UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

A soil-gas helium survey of the Hualapai Indian Reservation, northwest Arizona

By

C. Gilbert Bowles[1] and G. M. Reimer[1]

Open-File Report 86-36

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards.

[1]Box 25046, Federal Center
Denver, Colorado 80225

1986

CONTENTS

ILLUSTRATIONS

TABLES

APPENDICIES

A SOIL-GAS HELIUM SURVEY OF THE HUALAPAI INDIAN RESERVATION, NORTHWEST ARIZONA

By

C. Gilbert Bowles and G. M. Reimer

ABSTRACT

During a soil-gas helium survey on the Hualapai Indian Reservation in June and October 1982 the analysis of 2,060 samples yielded helium values that range from -111 to 242 parts per billion below or above helium in ambient air (5240 ppb). The analytical data are reproduced in tables, and the sample locations are plotted on maps. High concentrations of helium (greater than 110 ppb He above helium in ambient air) were detected in 40 samples. Anomalous helium was encountered adjacent to faults and at sinks and collapse structures. The Blue Mountain Gravels, the strata immediately underlying the Blue Mountain erosional surface, and the younger Music Mountain Conglomerate, have all yielded high concentrations of helium.

Cyclonic weather patterns, which are identified by spiralling flows of air into and away from the respective centers of low and high barometric pressure, and diurnal metorologic conditions effected changes in the concentrations of helium, carbon dioxide, methane, and radon in the soil gas. Measurements of surface radiation at 717 soil-gas sites also recorded radiation fluxes associated with both the diurnal and the cyclonic meteorologic patterns. This variation in radiation level can be attributed largely to the effect of barometric pressure change upon the rate of diffusion and flow of radon from the ground.

INTRODUCTION

A soil-gas helium reconnaissance survey during June and October 1982, supplements other U.S. Geological Survey investigations conducted as part of a uranium resource assessment for the Hualapai Tribe supported by the Bureau of Indian Affairs. Soil-gas samples were collected in twenty three 7 1/2' quadrangles and in one 15' quadrangle. Most samples were obtained during traverses along primary and secondary roads (fig. 1a, b). These data were supplemented by detailed sampling at suspected collapse structures (fig. 1b). Raw helium data for each sample site are plotted on maps of plates 1-4.

Soil gas helium sampling has been shown to be a useful technique in the detection of structural features (Reimer and others, 1979). This technique may also be utilized to investigate deeply buried copper-uranium vein-type deposits similar to the Ridenour mine on the reservation (Miller, 1954; Granger and Raup, 1962) and the Orphan mine at Grand Canyon (Gornitz and Kerr, 1970; Bowles, 1977).

Helium is formed from alpha particles emitted during radioactive disintegration of members of the uranium and thorium decay series; therefore, high helium concentrations in the soil gas may indicate the presence of buried uranium deposits (Reimer and Otton, 1976). Helium is a stable element, as contrasted to radon which is a short-lived product of the uranium decay series with a half-life of only 3.8 days. This difference enables helium to be detected farther from its source, thereby providing a larger geochemical target that makes both localized and reconnaissance surveys practical.

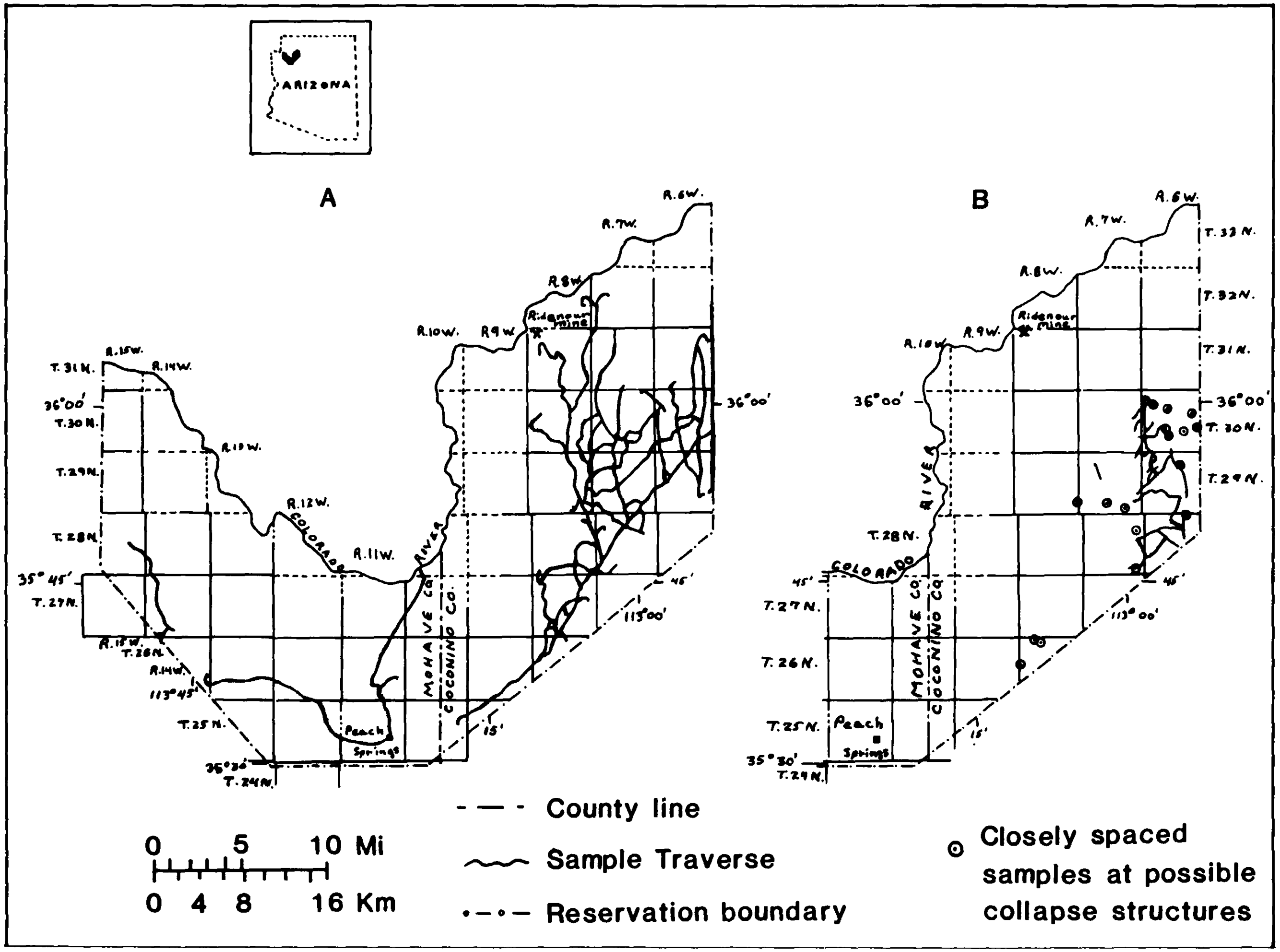

Figure 1.- Map showing areas of the Hualapai Indian Reservation sampled for soil-gas helium during surveys of June (fig. 1a) and October (fig. 1b), 1982.

The soil-gas sampling program was concentrated mainly in the eastern part of the Reservation, especially in two areas that had been assigned a high priority for study. No mineralized breccia pipe had been identified within either priority area, although the Ridenour mine and a radioactivity anomaly are present to the north (Miller, 1954). The more eastern part of the Hualapai Reservation offers the best terrain for the helium survey; it is a plateau that is relatively undissected by canyons carved by tributaries to the Colorado River (fig. 2). In this undissected terrain, bedrock is generally covered by soil, as contrasted to the exposed bedrock in the canyons.

The first part of the survey comprising both reconnaissance and detailed scales was conducted from June 4th to 14th when 1,449 samples were collected and analyzed. For reconnaissance, samples were taken at 0.2-mile spacings along roads throughout the higher priority areas, and at 0.5-mile spacings in adjacent areas and along a traverse into the western part of the reservation (pls. 1-3). For detailed studies, samples were taken at 250 ft. centers along foot traverses across a fault in the National Tank 7 1/2' Quadrangle (pl. 1). In addition, other samples were taken at closely spaced intervals (250 ft) over uraniferous sediments of Cenozoic age located in the the ancestral Peach Springs Canyon (pl. 3). This area, known as the Mulberry Springs prospect, was drilled in 1976 by Western Nuclear.

The second part of the survey was conducted from October 20th to 30th, when an additional 611 samples were collected and analyzed (pl. 4). Much of the October sampling was directed towards the evaluation of possible collapse structures located from aerial photographs (Sutphin, H. B., oral commun. 1982) (fig. 1b and pl. 4). These areas of collapse and suspected collapse were sampled at 250 ft. spacings along foot-traverses that crossed the collapsed areas, and one large topographic collapse adjacent to the east boundary of the Reservation was sampled on a grid pattern (pl. 4). Additional samples were collected along roads in areas east of 113^{o} west longitude to provide information to supplement existing widely spaced aerial radioactivity data (Aero Service, 1979). Also included was a repeat survey of some areas sampled in June in order to compare the variability of helium concentration for the June and October sampling periods.

PROCEDURES

Helium soil-gas samples are collected by pounding a thin, hollow steel probe into the ground to a depth of 0.75 m (30 inches) and using a hypodermic syringe to pull a sample from the probe. The sample is stored in the syringe until it is analyzed the same day by the mobile helium analyzer developed by the U.S Geological Survey (Reimer and others, 1979). The mobile helium analyzer consists of a truck-mounted mass spectrometer that can perform one helium analysis every 5 minutes with a sensitivity and precision of 10 parts per billion (ppb). This is adequate precision to reveal background changes in the helium soil-gas concentration and to help pinpoint areas of anomalous helium that may be associated with uranium or, perhaps, other types of energy deposits. Typically, 4 to 5 sample crews are assigned to collect samples, and during a reconnaissance survey each crew can collect about 20 samples a day.

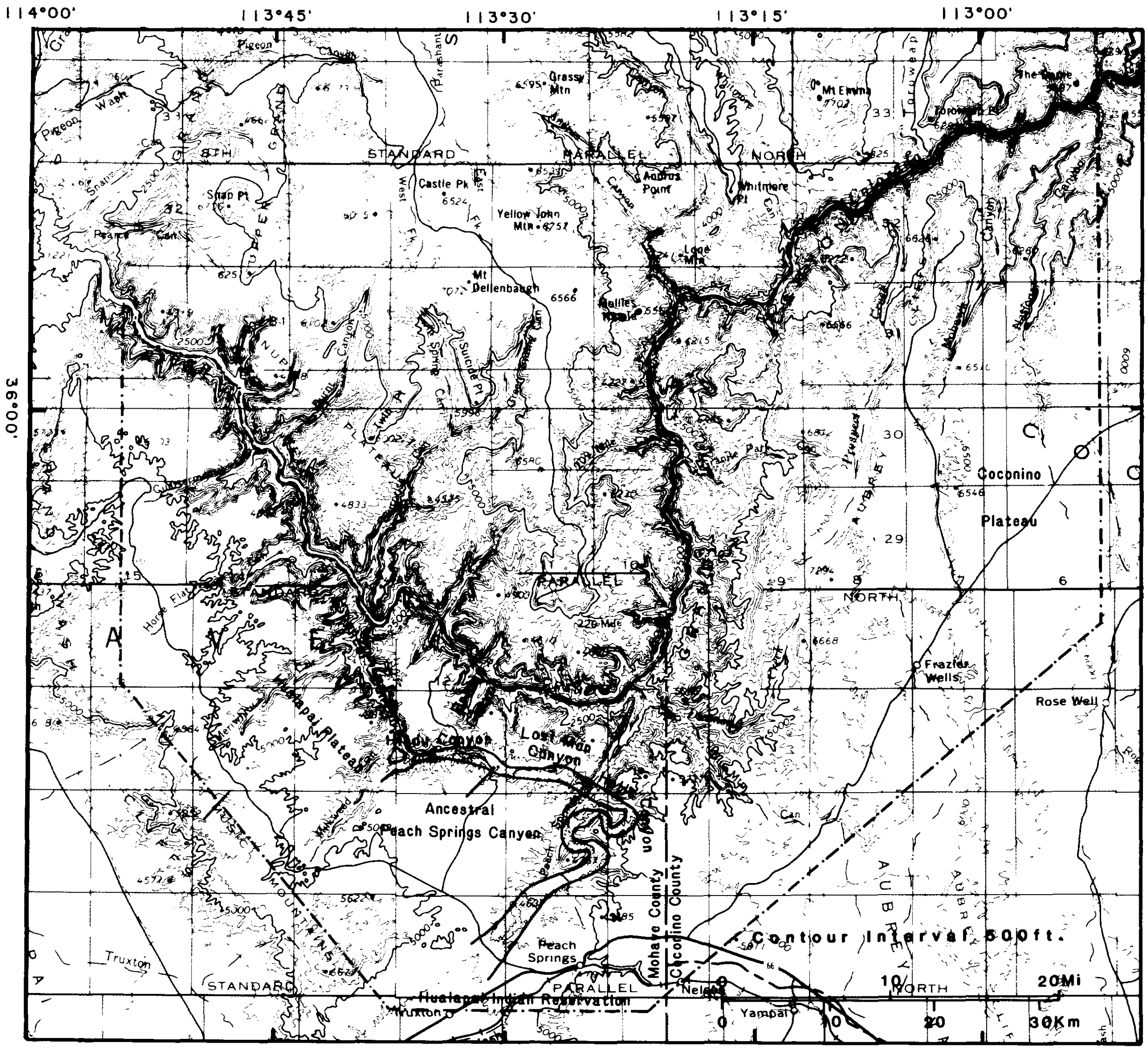

Figure 2.- Map showing topography and drainage system of the Hualapai Indian Reservation and the location of the ancestral Peach Springs Canyon.

The helium soil-gas data were corrected for diurnal variation of the helium concentration. For this study a linear diurnal variation in helium concentration with time was assumed. A regression line was calculated for each day's set of data and the slope of this line was used to correct the data to a common time of 12 noon for each day. Statistical data from which the corrections were made are included in table 1. Both the raw data and the corrected data are included in the appendicies.

Supplemental data collected during the soil-gas helium study of the Hualapai Indian Reservation were used to further investigate the effect of changing meteorologic conditions upon the concentrations of soil-gases. The supplemental data included: analyses of helium in soil-gas samples from a single control station; analyses of a limited number of samples for carbon dioxide, natural gas, and radon; and measurements of radiation at numerous sample sites. The helium samples from the control station were collected during the course of both the June and the October surveys. Generally, three to five samples were collected each day in order to monitor the diurnal meteorologic effects upon the helium concentration in the soil. Sixteen duplicate soil-gas samples collected in October were stored in steel cylinders until the gases were separated by gas chromotography and determined by thermoconductivity. The analyses for carbon dioxide, natural gas, and nitrogen plus oxygen were made by C. N. Threlkeld and A. Vuletich of the Water Resource Division of the U.S. Geological Survey. The carbon dioxide and natural gas (hydrocarbon) analyses were made to determine the abundance of these gases at a collapse structure. In addition to the above mentioned soil-gas samples, eighteen soil-gas samples of the June survey were checked for radon using an activated-phosphor alpha-sensitive scintillometer. The radon data were supplemented by radioactivity measurements made with a portable scintillometer at 717 soil-gas sample sites during June, and at 78 sites during October. Finally, these soil-gas and radioactivity data were compared with meteorologic data for weather stations located at Las Vegas, Nevada and Kingman, Arizona. The meteorologic data were obtained from the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce, and from Arizona State University.

GEOLOGY

The north boundary of the Hualapai Indian Reservation is at the Colorado River which has deeply eroded the western end of the Grand Canyon (fig. 2). Both the Grand Canyon and the side canyons, which are carved by northward-flowing tributaries that head within the Reservation, yield excellent exposures of rocks ranging in age from Precambrian through the Paleozoic (fig. 3). Throughout the eastern part of the Reservation the canyon rim and the Coconino Plateau are held up by the Kaibab Limestone (Billingsley and Huntoon, 1983; Huntoon, Billingsley, and Clark, 1981). West of Peach Springs Canyon the Hualapai Plateau is formed on rocks of Cambrian to Mississippian age; however, rocks at the canyon rim are limited to those of Mississippian and Pennsylvanian age (Huntoon, Billingsley, and Clark, 1982).

Table 1.--Statistical data for soil-gas helium surveys on the Hualapai Indian Reservation, June and October 1982

[statistical data are based upon all samples within ± 2 standard deviations, except as noted.]

Date	No. of samples	Mean sampling time $\overline{X}$	Mean helium (ppb) $\overline{Y}$	Mean helium (ppb) at 12 noon $\overline{Y}$ 12 n	Helium standard deviation (ppb) Y S.D.	Hourly change in helium concentrations Slope Y/X (ppb/hr.)	Y intercept of regression line
June							
4	191	13.27	32.12	36.00	23.36	-3.10	73.20
5	206	11.62	40.52	39.15	23.73	-3.50	81.15
6	163	11.64	50.99	49.36	26.47	-4.36	101.68
7	142	12.13	33.01	33.67	27.55	-5.40	98.47
8	168	12.18	32.01	33.03	27.72	-5.46	98.55
9*	63	14.99	32.07	35.32	28.12	-1.10	48.52
10	107	11.55	33.86	31.17	28.27	-6.01	103.29
11	147	12.78	20.79	23.35	25.70	-3.21	61.87
12	104	11.60	37.38	35.05	22.76	-5.70	103.45
14**	10	14.65	13.60	66.54	13.62	-20.01	306.66
4-14**	1,301	12.30	35.03	36.28	26.84	-4.24	87.16
October							
21	62	12.11	48.72	49.00	21.92	-2.49	78.88
22	69	12.71	47.77	49.02	23.34	-1.70	69.42
23	54	11.45	43.70	39.57	28.61	-7.50	129.57
24***	18	11.85	40.26	36.87	12.77	-21.79	298.35
25***	29	11.80	34.22	34.63	16.21	1.92	11.59
27	87	13.16	53.15	59.42	22.31	-5.37	123.86
28	54	11.33	67.90	61.71	24.08	-9.31	173.43
29	59	12.48	40.43	43.20	25.82	-5.89	113.88
30	58	12.94	40.43	43.02	18.70	-2.83	76.98
21-30***	506	12.30	47.93	49.50	28.24	-5.51	115.62

*-2.44 Slope value assigned to correct helium values in appendicies.

**-4.24 Slope value assigned to correct helium values in appendicies [based on slope of linear regression line for all samples (within ± 2 S.D.) collected June 4-14].

***-5.51 Slope value assigned to correct helium values in appendicies (based on slope of linear regression line for all samples collected October 21-30).

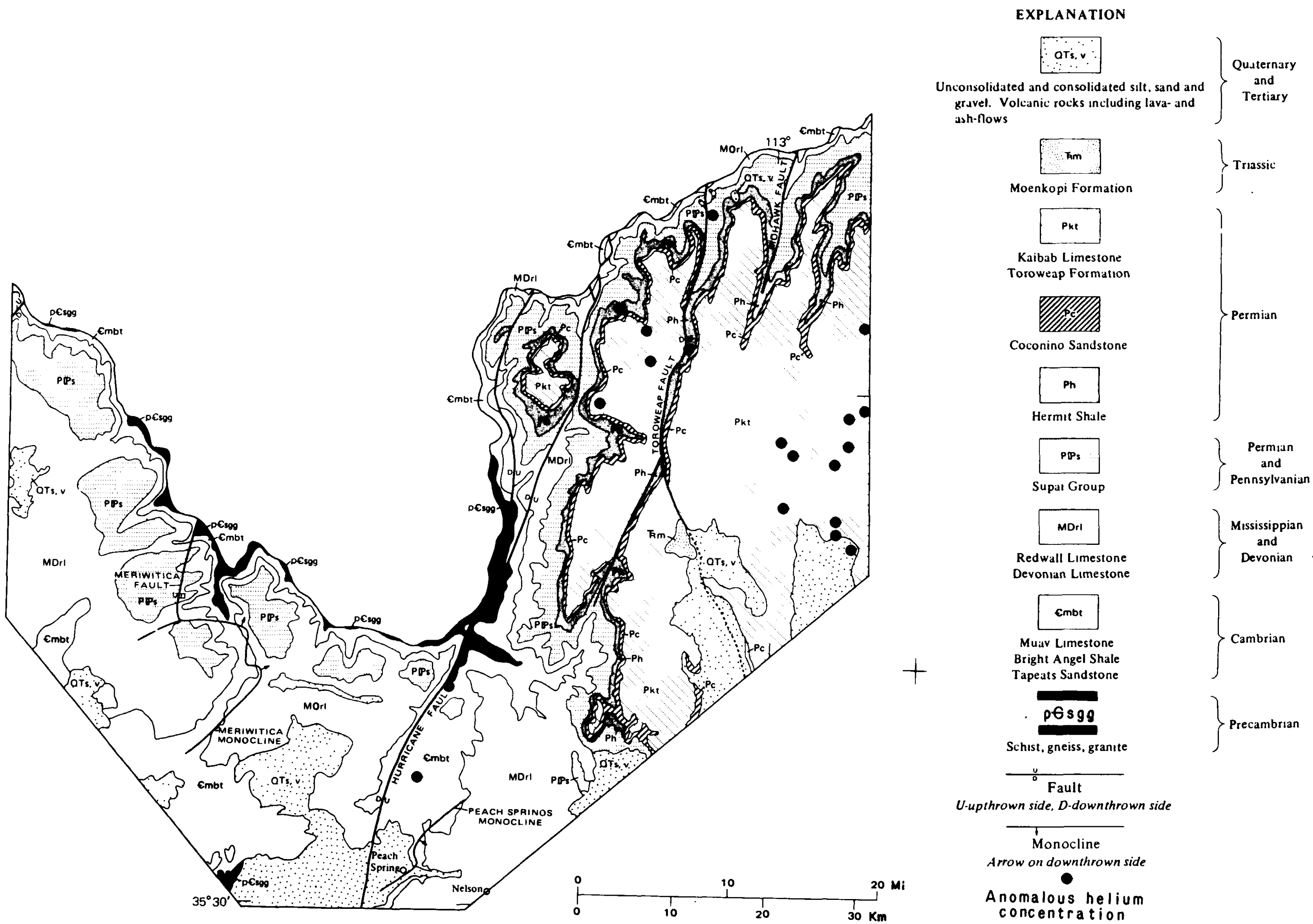

Figure 3.- Map showing anomalously high concentrations of soil-gas helium and the geology of the Hualapai Indian Reservation. (Geology from the State Geologic Map of Arizona.)

This study is concerned primarily with a part of the stratigraphic section that includes the Redwall Limestone of Mississippian age; the overlying Supai Group of Pennsylvanian and Permian age; and, in ascending order, the Hermit Shale, Coconino Sandstone, Toroweap Formation and Kaibab Limestone of Permian age (fig. 3). In addition the Blue Mountain Gravels of Early Cenozoic age (Koons, 1948, and Huntoon, Billingsley and Clark, 1981) and a series of sedimentary and volcanic rock of Early to Middle Cenozoic age (Young, 1966) are of interest.

Early Cenozoic erosion stripped most of the Mesozoic age rocks from the area; however, in places remnants of the Moenkopi Formation of Triassic age underlie the Blue Mountain Gravels. In the eastern part of the Reservation these gravels were deposited on a surface referred to in this report as the Blue Mountain surface. During Early to Mid-Cenozoic time a major river flowed eastward through Hindu and Lost Man Canyons and then southward through Hells Canyon (Young, 1966), otherwise known as the ancestral Peach Springs Canyon (fig. 2). By Mid-Cenozoic time the ancestral canyon was filled with sedimentary deposits consisting of the Music Mountain Conglomerate, Hindu Fanglomerate, Westwater Formation, Buck and Doe Conglomerate, and Willow Springs Formation (Young,1966; Huntoon, Billingsley, and Clark, 1978, 1982). Volcanic rock, including ash flows, lava flows, and agglomerates, found in the upper part of the Cenozoic sequence, are informally named the Hualapai Volcanics by Young (1966).

Northward-trending faults have created a series of eastward-dipping fault blocks that displace the Paleozoic rocks and Cenozoic deposits. In addition, the erosional surfaces have been displaced by these faults. This structural movement occurred throughout much of Cenozoic time; however, much of the structural displacement occurred during Late Cenozoic time. Along the Hurricane fault early displacement that predated the initial erosion of the ancestral Peach Springs Canyon has been reversed by a major uplift of the eastern fault block. Tectonic activity during the Cenozoic has undoubtedly affected groundwater flow and the development of solution collapse structures.

Sinks, collapse structures, and topographic depressions are common on the Coconino Plateau in the eastern part of the Reservation. These structures may result from dissolution of the Kaibab Limestone which caps the plateau, or they may be associated with a dissolution of the Redwall Limestone, similar to the process that formed uranium-copper-bearing breccia pipes during the Mesozoic era. Unfortunately evidence needed to determine the origin of these structures is generally lacking. Large areas of internal drainage in the National Tank Quadrangle are outlined by depression contours. These areas of depression may result from recent block faulting, or they may indicate areas of active dissolution and collapse that could be possible sites of primary or secondary uranium mineralization.

Uranium occurrences are present in the Music Mountain Conglomerate of Cenozoic age in the ancestral Peach Springs Canyon and also in a breccia pipe of collapse origin at the Ridenour mine. Exploration data at the Mulberry Springs uranium lease, located five miles north of Peach Springs, Arizona are not available; however, the radioactivity and helium data collected during the course of this study is consistent with the presence of uranium mineralization in the the Music Mountain Conglomerate. Not withstanding the favorability of the Cenozoic rocks for uranium, the greatest potential for economic deposits exists in breccia pipes similar to the one at the Ridenour mine. Copper and uranium occurs at the mine where the pipe structure penetrates the Esplanade Sandstone of the Supai Group. In addition to the above occurrences, uranium may also occur below an unconformity of Tertiary age. Uranium is associated with copper occurrences in the Kaibab Limestone where a high level of radioactivity was detected by an aerial radioactivity survey (Aero Service, 1979). High radioactivity was also detected above outcrops of the Blue Mountain Gravels. Possibly the uranium occurrences in the Kaibab Limestone are unconformity related deposits occurring in fractures and collapse structures in strata that once underlay the Blue Mountain Gravels. This possible relationship is obscured by erosion of these gravels at several of the copper prospects shown by McKee, Gomez, and Hibpshman in their figure 7 (1977).

DISTRIBUTION OF SOIL-GAS HELIUM

The soil-gas helium values ranged from -111 to 242 ppb with respect to ambient air. High values of helium (those in excess of 110 ppb) are generally found in the eastern part of the Hualapai Reservation (fig. 3). The samples that contain more than 110 ppb helium reported for either the uncorrected or corrected value, are listed in table 2. High concentrations of soil-gas helium were detected at the Mulberry Springs prospect in the ancestral Peach Springs Canyon above uranium occurrences in rocks of Cenozoic age (fig. 3). Commonly, relatively high helium (pl. 1, greater than 50 ppb He) occurs in the vicinity of faulted and fractured rocks, such as along the Toroweap fault (fig. 3) within Prospect Valley . This valley was formed by a major displacement along the Toroweap fault. A similar relationship of helium to faulted and fractured rocks may exist in the west half of the National Tank 7 1/2' Quadrangle where anomalously high and low helium values (pl.1) were detected during sampling traverses across a fault shown by O'Neill and others (1981).

High concentrations of soil-gas helium are also associated with erosional surfaces that are possibly correlative with the Blue Mountain surface, and with collapse structures. One sample, number 436 of the October survey, yielded a diurnally corrected 139 ppb helium. Sample number 472 from another collapse structure may also be anomalous (table 2). This sample, number 472, yielded a corrected value of 115 ppb helium. The two samples were collected at sites corresponding to collapse structures numbered, respectively, 525-C83 and 532-C83 by K. J. Wenrich (oral commun., 1984).

Other soil gases

Negative soil-gas helium concentrations that were observed in the June and October surveys may result from the presence of other terrestrially-derived gases. These gases dilute the helium in the soil and may reduce the helium concentration below the helium concentration of air (5,240 ppb). The helium survey revealed a general distribution of low and negative helium values at the margin of the Coconino Plateau where the plateau is dissected by headward eroding tributaries of the Colorado River . These low and negative helium values contain, respectively, 10 to -10 ppb He and less than -10 ppb He, as comparied to ambient air. Seventeen samples contained large negative helium values (-111 to -40 ppb He with respect to ambient air). Significant concentrations of other soil gases may be present at the localities where these samples were collected (fig.4).

