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Bureau of Mines
Report of Investigations 4784

INVESTIGATION OF THE NORWICH MANGANESE DEPOSIT, SILVER BOW COUNTY, MONT.

BY JOHN W. COLE

United States Department of the Interior— April 1951

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UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary
BUREAU OF MINES
James Boyd, Director

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April 1951

INVESTIGATION OF THE NORWICH MANGANESE DEPOSIT SILVER BOW COUNTY, MONT.

by

John W. Cole[1]

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1/ Mining engineer, Bureau of Mines, Minerals Division, Region II.

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INTRODUCTION AND SUMMARY

The Butte district has been the principal producer of metallurgical-grade manganese in the United States since World War I. Manganese dioxide nodules are produced from rhodochrosite ore by concentrating the rhodochrosite and roasting the concentrate in rotary "cement-type" kilns. The Anaconda Copper Mining Co. is the only producer at present. Under the stimulus of a purchasing program administered by Metals Reserve Company during World War II, however, several independently owned or operated mines (including the Norwich) produced manganese carbonate ore.

These mines were examined in June 1949 by John W. Taber, mining engineer, Bureau of Mines. A core-drilling program to develop ore in the Norwich mine was recommended and approved. Drilling was completed early in 1950. This report gives factual data obtained.

The Norwich mine is about 2 miles west of Butte, Mont. Butte is in southwest Montana about 4 miles west of the Continental Divide. Placer mining in the Butte district began in 1864. This was followed by lode mining in about 1875. Production of manganese began during World War I. Manganese production reached a peak during 1944, when 153,665 short tons of manganese nodules were produced from the Butte and Philipsburg districts. The Norwich mine produced approximately 8,000 tons of manganese carbonate ore that averaged over 23 percent manganese during the period 1943-45. Two inclined shafts, 80 and 185 feet deep, provide access to the Norwich mine workings. Length of drifts and crosscuts totals 800 feet. The main ore body in the Norwich mine was stoped for 200 feet along the strike and 185 feet down the dip. Width of the ore body ranged from 3 to 8 feet. Project work consisted principally of core drilling for extensions of the Norwich ore body. Drill-hole logs and assays are tabulated at the end of the report.

ACKNOWLEDGMENTS

The project was completed under the general supervision of D. W. Butner, acting chief mining engineer, Region II. Samples were analyzed by the Metallurgical Section under the supervision of Stephen M. Shelton, Regional Director, Region II.

Officials of Anaconda Copper Mining Co. furnished many helpful data and advice concerning geology and also methods of coring soft, altered rock and vein material. John H. Cole, manager, Domestic Manganese & Development Co., kindly furnished office and warehouse space for the project.

LOCATION AND ACCESSIBILITY

Butte is in southwest Montana, west of the Continental Divide, on the headwaters of the Clark Fork River (fig. 1). Four transcontinental railroads and U. S. Highway 10S serve Butte. Air transportation is supplied by Northwest Airlines and Western Airlines.

The Norwich mine is situated 1 mile west of the crest of Big Butte and about 2 miles from the center of the city (fig. 2). It is reached by graded county roads from the city limits.

PHYSICAL FEATURES AND CLIMATE

Butte is situated about 4 miles west of the Continental Divide, which here reaches an altitude of approximately 7,500 feet. The altitude of Butte ranges from 5,400 to 6,000 feet. The major part of the city lies north and west of Silver Bow Creek. The gently sloping grass- and sage-covered hills west of Butte contrast strongly with the more youthful topography of East Ridge. The older topography is broken by Big Butte, which rises about 500 feet above the surrounding level west of the city.

The climate is typical of western Montana at this altitude. Temperature ranges from 90° to minus 40°. Precipitation is moderate, however, and the climate is suitable for year-round mining.

HISTORY AND PRODUCTION

The first lode claims in the Butte district were staked on prominent silver vein outcrops soon after the discovery of gold placer deposits along Missoula Gulch in 1864. Lode mining did not become active, however, until 1875, when rich silver ore was discovered in the Travona lode. Silver mining reached its peak and subsided by 1892, when most of the silver mines were closed, partly owing to a decline in the price of silver. Production of copper was begun in 1879-80, when the first copper smelter was erected. Zinc mining became important after 1910, when the flotation ore-dressing process was developed. Production of metals from Silver Bow County, most of which came from the Butte district, is shown in table 1:

TABLE 1. - Production of metals from Silver Bow County, 1882-1947 1/

Copper	short tons	6,601,006
Lead	do	245,497
Zinc	do	1,611,482
Gold	fine ounces	2,045,998
Silver	do	551,036,990

1/ Data compiled from Minerals Yearbook, 1947, p. 1456.

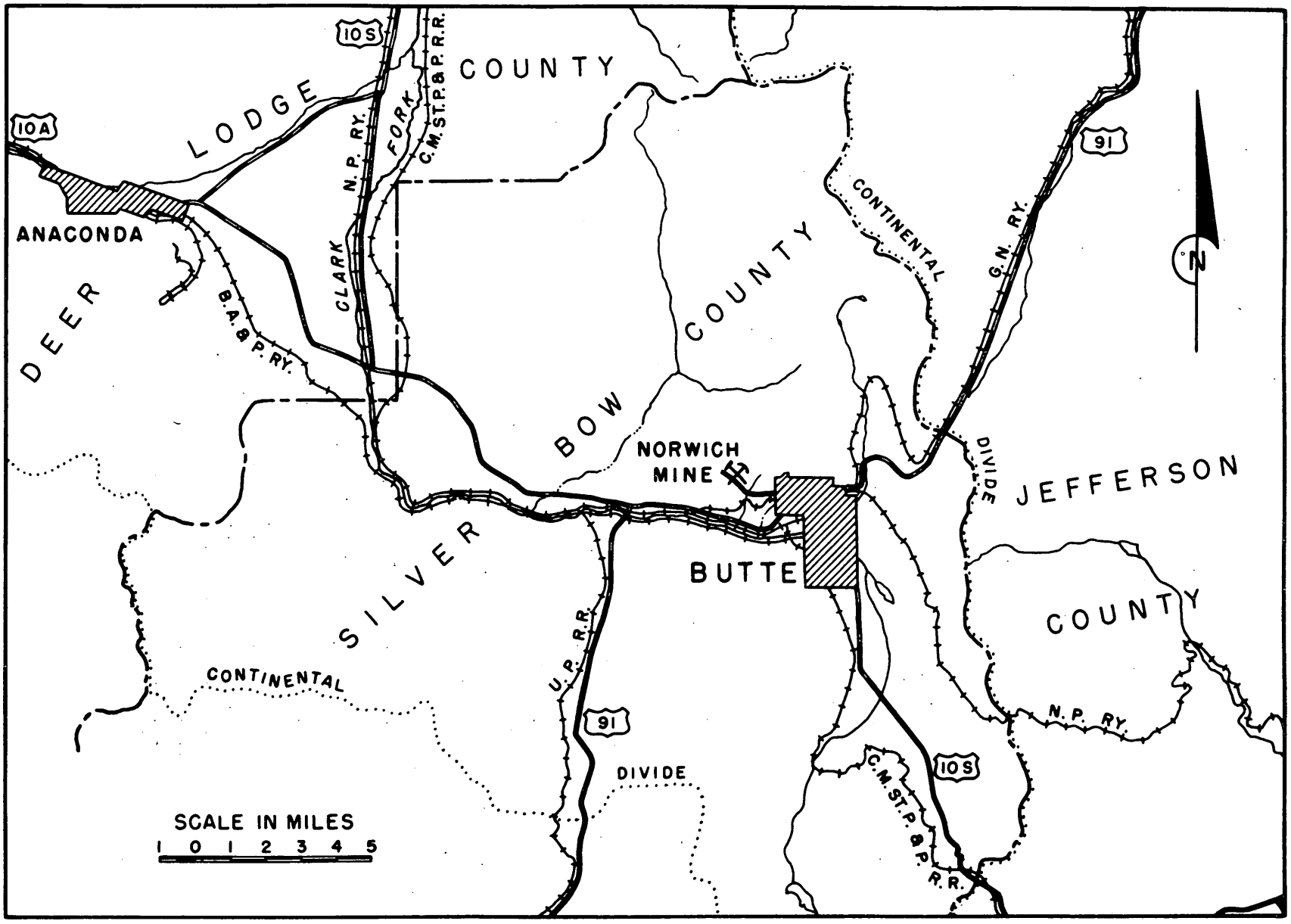


Figure 1. - Index map, Norwich mine, Silver Bow County, Mont.

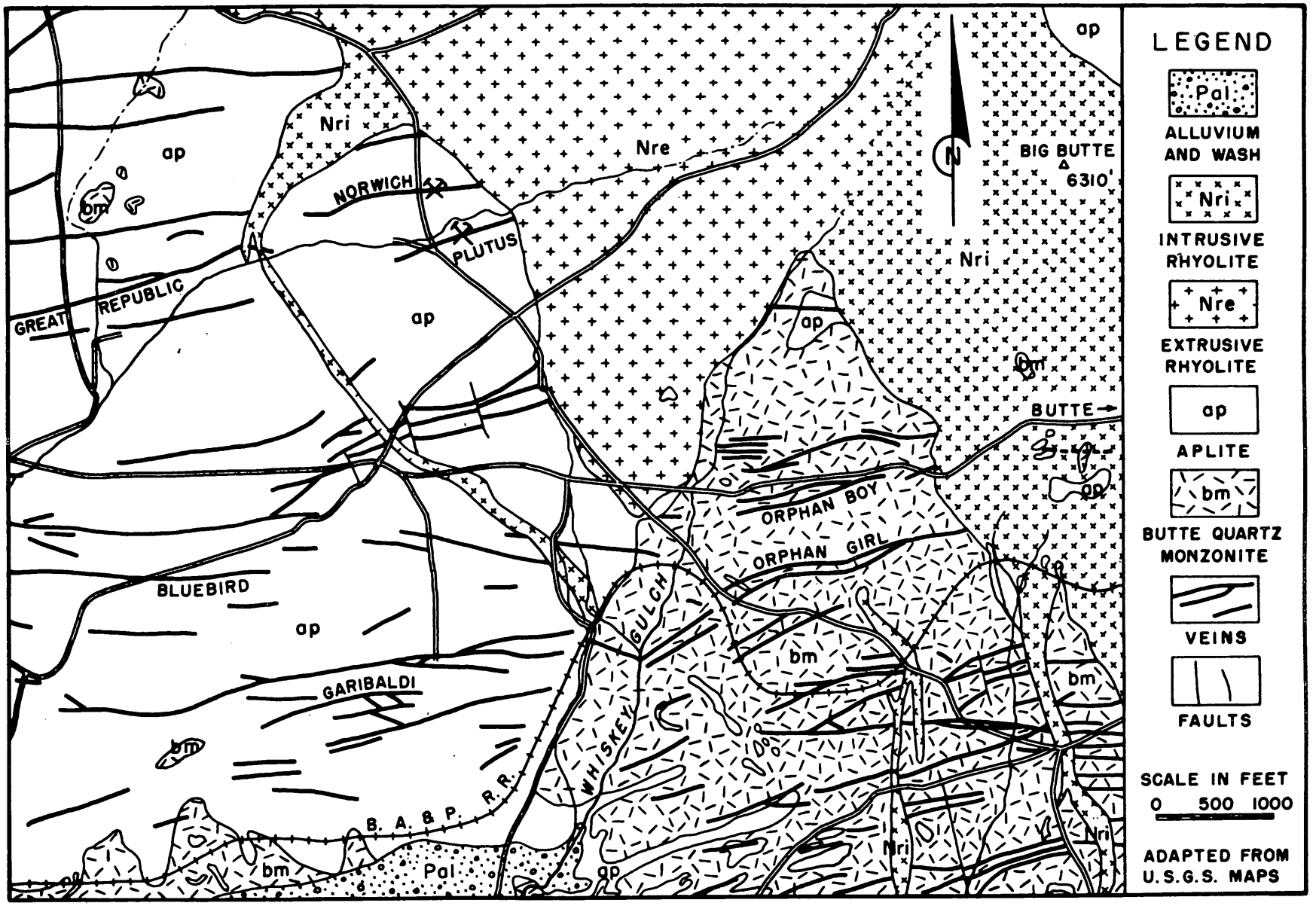


Figure 2. - Geology of part of the west Butte area, Silver Bow County, Mont.

Production of manganese ore from the Butte district began during World War I. During the period 1917-1919, about 78,000 tons of manganese ore was mined. About 74,000 tons was carbonate ore that was reduced to manganese dioxide nodules for the metallurgical industry. Production declined with the abrupt decrease in demand for manganese at the end of the war. A small, desultory production was maintained until 1940, when Anaconda Copper Mining Co. began to expand manganese production. Domestic Manganese & Development Co., acting as agents for Metals Reserve Company, erected a 400-ton mill in 1943 to concentrate manganese ore from the Butte and Philipsburg districts. Table 2 gives production of metallurgical-grade manganese ore from Montana, the greatest part of which represents manganese dioxide nodules produced from ore mined in the Butte district.

