# Allens Ranch quadrangle, North Tintic District, Utah

by Paul Dean Proctor

Utah Geological and Mineral Survey
Open-File Report 69
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# Allens Ranch

# Quadrangle

# Utah

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# ALLENS RANCH QUADRANGLE, UTAH

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## INTRODUCTION

The Allens Ranch quadrangle is just north of the important volcanic rock covered East Tintic mining district of central Utah. Details of the structural deformation of Paleozoic rocks, so important in the covered East Tintic district, and characteristics of fringe-zone wall rock alteration in these rocks, are well expressed in the Allens Ranch quadrangle. An earlier preliminary map (Proctor, 1956) is updated by additional details of structure, stratigraphy, volcanic rocks, and wall rock alteration.

## STRATIGRAPHY

Paleozoic rocks exposed in the Allens Ranch quadrangle total as much as 3,769 meters (12,368 ft.) and closely resemble those of the Tintic mining district (Lindgren and Loughlin, 1919; Morris and Lovering, 1961). These consist mostly of dolomites, limestones, some sandstones, and minor shales. The exposed section includes all systems of the Paleozoic except the Permian. Seventeen Paleozoic formations and several members are recognized and mapped. Cenozoic rocks of Oligocene time lie in angular discordance on the Paleozoic units and include an earlier and later volcanic rock group of rhyolitic ash flow tuffs and breccias and intermediate composition volcanic flow units. Agglomerates, conglomerates, interlayered volcanic flows, and basalt are all of Oligocene age. A thin limestone lies near the top of this section. Pleistocene gravels and fanglomerates, and finer-grained lake sediments, cover parts of the

older rock units. The former make up the main part of Cedar Valley in the center of the quadrangle.

## Cambrian System

Cole Canyon: This rock unit consists of alternating beds of light and dark gray dolomites 10-25 feet thick, and more abundant light colored laminated beds toward the top. Total exposed thickness approaches 153 meters (500 ft.). Exposures are confined to the area of Pinyon Peak in the south central part of the quadrangle.

Opex Formation: This is a relatively thin formation, 30.5 m to 49 m (100-160 ft.) thick, composed of oolitic, pisolitic and sandy gray dolomite. Flat pebble conglomerates are locally present. Exposures are in the south central part of the map area on the north ridge of Pinyon Peak and to the east.

Ajax Dolomite: Best exposed on Pinyon Peak and to the north and east, this 152 m (500 ft.) thick formation is subdivided into lower, Emerald and upper members. These consist of massive gray ledge-maker dolomites, mottled and banded with cherts near the base. Distinctive light colored, coarse grained, massive dolomites make up the Emerald member.

## ORDOVICIAN SYSTEM

Opohonga Formation: Ranging in thickness from 305 m (1000 ft.) in the western part of the quadrangle to less than 152 m (500 ft.) in the eastern portion, this distinctive formation consists of argillaceous streaked, thin-bedded limestone on the west, and mainly dolomites in the east. The latter is probably of

hydrothermal origin. Some cherts are near the base, and local flat-pebble conglomerates are also present in the formation.

Fish Haven Dolomite: Exposures occur along the west central edge, the east central part and in the northeast quarter of the mapped area. Thickness approximates 85 m (280 ft.), with the formation consisting of massive mottled light and dark ledge-maker, fine-grained dolomites and some 1.5 m (5 ft.) thick laminated dolomites. Abundant nodular cherts occur near the base and a distinctive leopard-skin like mottled gray dolomite is at the top.

## ORDOVICIAN-SILURIAN-DEVONIAN

Bluebell Dolomite: With fossils of Ordovician, Silurian, and Devonian age, and poor definitiveness of lithology, this group of dolomites is included in the Bluebell Dolomite. In general the dolomites are dark, thin- to massive-bedded with interbedded wavy laminated beds. The latter may be of algal origin. Thin brown chert stringers occur near the top of the 110-201 m (360-660 ft.) thick formation. It crops out along the southwest side of the quadrangle, near Pinyon Peak and to the north, and in the core of Greeley Hill anticline.

Because of lack of good marker horizons, some local outcrop areas of Bluebell are mapped as undifferentiated. These may include portions of the underlying Ordovician Fish Haven as well as the restricted Bluebell Formation.

## DEVONIAN SYSTEM

Victoria Formation: An unconformity separates the Bluebell Dolomite from the overlying Devonian Victoria Formation. The latter consists of ash gray arenaceous dolomite and minor quartzites, with local conglomeratic and breccia dolo-

mites. The thickness is fairly constant at 75-85 m (248-280 ft.). Exposures occur along the west central boundary, on Pinyon Peak, in the vicinity of the Lehi Tintic mine and north to Greeley shaft, on Wanlass Hill and northeastward on Greeley Hill.

