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ABUNDANCES OF URANIUM, THORIUM, AND POTASSIUM FOR SOME AUSTRALIAN CRYSTALLINE ROCKS

OPEN-FILE REPORT 75-393

Menlo Park, California

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United States Department of the Interior

U.S. Geological Survey

ABUNDANCES OF URANIUM, THORIUM, AND POTASSIUM FOR SOME AUSTRALIAN CRYSTALLINE ROCKS

by

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This report is preliminary and has not been edited
or reviewed for conformity with Geological Survey standards.

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1. INTRODUCTION

This report contains a tabulation of the basic radioelement and radiogenic heat data obtained during an Australian National University (ANU) - United States Geological Survey (USGS) heat-flow project, directed jointly by J. C. Jaeger (ANU) and J. H. Sass (USGS). Most samples were collected during the periods June through September, 1971 and 1972. The measurements were made subsequently by two of us (C. M. Bunker and C. A. Bush) using the gamma-ray spectrometric techniques described by Bunker and Bush (1966, 1967). Interpreting the spectra for quantitative analyses of the radioelements was accomplished with an iterative least-squares computer program modified from one by Schonfeld (1966). Uranium content determined by gamma-ray spectrometry is based on a measurement of the daughter products of ^{226}Ra. Equilibrium in the uranium-decay series was assumed for these analyses. Throughout the report, when U content is stated, radium-equivalent uranium is implied. The coefficient of variation for the accuracy of the radioelement data, when compared to analyses by isotope dilution and flame photometry is about 3 percent for radium-equivalent uranium and thorium and about 1 percent for potassium. These percentages are in addition to minimum standard deviations of about 0.05 ppm for U and Th, and about 0.03 percent for K.

Wherever possible, crystalline basement rocks were sampled from the same hole and/or the nearest basement outcrops to the heat-flow determination. In some regions (e.g., Western Australia, The Eyre Peninsula

of South Australia, the Bathurst Batholith of New South Wales) samples collected by others for isotopic age dating were used to extend the areal coverage.

In this report, we give the sample locations to the nearest minute, depth below surface (where appropriate) and the abundances of U(ppm), Th(ppm) and K %. From these, we derive the heat production (H) in μcal/g-yr from the expression

$$H = 0.73\ U(ppm) + 0.20\ Th(ppm) + 0.27\ K\ (\%) \qquad (1)$$

(See Table 23-7, of Wetherill, 1966.) This quantity is independent of density, but can be converted to the more frequently used volumetric heat-generation units (1 HGU = 10^{-13} cal/cm^3 sec = 0.418μw/m^3) by multiplying the value of H obtained from equation 1 by (density/3.156). In the accompanying volume (Munroe and others, 1975) heat productions associated with individual heat-flow determinations are given in HGU.

The format of the following sections follows closely that of the companion volume (Munroe and others, 1975). One section is devoted to each state and individual sites or physiographic regions are listed alphabetically.

Acknowledgments. We thank Raymond Crawford, Brendan Thomson, Virginia Oversby, Tom Vallance, Hans Tammemagi, David Simpson, John Richards, and John Cooper for their help in obtaining the samples.

2. RADIOELEMENT CONTENTS IN ROCKS

Table 2-1 gives the radioelement contents of three composite samples from a heat-flow site at Apsley on the southern margin of the Bathurst Batholith. Table 2-2 presents data from miscellaneous granitoid rocks within the Bathurst Batholith. These samples were obtained through the kindness of Dr. T. Vallance, University of Sydney. Table 2-3 gives radioelement and heat-production data from a hole drilled especially for heat flow in the Moruya granodiorite (Munroe and others, 1975; Sass and others 1975). Finally, Tables 2-4 through 2-9 list the data from tunnels within the Snowy Mountains Hydroelectric Scheme. Heat flow from this area was published by Sass and others (1967) and the large number of radioelement measurements was made to see if differences in heat flow among the various tunnels could be explained by variations in radioelement contents. The mean abundances of the radioelements in all tunnels is, however, fairly uniform (see Sass and others, 1975) so that another explanation must be sought.

The approximate locations of the samples in Tables 2-4 through 2-9 can be estimated with respect to Figure 2-1 and the station numbers shown in the tables. Station numbers indicate the distance, in hundreds of feet from the tunnel portal shown as the "0" end on Figure 2-1. Thus, for example, in Table 2-4, station 17+41 is 1741 feet from the NE portal of the tunnel.