Table 2.--Soil gas samples containing more than 110 ppb helium, as indicated by either the uncorrected or the corrected value. All helium values reported with respect to ambient air

Sample number	June '82 survey Helium value (ppb) (uncorrected data)	(corrected for diurnal variation--linear relationship assumed)	Quadrangle	Location	Comments
81	147	132	National Tank	SW1/4SW1/4 sec. 24, T. 29 N., R. 7 W.	Position of Blue Mountain surface.
86	113	100	National Tank	SW1/4NW1/4 sec. 17, T. 29 N., R. 6 W.	Position of Blue Mountain surface.
366	116	109	Vulcans Throne SW	NW1/4NW1/4NW1/4 sec. 33, T. 31 N., R. 8 W.	Location adjacent to northwest-trending fault, upthrown side; on ridge near drainage head.
369	116	110	Vulcans Throne SW	SE1/4NE1/4SW1/4 sec. 28, T. 31 N., R. 8 W.	Location on ridge near head of drainages.
375	132	129	Vulcans Throne SW	NW1/4NW1/4SE1/4 sec. 21, T. 31 N., R. 8 W.	Location on ridge near head of drainages.
423	120	106	National Tank	SE1/4NW1/4SE1/4 sec. 7, T. 29 N., R. 6 W.	Location along fault.
431	120	109	National Tank	SE1/4NW1/4SW1/4 sec. 31, T. 30 N., R. 6 W.	Location along fault.
510	100	111	Vulcans Throne SW	SE1/4SE1/4SW1/4 sec. 7, T. 31 N., R. 8 W.	Sample from colluvium above older surface on Hermit Shale.
529	120	112	Vulcans Throne SE	NW1/4NW1/4SW1/4 sec. 25, T. 31 N., R. 8 W.	Location along small fault at Toroweap monocline and adjacent to Toroweap fault.
567	105	126	Vulcans Throne	SW1/4NW1/4SE1/4 sec. 7, T. 32 N., R. 7 W.	Sample from younger colluvium near Toroweap fault.
578	132	117	National Tank	NW1/4SW1/4NE1/4 sec. 33, T. 30 N., R. 6 W.	Location near older drainage developed on Blue Mountain surface.
583	122	109	National Tank	SW1/4SE1/4NW1/4 sec. 28, T. 30 N., R. 6 W.	Location near Potter's Hole (sink).
882	110	111	National Tank	SW1/4SW1/4SW1/4 sec. 26, T. 30 N., R. 6 W.	Location below Blue Mountain surface.
884	140	141	National Tank	NE1/4NW1/4SW1/4 sec. 26, T. 30 N., R. 6 W.	Location below Blue Mountain surface.
1028	119	114	National Tank	SE1/4NE1/4NW1/4 sec. 7, T. 29 N., R. 6 W.	Location west of fault in meander drainage established on Blue Mountain surface.
1089	236	242	Hockey Puck Spring	NE1/4SE1/4 sec. 14, T. 30 N., R. 6 W.	Sample taken at 1/2 probe depth because of shallow bedrock.
1160	126	122	National Tank	SW1/4NW1/4NW1/4 sec. 31, T. 30 N., R. 6 W.	Location along fault.
1170	131	138	Peach Springs	SE1/4NW1/4SW1/4 sec. 26, T. 26 N., R. 11 W.	Sample from Music Mountain Conglomerate(?) of Early Cenozoic age.
1172	164	171	Peach Springs	NE1/4NW1/4SE1/4 sec. 26, T. 26 N., R. 11 W.	Sample from Music Mountain Conglomerate(?) of Early Cenozoic age.
1415	120	120	Peach Spgs. Canyon	SW1/4NE1/4NE1/4 sec. 19, T. 27 N., R. 10 W.	Location near Hurricane fault.
1416	120	121	Peach Spgs. Canyon	SW1/4NE1/4SE1/4 sec. 18, T. 27 N., R. 10 W.	Location near Hurricane fault.
1441	149	146	National Canyon	NW1/4NE1/4 sec. 24, T. 31 N., R. 6 W.	Location at Blue Mountain surface(?).
1443	138	136	National Canyon	SW1/4SE1/4 sec. 13, T. 31 N., R. 6 W.	Location at Blue Mountain surface(?).

Sample number	October '82 survey Helium value (ppb) (uncorrected data)	(corrected for diurnal variation--linear relationship assumed)	Quadrangle	Location	Comments
102	181	169	National Tank	SW1/4SW1/4 sec. 4, T. 29 N., R. 6 W.	Position of Blue Mountain surface(?).
103	172	160	National Tank	Ctr. NE1/4 sec. 8, T. 29 N., R. 6 W.	Position of Blue Mountain surface(?).
105	121	110	National Tank	NW1/4NW1/4 sec. 17, T. 29 N., R. 6 W.	Location near fault and below Blue Mountain surface.
108	121	112	National Tank	NW1/4NW1/4NW1/4 sec. 24, T. 29 N., R. 7 W.	Position of Blue Mountain surface.
120	134	132	Dike Tank	NE1/4 sec. 27, T. 29 N., R. 6 W.	Position above alluviated valley.
121	117	116	Dike Tank	Ctr. S1/2 sec. 27, T. 29 N., R. 6 W.	Location at margin of alluviated valley.
132	114	107	National Tank	SE1/4NW1/4NE1/4 sec. 7, T. 29 N., R. 6 W.	Location adjacent to fault.
135	119	113	National Tank	NW1/4SE1/4 sec. 6, T. 29 N., R. 6 W.	Location adjacent to fault.
141	123	118	National Tank	NW1/4SW1/4 sec. 31, T. 30 N., R. 6 W.	Location adjacent to fault.
145	113	109	National Tank	NW1/4SW1/4SW1/4 sec. 30, T. 30 N., R. 6 W.	Location adjacent to fault.
436	154	139	National Tank	SW1/4NW1/4 sec. 23, T. 30 N., R. 6 W.	Location at west margin of intermittant pond, possible sink.
472	98	115	National Tank	SW1/4NW1/4NW1/4 sec. 13, T. 30 N., R. 6 W.	Location at south margin of a collapse.
535	141	109	Dike Tank	NW1/4NE1/4SE1/4 sec. 26, T. 29 N., R. 7 W.	Location at Blue Mountain surface.
536	125	95	Dike Tank	SE1/4SW1/4NW1/4 sec. 25, T. 29 N., R. 7 W.	Location at Blue Mountain surface.
546	112	87	National Tank	NE1/4NE1/4SW1/4 sec. 20, T. 29 N., R. 6 W.	Location adjacent to fault(?).
551	126	104	Dike Tank	NE1/4NW1/4NW1/4 sec. 27, T. 29 N., R. 6 W.	Location in alluviated valley.
552	112	91	Dike Tank	SE1/4NE1/4SE1/4 sec. 28, T. 29 N., R. 6 W.	Location in alluviated valley.

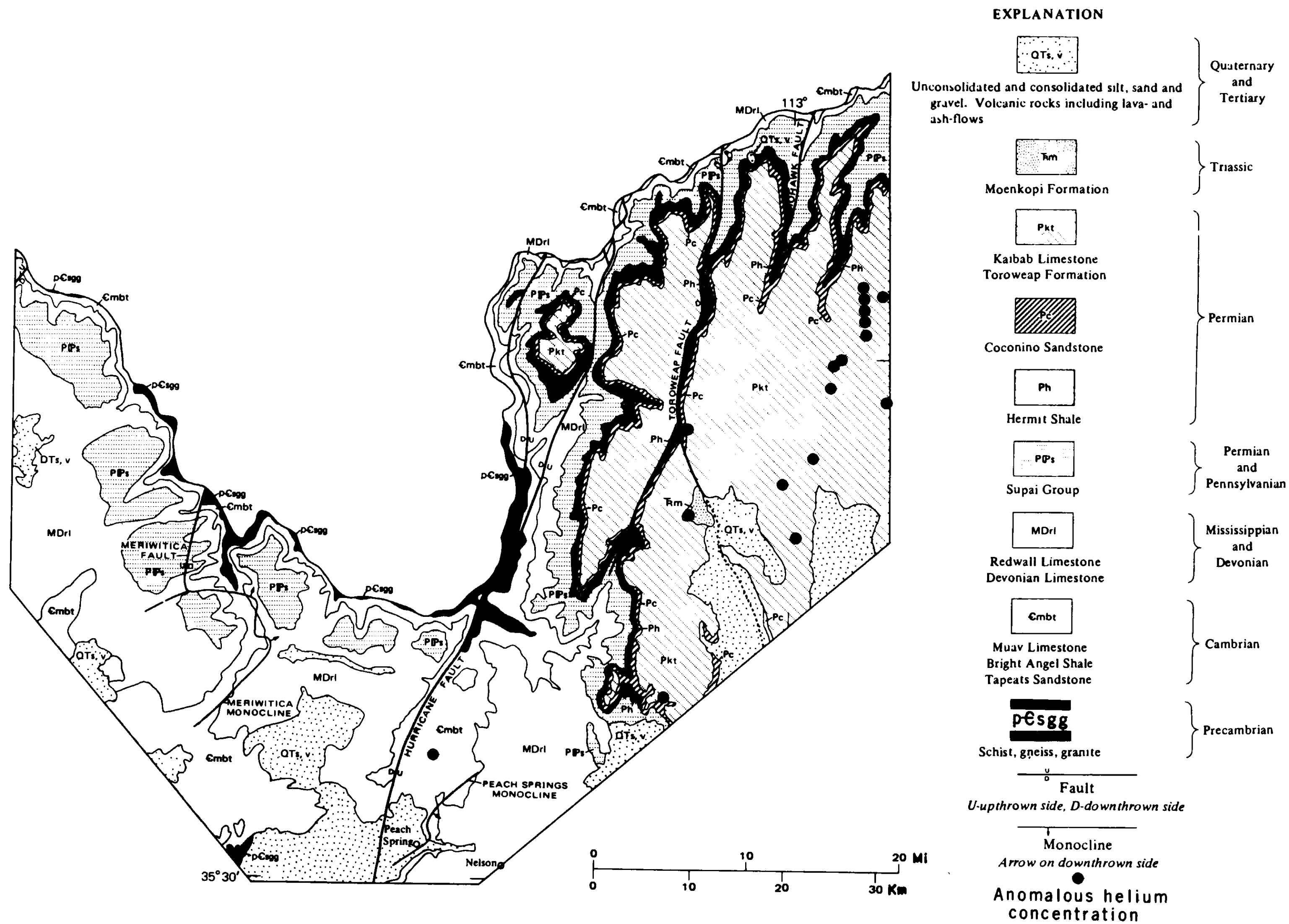

Figure 4.- Map showing anomalously low concentrations of soil-gas helium and the geology of the Hualapai Indian Reservation. (Geology from the State Geologic Map of Arizona.)

Analysis of sixteen soil-gas samples collected during the October helium survey of a collapse structure yielded an average carbon dioxide (CO_2) concentration of 0.26 percent. The concentration of CO_2 ranged from 0.01 to 0.47 percent (table 3). These concentrations represent an excess of carbon dioxide above that contained in air ranging from 0.06 to 0.41 percent CO_2. If helium concentrations are corrected for excess carbon dioxide, the maximum correction for these samples would be 21 ppb He.

Three of the sixteen samples containing carbon dioxide also contained methane (CH_4). Two of these samples contained only minor amounts of methane, but sample no. 635 contained 1.46 percent CH_4 (table 3). A correction of the helium value of sample no. 635 for methane dilution would increase the helium concentration from 42 to 119 ppb.

Radon was detected in 17 samples of soil gas collected for radiometric analysis during the June survey. The scintillometer count in these 17 samples (table 4) ranged from 7 to 82 counts per minute (cpm) and averaged 39 cpm.

DISCUSSION

The purpose of the geochemical sampling of soil-gas helium is two-fold. The helium survey seeks to identify both localities and environments that may be favorable for uranium exploration. Full interpretation of soil-gas data is dependent upon both geologic and hydrologic knowledge; however, the data also supplement this knowledge. The user of these soil-gas data should be aware of the variables that affect the distribution of gases in the soil. These variables can be classified into three groups - geologic variables, hydrologic variables, and meteorologic variables. Variables in one group frequently interact with those of another group to influence the distribution and concentration of helium. Although many of these variables affect the concentration of all gases in the soil, individual properties of each gas differ, thereby influencing the rate of gaseous diffusion, the concentration of each gas, and the relative concentration of all the gases.

Geologic Variables

A fundamental geologic variable to be considered during the interpretation of helium soil-gas data is the source of the helium. Because helium is evolved from alpha particles emitted by elements in either the uranium or thorium decay series, one or both of these sources may contribute to a helium anomaly. In this respect helium data are similar to data obtained from a total-count radiometric survey, except that, unlike the radiometric data, helium data are unaffected by the potassium content of the rocks.

Locally on the Hualapai Reservation thorium may be the source for much of the helium in the soil. Aerial radiometric data (Aero Service, 1979) indicates that high radiation from the thorium decay series is present in the Aubrey Valley and extends northward past Frazier Wells to include areas capped by the Blue Mountain Gravel. Equivalent thorium has also been detected by the aerial radiometric survey in the vicinity of Robbers Roost Canyon where the Blue Mountain Gravels and Robbers Roost Gravels were mapped by Huntoon, Billingsley, and Clark (1981). Thorium may also contribute to high soil-gas helium concentrations in Prospect Valley and Peach Springs Canyon. Farther to the west

Table 3.--Analysis of carbon dioxide, methane, nitrogen, and helium from a collapse structure, sec. 13 and 24, T. 30 N., R. 6 W., Hualapai Indian Reservation

Field Number	October 30, 1982 Time	Carbon dioxide (%)		Methane* %	Nitrogen* %	Helium (ppb)
		Total	Above air			
634	11:41	0.256	0.223	0.017	99.726	42
635	11:46	0.144	0.111	1.46	98.396	42
636	11:52	0.267	0.234	--	99.733	28
637	11:59	0.140	0.107	--	99.860	28
639	12:19	0.171	0.138	--	99.828	28
643	13:19	0.095	0.062	--	99.904	21
645	13:59	0.470	0.403	--	99.510	29
646	14:06	0.147	0.114	--	99.852	15
650	14:44	0.209	0.176	--	99.791	73
714	10:46	0.348	0.315	--	99.652	84
721	11:13	0.423	0.390	--	99.577	84
722	11:42	0.164	0.131	--	99.836	57
723	11:44	0.330	0.263	--	99.670	57
724	11:49	0.315	0.282	--	99.685	71
726	12:15	0.230	0.163	--	99.770	57
739	14:50	0.474	0.407	0.018	99.500	37

*analysts C. N. Threlkeld and A. Vuletich

Table 4.--Soil-gas radon counts, Hualapai Indian Reservation, June 4-8, 1982

Date June	Sample number	Time (decimal hours)	Radon (cpm)
4	101	10.33	82
4	319	12.00	10
4	338	14.58	41
4	247	14.67	65
4	130	14.75	37
4	348	15.58	30
5	149	8.80	52
5	171	13.58	18
5	502	14.42	69
6	514	9.00	24
6	566	16.78	11
6	575	18.25	20
7	578	9.17	32
7	757	11.03	70
7	838	15.13	7
8	847	9.33	48
8	895	13.33	51

in the Milkweed Canyon-Hindu Canyon-Lost Man Canyon area thorium may be associated with the Peach Springs tuff and underlying sediments of Tertiary age that fill an ancient canyon eroded during the mid Cenozoic. The Meriwhitica Canyon area also has anomalous concentrations of thorium or its daughters.

Thorium may be derived from sources located south of the Hualapai Reservation in the Hualapai, Aquarius, Peakcock, and Cottonwood Mountains (Aero Service, 1979). No data are currently available to indicate whether thorium from these sources was carried northward by Early-to-Middle Cenozoic streams to the areas indicated by the aerial radiomecric survey, or even whether radium-228, the thorium daughter, is in the surface and ground water that flows northward toward the Colorado River. However,it is possible that the soil-gas helium concentrations on the Reservation are comprised, in part, by helium derived from the thorium decay series. The original thorium source possibly existed south of the Reservation.

Uraniferous sources for helium are disseminated throughout the crustal rocks, and are also concentrated in the form of economic or subeconomic deposits. Anomalous concentrations of helium may be detectable in the soil above uranium deposits. Migration of helium to the surface occurs most readily where the permeability of the rock is high, or where faults or fractures provide channels for its movement. Two mechanisms for helium migration exist. Helium may diffuse within ground water and within other gases, and it may also be transported by a carrier liquid (water) or gas. The presence of a carrier can result in a more rapid migration of helium. Flow of gas or ground water may transport helium away from its site of origin, i.e., the uranium source. If this happens, helium can be displaced laterally far from its point of origin, possibly a buried uranium deposit (Reimer and Otton, 1976). Helium halos may incorporate helium derived from multiple uranium deposits or from deposits occurring at more than one depth. Shallower uranium deposits are more likely to be identified by a soil-gas survey, and uranium occurrences within the soil zone, or in the underlying rocks, may mask the detection of more deeply buried deposits.

Geologic data suggest that three types of uranium occurrences are present on the Hualapai Indian Reservation. These occurrences may be classified as vein-type (breccia pipe) deposits, penecondordant (essentially stratabound) deposits, and unconformity related deposits. A vein-type uranium deposit in the form of a mineralized breccia pipe of solution-collapse origin is present in Paleozoic rocks at the Ridenour mine. The copper-uranium deposit is similar in origin to the Orphan ore body at the South Rim of the Grand Canyon.

Uranium and copper deposits of the breccia pipes in the Grand Canyon district commonly are present in the Esplanade Sandstone of the Supai Group, although deposits in the Orphan pipe occur as high, stratigraphically, as the Hermit Shale. Uranium and copper have been redistributed within the Orphan pipe. Secondary uranium and copper enrichment of deposits in breccia pipes may be localized by the position of the ground-water table that, for long periods of time, was stabliized by erosional, structural, and volcanic events (Bowles, 1977). Breccia pipes are the most favorable exploration targets.

Peneconcordant uranium deposits in fluvial rocks of Cenozoic age have been recognized in Hells Canyon. This canyon forms a segment of a major ancestral drainage sometimes referred to as the ancestral Peach Springs Canyon (Bowles, 1977). This early drainage system includes Lost Man, Hindu, and Milkweed Canyons to the west (fig. 2) where a similar favorable environment for uranium deposits exists.

The possibility of unconformity-related deposits is suggested by aerial radiometric and helium data. Cenozoic sediments deposited upon the Late Permian and Early Triassic rocks of the Coconino Plateau yield high radioactivity. The presence of deposits associated with the unconformity has not been confirmed at this time; therefore the existence of this environment is speculative. High helium values were detected in the eastern part of the Hualapai Reservation within areas outlined by closed topographic depressions. The presence of Quaternary and Holocene sediments may conceal collapse structures and breccia pipes. Possibly the depressed areas result from the reactivation of solution and collapse. Such a geologic setting could yield karst-type uranium deposits similar to those of the Pryor Mountains in Wyoming. This type of deposit, which is also characterized by limestone solution and collapse, is not included with the vein-type or breccia-pipe deposits, because the extent of the collapse structures may be restricted to the Kaibab Limestone and Toroweap Formation, and because the source of mineralizing solutions and the age of the deposits probably are different. As yet, this geologic environment has not been tested on the Hualapai Reservation.

Faults and associated fractures present at Prospect Valley, Peach Springs Canyon, and the Coconino Plateau may be mineralized with uranium and copper minerals. High helium values have been detected in these areas, but the source of the helium is unknown. Shallow occurrences of redistributed metals, including uranium, may be localized by fractures associated with the faults. Possibly, mineralization has occurred at depth along the structures. Permeable fault systems may produce high helium because the faults act as conduits for migration of helium from depth and not because the faults are mineralized by uranium or thorium. Another possible cause for the high helium concentrations found in this structural setting is a release of helium from ground water in the vicinity of the structures. This mechanism for helium concentration will be discussed later under the hydrologic variables.

The porosity and permeability of the soil at each soil-gas sample site can affect the concentration of helium found in the soil-gas sample. Low permeability in the soil reduces the rate of degassing to the atmosphere thus permitting helium to accumulate. In addition, the low permeability also reduces the penetration of atmospheric gases into the soil.

Hydrologic Variables

Conditions that affect the mobility and solubility of helium and other gases in ground water also indirectly affect the concentrations of these gases in the soil. Gases are dissolved in water in proportion to their solubilities. In addition, the concentration of the dissolved gases varies directly with fluid pressure and inversely with fluid temperature; however, fluid pressure is the dominant factor in most areas. Therefore, larger concentrations of gases are dissolved in the deeper ground waters. Similar conditions can occur where springs discharge into the deeply encised canyons.

Conditions favoring the degassing of ground water are present on the Hualapai Reservation. Aquifers dip northward toward the Grand Canyon where ground water commonly discharges as springs in the side canyons. The ground water table slopes northward, controlled by the points of spring discharge. A decrease in fluid pressure, i.e., a northward slope of the potentiometric surface, toward discharging springs in the canyons is to be expected. Beneath the northward-sloping potentiometric surface an artesian flow and degassing of the ground water probably occurs. Evidence of a deep flow pattern is found in the discharge of thermal helium-bearing spring water at the mouth of Prospect Canyon. The high concentration of helium in the spring water, as reported by K. Wenrich (oral commun.), may be derived either from a single deposit of uranium, or it may result from a contribution of helium derived from ubiquitous background levels of uranium within the aquifers and surrounding rocks.

The concentrations of helium relative to the other gases dissolved in spring water on the Reservation commonly is less than the amount present in the atmosphere. Negative helium values reported by K. Wenrich (oral commun.) indicate an abundance of other terrestrially-formed gas. Carbon dioxide probably is abundant in these waters, especially in springs discharging from limestone aquifers.

During the degassing of ground waters the relative abundance of helium in the released gas is determined by the solubilities and degree of saturation of all the gases in the water. If the dissolved helium concentration is close to the saturation point, a decrease of fluid pressure during artesian flow may cause a release of free-gas helium before other dissolved gases achieve their saturation point. An anomalous concentration of helium might then be detected in the soil.

If other gases are also at the saturation point, a reduction in pressure could trigger the release of a disproportionally large volume of gas that is more soluble than helium. Under this condition, negative helium values, with respect to ambient air, probably would be found in the soil gas. Commonly, soil-gas samples contain greater concentrations of carbon dioxide than are found in air. These CO_2 concentrations may be derived, in part, from helium dissolved both in the ground water and in the soil moisture; therefore, the dilution of helium by CO_2,and the resultant negative helium concentrations with respect to ambient air, may be determined not only by the rate of formation of carbon dioxide in the earth, but also by the changes in pressure caused by hydrologic and meteorologic conditions. Soil gas sampled at the collapse structure at the eastern margin of the Reservation contained carbon dioxide above the level found in air. If the helium concentrations were corrected for a dilution by terrestrially-formed CO_2, the helium value would be increased by about 14 ppb.

Soil-gas samples collected on the Hualapai Reservation may yield carbon dioxide from three possible sources. The gas may be produced in the soil zone during the decay of organic matter. Carbon dioxide may also be produced in the Kaibab Limestone and the Toroweap Formations which cap the Coconino Plateau. A third major source would be the deeply buried Redwall Limestone. Very negative helium values could indicate large concentrations of carbon dioxide and the position of a collapse structure through which the gas migrates toward the surface.

The ability of soil-gas or ground-water sampling to detect anomalous emissions of helium or radon can be reduced by a rapid flow of ground water past a uranium deposit. This effect was noted in a study of helium in the Edgemont uranium district of the southern Black Hills of South Dakota and Wyoming (Bowles and others, 1980). Where a rapid ground-water flow occurs in the vicinity of a uranium deposit, helium may not be produced rapidly enough to build up an anomalous concentration in the water. Anomalous concentrations of helium would not be found in the soil above the uranium deposit, although the helium halo could be offset in the direction of ground-water flow if a selective degassing of helium occurs in the manner outlined previously. Radon is similarly affected; however, the short radon half-life also commonly prevents detection of anomalous radon concentrations unless the uranium and/or radium deposits are near the collecting site for the randon sample. There is insufficient ground-water data to determine whether the flow rate of the ground water is a significant factor in the interpretation of the helium data from the Hualapai Reservation.

Meteorologic Variables

Variations in the concentrations of helium and other gases in the soil of the Hualapai Indian Reservation occur in three cyclic patterns that reflect diurnal (daily) patterns, short term or cyclonic and weather front patterns, and seasonal meteorologic patterns. The effects of meteorologic conditions upon the concentrations of gases within the soil have been studied by Onchukov (1956), Kraner, Schroeder, and Evans (1964), Robertson (1969), Clements and Wilkening (1974), Jeter and others (1977), Reimer (1979), Jeter (1980), Ball, Nicholson, and Peachey (1983), and others.

The meteorologic variables considered are barometric pressure, air temperature, relative humidity, dew point, precipitation, wind speed, and cloud cover. The influence of these meteorologic conditions upon the concentrations of soil gases decreases with sample depth. The concentrations of soil gases are also affected by soil permeability, and soil moisture. Although there are interrelationships between the meteorologic variables identified above, emphasis in this report is placed upon barometric pressure. Decreases in barometric pressure act as a pump, creating a flow of soil gas to the atmosphere; later, increased pressure causes a return flow of air into the soil. The flow of gases from the soil may be reduced by precipitation and condensation which may saturate the upper levels of the soil, thereby reducing the effective porosity and permeability. Moisture added by precipitation or condensation also dissolves gases, thus reducing the concentration of free gases in the soil. Later, evaporation of the soil moisture releases the dissolved gases. Air temperature and dew-point factors also affect soil moisture and the concentration of soil gases. In addition, solar energy raises soil temperature and decreases soil moisture, thereby indirectly affecting the concentrations of soil gases, especially in the upper one foot of the soil zone.

Diurnal meteorologic variations and soil-gas data

Diurnal variations in the concentrations of helium, radon, carbon dioxide and methane collected on the Reservation coincide with the diurnal cycles in meteorologic data collected by the U.S. National Weather Service at Las Vegas, Nevada and Kingman, Arizona. The diurnal variation in barometric pressure is illustrated by a plot of the averages for the hourly barometric pressures recorded at Las Vegas during the period of June 4-14 (fig. 5a). Maximum pressure commonly occurs between 8 and 10 a.m. followed by a decrease in pressure after 10 a.m. until a minimum pressure is recorded, generally between 3 and 4 p.m. The diurnal variation in barometric pressure is an atmospheric tide of cyclic regularity; however, the greatest pressure variations are caused by atmospheric waves generated not by the gravitational forces that cause the ocean tides, but by solar heating (Clancy, 1968, p. 190). The barometric pressure data from Las Vegas (fig. 5) reflect the semi-diurnal solar cycle as discussed by Clancy. The semi-diurnal cycle has a pressure maximum at 10:00 a.m. (local solar time) and another pressure high at 10:00 p.m.; however, the secondary night-time pressure wave is small as compared to the day-time wave.

The variations in barometric pressure at Las Vegas are an approximation of the pressure changes that occur on the Hualapai Reservation. The higher elevations on the Coconino Plateau result in lower pressures. This difference in pressure is partially offset by the lower air temperatures on the plateau. Cooling of the air above the Plateau probably occurs somewhat earlier in the afternoon than on the desert floor at Las Vegas. This difference could cause an increase in barometric pressure somewhat earlier than on the plateau than at Las Vegas. Not withstanding these differences, the hourly barometric pressure recorded at Las Vegas provides a suitable illustration of the pattern of diurnal variation in barometric pressure generally occurring on the Reservation during the helium surveys.

The concentration of helium in soil-gas samples collected for the period from June 4-14, 1982 fluctuated in response to the changes in barometric pressure. A comparison of the meteorologic data and the helium data for 1293 samples containing -25 to 99 ppb helium with respect to ambient air illustrates the effect of diurnal meteorologic conditions upon the helium concentration in soil-gas samples (fig.5). The helium data for all the days of the survey have been combined according to the hour of the day when the samples were collected, and the average helium concentration has been calculated for each hour (fig. 5c). The hourly averages of the barometric pressure for the sampling period are shown in figure 5a, and these data in figures 5a and 5c are further reduced to show the hourly rate of change in barometric pressure and the hourly percent of samples with greater than 10 ppb He (fig. 5b). It should be noted that the helium concentrations seem to be related to both the diurnal barometric pressure and the rate of change in the barometric pressure. Furthermore, the curves for both sets of data in figure 5b have inflection points between the hours of 2 and 3 p.m. A comparison of all curves plotted in figure 5 suggests that the flow of helium from the soil is affected by the rate of change in barometric pressure. Table 5 includes diurnal statistical data used in the preparation of figure 5.

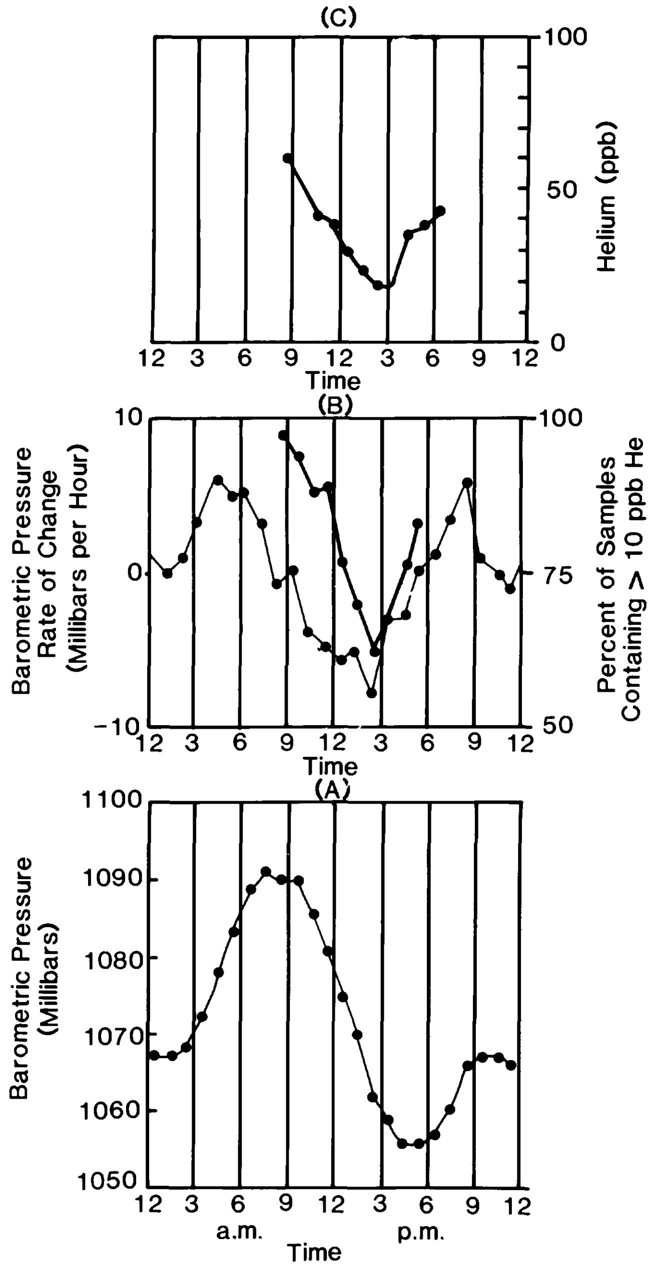

Figure 5.- Graphs showing (a) the average hourly barometric pressure recorded June 4-14, 1982 at Las Vegas, Nevada, (b) the average hourly rate of change of barometric pressure and the hourly percent of the soil-gas samples from the Hualapai Indian Reservation that contain more than 100 ppb helium (heavy line), and (c) the average hourly concentration of helium in these samples.

Table 5.--Statistical data showing hourly variation in mean helium concentration in soil-gas for samples containing -25 to 95 ppb helium, Hualapai Indian Reservation, June 4-14, 1982.