Pinyon Peak Limestone: This formation is the beginning of the major limestone units of the Paleozoic rocks in this area. A blue-gray lithographic limestone, non-fossiliferous is at the base. This is overlain by argillaceous medium-gray fossiliferous limestone toward the top. A sandstone bed, about 1.5 m (5 ft.) thick marks the top of the formation. Thickness is quite variable, from 26-74 m (84-243 ft.), possibly the result of thinning in folded and faulted areas. Best outcrop areas are on Pinyon Peak, the type locality, near Greeley shaft, and on Wanlass and Greeley hills.

## MISSISSIPPIAN SYSTEM

Fitchville Formation: Argillaceous-streaked blue limestones occur at the base of the formation. These change to gray and black cherty dolomites (in the eastern area) and limestones (western area). They are overlain by a sugary dolomite and lithographic limestone. The top of the formation has a 0.6-1.5 m (2-5 ft.) thick wavy laminated bed described as the Curley Bed (Proctor and Clark, 1956). The Fitchville is from 102-163 m (335-535 ft.) thick. Good exposures occur on Pinyon Peak, to the north of Lehi Tintic mine, on Wanlass Hill, and northward on Greeley Hill.

Gardison Formation: Ranging in thickness from 178-207 m (580-680 ft.), this formation is characterized by very fossiliferous limestones. The lower member

is about 122 m (400 ft.) thick and consists of massive to medium-bedded dark to medium gray limestones of fine to medium grain, some showing clastic texture. The upper member, 85 m (280 ft.) thick, is also very fossiliferous blue to gray-blue cherty limestone beds to 1.2 m (4 ft.) thick. Best exposures are in the Blowhole Hill-Greeley Hill areas, southward near the Sego Lily shaft and along the mountain front north of the Lehi Tintic mine. The type locality is on Gardison Ridge on the west central boundary of the quadrangle (Morris and Lovering, 1961).

Deseret Limestone: Two major lithologies characterize this formation. The lower parts consist of about 38 m (125 ft.) of orange-weathering phosphatic shales, dolomites, and cherts. The upper part of the formation is made up of dark gray to blue limestones with abundant nodular and bedded cherts. The base of the upper member consists of well developed sand-streaked limestones, often with conspicuous cross-layered primary structures. The formation is 219-288 m (718-945 ft.) thick. Good exposures are in the western and southwestern parts of the quadrangle, in the Lehi Tintic, Tintic Delmar, Sego Lily mine areas, on Blowhole Hill and Greeley Hill. The latter are mainly underlain by the formation.

Humbug Formation: This distinctive formation consists of alternating brown sandstone, orthoquartzites, and blue to bluish gray relatively sand-free limestones and encrinites. Cross-layering is common. The formation is 274 m (900 ft.) thick. It is well exposed along the west central boundary, near Bismark Hill, east of Davis Canyon, just west of Rattlesnake Pass and along the eastern boundary of Wanlass Hill, Reservoir Hill, and in the southeastern portion of the quadrangle.

Great Blue Formation: Originally described to the north in the Mercur-Ophir district (Gilluly, 1932), this formation crops out extensively in the southwestern part of the quadrangle, and the extreme northeastern portion. Four members are recognized (Morris and Lovering, 1961): The Topliff lower limestone some 76 m (250 ft.) thick; Paymaster chertiferous blue to brown weathering fossiliferous limestone, with some brown weathering interbedded fossiliferous limestones and shales, all about 187 m (600 ft.) thick; the Chiulos member 281 m (900) ft.) thick of black to olive drab shales and lesser limestones and overlying brown cross-bedded quartzite; and the uppermost Poker Knoll member of dark gray to tan, weathering dolomites, dolomitic limestones, black cherts and black shales only partly exposed and about 200 feet thick. The formation is mainly confined to the Chiulos Canyon and Bismark Hill areas in the southwestern part of the quadrangle and north of Greeley Hill.

## PENNSYLVANIAN SYSTEM

Manning Canyon Shale: While not exposed, the presence of the overlying formation and extensive Lake Bonneville silt cover suggests this formation may be present in the northwestern part of the area west of Ten Mill Hill. No thicknesses are measurable in this area.

