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SIMPLE BOUGUER GRAVITY ANOMALY MAP
OF THE
RICHMOND AND TAYLORSVILLE BASINS AND VICINITY, VIRGINIA

# SIMPLE BOUGUER GRAVITY ANOMALY MAP OF THE RICHMOND AND TAYLORSVILLE BASINS AND VICINITY, VIRGINIA

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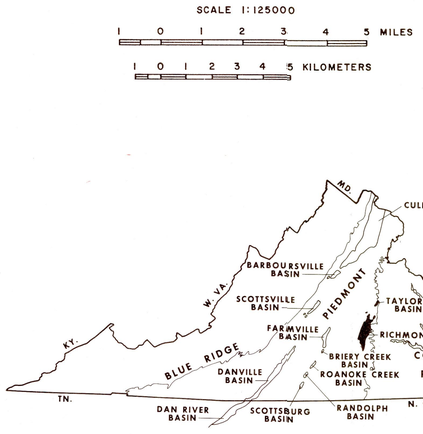
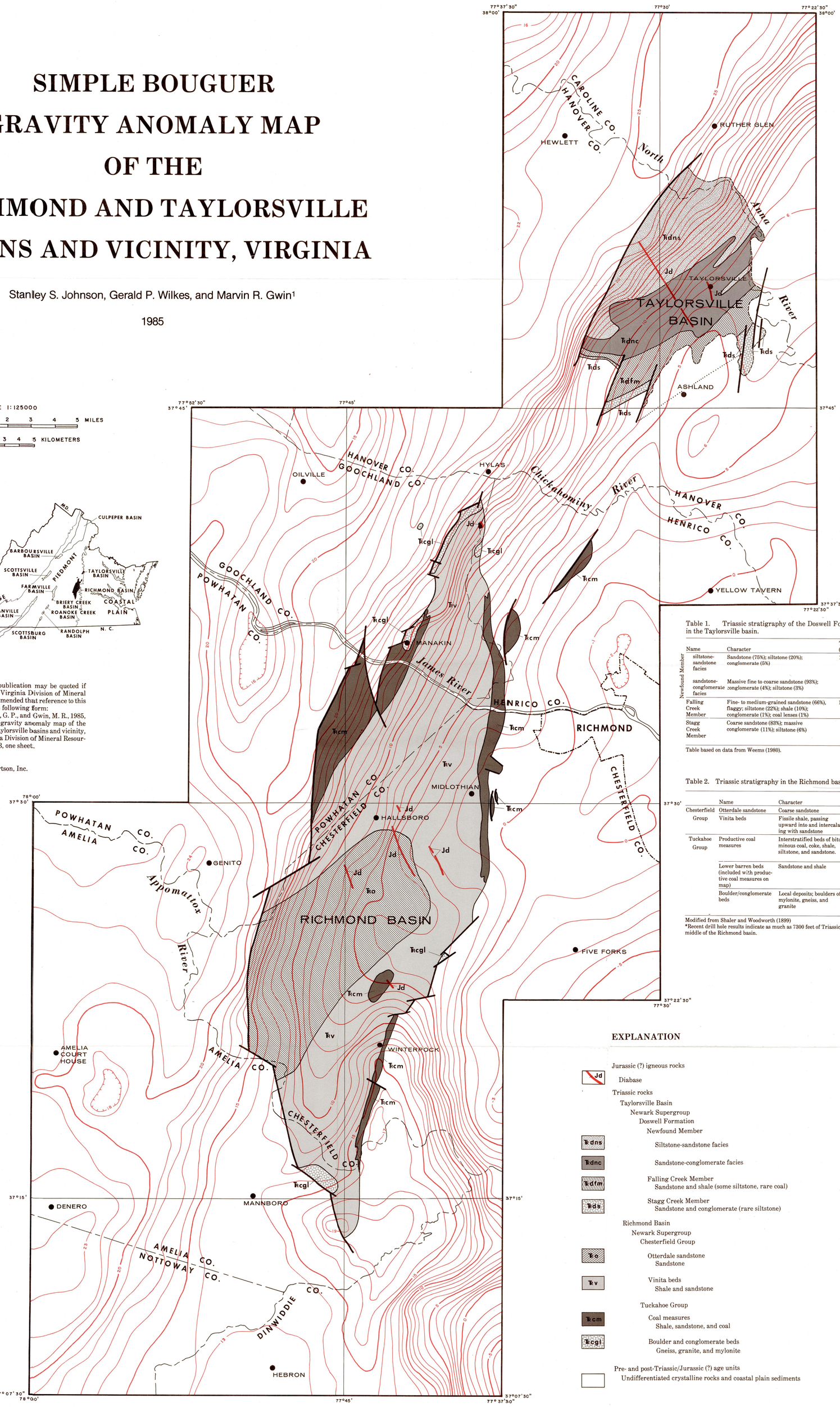
1985

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Johnson, S. S., Wilkes, G. P., and Gwin, M. R., 1985, Simple Bouguer gravity anomaly map of the Richmond and Taylorsville basins and vicinity, Virginia: Virginia Division of Mineral Resources Publication 53, one sheet.

