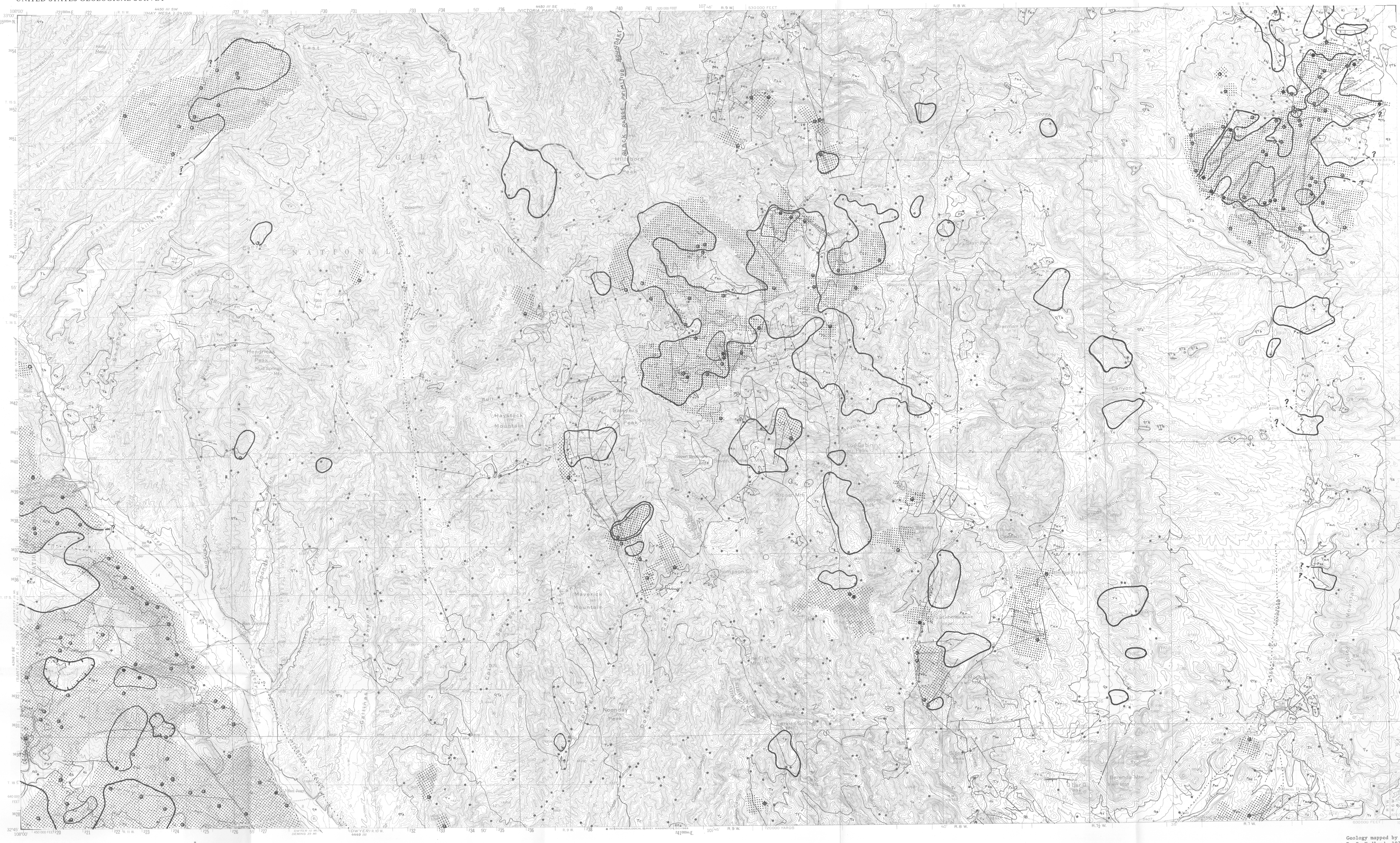
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-900D
Cu, HILLSBORO AND SAN LORENZO QUADS., NEW MEXICO



Base from U.S. Geological Survey, Hillsboro, 1940 and San Lorenzo, 1956, 1:62,500