Hour	No. of samples	Mean sampling time (decimal) $\bar{x}$	Mean helium (ppb) $\bar{y}$	Helium S.D. Y S.D.
8- 9 a.m.	47	8.67	59.79	20.24
9-10 a.m.	199	9.57	51.55	22.72
10-11 a.m.	244	10.50	41.26	25.28
11-12 a.m.	195	11.50	38.88	25.42
12- 1 p.m.	111	12.51	29.42	24.52
1-2 p.m.	145	13.51	22.57	25.47
2- 3 p.m.	145	14.55	17.92	21.33
4- 5 p.m.	58	16.48	34.83	27.51
5- 6 p.m.	24	17.46	36.58	19.62
6- 7 p.m.	6	18.28	41.83	19.14

The rate of change in barometric pressure accelerates or decelerates the barometric pumping and the flow of gases both into or out of the soil. The escape of helium gas into the air results both from the diffusion of helium and the flow of helium-bearing gases. Gaseous flow is the more effective mechanism for the transfer of helium from the soil to the atmosphere. Therefore, it may be expected that changes in the pumping rate, resulting from an increase or decrease in the rate of change in barometric pressure, may be reflected in the distribution of helium in the soil.

The diurnal cycle for barometric pressure affects all soil gases; however, not all gases respond to the meteorologic fluctuations at the same rate. The differences in size and weight of the molecules, as well as the solubility of each gas affect their escape from the soil. Carbon dioxide and methane analysis of sixteen samples revealed a diurnal pattern similar to that for helium (table 3). The 5-sample moving averages plotted for carbon dioxide vs time and for helium vs time (fig. 6) show a similar decrease in the concentrations of these gases during the morning hours and an increase in their concentration by mid-afternoon. Although methane was detected in only three of the soil-gas samples, it too apparently has a diurnal distribution pattern that is, in gross aspects, similar to the distribution of helium and carbon dioxide. The three samples that contain methane were collected either relatively early or relatively late in the day, and conversely samples that contain no detectable methane were collected from 12 noon until nearly 3 p.m., a time when helium and carbon dioxide concentrations generally are low.

The diurnal distribution of soil-gas radon, as determined from 17 soil-gas samples analyzed by radon counting during the June survey, differed from the helium distribution. A two-sample moving average for radon (fig. 7) increased during the early morning hours to a maximum level between 10 and 11 a.m., then registered a mid-day low before increasing again to a mid-afternoon high near 2:30 p.m. This was followed by an abrupt decrease in the radon value. Low radon values persisted for the remainder of the afternoon period. The different responses of the radon and helium to the diurnal variation in barometric pressure can be attributed to a lag in the degassing of radon relative to helium. The larger and heavier radon molecule does not migrate as readily from the soil during gaseous flow and diffusion at midday, thus the radon concentration in the soil increases relative to helium and the other soil gases. Supporting this interpretation for the degassing of radon is June data (fig. 7) from 716 sample sites at which surface radioactivity was measured with a scintillometer. Although the scintillometer does not count alpha particles emitted by the decay of 222Rn or its daughter 218Po, it does count beta and gamma radiation associated with the decay of 214Pb and 214Bi. These two members of the uranium decay series have half-lives, respectively, of 26.8 and 19.7 minutes. Therefore, surface radiation recorded with a scintillometer includes radiation emitted by these short-lived radioactive daughters, and can be used indirectly to measure variations in radon concentration. The diurnal variation in the surface radioactivity is attributable to the near-surface distribution of radon. The

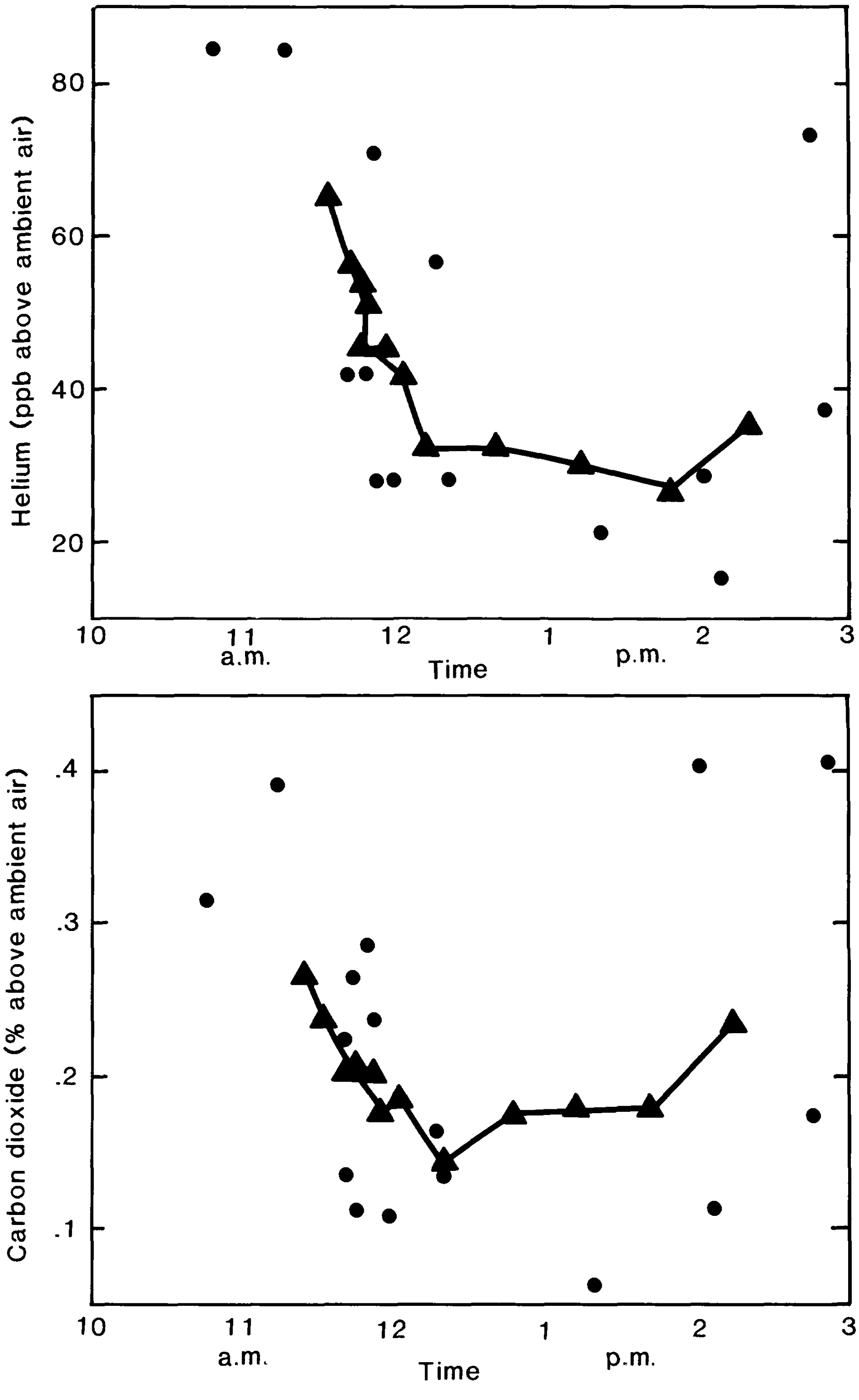

Figure 6.-- Graphs showing diurnal variations in helium and carbon dioxide as indicated by 5-sample moving averages. Data from samples collected at a collapse structure, Hualapai Indian Reservation, October 30, 1982.

surface radioactivity increased to maximum readings between 9 and 10 a.m. and was also very high between the hours of 2 and 4 p.m. A decrease in the surface radioactivity during the midday hours is attributed to the solar heating of the upper part of the soil zone and to the heating of the air at the ground surface coupled with the reduction of barometric pressure. This solar heating and decrease in barometric pressure causes the release of radon and other gases from soil moisture and a convection-aided flow of gases, especially from the uppermost 1-2 feet of the soil. Atmospheric convection currents rapidly carry the radon gases away from the ground surface resulting in lower radioactivity recorded by the scintillometer at the surface. As the barometric pressure becomes stable and starts to increase, the release of radon to the atmosphere apparently is blocked and the radon concentration in the soil gas increases causing an increase in surface radioactivity. Late in the afternoon increasing barometric pressure causes an inflow of air into the soil which displaces radon in the shallower part of the soil zone. The effect of the inflow of air into the upper soil zone is found in the low level of surface radioactivity after 4 p.m.

The diurnal variations for soil-gas helium and radon and the diurnal variation in surface radiation focus attention upon the effect that differing rates of diffusion and flow for each soil gas must have upon the soil-gas helium concentration. In order to examine this effect upon the soil-gas helium data collected during June a histogram (fig. 8) was prepared showing the hourly average percentage of soil-gas samples reporting helium concentrations of less than 10 ppb. Just as the average concentration of soil-gas helium is a minimum between 2 and 3 p.m., the percentage of soil-gas samples reporting helium concentrations of under 10 ppb helium, with respect to ambient air, peaked at 38 percent between 2 and 3 p.m. In accordance with the ± 10 ppb He instrumental precision for the analyses, the reported helium concentrations of less than 10 ppb may result from the presence of significant concentrations of atmospheric gases or from concentrations of terrestrially formed gases. As a further refinement of the data treatment the percentage of samples that probably contain significant concentrations of other terrestrially formed gases is included in figure 8. These samples contain less than -10 ppb helium. This group of samples peaked at nearly 21 percent of all samples collected between 3 and 4 p.m. This inflection point for samples having negative concentrations of helium is an hour later than the inflection point for samples in the 10 to -10 ppb He range.

During the diurnal decrease in barometric pressure, helium escapes more rapidly from the soil than the heavier gases, thereby causing a relative decrease of the helium concentration. As the barometric pressure decreases, an increasing percentage of soil-gas samples record a drop in helium concentration below the 5,240 ppb He found in air (fig. 8). The earlier discussion of soil-gas-radon data and surface-radioactivity data indicated that high levels of radon remain in the soil during the diurnal period of minimum barometric pressure between 2 and 3 p.m. (fig. 7), a time when soil-gas helium values are a minimum.

Although radon and the lighter gases flow and diffuse from the shallower soil zones with the initial decrease in barometric pressure, the bimodal distribution of radon and surface radioactivity apparently reflects the slower rate of radon degassing, especially degassing from the deeper soil zones and underlying rocks. The effect upon the helium data of the different rates of degassing is to cause a pseudo-dilution of helium. A comparison of the ratio of soil-gas radon, as indicated by surface radioactivity data to helium reflects a diurnal pseudo-dilution of helium, as well as a slower rate of flow and diffusion of radon (fig. 9). Unfortunately, the possibility of determining the relative

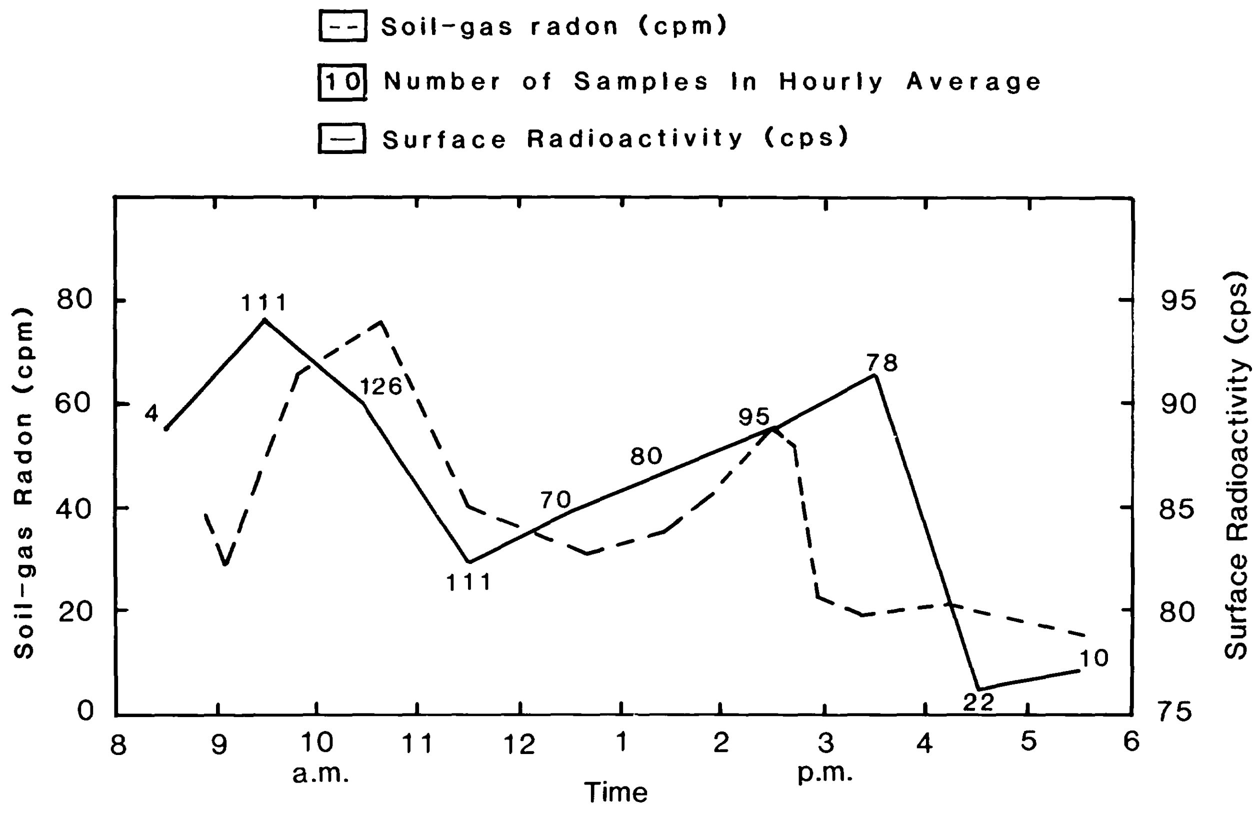

Figure 7.-- Comparison of diurnal variations in surface radioactivity and soil-gas radon, Hualapai Indian Reservation, June 1982. Surface radioactivity plotted from hourly averages. Radon plot represents a 2 sample moving average.

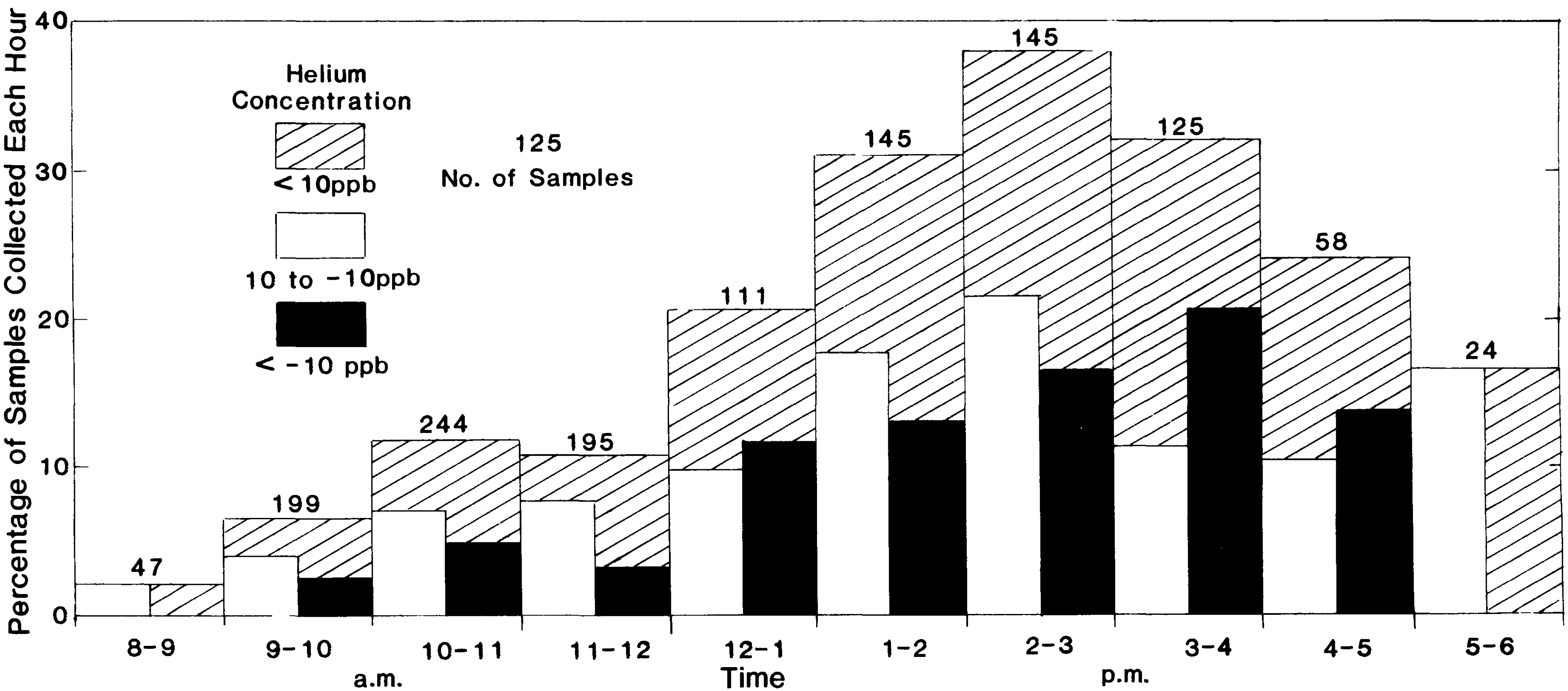

Figure 8.- Histogram showing relative hourly percentages of low-level soil-gas helium in 1923 samples collected on the Hualapai Indian Reservation, June 1982.

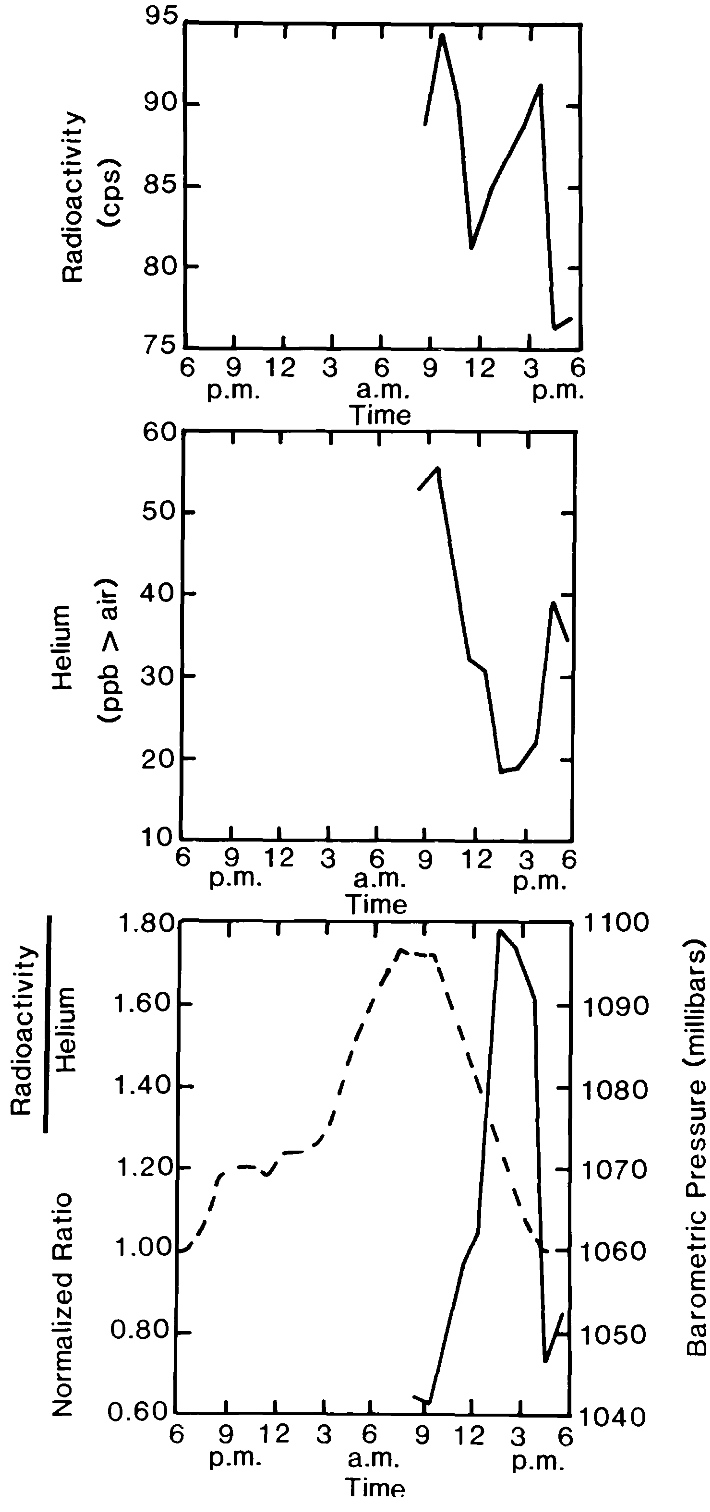

Figure 9.- Graphs showing effect of diurnal variation in barometric pressure* (dashed line) upon the concentration of soil-gas helium and radon (as indicated by surface radioactivity) Hualapai Indian Reservation, June 1982. Ratio of radioactivity to helium normalized to the averaged ratio for the 10 hours of sample collection. *Barometric pressure data recorded by the U.S. National Weather Service at Las Vegas, Nevada.

depth of uraniferous source rocks from a radon- or radioactivity-to-helium ratio is diminished by the diurnal barometric pumping of the soil gases. Low ratios would indicate deeply buried or distant uranium sources only when soil-gas samples are collected during the early hours of the afternoon. Samples numbered 510 and 884 of the June survey appear to meet this criterion. These samples were collected, respectively, in the SWSWSE 1/4 of Sec. 7, T. 31 N., R. 8 W., within the Vulcans Throne SW 7 1/2' quadrangle and in the NENWSW 1/4 of Sec. 26, T. 30 N., R. 6 W., within the National Tank 7 1/2' quadrangle.

Cyclonic meteorologic variations and soil-gas data

The soil-gas helium data of this study were affected by differences in barometric pressure resulting from the horizontal shifting of cyclonic air masses, i.e., from advection. Low concentrations of soil-gas helium are associated with cyclones which are characterized by a spiraling counter clockwise flow of air into regions having low barometric pressure, overcast skies, and precipitation. High concentrations of helium are associated with anticyclones which are characterized by a spiraling clockwise flow of air away from regions having high barometric pressure, clear skies, and no precipitation. The effect of variations in barometric pressure upon soil-gas helium concentrations is essentially the same regardless of whether the pressure fluxes occur in a diurnal or cyclonic pattern. However, the effect of these different meteorologic patterns upon the barometric pressure and helium concentration is cumulative.

Good examples of the relationship between cyclonic weather patterns and the soil-gas helium concentration occurred during the October helium survey. Two weather cycles are illustrated by the data from Las Vegas (pl. 5). On October 19th a cold front brought high pressure into the region. After that a general warming trend occurred until early on the 24th. Cloud cover, as recorded at Las Vegas during this period, varied from clear to overcast skies; traces of precipitation were reported between 11 a.m. and 1 p.m. on the 24th. A continuing drop in barometric pressure took place during the 25th and continued until the afternoon of the 26th when high winds brought a second cold front and a new weather cycle into the region. This second weather cycle, which commenced on the 26th, continued until the 30th when more precipitation occurred.

Helium concentrations in the soil-gas samples on the Hualapai Reservation during October reflected the two weather cycles (pl. 5). Highest helium values and a high daily average helium concentration occurred after clearing skies when high pressure was dominant. It should be noted that the diurnal variation in the helium concentration was great during this period of high barometric pressure and clearing skies, a time when degassing of the soil was accelerated by maximum solar heating.

The cyclonic meteorologic patterns during the June survey were not as well defined as those during the October survey; however, the concentration of soil-gas helium in June does reflect the cyclonic variations in barometric pressure (pl. 6). If the diurnal variations in barometric pressure and helium concentration are removed from the data by using daily averages, then the cyclonic meteorologic effect upon the helium concentration in the soil during June is more evident (fig. 10).

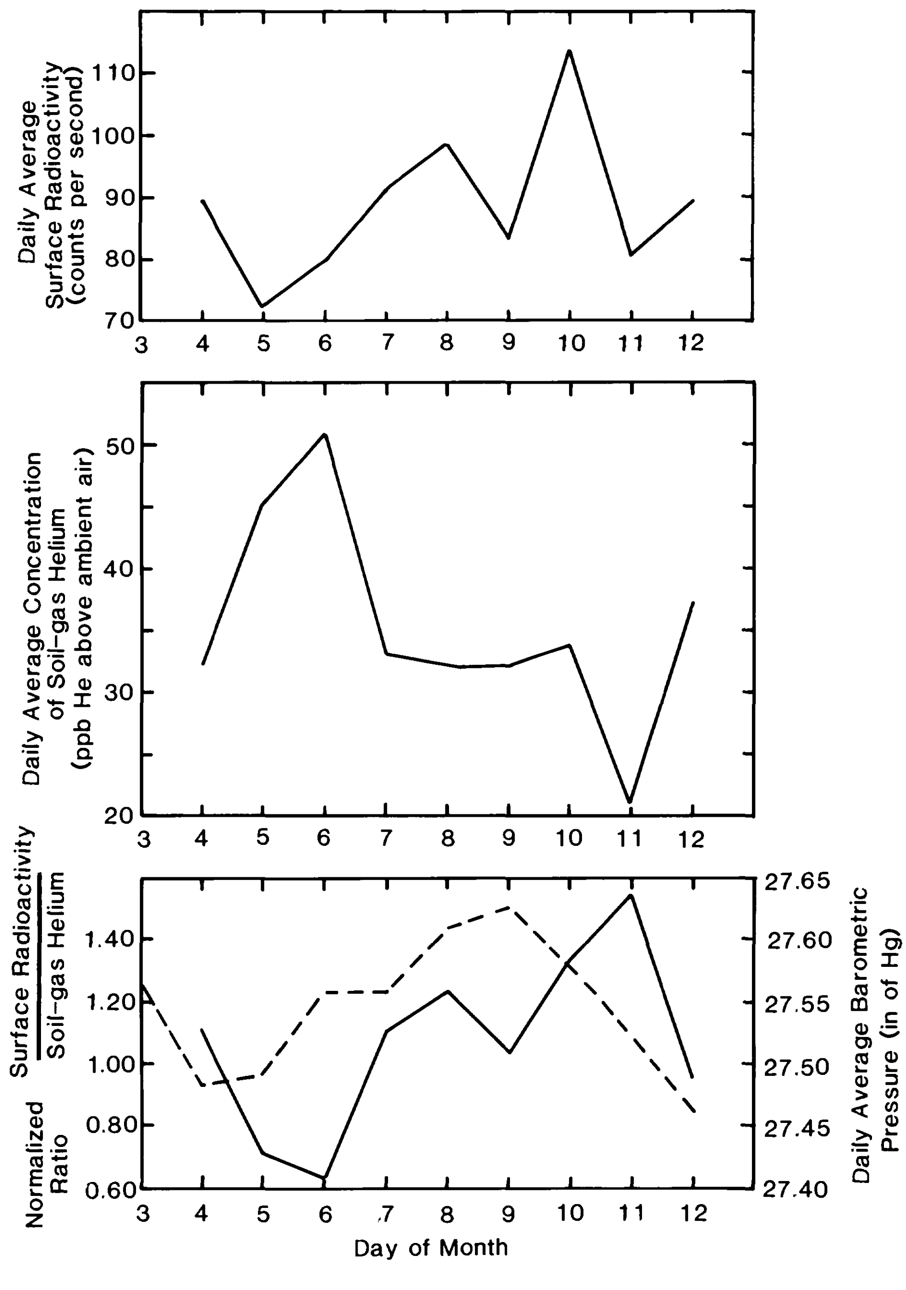

Figure 10.- Graphs showing effect of cyclonic variation in barometric pressure (dashed line) upon the concentrations of soil-gas helium and radon (as indicated by surface radioactivity), Hualapai Indian Reservation, June 1982. Ratio of radioactivity to helium normalized to the average ratio for the 9 days of sample collection shown on the graph. Barometric pressure data recorded by the U.S. National Weather Service at Las Vegas, Nevada.

Surface radioactivity data also shows the effect of cyclonic meteorologic conditions upon the concentration of radon in the upper part of the soil. Figure 10 shows an increase in the daily average of the radioactivity measurements resulting from an increase in barometric pressure; however, just as was noted previously for the diurnal variations in radon and radioactivity (fig. 7), the full effect of cyclonic variations in barometric pressure upon the radon concentration is delayed. If a ratio of radioactivity to helium is plotted and compared to the plot for barometric pressure, the similarity of the two curves is inescapable; but the radioactivity curve appears to be displaced along the timescale by a period of 1 to 2 days. The similarity and the offset of the two curves can only be explained by the relatively slow diffusion and flow of radon in the ground in response to the changing barometric pressure as compared to the response of helium.

Seasonal meteorologic variations and soil-gas data

Soil-gas helium data recorded higher levels of helium in the soil during the October survey than during the June survey (table 1 and pls. 5 and 6). Notwithstanding the fact that the October survey included many samples from collapse structures and also samples collected from some areas not previously sampled, the higher average helium concentration during October is attributed largely to seasonal meteorologic conditions, not to the geologic environment.

During October, air temperatures were cooler; the barometric pressure was higher; the cloud cover was greater; and, except during periods when cold fronts encroached upon the region, there generally was less wind. In addition, except during these encroachments of the cyclonic weather fronts, the diurnal range of barometric pressure and temperature commonly was somewhat lower in October. This seasonal effect upon the diurnal range of temperature and pressure during October has resulted in a diurnal variation in the soil-gas helium concentration that is commonly smaller in October than in June.

Evaluation of Data Corrections for Helium

Corrections of the helium data using a linear-regression correction are, at best, an approximation of representative soil-gas helium values. The most reliable corrections are made when the soil-gas samples are collected under "average conditions". Large divergences from these conditions with respect to sample depth, soil permeability, and soil moisture could result in significantly different helium values.

Diurnal variations in helium concentration during the hours of sample collection diverge from a linear relationship for helium vs. time. Therefore, data corrections based upon a linear regression line generally result in helium values that are too high for samples collected during the early- to mid-morning hours and during the late afternoon; whereas helium values for samples collected during the early afternoon generally are too low.

No correction has been made for cyclonic and seasonal variations in helium concentration; however, a correction can be made using data from table 1 of this text and the diurnally corrected helium data in the Appendicies. The cyclonic meteorologic effect upon the helium values for samples collected during the June and October surveys may be diminished by subtracting the daily mean helium concentration at 12:00 noon from the mean helium concentration at 12:00 noon for all days of that survey (table 1) and then adding the resulting helium value to the diurnally corrected helium value from the appendicies. The maximum cyclonic correction by this method for June data would be ±13 ppb He. Insufficient samples were collected on June 14th to calculate a reliable cyclonic correction for that day. The maximum and minimum cyclonic helium corrections for data collected during October would be by a similar corrective process +15 ppb He and -12 ppb He, respectively.

