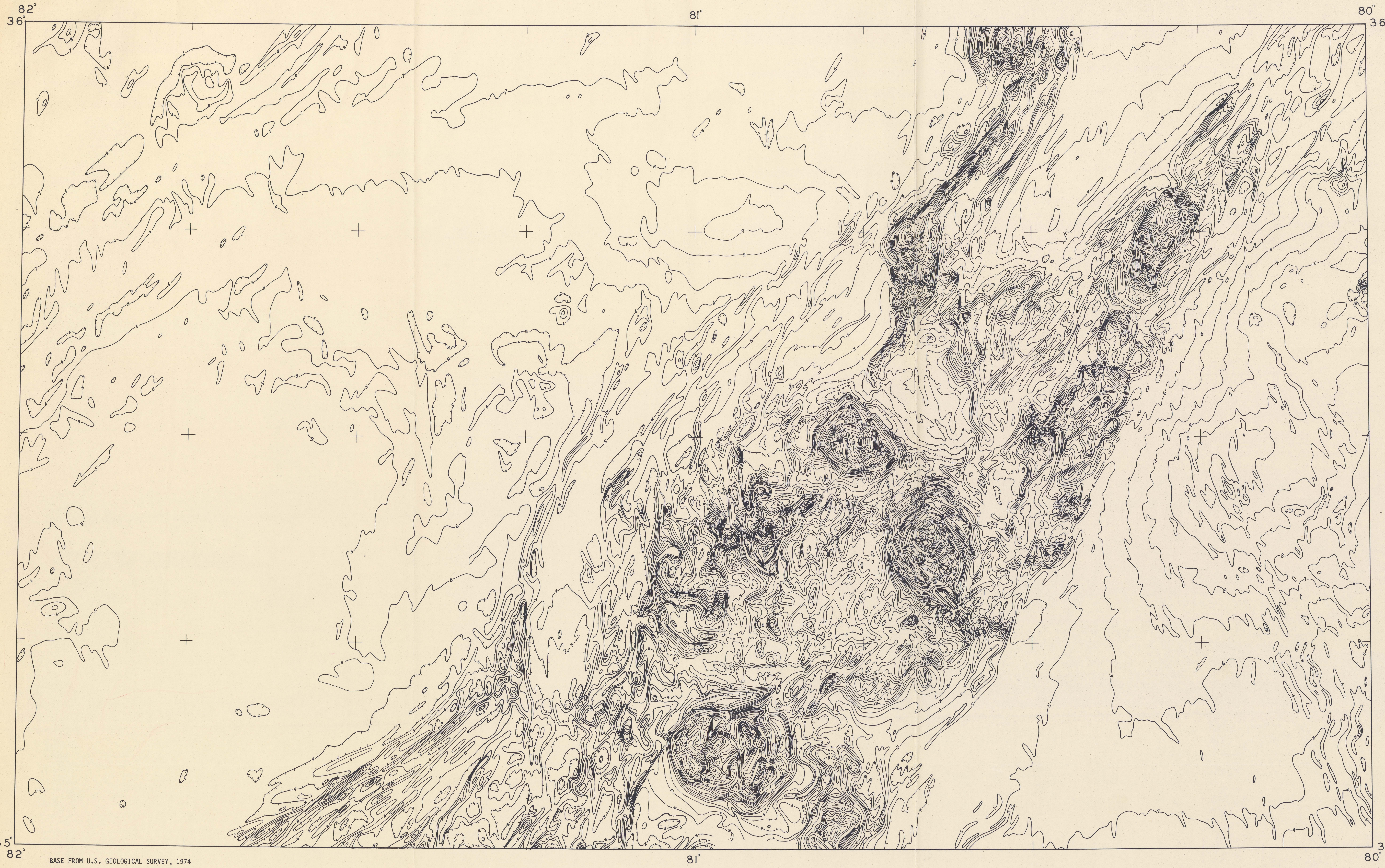
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT 80-229
DANIELS AND ZIETZ—PRELIMINARY AEROMAGNETIC MAP,
CHARLOTTE 1×2 DEGREE QUAD., NORTH CAROLINA,
SOUTH CAROLINA



BASE FROM U.S. GEOLOGICAL SURVEY, 1974

INTRODUCTION

The aeromagnetic map of the Charlotte 1 x 2 degree quadrangle was assembled from 6 individual detailed aeromagnetic surveys flown between 1956 and 1976 (see index map). The International Geomagnetic Reference Field had been subtracted from the data prior to assembly. An arbitrary common datum was selected and the surveys were recontoured at the joins. The 100 gamma contour interval was selected because it shows the magnetic contrast between areas to best advantage. To complement the magnetic data a gravity survey was conducted by the U.S. Geological Survey and this data is available in a companion map (Wilson and Daniels, in press). Each of these maps has been interpreted in relation to the other and to the geologic map prepared as part of the same program (Goldsmith and others, 1978). It should be noted that the geophysics has had a measureable influence on some of the geologic mapping.

