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RADIOMETRIC AGES OF BASEMENT ROCKS IN THE NORTHERN
MIDCONTINENT, U.S.A.

by

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CUSMAP FOLIO NOTE

These two maps are part of a folio of maps and cross sections of the northern midcontinent area, bounded by 36°-46° N. latitude and 88°-100° W. longitude, prepared under the Midcontinent Strategic and Critical Minerals Project. This project is a cooperative activity between the U.S. Geological Survey and the geological surveys of the included states. Other maps in this folio will be published as U.S. Geological Survey Miscellaneous Field Studies maps MF-1835-xx, and as U.S. Geological Survey Miscellaneous Investigations Series maps.

NOTE ON RADIO-METRIC AGES

These two maps (maps A and B) show the localities of basement rocks that have been isotopically dated. The symbol marking the sample locality also symbolizes the time range into which the isotopic age would be placed. These time ranges were selected to represent the eon and era subdivisions of the Precambrian time scale (figure 1). However, the symbol does not necessarily indicate that this age range encompasses the actual age of the rock. If more than one age has been determined for a rock sample, the oldest age is used in selecting the appropriate time symbol: a solid square for the Archean Eon, solid triangle for Early Proterozoic Era, solid circle for Middle Proterozoic Era, and open circle for Late Proterozoic Era.

Map A presents samples giving U-Pb ages; map B presents samples giving K-Ar and (or) Rb-Sr ages. Map A is a more accurate representation of the actual age terranes for the basement rocks than is map B.

Considerable isotopic dating has been done on exposed basement rocks in Wisconsin, Missouri, and Minnesota (mainly in the Minnesota River Valley). Elsewhere, the availability and suitability of core samples limit the age coverage; there are wide areas in the midcontinent region where no age information is available.

The basement rocks in Minnesota and eastern South Dakota are mainly Archean. Some of the oldest North American rocks are exposed in Minnesota. Archean and Early Proterozoic rocks are exposed in Wisconsin and Michigan. To the south, the basement rocks are predominantly Middle Proterozoic although a few Early Proterozoic and Late Proterozoic ages have been obtained. The latter may have resulted from either of two factors: (1) meteoric or hydrothermal waters reacting with the rock sometime during the Phanerozoic or (2) the reactivation of shear zones and faults as a result of regional stresses imposed by distant tectonic events.

At present, isotopic ages are best used to place the basement rocks within designated age terranes. Geologic contacts of buried crystalline rocks cannot be as accurately mapped as is possible in areas where the crystalline rocks are exposed--parts of Wisconsin, Michigan, Missouri, Minnesota, South Dakota, and Oklahoma. Boundaries between Archean, Early Proterozoic, and Middle Proterozoic terranes are only vaguely known (see P. K. Sims, in press; Bickford and others, 1981).

The early geochronological investigations of the midcontinent by Catanzaro (1963), Goldich and others (1966), Lidiak and others (1966), and Muehlberger and others (1966) are still valid. Because of technological improvements in instrumentation and analytical procedures (Krogh, 1973), it is now possible to accurately date much smaller samples (for instance; a few milligrams of zircon). Thus, some of the drill core samples that were originally rejected for dating purposes are now amenable for dating. These new advances are exemplified by investigations by Bickford and others (1981), Hoppe and others (1983), and Thomas and others (1984). These recent papers plus investigations by Sims and Peterman (1980), Goldich and others (1980), Goldich and Wooden (1980), Cummings (1984); and Peterman and others (1985) show that the Archean rocks have had a very long and complex history and that tectonic events of the Proterozoic can be geochronologically defined. Investigations in the lead isotopic system in sulfide ores and metavolcanics of northern Wisconsin (Afifi and others, 1984) and the buried granite of northern Illinois (Doe and others, 1983) are also contributing to the knowledge of the Proterozoic and its possible influence on Phanerozoic events.

The systematics of the U-Pb isotopic systems enable a geochronologist to determine probable time of crystallization of a rock, provided subsequent regional thermotectonic events were not too severe. K-Ar and Rb-Sr isotopic systems of coexisting micas, feldspars, and other minerals under the same conditions usually give younger ages. Thus, U-Pb ages are usually more reliable indicators of the age of a rock than K-Ar or Rb-Sr ages. Because zircon separates usually yield 4 or 5 ages and because these ages are usually discordant, more weight was given to concordia-intercept ages and (or) $^{207}\text{Pb}/^{206}\text{Pb}$ ages in preparing the map for U-Pb dated rocks.

Map A shows localities for samples that gave U-Pb ages for basement rocks. The sample localities in each state are numbered separately and are tabulated by state--a total of 111 samples. As an aid to the reader, a U-Pb age is shown with each sample locality. Sample information is also listed by state in tables 1-8 and consists of map number, county, latitude and longitude, rock type or formation (for exposed samples), sample number, isotopic age(s), and reference(s). Almost all U-Pb ages were obtained from zircon concentrates. The listed data are all published information (except for one Wisconsin sample, no. 51), and the reader is referred to the listed reference for more detailed information. The U-Pb ages and other information for Wisconsin sample no. 51 were obtained from Z.E. Peterman, U.S. Geological Survey. The tabulated ages are calculated (or recalculated) with the presently accepted decay values for uranium (Steiger and Jäger, 1977). Most of the tabulated data was retrieved from the Radiometric Age Data Bank of the U.S. Geological Survey.

Map B shows the localities for 569 samples of basement rock for which K-Ar and (or) Rb-Sr ages were calculated. As with the U-Pb ages, sample information for the K-Ar and Rb-Sr samples is tabulated in tables 9-18 which list map number, county, latitude and longitude, rock type (formal geologic name if known), sample number, material dated, isotopic age(s), and reference(s). Some K-Ar and Rb-Sr ages were recalculated to conform to the presently accepted decay constants for potassium and rubidium (Steiger and Jäger, 1977). Except for eight unpublished Rb-Sr ages for Wisconsin samples (contributed to this tabulation by Z.E. Peterman, U.S. Geological Survey), the tabulated data are all published information. Most of the tabulated data was retrieved from the Radiometric Age Data Bank of the U.S. Geological Survey.

Subdivision		Age estimates of boundary (million years)
Proterozoic (P)	Late Proterozoic ² (Z)	~570 ¹
	Middle Proterozoic ² (Y)	900
	Early Proterozoic ² (X)	1600
Archean (A)	Late Archean ² (W)	2500
	Middle Archean ² (V)	3000
	Early Archean ² (U)	3400
pre-Archean ³		— (3800?) — — —
¹ Rocks older than 570 Ma also called Precambrian.		
² Geochronometric units.		
³ Informal time term without specific rank.		

Figure 1. Subdivisions of the Precambrian in use by the U.S. Geological Survey.

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Table 1.--Location and U-Pb zircon ages for granite samples of the basement of Illinois
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location Latitude Longitude	Sample no.	Age (Ma)		Reference
				²⁰⁷ Pb/ ²⁰⁶ Pb	Concordia intercept	
1	Henry	41-20-50N 90-21-20W	81-5(A) 81-5(B) 81-5(E) 81-5(G)	1453 1447 1407 1374	} 1466 ± 6	Hoppe and others, 19 ⁸³
2	Madison	38-39-45N 89-46-15W	81-6(X)	1486	--	Do.
3	Stephenson	42-26-45N 89-50-25W	UPH3(A) ¹ UPH3(A) UPH3(B) UPH3(DE)	1446 1419 1401 1368	} 1465 ± 8	Do.
4	do.	42-30-10N 89-51-30W	UPH1(A) UPH1(B) UPH1(C) UPH1(F)	1441 1441 1430 1396		

Table 2.--Location and U-Pb zircon ages for granite sample of the basement of Iowa
[Ma, million years]

Map no.	County	Location Latitude Longitude	Sample no.	Age (Ma)		Reference
				²⁰⁷ Pb/ ²⁰⁶ Pb	Concordia intercept	
1	Jackson	42-09-00N 90-17-00W	81-2(B) 81-2(C) 81-2(D) 81-2(E)	1470 1465 1456 1453	} 1485 ± 10	Hoppe and others, 19 ⁸³

Table 3.--Location and U-Pb zircon ages for granite samples of the basement of Kansas
[Do, ditto; Ma, million years]

Map no.	County	Location Latitude Longitude	Sample no.	Age (Ma)		Reference
				²⁰⁷ Pb/ ²⁰⁶ Pb	Concordia intercept	
1	Douglas	39-00-45N 95-28-10W	81	1339 ± 12	(6-point chord)	Bickford and others, 1981
2	Greenwood	37-45-16N 96-02-53W	23	1380 ± 33	(4-point chord)	Do.
3	Miami	38-28-27N 94-54-25W	62	1361 ± 6	(6-point chord)	Do.
4	Nemaha	39-35-12N 96-01-18W	83	1608 ± 3	(5-point chord)	Do.
5	do.	39-36-37N 96-02-02W	30	1626 ± 15	do.	Do.
6	Riley	39-09-15N 96-38-55W	82	1382 ± 13	do.	Do.
7	Rush	38-30-40N 99-07-05W	46	1530 ± 100	(3-point chord)	Do.
8	Russell	38-48-12N 98-49-25W	49	1450 ± 15	(4-point chord)	Do.
9	Woodson	37-47-45N 95-47-00W	56	1408 ± 21	(5-point chord)	Do.

Table 4.--Location and U-Pb zircon ages for basement samples of Michigan
[Do, ditto; Ma, million years]

Map no.	County	Location Latitude Longitude	Rock type or formation	Sample no.	Age (Ma)				Concordia intercept	Reference
					U/Pb ¹	U/Pb ²	Pb/Pb ³	Th/Pb ⁴		
1	Dickinson	45-56-08N 88-02-41W	Schist inclusion in Granite Bluff Gneiss	25B (LS-114A)	2170	2400	2590	1915	2660	Aldrich and others, 1965
2	do.	45-56-08N 88-02-41W	Granite Bluff Gneiss	do.	990	1352	1970	1695	2660	Do.

¹ ²⁰⁶Pb/²³⁸U, ² ²⁰⁷Pb/²³⁵U, ³ ²⁰⁷Pb/²⁰⁶Pb, ⁴ ²⁰⁸Pb/²³²Th

Table 5.--Location and U-Pb zircon ages for basement samples of Minnesota
[Leaders (--) indicate age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type or formation	Sample no.	Age (Ma)				Concordia Th/Pb* intercept	Reference
		Latitude	Longitude			U/Pb ¹	U/Pb ²	Pb/Pb ³	Th/Pb ⁴		
1	Chippewa	44-49-41N	95-33-39W	Montevideo Gneiss	3	2880±60	3090±60	3230±65	--	3500	Catanzaro, 1963
2	do.	44-49-42N	95-33-33W	granite	4	1575±30	1670±35	1800±35	--	--	Do.
3	Nicollet	44-24-44N	94-40-58W	Morton Gneiss	337D	2540	2800	3010	--	3510	Goldich and others, 1970
4	do.	44-24-44N	94-40-58W	do.	337L	2390	2640	2830	--	3510	Do.
5	Redwood	44-32-34N	95-02-30W	Clay derived from Morton Gneiss	337L-2 3	2460 1560	2690 2470	2860 3330	2015 --	--	Do. Stern and others, 1966
6	do.	44-33-08N	95-07-36W	do.	2	1675	2450	3170	--	--	Do.
7	do.	44-33-43N	95-05-41W	do.	1	451	1188	3000	--	--	Do.
8	do.	44-39-03N	95-13-44W	Morton Gneiss	339	2415	2705	2930	--	--	Goldich and others, 1970
9	do.	44-41-20N	95-21-28W	Sacred Heart Gneiss	339U	2420	2760	3030	2670	3510	Do.
10	Renville	44-32-50N	94-58-38W	Morton Gneiss	388 76A	2100 3110	2345 2750	2570 2510	-- 1795	2610 --	Do. Do. Do.
11	do.	44-32-52N	94-58-24W	do.	338	2560	2830	3040	--	3510	Do.
12	do.	44-32-53N	94-58-37W	granite	781A	2550	2840	3055	--	--	Goldich and Wooden, 1980
13	do.	44-33-11N	94-59-36W	Morton Gneiss	781B 781C	2565 2535	2835 2815	3035 3025	-- --	3043±26	Do. Do.
14	do.	44-33-11N	94-59-36W	do.	2	2800±55	3030±60	3190±65	--	3500	Catanzaro, 1963
15	do.	44-33-13N	94-59-33W	do.	1 389D2	2590±55 2670	2870±60 2970	3050±60 3170	-- --	3510	Do. Goldich and others, 1970
16	do.	44-37-46N	95-10-49W	do.	673.1	3150	3245	3305	--	--	Goldich and Wooden, 1980
17	Yellow Medicine	44-48-01N	95-32-15W	Granite Falls Formation	673.2 673.3 673.4 673.5 346	2935 2840 2690 2765 2550	3155 3105 2970 3040 2580	3300 3280 3170 3230 2600	-- -- -- -- 2530	3487±123 2650 2610	Do. Do. Do. Do. Goldich and others, 1970
18	do.	44-48-01N	95-32-15W	do.	345.1 345.2 345.3	2390 2385 2485	2480 2510 2550	2610 2610 2610	-- -- --	2610	Do. Do. Do.
19	do.	44-48-58N	95-33-45W	gneiss	611-12A 611-12B	2695 2575	2900 2849	3050 3050	2522 2660	3050	Goldich and Wooden, 1980 Do.