UTM GRID AND 1956 MAGNETIC DECLINATION AT CENTER OF

QUADRANGLE LOCATION

SCALE 1:48 000

Geology mapped by D. C. Hedlund, 1977

CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS

Qs — QUATERNARY

SEDIMENTARY AND VOLCANIC ROCKS

QTb, QTs — QUATERNARY AND TERTIARY

Trl, Trn, Tv, Tr — TERTIARY

Kv, Ks — CRETACEOUS

Pzu — PALEOZOIC

IGNEOUS AND METAMORPHIC ROCKS

p€u — PRECAMBRIAN

INTRUSIVE ROCKS

Tri, Trs, Tas — TERTIARY

Tql, Ta, Trsd — TERTIARY

Ka, Kql, Ki — CRETACEOUS

LIST OF MAP UNITS

Qs	UNCONSOLIDATED SEDIMENTARY DEPOSITS (QUATERNARY)
QTs	GILA AND SANTA FE FORMATIONS (QUATERNARY AND TERTIARY)
QTb	BASALTIC LAVA AND GILA AND SANTA FE FORMATIONS (QUATERNARY AND TERTIARY)
Tv	LAVAS AND ASH-FLOW TUFFS (OLIGOCENE)
Tr, Trl, Trn	RHYOLITE FLOWS AND DOMES (OLIGOCENE)
Tri, Trs	RHYOLITE PLUGS, STOCKS AND SILLS (OLIGOCENE)
Tas	ANDESITE SILLS AND DIKES (OLIGOCENE)
Tql	QUARTZ LATITE DIKE OR SILL (OLIGOCENE?)
Ta	ANDESITE SILLS (OLIGOCENE?)
Trsd	RHYOLITE SILLS AND DOMES (OLIGOCENE?)
Ka	ANDESITE DIKES AND SILLS (UPPER CRETACEOUS)
Ki	QUART MONZONITE, GRANITE, MONZODIORITE AND DIORITE (UPPER CRETACEOUS)
Kql	QUARTZ LATITE DIKES OF COPPER FLAT (UPPER CRETACEOUS)
Kv	ANDESITIC FLOWS OF COPPER FLAT (UPPER CRETACEOUS)
Ks	BEARTOOTH QUARTZITE (UPPER? CRETACEOUS)
Pzu	UNDIVIDED SEDIMENTARY ROCKS (PALEOZOIC)
p€u	UNDIVIDED GRANITIC AND HORNBLENDIC ROCKS (PRECAMBRIAN)

CONTACT--Dotted where concealed

FAULT--Dashed where approximately located; dotted where concealed. Where known, ball and bar on the downthrown side. U, upthrown side; D, downthrown side

ANTICLINAL AXIS--Showing crestline. Dashed where approximately located

Geochemical Explanation

MAGNETIC (M-1) FRACTION--Isopleths approximately delineate source basins of stream sediments containing anomalous amounts of Cu in the magnetic (M-1) fraction. Hachures indicate low areas within anomalies; queried where control is lacking

Copper--≥200 ppm

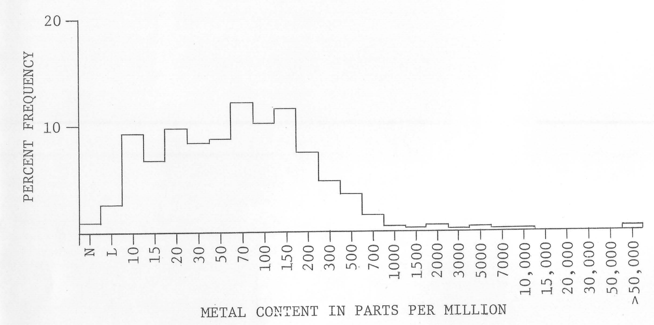
Copper--≥1,000 ppm

NONMAGNETIC (NM-1) FRACTION--Patterned areas approximately delineate source basins of stream sediments containing anomalous amounts of Cu in the nonmagnetic (NM-1) fraction. Sample localities indicated by circles

