16-57	0.90	0.04815	0.00353	0.2447	0.01658	0.03687	0.00115	0.0112	0.00063	107	95	222	14	233	7	225	13	95
MJ16-58	0.85	0.05313	0.00207	0.51469	0.01844	0.07027	0.00136	0.02187	0.00067	334	47	422	12	438	8	437	13	96
MJ16-59	0.52	0.15858	0.003	9.57793	0.13688	0.43804	0.00541	0.12215	0.00151	2441	33	2395	13	2342	24	2329	27	104
MJ16-60	1.44	0.05142	0.00319	0.14813	0.00849	0.0209	0.00055	0.00666	0.00023	260	84	140	8	133	3	134	5	105
MJ16-61	0.12	0.05439	0.00141	0.50592	0.01201	0.06747	0.00099	0.02126	0.00096	387	28	416	8	421	6	425	19	99
MJ16-62	0.90	0.0494	0.00642	0.1162	0.01385	0.01706	0.00092	0.00529	0.0005	167	169	112	13	109	6	107	10	103
MJ16-63	0.12	0.07239	0.00082	1.59063	0.01647	0.1594	0.00173	0.04834	0.00126	997	10	967	6	953	10	954	24	101
MJ16-64	1.35	0.1096	0.00203	4.81359	0.08216	0.3186	0.00487	0.08988	0.00168	1793	14	1787	14	1783	24	1740	31	101
MJ16-65	0.26	0.05662	0.00151	0.50902	0.01242	0.06521	0.00098	0.02143	0.00081	477	29	418	8	407	6	429	16	103
MJ16-66	0.32	0.11426	0.00138	4.93955	0.05504	0.31361	0.00379	0.09351	0.00207	1868	10	1809	9	1758	19	1807	38	106
MJ16-67	0.75	0.04974	0.00182	0.15561	0.00523	0.02269	0.0004	0.00716	0.00022	183	46	147	5	145	3	144	4	101
MJ16-68	2.02	0.18661	0.00223	13.509	0.15506	0.52513	0.00707	0.14321	0.00198	2713	10	2716	11	2721	30	2705	35	100
MJ16-69	0.71	0.05354	0.00243	0.26404	0.01097	0.03578	0.00076	0.01099	0.00043	352	56	238	9	227	5	221	9	105
MJ16-70	1.29	0.08031	0.00882	0.17118	0.01469	0.01546	0.00108	0.00765	0.00048	1205	77	160	13	99	7	154	10	162
MJ16-71	0.34	0.11384	0.00272	4.86573	0.10686	0.31005	0.00575	0.09228	0.00435	1862	18	1796	18	1741	28	1784	80	107
MJ16-72	0.31	0.11169	0.00138	3.72842	0.02741	0.24211	0.0024	0.0699	0.00072	1827	23	1577	6	1398	12	1366	14	131
MJ16-73	0.28	0.11486	0.00157	4.80012	0.04146	0.31109	0.00321	0.08726	0.00097	1878	25	1785	7	1757	16	1691	18	107
MJ16-74	0.36	0.05556	0.00151	0.49971	0.01233	0.06523	0.00074	0.02033	0.00022	435	62	412	8	407	4	407	4	101
MJ16-75	0.83	0.16677	0.00196	10.96213	0.12237	0.47682	0.00619	0.13511	0.00234	2525	10	2520	10	2513	27	2561	42	100

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Min River																		
MJ16-76	0.41	0.11363	0.0032	4.64497	0.11879	0.31552	0.00627	0.09407	0.00688	1858	21	1757	21	1774	31	1817	127	105
MJ16-77	0.20	0.08627	0.00397	2.55146	0.10707	0.21455	0.00609	0.07457	0.0074	1344	41	1287	31	1253	32	1454	139	107
MJ16-78	0.60	0.16735	0.00146	10.88995	0.08992	0.47203	0.00527	0.14069	0.0019	2531	9	2514	8	2492	23	2661	34	102
MJ16-79	0.43	0.05818	0.0059	0.20299	0.01862	0.02531	0.00116	0.00718	0.00089	537	122	188	16	161	7	145	18	117
MJ16-80	1.10	0.04861	0.005	0.1105	0.0106	0.01649	0.00064	0.0054	0.00036	129	143	106	10	105	4	109	7	101
MJ16-81	1.17	0.11451	0.00237	5.1481	0.09813	0.32613	0.00546	0.09686	0.00209	1872	15	1844	16	1820	27	1869	39	103
MJ16-82	1.50	0.04605	0.00333	0.09637	0.00666	0.01518	0.00032	0.00491	0.0001	0	160	93	6	97	2	99	2	96
MJ16-83	0.47	0.06632	0.00083	1.25003	0.01433	0.13673	0.00152	0.04235	0.00067	816	11	823	6	826	9	838	13	100
MJ16-84	0.89	0.05898	0.00217	0.5818	0.0196	0.07155	0.00137	0.02257	0.00067	566	41	466	13	445	8	451	13	105
MJ16-85	1.22	0.05026	0.00296	0.24414	0.01339	0.03524	0.00087	0.01162	0.00042	207	82	222	11	223	5	234	8	100
MJ16-86	1.42	0.09408	0.00148	3.27484	0.04719	0.2525	0.00333	0.07668	0.00112	1510	12	1475	11	1451	17	1493	21	104
MJ16-87	0.17	0.14591	0.00136	7.90657	0.06895	0.39309	0.00442	0.11427	0.00289	2299	9	2220	8	2137	20	2187	52	108
MJ16-88	0.09	0.11497	0.0027	5.23824	0.09324	0.33045	0.00507	0.09513	0.00147	1879	43	1859	15	1841	25	1837	27	102
MJ16-89	0.37	0.13649	0.00159	4.50762	0.02879	0.23952	0.00233	0.06778	0.0008	2183	21	1732	5	1384	12	1326	15	158
MJ16-90	0.75	0.05333	0.00248	0.26227	0.01114	0.03567	0.00078	0.01151	0.0005	343	57	236	9	226	5	231	10	104
MJ16-91	2.37	0.09684	0.00459	3.6561	0.1592	0.27388	0.00852	0.08011	0.00249	1564	40	1562	35	1560	43	1558	47	100
MJ16-92	0.14	0.05523	0.00164	0.44135	0.01198	0.05796	0.00093	0.02388	0.00255	422	33	371	8	363	6	477	50	102
MJ16-93	1.08	0.11446	0.00367	4.883	0.14348	0.30947	0.00728	0.09395	0.00317	1871	24	1799	25	1738	36	1815	59	108
MJ16-94	0.71	0.12775	0.00188	6.51347	0.08917	0.36985	0.00513	0.10841	0.00207	2067	11	2048	12	2029	24	2080	38	102
MJ16-95	0.65	0.0557	0.01897	0.28289	0.08836	0.03684	0.0053	0.01092	0.0033	440	397	253	70	233	33	220	66	109
MJ16-96	0.70	0.05966	0.0024	0.60046	0.02209	0.073	0.0015	0.02177	0.00078	591	45	478	14	454	9	435	15	105
MJ16-97	0.66	0.07156	0.00194	1.55778	0.03856	0.1579	0.00266	0.04664	0.00141	973	25	954	15	945	15	921	27	101
Jiulong River																		
JL01-1	0.46	0.05358	0.00117	0.27831	0.00552	0.03783	0.0005	0.01072	0.0002	353	23	249	4	239	3	216	4	104
JL01-2	0.40	0.17196	0.00136	12.93791	0.09902	0.51123	0.00604	0.12938	0.00191	2577	9	2675	7	2672	25	2459	34	96
JL01-3	0.85	0.04886	0.0008	0.14366	0.00211	0.02165	0.00026	0.00476	0.00007	141	16	136	2	138	2	96	1	99
JL01-4	0.45	0.04943	0.00091	0.12196	0.00203	0.01817	0.00023	0.00473	0.00009	168	18	117	2	116	1	95	2	101
JL01-5	0.68	0.07014	0.00053	1.78917	0.01273	0.1901	0.00188	0.04897	0.00043	932	10	1042	5	1122	10	966	8	93
JL01-6	1.01	0.04743	0.00122	0.1646	0.00403	0.02586	0.00032	0.00691	0.00011	71	35	155	4	165	2	139	2	94
JL01-7	0.72	0.05057	0.0019	0.11326	0.00407	0.01668	0.00025	0.00501	0.00012	221	55	109	4	107	2	101	2	102

