Data Article

U-Pb SHRIMP geochronology data from the eastern Central Kibalian Superterrane, Bomu-Kibalian Craton, northeastern DRC: Implications for the tectonic evolution of the Kilo Terrane

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\textbf{A B S T R A C T}

This brief presents new U-Pb SHRIMP (Sensitive High-Resolution Ion Microprobe) geochronology data on zircons and titanites dated from the gold-rich Kilo Terrane in the eastern Central Kibalian Superterrane, northeastern DRC. Out of 40 rock samples (Table S1), only 36 samples produced zircons and titanites suitable for U-Pb SHRIMP dating (Tables S2A-S2E). Raw ion-microprobe SHRIMP analyses of specific zircon/titanite grain-spots returned U-Th-Pb compositions and radiogenic isotope ratios (Tables S4-S40), from which age dates (Table 3, Figs 8A-8HH and 13A-F) were derived. With the exception of Table 3, all Tables are presented in the Supplementary Material. The new age dates in this Brief can be used in advancing understanding of the gold metallogeny and implications to exploration targeting for large to giant gold deposits in the Bomu-Kibalian Craton.

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Specifications Table

| Subject            | Earth and Planetary Science: Economic Geology |
|--------------------|-----------------------------------------------|
| Specific subject area | U-Pb SHRIMP zircon and titanite geochronology attempted to unravel the crustal growth histories of the amphibolite-granulite facies Western Ituri Terrane and the gold-rich greenschist-amphibolite facies Kilo Terrane, in the eastern Central Kibalian Superterrane, northeastern Democratic Republic of Congo. |
| Type of data       | Table S1: Location and brief descriptions of the dated sample; Table S2A-S2E: Description of zircon morphology and U-Pb analytical results; Tables S4-S40: U-Th-Pb compositions and radiogenic isotope ratios all presented in the Supplementary Material. |
| How data were acquired | • Scanning Electron Microscopy (SEM) imaging of zircons to reveal external and internal morphologies conducted by a Phillips JEOL-6400 SEM at the University of Western Australia.  
• Ion-Microprobe SHRIMP II utilising Koehler focusing of an O₂⁻ ion beam to make in-situ U-Th-Pb isotope analysis with a spot size of 25-30 μm on sectioned zircon and titanite grains [1–3].  
• The ion-microprobe SHRIMP II analyses conducted at the John de Laeter Centre, Curtin University, Perth, Western Australia.  
• Calculations of ages, either 207Pb/206Pb or 206Pb/238U based on the isotopic constants of Steiger and Jäger [4]. SHRIMP data reduction utilised SQUID II and Isoplot [5,6].  
• Ages quoted in the text are at 2σ error, whereas those in the tables of analytical results (Tables S4-S40) are reported at 1σ error. |
| Data format        | U-Pb analytical zircon and titanite age data are presented in standard format (Tables S4-S40), whereas zircon morphology and analytical results presented in Tables S2A-S2E. Age dates are summarised in Table 3. |
| Parameters for data collection | Samples of mafic-to-felsic plutonic rocks, basaltic andesite and lamprophyre dyke individually crushed, milled and sieved to retain the 60# mesh fraction. The latter returned a variety of best zircons, which were analysed consistent with procedures followed by Stern (2001) and Nasdala et al. (2008). Titanites were analysed consistent with procedures similar to those followed by Mohan et al. [7] and Heaman [8]. |
| Description of data collection | Grains were cast in a 25 μm epoxy mount, polished to expose half-section zircon grains, cleaned and dried prior to imaging by SEM using secondary backscattered electron and cathodoluminescence to reveal detailed external and internal morphologies of zircons. The mounts were then cleaned and coated with gold to yield an across-mount resistance of 5-20 Ω, ready for ion-microprobe SHRIMP II analysis. |
| Data source location | Eastern Central Kibalian Superterrane, in the Ituri Province of eastern Democratic Republic of Congo (Table S1). Data were collected through AngloGold Ashanti Ltd, and the present custodian of the data is Ashanti Goldfields Kilo (AGK) and Mongbwalu Gold Mines, DRC. |
| Data accessibility | In the article (Table 3) and in the Supplementary materials (Tables S1, S2A-S2E and S4-S40). |
| Related research article | J Kabete, J.K., McNaughton, N.J., Bashizi, A., Kiza, B. 2021. Geologic-tectonic setting of the gold-endowed Kilo Terrane in the eastern Central Kibalian Superterrane, northeastern Democratic Republic of Congo. Precambrian Research 359: 106–182. |

Value of the Data

- The U-Pb SHRIMP zircon/titanite age dates in this brief constitute the first robust geochronological data so far generated from the eastern Central Kibalian Superterrane, NE Congo Craton (ECKS).
- The data are used to establish the geologic-tectonic setting of the ECKS and to test whether causative tectonic processes operated at a global scale [9].
- The robustness of the new data is similar to other U-Pb SHRIMP zircon/titanite data from the Yilgarn Craton, Australia and Superior Province, Canada, among other places.
- These datasets can be used to advance understanding of the gold metallogeny and its implications in targeting for large to giant deposits in the Bomu-Kibalian Craton, DRC.
Fig. 1. Solid geology of the north-eastern part of the Democratic Republic of Congo (DRC: inset), showing the crustal components of the Bomu-Kibalian Craton, including interpretative superterrane subdivisions of the Kibalian Greenstone Region, the West Nile Complex and intracratonic Neoproterozoic basins. Lineaments interpreted from radasat and regional-scale magnetic images [9].

Selected greenstone abundant crustal blocks, including:
1 = Moto-Zani, 2 = Isiro-Tina Terranes: Northern Kibalian Superterrane;
3 = Bakouma-Puloubou Terrane in the western Central Kibalian Superterrane
4 = Kilo, 9: Western Ituri Terranes = eastern Central Kibalian Superterrane;
6 = Tele-Panga and 5 + 7 = Nyagu-Mambasa Terrane = Southern Kibalian Superterrane
8 = a suspect, Angumu-Lubero Superterrane.

Selected granite-abundant crustal blocks
10 = Likopi-Masikini Terrane (LMD)
11 = West Nile Complex
12 = Irumu Basin