TABLE 2. - Metallurgical manganese ore shipped from Montana, 1936-1947 1/, short tons

Year	Tonnage	Percent Mn
1936.....	5,765	-
1937.....	18,860	-
1938.....	5,936	-
1939.....	2,512	-
1940.....	9,218	58.8
1941.....	43,555	-
1942.....	120,409	-
1943.....	2/ 130,789	-
1944.....	3/ 153,665	4/
1945.....	5/ 143,888	-
1946.....	192,227	60.28
1947.....	123,490	59.6

1/ Data compiled from Minerals Yearbook.

2/ Includes 128,084 tons of sintered nodules that averaged 61.10 percent Mn produced by Anaconda Copper Mining Co.

3/ Includes 19,277 tons of sintered nodules that contained 51.02 percent Mn produced by Domestic Manganese and Development Co. as agents for Metals Reserve Co.

4/ Nodules produced by Anaconda Copper Mining Co. averaged 60.61 percent Mn.

5/ Includes 14,094 tons of nodules that contained 54.47 percent Mn produced by Domestic Manganese & Development Co.

The situation of the Little Sarah shaft on the Butte Special quadrangle map indicates that this claim was the first to be prospected in the Norwich area. Underground work on the Norwich claim was initiated during World War II by drifting from the Little Sarah shaft and raising the Norwich shaft to the surface. Most of the work on the adjoining Plutus claim was completed before 1921.

Available records indicate the Norwich mine produced approximately 8,000 tons of manganese carbonate ore that averaged over 23.00 percent Mn during the period 1943-45. About 1,800 tons of manganese oxide ore also was produced during the same period.

PROPERTY AND OWNERSHIP

The Norwich mining property consists of one patented lode mining claim, Survey No. 2724. Ownership was divided among 11 individuals represented by Ted. Woodward, Fishtrap, Mont. The mine was leased with options to purchase by Irving G. Irving, 84 Hirbour Building, Butte, Mont.

The Plutus patented lode mining claim was owned as follows:

Owner	Extent of ownership
National Bank of Commerce of Seattle	One-half
Anaconda Copper Mining Co.	One-fourth
Eunice E. Rickman	One-eighth
Maude I. G. Oliver	Do.

MINE WORKINGS

The Norwich and Plutus mines were inaccessible. The water level in the Norwich shaft was 40 feet below the collar. The timber had failed in the Plutus shaft. Descriptions of these mines, taken from maps of the Norwich mine workings and an old company map of the Plutus, follow:

Norwich Mine

Entrance to the Norwich mine was through two inclined shafts - the Norwich and the Little Sarah (figs. 3 and 4). The Little Sarah shaft is the oldest working in the immediate area; it is 80 feet deep. The Norwich shaft is 185 feet deep on the incline. Levels are turned at depths of 70, 150, and 170 feet. Length of drifts and crosscuts totals 800 feet.

Plutus Mine

Entrance to the Plutus mine was through a 400-foot deep vertical shaft, with levels at 125, 225, and 400 feet. A crosscut extends from the bottom of the shaft to the Norwich veins; the drift on the Norwich vein is 480 feet long.

GENERAL GEOLOGY

Geology of the Butte district has been described by many eminent geologists, including Weed[2], Emmons and Tower[4], Sales[5], Hart , and Gidel[6].

2/ Weed, W. H., Description of the Butte Special District: Butte Special Folio, U. S. Geol. Survey Folio 38, 1898.
Weed, W. H., Geology and Ore Deposits of the Butte District, Montana: U. S. Geol. Survey Prof. Paper 78, 1912.

3/ Emmons, F. E., and Tower, G. W., Jr., Economic Geology of the Butte Special District: Butte Special Folio, U. S. Geol. Survey Folio 38, 1898.

4/ Sales, R. H., Ore Deposits of Butte, Mont.: AIME, 1914, vol. 46, pp. 3-109.

5/ Hart, L. H., The Butte District, Montana: Copper Resources of the World, 16th International Geol. Congress, 1935, pp. 287-293.

6/ Gidel, M. H., The Butte District, Montana: Copper Resources of the World, 16th International Geol. Congress, 1935, pp. 293-304.

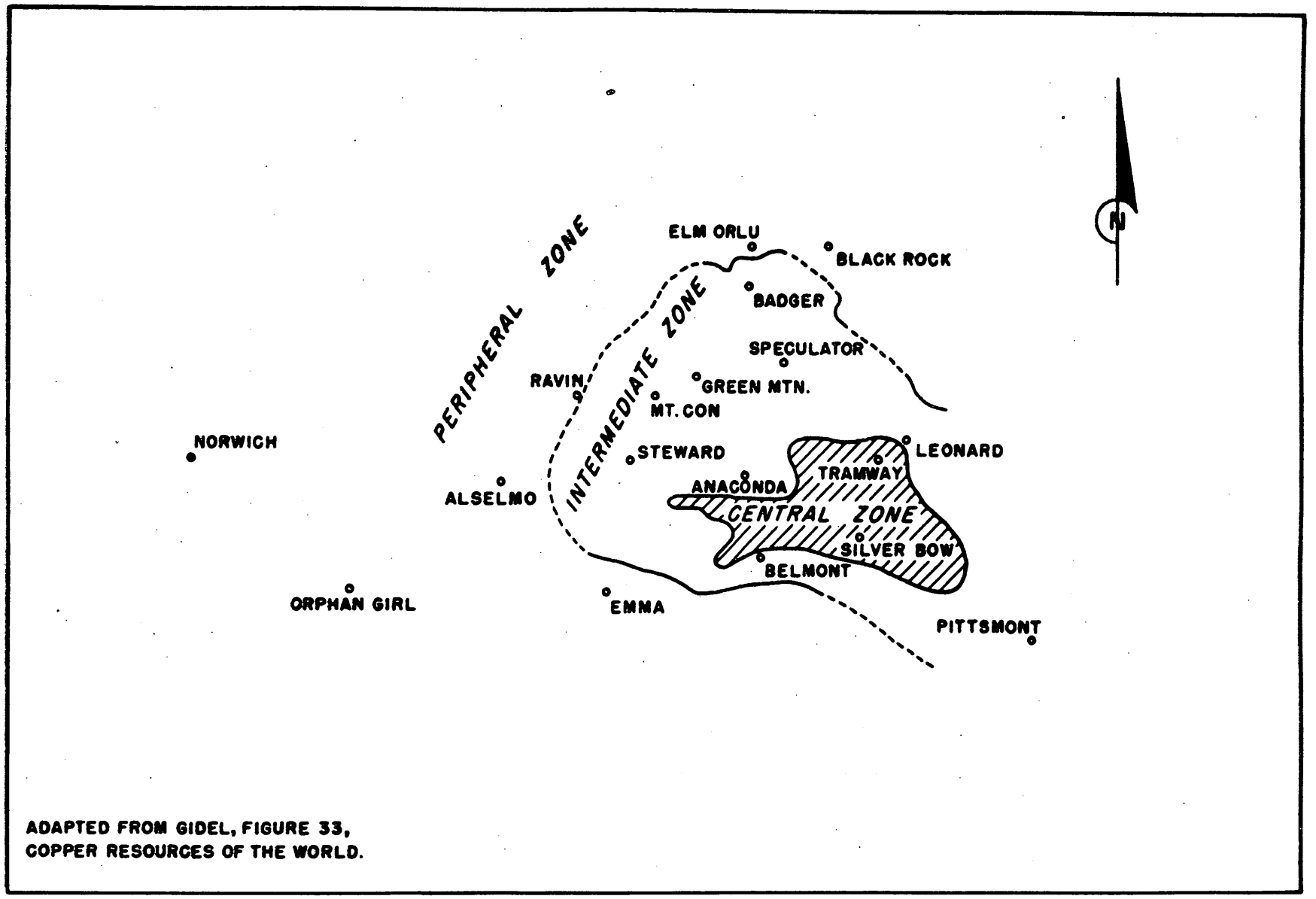


Figure 3. - Plan at altitude 4,600 feet showing general zonal arrangement of ore minerals at Butte, Silver Bow County, Mont.

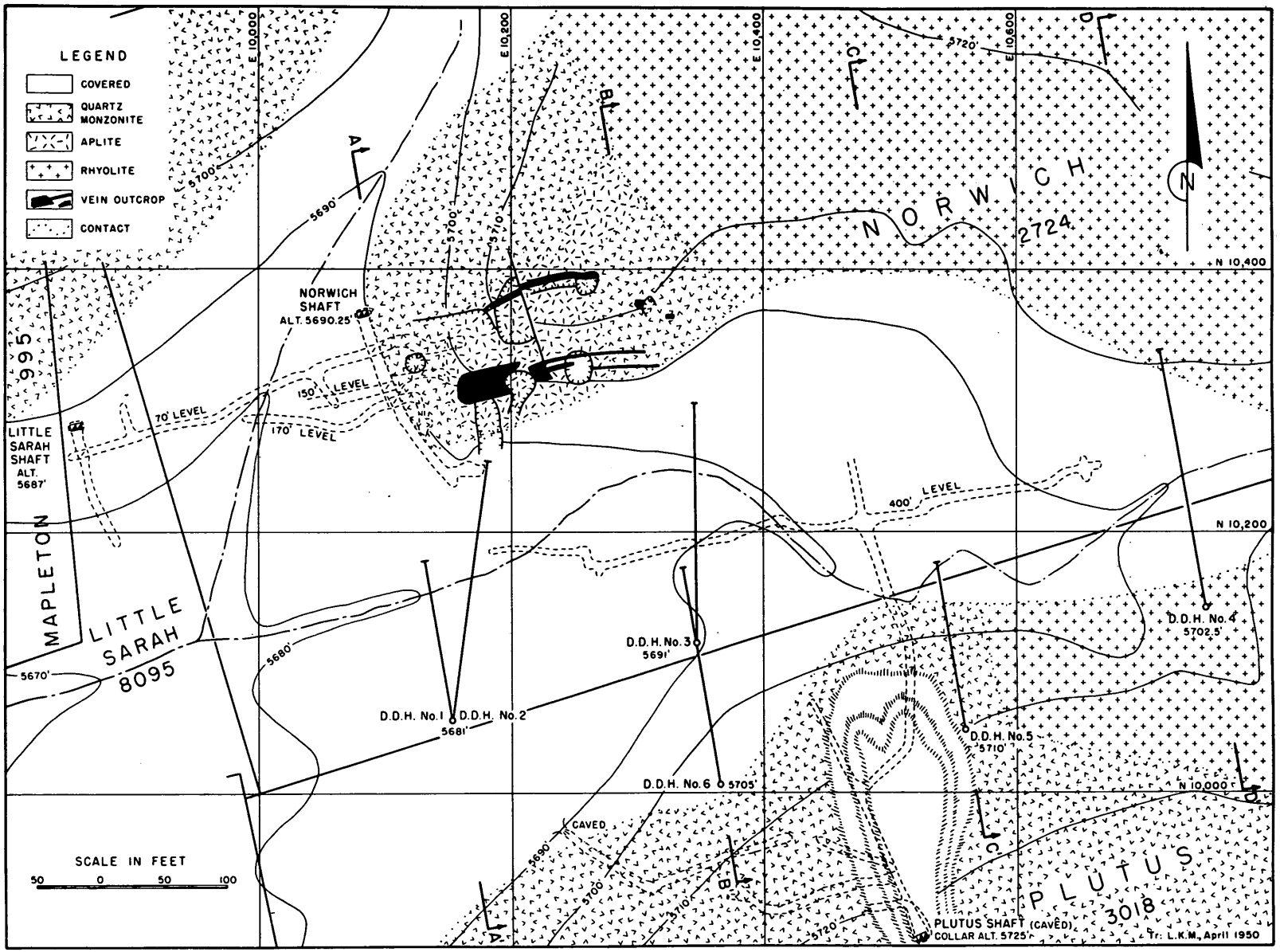


Figure 4. - Surface geology, underground workings, and drill holes, Norwich and Plutus claims, Silver Bow County, Mont.

A brief summary of the geology, as reported by these authors, follows: The Butte ore deposits are enclosed in quartz monzonite of the Boulder batholith that has been assigned to the late Cretaceous period. Locally the quartz monzonite grades into segregations of aplite, particularly in the west Butte area. Premineral quartz porphyry dikes are intruded into the quartz monzonite in the central part of the mineralized area. Postmineral rhyolite dikes, plugs, and flows occur principally in the west Butte area.

The Butte ore deposits are in three sets of fissure veins. (1) The Anaconda or east-west veins are the oldest. They appear to be simple tension fractures. The Blue veins stike northwest and dip southwest. They are the earliest fault fissures. Movement on the Blue veins is principally horizontal; the southwest segment has moved southeast with respect to the northwest segment. (2) The Steward fault fissures strike northeast and dip south; they are normal faults. Post-mineral movement is evident on the Blue and Steward systems. (3) Later faults include the Middle, Rarus, and Continental systems.