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Jiulong River																		
JL01-8	0.54	0.04978	0.00098	0.2675	0.00499	0.04001	0.00046	0.01219	0.00019	185	23	241	4	253	3	245	4	95
JL01-9	1.17	0.17099	0.007	0.59221	0.02165	0.02512	0.00046	0.00695	0.00014	2567	70	472	14	160	3	140	3	295
JL01-10	0.35	0.05179	0.00044	0.23444	0.00178	0.0333	0.00033	0.00966	0.0001	276	11	214	1	211	2	194	2	101
JL01-11	0.56	0.05355	0.0007	0.28776	0.00334	0.03952	0.00044	0.00996	0.00013	352	12	257	3	250	3	200	3	103
JL01-12	0.54	0.05021	0.00328	0.17963	0.01147	0.02595	0.00037	0.00819	0.00009	205	150	168	10	165	2	165	2	102
JL01-13	0.30	0.0489	0.00063	0.17079	0.00197	0.02567	0.00028	0.00749	0.00012	143	12	160	2	163	2	151	2	98
JL01-14	0.27	0.04862	0.00065	0.2154	0.00261	0.03256	0.00036	0.00885	0.00016	130	13	198	2	207	2	178	3	96
JL01-15	0.69	0.05315	0.00449	0.17804	0.01387	0.02435	0.00086	0.00746	0.00049	335	113	166	12	155	5	150	10	107
JL01-16	0.11	0.09232	0.00047	3.2784	0.01528	0.26095	0.00253	0.16841	0.00159	1474	11	1476	4	1495	13	3146	28	99
JL01-17	0.45	0.05038	0.00096	0.16495	0.00283	0.02405	0.0003	0.00624	0.00012	213	19	155	2	153	2	126	2	101
JL01-18	1.04	0.0529	0.00078	0.27059	0.00357	0.03757	0.00043	0.00876	0.0001	325	13	243	3	238	3	176	2	102
JL01-19	0.73	0.0519	0.00267	0.13979	0.00661	0.01956	0.00045	0.0058	0.00018	281	67	133	6	125	3	117	4	106
JL01-20	0.49	0.04731	0.00088	0.11107	0.00187	0.01724	0.00021	0.00429	0.00008	65	19	107	2	110	1	87	2	97
JL01-21	0.69	0.04735	0.00291	0.16171	0.00921	0.0248	0.00064	0.00774	0.00038	67	79	152	8	158	4	156	8	96
JL01-22	0.96	0.05285	0.00041	0.28307	0.00198	0.03929	0.00039	0.00908	0.00007	322	11	253	2	248	2	183	1	102
JL01-23	1.43	0.07586	0.00113	0.30717	0.01283	0.04363	0.00053	0.01048	0.00012	1091	12	278	4	275	3	211	2	101
JL01-24	0.86	0.04928	0.00096	0.16722	0.00296	0.02489	0.00031	0.00554	0.00009	161	20	157	3	158	2	112	2	99
JL01-25	0.24	0.0981	0.00062	4.32438	0.02566	0.30591	0.00319	0.07369	0.00076	1588	10	1698	5	1719	16	1437	14	92
JL01-26	0.91	0.04605	0.00295	0.10255	0.00615	0.01615	0.00036	0.00617	0.00049	0	140	99	6	103	2	124	10	96
JL01-27	0.75	0.05177	0.00158	0.21792	0.00633	0.0311	0.00042	0.00935	0.00018	275	42	200	5	197	3	188	4	102
JL01-28	0.42	0.05098	0.00181	0.2786	0.00938	0.03963	0.00044	0.01248	0.00014	240	84	250	7	251	3	251	3	100
JL01-29	0.51	0.0509	0.00157	0.16344	0.00471	0.02329	0.00026	0.00734	0.00007	236	73	154	4	148	2	148	1	104
JL01-30	0.61	0.14204	0.00112	8.87349	0.08334	0.435	0.00594	0.11123	0.0015	2252	9	2312	7	2187	14	2492	27	103
JL01-31	0.04	0.05009	0.00039	0.2868	0.00211	0.04223	0.00041	0.02596	0.00037	199	11	256	2	267	3	518	7	96
JL01-32	0.71	0.05489	0.00312	0.14327	0.00786	0.01893	0.00028	0.00591	0.00007	408	131	136	7	121	2	119	1	112
JL01-33	0.62	0.05113	0.00057	0.26934	0.00269	0.03857	0.00041	0.00959	0.00011	247	11	242	2	244	3	193	2	99
JL01-34	0.71	0.05888	0.00336	0.19283	0.01062	0.02375	0.00036	0.00735	0.00009	563	128	179	9	151	2	148	2	119
JL01-35	0.62	0.05215	0.00297	0.13326	0.00735	0.01853	0.00027	0.00582	0.00007	292	133	127	7	118	2	117	1	108
JL01-36	0.88	0.09691	0.00455	0.2431	0.0106	0.01819	0.00032	0.00533	0.00009	1566	90	221	9	116	2	107	2	191
JL01-37	0.29	0.10099	0.00074	4.0845	0.02813	0.29768	0.00297	0.08804	0.00101	1642	9	1651	6	1680	15	1705	19	98

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Jiulong River																		
JL01-38	0.62	0.05857	0.00181	0.60709	0.01785	0.07627	0.00109	0.02599	0.00054	551	39	482	11	474	7	519	11	102
JL01-39	0.85	0.06012	0.00356	0.26932	0.01546	0.03249	0.00047	0.01003	0.00011	608	132	242	12	206	3	202	2	117
JL01-40	0.63	0.0511	0.00308	0.15558	0.00909	0.02208	0.00033	0.00695	0.00008	245	140	147	8	141	2	140	2	104
JL01-41	0.13	0.05802	0.00041	0.85733	0.00543	0.10795	0.00106	0.03993	0.00049	531	11	629	3	661	6	791	10	95
JL01-42	0.78	0.0532	0.00218	0.16847	0.00642	0.02299	0.00042	0.00728	0.00024	337	54	158	6	147	3	147	5	107
JL01-43	1.21	0.14108	0.00168	8.77567	0.10074	0.42608	0.00541	0.11378	0.00139	2241	9	2315	10	2122	24	2178	25	106
JL01-44	0.80	0.0484	0.00403	0.1402	0.01136	0.02101	0.00039	0.00666	0.00012	119	188	133	10	134	2	134	2	99
JL01-45	0.81	0.0522	0.00047	0.28962	0.00243	0.04025	0.00041	0.05618	0.00163	294	11	258	2	254	3	1105	31	102
JL01-46	0.64	0.04791	0.00167	0.16763	0.00536	0.02549	0.00043	0.00651	0.0002	95	44	157	5	162	3	131	4	97
JL01-47	0.65	0.10064	0.00066	4.68431	0.02929	0.3108	0.00335	0.08594	0.00076	1636	10	1764	5	1791	16	1666	14	91
JL01-48	0.45	0.05529	0.00261	0.33194	0.01509	0.04354	0.00056	0.01358	0.00018	424	108	291	12	275	3	273	4	106
JL01-49	0.46	0.05315	0.00255	0.18405	0.00849	0.02512	0.00034	0.00787	0.00009	335	112	172	7	160	2	158	2	108
JL01-50	0.98	0.04945	0.00466	0.11595	0.00983	0.0171	0.00074	0.00378	0.00027	169	115	111	9	109	5	76	5	102
JL01-51	0.69	0.04936	0.00207	0.11412	0.00445	0.01684	0.00031	0.00421	0.00012	165	57	110	4	108	2	85	2	102
JL01-52	0.75	0.05153	0.00168	0.26189	0.00764	0.03706	0.00066	0.00904	0.00027	265	36	236	6	235	4	182	5	100
JL01-53	0.73	0.04903	0.002	0.12588	0.00473	0.0187	0.00035	0.00466	0.00016	149	53	120	4	119	2	94	3	101
JL01-54	1.00	0.04977	0.00275	0.11723	0.00581	0.01717	0.00046	0.00367	0.00015	184	67	113	5	110	3	74	3	103
JL01-55	0.63	0.0463	0.00182	0.10285	0.00379	0.01618	0.00027	0.00393	0.0001	13	47	99	3	103	2	79	2	96
JL01-56	0.70	0.04828	0.00187	0.15233	0.00552	0.02298	0.0004	0.00532	0.0001	113	53	144	5	146	3	107	2	99
JL01-57	0.70	0.06348	0.00633	0.15153	0.01488	0.01731	0.00031	0.00531	0.00011	724	220	143	13	111	2	107	2	129
JL01-58	0.66	0.05571	0.00318	0.19514	0.01074	0.02541	0.00039	0.00791	0.0001	441	131	181	9	162	2	159	2	112
JL01-59	1.11	0.05	0.00371	0.17671	0.01189	0.02574	0.00087	0.00563	0.00029	195	94	165	10	164	5	113	6	101
JL01-60	0.57	0.05056	0.00053	0.26467	0.00253	0.03811	0.0004	0.0098	0.00011	221	11	238	2	241	2	197	2	99
JL01-61	1.10	0.04981	0.0051	0.10803	0.01013	0.01578	0.00068	0.00437	0.00029	186	133	104	9	101	4	88	6	103
JL01-62	0.73	0.05001	0.0031	0.11873	0.00666	0.01727	0.00049	0.00425	0.00023	195	78	114	6	110	3	86	5	104
JL01-63	0.60	0.05131	0.00092	0.1753	0.00285	0.02485	0.0003	0.0065	0.00011	255	18	164	2	158	2	131	2	104
JL01-64	0.60	0.11214	0.00082	5.32096	0.03682	0.33457	0.00343	0.09074	0.00087	1834	9	1872	6	1739	16	1756	16	105
JL01-65	1.02	0.05079	0.00188	0.16318	0.00561	0.02338	0.0004	0.00598	0.00016	231	48	153	5	149	3	121	3	103
JL01-66	0.73	0.04907	0.00088	0.1576	0.00257	0.02334	0.00028	0.00573	0.00009	151	18	149	2	149	2	115	2	100
JL01-67	0.94	0.04996	0.00088	0.1745	0.00279	0.02538	0.00031	0.00583	0.00008	193	17	163	2	162	2	117	2	101

