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AIRBORNE RADIOACTIVITY SURVEYS IN THE MOJAVE DESERT REGION, KERN, RIVERSIDE, AND SAN BERNARDINO COUNTIES, CALIFORNIA

By
R. M. Moxham

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July 1952

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by

R. M. Moxham

ABSTRACT

Airborne radioactivity surveys in the Mojave Desert region, Kern, Riverside, and San Bernardino counties were made in five areas recommended as favorable for the occurrence of radioactive raw materials:

(1) Rock Corral area, San Bernardino County.

(2) Searles Station area, Kern County.

(3) Soledad area, Kern County.

(4) White Tank area, Riverside and San Bernardino counties.

(5) Harvard Hills area, San Bernardino County.

Anomalous radiation was detected in all but the Harvard Hills area. The radioactivity anomalies detected in the Rock Corral area are of the greatest amplitude yet recorded by the airborne equipment over natural sources. The activity is apparently attributable to thorium-bearing minerals associated with roof pendants of crystalline metamorphic rocks in a granitic intrusive. In the Searles Station, Soledad, and White Tank areas, several radioactivity anomalies of medium amplitude were recorded, suggesting possible local concentrations of radioactive minerals.

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*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

INTRODUCTION

The airborne radioactivity surveys in the Mojave Desert region, California, were made on March 21 and 22, 1952, by the U. S. Geological Survey as part of a cooperative program with the U. S. Atomic Energy Commission. The following five areas (fig. 1) in Kern, Riverside, and San Bernardino counties were surveyed:

1. The Rock Corral area of about 80 square miles in the southwestern part of San Bernardino County is on the northeast flank of the San Bernardino Mountains, approximately 50 miles northeast of the city of San Bernardino.

2. The Searles Station area of about 28 square miles is in the northeastern part of Kern County. Searles Station, which lies a few miles east of the surveyed area, is on the Southern Pacific Railroad about 8 miles north of the town of Randsburg.

3. The Soledad area of about 50 square miles is in the southwestern part of Kern County, a short distance south of the town of Mojave.

4. The White Tank area of about 30 square miles is on the boundary between San Bernardino and Riverside counties. White Tank, a spring and watering station, is in the south-central part of the area. The town of Twentynine Palms is at the northwest corner of the area.

5. The Harvard Hills area of about 12 square miles is in the west-central portion of San Bernardino County. Harvard Siding in the western part of the area is on the Union Pacific Railroad approximately 21 miles east of Barstow.

The surveys were made with scintillation detection equipment mounted in a Douglas DC-3 aircraft. A nominal 500-foot flight level was maintained during all traverses, and the distance of the aircraft from the ground was measured and continuously recorded with a radar altimeter. Aerial photographs were used for pilot guidance, and the flight path of the aircraft was recorded by a gyrostabilized continuous-strip film camera.

