

- Sedimentary Units**
- Qal** - alluvium: Tan to light gray, unconsolidated, poorly sorted and stratified deposits of angular to subrounded gravel, sand, silt, and clay in stream drainages. Similar to point bars, terraces, and natural levees along larger creek floodplains. The Tar River drainage contains many boulder-sized clasts of underlying crystalline rocks.
 - Trg** - Tertiary upland gravel (Pliocene?): Local surficial unit as patches at high elevations north of Stem. Primarily unconsolidated, subangular to subrounded ironstone and quartz pebble to cobble gravels in hematitic- and limonite-rich sandy soil.
 - Trsi** - siltstone and minor pebbly sandstone: Red-brown, fine-grained, thinly bedded siltstone that locally contains interbeds of pebbly sandstone. Pebbles range from granitoid clasts to milky quartz in composition. Commonly overlain by diabase sills that locally produce a deep maroon-brown coloration and well-indurated outcrops suggestive of baking due to contact metamorphism.
 - Trps** - pebbly sandstone: Whitish-yellow and pink-brown to reddish-brown, coarse- to very coarse-grained pebbly arkosic sandstone to medium- to fine-grained arenaceous sandstone. Individual pink K-feldspar clasts common in arkose along with subrounded to rounded blue-gray quartz pebbles and grains. Typically displays a white clay/silt cement. Locally contains cross-beds and horizons of polymeric conglomerate that include epidote, greenstone, and metagranitoid clasts up to 15 cm.
 - Trps/si** - pebbly sandstone and siltstone undifferentiated: Interlayered whitish-yellow and pink-brown to reddish-brown, coarse-grained pebbly arkosic sandstone to medium- to fine-grained sandstone and red-brown, fine-grained, thinly bedded siltstone that locally contain interbeds of pebbly sandstone and polymeric conglomerate.
 - Trundiff** - Triassic sediments undifferentiated: Undifferentiated Triassic sediments from Gottfried, et al., 1991.
- Fault Zone Unit**
- PCac** - silicified cataclasis: Silicified and highly fractured zones containing mm- to cm-scale silicified angular clasts. Extensional veins of rhombohedral quartz prisms and epidote common. Silicified and epidotized clasts of metamorphosed diorite, tonalite, or granodiorite may be locally preserved. In some areas, silicification and epidotization is so extensive that protolith relationships are obscured. Considered to be Mesozoic or Cenozoic in age, but may also include Paleozoic effects.
- Intrusive Units**
- Jd** - Diabase: Dark green-black to gray-blue-black, melanocratic, plagioclase and augite phryic diabase that may be olivine bearing. Locally becomes gabbroic, especially where large sills intrude Late Triassic sedimentary rocks. Commonly forms massive stream outcrops and waterfalls in soil outcrops above the sedimentary rocks and along dikes that inject the crystalline rocks. Otherwise, weathers to tan-gray, spheroidally rounded, dense boulders and cobbles or punky cobbles and pebbles that can be traced along strike when outcrop is absent. Solid lines where observed as dikes and sills greater than 3 m thick, dotted lines where inferred from aeromagnetic data. Red station locations indicate isolated outcrops or boulder fields of diabase.
 - Jd-recon** - Jurassic diabase reconnaissance: Jurassic diabase from reconnaissance and geophysical data as depicted in Gottfried, et al., (1991).
- Carolina Terrane**
- Metaintrusive Units**
- CZrg** - trondhjemite and granodiorite: Leucocratic (C1 less than 5), light pink-tan to tan-gray white, medium to fine grained meta-morphosed trondhjemite and granodiorite containing conspicuous white plagioclase, blue-gray quartz, and locally K-feldspar in a phanitic, hypidiomorphic granular texture. Locally contains K-feldspar. May occur as domains of small chips and cobbles in a soil having an orange-brown coloration, especially along the crystalline-sedimentary rock contact between the Carolina terrane and the Deep River rift basin. Some chips carry white mica while others are highly epidotized and in part silicified suggesting a local ductile-brittle deformation overprint. In other areas, forms cm-scale dikes that crosscut coarse-grained tonalite and granodiorite.
