RADIOMETRIC GEOCHRONOLOGY REAPPRAISED

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The use of radiometric dating in Geology involves a very selective acceptance of data. Discrepant dates, attributed to open systems, may instead be evidence against the validity of radiometric dating.

A systematic and critical review of dating applications is presented; emphasis being placed on the geologic column. Over 300 serious discrepancies are tabulated. It is, however, demonstrated that most discrepant results are not published. Discrepant dates capriciously relate to petrography and regional geology.

Neither internal consistencies, mineral-pair concordances, nor agreements between different dating methods necessarily validate radiometric dating.

The large spread of values for igneous and metamorphic rocks (especially of the Precambrian) may indicate artificial imposition of time-values upon these rocks.

Plan of this Article

Introduction

Radiometric dating is supposed to confirm and quantify the evolutionary-uniformitarian claims of geologic ages with biological evolution. All speculations of a legendary Flood, a local Flood, or a tranquil Flood placed aside, both evolutionist-uniformitarians and Creationist-Diluvialists will agree that there is no evidence of a truly global Flood if uniformitarian time scales are accepted in any way. Once divested of all the time claims imposed upon it, the fossiliferous rock testifies to the Noachian Deluge, and all life (fossil and extant) is then mutually contemporaneous as is demanded by a literal six (24 hr.) day Creation. Therefore acceptance of radiometric dating abrogates not merely a young earth, but also the six-day Creation and the Universal Deluge.

Creationist-Diluvialists have uncovered dozens of powerful evidences for an Earth age of only several thousand years, and these scientific evidences are summarized by Morris.[212] Reasons for questioning the validity of radiometric dating are presented in the major works by Whitcomb and Morris,[213] Cook,[214] Slusher,[215] and Wilkerson.[216] These works center on the many unproven assumptions behind radiometric dating. This work, by contrast, seeks critically to evaluate the claims of radiometric dating via a geological approach; the author believing that dating is best understood in its geologic context.

The intended theme of this work is best portrayed by the following statements by Goldich:[217] "Fifteen years ago, radiometric age determinations on minerals and rocks were so startling that 'absolute age' became a password. Intensive research with successive improvements in the K-Ar, Rb-Sr, and U-Pb methods, however, revealed that geologic processes influence isotopic systems and that the age measurements are analytical values that commonly require geological interpretation." Thus open systems caused by geologic events ("geological interpretation") is claimed as a cause of spurious dates, but a less self-congratulatory view would be that only a *select* number of dates are accepted as indicating the true age of the rock; others explained away as having become open systems.

Owing to the breadth of the topic of radiometric dating, this work will not consider any extraterrestrial dating, nor marine dating, and little Pleistocene dating. Attention will be focused upon the dating of biostratigraphically-defined materials in the Phanerozoic. The dating of the fossil record is thus emphasized over the Pre-Cambrian because it is the Phanerozoic which is a pivotal point in both the evolutionist-uniformitarian and Creationist-Diluvialist paradigms, and because that is where radiometric dating can be compared with fossil dating.

I. Phanerozoic Geochronology: Selection Amidst Contradictions

A. Introduction to Phanerozoic Geochronology

The values given for geologic periods in terms of the time come from dated material that is biostratigraphically defined. It will become obvious that actually grossly contradictory results are obtained from materials of the same geologic periods and that some values are accepted as true, while others are explained away.

It can not be said that discrepancies are primarily caused by the poorer analytical equipment available in the late 1950's/early 1960's as contrasted with that of the late 1970's. Recently, Waterhouse[315] said: "Improved laboratory techniques and improved constants have not reduced the scatter in recent years. Instead the uncertainty grows as more and more data is accumulated . . . ."

Table 1 is a compilation of over 300 different sets of dates that are in gross conflict with one another and with expected values for their indicated paleontological positions. How unwanted and discrepant dates are ra-

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Table 1. The phanerozoic time scale: major inconsistencies. This is a compilation of over 350 different radiometric dates that are very anomalous with respect to accepted values for their biostratigraphic positions. At left are the values for geological periods (and subdivisions of them) in millions of years, taken from radiodates that are considered to be correct. The numerical values for the subdivisions of the time scale are those of Braziunas.[211] To the right of them are given the discrepant results. How these dates are explained away is extensively discussed in the text.

The asterisk (*) denotes a date from a biostratigraphically-bracketed igneous body; non-asterisk items are direct dates on sedimentary rock. Dates for sedimentary rocks are obtained from separated authigenic minerals: g-glauconite; il-illite. Directly dating fossils (ca-calcite) is not considered to be reliable (only 2 examples are given) and is hardly ever done. Dates from igneous rocks are obtained from entire samples (wr- whole-rock; wri-whole rock isochron) or from mineral separates (mi-mineral isochron; b-biotite; s-sanidine; l-lepidolite; m-muscovite; p-phlogopite; h-hornblende; arf-arfvedsonite; z-zircon; mo-monzanite; ch-chevkinite; hu-hutchettolite; gl-undevitrified volcanic glass (1 example only given); pl-plagioclase feldspar). Information not given is denoted: ng.

Age Expected	*Age Obtained*	*Method & Material*	*Common or Formational Name/Locality*	*Reference*
			TERTIARY	
1	81	K-Ar g	sandstone/Yenisei, USSR	1
5	1-10.6	K-Ar s, b	*Bailey Ash/California, USA	2
9.5	13-31	K-Ar s	*tuff/Nevada, USA	322
10	95	K-Ar wr	*basalt/Nigeria	3
10	153 ± 10	K-Ar h	*Nogales Fm. (tuff)/Arizona, USA	4
11	6.4-7.6 7.2	K-Ar ng Rb-Sr mi	*Mount Capanne granodiorite/Elba Island, Italy	5
12	30-36	K-Ar g	ng/ng	6
23	3.4	K-Ar wr	*Suta Volcanics/Solomon Islands	391
<25	30-40	Rb-Sr wri	*volcanics/Saudi Arabia	7
27	31-43	K-Ar wr	*Velolnyk suite (volcanics)/Kamchatka, USSR	392
30	21.6	K-Ar s	*tuff/Oregon, USA	8
38	21-2	K-Ar g	sediments/New Zealand	9
42	18-36	K-Ar g	sediment/California, USA	10
42	31	K-Ar g	sediment/Hordhorn, W. Germany	11
47	24-153	K-Ar b	*tuffs/Wyoming, USA	12
52	39	K-Ar g	Winona sand/Gulf Coast, USA	13
55	200-280	Pb^{207}/Pb^{206}	ores/Wyoming, USA	393
60	38	K-Ar g	ng/Gulf Coast, USA	13
60	35-110 42-113 114-430	Pb^{206}/U^{238} Pb^{207}/U^{235} Pb^{207}/Pb^{206}	Front Range ores/Colorado, USA	14
<65	49-271	K-Ar wr	*Mafic Dykes/Mull, Scotland	323
65	46	K-Ar b	*Ruby Star Granodiorite/Arizona, USA	15
65	46	K-Ar g	sediment/California, USA	16
65	260 ± 54	Rb-Sr wri	*Loch Uisg Granophyre/Scotland	324
>65	42-48	K-Ar wri	*andesite/British Columbia, Canada	17
<70	500	Rb-Sr wri	*basalts/Patagonia, Argentina	394
<70	494 ± 20 756 ± 80 794 ± 50	Pb^{206}/U^{238} z Pb^{207}/U^{235} z Pb^{208}/Th^{232} z	*granites/Utah, USA	18
<70	2750 300	Rb-Sr wri Pb^{207}-Pb^{206}	*volcanics/Inner Hebrides, Scotland	18
<70	90-1330	Rb-Sr wri	*basalts/western USA	20
<70	290, 400	Rb-Sr wri	*andesite/Peru	20

CRETACEOUS

70	103	K-Ar ng	*Brazeau FM. (bentonite)/Alberta, Canada	21
>70	9-31	Rb-Sr b	*Mandi granite/Manikaran, India	395
72	12-21 20	K-Ar ng Rb-Sr wri	*Pamir-Shugnan granites/India	22
74	104±8	K-Ar g	Tinton Sands/New Jersey, USA	23
>74	47	K-Ar h	*Ginger Ridge granodiorite/Jamaica	24
<75	490-770	Pb^{207}/Pb^{206}	ore/Nigeria	325
<75	120, 481	K-Ar h	*diorite/Colorado, USA	60
75	142	K-Ar p	*kimberlite/Orange Free State	25
77	105±3	K-Ar g	Woodbury Fm./New Jersey, USA	23
>82	45, 55	K-Ar wr	*Mifune Group (tuffs)/Kyusha, Japan	326
~90	~250	Rb-Sr wri-il	Pierre Shale/South Dakota, USA	26
96	44, 76-8	K-Ar g	sediment/Brezina, Czechoslovakia	27
96	66-116	K-Ar g	sandstone/Georgia, USSR	28
99	42 59-82	K-Ar il K-Ar g	*Viking Fm. (bentonite)/Alberta, Canada	29
100	142±10	K-Ar g	ng/ng	6
100	68-73	U^{238}/Pb^{206}	*Mbeya Carbonatite/Tanganyika	30
100	170-8	K-Ar il	clays/Texas, USA	31
100	22-1343	K-Ar b, h, wr	*lamprophyre dikes/New Zealand	396
101	75-115	K-Ar g	Clearwater Fm./Alberta, Canada	32
101	70	K-Ar g	sediment/north Caucasus, USSR	27
>102	72-143	K-Ar b	*Eagle Granodiorite/British Columbia, Canada	33
105	70-80	K-Ar b	Santa Lucia Plutons/California, USA	327
>105	61	K-Ar b	*Tres Guanos Quartz Monzonite/Cuba	34
>112	58-143	K-Ar b, h	*Peninsular Ranges Batholith/California, USA-Mexico	35
115	31	K-Ar g	sediment/Salzgitter, W. Germany	36
118	88	K-Ar g	sediment/Esciagnelles, France	37
~120	60-68, 129-150	K-Ar wr	*trachybasaltic dikes/Cordoba, Argentina	328
<120	241	K-Ar wr	*diabase dyke/Franklin, Canada	38
>122	71-149	K-Ar wr	*Isfjorden diabases/Advantdalen, Norway	329
<130	235-382	Pb^{207}/Pb^{206} z	*granites/Japan	39
<130	500	Rb-Sr wri	*volcanics/James Ross Island, Antarctica	40
~130	70 70	K-Ar wr Rb-Sr wri	*volcanics/Chile	330

JURASSIC

±130	74±5	Rb-Sr wri	*Serie Tobifera volcanics/Chile	331
>130	74	K-Ar wr	*Rock Hill Basalt/Nevada, USA	41
>130	95, 120	K-Ar wr	*La Teta Lava/Colombia	332
<140	163, 186	K-Ar ng	*Coast Range Batholith/Alaska, USA	42
140	275±20	K-Ar h	*Pearse Peak Diorite/Oregon, USA	43
~140	435-780	Rb-Sr il	Shale/Great Basin, Australia	333

140	105-171 104-150	K-Ar b, h Rb-Sr wri	*Nelson Batholith/British Columbia, Canada	44, 397
140	95-160	K-Ar b, h	*Wallowa Batholith/Oregon, USA	45
140	50	K-Ar wr	*basalt/Caucasus Mts., USSR	398
>140	3-23	Rb-Sr m, b	*Mt. Bukulia Granite/Yugoslavia	334
145	106, 117	K-Ar g	sediment/Milne Land, Greenland	32
145	77-180	K-Ar ca	Malm Limestones/Bavaria, W. Germany	46
148	86-118	K-Ar g	Fernie Fm./Alberta, Canada	47
>150	114-78	K-Ar wr	*Apoteri volcanics/Guyana-Brazil	48
152	26	K-Ar g	sediment/Braunschweig, W. Germany	49
>153	67-240	K-Ar b, h, m	*granites/West Malaysia	50
>153	110	Rb-Sr mi	*pegmatite/New Zealand	399
~155	61±2	K-Ar h	*Novatak Glacier pluton/Alaska, USA	335
~155	1020±320	Rb-Sr wri	*volcanics/Dronning Maud Land, Antarctica	51
157	92-145	K-Ar wr	*volcanics/Zuidwal, Netherlands	336
160	140-165 85-163	K-Ar b Rb-Sr b	*Carmel Fm. (bentonite)/Utah, USA	52
160	70-109	K-Ar wr	*Rajmahal Traps (lavas)/India	400
~160	78	K-Ar b	*Chocolate Fm. (volcanic breccia)/Peru	337
165	106±6	K-Ar b	*granodiorite/British Columbia, Canada	53
165	21	K-Ar g	sediment/Coston Del Vette, Italy	54
165	63, 138-178	K-Ar b	*Topley intrusions/British Columbia, Canada	55
165	176, 228	Rb-Sr wri-il.	Bedford Canyon Fm. (shale)/California, USA	425
165	109-165	K-Ar wr	*Volcanics/North Sea, England	426
<170	7-250	K-Ar wr	*Basalts/Victoria Land, Antarctica	427
<170	223	K-Ar b	*granodiorite/Yukon, Canada	56
170	78-90	K-Ar b, h	*Chigmit Mountains Batholith/Alaska, USA	57
~175	265	Rb-Sr wri	*rhyodacite/California, USA	338
178	134-76	K-Ar wr	*Kirkpatrick Basalt/Victoria Land, Antarctica	58
<180	296-302	K-Ar wr	*dolerite/Midlands, England	59
<180	2661 2774 2860	Pb^{206}/U^{238} z Pb^{207}/U^{235} z Pb^{207}/Pb^{206} z	*Independence dikes/California, USA	401
~180	70, 120-250	K-Ar b	*granite porphyry, pegmatite/Caucasus Mts., USSR	61

