DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

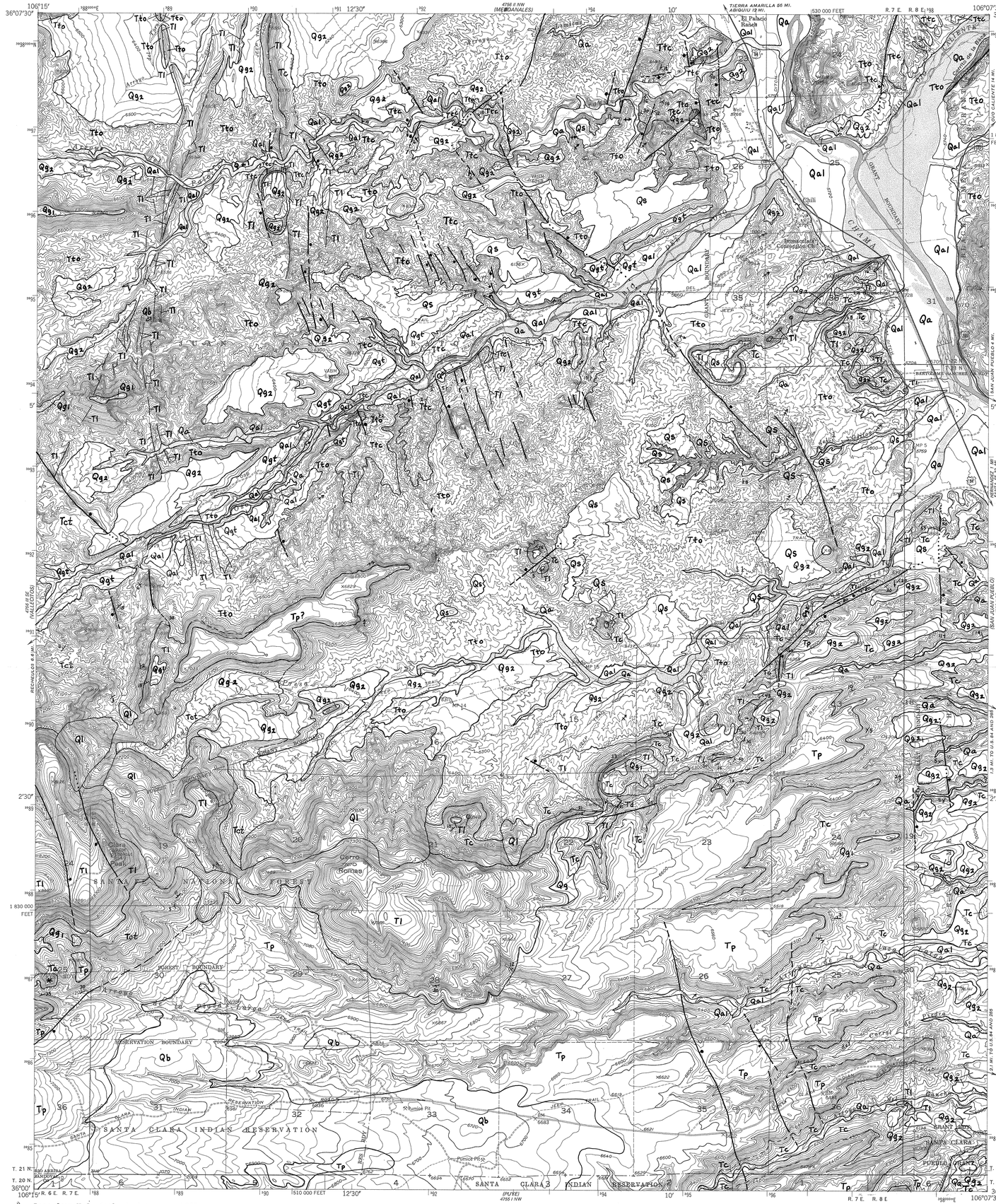
GEOLOGIC MAP OF THE CHILI QUADRANGLE, RIO ARRIBA COUNTY, NEW MEXICO

By David P. Dethier and Kim Manley

MISCELLANEOUS FIELD STUDIES MAP
Published by the U.S. Geological Survey, 1985

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1814



Base from U.S. Geological Survey, 1953; photorevised, 1977

Geology mapped in 1980-82

SCALE 1:24 000

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1977 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

