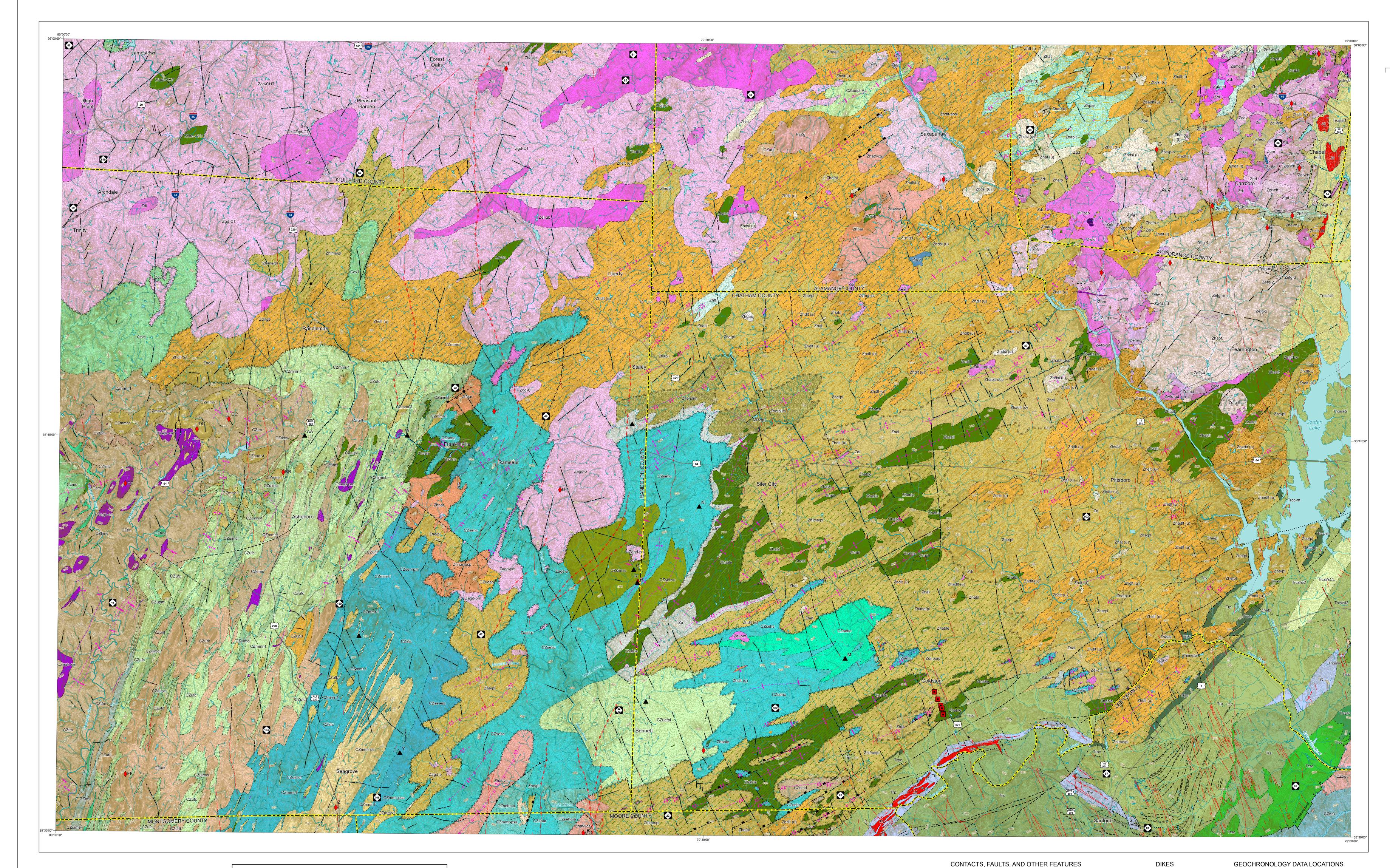
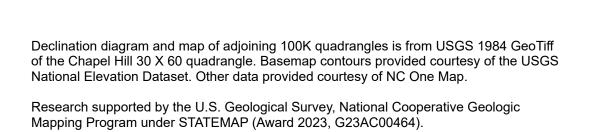
This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program