According to Hart7/, introduction of the ore minerals occupied a geologically short period. "The Anaconda and Blue sets of fissures and the earliest Steward fissures are probably all related to a single diastrophic event." The Anaconda system of veins has been by far the most productive. The Blue system is next in commercail importance. The Steward veins are "probably relatively less mineralized, because ore deposition had passed its maximum before the fissures were formed."

Minerals were deposited in a typically zonal pattern (fig. 3) first described by Sales8/ and later by Gidel9/.

Copper ore predominates in the central zone, zinc ore in the intermediate zone, and silver and manganese ores in the peripheral zone. Rhodochrosite and rhodonite were the last minerals to be introduced. The character of the mineral deposits grades from massive sulfides in the central zone to siliceous veins in the peripheral zone. According to Gidel,9/ the limits of the zones appear to dip vertically near the outer limits and horizontally near the center of the district.

Published information concerning the peripheral zone is sketchy and incomplete. The general attitude of the veins in the west Butte area suggests that they are related to the Anaconda veins. Generally, they strike slightly north of east and dip south. Before production of manganese from rhodochrosite became feasible, production from these veins consisted principally of silver ore from enriched deposits within a few hundred feet of the surface.

DESCRIPTION OF THE DEPOSITS

The Norwich ore body appears to be part of a vein that extends west into the Mapleton claim and possibly farther into the Great Republic claim. The

7/ Work cited in footnote 5.
8/ Work cited in footnote 4.
9/ Work cited in footnote 6.

Norwich vein terminates to the east against the extensive rhyolite outcrop that surrounds Big Butte. A brief description of the Norwich ore body, as shown on mine maps, follows:

The main ore body in the Norwich mine was stoped for 200 feet along the strike and 185 feet down the dip. The width of the ore body ranged from 3 to 8 feet. The productive part of the vein strikes N. 80° E. and dips 60° S. Numerous minor cross faults offset the vein to the right a maximum of 3 or 4 feet. The dip of the vein flattens in the lowest level. A crosscut 70 feet into the hanging wall of the veins from the 170 level cuts a 4- to 5-foot vein of good manganese ore enclosed in heavy altered granite.

WORK DONE BY THE BUREAU OF MINES

Project work consisted principally of core drilling. Surveying incidental to core drilling included verifying locations of the various mine openings and preparation of a surface map. Six holes, ranging in depth from 246.8 feet to 410.2 feet, were drilled.

Core recovery was poor through the ore zones in the first holes. Improved drilling techniques and use of special core barrels for coring soft ground provided nearly 100 percent core through the ore zones in holes 5 and 6. Sludge recovery averaged about 50 percent.

Geologic and assay logs are given in table 3. Hole positions and cross sections are shown on figures 4, 5, and 6.

TABLE 3. - Geologic and assay logs

Hole 1

Coordinates: N. 10,056 E. 10,153
Altitude of collar: 5,684.4
Depth: 246.8
Inclination: -61 1/2°
Bearing: N. 10° W.

Geologic Log

Interval, feet	Length, feet	Formation
0-109.0	109.0	Sandy overburden.
109.0-172.1	63.1	Altered granite. Alternation increases with depth.
172.1-199.8	27.7	Soft, green, altered granite. Disseminated pyrite.
199.8-211.7	11.9	Granitic sand, pinkish color. 200.4-203.1 may be $MnCO_3$.
211.7-212.2	.5	White kaolin.
212.2-246.8	34.6	Aplitic sand.

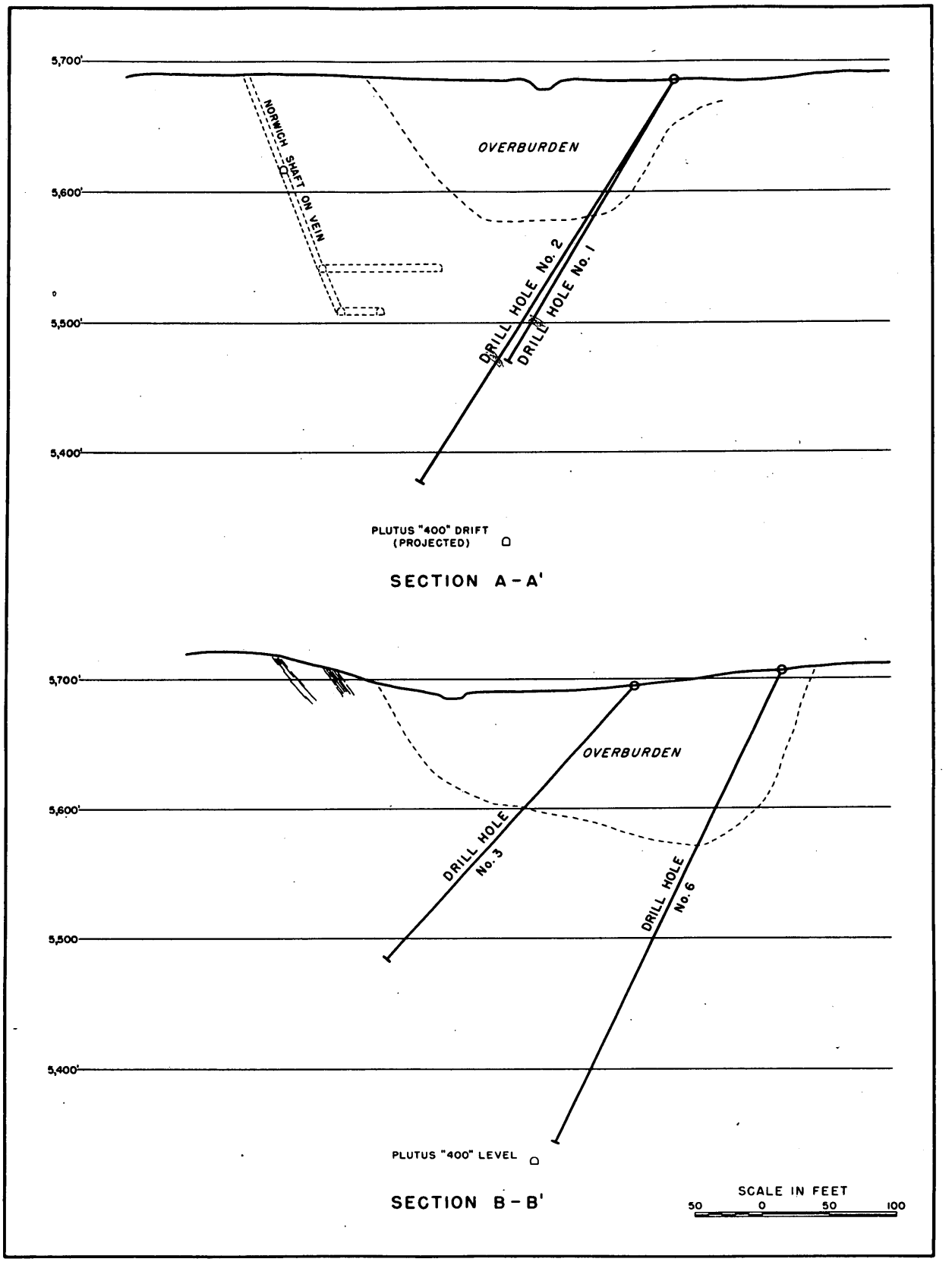


Figure 5. - Sections A-A' and B-B', holes 1, 2, 3, and 6, Norwich mine, Silver Bow County, Mont.

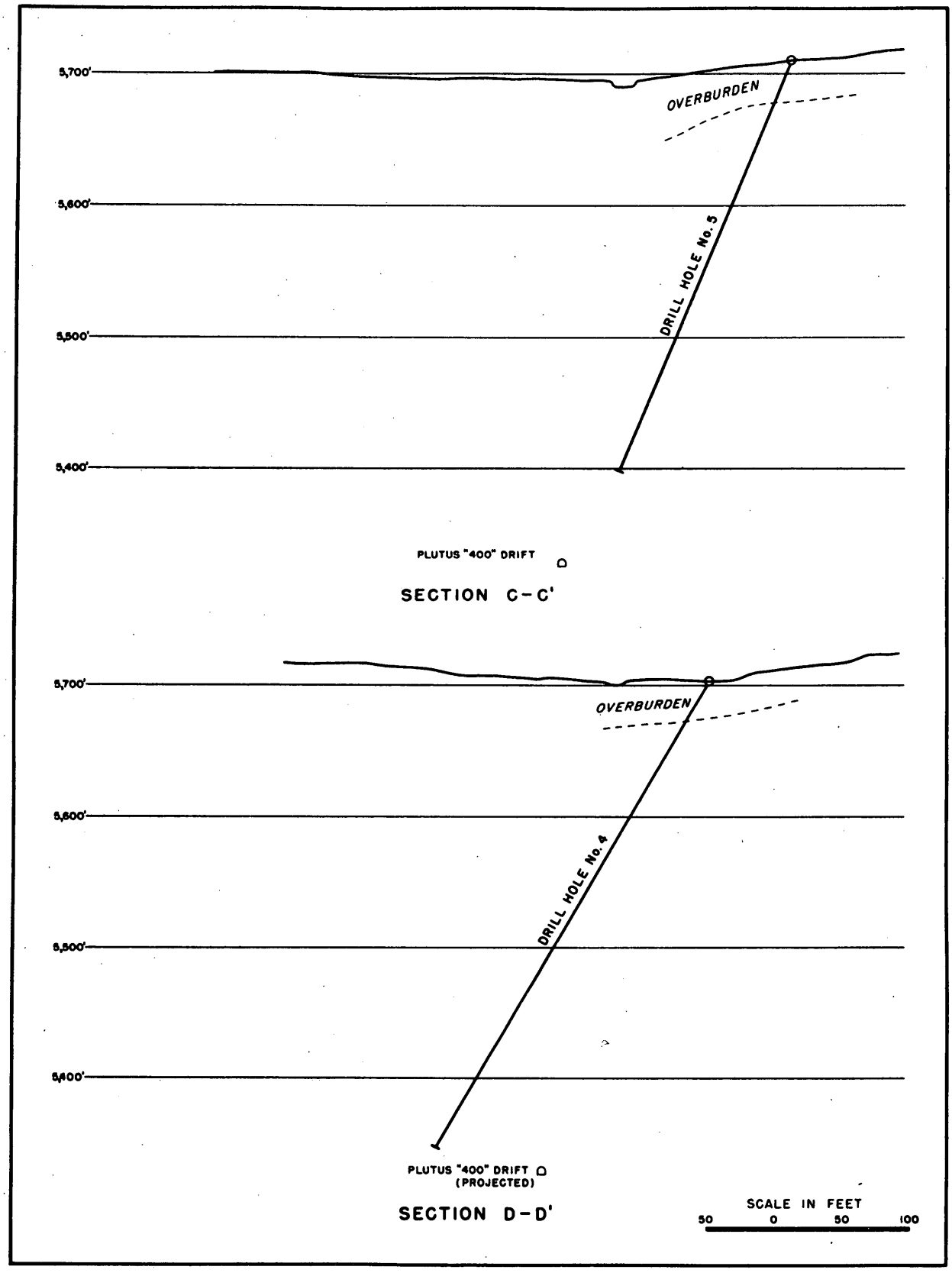


Figure 6. - Sections C-C' and D-D', holes 4 and 5, Norwich mine, Silver Bow County, Mont.

Hole 1 (Cont.)

Assay Log

Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
186.8-191.6	4.8	12	34	c	0.1	*0.05	tr.	*0.05
				s	.5	* .05	tr.	.1
191.6-199.8	8.2	15	43	s	.4	* .05	tr.	* .05
199.8-203.1	3.3	0	97	s	3.1	* .05	tr.	.1
203.1-204.3	1.2	0	158	s	1.0	* .05	tr.	* .05
204.3-208.0	3.7	0	120	s	1.9	* .05	tr.	.1
208.0-211.7	3.7	0	90	s	4.6	* .05	tr.	* .05
211.7-212.2	.5	0	34	s	5.3	* .05	tr.	* .05
212.2-216.6	4.4	0	86	s	9.7	* .05	tr.	* .05
216.6-217.6	1.0	0	270	s	6.1	* .05	tr.	* .05
217.6-238.0	20.4	0	10	s	1.1	* .05	tr.	* .05
238.0-241.6	3.6	0	120	s	1.0	* .05	tr.	* .05
241.6-246.8	5.2	0	118	s	1.2	* .05	tr.	* .05

Hole 2

Coordinates: N. 10,056 E. 10,154
Altitude of collar: 5,684.4
Depth: 374.3
Inclination: -57°
Bearing: N. 8° E.