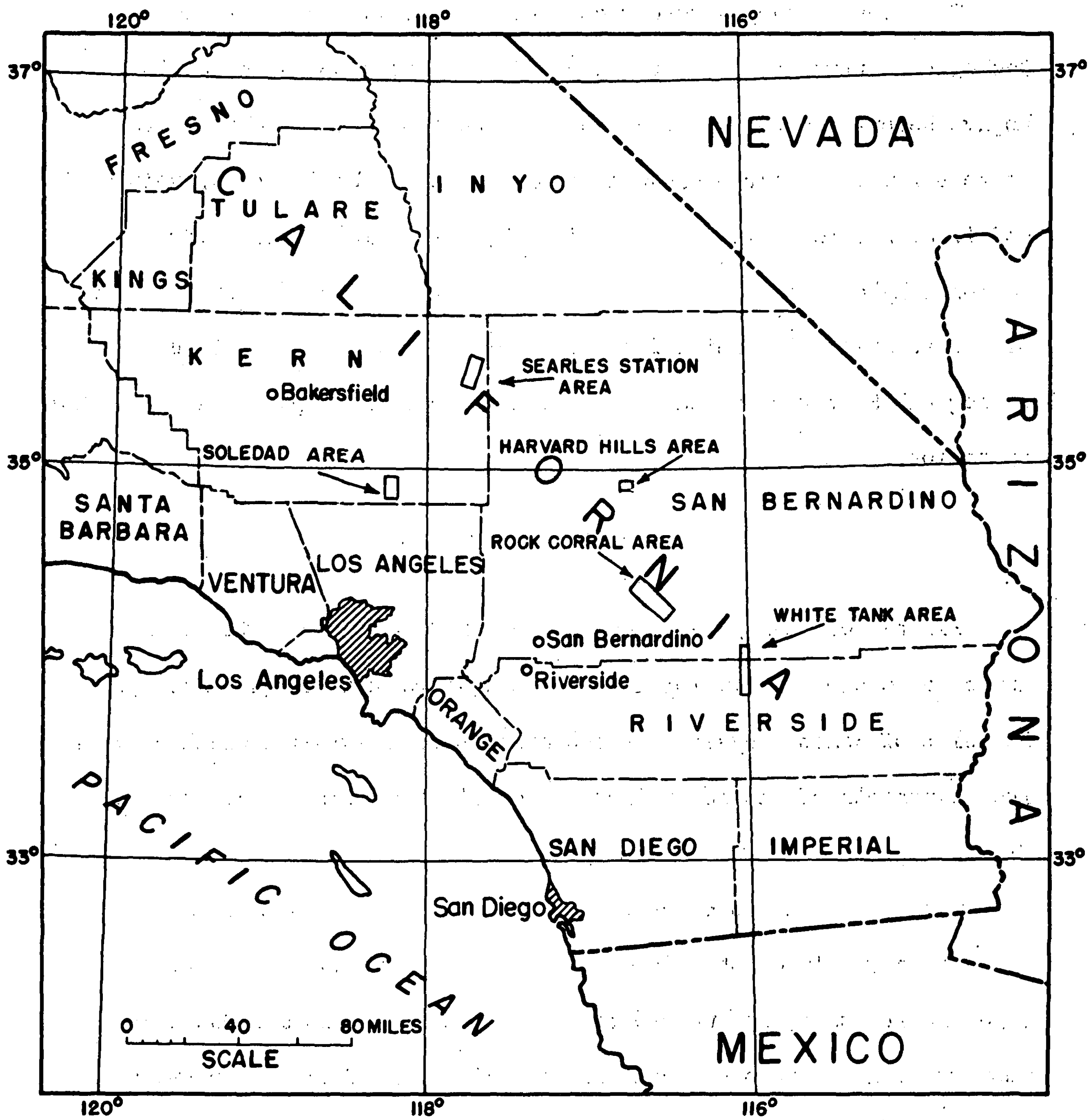


FIGURE 1. INDEX MAP OF SOUTHERN CALIFORNIA

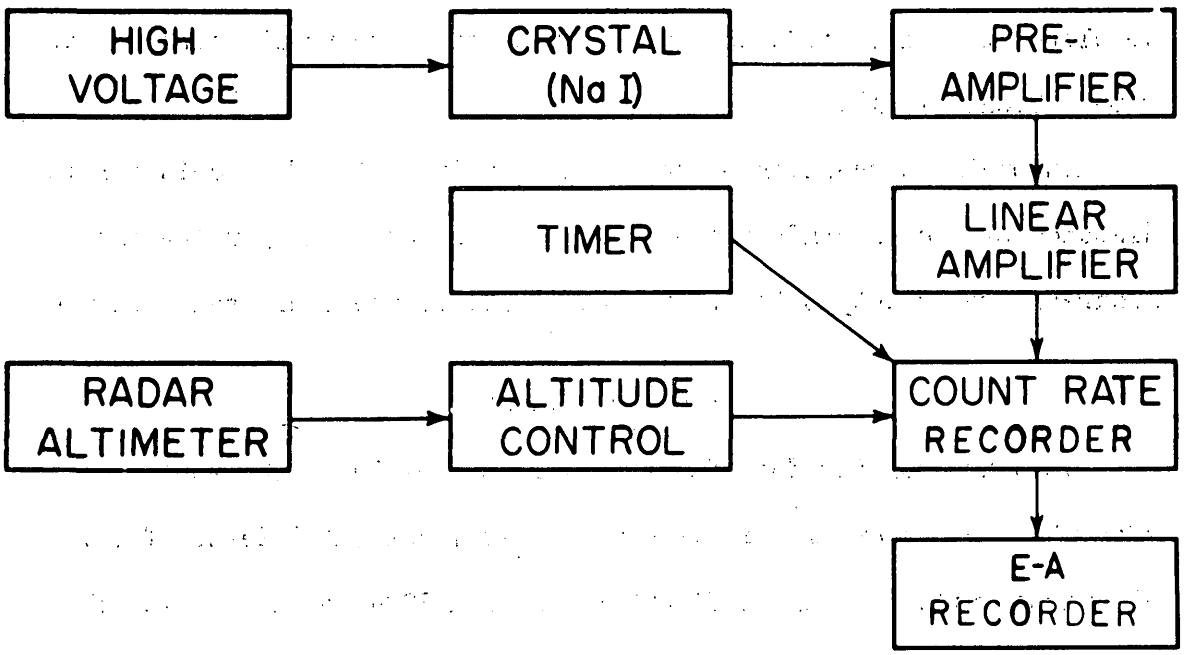
Figure 1

The areas surveyed were recommended by D. F. Hewett of the Geological Survey based on his knowledge and reconnaissance of the Mojave Desert region; G. W. Walker gave advice on the specific areas to be surveyed. Acknowledgment is made to F. J. Davis, P. W. Reinhardt, and T. J. Bortner, all of the Health Physics Division, Oak Ridge National Laboratory, for the design, development, and flight operation of the scintillation detection equipment. J. L. Meuschke of the Geological Survey prepared the pre-flight data and supervised the flight operations.

RADIOACTIVITY MEASUREMENTS

All radioactivity measurements were made using scintillation detection equipment developed by the Oak Ridge National Laboratory, Division of Health Physics, in cooperation with the Geological Survey. The components of the scintillation detection equipment are shown in figure 2.

The radiation detectors proper are 2-inch thick by 4-inch diameter crystals of thallium-activated sodium iodide. Six such crystals are used, in two groups of three each. Standard RCA 5819 photomultiplier tubes collect the scintillations from the crystals and feed the resultant pulses into the amplification stages.



BLOCK DIAGRAM OF SCINTILLATION DETECTION EQUIPMENT

Figure 2

The count rate recorder is a new development and is essentially similar to a scaling circuit. The incoming signal is measured over a one-second period and is recorded in the following one-second period. A continuous record is provided by two channels in the recorder which alternately measure and record the gamma radiation intensity. This development is a considerable improvement over the usual counting-rate meter (Stead, 1951).

Automatic correction of the radiation intensity for variation in distance of the aircraft above the ground is achieved by using the radar-altimeter output to modify the output of the count rate recorder.

Extent of coverage

At a nominal 500-foot flight level, the width of the zone from which radioactivity is measured is at least 1,400 feet. Thus, at quarter-mile spacing of flight lines or 1,320-foot intervals, the entire area should be adequately covered.

In order to complete the Mojave Desert surveys in the allotted time, it was necessary in some instances to use a flight line spacing of half a mile, or 2,640 feet. This preliminary flight pattern did not give full coverage of the areas surveyed; but, with proper orientation of the flight lines with respect to the geologic conditions, the coverage was sufficient to delineate the grosser features of the radiation intensity pattern. Where significant anomalous radiation was detected, intermediate flight lines were subsequently flown so that the final flight-line pattern in areas of interest had an approximate quarter mile or 1,320-foot spacing, giving complete coverage.

Interpretation of radioactivity anomalies

The interpretation of radioactivity anomalies is based on the observed response of the scintillation detection equipment under controlled conditions, both for point and broad sources of radiation. The data which have been acquired during previous airborne surveys and experimental flights indicate that point sources of radiation of moderate intensity, such as a few milligrams of radium or vein networks, mine dumps, and other localized concentrations of small areal extent, tend to produce anomalies of medium amplitude and of relatively short duration, usually less than 16 seconds at 500 feet above the ground. Broad sources of weakly radioactive materials, such as outcrops of granitic stocks, tend to produce broader anomalies of medium amplitude of more than 16-second duration. A point source of intense radiation, such as several grains of radium, increases both the duration width and the amplitude (height) of an anomaly; such a point source will produce an anomaly of more than 16-second duration with an amplitude much greater than that produced by a broad source of weakly radioactive materials.

Thus, a radioactivity anomaly is arbitrarily defined in terms of width and amplitude of the anomaly. We cannot interpret the anomaly in terms of either the radioactive content or the actual surface distribution of the radioactive materials causing the anomaly. Actually, the size (area under curve) of an anomaly is proportional to the product of grade in percent uranium times the area over which that grade is exposed. Based on measurements over known sources supported by theoretical calculations, the grade in percent uranium multiplied by the area in square yards is a constant of about 20; that is, a 1.0 percent uranium ore exposed over 20 square yards would produce the same anomaly as 0.1 percent ore over 200 square yards, or 0.01 percent over 2,000 square yards.