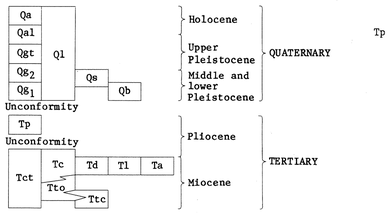
NEW MEXICO
QUADRANGLE LOCATION

GEOLOGIC MAP OF THE CHILI QUADRANGLE, RIO ARRIBA COUNTY, NEW MEXICO

By
David P. Dethier and Kim Manley

1985

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qa ALLUVIUM (HOLOCENE)--Light-brown, well-sorted, unconsolidated arkosic silt, sand, gravelly sand, and cobble to boulder gravel in and near the channels of Rio Chama, Rio Ojo Caliente, Rio del Oso, and major east-draining tributaries. Deposits in the flood plains of Rio Chama and Rio Ojo Caliente contain interbedded sand and well-rounded gravel, silty sand, and organic matter; arroyo deposits generally consist of sand or gravelly sand overlain by a moderately rounded surface gravel. Gravel composition is diverse: gravel along Rio Chama and Rio Ojo Caliente consists primarily of clasts of Precambrian metamorphic rocks and Tertiary volcanic rocks of intermediate composition; and gravel along the arroyos consists primarily of clasts of Tertiary volcanic rocks of mafic and intermediate composition. Maximum thickness approximately 15 m

Qal OLDER ALLUVIUM (HOLOCENE AND UPPER PLEISTOCENE)--Light-brown, well-sorted, unconsolidated arkosic sand, gravelly sand, and cobble to boulder gravel underlying low terraces and surfaces adjacent to major rivers and arroyos. Includes small amounts of alluvium in minor tributaries. Organic-rich layers common in terrace deposits along Rio del Oso. Alluvium consists of crossbedded sand and channel gravel composed of clasts of Tertiary volcanic rocks of mafic and intermediate composition, and, less commonly, clasts of Precambrian metamorphic rocks. Soil development shows oxidation to a depth of as much as 60 cm, and thin films and pore-fillings of calcium carbonate to a depth of 80 cm. The degree of soil development indicates the deposits are as old as late Pleistocene. Maximum thickness 10 m along Rio del Oso; thickness elsewhere 2-4 m

Ql LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE)--Poorly sorted, unconsolidated, nonstratified deposits composed mainly of Miocene sedimentary rocks and basalt boulders. Includes slumps, debris flows, talus, and some colluvium. Thickness variable; north of Clara Peak, more than 20 m thick

Qgt TERRACE GRAVEL (UPPER PLEISTOCENE)--Light-brown to gray, moderately well sorted, unconsolidated cobble gravel and sand along Rio del Oso 3-55 m above present drainage. Clasts predominantly Tertiary volcanic rocks of mafic and intermediate composition. Thickness approximately 10 m

Qg_2 UNIT 2, LOW-LEVEL GRAVEL (UPPER PLEISTOCENE)--Light-brown to gray, moderately well sorted, unconsolidated cobble to pebble gravel and sand. Forms numerous isolated patches approximately 6-80 m above present drainage. In part equivalent to sandy alluvium (Qs) in age. Clasts are Tertiary volcanic rocks of mafic and intermediate composition. Thickness approximately 7 m

Qg_1 UNIT 1, HIGH-LEVEL GRAVEL (MIDDLE TO LOWER PLEISTOCENE)--Gray, moderately well sorted, slightly consolidated cobble gravel and sand approximately 100-180 m above present drainage. Interbedded with the Otowi Member of the Bandelier Tuff (Qb). In upper 2 m of deposit, undersides of clasts coated with calcium carbonate as much as 3 mm thick. Clasts are Tertiary volcanic rocks of mafic and intermediate composition. Maximum thickness 40 m

Qs SANDY ALLUVIUM (MIDDLE TO LOWER PLEISTOCENE)--Light-brown to reddish-yellow, well-sorted, generally well stratified arkosic sand and minor gravel overlain by 0.5-2 m of reddish-yellow, poorly sorted, poorly lithified, and nonstratified pebbly silty sand. Deposits are planar to crossbedded, oxidized to a depth of 1.5-3 m, and variably cemented by calcium carbonate. At its uppermost limit, the sandy alluvium lies at roughly the same elevation as the unit 2, low-level gravel (Qg_2) along Rio del Oso, but sandy alluvium generally contains much less gravel (<10 percent compared to 50 percent). Best exposures along Arroyo del Ojitos. Maximum thickness 15 m along Arroyo del Ojitos; 2-4 m thick elsewhere