An additional seasonal correction of 13 ppb He can be added to the diurnally and cyclonically corrected June data to enable a direct comparison of these data from the summer and fall seasons. The combined cyclonic and seasonal corrections for the June data would result in a change in the diurnally corrected values in table 1 of the Appendicies ranging from -2 to +28 ppb He.

Large concentrations of other terrestrially formed gases compound the problem of data correction, because they dilute the helium and can conceal significant amounts of helium in the soil. Although dilution effects are common in most geochemical studies, they can be critical in soil-gas helium studies because anomalous helium concentrations represent a variation of less than 2% in the total helium content of a soil-gas sample. An example of a critical dilution effect was found in one of the sixteen samples analyzed for other soil gases. Sample no. 635 collected on October 30th contained 1.46% methane. As reported earlier, a correction of the total helium concentration for this dilution would increase the helium concentration to a value of 119 ppb He above ambient air, which is considered to be anomalous.

An additional factor affecting helium data correction is the pseudo-dilution of helium by other terrestrially formed gases. An apparent dilution of helium by these other gases occurs when the lighter helium diffuses and flows more rapidly from the ground than the heavier gases thereby causing a decrease in the concentration of helium within the soil. The pseudo-dilution effect can be found in the diurnal increase in the percentage of samples having low and negative helium concentrations during the hours when the barometric pressure is decreasing (fig. 8). The cyclonic pattern for the distribution of helium and radon (as indicated by surface radioactivity measurements) also shows lower concentrations of helium relative to the concentrations of radon during periods of decreasing barometric pressure (fig. 10). This pseudo-dilution can magnify the effect of the actual dilution of helium by other terrestrially formed gases, as evidenced by the increased number of negative helium values (with respect to ambient air) reported during periods of low barometric pressure. This effect is common at times when cyclones dominate the weather pattern, especially during the mid-day period. Although the helium corrections for diurnal and cyclonic variations in meteorologic conditions may provide reliable corrections for the average sample collected under average soil conditions; the absence of control for abnormal soil conditions and for large dilutions by other terrestrial gases may permit anomalous helium concentrations to go undetected in spite of the diurnal and cyclonic corrections.

Extended Studies

The text, table, and maps indicate sample sites and environments where high concentrations of helium were detected, and where a potential for uranium occurrences may exist. Text figures showing the location of sample sites and the uncorrected helium values may be used in conjunction with the data tables in the appendicies to identify sites having significantly higher helium than other sites sampled on the same traverse during a limited period of time. An examination of these data may disclose sites producing significant amounts of helium which are partially masked by the concentrations of other gases in soil.

Sites of reported high concentrations of helium should be examined and evaluated after a full consideration of all geologic, hydrologic, and meteorologic factors affecting soil-gas helium interpretation.

Additional data collection, including surface radioactivity and soil-gas radon counts and soil-gas sampling may be desirable. The volume of sample collected should be sufficient to enable the analysis for other terrestrially formed gases. It is recommended that all meteorologic variables be recorded continuously at the survey site during the period of sample collection and for a minimum period of 24 hours prior to sample collection. This procedure would assist data correction. An alternative procedure would consist of the periodic collection of samples over an extended period of time in order to average out the meteorologic effects upon the soil-gas data.

CONCLUSIONS

The soil-gas helium survey recorded high helium values within several different geologic environments including the Mountain Music Conglomerate, a host rock for known uranium occurrences in Hells Canyon. Other geologic environments yielding high concentrations of soil-gas helium include sites adjacent to faults, and sites at sinks and collapse structures. Additional sites with high concentrations of helium are associated with the Blue Mountain surface and the overlying deposits of Mid- to Late Cenozoic age.

A failure to detect anomalous concentrations of helium does not necessarily indicate a low uranium potential, if the samples were collected at times when diurnal and cyclonic meteorologic conditions resulted in a strong degassing of the soil with a preferential degassing of helium.

The large data base accumulated during the study has enabled the recognition of interrelationships between the concentrations of helium and radon in the soil gas resulting from cyclonic and diurnal meteorologic conditions. The data collected during this study also indicate that these variations in meteorologic conditions contribute to variations of radon concentration in the soil that affect all surface radiation measurements above soils. Aerial radiometric surveys, which commonly scan areas that are soil covered, can be affected by these variations in meteorologic conditions.

This helium study emphasizes the necessity for the recording of meteorologic data for a minimum period of 24 hours prior to the commencement of a soil-gas survey as well as the necessity for a continuous detailed monitoring of meteorologic conditions throughout the period of sample collection.

Other terrestrially formed gases may dilute soil-gas helium concentrations resulting in a failure to detect areas producing anomalous amounts of helium.

Soil-gas helium data may indicate the presence of other terrestrially formed gases. Analysis of these gases is necessary for the evaluation of the helium data, and this analysis could contribute to a recognition of geochemical processes favorable for the deposition and preservation of uranium deposits.

ACKNOWLEDGEMENTS

We thank the following people for their assistance in the sample collection and data preparation: Josh Been, Harry Day, Sharon Gable, Paul Hildebrandt, Don Murrey, Lori Taqawa, and S. Gunnaleka. Our study has benefitted significantly from the analysis of carbon dioxide and methane by C. N. Threlkeld and A. Vuletich. We thank the Hualapai Tribal Council for access to tribal lands during the course of this study.

REFERENCES

Aero Service, 1979, Airborne gamma-ray spectrometer and magnetometer survey, Williams Quadrangle (Arizona), Final Report Volume II: GJBX-59 '79.

Ball, T. K., Nicholson, R. A., and Peachey, D., 1983, Effects of meteorological variables on certain soil gases used to detect buried ore deposits: Transactions of the Institution of Mining and Metallurgy, v. 92, November 1983, p. B183-B190.

Billingsley, G. H.,Jr., 1983, Geologic map of Vulcan' Throne and vicinity, western Grand Canyon, Arizona: Grand Canyon Natural History Association

Bowles, C. G., 1977, Economic implications of a new hypothesis of origin of uranium- and copper-bearing breccia pipes, Grand Canyon, Arizona [abs.], in Short papers of the U.S. Geological Survey Uranium-Thorium Symposium, 1977: U.S. Geological Survey Circular 753, p. 25-27.

Bowles, C. G., Reimer, G.M., Been, J.M.,and Murrey, D. G., 1980, Helium investigations in the Edgemont uranium district southern Black Hills, South Dakota and Wyoming: U. S. Geological Survey Open-File Report 80-1077, p. 1-30.

Clancy, E. P., 1968, The tides-pulse of the earth: Doubleday and Co. Inc., p. 1-190.

Clements, W. E., and Wilkening, M. H., 1974, Atmospheric pressure effects on ^{222}Rn transport across the earth-air interface: Journal of Geophysical Research, v. 79, no. 33, p. 5025-5029.

Gornitz, V. M., and Kerr, P. F., 1970, Uranium mineralization and alteration, Orphan mine, Grand Canyon, Arizona: Economic Geology, v. 65, no. 7, p. 751-768.

Granger, H. C., and Raup, R. B., 1962; Reconnaissance study of uranium deposits in Arizona: U.S. Geological Survey Bulletin 1147-A.

Huntoon, P. W., Billingsley, G. H., Jr., and Clark, M. D., 1978, Geologic map of the western Grand Canyon district, sheet 24: unpublished geologic map Grand Canyon Natural History Association and Wyoming Water Resources Research Institute.

_____1981, Geologic map of the Hurricane fault zone and vicinity, western Grand Canyon, Arizona: Grand Canyon Natural History Association.

_____1982, Geologic map of the Lower Granite Gorge and vicinity, western Grand Canyon, Arizona: Grand Canyon Natural History Association.

Jeter, H. W., 1980, A modeling study of gaseous Rn-222, Xe-133, and He-4 for uranium exploration: Teledyne Isotopes, Bendix contract DE-AC13-76GJ01664 subcontract 78-076-L, p. 1-111.

Jeter, H. W., Martin, J. D., and Schutz, D. F., 1977, The migration of gaseous radionuclides through soil overlying a uranium ore deposit: a modeling study: Teledyne Isotopes, GJBX-67[77], IWL-4611-410, p. 1-42.

Koons, E. D., 1948, Geology of the Eastern Hualapai Indian Reservation Area, Plateau, v. 20, no. 4, p. 53-60.

Kraner, H. W., Schroeder, G. L., and Evans, R. D., 1964, Measurements of the effects of atmospheric variables on radon-222 flux and soil-gas concentrations, in The Natural Radiation Environment: University of Chicago Press, p. 191-215.

McKee, E. H., Gomez, P.M., and Hibpshman, M. H., 1977, Status of mineral resource information for the Hualapai Indian Reservation, Arizona, Administrative Report BIA-31, prepared by U. S. Geological Survey and U. S. Bureau of Mines for U. S. Bureau of Indian Affairs.

Miller, R. D., 1954, Copper-uranium deposit at the Ridenour mine, Hualapai Indian Reservation, Coconino County, Arizona, Part I: U.S. Atomic Energy Commission, RME-2014.
O'Neill, A. J., Nystrom, R. J., and Thiede, D. S., 1981, National Uranium Resource Evaluation, Williams Quadrangle, Arizona: Bendix Field Engineering Corp., GJQ-009 (81), pl.7.
Onchukov, D. N., 1956, Diurnal relationships in the transfer of heat and moisture in soils; Pochvovedenie, no. 5, p. 25-30.
Reimer, G. M., 1979, The use of soil-gas helium concentrations for earthquake prediction: Studies of factors causing diurnal variation, U.S. Geological Survey Open-File Report 79-1627, p. 1-68.
Reimer, G. M., and Otton, J. K., 1976, Helium in soil-gas and well water in the vicinity of a uranium deposit, Weld County, Colorado: U.S. Geological Survey Open-File Report 76-699, p. 1-10.
Reimer, G. M., Denton, E. H., Freidman, I., and Otton, J. K., 1979, Recent development in uranium exploration using the U.S. Geological Survey's mobile helium detector: Journal of Geochemical Exploration, v. 11, p. 1-12.
Robertson, J. B., 1969, Diffusion from a gaseous source in a porous medium - a field and theoretical comparison: U. S. Geological Survey Professional Paper 650-D, p. 265-273.
Young, R. A., 1966, Cenozoic geology along the edge of the Colorado Plateau in northwestern Arizona: St. Louis, Missouri, Washington University, Department of Earth Sciences, Ph.D. dissertation, 167 p.

APPENDICIES

Table 1.--Soil-gas helium analyses for samples collected on the Hualapai Indian Reservation during June 1982. (All helium is reported relative to the helium concentration in ambient air (5,240 ppb He).

Table 2.--Soil-gas helium analyses for samples collected on the Hualapai Indian Reservation during October 1982. (All helium is reported relative to the helium concentration in ambient air (5,240 ppb He).

Table 3.--Surface radioactivity at soil-gas sample sites, Hualapai Indian Reservation.

Table 1.--Soil-gas helium analyses for samples collected on the Hualapai Indian Reservation during June 1982. (All helium is reported relative to the helium concentration in ambient air (5,240 ppb He))

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
1	4	9:35	35 33 08	113 18 40	84	77
2	4	9:40	35 33 32	113 18 22	42	35
3	4	9:45	35 33 47	113 17 57	52	45
4	4	9:50	35 33 59	113 17 29	63	56
5	4	9:55	35 34 13	113 16 59	63	57
6	4	10:00	35 34 26	113 16 28	21	15
7	4	10:05	35 34 41	113 16 00	52	46
8	4	10:10	35 35 03	113 15 41	52	46
9	4	10:16	35 35 27	113 15 24	42	37
10	4	10:21	35 35 49	113 15 09	63	58
11	4	10:27	35 35 52	113 14 36	52	47
12	4	10:34	35 36 06	113 14 13	84	80
13	4	10:47	35 36 20	113 13 44	63	59
14	4	10:55	35 36 33	113 13 13	31	28
15	4	11:00	35 36 44	113 12 44	31	28
16	4	11:05	35 36 54	113 12 13	52	49
17	4	11:11	35 37 11	113 11 48	52	49
18	4	11:17	35 37 28	113 11 27	21	19
19	4	11:25	35 37 53	113 10 59	42	40
20	4	11:25	35 38 10	113 10 32	42	40
21	4	11:32	35 38 36	113 10 21	63	62
22	4	11:41	35 38 53	113 10 06	10	9
23	4	11:46	35 38 56	113 09 56	52	51
24	4	11:51	35 39 01	113 09 41	10	10
25	4	11:57	35 39 05	113 09 28	42	42
26	4	12:03	35 39 13	113 09 21	10	10
27	4	12:08	35 39 23	113 09 16	-31	-31
28	4	12:12	35 39 33	113 09 14	-42	-41
29	4	12:16	35 39 43	113 09 11	0	1
30	4	12:21	35 39 51	113 09 04	42	43
31	5	7:58	35 40 00	113 08 58	54	40
32	5	8:03	35 40 10	113 08 56	72	58
33	5	8:08	35 40 18	113 08 54	36	22
34	5	8:12	35 40 30	113 08 56	54	41
35	5	8:17	35 40 40	113 08 49	72	59
36	5	8:22	35 40 49	113 08 44	54	41
37	5	8:27	35 40 58	113 08 37	0	-12
38	5	8:34	35 40 54	113 08 27	72	60
39	5	8:39	35 40 54	113 08 13	72	60
40	5	8:44	35 40 58	113 08 07	72	61
41	5	8:48	35 41 07	113 07 57	45	34
42	5	8:54	35 41 17	113 07 50	72	61
43	5	9:01	35 41 26	113 07 46	72	62
44	5	9:06	35 41 36	113 07 40	36	26
45	5	9:12	35 41 47	113 07 34	0	-10
46	5	9:16	35 41 57	113 07 31	36	26
47	5	9:21	35 42 09	113 07 27	54	45
48	5	9:27	35 42 19	113 07 19	36	27
49	5	9:33	35 42 26	113 07 14	9	0
50	5	9:38	35 42 36	113 07 08	36	28
51	5	9:44	35 42 45	113 07 10	18	10
52	5	9:49	35 42 54	113 07 07	18	10
53	5	9:55	35 43 17	113 06 54	27	20
54	5	10:01	35 43 44	113 06 37	27	20
55	5	10:10	35 43 40	113 06 05	36	30
56	5	10:15	35 43 27	113 05 34	36	30
57	5	10:25	35 44 07	113 06 23	54	48
58	5	10:30	35 44 33	113 06 13	27	22
59	5	10:36	35 44 56	113 06 04	36	31
60	5	10:43	35 45 13	113 05 37	36	32
61	5	14:48	35 45 33	113 05 19	39	49
62	5	14:55	35 45 56	113 04 58	0	10
63	5	15:01	35 46 18	113 04 41	10	21
64	5	15:06	35 46 42	113 04 26	49	60
65	5	15:11	35 47 03	113 04 14	50	61
66	5	15:15	35 47 25	113 03 56	40	51
67	5	15:21	35 47 45	113 03 36	20	32
68	5	15:25	35 48 07	113 03 17	10	22
69	5	15:31	35 48 30	113 03 04	30	42
70	5	15:36	35 48 53	113 02 45	30	43
71	5	15:42	35 49 17	113 02 32	10	23
72	5	15:48	35 49 38	113 02 15	-10	3
73	5	15:54	35 50 01	113 01 59	0	14
74	5	16:01	35 50 20	113 01 30	-30	-16
75	5	16:07	35 50 37	113 01 11	40	54
76	5	16:12	35 50 57	113 00 48	0	15
77	5	16:16	35 51 17	113 00 30	30	45
78	5	16:23	35 51 37	113 00 11	0	15
79	5	16:29	35 51 58	112 59 51	0	16
80	5	16:36	35 52 17	112 59 37	30	46
81	6	8:35	35 52 40	112 59 22	147	132
82	6	8:40	35 53 04	112 59 06	84	69
83	6	8:46	35 53 16	112 58 36	82	68
84	6	8:51	35 53 29	112 58 09	82	68
85	6	8:56	35 53 46	112 57 46	82	69
86	6	9:07	35 54 04	112 57 21	113	100
87	6	9:08	35 54 18	112 57 09	53	41
88	6	9:14	35 54 25	112 57 01	42	30
89	6	9:20	35 54 34	112 56 54	9	-3
90	6	9:25	35 54 47	112 56 48	37	26
91	6	9:30	35 54 51	112 56 39	37	26
92	6	9:34	35 55 00	112 56 32	74	63
93	6	9:40	35 55 09	112 56 26	64	54
94	6	9:45	35 55 18	112 56 18	95	85
95	6	9:49	35 55 25	112 56 11	53	43
96	6	9:54	35 55 33	112 56 04	37	28
97	6	10:01	35 55 43	112 55 55	37	28
98	6	10:06	35 55 52	112 55 48	27	19
99	6	10:11	35 56 00	112 55 40	37	29
101	4	10:15	35 50 16	113 02 40	31	26
102	4	10:30	35 50 50	113 03 12	51	46
103	4	10:45	35 51 14	113 03 50	0	-4
104	4	10:54	35 51 46	113 04 27	51	48
105	4	11:00	35 52 07	113 04 38	41	38
106	4	11:07	35 51 54	113 04 58	41	38
107	4	11:13	35 51 53	113 05 27	21	19
108	4	11:22	35 52 01	113 05 57	10	8
109	4	11:31	35 52 32	113 06 02	41	40
110	4	11:50	35 54 03	113 05 33	0	-1
111	4	11:56	35 53 42	113 06 03	0	-0
112	4	12:05	35 53 17	113 06 05	62	62
113	4	12:13	35 53 19	113 05 36	10	11
114	4	12:21	35 52 41	113 05 12	10	11
115	4	12:35	35 52 53	113 04 37	31	33
116	4	12:43	35 52 53	113 03 51	41	43
117	4	12:51	35 53 27	113 02 41	21	24
118	4	13:01	35 52 59	113 02 27	0	3
119	4	13:05	35 52 32	113 02 18	0	3
120	4	13:15	35 52 13	113 02 09	0	4
121	4	13:25	35 51 35	113 02 02	0	4
122	4	13:37	35 51 01	113 01 38	0	5
123	4	13:45	35 50 27	113 01 32	-31	-26
124	4	14:03	35 53 50	113 02 49	10	16
125	4	14:13	35 55 03	113 03 03	0	7
126	4	14:19	35 54 55	113 03 04	21	28
127	4	14:22	35 54 45	113 03 05	0	7
128	4	14:29	35 54 31	113 03 04	0	8
129	4	14:34	35 54 22	113 03 02	21	29
130	4	14:42	35 55 20	113 02 57	-10	-2
131	4	14:51	35 55 34	113 02 55	21	30
132	4	14:56	35 55 48	113 02 58	0	9
133	4	15:00	35 55 59	113 03 02	0	9
134	4	15:05	35 56 09	113 03 04	21	31
135	4	15:09	35 56 22	113 03 06	10	20
136	4	15:13	35 56 39	113 03 00	-10	-0
137	4	15:19	35 56 51	113 03 00	-10	0
138	4	15:23	35 57 01	113 03 01	41	51
139	4	15:27	35 57 12	113 03 01	-21	-10
140	4	15:32	35 57 22	113 03 04	31	42
141	4	15:37	35 57 31	113 03 08	21	32
142	4	15:42	35 57 50	113 03 12	21	32
143	4	15:46	35 58 05	113 03 19	41	53
144	4	15:53	35 58 18	113 03 25	21	33
145	4	15:57	35 58 29	113 03 30	-21	-9
146	4	16:02	35 58 34	113 03 40	41	54
147	5	8:33	35 58 42	113 03 47	70	58
148	5	8:40	35 58 53	113 03 55	70	58
149	5	8:48	35 59 06	113 04 03	40	29
150	5	8:56	35 59 13	113 04 13	30	19
151	5	9:04	35 59 22	113 04 20	40	30
152	5	9:15	35 59 29	113 04 26	80	70
153	5	9:25	35 59 38	113 04 35	80	71
154	5	9:32	35 59 46	113 04 36	90	81
155	5	9:38	35 59 53	113 04 42	80	72
156	5	9:46	36 00 05	113 04 46	30	22
157	5	9:58	36 00 18	113 04 45	30	23
158	5	10:01	36 00 29	113 04 48	60	53
159	5	10:07	36 00 39	113 04 49	50	43
160	5	10:13	36 00 48	113 04 49	40	34
161	5	10:21	36 00 57	113 04 52	40	34
162	5	10:37	36 01 08	113 04 54	80	75
163	5	10:43	36 01 20	113 04 57	30	26
164	5	10:51	36 01 30	113 04 56	70	66
165	5	10:58	36 01 42	113 04 55	60	56
166	5	11:04	36 01 50	113 04 51	50	47
167	5	11:11	36 02 13	113 04 48	80	77
168	5	11:25	36 02 22	113 04 41	50	48
169	5	11:30	35 02 33	113 04 39	40	38
170	5	11:42	36 02 41	113 04 37	0	-1
171	5	13:35	36 02 50	113 04 37	31	37
172	5	13:45	35 03 06	113 04 30	23	29
173	5	13:52	36 03 17	113 04 33	31	38
174	5	13:59	36 03 26	113 04 30	15	22
175	5	14:05	36 03 37	113 04 26	23	30
176	5	14:11	36 03 48	113 04 26	31	39
177	5	14:17	35 03 54	113 04 16	16	24
178	5	14:23	36 03 59	113 04 06	0	8
179	5	14:30	36 04 06	113 03 54	31	40
180	5	14:37	36 04 13	113 03 44	15	24
181	5	14:44	36 04 18	113 03 33	62	72
182	5	14:51	36 04 27	113 03 20	0	10
183	5	14:58	36 04 37	113 03 08	62	72
184	5	15:03	36 04 47	113 03 04	15	26
185	5	15:10	36 04 58	113 03 00	23	34
186	5	15:15	36 05 06	113 02 57	23	34
187	5	15:22	35 05 23	113 02 54	17	29
188	5	15:28	36 05 32	113 03 03	66	78
189	5	15:36	36 05 43	113 03 07	17	30
190	5	15:42	36 05 54	113 03 06	8	21
191	5	15:47	36 06 02	113 03 07	66	79

Table 1.--continued

Sample Number	Day (June)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He(ppb)	Corr. He(ppb)
192	5	15:53	36 06 12	113 03 08	66	80
193	5	16:02	36 06 22	113 03 07	66	80
194	5	16:08	36 06 45	113 03 02	57	71
195	5	16:13	36 06 57	113 03 04	25	40
196	5	16:20	36 07 14	113 02 54	33	48
196A	6	9:00	35 59 11	113 04 30	60	47
197	6	9:04	35 59 06	113 04 43	60	47
198	6	9:11	35 58 58	113 04 48	40	28
199	6	9:28	35 58 52	113 05 04	70	59
201	4	10:00	35 40 46	113 08 09	102	96
202	4	10:05	35 40 37	113 08 08	82	76
203	4	10:10	35 40 27	113 08 06	82	76
204	4	10:13	35 40 28	113 07 53	61	55
205	4	10:15	35 40 32	113 07 46	41	36
206	4	10:20	35 40 27	113 07 39	82	77
207	4	10:25	35 40 18	113 07 36	61	56
208	4	10:30	35 40 10	113 07 35	82	77
209	4	10:35	35 40 05	113 07 30	51	47
210	4	10:45	35 40 43	113 07 45	41	37
211	4	10:50	35 40 54	113 07 45	31	27
212	4	11:00	35 41 04	113 07 47	31	28
213	4	11:05	35 41 14	113 07 48	20	17
214	4	11:20	35 42 12	113 07 31	41	39
215	4	11:25	35 42 20	113 07 39	82	80
216	4	11:30	35 42 27	113 07 47	41	39
217	4	11:35	35 42 34	113 07 51	51	50
218	4	11:40	35 42 42	113 07 58	20	19
219	4	11:45	35 42 56	113 08 02	41	40
220	4	11:49	35 43 07	113 08 02	20	19
221	4	11:50	35 43 08	113 08 14	51	50
222	4	11:55	35 43 03	113 08 26	51	51
223	4	11:59	35 42 55	113 08 33	41	41
224	4	12:04	35 42 45	113 08 36	41	41
225	4	12:10	35 42 36	113 08 35	-31	-30
226	4	12:15	35 42 26	113 08 38	-31	-30
227	4	12:20	35 43 17	113 07 55	41	42
228	4	12:25	35 43 13	113 07 43	41	42
229	4	12:30	35 43 17	113 07 32	31	33
230	4	12:35	35 43 23	113 07 18	31	33
231	4	12:40	35 43 27	113 07 07	41	43
232	4	12:45	35 43 34	113 06 58	41	43
233	4	13:10	35 44 33	113 06 20	82	86
234	4	13:15	35 44 44	113 06 22	31	35
235	4	13:20	35 44 55	113 06 23	21	25
236	4	13:25	35 45 04	113 06 26	0	4
237	4	13:30	35 45 13	113 06 29	41	46
238	4	13:35	35 45 23	113 06 38	62	67
239	4	13:45	35 45 30	113 06 48	41	46
240	4	13:50	35 45 41	113 06 54	0	6
241	4	14:05	35 41 21	113 08 04	41	47
292	5	9:35	35 44 13	113 09 56	70	62
293	5	9:41	35 44 22	113 09 55	80	72
294	5	9:45	35 44 32	113 09 53	40	32
295	5	9:50	35 44 43	113 09 52	70	62
296	5	9:55	35 44 51	113 09 47	60	53
297	5	9:59	35 44 59	113 09 48	50	43
298	5	10:05	35 44 56	113 10 03	30	23
299	5	10:10	35 45 10	113 10 12	20	14
301	4	10:05	35 51 58	113 06 18	0	-6
302	4	10:15	35 52 22	113 06 24	42	37
303	4	10:30	35 52 46	113 06 34	0	-5
304	4	10:35	35 53 10	113 06 45	52	48
305	4	10:40	35 53 37	113 06 58	52	48
306	4	10:50	35 54 00	113 07 15	21	17
307	4	10:55	35 54 10	113 07 16	84	81
308	4	11:05	35 54 18	113 07 17	63	60
309	4	11:10	35 54 29	113 07 20	10	7
310	4	11:15	35 54 38	113 07 21	21	19
311	4	11:20	35 54 48	113 07 26	21	19
312	4	11:25	35 54 58	113 07 24	21	19
313	4	11:30	35 55 05	113 07 19	63	61
314	4	11:35	35 55 12	113 07 17	-42	-43
315	4	11:40	35 55 21	113 07 23	42	41
316	4	11:45	35 55 32	113 07 23	63	62
317	4	11:50	35 55 42	113 07 18	63	62
318	4	11:57	35 55 51	113 07 26	42	42
319	4	12:00	35 56 02	113 07 49	31	31
320	4	13:30	35 56 08	113 07 58	41	46
321	4	13:35	35 56 14	113 08 03	21	26
322	4	13:40	35 56 23	113 08 05	21	26
323	4	13:45	35 56 33	113 08 02	51	56
324	4	13:50	35 56 42	113 07 59	41	47
325	4	13:55	35 56 53	113 07 59	41	47
326	4	14:05	35 57 03	113 07 57	21	27
327	4	14:08	35 57 14	113 07 59	10	17
328	4	14:10	35 57 24	113 08 00	41	48
329	4	14:15	35 57 34	113 07 55	31	38
330	4	14:20	35 57 43	113 07 51	21	28
331	4	14:27	35 57 51	113 07 47	0	8
332	4	14:27	35 58 03	113 07 41	0	8
333	4	14:30	35 58 13	113 07 40	0	8
334	4	14:30	35 58 24	113 07 41	41	49
335	4	14:35	35 58 36	113 07 40	21	29
337	4	14:42	35 58 45	113 07 34	21	29
338	4	14:50	35 58 56	113 07 36	41	50
339	4	14:55	35 59 06	113 07 35	31	40
340	4	14:57	35 59 16	113 07 34	21	30
341	4	15:00	35 59 27	113 07 32	21	30
342	4	15:05	35 59 36	113 07 33	41	51
343	4	15:10	35 59 46	113 07 32	31	41
242	4	14:12	35 41 29	113 08 13	21	28
243	4	14:17	35 41 38	113 08 24	10	17
244	4	14:20	35 41 46	113 08 32	21	28
245	4	14:25	35 41 56	113 08 37	41	48
246	4	14:30	35 42 07	113 08 39	-10	-2
247	4	14:40	35 42 17	113 08 39	62	70
248	4	14:45	35 41 24	113 08 27	51	60
249	4	14:50	35 41 29	113 08 39	21	30
250	4	14:55	35 41 37	113 08 48	41	50
251	4	15:00	35 41 45	113 08 51	31	40
252	4	15:10	35 41 16	113 08 18	-10	-0
253	4	15:15	35 41 09	113 08 11	-10	0
254	4	17:00	35 41 16	113 08 34	88	104
255	4	17:05	35 41 15	113 08 46	66	82
256	4	17:10	35 41 14	133 08 58	55	71
257	4	17:15	35 41 17	113 09 10	33	49
258	4	17:20	35 41 18	113 09 22	44	61
259	4	17:25	35 41 12	113 09 33	11	28
260	4	17:30	35 41 06	113 09 39	0	17
261	4	17:35	35 40 58	113 09 47	17	34
262	4	17:40	35 40 48	113 09 47	34	52
263	4	17:40	35 40 37	113 09 47	34	52
264	4	17:50	35 40 27	113 09 44	51	69
265	4	17:55	35 40 18	113 09 42	34	52
266	4	18:00	35 40 07	113 09 38	42	61
267	4	18:05	35 39 57	113 09 37	51	70
268	4	18:10	35 39 46	113 09 37	34	53
269	4	18:20	35 39 36	113 09 37	51	71
270	4	18:25	35 39 25	113 09 34	28	48
271	4	18:30	35 39 13	113 09 35	17	37
272	5	8:00	35 41 27	113 09 18	60	46
273	5	8:05	35 41 34	113 09 11	60	46
274	5	8:10	35 41 43	113 09 04	50	37
275	5	8:15	35 41 54	113 09 05	10	-3
276	5	8:20	35 41 56	113 09 20	80	67
277	5	8:25	35 42 03	113 09 31	60	47
278	5	8:30	35 42 04	113 09 41	50	38
279	5	8:35	35 42 09	113 09 53	60	48
280	5	8:40	35 42 17	113 10 02	70	58
281	5	8:45	35 42 29	113 09 57	60	49
282	5	8:50	35 42 37	113 09 58	80	69
283	5	8:55	35 42 46	113 09 53	40	29
284	5	9:00	35 42 57	113 09 55	40	30
285	5	9:05	35 43 06	113 09 51	40	30
286	5	9:09	35 43 17	113 09 54	40	30
287	5	9:15	35 43 26	113 09 47	60	50
288	5	9:21	35 43 36	113 09 52	0	-9
289	5	9:25	35 43 43	113 10 03	50	41
290	5	9:30	35 43 53	113 10 05	60	51
291	5	9:35	35 44 03	113 10 03	60	52
344	4	15:15	35 59 58	113 07 29	21	31
345	4	15:20	36 00 11	113 07 26	42	52
346	4	15:25	36 00 23	113 07 28	42	53
347	4	15:30	36 00 34	113 07 34	42	53
348	4	15:35	36 00 44	113 07 43	42	53
349	4	15:40	36 00 52	113 07 49	21	32
350	4	15:45	36 01 02	113 07 54	10	22
351	4	15:40	36 01 09	113 08 03	-10	1
352	4	15:45	36 01 17	113 08 11	31	43
353	4	16:00	36 01 22	113 08 21	42	54
354	5	9:00	36 01 32	113 08 26	40	30
355	5	9:05	36 01 43	113 08 26	80	70
356	5	9:10	36 01 47	113 08 16	40	30
357	5	9:15	36 01 42	113 08 04	60	50
358	5	9:20	36 01 34	113 07 55	0	-9
359	5	9:25	36 01 24	113 07 50	40	31
360	5	9:30	36 01 16	113 07 44	62	53
361	5	9:35	36 01 27	113 07 39	45	37
362	5	9:45	36 01 37	113 07 37	62	54
363	5	9:50	36 01 45	113 07 46	45	37
364	5	9:55	36 01 56	113 07 49	62	55
365	5	10:00	36 02 00	113 08 00	99	92
366	5	10:07	36 02 06	113 08 11	116	109
367	5	10:15	36 02 08	113 08 24	57	51
368	5	10:17	36 02 18	113 08 31	66	60
369	5	10:22	36 02 23	113 08 43	116	110
370	5	10:30	36 02 32	113 08 54	99	94
371	5	10:35	36 02 42	113 08 54	99	94
372	5	10:40	36 02 52	113 08 52	57	52
373	5	10:50	36 03 01	113 08 50	57	53
374	5	10:55	36 03 12	113 08 47	57	53
375	5	11:00	36 03 22	113 08 41	132	129
376	5	11:05	36 03 32	113 08 40	83	80
377	5	11:10	36 03 42	113 08 39	66	63
378	5	11:20	36 03 52	113 08 36	66	64
379	5	11:25	36 04 02	113 08 29	83	81
380	5	11:30	36 04 10	113 08 23	50	48
381	5	11:35	36 04 17	113 08 15	66	65
382	5	11:40	36 04 28	113 08 17	66	65
383	5	11:45	36 04 38	113 08 18	66	65
384	5	11:50	36 04 43	113 08 29	66	65
385	5	11:55	36 04 49	113 08 37	41	41
386	5	12:00	36 04 58	113 08 51	66	66
387	5	12:10	36 05 05	113 08 59	66	67
388	5	12:40	36 04 51	113 08 58	66	68
389	5	12:40	36 04 42	113 08 58	40	42
390	5	13:05	36 04 25	113 08 58	0	4
391	5	13:15	36 04 30	113 09 08	30	34
392	5	13:20	36 04 34	113 09 21	30	35
393	5	13:25	36 04 43	113 09 28	0	5

