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NEW RADIOMETRIC AGES ON VOLCANIC ROCKS FROM THE MOGOLLON–DATIL VOLCANIC FIELD, SOUTHWESTERN NEW MEXICO

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Radiometric ages are reported for 11 different volcanic rock units from the north-central part of the Mogollon-Datil volcanic field, New Mexico. No previous age data are available for this area except through correlation. This area, approximately 1000 km², consists of Tertiary volcanic and volcaniclastic rocks with a maximum thickness of approximately 1500 m. The generalized stratigraphy of more than 30 mappable units is (1) a lower succession of interbedded andesitic mudflow breccia, volcaniclastic sediments, and andesite lava flows from 39 to 37 M.Y.B.P.; (2) a middle succession, consisting primarily of interbedded rhyodacite to rhyolite ash-flow tuff and volcaniclastic sediments, with lesser amounts of intertonguing basaltic andesite and andesite lava flows, rhyolite lava flows and domes, rhyolitic tuff-breccia, and minor interbedded airfall tuff from 37 to 29 M.Y.B.P.; (3) an upper succession of basaltic andesite to rhyolite lava flows and minor intrusions that are 24 m.y. old in the eastern part of this area (not dated in the central and western parts). Osburn and Chapin (in press) have discussed the stratigraphic nomenclature of the region from Datil to Socorro with some changes in the names of a few units. For more detailed information the reader is referred to Jones (1980), Lopez and Bornhorst (1979), Bornhorst and Elston (1978), Bornhorst (1976), Lopez (1975), and Stearns (1962). All new ages given are internally consistent and support correlations made by field and petrologic methods.

Analytical data for K-Ar and fission-track ages are given below. The decay constants used in the age calculations are as follows: $\lambda\beta = 4.962 \times 10^{-1}yr^{-1}$; $\lambda\epsilon = 0.581 \times 10^{-10}yr^{-1}$; and $K^{40}\Sigma K = 0.01167$ atomic percent.

The quoted analytical error for the calculated age of a sample represents one standard deviation. For fission track, spontaneous fission of $U^{238} = \lambda_F - 7.03 \times 10^{-17}yr^{-1}$; P_s = number of fossil tracks counted; P_i = number of induced tracks counted (multiplied by 2); ϕ = neutron flux in neutrons/cm² × 10^{14}; and P_s and P_i are counted for equal surface area. All fission-track ages reported here are for zircons.

Published ages are included under comments. All K-Ar ages have been corrected for the revised 1976 IUGS ^{40}K abundance and decay constants, according to the methods by Dalrymple (1979).

SAMPLE DESCRIPTIONS

1. *77T22* — Fission track

Andesite lava clast from Dog Springs Member (Osburn and Chapin, in press) of the Spears Formation (SW/4 S7,T1S,R10W; 34°13'51"N,107°55'0"W; NM). *Analytical data:* $P_s = 1535$; $P_i = 2102$; $\phi = 8.8770$. *Comments:* Oldest Tertiary volcanic unit in region; rests on the Eocene Baca Formation. Clast from the upper part of the Spears Formation in the Joyita Hills has been dated at 37.1 (Burke and others, 1963; old constants).

(zircon)38.6 ± 1.5 m.y.

2. *76T5* — Fission track, K-Ar

Datil Well Tuff (Lopez and Bornhorst, 1979); ash-flow tuff (SW/4 S2,T2S,R10W; 34°09'22"N, 107°51'00"W; NM). *Analytical data:* fission track: $P_s = 1090$; $P_i = 1530$; $\phi = 8.8393$. K-Ar: K_2O = 7.761%, 7.640%, 7.632%, 7.638%; $*Ar^{40}$ = 3.829×10^{-10} mole/gm, 3.836×10^{-10} mole/gm, 3.869×10^{-10} mole/gm; $*Ar^{40}/\Sigma Ar$ = 96.4%, 96.5%, 96.6%. *Comments:* Stratigraphically above the Dog Springs Member of the Spears Formation and below the Rock House Canyon Tuff (not dated).

(zircon)37.7 ± 1.8 m.y.
(sanidine)35.6 ± 0.7 m.y.

3. *76T193* — Fission track

Blue Canyon Tuff (Lopez and Bornhorst, 1979); ash-flow tuff (SW/4 S1,T2S,R12W; 34°04'21"N, 108°02'50"W; NM). *Analytical data:* $P_s = 896$; $P_i = 1420$; $\phi = 8.77622$. *Comments:* Stratigraphically above the Rock House Canyon Tuff and below the Hells Mesa Tuff in the Datil area and the tuff breccia of Horse Springs Canyon in the Horse Springs area.