1 ²⁰⁶Pb/²³⁸U, 2 ²⁰⁷Pb/²³⁵U, 3 ²⁰⁷Pb/²⁰⁶Pb, 4 ²⁰⁶Pb/²³²Th, 5 allanite was dated

Table 6. Location and U-Pb zircon ages for basement samples of Missouri
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type or formation	Sample no.	Age (Ma)		Reference
		Latitude	Longitude			Concordia intercept		
1	Crawford	38-08-15N	91-14-05W	metarhyolite	78	1450	(5-point chord)	Bickford and others, 1981
2	Gasconade	38-21-10N	91-35-00W	granite	77	1458±10	(5-point chord)	Do.
3	Gentry	40-15-55N	94-18-50W	do.	74	1637±10	(4-point chord)	Do.
4	Howard	39-12-25N	92-48-45W	do.	75	1443±12	(5-point chord)	Do.
5	Iron	37-32-00N	90-40-45W	Royal Gorge Rhyolite	not given	1530±20	(4-point chord)	Bickford and Mose, 1975
6	Jackson	39-04-10N	94-07-00W	granite	80	1365±10	(5-point chord)	Bickford and others, 1981
7	Laclede	37-33-20N	92-29-35W	diorite	66	1465±10	(5-point chord)	Do.
8	do.	37-37-00N	92-34-00W	gneiss	65	1465±7	(7-point chord)	Do.
9	Madison	37-33-20N	90-26-20W	Silvermine Granite	M06	1501±40	(3-point chord)	Bickford and Moses, 1975
10	do.	37-33-25N	90-26-45W	granite	M-5	1--		Tilton and others, 1962
11	McDonald	36-31-30N	94-36-00W	do.	79	1367±3	(5-point chord)	Bickford and others, 1981
12	Osage	38-36-00N	91-48-00W	tuff	76	1644±26	(4-point chord)	Do.
13	Reynolds	37-31-50N	90-49-30W	Munger Granite	M026	1408±12	(3-point chord)	Bickford and Mose, 1975
14	do.	37-31-50N	90-49-30W	Porphyry	not given	1378±6	(4-point chord)	Thomas and others, 1984
15	Shannon	37-21-00N	91-22-45W	granite	67	1473±15	(5-point chord)	Bickford and others, 1981
16	St. Francois	37-40-45N	90-23-30W	Butler Hill Granite	M01	1500±20	(3-point chord)	Bickford and Mose, 1975
17	do.	37-41-30N	90-32-45W	Breadtray Granite	M07	1495±40	(5-point chord)	Do.
18	St. Genevieve	37-50-00N	90-14-00W	granodiorite of Hawn Park	MB73	1514±20	(4-point chord)	Do.

1 $^{206}\text{Pb}/^{238}\text{U}$ age = 970±30Ma, $^{207}\text{Pb}/^{235}\text{U}$ age = 1120±35Ma, $^{207}\text{Pb}/^{206}\text{Pb}$ age = 1425±40Ma, $^{206}\text{Pb}/^{238}\text{Th}$ age = 1230±35Ma

Table 7. Location and U-Pb zircon ages for basement samples of Oklahoma
[Ma, million years]

Map no.	County	Location		Rock type	Sample no.	Age (Ma)		Reference
		Latitude	Longitude			Concordia intercept		
1	Mayes	36-22-15N	95-03-00W	granophyric	not given	1370±20	(5-point chord)	Bickford and Lewis, 1979
2	Osage	36-11-37N	96-05-03W	rhyolite	not given	1371±11	(4-point chord)	Thomas and others, 1984
3	Ottawa	36-59-00N	94-51-30W	microgranite	61	1383±8	(4-point chord)	Bickford and others, 1981

Table 8.--Location and U-Pb zircon ages for basement samples of Wisconsin
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type or formation	Sample no.	Age (Ma)				Concordia intercept	Reference
		Latitude	Longitude			U/Pb ¹	U/Pb ²	Pb/Pb ³			
1	Chippewa	44-55-54N	91-23-24W	leucotonalite	12	1442	1587	1785	--	--	Van Schmus, 1980
2	do.	44-56-00N	91-23-30W	trondjemite	VS77-1A,B	--	--	--	1850	1850	Maass and Van Schmus, 1980
3	Clark	44-27-42N	90-40-42W	granite	21A	1585	1695	1835	--	--	Van Schmus, 1980
4	do.	44-32-25N	90-35-52W	Neillsville Augen Gneiss	VS76-25	--	--	--	2535±10	2535±10	Maass and Van Schmus, 1980
5	do.	44-33-05N	90-39-25W	Neillsville Granite	VS78-6	1875±25	--	--	--	--	Do.
6	do.	44-44-10N	90-44-15W	gneiss	VS76-22	--	--	--	1850	1850	Do.
7	Eau Claire	44-43-48N	90-59-30W	rhyolite	18A	1738	1791	1851	}	1859±20	Van Schmus, 1980
					18B	1632	1725	1840			
8	do.	44-48-36N	91-17-00W	tonalite	11A	1740	1785	1839			
					11B	1700	1765	1842	}	1842±10	Do.
9	do.	44-49-15N	91-17-37W	amphibolite, Eau Claire River Complex	not given	1835*	--	--			
									--	--	Cummings, 1984
10	do.	44-49-15N	91-17-37W	amphibolite	VS78-6	--	--	--	1850	1850	Maass and Van Schmus, 1980
11	Florence	45-43-30N	88-06-30W	Hoskin Lake Granite	3	1555±24 1505±23 1602±24 1278±19	1675±25 1640±24 1715±26 1476±22	1820±27 1815±27 1835±28 1765±27	}	1880±15	Banks and Cain, 1969
					81-3(C)	--	--	1497			
					81-3(D)	--	--	1477			
					81-3(E)	--	--	1473			
12	Grant	42-53-00N	91-04-00W	granitoid	81-3(G)	--	--	1436	}	1509±12	Hoppe and others, 1983
					2	--	--	--			
					2A	1618	1680	1757			
					1	--	--	--			
13	Green Lake	43-43-40N	88-53-30W	rhyolite		--	--	--	1760±10	1760±10	Van Schmus, 1978
14	do.	43-43-54N	88-53-48W	do.		--	--	--	1760±10	1760±10	Van Schmus, 1980
15	do.	43-43-50N	89-08-50W	do.		--	--	--	1760±10	1760±10	Van Schmus, 1978
16	do.	43-44-42N	89-10-06W	do.	1	1565	1640	1739	1760±10	1760±10	Van Schmus, 1980
17	Jackson	44-17-48N	90-50-48W	granite	10A	1569	1679	1819	--	--	Do.
					10D	1165	1398	1774	--	--	
18	do.	44-24-30N	90-43-40W	Hatfield Gneiss	VS77-8	--	--	--	2815±20	2815±20	Maass and Van Schmus, 1980
19	Langlade	45-19-00N	88-52-00W	granite	75SD-2WR	1650*	--	--	--	--	Arifi and others, 1984
20	Marathon	44-48-24N	89-40-36W	tonalite	8A	1555	1663	1801	--	--	Van Schmus, 1980

Table 8.--Location and U-Pb zircon ages for basement samples of Wisconsin (cont'd)
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type or formation	Sample no.	Age (Ma)				Reference
		Latitude	Longitude			U/Pb ¹	U/Pb ²	Pb/Pb ³	Concordia intercept	
21	Marathon	44-58-30N	89-36-24W	rhyolite	7A	1732	1780	1836	1859±20	Van Schmus, 1980
					7D	1616	1708	1823		
22	do.	45-01-54N	89-23-18W	Kalinke Quartz	6A	1638	1712	1805	--	Do.
				Monzonite	6C	1473	1604	1781	--	
23	Marquette	45-18-30N	88-02-40W	Amberg	1	1104±16	1352±21	1760±27		Banks and Cain, 1969
				Granite		1208±18	1426±21	1775±27	1830±15	
						832±12	1106±17	1695±24		
24	do.	45-33-45N	88-03-51W	metarhyolite, Quinnesec Formation	not given	1690±28	1755±26	1840±36	1875±30	Do.
						1595±24	1705±26	1825±38		
25	do.	45-37-15N	88-02-00W	Newingham	2	1505±23	1640±25	1810±36		Do.
				Granodiorite		1540±24	1660±25	1810±27		
						1570±23	1675±25	1805±27	1830±15	
						1412±21	1570±24	1790±27		
26	do.	45-41-02N	88-12-00W	Dunbar Gneiss	5	1410±21	1570±24	1780±27		Do.
						1378±21	1540±24	1765±27		
						1590±24	1690±26	1810±27	1850±15	
						1188±18	1392±21	1715±25		
						1422±21	1570±24	1770±27		
27	do.	45-45-50N	88-02-41W	quartz diorite	27(LS-53)*	1585	1700	1840	1920	Aldrich and others, 1965
28	do.	45-46-15N	88-01-42W	Hoskin Lake Granite	26(LS-54)?	832	1106	1690	1920	Do.
29	Marquette	43-42-12N	89-20-42W	rhyolite	19A	1664	1704	1754		Van Schmus, 1980
					19B1	1642	1688	1746	1760±10	
					19C	1589	1661	1754		
30	do.	43-42-20N	89-20-30W	do.	3-A	--	--	--	1760±10	Van Schmus, 1978
					3-B	--	--	--		
31	do.	43-47-36N	89-19-36W	granite	3A	1410	1546	1737		Van Schmus, 1980
					3B	1219	1407	1704	1760±10	
32	do.	43-47-40N	89-19-30W	do.	19-A	--	--	--		Van Schmus, 1978
					19-B1	--	--	--	1760±10	
					19-C	--	--	--		
33	Oconto	45-09-25N	88-27-30W	Belongia Granite	VS70-63	--	--	--	1485±15	Van Schmus and others, 1975a
34	do.	45-09-40N	88-29-30W	do.	B71-3	--	--	--	1485±15	Do.

Table 8.--Location and U-Pb zircon ages for basement samples of Wisconsin (cont'd)
[Leader (---) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type or formation	Sample no.	Age (Ma)				Concordia intercept	Reference	
		Latitude	Longitude			U/Pb ¹	U/Pb ²	Pb/Pb ³				
35	Oneida	45-32-30N	89-09-48W	granite	5A	1219	1403	1695	}	1760±10	Van Schmus, 1980	
36	Portage	44-27-50N	89-39-15W	migmatite	5B	844	1090	1622		}	2780±30	Van Schmus and Anderson, 1977
					75-6(A1)	2349	2566	2743				
					75-6(A2)	2336	2559	2740				
					75-6(A3)	2295	2534	2731				
					75-6(C)	2202	2491	2736				
37	do.	44-28-18N	89-39-18W	tonalite	75-6(D)	2044	2389	2697	}	1824±25	Van Schmus, 1980	
					23A	1684	1746	1821			Do.	
					23C	1492	1623	1798			Do.	
					20A	1494	1613	1772			Do.	
					20C	1427	1565	1756			Do.	
39	do.	44-29-18N	89-34-54W	do.	22A	1448	1577	1754				
40	do.	44-29-30N	89-34-05W	do.	75-8	1498	1612	1765			Van Schmus and Anderson, 1977	
41	do.	44-29-30N	89-34-05W	gneiss	75-9E	1448	1577	1754		--	Do.	
42	Rusk	45-35-36N	91-06-48W	leucotonalite	13	1382	1521	1719		--	Van Schmus, 1980	
43	Sawyer	45-45-42N	91-13-18W	granite	14A1	1456	1569	1724	}	1760±10	Do.	
44	Waupaca	44-37-40N	88-59-00W	Red River Quartz Monzonite	14B	1329	1477	1697		}	1485±15	Van Schmus and others, 1975a
					VS70-36	--	--	--				
45	Wood	44-25-36N	90-11-54W	dacite	15A	1586	1674	1786	}	1824±25	Van Schmus, 1980	
46	do.	44-26-10N	90-10-30W	migmatite	15C	1485	1602	1761		}	--	Van Schmus and Anderson, 1977
					75-10(A2)	2065	2386	2672	Do.			
47	do.	44-26-10N	90-10-30W	rhyolite	75-10(A3)	1981	2339	2668	}	--	Do.	
48	do.	44-26-12N	89-46-54W	tonalite	74-2	1586	1674	1786		}	1842±10	Van Schmus, 1980
					9A	1674	1748	1838	Do.			
49	do.	44-30-06N	90-07-54W	quartz monzonite	9B	1520	1658	1839	}	--	Do.	
					9D	1522	1658	1828		Do.		
					17A	1451	1610	1825		Do.		
50	do.	44-31-42N	90-12-14W	granite	16A	1647	1726	1823	}	--	Do.	
51	Price	45-58-00N	90-18-30W	gneiss	RL-2	1507	1657	1833		}	1852±6	This paper
					RL-2(-250)							
					RL-2(-325)	1250	1490	1851				

Table 8.--Location and U-Pb zircon ages for basement samples of Wisconsin (Cont'd)
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Longitude	Rock type or formation	Sample no.	Age (Ma)				Reference
		Latitude	Latitude				U/Pb ¹	U/Pb ²	Pb/Pb ³	Concordia intercept	
52	Marquette	45-40-42N	88-12-48W		Dunbar	W143(+200)	1696	1760	1836	1862	Peterman and others, 1985
53	do.	45-39-54N	88-17-36W		Gneiss	W742	1325	1490	1733	1862	Do.
54	do.	45-39-54N	88-15-30W		do.	(150-200) W679A (100-150) W679A	1750	1791	1839	1862	Do.
55	Adams	44-09-57N	89-43-13W		granite	(250-325) not given	1481	1608	1778		Taylor, 1983