Geologic Log

Interval, feet	Length, feet	Formation
0-78.6	78.6	Sandy overburden
78.6-127.8	49.2	Granite, minor alteration
127.8-131.5	3.7	Granite, green, altered. Fault 127.8-129. Pyrite.
131.5-132.7	1.2	Granite and aplite.
132.7-166.7	34.0	Granite, broken, altered. 137 ft. 1/16" stringer $MnCO_3$ 65°. Pink color noted in sludge. 156.5 ft. 1/8" stringer $MnCO_3$ 30°.
166.7-169.8	3.1	Aplite.
166.8-173.1	3.3	Fault.
173.1-237.5	64.4	Altered aplite, drilled like sand and gouge.
237.5-246.2	8.7	Aplite, small $MnCO_3$ stringers.
246.2-258.0	11.8	Altered aplite.
258.0-263.2	5.2	Altered aplite, mineralized stringers. Quartz and $MnCO_3$.
263.2-269.9	6.7	Altered aplite, soft.
269.9-277.0	7.1	Soft, vein material - $MnCO_3$ 275-277.
277.0-299.9	22.9	Altered granite.
299.9-350.0	50.1	Aplite.
350.0-374.3	24.3	Aplite.

Hole 2 (Cont.)

Assay Log

Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
135.1-139.7	4.6	22	35	s	0.3	*0.05	tr.	*0.05
169.8-173.1	3.3	0	37	s	.1	* .05	tr.	.1
174.1-176.2	2.1	14		c	.1	* .05	tr.	* .05
176.2-178.1	1.9	0	41	s	.4	* .05	tr.	* .05
178.1-187.3	9.2	0	73	s	.6	* .05	tr.	.1
187.3-192.9	5.6	0	147	s	.65	* .05	tr.	* .05
192.9-209.8	16.9	0	60	s	1.75	* .05	tr.	* .05
209.8-228.0	18.2	0	78	s	1.2	*0.05	tr.	*0.05
228.0-231.0	3.0	0	126	s	1.1	* .05	tr.	.1
231.0-234.0	3.0	0	104	s	1.4	* .05	tr.	* .05
234.0-236.2	2.2	0	55	s	1.5	* .05	tr.	* .05
236.2-237.5	1.3	0	50	s	2.4	* .05	tr.	* .05
237.5-243.0	5.5	25	65	c	2.1	* .05	tr.	3.1
					2.1	* .05	tr.	1.4
243.0-246.2	3.2	0	24	s	1.3	* .05	tr.	* .05
246.2-248.1	1.9	74	39	c	.9	* .05	tr.	.2
				s	1.4	* .05	tr.	* .05
248.1-254.1	6.0	0	65	s	1.4	* .05	tr.	* .05
254.1-257.0	2.9	0	68	s	1.0	* .05	tr.	* .05
257.0-258.0	1.0	50	168	c	2.0	* .05	tr.	.1
				s	1.8	* .05	tr.	* .05
258.0-263.2	5.2	15		c	3.1	* .05	tr.	* .05
258.0-258.9	.9	67	44	s	1.45	* .05	tr.	* .05
258.9-263.2	4.3	5	55	s	2.7	* .05	tr.	* .05
263.2-266.2	3.0	0	47	s	2.7	* .05	tr.	* .05
266.2-267.5	1.3	15	37	c	21.4	* .05	tr.	4.0
				s	18.0	* .05	0.01	3.2
267.5-268.6	1.1	0	28	s	12.7	* .05	.005	2.6
268.6-269.9	1.3	0	10	s	22.1	* .05	tr.	2.0
269.9-277.0	7.1	0	49	s	16.1	* .05	tr.	1.0
277.0-278.8	1.8	0	44	s	1.45	* .05	tr.	.2
278.8-284.1	5.3	0	33	s	1.1	* .05	tr.	* .05
284.1-289.6	5.5	15	55	s	.9	* .05	tr.	* .05
289.6-294.9	5.3	0	24	s	1.5	* .05	tr.	* .05
294.9-299.9	5.0	0	23	s	1.2	* .05	tr.	.1
299.9-304.3	4.4	45	29	s	1.3	* .05	tr.	.1
304.3-305.2	.9	44	160	s	2.2	* .05	tr.	.3
345.1-350.0	4.9	14	31	s	.2	* .05	tr.	* .05
350.0-354.5	4.5	0	38	s	.25	* .05	tr.	* .05
354.5-360.8	6.3	0	33	s	.2	* .05	tr.	.1
360.8-366.9	6.1	0	23	s	.4	* .05	tr.	* .05
366.9-374.3	7.4	19	30	s	.1	* .05	tr.	* .05

Hole 3

Coordinates: N. 10,115 E. 10,346
Altitude of collar: 5,691
Depth: 277.3
Inclination: -48 1/2°
Bearing: North

Geologic Log

Interval, feet	Length, feet	Formation
0-116.7	116.7	Sandy overburden.
116.7-149.9	33.2	Granite, medium hard.
149.9-177.0	27.1	Granite, soft, altered, disseminated pyrite.
177.0-203.1	26.1	Aplite, altered, disseminated pyrite, narrow $MnCO_3$ stringers.
203.1-230.8	27.7	Altered aplite, minor pyrite.
230.8-236.4	5.6	Oxidized aplite, sandy, brown.
236.4-277.3	40.9	Aplite, hard, minor alteration

Assay Log

Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
116.7-120.0	3.3	9	36	s	0.5	*0.05	tr.	*0.05
143.8-149.9	6.1	21	61	s	.75	* .05	tr.	* .05
149.9-152.7	2.8	25	55	s	.6	* .05	tr.	* .05
152.7-158.6	5.9	17	43	s	.5	* .05	tr.	.1
158.6-159.9	1.3	0	36	s	.9	* .05	tr.	.1
159.9-163.2	3.3	15	35	s	1.3	* .05	tr.	* .05
163.2-168.2	5.0	0	42	s	.2	* .05	tr.	* .05
168.2-173.7	5.5	0	55	s	.5	* .05	tr.	* .05
173.7-177.0	3.3	0	80	s	.6	* .05	tr.	* .05
177.0-182.0	5.0	38	97	c	1.7	* .05	tr.	* .05
				s	.75	* .05	tr.	* .05
182.0-186.5	4.5	11	48	c	.7	* .05	tr.	* .05
				s	.9	* .05	tr.	.2
186.5-187.9	1.4	0	46	s	1.1	* .05	tr.	.2
187.9-192.9	5.0	10	52	c	.5	* .05	tr.	.3
				s	2.35	* .05	tr.	* .05
192.9-197.4	4.5	22	78	c	4.8	* .05	tr.	* .05
				s	2.0	* .05	tr.	.1
197.4-198.9	1.5	55	60	c	3.0	* .05	tr.	* .05
				s	2.0	* .05	tr.	* .05
198.9-203.1	4.2	33	62	c	1.4	* .05	tr.	* .05
				s	2.5	* .05	tr.	* .05
203.1-208.1	5.0	8	72	c	.5	* .05	tr.	.3
				s	1.7	* .05	tr.	* .05

Hole 3 (Cont.)

Assay Log (Cont.)

Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
208.1-213.5	5.4	0	55	s	1.8	*0.05	tr.	0.1
213.5-216.8	3.3	6	45	s	1.4	* .05	tr.	* .05
216.8-221.5	4.7	34	27	s	.5	* .05	tr.	* .05
221.5-226.8	5.3	26	43	s	.5	* .05	tr.	* .05
226.8-230.8	4.0	5	41	s	.9	* .05	tr.	* .05
230.8-236.4	5.6	11	66	s	.3	* .05	tr.	* .05
236.4-242.0	5.6	25	134	s	.2	* .05	tr.	* .05
242.0-245.7	3.7	38	66	s	.9	* .05	tr.	* .05
245.7-249.5	3.8	34	4	s	.7	* .05	tr.	* .05
249.5-251.6	2.1	90	42	s	.3	* .05	tr.	* .05
251.6-254.7	3.1	23	47	s	.3	* .05	tr.	* .05
254.7-257.5	2.8	39	55	s	.4	* .05	tr.	* .05
257.5-261.6	4.1	51	43	s	.25	* .05	tr.	* .05
261.6-266.0	4.4	68	28	s	.3	* .05	tr.	* .05
266.0-271.0	5.0	36	52	s	.3	* .05	tr.	* .05
271.0-277.3	6.3	32	84	s	.4	* .05	tr.	* .05

Hole 4

Coordinates: N. 10,142 E. 10,748
Altitude of collar: 5,702.5
Depth: 410.2
Inclination: -61°
Bearing: N. 10° W.

Geologic Log

Interval, feet	Length, feet	Formation
0-36.9	36.9	Sandy overburden.
36.9-106.3	69.4	Rhyolite, soft
106.3-133.2	26.9	Rhyolite, soft, sandy.
133.2-347.1	213.9	Rhyolite, soft.
347.1-410.2	63.1	Granite

Assay Log

Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
133.2-143.7	10.5	23	22	s	0.1	*0.05	tr.	*0.05
281.5-289.8	8.3	35	26	s	.1	* .05	tr.	* .05
370.3-380.1	9.8	14	23	s	.2	* .05	tr.	* .05
380.1-390.1	10.0	20	30	s	.2	* .05	tr.	* .05
390.1-400.1	10.0	26	20	s	.1	* .05	tr.	* .05
400.1-410.2	10.1	0	20	s	.1	* .05	tr.	* .05

Hole 5

Coordinates: N. 10,047 E. 10,559
Altitude of collar: 5,710
Depth: 336.1
Inclination: -68°
Bearing: N. 10° W.

Geologic Log

Interval, feet	Length, feet	Formation
0-37.6	37.6	Overburden
37.6-89.2	51.6	Aplite, oxidized, fractured, hard.
89.2-91.0	1.8	Drilled like sand.
91.0-99.3	8.3	Aplite, oxidized.
99.3-100.8	1.5	Drilled like sand.
100.8-137.2	36.4	Aplite, oxidized, fractured, hard.
137.2-142.0	4.8	Sand, fault?
142.0-181.0	39.0	Aplite, oxidized, fractured, hard.
181.0-200.5	19.5	Aplite, altered, soft.
200.5-209.8	9.3	Aplite, hard, water course at 203.0'.
209.8-211.0	1.2	Aplite, hard.
211.0-214.7	3.7	Sand.
214.7-224.7	10.0	Aplite, hard.
224.7-246.0	21.3	Sand, probably altered aplite.
246.0-254.3	8.3	Aplite, soft, altered, water course 254.3 ft.
254.3-266.7	12.4	Aplite, soft, kaolinized.
266.7-267.7	1.0	Sulfides in spongy quartz.
267.7-268.8	1.1	Probably same.
268.8-278.8	10.0	Altered aplite, soft, kaolin seam at 272 ft.
278.8-308.8	30.0	Altered aplite, soft, minor pyrite.
308.8-310.3	1.5	Altered aplite, minor seams $MnCO_3$.
310.3-324.4	14.1	Altered aplite, minor pyrite and $MnCO_3$.
324.4-336.1	11.7	Altered aplite.

Assay Log

Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
115.8-117.0	1.2	25	58	s	4.9	*0.05	tr.	*0.05
137.2-142.0	4.8	0	63	s	4.1	* .05	tr.	* .05
181.0-186.4	5.4	9	42	s	4.8	* .05	tr.	* .05
186.4-197.6	1.2	0	148	s	.5	* .05	tr.	* .05
187.6-190.0	2.4	0	16	s	3.2	* .05	tr.	* .05
190.0-197.5	7.5	0	64	s	.1	* .05	tr.	* .05
197.5-199.0	1.5	0	88	s	1.8	* .05	tr.	* .05
199.0-199.6	.6	0	142	s	2.7	* .05	tr.	* .05
199.6-200.5	.9	0	28	s	14.9	* .05	tr.	* .05

Hole 5 (Cont.)

Assay Log (Cont.)

Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
200.5-203.2	2.7	52	7	s	10.2	*0.05	tr.	*0.05
214.7-219.0	4.3	28	29	s	7.3	* .05	tr.	* .05
224.7-230.3	5.6	0	68	s	.7	* .05	tr.	* .05
230.3-232.6	2.3	0	158	s	1.6	* .05	tr.	.1
232.6-237.6	5.0	0	256	s	.5	* .05	tr.	.2
237.6-242.6	5.0	0	57	s	.5	* .05	tr.	* .05
242.6-246.0	3.4	0	71	s	.8	* .05	tr.	.1
246.0-254.3	8.3	64	35	s	.9	* .05	tr.	* .05
266.7-267.7	1.0	100		c	.2	* .05	tr.	.2
267.7-268.8	1.1	0	73	s	1.4	* .05	tr.	* .05
268.8-271.3	2.5	48	24	s	.6	* .05	tr.	* .05
273.9-276.5	2.6	38	25	s	2.2	* .05	tr.	* .05
276.5-278.8	2.3	0	32	s	.4	* .05	tr.	.9
295.9-298.5	2.6	100	40	s	.3	* .05	tr.	.4
301.1-303.5	2.4	125	63	s	.9	* .05	tr.	.4
303.5-306.2	2.7	100	31	s	1.1	* .05	tr.	.3
315.9-318.8	2.9	114	49	s	.4	* .05	tr.	.4
324.4-330.0	5.6	36	34	s	1.6	* .05	tr.	* .05
330.0-332.5	2.5	100	87	s	.8	* .05	tr.	* .05
332.5-335.1	2.6	62	144	s	.5	* .05	tr.	* .05
335.1-336.1	1.0	100	147	s	.5	* .05	tr.	* .05

Hole 6

Coordinates: N. 10,006 E. 10,365
Altitude of collar: 5,706.0
Depth: 401.3
Inclination: -65°
Bearing: N. 10° W.