Qb BANDELIER TUFF (MIDDLE TO LOWER PLEISTOCENE)--White to gray, nonwelded ash-flow tuff and pumiceous air-fall lapilli deposits. In the northwest part of the quadrangle, underlain and overlain by thin deposits of basaltic gravel correlated with the unit 1, high-level gravel (Qg_1); elsewhere overlies Puye Formation (Tp). Boundary between the Puye and Bandelier in southwest part of quadrangle modified from Smith and others (1970) to enlarge the area occupied by the Bandelier. The Bandelier of Smith and others was subdivided into two members, the Otowi and Tschirege (which have K-Ar ages of 1.4 and 1.1 m.y., respectively (Doell and others, 1968)). Thickness as much as 12 m

SANTA FE GROUP

As commonly used includes from youngest to oldest: Puye, Chamita, and Tesuque Formations

Tp PUYE FORMATION (PLIOCENE)--Gray, moderately well sorted, poorly to moderately lithified cobble to boulder gravel; nonsorted laharic deposits; pumiceous sand; and a well-sorted, well-rounded basal gravel called the Totavi Lentil (Kelley, 1956; Griggs, 1964). Gravel composed of clasts of Tertiary andesite and latite fills channels cut as much as 1.4 m into underlying deposits; maximum observed clast size 0.8 m (intermediate axis). Lahars composed of volcanic clasts of intermediate composition range from silt containing scattered cobbles to boulder-rich, sandy diamictons; observed maximum clast size 2.7 m (intermediate axis). The Totavi Lentil, composed predominantly of Precambrian metamorphic clasts, is as thick as 7 m. Underlies the Bandelier Tuff (Qb) and unconformably overlies the Chamita Formation (Tc). Transport directions, measured from crossbeds at 5 locations, give a mean transport direction of 45° and range from 20° to 65°. Several kilometers south of the quadrangle the lower part of the Puye dated as 2.9 m.y. by fission-track method (Manley, 1979); 10 km east of Los Alamos overlying basalt dated as 2.1 m.y. by K-Ar method (Manley, 1979). Thickness in southern part of quadrangle greater than 100 m; elsewhere generally less than 15 m

Tct CHAMITA FORMATION OF GALUSHA AND BLICK (1971) AND TESUQUE FORMATION UNDIVIDED (LOWER PLIOCENE AND MIOCENE)--Interbedded light-brown to pale-greenish-yellow quartzose sandstone; red siltstone, silty sandstone, and thin (<80 cm) beds and lenses of granule conglomerate composed of Tertiary volcanic clasts of intermediate composition; and rare cobbles of scoriaceous basalt. Between Clara Peak and Rio del Oso lower 100 m contains interbeds of white to light-brown, limey sandstone and thin beds (10-70 cm) of white to gray vitric air-fall tephra. Lower 100 m appears to grade upward into a sequence of interbedded sandstone and silty sandstone which is best exposed on the southeast slopes of Clara Peak. Sandstone is massive to thick bedded (1-3 m) and planar bedded with rare, low-angle crossbeds. Silty sandstone beds generally less than 2 m thick, but locally comprise as much as 30 percent of the upper part of the sequence. Base of unit not exposed; locally interbedded with, and overlain by, Lobato Basalt (Tl). Thickness approximately 300 m

