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A digital geologic map and explanation of the San Antonio Mountain quadrangle, Rio Arriba and Taos Counties, New Mexico

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INTRODUCTION

This dataset comprises a GSMAP version 8 coverage (Selner and Taylor, 1992) for a digital geologic map of the San Antonio Mountain quadrangle, Rio Arriba and Taos Counties, New Mexico. Digital data were obtained from 1:24,000 scale, stable-base author-compilation by point-mode digitizing. Contacts, faults and geologic features were digitized as linear topologic entities; no polygons are defined in this dataset. The map is based on a polyconic projection. Map units are labeled and map symbology is included.

The dataset is distributed on an IBM compatible, 5.25 inch, 1.2 megabyte format diskette. The following files are included with this dataset and are required for proper execution under version 8 of GSMAP:

LABELS.DAT
S_ANT_NM.PLT
S_ANT_NM.LSF
S_ANT_NM.NDX
S_ANT_NM.PRJ

Additionally, the file S_ANT_NM.PPP contains an HPGL (Hewlett-Packard Graphics Language) plot file of the geologic map which can drive a Hewlett Packard 7585 compatible, large format pen-plotter or any other output device that is compatible with HP 7585-series equipment.

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

[Surficial deposits are generally more than 2 m thick where mapped, but thinner deposits are mapped in some locations to show their areal distribution and stratigraphic relations. The distributions of active stream-channel and flood-plain alluvium are delineated from aerial photographs with the aid of a Kern PG-2 stereoplotter; their mutual contacts are generally gradational and approximately located. The two units are only distinguished in the Rio San Antonio drainage. Age estimates and correlations are based on preservation of original surface morphology and the height of the alluvial depositional surface]

Qa **Active-stream channel alluvium (Holocene)** -- Silt, sand, pebble and cobble gravel, and peat-bearing deposits in valley bottoms along active stream channels. Locally includes small alluvial-fan deposits and colluvium at margins of valley bottoms. Depositional surface typically less than 1 m above present stream level. Not mapped along minor streams. Thickness unknown, but probably 1-8 m; base not exposed

Qfp **Flood-plain alluvium (Holocene)** -- Moderately well sorted, sandy and silty overbank alluvium and underlying well-sorted sandy pebble to cobble gravel. Forms extensive, slightly undulating, flood plains along the Rio San Antonio. Depositional surface typically 1 to 3 meters above present stream level. Thickness unknown, but may be as much as 8 m

Qafp **Undifferentiated alluvium (Holocene)** -- Includes alluvium of active stream channels (Qa) and of adjacent flood plains (Qfp) where the two units interfinger extensively.

Qc **Colluvium (Holocene and Pleistocene)** -- Poorly sorted detritus on the slopes of San Antonio Mountain, size ranges from silt to boulders. Locally includes small alluvial-fan and talus deposits. Thickness probably 1-5 m

BEDROCK

Regional lavas and related rocks

[Bedrock consists entirely of Tertiary mafic and intermediate volcanic rocks and basin-fill volcaniclastic sedimentary units that were deposited during extension in the San Luis basin and uplift of its western flank. The map area comprises part of the western boundary of the San Luis basin, a shallow dip slope of eastward-tilted volcanic and sedimentary rocks of the southern San Juan and Tusas Mountains. The Oligocene and Miocene units exposed in the map area largely project beneath the Pliocene and younger valley fill of the San Luis basin and the Pliocene volcanic cover of the Taos Plateau volcanic field. Volcanic rock names conform to the IUGS classification system (Le Bas and others, 1986) but the associated modifiers have been omitted for brevity. Formation subunit names are derived more from compositional characteristics than geographic association: thus, the unit symbol for basalts of the Hinsdale Formation is Thb; in some areas Thb can be subdivided into lower (Thbl), middle (Thbm), and upper (Thbu) subunits according to local stratigraphic position. Where volcanic rocks originated from a monogenetic volcanic center, unit names are based on a geographic feature and modified by a compositional or lithologic description term. Ages for volcanic rocks are based on potassium-argon (K-Ar) whole-rock determinations. Unpublished age determinations by H.H. Mehnert, and others cited, have been calculated using the IUGS decay constants (Steiger and Jager, 1977). Contacts that extend into adjacent geologic maps to the west and south (Manley, 1982; Manley and Wobus, 1982) show some disagreement according to assignment of basaltic rocks to formations and to actual location of contacts between volcanic rocks and underlying volcaniclastic sediments. All contacts for this map were transferred from aerial photographs (approximately 1:21,000 scale) using a Kern PG-2 stereoplotter.]