1 ²⁰⁶Pb/²³⁸U, 2 ²⁰⁷Pb/²³⁵U, 3 ²⁰⁷Pb/²⁰⁶Pb

4 rutile sample dated

5 whole-rock sample dated; ²⁰⁶Pb/²³²Th age = 1950 Ma

6 ²⁰⁶Pb/²³²Th age = 1655 Ma

7 ²⁰⁶Pb/²³²Th age = 1036 Ma

8 may not be a concordia intercept age

Table 10.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Iowa
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location	Latitude	Longitude	Rock type	Sample no.	Material dated	Model Age (Ma)		Reference
								K-Ar	Rb-Sr	
1	Clay	43-10-30N	95-10-45W		granite	IA2	biotite	--	1320±70	Lidiak and others, 1966
2	do.	43-10-30N	95-10-45W		norite	IA1	do.	--	1360±130	Do.
3	Clinton	41-46-00N	90-13-10W		granite	IA7	do.	1290±65	1300	Do.
4	Dubuque	42-30-30N	90-40-00W		do.	IA6	do.	1410±70	1410	Do.
5	Jackson	42-08-35N	90-17-00W		do.	81-2	K-feldspar	--	1302	Hoppe and others, 1983
							biotite	--	1309	
6	Page	40-40-00N	95-03-00W		do.	IA8	muscovite	1300±65	1280	Lidiak and others, 1966
7	Pocahontas	42-34-50N	94-31-50W		gneiss	IA4	biotite	1210±60	1270	
8	do.	42-34-50N	94-31-50W		do.	IA3	biotite	730±35	1110	Do.
9	do.	42-34-00N	94-35-20W		do.	IA9	do.	980±50	1170	Do.
10	Sioux	43-11-24N	96-08-08W		ryholite	not given	muscovite	--	1130	Do.
11	Winneshek	43-16-20N	91-42-50W		gabbro	IA5	whole rock	--	1520±50	Lidiak, 1971
							biotite	1300±65	1170±110	Lidiak and others, 1966

Table 9.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Illinois
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Longitude	Rock type	Sample no.	Material dated	Model Age (Ma)		Reference
		Latitude	Latitude					K-Ar	Rb-Sr	
1	Boone	42-10-30N		88-53-20W	monzonite	IL1	biotite	1380±70	1300	Lidiak and others, 1966
2	DeKalb	41-59-10N		88-37-40W	granite	IL2	do.	1210±60	930	Do.
3	Henry	41-20-50N		90-21-15W	do.	IL6	do.	1410±70	1420±80	Do.
4	do.	41-20-50N		90-25-20W	do.	81-5	biotite	--	1355	Hoppe and others, 1983
5	LaSalle	41-37-30N		88-36-40W	do.	IL3	K-feldspar	--	1298	
							biotite	650±30	620	Lidiak and others, 1966
6	Lee	41-40-50N		89-23-30W	do.	IL5	do.	1310±65	1240	Do.
7	do.	41-40-45N		89-18-50W	do.	IL4	do.	--	1180±60	Do.
							do.	--	1150	
8	Mercer	41-06-20N		90-53-30W	do.	IL7	do.	1360±70	1270	Do.
9	Stephenson	42-26-00N		89-52-00W	do.	UPH3 2209-J	whole rock	--	1393	Hoppe and others, 1983
10	do.	42-26-00N		89-52-00W	do.	UPH3 2242-H	do.	--	1409	Do.
							do.	--	11404±35	
11	do.	42-26-00N		89-52-00W	do.	UPH3 2271-E	whole rock	--	1381	Do.
							plagioclase	--	1443	
							K-feldspar	--	1375	
12	do.	42-26-00N		89-52-00W	do.	UPH3 2622-E	whole rock	--	1386	Do.
							do.	--	11404±35	
13	do.	42-26-00N		89-52-00W	do.	UPH3 2969-F	do.	--	1427	Do.
							do.	--	11404±35	
14	do.	42-26-00N		89-52-00W	do.	UPH3 3333-F	do.	--	1434	Do.
							do.	--	11404±35	
15	do.	42-26-00N		89-52-00W	do.	UPH3 4059-G	do.	--	1395	Do.
							do.	--	11404±35	
16	do.	42-26-00N		89-52-00W	do.	UPH3 4421-F	do.	--	1445	Do.
							do.	--	11404±35	
17	do.	42-26-00N		89-52-00W	do.	UPH3 4610-G	do.	--	1428	Do.
							do.	--	11404±35	
18	do.	42-26-00N		89-52-00W	do.	UPH3 4689-F	biotite	--	1364	Do.
							K-feldspar	--	1429	
							whole rock	--	1382	
							do.	--	11404±35	
19	do.	42-26-00N		89-52-00W	do.	UPH3 4969-E	whole rock	--	1353	Do.
							do.	--	11404±35	

¹ 9-point Rb-Sr whole-rock isochron age (samples from drill hole UPH3); U-Pb concordia-intercept age for this granite is 1465 Ma.

Table 11.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Kansas
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type	Sample no.	Material dated	Model Age (Ma)		Reference
		Latitude	Longitude				K-Ar	Rb-Sr	
1	Barton	38-31-30N	98-28-40W	schist	not given	not given, probably biotite	1175	--	Cole and Merriam, 1962
2	do.	38-26-00N	99-00-15W	do.	do.	do.	1470	--	Do.
3	do.	38-39-30N	98-48-00W	quartzite	KA9	whole rock	--	1400±140	Muehlberger and others, 1966
4	do.	38-41-15N	98-47-30W	granite(?)	3	do.	--	1451	Bickford and others, 1981
5	do.	38-39-35N	98-48-10W	quartzite	not given	not given	--	1400	Cole and others, 1964
6	Butler	37-47-25N	96-31-47W	granite(?)	9	whole rock	--	1468	Do.
7	do.	37-48-20N	96-57-40W	granite	KA25	biotite	--	1230±60	Muehlberger and others, 1966
8	do.	37-48-48N	97-58-08W	do.	8	whole rock	--	1280±160	Bickford and others, 1981
9	do.	38-02-43N	96-49-48W	do.	5	do.	--	1340	Do.
10	do.	38-02-55N	96-51-34W	granite(?)	6	do.	--	1343	Do.
11	do.	38-02-55N	96-52-10W	granite	7	do.	--	1328	Do.
12	do.	38-03-00N	96-50-00W	gneiss	KA24	K-feldspar	--	1450±90	Muehlberger and others, 1966
13	do.	37-54-15N	96-48-15W	granite	1060F 1060M	do. muscovite	--	1420±20 1300±20	Denison and others, 1969
14	Chase	38-20-47N	96-36-00W	granite(?)	11	whole rock	--	1293±15	Bickford and others, 1981
15	do.	38-21-00N	96-37-00W	gneiss	KA23	K-feldspar	--	1299 1500±90	Muehlberger and others, 1966
16	do.	38-22-09N	96-40-55W	granite(?)	10	whole rock	--	1499	Bickford and others, 1981
17	do.	38-20-33N	96-37-43W	do.	12	do.	--	1361	Do.
18	Cherokee	37-00-30N	94-51-30W	do.	59	do.	--	1227	Do.
19	do.	37-00-30N	94-51-30W	do.	57	do.	--	1352	Do.
20	do.	37-00-40N	94-50-30W	do.	58	do.	--	1027	Do.
21	do.	37-10-32N	94-50-35W	do.	14	do.	--	1283	Do.
22	Ellis	38-44-00N	99-32-30W	do.	22	do.	--	1350	Do.
23	do.	38-45-00N	99-17-06W	do.	21	do.	--	1532	Do.
24	do.	38-48-22N	99-32-42W	do.	20	do.	--	1465	Do.

Table 11.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Kansas (cont'd)
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type	Sample no.	Material dated	Model Age (Ma)		Reference
		Latitude	Longitude				K-Ar	Rb-Sr	
25	Ellis	38-51-00N	99-29-30W	gneiss	not given	not given, probably biotite whole rock	910	--	Cole and others, 1964
26	do.	39-06-48N	99-16-00W	granite(?)	19	whole rock	--	1438	Bickford and others, 1981
27	Kingman	37-40-00N	98-27-30W	granite	not given	biotite	1110	--	Cole and others, 1964
28	do.	37-40-00N	98-27-20W	do.	KA26	K-feldspar do.	--	1350 1400±70	Muehlberger and others, 1966
29	do.	37-40-22N	98-26-51W	granite(?)	24A	whole rock	--	1452	Bickford and others, 1981
30	do.	37-40-22N	98-26-51W	do.	24B	do.	--	1337	Do.
31	Lyon	38-27-08N	95-57-40W	do.	25	do.	--	1160	Do.
32	Marshall	39-34-07N	96-27-26W	do.	27	do.	--	1418	Do.
33	do.	39-47-30N	96-17-20W	adamellite	KA13	K-feldspar	--	1660±80	Muehlberger and others, 1966
34	do.	39-56-28N	96-21-17W	granite(?)	26	whole rock	--	1394	Bickford and others, 1981
35	Brown	39-58-50N	95-45-05W	granite	4	do.	--	1310	Do.
36	Atchison	39-26-50N	96-00-41W	granite(?)	1	do.	--	1249	Do.
37	Nemaha	39-36-23N	95-55-15W	do.	29	do.	--	1663	Do.
38	do.	39-52-35N	95-58-00W	granite	KA11	do.	--	1530±100	Muehlberger and others, 1966
39	do.	39-56-38N	96-10-40W	granite(?)	28	do.	--	1540 1410	Bickford and others, 1981
40	Morris	38-32-30N	96-42-00W	granite	KA22	K-feldspar	--	1470±80	Muehlberger and others, 1966
41	do.	38-39-30N	96-22-45W	quartzite	KA21	whole rock	1270±65	1450±90	Do.
42	do.	38-39-42N	96-22-20W	schist	not given	not given	1300	--	Cole and Merriam, 1962
43	Pottawatomie	39-14-20N	96-26-00W	adamellite	KA17	whole rock	--	1600±100	Muehlberger and others, 1966
44	do.	39-15-20N	96-28-20W	do.	KA18	K-feldspar	--	1880±20	Do.
45	do.	39-23-10N	96-35-50W	do.	KA15	do.	--	1400±70	Do.
46	do.	39-32-30N	96-30-30W	gneiss	KA14	do.	--	2020±170	Do.

Table 11.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Kansas (cont'd)

Map no.	County	Location		Longitude	Rock type	Sample no.	Material dated	Model Age (Ma)		Reference
		Latitude	Latitude					K-Ar	Rb-Sr	
47	Riley	39-20-40N		96-56-00W	meta-arkose hornfels	KA16	microcline	--	1370±170	Do.
48	Barber	37-19-02N		98-25-55W	granite(?)	2	whole rock	--	1152	Bickford and others, 1981
49	Sedgwick	37-44-27N		97-19-47W	do.	51	do.	--	1386	Do.
50	Rush	38-27-23N		99-06-28W	do.	46D	do.	--	1401	Do.
51	do.	38-28-30N		99-05-55W	schist	not given	not given, probably biotite	1210	--	Cole and Merriam, 1962
52	do.	38-30-40N		99-07-05W	granite	46A	whole rock	--	1466	Bickford and others, 1981
53	do.	38-30-42N		99-07-00W	do.	not given	not given, probably biotite	1270	--	Cole and Merriam, 1962
54	do.	38-31-52N		99-04-13W	granite(?)	42	whole rock	--	1422	Bickford and others, 1981
55	do.	38-31-00N		99-13-05W	do.	47	do.	--	1353	Do.
56	do.	38-32-08N		99-12-23W	do.	44	do.	--	1365	Do.
57	do.	38-33-10N		99-08-00W	do.	41	do.	--	1451	Do.
58	do.	38-35-26N		99-11-00W	do.	43	do.	--	1634	Do.
59	do.	38-36-03N		99-15-35W	do.	45	do.	--	1568	Do.
60	do.	38-38-58N		99-17-23W	do.	40	do.	--	1398	Do.
61	Russell	38-45-23N		98-52-18W	do.	50	do.	--	1441	Do.
62	do.	38-48-12N		98-49-25W	granite	49	do.	--	1382	Do.
63	do.	38-52-20N		98-59-22W	granite(?)	48	do.	--	1164	Do.
64	Ellsworth	38-51-00N		98-27-30W	granite	KA5	biotite	1210±60	--	Muehlberger and others, 1966
65	Sumner	37-15-15N		97-10-30W	do.	KA27	whole rock K-feldspar	--	1470±110	Do.
66	do.	37-15-17N		97-10-47W	granite(?)	52	whole rock	--	1478	Bickford and others, 1981
67	do.	37-15-58N		97-10-31W	do.	53	do.	--	1248	Do.
68	Norton	39-44-45N		99-59-30W	pegmatite	not given	biotite	1110	--	Cole and others, 1964; Scott and McElroy, 1964
69	do.	39-44-45N		99-59-30W	schist	do.	biotite	1250	--	Cole and others, 1964; Scott and McElroy, 1964

Table 11.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Kansas (cont'd)
[Leader (--) indicates age was not calculated. Do, ditto; Ma, million years; years]

Map no.	County	Location		Rock type	Sample no.	Material dated	Model Age (Ma)		Reference
		Latitude	Longitude				K-Ar	Rb-Sr	
70	Norton	39-42-37N	99-51-15W	granite(?)	34	whole rock	--	1492	Bickford and others, 1981
71	do.	39-43-03N	99-49-35W	do.	33	do.	--	1622	Do.
72	do.	39-38-00N	99-47-28W	do.	35	do.	--	1564	Do.
73	Rooks	39-11-50N	99-33-00W	do.	39	do.	--	1450	Do.
74	do.	39-20-12N	99-15-40W	do.	37	do.	--	1498	Do.
75	do.	39-11-00N	99-05-35W	gneiss	KA4	biotite	--	1220±70	Do.
76	do.	39-10-40N	99-05-35W	granite(?)	38	whole rock	--	1451	Do.
77	Woodson	37-45-55N	95-34-25W	do.	55	do.	--	1272	Do.
78	do.	37-47-00N	95-43-00W	granite	KA28	K-feldspar	--	1260±70	Muehlberger and others, 1966
79	do.	37-47-00N	95-43-00W	do.	not given	not given	--	1240±30	Cole and others, 1964
80	Greenwood	37-45-16N	96-02-53W	do.	23A	whole rock	--	1348	Bickford and others, 1981
81	do.	37-45-15N	96-02-45W	do.	1059F	K-feldspar	--	1273	Denison and others, 1969
82	Wilson	37-26-32N	95-45-44W	do.	54	whole rock	--	1438	Bickford and others, 1981
83	Chautauqua	37-15-43N	96-01-35W	granite(?)	13	do.	--	1409	Do.