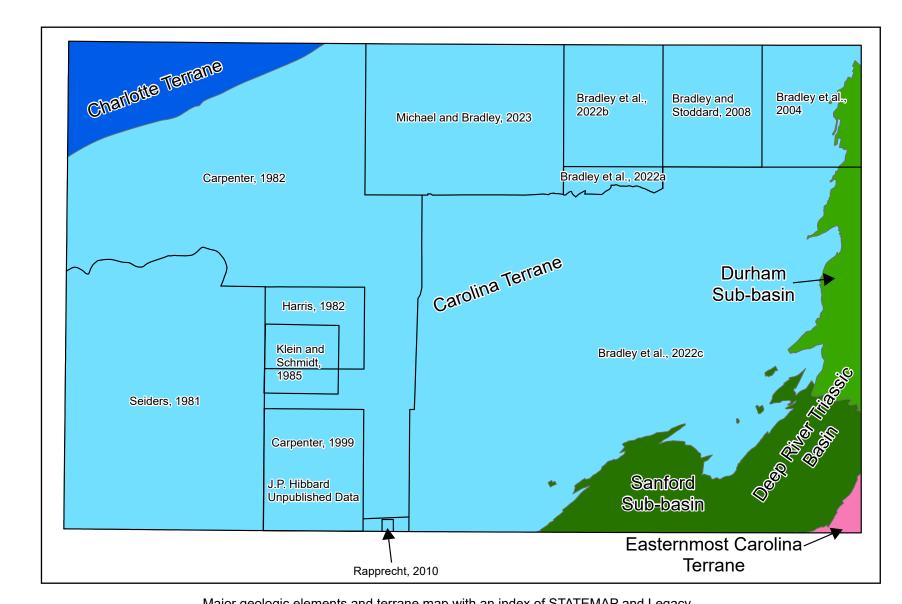


Magnetic north declination -8° 53'



(NOAA National Centers for Environmental Information Website, April 5, 2024)

This map and explanatory information is submitted for publication with the understanding that the United States Government is authorized to reproduce and distribute reprints for governmental use. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government. Acknowledgments: Many thanks to James P. Hibbard for the discussions, guidance, and continued assistance with enhancing the understanding of the Carolina terrane. Thanks to Joe Moye for reviving discussions of the stratigraphy in the Carolina terrane with his paper The Albemarle Sequence of the Carolina Terrane in Central North Carolina: Geologic and metallogenic analysis with an alternative model (Moye, 2023). Emily K. Michael digitized legacy linework in the Asheboro and Ramseur areas. Michael A. Medina contributed significantly to cartographic work for the Chatham County portions of the map area.



This compiled geologic map, partially supported by the U.S. Geological Survey (USGS), National Cooperative Geologic Mapping Program under STATEMAP completes a multi-year project to compile the entire bedrock portion of the Chapel Hill 30'x 60' Quadrangle (Chapel Hill 100K) in support of the USGS US Geoframework Initiative's vision for a nation-wide. seamless geologic map.

COUNTOUR INTERVAL - 10 FEET

The goal of this compilation effort was to produce a new 1:100,000-scale digital geologic map of the study area using the USGS Geologic Mapping Schema (GeMS). When available, geologic data at scales more detailed than 1:100,000-scale were used (i.e. 1:24,000-scale data). Data from the more detailed maps were preserved at the scale originally mapped. As such, some map unit polygons are very small on this 100,000-scale map and are unlabeled. The unit name of the unlabeled polygon can typically be interpreted from nearby labeled polygons. The GeMS digital database should be utilized in conjunction with this layout version of the map.

