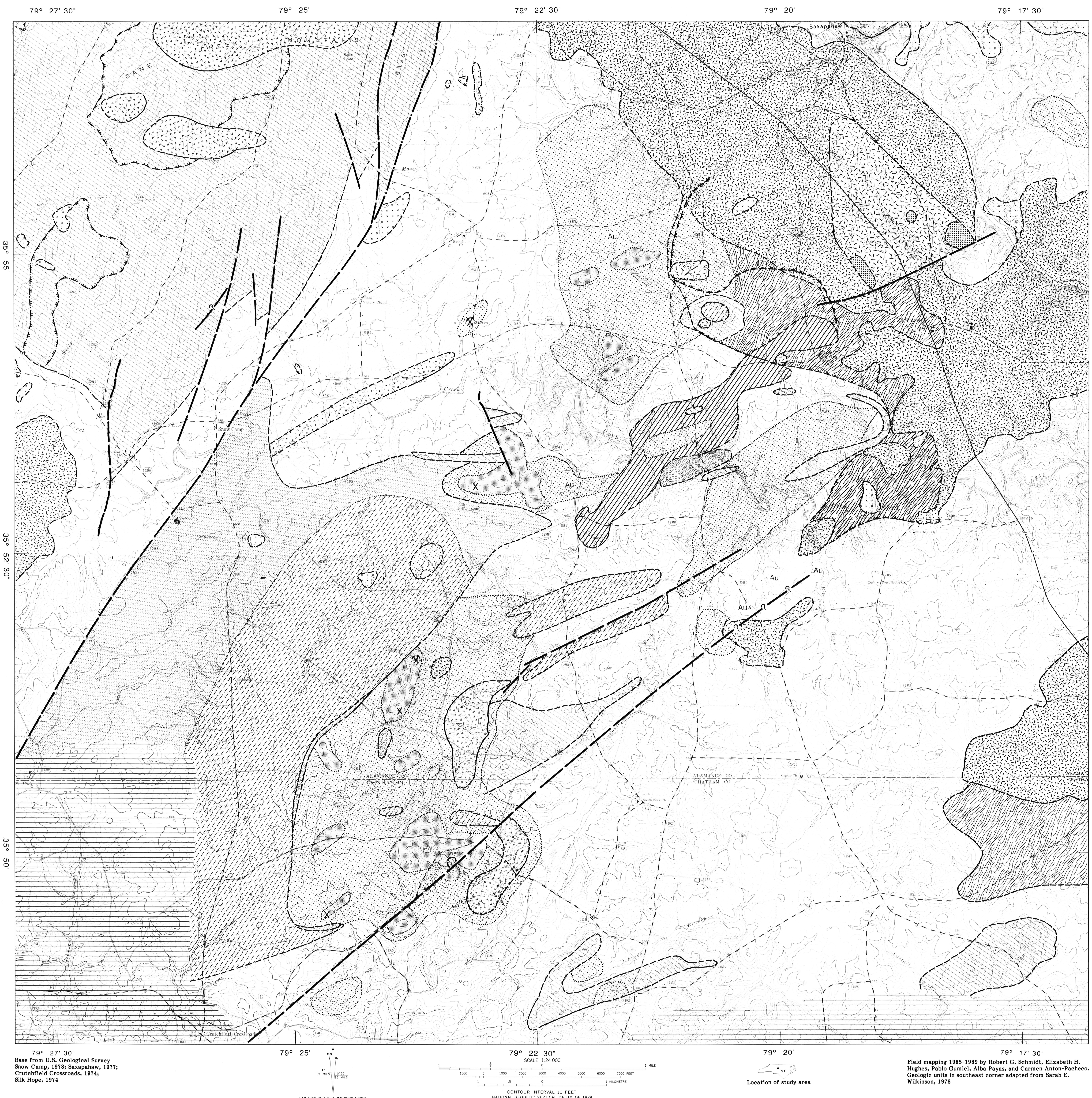
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



Base from U.S. Geological Survey Snow Camp, 1978; Saxapahaw, 1977; Crutchfield Crossroads, 1974; Silk Hope, 1974

