Rubidium/Strontium Radiometric Dating

How reliable is radiometric dating? We are repeatedly told that it proves the Earth to be billions of years old. If radiometric dating is reliable than it should not contradict the evolutionary model. According to the Big Bang theory the age of the Universe is 10 to 15 billion years.[1] Standard evolutionist publications give the age of the universe as 13.75 Billion years. [2, 3]

Standard evolutionist geology views the Earth as being 4.5 billion years old. Here are some quotes from popular text: "The age of the Earth is 4.54 ± 0.05 billion years." [4] "The Solar System, formed between 4.53 and 4.58 billion years ago." [1] "The age of 4.54 billion years found for the Solar System and Earth." [1] "A valid age for the Earth of 4.55 billion years." [5, 6]

If we run the isotopic ratios give in standard geology magazines through the computer program Isoplot [7] we find that the Uranium/Thorium/Lead isotopic ratios in the rocks disagree radically with the Rubidium/Strontium ages. The U/Th/Pb ratios give ages older than the evolutionist age of the Earth, Solar System, Galaxy and Universe. How can Earth rocks be dated as being older than the Big Bang?

If we use isotopic formulas [8-11] given in standard geology text we can arrive at ages from the Rb/Sr and Nd/Sm ratios. The formula for Rb/Sr age is given as:

$$t = \frac{2.303}{\lambda}\log\left(\frac{(87Sr/86Sr) - (87Sr/86Sr)_0}{(87Rb/86Sr)} + 1\right) \quad \textbf{[1]}$$

Where t equals the age in years. λ equals the decay constant. (87Sr/86Sr) = the current isotopic ratio. $(87Sr/86Sr)_0$ = the initial isotopic ratio. (87Rb/86Sr) = the current isotopic ratio. The same is true for the formula below.

$$t = \frac{2.303}{\lambda}\log\left(\frac{(143Nd/144Nd) - (143Nd/144Nd)_0}{(147Sm/144Nd)} + 1\right) \quad \textbf{[2]}$$

Here are examples of isotopic ratios taken from several articles in major geology magazines which give absolutely absurd dates.

Sm-Nd And Rb-Sr Isotopic Systematics Of Ureilites

These meteorite samples were dated in 1991 by scientist from the University of Arizona, and the University of California. According to the article [15] the age of the sample is: "Whole-rock samples of these ureilites are highly depleted assemblages (147Sm/144Nd = 0.33-0.35) having Sm-Nd model ages consistent with 4.55 Ga.". If we run the Rubidium/Strontium isotope ratios listed in the article [16] through Microsoft Excel we get the following values:

1. Sm/Nd Versus Rb/Sr

Dating Summary	Age 147Sm/144Nd	Age 87Rb/86Sr
Average	4,170	7,759
Maximum	4,912	19,652
Minimum	2,929	2,423
Difference	1,983	17,228

2. Rb/Sr, Maximum Ages

87Rb/86Sr Age Sorted	87Rb/86Sr Age Sorted
19,652	10,139
17,419	8,490
14,812	7,714
13,794	6,819
11,015	5,377

The Rb/Sr ratios give a 17 billion year spread of dates. I the Solar System is only 4.5 billion years old how can such stupid dates exist?

Sr, Nd, Pb And Os Isotopes

These samples from the Precambrian crystalline basement of Schirmacher Oasis, East Antarctica were dated in 2001 by scientist from Germany and Switzerland. [17] According to the essay [18] the age of the sample is 1500 million years. If we run the Lead and Rubidium isotope ratios [19] through Isoplot and Microsoft Excel we get the following values:

3. Multiple Dating Summary

Dating Summary	Age 207Pb/206Pb	Age 206Pb/238U	Age 87Rb/86Sr	Age 147Sm/144Nd
Average	5,069	9,857	446	447
Maximum	5,123	11,602	448	454
Minimum	5,026	6,403	444	439
Difference	97	5,198	3	14

4. U/Pb, Maximum Ages

Age Sorted 206Pb/238U	Age Sorted 206Pb/238U
11,602	10,303
11,193	9,534
11,158	8,095
10,568	6,403

The Uranium/Lead dates are 10 to 20 times older than the other two methods. The author's choice of the "true age" is just a guess. Five dates are older than the evolutionist age [10 Billion Years] of the Milky Way galaxy.

