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GEOLOGICAL SURVEY CIRCULAR 475

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Abstract

Geologic mapping in the Ely quadrangle, Nevada, in 1958 to 1960, revealed structural irregularities and rock alteration suggesting that the Ward Mountain area of the Egan Range contains concealed intrusive rocks and possibly accumulations of metals of economic value. An aeromagnetic survey by the U. S. Geological Survey tested this theory and a large magnetic anomaly, similar to one near Ruth, Nev., was outlined in the southwest quarter of the quadrangle. Subsequently, a geochemical study tested the possibility that the magnetic anomaly reflects a buried mineralized intrusive.

The Egan Range is a major north-trending mountain range in east-central Nevada. The central part of the range, which is the subject of this report, lies south-southwest of Ely between Steptoe Valley on the east and White River Valley on the west (fig. 1). The average altitude of the crest of the range in this area is about 10,000 feet above sea level, and the highest peak is 10,933 feet. Near Ruth the altitude decreases to about 7,000 feet. The floors of the adjoining valleys are about 6,000 to 6,500 feet above sea level.

Paleozoic sedimentary rocks of the range are a sequence of dolomite, limestone, shale, and sandstone ranging in age from Ordovician to Permian. These rocks are overlain in places along the eastern flank by early Tertiary sedimentary rocks and by somewhat younger volcanic rocks. Gravity data indicate several thousand feet of Cenozoic sedimentary rocks (valley fill) in Steptoe Valley but generally less in White River Valley.

Small quartz monzonite dikes of early Tertiary or Late Cretaceous age intrude the Paleozoic rocks on the east flank of Ward Mountain, and similar intrusive rocks are exposed near Ruth.

The pre-Tertiary rocks have been complexly folded and displaced by thrust and high-angle faults, whereas the Tertiary rocks have been only slightly folded and tilted.

An aeromagnetic survey of the central part of the Egan Range was flown at an elevation of 11,500 feet along north-south lines spaced about 2 miles apart. The resulting magnetic data are shown by contours on figure 1.

A positive magnetic anomaly extends over most of the range from Ruth south to the edge of the map. Two local positive anomalies are superimposed on the more extensive anomaly. The northern anomaly is centered over the south edge of the Robinson mining district, where disseminated copper deposits occur in an east-trending zone of metamorphosed sedimentary rocks and altered monzonite porphyry. The near-surface igneous rocks associated with the copper deposits can account for only part of the measured northern anomaly, and a major part of it must be caused by a buried igneous body of greater areal extent.

The southern magnetic anomaly is centered over the west edge of the Egan Range where the range is composed of non-magnetic Paleozoic sedimentary rocks. The magnetic anomaly is interpreted as due to a large mass of igneous rocks underlying the thickest part of the Egan Range and the eastern edge of White River Valley. The zone of high magnetic intensity connecting this anomaly with the anomaly near Ruth suggests that the igneous bodies believed to produce the two local anomalies are connected at depth.

The geologic features (fig. 2) of the general area of the southern magnetic anomaly tend to confirm this interpretation. In gross aspect this part of the Egan Range appears to be a simple tilted fault block similar to many other ranges in Nevada and Utah. In detail, however, the structure is more complex. The sedimentary rocks have been cut by numerous faults that displace the beds from a few tens of feet to several thousand feet and divide the range into several smaller structural blocks.

Overturned folds and thrust faults mapped within and beyond the the limits of the area shown in figure 2 indicate that thrust-faulting was important in the early development of the range. Along Rowe Creek, below the outcrop belt of the Chainman Shale, the beds are overturned and dip to the west on the limb of a recumbent fold that is overturned to the east. The attitude of the fold indicates that a thrust plate moved to the east over the rocks now exposed. The small klippen of Devonian rocks 1 and 3 miles south of Rowe Creek may represent remnants of this plate.

