Appendix E: Radiometric dates, in Furer, L.C., and Amoco Oil Co., Data compilation of the 1972 field party, southeast Brooks Range and Fort Yukon, Alaska; Vol 2

Furer, L.C., and Amoco Oil Co.

GMC DATA REPORT 465E

This GMC data report from the Amoco Heritage collection has been made available through funding from the FY2018 USGS National Geological and Geophysical Data Preservation Program, Grant Number G18AP00054. This project report is presented in its original format and has not been reviewed for technical content or for conformity to the editorial standards of DGGS. It should not be used or cited as reviewed data.

2019
State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys
GEOLOGIC MATERIALS CENTER

APPENDIX E

RADIOMETRIC DATES 1972

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

31 October 1972 0014
CF74 0230

Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Dear Mr. Reno:

Enclosed are the analytical reports of the K-Ar age determinations on six (6) of the seventeen (17) samples described in your letter of 11 September 1972. One sample (your no. 8433) has such a low potassium content that it is not feasible to attempt an age determination.

Your sample 8385 gave an age of about 120 million years. Sample 8423 gave an age of about 63 million years. The first age is Cretaceous and the second is Tertiary. Sample 8848 gave an age of about 188 million years, with a rather large possible error because of the low K content. This age may be either late Triassic or early Jurassic, depending on where you chose to put this boundary. Sample 9088 gave an age of about 134 million years, also with a rather large possible error. This age could be late Jurassic or early Cretaceous.

Your two granitic samples "A" and "B" were dated on biotite concentrates and gave indistinguishable Oligocene ages of about 30 million years.

We are working on your other samples and I will forward the rest of the results to you when they are available. In the meantime, I have enclosed our invoice for this work.

Sincerely,

Richard H. Reesman

Richard H. Reesman
General Manager

RHR/dm
encl:

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617) 876-3691

POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-2389 — Date Received: 26 September 1972

Your Reference: 9088 19+30 - 13N-3E — Date Reported: 30 October 1972

Submitted by:

Duane Reno
Amoco Production Co.
Security Life Bldg.
Dnever, Colorado 80202

Sample Description & Locality: Greenstone (?)

Material Analyzed: Whole rock, crushed to -40/+60 mesh.

Ecol or later

Ar^{40*}/K^{40} = .008095 — AGE = 134 ± 14 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.001349	.191	.001319
.001288	.116	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.134	.133	.162
.133		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-2388

Date Received: 26 September 1972

Your Reference: 8848 34-35-9N-1E

Date Reported: 30 October 1972

Submitted by:

Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality:

Andesite

Material Analyzed:

Whole rock, crushed to -40/+60 mesh.

Ar^{40*}/K^{40} = .01158

AGE = 188 ± 19 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.002087	.192	.001999
.001911	.187	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.142	.141	.172
.141		

Constants Used:

$\lambda\beta = 4.72 \times 10^{-10}$/ year

$\lambda e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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GEOCHRON LABORATORIES DIVISION
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POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R- 2387 — Date Received: 26 September 1972

Your Reference: 8433 SW-Sec16-T8N-4W — Date Reported:

Submitted by:

Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Andesite

Material Analyzed: Whole rock, crushed to -40/+60 mesh.

Ar^{40*}/K^{40} = — AGE = — M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm

Unable to analyze---no potassium.

Constants Used:

$\lambda\beta = 4.72 \times 10^{-10}$/ year

$\lambda e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM--ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-2380 — Date Received: 26 September 1972

Your Reference: 8385 T-9N-2E — Date Reported: 30 October 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Basalt

Material Analyzed: Whole rock, crushed to -40/+60 mesh.

Ar^{40*}/K^{40} = .007221 — AGE = 120 ± 5 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.02232	.723	.02258
.02284	.763	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
2.596	2.563	3.126
2.530		

Constants Used:

$\lambda\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. B-2386 — Date Received: 26 September 1972

Your Reference: 8423 22-11N-4E — Date Reported: 30 October 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Coarse-grained biotite-amphibole granite.

Material Analyzed: Biotite concentrate, -60/+100 mesh. Purity greater than 98%.