Table 2-1

Apsley, New South Wales, DH6A (Quartz Sericite Schist)
S.Lat. 33° 34', E.Long. 149° 34'

Depth (ft)	U	Th	K	H
201.5	3.52	13.02	6.02	6.80
302	3.92	14.25	6.74	7.53
400	3.46	13.48	6.40	6.95

Table 2-2

Bathurst Batholith, New South Wales (From University of Sydney Collection)

Locality	S. Lat.	E. Long.	U	Th	K	H	Rock
Evans Crown	33° 31'	149° 55'	4.22	27.90	3.77	9.68	Granite
Hartley	33° 32'	150° 10'	5.51	20.68	3.17	9.02	Granite
Tarana (1)	33° 31'	149° 55'	5.84	31.15	4.11	11.60	Granite
Tarana (2)	33° 31'	149° 55'	2.12	13.24	4.14	5.31	Granite
Yetholme	33° 27'	149° 50'	3.63	17.26	3.20	6.97	Granite
Rock Forest	33° 21'	149° 23'	4.32	16.26	2.82	7.24	Granite
Sodwall's Granite	33° 31'	149° 59'	4.08	14.12	3.01	6.62	Granite
Dunkeld	33° 25'	149° 29'	7.83	19.03	2.98	10.33	Hornblende granodiorite
Orange Road	33° 17'	149° 06'	7.97	19.29	3.00	10.49	Porphyritic granite

Table 2-3

Moruya, New South Wales

Depth (ft)	S. Lat.	E. Long.	U	Th	K	H	Rock
100	35° 54'	150° 07'	2.54	5.88	1.78	3.52	Granodiorite
200	35° 54'	150° 07'	2.30	5.35	1.76	3.22	Granodiorite
211.5	35° 54'	150° 07'	2.73	17.21	1.71	5.90	Granodiorite
300	35° 54'	150° 07'	2.41	9.60	1.80	4.16	Granodiorite
332.5	35° 54'	150° 07'	2.25	5.65	1.66	3.22	Granodiorite
400	35° 54'	150° 07'	2.38	7.43	1.79	3.71	Granodiorite
466.5	35° 54'	150° 07'	2.70	8.53	1.78	4.16	Granodiorite
492.5	35° 54'	150° 07'	2.23	7.92	1.79	3.70	Granodiorite
500	35° 54'	150° 07'	3.44	13.18	1.86	5.65	Granodiorite
506.5	35° 54'	150° 07'	2.18	8.02	1.81	3.68	Granodiorite
529	35° 54'	150° 07'	2.82	6.14	1.69	3.74	Granodiorite
541	35° 54'	150° 07'	3.01	7.02	1.82	4.09	Granodiorite

Figure 2-1. Location of Snowy Mountains Tunnels. Pattern shows granitic outcrops; O, portal end of tunnel.

Abbreviations are as follows:

E.S. Eucumbene - Snowy Tunnel, Table 2-4

M.P. Murray 1 Pressure Tunnel, Table 2-5

T.T. Tooma Tumut Tunnel, Table 2-6

E.T. Eucumbene - Tumut Tunnel, Table 2-7

I.B. Island Bend Tunnel, Table 2-8

S.G. Snowy - Geehi Tunnel, Table 2-9

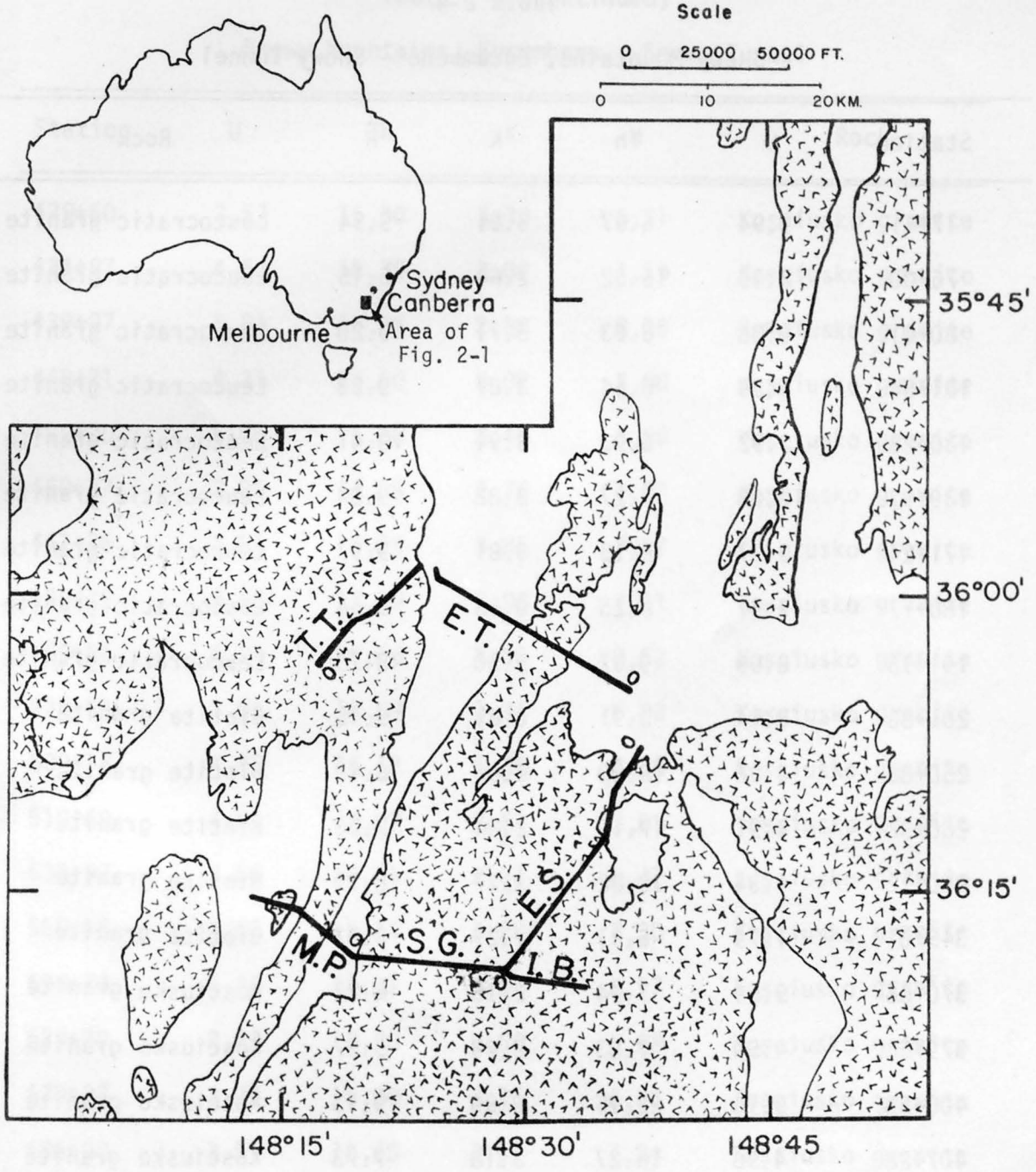
Scale
0 25000 50000 FT.
0 10 20KM.
Sydney
Canberra
Melbourne
Area of
Fig. 2-1
35°45'
36°00'
36°15'
T.T.
E.T.
E.S.
M.P.
S.G.
I.B.
148°15'
148°30'
148°45