1. Data Description

1.1. Geological framework

The eastern Central Kibalian Superterrane (Fig. 1) comprises two crustal blocks: 1) the Western Ituri Terrane (WIT) and 2) the Kilo Terrane (Fig. 2). The Western Ituri Terrane (WIT) comprises porphyritic charnockitic to enderbitic rocks, biotite-granite orthogneisses and biotite-quartz-feldspathic gneisses in widespread, N-S-trending migmatic, granodioritic and undifferentiated gneissic belts (Fig. 3). Granitic to granodioritic orthogneisses in this terrane contain high-density of rafts and/or enclaves of igneous-sedimentary rocks, interleaves of leucocratic/leucosome bands, aplite dykes and pegmatite veins (Fig. 4A).
Fig. 2. A seamless geology map of the eastern Central Kibalian Superterrane illustrating Sub-Terranes, from north to south, including: GKST=Galaya-Kilo Terrane; LPST=Liongo-Pimbo Sub-Terrane, BBST=Balazana-Bunia Sub-Terrane; Terranes. Showing hypothetical terranes from west to east, including: MAT=Mambasa Terrane; WIT=Western Ituri Terrane; KIT=Kilo Terrane; and selected domains such as: IRD=Ituri River Doman; IRD (IRB)=Irumu Basin over IRD; TLD=Talolo Domain; YAD=Yedi-Akwe Domain; MMD=Mongbwalu-Musoma Domain; Selected towns/villages/gold deposits include: 1) Yedi; 2) Galaya; 3) Akwe; 4) Adidi-D7 Kanga deposit; 5) Alosi; 6) Viewx Kilo; 7) Camp III; 8) Musoma; 9) Sindani; 10) Nizi (old King Leopold); 11) Mont-Tsi; 12) Gina; 13) Mambeleza; 14) Talolo. 143 Town/Village with airstrip includes: M=Mongbwalu; B=Bunia; N=Nyakunde.
Fig. 3. The solid geology of the eastern Central Kibalian Superterrane, illustrating belts that are situated in each of the interpretative domains which make up the Western Ituri and Kilo Terranes as well as marginal crustal blocks, from north to south comprising: MTB: Matadiri; MTB: Makofi East; GAB: Galaya-Akwe, and PWB: Pawa Belt, all making up the YAD: Yedi-Akwe Domain; MDB: Mongbwalu-Dala and AMB: Abelkoso-Musoma in the MMD: Mongbwalu-Musoma Domain; LOB: Lioongo, and AWB: Andisa West Belts of LOD: Lioongo Domain; ADB: Alosi-Dindo and PBB: Petsi-Bakonde and Kilo-Sindani Belts of APD: Alosi-Pimbo Domain; BZB: Bunzenzele, WBB: Walu-Balazana, NGB: Nyangaray in the BWD: Bunia-West Domain; LTB: Mont Luma-Tsi; SLB: Soliboco; LGB: Loga Belts in the BED: Bunia-East Domain; MSB: Masumbuko TTT: Masumbuko and LGB: Lagu Belts in the MLD: Masumbuko-Lagu Domain; RUS: Russa-Talolo and AMB: Abia-Maga Belts in the TAD: Talolo Domain; and BGB: Bunia Granite Belt. This figure also shows the geochronology sample locations and traces for the cross-sections presented in this paper. Please note that samples in the Mont-Luma-Tsi Belt are shown in Fig. 7. A clearer map (Fig. 3 Supplementary) is part of the Supplementary Material.
Fig. 4. A) Schematic, WSW-ENE cross-section showing potential juxtapositions of domains across the superterrane, from west the Western Ituri Terrane, through Ituri River Domain into the Kilo Terrane, and the Likopi-Masikini Domain to the east; B) Schematic, SW-NE cross-section (i.e. looking NW in Fig. 3), illustrating diverse bedrock geology, geometrical orientation and crustal growth histories (i.e. in black ink are respective granite emplacement ages and in red are xenocrystic zircon ages inherited from earlier magmatic events) between the greenstone-abundant Kilo Terrane and amphibolite-granulite-facies Western Ituri Terrane.

The Kilo Terrane comprises complexly folded and faulted greenschist-amphibolite facies Galaya-Kilo Sub-Terrane (GKST) and Balazana-Bunia Sub-Terrane (BBST), sutured by a relatively narrow, Liongo-Pimbo Sub-Terrane (LPST; Fig. 2). The Galaya-Kilo Sub-Terrane comprises two crustal blocks: Yedi-Akwe Domain (YAD) and Mongbwalu-Musoma Domain (MMD). The Yedi-Akwe Domain (YAD) comprises variably extensive Lower Kibalian Supergroup of ENE-WSW-
trending upper greenschist to lower amphibolite facies mafic-ultramafic supracrustal belts. They include the Galaya-Akwe Belts of variably thick interflows of turbiditic carbonaceous metapelites, basalts and ultramafic schist intruded by relatively small diorite-to-tonalite plutons, apophyses of gabbro and gabbroic-diorite, and high-K biotite-granite (Figs 3; 5 in [9]). The Mongbwalu-Musoma Domain (MMD) comprises three distinctive lithostructural belts (Figs. 3; 5 in [9]): 1) the Apolokuku-Camp Dragne Belt typified by convex-west mafic-ultramafic supracrustal rocks (Fig. 6A); 2) the Mongbwalu-Dala Belt typified by NNE-SSW-trending Mongbwalu Diorite Complex in mafic-ultramafic supracrustal rocks (Figs 4A and 6A-H); and 3) the Abelcose-Musoma Belt (AMB) typified by NE-SW-trending quartz-monzonite and syenites and Camp III diorite and granodiorite plutons in basaltic to andesitic volcanic-sedimentary rocks that include interflows of graphitic schist and slates (Fig. 3).
The Liongo-Pimbo Sub-Terrane (LPST) is made up of two crustal blocks: 1) the NW-SE-orientated Liongo Domain (LOD) of regionally-extensive, meta-pelitic-graphitic phyllite and schist, undifferentiated paragneisses, BIFs intruded and deformed together with gneissic biotite granite and granodiorite; and 2) E-W to NE-SW-trending Alosi-Pimbo Domain (APD) of the complexly folded and faulted silicate-facies BIFs, meta-pelitic-carbonaceous sedimentary and
volcaniclastic rocks intruded and deformed together with quartz-diorite, tonalite and granodiorite, some preserving strong E-W-trending shear-foliation fabric (e.g. MONG-04 in Fig. 5F).

The Balazana-Bunia Sub-Terrane (BBST) comprises Bunia-West, Bunia Granite, Bunia-East and Talolo Domains (Fig. 4 in [9]). The preservation of the Upper Kibalian intermediate-to-felsic pyroclastic rocks in the WBB, TLB, and SLB, and that of pyroxene-gabbro, pyroxenite and olivine pyroxenite complexes in the LGB, further distinguishes this sub-terrane from others (Fig. 3). The NE-SW-trending Bunia Granite Domain is anomalously extensive than any other internal mafic-to-felsic granite batholith in the Kilo Terrane. It comprises strongly magnetitic quartz-diorite-to-granodiorite plutons towards Russa-Talolo Belt, non-magnetic quartz-diorite-tonalite-granodiorite in the centre and highly radiometric and strongly magnetic granodiorite and biotite-granites towards the Soliboco Belt (GB in Fig. 3).

The western and eastern margins of the Kilo Terrane comprise two crustal blocks: 1) concave-westward Ituri River Domain (IRD:DD1-DD3) extending southerly across into the Neoproterozoic Irumu Basin (IRD: Fig. 2 and DD3 in Fig. 3). This constructive margin comprises juvenile felsic granites intrusive into migmatitic paragneiss, mafic schist and gneisses (Figs 3 and 4B); and 2) the Masumbuko-Lagu Domain of the NNE-SSW to N-S-trending Masumbuko Belt (silicate-facies BIFs and metapelitic sedimentary rocks) and the N-S-trending Lagu Belt of reworked high-grade igneous-sedimentary rocks overprinted by brittle deformation and retrograde metamorphic features (Figs 3 and 4B).

Mont Nongo basin in the Mongbwalu-Musoma Domain, forms among other intracratonic basins, which developed in the Congo Craton during the tectonic reactivation of pre-existing first-order lithotectonic boundaries during the late Neoproterozoic break-up of the Rodinia continent.

1.2. U–Pb SHRIMP zircon/titanite geochronology

In this study, U–Pb SHRIMP zircon and/or titanite geochronology data from 36 out of 40 samples (Table S1) are used to establish the geologic-tectonic setting of the gold-rich Kilo Terrane in the eastern Central Kibalian Superterrane (Fig. 2; [9]). Brief descriptions of the samples, zircons and titanites morphological features, and U–Pb SHRIMP analytical results, are presented from west to east, starting with the Western Ituri Terrane, Kilo Terrane and finishing with Moto-Zani Terrane (Figs 1, 3 and 4A and B).

2. Rocks dated from Western Ituri Terrane (Figs 3 and 4)

2.1. Charnockitic-enderbbitic rock: WIG-01, mount 13-15B

A sample of a weakly gneissic charnockitic-enderbbitic rock (20–25% plagioclase, 15–20% alkali feldspar, 20–25% green hornblende, 10–15% quartz, 10–15% biotite, 3–5% orthopyroxene, 2–3% opaque minerals, 1–2%, apatite with traces of epidote, titanite and zircon), cropping out intermittently in widespread orthogneiss belts in this terrane: Table S1; Figs 3, 4A and 5A). According to Kabete et al. [9], this rock evolved from residuum from the partial melting of a precursor syeno-dioritic to tonalitic rocks. It produced zircons (Table S2A), whose analyses (Table S4) define a single population age of 2566±4 Ma (n=10; MSWD=0.62; Figs 4B and 8A).