The radioactivity anomalies described herein have been classified for practical purposes by width, with four categories defined by the duration of an anomaly in seconds, and by amplitude, with two categories defined by multiples of the range of variation of radiation measurements for the area adjacent to the anomaly. Range is herein defined as the extreme limits of variation (approximating three times the standard deviation of individual measurements) about the average level of radiation measurements adjacent to the anomaly. Multiples of range are measured from the average level of measurement adjacent to the anomaly projected through the area of the anomaly.

The four categories for width of anomaly are:

	Designation	Map symbol	Width (duration in seconds)
1.	Sharp peak		less than 8 seconds
2.	Peak		8-16 seconds
3.	Broad peak		16-32 seconds
4.	Very broad peak		32 seconds

The two categories for amplitude of anomaly are:

	Designation	Map symbols	Amplitude
1.	Strong	S	more than 2 times range
2.	Medium	M	between 1 and 2 times range

In the following text, the anomalies are listed for each area according to the flight line and the index number; thus, 4-32.6 is the anomaly located on flight line 4 at index number 32.6.

In general, anomalies of the first and second width category—"sharp peaks" and "peaks"—suggest local concentrations of radioactive materials; anomalies of the third and fourth category—"broad peaks" and "very broad peaks"—tend to represent a geologic unit such as a sedimentary formation or igneous body rather than a local concentration of radioactive materials. Anomalies of strong amplitude suggest a higher concentration of radioactive materials in terms of equivalent uranium content than do anomalies of medium amplitude. The foregoing generalizations are not applicable in all instances, but they have been used as guiding principles in the absence of other qualifying geologic evidence in the interpretations given below.

Location of anomalies

The location of anomalies on a base map requires the assumption of straight-line flight and constant ground speed between recognizable points on photographic or other base maps in the compilation and plotting of flight data. Thus, if the distance between such points is large, the error in estimated location midway between the points may be considerable. A second factor introducing error in estimated location is the small variable lag in recording attributable to imperfections of linkage among the different instruments in the aircraft. Adjustment for a consistent and uniform lag in recording has been made, but some additional error in location is inevitably introduced by the small variable lag, probably not exceeding 200 feet along the flight line. The error in estimated location of anomalies resulting from these two factors may be several hundred feet in the direction of the flight path of the aircraft.

A third and by far the most important factor introducing error in the estimated location of an anomaly is the indeterminate position of the radioactive material causing the anomaly in the plane normal to the flight path of the aircraft. The location of a given anomaly may be estimated to within a few feet in respect to the ground point vertically below the aircraft. However, because the scintillation detection system will easily "see" a source at an air distance of as much as 1,000 feet, the true ground position of the source detected at a nominal 500-foot flight level may be as much as 850 feet from the estimated or apparent location on either side of the flight line in a direction normal to the flight line. In investigating the nature of the radioactive material causing an anomaly, it is advisable to examine the area within a radius of 1,000 feet from the estimated location of the anomaly.

Lacking suitable base maps in the Rock Corral and Searles Station areas, it was necessary to plot the anomalies on planimetric maps traced from uncontrolled photomosaics, so that considerable distortion in horizontal position may be expected. The true geographic locations of the anomalies can not be determined from these compilations but sufficient details of the planimetry have been shown to permit location with respect to recognizable features of the topography, drainage, and culture.

All anomalies detected during the surveys of the various areas are listed in Table 1, which gives the flight line, index number, anomaly width and amplitude, and remarks.

Table 1.—Airborne radioactivity anomalies in the Mojave Desert, California.

Flight Line	Index Number	Anomaly Width	Anomaly Amplitude	Remarks
		Rock Corral area		
2	46.3	Sharp peak	M	
3	62.3	do.	M	
3	63.3	Broad peak	S	
3	79.7	Sharp peak	M	
4	14.5	Very broad peak	S	
4	15.5	do.	S	
4	19-20	do.	S	
4	24.5	Peak	M	
4	27	Sharp peak	M	
4	31.5	Very broad peak	S	off scale
5	54.8	do.	S	
5	61.5	Broad peak	M	
5	64.2	Very broad peak	M	
5	73.3-74.2	do.	S	
6	09	do.	S	
6	19	Very broad peak	S	
6	21	Peak	S	
6	29.3	Very broad peak	M	
7	57.3	do.	M	
7	64.5	Sharp peak	M	
7	68.2	do.	S	
8	23.5	Very broad peak	M	
8	35.2	Sharp peak	M	
8	37.3	Peak	M	
8	39.2	Broad peak	M	
9	74.3	Very broad peak	M	
9	76.5	do.	M	
10	47-49	do.	M	
11	01.5	Peak	M	
11	01.9	Very broad peak	M	
12	22.4	Broad peak	M	
7A	87.8	Peak	M	
7A	92.4	do.	M	
7A	93.8	Very broad peak	M	
7A	97.8	Sharp peak	M	
7A	02.6	do.	M	
7A	06.9	Very broad peak	S	
6A	24.3	Sharp peak	M	
6A	28	Broad peak	S	
6A	30.4	do.	S	
6A	31.8	Very broad peak	S	
6A	35.8	Peak	M	
6A	39.9	Very broad peak	M	

Flight Line	Index Number	Anomaly Width	Anomaly Amplitude	Remarks
		Rock Corral area (Cont'd.)		
5A	46.1	Very broad peak	S	
5A	53	do.	S	off scale
5A	54.5	Peak	S	
5A	58.8	do.	S	
4A	76-78	Very broad peak	S	off scale
4A	89	do.	S	
4A	91.5-93.2	do.	S	
3A	01.8	Broad peak	M	
3A	15-15.8	Very broad peak	S	
2A	25.8	do.	M	
2A	42.7	do.	M	
		Searles Station area		
4A	46.9	Peak	M	
3A	29.2	Broad peak	M	
2A	18.2	Very broad peak	M	
3	17.7	Sharp peak	M	
3	14.1	Peak	M	
2	99	do.	M	
1	74.2	Sharp peak	M	
		Soledad area		
2	44.3	Peak	M	
2	48.2	do.	M	
4A	15.6	do.	M	
		White Tank area		
3	52.8	Sharp peak	M	
5	25.1	Peak	M	
6	32.4	Sharp peak	M	
6	32.6	do.	M	

ROCK CORRAL AREA

General Geology

A reconnaissance map of the geology of the northwestern part of the Rock Corral area, showing the major features, has been made (Vaughan, 1922). No geologic mapping has been done in the eastern part of the area.

The oldest rocks in the Rock Corral area are schists, gneiss, and meta-sediments of probable pre-Cambrian age. Vaughan has mapped several outcrop areas of these units west of Rock Corral which is at the extreme west end of the surveyed area. In more recent investigations Hewett has found other areas of crystalline metamorphic rocks, as yet unmapped, in the immediate vicinity of Rock Corral.