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
Jiulong River																		
JL01-68	0.61	0.04992	0.00128	0.26007	0.00616	0.03789	0.00054	0.01016	0.00022	191	30	235	5	240	3	204	4	98
JL01-69	1.03	0.05975	0.00217	0.53119	0.01713	0.06459	0.00134	0.01848	0.00057	595	36	433	11	403	8	370	11	107
JL01-70	0.54	0.04983	0.00232	0.15357	0.00667	0.02241	0.00044	0.00604	0.0002	187	65	145	6	143	3	122	4	101
JL01-71	0.81	0.04841	0.00087	0.14306	0.00234	0.02146	0.00026	0.00517	0.00008	119	18	136	2	137	2	104	2	99
JL01-72	0.65	0.04741	0.00157	0.1079	0.00335	0.01655	0.00025	0.00442	0.00009	70	45	104	3	106	2	89	2	98
JL01-73	0.88	0.0505	0.00135	0.25882	0.0063	0.0372	0.00055	0.00918	0.0002	218	30	234	5	235	3	185	4	100
JL01-74	1.10	0.04948	0.00122	0.24545	0.00545	0.036	0.00052	0.00879	0.00017	171	27	223	4	228	3	177	3	98
JL01-75	0.64	0.05004	0.00206	0.11033	0.00421	0.01603	0.0003	0.00399	0.0001	197	54	106	4	103	2	80	2	103
JL01-76	0.54	0.04815	0.00094	0.1582	0.0028	0.02383	0.0003	0.00578	0.00011	107	20	149	2	152	2	116	2	98
JL01-77	0.46	0.04749	0.00066	0.15235	0.00192	0.02327	0.00026	0.00607	0.00009	74	13	144	2	148	2	122	2	97
JL01-78	0.72	0.06333	0.00073	1.15392	0.01206	0.13212	0.00146	0.03076	0.00038	719	11	779	6	800	8	612	7	97
JL01-79	0.08	0.10278	0.0005	4.28543	0.0193	0.29228	0.0029	0.08289	0.00097	1675	11	1691	4	1603	14	1610	18	104
JL01-80	0.48	0.05179	0.00184	0.16833	0.00544	0.02356	0.00042	0.00645	0.00023	276	42	158	5	150	3	130	5	105
standard zircons																		
91500	2.782	0.07392	0.00159	1.83248	0.03624	0.17982	0.00265	0.05239	0.00174	1039	19	1057	13	1066	14	1032	33	
91500	2.846	0.07462	0.00164	1.84183	0.03708	0.17903	0.00266	0.05333	0.00176	1058	19	1061	13	1062	15	1050	34	
91500	2.832	0.07811	0.00196	1.93462	0.04429	0.17966	0.00295	0.05591	0.00211	1150	22	1093	15	1065	16	1100	40	
91500	2.873	0.07571	0.00198	1.87547	0.04505	0.17968	0.00301	0.05388	0.00215	1087	24	1072	16	1065	16	1061	41	
91500	2.804	0.07452	0.00203	1.84387	0.04606	0.17947	0.00309	0.05388	0.00225	1056	25	1061	16	1064	17	1061	43	
91500	2.809	0.07277	0.00173	1.79559	0.03907	0.17899	0.0028	0.05406	0.00194	1008	21	1044	14	1061	15	1064	37	
91500	2.815	0.07739	0.002	1.91263	0.04518	0.17926	0.00302	0.05592	0.00218	1131	23	1086	16	1063	17	1100	42	
91500	2.797	0.07785	0.00194	1.92132	0.04372	0.17902	0.00294	0.05305	0.00202	1143	22	1089	15	1062	16	1045	39	
91500	2.898	0.07367	0.00177	1.82226	0.04038	0.17943	0.0028	0.0522	0.00187	1032	22	1053	15	1064	15	1028	36	
91500	2.814	0.07531	0.00179	1.8605	0.04053	0.17921	0.00284	0.05511	0.00196	1077	21	1067	14	1063	16	1084	38	
91500	2.928	0.07581	0.00172	1.87195	0.03892	0.17911	0.00275	0.0547	0.00186	1090	20	1071	14	1062	15	1076	36	
91500	2.887	0.07226	0.00188	1.78378	0.04266	0.17907	0.00297	0.05289	0.00207	993	24	1040	16	1062	16	1042	40	
91500	2.921	0.07181	0.00172	1.7775	0.03921	0.17956	0.00282	0.0534	0.00193	981	22	1037	14	1065	15	1052	37	
91500	2.86	0.07537	0.00176	1.86513	0.03987	0.17951	0.00281	0.0547	0.00194	1078	21	1069	14	1064	15	1076	37	
91500	2.811	0.07511	0.00196	1.85367	0.04445	0.17902	0.003	0.05579	0.00216	1071	24	1065	16	1062	16	1097	41	
91500	2.875	0.07599	0.00182	1.87497	0.04107	0.179	0.00284	0.05335	0.00193	1095	21	1072	15	1062	16	1051	37	