Just north of Rowe Creek and near the center of the southern magnetic anomaly (shown in detail in fig. 3), the rocks are cut by the Rowe Creek fault, which displaces the rocks several thousand feet in a left-lateral sense. The fault is terminated on the east by a northwest-trending reverse fault. This reverse fault appears to die out to the southeast in the Chainman Shale, although its counterpart or continuation may be one of the strong faults that cut the Pennsylvanian and Permian rocks to the southeast. Similarly, the off-

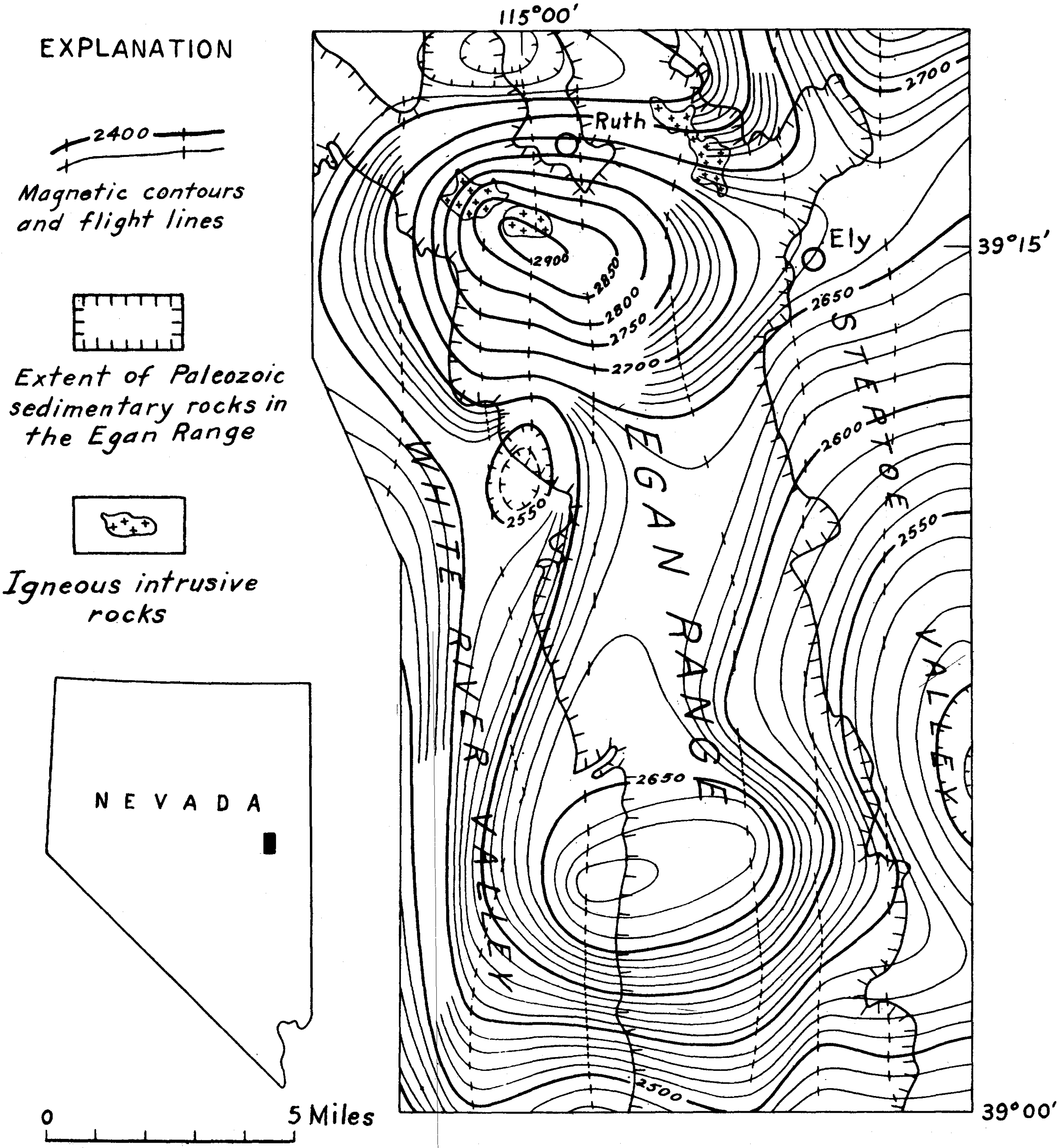

Figure 1.--Aeromagnetic map of the central Egan Range. Values are total magnetic intensity relative to an arbitrary datum. Contour interval is 10 and 50 gammas. Flight level is 11,500 feet above sea level. Magnetic survey was flown and compiled under the supervision of J. L. Meuschke. Geology is generalized from Guidebook to the geology of east-central Nevada, Intermountain Association of Petroleum Geologists, 11th Annual Field Conference, 1960, held with Eastern Nevada Geological Society.