Sr-Nd-Pb Isotope Systematics Of Mantle Xenoliths

These samples Somerset Island, Canadian Arctic were dated in 2001 by scientist from the University of Quebec. [20] According to the essay [20] the age of the sample is "Sr, Nd, and Pb isotopic compositions were determined for a suite of Archean garnet peridotite and garnet pyroxenite xenoliths and their host Nikos kimberlite (100 Ma) from Somerset Island". If we run the Lead and Rubidium isotope ratios [21] through Isoplot and Microsoft Excel we get the following values:

5. Multiple Dating Summary

Dating	87Rb/86Sr	147Sm/144Nd	206Pb/238U	207Pb/206Pb
Summary	Age	Age	Age	Age
Average	243	100	4,349	4,974
Maximum	2,523	101	9,644	5,092
Minimum	65	99	1,173	4,904
Difference	2,458	2	1,991	31

6. U/Pb, Maximum Ages

206Pb/238U	207Pb/206Pb
Age Sorted	Age Sorted
9,644	5,092
8,218	5,001
7,359	4,996
6,417	4,992
6,280	4,989
5,273	4,987
5,231	4,986
5,213	4,985
5,033	4,980

The Uranium/Lead dates are 10 to 150 times older than the other two methods. The author's choice of the "true age" is just a guess. Eighteen dates are older than the evolutionist age [4.5 Billion Years] of the Earth.

Strontium, Neodymium, And Lead Isotope Variations

These samples from the Alpha Ridge, central Arctic Ocean were dated in 1997 by scientist from the University of Wisconsin. [22] According to the essay [22] the age of the sample is "Provenance changes of silicate sediment deposited during the Late Cenozoic (5-0 Ma)". If we run the Lead 207/206 isotope ratios [23] through Isoplot and Microsoft Excel we get the following values:

7. Lead 207/206 Dating Summary

Average	4,986
Maximum	5,239
Minimum	4,960
Std Deviation	40

According to the essay the true age by the Rb/Sr method is just 5 million years old. That is 1,000 times younger than the Lead 207/206 dating method.

Crystallization History Of Rhyolites At Long Valley

These samples from Long Valley, California were dated in 2002 by scientist from England and The Netherlands. [24] According to the essay [24] the age of the sample is "In this study, we present $^{87}Rb/^{86}Sr$ and $^{230}Th/^{238}U$ isotope analyses of glasses and phenocrysts from postcaldera rhyolites erupted between 150 to 100 ka from the Long Valley magmatic system." According to various dating charts [25] the samples are only 100 thousand years old. If we run the Lead and Rubidium isotope ratios [26] through Isoplot and Microsoft Excel we get the following values:

8. Multiple Dating Summary

Dating Summary	Age 87Rb/86Sr	Age 207Pb/206Pb
Average	-2	4,953
Maximum	5	4,954
Minimum	-16	4,951
Difference	21	3

The Lead 207/206 date is 49,500 times the so called true age. The Rubidium/Strontium dates are way off to.

Fluid–Rock Interaction During Progressive Migration

These samples from the Cretaceous Okorusu carbonatite complex (Namibia) were dated in 2003 by scientist from England, Germany and Brazil. [27] According to the essay [27] the age of the sample is "A crush-leach experiment for fluid inclusions in the hydrothermal quartz yielded a Rb-Sr isochron age of 103 Ma." If we run the Lead and Rubidium isotope ratios [28] through Isoplot and Microsoft Excel we get the following values:

9. Multiple Dating Summary

Dating	87Rb/86Sr	206Pb/238U	207Pb/235U	207Pb/206Pb
Summary	Age	Age	Age	Age
Average	32	10,874	5,214	4,598
Maximum	351	36,764	10,638	5,019
Minimum	0	138	328	2,047
Difference	351	36,626	10,310	2,972

10. U/Pb, Maximum Ages

206Pb/238U	207Pb/235U	207Pb/206Pb
Age Sorted	Age Sorted	Age Sorted
36,764	10,638	5,019
25,353	8,816	5,013
22,728	8,372	5,000
17,110	7,449	4,990
7,145	5,517	4,943
4,321	4,632	4,937
2,955	4,257	4,888

The 206Pb/238U dates are between 29 to 360 times to old. The 207Pb/235U dates are between 42 to 106 times to old. The 207Pb/206Pb dates are all 50 times to old. The Rubidium/Strontium dates are way off to.