Table 2-4

Snowy Mountains, Eucumbene - Snowy Tunnel

Station	U	Th	K	H	Rock
17+41	9.94	6.57	3.61	9.54	Leucocratic granite
76+00	3.19	15.52	2.64	6.15	Leucocratic granite
80+01	9.36	6.83	3.71	9.20	Leucocratic granite
101+54	9.39	6.64	3.87	9.23	Leucocratic granite
130+28	10.92	6.93	3.91	10.41	Leucocratic granite
139+97	10.08	7.27	3.82	9.84	Leucocratic granite
171+24	10.57	6.13	3.81	9.97	Leucocratic granite
180+17	7.17	6.25	0.58	6.64	Leucocratic granite
191+16	8.09	9.67	3.30	8.73	Leucocratic granite
201+30	5.14	5.91	0.81	5.15	Biotite granite
250+80	4.22	12.50	3.05	6.40	Biotite granite
260+32	3.91	17.15	2.84	7.05	Biotite granite
280+12	4.34	10.02	3.77	6.19	Biotite granite
345+01	1.79	6.91	1.27	3.03	Biotite granite
370+06	5.59	7.74	2.18	6.22	Kosciusko granite
379+50	4.59	7.83	2.43	5.57	Kosciusko granite
400+38	6.10	22.15	0.90	9.13	Kosciusko granite
407+28	4.96	16.27	3.18	7.73	Kosciusko granite
418+20	6.22	16.02	1.56	8.17	Kosciusko granite
428+70	3.86	16.78	0.47	6.30	Kosciusko granite
428+78	4.34	16.07	2.84	7.15	Kosciusko granite

Table 2-4 (continued)

Snowy Mountains, Eucumbene - Snowy Tunnel

Station	U	Th	K	H	Rock
429+50	3.57	16.30	3.13	6.71	Kosciusko granite
434+97	4.53	15.35	3.02	7.19	Kosciusko granite
439+97	5.81	15.16	2.88	8.05	Kosciusko granite
448+21	4.31	15.60	3.02	7.08	Kosciusko granite
450+20	5.06	11.26	3.45	6.88	Kosciusko granite
460+27	3.85	17.55	2.76	7.07	Kosciusko granite
467+86	3.81	18.05	3.25	7.27	Kosciusko granite
469+79	3.96	17.59	2.96	7.21	Kosciusko granite
469+86	6.74	16.56	1.05	8.52	Kosciusko granite
478+53	3.05	13.69	3.91	6.02	Kosciusko granite
509+18	4.90	16.12	3.30	7.69	Kosciusko granite
519+69	4.01	16.07	3.51	7.09	Kosciusko granite
538+97	3.66	16.01	2.21	6.47	Kosciusko granite
559+46	4.63	15.26	3.20	7.30	Kosciusko granite
609+73	5.78	16.81	3.68	8.57	Kosciusko granite
629+29	2.93	18.90	0.60	6.08	Kosciusko granite
670+33	3.77	16.80	3.15	6.96	Kosciusko granite
686+00	3.51	18.65	3.51	7.24	Kosciusko granite
690+62	4.38	16.99	3.20	7.46	Kosciusko granite
710+60	3.99	18.64	2.77	7.39	Kosciusko granite
730+06	6.08	9.37	2.36	6.95	Island Bend granite

Table 2-4 (continued)

Snowy Mountains, Eucumbene - Snowy Tunnel

Station	U	Th	K	H	Rock
760+41	5.70	10.09	2.27	6.79	Island Bend granite
770+83	4.29	8.25	2.67	5.50	Island Bend granite