[1]Froehling and Robertson, Inc.

Table 1. Triassic stratigraphy of the Doswell Formation in the Taylorsville basin.

| | Name | Character | Thickness (in feet) | Map Designation |
|---|---|---|---|---|
| Newfound Member | siltstone-sandstone facies | Sandstone (75%); siltstone (20%); conglomerate (5%) | 1500+ - 2500+ | Trdns |
| | sandstone-conglomerate facies | Massive fine to coarse sandstone (93%); conglomerate (4%); siltstone (3%) | 500+ - 1500+ | Trdnc |
| | Falling Creek Member | Fine- to medium-grained sandstone (66%), flaggy; siltstone (22%); shale (10%); conglomerate (1%); coal lenses (1%) | 1200+ | Trdfm |
| | Stagg Creek Member | Coarse sandstone (83%); massive conglomerate (11%); siltstone (6%) | 800+ | Trds |

Table based on data from Weems (1980).

Table 2. Triassic stratigraphy in the Richmond basin*

| | Name | Character | Thickness (in feet) | Map Designation |
|---|---|---|---|---|
| Chesterfield Group | Otterdale sandstone | Coarse sandstone | 500+ | Tro |
| | Vinita beds | Fissile shale, passing upward into and intercalating with sandstone | 2000+ | Trv |
| Tuckahoe Group | Productive coal measures | Interstratified beds of bituminous coal, coke, shale, siltstone, and sandstone. | 500+ | |
| | Lower barren beds (included with productive coal measures on map) | Sandstone and shale | 0 - 300+ | Trcm |
| | Boulder/conglomerate beds | Local deposits; boulders of mylonite, gneiss, and granite | 0 - 50+ | Trcgl |

Modified from Shaler and Woodworth (1899)
*Recent drill hole results indicate as much as 7300 feet of Triassic rocks are present in the middle of the Richmond basin.

## EXPLANATION

Jurassic (?) igneous rocks
- Jd — Diabase

Triassic rocks
- Taylorsville Basin
  - Newark Supergroup
    - Doswell Formation
      - Newfound Member
        - Trdns — Siltstone-sandstone facies
        - Trdnc — Sandstone-conglomerate facies
        - Trdfm — Falling Creek Member: Sandstone and shale (some siltstone, rare coal)
        - Trds — Stagg Creek Member: Sandstone and conglomerate (rare siltstone)
- Richmond Basin
  - Newark Supergroup
    - Chesterfield Group
      - Tro — Otterdale sandstone: Sandstone
      - Trv — Vinita beds: Shale and sandstone
    - Tuckahoe Group
      - Trcm — Coal measures: Shale, sandstone, and coal
      - Trcgl — Boulder and conglomerate beds: Gneiss, granite, and mylonite

Pre- and post-Triassic/Jurassic (?) age units
- Undifferentiated crystalline rocks and coastal plain sediments

## KEY

Contacts
- Exposed, approximate, or inferred
- Subsurface contact based on well control
- Coastal Plain overlap (Taylorsville basin)

Fauits
- Exposed, approximate, or inferred

Bouguer gravity contour
- Hachured contour indicates local minimum closure

Contour interval 1.0 milligal

Contours based on machine-contoured map; reduction density 2.67 g/cm³; datum, 980,118.00 milligals; no terrain correction

Base map from the U. S. Geological Survey

## GENERAL GEOLOGY

The Richmond and Taylorsville basins in eastern Virginia are north-northeast trending faulted troughs that contain Late Triassic sedimentary rocks. The basins are near the Coastal Plain overlap. The two basins form part of a belt of faulted basins, all of early Mesozoic age, that lie along the east coast of North America from Georgia to Nova Scotia. These basins (and five smaller erosional outliers) make up an eastern belt of early Mesozoic basins that are exposed in Virginia. Cretaceous and Tertiary sediments cover other Triassic basins to the east of the Coastal Plain overlap. A central belt consists of the Farmville basin and five smaller late Triassic outliers located to the southwest of the exposed eastern belt. A western belt parallel to the inner edge of the Piedmont province is made up of the Culpeper, Barboursville, Scottsville, and Danville basins.