2.2. Biotite granodioritic gneiss: WIG-02, mount 13-15A

A biotite granodioritic to granitic gneiss (30–40% plagioclase, 25–35%, alkali-feldspar, 15–20% quartz, 5–10% biotite, 1–2% epidote and titanite and zircons in biotite-rich patches: Table S1; Fig. 5B) sampled from widespread orthogneisses with high contents of xenoliths and rafts of
Table 3
Summary of dated feature, illustrating emplacement, xenocryst and overprint ages

| Sample No. | Mount No. | Dated feature | Emplacement protolith Age +/− 95% C.I. (Ma) | Xenocrysts (Ma) | Overprint Age (Ma) |
|------------|-----------|---------------|-------------------------------------------|----------------|-------------------|
| MONG-01    | 10-08A    | Biotite micro-granite | 2638+−5 | 2661 |
| MONG-02    | 10-08B    | Mont-Nongo Quartz-Arenite | <1086+−43 | Nil |
| MONG-04    | 10-08C    | Porphyritic biotite-granite | 2595+−9 | Nil |
| MONG-06    | 10-08D    | Quartz-microdiorite | 2665+−12 | Nil |
| MONG-07    | 10-09A    | Micro-granodiorite | 2641+−10 | 2686 |
| MONG-09    | 10-09B    | Tonalitic-granodiorite | 2621+−7 | Nil |
| MG1-N208   | 10-10C    | Biotitic-tonalite | 2627+−13 | 2655-2790 |
| MONG-10    | 10-09C(10-14A) | Biotite-granodiorite | 2578+−6 | Nil |
| KL67B      | 10-23A    | Biotite granodiorite | 2651+−4 | Nil |
| KL70A      | 10-23B    | Biotite granite gneiss | 2607+−9 | 2650 2470+−7 |
| KL74B      | 10-23C    | Hornblende granite | 2619+−5 | 2866 |
| KL80E      | 10-24A    | Hornblende-granodiorite | 2616+−5 | Nil |
| KL82B      | 10-24B    | Biotite granodiorite/granite | 2586+−4 | 2711-2610 |
| KL-88A-1   | 10-24C    | Hornblende-quartz-monzonite | 2592+−6 | 2620 |
| KL-88A-2   | 10-25A    | Biotite quartz-monzonite | 2586+−5 | 2625 |
| BU-03      | 10-25B    | Quartz-diorite | 2627+−6 | Nil |
| BU-05      | 10-25C    | Hornblende-granodiorite | 2627+−8 | Nil |
| JK-11      | 06-19B    | Promylonitic quartz-diorite | 2647+−7 | Nil |
| JK-12      | 06-19C    | Quartzo-feldspathic rock | 2647+−7 | Nil |
| JK-13      | 06-20A    | Diorite/quartz-bearing diorite | 2651+−6 | Nil |
| JK-14      | 06-20B    | Lamprophyre dyke | 2649+5 | Nil |
| FKB-MT-01  | 12-36A    | Amphibole granodiorite | 2630+−6 | 2660 |
| MTD0015-G01| 12-37A    | Potassic tonalite | 2659+−9 | Nil |
| MTD0015-G02| 12-37B    | Potassic quartz-diorite | 2651+−5 | Nil |
| MTD0013-G03| 12-37C    | Albitised tonalite/quartz-diorite | 2650+−6 | Nil |
| MTD0019-G04| 12-37D    | Quartz-gabbro/gabbroic-diorite | 2655+−5 | Nil |
| ZAN-DL-01  | 13-01A    | Otta Granite. Granodiorite | 2630?? | 533+−14 |
| ZAN-OTT-02 | 13-01B    | Banded biotite-orthogneiss | 2610+−10 | 2657+−9 |
| AKDD003-G01| 13-02A    | Quartz monzodiorite | 2645+−9 | 2603+−19 |
| MONG-DD252 | 13-02B    | Biotite microdiorite | 2546+−49 | 2666 |
| AKDD004-G01| 0 no zircons | Quartz-gabbro | - | |
| WIG-01     | 13-15B    | Charnockitic-enderbbitic rock | 2566+−4 | Nil |
| WIG-02     | 13-15A    | Gneissic biotite-granodiorite | 2562+−7 | Nil |
| WIG-03     | 13-15C    | Biotite leucosome bands | (2562+−7) | Nil 2556+−4 |
| SENZ-01    | poor zircons | Pillow porphyritic basaltic-andesite | - | Nil |
| IRD-01     | 13-16B    | Biotite-amphibole granite gneiss | 2589+−6 | Nil |
| ISU-0101   | poor zircons | Porphyritic andesitic flow | - | Nil |
| ADIDU-01   | 13-16D    | Porphyritic pillow basalt | 2657+−9 | Nil |

quartzite, banded mafic schist, and BIFs, quartz veins and aplite dykes (Figs 3 and 5B). Zircons from this sample (Table S2A) returned analytical results (Table S5) defining a single-age population of 2562±7 Ma (n=14; MSWD=1.17; Figs 4B and 8B).

2.3. Biotite leucoocratic gneiss: WIG-03, mount 13-15C

This sample represents interleaves of metre-scale biotitic leucoocratic gneisses or biotite leuco-some interbands (30–40% each plagioclase and alkali feldspar, 10–15% quartz, 5–7% biotite, 1–2% each epidote and titanite, with 1% opaque minerals and traces of apatite and zircon: Table S1; Figs 3 and 5B) in biotite granodioritic gneiss (WIG-02: Figs 4A and B). It produced zircons (Table S2A), which returned analytical results (Table S6) defining a single-age population of 2556±4 Ma (n=11; MSWD=0.82), for the partial melting event (Figs 5B and 8C) of precursor rock (Table 3). Please note that WIG-02 is synchronous at 2562±7 Ma (Fig. 4B).
3. Rocks dated from Galaya-Kilo Sub-Terrane (Fig. 5: [9])

3.1. Quartz monzodiorite: AKDD003-01, zircon, mount 13-02A; Galaya-Akwe Belt

This sample of a deformed and altered quartz monzodiorite (45–55% saussaritised plagioclase, 10–15% quartz, 10–15% alkali feldspar, 5–10% hornblende and 1–2% epidote and opaque minerals, with <1% each of biotite, titanite, chloride and apatite; Table S1), represents relatively small diorite/quartz-diorite plutons typical of the Galaya-Akwe Belt (#3 in Figs. 2; and 3). It produced zircons (Table S2B) whose analytical results (Table S7A), define a single-age population age of 2645±9 Ma (MSWD=1.07, n=12) for the precursor quartz-monzodiorite (Fig. 8E).

3.2. Quartz monzodiorite: AKDD003-01, titanite, mount 13-02A; Galaya-Akwe Belt

This sample produced relatively few, small, subhedral titanite grains together with relatively large fragmental titanite grains (#3 in Fig. 2). Twenty-four analyses on 23 titanite grains (Table S7B) with low U-contents led to high common Pb corrections for all data. However, fifteen out of 24 analyses with <10% of common Pb and <10% discordance define a single-age population of 2603±19 Ma (n=15; MSWD=1.3). The large age uncertainty reflects low U-contents and hence low amount of radiogenic Pb measured, combined with error expansions associated with the large common Pb corrections. Nonetheless, there appears to be no correlation between the age and common Pb correction, so the common Pb correction is considered to be reliable and hence the age of 2603±19 Ma is potentially the formation age of the titanite.

The titanites from AKDD003-01 have distinctively high to low Th/U of both primary igneous and secondary titanites [10], interpreted to represent relict igneous and post-emplacement new titanite growth. The observation that both have the same age suggests that the rock was at a temperature above the Pb-diffusion blocking temperature for titanite (500–550 °C) until uplift and cooling occurred at ~2603 Ma. Most grains did not experience Th-U mobility during Pb-diffusion, and there is evidence of at least one grain with Th/U < 0.1 forming at ~2603 Ma.

