72.22

June 11, 1999

Note To: File

From: Scott Flanders SF

SUBJECT: DOCKETING OF INFORMATION WRITTEN PUBLIC COMMENTS RECEIVED FROM ON THE PRIVATE FUEL STORAGE ENVIRONMENTAL IMPACT STATEMENT

On April 29, 1999, public scoping meetings were held on certain aspects of the PFS EIS. In addition, to verbal comments provided at the meeting, the NRC allowed for written comments until May 28, 1999. Attached are comments received to date. The attached comments will be added to the PFS docket number 72-22.

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Written Comments Received as a Result of the April 29, 1999 Scoping Meeting

(1) Statement from the Women Concerned/Utahns United (Written Comments received at the April 29, 1999, scoping meeting)

(2) Metallic Mineral Potential of Skull Valley, Utah Geological Survey by R.W. Gloyn. (Written Comments received at the April 29, 1999, scoping meeting)

(3) Letter from Louise Hess to Scott Flanders (NRC), dated April 22, 1999

(4) Letter from Earl R. Morris, Director of the Utah Department of Public Safety, to Scott Flanders (NRC), dated May 4, 1999

(5) Letter from John E. Tanner, Jr. to Scott Flanders (NRC), dated May 19, 1999

(6) Letter from John Paul Kennedy to Scott Flanders (NRC), dated May 21, 1999

(7) Letter from Dianne Nielson, Director of the Utah Department of Environmental Quality, to Scott Flanders (NRC), dated May 27, 1999

(8) Letter from Christopher Robinson, President of Ensign Ranches of Utah, L.C., to Leon Berggren (BLM), dated May 24, 1999

(9) Letter from Joro Walker, Land and Water Fund of the Rockies, to Scott Flanders (NRC), dated May 28, 1999

Attachment

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US NUCLEAR REGULATORY

PUBLIC MEETING

APRIL 29, 1999

SALT LAKE CITY, UTAH

RE: SPENT FUEL STORAGE INSTALLATION -- SKULL VALLEY RESERVATION

Statement:

Women Concerned/UtahnsUnited is a long standing citizen's organization concerned about nuclear testing, Utah's downwind issues, the storage of 43% of the nation's chemical weapons in Utah and with the problems of chemical and biological testing at Dugway Proving Grounds. We are also opposed to the "temporary" nuclear waste storage site on the Goshute Reservation. We believe this is a "bad neighbor" idea.

The use of the word "temporary" storage is arguable. The transportation of spent nuclear fuel to this site may be subject to accidents that might be planned (sabotage) or unplanned. The possibility of Public Fuel Storage (PFS) opening the door to other power companies to store nuclear waste at the Goshute site is of major concern as we look to Utah's future.

The 820-acre nuclear storage facility is opposed, <u>not only,</u> by the State of Utah, the people of Utah, most grass-roots citizen's organizations but also by many members of the Goshute Tribe.

No one wants nuclear waste in their backyard, nor in their neighbor's backyard. Let's not dump nuclear waste in anyone's backyard. This waste needs to be stored near the plant that produced the waste until a permanent site is established. We need to look to the future for acceptable solutions in the production of this kind of waste product and the problems it produces. The Goshute and the PSF nuclear waste storage plan is a perfect example of a scandalous benefit to a few at a great expense to many.

Presented by:

Cherry Wong
Board Member

Rosemary A. Holt
Chairperson

RAH

Utah Geological Survey

Project:			Requesting Agency:
Metallic Mineral Potential of Skull Valley, Tooele County, Utah			Governor's Office of Planning and Budget
By: R. W. Gloyn	Date: 1/25/99	County: Tooele	Job No: ECON-99-01
USGS Quadrangle:			

ABSTRACT

The southern part of Skull Valley has potential for shallowly buried mineral deposits. The most likely deposit type is either skarn/porphyry copper deposits, perhaps with surrounding polymetallic lead-zinc-silver replacement deposits or "distal disseminated" gold-silver deposits. The area (1) is structurally complex with both thrust and high-angle faults, (2) contains lithologic units favorable for mineralization, particularly limestone and dolomite, (3) is within the "Unita trend" of Eocene-Oligocene intrusive rocks, and (4) is within the Park City-Bingham Canyon-Gold Hill belt of metallic mineral deposits. In addition, three distinct aeromagnetic anomalies are present in the area and may represent buried intrusive or volcanic rocks beneath alluvial fill. Gravity surveys suggest that bedrock is at relatively shallow depths beneath several of these anomalies. Minor lead-zinc-silver, iron, copper-silver, and arsenic-antimony-silver mines and prospects are found in the adjacent Cedar and Stansbury Mountains, but most are too far away to be related to the magnetic anomalies.

The southern Skull Valley area has sufficient geologic merit to justify additional work to improve and refine exploration target areas. Suggested work includes detailed ground magnetic surveys; additional geophysical surveys to identify alteration, sulfide mineralizations, and other characteristics; and field mapping and sampling of outcrops close to the identified target areas to identify subtle alteration or distal mineralization.

PURPOSE AND SCOPE

In mid-November 1998, the Governor's Office of Planning and Budget asked the Utah Geological Survey to evaluate the mineral potential of Skull Valley and the adjacent foothills of the Stansbury and Cedar Mountains. There was a question whether a proposed railroad spur might impact development of known or potential mineral resources. The study consisted of reviewing the available published information on the geology, geophysics,

geochemistry, and mineral occurrences of the area; compiling mineral occurrence data from unpublished file information at the Utah Geological Survey; plotting past and existing mining claims in the area; and contacting exploration companies and individuals who had previously worked in the area. No field examination was made.

The introduction, summary and conclusions sections were written for all readers, not just scientists and explorationists. These sections briefly cover all of the important points of the report and give some explanation of the significance of the data for exploration or mineral potential. The remaining sections of this report provide the detailed background information on geology, mineral occurrences, previous exploration and activity, geochemistry, geophysics, mineral potential and recommended additional work. They are directed toward technical readers and presume a geologic and mineral exploration background. They provide some of the necessary technical information needed for any follow-up exploration work in the area.

SUMMARY

The southern to central part of Skull Valley (figure 1) has potential for buried mineral deposits at relatively shallow depth covered by alluvium. The most likely deposits would be either porphyry copper/copper skarn deposits, perhaps with surrounding polymetallic lead-zinc-silver replacement deposits, or "distal disseminated," sediment-hosted gold-silver deposits.

The most prospective area is a 3 to 5 mile wide, 6 to 8 mile long, north-south-trending zone in T. 4-5 S., R. 8-9 W., Salt Lake Base Line and Meridian. This area is in the center of the western blocks identified as having potential for skarn/porphyry copper and lead-zinc-silver vein and replacement deposits (figure 1). This area: (1) contains two aeromagnetic anomalies that could represent buried intrusions, (2) is directly within the "Uinta trend" of Eocene-Oligocene intrusive rocks that include the Bingham, Park City, and Alta stocks responsible for major copper, lead-zinc, silver and gold mineralization, and (3) is within the Park City-Bingham Canyon-Gold Hill mineral belt of metallic mineral deposits. In addition, the area is northeast and east of a zone of surface silicification and silver-antimony anomalies that could represent fringe mineralization from the postulated porphyry copper system

A second prospective area is located about 8 miles to the southeast of the first prospective area in the northwest part of T. 5 S., R. 7 W. This prospective area is shown on figure 1 as the

eastern block identified as having potential for skarn/porphyry copper and lead-zinc-silver vein and replacement deposits. This area (1) contains a smaller aeromagnetic anomaly which could also represent a buried intrusion, (2) is within both the intrusive and metallic mineral deposit trends, and (3) is west of several silver-copper prospects that could represent fringe mineralization. The southern main magnetic anomaly and this eastern anomaly are partially on the Skull Valley Indian Reservation. Gravity surveys and proximity to exposed bedrock indicate that bedrock is relatively shallow across much of the area.

A third prospective area is located in the west half of T. 5 S., R. 9 W. east of the White Rocks prospect. This area has potential for disseminated gold-silver deposits in downdropped blocks of lower Great Blue Limestone east of a number of weakly mineralized jasperoid exposures. In this interpretation, these jasperoids are analogous to the Silver Chert at the Mercur gold mine. At Mercur, the Silver Chert is silicified and contains anomalous silver and antimony up to several miles from the area of gold mineralization. The exposed jasperoids at the White Rocks prospect could represent a distal fringe to the postulated gold mineralization in the covered pediment.

"Covered area" or pediment exploration plays search for postulated deposits which have not yet been discovered because they are buried beneath valley fill and have little or no surface outcrop. Such plays have become increasingly important exploration targets in recent years and have resulted in a number of sizable discoveries. Many of the gold discoveries of Atlas Minerals Company in the Eureka mining district of Nevada were pediment plays as was the Casa Grande copper deposit in Arizona. One of the world's largest copper deposits, La Escondida in Chile, was also a "covered area" play. Favorable areas for exploration are commonly identified on the basis of trends, geophysics, fringe mineralization and alteration, and projected structural intersections. Most "covered area" plays are for mineral deposit types which typically have a moderate to large lateral extent of either mineralization or alteration and are of sufficient size to be of interest to major companies. Favored targets include skarn/porphyry copper deposits and sediment-hosted precious metal deposits.

The southern Skull Valley area has sufficient geologic merit to justify additional work. Future work should include detailed ground magnetic surveys with interpretation by a trained exploration geophysicist to better identify the cause of the

magnetic anomalies, followed by one or more electrical survey methods to identify areas of sulfide mineralization or alteration. In addition, some limited field work and sampling of the rock outcrops within the valley proper and along the range fronts in the area of interest could be warranted. Particular attention should be directed toward searching for subtle alteration or zinc-manganese-barium geochemical anomalies that are often indicative of, and distal to, porphyry copper systems. In addition, detailed mapping of the exposed Great Blue Limestone in the south Cedar Mountains may identify more favorable host units in the limestone which could be correlated with those at Mercur; any future exploration could be directed toward these more favorable horizons.