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
394	5	13:30	36 04 50	113 09 36	40	45
395	5	13:37	36 04 58	113 09 43	30	36
396	5	13:45	36 05 08	113 09 47	20	26
397	5	13:50	36 05 18	113 09 54	60	66
398	5	13:55	36 05 23	113 10 06	70	77
399	5	14:00	36 05 33	113 10 14	0	7
400	5	10:15	35 45 15	113 10 25	80	74
401	5	10:20	35 45 14	113 10 38	40	34
402	5	10:25	35 45 23	113 10 40	0	-6
403	5	10:30	35 45 33	113 10 36	0	-5
404	5	10:35	35 45 44	113 10 29	40	35
405	5	10:40	35 45 55	113 10 24	40	35
406	5	10:50	35 45 23	113 10 13	30	26
407	5	11:00	35 45 32	113 10 05	20	17
408	5	11:10	35 45 40	113 09 57	30	27
409	5	11:15	35 45 47	113 09 48	0	-3
410	5	11:20	35 45 26	113 09 51	40	38
411	5	11:25	35 45 25	113 09 40	60	58
412	5	11:30	35 45 24	113 09 28	60	58
413	5	11:35	35 45 21	113 09 14	60	59
414	5	11:40	35 45 15	113 09 06	20	19
415	5	11:55	35 46 09	113 09 37	20	18
416	5	12:00	35 46 16	113 09 04	30	30
417	5	12:10	35 46 27	113 08 36	20	21
418	5	12:20	35 46 21	113 08 08	40	41
419	6	8:30	35 54 24	112 57 17	80	65
420	6	8:35	35 54 34	112 57 28	70	55
421	6	8:40	35 54 40	112 57 35	80	65
422	6	8:45	35 54 48	112 57 43	80	66
423	6	8:50	35 54 59	112 57 46	120	106
424	6	8:50	35 55 08	112 57 50	80	66
425	6	9:00	35 55 19	112 57 53	80	67
426	6	9:05	35 55 29	112 57 57	100	87
427	6	9:10	35 55 39	112 58 00	80	68
428	6	9:15	35 55 49	112 58 03	80	68
429	6	9:20	35 55 58	112 58 08	80	68
430	6	9:25	35 56 09	112 58 10	80	69
431	6	9:30	35 56 20	112 58 13	120	109
432	6	9:35	35 56 30	112 58 18	80	69
433	6	9:40	35 56 39	112 58 21	70	60
434	6	9:45	35 56 50	112 58 22	80	70
435	6	9:50	35 56 59	112 58 25	70	61
436	6	10:00	35 57 09	112 58 29	100	91
437	6	10:05	35 57 19	112 58 30	80	72
438	6	10:10	35 57 21	112 58 42	80	72
439	6	10:15	35 57 14	112 58 51	40	32
440	6	10:20	35 57 05	112 58 55	80	73
441	6	10:24	35 56 55	112 59 02	40	33
442	6	10:30	35 56 48	112 59 10	60	53
443	6	10:35	35 56 35	112 59 11	60	54

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
444	6	10:40	35 56 27	112 59 17	50	44
445	6	10:45	35 56 16	112 59 18	50	45
446	6	10:50	35 56 08	112 59 23	80	75
447	6	11:00	35 55 55	112 59 26	80	76
448	6	11:05	35 55 55	112 59 35	30	26
449	6	11:10	35 55 51	112 59 45	40	36
450	6	11:15	35 55 43	112 59 52	40	37
451	6	11:20	35 55 35	112 59 59	50	47
452	6	11:25	35 57 32	112 58 30	60	57
453	6	11:30	35 57 43	112 58 29	50	48
454	6	11:35	35 57 54	112 58 28	50	48
455	6	11:40	35 58 03	112 58 27	80	79
456	6	11:45	35 58 12	112 58 27	60	59
457	6	11:50	35 58 25	112 58 28	50	49
458	6	11:55	35 58 35	112 58 29	40	40
459	6	12:00	35 58 46	112 58 30	20	20
460	6	12:05	35 58 57	112 58 30	80	80
461	6	12:10	35 59 08	112 58 31	20	21
462	6	12:15	35 59 17	112 58 34	40	41
463	6	12:20	35 59 28	112 58 36	60	61
464	6	12:25	35 59 39	112 58 38	40	42
465	6	12:30	35 59 49	112 58 39	0	2
466	6	12:35	35 59 57	112 58 36	-20	-17
467	8	11:55	35 40 59	113 49 03	56	56
468	8	12:00	35 40 53	113 48 38	32	32
469	8	12:05	35 40 52	113 48 10	32	32
470	8	12:10	35 41 08	113 47 46	32	33
471	8	12:15	35 48 11	113 51 26	40	41
472	8	12:20	35 47 52	113 51 03	64	66
473	8	12:25	35 47 44	113 50 35	40	42
474	8	12:30	35 47 38	113 50 04	32	35
475	8	12:35	35 47 16	113 49 48	16	19
476	8	12:45	35 46 59	113 49 28	32	36
477	8	12:50	35 46 33	113 49 20	16	21
478	8	12:55	35 46 06	113 49 18	56	61
479	8	13:00	35 45 40	113 49 20	32	37
480	8	13:05	35 45 22	113 49 02	64	70
481	8	13:10	35 45 10	113 48 33	32	38
482	8	13:15	35 44 52	113 48 25	56	63
483	8	13:20	35 44 41	113 48 36	64	71
484	8	13:25	35 44 18	113 48 34	80	88
485	8	13:30	35 43 55	113 48 43	16	24
486	8	13:35	35 43 30	113 48 49	48	57
487	8	13:40	35 43 14	113 48 57	64	73
488	8	13:45	35 42 58	113 48 35	16	26
489	8	13:50	35 42 42	113 48 27	8	18
490	8	14:00	35 42 33	113 48 13	0	11

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
501	5	14:05	36 05 36	113 10 26	40	47
502	5	14:25	35 05 59	113 10 24	50	58
503	5	14:45	36 05 44	113 10 33	40	50
504	5	14:47	36 05 36	113 10 39	30	40
505	5	14:52	36 05 25	113 10 38	10	20
506	5	15:00	36 05 17	113 10 41	20	31
507	5	15:00	36 05 06	113 10 44	20	31
508	5	15:05	36 04 56	113 10 47	20	31
509	5	15:10	36 04 36	113 10 49	40	51
510	5	15:15	36 04 44	113 10 48	100	111
511	5	15:30	36 05 28	113 10 24	40	52
513	5	16:35	35 56 21	113 07 32	40	56
514	6	9:00	36 00 18	113 07 17	80	67
515	6	9:05	36 00 27	113 07 10	80	67
516	6	9:10	36 00 35	113 07 07	70	58
517	6	9:15	35 00 45	113 07 04	80	68
518	6	9:15	36 00 56	113 06 58	80	68
519	6	9:23	36 01 04	113 06 53	80	69
520	6	9:27	36 01 14	113 06 48	80	69
521	6	9:30	36 01 23	113 06 35	80	69
522	6	9:35	36 01 32	113 06 38	80	69
523	6	9:40	36 01 39	113 06 32	80	70
524	6	9:45	36 01 47	113 06 23	80	70
525	6	9:50	36 01 57	113 06 16	70	61
526	6	9:55	36 02 04	113 06 07	50	41
527	6	10:00	36 02 12	113 05 58	60	51
528	6	10:05	36 02 20	113 05 48	80	72
529	6	10:10	36 02 29	113 05 47	120	112
530	6	10:15	36 02 37	113 05 44	80	72
531	6	10:20	36 02 47	113 05 33	80	73
532	6	10:30	36 02 58	113 05 32	60	53
533	6	10:35	36 03 09	113 05 36	50	44
534	6	10:37	36 03 18	113 05 45	80	74
535	6	10:45	36 03 28	113 05 48	80	75
536	6	10:50	36 03 41	113 05 53	70	65
537	6	10:55	36 03 50	113 06 01	70	65
538	6	11:00	36 03 59	113 06 08	21	17
539	6	11:05	36 04 08	113 06 11	84	80
540	6	11:10	36 04 18	113 06 14	42	38
541	6	11:15	36 04 28	113 06 16	84	81
542	6	11:20	36 04 38	113 06 15	53	50
543	6	11:27	36 04 49	113 06 15	84	82
544	6	11:32	36 05 00	113 06 14	42	40
545	6	11:40	36 05 10	113 06 12	84	83
546	6	11:45	36 05 18	113 06 06	84	83
547	6	11:50	36 05 30	113 06 01	42	41
548	6	11:55	36 05 38	113 05 53	32	32

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
549	6	12:00	36 05 46	113 05 47	42	42
550	6	12:05	36 05 55	113 05 44	52	52
551	6	12:10	36 06 05	113 05 38	63	64
552	6	12:15	36 06 13	113 05 29	84	85
553	6	12:20	36 06 22	113 05 22	84	85
554	6	12:25	36 06 30	113 05 14	52	54
555	6	12:30	36 06 41	113 05 07	0	2
556	6	15:30	36 06 48	113 04 58	35	50
557	6	15:40	36 06 59	113 04 54	52	68
558	6	15:45	36 07 07	113 04 49	35	51
559	6	15:47	36 07 17	113 04 43	35	51
560	6	15:50	36 07 26	113 04 37	17	34
561	6	16:00	36 07 36	113 04 10	52	69
562	6	16:10	36 07 53	113 04 44	25	43
563	6	16:15	36 08 20	113 04 47	35	54
564	6	16:25	36 08 47	113 04 50	35	54
565	6	16:40	36 09 15	113 04 36	43	63
566	6	16:45	36 09 42	113 04 30	60	81
567	6	16:55	36 10 13	113 04 22	105	126
568	6	17:10	36 09 36	113 05 00	70	93
569	6	17:20	36 09 54	113 05 23	60	83
570	6	17:30	36 09 56	113 05 55	35	59
571	6	17:35	36 09 43	113 06 28	43	67
572	6	17:35	36 09 35	113 06 23	0	24
573	6	17:45	36 09 28	113 06 30	52	77
574	6	17:50	36 09 24	113 06 17	35	60
575	6	18:15	36 09 28	113 06 06	70	97
576	7	9:00	35 56 18	112 55 39	70	54
577	7	9:05	35 56 28	112 55 44	105	89
578	7	9:10	35 56 37	112 55 40	132	117
579	7	9:17	35 56 48	112 55 42	62	47
580	7	9:22	35 56 58	112 55 45	35	21
581	7	9:26	35 57 08	112 55 49	88	74
582	7	9:30	35 57 17	112 55 54	79	66
583	7	9:35	35 57 25	112 56 01	122	109
584	7	9:40	35 57 38	112 56 08	62	49
585	7	9:45	35 57 48	112 56 10	35	23
586	7	9:50	35 57 57	112 56 16	70	58
587	7	9:55	35 58 07	112 56 19	62	51
588	7	10:00	35 58 16	112 56 25	79	68
589	7	10:05	35 58 27	112 56 26	70	60
590	7	10:10	35 58 37	112 56 23	79	69
591	7	10:15	35 58 45	112 56 22	27	18
592	7	10:20	35 58 58	112 56 22	63	54
593	7	10:25	35 59 09	112 56 23	90	81
594	7	10:30	35 59 22	112 56 23	18	10
595	7	10:35	35 59 25	112 56 11	72	64
596	7	10:40	35 59 26	112 55 59	18	11
597	7	10:45	35 59 30	112 55 46	54	47
598	7	10:55	35 59 33	112 55 33	72	66

Table 1.--continued

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
599	7	11:00	35 59 35	112 55 25	39	34
600	6	10:17	35 56 09	112 55 31	74	67
601	6	10:23	35 56 17	112 55 24	37	30
602	7	9:05	35 56 25	112 55 18	101	85
603	7	9:11	35 56 34	112 55 09	55	40
604	7	9:15	35 56 42	112 55 01	37	22
605	7	9:19	35 56 51	112 54 55	55	41
606	7	9:24	35 56 59	112 54 49	37	23
607	7	9:28	35 57 09	112 54 40	37	23
608	7	9:33	35 57 16	112 54 32	37	24
609	7	9:38	35 57 25	112 54 25	55	42
610	7	9:44	35 57 33	112 54 15	37	25
611	7	9:49	35 57 38	112 54 04	37	25
612	7	9:56	35 57 43	112 53 53	74	63
613	7	10:05	35 57 49	112 53 44	70	60
614	7	10:11	35 57 55	112 53 33	26	16
615	7	10:15	35 58 00	112 53 21	46	37
616	7	10:21	35 58 05	112 53 10	26	17
617	7	10:25	35 58 12	112 52 59	17	8
618	7	10:31	35 58 18	112 52 48	0	-8
619	7	10:36	35 58 26	112 52 34	35	27
620	7	10:47	35 57 53	112 53 58	35	28
621	7	10:52	35 58 04	112 53 57	31	25
622	7	10:57	35 58 13	112 53 57	31	25
623	7	11:04	35 58 25	112 53 57	39	34
624	7	11:09	35 58 36	112 53 56	24	19
625	7	11:15	35 58 45	112 53 55	70	66
626	7	11:24	35 58 57	112 53 54	54	51
627	7	11:28	35 59 09	112 53 50	54	51
628	7	11:34	35 59 20	112 53 48	47	45
629	7	11:39	35 59 30	112 53 45	8	6
630	7	11:45	35 59 40	112 53 40	8	7
631	7	11:49	35 59 50	112 53 40	24	23
632	7	11:55	36 00 00	112 53 33	54	54
633	8	11:12	35 31 28	113 28 19	62	58
634	8	11:17	35 31 37	113 28 50	8	4
635	8	11:22	35 31 41	113 29 22	24	21
636	8	11:28	35 31 49	113 29 51	8	5
637	8	11:34	35 31 56	113 30 06	16	14
638	8	11:38	35 32 08	113 30 42	47	45
639	8	11:43	35 32 23	113 30 57	16	14
640	8	11:48	35 32 45	113 31 27	0	-1
641	8	11:54	35 33 26	113 31 44	8	7
642	8	12:03	35 33 58	113 31 56	47	47
643	8	12:05	35 34 22	113 32 09	8	8
644	8	12:13	35 34 42	113 32 26	24	25
645	8	12:18	35 35 00	113 32 54	16	18
646	8	12:25	35 35 19	113 33 39	24	26
647	8	12:40	35 35 29	113 34 05	0	4
648	8	12:45	35 35 43	113 34 36	8	12

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
649	8	12:50	35 36 02	113 35 21	0	5
650	8	12:56	35 36 19	113 36 00	0	5
651	8	13:02	35 36 36	113 36 36	0	6
652	8	13:01	35 36 53	113 37 19	-8	-2
653	8	13:06	35 37 05	113 37 58	8	14
654	8	13:12	35 37 01	113 38 39	0	7
655	8	13:21	35 36 50	113 39 28	0	7
656	8	13:26	35 36 48	113 40 10	-8	-0
657	8	13:31	35 36 44	113 40 57	-8	0
658	8	13:32	35 36 41	113 41 48	0	8
659	8	13:42	35 36 38	113 42 19	-16	-7
660	8	13:48	35 36 31	113 43 22	47	57
661	8	13:54	35 36 49	113 44 00	16	26
682	10	8:45	35 31 22	113 27 50	49	29
683	10	8:51	35 31 17	113 27 16	74	55
684	10	8:56	35 31 23	113 26 45	33	15
685	10	9:02	35 31 33	113 26 14	25	7
686	10	9:07	35 31 41	113 25 45	58	41
687	10	9:15	35 31 51	113 25 16	41	24
688	10	9:22	35 32 17	113 25 06	50	34
689	10	9:28	35 32 43	113 25 17	16	1
690	10	9:34	35 33 08	113 25 14	91	76
691	10	9:39	35 33 37	113 25 15	8	-6
692	10	9:45	35 34 02	113 25 22	91	77
693	10	9:51	35 34 24	113 25 37	66	53
694	10	9:57	35 34 44	113 25 51	49	37
695	10	10:03	35 35 07	113 26 04	49	37
696	10	10:08	35 35 32	113 26 22	41	30
698	10	10:14	35 36 17	113 26 17	66	55
699	10	10:19	35 36 29	113 27 08	66	56

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
701	6	9:34	35 58 51	113 05 00	40	29
702	6	9:44	35 58 40	113 05 08	60	50
703	6	9:55	35 58 31	113 05 14	60	51
704	6	10:02	35 58 25	113 05 18	10	1
705	6	10:07	35 58 15	113 05 22	60	52
706	6	10:13	35 58 09	113 05 29	0	-8
707	6	10:21	35 57 58	113 05 38	60	53
708	6	10:25	35 57 49	113 05 33	-30	-37
709	6	10:37	35 57 35	113 05 36	0	-6
710	6	10:45	35 57 26	113 05 39	0	-5
711	6	10:49	35 57 20	113 05 51	40	35
712	6	11:04	35 55 51	113 05 58	40	36
713	6	11:09	35 55 47	113 05 53	0	-4
714	6	11:18	35 55 38	113 05 44	-30	-33
715	6	11:22	35 55 31	113 05 35	50	47
716	6	11:25	35 55 21	113 05 33	0	-3
720	6	11:35	35 55 00	113 05 37	48	46
721	6	11:40	35 54 52	113 05 36	48	47
722	6	11:46	35 54 40	113 05 34	38	37
723	6	11:52	35 54 31	113 05 28	28	27
724	6	11:56	35 54 20	113 05 27	10	10
725	6	12:40	35 55 59	113 05 54	10	13
726	6	12:42	35 56 10	113 05 50	38	41
727	6	12:52	35 56 18	113 05 45	28	32
728	6	12:56	35 56 29	113 05 44	10	14
729	6	13:02	35 56 37	113 05 39	10	15
730	6	13:15	35 56 40	113 05 34	10	15
731	6	13:25	35 56 45	113 05 43	0	6
732	6	13:30	35 56 55	113 05 51	-38	-31
733	6	13:33	35 57 00	113 05 58	-38	-31
734	6	13:40	35 57 12	113 05 59	20	27
735	6	16:18	35 56 56	113 03 15	40	59
736	6	16:23	35 57 04	113 03 22	10	29
737	6	16:28	35 57 09	113 03 34	80	99
738	6	16:33	35 57 10	113 03 45	10	30
739	6	16:37	35 57 13	113 03 55	20	40
740	6	16:45	35 57 09	113 04 04	-30	-9
741	6	16:50	35 57 03	113 04 09	40	61
742	6	16:55	35 57 00	113 04 18	10	31
743	6	16:58	35 57 02	113 04 29	-20	2
744	7	9:21	35 57 06	112 04 44	38	24
745	7	9:27	35 56 59	113 04 48	38	24
746	7	9:40	35 56 49	113 04 59	38	25
747	7	9:40	35 56 42	113 05 10	67	54
748	7	9:46	35 56 43	113 05 19	10	-2
749	7	9:52	35 56 49	113 05 29	67	55
750	7	9:58	35 56 47	113 05 36	48	37
751	7	10:13	35 57 00	113 05 50	38	28
752	7	10:30	35 55 58	113 06 08	38	30
753	7	10:43	35 56 11	113 06 10	10	3

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
754	7	10:48	35 56 20	113 06 10	-10	-16
755	7	10:51	35 56 29	113 06 10	-19	-25
756	7	10:59	35 56 37	113 06 15	-10	-15
757	7	11:02	35 56 41	113 06 21	19	14
758	7	11:12	35 56 48	113 06 35	67	63
759	7	11:21	35 57 00	113 06 34	10	6
760	7	11:32	35 56 57	113 06 27	38	35
761	7	11:47	35 56 50	113 06 48	0	-1
762	7	11:56	35 56 42	113 06 57	-19	-19
763	7	12:00	35 56 46	113 07 05	-19	-19
764	7	12:48	35 56 55	113 07 07	10	14
765	7	12:52	35 57 02	113 07 06	10	15
766	7	12:55	35 57 12	113 07 08	10	15
767	7	13:04	35 57 20	113 07 05	10	16
768	7	13:08	35 57 28	113 06 57	10	16
769	7	13:14	35 57 31	113 06 45	-19	-12
770	7	13:20	35 57 44	113 06 38	-10	-3
771	7	13:26	35 57 53	113 06 31	10	18
772	7	13:32	35 58 03	113 06 24	38	46
773	7	13:37	35 58 12	113 06 27	-10	-1
774	7	13:43	35 58 29	113 06 31	38	47
775	7	13:47	35 58 35	113 06 32	-10	-0
776	7	13:52	35 58 47	113 06 26	25	35
777	7	13:56	35 58 52	113 06 18	33	43
778	7	14:16	35 59 00	113 06 17	49	61
779	7	14:28	35 59 09	113 06 11	16	29
780	7	14:34	35 59 20	113 06 05	8	22
781	7	14:41	35 59 31	113 06 05	-8	6
782	7	14:52	35 59 29	113 05 57	8	23
783	7	14:59	35 59 29	113 05 43	16	32
784	7	15:03	35 59 27	113 05 32	49	65
785	7	15:07	35 59 34	113 05 20	16	33
786	7	15:12	35 59 32	113 05 12	25	42
787	7	15:19	35 59 46	113 05 10	0	18
788	7	15:25	35 59 55	113 04 56	16	34
789	7	15:35	36 00 26	113 05 04	8	27
790	7	15:39	36 00 35	113 05 10	8	28
791	8	9:36	35 58 00	113 03 02	0	-13
792	8	9:43	35 58 05	113 02 50	18	6
793	8	9:45	35 58 14	113 02 46	27	15
794	8	9:47	35 58 25	113 02 45	37	25
795	8	9:50	35 58 36	113 02 46	0	-12
796	8	9:53	35 58 47	113 02 41	27	15
797	8	9:55	35 58 55	113 02 37	55	44
798	8	9:59	35 59 04	113 02 36	55	44
799	8	10:02	35 59 13	113 02 40	46	35
801	7	11:05	35 59 43	112 55 04	39	34
802	7	11:10	35 59 50	112 54 52	69	65
803	7	11:20	35 59 58	112 54 48	59	55
804	7	11:25	35 59 36	112 55 11	49	46