 - CZtg** - stem tonalite and granodiorite pluton: Leucocratic (C1 less than 10), light tan-gray white, bluish-gray white, or pinkish-white, medium-grained to coarse-grained, hypidiomorphic granular metamorphosed tonalite and granodiorite that locally contain porphyritic 2-4 mm blue quartz phenocrysts. Less commonly contain porphyritic pink K-feldspar and plagioclase phenocrysts adjacent to I-85, which occur in late Triassic aureole. Chlorite after biotite or hornblende forms an accessory mineral. Crosscut by mm- to cm-scale metamorphosed trondhjemite, monzonite, and granodiorite dikes. Aggregates of white mica, quartz, plagioclase, and orthoclase highlight steeply dipping foliation and dip-parallel lineation domains inferred to be highly fractured and/or phyltonic and protomylonitic high strain zones (CZfs). Cm- to m-scale enclaves of greenstone, either very fine-grained diorite or andesite, are conspicuous throughout the pluton.
 - CZda** - hornblende-bearing biotite tonalite: Leucocratic to mesocratic (C1-15-30), intermediate light green to gray-green, to dark gray-green-black, medium-grained, metamorphosed hypidiomorphic granular biotite or hornblende tonalite and minor granodiorite. Commonly forms hillside boulder outcrops and stream waterfalls, as well as massive bluff outcrops along the Tar River. Sausuritized and sericitized plagioclase and chloritized hornblende are common, and minor amounts of quartz may be present, locally producing quartz diorite. Porphyritic hornblende phenocrysts occur in some coarser-grained facies, other regions richer in plagioclase have a 'spotted' appearance. Cm- to m-scale enclaves of greenstone, either very fine-grained diorite or andesite, are conspicuous throughout the pluton. May be the southwest equivalent of diorite and quartz diorite in the Oxford 7.5-minute quadrangle.
 - CZps** - diorite: Mesocratic (C1-50), intermediate dark gray and green-black-white, coarse- to medium-grained metamorphosed hypidiomorphic granular diorite. Crosscut by mm- to cm-scale metamorphosed trondhjemite, monzonite, and granodiorite dikes. Commonly forms hillside boulder outcrops and stream waterfalls, as well as massive bluff outcrops along the Tar River. Sausuritized and sericitized plagioclase and chloritized hornblende are common, and minor amounts of quartz may be present, locally producing quartz diorite. Porphyritic hornblende phenocrysts occur in some coarser-grained facies, other regions richer in plagioclase have a 'spotted' appearance. Cm- to m-scale enclaves of greenstone, either very fine-grained diorite or andesite, are conspicuous throughout the pluton. May be the southwest equivalent of diorite and quartz diorite in the Oxford 7.5-minute quadrangle.
 - CZpsd** - gabbro and diorite: Dark gray to green-black, fine- to coarse-grained, metamorphosed hornblende, gabbro, with subordinate diorite. Includes minor fine-grained meta-trondhjemite dikes. Accessory pyrite locally present. Metadiorite locally contains accessory to minor amounts of quartz. Accessory magnetite associated with chloritized hornblende is common, and sericite and epidote group minerals commonly replace plagioclase (albite to anorthite). Proliferous hornblende phenocrysts with plagioclase inclusions locally present in coarser-grained varieties. Generally non-foliated, but weakly foliated varieties occur. Cm- to m-scale enclaves of greenstone, either very fine-grained diorite or andesite, are conspicuous throughout the pluton. (Lithologically similar to CZic mapped by Blake east of the Fishing Creek fault).
