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K-AR AGES OF INTRUSIVE ROCKS OF THE CENTRAL PELONCILLO MOUNTAINS HIDALGO COUNTY, NEW MEXICO

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This report presents K-Ar results done as part of a larger study of the central Peloncillo Mountains, western New Mexico, in cooperation with the New Mexico Bureau of Mines and Mineral Resources. The geologic map and detailed description of the structure and petrography of the area are described in Armstrong and others (in press).

Potassium analyses were performed by L. B. Schlocker and M. C. Cremer by flame photometer using lithium metaborate fusion, the lithium serving as an internal standard (Ingamells, 1970). Argon was analyzed by standard isotope dilution techniques described by Dalrymple and Lanphere (1969); the authors of this report were the analysts. Mineral separates were prepared by V. R. Todd. The uncertainty in reported age (± 3%) represents analytical uncertainty only, at one standard deviation. Constants used in the calculations are $\lambda_\epsilon = 0.572 \times 10^{-10}$ year^{-1}, $\lambda_{\epsilon'} = 8.78 \times 10^{-13}$ year^{-1}, $\lambda_\beta = 4.963 \times 10^{-10}$ year^{-1}, and $K^{40}/K_{total} = 1.167 \times 10^{-4}$ mole/mole.

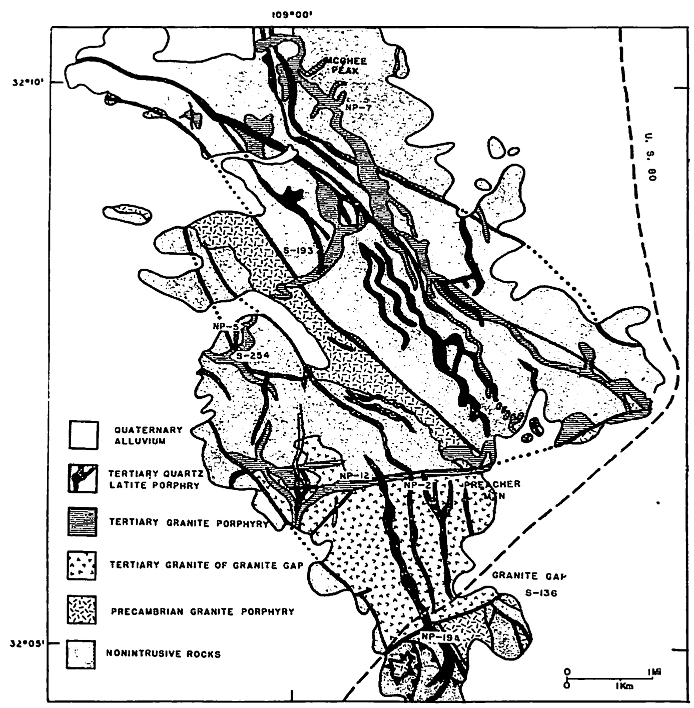

FIGURE 1 – Geologic map of the central Peloncillo Mountains, New Mexico (after Armstrong and others, in press).

GEOLOGIC DISCUSSION

The central Peloncillo Mountains consist of a broken faulted arch of Precambrian to middle Tertiary intrusive and extrusive igneous rocks and Cambrian to Cretaceous sedimentary rocks, overlain to the north and south by middle Tertiary and younger volcanic rocks (fig. 1). Precambrian granitic rocks and Paleozoic and Mesozoic sedimentary rocks are intruded and metamorphosed by four groups of igneous rocks (from oldest to youngest): 1) a granite pluton approximately 8 km^2 in outcrop area at Granite Gap; 2) granite porphyry dikes and sills; 3) fine-grained porphyritic to felsitic rhyolite dikes associated with and probably late-stage phases of the granite porphyry dikes and sills; and 4) quartz latite porphyry dikes and sills that intrude all older rocks.

All the igneous rocks yield middle Tertiary ages with the exception of a K-feldspar-quartz-muscovite pegmatite, which gave discordant Late Cretaceous and early Tertiary ages, and microcline from the Precambrian granite, which yielded a Late Cretaceous age (table 1, p. 4). The quartz latite porphyry gives a mean age of 26.8 m.y., which probably represents its emplacement age. The two next older units, the Tertiary granite porphyry and the granite of Granite Gap, yield the same mean K-Ar ages (31.6 m.y. and 31.7 m.y., respectively). A slightly younger perthitic K-feldspar age from the granite of Granite Gap may represent partial resetting during the latite intrusion. No K-Ar ages were determined for rhyolite and felsite dikes, as they are assumed to be the same age as the granite porphyry dikes and sills.