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
standard zircons																		
91500	2.861	0.07618	0.00205	1.88391	0.04634	0.1794	0.0031	0.05265	0.00221	1100	24	1075	16	1064	17	1037	42	
91500	2.902	0.0754	0.00209	1.86286	0.04746	0.17924	0.00309	0.05137	0.00222	1079	26	1068	17	1063	17	1013	43	
91500	2.833	0.074	0.00229	1.82319	0.05169	0.17878	0.00341	0.05082	0.00245	1041	29	1054	19	1060	19	1002	47	
91500	2.837	0.07648	0.00231	1.88769	0.05209	0.17909	0.00338	0.0608	0.00282	1108	27	1077	18	1062	18	1193	54	
91500	2.843	0.07948	0.00232	1.96163	0.05203	0.17909	0.00332	0.05543	0.00248	1184	26	1102	18	1062	18	1090	47	
91500	2.825	0.07105	0.00216	1.75945	0.04919	0.17969	0.00332	0.05574	0.00253	959	29	1031	18	1065	18	1096	48	
91500	2.907	0.07545	0.00211	1.8637	0.04773	0.17922	0.00317	0.05353	0.00228	1081	25	1068	17	1063	17	1054	44	
91500	2.842	0.07448	0.00264	1.83805	0.05977	0.17908	0.00373	0.05293	0.00286	1055	34	1059	21	1062	20	1042	55	
91500	2.907	0.07648	0.0029	1.89287	0.06575	0.17959	0.00404	0.05982	0.00334	1108	36	1079	23	1065	22	1174	64	
91500	2.917	0.07895	0.00247	1.95077	0.05568	0.1793	0.00348	0.05129	0.00259	1171	28	1099	19	1063	19	1011	50	
91500	2.851	0.07237	0.00276	1.79192	0.0628	0.17966	0.00396	0.05196	0.00314	996	37	1043	23	1065	22	1024	60	
91500	2.889	0.07363	0.00214	1.81808	0.04846	0.17916	0.00322	0.05189	0.0024	1031	27	1052	17	1062	18	1023	46	
91500	2.778	0.07242	0.00264	1.79209	0.06023	0.17954	0.0038	0.05192	0.00286	998	36	1043	22	1064	21	1023	55	
91500	2.842	0.07657	0.0026	1.89112	0.05878	0.1792	0.00367	0.05403	0.00287	1110	32	1078	21	1063	20	1064	55	
91500	2.828	0.07346	0.00266	1.81733	0.06035	0.17948	0.00385	0.05257	0.00298	1027	35	1052	22	1064	21	1036	57	
91500	2.868	0.07224	0.00201	1.7808	0.04559	0.17885	0.00306	0.05127	0.00222	993	26	1038	17	1061	17	1011	43	
91500	2.8	0.07337	0.00335	1.81016	0.07588	0.17898	0.00461	0.0531	0.00371	1024	45	1049	27	1061	25	1046	71	
91500	2.804	0.07495	0.00219	1.85059	0.04943	0.17911	0.00326	0.05281	0.00241	1067	27	1064	18	1062	18	1040	46	
91500	2.81	0.07578	0.00192	1.87241	0.04347	0.17923	0.00296	0.05386	0.00218	1089	23	1071	15	1063	16	1060	42	
91500	2.792	0.07314	0.0023	1.8104	0.05227	0.17955	0.00342	0.05288	0.00254	1018	30	1049	19	1065	19	1042	49	
91500	2.893	0.07404	0.00234	1.82678	0.053	0.17898	0.00345	0.05291	0.00262	1043	30	1055	19	1061	19	1042	50	
91500	2.809	0.07368	0.00227	1.82442	0.05157	0.17961	0.00339	0.06126	0.00264	1033	29	1054	19	1065	19	1202	50	
91500	2.923	0.07503	0.00218	1.85205	0.04933	0.17906	0.00323	0.05851	0.00257	1069	27	1064	18	1062	18	1149	49	
91500	2.883	0.07204	0.00191	1.78022	0.04328	0.17926	0.003	0.05176	0.0021	987	25	1038	16	1063	16	1020	40	
91500	2.917	0.07583	0.00205	1.87443	0.04638	0.17932	0.00308	0.05408	0.00224	1091	24	1072	16	1063	17	1065	43	
91500	2.855	0.07518	0.00183	1.85303	0.04132	0.1788	0.00286	0.05012	0.00191	1073	22	1065	15	1060	16	988	37	
91500	2.8	0.07285	0.00207	1.79638	0.04683	0.17886	0.00316	0.05532	0.00232	1010	26	1044	17	1061	17	1088	44	
91500	2.805	0.07761	0.002	1.91742	0.04524	0.17921	0.00301	0.05482	0.00223	1137	23	1087	16	1063	16	1079	43	
91500	2.811	0.08216	0.0021	2.03378	0.04739	0.17955	0.00301	0.05394	0.00217	1249	22	1127	16	1065	16	1062	42	
91500	2.793	0.07727	0.00201	1.91278	0.04545	0.17957	0.00303	0.05541	0.0022	1128	23	1086	16	1065	17	1090	42	

Analysis	Th/U	Isotope ratios								Ages (Ma)								Concordance
		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{208}Pb/^{232}Th$	1σ	
standard zircons																		
91500	2.894	0.07437	0.00198	1.83543	0.04488	0.17903	0.00304	0.05356	0.00222	1052	24	1058	16	1062	17	1055	43	
91500	2.81	0.07274	0.00191	1.79592	0.04328	0.17909	0.003	0.05383	0.00214	1007	24	1044	16	1062	16	1060	41	
91500	2.923	0.07114	0.00194	1.75732	0.04418	0.1792	0.00306	0.05238	0.0022	961	26	1030	16	1063	17	1032	42	
91500	2.883	0.07505	0.00254	1.85582	0.05757	0.17936	0.00366	0.05637	0.0029	1070	32	1066	20	1063	20	1108	55	
91500	2.917	0.0768	0.0024	1.89639	0.05418	0.17911	0.00345	0.05431	0.00263	1116	29	1080	19	1062	19	1069	50	
GJ-1	28.13	0.05862	0.00119	0.79064	0.01476	0.09783	0.00128	0.0308	0.00176	553	20	592	8	602	8	613	35	
GJ-1	28.32	0.0614	0.0012	0.80702	0.01447	0.09734	0.00124	0.02798	0.0016	653	19	601	8	599	7	558	31	
GJ-1	27.81	0.05888	0.00119	0.79067	0.01476	0.0974	0.00128	0.02788	0.00169	563	20	592	8	599	8	556	33	
GJ-1	28.67	0.05921	0.00117	0.7937	0.01436	0.09723	0.00127	0.03077	0.00167	575	19	593	8	598	7	613	33	
GJ-1	28.76	0.06161	0.00124	0.83123	0.01526	0.09786	0.0013	0.02802	0.00168	661	19	614	8	602	8	559	33	
GJ-1	27.8	0.0622	0.00126	0.82184	0.01526	0.09785	0.00129	0.03065	0.00182	681	19	609	9	602	8	610	36	
GJ-1	27.93	0.06041	0.00129	0.81245	0.01586	0.09756	0.00134	0.02782	0.0019	618	21	604	9	600	8	555	37	
GJ-1	27.79	0.0622	0.00131	0.8167	0.01577	0.09826	0.00131	0.03025	0.00186	681	20	606	9	604	8	602	36	
GJ-1	28.19	0.06025	0.0014	0.78487	0.01667	0.09752	0.00134	0.02606	0.00188	613	24	588	9	600	8	520	37	
GJ-1	27.52	0.05704	0.00131	0.78626	0.01527	0.09838	0.00128	0.0256	0.00166	493	22	589	9	605	8	511	33	
GJ-1	27.56	0.05957	0.0013	0.76157	0.01517	0.09877	0.00126	0.02829	0.00176	588	22	575	9	607	7	564	35	
GJ-1	27.62	0.05951	0.00139	0.79303	0.01633	0.09803	0.0013	0.02388	0.00183	586	23	593	9	603	8	477	36	
GJ-1	27.74	0.06152	0.00131	0.79236	0.01538	0.09844	0.00126	0.0284	0.0017	657	21	593	9	605	7	566	33	
GJ-1	28.43	0.05997	0.00128	0.79325	0.01509	0.09755	0.00125	0.0269	0.00171	602	21	593	9	600	7	537	34	
GJ-1	27.61	0.06204	0.00132	0.80932	0.01569	0.09665	0.00127	0.03234	0.00191	675	21	602	9	595	7	643	37	
GJ-1	28.73	0.06043	0.0013	0.7735	0.01528	0.09885	0.00127	0.02616	0.00168	619	22	582	9	608	7	522	33	
GJ-1	28.33	0.0604	0.00133	0.7942	0.01602	0.09838	0.00131	0.03086	0.0019	618	22	594	9	605	8	614	37	
GJ-1	28.66	0.06106	0.00152	0.83012	0.01894	0.09861	0.00147	0.03075	0.00217	641	25	614	11	606	9	612	43	
GJ-1	28.06	0.06289	0.00134	0.80804	0.01577	0.0982	0.00128	0.02596	0.00164	705	21	601	9	604	8	518	32	
GJ-1	28.42	0.06158	0.00135	0.82272	0.01651	0.09692	0.00135	0.02767	0.0018	660	21	610	9	596	8	552	35	
GJ-1	27.6	0.05923	0.0014	0.81086	0.01759	0.0993	0.00143	0.03025	0.00199	576	24	603	10	610	8	602	39	
GJ-1	28.71	0.05979	0.00151	0.80952	0.01873	0.09822	0.00147	0.02599	0.00204	596	26	602	11	604	9	519	40	

APPENDIX 2

Hf isotope data for detrital zircons from Min River and Jiulong River.