Oquirrh Formation: This is a formation of unusually great thickness as described by Gilluly (1932). Three hills in the northwestern part of the quadrangle are underlain by it. The middle part of the formation (Morris and Lovering, 1961) resembles the Humbug Formation in the alternating limestone-sandstone sequence. The lower, unexposed portion consists mainly of thin to medium bedded limestones somewhat argillaceous and medium to massive bedded

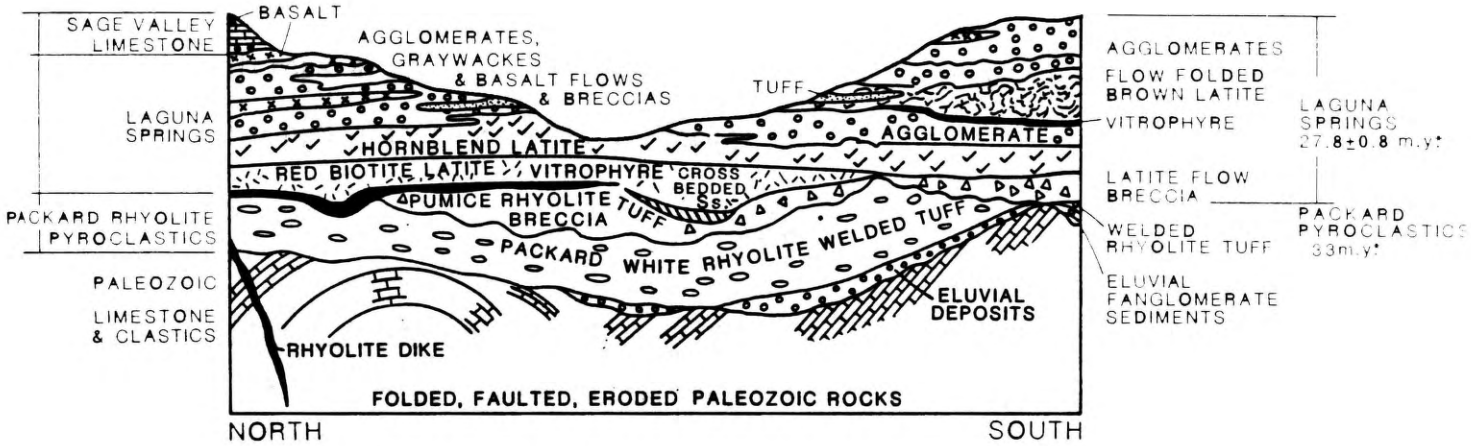
coarse grained limestones about 1550 feet thick (Ibid, p. 115). Pennsylvanian fossils, especially the fusulinids, distinguish the rock unit. Within the quadrangle as much as 609 m (200 ft.) of the middle part of the formation is exposed in the Ten Mill Hill area. The unit probably underlies the north central part of Cedar Valley.

## Cenezoic Tertiary System

Packard Rhyolite: A Tertiary rhyolitic ash flow and pumice tuff-breccia lie in angular discordance with the folded, faulted and deeply eroded Paleozoic rocks. Relief of several hundred feed is buried beneath the volcanic rock units. In some localities a probable Eocene(?) eluvial to fanglomerate-like limestone unit occurs beneath the Tertiary volcanic sequence and directly on the Paleozoic rocks.

The lower Tertiary volcanic unit is a white to gray rhyolite ash flow up to 152 m (550 ft.) thick. Greatest thicknes is in the southern part of the quadrangle, and the unit thins rapidly northward. It contains some lithics, minor pumice, and includes distinctive bi-pyramidal, beta-quartz phenocrysts and some feldspar in a dense devitrified to glassy matrix. Biotite, while present, is less abundant.

In the central part of the area, the rhyolitic ash flow is overlain by a grayish-brown pumice tuff breccia to 38 m (125 ft.) thick. Clasts of pumice slightly to non-compressed and up to 20 cm (8 in.) across lie within a finer-grained breccia matrix. In Chimney Rock Pass distinctive resistant weathering forms, carved by wind and water, stand out in base relief. The curved and scalloped forms are preserved by a thin resistant surface skin which forms on the softer material below. See Figure 1.




* Laughlin et al., 1969

Figure 1. Schematic drawing of volcanic units and sedimentary rocks in the Allens Ranch quadrangle.

Laguna Springs Formation: Latites, tuff-breccias, graywackes, agglomerates, and conglomerates and some interlayered basalts and limestones totaling over 609 m (2000 ft.) thick make up the Laguna Spring Formation. This lies on an erosion surface cut on the underlying Packard ash flow and tuff breccia, and also on the Paleozoic rocks. This flat to gently north and easterly inclined formation occurs in subdued outcrop forms in the central and eastern parts of the quadrangle and extends southward into the East Tintic district (Morris, 1964). Some clasts in the conglomerates are of altered latite, others are mainly of varied volcanic rock composition, including vitropheres. Latite clasts may reach 1 m (3 ft.) or more in diameter and are not uncommon in parts of the area. Good outcrops are rare and the formation is best recognized by the abundant weathered-out clasts of volcanic rocks.