Late Cretaceous

Ar^{40*}/K^{40} = .003727 — AGE = 62.6 ± 2.4 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.02286	.491	.02299
.02311	.496	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
5.255	5.055	6.167
5.064		
4.848		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

23 December 1972

Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Dear Mr. Reno:

Enclosed are the analytical reports of the K-Ar age determinations on the last four (4) of the samples described in your letter of 11 December 1972.

These samples all appeared to be gabbroic in nature, consequently we analyzed the feldspars from each sample and the measured ages must be considered to be minimum ages only.

Your sample 8341 gave an apparent K-Ar age of about 119 million years; sample 8347 gave an age of about 127 million years; sample 8382 gave an age of about 110 million years; and sample 8396 gave an age of about 91.5 million years.

I can't rule out the possibility that one or two of the finer-grained samples may be extrusive, from the appearance of the samples alone, but you undoubtedly have good geologic information on that point. If any of the samples are indeed extrusive then the measured K-Ar ages of the feldspars should be quite good for the ages of those rocks. For those rocks that are intrusive, however the true ages may be as much as about 35% greater than the measured ages.

I trust you will find these results useful in your work and if you should have any questions, please do not hesitate to contact me. Enclosed is our invoice for this work. We look forward to serving you again in the near future.

Sincerely,

Richard H. Reesman

Richard H. Reesman
General Manager

RHR/dm
encl: 4 reports & invoice #4014

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617)-876-3691

POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. F-2375 **Date Received:** 26 September 1972

Your Reference: 8341 **Date Reported:** 15 December 1972

28 – 11N – 18 E

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Fine-grained gabbro (?)

Material Analyzed: Feldspar concentrate, -60/+100 mesh.

Early Cret.

Ar^{40*}/K^{40} = .007203 AGE = 119 ± 5 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.01406	.574	.01453
.01499	.634	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.631	1.653	2.016
1.675		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. F-2376 **Date Received:** 26 September 1972

Your Reference: 8347 35 11N - 12E **Date Reported:** 22 December 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Gabbro

Material Analyzed: Feldspar concentrate, -60/+100 mesh.

$Ar^{40}*/K^{40}$ = .007696 AGE = Early Cret. 127 ± 6 M.Y.

Argon Analyses:

$Ar^{40}*$, ppm.	$Ar^{40}*$/ Total Ar^{40}	Ave. $Ar^{40}*$, ppm.
.01019	.217	.01014
.01008	.291	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.098	1.079	1.316
1.061		

Constants Used:

$\lambda\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40}*}{K^{40}} + 1\right]$$

Note: $Ar^{40}*$ refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. F-2379 **Date Received:** 26 September 1972

Your Reference: 8382 **Date Reported:** 22 December 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Fine-grained gabbro. (?)

Material Analyzed: Feldspar concentrate, -60/+100 mesh.

Early-late Cret.

Ar^{40*}/K^{40} = .006618 AGE = 110 ± 6 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.004618	.377	.004421
.004223	.402	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.551	.547	.667
.544		

Constants Used:

$\lambda\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
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POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. B-2386

Date Received: 26 September 1972

Your Reference: 8423 22-11N-4E

Date Reported: 30 October 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Coarse-grained biotite-amphibole granite.

Material Analyzed: Biotite concentrate, -60/+100 mesh. Purity greater than 98%.

Late Cretaceous Paleocene

Ar^{40*}/K^{40} = .003727

AGE = 62.6 ± 2.4 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.02286	.491	.02299
.02311	.496	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
5.255	5.055	6.167
5.064		
4.848		

Constants Used:

$\lambda\beta = 4.72 \times 10^{-10}$/ year

$\lambda e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

23 December 1972

Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Dear Mr. Reno:

Enclosed are the analytical reports of the K-Ar age determinations on the last four (4) of the samples described in your letter of 11 December 1972.

These samples all appeared to be gabbroic in nature, consequently we analyzed the feldspars from each sample and the measured ages must be considered to be minimum ages only.

Your sample 8341 gave an apparent K-Ar age of about 119 million years; sample 8347 gave an age of about 127 million years; sample 8382 gave an age of about 110 million years; and sample 8396 gave an age of about 91.5 million years.