Constraints On The U-Pb Isotopic Systematics

These samples from the Martian meteorite Zagami were dated in 2005 by scientist from the University of New Mexico. [29] According to the essay [29] the age of the sample is "Although the Rb-Sr and Sm-Nd systems define concordant crystallization ages of 166 +-6 Ma and 166 +- 12 Ma, respectively, the U-Pb isotopic system is disturbed. Nevertheless, an age of 156 Ma is derived from the ^{238}U-^{206}Pb isotopic system from the purest mineral fractions (maskelynite and pyroxene)." If we run the Lead and Rubidium isotope ratios [30] through Isoplot and Microsoft Excel we get the following values:

11. Multiple Dating Summary

Dating Summary	Age 87Rb/86Sr	Age 207Pb/206Pb	Age 206Pb/238U
Average	4,501	5,081	2,826
Maximum	6,186	5,204	6,566
Minimum	4,071	4,962	218
Difference	2,114	242	6,348

All the dating methods disagree strongly with each other.

Age And Radiogenic Isotopic Systematics

These samples from the Borden complex of northern Ontario were dated in 1986 by scientist from Carleton University, Ontario, the University of California at Santa Barbara, Santa Barbara, and the Ontario Geological Survey. [31] According to the essay [31] the age of the sample is "Rb-Sr and U-Pb data from the Borden complex of northern Ontario, a carbonatite associated with the Kapuskasing Structural Zone, indicate a mid-Proterozoic age. A $^{207}Pb/^{206}Pb$ age of 1872 ± 13 Ma is interpreted as the emplacement age of this body, grouping it with other ca. 1900 Ma complexes that are the oldest known carbonatites associated with the Kapuskasing structure." If we run the Lead and Rubidium isotope ratios [30] through Isoplot and Microsoft Excel we get the following values:

12. Multiple Dating Summary

Dating Summary	Age 147Sm/144Nd	Age 87Rb/86Sr	Age 208Pb/232Th	Age 207Pb/206Pb	Age 206Pb/238U
Average	1,888	3,815	115,021	5,187	38,752
Maximum	1,906	9,405	124,106	5,212	44,204
Minimum	1,868	1,515	107,946	5,174	31,695
Difference	38	7,890	16,160	38	12,509

The maximum 208Pb/232Th age is 82 times older than the minimum 87Rb/86Sr age. There is a 122 billion year difference between the oldest and youngest dates. The average 208Pb/232Th age is 115 billion years. The average 206Pb/238U age is 38 billion years.

13. U/Pb, Maximum Ages

Age Sorted 208Pb/232Th	Age Sorted 207Pb/206Pb	Age Sorted 206Pb/238U
124,106	5,212	44,204
119,630	5,188	41,998
116,743	5,184	41,408
113,288	5,183	38,515
108,412	5,181	34,690
107,946	5,174	31,695

Crustal Age Domains

These samples from the Mozambique Belt of Tanzania were dated in 1998 by scientist from Germany. [33] According to the essay [33] the age of the sample is "Most boundaries of these age domains are overprinted by Neoproterozoic (Pan-African) tectonism and metamorphism. Granitoids from the Archean craton show Nd model ages of 2.7–3.1 Ga." If we run the Lead and Rubidium isotope ratios [34] through Isoplot and Microsoft Excel we get the following values:

14. Multiple Dating Summary

Dating	Age	Age
Summary	87Rb/86Sr	207Pb/206Pb
Average	2,248	5,134
Maximum	2,865	5,333
Minimum	1,488	5,018
Difference	1,377	315

If the Rubidium/Strontium dating is accurate, the 207Pb/206Pb dates are stupid. The Earth is only supposed to be 4.5 billion years old.

Melt Peridotite Reactions

These samples from the Horoman Peridotite Massif, Japan were dated in 2010 by scientist from Japan. [35] According to the essay [36] the age of the sample is "The Re/Os isotope data of Saal et al. (2001) gave an apparent melting age of 900 Ma. Malaviarachchi et al. (2008) reported Sm/Nd and Lu/Hf isochron ages of 1 Ga as the partial melting age for the Horoman Massif." If we run the Lead and Hafnium isotope ratios [37] through Isoplot and Microsoft Excel we get the following values:

15. Multiple Dating Summary

Dating	Age	Age
Summary	207Pb/206Pb	176Lu/177Hf
Average	5,014	440
Maximum	5,050	955
Minimum	4,999	262
Difference	52	693

The spread of dates is just random. If the Hafnium dating is accurate, the 207Pb/206Pb dates are stupid. The Earth is only supposed to be 4.5 billion years old.