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Location of study area

Field mapping 1985-1989 by Robert G. Schmidt, Elizabeth H. Hughes, Pablo Gumiel, Alba Payas, and Carmen Anton-Pacheco. Geologic units in southeast corner adapted from Sarah E. Wilkinson, 1978

PROVISIONAL GEOLOGY OF THE SNOW CAMP-SAXAPAHAW AREA

The Snow Camp-Saxapahaw area is located within the Carolina slate belt, 20 km south of Burlington and 30 km west of Chapel Hill, in Alamance and Chatham Counties, North Carolina. The 268 square km area is underlain by volcanic and volcaniclastic rocks of a wide variety of textures and compositions from basaltic to rhyolitic. These are intruded by many plutons and small stocks of shallow intrusive rocks, also of diverse compositions, from gabbroic to granitic, many of which have associated strong hydrothermal alteration. Mineral potential of the area includes high-grade pyrophyllite, which has been quarried, and gold worked in various prospects and small-scale mines.

The area is one of locally abundant outcrops, though for the most part outcrops are widely scattered, and in some of the area they are rare. Mapping was carried out by standard field methods supplemented by use of Landsat color composite images and digitally classified images, side-looking radar images, published soils maps, and observation of natural forest vegetation. Following brief reconnaissance visits to the area in 1980-1984, mapping was carried out in 1984-1989. An earlier version of a geologic map for part of the area was released in open file by Hughes (1987), and her field observations and laboratory studies have been adapted and incorporated in this report.

Volcanic and volcaniclastic rocks--. Perhaps 4/5 of the area is underlain by volcanic and volcaniclastic rocks. We have subdivided these wherever possible but separation of most of them into mappable units is generally very difficult because outcrops are so irregular in distribution and the volcanic units tend to be thin and lenticular, hence discontinuous along strike.

The volcanic and volcaniclastic rocks have been provisionally divided into a complex of mixed basaltic to rhyolitic units within which only a few units could be mapped separately, and a younger crystal-rich rhyodacite and dacite unit that rests unconformably upon it. Within the older complex, a flow-banded siliceous rhyodacite-rhyolite unit makes up most of the bedrock in the highland area called the Cane Creek Mountains, and similar rock is present in other mappable patches, as well as in many small seemingly discontinuous interbeds which could not be mapped separately. One elongate area of probably andesitic bedrock near the center of the map is indicated by Tirzah and Efland soil types although no outcrop has been so far located.

The crystal-rich rhyodacitic and dacitic tuff present in the southwestern and central parts of the map is relatively well-exposed. It seems surprisingly uniform in texture and composition throughout, except for a thin cobble-rich layer present locally at the base. The cobbles are mostly rounded volcanic rocks of diverse types, up to 10 cm in diameter. The rest of the unit consists of abundant matrix-supported plagioclase and lesser quartz crystals in a very fine matrix. Dark fine-grained lithic clasts, mostly under 1 cm, but rarely several cm across, are essentially ubiquitous in the rest of the unit, some angular and some rounded. This unit hosts distinctly fewer subvolcanic bodies and probably no plutonic bodies, perhaps suggesting a younger age for it. Quartz-sericite alteration is found throughout the crystal-rich tuff, and we have tried to separately map the area of strongest alteration in the western and northern part of the unit, where the plagioclase has been strongly sericitized and the rock is also generally sheared.

Intrusive rocks--. Plutonic and subvolcanic rocks of several ages are very common in parts of the Snow Camp-Saxapahaw area, as they are in many places in the Carolina slate belt. In general the older andesitic/dacitic volcanic rocks have been invaded by many intrusive rocks; the rocks of the Cane Creek Mountain caldera complex by only the central granophyric plutons, a few felsic porphyry dikes, and perhaps small mafic stocks indicated only by soil type; and the younger crystal-rich tuff unit by only small mafic stocks suggested by soil type. The post-metamorphic quartz diorite-tonalite plutons are clearly youngest of all except for unmapped mafic dikes of Mesozoic age. The abundance of subvolcanic masses in the slate belt has been generally underestimated, no doubt partly because small porphyritic bodies may not be very different in appearance from porphyritic flows and crystal tuffs.