(zircon)33.2 ± 1.7 m.y.

4. *77T20* — Fission track

Tuff breccia of Horse Springs Canyon (Bornhorst, 1976); quartz monzonite clast (NW/4 S31,T4S,R14W; 33°55'09"N,108°15'56"W; NM). *Analytical data:* $P_s = 806$; $P_i = 1276$; $\phi = 8.5500$. *Comments:* Bikerman (1976) reported a K-Ar age of 33 ± 2 m.y. on friable rhyolite ash-flow tuff from NW/4 S36,T4S,R14W. According to his sample location the rock is the tuff-breccia of Horse Springs Canyon. Stratigraphically below Tularosa Canyon Rhyolite Tuff.

(zircon)32.4 ± 1.7 m.y.

5. *J-218* — Fission track

Tuff breccia of Horse Springs Canyon (Bornhorst, 1976); matrix (NW/4 SW/4 S10,T2S,R13W; 34°01'04"N, 108°12'43"W; NM). *Analytical data:* $P_s = 596$; $P_i = 1170$; $\phi = 10.700$.

(zircon)32.7 ± 1.9 m.y.

6. *76T3* — K-Ar

Hells Mesa Tuff (Deal and Rhodes, 1976); ash-flow tuff (NE/4 SW/4 S36,T2S,R11W; 34°05'14"N, 107°56'07"W; NM). *Analytical data:* K_2O = 8.343%, 8.323%, 8.318%, 8.403%; $*Ar^{40}$ = 3.761×10^{-10} mole/gm, 3.794×10^{-10} mole/gm; $*Ar^{40}/\Sigma Ar$ = 83.5%, 84.0%. *Comments:* Correlated as rhyolite tuff of Rock Tank by Lopez and Bornhorst (1976) and now as Hells Mesa Tuff (Osburn and Chapin, in press). Stratigraphically below Vicks Peak Tuff.

(sanidine)32.1 ± 0.7 m.y.

7. *T-417* Fission track
Vicks Peak Tuff (Farkas, 1969); ash-flow tuff (SW/4 SW/4 S24,T2S,R11W; 34°06'47"N,107°56'20"W; NM). *Analytical data:* P_s = 325; P_i = 556; ϕ = 8.9357. *Comments:* Correlated as A-L Peak Rhyolite Tuff by Lopez and Bornhorst (1979) and now as Vicks Peak Tuff (Osburn and Chapin, in press). Stratigraphically below basaltic andesite of the Crosby Mountains.

(zircon)31.3 ± 2.6 m.y.

8. *J-53* Fission track
Tularosa Canyon Rhyolite Tuff (Smith and Rhodes, 1974); ash-flow tuff (NW/4 SW/4 S10,T2S,R13W; 34°08'45"N,108°11'43"W; NM). *Analytical data:* P_s = 480; P_i = 1028; ϕ = 10.900. *Comments:* Smith and others (1976) report a fission-track age of 30.7 ± 1.3 m.y. for a sample from the type section in the Tularosa Mountains, southwest of this area. This ash-flow tuff has been correlated with the tuff of Davis Canyon (29.8 ± 1 m.y.) by Ratte (1980). Stratigraphically below rhyolite of Wye Hill.

(zircon)30.5 ± 1.9 m.y.

9. *T-384A* Fission track
Rhyolite of Wye Hill (Bornhorst, 1976); rhyolite lava (C S25,T4S,R14W; 33°55'55"N,108°15'37"N; NM). *Analytical data:* P_s = 187; P_i = 388; ϕ = 10.500. *Comments:* Stratigraphically below Squirrel Canyon Andesite.

(zircon)30.3 ± 2.6 m.y.

10. *76T4* K-Ar
Rhyolite of Wye Hill (Bornhorst, 1976) (S/2 S35,T4S,R14W; 33°54'45"N,108°16'W; NM). *Analytical data:* K_2O = 6.453%, 6.412%, $^{*40}Ar$ = 2.548 × 10^{-10} mole/gm, 2.544 × 10^{-10} mole/gm, 2.541 × 10^{-10} mole/gm; $^{*40}Ar/\Sigma Ar$ = 82.9%, 82.5%, 82.7%. *Comments:* The date is probably too young as evidenced by the date of the Squirrel Springs Canyon Andesite.

(sanidine)28.0 ± 0.6 m.y.

11. *T-249* Fission track
Squirrel Springs Canyon Andesite (Rhodes and Smith, 1976); andesite lava (NE/4 NE/4 S36,T3S,R14W; 34°0'23"N,108°14'35"W; NM). *Analytical data:* P_s = 579; P_i = 1220; ϕ = 10.300. *Comments:* Sample is from an intrusive plug of the lower flow-banded member of this unit (Bornhorst, 1976). Stragigraphically below tuff of Shelley Peak which is dated at 28.2 m.y. (average from Ratte and Finnell, 1978).