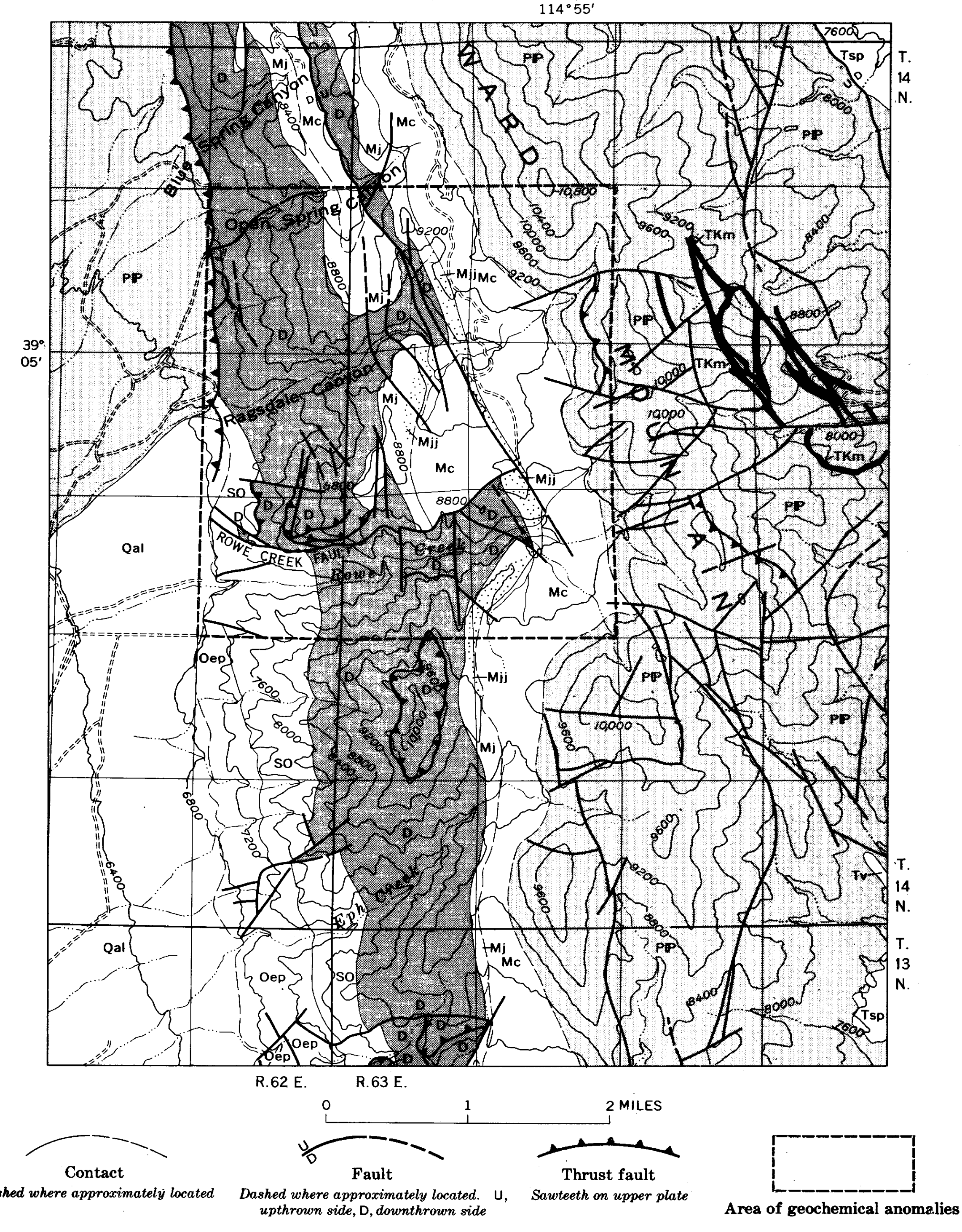

Figure 2.--Generalized geologic map of the southwest part of the Ely quadrangle, Nevada. Qal, alluvium (Quaternary); Tv, volcanic rocks, and Tsp, Sheep Pass Formation of Winfrey (1958) (Tertiary); TKm, monzonite porphyry (Tertiary or Cretaceous); PP, Permian and Pennsylvanian, undifferentiated; Mc, Chainman Shale (Mississippian); Mj, Joana Limestone, and Mjj, Joana jasperoid (Mississippian); D, Devonian, undifferentiated; SO, Silurian and Ordovician, undifferentiated; Oep, Eureka Quartzite and Pogonip Group (Ordovician). The Joana jasperoid is stippled. Geology by A. L. Brokaw and D. R. Shawe.

