GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

Date: November 30, 1976

Project Title: Potassium-Argon Study of Rocks from Russell Dam Site

Project No: G-35-624

Project Director: Dr. J. M. Wampler

Sponsor: U.S. Army Engineer Division; So. Atlantic, Corps of Engineers

Agreement Period: From 11/22/76 Until 12/31/76

Type Agreement: Contract No. DAC19-77-M-0082

Amount: $1,400 (Fixed Price)

Reports Required: As requested

Sponsor Contact Person (s):

Technical Matters	Contractual Matters (thru OCA)
D. A. Barnes So. Atlantic, Corps of Engineers 510 Title Bldg., 30 Pryor St., S.W. Atlanta, Georgia 30303	

Defense Priority Rating:

Assigned to: Geophysical Science (School/Laboratory)

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- Project Code (GTRI)
- Other

CA–3 (3/76)

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION

Date: December 27, 1976

Project Title: Potassium-Argon Study of Rocks from Russell Dam Site

Project No: G-35-624

Project Director: Dr. J. M. Wampler

Sponsor: U.S. Army Engineer Division; So. Atlantic, Corps of Engineers

Effective Termination Date: 12/31/76

Clearance of Accounting Charges: 12/31/76

Grant/Contract Closeout Actions Remaining: none

_ Final Invoice and Closing Documents
_ Final Fiscal Report
_ Final Report of Inventions
_ Govt. Property Inventory & Related Certificate
_ Classified Material Certificate
_ Other _____

Assigned to: Geophysical Science (School/Laboratory)

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CA—4 (3/76)

6-35-124

GEORGIA INSTITUTE OF TECHNOLOGY
SCHOOL OF GEOPHYSICAL SCIENCES
Atlanta, Georgia 30332
(404) 894-2857

November 23, 1976

Dr. James Neiheisel
South Atlantic Division Laboratory
U.S. Army Corps of Engineers
611 South Cobb Drive
Marietta, Georgia 30060

Dear Jim:

After much delay, I am enclosing the final report on the Potassium-Argon Study of Rocks from Russell Dam Site, which I undertook in September in accordance with a plan described in my letter of September 16, 1976. I regret that there has been so much delay in the completion of this work, but the extra time has allowed me first to obtain highly pure mineral separates for analysis and then to confirm the accuracy of the analytical work by duplicate analysis of most samples.

The report consists of four pages, as follows:

1. Summary of results on the primary samples from five stations
2. Summary of results on some additional samples
3. A table of analytical data
4. Comments on interpretation of the potassium-argon apparent ages.

The results reported herein are consistent with preliminary results reported to you by phone, with one exception. The preliminary result on the dike rock from station 21 + 15 was in error because of a mistake in my preliminary calculations. I am sorry for the error, but I am pleased to find that the correct result is consistent with your interpretation of the history of secondary alteration at the site.

I have enjoyed working with these interesting rock samples, and I thank you for the opportunity to carry out this study.

Sincerely,

J.M. Wampler
Associate Professor

JMW:cma
enclosures

SUMMARY OF RESULTS
(Primary Samples)

STATION	MATERIAL	POTASSIUM-ARGON APPARENT AGE*
19+20	Sericite, high purity. Separated by heavy liquids after disaggregation of sample	$295 \pm 6 \times 10^6$ y
20+95	Muscovite, high purity. Separated by heavy liquids after disaggregation of sample	$272 \pm 6 \times 10^6$ y
17+40	Feldspar (provided by Dr. Neiheisel)	$357 \pm 11 \times 10^6$ y
21+15	Whole rock sample of dike rock. Analytical sample was taken from the inner portion of the hand specimen, away from Mn-oxide stain or other surface alteration	$292 \pm 6 \times 10^6$ y
23+50	Whole rock sample of dike rock. Analytical sample was taken from a portion of the hand specimen showing little secondary alteration	$355 \pm 11 \times 10^6$ y

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*Apparent age is based on the following constants:

^{40}K decay constants: $\lambda_\beta = 4.72 \times 10^{-10}\text{y}^{-1}$

$\lambda_\varepsilon = 0.585 \times 10^{-10}\text{y}^{-1}$

$^{40}\text{K/K} = 0.000119$ (Atomic)

The indicated uncertainty in apparent age represents an estimate of the analytical precision at the 95% confidence level.