Basaltic andesite of Red Hill (Upper Pliocene?) -- Dark-gray flows of xenocrystic basaltic andesite (52-53 percent SiO_2) containing sparse phenocrysts of olivine, pyroxene and plagioclase; glomerocrysts of plagioclase, clinopyroxene and iron-titanium oxides are typical, and conspicuous xenocrysts of embayed quartz and resorbed sodic plagioclase are distinctive. Occurs only at Red Hill volcano which consists of lava flows and overlying composite cone. Red Hill is similar in morphology and composition to the 2.24 ± 0.15 Ma andesite cone on the northeast flank of San Antonio Mountain in the adjoining Pinabetoso Peaks 7.5 minute quadrangle (Lipman and Mehnert, 1979). Southeastern portion of cone removed by quarrying operations prior to 1991

Trxc **Cinder deposits** -- Predominantly cinder and spatter agglutinate, minor flow material. Typically near vent deposits

Trx **Flows** -- Massive flows, typically 3-4 m thick, conformably overlie tholeiitic basalt lava flows of the Servilleta Formation in southeast part of map area. Thickness 0-35 m

Basaltic andesite of Los Cerritos de la Cruz (Upper Pliocene?) -- Dark gray flows of xenocrystic basaltic andesite (52-55 percent SiO_2) containing sparse phenocrysts of olivine, plagioclase and clinopyroxene; glomerocrysts of plagioclase and clinopyroxene are typical and locally include olivine and orthopyroxene. Xenocrysts of embayed quartz (5mm typical), resorbed plagioclase and large alkali feldspar (up to several cm in length) are typical and tend to be more abundant and larger near the Cerritos de la Cruz cone. These deposits are similar in morphology and composition to the 2.24 ± 0.15 Ma andesite cone on the northeast flank of San Antonio

Mountain in the adjoining Pinabetoso Peaks 7.5 minute quadrangle (Lipman and Mehnert, 1979)

Tcxc **Cinder deposits** -- Predominantly cinder and spatter agglutinate with some thin interbedded lava flows preserved in two prominent cones in center of map area. Contains greater proportions of agglutinate and flow material than the cone at Red Hill (Trxc), and xenocrysts are larger and more abundant

Tcx **Flows** -- Massive flows, typically 3-5 m thick but locally as thick as 8 m on northwest side of Los Cerritos de la Cruz. Thickness 0-125 m

Td **Dacite of San Antonio Mountain (Pliocene)** -- Dark-gray, aphyric to weakly porphyritic, tabular dacite flows (62-63 percent SiO_2) that comprise a steep-sided monolithologic shield volcano superimposed on an andesite shield volcano (Ta). Phenocrysts, generally less than 1-3 percent, are predominantly clinopyroxene, but locally include traces of orthopyroxene and olivine. Plagioclase phenocrysts are notably abundant (up to 10 percent) in flows near summit of San Antonio Mountain. Whole-rock K-Ar age from flow on northeast flank of volcano 3.12 ± 0.17 Ma (Lipman and Mehnert, 1979). Thickness unknown, base not exposed

Ta **Andesite (Pliocene)** -- Medium dark-gray, weakly porphyritic andesite lava flows (56-57 percent SiO_2) containing 1-3 percent phenocrysts of olivine and pyroxene. Occurs as erosional remnants of an andesite shield volcano in the east-central part of the map area as well as on the east and north flanks of San Antonio Mountain in the La Segita Peaks and Los Pinos (Thompson and Lipman, 1993) 7.5 minute quadrangles respectively. Thickness 0-30 m

Ts **Servilleta Basalt (Pliocene)** -- Thin dark-gray pahoehoe flows of diktytaxitic olivine tholeiite (49-52 percent SiO_2) characterized by small olivine phenocrysts, and local vesicle pipes and vesicle segregation veins. Dominant basalt type of the Taos Plateau volcanic field (Dungan and others, 1984). Potassium-argon ages of flows east of the map area range between 3.6 and 4.5 Ma (Ozima and others, 1967; Lipman and Mehnert, 1979; Lipman and others, 1986) ; older ages correspond to the base of the exposed Servilleta section in the Rio Grande gorge 40 km southeast of the map area. Thickness 0-80 m, base not exposed