- Metavolcanic Units**
- Zdlit** - altered dacite lavas and tuffs: Leucocratic (C1 less than 5), tan to buff to white, locally red-brown to yellow, altered dacite lavas and tuffs. Intense hydrothermal alteration and elemental leaching produce domains of sericite-quartz phyllite, sericite-quartz rock, quartz-pyrophyllite (± andalusite) rock, and massive pyrophyllite having radiating crystal habit, especially on the top, and north and south flanks of Bowlings Mountain (Tallho) where pyrophyllite was mined. Punky rocks having hematite and limonite coatings and stains, and limonite replacement of sulfide minerals, likely pyrite, are also common. Relict lath-like and kaolinitized feldspar crystal shards are visible in some exposures distal to Bowlings Mountain. All relict structures are obliterated in highly altered rocks, especially in domains where primarily fine grained druse to sugary quartz and more minor feldspar and white mica form due to intense silicification. Some silicified domains are mixed with sericite-quartz phyllite, giving some local outcrops a highly foliated structure (Zdfld). Unit equivalent to unit h in McConnell and Glover (1982).
 - Zdsi** - dacite lavas and tuffs: Leucocratic (C1 less than 5), dark gray to gray-black, siliceous, microcrystalline lava and porphyritic lava containing white plagioclase and gray quartz phenocrysts up to 4 mm in diameter. Weathers to a tan-white color. Locally inter-layered with dark gray to black, non-welded lithic lapilli tuff. Clast types include gray-black microcrystalline lava and porphyritic plagioclase lava. Weathers to a tan-white color. Differentiation between lavas and massive tuffs is difficult in hand sample in many locations. Aggregates of white mica, quartz, and plagioclase highlight steeply east-dipping foliation and dip-parallel lineation domains inferred to be highly fractured and/or phyltonic high strain zones (CZfdh). Lavas are interpreted to be extrusive or hypabyssal intrusions associated with dacite domes. Tuff interlayers are either pyroclastic ash flow or air fall deposits generated during dacite dome eruption.
 - CZda** - fine-grained diorite and andesite: Melanocratic to mesocratic (C1 greater than 50), variably light green, gray-green, and dark black-green, fine- to medium-grained metamorphosed diorite or andesite. Crops out as enclaves in all metamorphic units. Chlorite, epidote, albite, white mica, and minor biotite form a crystalloblastic matrix that locally contains relict porphyritic plagioclase and porphyroblastic actinolite, either as a pseudomorph of hornblende and/or pyroxene. Where foliated, forms chlorite white mica phyltonic or schist. Highly fractured outcrops have triclinic fracture symmetry, forming subvertical brecciated/cataclastic clasts. Some are highly silicified and epidotized.
 - CZfg** - fragmental/elastic greenstone: Melanocratic (C1 greater than 65), dark gray-green to black-green, fine- to medium-grained, greenstone of uncertain origin. Forms two prominent enclaves exposed as resistant, creek- and hillside exposures in metamorphosed diorite. Contains sub-angular to sub-rounded, variably mm- to cm-sized fragments or clasts of felsic metaplutonic and mafic to intermediate metavolcanic and metaplutonic protoliths. Possibly volcanic vent, lahar, or epiclastic/volcaniclastic derived.