The pegmatite gave discordant ages from muscovite and microcline of 70 and 55 m.y., respectively. This pegmatite occurs only as an isolated patch in alluvium in the area where Precambrian granite porphyry occurs, so its assignment to either the Precambrian granite porphyry or the granite of Granite Gap is uncertain. We consider it unlikely that the pegmatite is related to the granite of Granite Gap because pegmatitic segregations in the granite usually do not contain muscovite, as does the pegmatite. The pegmatite may be related to the Precambrian granite porphyry or may have formed at some time earlier than the granite of Granite Gap. The coarse-grained mica of the pegmatite should be much more resistant to argon loss from subsequent heating than the finer grained minerals of the granite (Hanson and Gast, 1967); the poor argon retentivity of microcline makes its K-Ar age a minimum estimate. Thus the older ages yielded by the pegmatite may be evidence for some plutonism in the area before the middle Tertiary of which the granite of Granite Gap may have been part.

Table 1 – K-Ar ages of intrusive rocks, central Peloncillo Mountains, New Mexico

Sample no.	Mineral dated	Potassium-argon (m.y.)
Quartz latite porphyry		
S-37A[3]	Biotite	27.4±0.8
S-193	Biotite	27.7±0.8
	Plagioclase	25.8±0.8
73NP-23[2]	Biotite	27.0±0.8
	K-feldspar	26.1±0.8
Tertiary granite porphyry (dikes and sills)		
73NV-4[1,2]	Muscovite	31.4±0.9
73NP-7[1]	Muscovite/chlorite	31.7±1.0
73NP-5	Orthoclase	31.0±0.9
S-254	Biotite	32.2±1.0
Granite of Granite Gap		
73NP-12	Biotite	30.3±0.9
73NP-2	Biotite	32.5±1.0
S-136	Biotite	31.8±1.0
	Plagioclase	32.1±1.0
	K-feldspar	29.8±0.9
Pegmatite (graphic granite, feldspar, muscovite)		
73NP-19A	Microcline	55.3±1.7
	Muscovite	69.9±2.1
Precambrian granite porphyry		
73NP-18[3]	Muscovite	34.4±1.0
	K-feldspar	57.8±1.7

[1] Altered rock. [2] Not shown on Figure 1; located north of map area. [3] Not shown on Figure 1; located south of map area.

The Precambrian granite porphyry, which is overlain unconformably by the Bliss Sandstone (Cambrian), yielded a muscovite age of 34.4 m.y. and a microcline age of 58 m.y. Enough middle Tertiary igneous activity occurred in the area to explain these anomalously young ages by differential loss of argon during reheating.

In summary, major intrusive igneous activity occurred in the central Peloncillo Mountains during middle Tertiary time. K-Ar geochronology has not been able to completely resolve the age relations of all the igneous rocks due to the complex and multiple nature of the intrusion of different units.

SAMPLE DESCRIPTIONS

1. S-37A — K-Ar

Quartz latite porphyry. Brown groundmass with plagioclase and biotite phenocrysts (32°02′53″N, 108°57′00″W; NW¼ sec. 13, T26S, R21W; Cotton City 7½′ quad., Hidalgo Co., NM). Analytical data: (biotite) K_2O = 8.48%, 8.42%, $*Ar^{40} = 3.363 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 85.7%; collected by: M. L. Silberman and A. K. Armstrong. (biotite) 27.4±0.8 m.y.

2. S-193 — K-Ar

Quartz latite porphyry. Brown groundmass with plagioclase and biotite phenocrysts (32°08′25″N, 108°59′45″W; SW¼ sec. 10, T25S, R21W; Steins 7½′ quad., Hidalgo Co., NM). Analytical data: (biotite) K_2O = 8.88%, 8.88%, $*Ar^{40} = 3.565 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 77.4%; (plagioclase) K_2O = 1.114%, 1.126%, $*Ar^{40} = 4.188 \times 10^{-11}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 51.8%; collected by: M. L. Silberman and A. K. Armstrong. Comment: Plagioclase is intermediate andesine, and has minor sericitic alteration and contains glass inclusions. The biotite is fresh. We consider the biotite age more reliable because of the evidence of alteration of the plagioclase.
(biotite) 27.7±0.8 m.y.
(plagioclase) 25.8±0.8 m.y.