TRIASSIC

~180	120-25	K-Ar wr	*Serra Geral Fm. (lavas, diabase)/Brazil	339
180	105-175	K-Ar b	*granite/Billiton, Indonesia	62
180	170-265	K-Ar b, h	*Guichon Creek Batholith/British Columbia, Canada	63
<185	244±15	K-Ar wr	*mafic dike/Idaho, USA	64
185	291	K-Ar ng	micaceous sandstone/Nilgiri, India	65
185	137-219	K-Ar wr	*Karroo volcanics/Lesotho	66
~185	186-1230	K-Ar pl, wr	*diabase dikes/Liberia	402
<190	286	K-Ar h	*Tulameen ultramafic complex/British Columbia, Canada	67
~190	79, 140	K-Ar wr	*Watchung Basalt/New Jersey, USA	68

~190	151-201	K-Ar wr	*lavas/Connecticut, USA	69
~190	178-217, 328±24	K-Ar wr	*North Mountain Basalt/Nova Scotia, Canada	70
~190	80	K-Ar b	*Mt. St. Elias pluton/Alaska, USA	340
~190	139-217	K-Ar b	*Hotailuh Batholith/British Columbia, Canada	71
~190	89-199 104, 144	K-Ar b, h Rb-Sr wri	*Klotassin Batholith/Yukon, Canada	72
<195	152-235	K-Ar wr	*Foum Zguid dolerite, lavas/Morocco	73
195	126	K-Ar gl	*tuff/Alaska, USA	74
<200	246±10	K-Ar p	*kimberlite/Siberia, USSR	428
<	170, 259	Pb^{206}/U^{238}z	*diorite/California, USA	429
<200	212-278	K-Ar wr	*gabbroids/Tien Shan, USSR	430
~200	102-110	K-Ar wr	*diabase dikes/Arctic Canada	431
~200	100-220	K-ar ng	intrusives/New Zealand	432
200	118±10	K-Ar m	*pegmatite/Neyriz, Iran	433
~200	61-181	K-Ar wr	*volcanics/Othris, Greece	434
~200	98-107	K-Ar b	*granites, quartz monzonites/British Columbia, Canada	75
200	43-188	K-Ar ca	bone/Nordwurttemberg, W. Germany	46
200	20-218 295±20	Pb^{207}/U^{235}	Pitchblende, Chinle Fm./Arizona, USA	76
<204	270±45 360	Rb-Sr wri	*Ferrar Dolerite/Victoria Land, Antarctica	77
<205	363±15	Rb-Sr wri	*Inas Granite/Malaysia	78
~210	114-214	K-Ar ng	shale/Nilgiri, India	65
~210	175-237	Rb-Sr wri	*Predazzo granite/Dolomites, Italy	79
~220	131±5	K-Ar wr	*rhyolite/Peru	341
>225	188-270	K-Ar wr	*Korvunchana Series (basalts, tuffs, ejecta)/Tunguska, USSR	80
230	231-280	K-Ar wr	*Semeitau lavas/Kazakhstan, USSR	81

PERMIAN

230	241-75	K-Ar h	*Yakuno gabbros/Japan	342
>230	71-118	Pb^{207}/Pb^{206}	ore/Lenterios, Portugal	82
>230	97 111	Pb^{207}/U^{235} Pb^{206}/U^{238}	ore/Wittichen, W. Germany	82
>230	146-57	Pb^{207}/Pb^{206}	ore/La Crouzille, France	82
>230	87	K-Ar b	*granite/Kocaeli, Turkey	83
240	165	K-Ar g	limestone/Sokolka, USSR	84
240	173-243	Rb-Sr wri-il	Estrada Nova Fm. (shale)/Brazil	343
~240	175	K-Ar g	sediment/Kirovsk, USSR	85
240	310±70	Pb^{207}/Pb^{206}	ore/Thickley, Scotland	86
<250	346	K-Ar ng	*granite/Peru	87
~250	182	K-Ar wr	*trachyandesite lava/Caucasus Mts., USSR	85
~250	337±61	Pb^{207}/Pb^{206}	Jachymov Pitchblende/Bohemia, Czechoslovakia	88
250	165-263	K-Ar wr	*rhyolite, tuff/Zechstein, E. Germany	344

250	136-245	Rb-Sr b	*volcanics/New Zealand	89
~250	96±6	K-Ar b	*lavas/Oman, Iran	435
~250	1380	Rb-Sr wri	*Croydon Volcanics/Queensland, Australia	436
>250	130-182	K-Ar wr	*volcanics/Auk Field, England	437
>255	209	K-Ar b	*Mitaki Granite/Japan	90
<260	330-380	K-Ar p	*Stockdale kimberlite pipes/Kansas, USA	91
<260	294-351	Rb-Sr wri	*Nychum volcanics/Queensland, Australia	345
~260	165	K-Ar g	sediment/Vestspitsbergen, Norway	92
260	259-315 216	K-Ar b Th^{232}/Pb^{208}	*Oslo Series (subvolcanics)/Norway	93
260	219-280	Rb-Sr wri	*Barhalde Granite/Schwarzewald, W. Germany	94
~265	363	Rb-Sr il	Stearns Shale/Kansas, USA	95
265	193±7 230±11	K-Ar wr K-Ar b	*Filipowice Tuff/Krakow, Poland	96
265	252-374 164-595	K-Ar il Rb-Sr il	Eskridge, Stearns Shale/Kansas, USA	97
265	229-74	K-Ar wr	*Lizzie Creek Volcanics/Queensland, Australia	98
~265	245±220	Rb-Sr mi	*Donnersberg Rhyolite/Saar, W. Germany	99
<270	2700	U-Pb z	*Diorite dike/California, USA	100
<270	368±18	K-Ar b	*peridotite/Pennsylvania, USA	101
<270	1180±60	Rb-Sr wri	*Rose Dome Granite/Kansas, USA	102
<270	831	K-Ar h	*Tortilla Quartz Diorite/Arizona, USA	346
~270	280-300, 390	Rb-Sr wri	*Pine Mountain Granite/British Honduras	103
270	155	K-Ar g	sediment/ng	149

CARBONIFEROUS

>270	150-280	K-Ar b	*granites/northern Italy	104
>270	120-280	K-Ar b	*granites/Zabaikal, Mongolia	105
>270	157, 194 162, 220	Pb^{206}/U^{238} z Pb^{207}/U^{235} z	*granite/Switzerland	403
280	255, 859	Rb-Sr wri-il	Madera Fm. (shale)/New Mexico, USA	404
280	330-441	Rb-Sr il	underclays/Illinois, USA	405
280	190	K-Ar wr	*basalt, gabbro/Franklin, Canada	406
280	385	Pb^{207}/Pb^{206} z	*Monti Orfano granite/Italy	407
<285	305-475	Pb^{207}/Pb^{206}	ores/Limburg, Netherlands	106
290	220±25	Rb-Sr wri	*Wamsutta Fm. (rhyolite)/Massachusetts, USA	107
290	70-140 85	Pb^{207}/Pb^{206} K-Ar wr	*Mrzyglod diabase/Krakow, Poland	108
<300	390	U-Pb z	*porphyritic intrusions/British Columbia, Canada	109
300	139-315	K-Ar wr	*Whin Sill (diabase)/Northumberland, England	110
300	233	K-Ar il	shale/Missouri, USA	111
300	114-385	K-Ar il	shale/Iowa, USA	111
~300	85	K-Ar wr	*tuffs/Andscollo, Argentina	112
300	318-456 338-511	K-Ar il Rb-Sr il	underclays/Pennsylvania-Ohio, USA	113

300	230-55	K-Ar g	Veraya Tier sediments/Kuibyshev, USSR	114
>300	220-354	K-Ar ng	*Old Crow Batholith/Yukon, Canada	115
>300	20-350	K-Ar m, b	*granites/Caucasus Mts., USSR	116
~310	185-315	K-Ar wr	*Toadstone Lava/Derbyshire, England	117
310	162-262	K-Ar wr	*volcanics/Silesia, Poland	408
310	145	K-Ar b	*granite/Caucasus Mts., USSR	347
310	282-367	K-Ar wr	*basalt/Quebec, Canada	118
310	238	K-Ar wr	*felsite lava/Primorye, USSR	85
320	266	K-Ar wr	*porphyritic lava/Kara Mazar, USSR	85
>320	245-330	K-Ar arf., s	*Han Bogdo Batholith/Mongolia	119
330	267-312	K-Ar wr	*Waterswallows Sill/Derbyshire, England	120
>330	265±7 263±7 244±20	Pb^{206}/U^{238} z Pb^{207}/U^{235} z Pb^{207}/Pb^{206} z	*Sicker volcanics/British Columbia, Canada	121
>330	225	K-Ar b	*Vallorcine Granite/Aiguilles Rouges, Switzerland	122
334	250-78	K-Ar g	shale/Texas, USA	123
<335	420	Rb-Sr wri	*granites/Montagne Noire, France	124
~340	126±30	K-Ar wr	*pumice tuff/Nottinghamshire, England	117
<340	440±60	Pb^{207}/Pb^{206}	*Vosges granites/Col de Grosse Pierre, France	125
<340	780 2500	Pb^{207}/U^{235} z Pb^{207}/Pb^{206} z	*granite/Saxony, E. Germany	126
<340	347-500	K-Ar b	*granodiorites/Balkhash, USSR	409
340	247	K-Ar w	*dacitic lava/Aral, USSR	410
340	240-330	K-Ar ng	*granites/east Ural Mts., USSR	127
>342	268-373	Rb-Sr wri	*Nictaux granites/Nova Scotia, Canada	128
343	288, 307	K-Ar b	*Kuttung lavas/New South Wales, Australia	348
~345	154	K-Ar il	Rocky Mountain Fm./Alberta, Canada	47
>345	165	K-Ar ng	arkosic sandstone/Alexander I Land, Antarctica	129
<350	240-1630	K-Ar wr	*diabases/Georgia, USA	356
<350	400-453	K-Ar wr	*kimberlites/Siberia, USSR	411
350	222-284	K-Ar s	*Exshaw Fm. (bentonite)/Alberta, Canada	130
350	315±7	Rb-Sr wri	*tuffs/Aljustrel, Portugal	349

DEVONIAN

~350	240-330	K-Ar b	*granites/Aral, USSR	131
>350	242±10 218±11	K-Ar b Rb-Sr wri	*granite/Langkawi Island, Malaysia	50
>350	275±11	K-Ar b	*granite/Alaska, USA	132
360	290-330 286	K-Ar b Rb-Sr wri	*granite/Queensland, Australia	133
~360	248-375	K-Ar b	*biotite granite/Maine, USA	134
~360	249-93	K-Ar b	*binary granite/Maine, USA	134
~360	247±8	K-Ar b	*garnetiferous granite/Maine, USA	134
>360	239-306	K-Ar m	*Andover Granite/Massachusetts, USA	134
>360	221-241	K-Ar m, b	*Fitchburg Pluton/Massachusetts, USA	134
>360	260±8	K-Ar b	*Peabody Granite/Massachusetts, USA	134