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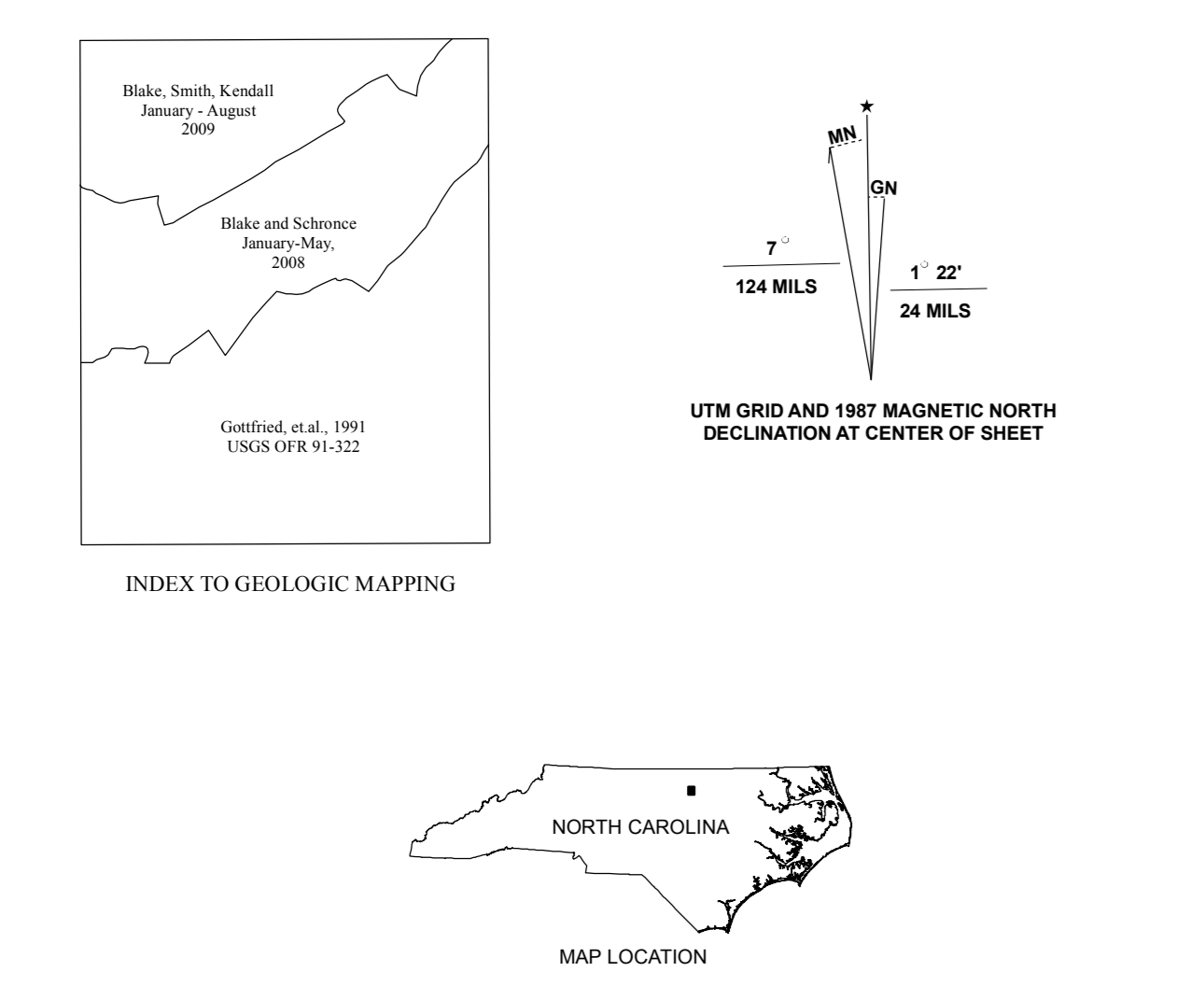
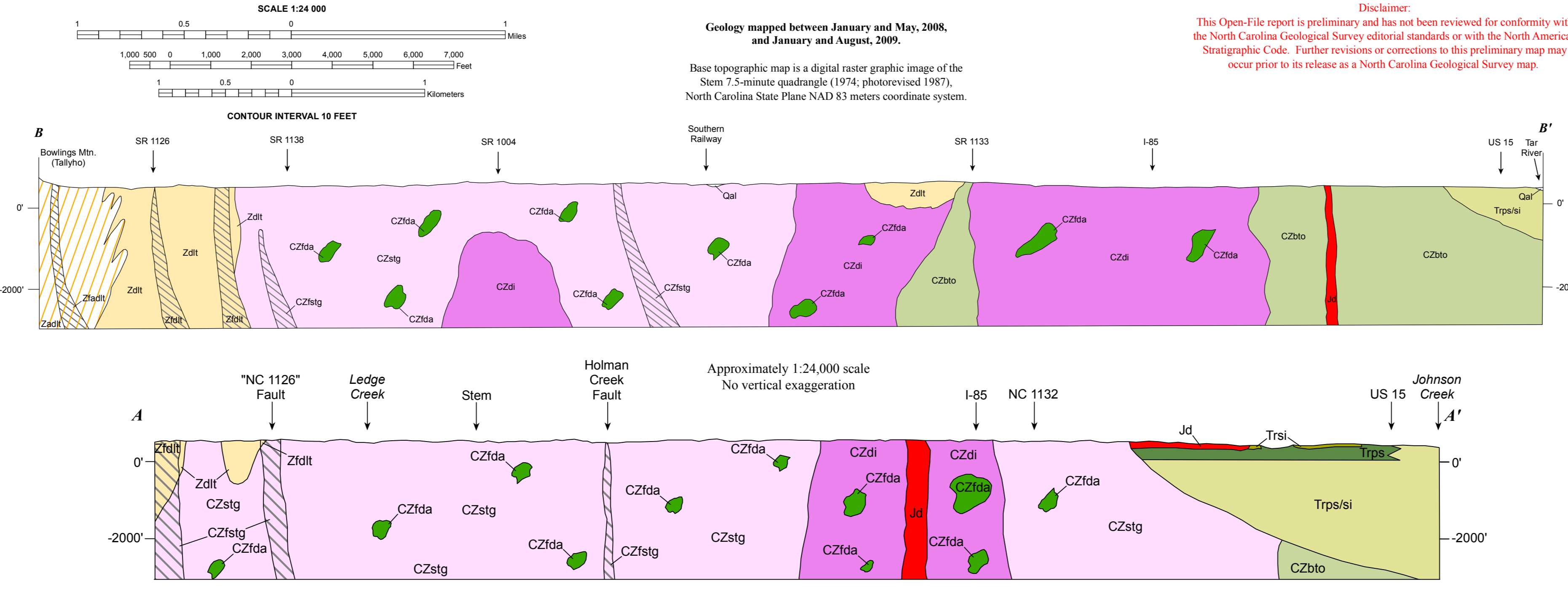
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- EXPLANATION OF MAPSYMBOLS**
- CONTACTS**
- Liithologic contacts - distribution and concentration of station locations and structural symbols indicates degree of relationship.
 - observation station location
 - geologic contact
 - - - - - inferred geologic contact
 - · · · · concealed geologic contact
 - - - - - diabase geologic contact
 - - - - - diabase reconnaissance geologic contact
 - diabase station location
- PLANAR FEATURES**
- Observation sites are centered on the strike bar or are at the intersection point of multiple symbols.
 - Planar feature symbols may be combined with linear features.
 - 28° strike and dip of bedding
 - 65° strike and dip of S₁ high strain foliation
 - 32° strike and dip of compositional layering
 - ✓ strike and dip of vertical S₂ high strain foliation
 - 63° strike and dip of envelope foliation
 - 75° strike and dip of fracture surface
 - ✓ vertical strike of fracture surface
- LINEAR FEATURES**
- 65° bearing and plunge of mineral lineation
 - ✓ horizontal mineral lineation
 - 65° bearing and plunge of stretching lineation
 - ✓ horizontal stretching lineation
- MINERAL RESOURCES AND OTHER FEATURES**
- 1 Abandoned pyrophyllite workings of Bowlings Mountain mine (Stuckey, 1967; Saxner, 1983)
 - 2 Abandoned pyrophyllite workings of Bowlings Mountain mine (Stuckey, 1967; Saxner, 1983)
 - 3 Abandoned crushed stone quarry



GEOLOGIC MAP OF THE STEM 7.5-MINUTE QUADRANGLE, GRANVILLE COUNTY, NORTH CAROLINA

By David E. Blake, Adam G. Schronce, Brett C. Smith and Jacob M. Kendall

Digital representation by Michael A. Medina



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