Tc Chamita Formation of Galusha and Blick (1971) (lower Pliocene and upper Miocene)--Light-brown, moderately sorted, poorly lithified quartz sandstone, reddish-brown silty sandstone and siltstone, gray pebble conglomerate, and white, gray, and pale-reddish-brown devitrified air-fall tephra. Sandstone composed of planar beds as thick as 80 cm; siltstone massive to thin bedded. Conglomerate generally has erosional base; individual beds commonly 2-5 m thick, although thicknesses of 25 m observed in the southeastern part of quadrangle. Maximum clast size approximately 35 cm (intermediate axis); predominant clasts are Tertiary volcanic rocks of intermediate composition and Precambrian metamorphic rocks; minor Paleozoic sandstone and fossiliferous limestone present locally. Tephra deposits contain unaltered quartz and biotite or hornblende and biotite phenocrysts and are generally 5-20 cm thick, although several isolated exposures are about 100 cm thick in the central part of quadrangle. Largest pumice clast observed, 2 cm (intermediate axis). Measurements on crossbeds, channels, and pebble imbrication in conglomerates at 17 sites indicate a mean transport direction of 215° and range from 170° to 300°. Clast composition and transport direction indicate the gravel was derived from north (Tusas Mountains) and east (Sangre de Cristo Mountains) (Manley, 1976). Overlain by Puye Formation (Tp) and interfingers with underlying Ojo Caliente Sandstone Member (Tto) (of Galusha and Blick, 1971) of the Tesuque Formation through a vertical distance of 5-15 m. Interlayered with flows of Lobato Basalt (Tl) about 30 m above base near the town of Chili. Maximum thickness 150 m

Tesuque Formation (lower and middle Miocene)

Tto Ojo Caliente Sandstone Member of Galusha and Blick (1971) (middle Miocene)--Very pale orange, well-sorted, medium- to coarse-grained, poorly consolidated, arkosic eolian sandstone. Locally includes beds of pale-greenish-yellow sandstone 1-2 m thick, thin (<20 cm), discontinuous beds of white to gray, devitrified, sheared air-fall tephra, and red, clay-rich siltstone. Basal 20-35 m contains interbedded conglomerate and fluvial sandstone. Air-fall tephra beds and locally prominent siltstone beds common in upper 40 m. Massive to pervasively crossbedded; most beds wedge shaped in cross section. Contains local zones of calcium carbonate cement that weather to form ledges, pillars, and log-shaped and spherical concretions. Most fault zones cemented; major faults form prominent ridges such as those southwest of La Chuachia in the northeast part of quadrangle. Crossbeds measured at 55 locations give a mean sediment transport direction of 64° and range from 10° to 120°. Interfingers with and overlies Chama-el Rito Member of the Tesuque Formation (Ttc) and underlies Chamita Formation (Tc). As thick as 210 m in the central and northwestern parts of quadrangle

Ttc Chama-el Rito Member of Galusha and Blick (1971) (middle Miocene)--Light-brown to pink, poorly consolidated, arkosic, planar-bedded sandstone, red siltstone and sandy siltstone, gray conglomerate, and beds of white to pale-green, fine-grained, devitrified air-fall tephra. Upper part includes interbeds of eolian sandstone 2-5 m thick and, in the northwest corner of the quadrangle, a tongue of conglomerate. Conglomerate beds rare; they have erosional basal contacts that cut into the underlying rocks a few centimeters to a few tens of centimeters, and grade laterally and vertically into sandstone. Clasts include Tertiary ash-flow tuffs of felsic to intermediate composition, Tertiary vesicular andesite, and Precambrian metamorphic rocks. Locally abundant air-fall tephra beds contain quartz and biotite phenocrysts, are as much as 80 cm thick, and are cemented with calcium carbonate and silica. Base of member not exposed. As much as 40 m of upper part grades into Ojo Caliente Sandstone (Tto) in the northwest part of quadrangle. Most exposures in fault-bounded blocks within Ojo Caliente Sandstone Member. Crossbeds measured at 7 sites give a mean sediment transport direction of 200° and range from 70° to 225°, which is consistent with a northern source area as indicated by clast composition. North of quadrangle overlies Miocene Abiquiu Tuff of Smith, 1938 (May, 1980). Maximum thickness 85 m

Td DIATOMITE (MIOCENE)--White to light-gray, laminated to thin-bedded diatomite (<30 cm) with interbedded gray vitric tephra beds as thick as 40 cm and one bed of pebble gravel consisting of volcanic clasts of felsic to intermediate composition. Interfingers with underlying palagonitic sediments of Lobato Basalt (Tl); overlain by Lobato Basalt and part of the Chamita Formation (Tc). Maximum thickness 30 m