CORRELATION OF AEROMAGNETIC DATA AND GEOLOGY

The Charlotte quadrangle spans 5 geologic belts (Goldsmith and others, 1978). From northwest to southeast these are; 1) Blue Ridge (NW of Brevard Zone), 2) Inner Piedmont Belt, 3) Kings Mountain Belt, 4) Charlotte Belt, and 5) Carolina Slate Belt (contains part of the Triassic-Jurassic Durham-Wadesboro Basin) (see location map). Although the boundaries of these belts are not everywhere agreed upon on geologic grounds, they are remarkably distinct on the magnetic map because of the abundance of magnetic rocks at the surface in the Charlotte and Kings Mountain Belts and the scarcity in the other three belts. Long-wavelength magnetic anomalies from deep sources (for example anomalies A and B, location map) are therefore apparent in the Inner Piedmont and Carolina Slate Belts because they are not obscured by the effects of surface rocks. Anomaly B in the Slate Belt is associated with a broad gravity high (Watkins and Yuval, 1965) probably indicating a large mafic body at depth. There are a few moderately magnetic surface rocks in the Inner Piedmont and Slate Belt. Evidence for their presence is the short-wavelength wiggles on the contours. One obvious source of these short-wavelength anomalies in the Slate Belt is the swarm of northwest trending Mesozoic diabase dikes which cause the narrow linear anomalies in the southeast part of the map.

Even though the surface rocks of the Kings Mountain and Charlotte Belts are strongly magnetic, the overall magnetic level is lower than in the adjacent belts indicating a substantial volume of non-magnetic rocks in the upper crust.

LOCAL MAGNETIC PATTERNS

The very prominent circular or oval magnetic highs are produced by mafic plutonic complexes in the Charlotte Belt. Near Concord, North Carolina, a gabbro-syenite ring complex (C on location map), (Bates and Bell, 1965) produces the most intense anomalies of the map. Similar anomaly shapes and intensities are generated by gabbro of the Mecklenburg (Hermes, 1968) and Weddington plutons (Goldsmith and others, 1978), (D and E on location map). Another large anomaly in northwestern Cabarrus County, North Carolina (F on location map) is associated with only a small mapped body of gabbro (Goldsmith and others, 1978) which indicates this pluton has not been completely unroofed. Other smaller mapped bodies of gabbro (Goldsmith and others, 1978) are all associated with intense anomalies.

Metagabbro bodies (G on location map), in some places associated with unmetamorphosed gabbro, are largely concentrated along the southeast edge of the Charlotte Belt (Goldsmith and others, 1978) and produce intense magnetic anomalies, though these are generally somewhat less intense than anomalies over the unmetamorphosed gabbros. Either metamorphism or structure may be a factor in this intensity difference. Lower amplitude gravity anomalies (Wilson and Daniels, in press) suggest the latter; these may have been either original sill-like structures or changed in shape during metamorphic deformation.

Post metamorphic granite plutons are abundant in the Charlotte Belt. These rocks are very weakly magnetic and are sharply delineated as magnetic lows because of the large magnetic contrast with the abundant mafic rocks in the belt. The larger plutons include the following; 1) Churchland (porphyritic granite), 2) Landis, 3) Mooreville, 4) Clover, and 5) York, (H,J,K,L,M on location map), (Horton and Butler, 1977; Goldsmith and others, 1978). Of these only the York pluton has significant internal magnetic highs that suggest heterogeneous composition or unusual structure. Comparison with total count aeroradioactivity gamma-ray maps (U.S. Geological Survey, 1977b, 1977d, 1977e, 1978a, 1978b) and spectral airborne gamma-ray maps (U.S. Department of Energy, 1979) shows that each of these plutons is also sharply delineated by gamma-ray highs that are dominently due to potassium sources (K-feldspar) with a lesser contribution from uranium and thorium sources. Again the York pluton seems to be a composite of granite and more mafic rocks.

Becuase the country rocks are non-magnetic and quite radioactive, the Gastonia granite in the Kings Mountain Belt (Horton and Butler, 1977) is indistinguishable on the magnetic or radioactivity maps.