Table 2-5

Snowy Mountains, Murray 1 Pressure Tunnel

Station	U	Th	K	H	Rock
15+72	2.68	7.63	1.77	3.96	Twin Creeks gneiss
22+75	4.67	12.93	3.10	6.83	Twin Creeks gneiss
29+79	2.99	9.98	3.06	5.00	Geehi metamorphic rock
88+42	5.05	14.04	2.01	7.04	Geehi metamorphic rock
111+00	4.36	7.22	2.55	5.32	Grey Mare granite
139+23	4.17	15.27	2.49	6.77	Grey Mare granite
150+43	5.50	50.49	2.48	14.78	Grey Mare granite
159+21	4.12	14.16	1.66	6.29	Grey Mare granite
169+58	2.04	18.31	1.25	5.49	Grey Mare granite
175+00	2.26	13.16	2.18	4.87	Grey Mare granite
193+	2.89	15.77	1.83	5.76	Grey Mare granite
245+15	6.82	18.52	3.57	9.65	Scammels granite
250+00	5.32	18.01	3.52	8.44	Scammels granite
260+00	7.86	18.03	3.75	10.36	Scammels granite
270+00	4.99	19.93	3.74	8.64	Scammels granite
279+90	5.24	15.16	3.19	7.72	Scammels granite
289+90	7.39	16.83	3.84	9.80	Scammels granite
300+00	7.51	17.07	3.62	9.87	Scammels granite

Table 2-6

Snowy Mountains, Tooma Tumut Tunnel

Station	U	Th	K	H	Rock
56+75	3.44	17.27	1.26	6.31	Biotite granite
80+00	3.94	17.96	2.16	7.05	Biotite granite
99+92	3.90	18.63	1.64	7.02	Biotite granite
109+97	3.66	17.27	2.66	6.84	Biotite granite
139+15	3.82	17.22	2.24	6.84	Biotite granite
147+95	2.42	17.47	2.96	6.06	Biotite granite
154+50	4.11	16.88	2.20	6.97	Biotite granite
176+35	4.64	16.66	2.88	7.50	Biotite granite
182+50	4.10	16.52	2.94	7.09	Biotite granite
190+50	3.08	14.21	2.62	5.80	Biotite granite
192+50	5.39	16.33	2.16	7.78	Biotite granite
204+60	3.15	15.89	3.07	6.31	Biotite granite
206+50	3.96	15.99	2.83	6.85	Biotite granite
210+50	4.69	12.81	3.14	6.83	Biotite granite
212+35	3.08	16.39	2.66	6.24	Biotite granite
216+70	4.15	12.83	3.00	6.41	Biotite granite
218+50	4.02	16.35	2.67	6.93	Biotite granite
220+33	4.85	16.30	2.57	7.49	Biotite granite
222+57	3.74	16.09	2.82	6.71	Biotite granite
226+40	5.85	12.79	3.55	7.79	Mica-poor granite
230+50	4.34	12.14	3.39	6.51	Mica-poor granite

Table 2-6 (continued)

Snowy Mountains, Tooma Tumut Tunnel

Station	U	Th	K	H	Rock
234+50	5.69	11.86	3.69	7.52	Mica-poor granite
236+35	3.05	12.02	1.08	4.92	Mica-poor granite
238+60	4.82	11.47	3.74	6.82	Mica-poor granite
240+51	4.83	14.48	3.05	7.25	Mica-poor granite
244+33	7.18	9.71	0.23	7.25	Mica-poor granite
246+48	4.93	10.39	3.83	6.71	Mica-poor granite
248+71	6.67	8.87	3.46	7.58	Mica-poor granite
250+42	7.57	8.58	3.79	8.27	Mica-poor granite
252+50	4.82	8.68	3.89	6.30	Mica-poor granite
254+50	8.54	6.90	3.69	8.61	Mica-poor granite
256+50	7.03	7.25	3.36	7.49	Mica-poor granite
258+50	9.88	6.89	3.09	9.42	Mica-poor granite
260+47	9.22	6.96	3.80	9.15	Mica-poor granite
264+43	8.39	7.64	3.73	8.66	Mica-poor granite
272+75	10.11	7.32	3.54	9.80	Mica-poor granite
274+65	6.26	5.29	3.16	6.48	Mica-poor granite
278+75	9.16	7.39	3.46	9.10	Mica-poor granite
280+80	2.61	7.21	0.15	3.39	Mica-poor granite
282+40	6.30	4.61	0.31	5.60	Mica-poor granite
288+50	12.37	6.31	3.85	11.30	Mica-poor granite
290+08	10.53	5.91	3.10	9.71	Mica-poor granite

Table 2-6 (continued)