Geologic Log

Interval, feet	Length, feet	Formation
0.150.0	150.0	Sandy overburden
150.0-199.0	49.0	Sand, probably soft altered granite.
199.0-245.3	46.3	Aplite, hard, broken, brown.
245.3-261.2	15.9	Aplite, altered, oxidized, medium hard.
261.2-280.8	19.6	Aplite, altered, very soft with kaolin. Blue clay seams at 268 and 275 ft. 60° to hole.
280.8-288.6	7.8	No core, drilled like sand and talc.
288.6-297.6	9.0	Aplite, altered, minor stringers $MnCO_3$. Blue clay seam 60° to hole.

Hole 6 (Cont.)

Geologic Log (Cont.)

Interval, feet	Length, feet	Formation
297.6-300.1	2.5	Sand.
300.1-304.2	3.1	Aplite, altered, minor stringers $MnCO_3$.
304.2-311.5	7.3	Aplite, altered, soft.
311.5-314.0	2.5	Aplite, altered, 6" blue clay at 312' 60° to hole.
314.0-317.6	3.6	Aplite, altered, minor stringers $MnCO_3$.
317.6-341.3	23.7	Aplite, altered, 1/16" stringers $MnCO_3$. crossing at 339.5.
341.3-357.5	16.2	Aplite, altered, disseminated pyrite.
357.5-377.3	19.8	Aplite, altered, disseminated pyrite and occasional stringers quartz and $MnCO_3$.
377.3-394.2	16.9	Aplite, hard, minor quartz stringers and disseminated pyrite. 1/16" $MnCO_3$ stringer parallel to hole 386-388.
394.2-397.8	3.6	Aplite, hard, quartz and $MnCO_3$ stringers parallel to hole.
397.8-401.3	3.5	Granite.

Assay Log

Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
202.1-203.4	1.3	69	59	s	0.2	*0.05	tr.	*0.05
245.3-250.3	5.0	0	40	s	.4	* .05	tr.	.2
264.0-264.1	.1	100		c	17.3	* .05	0.01	7.4
261.2-267.2	6.0	32	28	s	1.7	* .05	.01	.1
267.2-269.7	2.5	40	42	s	2.2	* .05	.01	.4
269.7-271.5	1.8	78	58	s	1.9	* .05	.01	.3
271.5-275.3	3.8	60	13	s	1.1	* .05	.01	* .05
275.3-278.0	2.7	0	27	s	.6	* .05	.005	.5
278.0-280.8	2.8	50	43	s	.5	* .05	.005	.6
280.8-283.6	2.8	0	26	s	.5	* .05	tr.	.3
283.6-286.1	2.5	0	50	s	.5	* .05	tr.	.1
286.1-288.6	2.5	0	76	s	.5	* .05	tr.	.1
288.6-295.0	6.4	20	74	s	.5	* .05	tr.	.5
295.0-297.6	2.6	35	69	s	.4	* .05	tr.	.4
299.0-300.1	1.1	0	58	s	1.8	* .05	tr.	.1
300.1-304.2	4.1	44	30	c	2.4	* .05	tr.	.1
				s	1.7	* .05	tr.	.2
304.2-307.7	3.5	100	25	s	.5	* .05	tr.	.1
307.7-311.5	3.8	76	30	s	.5	* .05	tr.	* .05
314.0-316-3	2.3	100		c	2.2	.1	tr.	.1
311.5-316.3	4.8	83	25	s	.9	* .05	tr.	* .05

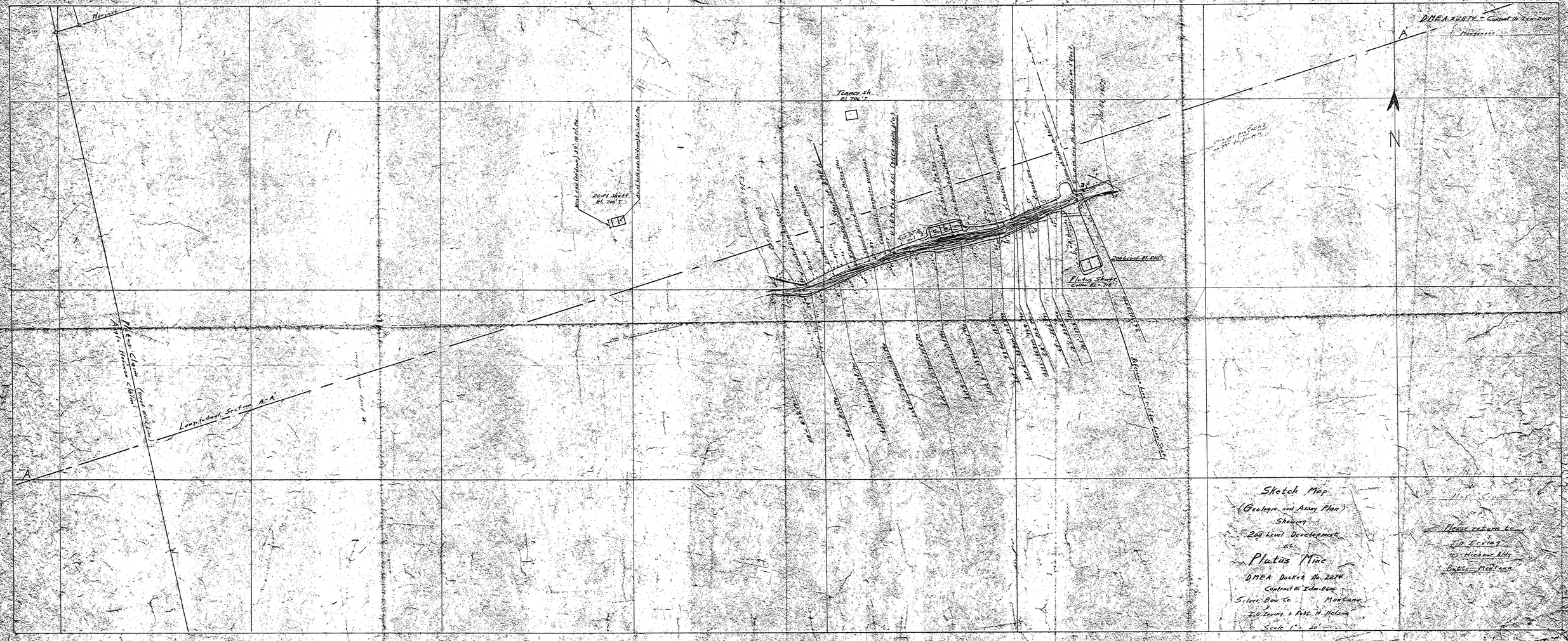
Hole 6 (Cont.)

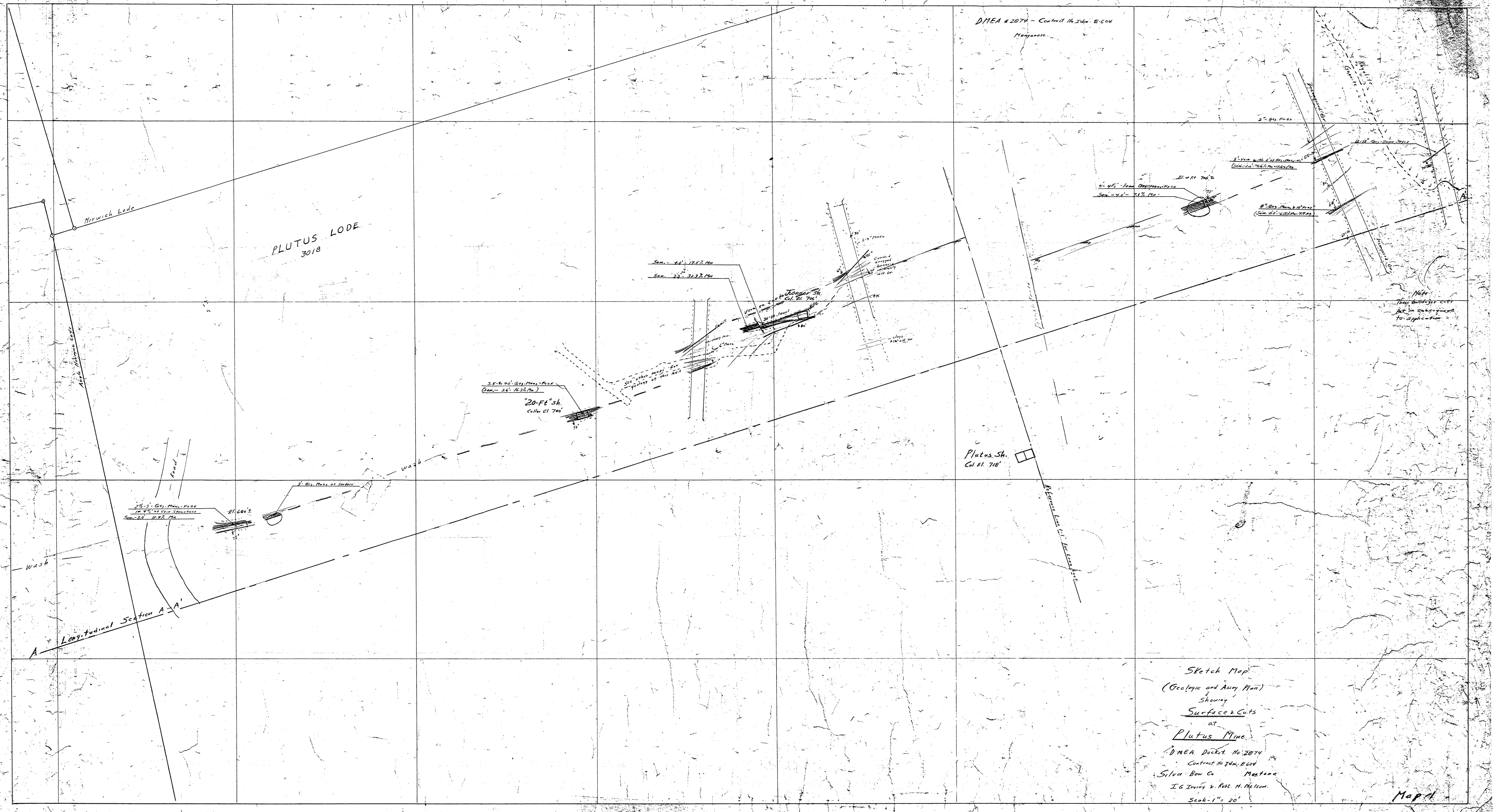
Assay Log (Cont.)