Like the Gastonia pluton, granitic plutons in the Inner Piedmont Belt cannot be easily distinguished from the country rock. The belt as a whole, however, stands out because it has the highest gamma-ray level of all the belts in the quadrangle. These sources differ from the granite plutons in the Charlotte belt because uranium and thorium dominates potassium in the spectral gamma-ray maps (U.S. Department of Energy, 1979). The mineral source responsible for this high level is probably monazite, a rare earth-thorium phosphate, unusually enriched in uranium in this area, found as an accessory mineral in both the granitic intrusive and the high-grade gneisses and schists (Overstreet and others, 1968). Monazite was mined in the Inner Piedmont Belt from small placer deposits between 1887 and 1917 (Overstreet, 1967) but the source of the gamma-ray anomalies is likely to be monazite in place in saprolite and weathered rock.

REFERENCES CITED

Bates, R.G., and Bell, Henry III, 1965, Geophysical investigations in the Concord quadrangle, Cabarrus and Mecklenburg Counties, North Carolina: U.S. Geological Survey Geophysical Investigations Map GP-522, scale 1:48,000, text 3p.

Goldsmith, Richard, Milton, D.F., and Wilson, F.A., 1978, Preliminary geologic map of the Charlotte 2 degree sheet: U.S. Geological Survey Open File Map 78-590, scale 1:250,000.

Henderson, J.R., and Gilbert, F.P., 1966, Aeromagnetic map of the Mount Pleasant, Albemarle, Denton, and Salisbury quadrangles, west-central North Carolina: U.S. Geological Survey Geophysical Investigations Map GP-581, scale 1:62,500.

Hermes, O. Don, 1968, Petrology of the Mecklenburg gabbro-metagabbro complex, North Carolina: Contributions to Mineralogy and Petrology, vol. 18, p. 270-294.

Horton, J.W., and Butler, J.R., 1977, Guide to the geology of the Kings Mountain Belt in the Kings Mountain area, North Carolina; in Burt, E.R., ed., Field guides for Geological Society of America, Southeastern Section Meeting, Winston-Salem, North Carolina: North Carolina Department of Natural and Economic Resources , p. 76-143.

Overstreet, W.C., 1967, The geologic occurance of monazite: U.S. Geological Survey Professional Paper 530, 327p.

Overstreet, W.C., White, A.M., Whitlow, J.W., Theobald, P.K. Jr., Caldwell, D.W., and Cuppels, N.P., 1968, Fluvial monazite deposits in the southeastern United States: U.S. Geological Survey Professional Paper 568, 85p.

U.S. Department of Energy, 1979, NURE aerial gamma-ray and magnetic reconnaissance survey, Charlotte Quadrangle, volume 2.

U.S. Geological Survey, 1977a, Aeromagnetic map of north-central North Carolina: U.S. Geological Survey Open File Map 77-192, scale 1:250,000.

____________, 1977b, Aeroradioactivity map of north central North Carolina: U.S. Geological Survey Open File Map 77-193, scale 1:250,000.

____________, 1977c, Aeromagnetic map of Spartanburg and vicinity, South Carolina: U.S. Geological Survey Open File Map 77-252, scale 1:250,000.

____________, 1977d, Aeroradioactivity map of Spartanburg and vicinity, South Carolina: U.S. Geological Survey Open File Map 77-253, scale 1:250,000.

____________, 1977e, Aeroradioactivity map of Charlotte and vicinity, North Carolina: U.S. Geological Survey Open File Map 77-722, scale 1:250,000.

____________, 1977f, Aeromagnetic map of Charlotte and vicinity, North Carolina: U.S. Geological Survey Open File Map 77-723, scale 1:250,000.

____________, 1978a, Aeroradioactivity map of Salisbury and vicinity, North Carolina: U.S. Geological Survey Open File Map 78-262, scale 1:125,000.

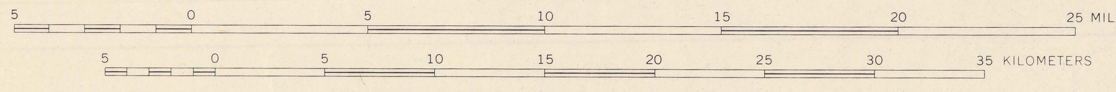
____________, 1978b, Aeroradioactivity map of West Charlotte, North Carolina: U.S. Geological Survey Open File Map 78-1087, scale 1:250,000.

____________, 1978c, Aeromagnetic map of West Charlotte, North Carolina: U.S. Geological Survey Open File Map 78-1088, scale 1:250,000.

Watkins, J.S., and Yuval, Zvi, 1966, Simple Bouguer gravity map of the Mount Pleasant, Albemarle, Denton, and Salisbury quadrangles, west-central North Carolina: U.S. Geological Survey Geophysical Investigations Map GP-581, scale 1:62,5000.