## Pleistocene

Lake Bonneville Sediments: Lake Bonneville sediments consist of an older series of gravels making up a spit in the Reservoir Pass area. This ranges to 23 m (75 ft.) thick and lies at 4975 feet elevation. An even thicker series of gravels has been deposited above these and ranges to 26 m (85 ft.) thick, in a spit-like form over 1000 feet in length. Both spits curve gently northeasterly or easterly across the west entrance of the pass. Other gravels form bar-like masses between Blowhole Hill and Greeley Hill and Blowhole Hill and Rattlesnake Pass west hill. Gravels also occur along the margin of these hills, probably as rubble swept into the former lake by water draining off the hills. Wave-cut terraces, some capped by partly consolidated gravels occur along the northwest and north sides of the hills in the northeast part of the quadrangle. West and

northwest of Allens Ranch homesite a conspicuous, but subdued, wave cut cliff runs several thousand feet northwesterly at about the 5135 foot elevation. This is cut into a series of older, probable Pleistocene fanglomerates prominently developed along the western, southern, and southeastern sides of Cedar Valley. Gravel terraces of about the same age extend southwestward into Chiulos Canyon. While wave-cut terraces of Lake Bonneville origin are well developed in the southeastern part of the quadrangle, the gravels on the terraces are mainly reworked clasts of the Laguna Springs Formation by wave action of the former lake.

The main portion of Cedar Valley is covered by fine-grained, tannish brown silts with local gravel lenses in and on them. The silts represent sediments of the former shallow embayment of Lake Bonneville from an elevation of about 5135 feet to just less than 4900 feet in this area. The central part of the valley has several 1-1.2 m (3-4 ft.) rises of arcuate shape, concave northward. These consist of disc-like pebbles up to 5 cm (2 in.) in diameter. They represent offshore bars, and standstill positions of the former lake. Elevations of these bars correspond to the wave-cut terraces on the bedrock hills to the east and northeast.

## STRUCTURAL GEOLOGY

Fold Blocks: Four structural blocks of folded and faulted sedimentary rocks occur within the area (Fig. 2). In the southwest part, in the Tintic Paymaster-Bismark Hill Block, the Mississippian rocks are folded into series of north trending anticlines and synclines, somewhat asymmetric in form and with doubly to north plunging characteristics. The anticlines have steeper east

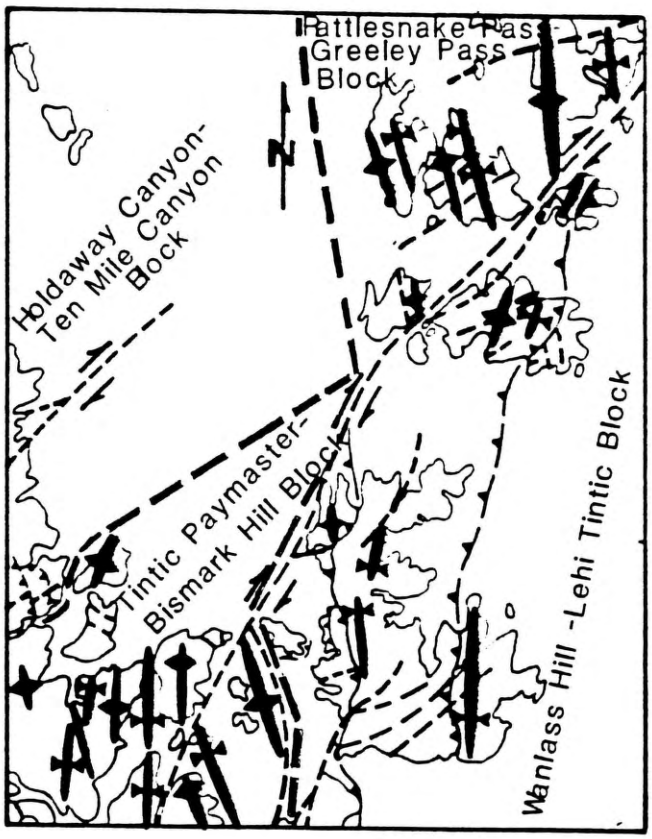



Figure 2 . The four major structural blocks within the Allens Ranch quadrangle.

limbs. Faults of northerly, northeasterly and northwesterly trends cut these folded rock units. The eastern boundary of the block is the Cedar Valley fault of northeasterly bearing. This diagonally cuts the quadrangle from the south to the north border.