3.3. Pillow basalt: ADIDI-01, titanite, mount 13-16D; Mongbwalu-Dala Belt

A sample of an amygdale-bearing porphyritic pillow basalt (Table S1; Fig. 6A in [9]), from a slice of thrust-transported pillow basalts on top of the Mongbwalu Diorite Complex (# 4 in Fig. 2). The amygdale-dominated parts of this sample comprise stubby to accicular plagioclase, fine-grained chlorite and quartz, and significant contents of fragmented sphene (titanites) relatively larger than zircons. Twenty-one analyses from 20 titanite grains (Table S8), were within 5% concordant (Fig. 8F), including those with generally moderate to low U-contents responsible for moderate age precision (Figs 4A and 8F). Due to the relatively high Th/U, these titanites are igneous and they crystalised during amygdale-filling event shortly after, or synchronous with, pillow basalt formation. They yield a single-age population of 2657±9 Ma (n=21; MSWD=1.10) for the minimum age of formation of the basalt.

3.4. Protomylonitic quartz-diorite: JK-11, mount 16-19B; Mongbwalu-Dala Belt

This sample is made of alternate C-fabric of relatively thin siliceous interbands bounding relatively thicker, S-fabrics of shear-foliated to mylonitic and sericite-altered chlorite-rich interbands (30–35% fine grained quartz/un-twinned feldspar (albitite), 25–30% biotite-chlorite, 20–25% epidote, 3–5% carbonate and 1–3% opaque minerals: Table S1; Fig. 4A). It forms part of a ~2–60 m wide mylonite-to-protomylonite zone, a host to barren- and gold-hosting quartz-veins in the
-4 Moz Au Adidi D7-Kanga prospect (# 4 in Fig. 2). Zircons from this sample (Table S2B) returned results (Table S9), defining a single-aged population of 2647±7 Ma (n=8; MSWD=0.7; Figs 8G).

3.5. Quartz-feldspathic rock: JK-12, mount 16-19C; Mongbwalu-Dala Belt

A sample of a porphyritic biotite quartz-feldspathic rock (~70–75% plagioclase mostly altered to sericite-muscovite-epidote, 20–25% biotite-chlorite, 3–5% opaque minerals and 1–3% leucoxene: Figs 4A, 6F and G; Table S1) from the hanging-wall of the proto-mylonite/mylonite zone (host to ~4 Moz Au Adidi D7-Kanga deposit) in the Mongbwalu Diorite Complex (# 4 in Fig. 2). Although previously logged as quartz-feldspar and/or feldspar porphyry, this rock represents albiteitic rocks which evolved via metasomatism of diorite-to-tonalite plutonic rocks [11]. It produced zircons (Table S2B), which returned analyses (Table S10) defining a single age population of 2650±5 Ma (Fig. 8H). Analyses with high common-Pb content (f206>1%), >5% discordant and young-age outlier are not used in the age calculation.

3.6. Diorite: JK-13, mount 06-20A; Mongbwalu-Dala Belt

A sample of a fractured and micro-faulted quartz-bearing diorite (Figs 4A and 5E), at the entrance of the historical Adidi-D7 Kanga underground mine (# 4 in Fig. 2). This diorite (40–45% amphiboles and pseudomorphs of pyroxenes, 35–40% plagioclase (mostly saussuritised), 3–5% biotite-chlorite, ~3–5% quartz and 1–3% opaque minerals), together with quartz-diorite and tonalite make up an over 70% of the Mongbwalu Diorite Complex (Table S1; Figs 3 and 4A). It produced 16 zircon grains (Table 2B), which returned 16 analyses (Table S11). When one young statistical outlier was omitted (#11-1: Table S11), the data yielded a 207Pb/206Pb age of 2651±6 Ma (MSWD = 1.2) for a diorite (Fig. 8I).

3.7. Lamprophyre dyke: JK-14, mount 06-20B; Mongbwalu-Dala Belt

A sample from one of the lamprophyre dykes (i.e. mantle-derived calc-alkaline magma intrusive into the Mongbwalu Diorite Complex: Figs 4A and 5E), exposed at the entrance of the historical Adidi-D7 Kanga underground mine (# 4: Fig. 2). This dyke (35–40% pyroxene-amphibole, 30–35% biotite-chlorite, 10–15% fine-grained carbonate-sericite-muscovite after plagioclase, and 7–10% opaque minerals: Table S1), is among other dykes, which intruded along N-S-trending faults and associated splays in the Mongbwalu Diorite Complex (Figs 3 and 4A). It produced zircons (Table S2B), which returned 24 analyses (Table S12), defining a single population age of 2649+/-5 Ma (n=23; MSWD=1.14) for the emplacement of the precursor dyke (Fig. 8J). There are neither older xenocrysts from adjacent rocks nor modification of zircon’s external and internal morphologies (Table S2B).

3.8. Biotite micro-granite: MONG-01, mount 10-08A; Mongbwalu-Dala Belt

A sample of a porphyritic biotite micro-granite (35–40% fine-grained plagioclase, 25–30% quartz and 25–30% alkali-feldspar: Table S1), from a highly-radiometric part of the biotite-to-granodiorite suite, which is tectonically overlain by the Mont-Nongo fluviatile basin in the Mongbwalu-Musoma Domain (Figs 3 and 4A; Fig. 5 in [9]). It produced 23 zircons (Table S2B), whose analyses (Table S13), when plotted on a concordia diagram (Fig. 8D) distinguish one
slightly older analysis of 2661 Ma xenocrystic age from 13 unacceptably highly discordant analyses (Fig. 8D). The remaining ten analyses are characterized by lower U-contents and define a statistical population age of 2638±5 Ma (MSWD=1.1; n=10) for a precursor porphyritic K-feldspar micro-granite (Fig. 8D; Table 3).

3.9. Biotite-granodiorite: MONG-10, mount 10-09C; Mongbwalu-Dala Belt

A sample of a weakly deformed NE-SW-trending biotite-granodiorite (35-45% plagioclase, 20–25% alkali-feldspar, 15–20% quartz and 5-10% chlorite, with white mica and epidote after amphiboles and biotite: Table S1; Figs 3 and 4A), cross-cut by brittle-ductile structures, some constituting cataclasite with variably sericitised plagioclase and Fe-rich chlorite (Fig. 8H in [9]). Zircons from this sample (Table S2B) contain abundantly high-U zircons (Table S14), which when plotted on a U-Pb concordia diagram display one discordant analysis (Fig. 8K). When two analyses with highest common-Pb corrections and two most discordant analyses with extremely high U-contents (Table S14) are omitted, the remainder still show a spread of ages with only one concordant analysis at 2558 Ma (Fig. 8K). The latter probably represents the minimum age for magmatism of the precursor biotite granodiorite, or a minimum age for a xenocryst. Further inspection of the heavy mineral concentrate from sample MONG-10 revealed zircons with a wide range of colouration. However, having established that the high-U content of the zircons degraded the age data, it was decided to selectively choose the clearest and least coloured zircons as the most representative of the lowest-U zircon population. This selection of zircons was mounted on a new SHRIMP mount (10-14A) and analysed (Table S15).

MONG-10, mount 10-14A

The SHRIMP isotopic data of zircons from sample MONG-10 (Table S14), were selected on the basis of their clarity and assumed lower U-contents, are presented in Table S15. In order to minimise data collection from high-U grains, zircons with U-contents greater than 250–300 ppm were rejected during rastering prior to analysis. This meant that only zircon data suspected to have low or minimal Pb-loss due to radiation damage were collected. In mount 10-09C, only one analysis from 21 analyses was concordant. Ten out of 12 zircon analyses made on 11 grains (mount 10-14A) produced sufficiently low MSWD of 1.33 to yield a single-aged population of 2578±6 Ma (Fig. 8K), compatible with data obtained from mount 10-09C.

