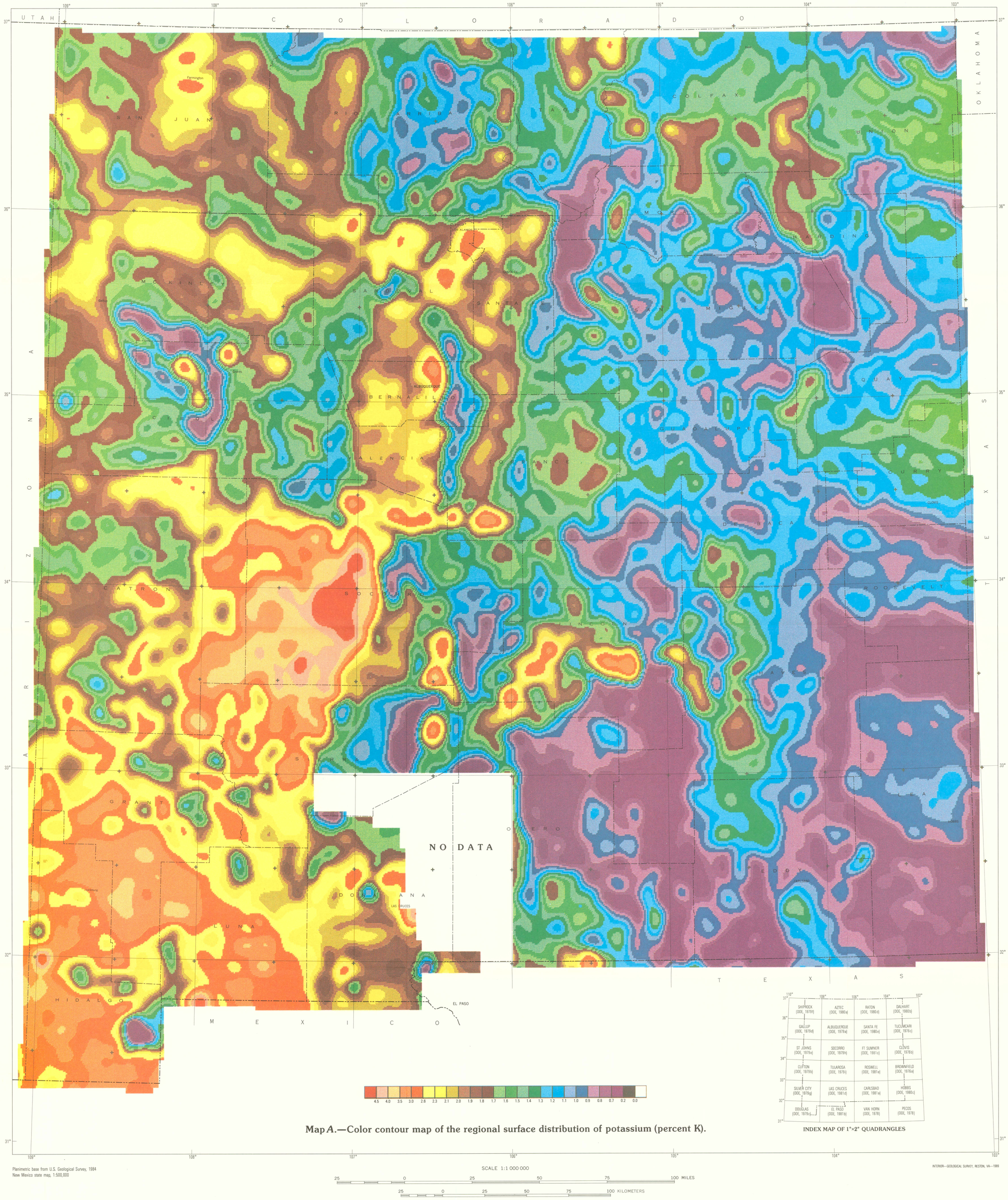

Map *A*.—Color contour map of the regional surface distribution of potassium (percent K).

INDEX MAP OF 1°×2° QUADRANGLES

Planimetric base from U.S. Geological Survey, 1984
New Mexico state map, 1:500,000