I can't rule out the possibility that one or two of the finer-grained samples may be extrusive, from the appearance of the samples alone, but you undoubtedly have good geologic information on that point. If any of the samples are indeed extrusive then the measured K-Ar ages of the feldspars should be quite good for the ages of those rocks. For those rocks that are intrusive, however the true ages may be as much as about 35% greater than the measured ages.

I trust you will find these results useful in your work and if you should have any questions, please do not hesitate to contact me. Enclosed is our invoice for this work. We look forward to serving you again in the near future.

Sincerely,

Richard H. Reesman

Richard H. Reesman
General Manager

RHR/dm
encl: 4 reports & invoice #4014

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617)-876-3691

POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. F-2379 **Date Received:** 26 September 1972

Your Reference: 8382 **Date Reported:** 22 December 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Fine-grained gabbro (?)

Material Analyzed: Feldspar concentrate, -60/+100 mesh.

Ar^{40*}/K^{40} = .006618 AGE = Early-late Cret. 110 ± 6 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.004618	.377	.004421
.004223	.402	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.551	.547	.667
.544		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

KRUEGER ENTERPRISES, INC.
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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. F- 2382

Your Reference: 8396

C10-10N-3E

Date Received: 26 September 1972

Date Reported: 22 December 1972

Submitted by:

Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: **Gabbro (?)**

Material Analyzed: **Feldspar concentrate, -60/+100 mesh.**

$Ar^{40}*/K^{40}$ = .005486

Lite Cnst.
AGE = 91.5 ± 5.9 M.Y.

Argon Analyses:

$Ar^{40}*$, ppm.	$Ar^{40}*$/ Total Ar^{40}	Ave. $Ar^{40}*$, ppm.
.002338	.273	.002256
.002173	.171	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.326	.337	.411
.348		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40}*}{K^{40}} + 1\right]$$

Note: $Ar^{40}*$ refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

KRUEGER ENTERPRISES, INC.
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24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617)-876-3691

PRICE CHANGE ANNOUNCEMENT

"REDUCTION"

EFFECTIVE 1 FEBRUARY 1972 K-Ar AGE DETERMINATIONS

Routine Service Age Determination:

Complete K-Ar age determination, in duplicate, on an unprepared specimen requiring mineral separation.....$300.00

Complete K-Ar age determination, in duplicate, on an unprepared specimen not requiring mineral separation.....$275.00

Complete K-Ar age determination, in duplicate, on any prepared sample (ready for analysis).....$250.00

Priority (48-Hour) Service Age Determinations:

Complete K-Ar age determination, in duplicate, on any sample, including preparation of sample as required, with results reported within 48-hours of receipt in our laboratory.....$600.00

Discounts no longer apply to these services.

Experience rated customers who were qualified for discounts under our previous price schedule will be charged the above rates unless their previous rate was lower, inwhich case they may continue submitting samples at this previous rate for the remainder of 1972 year.

Clients who anticipate large numbers of analyses may contact us to see if further reductions may be available under negotiated contracts.

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

22 November 1972

Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Dear Mr. Reno:

Enclosed are the analytical reports of the K-Ar age determinations on six (6) more of the samples described in your letter of 11 September 1972.

Three of the samples (8394, 8407 and 8411) give Cretaceous ages, the ages of the latter two samples being indistinguishable from one another. Two of the samples (8399 and FCH-785) give ages that appear to be Triassic. The replicate argon analyses for most of these samples are only fair, but there appears to be no reason to fault any of them from an analytical standpoint.

Your sample 8349 is a bit of an enigma. It appears to have essentially no measureable radiogenic argon. Since the K-content of the rock approaches nearly 2%, the rock must be quite young. Under the petrographic microscope the sample appears to be almost completely glassy, exhibiting no crystal structure, except for the occasional phenocrysts. While the argon retentivity of volcanic glasses is variable, ranging from very good to poor, I am not aware of our having seen any glasses that were completely non-retentive, in this laboratory. On this basis I have reported this analysis to you; I believe that the rock is most probably quite young, rather than being completely non-retentive. I would be interested in your comments on this sample from a geologic point of view.

We are working on the remainder of your samples and I will report out the results on them as soon as they are available.

