

THE APEX MINE
A TSUMEB TYPE DEPOSIT?

Washington County, Utah

A preliminary comparison of the Apex mine with other deposits known to contain gallium and germanium has revealed a number of striking similarities which have important implications for further exploration at the Apex mine and surrounding prospects. The attached table and cross sections supplement the brief descriptions of the three deposits discussed below. It should be stressed that these data are preliminary, and will undoubtedly be refined and revised as more information becomes available.

Bernstein (1986) has noted that the inferred primary mineralization at the Apex mine would resemble sulfide ore at Tsumeb, Namibia; Kipushi, Zaire; and Ruby Creek, Alaska. The Tsumeb mine in northern Namibia is a world-class deposit which during the period 1905-1979 produced 20.5 million tons of ore averaging 4.8% copper, 12.7% lead, 4.7% zinc and 1.05 oz/ton silver (Stheeman, 1982). The value of this ore at current metal prices, excluding significant credits in germanium and cadmium, is in excess of 5 billion dollars.

The deposit was formerly thought to be a classic example of an igneous-related breccia pipe (Guilbert and Park, 1986; Sohng, 1964). However, Button and Tyler (1981) have recently suggested that Tsumeb is a paleo-sinkhole filled by arenites (from the overlying Mulden arkose) and carbonate breccias, a conclusion much more compatible with geologic evidence currently available.

The geologic setting of the Tsumeb and Apex mines are strikingly similar. Two of the most notable features at Tsumeb are the vertical extent of mineralization (more than 5500 feet) and the increase in size and grade of ore with depth. Inspection of the cross sections shows that the size of the Tsumeb orebody in its upper levels is similar to the Apex mine to its current level of exploration at 1400 feet. Tsumeb produced 2.5 million tons in its upper 1890 feet; Apex has inferred reserves of about 1 million tons to a depth of 1400 feet.

Although information on the Kipushi deposit in Zaire is scanty, it appears to share many of the features common to the Tsumeb and Apex mines. These known deposits, and undoubtedly others which remain undiscovered, have a number of unifying characteristics:

1. Carbonate host rocks near margins of sedimentary basins.
2. Initial ground preparation at least in part due to solution collapse in a karst environment.
3. Distinctive sulfide assemblage containing Cu-Pb-Zn-Ag-As-Sb-Ga-Ge, with great vertical continuity and deep oxidation.
4. Mineralization in form of annular pipes, chimneys, and/or mantos where solutions encounter horizons favorable for replacement.
5. Absence of igneous rocks in mineralized areas.

Available data strongly suggest that the Apex mine is a Tsumeb-type deposit. If this assumption is correct, mineralization should extend to a considerable depth below the lowest workings of the Apex mine, with metal grades equal to or better than those encountered in the upper workings.

Similarly, the numerous shows which occur northwest and southeast of the Apex mine could have significant vertical dimensions, with ultimate size dependent on a combination of host rock, ground preparation, and structure. The closest analogy to these occurrences is described by Pelletier (1964, p. 129) in the Kombat district 40 miles south of Tsumeb. A series of so-called pseudo-aplite lenses (most likely arenaceous sediments washed into solution collapse zones prior to mineralization) occur in a sequence of Precambrian dolomites. The copper-lead ore associated with these inferred solution-collapse features forms elongate lenses over a strike length of 4 kilometers.

The Apex mine appears to be a bona-fide Tsumeb-type occurrence. Historic exploration efforts may only have begun to reveal the ultimate potential of this and surrounding occurrences. Because of the poddy, discontinuous nature of mineralization, exploration will be difficult but highly rewarding if new deposits are found.