>360	230±8	K-Ar b	*Esmond Granite/Rhode Island, USA	135
~370	173±16	Rb-Sr wri-il	Ponta Grossa Fm. (shale)/Brazil	350
370	308	K-Ar wr	*Lovozero Suite (basalt)/Kola, USSR	136
>370	307	K-Ar b	*granite/Bungonia, Australia	137
372	300-333	K-Ar wr	*Hoy Lavas (basalts)/Scotland	138
<375	440	Rb-Sr wri	*Webhannet, Lyman plutons/Maine, USA	139
375	285	K-Ar g	sediment/Saskatchewan, Canada	85
~375	246-306 241-335	K-Ar b Rb-Sr b	*granites/New Hampshire, USA	140
375	350-450	Pb^{206}/U^{238}	Chattanooga Shale/Tennessee, USA	141
<377	439±22	K-Ar b	*peridotite/New York, USA	101
380	310 305	Rb-Sr wri Rb-Sr g-mi	*Tioga Bentonite/Virginia, USA	142
380	266	K-Ar wr	*porphyritic lava/Kara Mazar, USSR	85
380	278-83	K-Ar wr	*nepheline syenite, tuff/USSR	85
~380	500-900	Pb^{207}/Pb^{206}	galena/Kazakhstan, USSR	143
390	475±80	Rb-Sr wri	*Irizar Granite/Victoria Land, Antarctica	351
390	303±18	Rb-Sr g	Carlisle Center Fm./New York, USA	144
390	295±9 605±83	K-Ar m Rb-Sr wri	*Kinsman Quartz Monzonite/New Hampshire, USA	134 140
395	238	K-Ar wr	*porphyritic lava, tuff/USSR	145
400	364-510	K-Ar b	*Shap adamellite/Westmorland, England	146,7
400	212, 360	K-Ar b	*Gocup Granite/New South Wales, Australia	352
400	321	Rb-Sr g	sediment/ng	148
400	240	K-Ar g	sediment/ng	149
400	401, 484	K-Ar h	*granite/Newfoundland, Canada	353

SILURIAN

400	290±15	K-Ar wr	*basalts/Aral, USSR	412
~400	114-190 315, 354 339±12	K-Ar b K-Ar h Rb-Sr wri	*Hikami granite/Japan	150
400	173±4	K-Ar wr	*rhyolite tuff/Florida, USA	438
400	264-380	K-Ar ng	*Mount Peyton Batholith/Newfoundland, Canada	439
>400	339±5	K-Ar m	*granite/Peru	440
>400	189±4	K-Ar b	*migmatite/Columbia	441
>400	250-400	Pb^{207}/Pb^{206}	galena/Kazakhstan, USSR	151
>400	330 238±30	Pb^{206}/U^{238} z Pb^{208}/Th^{232} z	*Cape Granite/Republic of South Africa	152
~405	247	K-Ar g	Binnewater Sandstone/New York, USA	153
~410	230, 550	Pb^{207}/Pb^{206}	galena/Perthshire, England	154
>410	245-88	K-Ar wr	*Vent Rhyolite/Wales	155
<420	1243	Rb-Sr wri	*Ornakam-Moldhesten granite/Norway	354
<420	411-493	Rb-Sr wri	*Murrumbidgee Batholith/New South Wales, Australia	413, 414
420	344-39	Rb-Sr il	Marblehead illite/Wisconsin, USA	405
420	326	K-Ar il	Bertie Fm./New York, USA	156

420	332	K-Ar il	Camillus Fm./New York, USA	157
420	345	Rb-Sr wri	*Newbury volcanics/Massachusetts, USA	355
420	369-519	K-Ar il	Colonus Shale/Skane, Sweden	158
>420	25-180, 410	K-Ar ng	*migmatites/Bulgaria	357
<430	635-94	K-Ar p	*kimberlite/east Siberia, USSR	159
430	363	K-Ar il	Rochester Shale/New York, USA	157
430	349	K-Ar b	*granite/Terskei Alatau, USSR	145
~430	314±9	K-Ar wr	*diabase/Wales	358
430	289	K-Ar il	State Circle Shale/Canberra, Australia	160
430	111-235	Rb-Sr wri-il	Trombetas Fm. (shale)/Brazil	359
>430	310-630	K-Ar wr	*Natkusiak Fm. (basalt lavas)/Franklin, Canada	161, 2
435	357	K-Ar il	Williamson Shale/New York, USA	163
435	367	K-Ar il	Sodus Fm./New York, USA	163
435	113-26	Rb-Sr b	*granites/Ax-les-Thermes, France	164
	275±11	Rb-Sr m		
	300-70	Rb-Sr wri		
<440	409, 563	Pb^{206}/U^{238} z	*Dale City Quartz Monzonite/Maryland, USA	165, 6
	432, 556	Pb^{207}/U^{235} z		
	535-47	Pb^{207}/U^{235} z		
	444, 555	Pb^{208}/Th^{232} z		
<440	400-1300	K-Ar h, b	*Furuland Granite/Sulitjelma, Norway	360
440	267-84	K-Ar il	Chimney Hill Limestone/USA	167

ORDOVICIAN

~440	510±10	Pb^{207}/Pb^{206} z	*Deadman's Bay Granite/Newfoundland, Canada	168
>440	306±10	Rb-Sr wri	*Oporto Granite/Portugal	415
>440	168	K-Ar b	*granite/Caucasus Mts., USSR	416
447	445, 337	K-Ar b	*Bail Hill Volcanics/Dumfriesshire, Scotland	169
447	294, 416	K-Ar wr	*Alcaparrosa Fm. (lavas)/San Juan, Argentina	361
<450	540±50	Rb-Sr wri	*Oughterard Granite/Ireland	170
<450	564±24	Rb-Sr wri	*Ben Vuirich Granite/Scotland	171
<450	580±20	K-Ar h	*Rosetown Pluton/New York, USA	172
<450	542-62	K-Ar b	*granite/Idaho, USA	173
	1310-1490	Rb-Sr wri		
<450	425-540	K-Ar b	*diorites/Kazakhstan, USSR	409
450	350-540	K-Ar il	Sylvan Shale/USA	232
450	272±13	K-Ar wr	*Vent Rhyolite/Wales	155
~450	308, 420	Rb-Sr wri-il	Anse du Veryach Series (shale)/France	362
450	402±25	K-Ar b	Utica shales/Quebec, Canada	174
	566±75	Rb-Sr b		
~450	329±10	K-Ar b	*Waits River Fm./New Hampshire, USA	134
~450	273-340	K-Ar b	*Albee Fm./New Hampshire, USA	134
>450	372±6	K-Ar m	*Main Donegal Granite/Ireland	175
>450	315	K-Ar b	*Ellicott City granodiorite/Maryland, USA	176
	300	K-Ar h		
~460	360	K-Ar ng	*granite porphyry/Caucasus Mts., USSR	363
~460	375-471	Rb-Sr g	sediment/ng	148

470	379	K-Ar s	*Mystery Cave bentonite/Minnesota, USA	364
470	350, 423	Rb-Sr il	claystones/Kentucky, USA	405
470	362, 371	K-Ar h, wr	*gabbro/Cockermouth, England	417
>470	300-420	Rb-Sr wri	*granites/Newfoundland, Canada	418
475	493-584	K-Ar b, h	*granite/eastern Canada	177
475	390 ± 19	K-Ar m	*Walloomsac Fm./Connecticut, USA	135
~475	376, 450	K-Ar wr	*diorite, gabbro/Quebec, Canada	365
475	362	K-Ar g	sediment/Georgia, USSR	145
475	44	Rb-Sr b	*bentonite/Tennessee, USA	366
475	300, 400-900	Rb-Sr il-mi	Lowville Limestone/New York, USA	113, 178
475	297	K-Ar g	*bentonite/Ostergotland, Sweden	179
<480	590	Rb-Sr wri	*Cooma Granite/New South Wales, Australia	180
~480	247-487	K-Ar ng	*Tangriseau microgranite/Wales	367
480	305 ± 10	K-Ar wr	*Warboys diorite/Huntington, England	181
<480	458-548	K-Ar h	*Ophiolite (mafic-ultramafic complex)/Newfoundland, Canada	368
495	355 ± 20	Rb-Sr g	sediment/Falkoping, Sweden	144
495	495, 362	Rb-Sr wri-il	shales/New Zealand	419
~500	407-11	K-Ar wr	*olivine diabase dike/Ontario, Canada	182
500	380 ± 35	Rb-Sr g	sediment/Stenbrottet, Sweden	183

CAMBRIAN

~500	345	K-Ar wr	*trachyandesites/Normandy, France	369
>500	392-584	Rb-Sr g	sediment/ng	148
~510	412 ± 60	K-Ar g	Murray Shale/Tennessee, USA	184
510	411-50 413-33	K-Ar g Rb-Sr g	Franconia Fm./Wisconsin-Minnesota, USA	185
>510	396-569	Rb-Sr wri	*Tioueiine granite/Ahaggar, Algeria	186
~520	225-400 330-430 720-920	Pb^{206}/U^{238} Pb^{207}/U^{235} Pb^{207}/Pb^{206}	kolm (alum shale)/Gullhogen, Sweden	187
~520	373-500	Rb-Sr wri-il	Erguy Kerity Fm. (shales)/France	362
~530	391-4	K-Ar b	*Windyhills Granite/Aberdeen, Scotland	188
540	340	K-Ar g	sediment/ng	149
<550	635-694	K-Ar -	*kimberlite/Siberia, USSR	428
550	404	K-Ar il	sediment/Bohemia, Czechoslovakia	442
~550	?-460	K-Ar wr	*felsic volcanics/Georgia, USA	443
~550	282-1097	K-Ar il	Conasauga Shale/Virginia, USA	189
~550	300-413	K-Ar g	sediment/Alberta, Canada	371
550	393	K-Ar il	Riley Fm./Texas, USA	190
~550	830-1160	Rb-Sr wri	*norites/Scotland	191
>550	284 ± 5	K-Ar wr	*Sledgers Fm. (lava)/Victoria Land, Antarctica	420
<560	764	Pb^{207}/U^{238} ch	*granite/North Baikal, USSR	192
565	346-390	Rb-Sr g	sediment (Mt. Whytte Fm.)/USA	183
~565	760 790	K-Ar g Rb-Sr g	sediment/Northern Territory, Australia	193

565	411-891 394	K-Ar wr K-Ar wri	*Bourinot group (volcanics)/Nova Scotia, Canada	372
>565	400±40	Pb^{208}-Th^{232} z	*Carlton rhyolite/Oklahoma, USA	373
>565	460	K-Ar b	*granite/Oklahoma, USA	194
568	447	K-Ar il	sediment/Shropshire, England	11
570	406	K-Ar g	sediment/Wyoming, USA	16
570	1145±98	Rb-Sr wri	*andesite/Suldal, Norway	374
570	645, 708	K-Ar g	Gros Ventre Shale/Wyoming, USA	195
570	399	K-Ar g	sediment/Narke, Sweden	179
570	395-511	K-Ar wr	*Antrim Plateau Volcanics/Victoria River, Australia	196
570	400-542	Rb-Sr g	Flathead Sandstone/Montana, USA	197
~570	490±15	ng ng	*Palmer Granite/Adelaide, Australia	375
570	385	K-Ar g	sediment/Byelorussia, USSR	198
575	395-413	K-Ar g	Cavell Fm./Alberta, Canada	47
575	413	K-Ar g	sediment/Gotland, Sweden	54
~580	894±58	Rb-Sr wri	*granite/Massachusetts, USA	199
580	457	K-Ar il	sediment/England	11
580	439	K-Ar g	Chilhowee Group/Tennessee, USA	190
580	334	K-Ar wr	*Lighthouse Cove Fm. (basalts)/Newfoundland, Canada	200
590	393-442	K-Ar il	Rome Fm./Virginia, USA	201
590	436	K-Ar g	sediment/Oland, Sweden	195
~600	486±22	K-Ar b	*granite/Pechora, USSR	202
600	479±20	K-Ar b	*Fairville Granite/New Brunswick, Canada	203
600	452-529	Rb-Sr wri-il	shales/Shropshire, England	421

UNDER CAMBRIAN

>600	350-420	K-Ar g	sediment/Kazakhstan, USSR	371
>600	320-380	K-Ar b	*granite/Danmarkshaven, Greenland	376
>600	500±17	Rb-Sr wri	*Hoppin Hill Granite/Massachusetts, USA	204
>600	100-550	K-Ar wr	*Akitkan Fm. (volcanics)/Baikal, USSR	377
>600	489±10	K-Ar b	*Athis granite/Normandy, France	205
>600	350-440	K-Ar b	*Carnsore Granodiorite/Ireland	378
>600	480±10	K-Ar m	*pegmatite/Wadi Hawashia, Egypt	206
>600	373-8	K-Ar b	*granite/Kviteseid, Norway	379
>600	480 320	Pb^{208}-Th^{232} mo Pb^{206}-U^{238} mo	*granite/Gebel Dara, Egypt	206
>600	450±120 370±25	Pb^{208}-Th^{232} z Pb^{206}-U^{238} z	*riebeckite granite/Gebel Gharib, Egypt	206
>600	420 410 370	Pb^{208}-Th^{232} hu Pb^{207}-U^{235} hu Pb^{206}-U^{238} hu	*granite/east Siberia, USSR	126
>600	34	K-Ar m	*granite porphyry/New Mexico, USA	380
>600	470±18	K-Ar il	sediment/Algeria	207
>600	485-570	K-Ar h	*diorites/Worcestershire, England	381
>600	460	Rb-Sr wri	*Wooltana Volcanics (basalt)/Australia	208

>600	340-412	K-Ar b	*granites/Norway	382
>600	482±30	Rb-Sr wri	*Bull Arm Volcanics/Newfoundland, Canada	209
>600	401±16	K-Ar wr	*mafic dykes/South West Africa	383
>600	370±38	Rb-Sr wri	*Coldbrook group (volcanics)/New Brunswick, Canada	210
>600	461-540	K-Ar b	*Mancellian granites/Chausey Islands, France	384
>600	300±5	Rb-Sr wri	*volcanics/Morocco	385
>600	440	K-Ar h	*charnockite/India	386
>600	510	Rb-Sr wri	*granite/Montagne Noire, France	422
>600	350-400	Rb-Sr wri	*granites/Alaska, USA	444
>600	368-1200	K-Ar m, b	*Forsayth Batholith/Queensland Australia	445

tionalized away is the topic for subsequent sections in this work.

