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Supplemental Material

Text. Sample Preparation and Geochemical Analysis Methodology.

Table S1. Major oxide percentages for metagneous rocks of the Wedowee-Emuckfaw-Dahlonga basin.

Table S2. Measured isotope ratios and normalized U-Pb ages calculated without ^{204}Pb Correction.

Table S3. Lu-Hf isotope analyses.

Table S4. Latitude-longitude (WGS84), geologic unit, and age information for samples analyzed as part of this project.

SAMPLE PREPARATION AND ANALYSIS

Major Element Analyses

All sample processing and geochemical analyses were conducted at the University of Florida's Center for Isotope Geoscience. For elemental analyses, samples were crushed with a rock hammer and a steel jaw crusher to produce cm-scale rock fragments. Fragments that best represented the sample, including those with minimal weathering, were pulverized into a fine powder using a steel ring mill. An aliquot of the powder was then dried, mixed with lithium borate dry fusion flux and melted in a Katanax K2 Prime Fluxer creating round glass beads. The glass beads were analyzed using wavelength dispersive X-ray fluorescence for major elements. Errors for major element analyses are <6%.

Zircon Mineral Separation and Preparation for U-Pb and Lu-Hf Analyses

Rock chips were pulverized in a RETSCH Cross Beater Mill SK 100. The resulting material was sieved using a 300 μm brass mesh screen which separated the material into a coarse (>300 μm) and fine (<300 μm) fraction. The fine fraction was placed into a "Blue Bowl" gold concentrator to hydraulically separate the dense and less dense minerals. Magnetic minerals (e.g., magnetite) were separated from the dried, denser mineral fraction using a hand magnet and further separated using a Frantz Magnetic Separator to isolate minerals of differing magnetic susceptibilities. The non-magnetic fraction was further separated by density using heavy liquids (tetrabromoethane, methylene iodide) techniques and cleaned with combinations of ethanol and acetone. Individual zircons were then mounted on a clean glass slide using double-sided tape, along with zircon standards FC-1, Duluth Gabbro of Forest City, MN and R33, from an Ordovician dioritic dike of the Braintree Complex, VT (Black et al., 2004). All zircons were then mounted in epoxy on a circular plastic mold and polished using a Buehler Ecomet 6 Variable Speed Grinder-Polisher and various grit plates to expose the cores of a majority of the zircons in

the epoxy plug. The plug was then placed into a Zeiss EVO Scanning Electron Microscope equipped with a Gatan cathodoluminescence detector. Individual zircons were imaged using backscattered electrons and cathodoluminescence. The resulting images were used to ascertain zoning and fractures within the zircons that could influence subsequent isotopic analyses.

U-Pb and Lu-Hf Geochronological Methodology

Analyses closely followed the methods described in Mueller et al. (2008). Epoxy-resin plugs containing the zircons were placed in an ultrasonic bath of dilute nitric acid (HNO_3) to remove common lead contamination from the surface of the plug. The plugs were then placed in a laser ablation system linked to a Nu-Plasma Multi-Collector Inductively Coupled Plasma Mass Spectrometer (MC-ICP-MS). Argon and helium gas were used to channel the ablated particles to the plasma and the mass spectrometer. Grains were ablated using a New Wave 213 nm UV laser with a beam diameter set to $\sim 20\ \mu\text{m}$ for uranium-lead and $40\ \mu\text{m}$ for lutetium-hafnium analyses. Two ablations of the FC-1 zircon standard (Mattinson, 2010; 1098 Ma) were performed between every 10 ablations of sample zircons for U-Pb analyses and periodic ablations of zircon standard R33 (420 Ma) as a secondary standard. In almost all instances, discordance was calculated by comparing $^{206}\text{Pb}/^{238}\text{U}$ ages versus $^{207}\text{Pb}/^{206}\text{Pb}$ ages for ages greater than ~ 1000 Ma, and versus $^{207}\text{Pb}/^{235}\text{U}$ ages for ages less than ~ 1000 Ma. For ages near 1000 Ma, the least discordant data of the two calculations were used. The $^{207}\text{Pb}/^{235}\text{U}$ ages were determined using ^{235}U abundances calculated from measured ^{238}U abundances. Data reduction and age calculations for U-Pb were completed using an in-house Excel spreadsheet, Calamari, utilizing FC-1 as the primary standard for data reduction. Errors for all $^{206}\text{Pb}/^{238}\text{U}$ ages reported in this study are at the 95% confidence level. Errors for individual samples are reported as two standard errors of the mean (2 s.e.m.). Ages calculated and reported herein are best viewed as minimum crystallization ages for each sample due to the Pb-loss evident in almost all analyses. All analyses for Lu, Hf, and Yb isotopes were made using Faraday collectors of the MC-ICP-MS. Lu-Hf isotopic analyses were conducted on the same zircons used for U-Pb, with ablation sites adjacent to the U-Pb analytical locations in the same cathodoluminescence-imaged zone. Data collected were normalized using the FC-1 zircon standard (every 15th analysis) using Isotopia, an in-house Excel spreadsheet. The $^{176}\text{Hf}/^{177}\text{Hf}$ ratios were corrected for Yb and Lu isobars using mass bias factors derived from Hf isotopes. Initial values are referenced to the chondritic model of Bouvier et al. (2008) and corrected to the age of each sample, each group of samples, or the age of the individual zircons for initial isotopic ratios of all zircons. The average of the measured $^{176}\text{Hf}/^{177}\text{Hf}$ ratios for the standard were within the range of published values (e.g., Woodhead and Hergt, 2005) and values determined at the University of Florida's Center for Isotope Geoscience for this standard by wet plasma (0.28217 ± 0.00002 , 2 s.e.m.); therefore, no corrections were made to the measured ratios.

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