SUPPORTING DATA AND DISCUSSION

The following text discusses various aspects of the geology, mineral occurrences, and geochemistry and geophysics of the area and how they relate to mineral potential within the southern and central Skull Valley area. Although not all of the aspects and areas discussed correspond directly to the identified potential areas, they are included to provide more regional information and background. For example, patented and unpatented mining claims are shown for the Cedar and Stansbury Mountains even though the identified potential areas are not in the mountains. Most topics discussed are accompanied by a 1:250,000-scale map summarizing the information.

Geology

The geology of the area has been studied by numerous workers. The Cedar Mountains were mapped by Maurer (1970), Skull Valley by Sack (1993), and the Stansbury Mountains by Rigby (1958), Sorensen (1982a) and Foose (1989). Moore and Sorenesen (1979) summarized the earlier mapping for their geologic map of the Tooele 1° x 2° quadrangle. In addition, Tooker published papers on the thrust faulting (Tooker, 1971, 1983), and Moore and McKee published a paper on the Phanerozoic magmatism and mineralization (Moore and McKee, 1983). No figure is included for this section because it would be substantially larger than the other figures. However, the 1:250,000 scale map of the Tooele 1° x 2° quadrangle shows most of the structures and structural domains discussed in this section.

In general, the geology of the area consists of several thrust sheets of folded Paleozoic sedimentary rocks cut by a series of later, high-angle faults. Many of these major thrust faults are concealed beneath alluvial fill in Skull Valley and Rush Valley,

but some are exposed in the Stansbury Mountains. The thrust faults separate different plates which form the Cedar Mountains (Skull Valley plate), the Stansbury Mountains (Tintic Valley plate), and South Mountain (Stockton plate).

The Cedar Mountains can be divided into (1) a northern area consisting of east- to northeast-trending anticlines and synclines of Middle to Upper Pennsylvanian sandstone, limestone, and calcareous sandstone; (2) a central area consisting of a north-trending anticline of Pennsylvanian-Permian sandstone, limestone, and silty limestone; and (3) a southern area consisting of northwest-trending anticlines and synclines of Mississippian to Permian limestone, sandstone, and shale. A thrust fault separates the northern area from the central area and a northwest-trending transcurrent fault separates the central area from the southern area. The eastern margins of the northern, central, and southern areas are characterized by a series of steeply east-dipping, high-angle reverse faults; in the northern and central areas these faults trend almost due north, but in the southern area they trend northwest. The western margins of the central and southern areas are characterized by a series of gently to moderately west-dipping, imbricate thrust faults (Cedar thrust and others). The rock types and structural styles of the Cedar Mountains should continue beneath the valley fill on the west side of Skull Valley. High-angle faults should provide channel ways for mineralization, particularly at postulated intersections with the transcurrent fault in the southwest part of Skull Valley. The expected rock types are also favorable for mineralization. North of the transcurrent fault, the bedrock should be mostly Oquirrh Formation or equivalent, which hosts lead-zinc-silver and copper-gold skarn deposits at Bingham Canyon. South of the transcurrent fault, the bedrock should be mostly Great Blue Limestone (which hosts disseminated gold-silver deposits at Mercur) and Manning Canyon Shale. The area north of the projected transcurrent fault contains the western porphyry/skarn copper and lead-zinc-silver replacement target areas. The area south of the transcurrent fault contains the disseminated precious metal target area.

The Stansbury Mountains consist of a western zone containing a major north-trending anticline with subsidiary north- to northeast-trending anticlines and synclines of Cambrian quartzite and Cambrian to Lower Devonian sandstone, shale, limestone, and dolomite, and an eastern zone consisting of steeply east-dipping to locally overturned, Upper Devonian to Pennsylvanian limestone, shale, and sandstone. The contact between the Lower Devonian and younger rocks on the east side of the range has been interpreted as an unconformity by Rigby (1958) and as a thrust fault by Tooker

(1971). In Tooker's interpretation the range is divided into four small plates above shallowly west-dipping thrust faults (Delle, Timpie, Broad Canyon, and Tintic Valley). In Rigby's interpretation, the range is complexly and disharmonically folded with a high-angle reverse or thrust fault (Broad Canyon) within the upper Paleozoic units. A third interpretation is that the anticlinal core of the range (Cambrian to Devonian) represents a klippe above upper Paleozoic units. Additional work is needed to resolve these conflicting interpretations; the true picture may be a combination of these or other interpretations. In the Tooker interpretation, the mountain range and pediments to the west would be underlain by a series of stacked thrust faults; in the Rigby interpretation these thrusts are not required.

The western margin of the Stansbury Mountains is characterized by a number of discontinuous high-angle normal and reverse faults. The eastern margin of the range is generally unfaulted with Quaternary alluvium onlapping on east dipping bedrock units.

Scattered bedrock outcrops, drilling, and gravity values suggest that bedrock is present at relatively shallow depths over much of Skull Valley. The pediment in northeastern Skull Valley is probably underlain by west-dipping Ordovician to Mississippian sandstone, shale, and carbonate rocks cut by high-angle, north- and possibly northwest-trending faults. The structure beneath the pediment in southern Skull Valley is much more complex. Isolated bedrock exposures in southern Skull Valley consist of folded Ordovician to Mississippian rocks whose distribution requires some folding and faulting. Thrust faults are exposed at the range front in this area (Delle thrust) and probably continue beneath the cover to the north. In addition, the major Skull Valley thrust is present in the area, possibly located between the Ordovician rocks on Hickman Knoll and the Mississippian rocks to the east. The eastern skarn/porphyry copper and lead-zinc-silver vein/replacement target area is slightly east of the thrust and the buried bedrock in the target area would most likely be Mississippian to Pennsylvanian units including the Great Blue Limestone and Oquirrh Group. Both of these formations contain limestone and sandy limestone, which are favorable host units for both skarn and replacement deposits.

Igneous Rocks

Figure 2 shows the location of surface exposures of Eocene to Oligocene intrusive and volcanic rocks. The volcanic rocks are mostly andesitic to latitic flows, tuffs, and laharic breccias and are similar in both composition and age to the volcanic rocks in

the Oquirrh Mountains. The intrusive rocks consist of sills, dikes, and small plugs; most of the intrusive rocks in the Stansbury Mountains are sills and dikes (Rigby, 1958) and most of the intrusive rocks in the Cedar Mountains are mapped as small plugs (Maurer, 1970). The intrusive rocks are mostly granodioritic to monzonitic to quartz monzonitic and are often strongly porphyritic. They are remarkably similar in age and composition to the intrusive rocks in the Oquirrh Mountains that are associated with the Bingham Canyon, Ophir, and Stockton mining districts and also to the intrusive rocks in the Wasatch Mountains that are associated with the Park City, and Big and Little Cottonwood mining districts. The volcanic and intrusive rocks lie along a southwest-trending zone 10 to 25 miles wide and 150 to 170 miles long (Uinta trend). The intrusive rocks form a slightly narrower zone than the volcanic rocks, usually only 10 to 12 miles wide. Nearly all of the major ore deposits within the Wasatch and Oquirrh Mountains are associated with this trend. The favorable "potential area" in southern Skull Valley is in the center of this trend within the zone of intrusive rocks.

Mines and Prospects

The mines and prospects in the area have been examined and studied by Rigby (1958), Sorensen (1982c), Kness (1983), Almquist (1987), and the Utah Geological Survey (1998). Mine and prospect information has been summarized by Tripp and others (1989) and Stein and others (1989). The mines and prospects map (figure 3) shows the location of workings or mines for metallic or hydrothermal "industrial" minerals. No prospects or mines for "sedimentary" industrial minerals such as sand and gravel, zeolite, limestone, or diatomite are shown.

The Stansbury and Cedar Mountains are not strongly mineralized but do contain a few small deposits confirming their position within the Park City-Bingham Canyon-Gold Hill mineral belt. The two districts with reported production, Free Coinage and Third Term, are in the northern part of this mineral belt and much of the Free Coinage district may be outside the belt. Most of the mineral occurrences and mines shown on the map are several tens of miles from areas in southern Skull Valley identified as having potential for skarn/porphyry copper, lead-zinc-silver vein/replacement, and disseminated precious metal deposits and provide little direct information about the merits of the prospective areas. Only the White Rocks and Indian Hickman Canyon-Dry Canyon occurrences could represent distal mineralization from the postulated hydrothermal systems.

The northern part of the Cedar Mountains contains a number of thick aragonite veins which have been mined for building stone and poultry grit. These veins are up to 120 feet wide and traceable for up to 2,700 feet in outcrop (Utah Geological Survey, 1998). The larger veins trend N. 10°-30° E., but some of the small veins trend northwest. The veining is indicative of some hydrothermal activity, possible decalcification of limestone, but there is no strong indication that this hydrothermal activity was metal-bearing.

The southern part of the Cedar Mountains contains an extensive area of silicification with anomalous antimony, arsenic, thallium, and silver in the White Rocks prospect area. Some drilling was done on this prospect in the late 1980s by Freeport Exploration but reportedly intersected only minor, non-ore grade gold, less than 150 parts per billion gold (R. Steel, independent prospector and locator of CM claims, verbal communication, 1998). The area may still have some potential. The exposed anomalous silver-arsenic-antimony jasperoids may be analogous to the Silver Chert at Mercur which occurs below the main mineralization and extends up to several miles beyond the main zone of gold mineralization. The exposed jasperoids may be distal to a buried "gold center."