Thomas C. Patton
January 5, 1987

References Cited

- Bernstein, L.R., 1986, Geology and mineralogy of the Apex germanium-gallium mine, Washington County, Utah: U.S. Geol. Survey Bull. 1577, 9p.
- Button, Andrew, and Tyler, Noel, 1981, The character and economic significance of Precambrian paleoweathering and erosion surfaces in southern Africa: Econ. Geol., 75th Ann. Vol., p. 686-709.
- Guilbert, J.M., and Park, C.F. Jr., 1986, The Geology of Ore Deposits: W.H. Freeman and Company, New York, 985 p.
- Intiomale, M.M., and Oosterbosch, R., 1974, Geologie et geochemie du gisement de Kipushi, Zaire (The geology and geochemistry of the Kipushi deposit, Zaire): in Bartholome, Paul, ed., Gisements stratiformes et provinces cupriferes: Liege, Societe Geologique de Belgique, p. 123-164.
- Pelletier, R.A., 1964, Mineral resources of south-central Africa: Oxford University Press, New York.
- Sohnge, P.G., 1964, The geology of the Tsumeb Mine, in Haughton, S.H., ed., The geology of some ore deposits in southern Africa: Geol. Soc. of South Africa, Johannesburg, v. 2, p. 367-382.
- Stheeman, W.H., 1982, A practical solution to cable bolting problems at the Tsumeb mine: CIM Bull., v. 75, no. 838, p. 65-68.

EXPLORATION MODEL TSUMEB-APEX TYPE Ga-Ge DEPOSITS

Deposit	<u>Tsumeb</u>	<u>Kipushi</u>	<u>Apex</u>
Location	Namibia	Zaire	Utah
Host Rock	PC dolomite	PC ls/dolomite	Paleozoic limestone
Structural Control	solution collapse bx	fault(?)	solution collapse bx(?)
Geometry	pipe	vein/pipe	vein/chimney
Karst features	yes	yes	yes
Igneous rocks	post-ore	None	None
Mantos	yes	yes	yes
Ore Zone(1 x w)ft.	500x260 max.	1000-2500	350x60 max.
		x	
		50-200	
Ore Zone depth(ft.)	>5500	>3200	>1400
Oxidation depth(ft.)	0-1200,>2500	200	>1400
Supergene enrichment	yes	yes	yes
Organic material	yes	yes	?
Alteration	qtz,calcite,dolomite	dolomite? ^{yes}	qtz,dolomite
Production(tons)	20.5 x 10 ⁶	?	±100,000
Reserves(tons)	?	14 x 10 ⁶	1 x 10 ⁶
Grade	4.8% Cu	10% Cu	1.91% Cu
	12.7% Pb	1% Pb	minor
	4.7% Zn	18% Zn	1.75% Zn
	1.05 oz/ton Ag	4.7 oz/ton Ag	1.1 oz/ton Ag
	Ga,Ge credit	Ga,Ge credit	.079% Ge
			.039% Ga
Similar deposits	Kombat	?	Eldorado,Jubilee,et al.