Just to the north and west of the block is the Holdaway Canyon-Ten Mile Hill Block. Here the Paleozoic rocks along the western border are steeply inclined and form the steep to slightly overturned east limb of the North Tintic anticline (Disbrow, 1961). The steeply dipping limb at the south ends against an easterly-bearing tear fault in Holdaway Canyon. The latter fault bears to the east, turns abruptly northward, becomes a thrust fault and trends north-northwesterly until it leaves the quadrangle 4000 feet north of Holdaway Canyon. The rocks of this anticlinal limb range in age from Cambrian to Pennsylvanian.

The Rattlesnake Pass-Greeley Pass Block consists of paired anticlines and synclines of northerly trend of mainly Mississippian rocks. Older rocks are exposed in an anticlinal core on Greeley Hill. The folds are slightly asymmetic with steeper limbs of the anticlines on the east. Faults of northeasterly to east-northeast bearing cut these folds, and show some strike-slip movement. Some normal displacement is also present. The structural block is bounded by the Cedar Valley fault on the southeast.

The Wanlass Hill-Lehi Tintic structural block is the most complex of the four. It is bounded on the northwest by the Cedar Valley Fault. Along this fault, Paleozoic rocks within the southeast block are upturned, even slightly overturned eastward. Some rocks as old as Cambrian are exposed just southeast of Blowhole Hill. Similar structural conditions, but with younger rocks, occur along the northwest side of Wanlass Hill.

Small anticlines and synclines make up Reservoir Hill, but their axial bearings are strongly northeastward parallel to the trend of the Cedar Valley fault. Wanlass Hill is a large anticline of northerly trend with the east limb vertical to overturned eastward. It is cut by a moderately west dipping fault on the east, and several steeply dipping northeasterly bearing faults. Some of the latter are characterized by development of hydrothermal dolomite along them.

South of Chimney Rock Pass the Paleozoic rocks are folded into anticlines and synclines spatially related to a least two well-developed thrust faults. North of Greeley shaft an overturned anticline is floored by a small thrust fault which bears south. The latter turns abruptly westerly and becomes a tear fault. South of the intensely dolomitized rocks along this tear fault a prominent thrust fault bears southerly to the Lehi Tintic Mine area. Ordovician, Silurian, and Devonian rocks lie above Mississippian rocks in thrust block relationship in this area. The Mississippian rocks have been tightly folded into an easterly overturned asymmetric syncline. The rock units form rampart-like walls on the skyline.

South of the Lehi Tintic Mine, the thrust fault is faulted and displaced westward. It continues southward toward Pinyon Peak where it is covered by younger latites and rhyolites.

About one mile east of the Lehi Tintic thrust zone, beds of Cambrian, Ordovician, Silurian, and Devonian age are thrust eastward over Mississippian rocks. The latter are overturned sharply to slightly eastward near the Tintic Delmar shaft area. The folds and thrust are cut by northeasterly bearing faults of steep dip which show both normal and right-lateral displacements. This thrust, termed the Allens Ranch, bears northerly and is covered by younger

volcanic rocks. It may represent the East Tintic thrust (Morris, 1964; Proctor, 1951) well known as a loci of deposition for the recently discovered rich ore deposits of the East Tintic mining district where northeasterly ore-bearing fault channels intersect it.

The Cedar Valley fault, which essentially diagonally divides the quadrangle, is rather unique. It is at least 10 miles in length and is mainly hidden beneath valley fill. It is expressed by the juxtaposition of non-matching formations and structures along its trend. The presence of upended older rock units, some overturned to the east on the southeastern block, suggests an upward moving western block. Yet, fold axes trends and bed directions adjacent to the fault indicate a right lateral displacement along the fault. To the southwest near Bismark Hill the displacement suggests the beds on the west block have been downdropped. The overall view of the fault is a scissor-like displacement with the fulcrum near Rattlesnake Pass. Earlier movement may have been of right lateral type resulting in the drag of the fold axes to the northeast in the Reservoir Hill area. The fault also acted as a channelway for hydrothermal fluids as indicated by limonitic staining of the Packard Rhyolite and ferruginous calcite development in older Paleozoic rocks near the Greeley shaft.

## Wall Rock Alteration and Metallization

The Allens Ranch quadrangle is part of the North Tintic mining district. The Lehi Tintic mine and Selma mines areas are best known. Both of these are related to the Selma fault zone of northerly to northeasterly trend. More important geologically than the relatively small ore production from these mines

is the well developed wall rock alteration in the carbonate rocks (Proctor, 1964). This represents fringe zone carbonate wall rock alteration to a major mining district. The type and character has important implications in the search for other mining districts in carbonate rocks.