Tl LOBATO BASALT (MIOCENE)--Black alkali to olivine tholeiitic basalt flows, dikes, and sill, and associated palagonitic sedimentary rocks (Baldridge and others, 1980). Flows generally vesicular, 2-5 m thick, with oxidized to slightly scoriaceous tops. Dikes commonly 2-4 m thick but range from 0.2 m to about 10 m. Basalt in dikes is partly vesicular and more dense than in flows. Vesicles commonly filled with calcite and green clay minerals. Lobato flows overlie, and interfinger with, Chamita Formation (Tc) and overlie Chamita and Tesuque Formations undivided (Tct). Lobato dikes cut the Chama-el Rito (Ttc) and Ojo Caliente Sandstone (Tto) Members of the Tesuque Formation. K-Ar ages are 9.6±0.2 m.y. (Baldridge and others, 1980) and 8.3±2.4 m.y. (Manley and Mehnert, 1981) from a flow south of the town of Chili; 9.9±1.0 m.y. from a flow near the mouth of the Arroyo de la Presa (Manley and Mehnert, 1981); and 9.7±0.3 m.y. from a dike in the northwestern part of the quadrangle (Baldridge and others, 1980). Maximum thickness 300 m

Ta ANDESITE PLUG (MIOCENE)--Gray to grayish-green andesitic intrusive rock and minor, thin, platy flows(?). Intrudes, and apparently overlies, Chamita and Tesuque Formations undivided (Tct) in southeast part of quadrangle. Overlain by small, unmapped deposits of unit 1, high-level gravel (Qg_1). Age and relationship to Lobato Basalt (Tl) uncertain. Thickness 60 m

——— CONTACT--Dashed where approximately located. Wavy lines indicate hypothetical boundaries between equivalent units

——— FAULT--Dashed where approximately located; dotted where concealed. Ball on downthrown side, where displacement known

⊥ STRIKE AND DIP OF BEDS

← SEDIMENT TRANSPORT DIRECTION--Determined from flute clasts

←← SEDIMENT TRANSPORT DIRECTION--Determined from pebble imbrication

✱ VOLCANIC PLUG

REFERENCES

Baldridge, W. S., Damon, P. E., Shafiqullah, M., and Bridwell, R. J., 1980, Evolution of the Rio Grande Rift, New Mexico--New potassium-argon ages: Earth and Planetary Science Letters, v. 51, p. 309-321.

Doell, R. R., Dalrymple, G. B., Smith, R. L., and Bailey, R. A., 1968, Paleomagnetism, potassium-argon ages, and geology of rhyolites and associated rocks of the Valles caldera, New Mexico: Geological Society of America Memoir, no. 116, p. 211-248.

Galusha, Ted, and Blick, J. C., 1971, Stratigraphy of the Santa Fe Group, New Mexico: American Museum Natural History Bulletin, v. 144, no. 1, 127 p.

Griggs, R. L., 1964, Geology and ground-water resources of the Los Alamos area, New Mexico: U.S. Geological Survey Water-Supply Paper, 1753, 107 p.

Kelley, V. C., 1956, The Rio Grande Depression from Taos to Santa Fe: New Mexico Geological Society Guidebook, no. 7, p. 109-114.

Manley, Kim, 1976, The late Cenozoic history of the Española Basin, New Mexico: Boulder, University of Colorado, Ph. D. dissertation, 171 p.

———1979, Stratigraphy and structure of the Española Basin, Rio Grande rift, New Mexico, in Riecker, R. E., ed., Rio Grande Rift—Tectonics and Magnetism: Washington, D. C., American Geophysical Union, p. 71-86.

Manley, Kim, and Mehnert, H. H., 1981, New K-Ar ages for Miocene and Pliocene volcanic rocks in the northwestern Española Basin, and their relationships to the history of the Rio Grande rift: Isochron/West, no. 30, p. 5-8.

May, S. J., 1980, Geology of the Ojo Caliente-Rio Chama area, Rio Arriba and Taos Counties, New Mexico: Albuquerque, University of New Mexico, Ph. D. dissertation, 198 p.

Smith, H. T. U., 1938, Tertiary geology of the Abiquiu quadrangle, New Mexico: Journal of Geology, v. 46, no. 7, p. 933-965.

Smith, R. L., Bailey, R. A., and Ross, C. S., 1970, Geologic map of the Jemez Mountains, New Mexico: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-571, scale 1:250,000.

1456

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1985

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225