±5 billion

±5 billion

not counting Ga - Ge

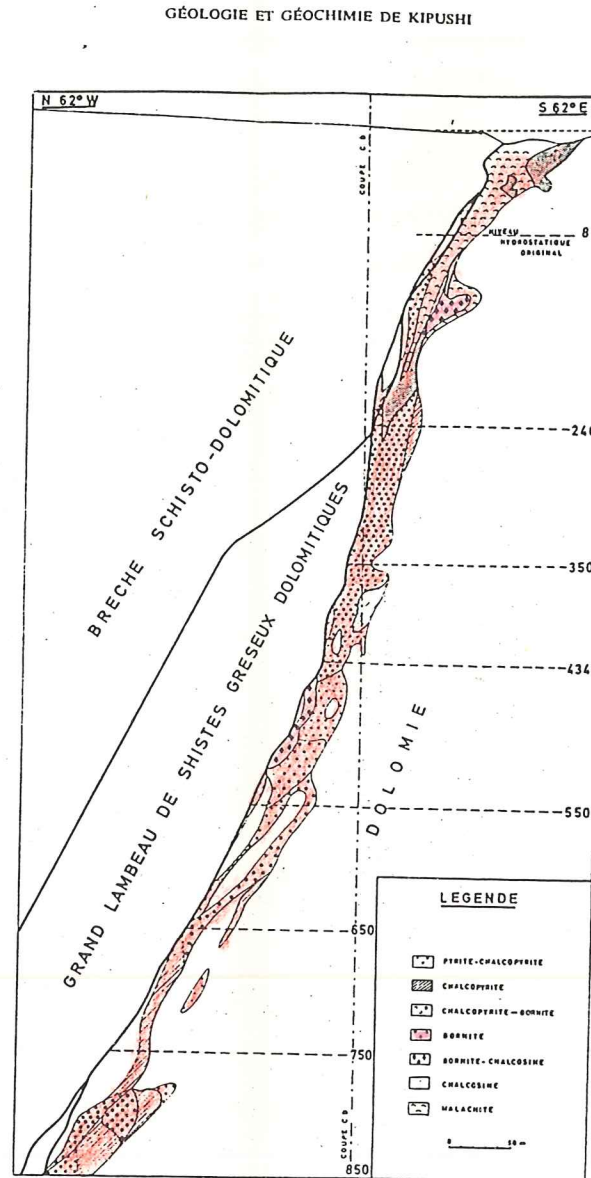
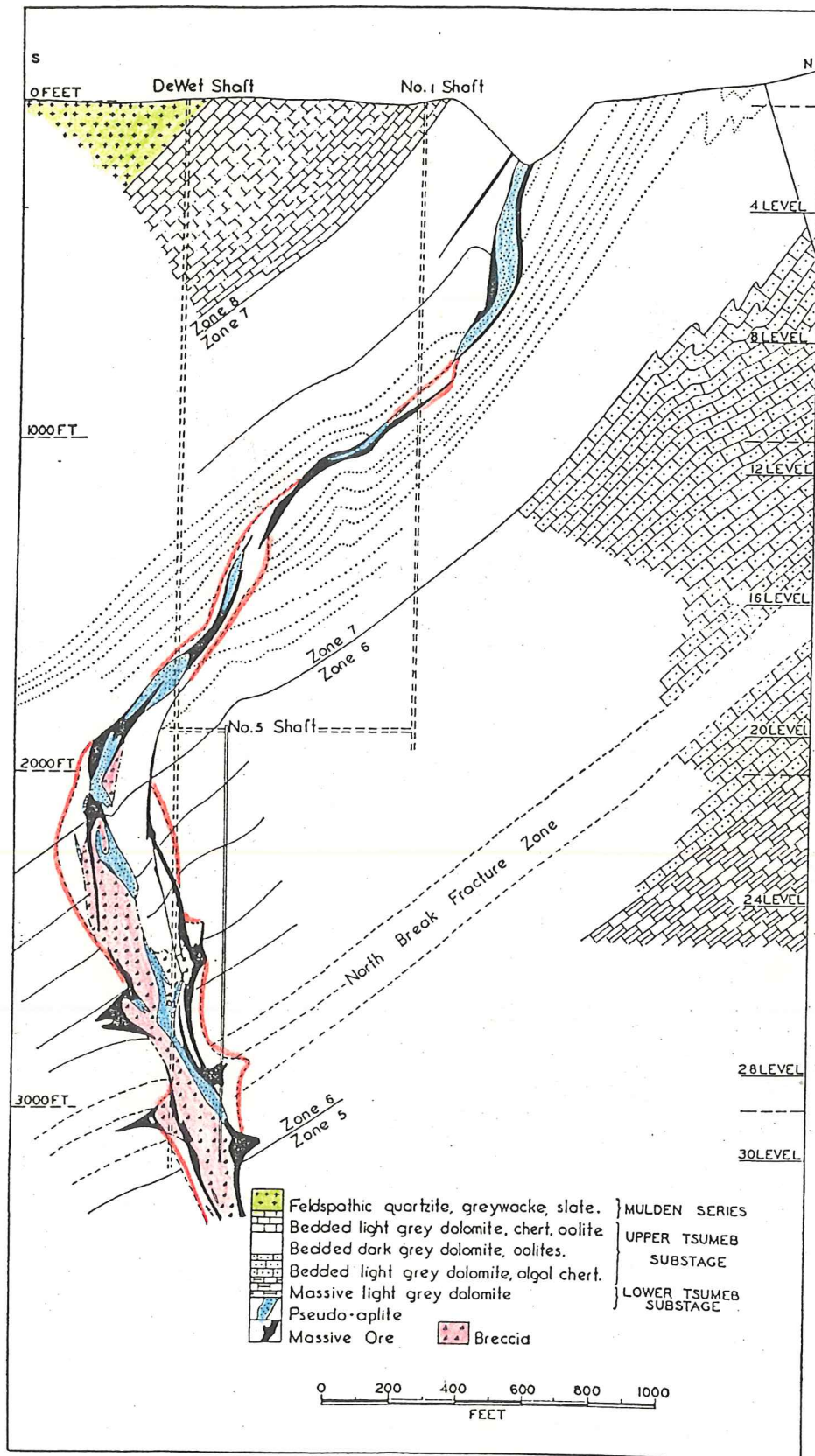