Feldspathic Clasts In Yamato-86032

These samples from the Yamato meteorite were dated in 2006 by scientist from USA and Japan. [38] According to the essay [38] the age of the sample is "The Y-86032 protolith formed at least 4.43 ± 0.03 Ga ago as determined from a Sm–Nd isochron for mineral fragments from the breccia clast composed predominantly of An93 anorthosite and a second clast of more varied composition." If we run the 87Rb/86Sr and 147Sm/144Nd isotope ratios [39] through Isoplot and Microsoft Excel we get the following values:

16. Multiple Dating Summary

Dating	Age	Age
Summary	87Rb/86Sr	147Sm/144Nd
Average	4,213	294,470
Maximum	5,277	315,266
Minimum	2,575	251,680
Difference	2,703	63,586

The maximum 147Sm/144Nd age is 122 times older than the minimum 87Rb/86Sr age. There is a 300 billion year difference between the oldest and youngest dates. According to the article the initial 143Nd/144Nd ratio is: "However, eNd for these data is more appropriately calculated as E*Nd HED* = -0.64 ± 0.13 relative to initial 143Nd/144Nd obtained at the Johnson Space Center" [40] The range is thus between -0.51 and -0.77. If we feed those initial ratios into Microsoft Excel we get the following dating range:

17. 143Nd/144Nd, Multiple Dating Summary

Dating	143Nd/144Nd	143Nd/144Nd	143Nd/144Nd
Summary	Initial = -0.64	Initial = -0.51	Initial = -0.77
Average	294,470	278,990	308,527
Maximum	315,266	299,395	329,645
Minimum	251,680	237,101	264,990
Difference	63,586	62,294	64,655

Using the initial isotope range we get a minimum age of 250 billion years! We get a maximum age of 330 billion years!

Cretaceous Seamounts Along The Continent

These samples from the Atlantic sea floor off the coast of Spain were dated in 2006 by scientist from France. [41] According to the essay [41] the age of the sample is "The ages reveal different pulses of alkaline magmatism occurring at 104.4 ± 1.4 (2r) Ma and 102.8 ± 0.7 Ma on the Sponge Bob seamount, at 96.3 ± 1.0 Ma on Ashton seamount, at 92.3 ± 3.8 Ma on the Gago Coutinho seamount, at 89.3 ± 2.3 Ma and 86.5 ± 3.4 Ma on the Jo Sister volcanic complex, and at 88.3 ± 3.3 Ma, 88.2 ± 3.9, and 80.5 ± 0.9 Ma on the Tore locality." If we run the 87Rb/86Sr and Uranium/Lead isotope ratios [42] through Isoplot and Microsoft Excel we get the following values:

18. Multiple Dating Summary

Dating	Age	Age	Age
Summary	207Pb/206Pb	206Pb/238U	87Rb/86Sr
Average	4,933	212	105
Maximum	4,943	702	293
Minimum	4,923	91	0
Difference	20	611	293

The three dating methods all disagree with each other. The Lead 207/206 ratios give dates 50 times to old.

19. Lead 207/206 Dating Summary

Average	390
Maximum	2,102
Minimum	-635
Difference	2,737

If we run another set of Lead 207/206 ratios [43] through Isoplot we find forty three of the Lead 207/206 dates are over 200 million years old. Nine have negative ages.

Petrology And Geochemistry Of Target Rocks

These samples from the Bosumtwi impact structure, Ghana were dated in 1998 by scientist from the University of Vienna, the University of the Witwatersrand, South Africa and Dartmouth College, New Hampshire. [44] According to the essay [44] the age of the sample is "A best-fit line for the Bosumtwi crater rocks in a Rb-Sr isotope evolution diagram yields an "age" of 1.98 Ga, and an initial 87Sr/86Sr ratio of 0.701, which is close to results previously obtained for granitoid intrusions in the Birimian of Ghana. Our Nd isotopic data yield depleted mantle model ages ranging from 2.16 to 2.64 Ga," If we run the 87Rb/86Sr isotope ratios [45] through Isoplot and Microsoft Excel we get the following values:

20. Rb/Sr Dating Summary

Average	**5,638**
Maximum	**7,015**
Minimum	**3,537**
Difference	**3,478**

21. Rb/Sr Dating, Maximum Ages

87Rb/86Sr	87Rb/86Sr	87Rb/86Sr
Maximum Age	**Maximum Age**	**Maximum Age**
7,015	**5,980**	**5,384**
6,932	**5,804**	**5,111**
6,761	**5,795**	**4,926**
6,322	**5,687**	**4,576**
6,146	**5,603**	**4,479**
5,994	**5,439**	**3,537**

The essay claims that the model age is 2.5 billion years. The minimum age obtained is 3.5 billion years. Fourteen dates are over 5 billion years. The Earth is only supposed to be 4.5 billion years old.

Geochronology Of The Deep Profile

These samples from the Vredefort granites in South Africa were dated in 1981 by scientist from the University of the Witwatersrand Johannesburg, South Africa. [46] According to the essay [46] the age of the sample is "Rb-Sr and Th-Pb isochrones of ~3500 m.y. are recorded in the mafic granulite relicts. A companion paper (Welke and Nicolaysen this issue) provides evidence for an early crust-forming event in this sector ~3800 m.y. ago. From ~3500 m.y. onward, these deeper crustal levels did not undergo addition of new Archean crust-forming material on a major scale." If we run the Uranium/Lead isotope ratios from table 3 in the article [47] through Isoplot and Microsoft Excel we get the following values:

22. Uranium/Lead Dating Summary

Dating	Age	Age	Age
Summary	**208Pb/232Th**	**206Pb/238U**	**207Pb/206Pb**
Average	**12,145**	**9,103**	**4,841**
Maximum	**18,319**	**16,498**	**5,337**
Minimum	**5,652**	**3,865**	**4,168**
Difference	**12,667**	**12,633**	**1,169**

23. Uranium/Lead Dating, Maximum Ages

Age Sorted 208Pb/232Th	Age Sorted 206Pb/238U	Age Sorted 207Pb/206Pb
18,319	16,498	5,337
14,951	16,120	5,312
14,880	14,623	5,232
14,002	10,837	5,220
13,502	10,737	5,176
12,101	9,657	5,118
11,815	9,496	5,101
11,594	7,902	4,756
11,416	5,324	4,630
11,130	4,615	4,358
10,381	4,441	4,342
8,137	4,230	4,184
5,652	3,865	4,168

The dates are spread over almost 13 billion years between the youngest and oldest. If we run the Uranium/Lead isotope ratios from table 7 in the article [48] through Isoplot and Microsoft Excel we get the following values:

24. Uranium/Lead Dating Summary

Dating Summary	Age 208Pb/232Th	Age 206Pb/238U	Age 207Pb/206Pb
Average	24,309	15,120	5,324
Maximum	64,610	25,894	6,498
Minimum	10,018	3,245	4,868
Difference	54,592	22,649	1,629

25. Uranium/Lead Dating, Maximum Ages

Age 208Pb/232Th	Age 206Pb/238U	Age 207Pb/206Pb
64,610	25,894	6,498
50,397	22,874	5,381
40,744	20,347	5,361
33,172	19,156	5,350
28,598	18,933	5,347
26,293	18,341	5,331
18,726	16,394	5,329
15,999	16,373	5,317
14,346	15,949	5,314
13,998	15,794	5,309
13,743	14,580	5,295
11,902	14,220	5,239
11,255	13,743	5,226
10,840	12,171	5,223
10,018	10,175	5,221

The dates are spread over a 61 billion year range, between the youngest and oldest. If we run the Uranium/Lead isotope ratios from table 4 in the article [49] through Isoplot and Microsoft Excel we get the following values:

26. Uranium/Lead Dating Summary

Dating	Age	Age
Summary	207Pb/235U	206Pb/238U
Average	3,220	3,446
Maximum	3,660	4,798
Minimum	2,931	2,889
Difference	728	1,909

If we run the Rubidium/Strontium isotope ratios from tables 2, 5, 6 and 8 in the article [50] through Microsoft Excel we get the following values:

27. Rubidium/Strontium Dating Summary

Rb/Sr Dating	Table 2	Table 5	Table 6	Table 8
Summary	Age	Age	Age	Age
Average	2,982	3,514	2,812	2,333
Maximum	3,038	4,523	2,888	2,423
Minimum	2,886	2,848	2,726	2,192
Difference	152	1,675	161	231

Again the author's choice of "true" dates and dating method is just random and meaningless.

