Volcanic rocks of south-central New Mexico

Richard H. Jahns, Frank E. Kottlowski, and Frederick J. Kuellmer

1955, pp. 92-95. https://doi.org/10.56577/FFC-6.92

in:

South-Central New Mexico, Fitzsimmons, J. P.; [ed.], New Mexico Geological Society 6th Annual Fall Field Conference Guidebook, 193 p. https://doi.org/10.56577/FFC-6

This page is intentionally left blank to maintain order of facing pages.

VOLCANIC ROCKS OF SOUTH-CENTRAL NEW MEXICO

By Richard H. Jahns, Frank E. Kottlowski,
and Frederick J. Kuellmer
California Institute of Technology
New Mexico Bureau of Mines and Mineral Resources
New Mexico Bureau of Mines and Mineral Resources

INTRODUCTION

Each of the authors has made detailed and reconnaissance geologic studies in south-central New Mexico, and herein describes the igneous history for that area with which he is most familiar. Jahns has studied the northern Black Range, the Sierra Cuchillo, the Salado Mountains, and other nearby areas; Kottlowski has investigated the Rio Grande vicinity and eastward, ranging from Socorro to Texas; and Kuellmer has worked from the Animas Hills southward, in the southern Black Range, and in part of the Mimbres and Gila Valleys. Although each part was written separately, even a casual reader will note a remarkable similarity in the general picture of volcanism.

PART I

Volcanic rocks will be seen on the field trip near Elephant Butte dam, along New Mexico Highway 52 west of Engle, and in the Cuchillo Range. Elephant Butte, itself, is a basalt neck, a remnant of a volcano similar to the better preserved cones and flows near Engle.

The oldest volcanic rocks in the Caballo area are the breccias, tuff lenses, volcanic conglomerates, and vent agglomerates of the basal Jose Creek member of the McRae formation. Dating by vertebrate and plant fossils indicates a Cretaceous age for at least the lower part of the McRae formation which overlies the Mesaverde formation. The upper and thicker part of the McRae consists of interbedded shales and sandstones containing much volcanic and arkosic detritus. Beds of the McRae formation probably underlie the alluvial gravels of much of the Jornada del Muerto in this area.

Along the southwest side of the Caballo Mountains and occurring in isolated fault blocks southward to San Diego Mountain, the basal Tertiary beds are of the Palm Park formation (Kelley and Silver, 1952, p. 120). The basal beds are coarse conglomerates and reddish silts which contain boulders of Precambrian and Paleozoic rocks and of purplish andesite. The upper part of the formation is chiefly of reddish to grayish andesitic breccia and tuff, similar to the oldest volcanics in the Dona Ana, Organ, Robledo, and Sierra Blanca Mountains.

Above the Palm Park formation, southwest of the Caballo Mountains, is the Thurman formation, which comprises a basal rhyolite tuff-breccia and several thousand feet of overlying light-gray sandy clays, tuffs, and tuffaceous sandstones. The Thurman formation is a northward-thinning lens of, and was derived from, the Bell Top formation, which is a thick rhyolitic volcanic series that forms most of the Sierra de las Uvas.

East of the Elephant Butte area and west of Engle, the pediment surface is dotted with basalt cones and related flows of Quaternary age. Looking northwest from Rhodes Pass the large "malpais" at the northwest tip of the Fra Cristobal Mountains will be visible; this Quaternary basalt covers about 150 square miles.

Basalt and rhyolite dikes and sills occur throughout the Caballo Mountains area, and as noted, Elephant Butte is an intrusive-extrusive basaltic plug. In the San Andres Mountains there are sills of greenish-gray hornblende andesite, intruded chiefly into lower Pennsylvanian beds. Salinas Peak, which will be seen from the mouth of Rhodes Canyon, is capped by a rhyolite sill, intruded into lower Pennsylvanian rocks. This extensive sill is petrographically similar to, and at nearly the same geologic horizon as, the Lookout Mountain sill in the Robledo Mountains, and the sill capping Quartzite Mountain in the southern San Andres Mountains.