The schist, gneiss, and meta-sediments have been intruded by acidic rocks, which occupy the major portion of the Rock Corral area. Several periods of intrusion have been recognized but the two principal lithologic types are quartz monzonite, which in much of the area is porphyritic or coarsely crystalline, and the Cactus granite, a gray-colored, uniformly coarse-grained rock. The Cactus granite is Cretaceous in age; the quartz monzonite is pre-Cactus in age but a more specific age assignment has not been made.

Pegmatites and fine-grained acidic dikes have been found in numerous places.

In the extreme southeastern part of the area there are remnants of basaltic lavas which were extruded during Quaternary time. The general distribution of the flows as plateau remnants is indicated on fig. 3 by topographic form lines.

Unconsolidated deposits of Quaternary age, comprising fanglomerate, glacial till, alluvium, terrace deposits, and detritus mantle the bedrock in many parts of the area, particularly the northern and western parts.

No mining of significance has been done in this area. Several gold prospects have been found but nothing of commercial interest is known.

Prospecting for radioactive ore has been carried on in the Rock Corral area since the discovery of small masses of thorium-bearing rock in 1949. Claims have been staked on several prospects about 2 miles east of Rock Corral. At least one shipment of ore has been made for testing purposes but no further production has been attempted.

Previous Investigations

A reconnaissance of the Rock Corral area was made early in 1952 by Walker and Baumgardner. Radiometric traverses by car were made along most of the passable roads in the area, and anomalous radiation was detected at several localities.

Hewett, Walker and Baumgardner later examined some of the occurrences of thorium-bearing rocks which had been reported by prospectors (Trace Elements Monthly Report, February 1952, p. 19). It was found that the radioactive minerals, including apatite, zircon, and monazite, were associated with small patches of biotite-rich roof pendants (?) in quartz monzonite porphyry.

Occurrence of radioactivity anomalies

The radiation pattern in the Rock Corral area includes anomalies of the greatest intensity yet recorded by the airborne scintillation detection equipment over natural sources. Anomalous radiation, detected in many parts of the Rock Corral area, occurs mainly in four small areas which lie to the northeast and east of Rock Corral and are shown on figure 3.

Anomalies classified as "strong" occur in these four areas, outlined by dashed lines on figure 3, approximately 1/2 mile northeast (Area 1), 1 mile northeast (Area 2), 2 1/2 miles east (Area 3), and 4 miles east (Area 4), of Rock Corral.

The anomalies of greatest amplitude in the Rock Corral area are in Area 4. The peak intensity of anomalies 4A-76 and 4-31.5 exceeded the maximum limit of the E-A recorder. Both are relatively wide, exceeding 32 seconds in duration.

One very broad anomaly, 5A-53, which also exceeded the maximum limit of the recorder, was detected in the northern portion of Area 3, and other strong anomalies ranging from average to very broad in width were also found in this area.

Strong, very broad anomalies were detected in Areas 1 and 2 but in general their amplitudes are somewhat less than those in Areas 3 and 4.

Several sharp anomalies of medium amplitude were found north and south of the principal areas described above.

Interpretation of anomalies

It seems unlikely that the anomalous radiation in the Rock Corral area is due solely to the mass effect of disseminated accessory minerals in the granitic rock which underlies most of the area. If such were the case, it would seem logical to expect a higher level of average radiation rather than the abrupt changes which were recorded. There seems to be no correlation between the occurrence of the anomalies and the known distribution of the Cactus granite intrusives, so that the increase in radiation intensity is apparently associated with either the pre-Cactus quartz monzonite or the pre-Cambrian metamorphic rocks.

The previous work of Hewett and Walker has shown that radioactive minerals are associated with roof-pendants of pre-Cambrian rock in the quartz monzonite. No geologic maps are available showing the areal distribution of the roof-pendants, but the aerial photos of the region suggest they are present in the areas of anomalous radiation. It seems likely that the pendants may be responsible, at least to some degree, for the increased radiation level.

In many places the anomalies appear to be over or near stream valleys, which suggests the possibility of local concentrations of radioactive accessory minerals on the surface of the alluvium in intermittent drainages. This might be a plausible explanation for anomalies 7A-87.8 and 2-46.3 which are a considerable distance away from any bedrock discernible on the aerial photos of the region.

SEARLES STATION AREA

General geology

The rocks of the Searles Station area range in age from Paleozoic to Miocene (fig. 4). The oldest units, which crop out in the southwestern part of the area, are composed of marine limestones, chert, clay shales, and sandstones of Paleozoic age. The Paleozoic strata abut against the Garlock fault on the south; to the north and east they have been intruded by the Atolia quartz monzonite of Jurassic age which occupies the central and northern part of the Searles Station area. In the southwestern part of the area, non-marine clay, sandstone, and conglomerate of the Rosamond formation of Miocene age overlie the undifferentiated Paleozoic sediments.

The area is noted chiefly for gold mining although both silver and tungsten are important commodities in the region immediately to the south. Torbernite and autunite are reported to have been found in a rhyo-dacite at Summit Diggings (6 miles north of Randsburg) which is about 2 1/2 miles east of the southeast corner of the surveyed area.

Occurrence of radioactivity anomalies

Seven anomalies were detected in the Searles Station area; their locations are shown on figure 4. All the anomalies in the area occur within the outcrop area of the Atolia quartz monzonite. Anomalies 1-74.2 and 3-17.7 are sharp peaks; 4A-46.9, 3-14.1, and 2-99 are peaks; 3A-29.2 is a broad peak; 2A-18.2 is a very broad peak. All are of medium amplitude.

Anomalies 3-14.1, 2-99, and 1-74.2 are rather closely grouped in an area about 2 miles due west of Laurel Peak; the others occur in widely separated areas both to the north and south.

In the absence of qualifying geologic data, it seems advisable to regard the sharp peaks and peaks as indicative of possible concentrations of radioactive materials; the broad and very broad peaks suggest differentiates in the quartz monzonite of somewhat higher radioactivity cropping out over a relatively large area.

SOLEDAD AREA

General geology

The major part of the bedrock in the Soledad area is quartz monzonite of upper Jurassic age (fig. 5). The plutonic rocks form the basement on which later sediments and extrusives were deposited. The younger rocks, members of the Rosamond formation of Miocene age, comprise chiefly non-marine arkosic sandstone, conglomerates, boulder beds, chert, tuffs, breccias, flows, and intrusive bodies of dacite and basalt (Simpson, 1934).