If you should have any questions, please do not hesitate to contact me. In the meantime, I am enclosing our invoice for this work.

Sincerely,

Richard H. Reesman

Richard H. Reesman
General Manager

RHR/dm

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617)-876-3691

POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-- 2383 **Date Received:** 26 September 1972

Your Reference: 8399 4-12N-2W **Date Reported:** 22 November 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Basalt

Material Analyzed: Whole rock, crushed to -40/+60 mesh.

Late Eo. - Early Jur.

Ar^{40*}/K^{40} = .01131 **AGE =** 184 ± 17 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.001626	.206	.002118
.002639	.309	
.001973	.110	
.002235	.323	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.152	.153	.187
.155		

Constants Used:

$\lambda\beta = 4.72 \times 10^{-10}$/ year

$\lambda e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617)-876-3691

POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R- 2378

Date Received: 26 September 1972

Your Reference: FCH - 785 12-6N-21E

Date Reported: 22 November 1972

Submitted by: Duane Reno
Amoco Production Co
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Basalt

Material Analyzed: Whole rock, crushed to -40/+60 mesh.

Late Perm - Early Tri

Ar^{40*}/K^{40} = .01361 AGE = 219 ± 11 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.008415	.550	.008359
.008825	.510	
.007837	.455	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.500	.503	.614
.507		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-2385

Date Received: 26 September 1972

Your Reference: 8411 13-11N-12W

Date Reported: 22 November 1972

Submitted by:

Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Andesite

Material Analyzed: Whole rock, crushed to -40/+60 mesh.

Ar^{40*}/K^{40} = .007280 AGE = Early Cret. 121 ± 7 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.003469	.270	.003979
.004060	.301	
.004408	.280	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.445	.448	.546
.451		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. F-2384 — Date Received: 26 September 1972

Your Reference: 8407 12-9N-9W — Date Reported: 22 November 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Medium-grained gabbro(?)

Material Analyzed: Feldspar concentrate, -60/+100 mesh.

Early Cret.

Ar^{40*}/K^{40} = .007124 — AGE = 118 ± 6 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.005844	.435	.005788
.005732	.431	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.666	.666	.812
.666		

Constants Used:

$\lambda\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. F-2381

Date Received: 26 September 1972

Your Reference: 8394 6-9N-3E

Date Reported: 22 November 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Medium-grained gabbro (?)

Material Analyzed: Feldspar concentrate, -60/+100 mesh.

Ar^{40*}/K^{40} = .004874

AGE = 81.5 ± 3.1 M.Y. Late Cret.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.03306	.809	.03396
.03514	.797	
.03369	.795	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
5.736	5.712	6.968
5.688		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-2377

Date Received: 26 September 1972

Your Reference: 8349 22-21N-21E

Date Reported: 22 November 1972

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Vesicular olivine basalt

Material Analyzed: Whole rock, crushed to -40/+60 mesh.

Pleistocene

Maximum Age = 170,000 years.

Ar^{40*}/K^{40} = .00001 AGE M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.00002 maximum	.005	.00002 maximum
.00000	.000	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.868	1.840	2.245
1.812		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-2474 **Date Received:** 22 February 1973

Your Reference: 6069 **Date Reported:** 1 March 1973

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Altered volcanic(?)
Northern Alaska

Material Analyzed: Whole rock, crushed to -40/+60 mesh.

Ar^{40*}/K^{40} = .009218 **AGE =** 151 ± 10 **M.Y.**

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.003351	.263	.003453
.003554	.259	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.308	.307	.374
.306		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. F-2473 **Date Received:** 22 February 1973

Your Reference: 7071 **Date Reported:** 7 March 1973

Submitted by: Duane Reno
Amoco Production Co.
Security Life Bldg.
Denver, Colorado 80202

Sample Description & Locality: Alteered volcanic.
Northern Alaska

Material Analyzed: Feldspar concentrate, -40/+60 mesh.
Composition: approximately 60% feldspar, 40% quartz.

Ar^{40*}/K^{40} = .003269 **AGE =** 55.1 ± 2.6 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.004930	.188	.004956
.004981	.200	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.243	1.242	1.515
1.242		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.