Analysis	Age (Ma)	$^{176}Yb/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf$	2σ	ε_{Hf} (t)	T_{DM2}
Min River									
MJ01-1	140	0.030061	0.000802	0.000967	0.000024	0.282223	0.000009	-16.9	2220
MJ01-2	229	0.022822	0.000021	0.000698	0.000002	0.282448	0.000010	-6.9	1668
MJ01-3	158	0.256246	0.000262	0.007430	0.000010	0.282429	0.000014	-9.9	1798
MJ01-5	457	0.038297	0.000830	0.001204	0.000022	0.282316	0.000018	-6.8	1836
MJ01-7	471	0.022218	0.000160	0.000922	0.000008	0.282592	0.000016	3.4	1208
MJ01-8	97	0.029338	0.000092	0.000918	0.000005	0.282715	0.000013	-0.4	1153
MJ01-9	151	0.156739	0.002176	0.004993	0.000070	0.282397	0.000013	-10.9	1836
MJ01-12	139	0.035523	0.000168	0.001095	0.000007	0.282429	0.000013	-9.6	1766
MJ01-13	243	0.027156	0.000988	0.000839	0.000030	0.282542	0.000013	-3.3	1462
MJ01-15	895	0.051039	0.001503	0.001618	0.000047	0.282129	0.000013	-4.1	1973
MJ01-16	2311	0.018007	0.000766	0.000602	0.000026	0.281278	0.000013	-1.9	2991
MJ01-17	369	0.023228	0.000198	0.000756	0.000007	0.282407	0.000011	-5.4	1685
MJ01-18	409	0.036025	0.000300	0.001192	0.000008	0.282230	0.000013	-10.9	2064
MJ01-20	417	0.025427	0.000206	0.000774	0.000006	0.282376	0.000011	-5.4	1719
MJ01-23	419	0.052249	0.000577	0.001727	0.000020	0.282303	0.000015	-8.2	1874
MJ01-24	1862	0.017808	0.000223	0.000548	0.000005	0.281642	0.000012	0.9	2440
MJ01-25	2497	0.011364	0.000280	0.000371	0.000006	0.280856	0.000010	-12.2	4021
MJ01-26	139	0.109775	0.000487	0.003077	0.000018	0.282514	0.000014	-6.8	1580
MJ01-27	173	0.043156	0.001489	0.001380	0.000042	0.282237	0.000013	-15.7	2193
MJ01-29	251	0.032370	0.000219	0.000987	0.000007	0.282412	0.000015	-7.8	1761
MJ01-30	919	0.102275	0.001917	0.003141	0.000051	0.282326	0.000016	2.4	1520
MJ01-31	1808	0.017626	0.000059	0.000525	0.000001	0.281464	0.000009	-6.6	2902
MJ01-32	483	0.001242	0.000111	0.000033	0.000004	0.282110	0.000011	-13.1	2269
MJ01-33	102	0.028703	0.000100	0.000904	0.000002	0.282500	0.000011	-7.9	1630
MJ01-34	149	0.031076	0.000355	0.001037	0.000011	0.282290	0.000010	-14.3	2064
MJ01-35	446	0.014731	0.000012	0.000462	0.000001	0.282303	0.000011	-7.3	1895
MJ01-36	153	0.078064	0.000559	0.002497	0.000014	0.282433	0.000015	-9.3	1749
MJ01-41	182	0.020796	0.000165	0.000721	0.000004	0.282076	0.000011	-21.1	2517
MJ01-42	147	0.029669	0.000634	0.000947	0.000016	0.282323	0.000011	-13.2	2014
MJ01-43	425	0.118893	0.001316	0.003882	0.000067	0.282400	0.000013	-5.3	1666
MJ01-44	498	0.032259	0.000352	0.001040	0.000013	0.282333	0.000013	-5.2	1755
MJ01-45	2387	0.006626	0.000137	0.000237	0.000004	0.281294	0.000012	1.1	2904
MJ01-46	231	0.022474	0.000030	0.000693	0.000001	0.282361	0.000009	-10.0	1906
MJ01-47	259	0.023813	0.000078	0.000610	0.000004	0.282364	0.000013	-9.2	1838
MJ01-48	465	0.027163	0.000161	0.000821	0.000002	0.282313	0.000011	-6.6	1824
MJ01-49	403	0.017166	0.000056	0.000541	0.000001	0.282286	0.000010	-8.8	1934
MJ01-50	814	0.039370	0.000295	0.001223	0.000009	0.282136	0.000015	-5.4	2012
MJ01-51	874	0.028858	0.000146	0.000770	0.000007	0.282171	0.000012	-2.6	1927
MJ01-52	428	0.028158	0.000518	0.000903	0.000014	0.282213	0.000011	-11.0	2082
MJ01-53	466	0.050020	0.001818	0.001497	0.000053	0.282445	0.000013	-2.1	1544
MJ01-54	1758	0.045828	0.000305	0.001361	0.000009	0.281558	0.000009	-5.4	2676
MJ01-55	153	0.037357	0.000241	0.001199	0.000008	0.282340	0.000012	-12.5	1954
MJ01-56	1774	0.008286	0.000076	0.000224	0.000001	0.281550	0.000011	-3.9	2829

Analysis	Age (Ma)	$^{176}Yb/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf$	2σ	ε_{Hf} (t)	T_{DM2}
Min River									
MJ01-57	1832	0.022120	0.000248	0.000672	0.000006	0.281611	0.000011	-1.0	2584
MJ01-58	1740	0.010120	0.000129	0.000315	0.000005	0.281608	0.000013	-2.8	2737
MJ01-59	613	0.040483	0.001270	0.001133	0.000037	0.282403	0.000013	-0.3	1541
MJ01-60	466	0.080449	0.000575	0.002434	0.000022	0.282301	0.000012	-7.5	1860
MJ01-61	2363	0.017519	0.000101	0.000568	0.000003	0.281212	0.000009	-3.0	3205
MJ01-62	163	0.320117	0.001768	0.010241	0.000061	0.282762	0.000019	1.7	1013
MJ01-63	155	0.056064	0.000853	0.001801	0.000028	0.282308	0.000013	-13.6	2024
MJ01-64	447	0.018369	0.000131	0.000545	0.000005	0.282401	0.000011	-3.8	1678
MJ01-65	139	0.076933	0.003620	0.002590	0.000123	0.282633	0.000016	-2.5	1313
MJ01-66	144	0.038104	0.000523	0.001207	0.000015	0.282450	0.000014	-8.7	1713
MJ01-67	146	0.035743	0.001705	0.001084	0.000050	0.282320	0.000015	-13.3	2000
MJ01-68	429	0.015514	0.000072	0.000465	0.000002	0.282337	0.000016	-6.4	1800
MJ01-69	2316	0.010870	0.000233	0.000319	0.000006	0.281348	0.000013	1.2	2825
MJ01-70	107	0.019469	0.000194	0.000592	0.000004	0.282513	0.000013	-7.3	1598
MJ01-71	1574	0.022870	0.000795	0.000638	0.000019	0.281460	0.000016	-12.1	3067
MJ01-73	229	0.045479	0.000655	0.001316	0.000022	0.282364	0.000013	-10.0	1851
MJ01-74	1684	0.012102	0.000225	0.000323	0.000005	0.281448	0.000011	-9.7	3053
MJ01-76	492	0.051406	0.001225	0.001536	0.000038	0.282284	0.000014	-7.3	1862
MJ01-77	2089	0.001655	0.000009	0.000044	0.000000	0.281332	0.000012	-4.2	3060
MJ01-78	117	0.042729	0.000546	0.001370	0.000019	0.282517	0.000015	-7.0	1582
MJ01-79	102	0.015853	0.000277	0.000459	0.000008	0.282653	0.000014	-2.4	1288
MJ01-80	137	0.022651	0.000317	0.000741	0.000012	0.282430	0.000013	-9.6	1762
MJ01-81	371	0.012421	0.000172	0.000292	0.000006	0.282273	0.000011	-9.9	1980
MJ01-82	419	0.040933	0.000302	0.001192	0.000011	0.282342	0.000014	-6.7	1786
MJ01-83	2506	0.013330	0.000063	0.000418	0.000002	0.281046	0.000011	-5.3	3299
MJ01-84	1672	0.000627	0.000010	0.000016	0.000000	0.281585	0.000010	-4.8	2656
MJ01-85	1664	0.000837	0.000010	0.000021	0.000000	0.281364	0.000010	-12.8	3171
MJ01-86	240	0.014052	0.000194	0.000464	0.000005	0.282443	0.000016	-6.8	1679
MJ01-87	103	0.041433	0.000230	0.001272	0.000004	0.282589	0.000017	-4.7	1432
MJ01-88	426	0.027080	0.000166	0.000902	0.000007	0.282506	0.000015	-0.6	1425
MJ01-89	224	0.028151	0.000755	0.000887	0.000020	0.282413	0.000018	-8.3	1746
MJ01-90	1621	0.009423	0.000061	0.000299	0.000003	0.281411	0.000014	-12.4	3128
MJ01-91	100	0.030247	0.000210	0.000962	0.000004	0.282756	0.000017	1.1	1061
MJ01-92	358	0.028265	0.000114	0.000911	0.000002	0.282523	0.000012	-1.5	1429
MJ01-93	393	0.027227	0.000277	0.000872	0.000007	0.282460	0.000015	-3.0	1543
MJ01-94	395	0.018386	0.000036	0.000569	0.000000	0.282361	0.000012	-6.3	1771
MJ01-95	404	0.039277	0.000103	0.001207	0.000005	0.282362	0.000011	-6.3	1763
MJ01-96	410	0.037372	0.000199	0.001173	0.000004	0.282279	0.000011	-9.1	1935
MJ01-97	1742	0.022556	0.000376	0.000669	0.000009	0.281467	0.000013	-8.1	2895
MJ01-98	2336	0.011417	0.000120	0.000372	0.000002	0.281117	0.000012	-6.7	3361
MJ01-99	98	0.034012	0.000126	0.001135	0.000005	0.282513	0.000014	-7.5	1606
MJ01-100	351	0.047334	0.000447	0.001370	0.000010	0.282557	0.000014	-0.6	1350
MJ01-101	1762	0.011824	0.000100	0.000353	0.000003	0.281446	0.000013	-8.1	2960
MJ01-102	426	0.021909	0.000251	0.000808	0.000008	0.282286	0.000013	-8.4	1927
MJ01-103	398	0.043372	0.000253	0.001591	0.000011	0.282348	0.000014	-7.0	1786