The rocks described above are exposed in the Rosamond Hills, a fault block which rises above the level of the Quaternary alluvium of the adjacent desert plains and valleys.

Numerous faults have been observed in the Soledad area. Probably the most significant of these is the Rosamond fault which forms the southern boundary of the Rosamond Hills. This is a normal fault, dipping steeply to the south, and with an estimated minimum vertical displacement of 800 feet. There is some evidence that the fault has exercised some control over ore deposition in the western part of the area. (Simpson, p. 406).

The area is noted primarily for lode gold mining, particularly in the southern and western portion of the Rosamond Hills.

Previous investigations

An autunite deposit has been located about 5 miles northwest of Rosamond, approximately 100 yards west of the Tropico-Mojave road, at an elevation of 2,775 feet (point A, fig. 5). The site was examined briefly by F. M. Chace (1950) who did not consider the deposit of economic interest at that time.

The autunite is disseminated through a 1-foot thickness of tuffaceous sandstone of the Rosamond formation, which crops out along the base of a cliff. The mineralized zone was traced for a lateral distance of about 40 feet and for approximately 20 feet up the dip. Insufficient work was done at that time to determine the precise extent and potentialities of the deposit.

Occurrence of radioactivity anomalies

Three anomalies were recorded in the Soledad area (fig. 5). Anomalies 2-44.3 and 4A-15.6 are about 4 miles northeast of Willow Springs. Anomaly 2-48.2 is approximately 2 1/2 miles northeast of Willow Springs.

The autunite deposit previously found in this area (point A, fig. 5) lies almost directly beneath flight line 7 but no radioactivity anomaly was detected. Apparently the distribution of radioactive material at this particular place is not substantially greater than indicated by Chace's brief investigation.

Two of the recorded anomalies, 2-44.3 and 4A-15.6, are about 2 1/4 and 1 1/2 miles due west of point A, respectively, and are within the same geologic formation. Both are classified as peaks of medium amplitude and are thought to indicate possible local concentrations of radioactive material. The proximity to a known autunite occurrence and the similarity of the geologic setting are at least so suggestive.

Anomaly 2-48.2, classified as a peak of medium amplitude, is situated in an entirely different geologic environment, being near a fault contact between Jurassic quartz monzonite and a dacite flow of Miocene age. As neither the quartz monzonite nor the dacite flows exhibited anomalous radiation elsewhere, concentration of radioactive material seems to be indicated at this locality.

WHITE TANK AREA

General geology

The southern part of the White Tank area, which is of primary interest, is underlain chiefly by igneous and metamorphic rocks ranging in age from pre-Cambrian to Jurassic. The oldest is the Pinto gneiss which occupies most of the eastern and southern parts of the area.

Locally, the Pinto formation contains bands of meta-sediments, but for the most part it is composed of metamorphic facies of granitic and gabbro-dioritic rocks. To the northwest the Pinto rocks were intruded during the Jurassic period by the White Tank monzonite. On the southern border of the surveyed area, Quaternary alluvial deposits occupy a basin south of a prominent fault scarp (Miller, 1938).

The region is noted principally for its past gold production. No mining activity has been reported for several years.

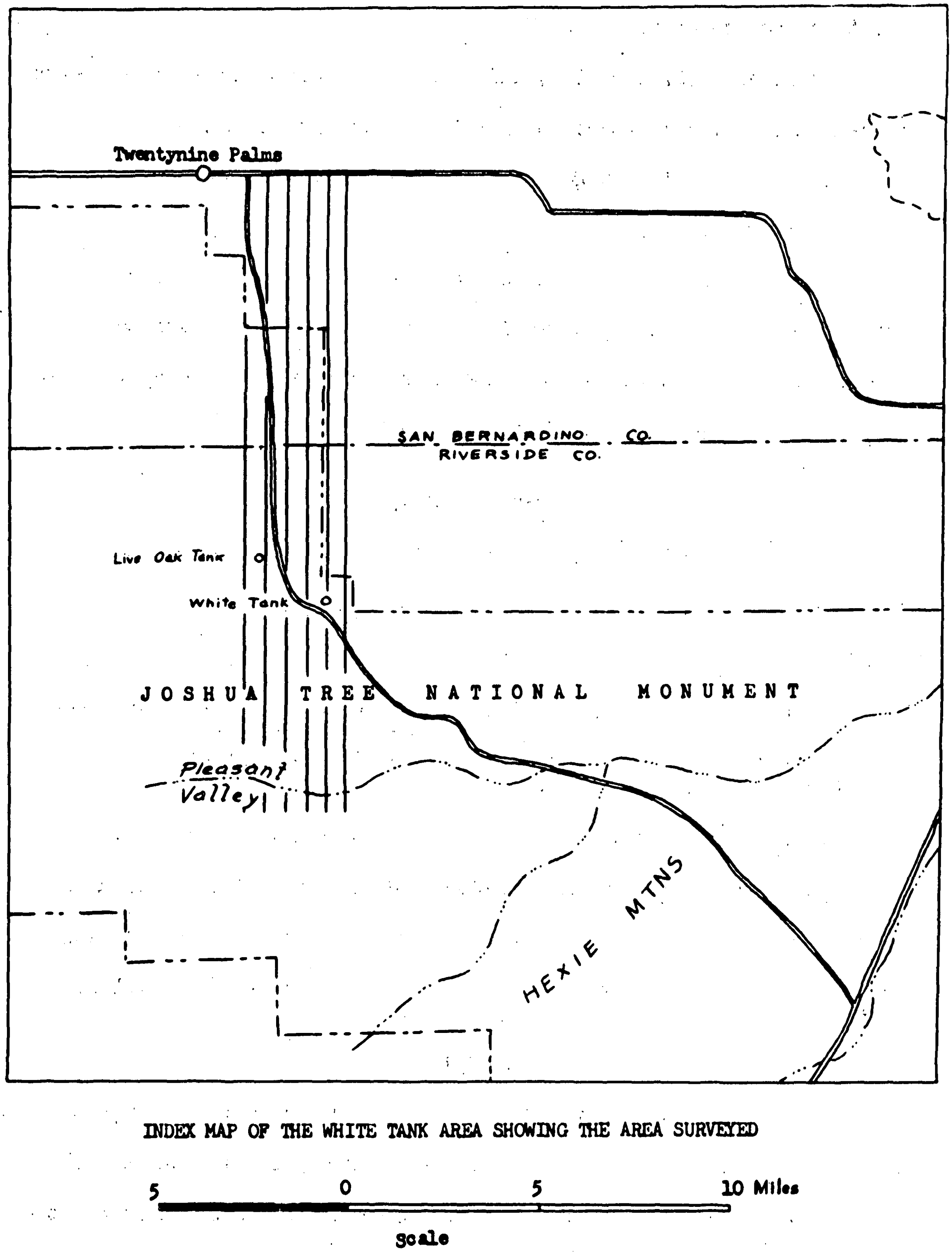
Previous investigations

A brief reconnaissance of the central part of the area was made by Wyant (1949). Radioactive minerals derived from the White Tank monzonite were found in moderate concentration on the surface of the alluvium near Live Oak Tank. A small radioactivity anomaly was found by ground surveys about 2.6 miles north of Live Oak Tank and was attributed to thorium-bearing accessory minerals associated with a pegmatite in the Pinto gneiss.