FIG. 4. — Coupe EF. Distribution minéralogique Cu, Fe.

(Intiomale and Oosterbosch, 1974, p.129).

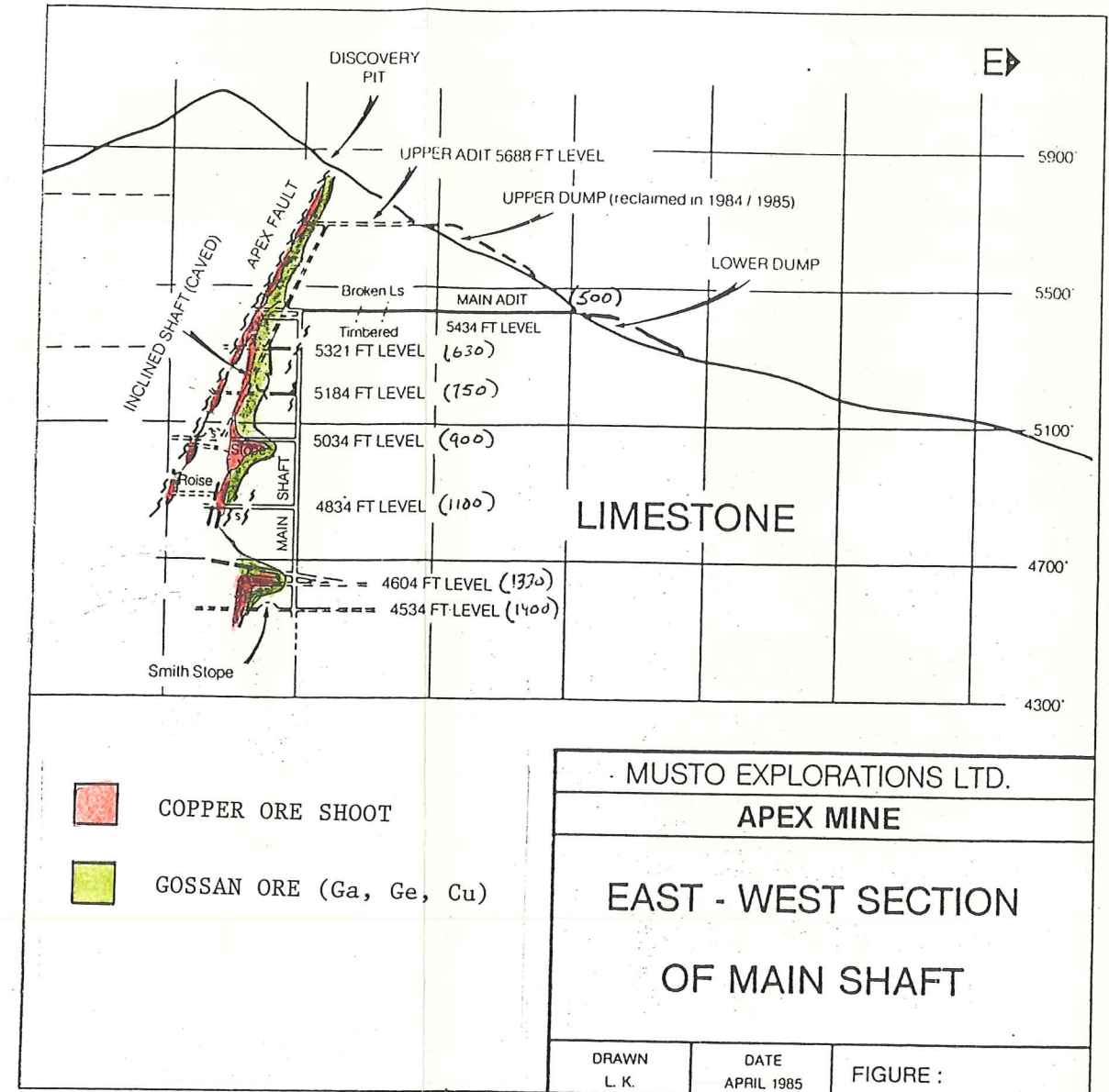












FIGURE 4-21. Geologic cross sections through the Tsumeb ore pipe. Above: North-South. Right: East-west. (After Tsumeb Corporation Staff, 1961, figures 3 and 4.)