Analysis	Age (Ma)	$^{176}Yb/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf$	2σ	ε_{Hf} (t)	T_{DM2}
Min River									
MJ01-105	181	0.012533	0.000231	0.000448	0.000007	0.282142	0.000012	-18.8	2370
MJ01-106	1715	0.009727	0.000021	0.000271	0.000000	0.281505	0.000013	-6.9	2821
MJ01-107	151	0.181106	0.003046	0.005696	0.000101	0.282356	0.000019	-12.4	1951
MJ01-108	154	0.023769	0.000271	0.000776	0.000008	0.282425	0.000015	-9.4	1765
MJ01-109	420	0.020490	0.000159	0.000770	0.000005	0.282379	0.000018	-5.2	1710
MJ01-110	136	0.017338	0.000255	0.000572	0.000007	0.282137	0.000016	-20.0	2409
MJ01-111	1414	0.011133	0.000074	0.000349	0.000003	0.281587	0.000017	-10.9	2833
MJ01-112	137	0.034510	0.000436	0.001159	0.000011	0.282445	0.000018	-9.1	1732
MJ01-113	429	0.030272	0.000124	0.000972	0.000004	0.282359	0.000016	-5.8	1753
MJ01-114	1679	0.016953	0.000075	0.000524	0.000003	0.281471	0.000013	-9.3	2936
MJ01-115	1690	0.006885	0.000392	0.000201	0.000012	0.281456	0.000013	-9.2	2938
MJ01-117	1727	0.013308	0.000016	0.000410	0.000001	0.281503	0.000016	-6.9	2828
MJ01-118	146	0.041588	0.000293	0.001373	0.000007	0.282298	0.000019	-14.1	2054
MJ01-119	2356	0.013068	0.000036	0.000379	0.000001	0.281041	0.000013	-8.9	3439
MJ01-120	422	0.014963	0.000043	0.000451	0.000001	0.282299	0.000013	-7.9	1881
MJ01-121	374	0.024260	0.000597	0.000742	0.000019	0.282400	0.000013	-5.5	1690
MJ01-122	1646	0.030688	0.000272	0.000877	0.000009	0.281414	0.000014	-12.4	3102
MJ01-123	1443	0.024646	0.000118	0.000697	0.000002	0.281485	0.000013	-14.3	3057
MJ01-124	758	0.012959	0.000031	0.000396	0.000002	0.282233	0.000014	-2.8	1820
MJ01-125	145	0.031481	0.000245	0.000983	0.000005	0.282289	0.000015	-14.4	2071
MJ01-126	106	0.047722	0.000578	0.001448	0.000019	0.282563	0.000016	-5.6	1491
MJ01-129	478	0.030609	0.000156	0.000951	0.000003	0.282816	0.000015	11.5	700
MJ01-130	249	0.013671	0.000306	0.000447	0.000010	0.282347	0.000014	-10.0	1878
MJ01-131	162	0.035350	0.000187	0.001192	0.000007	0.282348	0.000014	-12.0	1934
MJ01-132	472	0.044008	0.000905	0.001311	0.000026	0.282385	0.000016	-4.0	1675
MJ01-133	1803	0.021494	0.000133	0.000627	0.000004	0.281453	0.000015	-7.2	2907
MJ01-134	840	0.013196	0.000120	0.000406	0.000003	0.282006	0.000014	-9.0	2271
MJ01-135	2765	0.030582	0.000301	0.000925	0.000010	0.281095	0.000016	1.4	3134
MJ01-136	664	0.020173	0.000431	0.000665	0.000013	0.281972	0.000021	-14.2	2459
MJ01-137	1759	0.022184	0.000135	0.000692	0.000003	0.281523	0.000013	-5.8	2785
MJ01-138	714	0.042057	0.001101	0.001217	0.000026	0.282306	0.000016	-1.6	1711
MJ01-139	1602	0.006238	0.000281	0.000163	0.000009	0.281462	0.000013	-10.9	2978
MJ01-140	1102	0.018323	0.000098	0.000584	0.000004	0.281584	0.000014	-18.2	3039
MJ01-141	1500	0.015311	0.000040	0.000469	0.000000	0.281460	0.000012	-13.6	3064
MJ01-142	677	0.028306	0.000606	0.000969	0.000020	0.282044	0.000012	-11.5	2302
MJ01-143	104	0.033591	0.000770	0.001058	0.000021	0.282590	0.000014	-4.7	1429
MJ01-144	237	0.022534	0.000059	0.000713	0.000001	0.282436	0.000014	-7.2	1690
MJ01-145	1992	0.010032	0.000891	0.000361	0.000033	0.281364	0.000014	-5.7	2964
MJ01-146	1742	0.014127	0.000327	0.000426	0.000009	0.281442	0.000014	-8.8	2953
MJ16-01	170	0.034202	0.000366	0.001048	0.000010	0.282361	0.000011	-11.3	1899
MJ16-03	388	0.067393	0.000247	0.001965	0.000004	0.282395	0.000029	-5.7	1713
MJ16-04	1857	0.019431	0.000276	0.000482	0.000009	0.281340	0.000017	-9.8	3107
MJ16-05	145	0.052231	0.000398	0.001376	0.000012	0.282349	0.000013	-12.3	1941
MJ16-06	163	0.040939	0.000383	0.001165	0.000011	0.282314	0.000015	-13.2	2007
MJ16-07	130	0.029114	0.001145	0.000752	0.000028	0.282387	0.000012	-11.3	1864