This compilation effort compiled legacy data at scales ranging from 125K- to 24K-scale. From July 2023 to June 2024, NCGS staff conducted targeted foot and vehicle traverses to validate contacts from legacy sources and to collect new field data. Close attention was paid to rectifying edge-match issues between legacy data and recent 24K-scale mapping to allow accurate transitions of map units from areas with detailed data to areas of legacy data collected at smaller scales (e.g. 48K). More detailed and closer spaced traverses targeted areas of structural or stratigraphic complexity. Less detailed and wider spaced traverses were used in areas of less complex structure or rock types (e.g. areas underlain by homogenous plutons received less attention). LiDAR elevation data displayed as hillshade was used to help identify lineaments and possible faults and dikes that may be groundwater sources or preferred pathways for groundwater contaminants.

Compiled Bedrock Geologic Map of the Chapel Hill 30' x 60' Quadrangle (Chapel Hill 100K), North Carolina

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--?---- contact

--?---- fault

-- - - normal fault

--- thrust fault

-?----- anticline

-?- ---- syncline

Society of America Abstracts with Programs., Vol. 57, No. 2, 2025, doi: 10.1130/abs/2025SE-407549

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— - — Iidar lineament

IIII IIII IIII gradational contact

→•••••• unconformable contact

- → ?--- overturned anticline

- - ♥ ?--- overturned syncline

coal bed (Reinemund, 1955)

--- conglomerate beds (Reinemund, 1955)

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dotted where concealed, ? where questionable

→ → · · · · · Jd, diabase located via magnetic data

CZgb-e, gabbro in the Erect quadrangle

Jd, diabase intruded along fault (Reinemund, 1955)

CZda-e, dacite in the Erect quadrangle

CZmd-r, mafic porphyry of the Ramseur area

CZfd-r, felsic porphyry of the Ramseur area

—— – ---- CZabg-sm, Stony Mountain gabbro

Zgbp, gabbro to gabbro porphyry

<u>
→ → → → → → → </u> Zhm, Hunter Mountain

CZdi-e, diorite in the Erect quadrangle

———---- Jd, diabase

DUCTILE FAULT? Granite of the Cane Creek Mountains Albemarle Arc Plutons and Dikes Zwfd Zwfd-gd Zwfgd Zgd-CT Zsgr **Hyco Arc Plutons** Hyco Formation – upper portion Volcaniclastic sedimentary and volcanic units Zhel Zhe-m1 Zhe-m2 Zhe/p Zhe/p-n Zhp/e — Zhft Zhdasi Zgr-ccr Zgd-gr-p Zgd-leuco Zqmd-Zgd Zgd-ch Zdi Zdi-Hyco Formation – lower portion

pm Seagrove formation epiclastic rocks north of Purgatory Mountain

Seagrove formation intermediate to mafic volcanic and volcaniclastic rocks

ca. 579 Ma (Tadlock and Loewy, 2006) and ca. 569 Ma (Goliber and Coleman, 2023)

Samson et al. (2001) reported a youngest (SHRIMP-II) detrital zircon ²³⁸U/²⁰⁶Pb date of ca. 578 Ma collected from the southern portion of the South Boston 100K. Pollock et al. (2010) reported a youngest LA-ICP-MS U-Pb zircon age of 588±11 Ma for the unit in the Chapel Hill 100K (geochronology data location P).

personal communication, 2025). As such the Aaron Formation stratigraphic placement is in question.

Ca. 591 Ma for Zgd-CT (Bradley et al., 2025) and Ca. 605±7.4 Ma for Zsgr (Ingle et al., 2003)

In the Henderson 100K, recent preliminary LA-ICP-MS U-Pb zircon analyses from a meta-sandstone on the eastern limb of the

Virgilina synclinorium within the Aaron Formation indicates all MDAs are between ca. 540 Ma and ca. 545 Ma (T. LaMaskin,