The Richmond basin is about 12 miles west of the City of Richmond. The approximate geographic center of the Richmond basin is just southeast of Hallsboro, Chesterfield County. The basin is about 33 miles long and about 10 miles wide at its maximum width. The basin is exposed over an area of approximately 260 square miles (Weems, 1980). The five erosional outliers are in proximity to the northern end of the Richmond basin.

The Taylorsville basin lies about 16 miles north of the city of Richmond and about 7 miles northeast of the northern end of the Richmond basin. The exposed area of the Taylorsville basin is about 12 miles long and 7 miles wide, and has an area of approximately 50 square miles (Weems, 1980). The total area of this basin is unknown because of the Coastal Plain overlap.

The Richmond basin is surrounded by igneous and metamorphic rocks. The Petersburg granite occurs on the eastern edge of the basin and cataclastic rocks and gneisses form the western border. The exposed portion of the Taylorsville basin is bordered by the Petersburg granite on the south, cataclastic rocks on the west, and Coastal Plain sediments on the east. The basin may extend for some distance under the sediments in an east-northeast direction. Igneous intrusive rocks (diabase dikes) are rare in these basins.

The late Triassic sedimentary rocks in the eastern belt dip generally westward toward major normal faults that form the western margin of the basins. The western border faults of the Richmond and Taylorsville basins are also the eastern limit of the Hylas zone, a regional zone of cataclastic rocks. The eastern margins of the basins, including the erosional outliers, are generally unconformable contacts of conglomerates, sandstones, and coal measures with crystalline rock. Locally, cross faults of minor displacement are present along the Richmond and Taylorsville basins margins.

The Triassic sedimentary rocks of fluvial origin are mainly conglomerate, arkosic sandstone, and siltstone ("red beds"), but lacustrine limestone lenses, shales, and coal measures are locally important. Most of the clastic Triassic strata was probably derived from nearby source areas. Some of the material was rapidly deposited and had probably been moved only a relatively short distance. The detritus was deposited in a dynamic, intermittently closed basin environment. The changing depositional environment was because of changing drainage patterns, source area, subsidence, and intermittent movement along border faults.

Although only seven miles of Petersburg granite separate the exposed parts of the Richmond and Taylorsville basins, the stratigraphic nomenclature of each basin is quite different. Tables 1 and 2 show the stratigraphic names and relationships in each basin. Stratigraphic terminology of the erosional outliers is the same as that in the nearby Richmond basin.

## PROCEDURE AND INSTRUMENTATION

A total of 1,627 gravity observations were used in the compilation of the contour map. Of the 1,627 observations, 307 were published as part of a Statewide survey (Johnson, 1973, 1975) which generally utilized bench marks for elevation control. In addition to the Statewide survey points, 873 new measurements were taken at sites for which checked spot (usually road intersections) or bridge elevations could be determined from U. S. Geological Survey 7.5-minute quadrangle maps. About 174 measurements were acquired at 800 foot intervals along Interstate highways 64 and 295. Another 169 observations were acquired at approximately 1,300-foot intervals along U. S. highways 250, 60 and 360, and State Highway 6. The map also includes 104 observations taken for a detailed gravity survey at Winterpock (100-foot spacing). Elevations for these points were determined from Virginia Department of Highways and Transportation engineering drawings and by leveling. Elevation accuracy for each of these data sets is: first- through third-order leveling for bench marks; ±2.0 feet for spot and bridge elevations;±1.0 foot for the highway profiles; and ±0.3 foot for those points surveyed at Winterpock. Horizontal control for bench marks was used for station coordinates where data for control were available; for all other stations, latitude and longitude were scaled (manually) from U. S. Geological Survey 7.5-minute quadrangle topographic maps.

All measurements were made with a LaCoste-Romberg Model G geodetic gravity meter (number 77) with a nominal reading accuracy of 0.01 milligal. Duplicate measurements were made at each station. Each day's observations began and ended with a gravity measurement at one of four base stations established at Charlottesville, Ashland, Blackstone, and Chesterfield Courthouse (Johnson and Ziegler, 1972). All observations were made utilizing a modified ladder-sequence loop technique. The gravity base values were based on the pre-1971 international standardization net in order that the computed station values would be compatible with the gravity map of Virginia (Johnson, 1977). All values are relative to a datum of 980,118.00 milligals.

The computation and reduction of field data was done on computers at the University of Virginia, Charlottesville, using a modified GRAVAS program which includes corrections for earth tides and instrument drift. Gravity anomalies were calculated using the 1930 international geodetic reference formula and a density of 2.67 g/cm³. No terrain corrections were applied.

The gravity values were machine contoured by the Defense Mapping Agency, Aerospace Center, St. Louis Air Force Station, Missouri. The computer contour map was manually checked and, where deemed necessary, hand corrections were done.

## ACKNOWLEDGEMENTS

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