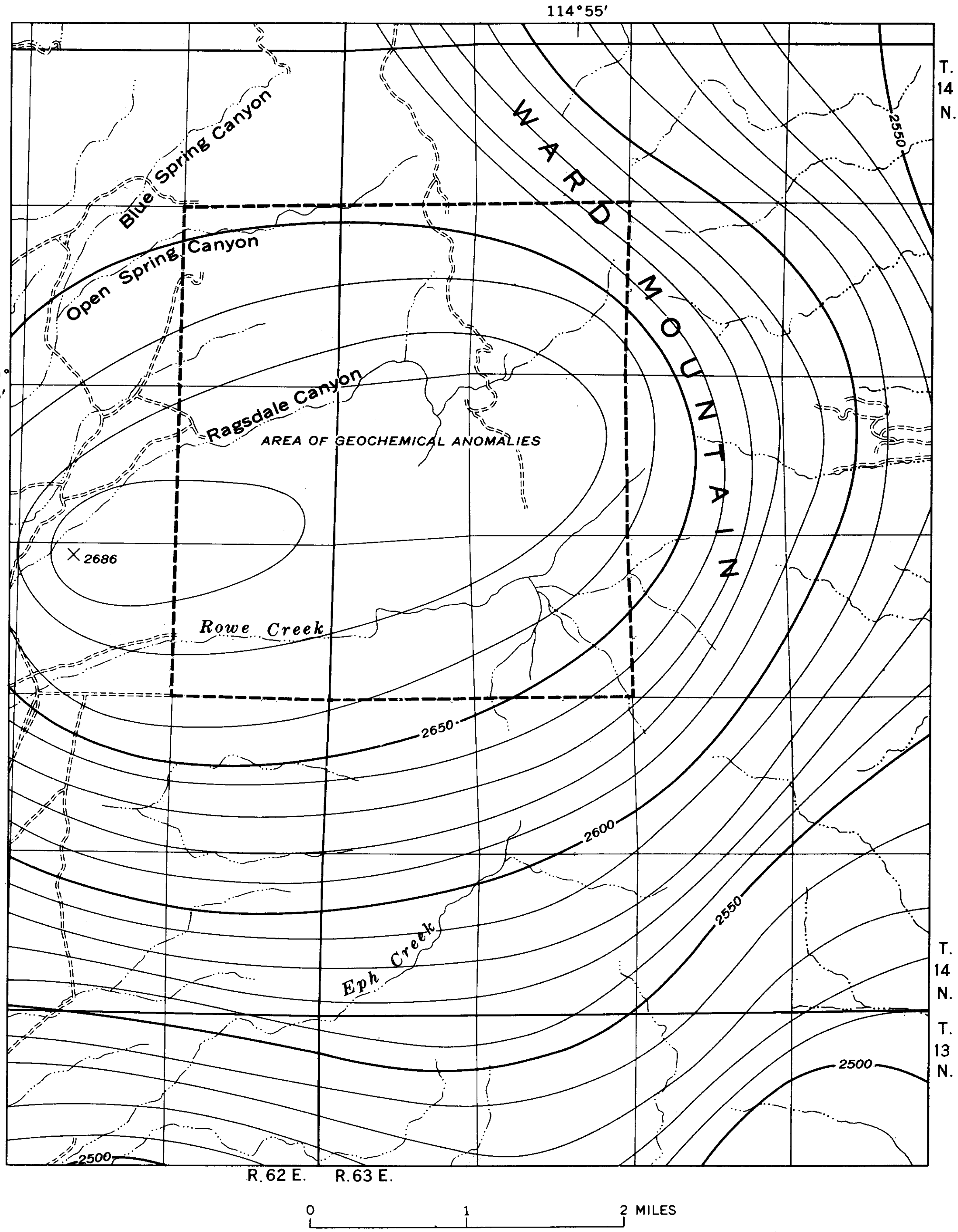

Figure 3.--Aeromagnetic map, southwest part of Ely quadrangle. Contour interval 10 gammas.