The Free Coinage district is located in the northeast part of the Stansbury Mountains. This district produced 449,244 pounds of lead, 5,400 pounds of zinc, 1,458 pounds of copper, 6,160 ounces of silver, and 5.2 ounces of gold from 1,503 tons of ore (Foose and others, 1989). Most of the production was from the Monte Carlo and Utah Bunker Hill mines. Ore consisted of argentiferous galena, pyrite, and chalcopyrite with quartz and calcite gangue in brecciated, often silicified, iron-stained Mississippian carbonate rocks (Gardison Limestone and Humbug Formation; Gardner Dolomite and Humbug Formation of Rigby, 1958). Most of the lead-zinc mineralization is along north-trending, west-dipping faults above the Broad Canyon thrust. Many of the faults are just limonite-stained and have low metal values, but the Monte Carlo mine contained a zone of sulfide pods estimated to be 5 to 6 feet thick and 50 to 60 feet long over a vertical distance of at least 280 feet along a N. 5° E.-striking, 65° W.-dipping fault (Almquist, 1987). In the northern part of the district, gold-silver-mercury mineralization is associated with north- to northeast-trending shear and breccia zones. The gold and silver values are low but anomalous (up to 75 parts per billion [ppb] gold and 10 parts per million [ppm] silver) (Almquist, 1987). Although the individual prospects show some variation in lead, zinc, and copper values and ratios, no systematic zoning pattern was apparent to indicate the center of the hydrothermal system. The silver-gold-mercury

mineralization does not appear to be distal to the base metal mineralization and may represent a separate, possibly later, event.

The Third Term district is located in the east-central part of the Stansbury Mountains approximately 6 miles south of the Free Coinage district. Workings and prospects occur along a 4-mile long, nearly 1-mile wide, north-trending zone above the Broad Canyon thrust. The district produced at least 77,951 pounds of lead, 2,623 pounds of copper, 1,336 ounces of silver, and a small amount of gold between 1875 and 1917 (Tripp and others, 1989). This production was from the central part of the district with most production probably from the Third Term mine and lesser production from the Stansbury and Metal Queen mines (Kness, 1983). These three deposits are similar and consist of irregular pods, lenses, and veinlets of galena and sphalerite and minor copper minerals along north- to northwest-trending shears and breccia zones in the Mississippian Gardison Limestone (upper Gardner Dolomite of Rigby, 1958) (Kness, 1983). North of this central zone, a number of mines and prospects were developed along a series of strongly iron-stained, low-grade to barren, subparallel N. 15°-20° E.-trending faults and breccia zones in Mississippian limestone and shale. No production is reported from these mines (Monarch, Dragon, and Rose) (Kness, 1983). South of the central zone, low-grade lead and silver with some copper is found in a number of small adits and prospects in brecciated and iron-stained limestone. Still farther south, the Silver Drum mine was developed along a series of north-northeast-trending shear zones in fine-grained sandstone. The shear zones contain disseminated to massive pyrite but no significant metal values (Kness, 1983). There is no apparent consistent metal zoning in the district, but the hydrothermal system was probably centered near the Third Term-Stansbury mines. This area is about 1 mile directly east of an intrusive monzonite porphyry sill and about 0.25 mile west of a similar monzonite porphyry sill (Rigby, 1958).

A number of isolated mines and prospects are present in the southern Stansbury Mountains (Kness, 1983). Most of these prospects were developed along iron-stained fracture or breccia zones and most contain little or no economic mineralization. The Bear Fork prospects are developed along a N. 10° E.-trending calcite-iron-cemented breccia with very low-grade copper-silver values in Mississippian Gardison Limestone (Kness, 1983). Below the workings, malachite, azurite, and cuprite float is found in glacial deposits presumably derived from a better mineralized, possibly covered, part of the breccia (Utah Geological Survey, 1998). Farther south in the Johnson Pass area, a number of mines are developed along north- to northwest-trending, iron-stained,

often calcite-veined faults or breccia zones generally in Silurian to Mississippian limestone or dolomite. The breccia zones are from 5 to possibly 20 feet wide. Samples collected by the U.S. Bureau of Mines (Kness, 1983) indicate very low base and precious metal values, generally less than 0.01 percent copper, 0.02 percent lead, and 0.2 ounces/ton silver. The largest mine in the area, the Ahlstrom mine, followed a N. 30° W.-trending fault/breccia zone more than 1,300 feet without encountering any significant mineralization.

Two small copper prospects occur in the southwestern part of the Stansbury Mountains (Kness, 1983) The southern prospect (Dry Canyon) is developed along a N. 75° E.-trending fracture zone with quartz-chalcopyrite-tetrahedrite veins and stringers. Assays show 1.0 to 2.0 percent copper, 5 to 10 ounces/ton silver, 0.01 to 0.3 ounces/ton gold, and anomalous antimony (0.72 percent). The northern prospect (Indian Hickman Canyon) is developed along a N. 35° E.-trending shear/fracture zone with quartz-chalcopyrite veins and pods. Manganese staining is found in the adjacent quartzite. The prospects are in quartzite of the Cambrian Pioche Formation. These prospects are 1.5 to 2 miles northeast of the southeastern skarn/porphyry copper potential area and could represent fringe mineralization from a buried porphyry system.

A number of iron prospects, including the Three Picks and Consolidated Lela prospects, are present in sections 6 and 7, T. 4 S., R. 7 W. (Big Pole Canyon-Spring Canyon area) of the west-central Stansbury Mountains. Hematite (some specularite), limonite, goethite, and minor magnetite occur as impregnations, replacements, and veinlets with quartz in sandstone and limestone near and adjacent to faults and fractures. Some samples contain low-grade copper values (0.02 percent Cu) (Kness,1983). The relationship of these prospects to the others in the Stansbury Mountains is not known.

Active and Abandoned Claims

Figure 4 shows the location of patented and unpatented mining claims including both active and abandoned claims within southern Skull Valley, southern Cedar Mountains, and southern Stansbury Mountains. The information for claims in R. 9-10 W. was collected from the Salt Lake Office of the U.S. Bureau of Land Management and the information for claims in R. 6-7 W. from Kness (1983) and Almquist (1987). Much of R. 8 W., T. 2-6 S. is either private land or part of the Skull Valley Reservation and not open for location of mining claims. Claims in R. 11 W., T 1-7 S. and T. 6 S., R. 5-12 W. were not researched. Most of the locations shown on figure

4 are generalized to quarter or half sections and do not necessarily reflect the true claim boundaries or orientation. As expected, most of the claims are near or on trend with known mineral occurrences or areas of jasperoid; however, the reason and rationale for some claim locations, particularly those in Skull Valley alluvium, are unknown. A number of these claims were recorded as placer claims and could have been for gold or silver. Although there are few claims in the southern Skull Valley and adjacent Stansbury and Cedar Mountains and most of these claims have lapsed, the map data do indicate that there has been some interest in the area by mineral exploration companies and individuals.

Geochemical Anomalies

The geochemical anomaly map (figure 5) contains data from a number of previous studies. It includes data from soil geochemical anomalies collected during the National Uranium Resource Evaluation Program (NURE) (Stein and others, 1989); rock geochemical data, panned concentrate data, and stream sediment data collected by United States Geological Survey (USGS) and United States Bureau of Mines (USBM) personnel during wilderness and roadless area evaluations (Sorensen, 1982b, 1982c; Kness, 1983; Almquist, 1987; Foose and others, 1989); and reported anomalies from industry. The quality of the data is quite variable and the distribution is erratic and irregular. Nearly all anomalies within the valleys were from NURE soils and most of these were single sample anomalies. The extent of these anomalies is probably exaggerated on figure 5 because of the wide-spaced sample distribution. Most of the "linear" anomalies are from rock samples, often collected along structures or groups of workings and often correspond closely to the mines and prospects. Most of the anomalies shown are only weakly anomalous and follow-up work would be required to determine their significance.

Soil Anomalies

Most of the soil anomalies are in alluvial or lacustrine deposits and represent "transported overburden." They probably do not reflect or indicate any mineralization in the underlying bedrock. In addition, extremely low values were considered anomalous in the original reports. The anomaly cut-off values used were: copper - greater than 37 ppm, lead - greater than 45 ppm, and silver - greater than 2 ppm. The lead soil anomaly in T. 2 S., R. 6 W. is probably due to the lead mines of the Free Coinage

district to the west. The copper-lead anomaly in T. 3 S., R. 8 W. is unexplained. The silver anomaly in T. 4 S., R. 9 W. is probably from the silver-arsenic-antimony-rich jasperoids to the south. The location of this anomaly just west of the magnetic high is considered to be coincidental. The lead anomaly in T. 4 S., R. 10 W. is also unexplained, but may be worthy of some reconnaissance follow-up in the Cedar Mountains.

Heavy Mineral Anomalies

The heavy mineral anomalies in the northern part of the Stansbury Mountains are mostly associated with the known workings, but in the southern part of the Stansbury Mountains they are unexplained. Most values are very low and not worthy of follow-up. However, one sample collected in Cow Hollow (section 10, T. 5 S., R. 6 W.) contained 300 ppm copper (Sorensen, 1982b) and may warrant follow-up examination.

Aeromagnetic Anomalies

A broad aeromagnetic high (defined by the -40 nanoTesla contour) occupies the southern part of Skull Valley (figure 6). Within this broad high are four peaks with values as high as +70 nanoTeslas that have been interpreted as representing shallow-sourced anomalies (Stein and others, 1989). The northeast anomaly corresponds to exposed, fresh, andesitic to latitic volcanics and the magnetic response is due to these volcanic rocks.

The southeast anomaly occurs along the range front fault of the Stansbury Mountains. Exposed units in the mountains include Cambrian limestone and shale, and a small outlier in the valley southwest of the anomaly is Mississippian limestone. These units are unlikely to produce a magnetic response. The anomaly may be due to shallowly buried volcanic or intrusive rocks. Three miles to the northeast and southeast of the anomaly are quartz veinlets and fractures with minor copper and silver mineralization (Indian Hickman/Dry Canyon and Rock Spring prospects) that could be interpreted to represent "fringe mineralization" from a porphyry system but are a bit farther away from the magnetic anomaly than expected. However, this anomaly is still thought to be worthy of some additional work.

The northwest anomaly is a fairly well-developed magnetic high. A small outcrop of Mississippian carbonate rock is exposed about 3 miles to the southeast, but otherwise the anomaly is covered by alluvial and lacustrine deposits. The anomaly could

represent shallowly buried volcanic or intrusive rocks and is worthy of additional work.

