GEORGIA INSTITUTE OF TECHNOLOGY

OFFICE OF RESEARCH ADMINISTRATION

RESEARCH PROJECT TERMINATION

Date: 22 August 1973

Project Title: "Age Dating of Rocks to Assist in Understanding the Geological History of Georgia Peidmont Area"

Project No: G-35-602

Principal Investigator: Dr. J. W. Wampler

Sponsor: State of Georgia Dept of Natural Resources

Effective Termination Date: Sept 31, 1973

Clearance of Accounting Charges: All charges should be clear by termination date

COPIES TO:

Principal Investigator
School Director
Dean of the College
Director of Research Administration
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Terminated Project File No. _____
Other _____

RA-4 (5/70)

April 25, 1973

Mr. S. M. Pickering, Director
Earth and Water Division
Department of Natural Resources
State of Georgia
19 Hunter Street, S. W.
Atlanta, Georgia 30334

Dear Sam:

Enclosed are potassium-argon analytical data and apparent ages of five samples of glauconite which were submitted to me last year. This completes the 30 K-Ar analyses which were agreed upon in a Memorandum of Understanding for a Research Study entitled "Age Dating of Rocks to Assist in Understanding the Geological History of the Georgia Piedmont Area."

Also, included are complete potassium-argon analytical data and apparent ages for a group of samples for which tentative apparent ages were reported June 23, 1972. One new analysis, of an orthoclase sample, has been added.

Some of the analyses reported under this program in 1969 have been found to be slightly in error, owing to an error in calibration. The errors are, fortunately, within the limits of error estimated earlier. I am enclosing a table with correct values f r all analytical data and apparent ages reported July 29, 1969.

Some of the samples in this program were submitted by Dr. James W. Smith and some by the University of Georgia. I understand you do not object to my sending appropriate analytical data directly to those who submitted samples.

In a separate letter, I shall propose some alternatives for continuation of a K-Ar research program, which I feel could be of considerable value to the State.

Sincerely,

J. M. Wampler
Associate Professor

JMW:gh
Encl.
cc: Office of Research Administration
Georgia Institute of Technology

SAMPLE	ANALYTICAL SAMPLE NUMBER	POTASSIUM CONTENT (% by weight)	RADIOGENIC (Percent of total argon)	ARGON* (Nanoliters-STP per gram)	APPARENT AGE** (Millions of years
1. Basal Marianna					
Hot water washed	GL-5W	3.88	74.7	7.27 ± 0.22	46.4 ± 1.5
Dilute acid washed	GL-5AW	3.92	67.4	7.05 ± 0.21	44.5 ± 1.5
2. Basal Red Bluff					
Hot water washed	GL-6W	0.65	48.5	3.476	
		0.626	81.2	3.469	
	Average	0.64		3.47 ± 0.10	131 ± 4
3. Glendon					
Hot water washed	GL-7W	5.04	63.6	5.60 ± 0.17	27.6 ± 0.9
4. Byram					
Hot water washed	GL-8W	3.94	58.8	4.47 ± 0.14	28.2 ± 0.9
5. Winona (Basal)					
Hot water washed	GL-9MW	5.61	84.0	9.43	
		5.59	86.6	9.41	
	Average	5.60		9.42 ± 0.28	41.7 ± 1.3

* The uncertainty associated with the amount of radiogenic argon is our estimate of accuracy at the 95% confidence level. Precision (reproducibility) of the argon analyses is somewhat better than the estimated accuracy - on the basis of a limited number of duplicate analyses, precision appears to be about ± 1%.

** Apparent age is based on the following constants:

$$\lambda_e = 0.585 \times 10^{-1}\ yr^{-1},\ \lambda_\beta = 4.72 \times 10^{-10}\ yr^{-1},\ K^{40}/K = 0.000119 \text{ (atomic)}.$$