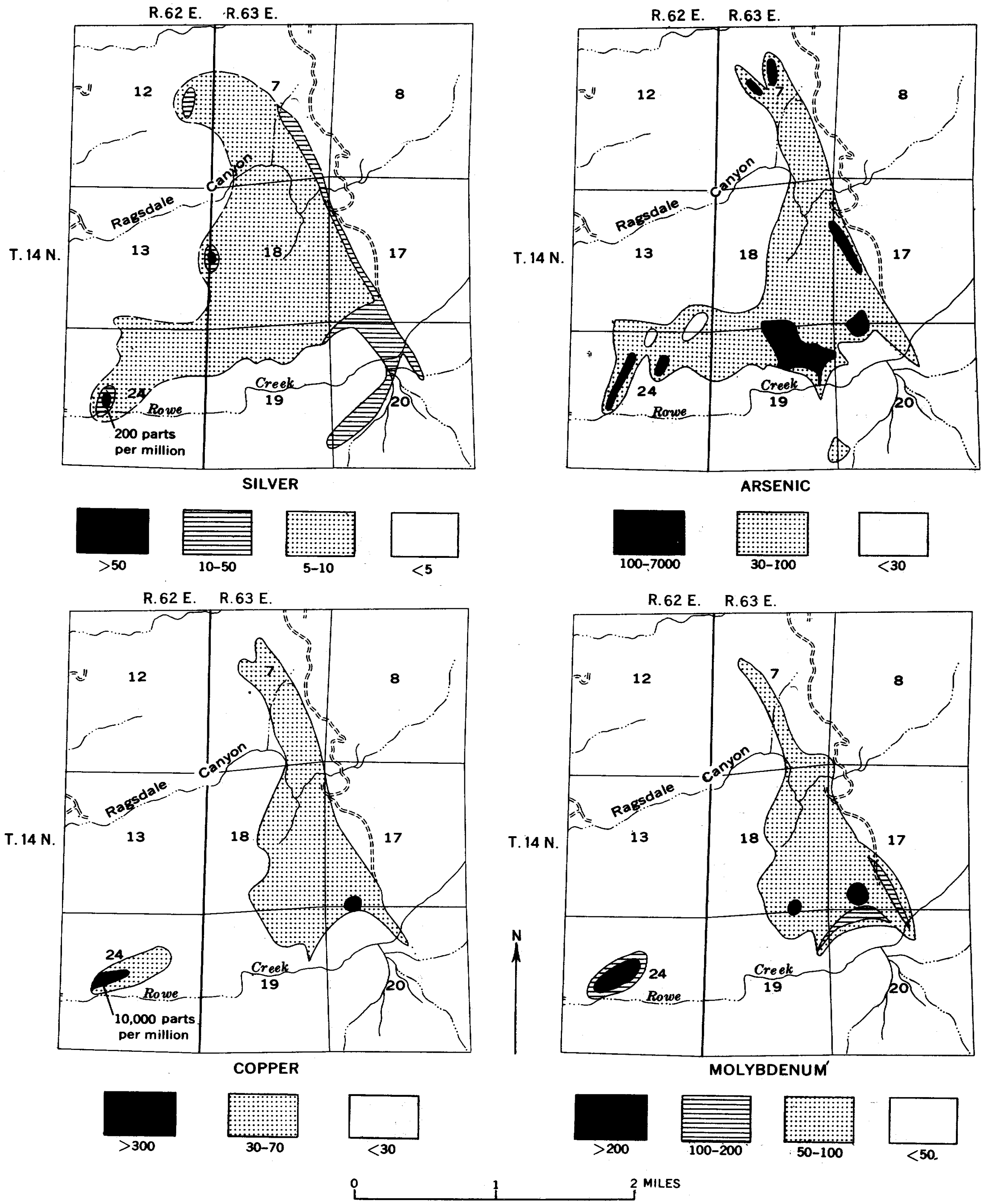

Figure 4.--General distribution, in parts per million, of silver, arsenic, copper, and molybdenum in jasperoids and in iron oxides in vugs and fractures.