Many other dates could have been listed, but Table 1 is limited to dates which approach 20% discrepancy: being either 20% "too young" or "too old" for their biostratigraphical positions. Many are over 30% discrepant. A 20% discrepancy means that an indicated date is off by at least one geologic period in the lower Mesozoic and off by two geologic periods in the early Paleozoic. From Table 1, it is evident that a 330 million year date is obtained for Carboniferous rock, but that the same value is often obtained for rocks as old as Cambrian. Viewed another way, Devonian rocks give "true" values near 375 million years, but also values of 220 ("properly" Triassic) and 450 ("properly" Ordovician).

The arbitrariness of the practice of selecting some values as being true and disregarding others which conflict with them was recently admitted by Waterhouse,[315] who commented: "It is, of course, all too facile to 'correct' various values by explanations of leakage, or initially high concentrates of strontium or argon. These explanations may be correct, but they must first be related to a time line or 'cline of values' itself subject to similar adjustments and corrections on a nonstatistical, nonexperimental basis."

Table 1 does not include the many anomalous dates from those minerals that have grown in disrepute with respect to radiometric dating. K-feldspars usually give K-Ar ages that are "too young," and this is attributed to argon loss associated with exsolution and perthitic growth. Only sanidine is considered reliable. Because of their K-feldspars, whole-rock dating of acidic intrusive igneous rocks is avoided, and mica or amphibole separates are used instead. Minerals such as beryl, cordierite, and zeolite often give erratic K-Ar ages attributable to isotope fractionation. With few exceptions, Table 1 is confined to datings on material that is considered to be reliable.

Very many igneous bodies which have been dated yield a wide spread of discordant dates, but they could not be entered into Table 1 because they have little or no biostratigraphic definition of their relative ages and thus escape violating any biostratigraphy. Others were entered into Table 1 as "greater than," "less than," or "approximately equal to" some biostratigraphic limit: dates being so anomalous that they violated even their liberal biostratigraphic limits. The heavy attention given to K-Ar dating in Table 1 reflects the overwhelmingly preponderant use of this method over all others combined; and it also serves to balance the heavy emphasis placed on U-Th-Pb dating by other Creationist scholars.

The uniformitarians may contend that there are many more dates in agreement with accepted values than there are anomalies such as all of Table 1. Even if this were true, it would not appear to be an overwhelming majority, and a significant minority of discrepant dates would probably be sufficient to discredit all of radiometric dating. Since most igneous bodies have wide biostratigraphic limits,[219] it is difficult to tell that a date is not anomalous because it could take on many different values and not be anomalous.

As a matter of fact, the number of determinations actually used to define "correct" values for the geologic column are fewer than the anomalies comprising Table 1, except for the Cenozoic and Cretaceous. Armstrong[316] compiled a listing of dates that are considered to be reliable time-points for the Phanerozoic; the list presumably up to date as of 1976-1977. There are 260 pre-Cenozoic dates compiled, but 98 of the 260 are Cretaceous, and many determinations have only partial biostratigraphic brackets.

Some estimates would make dates in agreement with accepted values a minority among all dates obtained in the Phanerozoic. That direct sediment dates (on glauconite) agree within plus or minus 10% of accepted values approximately half the time is estimated by Obradovich and Peterman.[218] Afanass'yev[219] considers dates from biostratigraphically bracketed intrusives to be less reliable than glauconite dates, while Armstrong and Besancon[220] point out that most dates on basaltic lavas are discordant. Combining these estimates, it may be that somewhat less than half of all dates agree within 10% of accepted values for their respective biostratigraphic positions.

B. The Selective Publication of Dating Results

An objective comparison between the number of fitting vs. the number of anomalous dates in the Phanerozoic is hindered (if not prevented) by the fact that anomalous dates frequently (or usually) are not reported in scientific journals.

Many researchers directly or indirectly imply that they are not reporting discrepant dates that they have obtained. An implication of there being unreported K-Ar ages that are "too young" and attributed to argon loss is made by Mitchell and Reen,[221] who write: "Alternatively, if the *reported* ages can be argued to be free of argon loss . . ." (emphasis added here and elsewhere unless otherwise indicated). A contrast between proper/published and anomalous/unpublished dates is evident in the following statements by Twiss and DeFord:[222] ". . . some of the ages do not correspond with stratigraphic position. The *reported* ages in millions of years are . . ." Armstrong[223] writes: "The dates *reported* are all consistent with observed geologic relationships." Polevaya *et.al*[224] write: "The *published* results attest to the possibility of obtaining rather reliable ages for glauconites by the argon method."

In a recollection of how anomalous dates re-occurred, Curtis *et. al.*[225] said: "As a result I suggest that it would be important to report all anomalous results." This is not done. Most sobering of all is the following recent statement by Mauger:[12] "In general, dates in the 'correct ball park' are assumed to be correct and are published, *but those in disagreement with other data are seldom published nor are discrepancies fully explained.*"

There is a tendency to leave unpublished the results which conflict with those of other investigators or which disagree with accepted values. Thus, a certain reluctance to provide a non-fitting date seems to be the case in this report by Forman:[226] "The remarkably congruent date obtained for the Tiburon Peninsula eclogite with that . . . for the Cazadero tectonic blocks is very pleasing (147 m.y. *versus* 135 to 150 m.y.). Thus it is a little untidy to report 106 m.y. for the age of the amphibolite on Catalina Island."

C. Direct Radiometric Dating of Sedimentary Rocks

Sedimentary rock samples are not indiscriminately dated because the constitutent detrital particles would ostensibly give the age of the source region(s), and not the time since sedimentation. Alternatively, some value between that of provenance and of sedimentary rock formation might be obtained. Dating of fossil material and limestone samples has been abandoned because in nearly every case (as ref. 46; Jurassic and Triassic, Table 1) the K-Ar ages are far too low, and this is attributed to the low argon-retentive properties of calcite.

Sedimentary rocks are dated by the K-Ar and Rb-Sr methods utilizing the authigenic minerals glauconite and illite. In dating glauconites, Rubinstein[227] commented: ". . . we often get anomalously high figures." This is supposedly caused by minute amounts of allogenic contaminant incorporated within the glauconite. Usually, however, glauconite K-Ar and Rb-Sr values are "too young" for their biostratigraphic position. Many such anomalously young dates are entered into Table 1.

Rationalizations for these discrepant dates have centered upon claims that glauconite is vulnerable to becoming an open system via spontaneous recrystallization, leaching, or slight heating. Although some correlation of anomalous dates with permeability of host rock and depth of burial were found by Morton and Long,[228] they otherwise stated: "Several factors were studied which could correlate with open-system behavior: grain morphology, extent of weathering, percent expandible layers, recrystallization caused by former deep burial, and permeability of the host rock . . . . None of these factors, singly or in combination, was infallibly useful to predict which of the Llano glauconites will have behaved as an open or closed chemical system . . . ." Owens and Sohl[229] found similar crystallinity and compositions between glauconites yielding expected, and anomalous, dates.

Depth of burial is supposed to produce diametrically opposed effects on glauconite dates. Evernden *et. al.*[230] considered deeply-buried glauconites to be less reliable than shallow-buried ones, on the grounds that the former are more likely to be exposed to heating. Holmes[231], by total contrast, contended that shallow-buried glauconites would tend to be less reliable because deeply-buried ones are better shielded from weathering.

Most any discrepant date can be excused on the basis of some presumed system-opening situation. The wide variety of factors which presumably cause open systems and plasticity in attributing anomalous dates to these factors suggest that these are just rationalizations. An alternative view would be that dates are discrepant not because of "open systems" and geologic causes but because radiometric dating is invalid.

K-Ar and Rb-Sr dates on the clay mineral illite produce far greater discrepancies than dates on glauconite. Table 1 includes dates on illite so anomalous that they are several times the "true age" of the rock, or a small fraction of the "true age." For instance, the Conasauga Shale (Cambrian, ref. 189, Table 1) gives us spread of ages ranging from Upper Carboniferous to twice the time since the Cambrian.

"Correct"-age illites are assumed to be authigenic. Those fractions which yield ages "too old" are explained away as being detrital in origin. Finally, those that give ages "too young" for their biostratigraphic positions are claimed to either be the result of argon loss from the authigenic illite, or from the illite being diagenetic and not authigenic in origin. Agreement with accepted values for the biostratigraphic positions may be coincidental. One such K-Ar dating on a shale was described by Hower *et. al.*:[232] "The whole-rock age is quite good for the Upper Ordovician. However, an examination of the K-Ar ages and minerology of the various particle sizes shows 'good' age must be at least partly fortuitous."

Rb-Sr mineral dates, like the K-Ar dates, are subject to the same interpretations when the dates turn out discrepant (for example Permian, ref. 95, Table 1). The Lowville Limestone (Ordovician, ref. 113, 178, Table 1) is one of several examples in Table 1 of situations where Rb-Sr illite isochrons are constructed but not accepted as the age of the rock because of their very discrepant values. The ages that were "too old" were supposed to indicate that the Sr isotopes had homogenized in the source region and not in the shale at the time of its deposition. At the same time, "too young" Rb-Sr isochrons were considered to be indicators of diagenetic Sr isotope homogenizations long after deposition of the shale. Still other Rb-Sr isochrons were not even considered to have any geological meaning.

U-Th-Pb methods have been used in dating uranium-bearing shales. They are now not considered to remain closed systems throughout alleged geologic time. The classic Swedish kolm (Cambrian, ref. 187, Table 1) is an outstanding example of erratic dates being attributed to its inability to remain a closed system.

D. Open-System Rationalizations for Discrepant Igneous Dates As Deduced from Petrography and Regional Geology

Radiometric dating finds its greatest utility in the dating of igneous rocks. The section after this one will consider radiometric dating of biostratigraphically-bracketed igneous bodies. This section will review some principles by which discrepant dates are attributed to some processes that would cause open systems. Microscopic studies of rock thin-sections helps determine if the rock has suffered weathering, deuteric alteration, or low grade metamorphism. The author is not denying that a heating, leaching, or weathering event on a rock could cause an open system and thereby make discrepant dates, but wishes to point out that a very plastic and capricious situation exists between the state of the rock and whether the dates from it are "good," or if they are anomalous.

Very many K-Ar dates from altered rocks are "good." For granites, Miller and Mohr[233] said: "But again there is microscopical evidence for appreciable alteration, at least of the feldspar, which must be reconciled with an apparently complete retention of radiogenic argon." Zartman[234] reported that: ". . . much greater discordances occur in fresh rather than obviously weathered rock." Armstrong[235] stated that: "In two cases altered and fresh samples of the same granite body were analyzed and in both excellent agreement was obtained." No correlation between degree of alteration of quartz monzonite and its ages was found by Bassett *et. al.*[236] Bell[237] warned: "In interpreting the isotopic ages, it should be remembered that isotopic diffusion does not necessarily imply recrystallization. The danger in confidently correlating certain petrofabric and isotopic events is apparent."