Figure 6, an index map of the White Tank area, shows the general orientation of the flight lines. The area of particular interest, which includes roughly the southern half of the region, is shown in figure 7.

Occurrence of radioactivity anomalies

Anomalies 3-52.8, 6-32.4, 6-32.6, and 5-25.1 were recorded by the airborne equipment in an area 3 to 4 miles south of White Tank. Their



INDEX MAP OF THE WHITE TANK AREA SHOWING THE AREA SURVEYED

Figure 6

locations are shown on figure 7.

Anomalies 3-52.8, 6-32.4, and 6-32.6 are classified as sharp peaks of medium amplitude; anomaly 5-25.1 is a peak of medium amplitude. The shape of the anomalies suggests a localized concentration of moderately radioactive material.

The concentration of radioactive materials in the alluvium near Live Oak Tank, previously investigated by Wyant, was not detected by the airborne survey, nor was any anomalous radiation recorded over the White Tank monzonite north of Live Oak Tank.

HARVARD HILLS AREA

The Harvard Hills area, shown on figure 1, has been examined briefly by Walker (Trace Elements Monthly Report, Feb. 1952, p. 19). It was found that

> autunite and carnotite (?) occur on joint and fracture surfaces in a sequence of low dipping bedded tuffs, chert, marly sandstone, and sandy limestone. (The) layered rocks are part of the Barstow formation of Miocene age

They found that the deposit is not of present economic interest.

The airborne radioactivity records of the Harvard Hills area do not indicate any radiation anomalies, and therefore, the compilation of data and the preparation of a base map have not been undertaken.

SUMMARY

The airborne radioactivity surveys of five areas in the Mojave Desert region located significant anomalous radiation in four areas. The radioactivity anomalies in the Rock Corral area have the greatest amplitude as yet recorded over natural sources, and may reflect concentration of thorium-bearing minerals occurring in pre-Cretaceous intrusive rocks or roof pendants of pre-Cambrian metamorphic rocks. In the Searles Station, Soledad, and White Tank areas, several radioactivity anomalies of medium amplitude were recorded, suggesting possible local concentrations of radioactive materials.

The amplitude of the anomalies in the Rock Corral area warrants immediate investigation to determine the nature of the radioactive materials causing the anomalies and to appraise the potentialities of the area as a possible source of uranium or thorium.

The existing geologic data suggest that the activity in the Rock Corral area may be due almost entirely to thorium rather than uranium, but other geologic data for the region, particularly for the Soledad area where torbernite occurs, indicate that uranium is also present.

Photographic base maps, on approximately 1:40,000 scale, have been compiled showing the flight lines and radioactivity anomalies. These maps should provide an adequate base for preliminary field examination.

The objectives of a field examination scheduled to start in late May or early June of this year, are to determine the nature of the radioactive materials causing the anomalies, to appraise the potentialities of the area, and to relate the amplitude and width of the radioactivity anomalies to the surficial distribution of the source materials for the purpose of developing a better interpretation of airborne radioactivity anomalies.