Mechanisms For Incompatible-Element Enrichment

These samples from the meteorite Northwest Africa 032 were dated in 2008 by scientist from the Lawrence Livermore National Laboratory, the University of New Mexico, the University of California, Berkeley and Arizona State University. [51] According to the essay [51] the age of the sample is "Rubidium–Sr isotopic analyses yield an age of 2947 ± 16 Ma." Two different diagrams [52] affirm this as the true age. If we run the Rubidium/Strontium isotope ratios from table 3 in the article [53] through Microsoft Excel we get the following values:

28. Rubidium/Strontium Dating Summary

Average	5,795
Maximum	13,933
Minimum	2,889
Difference	11,044

Out of the 11 isotope ratios, three gave ages over 10 billion years old. Two gave ages over 4 billion years old.

A Non-Cognate Origin Of The Gibeon Kimberlites

These samples from the Gibeon Province, Namibia were dated in 2001 by scientist from England and the Netherlands. [54] According to the essay [55] the age of the sample is 72 million years old. If we run the various isotope ratios from the article [56] through Microsoft Excel we get the following values:

29. Multiple Dating Summary

Dating Summary	Age 87Rb/86Sr	Age 147Sm/144Nd	Age 207Pb/206Pb
Average	107	72	4,963
Maximum	411	74	5,044
Minimum	-34	70	4,907
Difference	444	5	137

The Lead dates are 50 times older than the Rubidium dates. The Rubidium dates were spread over a 444 million year range. The authors choice of the "true" age is just a guess.

Zircon U–Pb Geochronology

These samples from the Shandong Province (Luxi), in the North China Craton were dated in 2007 by scientist from China and Canada. [60] According to the essay [60] the age of the sample is 144 billion years old. If we run the various isotope ratios from the article [59] through Microsoft Excel we get the following values:

30. Multiple Dating Summary

Dating Summary	Age 87Rb/86Sr	Age 207Pb/206Pb	Age 147Sm/144Nd
Average	143	5,052	131
Maximum	145	5,107	144
Minimum	139	4,999	-11
Difference	6	108	155

Radiometric Ages Of Basaltic Achondrites

These meteorite samples were dated in 1997 by scientist from the Carnegie Institution of Washington. [60] According to the essay [60] the age of the sample is 4.4 billion years old. If we run the various isotope ratios from the article [59] through Microsoft Excel we get the following values:

207Pb/P06Pb Dating	Table 1 Age Summary	Table 2 Age Summary
Average	4,941	4,686
Maximum	5,135	5,081
Minimum	4,557	4,371
Difference	578	711

Conclusion

As we have seen in this essay, such a perfect evolutionist fit is attained by selecting data and ignoring other data. A careful study of the latest research shows that such perfection is illusionary at best. The Bible believer who accepts the creation account literally has no problem with such unreliable dating methods. Much of the data in evolutionist's books is selectively taken to suit and ignores data to the contrary.

References

1 http://web.archive.org/web/20051223072700/http://pubs.usgs.gov/gip/geotime/age.html
The age of 10 to 15 billion years for the age of the Universe.

2 http://en.wikipedia.org/wiki/Age_of_the_universe

3 http://arxiv.org/pdf/1001.4744v1.pdf
Microwave Anisotropy Probe Observations, Page 39, By N. Jarosik

4 http://en.wikipedia.org/wiki/Age_of_the_Earth

5 http://sp.lyellcollection.org/content/190/1/205
The age of the Earth, G. Brent Dalrymple
Geological Society, London, Special Publications, January 1, 2001, Volume 190, Pages 205-221

6 The age of the earth, Gérard Manhes
Earth and Planetary Science Letters, Volume 47, Issue 3, May 1980, Pages 370–382

10 http://www.bgc.org/isoplot_etc/isoplot.html

11 Radioactive and Stable Isotope Geology, By H.G. Attendon, Chapman And Hall Publishers, 1997. Page 73 [Rb/Sr], 195 [K/Ar], 295 [Re/OS], 305 [Nd/Nd].

12 Principles of Isotope Geology, Second Edition, By Gunter Faure, Published By John Wiley And Sons, New York, 1986. Pages 120 [Rb/Sr], 205 [Nd/Sm], 252 [Lu/Hf], 266 [Re/OS], 269 [Os/OS].