Table 12.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Michigan
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Model Age (Ma)		Reference
		Latitude	Longitude				K-Ar	Rb-Sr	
1	Dickinson	45-55-00N	88-01-45W	schist (Michigamme Slate)	19(LS-129C)	biotite	1240	1280	Aldrich and others, 1965
2	do.	45-56-08N	88-02-41N	Granite Bluffs	25A(LA-114A)	biotite	1170	1090	Do.
3	Iron	45-57-21N	88-11-46W	Gneiss	18(LS-40A)	feldspar	1160	1540	Do.
4	do.	45-58-27N	88-13-29W	schist (Michigamme Slate)	14(HJ-68-55)	biotite	1290	1360	Do.
5	do.	45-58-31N	88-13-59W	metagabbro (sill)	15(HJ-63-55)	hornblende	1585	--	Do.
6	do.	45-59-13N	88-12-35W	amphibolite (Hemlock Formation)	12(HJ-20A-52)	do.	1575	--	Do.
7	do.	45-59-28N	88-12-35W	amphibolite (Michigamme Slate)	11(LS-40C)	do.	2490	--	Do.
8	do.	45-59-25N	88-17-30W	schist (Michigamme Slate)	13(LS-40H)	biotite	1250	1320	Do.
				mica schist (Michigamme Slate)		muscovite	1150	--	Do.
						biotite	1110	1280	Do.

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota

[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;

H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz; WR, whole rock]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Age (Ma)		Reference
		Latitude	Longitude				Model	Isochron	
							K-Ar	Rb-Sr	
1	Chippewa	44-46-29N	95-31-25W	Montevideo Gneiss	KA-209	B	1720±80	1855 3730	Goldich and others, 1961, 1970; Goldich and Hedge, 1974
2	do.	44-46-29N	95-31-25W	do.	KA-209	WR	--	-- 3720 (6) 3870±70 (5)	
3	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-104-9D)	WR	--	-- 3220±202(10) 3220±202(10)	Farhat and Wetherill, 1975 Do.
4	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-105-4D)	WR	--	-- 3220±202(10)	Do.
5	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-104-4D)	WR	--	-- 3220±202(10)	Do.
6	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-9-1R)	WR	--	-- 3220±202(10) 3105±90 (10)	Do.
7	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-9-8R)	WR	--	-- 3220±202(10) 3105±90 (10)	Do.
8	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-9-5D)	WR	--	-- 3220±202(10)	Do.
9	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-9-6R)	WR	--	-- 3220±202(10) 3105±90 (10)	Do.
10	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-9-4D+R)	WR	--	-- 3220±202(10)	Do.
11	do.	44-46-29N	95-31-25W	do.	KA-209 (MV-9-2R)	WR	--	-- 3220±202(10) 3105±90 (10)	Do.
12	do.	44-46-40W	95-31-53W	gneiss	209	WR	--	3725±145 3680±70 (7) 3675±115(3)	Goldich and others, 1980
13	do.	44-48-18N	95-32-23W	granulite	GF-30	WR	--	-- 2620±202(8)	Wilson, 1976
14	do.	44-48-20N	95-32-23W	do.	GF-31	H+Py WR	--	-- 2360 (2)	Do.
15	do.	44-48-20N	95-32-28W	do.	GF-32	WR	--	-- 2620±202(8)	Do.
						Pl	--	-- 1745 (2)	
						H+Py	--	-- 1631 (2)	
						Pl	--	-- 1639 (3)	
						H+Py	--	--	
16	do.	44-48-22N	95-32-05W	do.	GF-35	WR	--	-- 2620±202(8)	Do.
17	do.	44-48-22N	95-32-06W	do.	GF-37	WR	--	-- 2620±202(8)	Do.
18	do.	44-48-22N	95-32-06W	do.	GF-36	WR	--	-- 2620±202(8)	Do.
19	do.	44-48-22N	95-32-07W	do.	GF-38	WR	--	-- 2620±202(8)	Do.
20	do.	44-48-22N	95-32-16W	do.	GF-33	WR	--	-- 2620±202(8)	Do.
						Pl	--	-- 1790 (3)	
						H+Py	--	-- 1870 (2)	
						Pl	--	-- 1869 (3)	
						H+Py	--	--	
						WR	--	--	

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)
 [Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
 H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz, WR, whole rock]

Map no.	County	Location Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
							Model	K-Ar	Rb-Sr	
21	Chippewa	44-49-00N	95-31-00W	diabase dike	07-2	WR	1940	--	--	Tsunakawa and Yanagisawa, 1981 Do.
22	do.	44-49-00N	95-31-00W	Montevideo Gneiss	07-1	WR	1470	--	--	
23	do.	44-49-03N	95-33-31W	gneiss	464F	WR	--	3250	--	Goldich and others, 1980 Goldich and others, 1970
24	do.	44-49-41N	95-33-39W	Montevideo Gneiss	385	Pl	--	3270	--	
						WR	--	--	2300 (2)	
						F	--	--	1810 (2)	
25	do.	44-49-41N	95-33-39W	do.	KA-25	WR	--	--	--	Goldich and others, 1961 Do.
						B	1830±90	--	--	
26	do.	44-49-42N	95-33-33W	granite, Granite of Section 28	KA-29	B	1700±85	1710±80	--	Goldich and others, 1970 Do.
							--	--	--	
27	do.	44-49-42N	95-33-33W	do.	387WR	F	--	--	1790±160(4)	Goldich and others, 1970 Do.
28	do.	44-49-42N	95-33-38W	do.	386WR	W	--	--	1790±160(4)	
29	do.	44-49-42N	95-33-38W	do.	KA-28	B	1700±85	--	--	Goldich and others, 1961 Tsunakawa and Yanagisawa, 1981
30	do.	44-55-00N	95-41-30W	Montevideo Gneiss	08-1	F	1420	--	1600 (2)	
						WR	1560	--	--	
						Pl	2200	--	2700 (2)	
						WR	--	--	--	
31	do.	44-55-00N	95-41-30W	do.	08-02	F	1630	--	1700 (2)	Do.
						WR	1330	--	--	
						Pl	2080	--	2400 (2)	
32	do.	44-55-00N	95-41-33W	do.	09	WR	--	--	--	Do.
						F	1670	--	--	
						WR	1810	--	--	
						Pl	2360	--	1820±90 (4)	
						B	--	--	--	
33	do.	44-55-09N	95-42-56W	do.	608	WR	--	--	3720(6)	Goldich and Hedge, 1974
							--	--	3870±70 (5)	
34	do.	44-55-12N	95-42-54W	gneiss	813	WR	--	--	2910(3)	Goldich and others, 1980 Do.
35	do.	44-55-12N	95-42-54W	do.	613	WR	--	--	3680±70 (7)	
							--	--	3675±115(3)	
36	do.	44-55-13W	95-42-30W	Montevideo Gneiss	MV-100(6D)	WR	--	--	2822±199(6)	Farhat and Wetherill, 1975
37	do.	44-55-13W	95-42-30W	do.	MV-100(6R)	WR	--	--	2822±199(6)	
							--	--	3105±90 (10)	
38	do.	44-55-13W	95-42-30W	do.	MV-100(5D)	WR	--	--	2822±199(6)	Do.
39	do.	44-55-13W	95-42-30W	do.	MV-100(5R)	WR	--	--	2822±199(6)	
							--	--	3105±90 (10)	
40	do.	44-55-13W	95-42-30W	do.	MV-100(3D)	WR	--	--	2822±199(6)	Do.

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
H, hornblende; Mt, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz; WR, whole rock]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
		Latitude	Longitude				K-Ar	Rb-Sr	Isochron ¹ Rb-Sr	
41	Chippewa	44-55-13N	95-42-30W	Montevideo Gneiss	MV-100(3R)	WR	--	--	282±19(6) 3105±90(10)	Farhat and Wetherill, 1975
42	do.	44-55-21N	95-42-20W	Gneiss	608	WR	--	--	3680±70 (7) 3675±115(3)	Goldich and others, 1980
43	do.	44-55-23N	95-42-07W	do.	431	WR	--	--	2910 (3)	Do.
44	do.	44-55-23N	95-42-07W	do.	413	WR	--	--	2910 (3)	Do.
45	do.	44-55-33N	95-42-00W	Montevideo Gneiss	MV-102(3D)	WR	--	--	2559±22 (7)	Farhat and Wetherill, 1975
46	do.	44-55-33N	95-42-00W	do.	MV-102(3T)	WR	--	--	2559±22 (7)	Do.
47	do.	44-55-33N	95-42-00W	do.	MV-102(3R)	WR	--	--	2559±22 (7)	Do.
48	do.	44-55-33N	95-42-00W	do.	MV-102(5D)	WR	--	--	2559±22 (7)	Do.
49	do.	44-55-33N	95-42-00W	do.	MV-102(5R)	WR	--	--	2559±22 (7)	Do.
50	do.	44-55-33N	95-42-00W	do.	MV-102(4D)	WR	--	--	2559±22 (7)	Do.
51	do.	44-55-33N	95-42-00W	do.	MV-102(4R)	WR	--	--	2559±22 (7)	Do.
52	do.	44-55-33N	95-42-00W	gneiss (Monte- video Gneiss)	KA-27-1	B	1840±90	1790±85	--	Goldich and others, 1961
53	do.	44-55-33N	95-42-00W	Montevideo Gneiss	384	WR	--	2910	--	Goldich and others, 1970
54	do.	44-55-33N	95-42-00W	do.	369	WR	--	3430	--	Do.
55	do.	44-55-33N	95-42-00W	gneiss	368	WR	--	2590	--	Do.
56	Lac Qui Parle	45-11-57N	96-17-21W	Ortonville or Bellingham Granite	KA-56	B	1680±85	1710	--	Goldich and others, 1961, 1970
57	do.	45-11-57N	96-17-21W	do.	KA-55	B	1680±85	1750	--	Do.
58	do.	45-12-07N	96-16-53W	do.	KA-108	WR	--	2670	--	Do.
59	do.	45-13-28N	96-18-20W	granulite	KA-44	B	1680±85	1920	--	Goldich and others, 1961
60	do.	45-14-48N	96-19-33W	Ortonville or Odessa Granite	KA-109	B	2180±110	--	--	Goldich and others, 1961, 1970
61	Morrison	45-57-36N	94-08-19W	quartz monzo- nite (Pierz Granite)	KA-61	B	1740±85	--	--	Goldich and others, 1961
62	do.	45-59-23N	94-03-48W	Hillman Tonalite	KA-64	B	1790±90	1750±85	--	Do.
63	Nicollet	44-24-37N	94-40-52W	Morton Gneiss	659C	WR	--	--	3475±110(26)	Goldich and Wooden, 1980
64	do.	44-24-37N	94-40-52W	do.	659	WR	--	--	3475±110(26)	Do.
65	do.	44-24-37N	94-40-52W	do.	3370	WR	--	--	3475±110(26)	Do.
66	do.	44-24-44N	94-40-58W	do.	KA-51	B	2480±125	--	--	Goldich and others, 1961
67	do.	44-24-44N	94-40-58W	do.	337D	WR	--	3460	2990 (8)	Goldich and others, 1970
68	do.	44-24-44N	94-40-58W	do.	337L	WR	--	3200	2990 (8)	Do.
69	do.	44-27-12N	94-46-07W	Fort Ridgely Granite	KA-52	B	2300±115	--	--	Goldich and others, 1961
70	Redwood	44-26-59N	95-21-35W	Seaforth Gneiss	KA-210	B	2410±120	--	--	Do.