3.10. Biotite-microdiorite: MONG-DD252, zircon, mount 13-02B; Mongbwalu-Dala Belt

A sample of a porphyritic microdiorite (50–55% plagioclase, 30-35% hornblende-biotite-biotite, 3–5% epidote, 3–5% carbonate, 2–5% quartz, 1–3% alkali feldspar and 1–3% white mica-carbonate, and trace epidote, apatite, titanite and zircon: Table S1; Fig. 6B), representing rocks previously logged as doleritic dykes intrusive into the Mongbwalu Diorite Complex (Fig 4A). It is re-interpreted here to represent enclaves of mafic-to-intermediate plutonic rocks (e.g. Fig. 6E), which crystallised early in the magmatic history of the Mongbwalu Diorite Complex (e.g. Fig. 6B). Zircons from this sample (Table S2B), include four grains whose cathodoluminescence (CL) bright areas returned five analyses with the lowest U-contents (Table S16A). Four out of those five analyses gave two ages: 1) the 2666±15 Ma for emplacement of a precursor microdiorite (Fig. 8L); and 2) 2576±14 Ma as a resetting age following the tectonic events, which involved the Mongbwalu Diorite Complex (Fig. 4A).

3.11. Biotite microdiorite: MONG-DD252, titanite, mount 13-02B; Mongbwalu-Dala Belt

Titanite grains from this sample are mostly fragments of larger grains, and, as is typical of titanites, show no internal structure in SEM images. These titanite grains (Table S2B) possess
very low U-contents (~10 ppm U) and hence poor precision in their age. Consequently, only seven analyses were completed (Table S16B). Omitting analyses with the lowest U-content, the remaining six analyses returned an age of 2546±49 Ma (n=6; MSWD=0.62). The low U-contents of the titanites compared to the high U-contents of the zircons, as well as low Th/U ratio are indicative of secondary titanites [10]. This imprecise titanite age is within range to a U-Pb SHRIMP zircon resetting age of ~2576±14 Ma from the same sample.

3.12. Hornblende quartz-monzonite: KL-88A-1, mount 10-24C; Abelkoso-Musoma Belt

A sample of a hornblende quartz-monzonite (40–45% plagioclase and 25–30% alkali feldspar, interlocked with some hornblende and biotite, 10–15% quartz, 5–10% each biotite and hornblende: Table S1; Fig. 4A) from E-W to ENE-WSW-trending boudin-like bodies of late-kinematic syenitic granites in regionally-extensive, lower-order crustal-scale faults/shear zones parallel to sub-parallel with the major lithotectonic boundary between the Mongbwalu-Musoma and Alosi-Pimbo Domains (Figs 3 and 4A). This granite preserves early amphibolite-facies mineral paragenesis overprinted by late brittle structures and retrograde minerals (Fig. 9H in [9]). Zircons from this rock (Table S2B), returned 15 zircon analyses (Table S17), seven out of those with acceptable concordance and common Pb levels (Table S17), defining a single age population of 2592±6 Ma (MSWD=0.98) for the hornblende-biotite quartz-monzonite (Figs 4B and 8M). Analysis #11-1 with an older age of 2620 Ma is a xenocrystic age (Tables 3 and S17).

3.13. Biotite quartz-monzonite: KL-88A-2, mount 10-25A; Abelkoso-Musoma Belt

A sample of plagioclase-biotite-rich shear zones (35–40% plagioclase, 30–35% alkali-feldspar, 15–20% quartz with intergrowths of brown-biotite, epidote and less abundant muscovite after primary biotite and hornblende: Table S1: Fig. 9H in [9]) representing biotitic-metasomatic interbands in the hornblende quartz-monzonite (i.e. KL-88A-1: Figs 3, 4A). These interbands produced zircons (Table S2B), which returned 16 analyses (Table S18), plotted on a U-Pb concordia diagram (Fig. 8N). When >10% discordant analysis and one distinctly older analysis on grain #12-1 (i.e. 2625 Ma, xenocryst) are removed, the remaining 11 analyses yield a less skewed distribution, with pooled age of 2586±5 Ma (MSWD=0.97; n=11) for the biotite quartz-monzonite (Figs 4B and 8N; Table 3).

4. Rocks Dated from Liongo-Pimbo Sub-Terrane (Figs 3 and 4)

4.1. Hornblende granodiorite: KL-80E, mount 10-24A; Vieux Kilo-Sindani Belt

A sample of a granodiorite (50–55% plagioclase, 10-15% K-feldspar, 25–30% quartz and 5–10% green hornblende) from a N-S-trending Willy-Willy tonalitic-granodiorite (Figs 3 and 4A). This plutonic rock is characterised by the abundance of enclaves of diorite and quartz diorite, high-density of xenoliths of andesite and basaltic andesite and its intrusion across the E-W to NE-SW-trending Alosi-Pimbo Domain (Figs 3, 4A). It produced 17 zircon grains (Table S6C), which returned twenty analyses (Table S19), with discordance <10% forming a single-age population of 2615±5 Ma (MSWD=1.11; Fig. 9O), for a precursor granodiorite (Fig. 4A).

4.2. Biotite-granite: MONG-04, mount 10-08C; Petsi-Bakonde Belt

A sample of a strongly deformed, porphyritic biotite-granite (25–30% plagioclase, 20–30% alkali-feldspar, 20–25% quartz and 5–10% biotite: Fig. 5F; Table S1), from among other E-W-to NE-SW-trending highly radiometric and strongly magnetic granodiorites and granites, in
the Alosi-Pimbo Domain (Fig. 3). It produced zircons (Table S2C) which returned 23 analyses (Table S20). Out of those, 6 analyses define a single statistical age population of 2595±9 Ma (MSWD=1.1; n=6), for the precursor porphyritic biotite-granite (Fig. 8G), and the remaining defines an unconstrained resetting event and/or Pb-loss (Figs 5F vs. 8HH).

5. Rocks Dated from Balazana-Bunia Sub-Terrane (Figs 5 and 6)

5.1. Tonalitic-granodiorite: MONG-09, mount 10-09B; Walu-Balazana Belt (WBB)

A sample of a tonalitic-granodiorite (45–55% sericite-abundant groundmass, 35–45% sub-rounded quartz grains and 5–10% opaque minerals) in the NE-SW-trending meta-pelitic-sedimentary rocks of the Walu-Balazana Belt (Table S1; Fig. 3). It produced 13 zircons (Table S2C), which produced 13 analyses (Table S21). Twelve out of those analyses possess low to normal U-contents, which yield concordant to near-concordant data (Fig. 8Q), defining a single age-population of 2621±7 Ma (MSWD=0.54; n=12), for the precursor tonalitic-granodiorite. One analysis of 2573 Ma is a statistically younger outlier, related to minor diffusional Pb-loss.

5.2. Biotitic-tonalite: MG1-N208, mount 10-10C; Walu-Balazana Belt (WBB)

A sample of a medium to coarse-grained biotitic tonalite (Table S1; Fig. 3) with abundant enclaves of gabbroic diorite, diorite, and quartz-diorite, and high-content of xenoliths of basaltic and andesitic volcanic rocks. The rock is overprinted by high-density of quartz stockwork and chlorite and quartz veins/stringers impregnations. Zircons extracted from this sample (Table S2C) returned twelve analyses (Table S22). Six out of those are concordant to near concordant with low common-Pb (Table S22), defining a single-age population of 2627±13 Ma (MSWD=0.2; n=6) for the precursor biotite-tonalite (Fig. 8R). Three distinctly older, 2655–2790 Ma ages represent xenocrystic ages in the Bunia-West Domain (Table 3).

5.3. Quartz-diorite: BU-03, Mount 10-25B, Bunia Granite Belt (BGB)

A sample of a weakly deformed quartz-diorite (60–70% plagioclase, 10–15% quartz, 10–15% K-feldspar, 7–10% hornblende and 2–5% biotite, with chlorite, epidote and sericite: Table S1) from a non-magnetic part of the Bunia Granite Belt (Fig. 3 and Fig. 7E in [9]). It produced 16 zircons (Table S2C), which returned 16 analyses (Table S23). When a discordant analysis is omitted, a single-age population of 2627±6 Ma (MSWD = 1.11) for the precursor quartz-diorite is established (Fig. 8S).