CZsmd Seagrove formation mudstones

VIRGILINA SEQUENCE

East Farrington Pluton

Farrington Igneous Complex

Zefg-m East Farrington pluton main facies

Zefg-m1 _ East Farrington pluton main facies variety 1

Zefg-2 East Farrington pluton porphyritic granite

Żeig-3: East Farrington pluton fine-grained granite

Zefg-4 East Farrington pluton gray granitoid

ZZefg-5 Z East Farrington pluton satellite granite

Zefmd East Farrington monzodiorite porphyry

Zwfd West Farrington pluton diorite

West Farrington Pluton

Za Aaron Formation

HYCO ARC Hyco Arc Plutons

Zefg-6 East Farrington pluton satellite granitoid

Zwfd-gd West Farrington pluton diorite to granodiorite

Zwfgd West Farrington pluton leucogranodiorite

Zgd-CT Granodiorite (intrusive into the Carolina terrane)

Zsgr Granite to granodiorite of the Saxapahaw pluton

Zgr-ccr Granite of the Crutchfield Crossroads Quadrangle

Zgd-gr-p Granodiorite to granite of Piney Mountain Creek are

Zcgr Granite of the Chatham pluton

gb-mf Gabbro in the Meadow Flats area

Zgd-ch Granodiorite of the Chapel Hill pluton

Zgr-gd Granite to granodiorite

Zdi Diorite

Zgd Granodiorite

Zgr2 Granite

Zt-qdi Tonalite to quartz diorite

ca. 613 – 651 Ma (Wortman et al., 2000 and Barefoot, 2015)

CORRELATION OF MAP UNITS

LIST OF MAP UNITS [See Description of Map Units (in pamphlet) for complete unit descriptions and age information] UNMETAMORPHOSED INTRUSIVE BODIES **UWHARRIE GROUP** Uwharrie Volcanics Ingle et al. (2003) reported the weighted average of six ²⁰⁶Pb/²³⁸U ages for zircon grains by SHRIMP methods of 554±15 Ma for a sample from the Uwharrie Formation (SB-9) in unit Zurlt in the Southern Pines 100K. This location was resampled as a part of this study and yielded LA-ICP-MS ²⁰⁶Pb/²³⁸U weighted means ages of 537.6±2.8 Ma (MSWD = 1.8). Goliber and Coleman (2023) reported a CA-ID-TIMS weighted MPzgb-wx Olivine gabbronorite in the White Cross area mean age of 548.7±1.1 Ma from a felsic volcanic rock in the unit (geochronology data location O). A new and unpublished, LA-ICP-MS ²⁰⁶Pb/²³⁸U weighted mean age yielded 537.4±5.7 Ma (MSWD = 0.86) for a sample collected from Luther Place trail area in the Uwharries (geochronology data location FF). New and unpublished detrital zircon ages include: Maximum Depositional Ages (MDA) of 533 Ma. for sample CH100K-3675 (geochronology data location W); MDA of 526 Ma for sample CH100K-3834 TRIASSIC SEDIMENTARY ROCKS OF THE NEWARK SUPERGROUP (geochronology data location AA); and MDA of 552 Ma for sample CH100K-Ben-165 (geochronology data Deep River Basin: Durham Sub-basin Sandstone with interbedded conglomerates - Lithofacies Association III CZue/pl Uwharrie Volcanics mixed epiclastics, pyroclastics and lavas of the Devils Tramping Ground area Trcs Interbedded sandstone and pebbly sandstone - Lithofacies Association III CZue/pl-A Uwharrie Volcanics epiclastics pyroclastics and lavas of Alamance County Conglomerate - Lithofacies Association III CZuqdp Quartz dacite porphyry Conglomerate of the Chatham Group in the Merry Oaks Quadrangle Zupm Porphyritic felsic volcaniclastic rocks Trcsi/sCL Siltstone with interbedded sandstone - Lithofacies Association II with chert and limestone Trcs/si2 Sandstone with interbedded siltstone - Lithofacies Association II CZudap-a Altered dacite Trcsi/s Siltstone with interbedded sandstone - Lithofacies Association II CZurlt Uwharrie Volcanics rhyodacitic lavas and tuffs Trcs/si1 Sandstone with interbedded siltstone - Lithofacies Association I CZufc Felsic volcaniclastic rocks Lithofacies Association I Stratigraphic relationship unsure (may be synchronous with parts of Sanford sub-basin) CZufb Felsic volcanic breccia Deep River Basin: Sanford Sub-basin Zupu Porphyritic felsite east of Ulah Conglomerate of the Sanford Foramation ermediate to mafic lavas Trc Cumnock Formation CZuimcl Intermediate to mafic volcaniclastic rocks and lavas Trpc Conglomerate of the Pekin Formation Seagrove Formation (Informal) Pollock et al. (2010) reported a youngest LA-ICP-MS U-Pb zircon age of 545±7 Ma from a sample from the unit near Yow Mill (geochronology data location Y). Recent preliminary LA-ICP-MS U-Pb zircon analyses from two samples MISSISSIPPIAN TO PERMIAN INTRUSIVE ROCKS from the unit in the map area yield the following: for NCGS sample Coleridge-3055 (geochronology data location N), PzZg Granite of the Cane Creek Mountains there is a distinct age distribution that is <600 Ma and all MDAs are between ca. 545 Ma and ca. 549 Ma; for NCGS sample Bear Creek-626 (geochronology data location M), all MDAs are between ca. 551 Ma and ca. 560 Ma (T. LaMaskin, personal communication, 2025). **CAROLINA TERRANE** New and unpublished detrital LA-ICP-MS U-Pb zircon analyses from additional Seagrove formation samples in the ALBEMARLE ARC Chapel Hill 100K include: MDA of 559 Ma for sample COL-8005 (geochronology data location S); MDA of 554 Ma Albemarle Arc Plutons and Dikes for sample COL-472 (geochronology data location Q); and MDA of 523 Ma for sample CH100K-3839 A sample of Stony Mountain Gabbro from Ridges Mountain (geochronology data location EE), west of Asheboro, (geochronology data location X). yielded a 206 Pb/ 238 U date of 544.81 \pm 0.55 Ma and a 207 Pb/ 235 U date of 544.73 \pm 0.95 Ma (DeDecker et al., 2013). Morrison and Coleman (2023) reported a CA-ID-TIMS weighted mean age of 551.86±0.9 Ma (MSWD=3.5) from a Two zircon grains from a felsic dike or tuff (UNC Chapel Hill sample NC-18-02 / NCGS Station Coleridge-458) from sample from an abandoned quarry in the Parks Crossroads pluton (geochronology data location U). the unit (geochronology data location R) yielded crystallization ages of 550.1±2.4 Ma and 550.7±1.3 Ma (R. Mills, Zagb-sm Stony Mountain Gabbro