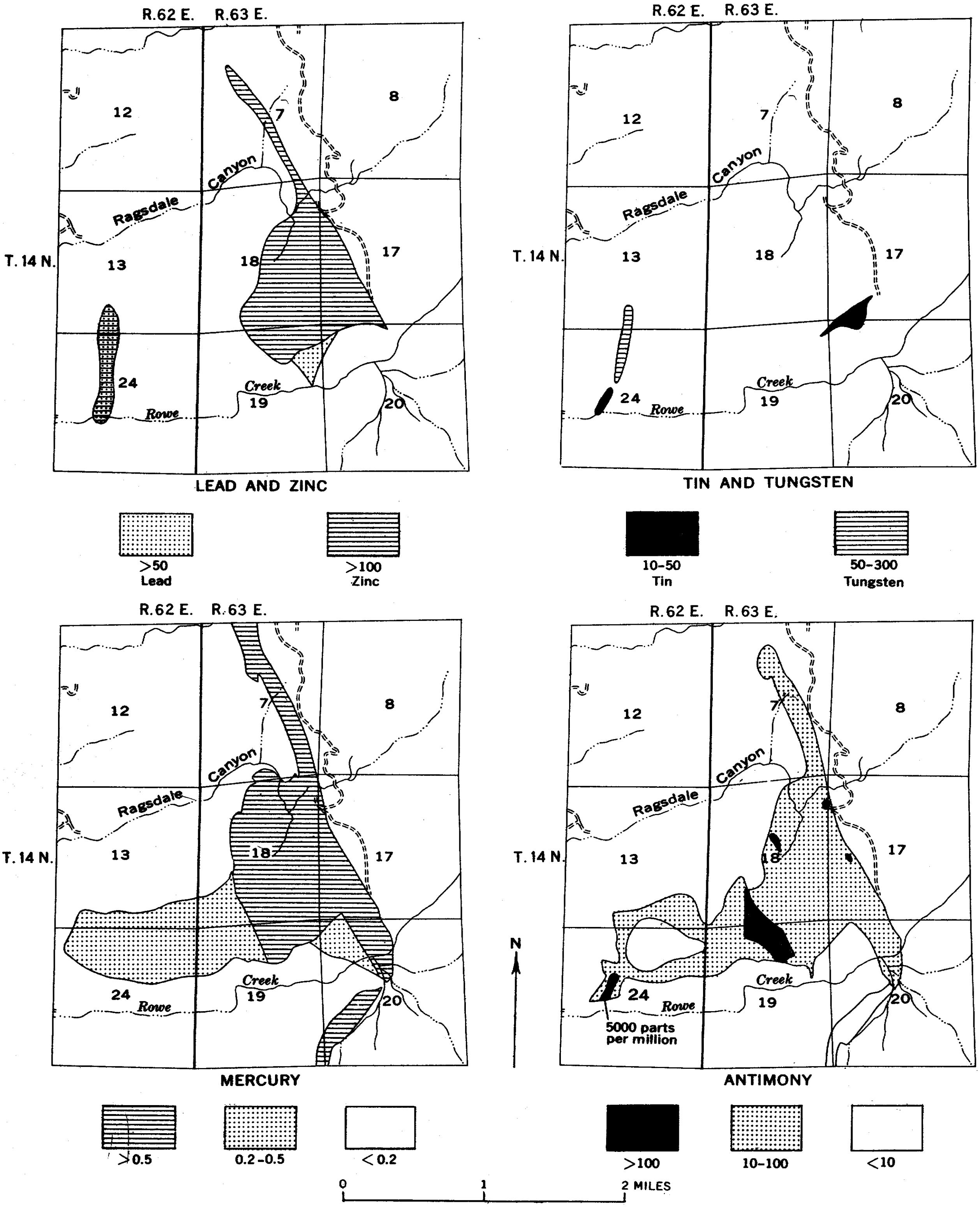

Figure 5.--General distribution, in parts per million, of lead, zinc, tin, tungsten, mercury, and antimony in jasperoids and in iron oxides in vugs and fractures.

set segment of the Rowe Creek fault may be one of the left-lateral faults that extend across Ward Mountain. Where Joana Limestone is cut by the reverse fault and related fractures it is altered to jasperoid, and many of the minor fractures are filled with secondary calcite and iron-oxide minerals. The exposed lower and middle Paleozoic limestones and dolomites also are silicified in the areas of structural deformation.

Some evidence suggests that the rocks near the magnetic anomaly, particularly in the vicinity of the klippen, have been differentially elevated, forming a structural high that might be due to doming related to a buried intrusive. The 1,500-foot difference in elevation between the two klippen shown on the map is more than can be accounted for by the known faulting.

The similarity of the two magnetic anomalies, the existence of major ore bodies in the area of the northern anomaly and of abandoned small mines on Ward Mountain, the presence of minor intrusive masses in the area of Ward Mountain, and the presence of jasperoid, all suggested that the area of the southern anomaly may also contain significant ore deposits. A geochemical study was therefore made.

Semiquantitative spectrographic analyses for 30 elements, including Cu, Pb, Mo, Ag, Sn, and W, were made in the field by U. Oda, M. DeValliere, and W. W. Janes, using a truck-mounted spectrograph. As, Sb, and Zn were determined by field-type chemical methods of analysis (Ward, Lakin, Canney, and others, in press). Hg analyses were made spectrographically by Paul Barnett using a large sample charge in special electrodes.