Snowy Mountains, Tooma Tumut Tunnel

Station	U	Th	K	H	Rock
292+24	9.26	7.39	3.64	9.22	Mica-poor granite
298+40	4.63	9.25	0.59	5.39	Mica-poor granite
300+00	4.32	8.88	0.45	5.05	Mica-poor granite
300+75	7.01	9.59	3.92	8.09	Mica-poor granite
314+61	3.94	13.63	0.93	5.85	Biotite granite
342+50	5.03	13.66	2.62	7.11	Biotite granite
345+65	3.28	16.23	2.68	6.36	Biotite granite
349+00	4.64	16.12	2.73	7.35	Biotite granite
356+01	4.00	17.13	2.72	7.08	Biotite granite
380+38	4.35	22.21	2.15	8.20	Quartzitic hornfels
400+55	3.21	9.52	1.66	4.70	Granitic gneiss
402+28	4.95	13.56	1.13	6.63	Granitic gneiss
404+52	3.06	31.05	3.65	9.43	Granitic gneiss
406+56	4.67	25.70	3.36	9.46	Granitic gneiss
408+41	4.39	24.86	5.07	9.55	Granitic gneiss
410+45	3.30	35.35	2.65	10.19	Granitic gneiss
412+56	2.35	8.15	1.87	3.85	Granitic gneiss
414+37	4.56	19.57	2.29	7.86	Granitic gneiss
416+44	7.90	11.82	4.03	9.22	Granitic gneiss
418+50	4.72	20.70	2.74	8.33	Granitic gneiss
420+41	4.46	19.74	3.40	8.12	Granitic gneiss

Table 2-6 (continued)

Snowy Mountains, Tooma Tumut Tunnel

Station	U	Th	K	H	Rock
422+50	4.96	21.86	3.11	8.83	Granitic gneiss
424+50	4.70	17.83	3.25	7.87	Granitic gneiss
426+	4.37	21.10	2.58	8.11	Granitic gneiss
428+86	5.24	19.22	3.45	8.60	Granitic gneiss
432+50	4.70	16.80	2.83	7.56	Granitic gneiss
434+50	4.65	16.02	3.04	7.42	Granitic gneiss
450+50	5.01	20.64	3.07	8.61	Granitic gneiss
458+33	2.35	16.72	1.92	5.58	Granitic gneiss
459+94	4.17	24.57	3.42	8.88	Granitic gneiss
462+50	3.02	1.87	3.27	3.46	Granitic gneiss

Table 2-7

Snowy Mountains, Eucumbene - Tumut Tunnel

Station	U	Th	K	H	Rock
60+30	4.25	20.99	3.10	8.14	Granite
239+41	3.74	16.84	0.88	6.34	Granite
250+10	4.36	15.86	2.47	7.02	Granite
339+56	4.27	12.92	2.93	6.49	Granite
350+08	5.00	16.06	3.45	7.79	Granite
359+11	4.17	14.63	3.02	6.79	Granite
369+47	6.85	12.15	2.75	8.17	Granite
378+50	12.34	16.66	3.61	13.31	Granite
487+94	12.82	6.04	3.20	11.43	Granite
689+48	3.38	20.07	2.70	7.21	Gneissic granite
691+39	6.08	5.66	5.57	7.07	Gneissic granite

Table 2-8

Snowy Mountains, Island Bend Tunnel

Station	U	Th	K	H	Rock
4+70	4.74	15.70	2.94	7.39	Granite
9+80	4.92	17.38	3.38	7.98	Granite
15+80	3.83	15.87	3.48	6.91	Granite
20+00	4.74	15.57	3.37	7.48	Granite
109+80	5.14	16.14	3.93	8.04	Granite
131+08	4.10	16.51	3.04	7.12	Granite
150+30	5.32	16.94	3.09	8.11	Granite

Table 2-9

Snowy Mountains, Snowy - Geehi Tunnel

Station	U	Th	K	H	Rock
42+14	4.87	25.85	1.11	9.02	Kosciusko granite
51+17	3.30	20.96	2.91	7.39	Kosciusko granite
62+11	3.33	19.02	1.76	6.71	Kosciusko granite
114+50	6.14	10.77	2.23	7.24	Kosciusko granite
127+78	3.34	17.88	3.28	6.90	Kosciusko granite
131+87	3.22	7.78	1.52	4.32	Kosciusko granite
145+03	4.67	17.29	2.92	7.66	Kosciusko granite
150+32	4.11	15.41	2.72	6.82	Kosciusko granite
163+20	5.27	14.97	2.53	7.52	Kosciusko granite
172+60	3.05	15.07	2.92	6.03	Kosciusko granite
197+20	5.03	17.53	2.75	7.92	Kosciusko granite
315+35	3.76	15.67	2.81	6.64	Kosciusko granite
318+82	4.02	16.27	2.54	6.87	Kosciusko granite
329+73	3.94	15.82	2.94	6.83	Kosciusko granite
339+90	4.08	15.71	2.95	6.92	Kosciusko granite
389+18	3.57	14.17	2.65	6.16	Kosciusko granite
399+97	2.42	9.98	0.89	4.00	Kosciusko granite
419+50	3.88	9.58	3.78	5.77	Leaning Rock gneiss

3. RADIOELEMENT CONTENTS OF ROCKS FROM NORTHERN TERRITORY

All heat flows near Tennant Creek were measured in Precambrian meta-sedimentary rocks. The crystalline basement for this complex sedimentary basin is Precambrian granite. This rock was sampled at eight locations in the Tennant Creek area, and the results are given in Table 3-1.