Additionally, two new and unpublished detrital LA-ICP-MS U-Pb zircon analyses from samples in the Southern Pines Mafic porphyry dikes of the Ramseur area 100K include: MDA of 543 Ma for sample SP100K-550363 and an MDA of 524 Ma for sample SP100K-550946. Seagrove formation epiclastic rocks of the Bear Creek area Seagrove formation felsic volcaniclastic rocks Diorite dikes in the Erect Quadrangle Seagrove formation epiclastic rocks of the Harpers Crossroads area Felsic porphyry dikes of the Ramseur area c-a Altered Seagrove formation epiclastic rocks of the Harpers Crossroads area Dacite dikes in the Erect Quadrangle nar Seagrove formation hydrothermally altered rocks Hunter Mountain dike -em Seagrove formation epiclastics of the Erect member Gabbro to gabbro porphyry dike

Zdi-c Diorite of the Colon Quadrangle Zabsi Andesitic to basaltic shallow intrusive -z Igneous complex of the Zachary Mines area Zdi-porp Diorite porphry of the Goldston Quadrangle Zgr-c Granite of the Colon Quadrangle

Zagd-pm Granodiorite of the Pilot Mountain area Zadigdt-pm Diorite and granodiorite to tonalite of the Pilot Mountain area Morrow Mountain Rhyodacite Suite