Copper--≥150 ppm

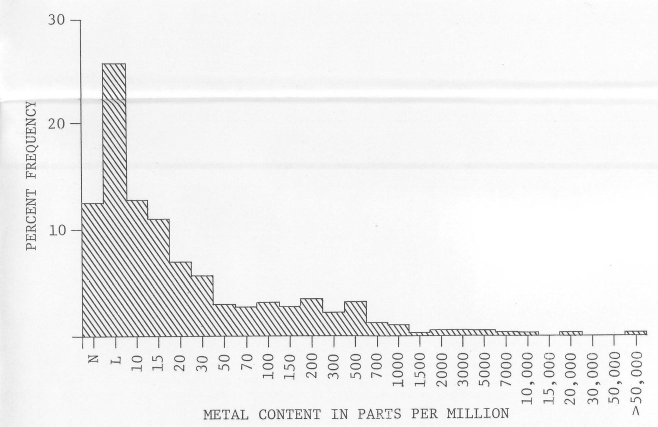
Copper--≥1,000 ppm

Copper--≥5,000 ppm



HISTOGRAM SHOWING COPPER DISTRIBUTION, M-1 fraction

Number of samples, 1,102; N, metal value in sample is below spectrographic detection limit; L, metal detected in sample but value is below the lowest spectrographic standard for this metal.



HISTOGRAM SHOWING COPPER DISTRIBUTION, NM-1 fraction

Number of samples, 1,102; N, metal value in sample is below spectrographic detection limit; L, metal detected in sample but value is below the lowest spectrographic standard for this metal.

DISCUSSION

This map shows the distribution of anomalous copper in the two sample fractions magnetic (M-1) and nonmagnetic (NM-1) plotted on a base which includes sample localities, topography, and generalized geology from Hedlund (1975a,b). It is part of a series of maps for several metals that accompany this folio. Distribution of copper values in each fraction are shown on the accompanying histograms.

Sample type

The sample material consists of that portion of pan-concentrated stream sediment having a specific gravity greater than bromoform. Prior to bromoform separation, magnetite ws removed from the pan concentrate with a hand magnet and discarded. The remaining heavy minerals were then separated magnetically into a magnetic (M-1) and nonmagnetic (NM-1) fraction. The magnetic (M-1) fraction is that portion of such material not magnetic at 0.1 ampere, but magnetic at a 1.0 ampere setting on a Frantz Isodynamic Separator (forward slope 25°, side slope 15°). The nonmagnetic (NM-1) fraction is one that is not magnetic at a 1.0 ampere setting.

The major mineral composition of these two heavy mineral fractions was determined visually with a binocular microscope. The magnetic (M-1) fraction is comprised dominantly of limonite, manganese oxide, and mafic rock forming minerals. High trace metal values occurring in the magnetic (M-1) fraction are generally contained in limonite or in the manganese oxides. The nonmagnetic (NM-1) fraction is composed dominantly of light-colored rock-forming accessory minerals and primary and secondary ore minerals.

Analytical Methods

Elements were determined by a semiquantitative spectrographic method described by Grimes and Marranzino (1968). Results of these spectrographic analyses are reported within geometric intervals having the boundaries 1,200, 830, 560, 380, 180, 120, and so on in ppm, but are shown in the histograms by approximate geometric midpoints such as 1,000, 700, 500, 300, 200, 150, and 100. Precision of a reported value is approximately plus or minus one interval at 68 percent confidence, or plus or minus two intervals at 95 percent confidence.

Copper concentrations ≥200 ppm in the magnetic (M-1) fraction and ≥150 ppm in the nonmagnetic (NM-1) fraction are considered anomalous. In most instances, a sample that is anomalous in Cu is also anomalous in at least one of the seven other elements shown on one of the companion maps.

Copper values range from not detected (N) through >50,000 ppm in both fractions. Copper in anomalous concentrations was found in 210 or 19.1 percent of the magnetic (M-1) fractions from the 1,102 sample sites within the map area. Anomalous Cu concentrations were found in 177 or 16.1 percent of the 1,102 nonmagnetic (NM-1) fractions from the same sites.

The Cu anomaly patterns of the two fractions largely complement each other spatially. The nonmagnetic (NM-1) fraction anomalies are generally more intense and restricted along through-going solution pathways. Magnetic (M-1) fraction anomalies, resulting from more uniform permeation of the host rock, are areally more extensive but less intense.

Some of the Cu anomaly patterns show a close relationship with aeromagnetic patterns. The geochemical anomalies coincide with specific aeromagnetic highs and lows.

Geochemical implications of sample fractions

Limonite and manganese oxides containing high trace metal values occur in the magnetic (M-1) fraction and are derived from joint surfaces, fractures, and very often, dispersions in volcanic caprock. This material is then mechanically transported to the stream bed. The trace metal rich limonite and manganese oxides are believed to result from processes associated with mineralization. Much of the limonite is pseudomorphic after pyrite. In areas where this trace metal rich limonite is found, it may be derived from weathered primary halos of disseminated pyrite and accompanying high trace metals that may indicate buried mineral deposits.