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)
 [Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
 H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz; WR, whole rock]

Map no.	County	Location Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)		Reference
							Model K-Ar	Isotopic Rb-Sr	
71	Redwood	44-30-10N	94-53-05W	amphibolite, Morton Gneiss	733	WR	--	2950±245(9)	Goldich and Wooden, 1980
72	do.	44-30-10N	94-53-05W	do.	731	WR	--	2950±245(9)	Do.
73	do.	44-30-20N	94-54-01W	gabro, Cedar Mountain Complex	KA-195	B	1760±90	--	Goldich and others, 1961
74	do.	44-30-34N	94-54-24W	granophyre-gabbro, Cedar Mountain Complex	16	H	1750±90	--	Hanson, 1968
75	do.	44-32-00N	95-07-00W	Morton Gneiss	02-3	F Pl WR B WR	-- -- -- -- --	-- 2550±60 (3) 1380 (2) --	Tsunakawa and Yanagisawa, 1981
76	do.	44-32-00N	95-07-00W	do.	02-2-2	WR	--	2550 (3)	Do.
77	do.	44-32-00N	95-07-00W	do.	02-1	WR	--	2550 (3)	Do.
78	do.	44-32-00N	95-07-00W	do.	02-2-1	WR	--	2550 (3)	Do.
79	do.	44-33-38N	95-05-40W	Morton Gneiss (weathered)	2	WR	--	2380 (2)	Goldich and Gast, 1966
80	do.	44-33-38N	95-05-40W	do.	1	B	1860	510	Do.
81	do.	44-33-48N	95-05-45W	do.	3A	B	1830	590	Do.
82	do.	40-33-48N	95-05-45W	do.	3B	B	1840	--	Do.
83	do.	44-34-15N	95-05-14W	Morton Gneiss	KA-186	B	2500±125	2490	Goldich and Gast, 1966; Goldich and others, 1961, 1970
84	do.	44-38-25N	95-13-47W	do.	KA-107	B	2560±130	2530±120	Goldich and others, 1961; Goldich and Gast, 1966
85	do.	44-38-47N	95-13-14W	do.	671C	WR	--	3475±110(26)	Goldich and Wooden, 1980
86	do.	44-38-47N	95-13-14W	do.	671	WR	--	3475±110(26)	Do.
87	do.	44-38-47N	95-13-14W	do.	339	WR	--	3475±110(26)	Do.
88	do.	44-39-03N	95-13-44W	do.	339	WR	--	3720 (6)	Goldich and Hedge, 1974;
89	do.	44-40-00N	95-19-00W	Sacred Heart Granite	05	B F Pl WR	-- -- -- --	2990 (8) 2370±50 (4)	Goldich and others, 1970 Tsunakawa and Yanagisawa, 1981
90	do.	44-40-48N	95-20-13W	do.	KA-9	B	2410±120	2480±120	Goldich and others, 1961, 1970
91	do.	44-41-02N	95-20-57W	do.	KA-23	F B	-- 2450±125	2800 --	Do.
92	do.	44-41-20N	95-21-28W	do.	388	WR	--	2800	Goldich and others, 1970
93	do.	44-41-22N	95-21-01W	do.	KA-13	B	2430±120	2450±125	Goldich and others, 1961

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)

[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;

H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz; WR, whole rock]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Model		Age (Ma)		Reference
		Latitude	Longitude				K-Ar	Rb-Sr	Rb-Sr	Isochron	
94	Redwood	44-41-31N	95-20-22W	Morton Gneiss	KA-208	B	2460±125	--	--	--	Goldich and others, 1961, 1970
						WR	--	2490	2990	(8)	
						F	--	2550	--	--	
						Pl	--	--	2500	(10)	
						WR	--	--	--	--	
						Pl	--	--	2590	(4)	
						WR	--	3290	--	--	
95	do.	44-41-32N	95-20-30W	do.	KA-171	B	2460±125	--	--	--	Goldich and others, 1961
96	Renville	44-32-50N	95-58-38W	do.	KA-15-1	B	2440±125	--	--	--	Goldich and others, 1961, 1970
						F	--	2450	--	--	
						Pl	--	2520	--	--	
						WR	--	--	2500	(10)	
						Pl	--	--	--	--	
						WR	--	2530±125	2530±120	--	Goldich and others, 1961, 1970;
97	do.	44-32-50N	95-58-38W	do.	KA-14-1	B	2050	2510	2500	(10)	Goldich and Gast, 1966
						Pl	--	--	--	--	
						WR	--	--	2970	2990	Goldich and others, 1970
98	do.	44-32-50N	95-58-38W	do.	76	WR	--	--	--	--	
99	do.	44-32-50N	95-58-38W	do.	KA-15-2	B	2540	--	--	--	Do.
						F	--	2410	--	--	
						Pl	--	2440	--	--	
						WR	--	--	2500	(10)	
						WR	--	--	--	--	Wilson, 1976
100	do.	44-32-50N	95-58-38W	amphibolite	Mort-2	WR	--	--	3450±150(3)	--	Do.
101	do.	44-32-50N	95-58-38W	do.	Mort-2	WR	--	--	3450±150(3)	--	Goldich and others, 1970
102	do.	44-32-52N	94-58-24W	Morton Gneiss	338	F	--	1980	--	--	
						Pl	--	2400	--	--	
						WR	--	--	2500	(10)	
						Pl	--	3160	--	--	
						WR	--	--	2590	(4)	
						WR	--	--	2990	(8)	Do.
103	do.	44-32-52N	94-58-24W	do.	338-I	WR	--	2710	--	--	
104	do.	44-32-53N	94-58-21W	amphibolite, Morton Gneiss	338-I	WR	--	--	2900±125(9)	--	Goldich and Wooden, 1980
105	do.	44-32-53N	94-58-22W	Morton Gneiss	8	H	2570±130	--	2870±145(7)	--	Hanson, 1968
106	do.	44-32-53N	94-58-30W	amphibolite, Morton Gneiss	BN-74-32	WR	--	--	2950±245(9)	--	Goldich and Wooden, 1980
107	do.	44-32-53N	94-58-30W	do.	BN-74-31	WR	--	--	2950±245(9)	--	Do.
108	do.	44-32-53N	94-58-37W	do.	BN-74-11	WR	--	--	2950±245(9)	--	Do.
109		44-32-53N	94-58-37W	adamellite	655	WR	--	--	2555±55 (10)	--	Do.
							--	--	2590±40 (16)	--	
110	do.	44-33-09N	94-59-32W	granodiorite	782	WR	--	--	2670 (3)	--	Do.
111	do.	44-33-09N	94-59-32W	do.	602	WR	--	--	2670 (3)	--	Do.
112	do.	44-33-09N	94-59-32W	adamellite	647	WR	--	--	2640±115(6)	--	Do.
113	do.	44-33-09N	94-59-32W	granite	674	WR	--	--	2735	--	Do.

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years] years; B, biotite; F, K-feldspar;
H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz; WR, whole rock]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Age (Ma)		Reference
		Latitude	Longitude				Model	Isochron	
							K-Ar	Rb-Sr	
114	Renville	44-33-09N	94-59-32W	amphibolite, BN-74-23A Morton Gneiss	WR	WR	--	--	Goldich and Wooden, 1980
115	do.	44-33-09N	94-59-32W	do.	BN-74-23C	WR	--	--	Do.
116	do.	44-33-09N	94-59-32W	do.	BN-74-23B	WR	--	--	Do.
117	do.	44-33-09N	94-59-32W	do.	BN-74-23E	WR	--	--	Do.
118	do.	44-33-09N	94-59-32W	do.	BN-74-23D	WR	--	--	Do.
119	do.	44-33-09N	94-59-32W	Morton Gneiss	644	WR	--	--	Do.
120	do.	44-33-09N	94-59-33W	do.	799	WR	--	--	Do.
121	do.	44-33-09N	94-59-33W	granite	290L	WR	--	2655	Do.
122	do.	44-33-09N	94-59-33W	vein	646	WR	--	--	Do.
123	do.	44-33-10W	94-59-33W	adamellite	680	WR	--	--	Do.
124	do.	44-33-10W	94-59-33W	aplite	459	WR	--	--	Do.
125	do.	44-33-10W	94-59-33W	adamellite	600B	WR	--	--	Do.
126	do.	44-33-10W	94-59-33W	do.	720A	WR	--	--	Do.
127	do.	44-33-10W	94-59-33W	do.	656	WR	--	--	Do.
128	do.	44-33-10W	94-59-33W	do.	651	WR	--	--	Do.
129	do.	44-33-10W	94-59-33W	aplite	648B	WR	--	--	Do.
130	do.	44-33-10W	94-59-33W	do.	648A	WR	--	2420	Do.
131	do.	44-33-10W	94-59-33W	Morton Gneiss	713	WR	--	--	Do.
132	do.	44-33-10W	94-59-33W	do.	682	WR	--	--	Do.
133	do.	44-33-10W	94-59-33W	do.	649B	WR	--	--	Do.
134	do.	44-33-10W	94-59-33W	do.	679D	WR	--	--	Do.

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)
 [Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
 H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz; WR, whole rock]

11, norrbotten, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156

Map no.	County	Location Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)		Reference	
							Model	Isocron ¹		
							K-Ar	Rb-Sr		
135	Renville	44-33-10N	94-59-33W	Morton Gneiss	679	WR	--	--	3475±110(26) 2920±325(10)	Goldich and Wooden, 1980
136	do.	44-33-10N	94-59-33W	amphibolite, Morton Gneiss	600G	WR	--	--	2950±245(9)	Do.
137	do.	44-33-10N	94-59-33W	do.	801	WR	--	--	2900±125(9) 2870±145(7) 2870±150(6) 2800±250(5)	Do.
138	do.	44-33-10N	94-59-33W	do.	677	WR	--	--	2900±125(9) 2870±145(7) 2870±150(6)	Do.
139	do.	44-33-10N	94-59-33W	Morton Gneiss	3890	WR	--	--	3475±110(26) 2920±325(10)	Do.
140	do.	44-33-10N	94-59-33W	aplite	652	WR	--	--	2590±40 (6) 2590±40 (16)	Do.
141	do.	44-33-10N	94-59-33W	do.	650	WR	--	--	2590±40 (6) 2590±40 (16)	Do.
142	do.	44-33-13N	94-59-33W	Morton Gneiss	390-L	WR	--	2700	2990 (8)	Goldich and others, 1970
						F	--	--	2190 (2)	
						WR	--	--		
						F	--	--		
						Pl	--	--	2500 (3)	
						WR	--	--		
143	do.	44-33-13N	94-59-33W	do.	389-D	WR	--	3330	2990 (8)	Do.
144	do.	44-33-18N	94-59-33W	adamellite	603	WR	--	--	2640±115(6)	Goldich and Wooden, 1980
145	do.	44-33-18N	94-59-33W	Morton Gneiss	633B	WR	--	--	3475±110(26) 2920±325(10)	Do.
146	do.	44-33-18N	94-59-33W	do.	633	WR	--	--	3475±110(26) 2920±325(10)	Do.
147	do.	44-34-00N	95-03-00W	basalt dike	01	WR	1820	--	--	Tsunakawa and Yanagisawa, 1981
148	do.	44-35-09N	95-08-48W	aplite	676	WR	--	2080	--	Goldich and Wooden, 1980
149	do.	44-35-09N	95-08-48W	Morton Gneiss	657	WR	--	--	3475±110(26)	Do.
150	do.	44-35-09N	95-08-48W	do.	637	WR	--	--	3475±110(26)	Do.
151	do.	44-35-09N	95-08-46W	do.	636	WR	--	--	3475±110(26)	Do.
152	do.	44-35-09N	95-08-46W	do.	745	WR	--	--	2555±55 (10) 2590±40 (16)	Do.
153	do.	44-35-09N	95-08-46W	do.	743	WR	--	--	2555±55 (10) 2590±40 (16)	Do.
154	do.	44-37-45N	95-10-50W	gneiss	654	WR	--	--	2555±55 (10) 2590±40 (16)	Do.
155	do.	44-37-45N	95-10-50W	do.	730	WR	--	--	2555±55 (10) 2590±40 (16)	Do.
156	do.	44-37-45N	95-10-50W	do.	729	WR	--	--	2555±55 (10) 2590±40 (16)	Do.