13 Absolute Age Determination, Mebus A. Geyh, Springer-Verlag Publishers, Berlin, 1990.
Pages 80 [Rb/Sr], 98 [Nd/Sm], 108 [Lu/Hf], 112 [Re/OS].

14 Radiogenic Isotope Geology, Second Edition, By Alan P. Dickin, Cambridge University Press, 2005. Pages 43 [Rb/Sr], 70 [Nd/Sm], 205 [Re/OS], 208 [Pt/OS], 232 [Lu/Hf].

15 Sm-Nd and Rb-Sr isotopic systematics of ureilites, Geochimica et Cosmochimica Acta, 1991, Volume 55, Pages 829-848

16 Reference 15, Pages 836, 837

17 Sr, Nd, Pb and Os Isotopes, Journal Of Petrology, 2001, Volume 42, Number 7, Pages 1387-1400

18 Reference 17, Pages 1389

19 Reference 17, Pages 1391, 1393

20 Sr-Nd-Pb isotope systematics of mantle xenoliths, Geochimica et Cosmochimica Acta, 2001, Volume 65, Number 22, Pages 4243

21 Reference 20, Pages 4246, 4248

22 Strontium, Neodymium, And Lead Isotope Variations, Geochimica et Cosmochimica Acta, 1997, Volume 61, Number 19, Pages 4181

23 Reference 22, Pages 4186, 4187

24 Crystallization History Of Rhyolites At Long Valley, Geochimica et Cosmochimica Acta, 2002, Volume 66, Number 10, Pages 1821

25 Reference 24, Pages 1825, 1828, 1831

26 Reference 24, Pages 1826

27 Fluid–Rock Interaction During Progressive Migration, Geochimica et Cosmochimica Acta, 2003, Volume 67, Number 23, Pages 4577

28 Reference 27, Pages 4579, 4586

29 Constraints on the U-Pb Isotopic Systematics, Geochimica et Cosmochimica Acta, 2005, Volume 69, Number 24, Pages 5819

30 Reference 29, Pages 5821, 5822

31 Age and Radiogenic Isotopic Systematics, Canadian Journal Of Earth Science, 1987, Volume 24, Pages 24

32 Reference 31, Pages 26, 27

33 Crustal Age Domains, Journal Of Petrology, 1998, Volume 39, Number 4, Pages 749

34 Reference 33, Pages 753, 754, 761

35 Melt Peridotite Reactions, Journal Of Petrology, 2010, Volume 51, Number 7, Pages 1417

36 Reference 35, Pages 1419

37 Reference 35, Pages 1433

38 Feldspathic Clasts in Yamato-86032, Geochimica et Cosmochimica Acta, 2006, Volume 70, Pages 5990–6015

39 Reference 38, Pages 6000

40 Reference 38, Pages 6008

41 Cretaceous Seamounts Along the Continent, Geochimica et Cosmochimica Acta, 2006, Volume 70, Pages 4950–4976

42 Reference 41, Pages 4965-4967

43 Reference 41, Pages 4961-4964

44 Petrology And Geochemistry Of Target Rocks, Geochimica et Cosmochimica Acta, 1998, Volume 62, Number 12, Pages 2179

45 Reference 44, Pages 2191

46 Geochronology of the Deep Profile, Journal Of Geophysical Research, 1981, Volume 86, Number B11, Pages 10663

47 Reference 46, Pages 10666

48 Reference 46, Pages 10668

49 Reference 46, Pages 10667

50 Reference 46, Pages 10666, 10667, 10668

51 Mechanisms for Incompatible-Element Enrichment, Geochimica et Cosmochimica Acta, 2009, Volume 73, Pages 3963–3980

52 Reference 51, Pages 3971, 3972

53 Reference 51, Pages 3967

54 A Non-Cognate Origin Of The Gibeon Kimberlites, Journal Of Petrology, 2001, Volume 42, Number 1, Pages 159

55 Reference 54, Pages 159, 166

56 Reference 54, Pages 163, 166

57 Zircon U–Pb Geochronology, Chemical Geology 255 (2008) 329–345

58 Reference 57, Pages 335

59 Reference 57, Pages 333, 335

60 Radiometric Ages of Basaltic Achondrites, Geochimica et Cosmochimica Acta, 1997, Volume 61, Number 8, Pages 1713

61 Reference 60, Pages 1717-1718

www.Creation.com