Analysis	Age (Ma)	$^{176}Yb/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf$	2σ	ε_{Hf} (t)	T_{DM2}
Min River									
MJ16-08	1666	0.017543	0.000139	0.000429	0.000002	0.281454	0.000016	-10.0	2972
MJ16-10	436	0.043012	0.001129	0.001278	0.000039	0.282311	0.000021	-7.4	1859
MJ16-12	1831	0.021971	0.000055	0.000530	0.000001	0.281531	0.000017	-3.7	2713
MJ16-13	2695	0.012786	0.000104	0.000303	0.000001	0.280876	0.000016	-6.8	3576
MJ16-14	1884	0.023166	0.000953	0.000594	0.000021	0.281452	0.000017	-5.4	2858
MJ16-15	145	0.037809	0.000076	0.000992	0.000002	0.282249	0.000025	-15.8	2160
MJ16-16	1776	0.021916	0.000547	0.000629	0.000020	0.281218	0.000016	-16.2	3430
MJ16-17	2191	0.038535	0.000490	0.000933	0.000010	0.281492	0.000016	2.5	2615
MJ16-18	1810	0.012297	0.000772	0.000330	0.000022	0.281524	0.000016	-4.2	2727
MJ16-19	875	0.029169	0.000491	0.000796	0.000011	0.282272	0.000016	1.0	1677
MJ16-20	862	0.039053	0.000779	0.001041	0.000018	0.282296	0.000016	1.4	1641
MJ16-21	1845	0.028006	0.000165	0.000674	0.000004	0.281465	0.000018	-5.9	2860
MJ16-22	106	0.028127	0.000333	0.000756	0.000010	0.282590	0.000022	-4.6	1428
MJ16-23	418	0.043351	0.000778	0.001090	0.000018	0.282294	0.000017	-8.4	1905
MJ16-24	1823	0.032185	0.000131	0.000752	0.000003	0.281506	0.000019	-5.0	2788
MJ16-25	116	0.044748	0.001381	0.001105	0.000030	0.282460	0.000020	-9.0	1712
MJ16-26	388	0.016626	0.000072	0.000369	0.000002	0.282305	0.000016	-8.4	1885
MJ16-28	2656	0.021292	0.000093	0.000537	0.000002	0.280919	0.000013	-6.6	3534
MJ16-29	1683	0.068076	0.000390	0.001733	0.000011	0.281878	0.000018	3.9	2129
MJ16-30	156	0.032325	0.000331	0.000838	0.000010	0.282348	0.000017	-12.1	1935
MJ16-31	224	0.031720	0.000389	0.000782	0.000010	0.282262	0.000022	-13.6	2085
MJ16-32	2278	0.022973	0.000553	0.000650	0.000017	0.281286	0.000017	-2.4	2983
MJ16-33	216	0.022117	0.000310	0.000585	0.000008	0.282419	0.000023	-8.2	1740
MJ16-34	427	0.023062	0.000232	0.000583	0.000007	0.282291	0.000019	-8.1	1898
MJ16-35	431	0.014683	0.000444	0.000390	0.000011	0.282359	0.000020	-5.6	1741
MJ16-36	419	0.030850	0.000901	0.000771	0.000022	0.282332	0.000019	-6.9	1814
MJ16-37	469	0.035972	0.000512	0.000895	0.000013	0.282496	0.000017	-0.1	1423
MJ16-38	2209	0.021256	0.000326	0.000524	0.000009	0.281397	0.000021	0.2	2773
MJ16-39	1855	0.061979	0.001543	0.001475	0.000037	0.281609	0.000020	-1.6	2601
MJ16-40	964	0.039162	0.000094	0.000932	0.000005	0.281963	0.000019	-8.1	2311
MJ16-41	222	0.029683	0.000238	0.000810	0.000005	0.282081	0.000020	-20.1	2483
MJ16-42	1957	0.020695	0.000697	0.000532	0.000020	0.281349	0.000017	-7.3	3031
MJ16-43	232	0.035693	0.001447	0.000901	0.000033	0.282509	0.000021	-4.8	1535
MJ16-44	224	0.023299	0.000119	0.000585	0.000004	0.282484	0.000021	-5.8	1591
MJ16-45	459	0.036926	0.000343	0.000966	0.000007	0.282583	0.000022	2.8	1235
MJ16-46	1821	0.021953	0.000292	0.000532	0.000007	0.281573	0.000018	-2.4	2627
MJ16-47	2742	0.030218	0.000312	0.000841	0.000008	0.281049	0.000022	-0.5	3236
MJ16-48	97	0.043706	0.000368	0.001082	0.000008	0.282493	0.000020	-8.2	1650
MJ16-50	227	0.034669	0.000253	0.000845	0.000005	0.282433	0.000019	-7.5	1706
MJ16-51	1881	0.022506	0.000644	0.000558	0.000014	0.281465	0.000018	-4.9	2827
MJ16-52	161	0.085637	0.001527	0.002044	0.000034	0.282405	0.000021	-10.1	1813
MJ16-53	1787	0.018956	0.000435	0.000467	0.000012	0.281417	0.000017	-8.6	2982
MJ16-54	2504	0.031714	0.000409	0.000793	0.000009	0.281273	0.000018	2.1	2890
MJ16-55	1873	0.049442	0.000409	0.001192	0.000012	0.281671	0.000022	1.4	2434
MJ16-56	1892	0.013517	0.000457	0.000326	0.000008	0.281353	0.000018	-8.4	3047

Analysis	Age (Ma)	$^{176}Yb/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf$	2σ	ε_{Hf} (t)	T_{DM2}
Min River									
MJ16-57	233	0.021324	0.000214	0.000537	0.000003	0.282249	0.000022	-13.9	2104
MJ16-58	438	0.041841	0.000557	0.001039	0.000012	0.282359	0.000022	-5.6	1749
MJ16-59	2441	0.028546	0.000108	0.000757	0.000004	0.281291	0.000023	1.3	2884
MJ16-60	133	0.053976	0.000829	0.001318	0.000022	0.282327	0.000021	-13.4	1997
MJ16-61	421	0.073973	0.002135	0.001884	0.000048	0.282361	0.000021	-6.1	1768
MJ16-62	109	0.070645	0.001992	0.001891	0.000057	0.282542	0.000022	-6.3	1536
MJ16-63	953	0.116861	0.001329	0.002770	0.000031	0.282304	0.000022	2.6	1639
MJ16-64	1793	0.037020	0.000535	0.000897	0.000010	0.281396	0.000025	-9.8	3057
MJ16-65	407	0.083487	0.000570	0.002052	0.000013	0.282324	0.000021	-7.8	1861
MJ16-66	1868	0.048718	0.000164	0.001190	0.000005	0.281525	0.000018	-3.9	2755
MJ16-67	145	0.049241	0.000421	0.001232	0.000010	0.282238	0.000020	-16.2	2186
MJ16-68	2713	0.035476	0.000239	0.000866	0.000003	0.280955	0.000021	-4.6	3459
MJ16-69	227	0.035191	0.000210	0.000859	0.000006	0.282471	0.000020	-6.2	1621
MJ16-71	1862	0.043034	0.000661	0.001039	0.000017	0.281714	0.000024	2.9	2334
MJ16-72	1827	0.008367	0.000342	0.000191	0.000008	0.281476	0.000020	-5.3	2809
MJ16-73	1878	0.046839	0.001680	0.001140	0.000041	0.281361	0.000018	-9.4	3101
MJ16-74	407	0.044161	0.000393	0.001103	0.000008	0.282320	0.000019	-7.7	1854
MJ16-75	2525	0.013630	0.000188	0.000328	0.000004	0.281361	0.000022	6.5	2638
MJ16-76	1858	0.025367	0.000280	0.000625	0.000005	0.281508	0.000017	-4.0	2754
MJ16-77	1344	0.051744	0.000066	0.001267	0.000001	0.281546	0.000016	-14.8	3015
MJ16-78	2531	0.041769	0.000821	0.001259	0.000022	0.281307	0.000019	3.1	2848
MJ16-80	105	0.028005	0.000785	0.000712	0.000017	0.282447	0.000020	-9.7	1745
MJ16-81	1872	0.036331	0.000216	0.000860	0.000004	0.281464	0.000020	-5.6	2860
MJ16-82	97	0.081189	0.002803	0.002072	0.000070	0.282617	0.000024	-3.9	1378
MJ16-83	826	0.041500	0.000186	0.001203	0.000007	0.282133	0.000023	-5.3	2027
MJ16-84	445	0.059479	0.001129	0.001693	0.000034	0.282372	0.000027	-5.2	1727
MJ16-85	223	0.024094	0.000393	0.000748	0.000010	0.282479	0.000017	-6.0	1604
MJ16-86	1510	0.062850	0.003244	0.001527	0.000079	0.281574	0.000026	-10.4	2875
MJ16-87	2299	0.032298	0.000477	0.000878	0.000011	0.281350	0.000019	0.0	2854
MJ16-88	1879	0.018216	0.000411	0.000450	0.000009	0.281432	0.000022	-6.0	2894
MJ16-89	2183	0.031744	0.001335	0.000798	0.000027	0.281157	0.000026	-9.4	3332
MJ16-90	226	0.020614	0.000089	0.000525	0.000001	0.282403	0.000025	-8.6	1768
MJ16-91	1564	0.034472	0.000263	0.000848	0.000009	0.281515	0.000023	-10.6	2929
MJ16-92	363	0.035693	0.001447	0.000901	0.000033	0.282509	0.000021	-1.9	1458
MJ16-93	1871	0.023651	0.000134	0.000585	0.000002	0.281405	0.000025	-7.3	2967
MJ16-94	2067	0.016983	0.000204	0.000442	0.000006	0.281322	0.000021	-5.6	3016
MJ16-95	233	0.019926	0.000185	0.000507	0.000005	0.282332	0.000030	-10.9	1923
MJ16-96	454	0.071255	0.006289	0.001910	0.000157	0.282362	0.000027	-5.4	1748
MJ16-97	945	0.022146	0.000460	0.000545	0.000012	0.281919	0.000027	-9.8	2402
JiulongRiver									
JL01-01	239	0.048273	0.000278	0.001602	0.000013	0.282570	0.000011	-2.5	1401
JL01-02	2577	0.008652	0.000191	0.000277	0.000006	0.280902	0.000011	-8.6	3591
JL01-03	138	0.042849	0.000148	0.001490	0.000011	0.282464	0.000010	-8.4	1692
JL01-04	116	0.021981	0.000159	0.000796	0.000004	0.282680	0.000011	-1.2	1220
JL01-05	932	0.033752	0.000472	0.001002	0.000016	0.281779	0.000010	-15.4	2733