Table 3-1

Tennant Creek Region

Location	S. Lat.	E. Long.	U	Th	K	H	Rock
New Hope	19° 43'	134° 28'	16.53	45.76	2.11	21.79	Granite
Barkly Highway	19° 29'	134° 19'	5.75	27.80	4.56	10.99	Granite
W/7-Mile 1	19° 32'	134° 10'	5.50	25.01	3.07	9.85	Granite
2	19° 33'	134° 10'	5.04	33.60	4.34	11.57	Granite
3	19° 33'	134° 11'	8.35	24.56	4.57	12.24	Granite
Black Angel	19° 31'	133° 58'	6.80	24.29	4.43	11.02	Granite
Red 2	19° 57'	134° 22'	5.95	24.08	4.65	10.41	Granite
Red 10	19° 58'	134° 33'	5.44	26.03	4.15	10.30	Granite

4. RADIOELEMENT CONTENTS OF ROCKS FROM SOUTH AUSTRALIA

Two holes were drilled especially for heat flow in the Eyre Peninsula of South Australia. The first was at Tarcoola (Table 4-4), the second at Wuddina (Table 4-5). Several other heat-flow measurements were in or near crystalline basement rocks and radioelement abundances from these are reported here. In view of some rather inconsistent results from the Eyre Peninsula, measurements of radioelement contents were made on a suite of fresh granite samples obtained by blasting especially for geochronological measurements (Parker, 1971). Results from these rocks are summarized in Table 4-6. Table 4-1 presents data from two holes drilled quite close together in a mineralized granodiorite near Bendigo Station. The rocks at Mootooroo (Table 4-2) are Precambrian gneisses similar to those found to the east at Broken Hill (see e.g., Carruthers, 1965). The samples listed in Table 4-3 were obtained by John A. Cooper a few km north of the drill hole from which heat flow was determined. Ordinarily, rocks from the hole would have been the preferred source of material; however, in this case, these rocks were severely altered whereas the rocks measured were relatively fresh and unaltered.

Rocks from the upper Yorke Peninsula (Table 4-7) were collected in an attempt to account for the high measured heat flows at Bute, Kadina, and West Doora (Sass and others, 1975; Munroe and others, 1975).

Table 4-1

Bendigo Station (Granodiorite)
S. Lat. 33° 12', E. Long. 139° 28'

Hole	Depth (ft)	U	Th	K	H
BD-3	612.5	7.33	15.31	2.28	9.03
	746.5	6.60	16.49	2.32	8.74
	932.5	7.31	16.53	1.46	9.04
BD-7	317.5	10.01	22.57	2.35	12.46
	400	8.17	22.17	2.44	11.06
	405	9.01	19.61	2.57	11.19
	525	9.32	21.85	2.87	11.95
	575	8.40	23.96	2.71	11.66
	725	7.93	20.57	2.32	10.53
	768	8.12	22.22	2.60	11.07
	925	8.16	23.29	2.15	11.20
	939	8.37	22.16	2.29	11.16

Table 4-2

Mootooroo, Hole MM 16 (Granitic Gneiss)
S. Lat. 32° 15', E. Long. 140° 56'

Depth (ft)	U	Th	K	H
129	3.04	31.75	2.47	9.24
188	3.46	31.34	3.58	9.76
245	3.26	28.66	3.74	9.12
364	3.41	33.41	2.36	9.81
411	2.91	19.33	2.69	6.71
459	2.63	34.39	3.70	9.80
712	3.49	25.91	3.93	8.79
917	3.12	20.12	2.38	6.94
1155	3.54	21.15	2.69	7.54
1442	5.06	33.72	2.54	11.13
1866	2.67	21.73	2.49	6.96

Table 4-3

Parabarana (Terrapinna Granite)
S. Lat. 30° 27', E. Long. 139° 18'

Sample #	U	Th	K	H
1	15.23	48.83	4.60	22.13
2	15.44	48.96	4.64	22.32
3	15.29	47.93	4.33	21.92
4	15.45	49.73	4.43	22.42

Table 4-4

Tarcoola (Coolladin Granite)
S. Lat. 30° 37', E. Long. 134° 30'

Depth (ft)	U	Th	K	H
10	3.15	20.03	4.36	7.49
80	3.27	18.62	4.55	7.34
101	2.92	16.89	4.49	6.72
194	3.42	19.35	4.31	7.53
216	3.69	21.46	4.46	8.18
286	3.66	22.19	4.28	8.26
307	3.58	17.82	4.50	7.39
381	3.58	15.75	4.51	6.98
399	4.01	21.48	4.41	8.41
495	4.76	18.42	4.44	8.36
515	4.10	16.95	4.54	7.67
585	2.73	19.60	4.39	7.10
609	3.57	22.04	4.38	8.20
679	3.56	18.09	4.41	7.41
700	3.17	18.09	4.48	7.14
795	3.37	20.47	4.49	7.76
816	3.97	23.78	4.53	8.87
886	3.18	17.21	4.54	6.99
905	4.50	20.14	4.52	8.53
1002	4.03	24.69	4.36	9.06

Table 4-5

Wudinna (Buckleboo Granite)
S. Lat. 32° 59', E. Long. 135° 33'