Table 1.-- continued

Sample Number	Day (June)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He(ppb)	Corr. He(ppb)
805	7	11:30	35 59 31	112 54 58	69	66
806	7	11:35	35 59 27	112 54 48	88	86
807	7	11:40	35 59 24	112 54 36	59	57
808	7	11:45	35 59 20	112 54 22	88	87
809	7	11:50	35 59 17	112 54 11	49	48
810	7	12:00	35 59 12	112 54 00	59	59
811	7	12:35	35 59 59	112 52 34	41	44
812	7	12:41	35 59 47	112 52 34	8	12
813	7	12:45	35 59 37	112 52 34	8	12
814	7	12:49	35 59 27	112 52 34	8	12
815	7	12:53	35 59 16	112 52 34	-8	-3
816	7	12:58	35 59 05	112 52 34	-8	-3
817	7	13:10	35 58 56	112 52 34	8	14
818	7	13:15	35 58 45	112 52 34	8	15
819	7	13:20	35 58 35	112 52 34	57	64
820	7	13:30	35 58 15	112 52 34	41	49
821	7	13:35	35 58 05	112 52 34	66	75
822	7	14:00	35 57 03	112 52 34	41	52
823	7	14:05	35 57 42	112 52 34	57	68
824	7	14:10	35 57 32	112 52 34	0	12
825	7	14:15	35 57 23	112 52 34	8	20
826	7	14:20	35 57 12	112 52 34	-24	-11
827	7	14:25	35 57 01	112 52 34	-57	-44
828	7	14:27	35 56 51	112 52 34	8	21
829	7	14:30	35 56 41	112 52 34	8	22
830	7	14:35	35 56 30	112 52 34	0	14
831	7	14:40	35 56 20	112 52 34	66	80
832	7	14:43	35 56 08	112 52 34	57	72
833	7	14:47	35 55 56	112 52 34	41	56
834	7	14:55	35 55 47	112 52 34	41	57
835	7	15:00	35 55 36	112 52 34	49	65
836	7	15:02	35 55 27	112 52 34	49	65
837	7	15:05	35 55 15	112 52 34	33	50
838	7	15:08	35 55 05	112 52 34	24	41
839	7	15:15	35 54 54	112 52 34	0	18
840	7	15:20	35 54 44	112 52 34	16	34
841	7	15:25	35 54 34	112 52 34	16	34
842	7	15:30	35 54 23	112 52 34	33	52
843	7	15:32	35 54 12	112 52 34	24	43
844	7	15:37	35 53 46	112 52 40	33	53
845	7	15:45	35 53 25	112 52 34	41	61
846	8	9:10	35 55 46	112 55 34	70	55
848	8	9:20	35 55 29	112 55 25	40	25
849	8	9:25	35 55 19	112 55 21	30	16
850	8	9:30	35 55 11	112 55 12	60	46
851	8	9:32	35 55 04	112 55 03	100	87
852	8	9:34	35 54 56	112 54 54	90	77
853	8	9:37	35 54 49	112 54 45	80	67
854	8	9:42	35 54 39	112 54 40	70	57
855	8	9:45	35 54 28	112 54 38	50	38
856	8	9:50	35 54 17	112 54 35	60	48
857	8	9:53	35 54 08	112 54 32	40	28
858	8	9:38	35 53 44	112 54 26	80	67
860	8	10:07	35 52 52	112 54 13	90	80
861	8	10:20	35 52 34	112 53 45	60	51
862	8	10:25	35 52 36	112 53 22	50	41
863	8	10:35	35 54 16	112 54 08	80	72
864	8	10:42	35 54 28	112 54 05	80	73
865	8	10:46	35 54 35	112 54 10	50	43
866	8	10:50	35 54 37	112 54 25	70	64
867	8	10:57	35 54 42	112 54 08	70	64
868	8	11:00	35 54 52	112 54 10	10	5
869	8	11:07	35 55 05	112 54 13	30	25
870	8	11:12	35 55 13	112 54 15	20	16
871	8	11:16	35 55 25	112 54 18	70	66
872	8	11:20	35 55 35	112 54 20	70	66
873	8	11:25	35 55 45	112 54 22	80	77
874	8	11:28	35 55 55	112 54 22	50	47
875	8	11:33	35 56 05	112 54 22	70	68
876	8	11:37	35 56 16	112 54 21	60	58
877	8	11:42	35 56 27	112 54 21	60	58
878	8	11:45	35 56 37	112 54 20	40	39
879	8	11:49	35 56 46	112 54 16	70	69
880	8	11:53	35 56 45	112 54 02	30	29
881	8	11:57	35 56 40	112 53 53	50	50
882	8	12:08	35 56 55	112 54 11	110	111
883	6	12:06	35 57 05	112 54 07	30	31
884	8	12:10	35 57 16	112 54 03	140	141
885	8	12:14	35 57 26	112 53 58	80	81
886	8	12:30	35 59 15	112 54 33	10	13
887	8	12:34	35 59 07	112 54 43	30	33
888	8	12:37	35 59 01	112 54 52	60	63
889	8	12:44	35 58 51	112 55 16	70	74
890	8	12:47	35 58 47	112 55 27	50	54
891	8	12:52	35 58 41	112 55 38	80	85
892	8	12:55	35 58 36	112 55 49	20	25
893	8	13:02	35 58 33	112 56 00	0	6
894	8	13:07	35 58 28	112 56 13	50	56
895	8	13:20	35 59 32	112 56 29	-10	-3
896	8	13:27	35 59 40	112 56 34	40	48
897	8	13:30	35 59 54	112 56 29	80	88
898	8	13:35	35 59 50	112 56 40	60	69
899	8	13:40	35 59 54	112 56 52	20	29
901	8	10:06	35 59 21	113 02 32	46	36
902	8	10:11	35 59 28	113 02 34	37	27
903	8	10:13	35 59 35	113 02 36	46	36
904	8	10:16	35 59 42	113 02 34	27	18
905	8	10:20	35 59 53	113 02 30	18	9
906	8	10:24	36 00 10	113 02 30	55	46
907	8	10:29	36 00 22	113 02 33	9	1
908	8	10:34	36 00 32	113 02 38	9	1
909	8	10:43	36 00 34	113 02 46	64	57
910	8	10:49	36 00 45	113 02 40	27	21
911	8	10:54	36 00 47	113 02 28	46	40
912	8	10:59	36 00 57	113 02 29	27	21
913	8	11:05	36 01 08	113 02 25	-9	-14
914	8	11:08	36 01 15	113 02 20	-9	-14
915	8	11:14	36 01 27	113 02 26	27	23
916	8	11:20	35 01 38	113 02 23	0	-4
917	8	11:25	35 01 46	113 02 52	16	13
918	8	11:31	35 01 54	113 01 48	8	5
919	8	12:20	35 57 38	113 02 49	0	2
920	8	12:26	35 57 28	113 02 40	-16	-14
921	8	12:30	35 57 23	113 02 28	8	11
922	8	12:34	35 57 24	113 02 17	-24	-21
923	8	12:37	35 57 26	113 02 07	0	3
924	8	12:41	35 57 25	113 01 54	24	28
925	8	12:45	35 57 18	113 01 46	16	20
926	8	12:47	35 57 15	113 01 35	40	44
927	8	12:50	35 57 13	113 01 24	-16	-11
928	8	12:54	35 57 16	113 01 12	27	32
929	8	12:57	35 57 25	113 01 07	54	59
930	8	13:03	35 57 30	113 00 57	18	24
931	8	13:05	35 57 34	113 00 43	0	6
932	8	13:10	35 57 43	113 00 37	9	15
933	8	13:12	35 57 52	113 00 34	-9	-2
934	8	13:16	35 58 03	113 00 30	-9	-2
935	8	13:19	35 58 11	113 00 26	0	7
936	8	13:23	35 58 19	113 00 22	54	62
937	8	13:27	35 58 27	113 00 15	18	26
939	9	12:04	35 57 36	113 02 04	43	43
940	9	12:12	35 57 47	113 02 07	0	0
941	9	12:18	35 57 57	113 02 06	54	55
942	9	12:24	35 58 08	113 02 03	18	19
943	9	12:30	35 58 16	113 01 54	54	55
944	9	12:35	35 58 23	113 01 46	36	37
945	9	12:39	35 58 30	113 01 39	27	29
946	9	12:45	35 58 31	113 01 27	54	56
947	9	12:49	35 58 27	113 01 16	27	29
948	9	12:54	35 58 28	113 01 01	54	56
949	9	12:59	35 58 26	113 00 50	-9	-7
950	9	13:05	35 58 31	113 00 44	63	66
951	9	13:10	35 58 38	113 00 36	63	66
952	9	13:15	35 58 45	113 00 27	18	21
953	9	13:50	35 57 01	113 01 28	45	49
954	9	13:55	35 56 50	113 01 23	72	77
955	9	13:59	35 56 44	113 01 22	54	59
956	9	14:20	35 56 36	113 01 24	18	24
957	9	14:20	35 56 28	113 01 32	45	51
958	9	14:43	35 56 12	113 01 47	-18	-11
959	9	14:47	35 56 04	113 01 54	0	7
960	9	14:51	35 55 53	113 01 54	48	55
961	9	14:55	35 55 43	113 02 00	27	34
962	9	15:01	35 55 33	113 02 05	-9	-2
963	9	15:45	35 55 23	113 02 09	-26	-17
964	9	15:52	35 55 13	113 02 08	-16	-7
965	9	15:20	35 55 27	113 02 14	-24	-16
966	9	15:25	35 55 22	113 02 25	-16	-8
967	9	15:32	35 55 15	113 02 37	-8	0
968	9	15:36	35 55 07	113 02 48	32	41
971	10	8:55	35 47 39	113 04 37	40	21
972	10	9:00	35 48 07	113 04 38	40	22
973	10	9:05	35 48 32	113 04 56	48	30
974	10	9:10	35 48 57	113 05 00	56	39
975	10	9:15	35 49 22	113 05 04	18	1
976	10	9:19	35 49 46	113 05 08	65	49
977	10	9:23	35 50 12	113 05 18	65	49
978	10	9:29	35 50 34	113 05 29	74	59
979	10	9:23	35 50 58	113 05 44	74	58
980	10	9:39	35 51 18	113 05 56	55	41
981	10	9:45	35 51 38	113 06 02	28	14
982	10	10:04	35 51 35	113 05 28	0	-12
983	10	10:30	35 51 13	113 03 03	-9	-18
984	10	10:45	35 51 36	113 02 50	-18	-26
985	10	10:54	35 52 08	113 02 32	65	58
986	10	11:15	35 49 41	113 01 46	46	41
987	10	11:20	35 49 33	113 01 16	0	-4
988	10	11:25	35 49 22	113 00 36	0	-4
989	10	11:28	35 49 13	113 00 03	9	6
990	10	11:35	35 49 44	113 00 07	0	-3
991	10	11:37	35 50 09	113 00 02	18	16
992	10	11:45	35 50 37	113 00 05	-9	-11
993	10	11:50	35 51 02	113 00 13	17	16
994	10	12:01	35 52 09	113 00 16	8	8
995	10	12:18	35 51 56	113 01 29	0	2
996	10	12:23	35 52 02	113 00 47	8	10
997	10	13:23	35 48 32	113 04 31	0	8
998	10	13:42	35 50 11	113 05 37	-25	-15
999	10	13:46	35 50 18	113 06 06	-51	-40
1001	8	13:45	35 59 57	112 57 05	-40	-30
1002	8	13:45	35 58 18	112 56 35	-40	-30
1003	8	13:57	35 58 09	112 56 44	20	31
1004	8	14:08	35 57 59	112 56 48	30	42
1005	8	14:11	35 57 51	112 56 54	10	22
1006	8	14:19	35 57 42	112 57 01	50	63
1007	8	14:22	35 57 34	112 57 08	60	73

Table 1.--continued

Sample Number	Day (June)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He(ppb)	Corr. He(ppb)
1008	8	14:26	35 57 25	112 57 18	30	43
1009	8	14:30	35 57 24	112 57 30	10	24
1010	8	14:34	35 57 26	112 57 43	-10	4
1011	8	14:42	35 57 27	112 57 55	0	15
1012	8	14:47	35 57 22	112 58 08	50	65
1013	8	14:51	35 57 21	112 58 20	60	76
1014	8	15:10	35 59 49	112 58 49	-20	-3
1015	8	15:15	35 59 45	112 59 01	60	78
1016	8	15:20	35 59 38	112 59 10	30	48
1017	8	15:30	35 59 30	112 59 19	50	69
1018	8	15:33	35 59 22	112 59 27	-20	-1
1019	8	15:36	35 59 12	112 59 34	30	50
1020	8	15:40	35 59 05	112 59 41	30	50
1021	9	9:03	35 54 35	112 57 32	81	74
1022	9	9:07	35 54 33	112 57 34	62	55
1023	9	9:10	35 54 30	112 57 37	54	47
1024	9	9:48	35 55 04	112 57 51	80	75
1025	9	9:51	35 55 04	112 57 53	28	23
1026	9	9:54	35 55 02	112 57 57	69	64
1027	9	9:57	35 55 01	112 57 59	0	-5
1028	9	10:00	35 55 00	112 58 00	119	114
1029	9	10:12	35 55 20	112 57 21	27	23
1030	9	10:16	35 55 21	112 57 49	14	10
1031	9	10:18	35 55 21	112 57 17	41	37
1032	9	10:21	35 55 22	112 57 43	41	37
1033	9	10:24	35 55 22	112 57 41	69	65
1034	9	10:55	35 56 05	112 58 05	31	28
1035	9	10:57	35 56 05	112 58 03	62	59
1036	9	10:03	35 56 05	112 58 00	20	15
1037	9	11:07	35 56 05	112 57 59	41	39
1039	9	14:30	35 36 46	113 24 49	0	6
1040	9	14:35	35 36 47	113 24 47	-20	-14
1041	9	14:45	35 36 48	113 24 48	60	67
1042	9	15:15	35 36 43	113 24 48	20	28
1043	9	15:23	35 36 45	113 24 47	-10	-2
1044	9	15:30	35 36 46	213 24 45	0	8
1045	9	16:05	35 36 26	113 25 24	48	58
1046	9	16:10	35 36 27	113 25 25	56	66
1047	9	16:15	35 36 21	113 25 27	72	82
1048	9	16:20	35 36 24	113 25 28	40	50
1049	9	16:25	35 36 26	113 25 31	32	43
1050	9	16:30	35 36 29	113 25 33	40	51
1051	9	16:35	35 36 31	113 25 32	16	27
1052	9	16:37	35 36 34	113 25 34	24	35
1053	9	16:42	35 36 36	113 25 33	48	59
1054	9	16:46	35 36 38	113 25 30	24	35
1055	9	16:52	35 36 41	113 25 30	72	84
1056	11	9:13	35 56 45	113 08 11	52	43
1057	11	9:17	35 56 53	113 08 14	84	75

Sample Number	Day (June)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He(ppb)	Corr. He(ppb)
1058	11	9:22	35 56 59	113 08 22	42	34
1059	11	9:25	35 57 06	113 08 28	63	55
1060	11	9:30	35 57 16	113 08 28	63	55
1061	11	9:36	35 57 23	113 08 37	52	44
1062	11	9:40	35 57 29	113 08 49	31	24
1063	11	9:44	35 57 39	113 08 51	31	24
1064	11	9:50	35 57 41	113 09 03	11	4
1065	11	9:54	35 57 44	113 09 15	34	27
1066	11	9:57	35 57 46	113 09 27	0	7
1067	11	10:01	35 57 47	113 09 40	68	62
1068	11	10:01	35 57 53	113 09 51	34	28
1069	11	10:10	35 58 01	113 10 00	23	17
1070	11	10:13	35 58 08	113 10 08	68	62
1071	11	10:16	35 58 17	113 10 13	57	51
1072	11	10:22	35 58 28	113 10 15	72	67
1073	11	10:26	35 58 38	113 10 17	10	5
1074	11	10:32	35 58 21	113 10 27	52	47
1075	11	10:36	35 58 24	113 10 37	21	17
1076	11	10:41	35 58 24	113 10 51	31	27
1077	11	10:46	35 58 26	113 11 02	62	58
1078	11	10:53	35 58 33	113 11 12	10	6
1079	11	10:58	35 58 41	113 11 21	21	18
1080	11	11:05	35 58 43	113 11 34	31	28
1081	11	11:10	35 58 44	113 11 47	41	38
1082	11	11:14	35 58 48	113 11 55	41	39
1083	11	11:18	35 58 56	113 11 45	21	19
1084	11	11:20	35 59 03	113 11 36	0	-2
1085	11	11:28	35 59 10	113 11 27	0	-2
1086	11	13:33	35 58 56	113 12 07	11	16
1087	11	13:39	35 58 54	113 12 19	43	48
1088	11	13:43	35 58 48	113 12 29	21	27
1089	11	13:50	35 58 58	113 12 35	236	242
1090	11	13:53	35 59 07	113 12 29	0	6
1091	11	13:57	35 59 16	113 12 25	11	17
1092	11	14:00	35 59 26	113 12 16	21	27
1093	11	14:05	35 59 35	113 12 14	32	39
1094	11	14:10	35 59 42	113 12 07	21	28
1095	11	14:20	35 59 04	113 12 01	-11	-4
1096	11	14:25	35 59 13	113 11 54	0	8
1097	11	14:30	35 59 22	113 11 47	-11	-3
1098	11	14:35	35 59 27	113 11 37	43	51
1099	11	14:40	35 59 26	113 11 25	-11	-2
1100	9	9:10	35 54 38	112 57 30	16	9
1101	9	9:18	35 54 40	112 57 29	41	35
1103	9	9:30	35 54 40	112 57 25	-18	-24
1104	9	9:34	35 54 40	112 57 22	41	35
1106	9	10:00	35 55 31	112 58 00	-14	-19
1107	9	10:03	35 55 30	112 58 02	14	9
1108	9	10:06	35 55 29	112 58 05	28	23

Sample Number	Day (June)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He(ppb)	Corr. He(ppb)
1109	9	10:09	35 55 28	112 58 07	20	16
1110	9	10:15	35 55 26	112 58 10	-31	-35
1111	9	10:20	35 55 35	112 57 25	0	-4
1112	9	10:23	35 55 36	112 57 52	0	-4
1113	9	10:26	35 55 38	112 57 50	0	-4
1114	9	10:28	35 55 39	112 57 49	10	6
1115	9	10:30	35 55 40	112 58 45	41	37
1116	9	10:48	35 56 13	112 58 15	-14	-17
1117	9	10:51	35 56 11	112 58 18	27	24
1118	9	10:54	35 56 11	112 58 20	69	66
1119	9	10:56	35 56 11	112 58 23	82	79
1120	9	14:40	35 36 26	113 24 59	31	37
1121	9	14:49	36 36 30	113 25 00	8	15
1122	9	14:56	35 36 34	113 25 00	16	23
1123	9	15:00	35 36 37	113 25 01	-10	-3
1124	9	15:11	35 36 39	113 25 00	0	8
1126	9	16:06	35 36 43	113 25 25	-40	-30
1127	9	16:10	35 36 15	113 25 56	8	18
1128	9	16:15	35 36 18	113 25 28	23	33
1129	9	16:19	35 36 22	113 25 30	0	10
1130	9	16:25	35 36 24	113 25 32	-16	-5
1131	9	16:19	35 36 26	113 26 35	16	26
1133	9	16:42	35 36 33	113 25 37	8	19
1134	9	16:50	35 36 36	113 25 38	0	12
1150	9	9:05	35 54 52	112 57 47	62	55
1151	9	9:10	35 54 51	112 57 49	41	34
1152	9	9:15	35 54 49	112 57 49	-74	-81
1153	9	9:08	35 54 47	112 57 51	80	73
1154	9	9:20	35 54 45	112 57 52	54	48
1155	9	9:45	35 55 39	112 58 02	54	49
1156	9	9:50	35 55 39	112 58 06	41	36
1157	9	9:55	35 55 39	112 58 09	54	49
1158	9	10:00	35 55 40	112 58 11	57	52
1159	9	10:10	35 55 40	112 58 14	57	53
1160	9	10:15	35 56 41	112 58 24	126	122
1161	9	10:20	35 56 42	112 58 26	62	58
1162	9	10:25	35 56 43	112 58 29	41	37
1163	9	10:30	35 56 43	112 58 30	57	53
1164	9	10:35	35 56 43	112 58 34	82	79
1166	9	11:05	35 56 14	112 58 07	27	25
1169	9	14:45	35 36 26	113 25 05	82	89
1170	9	14:50	35 36 29	113 25 05	131	138
1171	9	14:55	35 36 35	113 25 07	23	30
1172	9	15:00	35 36 32	113 25 07	164	171
1173	9	15:25	35 36 29	113 24 57	28	36
1174	9	15:30	35 36 27	113 24 56	39	47
1175	9	13:20	35 36 26	113 26 13	55	56
1176	9	16:30	35 36 26	113 26 11	70	81
1177	9	16:35	35 36 23	113 26 08	63	74

Sample Number	Day (June)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He(ppb)	Corr. He(ppb)
1178	9	16:40	35 36 19	113 26 05	64	75
1179	9	16:45	35 36 17	113 26 03	24	35
1180	9	16:50	35 36 14	113 25 59	40	52
1181	9	16:55	35 36 23	113 26 04	86	98
1182	9	17:00	35 36 25	113 26 01	80	92
1184	9	17:10	35 36 13	113 26 10	56	68
1200	10	13:51	35 50 32	113 06 22	25	36
1201	10	14:01	35 50 36	113 06 38	34	46
1202	10	14:17	35 49 15	113 04 47	34	48
1203	10	14:25	35 49 36	113 04 37	34	49
1204	10	14:31	35 49 55	113 04 23	0	15
1205	10	14:38	35 49 43	113 04 06	17	33
1206	10	15:04	35 46 07	113 04 29	57	75
1207	10	15:10	35 45 43	113 04 13	0	19
1208	10	15:14	35 45 22	113 03 57	-28	-9
1209	10	15:17	35 45 01	113 03 50	-9	11
1210	10	15:28	35 45 40	113 03 46	9	30
1211	10	15:32	35 45 54	113 03 22	19	40
1212	10	15:38	35 46 13	113 03 02	19	41
1213	10	15:44	35 46 27	113 02 36	39	61
1215	11	9:41	36 00 00	112 54 44	60	53
1216	11	10:08	36 00 09	112 54 38	40	34
1217	11	10:20	36 00 17	112 54 37	0	-5
1218	11	10:24	36 00 28	112 54 37	50	45
1219	11	10:28	36 00 36	112 54 38	40	35
1220	11	10:30	36 00 47	112 54 39	10	5
1221	11	10:33	36 00 59	112 54 39	0	-5
1222	11	10:35	36 01 11	112 54 39	-30	-35
1223	11	10:40	36 01 19	112 54 39	10	6
1224	11	10:48	36 01 28	112 54 39	10	6
1225	11	10:47	36 01 39	112 54 39	-20	-24
1226	11	10:52	36 01 50	112 54 39	0	-4
1227	11	11:01	36 01 58	112 54 39	20	17
1228	11	11:04	36 02 09	112 54 45	-10	-13
1229	11	11:05	36 02 17	112 54 49	-30	-33
1230	11	11:06	36 02 27	112 54 52	-50	-53
1231	11	11:08	36 02 36	112 54 54	-50	-53
1232	11	11:10	36 02 47	112 54 54	-70	-73
1233	11	11:12	36 03 04	112 54 54	-80	-83
1234	11	11:15	36 03 12	112 54 54	-20	-22
1235	11	11:17	36 03 21	112 54 51	-50	-52
1236	11	13:00	36 03 31	112 54 50	42	45
1237	11	13:04	36 03 38	112 54 49	0	3
1238	11	13:08	36 03 47	112 54 48	0	4
1239	11	13:11	36 03 56	112 54 47	-8	-4
1240	11	13:13	36 04 03	112 54 44	-8	-4
1241	11	13:17	36 04 13	112 54 42	0	4
1242	11	13:18	36 04 22	112 54 40	0	4
1243	11	13:20	36 04 33	112 54 38	-8	-4
1244	11	13:24	36 04 48	112 54 35	8	12

Table 1.-- continued

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
1245	11	13:27	36 05 00	112 54 32	0	5
1246	11	13:32	36 05 11	112 54 31	8	13
1247	11	13:34	36 05 22	112 54 28	8	13
1248	11	13:37	36 05 35	112 54 25	17	22
1249	11	13:40	36 05 44	112 54 21	42	47
1250	11	13:43	36 05 52	112 54 20	8	14
1251	11	13:46	36 06 01	112 54 12	-17	-11
1252	11	13:49	36 06 10	112 54 09	25	31
1253	11	13:52	36 06 20	112 54 10	0	6
1254	11	13:56	36 06 30	112 52 09	83	89
1255	11	14:00	36 06 30	112 54 00	17	23
1256	11	14:03	36 06 28	112 53 50	-8	-1
1257	11	14:06	36 06 21	112 53 35	-25	-18
1258	11	14:08	36 06 14	112 53 33	-17	-10
1259	11	14:12	36 06 05	112 53 30	0	7
1260	11	14:15	36 06 00	112 53 22	-8	-1
1261	11	14:18	36 05 50	112 53 28	-17	-10
1262	12	9:17	36 00 00	112 53 33	61	46
1263	12	9:20	36 00 10	112 53 28	61	46
1264	12	9:24	36 00 19	112 53 26	35	20
1265	12	9:27	36 00 28	112 53 25	26	11
1266	12	9:30	36 00 38	112 53 25	44	30
1267	12	9:32	36 00 48	112 53 25	52	38
1268	12	9:35	36 00 58	112 53 24	35	21
1269	12	9:32	36 01 09	112 53 24	52	38
1270	12	9:40	36 01 18	112 53 24	35	22
1271	12	9:44	36 01 27	112 53 24	44	31
1272	12	9:46	36 01 34	112 53 24	79	66
1273	12	9:52	36 01 42	112 53 26	35	23
1275	12	9:58	36 02 03	112 53 29	43	31
1276	12	10:02	36 02 12	112 53 31	34	23
1277	12	10:05	36 02 22	112 53 31	43	32
1278	12	10:07	36 02 32	112 53 32	43	32
1279	12	10:10	36 02 50	112 53 35	34	24
1280	12	10:12	36 03 03	112 53 38	43	33
1281	12	10:14	36 03 16	112 53 41	34	24
1282	12	10:17	36 03 23	112 53 45	34	24
1283	12	10:20	36 03 32	112 53 49	44	34
1284	12	10:25	36 03 41	112 53 50	34	25
1285	12	10:28	36 03 52	112 53 51	109	100
1286	12	10:33	36 04 05	112 53 55	25	17
1287	12	10:37	36 04 12	112 54 00	50	42
1288	12	10:40	36 04 22	112 54 04	25	17
1289	12	10:44	36 04 32	112 54 10	33	26
1290	12	10:47	36 04 48	112 54 09	50	43
1291	12	10:50	36 04 59	112 54 08	42	35
1292	12	10:52	36 05 10	112 54 05	42	36
1293	12	10:56	36 05 21	112 54 05	50	44
1300	10	9:18	35 53 24	113 02 36	-18	-34
1301	10	9:26	35 53 35	113 02 37	65	50

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
1302	10	9:40	35 53 42	113 02 34	46	32
1303	10	9:43	35 53 52	113 02 33	65	51
1304	10	9:53	35 53 57	113 02 23	28	15
1305	10	9:56	35 54 02	113 02 09	46	34
1306	10	10:05	35 54 07	113 02 00	28	16
1307	10	10:11	35 54 16	113 01 49	55	44
1308	10	10:22	35 54 24	113 01 42	65	55
1309	10	10:26	35 54 31	113 01 31	18	9
1310	10	10:31	35 54 33	113 01 17	28	19
1311	10	10:36	35 54 41	113 01 08	9	1
1312	10	10:40	35 54 50	113 01 00	9	1
1313	10	10:46	35 54 57	113 00 51	9	2
1314	10	10:50	35 55 05	113 00 43	28	21
1315	10	10:54	35 55 11	113 00 31	18	11
1316	10	10:58	35 55 20	113 00 24	0	-6
1317	10	11:02	35 55 29	113 00 16	28	22
1318	10	11:06	35 55 33	113 00 04	37	32
1319	10	11:56	35 55 16	113 03 06	55	55
1320	10	12:00	35 55 16	113 03 18	28	28
1321	10	15:10	35 55 12	113 03 25	9	28
1322	10	15:17	35 55 04	113 03 36	9	29
1323	10	15:22	35 55 06	113 03 48	9	29
1324	10	15:27	35 55 07	113 04 01	18	39
1325	10	15:32	35 55 07	113 04 13	-18	3
1326	10	15:37	35 55 03	113 04 24	28	50
1327	10	15:43	35 54 54	113 04 31	-9	13
1329	10	16:48	35 53 58	113 05 01	0	29
1330	10	16:58	35 54 06	113 04 55	-9	21
1331	11	14:15	36 09 32	112 52 41	9	16
1332	11	14:18	36 09 24	112 52 42	9	16
1333	11	14:20	36 09 14	112 52 48	0	7
1334	11	14:23	36 09 00	112 52 50	0	8
1335	11	14:26	36 08 50	112 52 40	9	17
1336	11	14:28	36 08 44	112 52 32	9	17
1337	11	14:31	36 08 32	112 52 31	46	54
1338	11	14:34	36 08 21	112 52 31	0	8
1339	11	14:37	36 08 10	112 52 31	9	17
1340	11	14:39	36 08 02	112 52 31	0	9
1341	11	14:42	36 07 50	112 52 31	0	9
1342	11	14:45	36 07 39	112 52 31	0	9
1343	11	14:48	36 07 28	112 52 31	56	65
1344	11	14:51	36 07 16	112 52 31	28	37
1345	11	14:54	36 07 04	112 52 31	-9	0
1346	11	14:57	36 06 51	112 52 31	0	9
1347	11	15:01	36 06 42	112 52 31	0	10
1348	11	15:04	36 06 31	112 52 31	0	10
1349	11	15:07	36 06 20	112 52 31	0	10
1350	11	15:10	36 06 11	112 52 31	0	10
1351	11	15:13	36 06 00	112 52 31	0	10
1352	11	15:16	36 05 50	112 52 31	-19	-9

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
1353	11	15:19	36 05 38	112 52 31	9	20
1354	12	10:55	35 54 20	113 05 16	8	2
1355	12	11:09	35 54 20	113 05 02	17	12
1356	12	11:34	35 54 54	113 05 23	17	15
1357	12	11:42	35 54 53	113 05 10	8	6
1358	12	12:01	35 54 48	113 05 00	68	68
1359	12	12:08	35 54 40	113 05 04	44	45
1360	12	12:16	35 54 30	113 05 10	0	2
1361	12	12:26	35 54 27	113 05 15	34	36
1362	12	13:45	35 48 15	113 05 19	44	54
1363	12	13:50	35 48 23	113 05 40	8	18
1364	12	13:56	35 48 25	113 06 23	17	28
1365	12	14:06	35 48 05	113 06 46	-8	4
1366	12	14:12	35 47 44	113 06 42	51	64
1367	12	14:18	35 48 02	113 07 04	0	13
1368	12	14:30	35 47 18	113 06 40	-8	6
1369	12	14:41	35 46 57	113 06 44	8	23
1370	12	14:52	35 47 09	113 07 03	-8	8
1371	12	15:00	35 47 23	113 07 29	44	61
1372	12	15:16	35 46 35	113 06 46	43	62
1373	12	15:22	35 46 10	113 06 43	8	27
1374	12	15:29	35 45 47	113 06 55	-17	3
1375	12	15:37	35 45 54	113 07 08	-8	13
1376	12	15:54	35 46 34	113 06 57	51	73
1377	12	15:59	35 46 24	113 05 57	34	57
1378	12	16:03	35 46 04	113 05 39	25	48
1379	14	14:23	35 59 00	113 12 37	16	26
1380	14	14:30	35 59 02	113 12 08	0	11
1381	14	14:37	35 59 04	113 12 40	24	35
1382	14	14:43	35 59 05	113 12 43	32	44
1383	14	14:48	35 59 07	113 12 44	-8	4
1384	14	14:57	35 58 57	113 12 37	8	21
1400	10	10:31	35 36 54	113 26 57	74	65
1401	10	10:37	35 37 19	113 26 46	58	50
1402	10	10:42	35 37 38	113 26 36	66	58
1403	10	10:48	35 38 02	113 26 20	58	51
1404	10	10:54	35 38 24	113 26 04	85	78
1405	10	11:01	35 38 51	113 26 07	68	62
1407	10	11:13	35 39 37	113 25 50	68	63
1408	10	11:18	35 39 59	113 25 34	59	55
1409	10	11:23	35 40 23	113 25 11	85	81
1410	10	11:28	35 40 48	113 24 55	68	65
1411	10	11:35	35 41 13	113 24 38	59	56
1412	10	11:42	35 41 36	113 24 02	59	57
1413	10	11:47	35 42 13	113 23 38	24	23
1414	10	11:52	35 42 36	113 23 17	32	31
1415	10	11:58	35 42 55	113 22 53	120	120
1416	10	12:05	35 43 25	113 22 50	120	121
1417	10	12:11	35 44 02	113 22 16	48	49
1418	10	12:18	35 44 36	113 21 55	64	66

Sample Number	Day (June)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
1419	10	12:23	35 45 22	113 21 05	40	42
1420	10	12:45	35 45 58	113 21 45	24	29
1421	11	9:23	36 00 10	112 52 33	30	22
1422	11	9:28	36 00 20	112 52 33	20	12
1423	11	9:32	36 00 30	112 52 33	0	-8
1424	11	9:36	36 00 41	112 52 33	20	12
1425	11	9:41	36 00 51	112 52 33	10	3
1426	11	9:45	36 01 02	112 52 33	70	63
1427	11	9:49	36 01 12	112 52 33	20	13
1428	11	9:54	36 01 26	112 52 33	54	47
1429	11	9:59	36 01 35	112 52 33	21	15
1430	11	10:06	36 01 42	112 52 33	64	58
1431	11	10:10	36 01 52	112 52 33	32	26
1432	11	10:14	36 02 02	112 52 34	21	15
1433	11	10:19	36 02 12	112 52 33	86	81
1434	11	10:24	36 02 22	112 52 33	64	59
1435	11	10:29	36 02 36	112 52 35	21	16
1436	11	10:35	36 02 44	112 52 37	-106	-111
1437	11	10:39	36 02 59	112 52 33	11	7
1438	11	10:44	36 03 09	112 52 33	53	49
1439	11	10:48	36 03 20	112 52 33	21	17
1440	11	10:55	36 03 30	112 52 33	-11	-14
1441	11	11:06	36 03 40	112 52 33	149	146
1442	11	11:12	36 03 50	112 52 33	21	18
1443	11	11:16	36 04 03	112 52 33	138	136
1444	12	10:07	36 04 12	112 52 33	34	23
1445	12	10:12	36 04 23	112 52 33	42	32
1446	12	10:18	36 04 34	112 52 33	34	24
1447	12	10:24	36 04 45	112 52 33	34	25
1448	12	10:29	36 04 56	112 52 33	25	16
1449	12	10:35	36 05 04	112 52 33	17	9
1450	12	10:42	36 05 13	112 52 33	25	18
1451	12	10:48	36 05 29	112 52 33	25	18
1501	11	14:43	35 59 34	113 11 17	0	9
1502	11	14:47	35 59 43	113 11 03	43	52
1503	11	14:50	35 59 48	113 10 51	0	9
1504	11	14:55	35 59 57	113 10 43	-32	-23
1505	11	15:15	35 57 17	113 08 34	25	35
1506	11	15:20	35 57 17	113 08 48	17	28
1507	11	15:23	35 57 20	113 09 01	33	44
1508	11	15:29	35 57 24	113 09 13	8	19
1509	11	15:33	35 57 23	113 09 26	17	28
1510	11	15:40	35 57 22	113 09 37	42	54
1511	11	15:45	35 57 24	113 09 49	67	79
1512	11	15:48	35 57 28	113 10 02	25	37
1513	11	15:54	35 57 33	113 10 14	0	13
1514	11	15:58	35 57 88	113 10 25	0	13
1515	11	16:01	35 57 40	113 10 38	57	70
1516	11	16:05	35 57 43	113 10 49	8	21