Hinsdale Formation (Oligocene and Miocene) -- Dark-gray basaltic lava flows, flow breccia and near-vent pyroclastic deposits. Includes basalt, basaltic andesite and andesite (49-59 percent SiO_2). As proposed by Lipman and Mehnert (1975), the Hinsdale Formation includes all basaltic rocks interlayered with volcaniclastic rocks of the Los Pinos Formation as well as those lavas overlying the Los Pinos Formation and pre-dating the voluminous outpouring of tholeittic Servilleta Basalt that underlies the Taos Plateau immediately to the east of the map area. Potassium-argon ages of east-dipping Hinsdale Formation lava flows range between 21.6 and 24.6 Ma (H.H. Mehnert, unpub. data, 1992) in flow packages that extend into the map area from the west. However, rocks mapped regionally as Hinsdale include mafic lavas as young as 3.9 Ma and as old as 27.5 Ma in areas north and northwest in the San Juan Mountains (Lipman and others, 1970; Lipman and Mehnert, 1975; H.H. Mehnert, unpub. data, 1992) and to the northeast in the San Luis Hills (Thompson and others, 1991). Delineation of subunits Thbu, Thbm, and Thbl is based on relative stratigraphic position and petrographic or petrologic characteristics

Thb **Basalt and basaltic andesite, undivided** -- Lava flows (49-54 percent SiO_2), typically 3-5 m thick, preserved as isolated hill-capping outcrops above the Los Pinos Formation in central and southern part of map area and as a more extensive continuous deposit north of the Rio San Antonio. Age of flows west of Malette Canyon is approximately 21.6±1.4 Ma based on a whole-rock, potassium-argon determination (H.H. Mehnert, unpub. data, 1992) from a flow near the base of a stratigraphically equivalent package of flows, 4 km west of the map area in the adjacent Broke Off Mountain quadrangle. Flows north of the Rio San Antonio may be as old as 24.6±1.8 Ma, based on a whole-rock, potassium-argon determination (H.H. Mehnert, unpub. data, 1992) on a flow from a flow package extending into the Los Pinos quadrangle immediately to the north. Phenocrysts of euhedral olivine are sparse(<5 percent), small, and partially altered to iddingsite. Groundmass is composed of andesine, augite, olivine and locally contains iron-titanium oxides. Thickness 0-80 m

Thbu **Upper basaltic andesite** -- Lava flows of intersertal-textured basaltic andesite (52-54 percent SiO_2) containing sparse (2-3 percent) phenocrysts of small (<1mm) euhedral and skeletal olivine with ubiquitous iddingsite alteration. Groundmass consists of olivine, augite, plagioclase and iron-titanium oxides. Thickness 0-150 m

Thbm **Middle basalt** -- Lava flows of aphyric basalt (49-51 percent SiO_2), distinguished from units Thbu above and Thbl below by very fine grained, felty groundmass texture and small (<<1mm) olivine phenocrysts. Thickness 0-90 m

Thbl **Lower basaltic andesite** -- Lava flows of intersertal-textured basaltic andesite (52-53 percent SiO_2) containing sparse (<5 percent) phenocrysts of small (<2 mm) olivine crystals with ubiquitous iddingsite alteration, minor augite and plagioclase microphenocrysts in a groundmass of olivine, augite, plagioclase and iron-titanium oxides. Thickness 0-70 m

Tlp **Los Pinos Formation, undivided (Oligocene)** -- Moderately well sorted bedded-conglomerates and poorly sorted sandstones. Clasts, subrounded to well rounded, consist predominantly of intermediate volcanic rocks derived from stratovolcanoes in the southeastern San Juan volcanic field and possibly the San Luis Hills in the central San Luis basin. Largely equivalent to the Esquibel Member as mapped by Manley (1982). Locally overlain by, and interbedded with, basalt and andesite flows of the Hinsdale Formation. Thickness 0-225 m

REFERENCES

Dungan, M.A., Muehlberger, W.R., Leininger, L., Peterson, C., McMillan, N.J., Gunn, G., Lindstron, M.M., and Haskin, L., 1984, Volcanic and sedimentary stratigraphy of the Rio Grande gorge and the late Cenozoic evolution of the southern San Luis Valley, *in* Baldridge, W.A., Dickerson, P.W., Riecker, R.E., and Zidek, J. eds., Rio Grande rift--northern New Mexico: New Mexico Geological Society Guidebook, 35th Field Conference, p. 157-170.

