DISCUSSION

The contour maps presented here are regional maps of the surface concentrations of potassium (percent K), equivalent uranium (parts per million eU), and equivalent thorium (parts per million eTh). 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 during the DOE National Uranium Resource Evaluation (NURE) Program (1975–1983); the index map shows the 1° x 2° quadrangles used.

The aerial surveys were flown by several different contractors using high-sensitivity gamma-ray spectrometers with 2,000–3,000 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 12–15 miles apart. The data were fully corrected by the contractors for background radiation, altitude variations, and airborne Bi-214 radiation. 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 (ppm eU), potassium (percent K), and equivalent thorium (ppm eTh).

To prepare these maps, the data were further processed. (1) The flight-line data were filtered using a Gaussian filter (with the standard deviation equal to 10 data points along the flight line) to reduce noise and other high-frequency variations. (2) Where necessary, level corrections were then made by adding or subtracting constant values to selected 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 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 occured. The fact that differences between systems are more common than agreement suggests that the calibration procedures may be fundamentally flawed, or that they may be subject to a variety of errors not presently recognized. (4) The data were then gridded at a 2-mile grid interval using a minimum curvature algorithm (Briggs, 1974; Webring, 1981). (5) The gridded data were additionally filtered using a fast Fourier technique to remove short-wavelength features (less than 25 km) that are not consistent with 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 comparsion of data from different parts of the map area. By "absolute sense", I mean the comparsion of these concentration values to values obtained from other sources, such as ground or laboratory measurements.

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 explorations. Clark and others (1972), Darnley (1970). Duval and others (1971), and Grasty and others (1978; 1979) described various aspects of aerial gamma-ray spectroscopy and its limitations.

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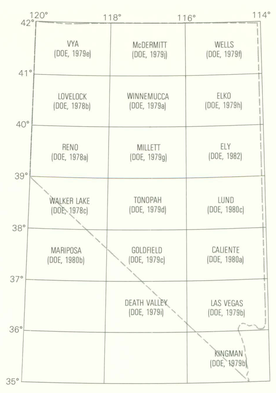

INDEX MAP OF NEVADA SHOWING 1° x 2° QUADRANGLES AND SOURCES OF DATA

EXPLANATION

Radiometric contour—Contour interval 0.3 percent. Hachures indicate closed area of lower value

SCALE 1:750 000

25 0 25 50 75 100 MILES

25 0 25 50 75 100 KILOMETERS

Contour map showing regional surface concentrations of potassium

AERIAL GAMMA-RAY CONTOUR MAPS OF REGIONAL SURFACE CONCENTRATIONS OF POTASSIUM, URANIUM, AND THORIUM IN NEVADA

By
Joseph S. Duval

1988

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

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