5.4. Hornblende granodiorite: BU-05, mount 10-25C, Bunia Granite Belt

A sample of a magnetic-bearing hornblende-granodiorite (~15–20% quartz, 15-20 alkali-feldspar, 50–55% plagioclase with 3–5% biotite after hornblende, and 1–3% epidote, chlorite, sericite: Table S1), from southwestern Bunia Granite Belt (BGB: Fig. 3). It produced 13 zircon grains (Table S6C), which returned 13 analyses (Table S24) plotted on concordia diagram (Fig. 8T). When outliers are omitted, a single-age population of 2627±8 Ma age (MSWD=1.4, n = 13) is established for the hornblende-granodiorite (Fig. 8T).
5.5. Quartz-microdiorite: MONG-06, mount 10-08D; Mont Luma-Tsi Belt

A sample of a shear-foliated quartz-microdiorite (i.e. 50–60% plagioclase (sericitised), 20–30% quartz, 5–10% carbonate 3–5% alkali feldspar, with 1–3% white mica and chlorite, ~1% opaque minerals, traces of apatite, epidote, titanite, tourmaline and zircon: Table S1) from the Nizi-Tsi Diorite Complex (Figs 3 and 7). This rock is more tonalitic to granodioritic in places with more abundant quartz-carbonate veins and stockwork stringers (Fig. 8E in [9]). Zircons from this rock (Table S2C), returned 12 analyses (Table S25), plotted on the U-Pb concordia diagram (Fig. 8U). Omitting analyses with the highest common Pb, and one statistical outlier, a 2665±12Ma (MSWD=1.1; n = 8) age for a precursor quartz-microdiorite is obtained (Fig. 8U).

5.6. Micro-granodioritic rock: MONG-07, mount 10-09A; Mont Luma-Tsi Belt

A sample of a micro-granodioritic rock (30–40% each plagioclase and quartz, 10–15% fine grained mica and carbonate and 5–10% Fe-rich chlorite (Table S1 and Fig. 7H in [9]), from quartz-
Fig. 8. Concordia plots showing all SHRIMP analytical data for igneous rocks (refer to Table S1 for respective rock types dated) sampled from representative parts of domains which make up the eastern Central Kibalian Superterrane, Kibalian Greenstone Region, Bomu-Kibalian Craton. Representative cathodoluminescence images for selected zircon samples illustrating external/internal zircon morphologies used to select dated spots for each sample are inserted in respective concordia plots. Potential post-Archean tectonic reactivation of the basement structures preserved in the Mont-Nongo Basin (Fig. 8G) is probably related to the resetting recorded by zircons extracted from sample MONG-04 (Fig. 8H).
feldspar-rich porphyritic rocks in the Nizi-Tsi Diorite Complex (Figs 3 and 7). This rock is considered to have evolved via metasomatism of precursor quartz-diorite or tonalite in the Nizi-Tsi Diorite Complex (e.g. Fig. 6E: [9, 11]). This sample produced 10 zircons (Table S2C), which returned 10 analyses (Table S26), including those with low U-contents, having consequential larger analytical uncertainties than normal. Of the 10, 9 analyses form a single age population
of 2641±10 Ma (MSWD=1.2; n=9), for the precursor rock (Fig 8V). The remaining analysis represents an older statistical outlier at a 2686 Ma from a xenocrystic zircon.
Fig. 8. Continued
5.7. Potassic tonalite: MTDD015-GO1, mount 12-37A; Mont Luma-Tsi Belt

A sample of a potassic tonalite (40–50% sericitised plagioclase, 25–30% quartz, 5–10% chlorite, 3–5% K-feldspar, 1–2% each white mica, carbonate, and opaque minerals, with a majority of amphiboles altered to chlorite, white mica and carbonate: Table S1) from the Nizi-Tsi Diorite Complex (Figs 3, 7). It produced 23 largely igneous zircons (Table S2C), which returned twenty-three analyses (Table S27). Excluding one discordant analysis, the remainder define a single-age population of 2659±9 Ma (n = 22; MSWD=1.3), for a precursor K-feldspar tonalite. Possible older outliers (grains #1 and #10, Table S27; yellow in Fig. 8W) do not show evidence of inheritance from cathodoluminescence (CL) images (Fig. 8W), and, as such, are considered to be part of the ~2659 Ma population.

5.8. Potassic quartz-diorite: MTDD015-GO2, mount 12-37B; Mont Luma-Tsi Belt

A strongly deformed biotite-altered potassic quartz-diorite (40–50% plagioclase, 20–25% quartz, 1–3% alkali feldspar, with alteration minerals, including 5–10% each white mica, carbonate and chlorite and 1–2% opaque minerals: Table S1; Fig. 6H) from the Nizi-Tsi Diorite Complex (Figs 3 and 7). It produced zircons (Table S2C), which returned analyses (Table S28), defining a single-age population of 2651±5 Ma (MSWD=1.09) for the precursor rock (Fig. 8X).

5.9. Quartz-felspathic rock: MTDD0013-GO3, mount 12-37C; Mont Luma-Tsi Belt

A sample of a quartz-felspathic rock (35–45% plagioclase, 25–35% quartz and 5–10% alkali feldspar, 3–5% biotite, 3–5% carbonate 2–3% opaque minerals, 1–2% white mica with <1% epidote, chlorite: Table S1; Fig. 6F), from a potentially albititic rock in the Nizi-Tsi Diorite Complex (Fig. 7). It produced zircons (Table S2C), which returned 21 analyses (Table S29). With only 2 analyses >5% discordant, the rest define a single population with an age of 2650±6 Ma (MSWD=0.97; Fig. 8Y), for the protolith of this rock.

5.10. Gabbroic-diorite: MTDD019-GO4, mount 12-37D; Mont Luma-Tsi Belt

A sample of a chlorite-altered gabbroic-diorite (~50–60% plagioclase mostly saussuritised), 10–15% quartz, 15–25% magnesium-rich chlorite mostly after clinopyroxene, 5% clinopyroxene,
3–5% epidote, 1–2% carbonate, 1% apatite and trace titanite and zircon: Table S1; Fig. 6C), forming as an apophyse in the Nizi-Tsi Diorite Complex (Figs. 3 and 7). It produced 21 zircon grains (Table S2C), which returned 22 concordant analyses (Table S30), defining a single-age population age of 2655±5 Ma (MSWD=1.10), for its emplacement (Fig. 8Z).

5.11. Biotite granodiorite: KL-67B, mount 10-23A; Soliboco Belt

A sample of a biotite granodiorite from strongly radiometric, Devi biotite-granite to granodiorite batholith in the axial planes of the Soliboco Belt (Fig. 3). This granite preserves granoblastic quartz, plagioclase and K-feldspar, and their interlockings with muscovite-biotite (high-grade metamorphic recrystallisation) and replacement of plagioclase by sericite and epidote (retrograde metamorphism), all implying the involvement of KL-67B in amphibolite-granulite facies deformation/metamorphism, subsequent exhumation, and retrograde metamorphism (Fig. 2). Twenty zircons extracted from this sample (Table S2C) produced 21 analyses (Table S20). Omitting discordant data and one younger outlier, 16 out of 21 analyses returned a single-age distribution of 2651±4 Ma with an MSWD of 1.14, for a granodiorite (Fig. 8AA).