The analytical results show that anomalous amounts of Ag, Hg, Cu, Pb, Zn, Mo, Sb, W, and Sn are present in jasperoid and iron-rich fracture fillings in the limestones and dolomites along and adjacent to major faults directly over the magnetic anomaly (figs. 4 and 5). The Rowe Creek fault and the northwest-trending fault that is roughly parallel to the outcrop belt of the Joana Limestone show the highest concentrations of metals and probably were the principal conduits for metal-bearing solutions. Ba, Cr, Fe, Mn, and Ti also are present in abnormally high concentrations in the anomalous area. Unaltered limestones and calcite veins are not appreciably enriched in any of the metals except perhaps mercury and arsenic.

The high concentration of metals along the faults and over the magnetic anomaly may be a leakage halo from metal deposits in and near the postulated concealed intrusive. The quartz monzonite dikes on the east side of the area are probably connected at depth with this postulated intrusive. The extensive alteration of limestone to jasperoid suggests that similar dikes are present at depth in the Rowe Creek area, under the geochemical anomalies. The depth to the intrusive rocks is not known; however, the low mobility of some of the elements in a limestone environment suggests that the intrusive may be at a relatively shallow depth.

Depth analyses of the geophysical data indicate that the top of the mass causing the major magnetic feature (fig. 1) is about 3,000 feet above sea level or 3,000 feet below the surface of White River Valley. Details of the magnetic field were not well defined by this survey, but the gradients associated with the southern magnetic high indicate that parts of the mass are nearer the surface than others. Its surface is probably irregular and may be quite shallow in some places.

References

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