The southwest anomaly is also a fairly well-defined magnetic high, although not quite as large as the northwest anomaly. It occurs 2 miles west of Hickman Knolls which are mapped as Ordovician carbonate rocks (Moore and Sorensen, 1979) and 5 miles east of the White Rocks prospect, a series of jasperoids in Mississippian Great Blue Limestone (Maurer, 1970) with anomalous arsenic, antimony, and silver values. The jasperoids could easily represent "distal disseminated" precious metal mineralization that commonly occurs several miles (up to 10 in some cases) from porphyry copper systems. For example, the Barneys Canyon and Melco deposits are thought to represent "distal disseminated" precious metal deposits associated with the Bingham Canyon porphyry system. The magnetic anomaly could represent volcanic or intrusive rocks and is worthy of additional exploration work.

Bouguer Gravity

The Bouguer gravity map (figure 7) suggests that bedrock is present at relatively shallow depths under much of Skull Valley. The northern part of Skull Valley appears to have relatively wide (up to 5-6 miles) zones of shallowly buried bedrock adjacent to the exposed bedrock in the Cedar and Stansbury Mountains (see figure 7). The shallow depth to bedrock has been confirmed by drilling in section 26, T. 3 S., R. 9 W. which intersected Pennsylvanian-Permian Oquirrh Formation at a depth of only 211 feet. To the south, the width of these shallow bedrock "zones" adjacent to the mountain ranges apparently narrows to less than 1 mile, based on gravity, but isolated blocks of exposed bedrock (Hickman Knolls) suggest even within the "basin fill" some isolated blocks of fault-bounded(?) bedrock are close to the surface. Gravity lows occur in the central part of Skull Valley between the "ledges" of shallowly buried bedrock adjacent to the range fronts. The northern gravity low is in the center of Skull Valley and probably represents lower density, alluvial-colluvial fill. The southern gravity lows are less easily interpreted. In this area, the gravity data show a 3- to 4-mile-wide, northwest-trending gravity low with three minima. The northern and central minima are at the margins of the broad aeromagnetic high and may be caused by something other than basin fill. Basin fill typically produces magnetic lows. The southern gravity low is south of the aeromagnetic high and could possibly be due to low-density valley fill.

The northern gravity low is southwest of the northern magnetic anomaly and the central low is immediately south of the southern

magnetic anomaly and 2 miles west of exposed bedrock. These two minima could represent a fault-bounded zone of lower density material or possibly altered rocks with lower density than the surrounding massive limestone and quartzite. The altered rocks could represent silicic intrusive or volcanic rocks. The north-northeast trend of these lows is roughly parallel to the regional structural fabric, giving some support to the fault-bounded block interpretation. The offset between the magnetic and gravity anomalies requires some additional explanation to support the altered intrusive/volcanic interpretation. Three possible explanations are: (1) the alteration is displaced from the intrusive, (2) the alteration partially destroyed the magnetic minerals in the intrusive or volcanic rocks, or (3) the magnetic highs represent magnetic mineralization at the margins of the intrusive.

In summary, the gravity data indicate that bedrock is at shallow depth over much of the areas having potential for skarn/porphyry or disseminated gold-silver deposits. The interpretation of the cause of the two gravity minima in the potential area is equivocal and neither supports nor negates the concept of a buried porphyry copper deposit. More work is needed to explain and interpret these gravity minima.

Favorable Tracts

The favorable tracts maps (figures 8 to 10) show tracts considered by the USGS to be favorable or prospective for certain deposit model types (Stein and others, 1989). They rank the potential as A, B, or C with the following definitions: (A) contains known deposits or obvious extensions of terrains with similar geological/geochemical/geophysical characteristics; (B) does not contain known deposits but has many favorable characteristics of the deposit model being considered; and (C) contains one or more factors such as geologic environment, geochemical indication, or geophysical expression. The southern Skull Valley area contains potential for porphyry copper-copper skarn deposits like the Bingham Canyon and Carr Fork type deposits; sediment-(carbonate) hosted precious metals (disseminated precious metal deposits) like the Carlin, Mercur, and Barneys Canyon mines; and polymetallic lead-zinc-silver-copper vein or replacement deposits like the mines in the Tintic and Park City mining districts. The porphyry copper-skarn copper potential is ranked as B to C with the more favorable area closer to the Stansbury Mountains (figure 8), the polymetallic vein/replacement potential is ranked as A to C with the more favorable area in the northern

part of the Stansbury Mountains (figure 9), and the sediment-hosted precious metal potential is ranked as A to B with the more favorable zone corresponding to the area of jasperoids in the southern Cedar Mountains (figure 10).

FUTURE WORK

Although the available preliminary data are permissive and even suggestive of buried mineral potential in the southern Skull Valley, additional, more detailed geophysical and geologic work is recommended before testing the area by drilling. The following additional work is suggested:

1. Detailed ground magnetic surveys of the skarn/porphyry copper potential areas to better define the anomalies, and interpretation of the results by a trained metals exploration geophysicist.
2. Additional geophysical surveys (most likely electrical) over more limited target areas selected by the geophysicists to identify alteration, sulfide mineralization, and other characteristics. The actual type of survey selected will depend in part on the presumed depth of cover. If cover is expected to be less than 1,000 feet, an ionization potential (IP) survey may be appropriate.
3. Field mapping and sampling of outcrops within and surrounding the selected target area. Particular emphasis should be on subtle alteration and alteration patterns and distal mineralization (zinc, manganese, barium, and other more "mobile" elements).

The above work should better define any drill targets and increase the ultimate chances for discovery of a minable deposit.

CONCLUSION

Mineral potential exists in the southern Skull Valley for several geologic model types: skarn/porphyry copper deposits, vein/replacement lead-zinc-silver deposits, and disseminated gold-silver deposits. Potential exists on both U.S. Bureau of Land Management land and Skull Valley Goshute Indian Reservation tribal land. The better potential is on the west side of the valley near the proposed railroad corridor.

Skarn/porphyry copper and disseminated gold-silver deposits are typically mined by open pit methods. Most open pits require relatively large areas for both the pit and waste dumps, often several square miles or more. Surface facilities such as railroads, warehouses, and transmission lines could encroach on the

area required for development of the deposit and create access or development problems. If a deposit is found, building of the railroad or other surface facilities over or near the deposit could negatively impact the mineral development of the resource.

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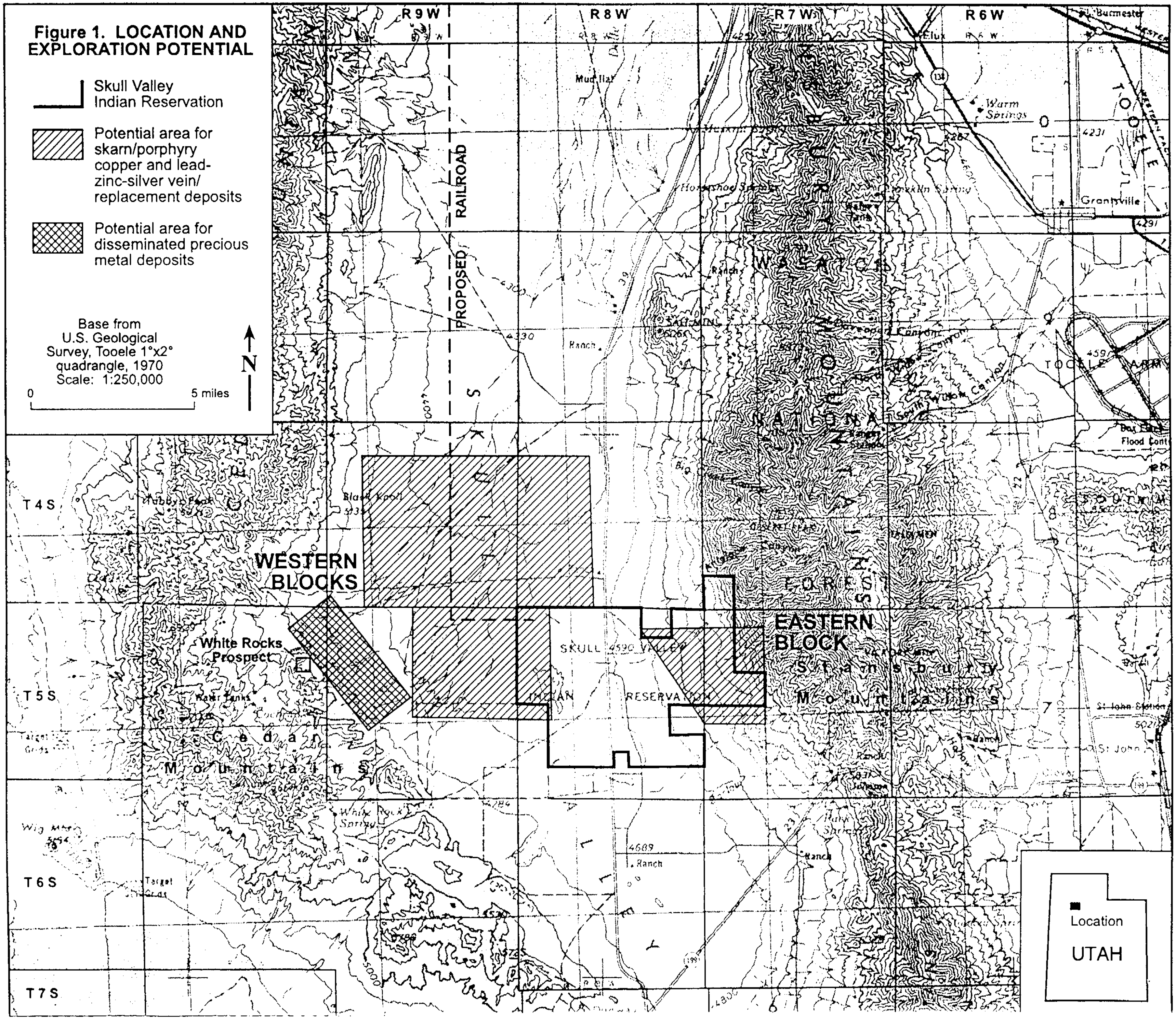