SUMMARY OF RESULTS
(Additional Samples)

STATION	MATERIAL	POTASSIUM-ARGON APPARENT AGE
19+20	Feldspar (very low potassium). Separated by heavy liquids after disaggregation of sample.	$488 \pm 20 \times 10^9$ y
20+95	Feldspar (low potassium). Separated by heavy liquids after disaggregation of sample.	$293 \pm 9 \times 10^9$ y
23+50	Whole rock sample of altered dike rock. Analytical sample was taken from an altered zone which extends about 1 cm on each side of a healed fracture through the hand specimen.	$442 \pm 35 \times 10^9$ y

ANALYTICAL DATA

STATION	MATERIAL	POTASSIUM (% by weight)	RADIOGENIC ARGON (% of total argon)	RADIOGENIC ARGON (STP nl/g)	APPARENT AGE (millions of years)
19+20	Sericite	8.72	99.2	111.2	
		8.60	99.2	109.7	
	Av.	8.66 ± 0.06		110.4 ± 1.6	295 ± 6
19+20	Feldspar	0.150	88.5	3.28	
		0.152	94.3	3.33	
	Av.	0.151 ± 0.004		3.30 ± 0.05	488 ± 20
20+95	Muscovite	8.71	99.1	102.3	
		8.68	99.6	101.3	
	Av.	8.70 ± 0.06		101.8 ± 1.4	272 ± 6
20+95	Feldspar	0.296 ± 0.005	92.8	3.74 ± 0.08	293 ± 9
17+40	Feldspar	0.348 ± 0.006	86.7	5.45 ± 0.11	357 ± 11
21+15	Whole rock	0.641	97.0	8.17	
		0.654	96.2	8.16	
	Av.	0.648 ± 0.007		8.16 ± 0.12	292 ± 6
23+50	Whole rock	0.470 ± 0.010	85.0	7.17 ± 0.14	355 ± 11
23+50	Altered zone	0.145 ± 0.010	78.1	2.68 ± 0.05	442 ± 35

COMMENTS ON INTERPRETATION OF POTASSIUM-ARGON AGES

Muscovite and Sericite: The potassium-argon apparent age of muscovite or sericite indicates the time elapsed since the mineral (last) became cool enough to retain argon (about 300°C). For igneous and hydrothermal mica, this time interval should be essentially the same as the age of the material unless there has been subsequent metamorphism. The potassium content of micas is sufficiently high that radiogenic argon which may have been incorporated at the time of formation is not normally significant.

Plagioclase Feldspar: Although plutonic K-feldspar is notorious for losing radiogenic argon, plagioclase feldspar normally behaves as a closed system for potassium and argon after its formation as part of igneous rocks. Therefore, the potassium-argon apparent age of plagioclase (from dolerites, for example) is often a good indicator of the age of igneous rocks which have not undergone metamorphism. However, for samples with very low potassium content, a small amount of initial radiogenic argon can be significant, making the apparent ages greater than the geologic age of the rock. The high apparent ages of the feldspar from station 19+20 and the altered dike rock from station 21+15 are probably due to the presence of initial radiogenic argon, since these samples have extremely low amounts of potassium.

Whole rocks: Potassium-argon apparent ages on whole-rock samples of igneous rock are reliable indicators of geologic age in favorable circumstances, and have been particularly useful for studies of mafic rocks (basalts and dolerites). Confirmation of the validity of whole rock ages requires multiple samples of unaltered rock. In the case of this work, the dike rock from station 21+15 is clearly different from the sample from station 23+50. The difference in apparent ages may be attributed to secondary alteration of the rock from station 21+15.