SCALE 1:1 000 000

25 0 25 50 75 100 MILES

25 0 25 50 75 100 KILOMETERS

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1989

DISCUSSION

The contour maps presented here are regional maps of the surface concentrations of percent potassium (percent K), parts per million equivalent uranium (ppm *e*U), and parts per million equivalent thorium (ppm *e*Th). The composite-color maps are regional maps that combine *K*, *e*U, *e*Th, and their various ratios as varying shades of red, green, and blue. The aerial gamma-ray data used to produce these maps were obtained from the U.S. Department of Energy (DOE) and are part of the data base obtained in 1975–1983 during the DOE National Uranium Resource Evaluation Program (NURE). Tapes containing digital data were assembled for the 1°×2° quadrangles shown on the index map. These data were measured by several different contractors using high-sensitivity gamma-ray spectrometers that have 2,000 to 3,000 cubic inches of sodium-iodide detector crystals. The nominal survey altitudes were 400 feet above the ground surface. The flight lines were flown east-west at line spacings ranging from 2 to 6 miles with north-south tie lines spaced 12 to 15 miles apart. The data were fully corrected by the contractors for background radiation, altitude variations, and airborne Bi-214 radiation. The airborne Bi-214 radiation results from the decay of Rn-222 emanating from the ground into the atmosphere. Using the DOE calibration pads at Grand Junction, Colorado (Ward, 1978), and the DOE dynamic test strip at Lake Mead, Arizona (Geodata International, Inc., 1977), the gamma-ray systems were calibrated so that the measurements could be expressed as the apparent surface concentrations of equivalent uranium (parts per million *e*U), potassium (percent K), and equivalent thorium (parts per million *e*Th).

To prepare the maps, the data were further processed. (1) The flight-line data were filtered using a Gaussian filter (with the standard deviation equal to 10) to reduce noise and high-frequency variations of the data. (2) Where necessary level corrections were then made by adding or subtracting constant values to parts of the data sets. Problems with data levels usually occurred within a single data set and may have been caused by small gain shifts in the spectra, the use of different background corrections, differences in water content of soil as the result of rain, or errors in data processing by the contractors. (3) Detector sensitivity corrections were then made by multiplying all or part of a data set by a constant factor because the different systems sometimes did not give equal results over the same material. Because all of the systems were calibrated using the same calibration sources, these sensitivity differences should not have occurred. The fact that differences between systems are more common than agreement suggests that the calibration procedures may be fundamentally flawed or that they are subject to a variety of errors not presently recognized. (4) All possible ratios of K, *e*U, and *e*Th were calculated.(5) The data were then gridded using a minimum curvature algorithm (Briggs, 1974: Webring, 1981). (6) The gridded data were additionally filtered to remove wavelengths less than 15 miles. The low-pass filtering of the gridded data was done using a fast Fourier technique to remove short-wavelength features that were not consistent with the flight-line spacing and the map scale.

Because of the wide flight-line spacing, the 2-mile grid interval, and the low-pass filters applied, the resulting maps are regional maps and should only be used in a regional context. The accuracies of the concentration values are estimated to be better than 20 percent in a relative sense and from 50 to 100 percent in an absolute sense. By relative sense, I mean the comparison of data from different parts of the maps. By absolute sense, I mean the comparison of these concentration values to values obtained from other sources such as ground or laboratory measurements.

After the final gridded data sets were obtained for each of the three elements—uranium, potassium, thorium, and the ratios eU/K, *e*U/eTh, K/*e*U, K/*e*Th, *e*Th/*e*U, and *e*Th/K, these data sets were used to make color contour (maps ***A–C***) and composite-color (maps ***D–G***) maps. The composite-color maps were made using the techniques described by Duval (1983). For each composite-color map three selected data sets were printed as varying shades of the primary colors, red, green, and blue, with the density of each color proportional to the magnitude of the data. The maps presented here are denoted as the composite element, uranium, potassium, and thorium maps. The composite element map (Map ***D***) combines uranium as shades of red, potassium as shades of green, and thorium as shades of blue. The composite uranium map (Map ***E***) combines uranium as shades of red, *e*U/K as shades of green, and *e*U/*e*Th as shades of blue. The composite potassium map (Map ***F***) combines potassium as shades of red, K/*e*U as shades of green, and K/*e*Th as shades of blue. The composite thorium map (Map ***G***) combines thorium as shades of red, *e*Th/*e*U as shades of green, and *e*Th/K as shades of blue. Because of the complexities of color combinations, the reader should not attempt to interpret the relative amounts of the elements or ratios from the observed colors except in a qualitative way. The value of these maps is to provide a synthesis of the radiometric data that shows at a glance a partial geochemical signature of the surface materials. As such these maps should be interpreted on the basis of color patterns and their correlations with other data.

These maps can be used to aid both geologic mapping and mineral exploration. Bates (1962), Gregory (1960), Moxham (1960), and Pitkin (1968) discussed the use of aerial gamma-ray data to aid geologic mapping. Force and others (1982) and Yeates and others (1982) presented examples of applications in mineral exploration. Clark and others (1972), Darnley (1970), Duval and others (1971), Grasty and others (1978, 1979), described various aspects of aerial gamma-ray spectroscopy and its limitations.

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1989

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