GWH INCORPORATED

A WHOLLY OWNED SUBSIDIARY OF
GoGe MINERALS CORPORATION
APEX GALLIUM-GERMANIUM PROJECT
WASHINGTON COUNTY, UTAH

LAND STATUS MAP

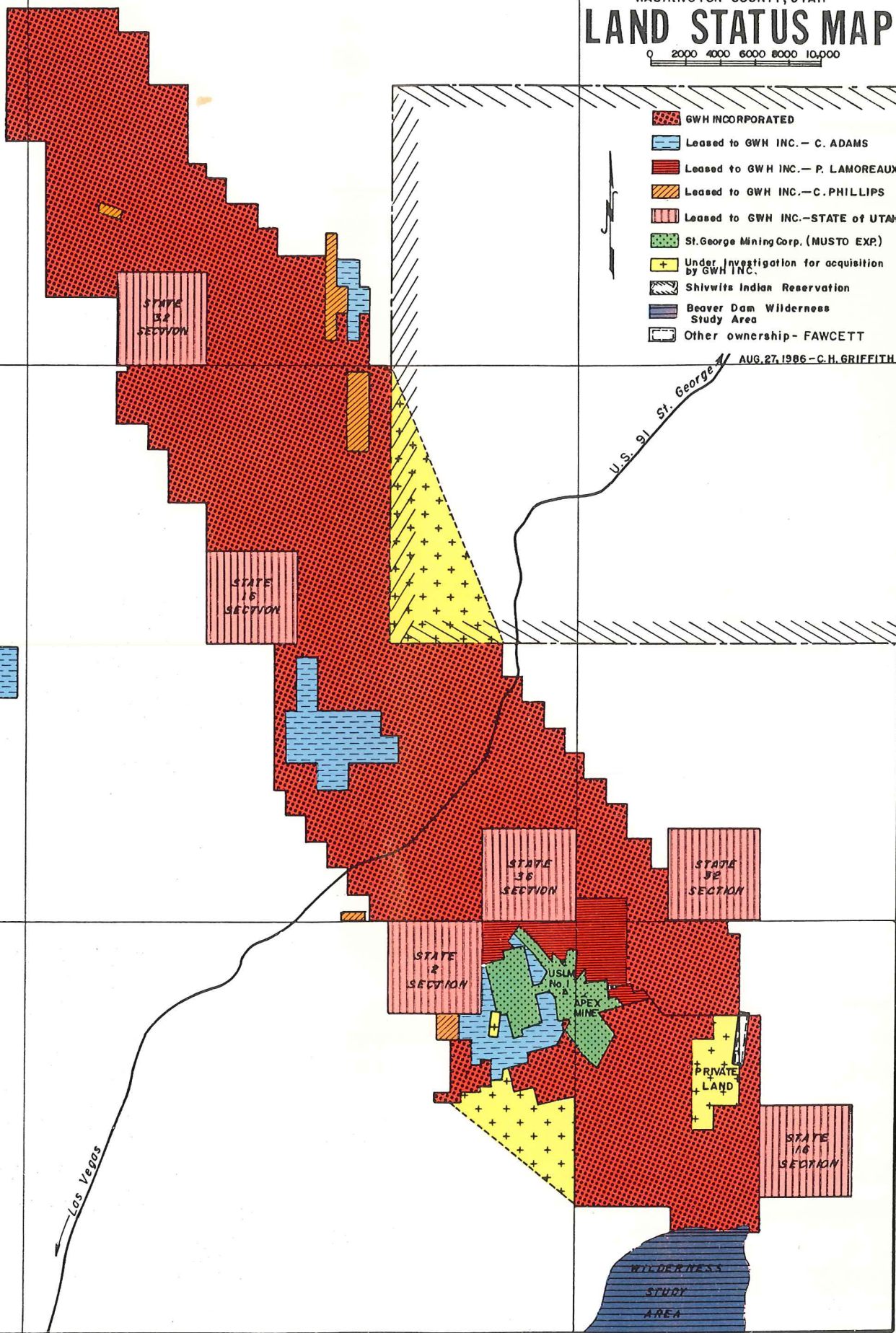
0 2000 4000 6000 8000 10,000

-  GWH INCORPORATED
-  Leased to GWH INC. - C. ADAMS
-  Leased to GWH INC. - P. LAMOREAUX
-  Leased to GWH INC. - C. PHILLIPS
-  Leased to GWH INC. - STATE OF UTAH
-  St. George Mining Corp. (MUSTO EXP.)
-  Under Investigation for acquisition by GWH INC.
-  Shivwits Indian Reservation
-  Beaver Dam Wilderness Study Area
-  Other ownership - FAWCETT

AUG. 27, 1986 - C.H. GRIFFITH

T 41 S
T 42 S
T 43 S

T 42 S
T 43 S



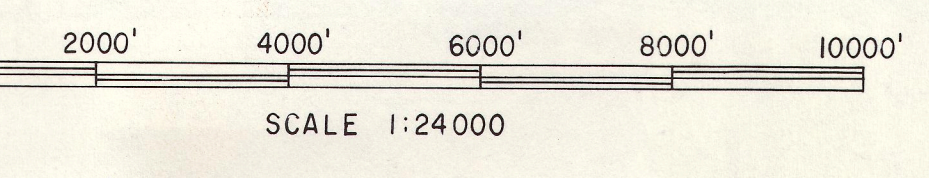
OREQUEST

APEX PROPERTY

LAND-STRUCTURE-PROSPECT

COMPOSITE MAP

Mapped by: C.H.G. May 1986 Tursagubet Mining District
 Revised by: B.D. Mar. 1997 Washington County Utah Figure 5