Analysis	Age (Ma)	$^{176}Yb/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf$	2σ	ε_{Hf} (t)	T_{DM2}
JiulongRiver									
JL01-06	165	0.063960	0.001306	0.001862	0.000038	0.282551	0.000011	-4.8	1488
JL01-07	107	0.018282	0.000282	0.000562	0.000010	0.282682	0.000011	-1.3	1221
JL01-08	253	0.034910	0.000271	0.001190	0.000014	0.282419	0.000010	-7.5	1724
JL01-10	211	0.070666	0.000631	0.002266	0.000020	0.282488	0.000013	-6.1	1604
JL01-11	250	0.026931	0.000164	0.000799	0.000003	0.282413	0.000011	-7.7	1735
JL01-12	165	0.027485	0.000090	0.000798	0.000002	0.282402	0.000010	-10.0	1809
JL01-13	163	0.040173	0.000542	0.001306	0.000016	0.282559	0.000012	-4.5	1466
JL01-14	207	0.042849	0.000210	0.001429	0.000006	0.282530	0.000016	-4.6	1506
JL01-15	155	0.039230	0.001608	0.001236	0.000050	0.282687	0.000011	-0.1	1184
JL01-16	1474	0.029702	0.001294	0.000932	0.000044	0.281655	0.000013	-7.7	2683
JL01-17	153	0.050612	0.001376	0.001825	0.000053	0.282524	0.000019	-6.0	1552
JL01-18	238	0.040485	0.000286	0.001199	0.000005	0.282394	0.000011	-8.7	1788
JL01-19	125	0.033270	0.000808	0.001124	0.000027	0.282567	0.000011	-5.0	1468
JL01-20	110	0.034736	0.000613	0.001203	0.000018	0.282678	0.000010	-1.4	1231
JL01-21	158	0.020037	0.000474	0.000614	0.000011	0.282741	0.000013	1.9	1058
JL01-22	248	0.088196	0.001200	0.002452	0.000027	0.282405	0.000011	-8.3	1772
JL01-23	275	0.031200	0.001654	0.001000	0.000048	0.282641	0.000012	0.8	1215
JL01-24	158	0.063882	0.000709	0.001921	0.000017	0.282553	0.000012	-4.9	1485
JL01-25	1588	0.045133	0.000548	0.001287	0.000019	0.281572	0.000011	-8.5	2820
JL01-26	103	0.034546	0.000366	0.001092	0.000014	0.282633	0.000012	-3.2	1335
JL01-27	197	0.069701	0.000589	0.001876	0.000011	0.282842	0.000011	6.1	818
JL01-28	251	0.036758	0.000197	0.001113	0.000006	0.282422	0.000010	-7.4	1717
JL01-29	148	0.114050	0.001148	0.003328	0.000018	0.282614	0.000013	-3.1	1363
JL01-30	2252	0.015607	0.000145	0.000477	0.000003	0.281207	0.000010	-5.5	3154
JL01-31	267	0.053562	0.000300	0.001793	0.000008	0.282392	0.000008	-8.3	1783
JL01-33	244	0.028748	0.000166	0.000847	0.000006	0.282404	0.000010	-8.2	1760
JL01-35	118	0.025736	0.000485	0.000829	0.000018	0.282713	0.000013	0.0	1145
JL01-37	1642	0.047665	0.000623	0.001355	0.000011	0.281499	0.000011	-10.0	2953
JL01-38	474	0.038773	0.000828	0.001261	0.000028	0.282142	0.000012	-12.6	2210
JL01-40	141	0.031526	0.000126	0.001013	0.000001	0.282515	0.000012	-6.5	1575
JL01-41	661	0.002901	0.000095	0.000083	0.000003	0.282010	0.000010	-12.7	2361
JL01-42	147	0.034211	0.000365	0.001130	0.000011	0.282575	0.000012	-4.3	1438
JL01-43	2241	0.017393	0.000221	0.000495	0.000004	0.280926	0.000012	-15.8	3766
JL01-44	134	0.039526	0.000767	0.001290	0.000025	0.282557	0.000013	-5.2	1486
JL01-45	254	0.031299	0.000884	0.000964	0.000028	0.282461	0.000014	-6.0	1628
JL01-46	162	0.021503	0.000477	0.000621	0.000011	0.282414	0.000012	-9.6	1783
JL01-47	1636	0.029979	0.000076	0.000826	0.000005	0.281517	0.000010	-8.9	2881
JL01-48	275	0.032616	0.000353	0.001058	0.000008	0.282760	0.000011	5.0	949
JL01-49	160	0.038752	0.000091	0.001189	0.000004	0.282349	0.000012	-12.0	1934
JL01-50	109	0.059846	0.001314	0.001936	0.000054	0.282657	0.000017	-2.2	1281
JL01-51	108	0.018644	0.000492	0.000580	0.000020	0.282724	0.000014	0.2	1126
JL01-52	235	0.027527	0.000203	0.000808	0.000004	0.282408	0.000011	-8.2	1755
JL01-53	119	0.045767	0.002293	0.001291	0.000057	0.282458	0.000013	-9.0	1716
JL01-54	110	0.045233	0.001101	0.001306	0.000047	0.282775	0.000018	2.0	1013
JL01-55	103	0.038154	0.000239	0.001211	0.000009	0.282536	0.000011	-6.6	1550

Analysis	Age (Ma)	$^{176}Yb/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf$	2σ	ε_{Hf} (t)	T_{DM2}
JiulongRiver									
JL01-56	146	0.058291	0.000557	0.001939	0.000025	0.282500	0.000010	-7.0	1610
JL01-59	164	0.049661	0.000749	0.001547	0.000023	0.282463	0.000011	-7.9	1680
JL01-60	241	0.028716	0.000337	0.000820	0.000011	0.282419	0.000010	-7.7	1728
JL01-61	101	0.050997	0.000783	0.001477	0.000021	0.282660	0.000011	-2.3	1277
JL01-62	110	0.020147	0.000325	0.000593	0.000007	0.282693	0.000010	-0.9	1194
JL01-63	158	0.061347	0.000756	0.001936	0.000022	0.282529	0.000012	-5.8	1540
JL01-64	1834	0.027224	0.000119	0.000775	0.000003	0.281444	0.000010	-7.0	2918
JL01-65	149	0.055698	0.001164	0.001752	0.000023	0.282684	0.000011	-0.4	1197
JL01-66	149	0.035816	0.000461	0.001013	0.000011	0.282579	0.000011	-4.1	1428
JL01-67	162	0.046018	0.000576	0.001430	0.000018	0.282384	0.000012	-10.7	1856
JL01-68	240	0.021824	0.000119	0.000691	0.000006	0.282683	0.000010	1.6	1138
JL01-69	403	0.051759	0.001092	0.001520	0.000036	0.282348	0.000014	-6.9	1800
JL01-70	143	0.039916	0.000549	0.001272	0.000022	0.282568	0.000017	-4.6	1456
JL01-71	137	0.056865	0.000408	0.001957	0.000008	0.282541	0.000012	-5.8	1525
JL01-72	106	0.015529	0.000146	0.000456	0.000002	0.282405	0.000012	-11.1	1836
JL01-73	235	0.023750	0.000476	0.000679	0.000011	0.282447	0.000011	-6.9	1669
JL01-74	228	0.039647	0.000352	0.001146	0.000014	0.282387	0.000013	-9.2	1809
JL01-75	103	0.015642	0.000123	0.000461	0.000006	0.282658	0.000012	-2.2	1275
JL01-76	152	0.038625	0.000275	0.001191	0.000010	0.282540	0.000011	-5.4	1514
JL01-77	148	0.051151	0.000824	0.001645	0.000037	0.282516	0.000011	-6.4	1572
JL01-78	800	0.017803	0.000619	0.000510	0.000012	0.282325	0.000011	1.4	1594
JL01-79	1675	0.014747	0.000274	0.000506	0.000006	0.281383	0.000011	-12.5	3127
JL01-80	150	0.032358	0.000185	0.001037	0.000008	0.282589	0.000012	-3.7	1405