Suite of intrusions with a range of ages and textures that are likely magmatically linked (Boorman et al., 2013 and Moye, 2023). Ingle et al. (2003) reported TIMS ²⁰⁷Pb/²⁰⁶Pb ages of 539±5 Ma for the Morrow Mountain rhyodacite in the Charlotte 100K. Bradley et al. (2025) reported LA-ICP-MS ²⁰⁶Pb/²³⁸U weighted means ages for two samples: A sample from the Seagrove area (geochronology data location Z) yielded an age of 536.4±6.1 Ma (MSWD =4.5) and a sample from Caraway Mountain (geochronology data location DD) yielded an age of 542.7±5.3 Ma (MSWD = 0.5). New and unpublished LA-ICP-MS ²⁰⁶Pb/²³⁸U weighted mean ages from the suite includes: 548.8±2.8 Ma (MSWD = 1.4) for a sample collected part of the part of th (MSWD = 0.44) for a sample collected from the Robbins area (Southern Pines 100K); and 553.2±2.5 Ma (MSWD = 1.6) for a sample collected near the landfill in the Troy area (Southern Pines 100K). Two samples were analyzed from the eastern portion of the Charlotte 100K in the vicinity of Dennis Mountain in the Uwharries. LA-ICP-MS ²⁰⁶Pb, J weighted mean ages from the samples yielded: 539.4±1.8 Ma (MSWD = 1.6)(sample CLT100k_BoormanE7_CGS6) and 546.0±3.1 Ma (MSWD = 1.6)(sample CLT100k_BoormanE9_CGS7). CZmmr-ps Porphyritic felsite near Seagrove

ALBEMARLE GROUP Layered and Stratified Rocks

Ccmc Mafic volcaniclastic rocks and subordinate mudstone

CZtfc Felsic volcaniclastic rocks

Mafic volcaniclastic rocks

CZmmr-psa Altered porphyritic felsite near Seagrove

Zagd-p Granodiorite of the Parks Crossroads pluton

Zdi-pcr Diorite of the Providence Church Road area

(see pamphlet for detailed table)

A detrital zircon age

U-Pb zircon crystallization age

Pollock et al. (2010) reported a youngest LA-ICP-MS U-Pb zircon age of 539±12 Ma for the Cid Formation from a sample from the Salisbury 100K. Ccv1 Cid Formation volcanics and epiclastic rocks of northwestern Randolph County Ccv2 Cid Formation volcanics and epiclastic rocks of High Point Lake area

Pollock et al. (2010) reported a youngest LA-ICP-MS U-Pb zircon age of 541±9 Ma for the Tillery Formation from a sample from the Charlotte 100K.

CZtm Laminated to thin-bedded graded mudstone Intermediate to mafic volcanics CZtpm Pebbly mudstone and mudstone conglomerat

CZtfm Felsite, felsic volcaniclastic rocks and interbedded, laminated- to thin-bedded mudstone

Zqmd-sc Quartz monzodiorite in the Snow Camp area Zqmd-mf Quartz monzodiorite in the Meadow Flats area Zdi-porphy Diorite porphyry of the Silk Hope Quadrangle Zdi-gb Diorite to gabbro Zgr-ch Granite of the Chapel Hill pluton Zgd-leuco Fine-grained luecocratic granodiorite Zdi-fine Fine-grained diorite

Hyco Formation - upper portion Wortman et al. (2000) reported a TIMS ²⁰⁷Pb/²⁰⁶Pb age of 615.7+3.7/-1.9 Ma (MSWD = 0.44) from a metamorphosed tuff from unit Zhdlt (u) in the Henderson 100K. Bowman (2010) reported a CA-TIMS ²⁰⁷Pb/²⁰⁶Pb ages of 616.5±1.2 Ma (MSWD = 0.027) from unit Zhf in the southern portion of the South Boston 100K. Bradley and Miller (2011) reported a CA-TIMS ²⁰⁷Pb/²⁰⁶Pb age of 613±1 Ma from a felsic tuff in Orange County in the Greensboro 100K. Hydrothermally altered units (Hyco) Zhat (u) Altered tuffs of the upper portion of the Hyco Formation

Zhat-f Altered tuffs within the Farrington Pluton Zhat (I) Altered tuffs of the lower portion of the Hyco Formation Zhhar Hydrothermally altered rocks Zhhar-sg Silica granofels hydrothermally altered rock Zhhar-qsp Quartz-sericite-pyrite schist Zhhar-ag Advanced argillic hydrothermally altered rock