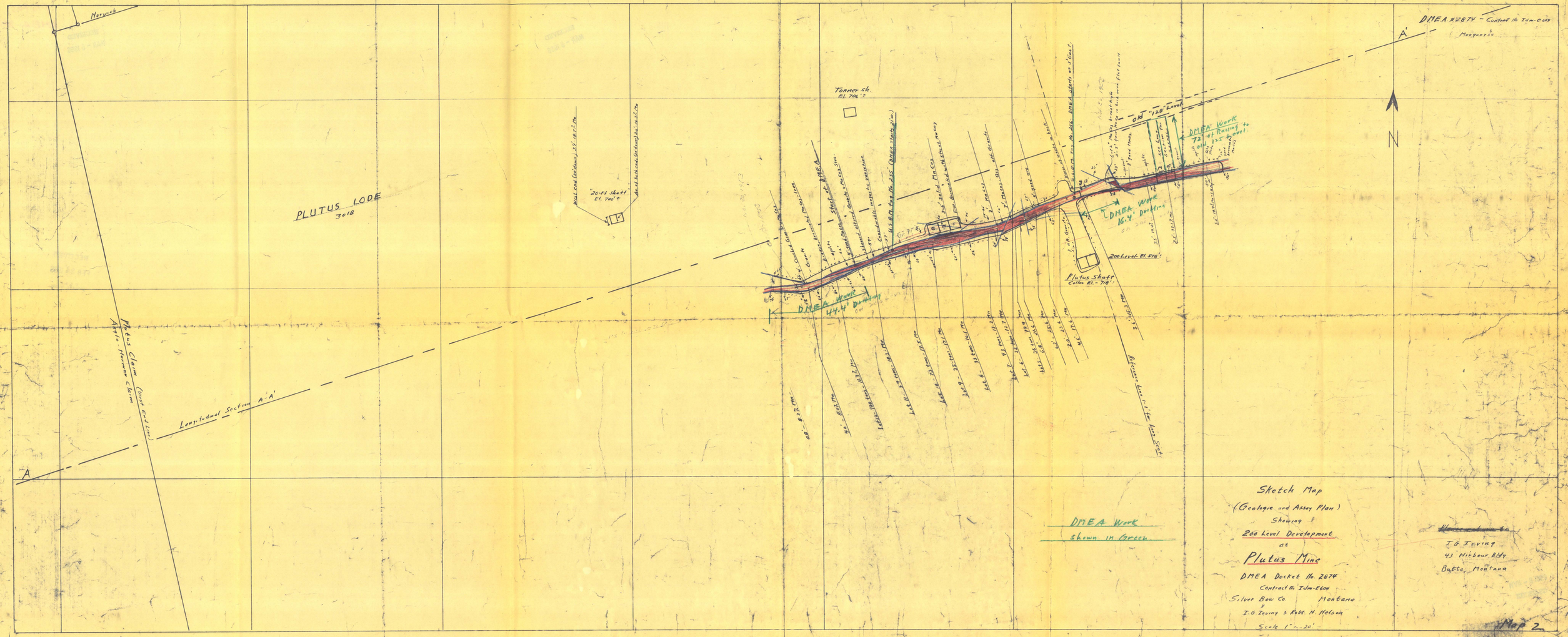
Interval, feet	Length, feet	Percent recovery			Analyses			
		Core	Sludge		Mn	Zn	Au	Ag
316.3-319.9	3.6	100	36	s	1.0	*0.05	tr.	0.4
319.9-327.1	7.2	89	28	s	.5	* .05	tr.	.1
327.1-333.3	6.2	100	25	s	.5	* .05	tr.	* .05
333.3-337.6	4.3	100	34	s	.8	* .05	tr.	.2
337.6-342.8	5.2	100	35	s	1.0	* .05	tr.	.1
342.8-347.1	4.3	100	35	s	.7	* .05	tr.	* .05
347.1-349.8	2.7	28	37	s	.5	* .05	tr.	* .05
349.8-353.9	4.1	78	48	s	.6	* .05	tr.	* .05
353.9-357.5	3.6	100	42	s	.5	* .05	tr.	* .05
357.5-362.6	5.1	50	44	s	.5	* .05	tr.	.1
362.6-366.1	3.5	100	56	s	.7	* .05	tr.	* .05
366.1-370.1	4.0	100	70	s	.6	* .05	tr.	* .05
370.1-374.9	4.8	100	78	s	.8	* .05	tr.	.1
374.9-377.3	2.4	100	104	s	.6	* .05	tr.	.2
384.4-390.0	5.6	100	32	s	.6	* .05	tr.	* .05
390.0-394.2	4.2	100	31	s	.6	* .05	tr.	* .05
394.2-396.7	2.5	24	42	s	1.5	* .05	tr.	* .05
394.2-397.0	2.8	30		c	1.4	* .05	0.005	3.0
396.7-397.8	1.1	100	50	s	1.5	* .05	tr.	.2
397.8-401.3	3.5	100	54	s	1.0	* .05	tr.	.1

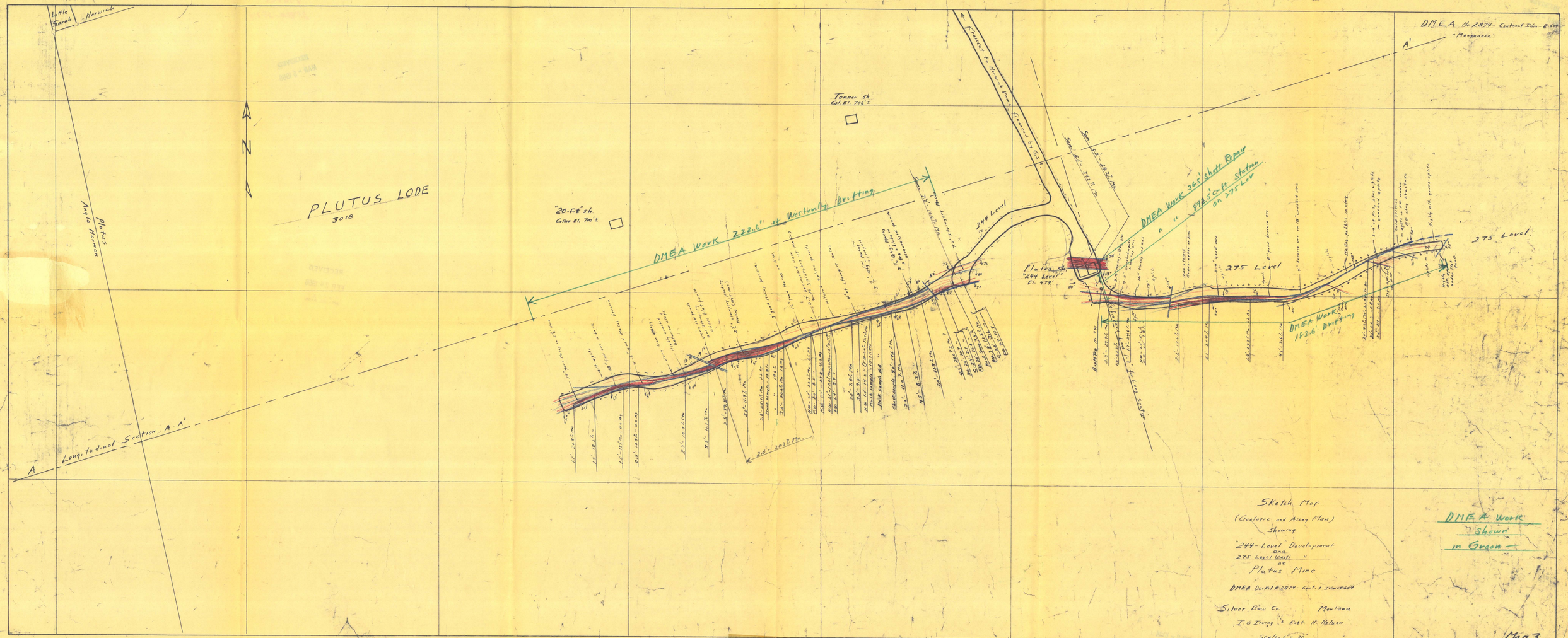
* Less than.
c Core sample.
s Sludge sample.

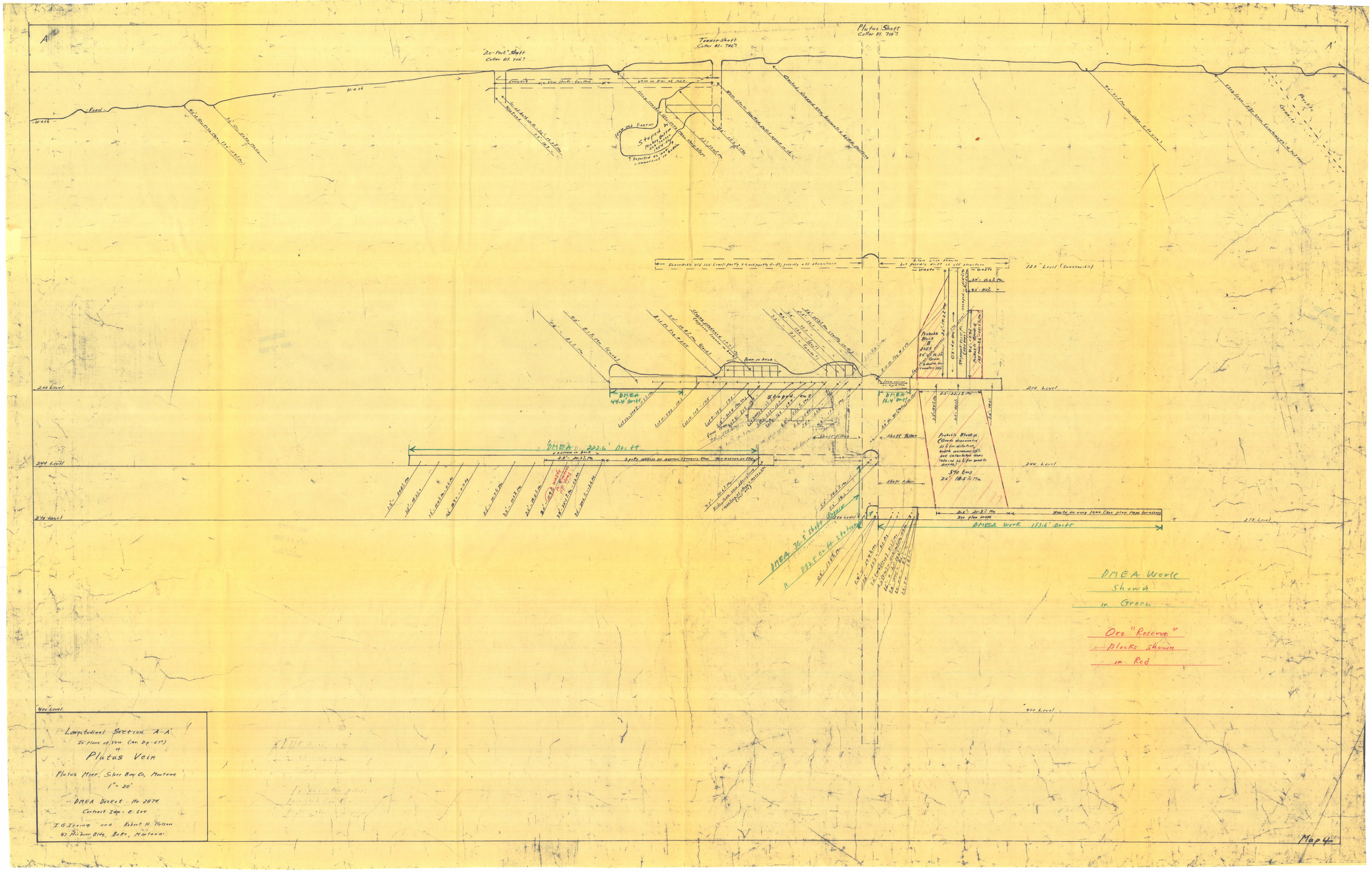
Interior - Bureau of Mines, Pittsburgh, Pa.


Sketch Map
(Geologic and Assay Plan)
Showing
200 Level Development
of
Plutus Mine
DMEA Docket No. 2874
Contract No. I-Ion-Bow
Silver Bow Co. Montana
J.G. Irving & Robt. H. Nielsen
Scale 1" = 20'
Please return to
J.G. Irving
40 Nielsen Bldg.
Butte, Montana
N
A
A'
Longitudinal Section A-A'
Plutus Claim
Apex: Nielsen Claim
Nevada
Tunnel Sh.
El. 700'±
"20-ft Shaft"
El. 700'±
200 Level El. 610'±
Plutus Shaft
Collar El. 710'±
DMEA #2874 — Contract No. I-Ion-Bow
Mesquite


DMEA # 2874 - Contract No. Idm. E-604
Manganese
Norwich Lode
PLUTUS LODE
3018
Aspen Mineral Lode
Sam. - 4.6' - 17.5 Z. Mn
Sam. - 2.9' - 31.3 Z. Mn
Longer Sh.
Col. El. 706'
"20-Ft" sh.
Collar El. 700'
Sam. - 3.6' - 16.3 Z. Mn
Wash
Road
El. 680'±
Plutus Sh.
Col. El. 718'
Reference Line Col. Ele. Lines
Note
These buildings were built in subsequent to application
Longitudinal Section A-A'
A
A'
Sketch Map
(Geologic and Assay Plan)
Showing
Surface Cuts
at
Plutus Mine
DMEA. Docket No. 2874
Contract No. Idm. E-604
Silver Bow Co. Montana
I. G. Irving & Robt. H. Nelson.
Scale - 1" = 20'
Map A


Norwick
PLUTUS LODE
3018
"20-ft Shaft
El. 760'±
Tonner sh.
El. 706'±
DMEA #2874 - Contract No. Idm-6604
Manganese
A'
A
N
"125" Level
DMEA Work
72' of Raising to
OH "125" Level
DMEA Work
16.4' Drifting
DMEA Work
44.4' Drifting
200 Level - El. 516'±
Plutus Shaft
Collar El. - 718'±
Makes Claim (Lost End Line)
Apex Norwick Claim
Longitudinal Section A-A'
DMEA Work
shown in Green
Sketch Map
(Geologic and Assay Plan)
Showing
200 Level Development
at
Plutus Mine
DMEA Docket No. 2874
Contract No. Idm-6604
Silver Bow Co. Montana
I. G. Irving & Robt. H. Nelson
Scale 1" = 20'
I. G. Irving
43 Hibbard Bldg
Butte, Montana
Map 2