5.12. Biotite-granodiorite: KL-82B, mount 10-24B; Ituri River Domain

A sample of a weakly gneissic, biotite–granodiorite (Table S1; Fig. 7J in [9]), from high-Na granites in the eastern part of the Ituri River Domain (i.e. towards Kilo Terrane: Figs 3 and 4A). These granites contain rafts of greenstones, boudins of strongly shear-foliated quartz-feldspathic material, and are in most places cross-cut by pegmatite veins and aplite dykes (Fig. 5D). It produced 23 zircons (Table S2D), which returned 26 analyses (Table S32). Out of those, seven analyses, including two with high common Pb corrections, returned significantly older, xenocrystic zircon ages of 2711 to 2610 Ma (Table S32). Although a majority of zircons display igneous morphology (Table S2D), several grains show distinct cores with rounded outer edges, suggesting their xenocrystic origin (Fig. 8BB). Sixteen analyses define a single-age population of 2586±4 Ma (MSWD=0.78) for the biotite granite (Figs 4B and 8BB).

5.13. Biotite granite: IRD-01 mount 13-16B; Ituri River Domain

This is a sample of a weakly gneissic but strongly deformed, biotite granite (25–35% altered plagioclase, 25–35% alkali feldspar, 20–25% quartz, 3–5% biotite, and 2–3% white mica and trace rutile, titanite and zircons), bounded by N-S-striking migmatitic rocks in the western part of the Ituri River Domain (i.e. towards Western Ituri Terrane: Figs 3 and 4A). This granite is cross-cut by E-W-trending quartz veins, fractures and micro-faults (Fig. 5C). It produced twenty zircons (Table S2D), which returned twenty-one analyses (Table S33). Out of those, seven define a single-age population of 2589±6 Ma (n= 7, MSWD=1.2), for the protolith of the biotite-granite (Figs 4B and 8CC).

5.14. Hornblende granodiorite: KL-74B, mount 10-23C; Likopi-Masikini Domain

A sample of a strongly deformed weakly gneissic hornblende granodiorite (~15–20% quartz, 7–10% alkali-feldspar, 60–65% plagioclase with 1–2% sericite/epidote after plagioclase, and ~1% biotite/chlorite after hornblende and traces of accessory minerals: Table S1; Fig. 7I in [9]) from a domain that sutures the Kilo Terrane to the Zani Sub-Terrane (Figs 2, 3 and 4A). This granite characterized by a high-density xenoliths and rafts of gneissic lithologies and enclaves of porphyroblastic biotite granite and leucocratic granodiorite (e.g. G-01 and G-02 in Fig. 5G). It
produced twenty-five zircons (Table S2D), which generated ten out of twenty analyses (Table S35) defining a single-age population of 2619±5 Ma (MSWD=0.89) for the precursor granodiorite (Figs 4B and 8E). One grain core analysis #12-1 returned a xenocrystal age of 2866 Ma (Fig. 8EE; Table 3). The remaining analyses (Table S35) were not used in the age calculation (Table S2D).

5.15. Biotite granite gneiss: KL-70A, mount 10-23B Masumbuko-Lagu Domain

A sample of a biotite quartzo-feldspathic orthogneiss of protolithic biotite granite (Table S1; Fig. 5H; Fig. 7L in [9]), from the Lagu Belt in the eastern margin of the Kilo Terrane (e.g. MLD in Fig. 2 and LAG in Fig. 3). It preserves mineral paragenesis amphiboles replaced by biotite, overprints of granoblastic-quartz and plagioclase by retrograde epidote, sericite forming after plagioclase, and chlorite forming after biotite and amphiboles: all pointing to deformation and metamorphism at amphibolite-granulite facies prior to exhumation and retrograde metamorphism [9]. This sample produced 12 zircon grains (Table S2D), which returned 20 analyses on both cores and rims (Table S34).

Nineteen of those constitute concordant (±5%) analyses with low common Pb (Table S34) representing two main age populations with some intermediate analyses (Fig. 8DD). The youngest 5 analyses are analytically indistinguishable, and they give a pooled age of 2470±7 Ma (i.e. MSWD=1.07). Apart from one distinctly older analysis from grain spot #7-1 with an age of 2648 Ma, the four oldest analyses form a statistical group with an age of 2607±9 Ma (MSWD=1.07). The remaining ages between 2470 and 2607 Ma do not form a cluster (Fig. 8DD; Table 3).

Detailed observations show zircon grain #2 with an unusually small portion of euhedral zoning overprinting sector-type zoning (Table S2D), often recorded from metamorphic zircons [12]. Detailed re-assessments show rim analyses consistently younger than old cores and the texture, altogether interpreted as either magmatic overgrowth on xenocrysts, or metamorphic overgrowths on magmatic zircons. However, the eight rim analyses show a considerable scatter (MSWD=2.4), indicating that some analyses probably represent overlap between rims and older cores. Furthermore, one analysis from a core (#2-1), has the same age as many of the rims, and is considered to have grown at the same time as the rims.

5.16. Quartz-arenite: MONG-02 mount 10-08B; Mont Nongo, Mongbwalu-Dala Belt

A sample of a brick-red quartz arenite interbedded with gravelly sandstone and quartzite (Fig. 9A), is part of the NE-SW-striking fault bounded siliciclastic sedimentary rocks of Mont Nongo basin, tectonically overlying the Abombi biotite granite and granodiorite suite (Fig. 4A and Fig. 6H in [9]). These rocks preserve NW-SE-trending penetrative fabrics, some impregnated with quartz veins and stringers (Fig. 9B). Zircons from this sample (Table S2D) returned thirty-one analyses (Table S36), which display a spread of ages between ~2640 Ma and 990 Ma (Fig. 8FF). Although one analysis (grain #25) preserves the age of ~990 Ma, the youngest population gives a pooled maximum age of 1086±43 Ma (MSWD=0.14; n=4), for deposition of protolithic quartz-arenite (Fig. 8GG).

6. Rocks Dated from Moto-Zani Terrane in the Northern Kibalian Superterrane

The Northern Kibalian Superterrane comprises the Moto-Zani Terrane, which is among other crustal blocks tectonically sutured to the Western Nile Complex to the north and extensive granodiorite-granite and gneiss belts to the south (Fig. 1). Three U-Pb SHRIMP geochronology samples (KIB-MT-01, ZAN-DL-01, and ZAN-OTT-02) from specific domains (Figs 1 and 10) in this
Fig. 9. The post-Archean Mont-Nongo basin of: A) ~1.1 Ga poorly-sorted conglomeratic sandstone preserved on top of the NE-SW-trending fault-bounded Abombi-Matete granite hill in the Mongbwalu-Dala Belt; B) penetrative shear fabric in the ~1.1 Ga poorly-sorted siltstone and sandstone, potentially deformed at ~950 Ma.

terrane are used to test whether there are crustal growth processes, which operated at craton-scale in the Northern and Central Kibalian Superterrane (Fig. 2). Rocks which produced zircons and titanites for U-Pb SHRIMP geochronology dating, zircons morphology and analytical data are briefly presented below.

6.1. Granodioritic-tonalite: KIB-MT-01, mount 12-36A; Kibali domain

A sample of a gneissic tonalitic-granodiorite (Table S1; Fig. 11A) exposed by quarry operations at Matiko village, was selected from among other granites in the NE-SW-trending Kibali domain [13]. This plutonic rock contains networks of sericite-muscovite and epidote-rich anastomosing micro-shear zones (Fig. 11B). It produced 28 zircon grains (Table S2E), which returned 29 analyses (Table S37), seventeen out of those being >5% discordant (Fig. 12A). The remaining twelve with <5% discordance form a single-aged population of 2630±6 Ma (MSWD = 0.90), for the Matiko granodioritic-tonalite (Fig. 12B).