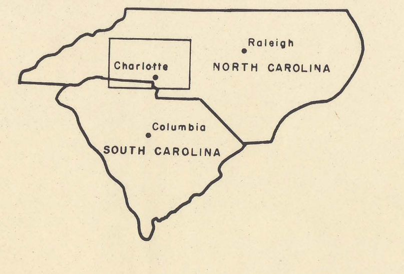
Wilson, F.A., and Daniels, D.L., in press, Preliminary Bouguer gravity map of the Charlotte 1 x 2 degree quadrangle, North Carolina: U.S. Geological Survey Miscellaneous Investigations Series I-1251-A , scale 1:250,000, text.

SCALE 1:250 000



TRANSVERSE MERCATOR PROJECTION
CONTOUR INTERVAL 100 GAMMAS

QUADRANGLE LOCATION



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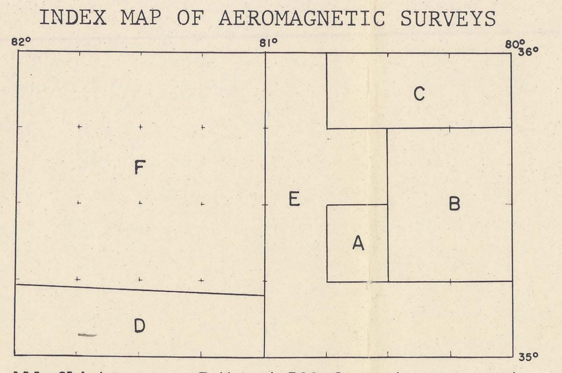
This report is preliminary and has not been edited for conformity with Geological Survey standards or nomenclature.

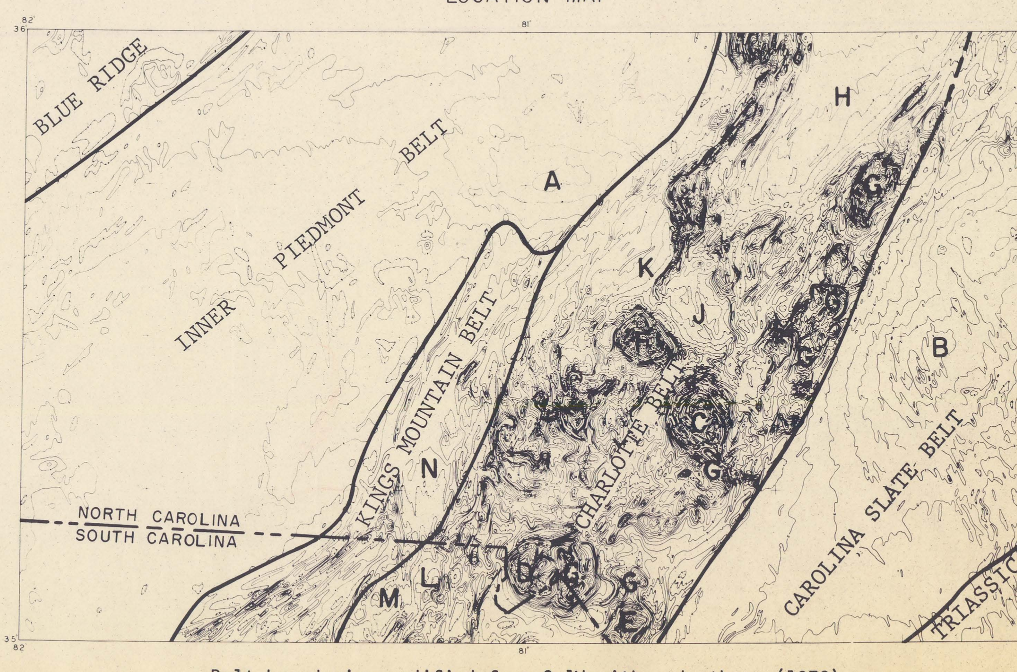
INDEX MAP OF AEROMAGNETIC SURVEYS



All flights were E-W and 500 feet above ground. The flight line spacing and survey sources are listed below.

A 1/2 mile, Bates and Bell, 1965
B 1/2 mile, Henderson and Gilbert, 1966
C 1 mile, U.S. Geological Survey, 1977a
D " " , 1977c
E " " , 1977f
F " " , 1978a

LOCATION MAP



Belt boundaries modified from Goldsmith and others (1978)

PRELIMINARY AEROMAGNETIC MAP OF THE CHARLOTTE 1×2 DEGREE QUADRANGLE, NORTH CAROLINA, SOUTH CAROLINA

By
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1980