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Supplemental Table S2: Analytical results of $^{40}Ar/^{39}Ar$ geochronology (Argon Lab Freiberg) (in separate Excel file).

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SAMPLE DESCRIPTIONS

This section provides lithologic descriptions of all samples based on thin section, hand sample, and outcrop analysis. Representative photomicrographs are provided in Figure S1.

803B3 is a leucogranite-gneiss sill. It comprises quartz, plagioclase, and tourmaline, and rare small, idiomorphic garnet. Muscovite forms the foliation and is up to 1-2 mm long; biotite is not present. Chlorite is rare and occurs in <0.2 mm flakes either parallel or growing across the foliation.

804C1 is a biotite-muscovite granite with K-feldspar, plagioclase, and 1-2 mm long muscovite and biotite flakes without a preferred orientation. Some small garnet and tourmaline grains are present. Biotite and muscovite are intergrown, bent, and broken, and contain many inclusions. Some biotite is entirely chloritized; most biotite has some chloritization, especially along grain margins and cleavage planes.

806D3 is a strongly foliated, mylonitized orthogneiss. No phenocrysts >1 mm are present but some small feldspar porphyroblasts occur. Tourmaline is present. Muscovite and biotite are strongly intergrown. Muscovite (≤1-2 mm, more typically 0.5 mm long) is more common than biotite (0.1 x 0.3 mm; width x length). Muscovite is intergrown with opaque phases. A few biotite grains are chloritized.

807A1 is a mylonitic augengneiss with ≤1 cm feldspar clasts. Biotite and muscovite form a wavy foliation, occur in a range of sizes up to 0.5 x 1-2 mm, and often are strongly intergrown. Chlorite is very rare.

807C1 is a grey gneiss with a felsic band with >1 cm recrystallized feldspar clasts. The sample is likely an orthogneiss, but could be of sedimentary origin with a strongly sheared felsic dike. Biotite and muscovite are frequent but small (biotite 0.1 x 0.3 mm, muscovite 0.3 x 1 mm), strongly intergrown, and form a distinct, straight foliation. Biotite is without chloritization; some chlorite grains occur. Allanite is a common accessory phase.

807D1 is a garnet-biotite schist with 1-5 mm thick compositional layering of more or less micaceous bands. Idiomorphic garnet blasts are <1-5 mm. Biotite is 0.3 x 0.8 mm and forms the foliation; it is locally chloritized, especially around garnet. Muscovite is absent except in few mica-rich layers.

807E1 is a biotite-muscovite schist with distinct ~1 mm thick mica and quartz-feldspar domains. The latter contain small biotite grains at various orientation to the foliation but no muscovite. The fabric is a crenulation overprinting an older foliation. Small tourmalines are frequent and aligned within the foliation. Biotite (0.1 x 0.3 mm) and muscovite (0.2 x 0.5 mm) are intergrown; biotite has a greenish color and no indication of chloritization.

810B1 is a weakly foliated felsic orthogneiss. Feldspar is mostly microcline; myrmekite and tourmaline are frequent. Muscovite is typically 0.5 x 2 mm, often intergrown with opaque minerals and biotite. Biotite is rare and small (0.1 x 0.3 mm); no chloritization is detected optically, but appears twidespread when observed with BSE.

811B1 is a fine-grained, weakly foliated garnet-biotite gneiss, a typical Haimanta metapsammite. More and less micaceous bands define a compositional layering. Biotite is common and occurs aligned in the foliation and is randomly oriented. Small garnet crystals are abundant. Biotite measures 0.2 x 0.8 mm without evidence of chloritization. Muscovite is extremely rare.

812D2 is a biotite-muscovite schist with tourmaline and allanite as the major accessories. Biotite measures 0.3 x 0.5 mm; muscovite is longer and thinner. Quartz-feldspar domains with small biotite flakes oriented oblique to the main fabric suggest a relic pre-existing foliation.

814G1 is a metapsammite with carbonate- and biotite-rich bands. Biotite is small (0.01 x 0.1 mm) with some chloritization. Large (≥1 mm) skeletal muscovite, oblique to the foliation and partly overgrown by foliation-forming biotite, is frequent and interpreted as detrital.

815C1 is a coarse-grained biotite-muscovite schist. Quartz and plagioclase show ample evidence of intra-crystalline deformation (undulose extinction and deformation bands). Tourmaline occurs. Biotite and muscovite are large (0.5 x 1-2 mm, biotite smaller than muscovite) and define the foliation. Biotite shows little chloritization.

815E1 is a garnet leucogranite with plagioclase, some microcline, and small but frequent garnet. Muscovite (0.5 x 1 mm) defines a weak foliation.

819A2 is a biotite and garnet bearing augengneiss with ≤2 cm feldspar blasts. Microcline and myrmekite are common, garnet and clinozoisite are ubiquitous. Biotite is frequent and measures 0.3 x 0.8 mm. No chlorite occurs. Muscovite (same size as biotite) is rare.