Table 1.--continued

Sample Number	Day (June)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He (ppb)	Corr. He (ppb)
1517	11	16:10	35 57 47	113 11 03	90	103
1518	11	16:15	35 57 47	113 11 15	49	63
1519	11	16:55	35 52 15	113 06 42	57	73
1520	11	17:03	35 51 48	113 06 54	41	57
1521	11	17:07	35 51 23	113 07 08	8	24
1522	11	17:12	35 51 40	113 07 26	41	58
1523	11	17:20	35 51 05	113 07 27	16	33
1524	12	9:25	36 00 08	112 56 18	72	57
1525	12	9:32	36 00 13	112 56 10	54	40
1526	12	9:39	36 00 20	112 56 18	90	77
1527	12	9:42	36 00 30	112 56 20	81	68
1528	12	9:47	36 00 39	112 56 20	63	50
1529	12	9:50	36 00 40	112 56 34	54	42
1530	12	9:54	36 00 46	112 56 45	54	42
1531	12	9:57	36 00 51	112 56 50	36	24
1532	12	10:00	36 01 00	112 56 45	72	61
1533	12	10:03	36 01 09	112 56 45	72	61
1534	12	10:07	36 01 16	112 56 49	63	52
1535	12	10:10	36 01 28	112 56 45	47	37
1536	12	10:13	36 01 38	112 56 42	57	47
1537	12	10:17	36 01 42	112 56 41	57	47
1538	12	10:20	36 01 49	112 56 50	57	47
1539	12	10:24	36 01 57	112 56 59	61	52
1540	12	10:28	36 02 02	112 56 52	75	66
1541	12	10:31	36 02 09	112 56 58	57	49
1542	12	10:35	36 02 08	112 57 09	47	39
1543	12	11:07	36 00 01	112 57 19	38	33
1544	12	11:12	36 00 03	112 57 29	61	56
1545	12	11:15	36 00 10	112 57 40	47	43
1546	12	11:22	36 00 19	112 57 49	0	-4
1547	12	11:24	36 00 26	112 57 59	9	6
1548	12	11:28	36 00 34	112 58 05	47	44
1549	12	11:33	36 00 38	112 58 16	57	54
1550	12	13:07	36 01 42	112 59 59	57	63
1551	12	13:11	36 01 38	112 59 50	0	7
1552	12	13:15	36 01 35	112 59 39	57	64
1553	12	13:18	36 01 30	112 59 29	57	64
1554	12	13:21	36 01 24	112 59 22	19	27
1555	12	13:24	36 01 20	112 59 02	47	55
1556	12	13:28	36 01 18	112 58 54	47	55
1557	12	13:31	36 01 11	112 58 44	9	18
1558	12	13:34	36 01 00	112 58 39	19	28
1559	12	13:37	36 00 51	112 58 31	38	47
1560	12	13:40	36 00 41	112 58 26	9	19
1561	12	13:42	36 00 46	112 58 28	-19	-9
1562	12	13:47	36 00 19	112 58 19	47	57
1563	12	13:50	36 00 08	112 58 18	28	38
1564	12	13:54	36 00 01	112 58 26	66	77
1701	14	14:27	35 59 00	113 12 36	32	42
1703	14	14:37	35 59 06	113 12 06	0	11
Sample Number	Day (June)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He (ppb)	Corr. He (ppb)
1704	14	14:39	35 59 07	113 12 06	16	27
1705	14	14:48	35 59 09	113 12 06	16	28
1731	8	9:15	35 55 38	112 55 29	60	45
1732	10	11:07	35 39 17	113 26 04	76	71

Table 2.--Soil-gas helium analyses for samples collected on the Hualapai Indian Reservation during October 1982. (All helium is reported relative to the helium concentration in ambient air (5,240 ppb He).)

Sample Number	Day (Oct)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
2	20	10:58	35 49 37	112 56 18	68	64
3	20	11:01	35 49 35	112 56 06	69	64
4	20	11:04	35 49 33	112 55 52	96	92
5	20	11:08	35 49 31	112 55 39	41	38
6	20	11:12	35 49 29	112 55 26	44	41
7	20	11:14	35 49 26	112 55 15	59	56
8	20	11:21	35 49 26	112 55 01	63	60
9	20	11:24	35 49 26	112 54 48	75	72
10	20	11:27	35 49 25	112 54 36	67	64
11	20	11:30	35 49 24	112 54 23	58	56
12	20	11:43	35 47 57	112 54 47	108	107
13	20	12:17	35 47 58	112 54 58	25	27
14	20	12:19	35 48 05	112 55 08	50	52
15	20	12:29	35 48 12	112 55 18	33	36
16	20	12:32	35 48 19	112 55 29	67	69
17	20	12:35	35 48 25	112 55 40	67	69
18	20	12:37	35 48 33	112 55 50	50	53
19	20	12:41	35 48 39	112 56 00	17	20
20	20	12:43	35 48 46	112 56 09	16	19
21	20	12:46	35 48 53	112 56 19	25	28
22	20	13:00	35 49 01	112 56 28	30	34
23	20	13:02	35 49 09	112 56 37	22	27
24	20	13:06	35 49 16	112 56 49	15	19
25	20	13:09	35 49 21	112 56 58	8	13
26	20	13:13	35 49 23	112 57 06	37	43
27	20	13:15	35 49 21	112 57 16	30	35
28	20	13:19	35 49 16	112 57 30	30	36
29	20	13:25	35 49 23	112 57 23	45	51
30	20	13:27	35 49 27	112 57 10	19	25
31	20	13:32	35 49 30	112 56 56	4	11
32	20	13:35	35 49 34	112 56 45	4	11
33	20	13:47	35 49 49	112 54 18	26	34
34	20	13:50	35 50 19	112 54 21	15	23
35	20	13:55	35 50 43	112 54 20	45	54
36	20	14:00	35 51 10	112 54 20	8	17
38	20	13:40	35 49 37	112 56 34	30	38
40	21	09:30	35 58 22	112 56 24	39	28
41	21	09:39	35 58 21	112 56 26	78	67
42	21	09:41	35 58 22	112 56 29	94	83
43	21	09:43	35 58 19	112 56 31	95	85
44	21	09:46	35 58 19	112 56 35	78	68
45	21	09:48	35 58 16	112 56 36	62	52
46	21	09:51	35 58 16	112 56 26	109	99
47	21	09:55	35 58 14	112 56 41	78	68
48	21	09:57	35 58 12	112 56 44	47	37
49	21	10:04	35 58 09	112 56 43	62	54
50	21	10:07	35 58 08	112 56 47	62	54
51	21	10:10	35 58 05	112 56 46	62	54
52	21	10:17	35 58 03	112 56 48	47	39
53	21	10:20	35 58 02	112 56 46	59	51
54	21	10:41	35 58 00	112 56 49	47	41
55	21	10:44	35 57 57	112 56 50	78	72
56	21	10:46	35 57 55	112 56 52	47	41
57	21	10:48	35 57 53	112 56 51	71	65
58	21	10:50	35 57 51	112 56 53	62	57
59	21	10:55	35 57 49	112 56 56	35	30
60	21	10:59	35 57 47	112 56 55	31	27
61	21	11:07	35 57 46	112 56 59	48	44
62	21	11:30	35 57 42	112 56 59	96	94
63	21	11:34	35 57 40	112 57 01	64	62
64	21	11:39	35 57 39	112 57 05	64	62
65	21	11:41	35 57 37	112 57 04	48	46
66	21	11:44	35 57 36	112 57 07	40	39
67	21	11:46	35 57 32	112 57 09	63	62
68	21	11:47	35 57 30	112 57 15	40	39
69	21	11:51	35 57 27	112 57 16	55	55
70	21	11:56	35 57 26	112 57 21	32	31
71	21	12:01	35 57 24	112 57 24	32	32
72	21	13:22	35 57 25	112 57 27	24	30
73	21	13:25	35 57 23	112 57 30	20	26
74	21	13:28	35 57 23	112 57 33	48	55
75	21	13:30	35 57 25	112 57 35	64	70
76	21	13:36	35 57 24	112 57 38	0	7
77	21	13:39	35 57 26	112 57 41	16	23
77A	21	13:39	35 57 26	112 57 41	0	8
78	21	13:41	35 57 25	112 57 44	32	40
79	21	13:43	35 57 27	112 57 46	28	36
80	21	13:47	35 57 25	112 57 50	73	81
81	21	13:51	35 57 26	112 57 53	65	73
82	21	13:54	35 57 28	112 57 55	81	90
83	21	13:56	35 57 28	112 57 58	65	74
84	21	13:59	35 57 26	112 57 59	48	58
85	21	14:03	35 57 26	112 58 03	65	74
86	21	14:05	35 57 23	112 58 07	28	38
87	21	14:08	35 57 20	112 58 08	48	58
88	21	14:12	35 57 19	112 58 11	65	75
89	21	14:19	35 57 21	112 58 14	32	43
90	21	14:22	35 57 20	112 58 18	48	59
91	21	14:26	35 57 21	112 58 21	32	44
92	21	14:29	35 57 21	112 58 24	48	60
93	21	14:32	35 57 21	112 58 58	32	44
95	22	10:32	35 55 36	112 59 59	81	76
96	22	10:40	35 55 45	112 59 51	81	77
97	22	10:43	35 55 54	112 59 43	97	93
98	22	10:46	35 55 54	112 59 33	97	93
99	22	10:47	35 55 54	112 59 26	65	61
100	20	09:30	35 55 55	112 55 43	86	75
101	20	09:39	35 55 35	112 56 03	69	58
102	20	09:46	35 55 13	112 56 22	181	171
103	20	09:51	35 54 52	112 56 39	172	163
104	20	09:57	35 54 31	112 56 58	103	94
105	20	10:05	35 54 09	112 57 17	121	112
106	20	10:11	35 53 51	112 57 41	86	78
107	20	10:16	35 53 34	112 58 05	88	81
108	20	10:22	35 53 20	112 58 32	121	113
109	20	10:29	35 53 07	112 58 59	69	62
110	20	10:34	35 52 52	112 59 16	90	84
111	20	10:40	35 52 32	112 59 28	103	97
112	20	10:53	35 55 31	112 55 26	86	81
113	20	10:59	35 55 08	112 55 10	86	82
114	20	11:04	35 54 49	112 54 44	103	99
115	20	11:10	35 54 23	112 54 38	103	100
116	20	11:15	35 53 57	112 54 31	69	66
117	20	11:21	35 53 33	112 54 24	67	64
118	20	11:26	35 53 07	112 54 17	88	85
119	20	11:31	35 52 40	112 54 15	83	81
120	20	11:40	35 52 18	112 54 36	134	132
121	20	11:52	35 51 53	112 54 46	117	116
122	20	12:03	35 51 31	112 55 03	83	84
123	20	12:11	35 51 09	112 55 18	67	68
124	20	12:20	35 50 45	112 55 33	75	76
125	20	12:31	35 50 24	112 55 52	67	69
126	20	12:40	35 50 03	112 56 13	72	75
128	21	08:57	35 54 23	112 57 17	84	70
129	21	09:02	35 54 30	112 57 26	42	28
130	21	09:06	35 54 38	112 57 34	43	30
131	21	09:10	35 54 46	112 57 41	86	73
132	21	09:14	35 54 55	112 57 46	114	101
133	21	09:18	35 55 05	112 57 47	71	59
134	21	09:23	35 55 15	112 57 51	104	92
135	21	09:27	35 55 25	112 57 54	119	107
136	21	09:32	35 55 35	112 57 57	104	93
137	21	09:36	35 55 44	112 58 00	89	78
138	21	09:41	35 55 54	112 58 04	89	79
139	21	09:48	35 56 04	112 58 07	93	82
140	21	09:53	35 56 12	112 58 09	108	98
141	21	09:59	35 56 22	112 58 12	123	114
142	21	10:04	35 56 33	112 58 17	100	91
143	21	10:07	35 56 42	112 58 21	93	84
144	21	10:12	35 56 53	112 58 22	54	46
145	21	10:16	35 57 04	112 58 25	113	105
146	21	10:21	35 57 13	112 58 27	81	73
147	21	10:29	35 57 22	112 58 29	65	58
148	21	10:37	35 57 33	112 58 29	48	42
149	21	10:46	35 57 42	112 58 27	81	75
150	21	10:52	35 57 54	112 58 26	48	43
151	21	10:58	35 58 04	112 58 25	81	76
152	21	11:04	35 58 14	112 58 25	31	27
153	21	11:08	35 58 25	112 58 25	31	27
154	21	11:13	35 58 36	112 58 26	47	43
155	21	11:17	35 58 46	112 58 26	62	59
156	21	11:21	35 58 57	112 58 29	94	91
157	21	11:26	35 59 07	112 58 30	78	75
158	21	11:35	35 59 17	112 58 31	62	61
159	21	11:39	35 59 26	112 58 33	71	69
160	21	11:46	35 59 38	112 58 34	62	61
161	21	11:52	35 59 54	112 58 36	62	62
162	21	13:01	35 57 22	112 58 36	12	17
163	21	13:05	35 57 22	112 58 43	0	5
164	21	13:13	35 57 22	112 58 50	47	52
165	21	13:19	35 57 21	112 58 56	47	53
166	21	13:26	35 57 21	112 59 01	47	53
167	21	13:37	35 57 13	112 58 49	16	23
168	21	13:43	35 57 04	112 58 56	31	39
169	21	13:48	35 56 55	112 59 03	24	32
170	21	13:52	35 56 46	112 59 09	24	32
171	21	13:56	35 56 35	112 59 12	16	25
172	21	14:02	35 56 23	112 59 19	39	49
175	22	10:14	35 59 45	112 59 02	47	41
176	22	10:22	35 59 37	112 59 11	62	57
177	22	10:26	35 59 28	112 59 22	31	26
178	22	10:29	35 59 18	112 59 32	62	58
179	22	10:36	35 59 10	112 59 39	47	42
180	22	10:42	35 59 01	112 59 40	78	74
181	22	10:47	35 58 53	112 59 53	64	60
182	22	10:51	35 58 44	112 59 59	64	60
183	22	12:16	35 58 59	112 58 37	32	33
184	22	12:20	35 58 54	112 58 44	12	13
185	22	12:25	35 58 51	112 58 48	48	49
186	22	12:31	35 58 48	112 58 52	8	10
187	22	12:36	35 58 44	112 58 58	16	18
188	22	12:40	35 58 39	112 59 09	30	32
189	22	12:46	35 58 34	112 59 20	30	32
190	22	12:51	35 58 24	112 59 23	15	18
191	22	12:57	35 58 14	112 59 29	15	18
193	23	09:15	35 57 28	112 55 58	75	37
194	23	09:18	35 57 26	112 55 58	98	60
195	23	09:21	35 57 24	112 55 58	90	54
196	23	09:25	35 57 21	112 55 58	60	24
197A	23	11:11	35 57 30	112 55 58	90	79
197	23	09:32	35 57 18	112 55 58	38	3
200	22	10:49	35 56 04	112 59 24	81	77
201	22	10:57	35 56 15	112 59 18	65	61
202	22	11:09	35 56 08	112 59 28	81	78
203	22	11:12	35 56 07	112 59 34	81	78
204	22	12:45	35 55 05	112 57 55	81	83
205	22	12:55	35 55 02	112 58 01	48	51
206	22	12:58	35 54 57	112 58 03	31	34
207	22	13:03	35 54 52	112 58 03	62	66
208	22	13:06	35 54 48	112 58 02	30	34

Table 2.--continued

Sample Number	Day (Oct)	Time	Lat. ° ′ ″	Long. ° ′ ″	Uncorr. He(ppb)	Corr. He(ppb)
209	22	13:10	35 54 46	112 58 08	31	35
210	22	13:12	35 54 45	112 58 16	78	82
211	22	13:15	35 54 41	112 58 19	78	82
212	22	13:18	35 54 43	112 58 26	47	51
213	22	13:25	35 54 37	112 58 21	47	51
214	22	13:29	35 54 34	112 58 26	62	67
216	23	09:37	35 57 31	112 55 55	29	-4
217	23	09:14	35 57 31	112 55 52	29	-9
218	23	09:20	35 57 31	112 55 49	0	-37
219	23	09:25	35 57 31	112 55 46	47	11
220	23	09:32	35 57 31	112 55 43	47	13
221	23	09:09	35 57 34	112 55 58	109	70
222	23	09:11	35 57 37	112 55 58	86	47
223	23	09:14	35 57 39	112 55 58	31	-7
224	23	09:18	35 57 41	112 55 58	78	40
225	23	09:22	35 57 44	112 55 58	47	10
226	23	09:44	35 57 31	112 56 02	78	47
227	23	09:49	35 57 31	112 56 05	62	32
228	23	09:51	35 57 31	112 56 08	62	33
229	23	09:54	35 57 31	112 56 11	31	2
230	23	10:02	35 57 31	112 56 14	94	66
231	23	10:44	35 54 36	112 54 45	47	29
232	23	10:48	35 54 34	112 54 45	32	16
233	23	10:52	35 54 31	112 54 45	8	-8
234	23	10:57	35 54 29	112 54 45	8	-7
235	23	11:03	35 54 26	112 54 45	65	51
236	23	10:43	35 54 42	112 54 45	97	79
237	23	10:45	35 54 45	112 54 45	65	47
238	23	10:47	35 54 47	112 54 45	15	-2
239	23	10:51	35 54 49	112 54 45	60	44
240	23	10:54	35 54 52	112 54 45	45	30
241	23	10:40	35 54 38	112 54 45	45	27
242	23	11:11	35 54 39	112 54 48	30	19
243	23	11:13	35 54 39	112 54 51	60	49
244	23	11:16	35 54 39	112 54 54	60	50
245	23	11:19	35 54 39	112 54 57	60	51
246	23	11:22	35 54 39	112 55 00	60	51
247	23	14:12	35 46 08	112 59 41	0	31
248	23	14:18	35 46 08	112 59 44	0	32
249	23	14:24	35 46 08	112 59 47	30	64
250	23	14:31	35 46 08	112 59 50	0	35
251	23	14:39	35 46 08	112 59 53	0	37
252	23	14:04	35 46 08	112 59 38	8	36
253	23	14:09	35 46 04	112 59 38	0	30
254	23	14:16	35 46 02	112 59 38	15	47
255	23	14:19	35 46 00	112 59 38	30	62
256	23	14:26	35 45 57	112 59 38	45	79
257	23	14:40	35 45 54	112 59 38	15	52
260	24	11:14	35 46 12	112 59 38	50	46
261	24	11:16	35 46 15	112 59 38	50	46

Sample Number	Day (Oct)	Time	Lat. ° ′ ″	Long. ° ′ ″	Uncorr. He(ppb)	Corr. He(ppb)
262	24	11:20	35 46 17	112 59 38	50	47
263	24	11:25	35 46 20	112 59 38	50	47
264	24	11:30	35 46 23	112 59 38	74	72
265	24	11:42	35 46 16	112 59 26	39	37
266	24	11:44	35 46 19	112 59 16	32	31
267	24	11:47	35 46 23	112 59 04	45	44
268	24	11:49	35 46 28	112 58 53	52	51
269	24	11:52	35 46 34	112 58 44	39	38
270	24	11:55	35 46 40	112 58 32	26	25
271	24	11:59	35 46 46	112 58 23	26	26
272	24	12:05	35 46 55	112 58 19	39	39
273	24	12:11	35 47 17	112 58 27	26	27
274	24	12:15	35 47 35	112 58 49	26	27
275	24	12:19	35 47 59	112 59 02	39	40
276	24	12:22	35 48 20	112 59 06	39	40
277	24	12:28	35 48 39	112 59 32	26	28
280	25	10:20	35 54 21	112 57 32	0	6
281	25	10:30	35 54 12	112 57 37	27	32
282	25	10:40	35 54 03	112 57 42	40	45
283	25	10:46	35 53 53	112 57 48	40	45
284	25	10:52	35 53 45	112 57 55	27	31
285	25	12:09	35 48 52	112 59 05	40	40
286	25	12:21	35 48 56	112 58 34	27	26
287	25	12:25	35 49 05	112 58 04	40	39
288	25	12:29	35 49 11	112 57 38	40	39
289	25	12:41	35 48 46	112 56 28	54	51
290	25	12:43	35 48 38	112 56 37	54	51
291	25	12:45	35 48 30	112 56 45	54	51
292	25	12:48	35 48 23	112 56 54	27	24
293	25	12:50	35 48 14	112 57 00	27	24
294	25	12:51	35 48 06	112 57 07	27	24
295	25	12:55	35 47 58	112 57 11	7	4
296	25	13:00	35 47 50	112 57 18	56	52
297	25	13:04	35 47 42	112 57 21	42	38
298	25	13:08	35 47 36	112 57 31	28	24
299	25	13:12	35 47 25	112 57 57	7	3
301	23	10:50	35 54 39	112 54 31	45	29
302	23	10:54	35 54 39	112 54 28	60	45
303	23	14:13	35 46 08	112 59 34	30	60
304	23	14:17	35 46 08	112 59 31	15	47
305	23	14:22	35 46 08	112 59 28	15	48
306	23	14:26	35 46 08	112 59 25	45	79
307	23	14:33	35 46 08	112 59 22	74	110
308	25	10:20	35 54 35	112 57 23	15	20
309	25	10:26	35 54 39	112 57 18	29	35
310	25	10:34	35 54 44	112 57 14	44	49
311	25	10:40	35 54 49	112 57 11	29	34
312	25	10:46	35 54 55	112 57 10	22	26
313	25	10:52	35 55 01	112 57 10	44	48
314	25	11:01	35 55 07	112 57 06	35	39

Sample Number	Day (Oct)	Time	Lat. ° ′ ″	Long. ° ′ ″	Uncorr. He(ppb)	Corr. He(ppb)
315	25	11:09	35 55 13	112 57 03	70	73
316	25	11:18	35 55 18	112 57 01	56	58
317	25	11:26	35 55 23	112 56 53	28	30
318	29	09:50	35 51 36	113 01 59	81	57
319	29	10:02	35 51 38	113 02 00	16	-5
321	29	10:13	35 51 43	113 02 00	89	69
322	29	10:17	35 51 46	113 02 00	65	46
323	29	10:21	35 51 48	113 02 00	16	-2
324	29	10:35	35 51 37	113 01 57	32	17
325	29	10:41	35 51 38	113 01 54	65	50
327	29	10:49	35 51 41	113 01 48	24	11
328	29	10:53	35 51 43	113 01 46	48	36
329	29	11:04	35 51 33	113 02 00	65	54
330	29	11:08	35 51 31	113 02 01	65	55
331	29	11:11	35 51 28	113 02 02	32	23
332	29	11:16	35 51 26	113 02 03	65	57
333	29	11:20	35 51 23	113 02 03	32	25
400	22	10:30	35 56 13	112 59 17	23	19
401	22	10:40	35 56 15	112 59 10	16	11
402	22	10:46	35 56 20	112 59 05	47	43
403	22	10:54	35 56 19	112 58 57	19	15
404	22	11:00	35 56 13	112 58 56	30	26
405	22	11:05	35 56 08	112 58 53	11	8
406	22	11:11	35 56 08	112 58 44	45	42
407	22	11:19	35 56 06	112 58 38	37	35
408	22	11:25	35 56 03	112 58 33	8	6
409	22	11:32	35 56 06	112 58 28	65	64
410	22	11:38	35 56 11	112 58 23	45	44
412	22	13:07	35 56 06	112 57 58	31	35
413	22	13:13	35 56 03	112 57 51	62	66
414	22	13:22	35 56 01	112 57 43	47	51
416	22	13:34	35 56 05	112 57 29	62	67
417	22	13:41	35 56 02	112 57 22	47	52
418	22	13:49	35 55 57	112 57 21	31	37
419	22	13:56	35 55 52	112 57 19	31	37
420	22	14:31	35 55 46	112 57 23	47	55
421	22	14:44	35 55 45	112 57 29	0	9
422	22	14:50	35 55 43	112 57 38	53	62
423	22	14:56	35 55 42	112 57 45	71	80
424	22	15:03	35 55 39	112 57 51	62	72
425	22	15:55	35 57 58	112 58 22	62	75
426	22	16:01	35 58 01	112 58 16	62	75
427	22	16:09	35 58 03	112 58 10	62	76
428	22	16:13	35 58 07	112 58 05	31	45
429	22	16:16	35 58 11	112 57 59	47	60
430	22	16:19	35 58 03	112 57 52	62	76
431	22	16:22	35 58 17	112 57 45	31	45
432	22	16:27	35 58 22	112 57 41	47	61
433	22	16:32	35 58 26	112 57 41	16	30
436	27	09:15	35 58 11	112 54 01	154	127

Sample Number	Day (Oct)	Time	Lat. ° ′ ″	Long. ° ′ ″	Uncorr. He(ppb)	Corr. He(ppb)
437	27	09:19	35 58 11	112 54 03	92	65
438	27	09:22	35 58 11	112 54 05	61	35
439	27	09:26	35 58 11	112 54 08	93	67
440	27	09:30	35 58 11	112 54 11	61	36
441	27	09:34	35 58 11	112 53 58	77	53
442	27	09:41	35 58 11	112 53 55	77	54
443	27	09:44	35 58 11	112 53 53	77	54
444	27	09:46	35 58 11	112 53 50	61	39
445	27	09:49	35 58 11	112 54 7	102	80
446	27	09:52	35 58 11	112 53 44	87	66
447	27	10:04	35 58 09	112 53 58	73	53
448	27	10:06	35 58 06	112 53 58	73	54
449	27	10:08	35 58 04	112 53 59	86	67
450	27	10:11	35 58 01	112 53 59	86	67
451	27	10:13	35 57 59	112 53 59	86	68
452	27	10:20	35 58 13	112 53 58	57	40
453	27	10:24	35 58 15	112 53 58	72	56
454	27	10:29	35 58 18	112 53 58	72	56
455	27	10:32	35 58 20	112 53 58	72	57
456	27	10:34	35 58 23	112 53 58	86	71
457	27	14:00	35 59 34	112 53 10	57	77
458	27	14:05	35 59 34	112 53 10	72	92
459	27	14:18	35 59 34	112 53 00	43	66
460	27	14:20	35 59 34	112 53 00	29	52
461	27	14:24	35 59 34	112 52 05	57	81
463	27	14:44	35 59 47	112 52 05	43	70
464	27	10:24	35 59 44	112 53 10	86	70
465	27	14:50	35 59 42	112 53 10	79	107
466	27	14:54	35 59 39	112 53 10	43	72
467	27	14:58	35 59 37	112 53 10	57	87
468	27	15:03	35 59 32	112 53 10	57	88
469	27	15:07	35 59 29	112 53 10	43	74
470	27	15:10	35 59 27	112 53 10	43	75
471	27	15:12	35 59 24	112 53 10	57	89
472	27	15:15	35 59 21	112 53 10	98	130
473	27	15:20	35 59 34	112 53 11	42	75
474	27	15:24	35 59 35	112 53 14	28	62
475	27	15:27	35 59 35	112 53 18	28	62
476	27	15:34	35 59 35	112 53 23	28	64
477	27	15:37	35 59 37	112 53 26	28	64
478	27	15:40	35 59 37	112 53 29	14	51
479	27	16:04	35 59 49	112 53 26	56	97
480	27	16:08	35 59 46	112 53 26	56	97
481	27	16:11	35 59 44	112 53 26	42	84
482	27	16:13	35 59 42	112 53 26	42	84
483	27	16:15	35 59 39	112 53 26	28	70
484	27	16:21	35 59 34	112 53 26	49	92
485	27	16:25	35 59 32	112 53 26	42	86
466	27	16:27	35 59 30	112 53 26	42	86
487	27	16:31	35 59 27	112 53 26	28	73