Lovering et al (1949) recognized several stages of wall rock alteration in the East Tintic district, just south of Allens Ranch quadrangle. Within the fringe area in the Paleozoic carbonate rocks in the mapped area, five correlative alteration stages to Lovering et al. are present. These include: early hydrothermal dolomitization, argillic alteration, jasperoidization and silicification, ferruginous calcite, and a final stage of metallization.

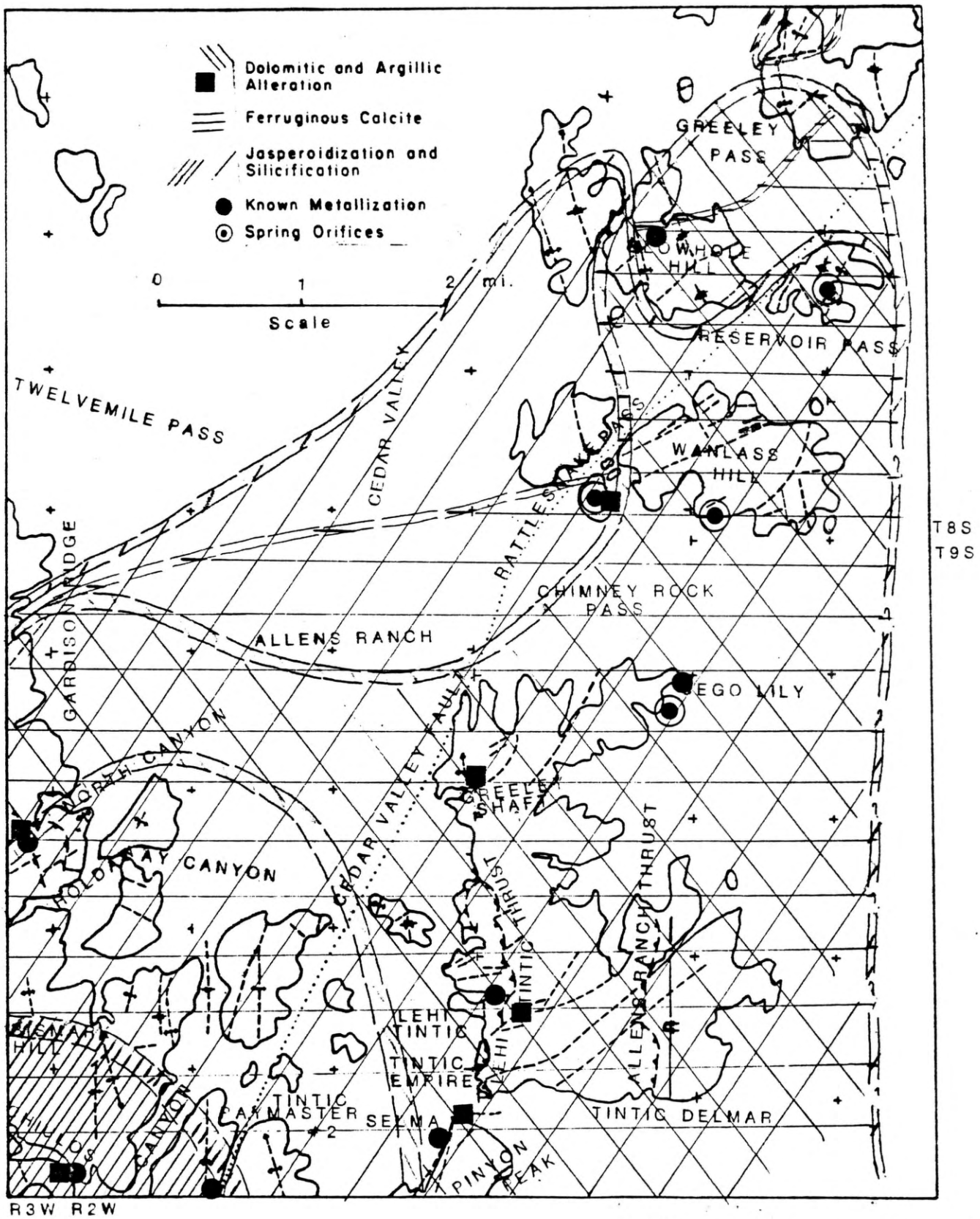
The five stages of carbonate wall rock alteration are mainly structurally controlled by faults. These acted as channelways for the hydrothermal fluids. Intensity of alteration is greatest in the southern part of the quadrangle, and nearest the main mining district. In this area stratigraphic replacement by altering fluids is locally prominent, and fault control, while important, involves lesser quantities of rock. To the north and east, faults become the main control and stratigraphy while locally altered is less quantitatively affected.