High metal concentrations in the nonmagnetic fraction (NM-1) occur where primary and secondary ore minerals are exposed at the surface and mechanically enter the stream bed.

Descriptions of anomalies

Magnetic (M-1) fraction Cu anomalies in the Copper Flat area (north-eastern corner of map) occur predominantly in the andesitic area to the south of the Copper Flat stock exposure and extend northeastward through the exposed intrusive. Smaller anomalies occur along the northern map margin in areas of andesite, jasperoid, and limestone. The main portion of the nonmagnetic (NM-1) fraction Cu anomaly shows a close areal correlation with the southern magnetic (M-1) fraction Cu anomaly as well as the northeastward trend through the mineralized intrusive. The Cu anomalies in both fractions show a close spatial correlation with a pronounced aeromagnetic high centered about 2 mi (3.2 km) south-southwest of the Copper Flat stock exposure.

Further south, minor magnetic (M-1) fraction Cu anomalies occur along the eastern margin of the map on Sibley Mountain. These low-level and isolated anomalies are believed to be associated with east-west trending structural features confined to the basement rocks. A small nonmagnetic (NM-1) fraction Cu anomaly in the Wilson Ranch vicinity (southeastern corner of map) is the northern end of the anomaly associated with the Lake Valley mining district located south of the map margin. The Cu anomalies occuring in the central portion of the map (T. 16-18 S., R. 8-9 W.) are part of an anomaly system best shown by Mo and Pb. This anomaly system is believed to be structurally controlled and forms a roughly rectilinear pattern consisting of nearly east-west and northwest-southeast linear trends. The eastern margin is delineated by the Pierce Canyon fault system and the western margin by the Grandview fault and its extension. This anomaly system is delineated only in part by Cu values. Small and scattered magnetic (M-1) and nonmagnetic (NM-1) fraction anomalies occur along portions of the Pierce Canyon fault system and the Grandview fault. Somewhat broader Cu anomalies occur in both fractions in the general Tierra Blanca area, which is one of the postulated east-west and northwest-southeast geochemical trend intersection areas.

The broadest and most intense Cu anomalies, in the central portion of the map, occur in the Kingston area. Here, anomalous Cu in magnetic (M-1) fraction samples delineates a semicircular area extending from Cross-O Mountain in the west, to the Gray Eagle Mine in the south, and Sawpit Canyon in the east. The highest magnetic (M-1) fraction Cu values occur in the samples collected west of the Gray Eagle Mine and in the headwaters of Sawpit Canyon. The nonmagnetic (NM-1) fraction Cu anomaly pattern duplicates the magnetic (M-1) fraction pattern to a large degree but it is less continuous and extends farther to the northwest into Mineral Creek. An aeromagnetic high-low couple in the area of Picket Spring Canyon headwaters, is centrally located with respect to the geochemical anomaly pattern.

The Rose Mine area (southwestern corner of the map) encompasses the uplifted block on the southwest side of the Mimbres fault extending northward to the edge of the outcrop area. Continuous magnetic (M-1) and nonmagnetic (NM-1) fraction Cu anomalies cover most of this area. The highest magnetic (M-1) fraction Cu values occur in the vicinity of the Rose Mine and in a small area to the north. The highest nonmagnetic (NM-1) fraction Cu concentrations occur in a northwest-trending belt adjacent to the Mimbres fault. Additional samples, collected to the west of the map margin, contained background concentrations of Cu in both fractions. A pronounced aeromagnetic high is centered in sections 26 and 35. Anomalous nonmagnetic (NM-1) fraction Cu values in samples collected in the Shingle Canyon area are believed to be the result of detrital trains from mining districts to the west of the map margin.

Minor and scattered Cu anomalies occur in both fractions in the general Hendricks Peak-Rabb Park area. Broader, though low level Cu anomalies in both fractions in the East Canyon may reflect the extensive basalt flows in this area.

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MAP SHOWING ANOMALOUS COPPER DISTRIBUTION IN STREAM SEDIMENT CONCENTRATES HILLSBORO AND SAN LORENZO QUADRANGLES EXCLUSIVE OF THE BLACK PRIMITIVE AREA SIERRA AND GRANT COUNTIES, NEW MEXICO

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