A single monozite intrusive is reported from the area near Truth or Consequences — a sill intruded into the basal Pennsylvanian of the Mud Springs Mountains. To the south in the Dona Ana and Organ Mountains, large sills and stocks of monzonitic rocks occur and appear to have been the source of mineralization. On San Diego Mountain, fluorite and barite veins occur in the Palm Park formation, while the overlying Thurman-Bell Top beds truncate the veins and contain cobbles of ore, and to the south, pebbles of monzonite.

PART II

Lithology and sequence of the volcanic rocks of the Animas Hills, and their southward extension, the Southren BlackRange, andeven the Silver City region are remarkably similar (Paige, 1916; Kuellmer, 1954; Jicha, 1954; Elston, 1953).

Dark-colored altered andesitic and latitic volcanic breccias, tuffs, and flows with a maximum thickness of 1,700 feet form the basal volcanic sequence. Most of these rocks are aphanitic porphyries, colored red-violet, purple, gray, green, black, or blue, and contain abundant white subhedral altered feldspar laths 2mm. and less in length. Locally, small hornblende or biotite grains are abundant. Such rocks make up the major part of the Animas Hills and are well exposed in road cuts between Hillsboro and the western edge of the Rio Grande trough along New Mexico Highway 180. The Copper Flat quartz monzonite porphyry, about five miles northeast of Hillsboro, intrudes this earliest volcanic sequence. Ore deposits (except for placer deposits) in this region are not found in any of the rocks younger than the andesitic and latitic volcanic rocks.

Isolated remnants of white, cream, tan, brown, and red tuffs, primarily pumiceous and crystal tuffs, in the Animas Hills area are the only exposures of the middle rhyolitic volcanic sequence, which forms extensive thick (minimum estimate: 1,300 feet) blanket-type deposits southward and westward toward Lake Valley, the southern part of the Black Range, the Mimbres Valley, and the Silver City area. The fact that several of these rhyolitic tuff remnants occur at the bottom of narrow gullies in the andesitic volcanic rocks of the Animas Hills suggests that the earliest volcanic rocks and the middle rhyolitic volcanic sequence are separated by an erosional unconformity. Throughout most of the area southwest of the Animas Hills (Hillsboro quadrangle) the two volcanic sequences are approximately conformable; however, in several localities (McClede Mt. and Trujillo Park) several hundred feet of water-laid tuff, and clastic sandstones and shales separate these two sequences. Higher in the Black Range, near Kingston, local angular unconformities separate the andesitic and rhyolitic sequences. Such variability is to be expected with any sort of terrestrial deposition.

The middle rhyolitic volcanic sequence is overlain disconformably by a series of lenticular sediments ranging from conglomerates to shales and from quartzose and arkosic sandstones to well-bedded water-laid tuffs. In almost every outcrop of the finer beds of this series diligent search has disclosed a fossil flora. Roland W. Brown (personal communication, 1953) has tentatively identified the flora from the most prolific collecting area as early Miocene to early Pliocene.

Both the middle rhyolitic volcanic sequence and the overlying lenticular sediments are unconformably overlain by the late basaltic volcanic sequence. In the Animas Hills area, this rock is a black to dark blue, massive to scoriaceous basaltic andesite with a maximum thickness of about 800 feet. Farther to the south, just north of Sibley Mountain, this sequence also includes a series of latitic flows and tuffs, which are black or banded pink and black, aphanitic, and with abundant large phenocrysts of plagioclase (1 cm. and less in long dimension). In most areas the late basaltic volcanic sequence marked the close of Tertiary volcanism, as the basaltic andesites are commonly overlain by alluvial sediments of the Santa Fe or Gila types.

The town of Hillsboro, however, is located in a valley cut in a quartz latite tuff and agglomerate and is one of the exceptional areas where the above-described late basaltic volcanic sequence does not form the youngest volcanic rocks. Here well-bedded, fine tuff to agglomerate beds, red in color, stratigraphically overlie the basaltic sequence. The thickness of this unit is unknown and laterally it grades into sediments of the Santa Fe and Gila types.

