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GEOLOGIC DISCUSSION

Numerous physiographic surfaces have been studied and named along the central Rio Grande in New Mexico (Bryan and McCann, 1938; Denny, 1941; Wright, 1946). Some surfaces have been presumed to be related to a long erosional history of an ancestral Rio Grande. More recently it alternately has been proposed that some of the earliest surfaces along the Rio Grande in southern New Mexico resulted from the filling of internally drained basins (Ruhe, 1962) and that the integrated Rio Grande drainage dates from middle Pleistocene time. We believe that probably some of the oldest physiographic surfaces along the Rio Grande in central New Mexico resulted from the filling of internally drained tectonic basins before the integration of the Rio Grande. Therefore, it is important to date these surfaces and to interpret how they bear on the tectonic and erosional development of the central Rio Grande trough.

During the 1973 field season, as part of a continuing study of the Cenozoic history of the Rio Grande trough in central New Mexico, Bachman examined several older physiographic surfaces in the Albuquerque-Belen basin and the relationship of basalt flows to these surfaces. One of the most extensive of these older surfaces is the Llano de Albuquerque, which extends for about 100 km (62 miles) between the southward-flowing Puerco and Rio Grande drainages. The Llano de Albuquerque is an undulating surface about 120 m (400 feet) above the Rio Grande flood plain and is underlain by a persistent pedogenic caliche that ranges in thickness from slightly more than 1 m (3 feet) to about 2.5 m (8 feet). This well-developed caliche is a useful mapping horizon that formed during a period of relative tectonic stability.

Although numerous volcanic vents and lava flows are present on or adjacent to the Llano de Albuquerque surface, those related to the Cerro de Los Lunas and the Albuquerque volcanoes best bracket the time of its formation. The Los Lunas volcano, a partly exhumed volcanic center with adjacent beds of lapilli tuff and lava flows, predates the surface. This basaltic mass intruded and deformed Tertiary and Quaternary sedimentary strata (part of the Santa Fe Group). Along the western margin of the Los Lunas volcano, the Llano de Albuquerque surfaces truncate the deformed strata, and deposits on the surface mantle the lava flows. At two localities talus on the flanks of the volcano has been cemented by the Llano de Albuquerque caliche. At no place near the Los Lunas volcano have basalts from that center flowed on the Llano de Albuquerque surface.

Numerous volcanoes elsewhere have poured lava and cinders over several square miles of the Llano de Albuquerque surface; however, most of these lava flows are apparently quite young. For example, west of Albuquerque a group of volcanic centers, known locally as the Albuquerque volcanoes, erupted in an erosional swale cut in the Llano de Albuquerque surface. Although the lava flows at Albuquerque probably were deposited a considerable time after dissection of the Llano de Albuquerque surface began, they provide a minimum age for the surface.

Four age determinations for the basalt flows by the K-Ar method indicate 1.01 to 1.31 m.y. for those at Cerro de Los Lunas and 0.19 m.y. for those at Albuquerque. These results indicate that the Llano de Albuquerque surface is no older than 1.01 to 1.31 m.y. and no younger than 0.19 m.y. Although this appears to be a wide span of time during which the Llano de Albuquerque surface could have formed, it narrows the time limits within the Pleistocene and is not incompatible with the mid-Pleistocene age of "most of the high surfaces along the Rio Grande" postulated by Kottlowski and others (1965, p. 292). In addition, these ages indicate that the Llano de Albuquerque surface is younger than the Mesa Chivato surface to the west in the Mount Taylor region, as was suggested by Bryan and McCann (1938, p. 8-11). K-Ar ages of the Mount Taylor volcanic rocks overlying the Mesa Chivato surface are about 2.6 m.y. (Bassett and others, 1963).

SAMPLE DESCRIPTIONS

The following samples were collected by G. O. Bachman and analyzed by R. F. Marvin, H. H. Mehnert, and Violet Merritt in the U.S. Geological Survey laboratories at Denver, Colorado. Constants used are: $\lambda_\epsilon = 0.585 \times 10^{-10}$/yr; $\lambda_\beta = 4.72 \times 10^{-10}$/yr; $K^{40}/K_{total} = 1.22 \times 10^{-4}$ gm/gm. Analytical uncertainty is quoted as 2σ.

1. D2321R(D) K-Ar (whole-rock) 1.01±0.10 m.y.
Vesicular basalt (from the upper surface of the W flank of Cerro de Los Lunas; 35°47′50″N, 106°48′00″W; Valencia Co., NM). Analytical data: K_2O = 2.53% and 2.57%; $*Ar^{40}$ = 0.381 x 10^{-11} moles/gm; $*Ar^{40}/\Sigma Ar^{40}$ = 4%.

2. D2322R(D) K-Ar (whole-rock) 1.31±0.05 m.y.
Vesicular basalt (from N part of E flank of Cerro de Los Lunas; 35°48′10″N, 106°45′55″W; Valencia Co., NM). Analytical data: K_2O = 2.33% and 2.30%; $*Ar^{40}$ = 0.4483 x 10^{-11} moles/gm; $*Ar^{40}/\Sigma Ar^{40}$ = 9%.

3. D2323R(D) K-Ar (whole-rock) 1.12±0.04 m.y.
Vesicular basalt (from S part of W flank of Cerro de Los Lunas; 35°47′30″N, 106°47′05″W; Valencia Co., NM). Analytical data: K_2O = 2.54% and 2.51%; $*Ar^{40}$ = 0.4184 x 10^{-11} moles/gm; $*Ar^{40}/\Sigma Ar^{40}$ = 22%.

4. D2324R(D) K-Ar (whole-rock) 0.19±0.04 m.y.
Porphyritic, dense, black basalt (from the base of a flow from the Albuquerque volcanoes, in a recent roadcut; NE ¼ SW ¼ sec. 20, T11N, R2E; 37°09′50″N, 106°45′30″W; Volcano Ranch quadrangle; Bernalillo Co., NM). Analytical data: K_2O = 0.45% and 0.45%; $*Ar^{40}$ = 0.1237 x 10^{-12} moles/gm; $*Ar^{40}/\Sigma Ar^{40}$ = 1%.

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