Depth (ft)	U	Th	K	H
33	4.86	38.94	4.74	12.62
132	5.99	48.08	4.69	15.25
230	4.48	47.77	4.63	14.07
329	4.34	39.22	4.82	12.31
394	6.20	62.19	4.50	18.18
492	6.18	44.86	4.94	14.82
556	5.69	36.03	4.17	12.49
623	5.48	39.53	4.40	13.09
656	5.50	34.58	4.63	12.18
696	5.73	47.47	4.88	14.99
704	6.76	60.05	4.78	18.24
742	5.31	56.76	5.03	16.59
784	3.05	20.04	5.13	7.62
837	5.82	49.73	4.74	15.47
876	5.49	55.29	4.54	16.29
915	4.25	36.61	5.11	11.80
981	6.19	56.81	5.05	17.24

Table 4-6

Eyre Peninsula

Location	S. Lat.	E. Long.	U	Th	K	H	Rock
Little Wudinna (1)	33° 00'	135° 31'	8.02	72.98	4.74	21.72	Granite
(2)	33° 00'	135° 31'	8.89	85.41	4.68	23.43	Granite
(3)	33° 00'	135° 31'	6.41	91.05	4.74	24.17	Granite
1.5 mi N of Wudinna	32° 58'	135° 33'	4.78	56.83	4.60	16.10	Granite
1 km W of Wudinna	32° 59'	135° 31'	3.44	26.51	5.18	9.20	Granite
Wudinna Hill	32° 59'	135° 33'	4.94	45.14	4.51	13.84	Granite
Pygery Rocks	32° 59'	135° 29'	3.20	54.74	4.58	14.52	Cleve meta. rocks
Polda Rocks	33° 01'	135° 32'	3.71	45.98	5.44	13.37	Granite
Iron Knob	32° 37'	137° 02'	28.34	103.94	4.90	42.80	Granite
Burkitt Granite (1)	32° 37'	137° 02'	15.46	30.83	7.92	19.86	Granite
(2)	32° 37'	136° 52'	3.04	4.14	1.87	3.54	Granite
(3)	32° 41'	137° 02'	11.27	53.36	4.86	20.21	Granite
(4)	32° 43'	137° 02'	2.65	35.82	2.85	9.87	Granite
(5)	32° 38'	137° 01'	19.50	88.12	4.46	33.06	Granite
Bittoli Dam	32° 40'	136° 23'	3.38	25.00	4.46	8.68	Qtz. flsp. porph.
Cunyarie Rocks	32° 56'	136° 18'	2.60	25.65	4.38	8.21	Granite
Buckleboo S	32° 48'	136° 04'	7.38	59.76	4.36	18.51	Granite
Buckleboo N	32° 47'	136° 04'	14.37	61.13	4.22	23.86	Granite
5 mi NNW Buckleboo	32° 43'	136° 02'	2.79	13.72	3.74	5.80	Granite
Cortlinye Rockhole	33° 01'	136° 16'	2.35	42.44	4.44	11.40	Gneiss
6 Mile Dam	32° 45'	136° 00'	4.67	24.18	3.41	9.16	Qtz. flsp. porph.

Table 4-6 (continued)

Eyre Peninsula

Location	S. Lat.	E. Long.	U	Th	K	H	Rock
Front Pennas Dam	32° 45'	135° 46'	3.96	40.84	3.83	12.09	Granite
Waulkinna Hill	32° 42'	135° 32'	4.18	27.68	4.40	9.78	Granite
Corrobinnie Hill	32° 59'	135° 44'	1.12	20.62	4.28	6.10	Granite
Cocata Hill	33° 13'	135° 08'	5.22	32.52	4.30	11.48	Granite
Kolballa Hill	33° 11'	135° 06'	3.40	34.39	4.04	10.46	Granite
Waulkinna Hill	32° 42'	135° 34'	7.28	28.03	4.36	12.10	Granite
Pildappa Rock	32° 48'	135° 15'	4.02	34.08	4.57	11.00	Granite
Tcharculdu Hill	32° 52'	135° 12'	2.94	16.98	4.34	6.72	Granite
Yarwondutta Rocks	32° 49'	135° 10'	2.12	21.85	4.30	7.08	Granite
Nunnyah	32° 09'	134° 23'	1.73	13.60	3.24	4.86	Granite
Wallalla Hill	32° 19'	134° 39'	6.18	46.94	3.56	14.86	Granite
Wirulla Hill	32° 24'	134° 36'	2.26	14.62	4.40	5.76	Granite
Parla Peak	32° 47'	134° 42'	2.21	13.45	4.56	5.54	Granite
Char N	33° 18'	137° 09'	13.02	80.93	4.44	26.89	Granite
Char S	33° 23'	137° 03'	6.24	73.35	4.68	20.49	Granite
Carpa E	33° 46'	136° 43'	0.99	3.28	1.30	1.72	Granite
Carpa W	33° 46'	136° 41'	4.30	18.21	3.86	7.82	Granite

Table 4-7

Upper Yorke Peninsula

Location	S. Lat.	E. Long.	U	Th	K	H	Rock
Kadina (1)	33° 58'	137° 44'	16.98	28.65	4.16	19.25	Granitic gneiss
(2)			16.64	16.89	0.96	15.78	Granitic gneiss
(3)			16.84	63.68	4.05	26.12	Gneiss
(4)			46.47	41.69	4.54	43.49	Gneiss
Pt. Riley (1)	33° 53'	137° 36'	15.62	133.35	5.45	39.55	Moonta prophyry
(2)			16.90	132.21	5.22	40.19	Moonta porphyry
Moonta (1)	34° 03'	137° 37'	43.02	8.06	0.90	33.26	Moonta porphyry
(2)			183.90	46.61	1.51	143.98	Moonta porphyry

5. RADIOELEMENT CONTENTS OF ROCKS FROM WESTERN AUSTRALIA

Results from heat-flow holes (or from the nearest basement outcrops) are given in Tables 5-1 through 5-4. In addition, Table 5-5 summarizes heat-production data from samples collected by Dr. V. Oversby (ANU) for uranium-lead isotope studies.