Mesas to the north and south of Hillsboro, and some of the higher altitudes of the Animas Hills are capped by thin (approximately 40 feet and less) black, scoriaceous basaltic flows. Below the upper surface the basalt commonly weathers into walnut-size bluish-gray angular nodules. East of the Animas Hills, from Seco Arroyo almost to Percha Creek basaltic rocks of similar appearance dip gently eastward and near the eastern limit of their exposures (approximately three miles east of the Animas Hills front) are overlain by a thin veneer of alluvial sediments of the Rio Grande trough. Such basalts have a negligible volume and areal extent in contrast to the Santa Fe (?) group sediments with which they are associated. Several of the high peaks in the Animas Hills contain basaltic plugs, and just to the southeast, south of New Mexico Highway 180, a similar basaltic dike truncates the Santa Fe (?) group alluvial sediments.

PART III

A similar three-fold succession of Tertiary volcanic rocks is widely exposed farther north in the Black Range, as well as in the Sierra Cuchillo, Salado Mountains, and other areas between the Black Range and the Rio Grande depression. These rocks rest with strong unconformity upon sedimentary rocks of

Paleozoic and Mesozoic age, and are overlain by terrestrial sediments and by olivine basalts of Quaternary age.

The lower unit of the volcanic section is at least 3,000 feet in maximum thickness, and comprises tuff-breccias, tuffs, agglomerates, volcanic conglomerates, and flows, all of andesitic and latitic composition. A remarkably uniform alteration, especially of groundmass constituents, characterizes most of these rocks. The sequence forms a broad outcrop belt along the eastern margin of the Black Range, as well as a second, somewhat narrower belt immediately east of the main spine of the Sierra Cuchillo.

By far the most abundant rock type is very coarse-grained, greenish to purplish gray tuff-breccia in which the clasts are preponderantly volcanic rocks. Fragments of Paleozoic and Precambrian rocks are scattered through the breccia in some areas, and in a few places Pennsylvanian and Permian limestones and redbeds form such a large percentage of the clasts that the volcanic origin of the entire rock is not immediately apparent.

For distances of several miles north and south of Hermosa, the basal tuff-breccia of the Black Range is overlain by flows of latite and by interlayered crystal-vitric tuffs, fine-to medium-grained tuff-breccias, and sedimentary strata of fluviatile and lacustrine origin. Fine-grained, varved beds that mark the position of a small lake immediately north and west of Hermosa contain a well-preserved fossil flora in which a single species of pine is predominant. The plant material is regarded by Daniel I. Axelrod (personal communication, 1955) as most probably of late Miocene or early Pliocene age.

The middle, and thickest, unit of the volcanic section is rhyolitic in composition, and consists of flows, crystal tuffs, pumice-rich lithic tuffs, tuff-breccias, and tuffaceous sandstone and conglomerate. Welded tuffs are widespread. This sequence forms a very large part of the Black Range, and also is exposed in a long, narrow strip of topographically irregular country that lies between the Sierra Cuchillo and the Rio Grande depression. It rests with distinct erosional unconformity upon the andesitic-latitic sequence, as first reported from the Black Range west of Chloride by Gordon (Lindgren, Graton, and Gordon, 1910, p. 262).

Many of the rhyolitic rocks form prominent cliffs, especially in the higher parts of the Black Range and in the San Mateo Mountains to the northeast. They are light colored when fresh, but generally weather buff, pink, red, brown, and medium to very dark gray.

The upper unit of the volcanic section is best exposed in the area south and east of the Sierra Cuchillo, and in the narrow, structurally low block that lies between the Sierra Cuchillo and the Black Range. It is characterized by flows of medium to dark-gray, fine-grained, dense to scoriaceous andesite and olivine-poor basalt. In many areas these are interlayered with pyroclastic material, as well as with fine-to coarse-grained fluviatile sediments that resemble the overlying section of Palomas gravel and/or Santa Fe formation. This more basic sequence overlies the rhyolitic section with an erosional unconformity in some places, but is not separated from it by an observable break in others.