Table 2.--continued

Sample Number	Day (Oct)	Time	Lat. ° ' ''	Long. ° ' ''	Uncorr. He(ppb)	Corr. He(ppb)
488	27	16:35	35 59 24	112 53 26	44	89
489	27	16:40	35 59 36	112 53 32	44	90
490	27	16:45	35 59 35	112 53 34	29	76
491	27	16:46	35 59 33	112 53 36	29	77
492	27	16:49	35 59 32	112 53 39	58	106
495	28	09:41	35 51 15	113 00 26	56	16
496	28	09:44	35 51 17	113 00 26	98	59
497	28	09:46	35 51 19	113 00 26	91	52
498	28	09:49	35 51 21	113 00 26	84	46
499	28	09:52	35 51 23	113 00 26	49	12
501	27	09:03	35 58 42	112 52 39	90	61
502	27	09:13	35 58 43	112 52 42	75	48
503	27	09:19	35 58 43	112 52 45	60	34
504	27	09:24	35 58 43	112 52 49	60	34
505	27	09:27	35 58 43	112 52 52	45	20
506	27	09:31	35 58 41	112 52 55	45	20
507	27	09:37	35 58 40	112 52 58	75	52
508	27	09:40	35 58 38	112 53 01	68	45
509	27	09:45	35 58 37	112 53 03	60	38
510	27	09:47	35 58 36	112 53 06	45	23
511	27	09:53	35 58 34	112 53 09	60	39
512	27	11:17	35 51 19	113 00 26	-75	-82
513	27	13:20	35 59 48	112 55 35	50	63
514	27	13:25	35 59 50	112 55 37	50	64
515	27	13:29	35 59 52	112 55 40	-75	-60
516	27	13:33	35 59 52	112 55 42	50	66
517	27	13:36	35 59 52	112 55 46	50	66
518	27	13:39	35 59 52	112 55 50	33	50
519	27	13:42	35 59 53	112 55 53	38	55
520	27	13:50	35 59 55	112 55 45	33	52
521	27	13:53	35 59 57	112 55 44	58	77
522	27	13:57	35 59 59	112 55 44	50	70
523	27	14:00	36 00 02	112 55 44	0	20
524	27	14:11	35 59 54	112 55 35	33	55
525	27	14:15	35 59 54	112 55 32	48	71
526	27	14:19	35 59 54	112 55 29	48	72
527	27	14:55	35 59 57	112 56 13	32	61
528	27	14:58	35 59 55	112 56 14	16	46
529	27	15:02	35 59 52	112 56 13	16	46
530	27	15:11	35 59 57	112 56 11	24	56
531	27	15:15	35 59 56	112 56 09	57	89
532	27	15:21	35 59 59	112 56 14	16	50
533	27	15:25	36 00 02	112 56 15	0	34
534	27	15:27	36 00 05	112 56 16	65	99
535	28	08:39	35 52 01	112 59 48	141	83
536	28	08:44	35 52 09	112 59 20	125	68
537	28	08:49	35 52 17	112 58 48	109	54
538	28	08:52	35 52 38	112 58 24	94	40
539	28	08:58	35 52 42	112 58 14	84	32
540	28	09:01	35 52 50	112 58 04	98	46
541	28	09:03	35 52 50	112 57 51	77	26
542	28	09:06	35 52 52	112 57 39	84	34
543	28	09:09	35 52 55	112 57 27	70	21
544	28	09:11	35 52 48	112 57 20	84	35
545	28	09:14	35 52 49	112 57 08	98	50
546	28	09:17	35 52 52	112 56 56	112	65
547	28	09:19	35 52 53	112 56 46	91	45
548	28	09:24	35 52 39	112 56 16	98	53
549	28	09:30	35 52 27	112 55 47	84	41
550	28	09:32	35 52 22	112 55 37	90	55
551	28	09:36	35 52 25	112 55 03	126	85
552	28	09:44	35 51 58	112 55 24	112	73
553	28	09:49	35 51 36	112 55 07	84	46
554	28	11:06	35 49 13	112 59 25	78	62
555	28	11:13	35 49 17	112 59 23	39	25
556	28	11:22	35 49 17	112 59 26	39	28
557	28	11:25	35 49 16	112 59 29	90	80
558	28	11:30	35 49 16	112 59 31	15	6
559	28	11:36	35 49 13	112 59 33	73	66
560	28	11:44	35 49 19	112 59 29	-87	-92
561	28	11:47	35 49 22	112 59 29	62	59
562	28	11:50	35 49 25	112 59 29	86	83
563	28	11:59	35 49 15	112 59 29	62	62
564	28	12:06	35 49 11	112 59 30	31	33
565	58	13:20	35 51 50	113 04 58	31	54
566	28	13:23	35 51 44	113 04 59	31	55
567	28	13:28	35 51 42	113 04 59	23	49
568	28	13:32	35 51 40	113 04 59	32	59
569	28	13:35	35 51 37	113 04 59	40	68
570	28	13:39	35 51 34	113 04 59	32	61
571	28	13:43	35 51 32	113 04 59	65	94
572	28	13:46	35 51 30	113 04 58	57	87
573	28	13:57	35 51 40	113 04 56	48	82
574	28	14:13	35 51 40	113 04 53	48	87
575	28	14:19	35 51 40	113 04 51	32	72
576	28	14:30	35 51 40	113 05 03	65	108
577	28	14:36	35 51 40	113 05 06	40	85
578	28	14:40	35 51 40	113 05 10	32	78
579	29	12:01	35 58 10	112 56 21	48	49
580	29	12:06	35 58 09	112 56 24	81	82
581	29	12:11	35 58 07	112 56 26	97	99
582	29	12:17	35 58 05	112 56 29	81	84
583	29	12:29	35 58 05	112 56 17	16	21
584	29	12:34	35 58 05	112 56 20	0	6
585	29	12:39	35 58 04	112 56 23	0	7
586	29	12:45	35 58 03	112 56 26	32	41
587	29	13:12	36 00 06	112 57 28	16	29
568	29	13:17	36 00 04	112 57 31	65	79
589	29	13:22	36 00 03	112 57 33	16	31
590	29	13:28	36 00 01	112 57 36	32	48
591	29	13:32	35 59 59	112 57 38	8	25
592	29	13:38	35 59 57	112 57 39	8	26
593	29	13:42	35 59 56	112 57 43	24	43
594	29	14:08	36 00 01	112 57 31	-16	7
595	29	14:12	35 59 59	112 57 28	5	29
596	29	14:17	35 55 57	112 57 26	0	25
597	29	14:23	35 59 55	112 57 23	0	26
598	29	14:35	36 00 04	112 57 34	-16	12
599	29	14:40	36 00 06	112 57 37	-16	13
600	28	10:43	35 51 13	113 00 28	67	45
601	28	10:56	35 51 11	113 00 30	94	76
602	28	11:00	35 51 09	113 00 32	101	84
603	28	11:04	35 51 06	113 00 33	94	78
604	28	11:11	35 51 03	113 00 33	54	40
605	28	11:14	35 51 02	113 00 34	54	41
606	28	11:17	35 51 00	113 00 28	94	82
607	28	11:20	35 50 58	113 00 27	67	56
608	28	10:50	35 51 11	113 00 25	94	74
609	28	11:28	35 51 01	113 00 34	74	65
610	28	11:30	35 51 00	113 00 37	81	72
611	28	11:33	35 51 03	113 00 26	81	73
612	28	11:37	35 51 04	113 00 23	67	61
615	29	10:43	35 40 12	113 09 11	59	45
616	29	09:50	35 40 12	113 09 16	50	26
617	29	10:35	35 40 12	113 09 19	67	51
618	29	10:41	35 40 12	113 09 14	50	36
619	29	11:15	35 37 59	113 10 23	67	59
620	29	11:24	35 37 57	113 10 25	67	60
621	29	11:29	35 37 55	113 10 26	33	28
622	29	11:34	35 37 54	113 10 28	50	45
623	29	11:41	35 37 55	113 10 30	67	63
624	29	11:44	35 37 58	113 10 33	50	47
625	29	12:02	35 37 52	113 10 30	50	50
626	29	12:07	35 37 00	113 10 32	67	68
627	29	12:15	35 39 58	113 08 41	24	27
628	29	12:20	35 39 57	113 08 41	40	44
629	29	12:25	35 39 58	113 08 45	16	21
630	29	12:30	35 40 00	113 08 41	40	46
631	29	12:35	35 40 02	113 08 41	16	23
634	30	11:41	35 58 39	112 52 55	42	40
635	30	11:46	35 58 37	112 52 55	42	41
636	30	11:52	35 58 34	112 52 55	28	27
637	30	11:59	35 58 32	112 52 55	28	28
638	30	12:15	35 58 39	112 52 52	22	23
639	30	12:19	35 58 37	112 52 52	28	30
640	30	12:24	35 58 34	112 52 52	28	30
641	30	12:30	35 58 32	112 52 52	28	31
642	30	13:14	35 58 39	112 52 49	10	17
643	30	13:19	35 58 37	112 52 49	21	28
644	30	13:23	35 58 34	112 52 49	42	49
645	30	13:59	35 58 39	112 52 46	29	40
646	30	13:06	35 58 37	112 52 46	15	20
647	30	13:09	35 58 34	112 52 46	22	28
648	30	13:14	35 58 32	112 52 46	15	21
649	30	14:40	35 58 39	112 52 58	44	58
650	30	14:44	35 58 37	112 52 58	73	87
651	30	14:46	35 58 34	112 52 58	29	44
652	30	14:49	35 58 32	112 52 58	37	51
653	30	15:00	35 58 39	112 53 01	15	30
654	30	15:05	35 58 37	112 53 01	51	67
655	30	15:10	35 58 34	112 53 01	58	75
656	30	15:15	35 58 32	112 53 01	58	75
700	29	14:43	36 00 08	112 57 39	16	46
701	29	14:47	36 00 10	112 58 42	16	47
702	29	15:13	36 00 39	112 58 09	8	43
703	29	15:20	36 00 39	112 58 13	81	117
704	29	15:23	36 00 38	112 58 16	65	102
705	29	15:25	36 00 38	112 58 19	32	70
706	29	15:29	36 00 37	112 58 22	40	78
707	29	15:35	36 00 36	112 58 14	40	80
708	29	15:39	36 00 33	112 58 13	16	56
709	29	15:42	36 00 31	112 58 10	32	73
710	30	09:47	35 58 42	112 52 36	42	30
711	30	10:25	35 58 42	112 52 39	21	13
712	30	10:35	35 58 42	112 52 43	42	35
713	30	10:40	35 58 42	112 52 46	49	42
714	30	10:46	35 58 42	112 52 49	84	78
715	30	10:49	35 58 42	112 52 52	49	43
716	30	10:51	35 58 42	112 52 55	56	50
717	30	10:55	35 58 42	112 52 58	42	36
718	30	11:02	35 58 42	112 53 01	56	51
719	30	11:04	35 58 42	112 53 04	56	51
720	30	11:10	35 58 42	112 53 07	42	38
721	30	11:13	35 58 42	112 53 10	84	80
722	30	11:42	35 58 44	112 52 55	57	55
723	30	11:44	35 58 46	112 52 55	57	55
724	30	11:49	35 58 49	112 52 55	71	70
725	30	11:54	35 58 51	112 52 55	57	56
726	30	12:15	35 58 44	112 52 52	57	58
727	30	12:19	35 58 46	112 52 52	42	44
728	30	12:24	35 58 49	112 52 52	7	9
729	30	12:38	35 58 51	112 52 52	42	45
730	30	13:10	35 58 44	112 52 49	56	62
731	30	13:17	35 58 46	112 52 49	56	63
732	30	13:22	35 58 49	112 52 49	42	49
733	30	13:27	35 58 51	112 52 49	28	36
734	30	13:46	35 58 44	112 52 46	72	81
735	30	13:53	35 58 46	112 52 46	58	68
736	30	13:57	35 58 49	112 52 46	14	24
737	30	14:40	35 58 44	112 52 58	29	43

Table 2.--continued

Sample Number	Day (Oct)	Time	Lat. ° ' "	Long. ° ' "	Uncorr. He(ppb)	Corr. He(ppb)
738	30	14:42	25 58 46	112 52 58	7	21
739	30	14:50	35 58 49	112 52 58	37	52
740	30	14:54	35 58 51	112 52 58	29	44
741	30	14:58	35 58 54	112 52 58	58	74
742	30	15:13	35 58 44	112 53 01	22	38
743	30	15:18	35 58 46	112 53 01	29	46
744	30	15:23	35 58 49	112 53 01	29	47

Table 3.--Surface radioactivity at soil-gas sample sites, Hualapai Indian Reservation

[Sample site numbers correspond to sample number of Tables 1 and 2 of Appendices]

Sample site no.	June Survey Day	June Survey Time	Radioactivity (cps)
101	4	10:15	110
102	4	10:30	120
104	4	10:54	100
105	4	11:00	80
106	4	11:07	80
107	4	11:13	95
108	4	11:22	100
109	4	11:31	70
110	4	11:50	105
111	4	11:56	90
113	4	12:13	115
114	4	12:21	80
116	4	12:43	110
117	4	12:51	115
118	4	13:01	100
119	4	13:05	105
120	4	13:15	105
124	4	14:03	105
127	4	14:22	95
128	4	14:29	100
130	4	14:42	105
136	4	15:13	95
139	4	15:27	100
143	4	15:46	90
147	5	8:33	60
148	5	8:40	65
150	5	8:56	95
151	5	9:04	95
152	5	9:15	55
153	5	9:25	100
154	5	9:32	55
155	5	9:38	60
156	5	9:46	55
157	5	9:58	55
158	5	10:01	85

Sample site no.	June Survey Day	June Survey Time	Radioactivity (cps)
159	5	10:07	90
160	5	10:13	100
161	5	10:21	85
162	5	10:37	80
163	5	10:43	110
164	5	10:51	75
165	5	10:58	80
166	5	11:04	85
167	5	11:11	60
168	5	11:25	60
169	5	11:30	100
170	5	11:42	60
171	5	13:35	90
172	5	13:45	80
173	5	13:52	70
174	5	13:59	70
175	5	14:05	70
176	5	14:11	60
177	5	14:17	80
178	5	14:23	100
179	5	14:30	70
180	5	14:37	80
181	5	14:44	100
182	5	14:51	100
183	5	14:58	75
184	5	15:03	80
185	5	15:10	85
186	5	15:15	80
187	5	15:22	80
188	5	15:28	70
189	5	15:36	60
190	5	15:42	80
191	5	15:47	60
192	5	15:53	70
193	5	16:02	60
194	5	16:08	60
195	5	16:13	70
196	6	9:00	110
197	6	9:04	120
198	6	9:11	100

Sample site no.	June Survey Day	June Survey Time	Radioactivity (cps)
199	6	9:28	400*
301	4	10:05	100
302	4	10:15	90
303	4	10:30	90
304	4	10:35	90
305	4	10:40	90
306	4	10:50	70
307	4	10:55	55
308	4	11:05	65
309	4	11:10	70
310	4	11:15	65
311	4	11:20	85
312	4	11:25	10
313	4	11:30	67
314	4	11:35	70
315	4	11:40	60
316	4	11:45	75
317	4	11:50	70
318	4	11:57	100
319	4	12:00	110
320	4	13:30	105
321	4	13:35	105
322	4	13:40	110
323	4	13:45	105
324	4	13:50	100
325	4	13:55	115
326	4	14:05	90
327	4	14:08	95
328	4	14:10	100
329	4	14:15	75
330	4	14:20	70
331	4	14:27	85
332	4	14:27	80
333	4	14:30	90
334	4	14:30	85
335	4	14:35	85
337	4	14:42	75
338	4	14:50	90
339	4	14:55	110
340	4	14:57	100

Sample site no.	June Survey Day	June Survey Time	Radioactivity (cps)
341	4	15:00	95
342	4	15:05	85
343	4	15:10	85
344	4	15:15	90
345	4	15:10	90
346	4	15:25	80
347	4	15:30	105
348	4	15:35	110
349	4	15:40	70
350	4	15:45	80
351	4	15:40	80
352	4	15:45	85
354	5	9:00	70
355	5	9:05	70
356	5	9:10	75
357	5	9:15	65
358	5	9:20	80
359	5	9:25	65
360	5	9:30	75
361	5	9:35	80
362	5	9:45	65
363	5	9:50	60
364	5	9:55	80
365	5	10:00	80
366	5	10:07	90
367	5	10:15	85
368	5	10:17	75
369	5	10:22	70
370	5	10:30	90
371	5	10:35	65
373	5	10:50	60
374	5	10:55	60
375	5	11:00	60
376	5	11:05	60
377	5	11:10	65
378	5	11:20	80
379	5	11:25	60
380	5	11:30	75
381	5	11:35	55
382	5	11:40	60

* maximum radioactivity at prospect

Table 3.--continued

Sample site no.	June Survey Day	Time	Radioactivity (cps)
383	5	11:45	70
384	5	11:50	60
385	5	11:55	70
386	5	12:00	55
387	5	12:10	55
388	5	12:40	55
389	5	12:40	70
390	5	13:05	45
391	5	13:15	55
392	5	13:20	65
393	5	13:25	75
394	5	13:30	70
395	5	13:37	80
396	5	13:45	75
397	5	13:50	55
399	5	14:00	65
501	5	14:05	60
502	5	14:25	120
503	5	14:45	55
504	5	14:47	55
506	5	15:00	60
507	5	15:00	60
508	5	15:05	65
509	5	15:10	70
510	5	15:15	60
513	5	16:35	95
514	6	9:00	120
515	6	9:05	80
516	6	9:10	85
517	6	9:15	65
518	6	9:15	75
519	6	9:23	70
520	6	9:27	65
521	6	9:30	75
522	6	9:35	75
523	6	9:40	55
524	6	9:45	90
525	6	9:50	50
526	6	9:55	90
527	6	10:00	50

Sample site no.	June Survey Day	Time	Radioactivity (cps)
528	6	10:05	80
529	6	10:10	55
530	6	10:15	70
533	6	10:35	85
534	6	10:37	60
535	6	10:45	80
536	6	10:50	70
537	6	10:55	70
538	6	11:00	70
539	6	11:05	65
540	6	11:10	80
541	6	11:15	70
542	6	11:20	60
544	6	11:32	60
545	6	11:40	80
546	6	11:45	60
547	6	11:50	70
548	6	11:55	85
549	6	12:00	70
550	6	12:05	80
551	6	12:10	70
552	6	12:15	60
553	6	12:20	55
554	6	12:25	60
555	6	12:30	65
556	6	15:30	65
557	6	15:40	65
558	6	15:45	70
559	6	15:47	80
561	6	16:00	60
562	6	16:10	65
563	6	16:15	65
565	6	16:40	75
566	6	16:45	110
567	6	16:55	65
568	6	17:10	90
570	6	17:30	95
571	6	17:35	65
572	6	17:35	65
573	6	17:45	60

Sample site no.	June Survey Day	Time	Radioactivity (cps)
574	6	17:50	40
575	6	18:15	110
576	7	9:00	110
577	7	9:05	115
578	7	9:10	130
579	7	9:17	125
580	7	9:22	120
581	7	9:26	130
582	7	9:30	125
583	7	9:35	115
584	7	9:40	95
585	7	9:45	90
586	7	9:50	90
587	7	9:55	90
588	7	10:00	70
589	7	10:05	80
590	7	10:10	110
591	7	10:15	115
592	7	10:20	120
593	7	10:25	130
594	7	10:30	115
595	7	10:35	105
596	7	10:40	90
597	7	10:45	100
598	7	10:55	80
599	7	11:00	80
701	6	9:34	100
702	6	9:44	110
703	6	9:55	100
704	6	10:02	100
705	6	10:07	90
706	6	10:13	80
707	6	10:21	90
708	6	10:25	80
709	6	10:37	80
710	6	10:45	80
711	6	10:49	80
712	6	11:04	100
713	6	11:09	80
714	6	11:18	80

Sample site no.	June Survey Day	Time	Radioactivity (cps)
715	6	11:22	80
716	6	11:25	80
720	6	11:35	80
721	6	11:40	80
722	6	11:46	90
723	6	11:52	80
724	6	11:56	60
725	6	12:40	70
726	6	12:42	60
727	6	12:52	80
728	6	12:56	80
729	6	13:02	100
730	6	13:15	250*
731	6	13:25	100
732	6	13:30	100
733	6	13:33	110
734	6	13:40	80
735	6	16:18	120
736	6	16:23	80
737	6	16:28	60
738	6	16:33	80
740	6	16:45	110
741	6	16:50	80
742	6	16:55	80
743	6	16:58	80
744	7	9:21	70
745	7	9:27	80
746	7	9:40	80
747	7	9:40	90
748	7	9:46	80
749	7	9:52	90
750	7	9:58	80
751	7	10:13	80
752	7	10:30	80
753	7	10:43	80
754	7	10:48	80
755	7	10:51	80
756	7	10:59	80
757	7	11:02	80
758	7	11:12	80

* maximum radioactivity at locality

Table 3.--continued

Sample site no.	June Survey Day	Time	Radioactivity (cps)
759	7	11:21	90
760	7	11:32	100
761	7	11:47	100
762	7	11:56	80
763	7	12:00	80
764	7	12:48	80
765	7	12:52	80
766	7	12:55	80
767	7	13:04	100
768	7	13:01	90
769	7	13:14	80
770	7	13:20	60
771	7	13:26	80
772	7	13:32	100
773	7	13:37	100
774	7	13:43	90
775	7	13:47	90
776	7	13:52	80
777	7	13:56	80
778	7	14:16	90
779	7	14:28	90
780	7	14:34	75
781	7	14:41	80
782	7	14:52	80
783	7	14:59	100
784	7	15:03	110
785	7	15:07	100
786	7	15:12	90
787	7	15:19	70
788	7	15:25	70
789	7	15:35	110
790	7	15:39	100
791	8	9:36	80
792	8	9:43	100
793	8	9:45	120
794	8	9:47	120
795	8	9:50	110
796	8	9:53	120
797	8	9:55	100
798	8	9:59	110

Sample site no.	June Survey Day	Time	Radioactivity (cps)
799	8	10:02	110
801	7	11:05	80
802	7	11:10	80
803	7	11:20	110
804	7	11:25	90
805	7	11:30	110
806	7	11:35	65
807	7	11:40	65
808	7	11:45	95
809	7	11:50	90
810	7	12:00	100
811	7	12:35	80
812	7	12:41	105
813	7	12:45	100
814	7	12:49	70
815	7	12:53	60
816	7	12:58	80
817	7	13:10	80
818	7	13:15	80
819	7	13:20	65
820	7	13:30	60
821	7	13:35	65
822	7	14:00	90
823	7	14:05	80
824	7	14:10	70
825	7	14:15	105
826	7	14:20	105
827	7	14:25	110
828	7	14:27	100
829	7	14:30	110
830	7	14:35	110
831	7	14:40	110
832	7	14:43	90
833	7	14:47	85
834	7	14:55	95
835	7	15:00	110
836	7	15:02	105
837	7	15:05	110
838	7	15:08	120
839	7	15:15	90

Sample site no.	June Survey Day	Time	Radioactivity (cps)
840	7	15:20	105
841	7	15:25	95
842	7	15:30	65
843	7	15:32	90
844	7	15:37	95
845	7	15:45	105
846	8	9:10	130
848	8	9:20	115
849	8	9:25	110
850	8	9:30	120
851	8	9:32	125
852	8	9:34	125
853	8	9:37	125
854	8	9:42	100
855	8	9:45	105
856	8	9:50	100
857	8	9:53	95
858	8	9:38	110
861	8	10:20	120
862	8	10:25	110
863	8	10:35	100
864	8	10:42	90
865	8	10:46	100
866	8	10:50	100
867	8	10:57	110
868	8	11:00	110
869	8	11:07	110
870	8	11:12	80
872	8	11:20	110
873	8	11:25	95
874	8	11:28	95
875	8	11:33	110
876	8	11:37	110
877	8	11:42	105
878	8	11:45	115
879	8	11:49	115
880	8	11:53	110
881	8	11:57	110
882	8	12:08	90
883	8	12:06	105

Sample site no.	June Survey Day	Time	Radioactivity (cps)
884	8	12:10	95
885	8	12:14	105
886	8	12:30	115
887	8	12:34	105
888	8	12:37	110
889	8	12:44	105
890	8	12:47	100
891	8	12:52	85
892	8	12:55	115
893	8	13:02	85
895	8	13:20	125
896	8	13:27	115
898	8	13:35	90
899	8	13:40	80
901	8	10:06	110
902	8	10:11	90
903	8	10:13	110
904	8	10:16	110
905	8	10:20	90
906	8	10:24	90
907	8	10:29	100
908	8	10:34	100
909	8	10:43	100
910	8	10:49	100
911	8	10:54	70
912	8	10:59	80
913	8	11:05	100
914	8	11:08	100
915	8	11:14	60
916	8	11:20	60
917	8	11:25	80
918	8	11:31	80
919	8	12:20	110
920	8	12:26	100
921	8	12:30	70
922	8	12:34	90
923	8	12:37	90
924	8	12:41	80
925	8	12:45	80
926	8	12:47	80

Table 3.--continued

Sample site no.	June Survey Day	June Survey Time	Radioactivity (cps)
927	8	12:50	60
928	8	12:54	80
929	8	12:57	90
930	8	13:03	80
931	8	13:05	100
932	8	13:10	90
933	8	13:12	100
934	8	13:16	80
935	8	13:19	100
936	8	13:23	90
937	8	13:27	90
939	9	12:04	80
940	9	12:12	60
941	9	12:18	70
942	9	12:24	80
943	9	12:30	80
944	9	12:35	100
945	9	12:39	70
946	9	12:45	80
947	9	12:49	80
948	9	12:54	90
949	9	12:59	90
950	9	13:05	80
951	9	13:10	80
952	9	13:15	90
953	9	13:50	60
954	9	13:55	60
955	9	13:59	90
956	9	14:20	70
957	9	14:20	80
958	9	14:43	80
959	9	14:47	80
960	9	14:51	70
961	9	14:55	80
962	9	15:01	80
963	9	15:45	95
964	9	15:52	90
965	9	15:20	95
966	9	15:25	100
967	9	15:32	120

Sample site no.	June Survey Day	June Survey Time	Radioactivity (cps)
968	9	15:36	110
971	10	8:55	135
972	10	9:00	120
973	10	9:05	120
974	10	9:10	120
975	10	9:15	118
976	10	9:19	122
977	10	9:23	120
978	10	9:29	122
979	10	9:23	118
980	10	9:39	100
981	10	9:45	98
982	10	10:04	100
983	10	10:30	120
984	10	10:45	120
985	10	10:54	120
986	10	11:15	110
987	10	11:20	120
988	10	11:25	110
989	10	11:28	80
990	10	11:35	96
991	10	11:37	90
992	10	11:45	80
993	10	11:50	75
994	10	12:01	100
995	10	12:18	100
996	10	12:23	95
997	10	13:23	140
998	10	13:42	100
999	10	13:46	90
1001	8	13:45	80
1002	8	13:45	100
1003	8	13:57	80
1004	8	14:08	90
1005	8	14:11	95
1006	8	14:19	95
1007	8	14:22	95
1008	8	14:26	90
1009	8	14:30	105
1010	8	14:34	90

Sample site no.	June Survey Day	June Survey Time	Radioactivity (cps)
1011	8	14:42	90
1012	8	14:47	80
1013	8	14:51	70
1014	8	15:10	110
1015	8	15:15	100
1016	8	15:20	100
1017	8	15:30	110
1018	8	15:33	105
1019	8	15:36	110
1020	8	15:40	115
1056	11	9:13	85
1057	11	9:17	85
1058	11	9:22	65
1059	11	9:25	65
1060	11	9:30	65
1061	11	9:36	60
1062	11	9:40	55
1063	11	9:44	65
1064	11	9:50	80
1065	11	9:54	90
1067	11	10:01	80
1068	11	10:06	80
1069	11	10:10	85
1070	11	10:13	65
1071	11	10:16	75
1072	11	10:22	70
1073	11	10:26	95
1074	11	10:32	70
1075	11	10:36	80
1076	11	10:41	75
1077	11	10:46	80
1079	11	10:58	65
1080	11	11:05	80
1081	11	11:10	90
1082	11	11:14	60
1083	11	11:18	65
1084	11	11:20	70
1085	11	11:28	80
1086	11	13:33	70
1088	11	13:43	80

Sample site no.	June Survey Day	June Survey Time	Radioactivity (cps)
1089	11	13:50	80
1090	11	13:53	80
1091	11	13:57	85
1092	11	14:00	90
1093	11	14:05	95
1094	11	14:10	90
1095	11	14:20	60
1096	11	14:25	85
1097	11	14:30	75
1099	11	14:40	90
1200	10	13:51	100
1201	10	14:01	100
1202	10	14:17	140
1203	10	14:25	120
1204	10	14:31	130
1205	10	14:38	140
1206	10	15:04	130
1207	10	15:10	140
1208	10	15:14	140
1209	10	15:17	140
1210	10	15:28	140
1211	10	15:32	120
1212	10	15:38	100
1213	10	15:44	120
1215	11	9:41	100
1216	11	10:08	100
1217	11	10:20	100
1218	11	10:24	100
1219	11	10:28	95
1220	11	10:30	100
1221	11	10:33	100
1222	11	10:35	100
1223	11	10:40	80
1224	11	10:48	90
1225	11	10:47	90
1226	11	10:52	90
1227	11	11:01	80
1228	11	11:04	90
1229	11	11:05	90
1230	11	11:06	90

Table 3.--continued

Sample site no.	June Survey Day	Time	Radioactivity (cps)
1231	11	11:08	80
1232	11	11:10	90
1233	11	11:12	80
1234	11	11:15	80
1235	11	11:17	90
1236	11	13:00	80
1237	11	13:04	70
1238	11	13:08	60
1239	11	13:11	80
1240	11	13:13	80
1241	11	13:17	80
1242	11	13:18	70
1243	11	13:20	80
1244	11	13:24	80
1245	11	13:27	90
1246	11	13:32	80
1247	11	13:34	80
1248	11	13:37	80
1249	11	13:40	70
1250	11	13:43	80
1251	11	13:46	90
1252	11	13:49	70
1253	11	13:52	90
1254	11	13:56	80
1255	11	14:00	80
1256	11	14:03	80
1257	11	14:06	100
1258	11	14:08	100
1259	11	14:12	100
1260	11	14:15	120
1261	11	14:18	105
1262	12	9:17	80
1263	12	9:20	70
1264	12	9:24	75
1265	12	9:27	60
1266	12	9:30	75
1267	12	9:32	80
1268	12	9:35	75
1269	12	9:32	80
1270	12	9:40	75

Sample site no.	June Survey Day	Time	Radioactivity (cps)
1271	12	9:44	100
1272	12	9:46	90
1273	12	9:52	110
1275	12	9:58	90
1276	12	10:02	85
1277	12	10:05	110
1278	12	10:07	80
1279	12	10:10	80
1280	12	10:12	70
1281	12	10:14	110
1282	12	10:17	100
1283	12	10:20	100
1284	12	10:25	100
1285	12	10:28	100
1286	12	10:33	75
1287	12	10:37	80
1288	12	10:40	100
1289	12	10:44	110
1290	12	10:47	115
1291	12	10:50	90
1292	12	10:52	110
1293	12	10:56	105
1501	11	14:43	85
1502	11	14:47	80
1503	11	14:50	95
1505	11	15:15	65
1506	11	15:20	75
1507	11	15:23	65
1508	11	15:29	65
1509	11	15:33	60
1510	11	15:40	65
1511	11	15:45	65
1512	11	15:48	75
1513	11	15:54	55
1514	11	15:58	50
1515	11	16:01	50
1516	11	16:05	65
1517	11	16:10	55
1518	11	16:15	65
1519	11	16:55	120

Sample site no.	June Survey Day	Time	Radioactivity (cps)
1520	11	17:03	100
1521	11	17:07	100
1522	11	17:12	80
1523	11	17:20	75