Figure 1. LOCATION AND EXPLORATION POTENTIAL

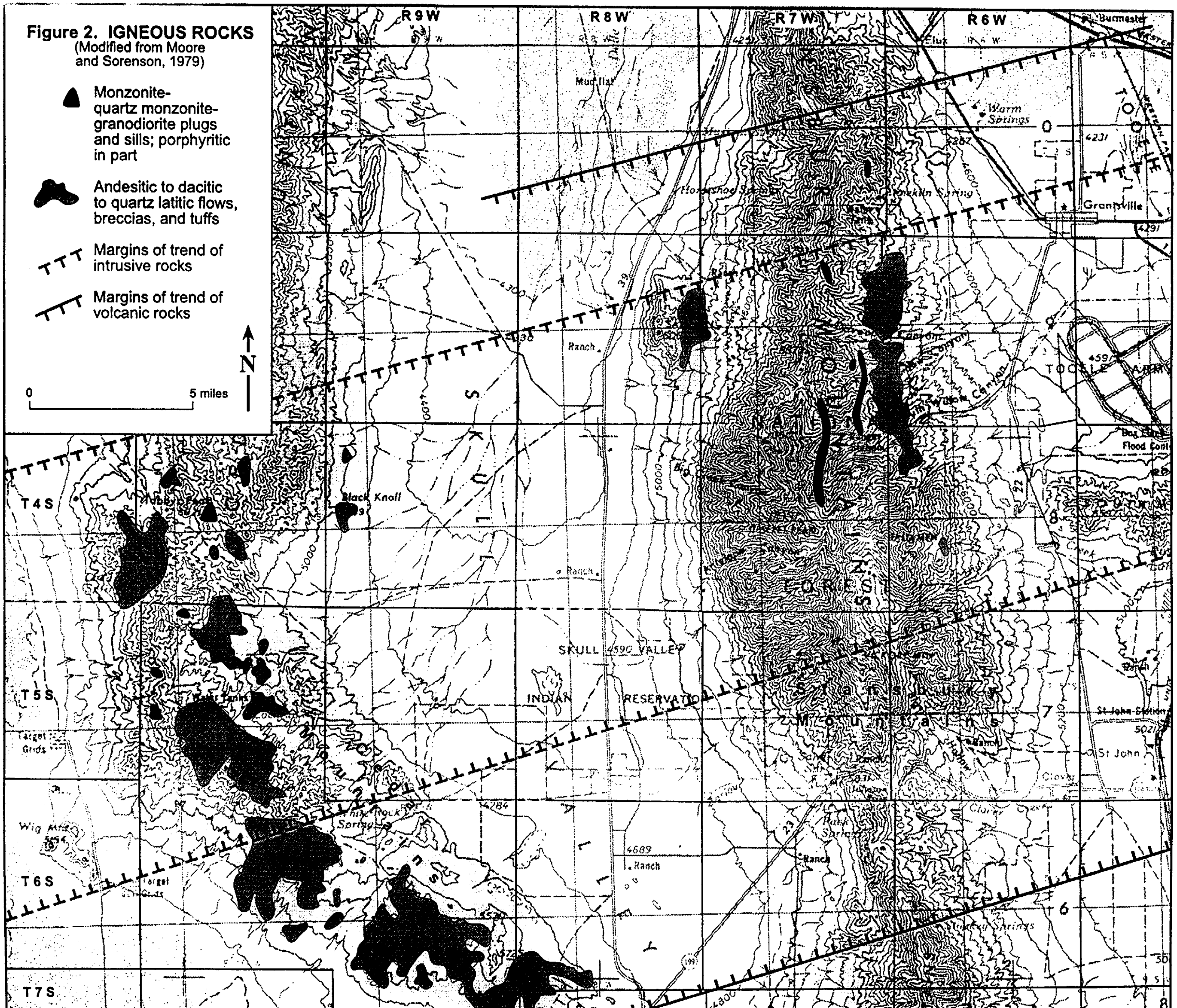

Figure 2. IGNEOUS ROCKS
(Modified from Moore and Sorenson, 1979)

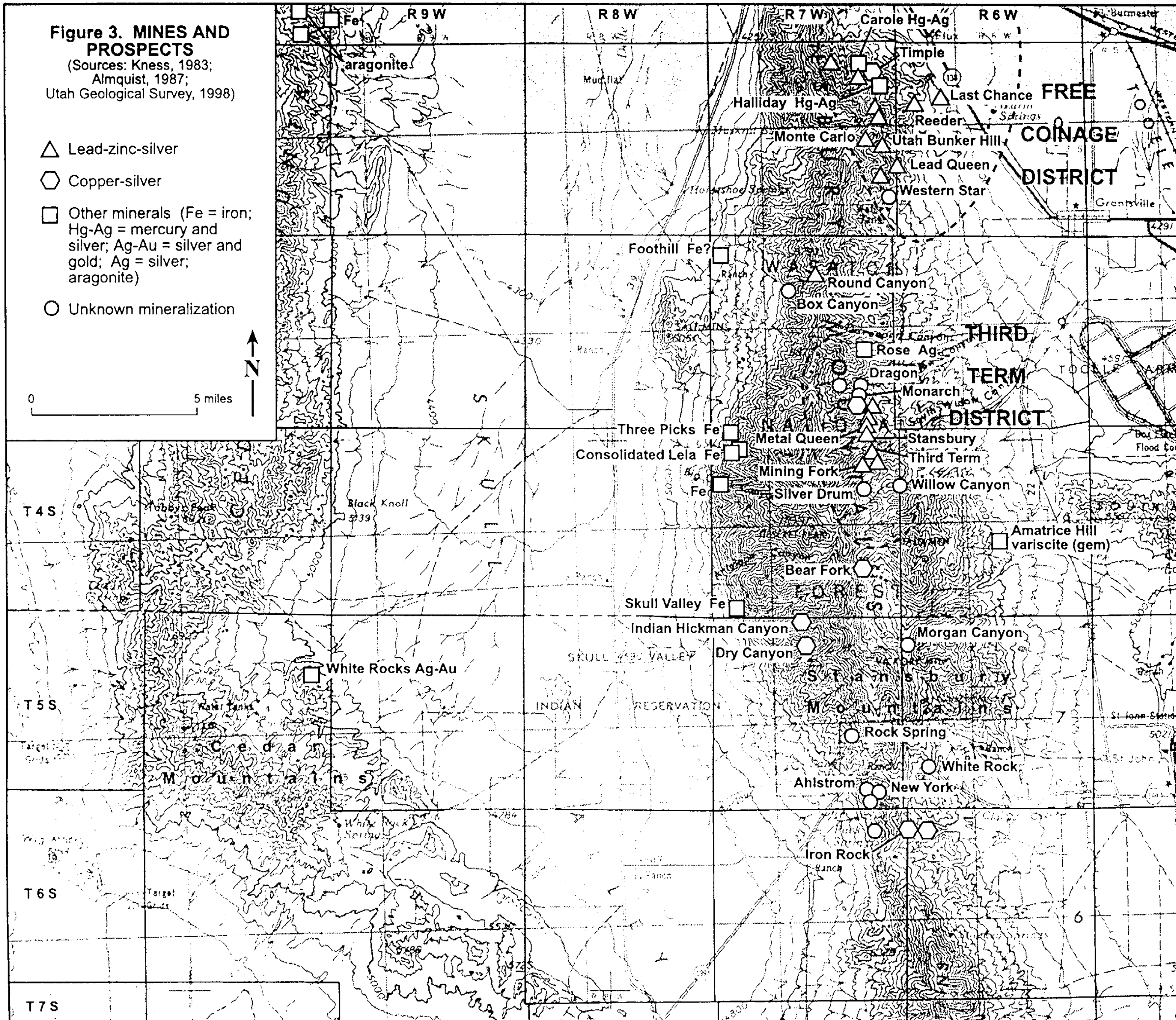

Figure 3. MINES AND PROSPECTS
(Sources: Kness, 1983; Almquist, 1987; Utah Geological Survey, 1998)