The section that rests upon the Tertiary volcanic rocks attests a period of widespread basin filling, punctuated now and then by local outpouring of basaltic flows and more extensive accumulation of silicic tuffs. This period of deposition lasted well into Pleistocene time, and then gave way to a period of even more widespread erosion that led to development of broad pediments. Flows of dark gray, dense to vesicular olivine basalt spread out on these surfaces from feeder fissures and from volcanic centers now marked by cinder cones and by low basaltic domes. Remnants of the flows appear on the present landscape as mesa cappings in the area south of the Sierra Cuchillo and east of the Black Range. A single remnant of the same basaltic blanket forms the cap on Table Top Mountain, at the west edge of the Sierra Cuchillo near Winston.

Hypabyssal intrusive rocks, many of them genetically related to parts of the Tertiary volcanic succession form large parts of the Sierra Cuchillo and also appear locally in the eastern part of the Black Range. All of them transect the Paleozoic rocks, but some of them extend farther upward than others into the overlying volcanic succession.

The oldest of the intrusive masses are dikes, sills, plugs, and laccoliths of dark-gray hornblende andesite, light- to medium-gray monzonite, and greenish and purplish rocks best described as andesite-latite tuff-breccia. The monzonite is most prominent in and adjacent to the Salado Mountains -- Sierra Cuchillo uplift, where it forms several masses one square mile or more in outcrop area; the other rocks occur mainly in the Black Range. All of them cut the andesitic-latitic volcanic sequence, but appear to antedate the overlying rhyolitic sequence.

Successively younger are intrusive masses of white felsite and fine-grained monzonite, porphyritic rhyolite, aplite and fine-grained granite, and red felsite. These occur mainly in the northern part

of the Sierra Cuchillo and in the country that flanks this range on the east. Dikes of the rhyolite, aplite, and granite cut at least the lower part of the rhyolitic volcanic sequence. Still younger dikes and small plugs of andesite and basalt transect the entire rhyolitic sequence and appear to have served as feeders for the upper, more basic sequence of volcanic rocks. The youngest intrusive rock is olivine basalt, dikes and plugs of which plainly are related to the mesa-capping flows of Quaternary age.

The base-metal deposits of the Cuchillo Negro district and the silver-lead-zinc deposits of the Palomas (Hermosa) district and areas farther north in the Black Range are associated with monzonite and other rocks of the earlier group of Tertiary intrusives. The tin deposits of the Black Range and those in the area east of the Sierra Cuchillo occur in rocks of the rhyolitic volcanic sequence. The gold-silver veins along the margin of the Black Range west and north of Winston occur in rocks of the andesitic-latitic volcanic sequence, but probably are related genetically to some of the younger igneous rocks. The beryllium, tungsten, lead-zinc, iron, and fluorspar deposits of the Iron Mountain district, in the northern part of the Sierra Cuchillo, have contact-metamorphic affinities and are genetically related to intrusive masses of porphyritic rhyolite, aplite, and granite.

REFERENCES

Elston, W. E. (1953) Geology and mineral resources of the Dwyer quadrangle, Grant, Luna, and Sierra Counties, New Mexico: Unpublished manuscript, Columbia University.

Jicha, H. L., Jr. (1954) Geology and mineral deposits of Lake Valley quadrangle, Grant, Luna, and Sierra Counties, New Mexico: New Mexico Bur. Mines and Mineral Res. Bull. 37.

Kelley, V. C., and Silver, C. (1952) Geology of the Caballo Mountains: Univ. New Mexico Pub. in Geol., No. 4.

Kuellmer, F. J. (1954) Geologic section of the Black Range at Kingston, New Mexico: New Mexico Bur. Mines and Mineral Res. Bull. 33.

Lindgren, W., Graton, L. C., and Gordon, C. H. (1910) The ore deposits of New Mexico: U. S. Geol. Survey Prof. Paper 68.

Paige, S. (1916) U. S. Geol. Survey, Geol. Atlas, Silver City Folio, No. 199.