Metamorphism--. All of the volcanic rocks and perhaps 3/4 of the intrusive rocks in the area have undergone regional metamorphism, mostly to mid-greenschist facies. The main metamorphic minerals present generally include quartz, sodic plagioclase, epidote, muscovite, biotite and chlorite. Local development of new actinolite or hornblende indicates that higher temperatures were probably reached at some sites. Local zones of hydrothermally-formed propylitic alteration are difficult to differentiate in the limited outcrops. The youngest plutonic and subvolcanic granitoid intrusives are considered to be essentially unmetamorphosed although an overprint of hydrothermal alteration makes this hard to recognize at all places.

Structural geology--. The structural geology is the least understood aspect of the areal geology here. Open to tight folding is assumed in all of the Snow Camp-Saxapahaw area, but recognizable layering is so rare that it is not mappable. Straight northeast-trending linear features, especially stream courses, suggest faults and shear zones, and most of those checked in the field were found to be zones of sheared or brecciated rocks. A few north- and northwest-trending faults are suggested by offset alteration zones and rock units, but none of these could be specifically identified in the field.

The complexity of interpretation of cleavage and joint directions in the area has made it impractical to include such interpretations in this provisional map. Common cleavages strike N. 70-85 E. and dip steeply or vertically; another group strikes N. 30-50 E. and also dips steeply NW to vertical.

Hydrothermal alteration--. The Snow Camp-Saxapahaw alteration systems are very large and together make up a northeast-trending zone about 13 km long and up to nearly 4 km wide. They share many characteristics with over 40 similar areas in the Carolina slate belt (Schmidt, 1985; Schmidt and Klein, 1985).

The most intensely altered parts of the systems, presumably innermost as the systems were formed, consist of large volumes of almost-pure fine-grained quartz rock. Near their edges are several lesser but in some cases significantly large masses of pyrophyllite-quartz including various amounts of pyrite and andalusite. These irregularly-shaped quartz-rich and associated pyrophyllite-rich rock masses are now mostly surrounded by extensive envelopes of quartz-sericite altered volcanic and subvolcanic rocks. Primary rock textures are mostly retained in the quartz-sericite altered rocks but are almost totally destroyed in much of the quartz-rich and pyrophyllite-rich rock.

Greisen-like rocks and associated Mo--. A group of highly altered rocks that lack fluorine or boron minerals but otherwise resemble classical greisens has been observed as float boulders and cobbles at three localities within the areas where post-metamorphic tonalite and quartz-diorite are present. No outcrop has been located. The greisen-like rock is of simple mineral composition, being made up of muscovite-quartz, ±epidote, ±sulfides. The proportion of quartz ranges 1/3 - 3/4. Most of the rock examined is partly or thoroughly oxidized so the original sulfides have not been observed. Molybdenite is assumed to have been a common accessory from the presence of Mo-rich ochres. Analysed samples of rock contained up to 850 ppm Mo, and 43 ppm Sn. No gold was detected above a threshold of 0.01 ppm. A trace of chalcopyrite is indicated by as much as 110 ppm Cu in one of the greisen-like rocks analysed. Residual bits of pyrite remain in some of the samples.

Metallic mineralization--. Presently recognized gold and silver mineralizations are limited to areas of strong quartz-sericite or propylitic alteration and to some narrow zones along northeast-trending shears, also generally accompanied by quartz-sericite alteration. Large areas of very strongly altered rock lack even small traces of mineralization so that identification of factors controlling ore depositon are particularly important here. The distriburion of significant old prospects and gold detected in quantity in panning were reported by D'Agostino and Schmidt (1985) and Schmidt and others (1987). Studies to identify the best geochemical indicator elements in the area are still underway.

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EXPLANATION

VOLCANIC ROCKS

Ca, Cb, Cc — Crystal-rich rhyodacite and dacite with common small lithic inclusions; texture and composition uniform over wide area. Consists of abundant matrix-supported plagioclase and lesser quartz crystals in a very fine-grained matrix. Small dark fine-grained lithic clasts generally present
Ca: Slight to moderate quartz-sericite alteration
Cb: Strong quartz-sericite alteration, in part strongly sheared
Cc: Clast-rich debris flow or volcanic conglomerate interpreted to be present locally at base of unit. Contains diverse rounded volcanic rock cobbles up to 10 cm. Probably does not include debris flow unit mapped east of Snow Camp community