In general, each of the wall rock alteration types forms a roughly concentric pattern, convex northeastward about the main Tintic mining district. The least expansive of the zones is argillic. This is mainly restricted to the southern portions of the quadrangle. Hydrothermal dolomite, the earliest of wall rock alteration affects stratigraphy in the south and forms a broadly concentric pattern of alteration in the carbonate rocks, with less extensivity in the northeastern parts of the area. Jasperoidization and silicification are

best developed in the southwestern part of the quadrangle. Here the alteration changes from massive jasperoid replacements of Mississippian rocks in Chiulos canyon to fine-grained gray quartz-jasperoid and calcite shoot-like masses along fault zones. Locally, banded calcite with lesser jasper in the zones occur in circular to subcircular replacement and filling masses in the carbonate rock. The regional pattern is one of a broad crescentic band convex to the north, but mainly restricted to the southern part of the area. This band is imposed upon the earlier and broader band of dolomitization.

Second most extensive wall rock alteration and latest image is ferruginous calcite. This consists of crystalline calcite dusted with fine-grained hematite. Cream, golden and white calcite fissure and replacement masses, possibly just later in age, are associated with the reddish to pinkish ferruginous calcite replacement masses, fissure-like masses, and what appears to be hot spring orifice fillings. The ferruginous calcite wall-rock alteration is widespread, and best developed north of the Selma mine, and near the Lehi Tintic mine, and Greeley shaft area. Spring-like orifices occur near the Sego Lily shaft, on east Wanlass Hill, south Wanlass Hill, just east of Rattlesnake Pass on the small limestone hill, and on Reservoir Hill. These openings to several feet in diameter, contain mammilary-like encrustations on the host rock and within a former spring orifice in the carbonate rocks. The internal structure is banded with ferruginous calcite, white calcite, and manganese-oxide-iron oxide, inches to feet in thickness. Locally, jasperoid bands are interlayered with the calcite suggesting a close time relationship between the two.

Metallization, the last of the stages of alteration, occurs at the Selma mine, the Lehi Tintic mine, at the Tintic Humboldt prospect in North Canyon, and




Modified from Proctor, 1964

Figure 3. Zones of wallrock alteration and metallization, Allens Ranch quadrangle.

at the Deprezzin shaft in Chiulos Canyon. Small galena-quartz dolomite showings also occur on Blowhole Hill. Minor mineralization is reported in Davis Canyon. Small commercial production of lead-zinc and some silver came from oxidized lead-zinc fissure and replacement bodies in the Lehi Tintic mine associated with prominent ferruginous calcite wall rock alteration.

The types of wall rock alteration, their general concentric pattern just north of the main Tintic mining district, increasing intensity toward the latter, and the sequence of wall rock alteration stages show promise of use in the search for hidden mining districts. Such application is possible when only portions of the wall rock alteration may be exposed in limited outcrops and a pattern can be predicted which would be peripheral to the buried or hidden district.

Figure 3 is a shematic map showing the zones containing the various wall rock alteration types, location of known metallization, and the known former hot spring orifices.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ALLENS RANCH QUADRANGLE
UTAH—UTAH CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 FIVEMILE PASS 15' QUADRANGLE

GEOLOGY BY PAUL DEAN PROCTOR 1950-51, 84-85.

Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1943 and planetable surveys 1947
Polyconic projection. 1927 North American datum
10,000-foot grid ticks: Utah coordinate system, central zone
To place on the predicted North American Datum 1983 move the projection lines 8 meters north and 46 meters east as shown by dashed corner ticks
Field photoinspected 1975
No major culture or drainage changes observed

SCALE 1:24 000

CONTOUR INTERVAL 25 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

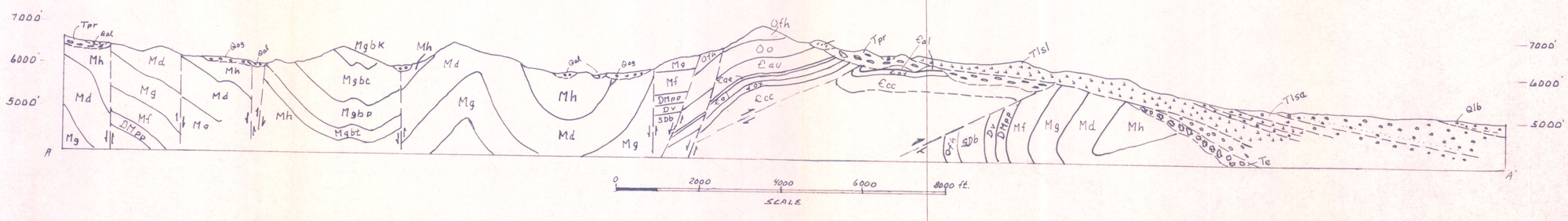
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Light-duty — Unimproved dirt