Le Bas, M.J., Le Maitre, R.W., Streckeisen, A., and Zanettin, B., 1986, A chemical classification of volcanic rocks based on the total alkali-silica diagram: Journal of Petrology, v. 27, p. 745-750.

Lipman, P.W., and Mehnert, H.H., 1975, Late Cenozoic basaltic volcanism and development of the Rio Grande depression in the southern Rocky Mountains, *in* Curtis, B.F. ed., Cenozoic

history of the southern Rocky Mountains: Geological Society of America Memoir 144, p. 119-154.

Lipman, P.W., and Mehnert, H.H., 1979, The Taos Plateau volcanic field, northern Rio Grande rift, *in* Riecker, R.C. ed., Rio Grande rift--Tectonics and magmatism: American Geophysical Union, Washington, D.C., p. 289-311.

Lipman, P.W., Mehnert, H.H., and Naeser, C.W., 1986, Evolution of the Latir volcanic field, northern New Mexico, and its relation to the Rio Grande rift, as indicated by potassium-argon and fission track dating: Journal of Geophysical Research, v. 91, p. 6329-6345.

Lipman, P.W., Steven, T.A., and Mehnert, H.H., 1970, Volcanic history of the San Juan Mountains, Colorado, as indicated by potassium-argon dating: Geological Society of America Bulletin, v. 81, p. 2329-2352.

Manley, Kim, 1982, Geologic map of the Broke Off Mountain quadrangle, Rio Arriba County, New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1450, scale 1:24,000

Manley, Kim, and Wobus, R.A., 1982, Reconnaissance geologic map of the Mule Canyon quadrangle, Rio Arriba County, New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1407, scale 1:24,000

Ozima, M., Kuno, M., Kaneoka, I., Kinoshita, H., Kobayashi, K., Nagata, T., Larsen, E.E., and Strangeway, D.W., 1967, Paleomagnetism and potassium-argon ages of some volcanic rocks from the Rio Grande gorge, New Mexico: Journal of Geophysical Research, v. 72, p. 2615-2622.

Selner, G.I., and Taylor, R.B., 1992, System 8. GSMAP, GSMEDIT, GSMUTIL, GSPOST, GSDIG and other programs version 8, for the IBM PC and compatible microcomputers, to assist workers in the earth sciences: U.S. Geological Survey Open-File Report 92-217, 217 p.

Steiger, R.H., and Jager, E., 1977, Subcommission on geochronology--Convention on the use of decay constants in geo- and cosmochronology: Earth and Planetary Science Letters, v. 36, p. 359-362.

Thompson, R.A., Johnson, C.M., and Mehnert, H.H., 1991, Oligocene basaltic volcanism of the northern Rio Grande rift--San Luis Hills, Colorado: Journal of Geophysical Research, v. 96, p. 13,577-13,592.

Thompson, R.A., and Lipman, P.W., 1993, A digital geologic map of the Los Pinos quadrangle, Rio Arriba and Taos Counties, New Mexico and Conejos County, Colorado: U.S. Geological Survey Open-File Map OF 92-711, scale 1:24,000.

Map Symbol Explanation

Contact--dashed where approximately located

Fault--Ball and bar on downthrown side; dashed where approximately located

10 **Strike and dip of beds**

Collapse feature--Common in mafic lava flows of the Hinsdale Formation

Interflow marker horizon--distinguishes prominant lava flow boundaries of major flow packages

Volcanic vent area

CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS

Qa
Qfp
Qafp
Qc
Holocene
Pleistocene
QUATERNARY

REGIONAL LAVAS AND RELATED ROCKS

Trxc
Trx
Tcxc
Tcx
Td
Ta
Ts
Pliocene
TERTIARY

Thbu
Thbm
Thbl
Thb
Miocene and Upper Oligocene

Tlp