Basalts and other mafic rocks are believed to be especially vulnerable to becoming open systems because of the ease of their alteration. But in dating basalts, Dasch *et. al.*[238] wrote: ". . . by analyzing samples of strongly altered (59) and relatively fresh (C20) rock from the same dike; within analytical uncertainly the two samples have identical K-Ar dates." Evans *et. al.*[239] reported: "Some of the present highly altered rocks gave discrepantly low ages, others, equally altered, did not appear to have suffered extensive argon loss. In addition, low ages were obtained from some apparently very fresh rocks. In fact, no direct quantitative correlation between the presence or amount of the fine-grained secondary minerals of reputed poor retentivity and the apparent age discrepancy observed could be established."

The fact that very many anomalous results by K-Ar dating come from unaltered material is frankly admitted by Durant *et. al.*:[240] "Although it is obviously better to work with fresh material, the fact that a rock is petrographically fresh is no guarantee that 40Ar loss or excess 40Ar phenomena are absent."

Rb-Sr dating is generally believed to be more resistant to heating than is K-Ar, but more vulnerable to leaching caused by weathering or hydrothermal fluids. Zartman[241] deliberately dated some weathered granite by Rb-Sr, and found: "That these minerals give such a consistent age pattern, indicating a closed system even upon exposure to rather severe weathering, is rather remarkable."

Many discrepant Rb-Sr dates have no alteration on the rock sample dated. Zartman *et. al.*[242] reported: "An anomalously low Rb-Sr age . . . was found for the biotite. Although no effects of metamorphism or alteration are visible in the syenite, some such process undoubtedly disturbed this . . . radiometric system." In speaking of all Rb-Sr dating, Faure and Powell[243] generalize: "First of all, there may be no minerological or textural evidence to warn the geochronologist that an igneous rock or any of its minerals he is analyzing for an age determination has been altered." In fact, Hamilton[244] wrote: "It is *quite common* for a metamorphic event detected by Rb-Sr dating to leave no obvious imprint on the hand specimen or in thin section."

The implications of all these findings are enormous. Any discrepant date can be explained away, and a heating or weathering event can be invented whenever necessary for this purpose. No evidence need be found because its absence can be attributed to it being strong enough to make the unwanted date discrepant, but too weak to show up in thin section. An illogical situation arises because at one time it is claimed that radiometric dates have withstood obvious alteration of the rock, while at other times they supposedly were so sensitive that they were made discrepant by an event too weak to alter the rock itself. A skeptical view of radiometric dating looks at all these lacks of correlation of alteration and discrepancy of dates as evidence that they are just rationalizatio;ns, and that discrepant dates are not primarily caused by alteration but by the fundamental invalidity of radiometric dating.

Rationalizations for discrepant dates are also formed on the basis of the regional geologic context of the rock sample being dated. The reasoning involved is best described by Evernden and Richards:[245] "Thus, if one believes that the derived ages in particular instances are in gross disagreement with established facts of field geology, he must conjure up geological processes that could cause anomalous or altered argon contents of the minerals."

It is interesting to note cases where the regional geology of the dated sample would indicate the likelihood of a date being discrepant, but it isn't; or else some dates are supposedly disturbed while others strangely are not. In his dating, Zartman[246] wrote: "It is difficult to postulate a mechanism responsible for the low Rb-Sr and K-Ar ages in the pegmatite biotite while the adjacent granitic biotite has not suffered a similar effect." Pankhurst[247] commented: "The writer thinks it unlikely that this biotite alone can have escaped the event so consistently recorded by the remainder, especially since it comes close to a contact with a younger intrusion. It seems that this result is anomalous . . . ."

On the basis of regional geology, a strong expectation of dates having been made discrepant via a later orogenic event near them was supposed by Eastin and Faure,[248] who found: "A remarkable feature of these volcanic rocks is that they appear *not* to have lost radiogenic Ar^{40} during the Ross Orogeny . . ." (emphasis theirs). Similarly, Haller[249] reported: "The biotite of a polygenic migmatite was found to yield a K-Ar age of 490 ± 12 m.y. The surprising thing about this result is that the isotopic age is not about 400 m.y. since the Caledonian effects appear to be so strong."

Burchart[250] stated: "Numerous cases have been reported in which Sr isotopic ratios have been found extremely sensitive to geologic events . . . which may have been indistinguishable by classic geologic or petrologic methods. The case of the Tatra Mountains serves as an example of just the opposite situation . . . a major event according to petrological record does not always leave its mark on isotopic dates." It is obvious that once again there is a very plastic relationship between anomalous dates, and their regional geology. That discrepant dates very frequently are not related to regional geology and can be explained away without resorting to it is evident in the following statement by Kratts:[251] ". . . an understanding of the true causes of discrepant vaues in concrete cases reveals geologic and geochemical events not discernible by the usual geologic methods."

Any discrepant date can be explained away by claiming that some event has opened the system, while at the same time claiming that the alleged event is not recorded in regional geology if the discrepancy cannot be conveniently fitted in to the geologic history of the region as envisioned by uniformitarians.

Not surprisingly, dates must agree with their biostratigraphic position in order to be considered valid indicators of age. In their datings, Wanless *et. al.*[252] commented: "No stratigraphic evidence is available to confirm or deny this age." Elsewhere, Williams *et. al.*[253] wrote: "The internal consistency demonstrated above is not a sufficient test of the accuracy of the age determinations; they must also be consistent within any age constraints placed on intrusion by fossils in the country rocks."

The investigators dating a Triassic basalt (ref. 70, Table 1) said: "The Mississippian age for sample NS-45 cannot be correct because it is grossly inconsistent with the stratigraphic position of the lavas. No clues as to apparent preferential loss of potassium or gain of excess Ar^{40} from this sample are in evidence from thin section examination." In dating the Ferrar Dolerite (ref. 77, Table 1), the authors wrote: "Rb-Sr analyses of an initial group of hypersthene tholeiites were well aligned on the isochron diagram. They appeared to define an isochron of 270 ± 45 million years. This result is incorrect, since it contradicts a firm stratigraphic control of the age . . . ."

Recently, Hayatsu[423] wrote: "In conventional interpretations of K-Ar age data, it is common to discard ages which are substantially too high or too low compared with the rest of the group or with other available data, such as the geological time scale. The discrepancies between the rejected and the accepted are arbitrarily attributed to excess or loss of argon." In invoking "excess argon" because of biostratigraphically and paleomagnetically discrepant K-Ar results from Pleistocene lavas, Armstrong [424] said: "This is an inherent uncertainty in dating young volcanic rocks; anomalies may be detected only by stratigraphic consistency tests, independent dating techniques, and comparison with the known time scale of geomagnetic reversals during the last 5 m.y. (Cox 1969)."

E. Radiometric Dating of Biostratigraphically-Bracketed Igneous Rocks

1. Effusives (Tuffs and Bentonites) and Extrusives (Lava Flows)

Since extrusives and effusives are depositionally accumulated, the Law of Superposition applies to them. The biostratigraphic bracket is imposed by the fact that they must be younger than what they overlie but older than whatever overlies them.

Volcanogenic ash very frequently yields "too old" K-Ar dates. It is claimed that this is from "excess radiogenic Ar" whereby the parent magma is contaminated with argon heated out of the wall rock (vent) that it is coming through, and that the minerals which crystallize do so too rapidly to degas this contaminant argon. Scarborough[254] writes: "Age information is interpreted carefully because of a distinct tendency for certain ash layers to contain a variable amount of excess argon." Eocene tuffs (ref. 12, Table 1) are one of several such examples.

Other anomalously old K-Ar dates are explained away by claiming contamination of the tuffs by detrital minerals. Christiansen *et. al.*[255] said: "Preliminary K-Ar data from alkali feldspars of the second and third ash-flow sequences yield dates apparently too great, suggesting contamination by Precambrian feldspars." These alleged contaminants cannot readily be distinguished, according to Curtis *et. al.*,[256] and they suggest that: ". . . the thing to do is get a sequence of dates and *throw out those that are vastly anomalous.*"

K-Ar dates from undevitrified volcanic glass (one example in Table 1-ref. 74) are not considered to be reliable. Other igneous materials, when "too young", are claimed to have undergone argon loss (for example, the Filipowice Tuff, Ref. 96). The ejecta of the Korvunchana Series (ref. 80) turned out "too young", and this was ascribed to supposed potassium additions. Unaltered mineral separates from bentonites which are "too young" likewise are attributed to open systems. The Carmel Formation bentonite (ref. 52) gave anomalously young K-Ar and Rb-Sr ages, and this was attributed to hydrothermal effects, even thought there is no evidence for it. The Tioga Bentonite (ref. 142), though weathered, amazingly yielded a good Rb-Sr isochron for 15 of 22 samples, although the isochron defined an anomalously young date.

Rationalizations for discrepant dates from lava flows are similar to those for tuffs. "Too old" K-Ar dates from lavas (for instance, basalt, ref. 118) are attributed to "excess argon." K-Ar dates from lavas are commonly discrepantly young, and these results are explained away by claiming some thermally-induced argon loss (as from deuteric alteration or low grade metamorphism) although (as the previous section demonstrated) no evidence for such an alleged event need be found.

Some of the many discrepantly young K-Ar dates from lavas included in Table 1 are: Karroo volcanics (ref. 66), Toadstone Lavas (ref. 117), Hoy Lavas (ref. 138), Antrim Plateau volcanics (ref. 196), etc. That contradictory dates from lavas occur as a rule is stated by Armstrong and Besancon:[220] "Detailed dating studies using pre-Tertiary whole rock basalt and dolerite specimens have been made . . . and limited optimism for the method appears justified. In spite of collection of unweathered samples and precautions taken to discard samples with evident alteration, it is *usual* to obtain a spectrum of discordant dates and to select the concentration of highest values as the correct 'age'." Even this is accommodating because, as Stewart *et. al.*[257] pointed out, a maximum in an age-value spread need not be accepted as any specific event.

Rb-Sr whole-rock isochron dating of lavas has produced its share of surprises. Some lavas have given Rb-Sr dates very much greater than the maximum permissable biostratigraphic age. Examples of this in Table 1 include the Ferrar Dolerite (ref. 77), refs. 19, 20, 40, and 191. It is claimed that these isochrons are not defining the time since the Sr isotope homogenization when the lava crystallized, but are defining some Sr isotope homogenization in the mantle. In supporting this, Pankhurst[258] remarked: "This is nothing short of a revolution in the fundamental principles of Sr-isotope geology."

Rb-Sr isochron dates which are "too young" are explained away by claiming that the isochrons are not the Sr isotope homogenization when the rock formed, but a re-homogenziation caused by some later thermal event on that rock. Some examples of this from Table 1 include the Wooltana volcanics (ref. 208) and the Coldbrook Group (ref. 210).

2. Intrusives (Hypabyssal and Plutonic Rocks)

The law of Cross-Cutting Relationships serves to set biostratigraphic brackets for intrusive rocks. An intrusive rock must be younger than any country rock that it intrudes, but older than any rock unconformably overlying it or containing clasts eroded off that intrusive.

Many discrepant results from intrusives are rationalized away immediately by accepting the dates but reinterpreting the biostratigraphic bracket. For instance, the Rose Dome Granite (ref. 102) was believed to contain Pennsylvanian (Upper Carboniferous)-aged inclusions, but this was dropped when the granite yielded a preCambrian Rb-Sr isochron age. A granite (ref. 173) intrudes a quartzite which was believed to be part of an Ordovician quartzite lithostratigraphic unit. This quartzite is now considered to be preCambrian and not part of the Ordovician quartzite because of PreCambrian dates from the granite.

A granite (ref. 199) gave an Rb-Sr date much greater than the biostratigraphic age of the rock intruded. This discrepancy was explained by claiming that the granite is "thrust in" tectonically, not intrusive. But against this, Gates *et. al.*[259] noted that it is: ". . . not marked by a major fault or an unconformity. Rather . . . seem to be interlayered and concordant throughout the mapped area."