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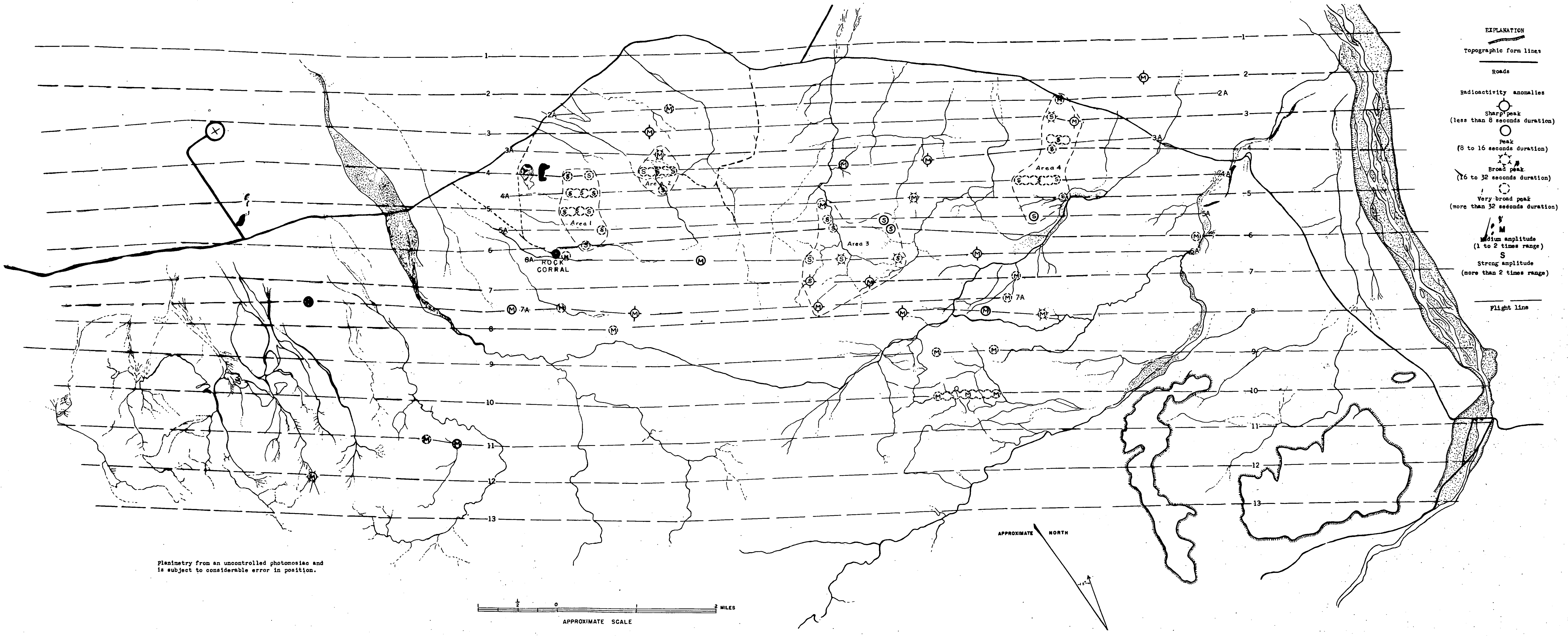
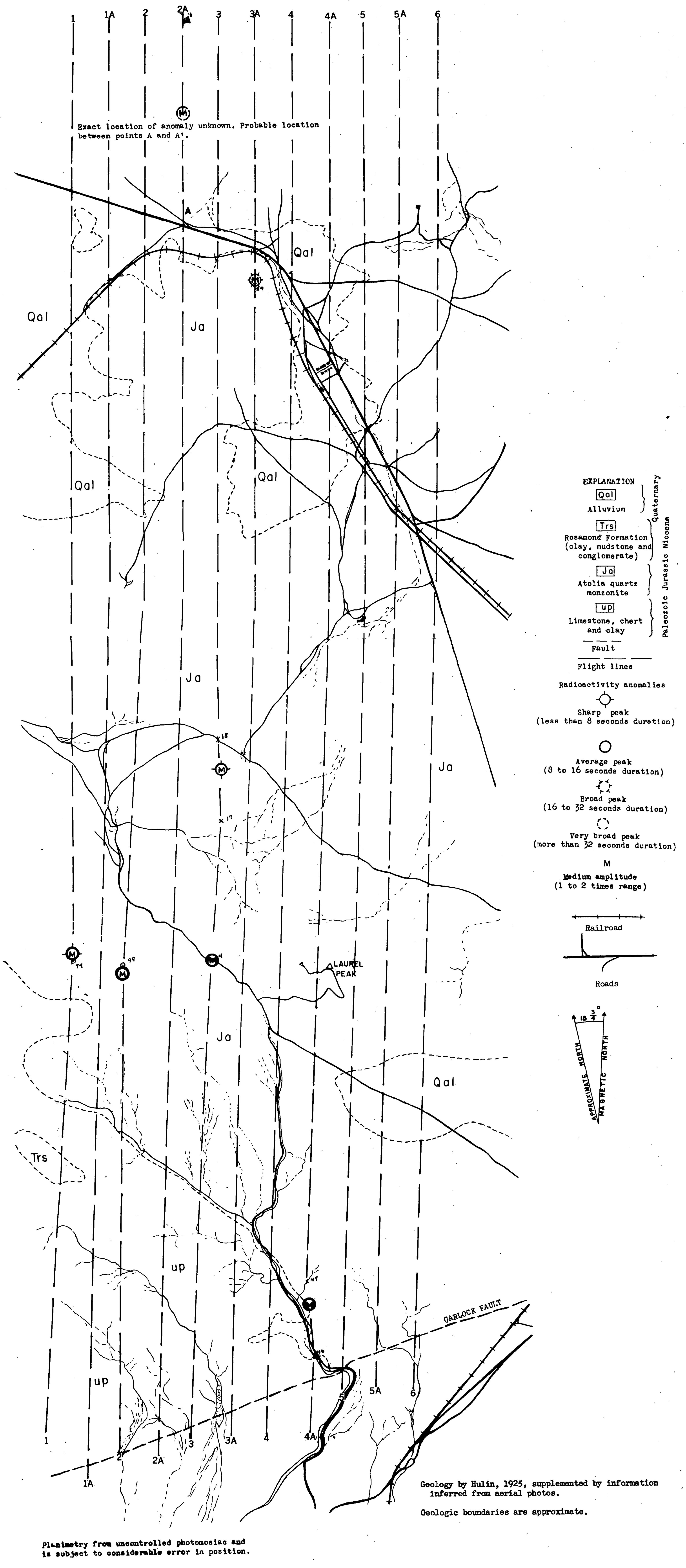