823G2 is a coarse-grained garnet-biotite orthogneiss with large plagioclase blasts, myrmekite, and abundant accessory phases (clinozoisite, sometimes with allanite cores, epidote, apatite, titanite, ~0.5 mm large carbonate). Biotite is large (up to 0.5 x 3 mm, typically 0.3 x 0.8 mm); its rims are locally chloritized.

823G3 is a mica schist with large, strongly chloritized skeletal garnet. Muscovite and biotite are small (0.2 x 0.5 mm), strongly intergrown, and form a wavy foliation that wraps around garnet. Post-kinematic biotite replaces garnet. Both biotite populations and garnet are partly chloritized.

827B1 is a fine-grained meta-pelite with a strong crenulation cleavage. Muscovite is more frequent than biotite and both are small (<0.1 mm). Chloritization is not visible with the optical microscope but appears widespread in BSE images.

ANALYTICAL METHODS

Ar-Ar step-heating age dating was carried out at the Noble Gas Laboratory, Dalhousie University, Halifax, Canada (DGC), and at the Argon Lab, Freiberg, Germany (ALF).

For the DGC analyses, 3-4 mg hand-picked mica concentrates were individually wrapped in aluminum foil, and then stacked in an aluminum irradiation canister. Between five and seven aliquots of the flux monitor, Fish Canyon sanidine, were interspersed among the samples. The canister was irradiated with fast neutrons in the nuclear reactor at McMaster University in Hamilton, Ontario, Canada. A double-vacuum tantalum resistance furnace was used to carry out step-heating. Isotopic analyses were made in a VG3600 mass spectrometer using Faraday and electron multiplier collectors.

For the ALF analyses, the mica separates were washed repeatedly in deionized water using an ultrasonic bath to remove dust and loose parts of the crystals. After washing and drying, 3 mg of sample was wrapped in Al foil for irradiation at the LVR-15 research reactor of the Nuclear Research Institute in Řež, Czech Republic (see Rutte et al., 2015 for detailed irradiation geometry and reactor specifics). Irradiated micas were unwrapped and loaded into 3 · 1 mm (diameter · depth) wells on oxygen-free copper discs. Step-wise heating of micas was performed using a power-controlled floating 30W New Wave CO2 laser system, with a defocused beam with a diameter of 3 mm. Heating time was 5 min per step. Argon isotope compositions were measured in static mode on a GV Instruments ARGUS noble gas mass spectrometer. Data reduction and time-zero intercept calculation were processed using in-house programme developed using Matlab®. Corrections for interfering Ar isotopes were done using $(^{36}Ar/^{37}Ar)_{Ca} = 0.000245 \pm 0.000012$, $(^{39}Ar/^{37}Ar)_{Ca} = 0.000932 \pm 0.000035$, $(^{38}Ar/^{39}Ar)_{K} = 0.01211 \pm 0.00061$, $(^{40}Ar/^{39}Ar)_{K} = 0.00183 \pm 0.00009$ and applying 5% uncertainty. Further analytical details are described in Pfänder et al. (2014).

Inverse isochron (IIA) and weighted mean ages (WMA) were calculated using ISOPLOT 4.15 (Ludwig, 2008). All ages were calculated using Fish Canyon sanidine (FCs) as fluence monitor. For the age calculations of the DGC data, an FCs age of 28.205 ± 0.046 Ma was assumed (Kuiper et al., 2008). For the ALF data, an FCs age of 28.305 ± 0.036 Ma was used (Renne et al., 2010). The slightly different values amount in 0.15% difference in the calculated sample ages, i.e. far below the age uncertainties. Therefore, and in view of the ongoing debate about the exact age of FCs (e.g., Phillips and Matchan, 2013) we did not recalculate the DGC data.

X-ray powder-diffraction data were collected by the Rietveld method to quantify the amount of chlorite and muscovite in biotite separates. Hand-ground powders were prepared as oriented samples by sedimentation on glass slides. One-dimensional diffraction patterns were taken in the interval 5-50°2Θ with constant step width of 0.02° and counting time 5 s/step, measured using a HZG-4 horizontal diffractometer (FPM) equipped with Cu long-fine focus tube, theta-compensating divergence slit, diffracted beam graphite monochromator and scintillation counter. Rietveld refinement was performed using the BGMN software (Bergmann et al., 1998), and starting models were taken from the ICSD collection codes 161225, 66258 and 34353 for biotite, chlorite and muscovite, respectively. Beside the Rietveld scale factors, the lattice parameter c_0, octahedral site occupation, and line profile parameters were refined to take into account the structural variability of the layer silicates. Estimated standard deviations 3σ were derived by the BGMN refinement matrix and used for plotting confidence intervals.

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