Little Sarah
Norwich
Platus
Anglo Norman
N
PLUTUS LODE
3018
"20-Ft" sh.
Collar El. 706'±
Tonner sh.
Col. El. 706'±
DMEA Work 232.6' of Westerly Drifting
244 Level
Plutus sh.
"244 Level"
El. 474'
DMEA Work 36.6' Shaft Repair
" " 18.5' Cut Station
on 275 Lev
275 Level
DMEA Work 123.6' Drifting
275 Level
DMEA No 2874 - Contact Isln - E-664
- Manganese
A'
A
Longitudinal Section A A'
Sketch Map
(Geologic and Assay Plan)
Showing
"244-Level" Development
and
275 Level (East) "
at
Plutus Mine
DMEA Docket #2874 Cont. & Isln E664
Silver Bow Co. Montana
I G Irving & Robt H. Nelson
Scale-1" = 20'
DMEA Work
Shown
in Green
Map 3



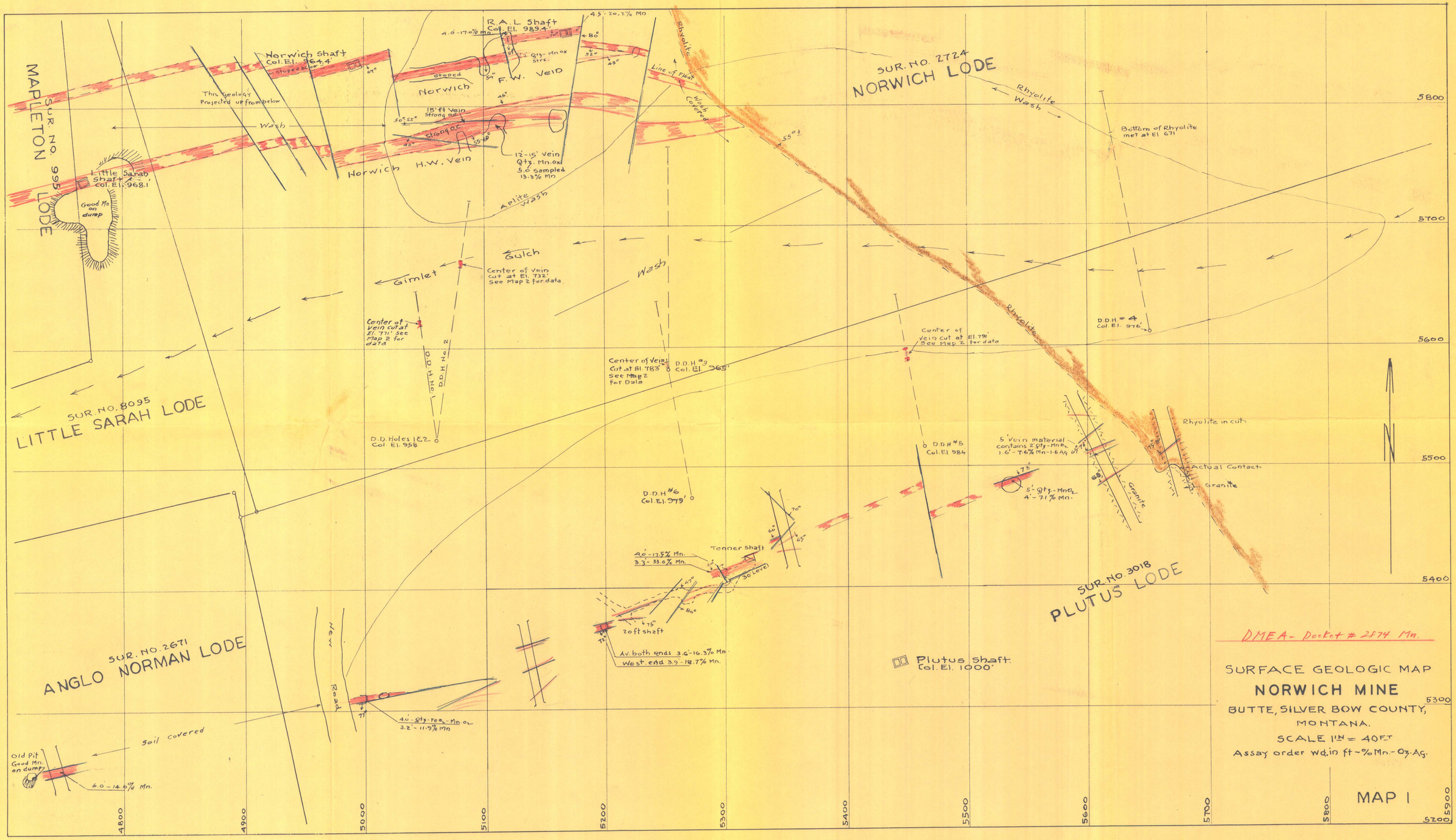
Longitudinal Section A-A'
In plane of Vein (Ave. Dip - 67°)
of
Plutus Vein

Plutus Mine, Silver Bow Co., Montana
1" = 20'

DMEA Docket - No 2874
Contract Idp - E-64

I G Irving and Robert H Nelson
43 Arthur Bldg, Butte, Montana

Map 4


SURFACE GEOLOGIC MAP
NORWICH MINE
BUTTE, SILVER BOW COUNTY, MONTANA.
SCALE 1IN = 40FT
Assay order wd. in ft - % Mn. - Oz. Ag.
MAP I
DMEA - Docket # 2874 Mn.
SUR. NO. 2724
NORWICH LODE
SUR. NO. 995
MAPLETON LODE
SUR. NO. 8095
LITTLE SARAH LODE
SUR. NO. 2671
ANGLO NORMAN LODE
SUR. NO. 3018
PLUTUS LODE
R.A.L. Shaft
Col. El. 989.4'
4.0-17.0% Mn.
4.5-20.2% Mn.
Norwich Shaft
Col. El. 964.4
Stoped
Norwich F.W. Vein
Qtz.-Mn ox stringers
Norwich H.W. Vein
15' ft Vein
Strong Qtz
12'-15' Vein
Qtz. Mn. ox
5.0 sampled
13.3% Mn
This Geology Projected up from below
Wash
Little Sarah Shaft
Col. El. 968.1'
Good Mn on dump
Rhyolite
Line of Float
Aplite Wash
Gulch
Gimlet
Center of Vein cut at El. 732' See Map 2 for data
Center of Vein cut at El. 771' See Map 2 for data
D.D.H. No. 1
D.D.H. No. 2
D.D. Holes 1 & 2
Col. El. 958
Center of Vein cut at El. 783' See Map 2 for Data
D.D.H. #3
Col. El. 965'
D.D.H. #6
Col. El. 979'
Center of Vein cut at El. 791' See Map 2 for data
D.D.H. #4
Col. El. 976'
Bottom of Rhyolite met at El. 671
D.D.H. #5
Col. El. 984
5' Vein material contains 2' Qtz.-MnO2
1.6'-7.6% Mn-1.6 Ag oz
5'-Qtz.-MnO2
4'-7.1% Mn.
Rhyolite in cut
Actual Contact
Granite
Tonner Shaft
4.0'-17.5% Mn.
3.3'-33.0% Mn.
30 Level
20 ft shaft
Av. both ends 3.6'-16.3% Mn.
West end 3.9'-18.7% Mn.
Plutus shaft
Col. El. 1000'
New Road
4.0'-Qtz.-rich-MnO2
3.2'-11.9% Mn
Soil covered
Old Pit
Good Mn. on dump
6.0-14.0% Mn.
5800
5700
5600
5500
5400
5300
5200
4800
4900
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900