The most common manipulations performed to resolve discrepancies involve the claim of composite plutons. A discrepant date can be explained away by claiming the sample dated is from an earlier or a later phase of the biostratigraphically-bracketed pluton. For instance, the anomalously old date from the Pine Mountain Granite (ref. 103) was explained away by regarding the Rb-Sr date as giving the age of an earlier phase of the Granite. Pertaining to an Ordovician granite (ref. 177), the authors wrote: "1) The Granitic bodies may be composite with an earlier, partly updated phase of latest PreCambrian or Early Cambrian age and a later phase in Middle or Late Ordovician, and 2) The granitic bodies were indeed emplaced during Middle Ordovician time but biotite and hornblende during (Devonian) alteration and/or slight recrystallization have absorbed freed radiogenic argon. *These explanations are not altogether satisfying.*"

The upper biostratigraphic limit on granites imposed by clast-bearing sedimentary strata was disregarded in the case of the granites entered in Table 1 under refs. 150, 203, and (Devonian) ref. 50, when radiometric dates conflicted with it. It was simply claimed that the clasts resulted from erosion of some hidden early or late granites, and not from the main granitic body being dated.

An amazing series of rationalizations were proposed for discrepant U-Th-Pb zircon dates from the Dale City Quartz Monzonite (ref. 165, 166). Seiders[165] accepted the intrusion of this body into a slate, but denied the Ordovician age of the slate claiming that the fossils from it were inconclusive. Higgins[166] accepted the biostratigraphic age-designation of the slate, but claimed that the Monzonite is not intrusive into it, but unconformable. Alternatively, he accepted the intrusive nature of the Monzonite into the slate but suggested that the anomalously old zircon U-Th-Pb dates are caused by inherited (contaminant) lead.

Dates from plutons that turn out discrepant are subject to the same open-system rationalizations as are those from lavas. An examination of Table 1 notes many plutons (for example, refs. 44, 104, 105, and many others) yielding a spread of mutually-contradictory K-Ar dates, some of which spread over several geologic ages.

K-Ar dates that are "too old" for their biostratigraphic positions are attributed to "excess argon" contamination or to an allegedly protracted two-stage magmatic history where the early phase (xenoliths, xenocrysts, or phenocrysts) is supposedly hundreds of millions of years before the later phase (groundmass).

Kimberlites and peridotites often show anomalously old K-Ar dates. Pertaining to the Stockdale kimberlite pipes, the authors wrote (ref. 91): "These ages are indicative of a xenocrystic origin of the micas." Hence the constituent minerals were assumed to have originated deep within the earth hundreds of millions of years before the intrusion. Elsewhere (ref. 101), the constituent biotites were flaky, suggesting an earlier origin, but some did not give anomalously old K-Ar dates. It was claimed that they had been degassed of their previously-accumulated radiogenic argon.

Of especial significance are some Siberian kimberlites (ref. 159), because not only the xenocrysts but also the groundmass gave "too old" K-Ar dates. The ease of explaining away any discrepant date was portrayed when it was claimed that the groundmass got anomalously old by K-Ar when the xenocrysts allegedly shed some of their argon into the magma just as it was crystallizing to form the groundmass.

Anomalously old K-Ar dates are not confined to ultramafic and mafic rocks. Hornblende from the Pearse Peak Diorite (ref. 43) was much "too old" by K-Ar, and this was attributed to its alleged occlusion of "excess argon." Much the same situation occurred in the case of the Rosetown Pluton (ref. 172); among others in Table 1.

K-Ar dates from intrusives often turn out far "too young" for their biostratigraphic positions. This is explained away by claiming that the K-Ar dates from 30 million to 350 million years from certain granites (ref. 116), the 30 million-year dates are supposed to be completely degassed by the heating of the Alpine orogeny, the 350 million-year dates are considered to have survived all the heating events, and the many dates in between are supposed to have no geologic meaning; being supposedly "hybrid ages" of partial argon loss during the Alpine heating event of 30 million years ago.

Thus, discrepantly young K-Ar dates can be claimed to have been completely "reset" if the anomalously young K-Ar date can be matched up with some inferred process (as orogeny) of regional geology, or it can be claimed to be geologically meaningless and giving a value in between the "true" age of the rock and the "true" age of a thermal event if the date does not correspond to either. The Vallorcine Granite (ref. 122) is one example of a "geologically meaningless" K-Ar date. Refs. 34, 127, 104, and 120 are just a few of the many hypabyssal and plutonic rocks of varying compositions that are entered into Table 1, and which give "too young" K-Ar dates. The Klotassin Batholith (ref. 72) is especially significant because the alleged heating event on it which made its K-Ar dates "too young" was supposedly intense enough to have also "rejuvenated" its Rb-Sr isochron date.

Another line of rationalizations for discrepantly young K-Ar dates for intrusives is the claim that they were deeply buried tens or hundreds of millions of years after their crystallization, making them too hot to hold their accumulating radiogenic argon for that amount of time. Some Devonian granites (refs. 134, 135) provide the classic example. It is supposed that they give K-Ar dates accepted for Permian because they were deeply buried from Devonian to Permian time. Zartman *et. al.*[260] admitted the difficulty of belief in such a prolonged post-crystallization burial of the granites, but accepted it because they found tectonism and regional metamorphism inferred for Permian time to be too localized to account for such a wide area yielding "too young" K-Ar dates from granites. Elsewhere, the batholith under ref. 35 is a similar example of alleged protracted burial.

A variation of the K-Ar method known as the Ar^{40}/Ar^{39} Spectral method has been used on plutons in recent years. It supposedly can distinguish between "excess argon," "rejuvenated," and "true" K-Ar dates because a true K-Ar date will shed its argon uniformly at different temperature fractions, giving rise to a flat spectrum. The disturbed rock or one with "excess argon" will give off very different amounts of argon in different temperature-fractions and give rise to a "stepped" and "saddle" spectrum, respectively.

That this method can invariably distinguish between "excess" and "disturbed" argon contents was questioned by one study.[261] Dallmeyer[262] found that "too young" K-Ar dates yielded undisturbed spectra, so he claimed that the Ar^{40}/Ar^{39} technique is incapable of distinguishing between a true date and a date of very prolonged burial. The claim that a flat spectrum indicates a true date comes to beg the question, because any flat spectrum from a "too young" conventional date can be claimed to be from protracted burial, and thus the whole method ends up avoiding the question that it is purported to answer.

The Ar^{40}/Ar^{39} method of K-Ar dating failed dramatically by giving flat spectra for samples that would virtually certainly be considered to have been disturbed, and for samples containing "excess argon." Biotites were taken from a gneiss in a contact metamorphic zone within a few hundred meters of an igneous intrusion. Conventional K-Ar dates were dramatically younger nearer the intrusion than further. In summarizing the results of the Ar^{40}/Ar^{39} method applied on the biotites, Ashkinadze *et. al.*[263] wrote: "The spectrum shows no features that would indicate any natural disturbance in the K-Ar system. The plateau levels could be erroneously taken as representing the true age of the specimens if the conclusions . . . were followed." In another experiment, Ashkinadze *et. al.*[264] performed the Ar^{40}/Ar^{39} method on biotites that had given absurdly old K-Ar dates. It gave a flat spectrum, failing to indicate any "excess argon."

The Rb-Sr whole-rock method is frequently used on intrusives. There is some subjectivity in isochron construction that enables samples to be chosen so that they define an isochron age in agreement with accepted values for the biostratigraphic position of the intrusives. Two quite different isochrons obtained from the Barhalde Granite (ref. 94) attest to this. An outright case of fudging the Rb-Sr isochron is evident in the following description of the Kinsman pluton (ref. 140) by authors Lyons and Livingston: "The Kinsman Quartz Monzonite for all six isochron points also yields an unsatisfactory isochron of 605 ± 83 m.y. The isochron shown . . . however, has been drawn by eliminating sample MK 37-73 . . . the resulting isochron of 411 ± 19 . . . embraces what we consider to be an accurate determination of the age of emplacement of the Kinsman."

Any discrepant Rb-Sr isochron can be explained away by claiming that some points on it don't "belong" on that isochron because they allegedly came from different crustal sources and had different initial Sr^{87}/Sr^{86} ratios. In the case of the Ben Vuirich Granite (ref. 171) the anomalously old Rb-Sr isochron was dismissed as "a spurious result" and attributed to source Sr isotopes not homogenizing.

Other anomalous Rb-Sr isochrons are rationalized away by claiming that they become open systems after the rock formed. In the case of the Cooma Granite (ref. 180), an alleged open system was the cause for the "too old" Rb-Sr isochron. By contrast, "incipient weathering" was the cause of the "too young" Rb-Sr isochron from the Hoppin Hill Granite (ref. 204). Either weathering or deuteric alteration was the alleged cause for the anomalously young isochrons from the Tioueiine granite (ref. 186), and hardly any alteration was visible in petrographic thin sections.

U-Th-Pb methods on intrusives are performed either on separated accessory minerals or on ore bodies that formed during late-magmatic or post-magmatic processes around intrusives. U-Th-Pb dates from pitchblendes and galenas are usually discordant and in conflict with biostratigraphic positions. Some European ores (ref. 82) gave "too young" U-Th-Pb dates because they allegedly were subject to later re-mineralizations. Others (for instance, refs. 106, 143, and 151) are much "too old" for the biostratigraphic positions of their host rocks, and are explained away by claiming that they became contaminated with ancient, "remobilized" lead during their mineralizations.

Zircons are the most common accessory mineral used for U-Th-Pb dating of intrusives. Like ore deposits, discrepant dates from them are attributed to various supposed open-system and contaminating conditions. The Deadman's Bay Granite (ref. 168) is one example of this, as is the Cape Granite (ref. 152). Zartman[265] pointed out that: ". . . the morphology of the zircon crystal does not always reflect the presence of inherited old radiogenic lead." Thus any anomalous zircon date can be explained away just because it is discrepant.

Some anomalously old U-Th-Pb dates from zircons are supposed to indicate that the zircons themselves are "xenocrystic," or inherited from the country rock through which the magma intruded. Zircons from plutons entered under refs. 18 and 100 are examples of this explanation.

In considering all the dating methods, it should not be supposed that dates which fit accepted values for Phanerozoic systems are the only ones that are consistent. That discrepant dates also are consistent is pointed out by Polyakov *et. al.*:[266] "Still more important is the fact that 'rejuvenated' dates are nonrandom and recur on a regional or even a global scale." The significance of dates that are internally consistent from different samples of the same outcrop or the same igneous body; and dates which are in agreement by different dating methods will all be discussed in the next section (considering both Phanerozoic and Precambrian consistencies).

II. Highlights of Precambrian and Non-Biostratigraphic Geochronology

A. Consistency and Concordances Among Radiometric Dates

It is often claimed that reliable K-Ar dates can be objectively distinguished from apparent dates because the former will show internal consistence from widely separated samples, while the latter will scatter because an altering event does not affect all regions of the sampling area equally.

In practice, the analytic data is subordinate to geologic "fit" of the dates obtained. Marvin *et. al.*[267] write: "Many geologists commonly evaluate age determinations only in the light of geologic evidence and do not adequately consider the importance of the analytical data. Admittedly, an analytically valid age may occasionally prove to be geologically spurious because it conflicts with incontrovertible geologic field relations."

There are many instances of dates with good internal consistency being rejected as not giving the correct age of a rock because they conflict with accepted values. In a Precambrian situation, K-Ar dates were much younger than the (presumed correct) Rb-Sr dates, and about the K-Ar dates McKee and Noble[268] commented: "Continuous partial argon loss may have occurred. If this is the case, the consistency of these apparent ages is fortuitous."

Cases of modern lavas giving anomalously old K-Ar dates are so well known to Creationists that they are not repeated here. In one case, authors McDougall *et. al.*[269] warned against accepting consistent K-Ar dates as necessarily valid, because they found that: "With few exceptions, anomalously old but often internally consistent K-Ar dates were found for the lavas."

The fact that anomalously young K-AR dates can be internally consistent was pointed out by Wetherill.[176] A different argument from consistency involves the supposition that samples of widely differing K^{40} concentrations which yield consistent K-Ar dates are valid because a suite of samples would not have gained or lost Ar^{40} in just the right amounts to be identically proportional to their respective K^{40} concentrations. But a series of anomalously old but correlative K^{40}/Ar^{40} situations was described by Kaneoka and Aoki,[319] who wrote: A Greenland dolerite has also shown an anomalous old age in spite of good correlation in the $^{40}Ar/^{36}Ar$ vs. $^{39}Ar/^{36}Ar$ isochron diagram. These evidences suggest that the excess Ar^{40} is sometimes located in K or K-similar sites." Consistency of K-Ar dates is therefore no proof for their validity.