1 mole K = 39.10 grams

1 mole Ar = 22.415 STP liters

FINAL DATA ON SAMPLES REPORTED JUNE 25, 1972 *

SAMPLE	ANALYTICAL SAMPLE NUMBER	POTASSIUM CONTENT (Weight %)	RADIOGENIC ARGON ** (Percent of Total Argon)	RADIOGENIC ARGON ** (STP Nanoliters per Gram)	APPARENT AGE (Millions of Years)
From University of Georgia:					
#142, Rhyolite					
Whole rock	G142WR	2.71	98.3	39.9 ± 1.2	337 ± 11
#155, Rhyolite					
Muscovite	G155CHL	5.43	97.2	96.6 ± 2.9	400 ± 12
Remainder of rock	G155CL	4.26	91.2	42.0 ± 1.3	232 ± 7
#159, Syenite					
Hornblende	G159HNM	1.55	98.3	21.23 ± 0.64	315 ± 10
From pegmatite, Monticello, Ga.					
#161, Pink Orthoclase	G161C	10.75	97.2	106.3 ± 3.2	233 ± 7
#166, Albite	G166C	0.631	82.4	10.00 ± 0.30	360 ± 11
From James W. Smith					
Muscovite, 10.5 miles S.W. of Monticello, Ga.	MUS-1C	8.69			
		8.67			
Average		8.68	90.4	107.7 ± 3.3	288 ± 9
Camak, biotite from rock adjacent to dike	JWS-1M	6.86	92.1	61.3 ± 1.8	212 ± 7
Camak, biotite from rock 50 feet from dike	JWS-3CHLW	7.84	98.4	88.6 ± 2.7	264 ± 8
Glauconite Samples:					
Twiggs Clay #1 (impure)	GL-1CCHM	4.94	50.1	6.56 ± 0.33	33.0 ± 1.7
Bashi					
Cold water washed	GL-2C	6.62	78.6	13.77 ± 0.42	51.4 ± 1.6
Hot water washed	GL-2CW	6.53	83.1	13.83 ± 0.42	52.3 ± 1.6

continued on attached page

Tuscahoma	GL-3MM	5.36	80.3	11.22 ± 0.34	51.7 ± 1.6
Basal Tuscahoma					
Clean pellets	GL-4CC	6.38	85.0	13.55 ± 0.41	52.5 ± 1.6
Fines from ultrasonic disaggregation	GL-4F	6.21	79.9	12.89 ± 0.39	51.3 ± 1.6

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* Includes one new analysis - Analytical Sample Number G-161C.

** The uncertainty associated with the amount of radiogenic argon is our estimate of accuracy at the 95% confidence level.

** Apparent age is based on the following constants:

K^{40} decay constants: $\lambda_\beta = 4.72 \times 10^{-10}$/hear

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

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

1 mole K = 39.10 grams

1 mole Ar = 22.415 STP liters

REVISION OF DATA REPORTED JULY 29, 1969

SAMPLE IDENTIFICATION NUMBER		POTASSIUM CONTENT* (% by Weight)	RADIOGENIC ARGON (% of Total Argon)	RADIOGENIC ARGON (STP Nanoliters per gram)	APPARENT AGE ** (Millions of years)
K-Ar-1		7.73	90.8	99.3	
		8.07	82.0	102.5	
	Average	7.90		100.9	296 ± 15
K-Ar-3		5.89	93.1	94.4	
		6.13	90.0	94.9	
	Average	6.01		94.7	359 ± 18
K-Ar-4		7.04	94.0	99.8	
		7.41	82.7	103.1	
	Average	7.22		101.4	323 ± 16
K-Ar-5		6.17	84.7	108.8	
		6.00	80.9	114.0	
	Average	6.08		111.4	411 ± 21
VA-1		7.40	96.2	108.7	
		7.58	85.9	111.6	
	Average	7.49		110.2	337 ± 17
VA-2		7.07	78.6	126.3	
		7.18	96.7	123.2	
	Average	7.12		124.7	395 ± 20
VA-3		7.50	78.3	141.8	
		7.76	95.9	143.8	
	Average	7.63		142.8	419 ± 21

* Footnotes on attached page

* For four of the samples in the original report, 3 potassium analyses were given and averaged. One set of these analyses appears to have been of questionable reliability, so it has not been included in the revised data. Potassium contents reported here average higher than in the initial report because of a small error in calibration which affected one set of analyses.

** The error range assigned is 5% of the apparent age. This was originally reported as an estimate of precision. It may now be considered as an estimate of accuracy of the analytical data at the 95% confidence level. This change in meaning results from much improved certainty in the accuracy of calibration for both potassium and argon, since the time of the original report. Note that both the potassium and argon values differ slightly from those in the original report, owing to improvements in calibration.

The apparent age was calculated using the following constants:

K^{40} decay constants: $\lambda_\beta = 4.72 \times 10^{-10}$/year

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

$K^{40}/K = 0.000119$ (atomic)

1 mole K = 39.10 grams

1 mole Ar = 22.415 STP liters

GEORGIA INSTITUTE OF TECHNOLOGY
SCHOOL OF GEOPHYSICAL SCIENCES
Atlanta, Georgia 30332
(404) 873-4211

June 23, 1972

Mr. Sam Pickering, Director
Earth and Water Resources Division
Department of Natural Resources
State of Georgia
19 Hunter St., S. W.
Atlanta, Ga. 30334

Dear Sam:

Enclosed are results of 14 potassium-argon age determinations on 11 different samples which have been submitted to me under a project which was initiated in 1968. Since I have not been able to complete all the analyses originally proposed, I am requesting that our Office of Research Administration hold my grant open at this time for 11 analyses at \$100 each. I realize there may be some question about the authorization of these analyses. I will be glad to have authorization analyses for any samples which were not properly authorized.