(zircon)29.3 ± 1.7 m.y.

12. *76T2* K-Ar
Basaltic andesite of the Crosby Mountains (Lopez and Bornhorst, 1979); andesite lava (SE/4 NE/4 S10,T2S,R11W; 34°08'53"N,108°57'44"W; NM). *Analytical data:* K_2O = 6.736%, 6.711%, $^{*40}Ar$ = 2.357 × 10^{-10} mole/gm, 2.375 × 10^{-10} mole/gm; $^{*40}Ar/\Sigma Ar$ = 83.4%, 84.0%. *Comments:* This is the youngest volcanic unit in the east part of the area discussed here. Correlation with units of similar character and stratigraphic position in other parts of the Mogollon-Datil volcanic field suggests an age of between 25 and 20 M.Y.B.P.

(whole-rock)24.3 ± 0.6 m.y.

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REFERENCES

Bikerman, Michael (1976) Initial Sr^{87}/Sr^{86} ratios and K-Ar dates of some volcanic rocks from Catron County, New Mexico: Geological Society of America, Abstracts with Programs, v. 8, no. 5, p. 569.

Bornhorst, T.J. (1976) Volcanic geology of the Crosby Mountains and vicinity, Catron County, New Mexico: M.S. thesis, University of New Mexico, Albuquerque, New Mexico, 113 p.

Bornhorst, T.J., and Elston, W.E. (1978) Road log from Reserve, New Mexico to Magdalena, New Mexico via Horse Springs and Datil: New Mexico Geological Society Special Publication No. 7, p. 99-105.

Burke, W.H., Kenny, G.S., Otto, J.B., and Walter, R.D. (1963) Potassium-argon dates, Socorro and Sierra Counties, New Mexico: New Mexico Geological Society Guidebook of the Socorro region, 14th Field Conference, p. 224.

Dalrymple, G.B. (1979) Critical tables for conversion of K-Ar ages from old to new constants: Geology, v. 7, p. 558-560.

Deal, E.G., and Rhodes, R.C. (1976) Volcano-tectonic structures in the San Mateo Mountains, Socorro County, New Mexico: New Mexico Geological Society Special Publication No. 5, p. 51-56.

Farkas, S.E. (1969) Geology of the southern San Mateo Mountains, Socorro and Sierra Counties, New Mexico: Ph.D. dissertation, University of New Mexico, Albuquerque, New Mexico, 137 p.

Jones, D.P. (1980) Volcanic geology of the Alegros Mountain area, Catron County, New Mexico: M.S. thesis, University of New Mexico, Albuquerque, New Mexico, 76 p.

Lopez, D.A. (1975) Geology of the Datil area, Catron County, New Mexico: M.S. thesis, University of New Mexico, Albuquerque, New Mexico, 72 p.

Lopez, D.A., and Bornhorst, T.J. (1979) Geologic map of the Datil area, Catron County, New Mexico: U.S. Geological Survey Miscellaneous Investigations Map I-1098.

Osburn, G.R., and Chapin, C.E. (in press) Stratigraphic nomenclature for Cenozoic rocks of the northeastern Mogollon-Datil volcanic field: New Mexico Bureau of Mines and Mineral Resources Stratigraphic Chart No. 1.

Ratte, J.C. (1980) Geologic map of the Saliz Pass Quadrangle, Catron County, New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1203.

Ratte, J.C., and Finnell, T.J. (1978) Road Log from Silver City to Reserve via Glenwood and the Mogollon mining district: New Mexico Geological Society Special Publication No. 7, p. 49-63.

Rhodes, R.C., and Smith, E.I. (1976) Stratigraphy and structure of the northwestern part of the Mogollon Plateau volcanic province, Catron County, New Mexico: New Mexico Geological Society Special Publication No. 5, p. 57-63.

Smith, E.I., Aldrich, J.J., Jr., Deal, E.G., and Rhodes, R.C. (1976) Fission-track ages of Tertiary volcanic and plutonic rocks, Mogollon Plateau, southwestern New Mexico: New Mexico Geological Society Special Publication No. 5, p. 117-118.

Smith, E.I., and Rhodes, R.C. (1974) Squirrel Springs volcano-tectonic depressions—A buried cauldron in southwestern New Mexico: Geological Society of America Bulletin, v. 85, p. 1865-1868.

Stearns, C.E. (1962) Geology of the north half of the Pelona quadrangle, Catron County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Bulletin 78, 46 p.