AIRBORNE RADIOACTIVITY SURVEY IN THE ROCK CORRAL AREA SAN BERNARDINO COUNTY, CALIFORNIA

Figure 3

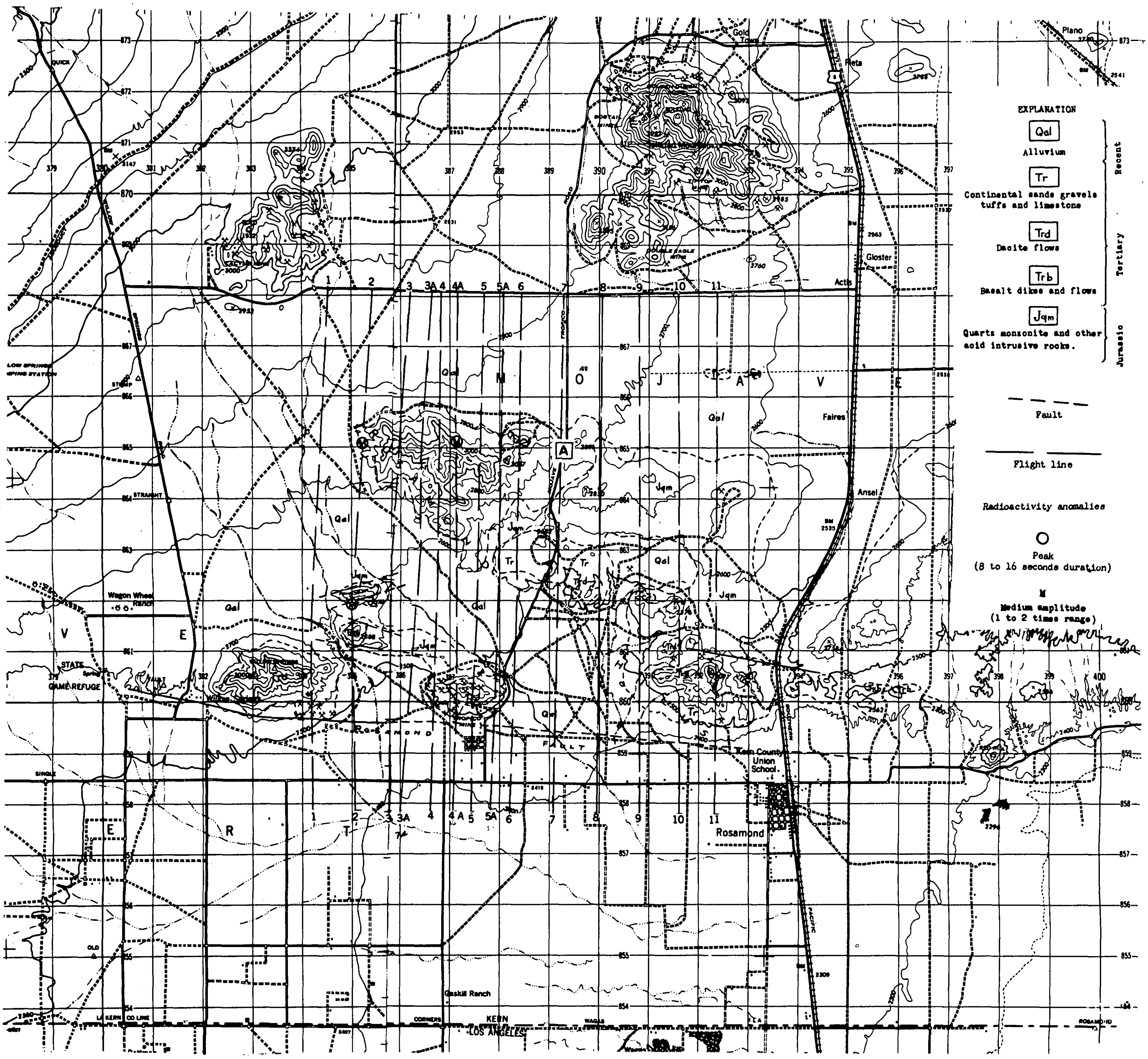


AIRBORNE RADIOACTIVITY SURVEY IN THE SEARLES STATION AREA, KERN COUNTY, CALIFORNIA

1 ½ 0 1 MILES

APPROXIMATE SCALE

Figure 4



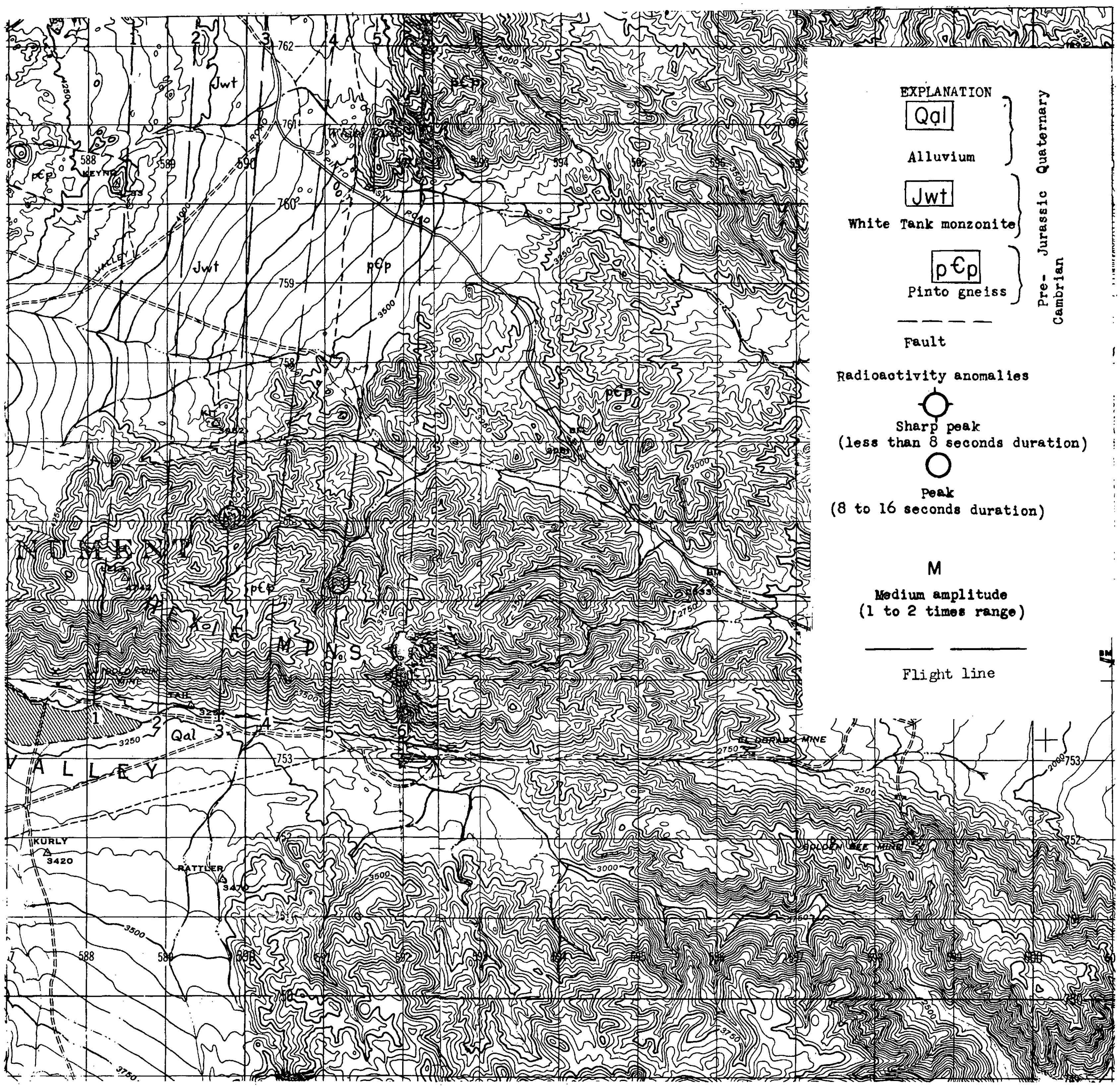
Base from Army Engineers
Rosamond and Willow Springs
quadrangles, 1947.

Geology by Hulin, 1925 and
from California State
Geological Survey map.
(Geological boundaries are approximate)

AIRBORNE RADIOACTIVITY SURVEY IN THE SOLEDAD AREA, KERN COUNTY CALIFORNIA

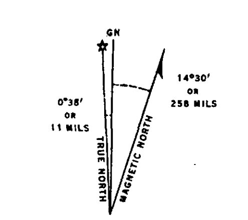
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

Figure 5



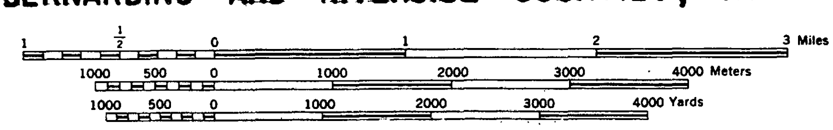
Base from Army Engineers
Pinkham Wells and Pinyon Wells
quadrangles, 1947

Geology by Miller, 1938 and
from California State
Geological Survey map.
(Geological boundaries are
approximate)



APPROXIMATE MEAN DECLINATION 1947
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 2' WESTERLY

AIRBORNE RADIOACTIVITY SURVEY IN THE WHITE TANK AREA, SAN BERNARDINO AND RIVERSIDE COUNTIES, CALIFORNIA



CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL (1929 ADJ.)

Figure 7