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)
 [Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
 H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz; WR, whole rock]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Age (Ma)		Reference
		Latitude	Longitude				Model	Isotopes	
							K-Ar	Rb-Sr	
157	Renville	44-37-45N	95-10-50W	aplite	628	WR	--	2590±40 (6)	Goldich and Wooden, 1980
158	do.	44-37-45N	95-10-50W	do.	587	WR	--	2590±40 (16)	Do.
159	do.	44-37-46N	95-10-49W	Morton Gneiss	673	WR	--	2590±40 (6)	Do.
160	do.	44-37-46N	95-10-49W	do.	669C	WR	--	3475±110(26)	Do.
161	do.	44-37-46N	95-10-49W	do.	660	WR	--	3475±110(26)	Do.
162	do.	44-37-46N	95-10-49W	do.	629B	WR	--	3475±110(26)	Do.
163	do.	44-38-25N	95-10-50W	amphibolite, Morton Gneiss	BN-74-28	WR	--	2950±245(9)	Do.
164	do.	44-38-25N	95-12-30W	do.	BN-74-26	WR	--	2950±245(9)	Do.
165	do.	44-38-25N	95-11-55W	do.	BN-74-25	WR	--	2950±245(9)	Do.
166	do.	44-39-00N	95-11-00W	Morton Gneiss	03-1	WR	--	2240	Tsunakawa and Yanagisawa, 1981
167	Renville or Redwood	44-34-30N	95-06-00W	gneiss	784	WR	--	2555±55 (10)	Goldich and Wooden, 1980
168	do.	44-34-30N	95-06-00W	do.	783	WR	--	2590±40 (16)	Do.
169	do.	44-34-30N	95-06-00W	do.	772	WR	--	2555±55 (10)	Do.
170	do.	44-34-30N	95-06-00W	Morton Gneiss	785	WR	--	2590±40 (16)	Do.
171	do.	44-34-30N	95-06-00W	do.	740	WR	--	3475±110(26)	Do.
172	do.	44-34-30N	95-06-00W	do.	739A	WR	--	3475±100(26)	Do.
173	do.	44-34-30N	95-06-00W	aplite	741	WR	--	2160	Do.
174	Sherburne	45-30-15N	94-10-55W	St. Cloud	10	B	--	1780	Keighin and others, 1972
175	Stearns	45-28-05N	94-20-06W	Granodiorite	11	H	1800±90	--	Hanson, 1968
176	do.	45-28-30N	94-20-00W	Granite	KA-6	B	1650±80	--	Goldich and others, 1961
177	do.	45-28-30N	94-20-00W	quartz monzonite	532	B	1690	--	Keighin and others, 1972
178	do.	45-31-32N	94-12-06W	granodiorite, St. Cloud	KA-10	B	1790±90	--	Goldich and others, 1961
179	do.	45-31-40N	94-16-57W	Granite	14	WR	1580±80	--	Hanson, 1968
180	do.	45-31-42N	94-17-00W	basalt dike	536	B	1680	--	Keighin and others, 1972
181	do.	45-31-56N	94-14-23W	quartz monzonite	13	WR	1470±75	--	Hanson, 1968
182	do.	45-32-09N	94-13-52W	do.	12	WR	1290±70	--	Do.
183	do.	45-38-07N	94-13-23W	St. Cloud Granite	KA-58	B	1650±80	1710±80	Goldich and others, 1961
184	Yellow Medicine	44-33-55N	95-35-01W	Sacred Heart Granite	KA-24	B	2300±115	--	Goldich and others, 1961, 1970
185	do.	44-41-32N	95-21-40W	amphibolite	SH-1	WR	--	--	Willson, 1976
186	do.	44-47-00N	95-33-00W	diabase dike	06	WR	2160	--	Tsunakawa and Yanagisawa, 1981

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)
 [Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
 H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz, WR, whole rock]

Map no.	County	Location	Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
								Model	K-Ar	Rb-Sr	
187	Yellow Medicine	44-47-15N	95-31-49W		andesite dike	M8315	B	1800±90	--	--	Hanson and Himmelberg, 1967
188	do.	44-47-58N	95-32-10W		gneiss	GP-20	H	1690±85	--	--	Wilson, 1976
189	do.	44-48-00N	95-32-14W		do.	GP-6	WR	--	--	3462±140(5)	Do.
							B	--	--	1859 (2)	
							WR	--	--	1768 (2)	
							PL	--	--	3462±140(5)	Do.
							WR	--	--	3462±140(5)	
190	do.	44-48-00N	95-32-15W		do.	GF-4	WR	--	--	1745	
							B	--	--	1754	
							Pl	--	--	1741±40 (5)	
							WR	--	--	2500 (3)	Goldich and others, 1980
191	do.	44-48-00N	95-32-15W		metagraywacke	815	Mn	--	--	2500 (3)	Do.
192	do.	44-48-00N	95-32-15W		do.	817	WR	--	--	2500 (3)	Do.
193	do.	44-48-00N	95-32-15W		do.	816	WR	--	--	2500 (3)	Do.
194	do.	44-48-01N	95-32-15W		gneiss	KA-22	B	1790±90	--	--	Goldich and others, 1961
195	do.	44-48-01N	95-32-16W		do.	GF-23	WR	--	--	3462±140(5)	Wilson, 1976
196	do.	44-48-12N	95-32-17W		do.	GF-3	WR	--	--	3462±140(5)	Do.
							Pl	--	--	1870 (3)	
							Q	--	--	1650 (2)	
							WR	--	--	2343±256(4)	Do.
197	do.	44-48-03N	95-32-18W		do.	GF-5	B	--	--	1740 (2)	
							WR	--	--	1740 (2)	
							Pl	--	--	2343±256(4)	Do.
							WR	--	--	2343±256(4)	Hanson and Himmelberg, 1967
198	do.	44-48-03N	95-32-19W		do.	GF-24	WR	--	--	2620±200(8)	Wilson and Murthy, 1976
199	do.	44-48-03N	95-33-38W		do.	M8185	H	2720±135	--	3010±345(4)	Goldich and others, 1980
200	do.	44-48-04N	95-32-20W		do.	GF-1	WR	--	--	3530±55 (5)	Do.
201	do.	44-48-04N	95-32-21W		do.	GF-2	WR	--	--	3680±70 (7)	Do.
							WR	--	--	3530±55 (5)	Do.
202	do.	44-48-05N	95-32-17W		metagabbro	not given	WR	--	--	2800 (3)	Do.
203	do.	44-48-58N	95-33-45W		gneiss	54GN	WR	--	--	2800 (3)	Do.
204	do.	44-48-58N	95-33-45W		do.	54GN	WR	--	--	2800 (3)	Do.
205	do.	44-48-58N	95-33-45W		amphibolite	M-14-16	WR	--	--	2800 (3)	Do.
206	do.	44-48-58N	95-33-45W		do.	777	WR	--	--	2800 (3)	Do.
207	do.	44-48-58N	95-33-45W		do.	763	WR	--	--	2800 (3)	Do.
208	do.	44-48-58N	95-33-45W		gneiss	733	WR	--	--	3680±70 (7)	Do.
								--	--	3010±345(4)	
								--	--	3530±55 (5)	
								--	--	2265±60 (6)	

Table 13.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Minnesota (cont'd)
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
H, hornblende; Mn, magnetite; Pl, plagioclase; Py, pyroxene; Q, quartz, WR, whole rock]

Map no.	County	Location	Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
								K-Ar	Model	Isochron ¹ Rb-Sr	
209	Yellow Medicine	44-48-58N	95-33-45W		gneiss	701	WR	--	--	3680±70 (7) 3010±345(4) 3530±55 (5)	Goldich and others, 1980
210	do.	44-48-58N	95-33-45W		do.	700	WR	--	--	2265±60 (6)	Do.
211	do.	44-48-58N	95-33-45W		do.	696	WR	--	--	2575±80 (7)	Do.
212	do.	44-48-58N	95-33-45W		do.	695	WR	--	--	2575±80 (7)	Do.
213	do.	44-48-58N	95-33-45W		do.	694	WR	--	--	2575±80 (7)	Do.
214	do.	44-48-58N	95-33-45W		do.	693	WR	--	3100	2265±60 (6)	Do.
215	do.	44-48-58N	95-33-45W		do.	692	WR	--	--	2575±80 (7)	Do.
216	do.	44-48-58N	95-33-45W		do.	691	WR	--	--	2575±80 (7)	Do.
217	do.	44-48-58N	95-33-45W		do.	612	WR	--	--	2265±60 (6)	Do.
218	do.	44-48-58N	95-33-45W		do.	611	WR	--	--	2575±80 (7)	Do.
219	do.	44-48-58N	95-33-45W		do.	606	WR	--	--	3680±70 (7) 3530±55 (5) 3010±345(4) 2265±60 (6)	Do. Do.
220	do.	44-48-58N	95-33-45W		do.	54CR	WR	--	--	2575±80 (7)	Do.
221	do.	44-49-00N	95-33-44W		Montevideo Gneiss	606	WR	--	--	3720 (6) 3870±70 (5)	Goldich and Hedge, 1974 Goldich and others, 1961
222	do.	44-49-00N	95-33-44W		Montevideo Granite	KA-54-1	B	1760±90	1750±85	--	Hanson and Himmelberg, 1967
223	do.	44-49-12N	95-33-45W		andesite dike	M8314	B	1770±90	--	--	
							H	1730±85	--	--	
224	do.	44-49-23N	95-35-57W		Montevideo Gneiss	605	WR	--	--	3720 (6) 3870±70 (5)	Goldich and Hedge, 1974
225	do.	44-49-28N	95-34-49W		diabase dike	M8132	H	2080±105	--	--	Hanson and Himmelberg, 1967
226	do.	44-49-32N	95-35-18W		gneiss	793	WR	--	--	3035 (3)	Goldich and others, 1980
227	do.	44-49-32N	95-35-18W		do.	792	WR	--	--	3035 (3)	Do.
228	do.	44-49-32N	95-35-18W		do.	791	WR	--	--	3035 (3)	Do.
229	do.	44-49-32N	95-35-18W		do.	790	WR	--	--	3190 (2)	Do.
230	do.	44-49-32N	95-35-18W		do.	605	WR	--	--	3190 (2)	Do.
231	do.	44-50-05N	95-34-03W		do.	607	WR	--	--	3045 (3)	Do.
232	do.	44-50-05N	95-34-03W		do.	620	WR	--	--	3045 (3)	Do.
233	do.	44-50-05N	95-34-03W		do.	609	WR	--	--	3045 (3)	Do.
234	do.	44-50-05N	95-34-12W		andesite dike	M8313	H	1930±95	--	--	Hanson and Himmelberg, 1967
235	do.	44-50-16N	95-34-15W		Montevideo Gneiss	609	WR	--	--	3720 (6) 3870±70 (5)	Goldich and Hedge, 1974
236	do.	44-50-32N	95-36-06W		andesite dike	M8306	H	1720±85	--	--	Hanson and Himmelberg, 1967
237	do.	44-50-32N	95-36-14W		diabase dike	M8305	WR	1800±90	--	--	Do.

¹ Whole-rock isochron ages that are exactly the same belong to the same isochron except for the 2590±40 Ma ages--two independent isochrons gave this age. The number in parenthesis indicates the number of points forming the isochron giving the listed age.
² "weathered (altered) biotite"--age is spurious.

Table 14.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Missouri
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
H, hornblende; M, muscovite; Pl, plagioclase; WR, whole rock]

Map no.	County	Location Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
							K-Ar	Model Rb-Sr	Isochron Rb-Sr	
1	Audrain	39-08-00N	91-44-30W	pegmatite	MO4	M	1410±70	--	--	Muehlberger and others, 1966
2	do.	39-08-00N	91-44-30W	metadacite	MO3	WR	--	1510±70	--	Do.
3	Camden	38-11-00N	92-47-45W	granite	MO15	WR	--	1250±60	--	Do.
4	do.	37-54-00N	92-42-30W	pegmatite	MO18	M	--	1570±90	--	Do.
5	do.	37-53-45N	92-43-00W	do.	M-20	M	--	1360±70	--	Do.
6	Clark	40-27-30N	91-34-45W	aplite	MO2	F	--	1300±40	--	Tilton and others, 1962
7	do.	40-27-30N	91-34-45W	diorite	MO1	B	--	1150±80	--	Muehlberger and others, 1966
8	Douglas	37-00-45N	92-31-40W	do.	MO17	B	--	1510±75	--	Do.
9	Franklin	38-37-00N	90-44-30W	rhynolite	MO7	WR	--	1280±65	--	Do.
10	Iron	37-18-30N	90-43-30W	Annapolis Rhynolite	MO14	WR	--	1300±60	--	Do.
11	do.	37-38-00N	90-42-15W	pegmatite	MO11	M	1260±60	1250	--	Do.
12	do.	37-39-10N	90-41-15W	Graniteville Granite	MO12	WR	--	--	--	Bickford and Mose, 1975
13	do.	37-39-45N	90-40-50W	do.	MO8Rb-2	WR	--	--	--	Do.
14	do.	37-39-45N	90-40-50W	do.	MO8Rb-1	WR	--	--	--	Do.
15	do.	37-39-45N	90-40-50W	do.	MO8Rb-4	WR	--	--	1246±92	Do.
16	do.	37-39-45N	90-40-50W	do.	MO8Rb-3	WR	--	--	--	Do.
17	do.	37-39-45N	90-40-50W	do.	MO10	WR	--	--	--	Do.
18	do.	37-39-45N	90-40-50W	do.	MO9	WR	--	--	--	Do.
19	do.	37-40-00N	90-41-15W	do.	MO11	WR	--	--	--	Do.
20	do.	37-40-00N	90-41-15W	do.	MO12	WR	--	--	--	Do.
21	do.	37-39-40N	90-41-13W	granite	M16	B	1290±40	1290±40	--	Tilton and others, 1962
22	do.	37-39-15N	90-41-15W	xenolith in granite	not given	F	--	1270±40	--	Allen and others, 1959
23	do.	37-39-40N	90-41-00W	do.	do.	M	1220	--	--	Do.
24	do.	37-39-40N	90-41-00W	do.	do.	M	1220	--	--	Do.
25	do.	37-40-00N	90-47-30W	granite	MO12	WR	--	1230±60	--	Muehlberger and others, 1966
26	Madison	37-33-25N	90-29-05W	vein	not given	I	1360	--	--	Allen and others, 1959
27	do.	37-33-30N	90-26-30W	Silvermine Granite	MO5	F	--	--	--	Bickford and Mose, 1975
28	do.	37-33-25N	90-26-45W	pegmatite	M-4	WR	--	--	1290	Do.
29	do.	37-36-30N	90-20-30W	Slabtown Granite	MO30	M	1410±40	1400±40	--	Tilton and others, 1962
30	do.	37-37-20N	90-21-10W	do.	MO36	WR	--	--	--	Bickford and Mose, 1975
31	do.	37-37-20N	90-21-10W	do.	MO31	WR	--	--	1293±98 ²	Do.
32	do.	37-37-20N	90-21-10W	do.	MO705	WR	--	--	--	Do.
33	do.	37-37-20N	90-21-10W	do.	MO704	WR	--	--	--	Do.
34	do.	37-37-20N	90-21-10W	do.	MO703	WR	--	--	--	Do.
35	do.	37-37-45N	90-21-20W	do.	MO700	WR	--	--	--	Do.