6.2. Biotite-granodiorite: ZAN-DL-01, zircon, mount 13-01A; Zani Sub-Terrane

A sample of a strongly deformed and altered biotite-granodiorite (30–40% quartz, 15–20% plagioclase, 3–5% alkali feldspar, and 3–5% biotite; Table S1; Fig. 11C) is from the Dilolo Granite Complex in the Kepira-Kerekere Domain (Figs 1 and 10). It constitutes quartzo-feldspathic granitic rock traversed by anastomosing shear zones with strong pervasive white-mica/sericite and chlorite-sericite infilling micro-fractures and shear zones (Fig. 11D). Although zircons extracted from this sample (Table S2E), were analysed (Table S38), the majority of the data collected were rejected due to very high U-contents and/or high common Pb contents (Table S38). Amongst three out of six near-concordant analyses (Fig. 12C), returned two ages of 2623±9 and 2629±12 Ma (Table S38), broadly suggesting the Archean emplacement age (Table 3) for the protolith of the Dilolo biotite granodiorite. The co-existence of titanite with high-U zircons afforded a favourable opportunity to undertake U-Pb titanite SHRIMP geochronology.
6.3. **Biotite-granodioritic granite: ZAN-DL-01, titanite, mount 13-01B**

Titanite grains from this sample are mostly fragments of larger grains, and, as is typical of titanite, show no internal structure in SEM images. Nine U-Th analyses on nine grains returned titanite data with low U-contents and high common Pb contents (Table S39). The low U-contents and very low Th/U mean that these titanites did not form from the same magma that crystallised
Fig. 11. Selected rock types and representative plane and crossed polarized photomicrographs (FOV = 4 mm) of mineral textures from the Moto-Zani Terrane in the Northern Kibalian Superterrane representing: A) Matiko tonalitic-granodioritic granite, near Kalimva, some 25 kms northwest of Kibali gold mine; B) representative photomicrograph showing hornblende-porphyrroblastic and mosaic-textured quartz-eyes with epidote in pressure shadows; C) strongly deformed and altered biotite granite (Dilolo granite) in the hanging-wall of the NW-SE-trending Zani-Kodo domains; D) photomicrograph illustrating grain-size reduction due to deformation (quartz and plagioclase “eyes”) in the Dilolo granite; E) deformed and altered granite-gneiss, part of strongly deformed Ottu-Djelasiga Domain; F) photomicrograph showing interstitial biotite, white mica and epidote between quartz and alkali feldspar demonstrating grain size reduction and recrystallisation due to deformation.

to form high-U zircons [10], but from tectonothermal or hydrothermal processes. Out of nine analyses from these titanites (Table S39), six analyses with <7% common Pb yield a 206Pb/238U age of 533±14 Ma (MSWD = 1.14; Fig. 12D), which marks the timing of a tectono-thermal overprint in the Zani-Kodo Sub-Terrane (Figs 1 and 10).
**Fig. 12.** Concordia plots inserted with representative cathodoluminescence (CL) images of selected zircons for: A) sample KIB-MT-01, Matiko tonalitic-granodioritic granite. Unfilled ellipses within 5% of concordant; filled ellipses are >5% discordant and CL image of typical magmatic zircons; B) concordia plot for zircon data which are within 5% of concordant and example of zircons with more massive, less zoned cores; C) concordia plot for zircon data in sample ZAN-DL-01, Dilolo Granite and CL image of zircon grains among the few which had continuous core-to-rim euhedral zoning; D) Concordia plot for low common Pb titanite data in sample Dilolo Granite; E) near concordant zircon data in sample ZAN-OTT-01, Ottu Gneiss with CL image of grain 12, showing dark CL overgrowth to the left; F) Concordia plot for near concordant zircon data in sample Ottu Gneiss.

### 6.4. Banded biotite-orthogneiss: ZAN-OTT-02, Mount 13-02B

A sample of a deformed banded biotite-orthogneiss (*Table S1; Figs 11E and F*) from the E-W- to NE-SW-trending Ottu Gneiss Complex, which together with strongly deformed biotite quartzo-feldspathic gneisses and strongly magnetic amphibolitic gneisses, make up a
large part of the Ottu Djalasiga Domain (Fig. 10). Twenty-eight zircons from this sample (Table S6E), returned 30 analyses (Table S43). Out of those, 16 are within 5% of concordance (Table S40), spreading in age from ~2670 to ~2600 Ma (Fig. 12E and 12F), thus reflecting more than one age population. With a natural break at ~2645 Ma, an older age group of 2657±9 Ma (n = 4; MSWD = 1.14) and a younger age group of 2610±6 Ma (n= 12; MSWD = 1.4) are derived from the zoned zircons (Fig. 12E). No age data could be collected from the dark rims. The bi-modal age distribution of the near-concordant data from sample ZAN-OTT-02 suggest 2610 Ma as the emplacement age for the protolith of the Ottu biotite-orthogneiss and 2657 Ma as the age of xenocrystic cores (Table 3). The fact that the U-, Th- and Th/U for both age groups overlap, and there is no textural evidence available from cathodoluminescence (CL) imaging to suggest a younger tectonothermal overprint.

7. Summary of U-Pb Zircon/Titanite Ages Presented in this Brief

Table 3.

8. Experimental design, materials and methods

8.1. Experimental designs and material

Samples were individually crushed, milled and sieved to retain the 60# mesh fraction, which was cleaned by normal tap water to remove fine material. Retained heavy material was dried and mixed with a 2.85 ± 0.02 g/ml heavy liquid and allowed to settle, separating heavy material from lighter material. Distilled water followed by acetone was used to clean and dry the heavy fraction. A Frantz Isodynamic magnetic separator was used to separate the dry sample into magnetic and non-magnetic fractions. Zircons from the non-magnetic fraction were hand-picked under a high-magnification binocular microscope, and cast in a 25 mm epoxy mount together with chips of the BR266 (559 Ma; 903 ppm U; Stern, 2001) or M257 standard zircon (561.3 Ma, 840 ppm U; Nasdala et al., 2008). Procedures for titanite were similar to those followed by Mohan et al. [7], using the ORB-A titanite standard (2691.5 Ma) and Khan (700 ppm U; [8]) for calibration.

8.2. Methods

The mounts were polished to expose half-section zircon grains, cleaned and dried ready for imaging by scanning electron microscopy (SEM) to reveal detailed external and internal morphologies of zircons. Scanning Electron Microscope (SEM) images of zircons in this study were taken using a Phillips JEOL-6400 SEM at the University of Western Australia. The SEM images allow the sampler to target particular growth zones and avoid taking analyses on cracks and radiation-damaged zircon areas [14]. As is typical, titanite show no internal structure in SEM images. The zircon and titanite mounts were then cleaned and coated with gold to yield an across-mount resistance of 5–20 Ω, ready for ion-microprobe SHRIMP analysis. The latter utilises Koehler focusing of an O2− ion beam to make in-situ U-Th-Pb isotope analyses with a spot size of 25–30–μm on sectioned zircon and titanite grains [1–3]. The ion-microprobe SHRIMP U-Pb analyses were undertaken at the John de Laeter Centre, Curtin University, Perth, Western Australia.

Data reduction used SQUID II [5]. In order to define a representative age population, analyses with high common Pb corrections (typically >1%) and discordance (typically >5%) were usually not considered. Obvious outliers were removed and subtle outliers were assessed by calculating
mean square of weighted deviates (MSWD) to identify coherent populations. Interpretations of zircon growth and recrystallisation zones from SEM images were integrated with the statistical assessment of age populations. Calculations of 207Pb/206Pb or 206Pb/238U ages are based on the isotopic constants of Steiger and Jäger [4]. In the few cases where ages are calculated from lower and upper intercepts of the discordia line with the concordia, Isoplot [6] was used to estimate the respective best-fit ages. Ages quoted in the text are at 2σ error (Tables S4–S40), whereas those in the tables of analytical results are reported at 1σ error. Brief descriptions of zircon morphologies from cathodoluminescence imaging and SHRIMP analyses (Table S2A–S2E).

**CRediT Author Statement**

The material presented in this article is authors’ work: 1) Joas M Kabete and Neal J McNaughton for co-conceptualization of the research problems to be resolved, field mapping geology, sampling, U-Pb SHRIMP zircon and titanite analyses, and writing of the original and revised drafts; and 2) Avos Bashizi and Blasé Kiza, for assisting in field mapping geology, map generation, data organisation and reviewing of the manuscripts.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

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**Supplementary Materials**

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2021.107213.

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