In Rb-Sr whole-rock dating, it is commonly believed that if the points plotted to define an isochron show good collinearity, then the rock remained a closed system and the date will be valid. But against this view, Goldich[217] wrote: "Linearity of points defining a whole-rock Rb-Sr isochron is not a sufficient criterion of the isochron age being the time of igneous emplacement or crystallization." Elsewhere, Matsuda[270] made a very similar statement.

A profound regional internal consistency for "too young" Rb-Sr isochrons was attributed to orogenic reheating. Fairbain *et. al.*[271] wrote: "If this is the actual explanation, it is remarkable that it has operated to about the same degree on three volcanic series hundreds of miles apart."

It is widely held that when K-Ar dates on biotite and hornblende are in agreement, the date is valid. Numerous authors approximate the energy of activation for thermally-induced argon loss to be reached at minimum temperatures of 250 °C for biotite and 450 °C for hornblende. Had a pluton cooled so slowly that it yielded spurious K-Ar dates, the hornblende date would be older than the biotite date because the former is cool enough to retain its accumulating radiogenic argon sooner than the latter. Alternatively, had there been a later heating event on the rock, K-Ar biotite/hornblende would be discordant because the biotite alone would be degassed, or (if hot enough to degas both) the hornblende would still be older because again it would be cool enough to retain its argon sooner that the biotite.

That is the theory. In fact, there are many cases of consistent K-Ar dates from these mineral separates that are "too young." The Chigmit Mountains Batholith (ref. 57) is one example. Elsewhere, McDougall and Leggo[272] wrote: ". . . hornblende and biotite K-Ar ages agree in a few cases where the measured ages are too young . . . . Hence, arguments based on consistency of results must be used with caution." Webb and McDougall[273] studied 51 discordant biotite/hornblende pairs and found no statistically significant preference for one to be older than the other. They concluded: "The concordance of biotite and hornblende K-Ar ages could lead to the erroneous conclusion that the date is the time of emplacement or strong metamorphism."

In K-Ar dating of the Peninsular Ranges Batholith (ref. 35), concordant but anomalously young biotite/hornblende pairs were found. The claim made was that the Batholith was deeply emplaced for tens of millions of years after intrusion, making it too hot for either mineral to retain argon. Then it is supposed that it got uplifted so rapidly that it cooled from above 450 °C to below 250 °C so quickly that no difference is shown between biotite and hornblende despite the fact that they are "too young". A similar train of thought was utilized by Wetherill *et. al.*[274] for a similar find.

The most powerful argument claimed for the validity of radiometric dates is the agreement of results from different dating methods. K-Ar/Rb-Sr whole-rock and U-Th-Pb/Rb-Sr whole-rock agreements appear to be more common than K-Ar/U-Th-Pb and non-concordia U-Th-Pb concordances. It is thus significant that the Rb-Sr isochron can be fudged.

Just as the Rb-Sr isochron can be fudged to get it to fit biostratigraphic evidence (as in the previously-discussed Barhalde Granite (ref. 94) and Kinsman Quartz Monzonite (ref. 140)) so it can be fudged to get it to agree with K-Ar or U-Th-Pb. An indication of some subjectivity in Rb-Sr isochrons was shown when several granites yielded isochrons ranging from 418 to 479 m.y., and when the data were pooled together, a 413 ± 7 m.y. isochron resulted.[275]

A U-Pb zircon date of 2560 m.y. was in disagreement with an Rb-Sr isochron of 1840 m.y. until the latter was subject to the following initial-ratio fudge: "An age of 2510 is obtained by calculating an average rock total and by using a more normal r_i."[278]

The numbers of cases of concordances are no doubt exaggerated by the selective publication of dating results. In a discordancy, the results of the method most considered correct will be published, and the results of another method ignored. In one granite (ref. 133) K-Ar and Rb-Sr isochron dates are in agreement, but "too young" for the biostratigraphic position. Just as the agreement was minimized by noting the change in Rb-Sr value by a change in initial Sr^{87}/Sr^{86} ratio (changeable from allegedly poor radiogenic Sr^{87} enrichment), so other agreements may be caused by adjusting the initial ratio.

Certain concordances are dissolved after further studies. In one situation described by Higgins,[276] U-Pb and Rb-Sr isochron dates agreed at 425 m.y. for three igneous bodies. One of the igneous bodies was reinterpreted as being much later and its 425 m.y. Rb-Sr mineral isochron dissolved and considered a meaningless result.

Allsopp *et. al.*[277] wrote: ". . . measurements on one pegmatite sample . . . indicated an apparent Rb-Sr age of 3.4 b.y.; this age was then interpreted as support for the 3.4 b.y. lead-model age . . . . Although analytically correct, the high apparent age . . . is considered anomalous in the light of new measurements . . . ."

Geologic interpretations are frequently changed in order to avoid situations where there would otherwise be a gross conflict between biostratigraphy and results in agreement by two or more radiometric dating methods. Clasts from the Hikami Granite (ref. 150) and an unnamed Devonian granite (ref. 50) were reinterpreted as being derived from a supposedly hidden later granite in order to avoid an anomalously young situation for the agreeing K-Ar/Rb-Sr whole-rock isochron dates. The biostratigraphic age of conglomerate containing clasts of the Pamir-Shugnan Granites (ref. 22) was changed for the very same reason. When K-Ar/Rb-Sr dates on glauconite (ref. 193) were much "too old" for the biostratigraphy but in agreement with each other, the glauconite was claimed to be reworked. Yet it was considered enigmatic because the nearest appropriate source area was much too distant for a soft glauconite pellet to be transported.

At least 2 of the 4 U-Th-Pb dating methods would be simultaneously in agreement with each other and "too old" (for example, ref. 18) if the claim of the "xenocrystic" origin was not accepted.

Concordant results by two or more methods, as the results from only one method, can be rejected as giving the age of the rock and instead considered to have other geologic meaning. Anomalously young but concordant K-Ar/U-Th-Pb dates from the Mrzyglod diabase (ref. 108) are supposed to indicate that the alleged heating event which had completely "rejuvenated" the K-Ar date also was related to a uranium mineralization. Discrepantly young but concordant K-Ar/Rb-Sr isochron from the Klotassin Batholith (ref. 72) are supposed to reflect a later heating event having "rejuvenated" both dates.

Still other agreements between different dating methods are considered to have no meaning whatsoever. In commenting on a K-Ar/Rb-Sr agreement on biotite, Wasserburg and Lanphere[279] said that it ". . . is a case of accidental concordance. That is, the time calculated does not have any meaning in terms of an event." In fact, anomalous agreements of K-Ar/Rb-Sr on biotite are so common that equal daughter-product loss is invoked, as by Webb and McDougall:[280] ". . . the frequent correspondence between Rb-Sr and K-Ar ages on this mineral from all environments suggests that Sr diffuses at similar rates and at the same temperatures as does Ar." K-Ar/Rb-Sr agreements on glauconite that are "too young" are also common (for example ref. 185, the Franconia Formation), and Hurley[281] proposed a similar explanation.

Miller and Kulp[282] described a case of what they considered to be a series of fortuitous agreements between Pb^{206}/U^{238} and Pb^{207}/U^{235} caused by a mixing-in of contaminant lead. Stuckless *et. al.*[283] found a Rb-Sr isochron in agreement with K-Ar but considered the possibility that the isochron: ". . . may be fortuitous." A granite yielded concordant K-Ar/Rb-Sr isochron values which fell into a time span considered to be a period of tectonomagmatic quiescence. For that reason, Armstrong[284] suggested that the mutually-corroborating results are neither the age of the granite nor a "rejuvenating" event but an in-between value: ". . . by coincidence, nearly concordant but meaningless K-Ar and Rb-Sr dates."

A fortuitious U-Th-Pb/Rb-Sr isochron agreement is supported by Dietrich *et. al.*,[285] who write: "the 1320± 100 m.y. date defined by a whole rock isochron is not known to correlate with any well-recognized sedimentary or tectonic event (It is similar to the discordant 'age' of about 1300 m.y. reported from two probably detrital zircon samples . . . any agreement with these 1300 m.y. 'ages' would appear to be little more than a coincidence.)."

The fact that there are many anomalous dates which agree by two methods and are explained away as mutually rejuvenated or totally fortuitious suggests that concordant dates need not be accepted as an unassailable proof for the validity of radiometric dating. The fact that agreements considered to be fortuitous occur on a routine basis in some cases (Rb-Sr/K-Ar agreements on glauconite and igneous biotite) further encourages belief that all concordances may have a geochemical explanation that has nothing to do with the true ages of the rocks dated.

Of course, it is important to note that comparisons between results of different dating methods are commonly (if not usually) discordant, and are promptly dismissed as open systems. York and Farquhar[387] said: Where the results of comparisons of this sort disagree, it is clear that some sort of transfer of materials into or out of the rock or mineral has taken place. It has also become apparent from the number of published discordant ages that disturbances of this nature are far more common than was formerly realized."

In speaking of the U-Th-Pb methods, Davidson[388] wrote: "Ideally, the isotopic ratios . . . should all give results in good agreement . . . . In practice, very few uranium and thorium minerals have been found to exhibit this concordant pattern of ages, and the much more common discordances between the three or four values have been facilely explained away, as each investigator thought best fitted to local circumstances . . . ."

Hurley and Rand [389] did a comparison of K-Ar and Rb-Sr results from the Precambrian continental crust, using published and some unpublished sources from nearly every continental region on earth. The best-fit line on the Rb-Sr vs. K-Ar graph was K-Ar = .75Rb-Sr, indicating a systematic tendency of K-Ar/Rb-Sr discordance. One fourth of the points were indicative of such discordancy that they plotted at or near the line K-Ar = .5Rb-Sr.

In writing of results of datings in Phanerozoic orogenic belts, Brown and Miller[390] said: "In general, strong discordances can be expected among ages deduced by different methods." Since most dates obtained by the simultaneous application of more than one method come from orogenic belts, it may follow that the majority of comparative datings from the Phanerozoic, as in the Precambrian, are discordant.

B. Radiometric Violations of Superpositional and Cross-Cutting Relationships

Radiometric dates routinely violate common-sense relationships of field geology. It is almost self-evident that in a depositional situation the topmost beds must be at least slightly younger than those below them, and in an intrusive relationship it is the intruding body which must be younger than the body it cuts.

In writing about tuffs (obvious depositional accumulation), Curtis *et. al.*[286] write: "These beds may appear to be pure . . . yet gave different ages from top to bottom; *the younger age being on the bottom.*" The rationalization invoked for this absurd situation was that the first-deposited were uncontaminated while the upper beds were subject to influx of contaminating detrital minerals.

A tuff yielding a K-Ar date of 40-41 m.y. was found intruded by a dike and sill yielding K-Ar dates of 49-50 m.y.[287] A diorite whose biotite yielded a 157 m.y. K-Ar date is intruded by a quartz diorite yielding a 204 m.y. K-Ar biotite date.[87] Violations of cross-cutting relationships are not exceptional. Hopson[288] states: "This curious relationship, in which the pegmatites give mineral ages older than those from the host rocks, is now known to be common . . . ." These gross anomalies are explained away by claiming that the pegmatite gives older K-r ages than the intruded country rock because the country rock is composed of fine-grained minerals that are more vulnerable to thermally-induced argon loss. This is accommodating, because many coarse-grained pegmatites properly give younger K-Ar and Rb-Sr mineral dates than the fine-grained country rock. Furthermore, Leach *et. al.*[289] found coarse-grained schists giving ages near 72 m.y. whereas fine-grained varieties gave dates near 123 m.y., and they appealed to ". . . some other process . . . " to explain this.

A different set of violations involves Rb-Sr whole-rock isochrons. The Stony Creek Granite of 610±50 m.y. Rb-Sr isochron age cuts the Monson Gneiss of 444±15 m.y. Rb-Sr isochron age.[290] Remobilization of Sr isotopes during metamorphism was the supposed cause of this.

Violations are especially prominent in Precambrian rocks. A pegmatite yielding Rb-Sr isochrons of 1.7 to 2.7 b.y. cuts the country rock which yields 2.0-2.2 b.y. Rb-Sr isochrons.[291] In the Baltic Shield, metamorphic rocks of the Kola series give Rb-Sr dates of 2.4-2.7 b.y. and maximum K-Ar dates of 2.7-2.8 b.y. They are intruded by basic and ultrabasic rocks comprising the Nonchegorsk Massif, and yield U-Pb dates of 2.9 b.y. and K-Ar dates of 3-3.5 b.y. Elsewhere, granites cutting the Kola Series have given K-Ar dates from 2.8 to 3.6 b.y. and U-Pb dates of 2.8 b.y.[292] In the Guyana Shield, the basement rock yields a 1.8. b.y. Rb-Sr isochron date, while a gabbroic-doleritic mass intruding it gives K-Ar dates up to 3.06 b.y. "Excess argon" in the basic rocks is the rationalization invoked.[293] Space limitations prevent the listing of countless other violations.