Table 14.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Missouri (cont'd)
 [Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
 H, hornblende; M, muscovite; Pl, plagioclase; WR, whole rock]

Map no.	County	Location Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
							Model	Rb-Sr	Isochron Rb-Sr	
36	Reynolds	3731-50N	90-49-30W	Munger Granite	M028	WR	--	--	1250±44	Bickford and Mose, 1975
37	do.	3731-50N	90-49-30W	Porphyry	M026	WR	--	--		Do.
38	do.	3731-50N	90-49-30W	do.	M027	WR	--	--		Do.
						F	--	--		
						Pl	--	--	1110±40	
						H	--	--		
39	do.	37-31-30N	90-50-00W	do.	M013	WR	--	1260±70	--	Muehlberger and others, 1966
40	St. Francois	37-38-50N	90-21-30W	do.	M033	WR	--	--	1293±98	Bickford and Mose, 1975
41	do.	37-39-55N	90-33-45W	Breadtray ^a	M041	WR	--	--		Do.
				Granite						
42	do.	37-40-05N	90-33-30W	do.	M0306	WR	--	--		Do.
43	do.	37-40-15N	90-33-45W	do.	M040	WR	--	--	1262±69 ^a	Do.
44	do.	37-40-30N	90-31-30W	do.	M0398	WR	--	--		Do.
45	do.	37-40-30N	90-31-30W	do.	M0388	WR	--	--		Do.
46	do.	37-40-10N	90-24-45W	Butler Hill ^a	M021	F	--	--	1320±50	Do.
				Granite						
47	do.	37-40-30N	90-24-00W	do.	M0208	WR	--	--		Do.
48	do.	37-40-20N	90-23-45W	do.	M023	WR	--	--		Do.
49	do.	37-40-45N	90-23-30W	do.	M0315	WR	--	--	1378±72	Do.
50	do.	37-40-45N	90-23-30W	do.	M0314	WR	--	--		Do.
51	do.	37-40-45N	90-23-30W	do.	M0313	WR	--	--		Do.
52	do.	37-40-45N	90-23-30W	do.	M0312	WR	--	--		Do.
53	do.	37-40-45N	90-23-30W	do.	M0220	WR	--	--		Do.
54	do.	37-41-30N	90-32-45W	Breadtray ^a	M0308	WR	--	--		Do.
				Granite						
55	do.	37-41-30N	90-32-45W	do.	M0378	WR	--	--	1262±69 ^a	Do.
56	do.	37-42-15N	90-32-30W	do.	M0310	WR	--	--		Do.
57	do.	37-43-15N	90-31-45W	do.	M0311	WR	--	--		Do.
58	St. Charles	38-52-30N	90-54-00W	diorite	M05	B	1410±70	--	--	Muehlberger and others, 1966
59	St. Louis	38-52-00N	90-16-00W	granite	M06	K	--	1380±70	--	Do.
60	Vernon	37-44-15N	94-09-00W	do.	M016	B	1340±65	--	--	Do.
						WR	--	1420±80	--	
61	Washington	37-44-50N	90-47-30W	do.	M010	B	1240±60	1160	--	Do.
62	do.	38-06-40N	91-03-30W	aplite	M09	K	--	1360±70	--	Do.
63	do.	38-06-40N	91-03-30W	rhyolite	M08	WR	--	1340±60	--	Do.
64	McDonald	36-31-20N	94-29-30W	microgranite	1177F	K	--	1259±30	--	Denison and others, 1969
65	Laclede	37-34-00N	92-30-00W	diorite	not given	B?	1160	--	--	Allen and others, 1959

Table 14.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Missouri (cont'd)
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years; B, biotite; F, K-feldspar;
H, hornblende; M, muscovite; Pl, plagioclase; WR, whole rock]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
		Latitude	Longitude				Model	Rb-Sr	Isochron	
66	LaClède	37-33-20W	92-32-45W	amphibolite	L-2-1905	Pl	1210±30*	--	--	Honda and others, 1985; Silverter, 1984
67	Iron	37-37-00N	90-37-30W	Shepard Mountain Gabbro Dike	PRM-98-1	Pl	1238±30*	--	--	Honda and others, 1985; Silverter, 1984

* zinnwaldite

* No. 40 is part of this isochron

* U-Pb concordia-intercept age is 1500 Ma for this pluton

* Nos. 54 through 57 are part of this isochron

* Nos. 41 through 45 are part of this isochron

* *Ar/*Ar plateau age

Table 15. Data and K-Ar and Rb-Sr ages for samples of basement rock of Nebraska (cont'd)
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type	Sample no.	Material dated	Model Age (Ma)		Reference
		Latitude	Longitude				K-Ar	Rb-Sr	
1	Blaine	42-02-00N	99-43-30W	granite	NR6	K-feldspar	--	1480±70	Goldich and others, 1966
2	Boone	41-51-00N	98-05-40W	schist	NR5	whole rock	1230±60	--	Do.
3	Buffalo	40-44-10N	99-24-00W	gneiss	NR25	biotite	--	1200±60	Do.
4	do.	40-54-30N	99-22-40W	granodiorite	NR24	whole rock	--	1200±220	Do.
5	do.	40-54-30N	99-22-40W	granofels	NR23	do.	--	830±80	Do.
6	Holt	42-23-00N	99-02-15W	granodiorite	NR4	do.	--	1480±100	Do.
7	Pawnee	40-03-15N	96-01-10W	adamellite	NR27	biotite	1170±60	--	Do.
8	Rock	42-38-40N	99-22-30W	schist	NR3	K-feldspar	--	1530±190	Do.
9	Saunders	41-04-00N	96-31-50W	basalt	NR26	whole rock	1190±60	--	Do.
						do.	1000±50	--	Do.

Table 16.--Data and Rb-Sr ages for samples of basement rock of Oklahoma
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type	Sample no.	Material dated	Rb-Sr Age (Ma)		Reference
		Latitude	Longitude				Model	Isochron	
1	Delaware	36-12-00N	94-49-00W	microgranite	1180F	K-feldspar	1306±25	--	Denison and others, 1969
2	do.	36-14-30N	94-53-10W	rhyolite	1179F	do.	1277±40	--	Do.
3	Mayes	36-23-15N	95-03-00W	granite	OK10	do.	1320±80	1240±30	Muehlberger and others, 1966
4	do.	36-24-00N	95-11-30W	do.	1183F	do.	1318±20	--	Denison and others, 1969
5	do.	36-06-00N	95-22-00W	rhyolite	1202W	whole rock	1303±30	--	Do.
6	Rogers	36-15-20N	95-33-00W	granite	OK9	K-feldspar	1270±11	1240±30	Muehlberger and others, 1966
7	Osage	36-11-45N	96-05-00W	rhyolite	1201W	whole rock	1281±20	--	Denison and others, 1969
8	do.	36-22-10N	96-17-30W	microgranite	OK5	K-feldspar	1280±70	1240±30	Muehlberger and others, 1966
9	do.	36-34-20N	96-08-50W	rhyolite	OK7	whole rock	1230±60	1240±30	Do.
10	do.	36-37-00N	96-28-00W	microgranite	OK6	do.	1190±60	1240±30	Do.
11	Pawnee	36-17-00N	96-28-10W	rhyolite	OK4	do.	1220±60	1240±30	Do.
12	do.	36-25-50N	96-59-00W	do.	OK3	do.	1310±80	1240±30	Do.
13	Kay	36-55-00N	97-13-30W	adamellite	OK2	K-feldspar	1260±70	--	Do.
14	Noble	36-28-05N	97-23-45W	do.	4	microcline	1290±50	1300	Denison and others, 1966
						biotite	1300±50		
						whole rock	1340±100		

* 7-point isochron

Table 17.--Data and K-Ar and Rb-Sr ages for samples of basement rock of South Dakota
[Leaders (--) indicates age was not calculated. Do, ditto; Ma, million years]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Model Age (Ma)		Reference
		Latitude	Longitude				K-Ar	Rb-Sr	
1	Davison	43-41-40N	98-05-45W	granodiorite	SD18	biotite	--	1670±80	Goldich and others, 1966
2	Grant	45-12-30N	96-31-00W	granite	SD15	K-feldspar	--	2720±250	Do.
				(Ortonville? Granite)		whole rock	--	2490±300	
3	do.	45-12-35N	96-30-45W	Milbank Granite	406WR	K-feldspar	--	12530	Goldich and others, 1970
4	do.	45-12-40N	96-30-45W	do.	57B	whole rock	--	12530	
					KA-57K-f	biotite	1970±100	--	Goldich and others, 1961, 1970
5	do.	45-13-00N	96-31-30W	granite	SD14	K-feldspar	--	12530	
				(Ortonville? Granite)		do.	--	2590±240	Goldich and others, 1966
6	Kingsbury	44-15-00N	97-18-00W	quartz latite	SD16	whole rock	--	1700±90	Do.
7	Marshall	45-42-45N	97-58-10W	adamellite	SD13	biotite	2390±120	--	Do.
						K-feldspar	--	2350±140	
8	Sanborn	44-09-00N	97-55-15W	felsite	SD17	whole rock	1680±85	1700±80	Do.
				porphyry					
9	Tripp	43-00-20N	99-58-00W	adamellite	SD12	K-feldspar	--	1480±80	Do.
10	do.	43-09-45N	99-44-30W	do.	SD11	do.	--	1510±80	Do.
11	Union	42-36-40N	96-33-30W	do.	SD19	do.	--	1460±100	Do.

* 6-point isochron, includes samples in Minnesota

Table 18.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Wisconsin
[Leaders (--) indicate age was not calculated. Do, ditto; Ma, million years; A, apatite; B, biotite;
F, K-feldspar; H, hornblende; M, muscovite; Mi, microcline; WR, whole rock]

Map no.	County	Location Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)		Reference
							K-Ar	Model Rb-Sr	
1	Clark	44-32-30N	90-36-00W	gneiss	KA-330	B	1490	--	Goldich and others, 1966
2	Columbia	43-27-57N	89-31-43W	rhyolite	BA-1	WR	--	--	Dott and Dalziel, 1972
3	Florence	45-45-56N	88-04-00W	Hoskin Lake Granite	VS68-91	WR	--	--	Van Schmus and others, 1975b
4	do.	45-47-00N	88-05-00W	granite	W11	B	1170±60	--	Goldich and others, 1966
5	Marinette	45-45-50N	88-02-41W	quartz diorite 27(LS-53)		B	1380	1320	Aldrich and others, 1965
						H	1585	--	
6	do.	45-46-15N	88-01-42W	Hoskin Lake Granite	26(LS-54)	B	1230	1320	Do.
						M	1360	1470	
						F	1080	1500	
7	Florence	45-46-06N	88-04-18W	do.	W506	B	--	1245	Peterman and others, 1985
8	Marinette	45-42-06N	88-04-54W	Dunbar Gneiss	W504	WR	--	--	Do.
						B	--	1277	
9	Florence	45-43-36N	88-07-36W	Hoskin Lake Granite	W511	WR	--	--	Do.
						B	--	1384	
10	do.	45-43-36N	88-11-36W	Dunbar Gneiss	W491	WR	--	--	Do.
						B	--	1108	
						WR	--	1766 (12)	
11	do.	45-46-00N	88-13-00W	amphibolite, Quinneseec Formation	28(LS-125)	B	1350	1330	Aldrich and others, 1965
						H	1375	--	
12	do.	45-46-30N	88-19-42W	Bush Lake Granite	W411F	B	--	1144	Peterman and others, 1985
13	do.	45-46-00N	88-17-18W	do.	W744	WR	--	--	Do.
						B	--	1166	
14	Marathon	44-57-15N	89-25-15W	tonalite	28-84	WR	--	--	Z. E. Peterman (USGS), oral commun., 1985
15	do.	44-46-10N	89-41-10W	metavolcanic	D-1366	WR	--	--	Van Schmus and others, 1975b
							--	1605±45 (5) 1580±23 (10)	
16	do.	44-47-20N	89-40-50W	granite	VS-72-45	WR	--	--	Do.
							--	1608±86 (5) 1620±31 (14) 1579±42 (11)	
17	do.	44-53-20N	89-39-10W	do.	D-1383	WR	--	--	Van Schmus and others, 1975a
18	do.	44-54-20N	89-43-00W	granite, Wau- sau Syenite Complex	VS72-57	WR	--	1407 1406	Do.
19	do.	44-57-50N	89-40-00W	do.	VS70-119	WR	--	--	Do.
20	do.	44-57-50N	89-40-00W	do.	VS70-121	WR	--	1415 1475	Do.
21	do.	44-58-33N	89-35-50W	rhyolite	D-1539	WR	--	--	Van Schmus and others, 1975b
22	do.	44-59-30N	89-38-30W	metavolcanic	D-1363	WR	--	--	Do.
							--	1605±45 (5) 1580±23 (10) 1437±34 (14)	
23	do.	45-00-50N	89-19-00W	Red River Quartz Monzo- nite ²	VS72-48	WR	--	--	Van Schmus and others, 1975a

