DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
DIVISION OF BIOLOGY AND MEDICINE
U.S. ATOMIC ENERGY COMMISSION

GEOPHYSICAL INVESTIGATIONS
MAP GP-309

NATURAL GAMMA AERORADIOACTIVITY OF PARTS OF THE LOS ANGELES REGION, CALIFORNIA

By
K. G. Books

EXPLANATION

450-500
Radioactivity boundary
Solid where well defined, dashed where transitional. Numbers indicate general range of radioactivity levels in counts per second

300-400 450-650 200-300
Traverses made in inaccessible areas
Hachures point toward lower levels of radioactivity

Boundary of area surveyed

1200	650
1100	550
900	500
800	450
700	400

Approximate upper level within boundary of similar radioactivity
Numbers indicate counts per second

The survey was made with scintillation detection equipment (Davis and Reinhardt, 1957[1/]), installed in a twin-engine aircraft. Parallel north-south flight traverses spaced at one-mile intervals were flown at a nominal altitude of 500 feet above the ground. Single traverses were flown along roads in areas where rough topography prevented systematic surveying. The flight path of the aircraft was recorded by a gyrostabilized continuous-strip camera. The radioactivity data were compensated for deviations from the 500-foot surveying altitude, and for the cosmic-ray component.

The effective area of response of the scintillation equipment at an altitude of 500 feet is about 1,000 feet in diameter, and the radiation recorded is an average of the radiation received from within the area. The scintillation equipment accepts only pulses originating from gamma radiation with energies greater than 50 kev (thousand electron volts). A cesium-137 source is used during periodic calibrations to assure uniformity of equipment response.

The gamma-ray flux at 500 feet above the ground has three principal sources: cosmic radiation, radionuclides in the air (mostly radon daughter products), and radionuclides in the surficial layer of the ground. The cosmic component is determined twice daily by calibrations at 2,000 feet above the ground, and is removed from the radiation data.

The component due to radionuclides in the air at 500 feet above the ground is difficult to evaluate. It is affected by meteorological conditions, and a tenfold change in radon concentration is not unusual under conditions of extreme temperature inversion. However, if inversion conditions are avoided, the air component may be considered to be fairly uniform on a given day in a particular area, and will not affect the discrimination of the radioactivity levels that reflect changes in the ground component.

The ground component comes from approximately the upper 6 inches of the ground. It consists of gamma rays from natural radionuclides, mostly members of the uranium and thorium radioactive decay series and potassium-40, and fallout of radioactive nuclear fission products. Locally the amount of fallout must be small, because the lowest total radiation measured is 150 counts per second in areas not affected by absorption of gamma energy by water. The distribution of fallout in the area surveyed is assumed to be uniform.

1/Davis, F. J., and Reinhardt, P. W., 1957, Instrumentation in aircraft for radiation measurements: Nuclear Sci. and Eng., v. 2, no. 6, p. 713-727.

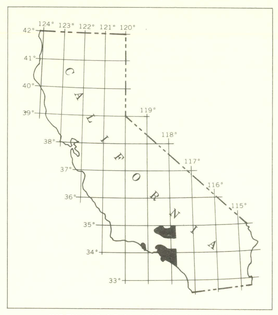
There is a moderate range in natural radioactivity within the several areas flown. In the coastal plain areas and in the San Fernando Valley the aeroradioactivity levels range from 200-300 cycles per second to 600-900 cps. In the Mojave Desert area the aeroradioactivity levels range from 400-500 cps to 900-1200 cps.

In general, the aeroradioactivity levels associated with lowland alluvium are lower than those associated with adjacent rocks, consequently the lowlands are approximately outlined by changes in aeroradioactivity levels. Other sedimentary deposits that show distinctive radioactivity are the playa lake deposits in the Mojave Desert area.

The consolidated sedimentary and metamorphic rocks, with the exception of those in the eastern Santa Monica Mountains, are not usually distinguishable by their radioactivity levels. Igneous rocks generally have the highest radioactivity.

A detailed study of the Los Angles aeroradioactivity survey is published separately 1/.

1/Books, K. G., in preparation, Aeroradioactivity and related surface geology of parts of the Los Angeles region California: U.S. Atomic Energy Comm. Rept. CEX-59.4.16



INDEX MAP OF CALIFORNIA SHOWING AREAS SURVEYED FOR THIS REPORT

Base from 1:250,000-scale topographic map series, Los Angeles, San Bernardino, Long Beach, and Santa Ana sheets

Aeroradioactivity survey made at 500 feet above the ground under the direction of G. E. Andreasen

TRUE NORTH
1961 MAGNETIC DECLINATION VARIES BETWEEN 15°00' AND 16°00' E. ANNUAL CHANGE VARIES BETWEEN 2.3' AND 2.4' WESTERLY

SCALE 1:250 000
4 2 0 4 8 12 16 20 MILES

1962

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