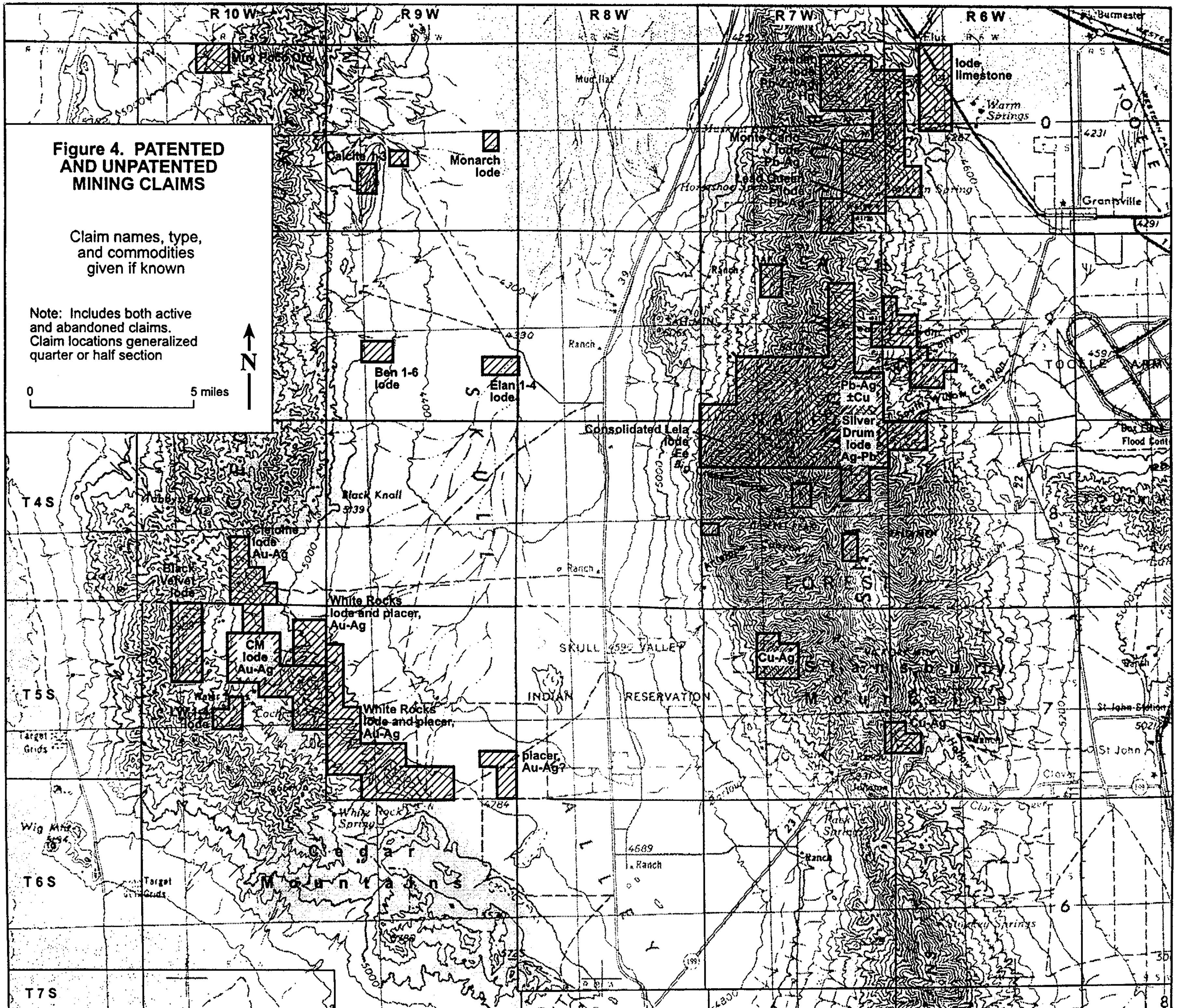

Figure 4. PATENTED AND UNPATENTED MINING CLAIMS
Claim names, type, and commodities given if known
Note: Includes both active and abandoned claims. Claim locations generalized quarter or half section
0
5 miles
N
R 10 W
R 9 W
R 8 W
R 7 W
R 6 W
T 4 S
T 5 S
T 6 S
T 7 S
lode limestone
Monte Carlo lode Pb-Ag
Calcite 1-3
Monarch lode
Ben 1-6 lode
Elan 1-4 lode
Pb-Ag ±Cu
Consolidated Lela lode Fe
Silver Drum lode Ag-Pb
Clarome lode Au-Ag
Black Velvet lode
White Rocks lode and placer, Au-Ag
CM lode Au-Ag
White Rocks lode and placer, Au-Ag
placer, Au-Ag?
Cu-Ag
Cu-Ag
SKULL VALLEY
INDIAN RESERVATION
Grantsville
Warm Springs
Black Knoll
Cedar Mountains

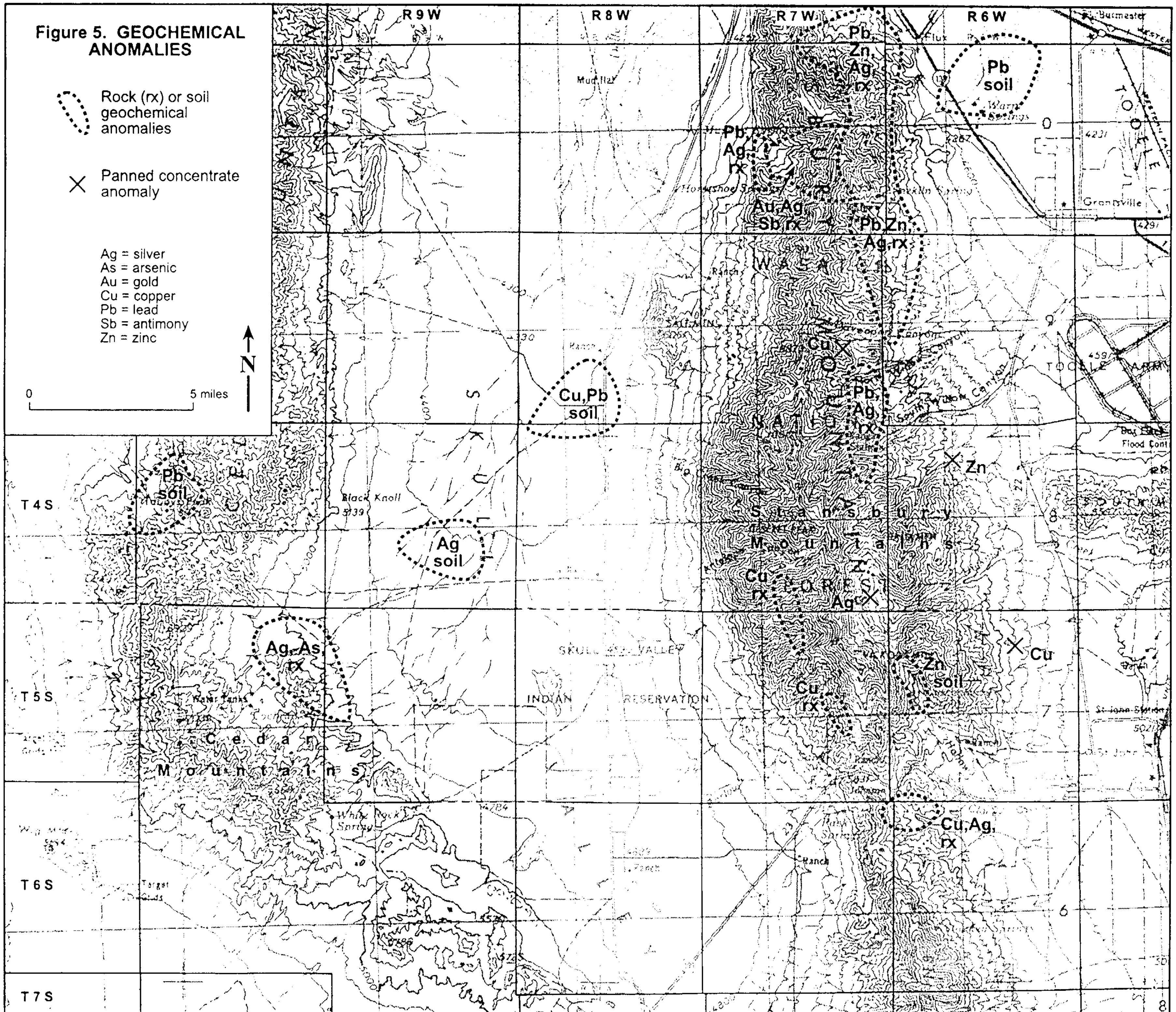
Figure 5. GEOCHEMICAL ANOMALIES
Rock (rx) or soil geochemical anomalies
Panned concentrate anomaly
Ag = silver
As = arsenic
Au = gold
Cu = copper
Pb = lead
Sb = antimony
Zn = zinc
N
0
5 miles
R 9 W
R 8 W
R 7 W
R 6 W
T 4 S
T 5 S
T 6 S
T 7 S
Pb Zn Ag rx
Pb soil
Pb Ag rx
Au,Ag, Sb rx
Pb,Zn, Ag,rx
Cu
Cu,Pb soil
Pb, Ag, rx
Zn
Pb soil
Ag soil
Cu rx
Ag
Ag, As rx
Cu
Zn soil
Cu rx
Cu,Ag, rx
Grantsville
Black Knoll
Skull Valley
Indian Reservation
Stansbury Mountains
Cedar Mountains
Tooele
Tooele Army
Burmester
Flux
Warm Springs
Horseshoe Springs
White Rock Spring
Ranch

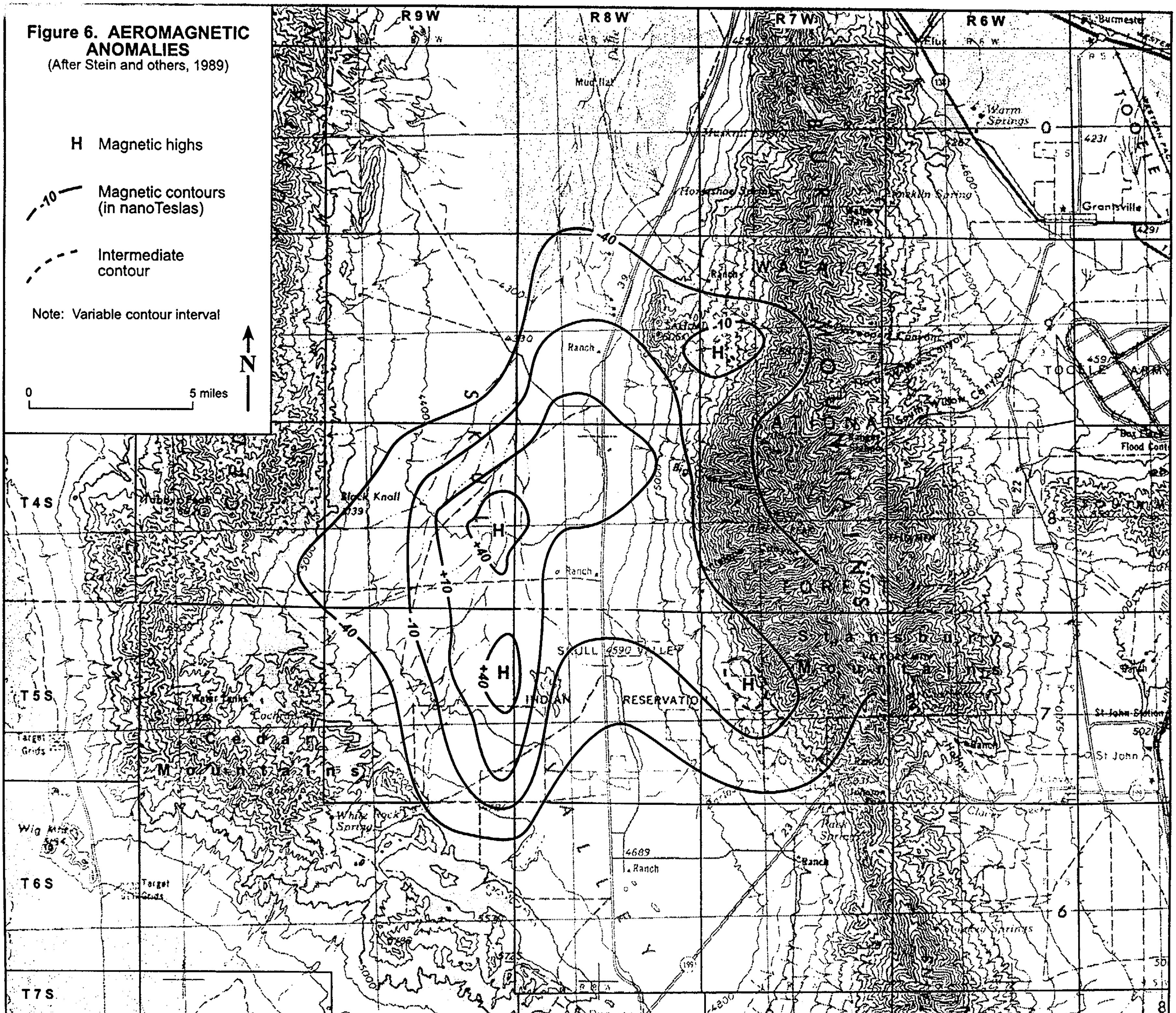

Figure 6. AEROMAGNETIC ANOMALIES
(After Stein and others, 1989)