Table 18.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Wisconsin (cont'd)
 [Leaders (--) indicate age was not calculated. Do, ditto; Ma, million years; A, apatite; B, biotite;
 F, K-feldspar; H, hornblende; M, muscovite; MI, microcline; WR, whole rock]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
		Latitude	Longitude				K-Ar	Model	Rb-Sr	
24	Marathon	45-00-23N	89-29-48W	metasediment	D-1362	WR	--	--	1605±45 (5) 1580±23 (10)	Van Schmus and others, 1975b
25	do.	45-01-58N	89-32-31W	granite	D-1357	WR	--	1590	1553±95 (5) 1580±23 (10)	Do.
26	do.	45-02-20N	89-29-57W	do.	D-1358	WR	--	1600	1579±42 (11) 1553±95 (5)	Do.
27	do.	45-03-47N	89-38-20W	do.	D-1361	WR	--	1597	1580±23 (10) 1579±42 (11)	Do.
28	do.	45-04-11N	89-39-44W	do.	D-1364	WR	--	1554	1580±23 (10) 1579±42 (11)	Do.
29	Marquette	45-18-28N	88-02-40W	Athelstane Quartz	VS68-77	WR	--	1697	1770±50 (7)	Do.
30	do.	45-18-28N	88-02-40W	Monzonite	VS68-76	WR	--	1716	1770±50 (7)	Do.
31	do.	45-18-28N	88-02-40W	do.	VS68-78	WR	--	1642	1579±42 (11)	Do.
32	do.	45-19-12N	88-00-42W	aplite	W533	WR	--	--	1766 (12)	Peterman and others, 1985
33	do.	45-25-38N	88-06-35W	Athelstane Quartz	VS69-31	WR	--	--	1770±50 (7)	Van Schmus and others, 1975b
34	do.	45-25-45N	88-14-00W	do.	VS69-34	WR	--	--	1770±50 (7)	Do.
35	do.	45-25-50N	88-09-30W	do.	VS69-33	WR	--	--	1770±50 (7)	Do.
36	do.	45-30-54N	88-09-48W	do.	W913	B	--	1385	--	Peterman and others, 1985
37	do.	45-32-57N	88-09-20W	do.	VS69-32	WR	--	--	1770±50 (7)	Van Schmus and others, 1975b
38	do.	45-32-42N	88-00-00W	do.	W903	B	--	1354	--	Peterman and others, 1985
39	do.	45-37-36N	88-02-24W	Newingham Tonalite	W123	B	--	1502	--	Do.
40	do.	45-39-00N	88-05-36W	do.	W132	WR	--	1326	1766 (12)	Do.
41	do.	45-39-54N	88-17-36W	Dunbar Gneiss	W742	WR	--	1131	1766 (12)	Do.
42	do.	45-40-00N	88-09-30W	do.	W651	WR	--	1172	1766 (12)	Do.
43	do.	45-40-42N	88-12-48W	aplite	W143B	WR	--	1405	1766 (12)	Do.
44	do.	45-40-42N	88-12-48W	Dunbar Gneiss	W143A	B	--	1160	--	Do.
45	do.	45-39-06N	88-13-48W	do.	W145	WR	--	1163	1766 (12)	Do.
46	do.	45-39-54N	88-15-30W	do.	W679A	B	--	1119	1766 (12)	Do.
47	do.	45-40-43N	88-03-54W	Newingham Tonalite	W739	WR	--	1307	1766 (12)	Do.

Table 18.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Wisconsin (cont'd)
 [Leaders (--) indicate age was not calculated. Do, ditto; Ma, million years; A, apatite; B, biotite;
 F, K-feldspar; H, hornblende; M, muscovite; Mi, microcline; WR, whole rock]

Map no.	County	Location Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)		Isochron Rb-Sr	Reference
							K-Ar	Model Rb-Sr		
48	Marquette	43-42-10N	89-20-30W	rhyolite	VS70-84	WR	--	1620	1630±39 (9) 1620±31 (14)	Van Schmus and others, 1975b
49	do.	43-42-10N	89-20-30W	do.	VS70-83	WR	--	1688	1630±39 (9) 1620±31 (14)	Do.
50	do.	43-42-50N	89-26-55W	do.	VS70-81	WR	--	1627	1630±39 (9) 1620±31 (14)	Do.
51	do.	43-43-00N	89-27-30W	do.	VS70-82	WR	--	1643	1630±39 (9) 1620±31 (14)	Do.
52	do.	43-47-40N	89-19-40W	granite	VS70-18	WR	--	1612	1608±86 (5) 1620±31 (14) 1579±42 (11)	Do.
53	do.	43-47-40N	89-19-40W	Maushara Granite	VS70-22	WR	--	1682	1608±86 (5) 1620±31 (14) 1579±42 (11)	Do.
54	Price	45-46-00N	90-32-00W	granite	W54	WR B	-- --	-- 1305	1885±65 (5) --	Sims and Peterman, 1980; Z. E. Peterman (USGS), oral commun., 1985
55	do.	45-58-00N	90-18-30W	gneiss	RL-2	WR	--	1805	--	Z. E. Peterman (USGS), oral commun., 1985
56	do.	45-49-00N	90-10-00W	granite	W55	B M1 AP WR	1598±54 -- -- --	-- -- -- --	1545±55 (4) --	Sims and Peterman, 1980
57	Oneida	45-45-00N	89-05-00W	gneiss	IM-12	WR B	-- --	-- 1134	1885±65 (5) --	Peterman and others, 1985
58	do.	45-34-26N	89-03-08W	metavolcanic	D-1354	WR	--	--	1605±45 (5) 1580±23 (10)	Van Schmus and others, 1975b
59	do.	45-32-25N	89-09-55W	granite	D-1356	WR	--	1555	1553±95 (5) 1560±23 (10) 1579±42 (11)	Do.
60	Rusk	45-24-00N	91-09-00W	tonalite	W66	WR	--	--	1845±85 (3)	Do.
61	do.	45-33-00N	90-57-30W	do.	W119	B WR	-- --	-- 1690	-- 1845±85 (3)	Z. E. Peterman (USGS), oral commun., 1985; Van Schmus and others, 1975b
62	do.	45-36-00N	91-07-00W	do.	W118	B WR	-- --	-- 1693	-- 1845±85 (3)	Z. E. Peterman (USGS), oral commun., 1985; Van Schmus and others, 1975b
63	Sauk	43-22-57N	89-47-47W	Baxter Hollow Granite	68-6C	WR	--	1530±130	--	Dott and Dalziel, 1972
64	do.	43-22-57N	89-47-47W	do.	68-6B	WR	--	1560±140	--	Do.
65	do.	43-22-57N	89-47-47W	do.	68-6A	WR	--	1500±120	--	Do.
66	do.	43-25-08N	89-53-29W	phyllite, Baraboo	68-2	WR	1119±40	--	--	Do.
67	do.	43-26-01N	89-46-29W	Quartzite	US-12	WR	770±50	--	--	Do.
68	do.	43-30-12N	89-37-27W	rhyolite	U-2	WR	--	--	1610±40 (5)	Do.

Table 18.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Wisconsin (cont'd)
 [Leaders (--) indicate age was not calculated. Do, ditto; Ma, million years; A, apatite; B, biotite;
 F, K-feldspar; H, hornblende; M, muscovite; Mi, microcline; WR, whole rock]

Map no.	County	Location		Rock type or formation	Sample no.	Material dated	Age (Ma)		Reference
		Latitude	Longitude				Model K-Ar	Isochron Rb-Sr	
69	Sauk	43-30-20N	89-38-15W	rhyolite	U-6	WR	--	1610±40 (5)	Do.
70	do.	43-30-41N	89-39-47W	do.	U-1	WR	--	1610±40 (5)	Do.
71	do.	43-30-41N	89-39-47W	do.	U-4	WR	--	1610±40 (5)	Do.
72	Sawyer	45-40-00N	90-44-00W	granodiorite	W249B	B	1615±55	} 1655±55 (4)	Sims and Peterman, 1980
						Mi	--		
						Ap	--		
						WR	--		
73	do.	45-40-00N	90-44-00W	tonalite	W249A	B	--	1885±65 (5)	Z. E. Peterman (USGS), oral commun., 1985; Sims and Peterman, 1980
						WR	--	1885±65 (5)	
74	do.	45-46-00N	91-02-00W	do.	W251	B	--	1696	Z. E. Peterman (USGS), oral commun., 1985; Sims and Peterman, 1980
						WR	--	1885±65 (5)	
75	Shavano	44-44-25N	89-00-00W	Red River Quartz Monzo- nite ²	VS70-57	WR	--	1437±34 (14)	Van Schmus and others, 1975a
76	do.	44-48-30N	88-56-00W	do.	VS70-55	WR	--	1437±34 (14)	Do.
77	do.	44-48-40N	88-47-00W	do.	VS70-53	WR	--	1455	Do.
78	do.	44-49-35N	88-41-30W	do.	VS70-45	WR	--	1448	Do.
79	do.	44-50-40N	88-44-30W	do.	VS70-50	WR	--	1426	Do.
80	do.	44-52-55N	88-47-00W	do.	VS70-51	WR	--	1406	Do.
81	do.	44-55-40N	88-54-00W	do.	VS70-48	WR	--	1437±34 (14)	Do.
82	do.	44-56-40N	88-45-30W	do.	VS70-44	WR	--	1437±34 (14)	Do.
83	Menominee	44-58-35N	88-49-30W	do.	VS70-40	WR	--	1437±34 (14)	Do.
84	Waupaca	44-25-00N	89-03-00W	granite	KA-12	B	1440	--	Goldich and others, 1961 Van Schmus and others, 1975a
85	do.	44-26-10N	89-05-00W	Red River Quartz Monzo- nite ²	VS70-31	WR	--	1437±34 (14)	
86	do.	44-38-30N	88-51-30W	do.	VS70-58	WR	--	1437±34 (14)	Do.
87	Waushara	44-02-05N	89-07-29W	Waushara Granite	VS70-26	WR	--	1608±86 (5)	Van Schmus and others, 1975b
							--	1620±31 (14)	
88	do.	44-02-35N	89-05-52W	do.	VS70-29	WR	--	1579±42 (11)	Do.
89	Wood	44-25-40N	89-46-40W	aplite	D-1378	WR	--	1608±86 (5)	Do.
90	Green Lake	43-43-50N	89-10-10W	rhyolite	VS70-7	WR	--	1620±31 (14)	
91	do.	43-43-50N	89-10-10W	do.	VS70-8	WR	--	1630±39 (9)	Do.
92	do.	43-58-20N	88-56-00W	metarhyolite	VS70-2	WR	--	1620±31 (14)	Do.
93	do.	43-58-30N	88-56-00W	rhyolite	VS70-1	WR	--	1620±31 (14)	Do.
							--	--	Do.
							--	1475	Do.
							--	1414	Do.

Table 18.--Data and K-Ar and Rb-Sr ages for samples of basement rock of Wisconsin (cont'd)
 Leaders (--) indicate age was not calculated. Do, ditto; Ma, million years; A, apatite; B, biotite;
 F, K-feldspar; H, hornblende; M, muscovite; Mi, microcline; WR, whole rock

Map no.	County	Location Latitude	Longitude	Rock type or formation	Sample no.	Material dated	Age (Ma)			Reference
							K-Ar	Rb-Sr	Isochron ¹ Rb-Sr	
94	Green Lake	43-50-45N	88-51-35W	ryholite	W13	WR	--	1540±70	--	Goldich and others, 1966
95	do.	43-43-40N	88-53-30W	porphyry ryholite	VS70-6	WR	--	1564	1630±39 (9) 1620±31 (14)	Van Schamus and others, 1975b
96	do.	43-43-40N	88-53-30W	do.	VS70-5	WR	--	1619	1630±39 (9) 1620±31 (14)	Do.
97	do.	43-43-40N	88-53-30W	do.	VS70-3	WR	--	1635	1630±39 (9) 1620±31 (14)	Do.
98	Jefferson	43-07-30N	85-52-30W	Waterloo Quartzite	W14	M	1420±70	--	--	Goldich and others, 1966
99	Lincoln	45-18-15N	89-46-00W	tonalite	W314	B	--	1249	--	Z. E. Peterman (USGS), oral commun., 1985
100	Oconto	45-07-50N	88-26-00W	Belongia Granite ²	VS69-43	WR	--	1354	--	Van Schamus and others, 1975a
101	do.	45-09-40N	88-28-00W	do.	VS72-59	WR	--	1329	--	Do.
102	do.	45-10-30N	88-28-00W	do.	VS69-41	WR	--	1383	--	Do.
103	do.	45-10-30N	88-28-00W	do.	VS69-40	WR	--	1389	--	Do.
104	do.	45-11-00N	88-29-00W	ryholite	W12	F	--	1350±70	--	Goldich and others, 1966
105	do.	45-11-35N	88-26-00W	porphyry Hager Rhyolite Porphyry ²	VS70-74	WR	--	1433	--	Van Schamus and others, 1975a
106	do.	45-12-30N	88-23-00W	do.	VS70-73	WR	--	1398	--	Do.
107	do.	45-12-30N	88-23-00W	do.	VS70-70	WR	--	1440	--	Do.
108	do.	45-12-50N	88-24-30W	do.	VS70-69	WR	--	1375	--	Do.
109	Portage	44-33-15N	89-34-00W	Red River Quartz Monzonite ²	VS72-38	WR	--	1479	1437±34 (14)	Do.
110	do.	44-33-30N	89-35-30W	do.	VS72-39A	WR	--	1457	1437±34 (14)	Do.
111	do.	44-33-30N	89-35-35W	do.	D-1369	WR	--	1379	--	Do.
112	Adams	44-09-57N	89-43-13W	granite	not given	3	--	--	1580 (3)	Taylor, 1983

¹ Whole-rock isochron ages that are exactly the same belong to the same isochron. The number in parenthesis indicates the number of points forming the isochron giving the listed age.

² Part of the Wolf River batholith.

³ Mineral concentrates.