Rank absurdities arise from radiometric dating which are explained away in terms of metamorphic processes. For instance, Varadarajan[317] found that the Amritpur Granite of India yields K-Ar dates of 1.3-1.9 b.y. and intrudes metavolcanics of 228 m.y. He rejected others' suggestions that the contact is not intrusive, and proposed that the ages are correct but that the Granite was partially remelted after 228 m.y. ago, and thereby emplaced intrusively into the much younger metavolcanics. In another case,[318] the Kochatev granite massif of 450 m.y. was unconformably overlain by the Zerendinsk Series of 1.2-1.5 b.y. The rationalization invoked for this absurdity was that the granite had been remelted while the overlying formation was unaffected.

Probably the greatest violations of all are radiometric dates many times greater than the accepted 4.5 b.y. age of the earth. They may be a type of *reductio ad absurdum* of accepting billions-of-years ages for rocks. A plagioclase crystal gives an unexplicable age of 4.9 b.y. while everything else around gives Rb-Sr ages of 1.3-1.5 b.y.[294] Mark *et.al.*[295] found a probably Tertiary basalt yielding an isochron of 10 b.y. The Pharump diabase[296] from the Precambrian of California yielded an Rb-Sr isochron of no less than 34 b.y., which is not only over 7 times the age of the earth but also greater than some uniformitarian estimates of the age of the universe. This super-anomaly was explained away by claiming some strange metamorphic effect on the Sr.

K-Ar ages much greater than inferred earth age are also common. Gerling *et. al.*[297] called attention to some chlorites yielding K-Ar dates of 7 to 15 b.y. It had been noted that some minerals which yield such dates (as beryl, cordierite, etc.) can be claimed to have trapped excess argon in their channel structures or to have fractioned the Ar isotopes, but none of this can apply to the simple mica-like structure of chlorite. They also pointed out that for the anomalies to be accounted for by excess argon, unreasonably high partial pressures of Ar during crystallization would have to be required. They concluded by suggesting some unknown nuclear process which no longer operates to have generated the Ar. Elsewhere, Galimov[298] suggested that ^{40}K captures an external electron via K-capture. The possibility of K decaying to Ar some other way should be interesting to those Creationist physicists studying the question of how invariant decay rates are.

C. Age Values for Igneous and Metamorphic Terranes

It is most interesting to note many cases where radiometric dating imposes time partitions which appear to be unsupported or contradicted by lithostratigraphic evidence. In dating layers of lava flows, Williams and Curtis[299] wrote: "According to potassium-argon determinations, the exposed volcanic rocks range in age from about 2.5 m.y. to 1.4 m.y. We admit, however, that some age-determinations are difficult to reconcile with observations made in the field. The absence of signs of deep erosion and soil-horizons suggests that accumulation of the Rampart beds was essentially a continuous process, without long periods of volcanic quiet."

Precambrian terranes composed of igneous and metamorphic rock contain unconformities which are supposed to be erosional surfaces generated during orogenic cycles each of which is hundreds of millions of years in duration. Several cycles are supposed to have occurred during the Aphebian (dates as 1.7 to 2.5 b.y.) and Archean (over 2.5 b.y.). Stockwell[300] notes many cases were Aphebian rocks grade directly into Archean, and attributes this to the destruction of the alleged unconformities during gneissification. An alternate view would be that the unconformities never existed, that the hundreds of millions of years never elapsed, and that radiometric dating has artificially segmented continuous strata into fallacious time partitions.

At the same time, Archean rock is unconformably overlain by igneous and metamorphic rock sometimes billions of years younger. Yet Hurley *et. al.*[301] observe that commonly the radiometric ages are the same on both sides of the unconformity; that Archean basement tends to be as radiometrically young as the overlying material. This is attributed to rejuvenation of Archean as the overlying rocks are formed, but an alternative view is that rocks supposedly billions of years apart in time are uniformly young because radiometric dating is invalid and so are the artificially-erected time designations, and various contrivances are necessary to harmonize lithostratigraphy with radiometric dating and uniformitarian concepts.

In generalizing on all Precambrian geochronology, Peterman *et. al.*[302] wrote: ". . . correlations based on lithologic and successional similarities and 'layer cake' stratigraphy generally result in an oversimplification and serious errors." This is supposedly caused by the geologic complexity of Precambrian terranes, but another view is that radiometric dates routinely violate not only lithostratigraphy, but result in a completely artificial imposition of time partitions which have no basis in reality and naturally result in confusion.

Dott and Dalziel[303] wrote: "Lithic correlation of the Baraboo metasedimentary sequence with Animikie rocks in northern Michigan and northern Wisconsin has seemed compelling, for each succession has pure quartzite overlain by a carbonate and iron-bearing interval, which is in turn succeeded by thick slates." The Baraboo rocks have yielded a "meaningless" date near 750 m.y. and a spread of K-Ar and Rb-Sr dates from 1.1 to 1.6 b.y. By contrast, Animikie rocks have given U-Pb and Rb-Sr dates from 1.9 to 2.1 b.y., with an even older correlative of 2.1-2.4 b.y. dates. Are rocks of such similar composition and lithostratigraphy really separated by hundreds of millions of years of time, or is radiometric dating a delusion?

Unnatural time-imposition by radiometric dating may be evident even in rocks that approach 4.0 b.y.— the oldest dates accepted for terrestrial material, In comparing greenstone-granite formations from Greenland that have yielded dates near 3.8 b.y. with other greenstone-granites that give only 2.7-3.3 b.y. dates, Moorbath *et. al.*[304] commented: "The major volcanic and sedimentary features are essentially indistinguishable from those of younger greenstone belts in North America and southern Africa . . . ."

An extremely plastic acceptance of radiometric dates is admitted for the Precambrian. Sabine and Watson[305] cite: ". . . the rather subjective task of separating 'true' from 'apparent' ages." Wasserburg and Lanphere[306] appealed to complex Precambrian histories to explain discrepant dates, and commented: ". . . geochronologic studies commonly lead to a confusing array of data, in which many of the determinations . . . are not the age of primary metamorphism or intrusions." Barton[307] said: "As in the case with radiometric ages determined from almost any rock unit, it is impossible to establish unequivocally that the ages reported here reflect the time of original crystallization or emplacement of the bodies from which they are derived."

Just as dates in the Phanerozoic must fit accepted values for their biostratigraphic positions in order to be accepted as valid, so also radiometric dates are selectively accepted depending upon the geologic relationships of Precambrian rock. The subordinate nature of radiometric dates even in the Precambrian is evident in the following statement by Pulvertaft:[308] ". . . poor exposures and low relief have forced geologists to rely too much on isotopic age determinations."

A very prominent feature of Precambrian geochronology is the fact that radiometric dates from the igneous and metamorphic complexes spread over hundreds of millions (or even billions) of years. Odom and Fullagar[309] found the Cranberry Gneiss yielding Rb-Sr isochrons from 670 m.y. to 1.3 b.y. and commented: ". . . the so-called Cranberry Gneiss might represent a time span equivalent to that of the entire Phanerozoic."

This is not exceptional. Sabine and Watson[310] point out that: ". . . one outcome of isotopic age-studies had been the demonstration that some metamorphic complexes had been built up by repeated activity over periods of several hundred million years." A skeptical view of radiometric dating would question the incredible lengths of time indicated for these rocks and suggest that there is actually a very self-contradictory spectrum of dates and that this spectrum is not caused by repeated petrogenetical activity but that it actually illustrates the meaningless and invalidity of radiometric dating.

Very self-contradictory age-spreads in the Precambrian are so common that it is claimed there was repeated tectonomagmatic activity going on for billions of years in given regions. Pulvertaft[311] writes: "Reactivation is recognized by most geologists as a common feature of Pre-Cambrian basement areas. What is not always realized is the scale on which it may have taken place."

The Sao Francisco Craton of Brazil shows a K-Ar spread of 1.1 to 1.9 b.y.[312] Elsewhere, Peterman and Hedge[313] found both K-Ar and Rb-Sr mineral dates in a huge mutually-contradictory spread of 80 m.y. to 1.8 b.y. Gerling *et. al.*[292] reported K-Ar dates from the Baltic Shield spreading from a high of 3.5 b.y. to a low near 1.2 b.y. In the Saamo-Karelion Zone alone, a spread of 1.7 to 2.8 b.y. was encountered.[314]

When stripped of all the claims of reactivation, it is obvious that rocks yield ages which spread over significant fractions of the entire earth's alleged 4.5 b.y. history. Such absurdly contradictory results may be further evidence against the validity of radiometric dating.

Creationists and Diluvialists are not alone in their disbelief of radiometric dating. The fact that radiometric dating lacks credibility even in some uniformitarian circles is evident in the following statement by Houtermans:[320] "Sometimes the dates given by radioactive methods are accepted enthusiastically by the classical geologists, sometimes if these dates do not fit their previously formed hypotheses they come to the conclusion to deny the usefulness of radioactive methods altogether." Similarly, Brown and Miller[321] commented: "Much still remains to be learned of the interpretation of isotopic ages and the realization that the isotopic age is not necessarily the geologic age of a rock has led to an over-skeptical attitude by some field geologists." Whether the skepticism has been excessive or whether it has been insufficient is, of course, a matter of opinion.

Every paradigm has explanations for data that won't fit it. The paradigm crumbles when the explanations are not accepted and considered to be only excusing rationalizations that cover-up the basic failure of the paradigm. Likewise, all of the various open-system explanations for discrepant results may be accepted at face value, or they may be seen as excusing rationalizations that cover up the invalidity of radiometric dating and all the eons of time that it purportedly demonstrates and measures.

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AA —Geophysical Journal of the Royal Astronomical Society
AG —American Association of Petroleum Geologists Bulletin
AJ —American Journal of Science
AN —Antarctic Journal of the United States
BV —Bulletin volcanogique
CE —Canadian Journal of Earth Sciences
CG —Geological Survey of Canada Paper
CH —Chemical Geology
CO —Proceedings of the International Geological Congress
CT —Contributions to the Geologic Time Scale (American Association of Petroleum Geologists Studies in Geology No. 6)
DE —Doklady: Earth Science Sections (translation from Russian)
EG —Economic Geology
EP —Earth and Planetary Science Letters
GA —Geological Society of America Abstracts with Programs
GB —Geological Society of America Bulletin
GC —Geochimica et Cosmochimica Acta
GE —Geology
GG —BMR Journal of Australian Geology and Geophysics
GH —Eclogae Geologicae Helvetiae
GI —Geochemistry International
GJ —Geochemical Journal (of Japan)
GL —Quarterly Journal of the Geological Society of London
GM —Geological Society of America Memoir
GN —Norges Geologiske Undersokelse Bulletin
GP —Geological Society of America Special Paper
GR —Journal of Geophysical Research
GU —Journal of the Geological Society of Australia
IG —International Geology Review
IN —Journal of the Geological Society of India
IS —Isochron/West: A Bulletin for Isotope Geochronology
JG —Journal of Geology
JR —Journal of Research of the United States Geological Survey
KG —Kwartalnik Geologiczny
LG —Liverpool Manchester Geological Journal
MI —Geologie en Mijnbouw
MP —Contributions to Minerology and Petrology
NA —Nature
NP —Norsk Polarinstitutt Skrifter

NY —New York Academy of Sciences Transactions
OG —Overseas Geology and Mineral Resources
PE —Journal of Petrology
RE —Precambrian Research
RU —Geologische Rundschau
SC —Science
SG —Scottish Journal of Geology (Transactions of the Edinburgh Geological Society prior to 1964)
SP —Journal of Sedimentary Petrology
SR —Colloques Internationaux du Centre National de la Recherche Scientifique
SV —Springer Verlag Publishing Co. Berlin, Heidelberg, New York
TI —Norsk Geologisk Tiddskrift
TS —The Phanerozoic Time Scale (Geological Society of London Special Publication 120s)
UG —United States Geological Survey Professional Paper
UN —Transactions American Geophysical Union
YG —Proceedings of the Yorkshire Geological Society
ZG —New Zealand Journal of Geology and Geophysics

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(Continued on page 147)