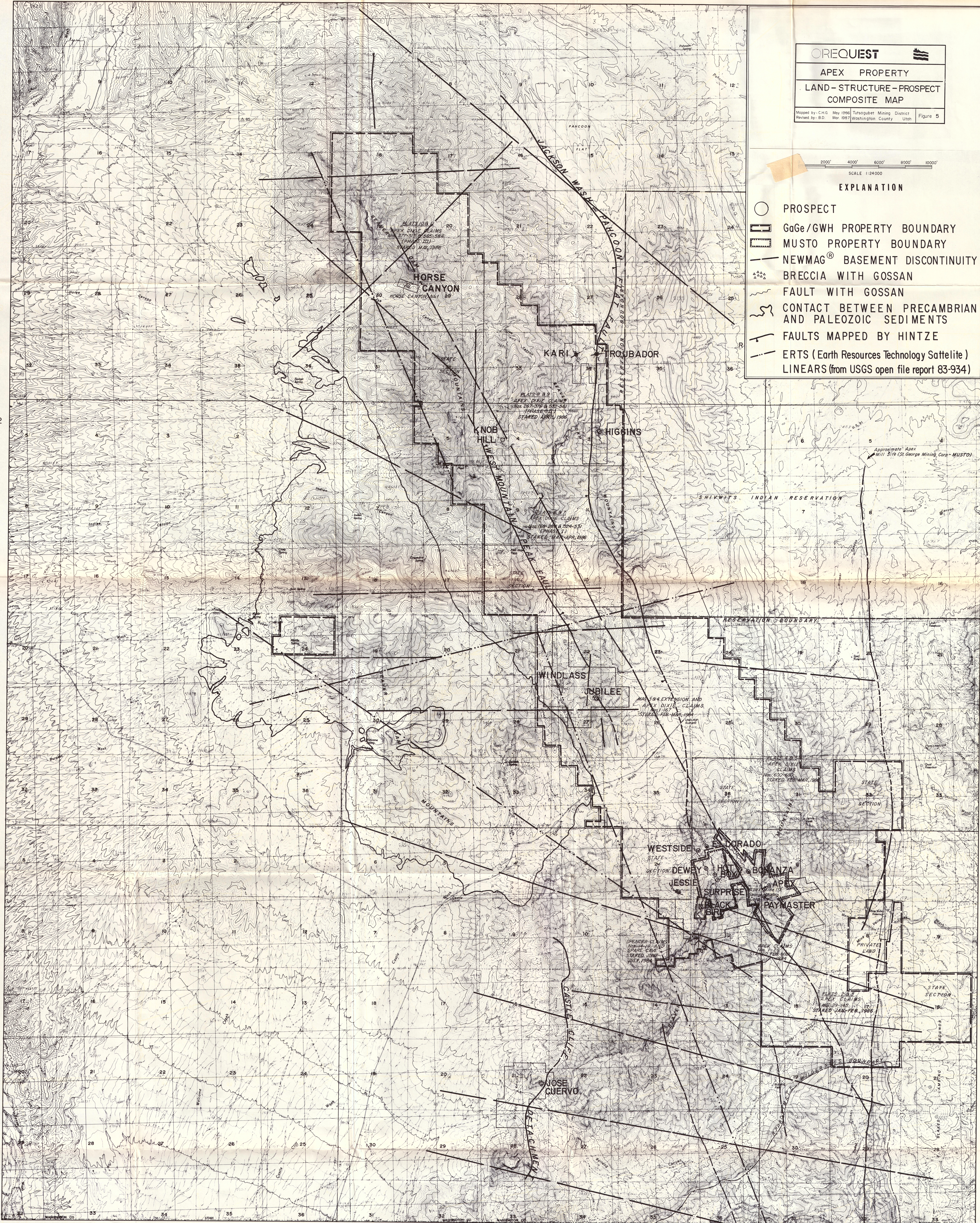


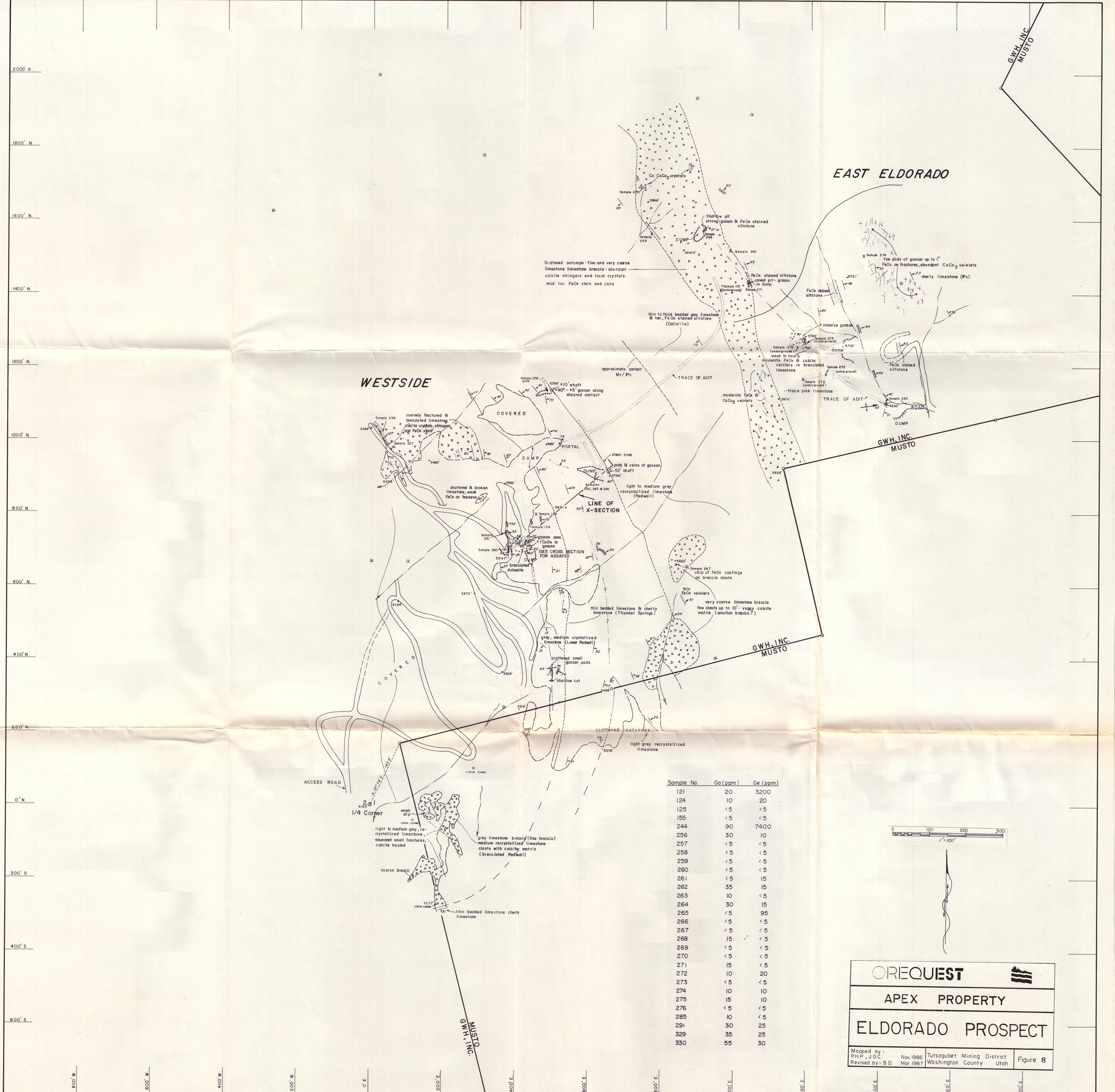
EXPLANATION

- PROSPECT
- ▬ GaGe/GWH PROPERTY BOUNDARY
- ▬ MUSTO PROPERTY BOUNDARY
- ▬ NEWMAG® BASEMENT DISCONTINUITY
- ▲▲▲ BRECCIA WITH GOSSAN
- ▬ FAULT WITH GOSSAN
- ▬ CONTACT BETWEEN PRECAMBRIAN AND PALEOZOIC SEDIMENTS
- ▬ FAULTS MAPPED BY HINTZE
- ▬ ERTS (Earth Resources Technology Satellite) LINEARS (from USGS open file report 83-934)

T 41 S
T 42 S
T 42 S
T 43 S

T 41 S
T 42 S
T 42 S
T 43 S

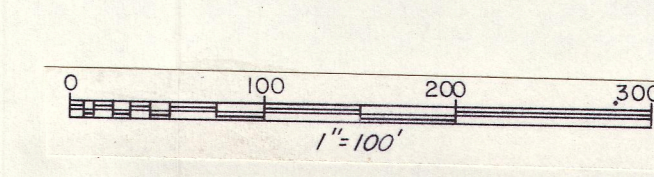




2000' N
1800' N
1600' N
1400' N
1200' N
1000' N
800' N
600' N
400' N
200' N
0' N
200' S
400' S
600' S

800' W
600' W
400' W
200' W
0' E
200' E
400' E
600' E
800' E
1000' E
1200' E
1400' E
1600' E
1800' E

Sample No	Ga (ppm)	Ge (ppm)
121	20	3200
124	10	20
125	< 5	< 5
155	< 5	< 5
244	90	7400
256	30	10
257	< 5	< 5
258	< 5	< 5
259	< 5	< 5
260	< 5	< 5
261	< 5	15
262	35	15
263	10	< 5
264	30	15
265	< 5	95
266	< 5	< 5
267	< 5	< 5
268	15	< 5
269	< 5	< 5
270	< 5	< 5
271	15	< 5
272	10	20
273	< 5	< 5
274	10	10
275	15	10
276	< 5	< 5
285	10	< 5
291	30	25
329	35	25
330	55	30



OREQUEST

APEX PROPERTY

ELDORADO PROSPECT

Mapped by: P.H.S., J.C.C. Nov 1986
 Revised by: B.D. Mar 1987
 Tutsaquet Mining District
 Washington County Utah
 Figure 8