3. 73NP-23 — K-Ar

Quartz latite porphyry. Brown groundmass with plagioclase, K-feldspar, and biotite phenocrysts (32°13′15″N, 109°00′15″W; NE¼ sec. 16, T24S, R21W, Vanar 15′ quad., Hidalgo Co., NM). Analytical data: (biotite) K_2O = 8.90%, 8.89%, $*Ar^{40} = 3.490 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 71.2%; (K-feldspar) K_2O = 8.28%, 8.29%, $*Ar^{40} = 3.138 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 85.6%; collected by: M. L. Silberman and A. K. Armstrong. Comment: Biotite and K-feldspar ages of the three samples [S-37A (no. 1), S-193 (no. 2), and 73NP-23 (no. 3)] of quartz latite porphyry are concordant. The plagioclase age of sample S-193 (no. 2) is discordant. (biotite) 27.0±0.8 m.y.
(K-feldspar) 26.1±0.8 m.y.

4. 73NV-4 — K-Ar

Altered tertiary granite porphyry. Pale-gray groundmass with quartz, K-feldspar, and muscovite phenocrysts (32°11′49″N, 109°00′13″W; SE¼ sec. 21, T24S, R21W, Vanar 15′ quad., Hidalgo Co., NM). Analytical data: (muscovite) K_2O = 8.27%, 8.38%, $*Ar^{40} = 3.798 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 77.1%; collected by: M. L. Silberman and A. K. Armstrong. Comment: Original biotite was recrystallized to muscovite. (muscovite) 31.4±0.9 m.y.

5. 73NP-7 — K-Ar

Altered tertiary granite porphyry. Pale-gray groundmass with quartz, K-feldspar, and mixed layer muscovite-chlorite phenocrysts (32°09′46″N, 108°59′34″W; NW¼ sec. 3, T25S, R21W; Steins 7½′ quad., Hidalgo Co., NM). Analytical data: (muscovite-chlorite)

5. (continued)
K_2O = 3.18%, 3.18%, $*Ar^{40} = 1.468 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 17.4%; collected by: M. L. Silberman and A. K. Armstrong. Comment: Near Silver Hill Mine; original biotite recrystallized to a mixed layer intergrowth of muscovite and chlorite.
(muscovite/chlorite) 31.7±1.0 m.y.

6. 73NP-5 K-Ar
Tertiary granite porphyry. Pale-gray groundmass with quartz, K-feldspar, biotite, and pyroxene phenocrysts (32°07′49″N, 109°00′16″W; center sec. 16, T25S, R21W; Vanar 15′ quad., Hidalgo Co., NM). Analytical data: (orthoclase) K_2O = 12.09%, 11.94%, $*Ar^{40}$ = 5.0407×10^{-10} mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 81.8%; collected by: M. L. Silberman and A. K. Armstrong.
(orthoclase) 31.0±0.9 m.y.

7. S-254 K-Ar
Tertiary granite porphyry. Pale-gray groundmass with quartz, K-feldspar, and biotite phenocrysts (32°07′29″N, 109°00′31″W; SW¼ sec. 16, T25S, R21W; Vanar 15′ quad., Hidalgo Co., NM). Analytical data: (biotite) K_2O = 7.88%, 7.91%, $*Ar^{40} = 3.691 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 70.4%; collected by: M. L. Silberman and A. K. Armstrong. Comment: Concordant ages of biotite, K-feldspar, muscovite, and mixed-layer intergrowth of chlorite and muscovite from the four Tertiary granite porphyry samples indicate that emplacement and alteration of the granite porphyry occurred at approximately the same time. Alteration of these sills and dikes is spatially associated with base metal-bearing skarn mineralogy in carbonate wall rocks (Gillerman, 1958; Silberman and others, 1974). Alteration, mineralization, and metamorphism are processes that are probably related (Gillerman, 1958) and were generated by intrusion of the granite porphyry dikes and sills.