Zhat/vcs Altered tuffs and volcaniclastic sedimentary rocks

Zhat Altered tuffs

Zq Quartz body Volcanoclastic - sedimentary units Zhel Epiclastic rocks and lavas Zhe Epiclastics Zhp/e Mixed pyroclastic-epiclastics

Zhe/p Mixed epiclastic-pyroclastic rocks Zhe/p-n Mixed epiclastic-pyroclastic rocks of Neville Creek area Zhe-m1 Morgan Creek epiclastics 1 Zhft Felsic tuffs

Zhollt-absi Dacitic lavas and tuffs of the Hyco Formation infested by andesitic to basaltic dikes Zhe/pl Mixed epiclastic-pyroclastic rocks with interlayered dacitic lavas Zhe/plim Mixed epiclastic-pyroclastic rocks with interlayered intermediate to basaltic lavas Zhqdp Quartz dacite porphyry

Zhdasi
Dacitic to andesitic shallow intrusive Zhdlt (u) Dacitic lavas and tuffs of the upper portion of the Hyco Formation Zhfit-bw Felsic to intermediate tuffs of the Big Woods area Zhe/pl-c Conglomerate dominated mixed epiclastic-pyroclastic rocks

dlt-Q Quartz dacite lavas and tuffs

Zhdsi (u) Dacitic shallow intrusive of the upper portion of the Hyco Formation Zhime/pl Mixed intermediate to mafic epiclastic-pyroclastic rocks with interlayered intermediate to mafic lavas Andesitic to basaltic lavas and tuffs of the Dry Creek area Andesitic to basaltic lavas with interlayered epiclastic rocks

Zhadlt (u): Andesitic to dacitic lavas and tuffs of the upper portion of the Hyco Formation Andesitic to basaltic lavas

Andesitic to basaltic lavas and conglomerate Andesitic to basaltic lavas and tuffs Andesite to basalt porphyry of the Dry Creek area Andesitic to basaltic shallow intrusive of the Hyco Formation

Hyco Formation - lower portion Wortman et al. (2000) reported TIMS ²⁰⁷Pb/²⁰⁶Pb ages of 633+2.0/-1.5 Ma (MSWD = 0.57) and 632.9+2.6/-1.9 Ma (MSWD = 0.87) from a granite (geochronology data location C) and flow banded rhyolite (dacite)(geochronology data location F), respectively, associated with the Hyco Formation in the Chapel Hill 100K. Bradley and Miller (2011) reported a CA-TIMS ²⁰⁷Pb/ ^{.06}Pb ages of 630±1 Ma and 628.5±1 Ma from a dacitic tuff (geochronology data location D) and dacite (geochronology data location G), respectively, from southern Orange County in the Chapel Hill 100K. Zhdsi (I) Dacitic shallow intrusive of the lower portion of the Hyco Formation

Zhdlt (I) Dacitic lavas and tuffs of the lower portion of the Hyco Formation Zhft (I) Felsic tuffs Zhft-b (I) Felsic tuffs of the Blackwood area

EASTERNMOST CAROLINA TERRANE

A sample from Big Lake-Raven Rock schist (CZbr1) in the Raleigh 100K sheet contains discordant zircon fractions that yield FIMS 207 Pb/ 206 Pb crystallization ages of ca. $\dot{5}$ 79-57 $\dot{3}$ Ma and an upper intercept age of 575±12 Ma (Goldberg, 1994). Plutonic Rocks Buckhorn Dam Meta-intrusive Suite CZbg Meta-granitoid rocks of the Buckhorn Dam intrusive suite

Layered and Stratified Rocks Cary Metamorphic Suite CZbr3 Big Lake-Raven Rock schist 3 CHARLOTTE TERRANE

Plutonic Rocks Zgd-CHT Granodiorite (intrusive into the Charlotte terrane) Xenoliths of basalt, diorite and altered rocks of the Charlotte terrane