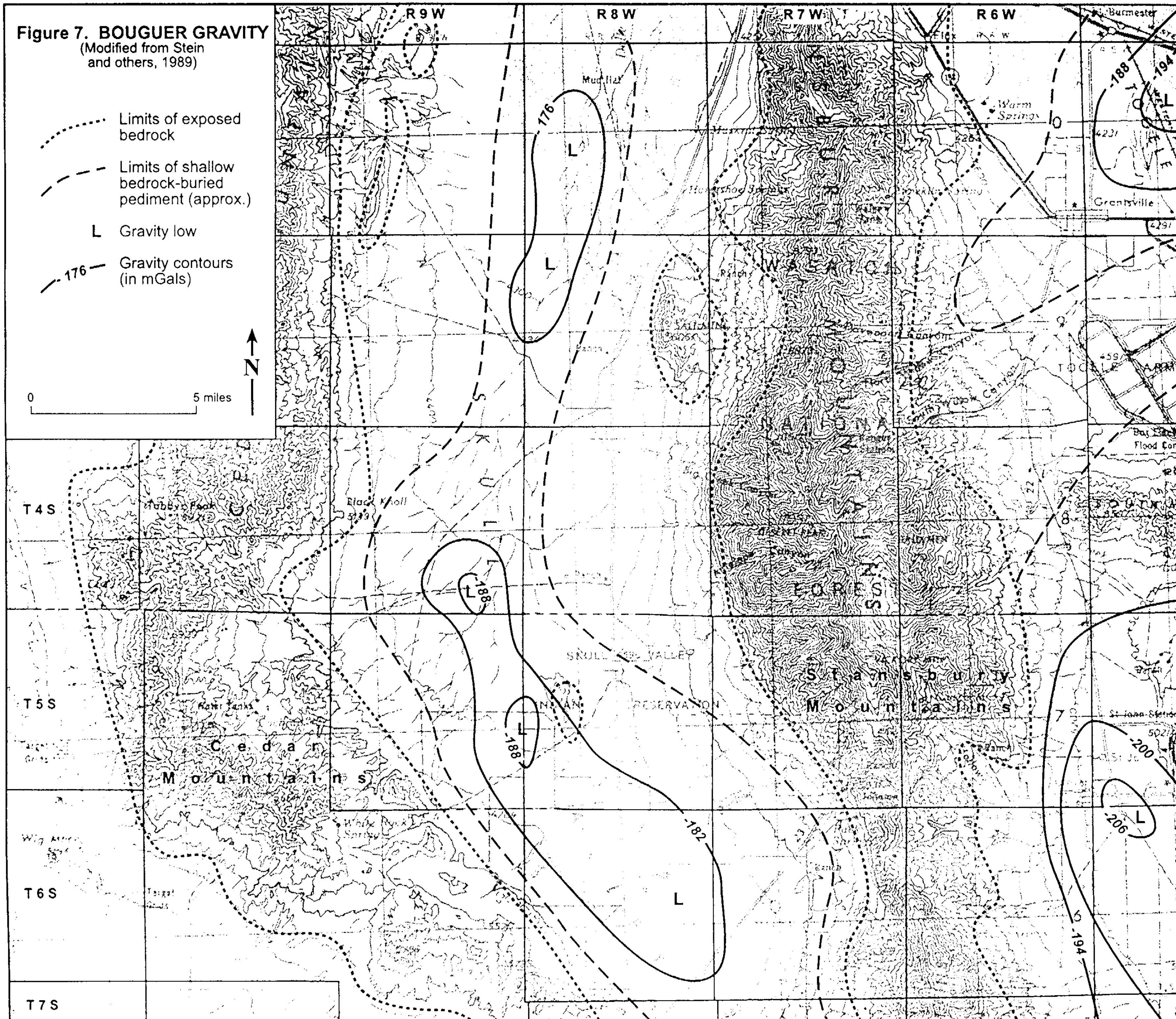

Figure 7. BOUGUER GRAVITY
(Modified from Stein and others, 1989)

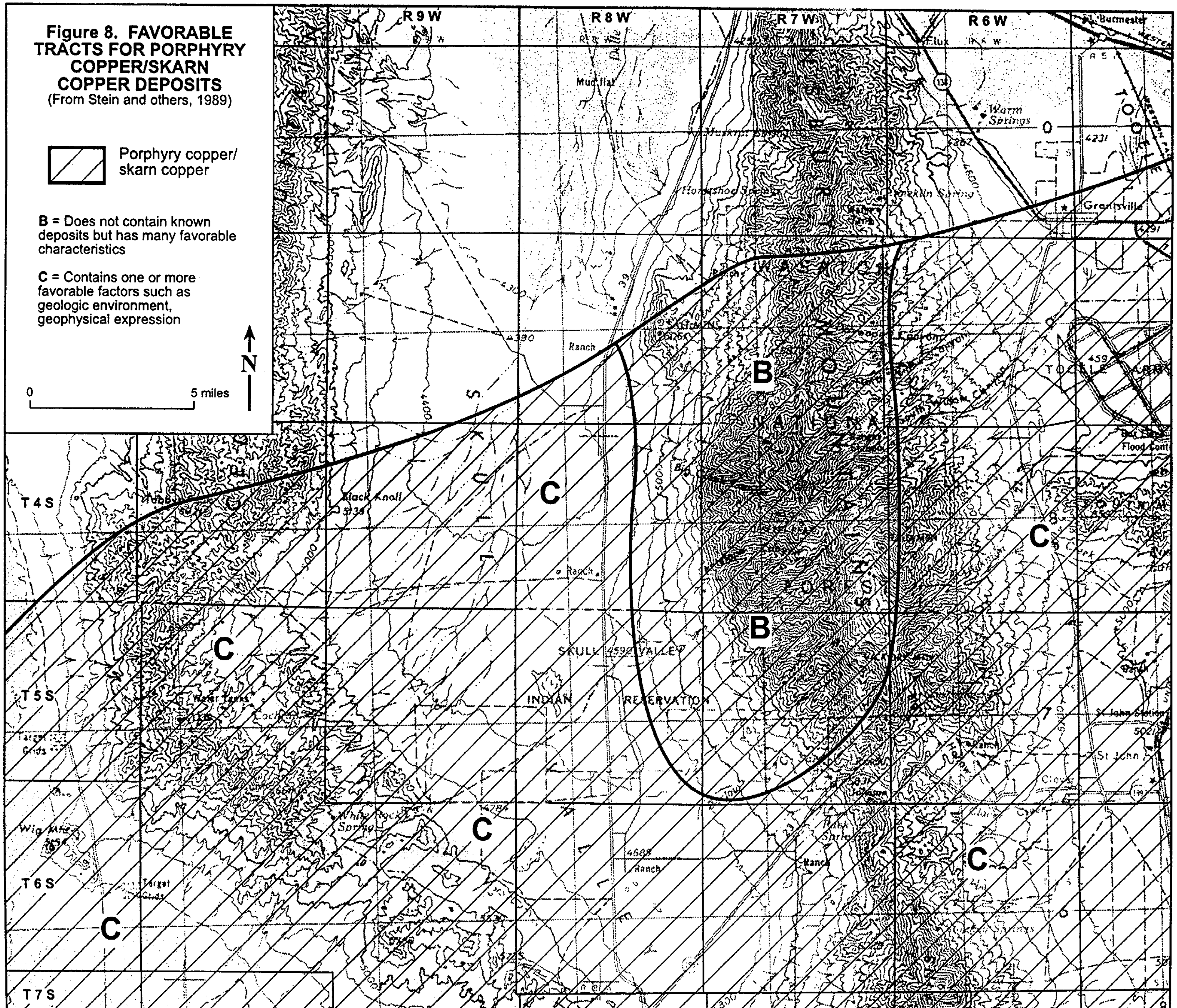

Figure 8. FAVORABLE TRACTS FOR PORPHYRY COPPER/SKARN COPPER DEPOSITS
(From Stein and others, 1989)