QUADRANGLE LOCATION

ALLENS RANCH, UTAH
SE/4 FIVEMILE PASS 15' QUADRANGLE
N4000—W11200/7.5

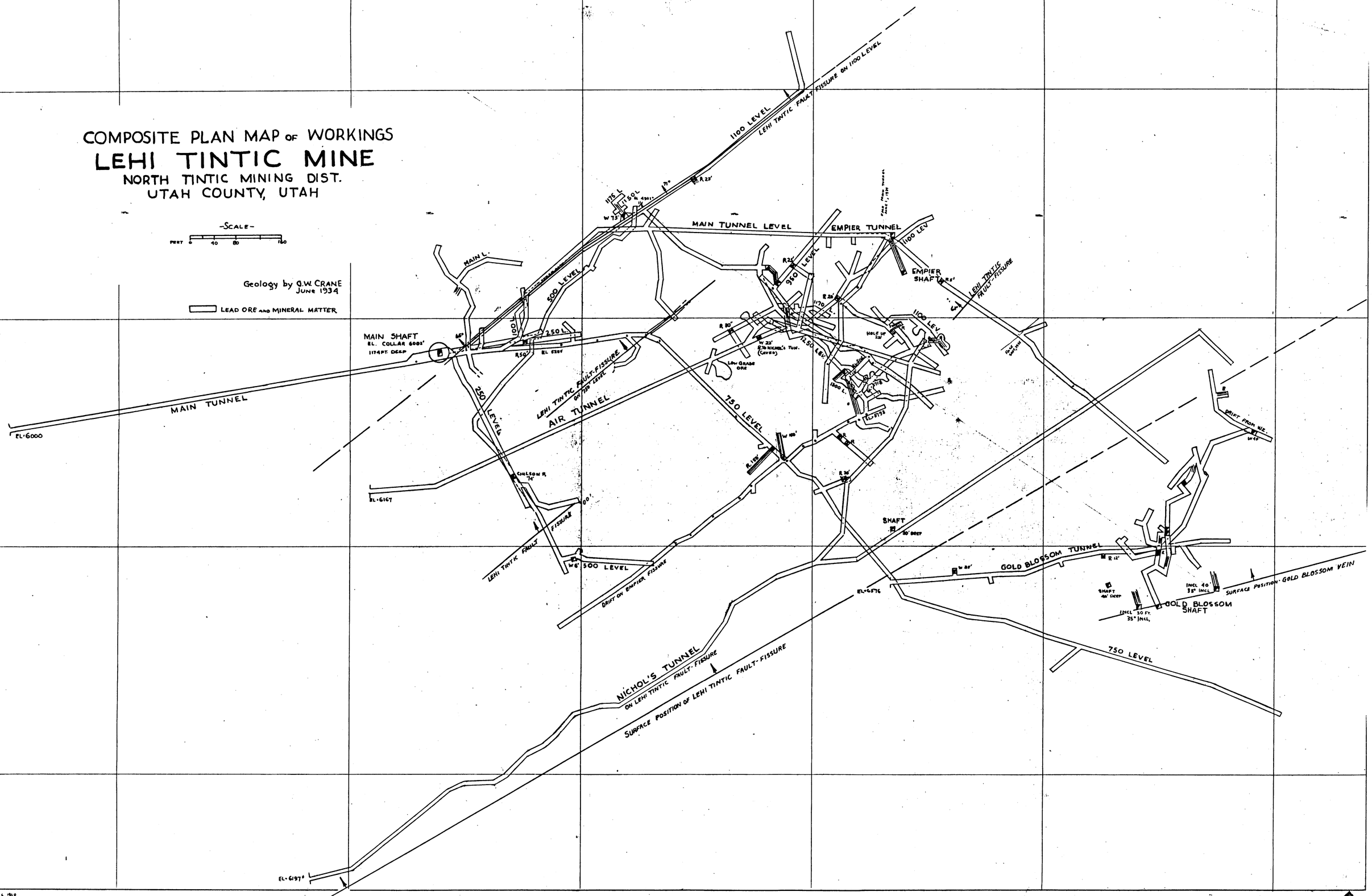
1947
PHOTOREVISED 1969
DMA 3564 II SE—SERIES V897
PHOTOINSPECTED 1975




GEOLOGIC CROSS-SECTION - SOUTH BOUNDARY - ALLENS RANCH QUADRANGLE

Utah Geological + Mineral Survey
Open-File Report 69

# COMPOSITE PLAN MAP OF WORKINGS
# LEHI TINTIC MINE
## NORTH TINTIC MINING DIST.
## UTAH COUNTY, UTAH




BY JOHN L. EMISH SEPT 6, 1950