Rhyolite and felsite dikes are believed to be late stage equivalents of the granite porphyry with which they are commonly associated, sometimes occurring as fine-grained chill zones along contacts of the granite porphyry with wall rocks. Rhyolite and felsite, as well as the granite porphyry, are intruded by the quartz latite porphyry. (biotite) 32.2±1.0 m.y.

8. 73NP-12 K-Ar
Aplite of Granite Gap. Medium-grained microgranite (32°06′23″N, 108°59′28″W; NW¼ sec. 27, T25S, R21W; Cotton City 7½′ quad., Hidalgo Co., NM). Analytical data: (biotite) K_2O = 8.32%, 8.29%, $*Ar^{40} = 3.658 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 57.5%; collected by: M. L. Silberman and A. K. Armstrong. (biotite) 30.3±0.9 m.y.

9. 73NP-2 K-Ar
Granite of Granite Gap. Medium-grained to coarse-grained biotite quartz monzonite (32°06′24″N, 108°58′59″W; NE¼ sec. 27, T25S, R21W; Cotton City 7½′ quad., Hidalgo Co., NM). Analytical data: (biotite) K_2O = 8.10%, 8.09%, $*Ar^{40} = 3.822 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 79.5%; collected by: M. L. Silberman and A. K. Armstrong.
(biotite) 32.5±1.0 m.y.

10. S-136 K-Ar
Granite of Granite Gap. Medium-grained to coarse-grained biotite quartz monzonite (32°05′33″N, 108°57′59″W; NE¼ sec. 35, T25S, R21W; Cotton City 7½′ quad., Hidalgo Co., NM). Analytical data: (biotite) K_2O = 9.20%, 9.16%, $*Ar^{40} = 4.235 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 79.3%; (plagioclase) K_2O = 0.689%, 0.692%, $*Ar^{40} = 3.222 \times 10^{-11}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 64.3%; (K-feldspar) K_2O = 11.07%, 11.20%, $*Ar^{40} = 4.809 \times 10^{-10}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 84.5%; collected by: M. L. Silberman and A. K. Armstrong. Comment: The K-feldspar, which is perthitic, yields an age lower than those from biotite and plagioclase in the same sample. The perthite age would normally be considered a minimum figure. The concordance of the biotite and plagioclase ages suggests the granite crystallized in the middle Tertiary. (biotite) 31.8±1.0 m.y.
(plagioclase) 32.1±1.0 m.y.
(K-feldspar) 29.8±0.9 m.y.

11. 73NP-19 K-Ar
Pegmatite of Granite Gap (32°05′01″N, 108°58′04″W; SE¼ sec. 35, T25S, R21W; Cotton City 7½′ quad., Hidalgo Co., NM). Analytical data: (microcline) K_2O = 12.79%, 12.75%, $*Ar^{40} = 1.032\% \times 10^{-9}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 88.1%; (muscovite) K_2O = 10.53%, 10.61%, $*Ar^{40} = 1.084 \times 10^{-9}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 86.1%; collected by: M. L. Silberman and A. K. Armstrong. Comment: Isolated outcrop in alluvium. Pegmatite outcrop consists of graphic granite, quartz, and coarse-grained K-feldspar and muscovite.
(microcline) 55.3±1.7 m.y.
(muscovite) 69.9±2.1 m.y.

12. 73NP-18 K-Ar
Precambrian granite porphyry. Coarse-grained (32°03′24″N, 108°56′45″W; SW¼ sec. 12, T26S, R21W; Cotton City 7½′ quad., Hidalgo Co., NM). Analytical data: (muscovite) K_2O = 10.44%, 10.37%, $*Ar^{40}$ = 5.208×10^{-10} mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 81.4%; (K-feldspar) K_2O = 12.15%, 12.10%, $*Ar^{40} = 1.026 \times 10^{-9}$ mole/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 93.4%; collected by: M. L. Silberman and A. K. Armstrong. Comment: Muscovite appears to be alteration product of biotite. Dates on both minerals are considered minimum ages.
(muscovite) 34.4±1.0 m.y.
(K-feldspar) 57.8±1.7 m.y.

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