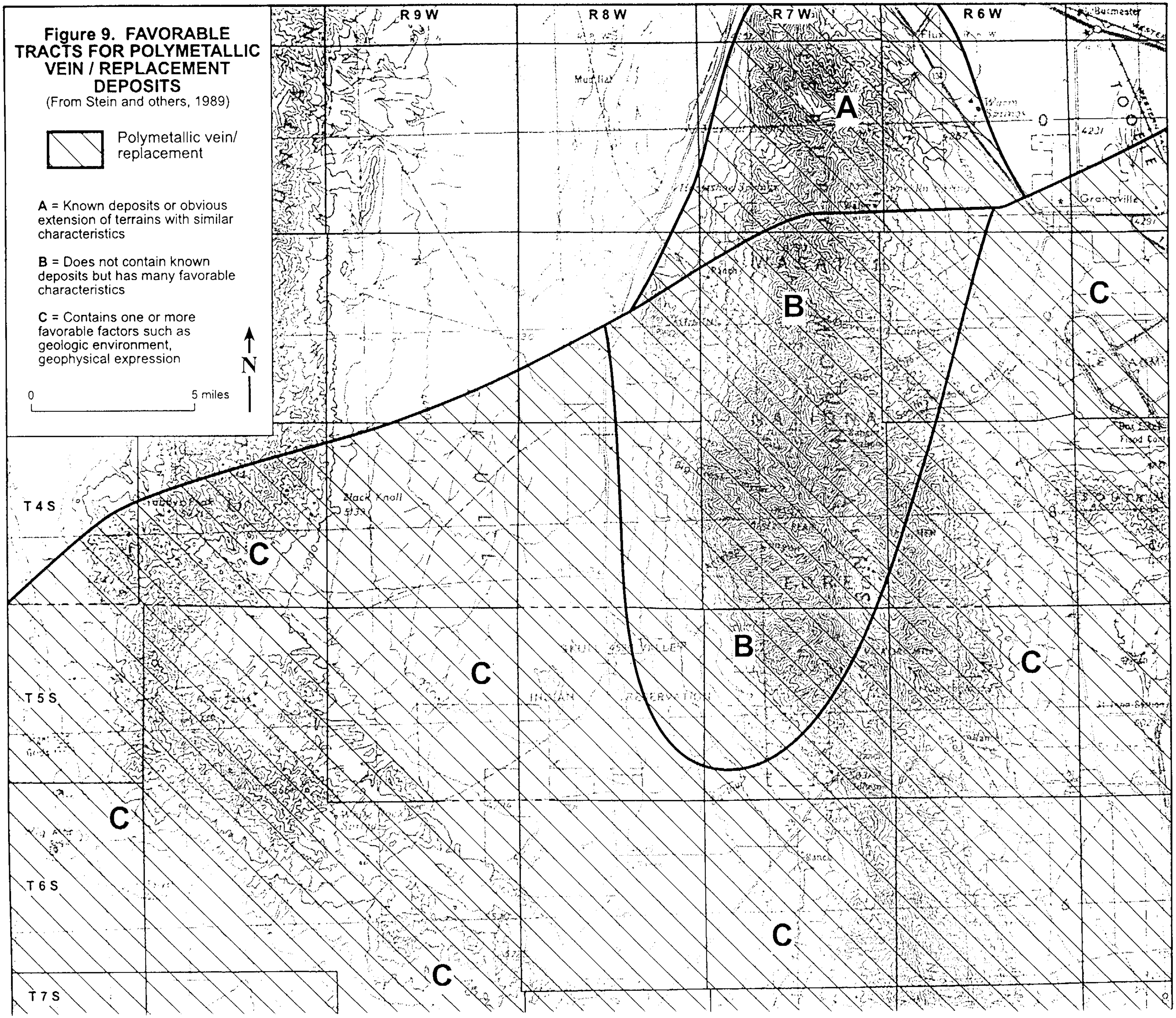

Figure 9. FAVORABLE TRACTS FOR POLYMETALLIC VEIN / REPLACEMENT DEPOSITS
(From Stein and others, 1989)

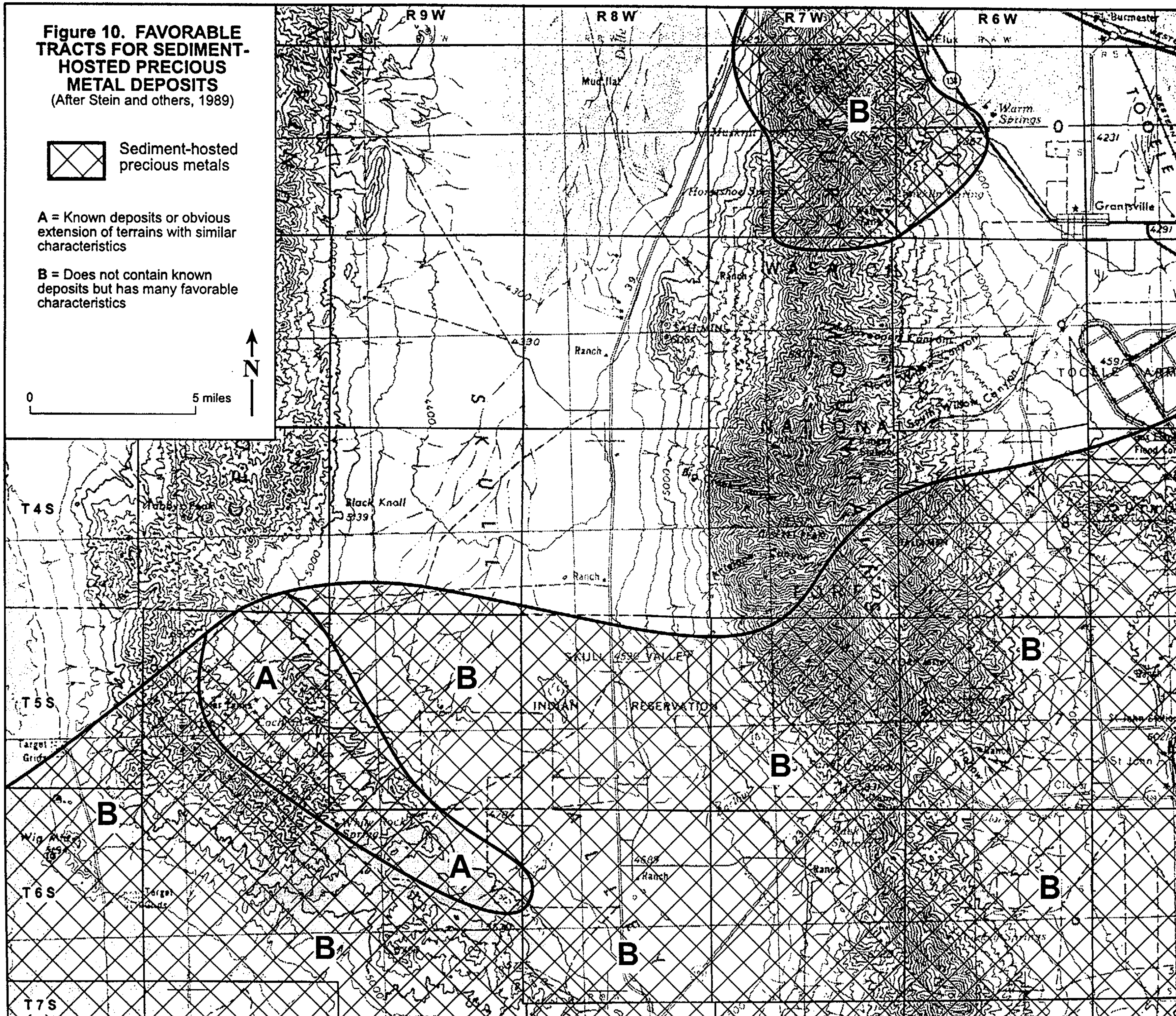

Figure 10. FAVORABLE TRACTS FOR SEDIMENT-HOSTED PRECIOUS METAL DEPOSITS
(After Stein and others, 1989)

State of Utah

DEPARTMENT OF PUBLIC SAFETY
DIVISION OF COMPREHENSIVE EMERGENCY MANAGEMENT

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Earl R. Morris
Director

May 4, 1999

Mr. Scott C. Flanders
Senior Environmental Project Manager
Spent Fuel Project Office
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Flanders:

The Utah Department of Public Safety, Division of Comprehensive Emergency Management (CEM) is the sole State agency designated to mitigate, prepare for, respond to, and recover from the effects of disasters and emergencies throughout Utah. Our vital mission is specifically mandated by Utah statute, and we work closely with local, State and federal agencies, and private sector organizations in the fulfillment of this important work. CEM's long history of service has been recognized to be among the finest in the emergency management field.

As CEM Director, I am appointed as the Governor's Authorized Representative (GAR) in times of emergency and disaster, with specific duties and responsibilities delineated in the State of Utah Emergency Operations Plan that correlate to the Federal Response Plan. I also hold the primary State relationship with the Federal Emergency Management Agency through Region VIII in Denver, Colorado. For example, the GAR coordinates all wildfire suppression activities throughout the State, working closely with the Utah State Forester and the federal Interagency Fire Center.

From this perspective, it is incomprehensible that Private Fuel Storage, L.L.C. (PFS) persists in ignoring the health and safety requirements of the residents of Utah by avoiding contact and coordination with CEM, a posture it has maintained since the inception of its initial proposal to store high-level nuclear waste on the Skull Valley Band, Goshute Indian Reservation in Tooele County. CEM has previously provided extensive oral and written comments during previous public scoping processes related to the PFS proposal, and has directly provided substantial information to PFS and Nuclear Regulatory Commission representatives. To-date, PFS has made no attempt to address any of the critical issues and emergency planning elements brought forth by CEM.

In the absence of PFS' recognition of its responsibility to follow the precedent of "maximum protection" of the public and environment previously established by CEM, and PFS' continuing failure to cooperate, communicate and coordinate with CEM on all emergency management planning requirements, this agency must vigorously oppose any efforts by PFS to establish the high-level nuclear waste storage facility at Skull Valley. Accordingly, CEM expresses its complete lack of confidence in Private Fuel Storage's proposal of this ill-conceived facility that is so clearly not in the best interests of the people of Utah.

Thank you for your consideration and support of our position.

Sincerely,

Earl R. Morris
Director

ERM/dc/ls

cc: Dr. Dianne Nielson, Executive Director
Utah Department of Environmental Quality

Ferris E. Groll, Deputy Commissioner
Utah Department of Public Safety

Mr. Leo Berggen, Resource Advisor
U.S. Department of the Interior
Bureau of Land Management

Mr. Dale Hamberg
Land Operation Officer
U.S. Department of the Interior
Bureau of Indian Affairs