Table 5-1

Kambalda, Hole 6003 (Granite)
S. Lat. 31° 12', E. Long. 121° 41'

Depth (ft)	U	Th	K	H
1113	2.22	6.54	1.87	3.43
1280	2.45	6.49	1.91	3.60
1431	2.18	6.17	1.79	3.31
1476	2.34	6.35	2.02	3.52
2167	2.37	5.99	2.20	3.52
2456	2.51	6.27	2.15	3.67
2534	2.48	6.31	2.03	3.62
2595	2.81	7.90	2.08	4.19
2615	2.65	7.38	1.99	3.95
2722	2.25	6.33	1.70	3.37
2964	2.38	6.12	1.88	3.47
3104	2.39	6.46	1.96	3.57
3759	2.53	6.19	1.98	3.62

Table 5-2

Mt. Goode, Hole 22B (Granite)
S. Lat. 27° 37', E. Long. 120° 34'

Depth (ft)	U	Th	K	H
140	1.37	14.21	2.92	4.63
173	1.22	14.98	2.97	4.69
240	2.70	14.88	2.77	5.69
265	2.97	14.75	2.70	5.85
272	3.31	14.77	2.78	6.12
308	2.39	14.86	2.55	5.41

Table 5-3

Mt. Windarra (Gneissic Granite)
S. Lat. 28° 29', E. Long. 122° 14'

Depth (ft)	U	Th	K	H
1650	2.20	6.87	1.34	3.34
1670	2.49	6.75	1.74	3.64
1685	2.56	7.53	1.87	3.88
1694	1.55	5.97	1.22	2.65
1715	1.60	5.41	1.69	2.71

Table 5-4

Widgiemooltha (Granite Outcrops)
S. Lat. 31° 42', E. Long. 121° 34'

Sample #	U	Th	K	H
1	1.24	8.45	2.79	3.35
2	1.22	6.95	2.39	2.92
3	1.27	8.06	3.10	3.37
4	1.22	8.09	2.91	3.29

Table 5-5

Archean Granitic Rocks

Locality	ANU #	S. Lat.	E. Long.	U	Th	K	H
Bonnievale #1		30° 51'	121° 09'	1.25	4.49	1.57	2.23
#2				1.27	4.68	1.46	2.26
#3				1.32	4.66	1.58	2.32
#4				1.34	4.26	1.56	2.25
#5				1.28	4.70	1.61	2.31
#6				1.20	4.62	1.48	2.20
Karramindi	71- 736	31° 02'	121° 22'	3.37	37.76	4.15	11.13
Munari	71- 737	30° 51'	120° 17'	7.43	32.80	4.03	13.07
	71- 738			6.18	34.53	3.93	12.48
	71- 740			5.65	36.85	3.98	12.57
Karonie	71- 742	31° 55'	122° 33'	3.24	12.87	3.55	5.90
	71- 743			6.40	14.62	3.57	8.56
	71- 744			1.83	2.55	3.49	2.79
	71- 745			3.02	14.68	3.48	6.08
Buldania	71- 908	32° 04'	122° 00'	6.28	11.77	1.98	7.47
	71- 911			3.13	7.73	2.47	4.50
Paynes Find	71-1059	29° 00'	117° 43'	7.33	51.27	4.22	16.47
	71-1060			8.16	48.38	3.90	16.69
	71-1061			8.64	46.59	3.85	16.66
27 Mi S. Cue	71-1064	27° 48'	117° 52'	3.80	28.33	3.72	9.44
	71-1065			6.83	25.43	3.74	11.08

Table 5-5 (continued)

Archean Granitic Rocks

Locality	ANU #	S. Lat.	E. Long.	U	Th	K	H
Tuckannara	71-1067	27° 09'	118° 04'	2.85	10.37	1.57	4.58
	71-1068			4.78	8.92	2.16	5.86
S. of Wiluna	71-1069	27° 09'	120° 08'	5.47	30.80	3.93	11.21
	71-1070			8.63	25.66	4.10	12.54
Kathleen Val.	71-1071	27° 25'	120° 39'	2.40	13.97	2.30	5.17
	71-1072			3.15	16.31	2.77	6.31
	71-1073			11.67	25.34	3.54	14.54
	71-1074			2.61	24.40	3.97	7.86
Kookynie	71-1075	29° 21'	121° 30'	3.15	9.03	1.03	4.38
	71-1076			3.68	6.92	1.06	4.36
Bullabulling	71-1077	31° 09'	120° 48'	8.10	65.35	4.24	20.13
	71-1078			5.33	60.09	3.98	16.98

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