Aa, Ab, Ac, Ad — Aa: Mostly undivided older volcanic complex of mixed basaltic to rhyolitic volcanic rocks, in part fragment-rich; includes a few flows. Fragmental rocks locally include clasts up to 40 cm long
In part subdivided as follows:
Ab: Few or no outcrops observed but andesitic or basaltic bedrock indicated by Tirzah- and Efland-type soils
Ac: Distinctive lenses of siliceous rhyodacite or rhyolite, locally flow-banded and locally porphyritic. Interpreted to thicken in the northwest corner of area where they form the main bedrock. Considered the equivalent of the "Big Branch-2 unit" mapped in the southeastern part of the area by Wilkinson (1978).
Ad: Debris flow unit east of Snow Camp community comprising several thin interbeds of conglomerate and flow breccia separated by layers of dacite and andesitic tuff

INTRUSIVE ROCKS

Tonalite and quartz-diorite, little metamorphosed; includes many pendants and screens of metamorphosed quartz-diorite and tonalite, and masses of contact-metamorphosed volcanic rock. Porphyritic in small isolated apophyses. Strong quartz-sericite and potassic alteration

Partially-mapped limit of dacite, tonalite, and quartz-diorite porphyry apophyses in adjacent units; little metamorphosed. Local quartz-sericite and potassic alteration

Regional Metamorphism

Quartz-diorite-hornfels-volcanic rock injection complexes. Intrusive component may equal or exceed volcanic-rock derived hornfels

Hornblende granodiorite, quartz-monzonite, and monzodiorite, medium grained, common graphic or myrmekitic textures, widely contaminated by assimilition of andesitic wallrocks; mafic mineral content may be as much as 40%. Potash feldspar, when present, is generally the result of hydrothermal alteration. Limits of areas where this rock occurs cannot be inferred from soils types

Granite, quartz-monzonite, quartz-diorite and tonalite, older than last regional metamorphism. Generally medium grained, hypidiomorphic granular to porphryritic, generally silicified. Close control of many outlines inferred from extent of Appling, Cecil and Helena soils, with which the bedrock appears to correlate well

Limit of small porphyritic apophyses of metamorphosed quartz-diorite and tonalite. Shown only in northeast part of map where outcrop information is adequate

Fine-grained granophyric granite and quartz-monzonite. Not reliably outlined by soils type; similar soils form on adjacent silicic hornfels

Small bodies of gabbro, porphyritic gabbro and hornblende gneiss, with generally sparse outcrops. There is field evidence of marginal chilling and wallrock assimilation. Cuneform quartz and myrmekite are present; metamorphic hornblende is common. Also includes several areas inferred from similar Davidson, Iredell, and Mecklenburg-type soils

HYDROTHERMALLY ALTERED AND CONTACT METAMORPHOSED ROCKS

Quartz-sericite-pyrite and quartz-pyrite rocks; also includes potassic and epidote-rich altered rocks within and near plutons. Narrow contact-metamorphosed zone east of two plutons of of hornblende granodiorite near South Fork is probably recrystallized without significant chemical change

Intensely altered and very siliceous quartz-granofels central cores and associated pods of pyrophyllite-andalusite-pyrite rock

Areas where greisen-like quartz-epidote-muscovite rock is common in surface float

Limit of contact aureole in felsic volcanic rocks as indicated by mostly Appling-type soils

Area not mapped at this scale

Symbols

Geologic contact, position closely controlled by adjacent outcrops

Inferred contact, outcrop control poor or position inferred from topography. Queried where very speculative

Inferred contact, position adjusted to conform to mapped soils boundaries

Fault, position inferred from topographic features, juxtaposition of rock types, observed sheared zones, and lineaments noted on Landsat and side-looking radar images. Queried where very speculative

Inferred fault, position adjusted to conform to mapped soils boundaries

Boundary of zone of hydrothermal alteration, generally very gradational

Au — Small former gold mine or prospect

⚒ — Former pyrophyllite or pyrophyllite-sericite mine

X — Small former pyrophyllite mine or prospect

PROVISIONAL GEOLOGIC MAP OF THE SNOW CAMP-SAXAPAHAW AREA, NORTH CAROLINA

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