I hope we will be able to continue this program during the new fiscal year. The results on the glauconite samples look quite promising.

I have just discovered that there is a moderately large uncertainty (perhaps ± 5%) in the calibration of my argon analyses. I plan to repeat the calibration carefully in July, so I am not submitting complete analytical data at this time. I will send you complete analytical data on these samples when the calibration is done, with revised (if necessary) of the age values. (Note that the calibration error, if any, will affect all age values by the same percentage.)

Sincerely,

J. M. Wampler
Associate Professor

cc: Mr. Dwight Allen
Office of Research Administration
Georgia Institute of Technology

SAMPLE	ANALYTICAL SAMPLE NUMBER	APPARENT AGE (millions of years)
From University of Georgia:		
#142, Rhyolite		
Whole rock	G142WR	347
#155, Rhyolite		
Muscovite	G155C-L	411
Remainder of rock	G155CL	294
#159, Syenite		
Hornblende	G159HBM	347
#166, Albite from pegmatite, Mitchell Co.	G166C	371
From James W. Smith:		
Muscovite, 10.5 miles S. W. of Montezuma, Ga.	MTS-1C	292
Camak, biotite from rock adjacent to dike	JWS-1M	294
Camak, biotite from rock 50 feet from dike	JWS-3CRBM	272
Glauconite Samples:		
Twiggs Clay #1	GL-1CCBM	34.2
Bashi		
Cold water washed	GL-2C	53.3
Hot water washed	GL-2CW	53.9
Tuscahoma	GL-3MM	53.6
Basal Tuscahoma		
Clean pellets	GL-4CC	54.2
Fines from ultrasonic disaggregation	GL-4F	53.2

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CERAMIC ENGINEERING

Geophysical Sciences

July 29, 1969

Dr. A. S. Furcron, Director
Department of Mines, Mining and Geology
State Division of Conservation
19 Hunter Street, S. W.
Atlanta, Georgia 30334

Dear Dr. Furcron:

Enclosed are analytical results on mica samples which were submitted to us in 1968 for K-Ar age determinations. K-Ar ages on these samples were submitted in August, 1968 via a letter to James W. Smith, but the duplicate analyses had not been completed at that time. Consequently the apparent ages reported here are slightly, but not significantly, different from the values reported earlier.

Each of the seven samples has been analysed in duplicate for both potassium and argon, for a total of 14 complete analyses. (Because of some uncertainties in our early potassium analyses, several of these samples were actually analysed for potassium three times.) Our laboratory will resume K-Ar analysis in September, and we will look forward to receiving additional samples from you whenever you have them available.

Sincerely,

J. M. Wampler
Associate Professor
Geophysical Sciences

JMW:dc
Encl.

SAMPLE IDENTIFICATION NUMBER		POTASSIUM (% BY WEIGHT)	RADIOGENIC Ar^{40} (10^{-6}cc(STP)/gm)	ATMOSPHERIC* (% of TOTAL ARGON)	APPARENT ** AGE (MILLIONS OF YEARS)
K-Ar-1		7.95	102.2	8.9	
		7.73	102.4	18.2	
	AVERAGE	7.84	102.3		302± 15
K-Ar-3		5.75	95.0	7.0	
		5.72	94.8	10.1	
		5.89			372± 19
	AVERAGE	5.79	94.9		
K-Ar-4		6.94	100.3	6.1	
		7.23	102.9	17.4	
		7.04			
	AVERAGE	7.07	101.6		330± 16
K-Ar-5		5.62	109.3	15.5	
		5.10	114.0	19.3	
		6.17			
	AVERAGE	5.63	111.6		441± 44
VA-1		7.30	109.2	3.9	
		7.07	111.5	14.3	
		7.40			
	AVERAGE	7.26	109.8		346± 17
VA-2		6.97	126.1	21.6	
		7.07	111.5	3.4	
	AVERAGE	7.02	124.8		400± 20
VA-3		7.55	143.2	21.8	
		7.36	142.6	4.2	
	AVERAGE	7.45	142.9		428± 21

*(FOOTNOTES ON FOLLOWING PAGE)

* Atmospheric argon was primarily from the analytical system rather than from the samples themselves. These numbers are significant only as they indicate the magnitude of the correction required for the presence of atmospheric argon.

* * The error range assigned is 5% of the apparent age, except for K-Ar-5 where an error of $\pm$ 10% is assigned. The 5% uncertainty is a conservative estimate of analytical precision at the 95% confidence level. K-Ar-5 was a rather coarse and inhomogeneous sample, so the poor reproducibility of the analyses on this material may be a result of sampling errors. The apparent age was calculated using the following constants:

K^{40} decay constants: $\lambda_\beta = 4.72 \times 10^{-10}$/year

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

$K^{40}/K = 0.000119$ (atomic ratio)

1 mole K = 39.10 gm

1 mole Ar = 22,415 cc (STP)