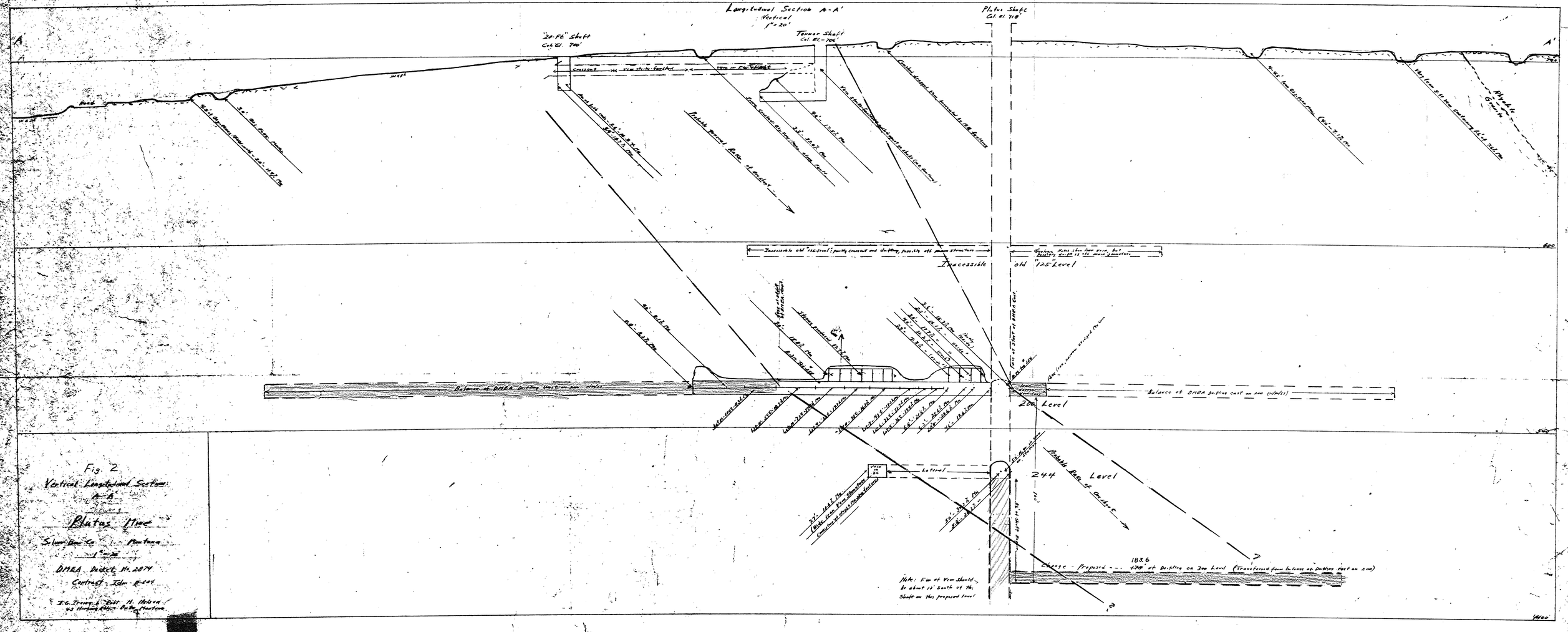
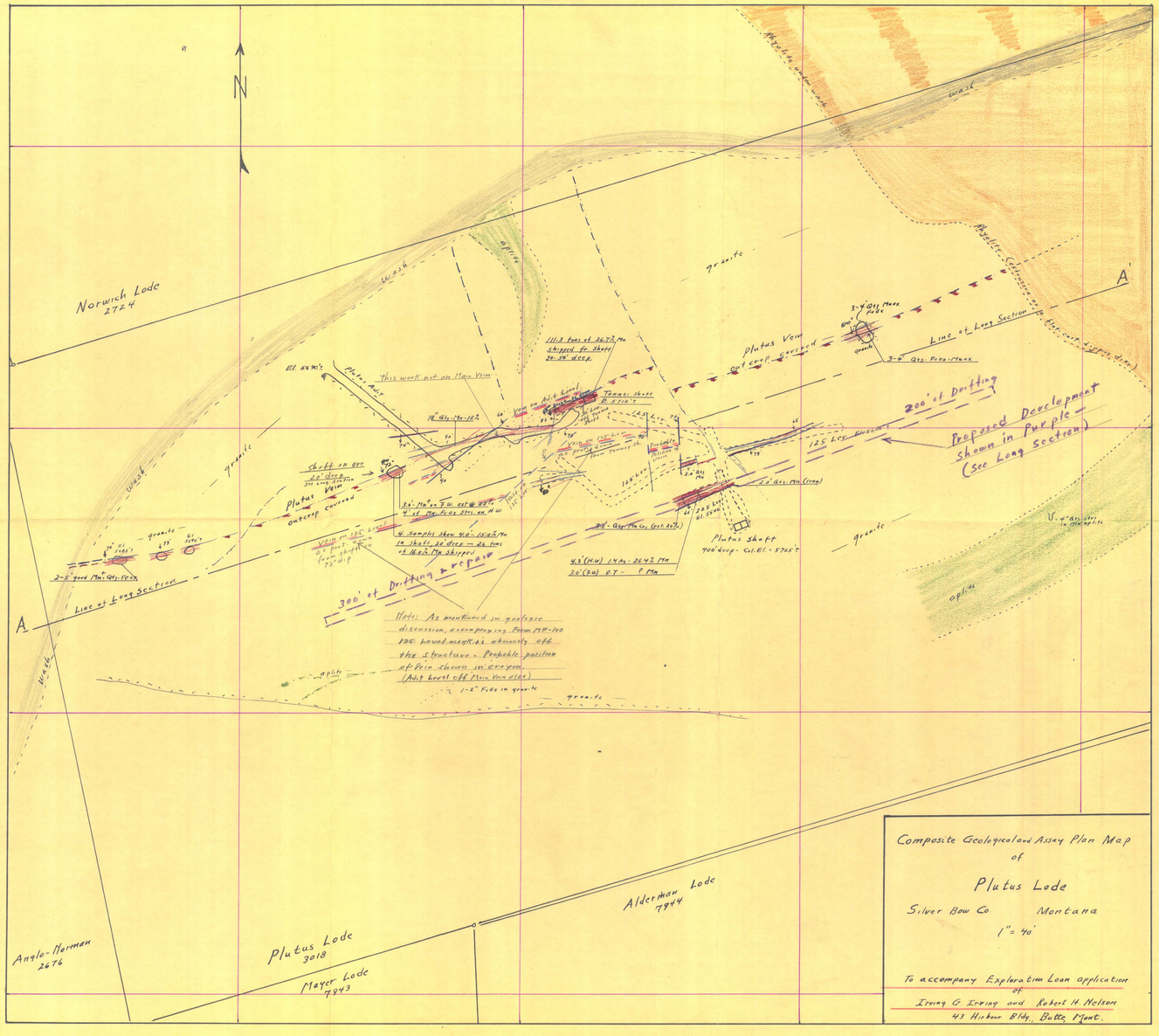
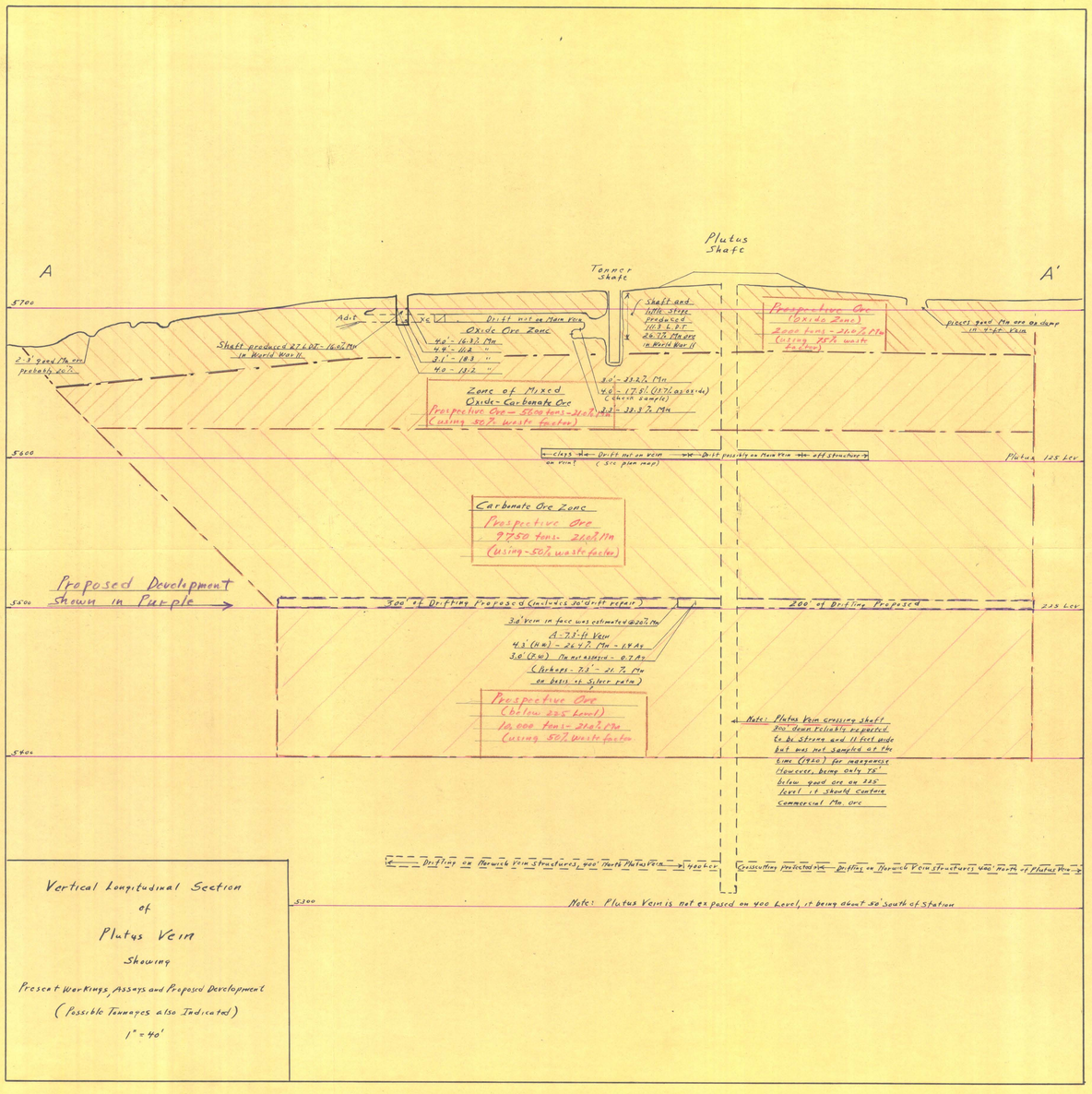


Fig. 2
Vertical Longitudinal Section
A-A'
Plutus Mine
Silver Bow Co. - Montana
1" = 20'
DMEA. Project No. 2074
Contract - Idm - 8-204
J.G. Trump & Prof. H. Pelletier
93 Hardin Bldg. Butte, Montana

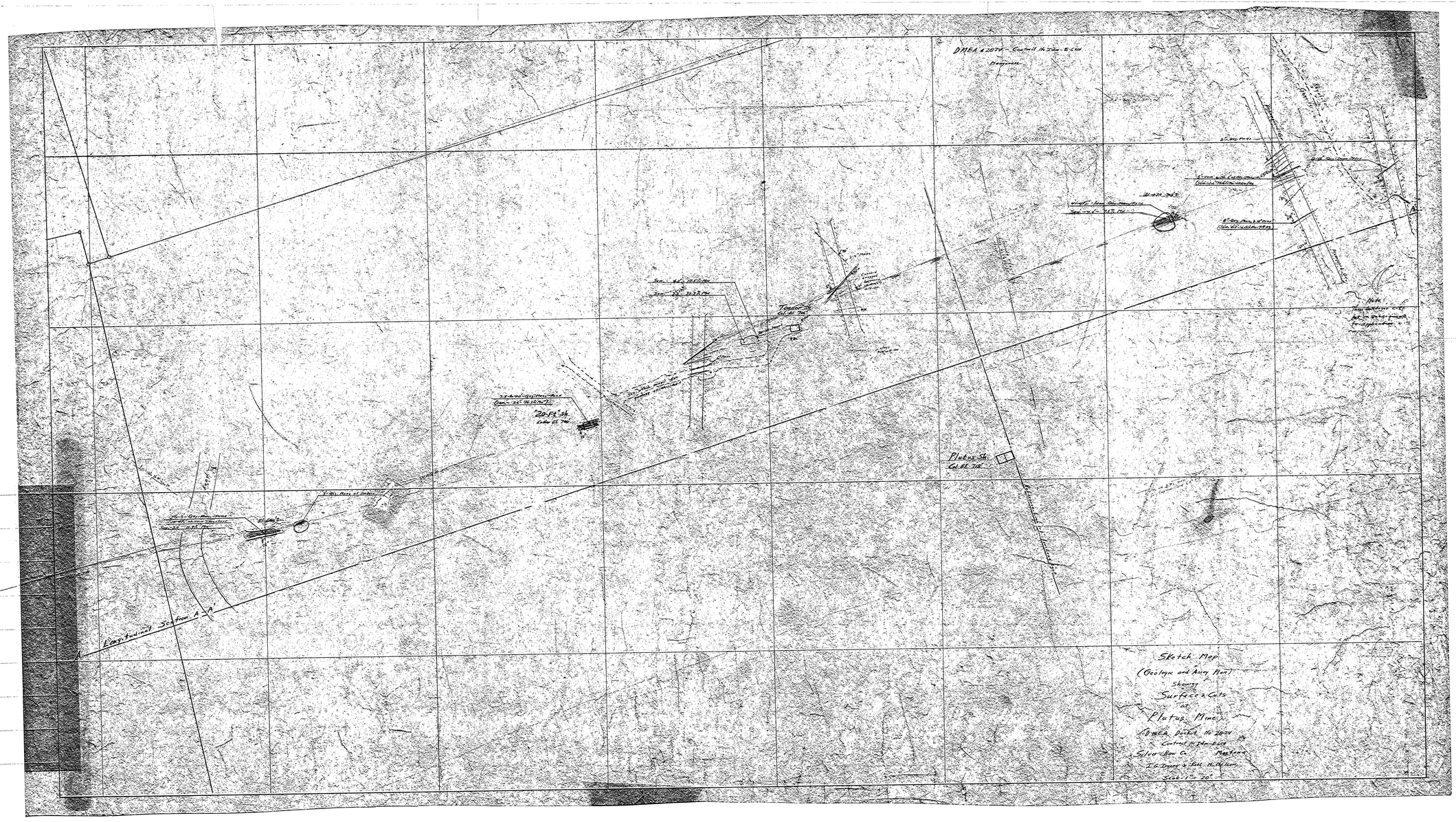


Composite Geological and Assay Plan Map
of
Plutus Lode
Silver Bow Co. Montana
1" = 40'

To accompany Exploration Loan application
of
Irving G. Irving and Robert H. Nelson
43 Harbour Bldg., Butte Mont.



Vertical Longitudinal Section
of
Plutus Vein
Showing
Present Workings, Assays and Proposed Development
(Possible Tonnages also Indicated)
1" = 40'

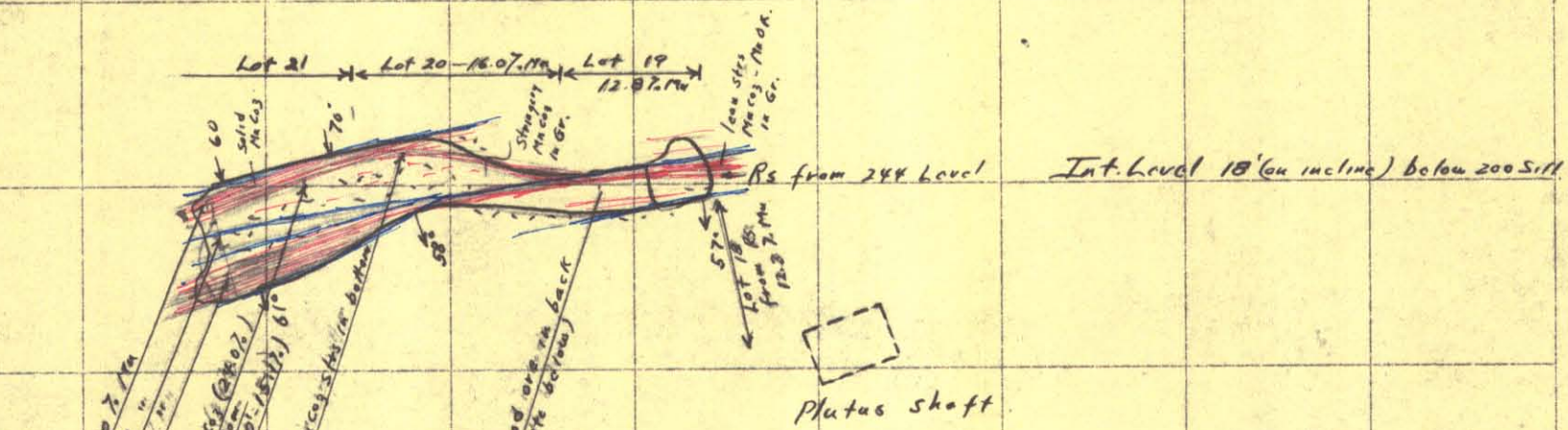

DMEA # 207H - Contact No 2204 - E.C.M.
Manganese
Longitudinal Section A-A'
20-Ft Sh.
Plutus Sh.
Sketch Map
(Geology and Assy Plan)
Showing
Surface & Cuts
at
Plutus Mine
DMEA Docket No 2204
Contact Manganese
Silver Bow Co. Montana
I.A. Drum & Jos. H. Hollow
Scale 1" = 20'

DMEA- 2874
Idm-E-604

(Manganese)

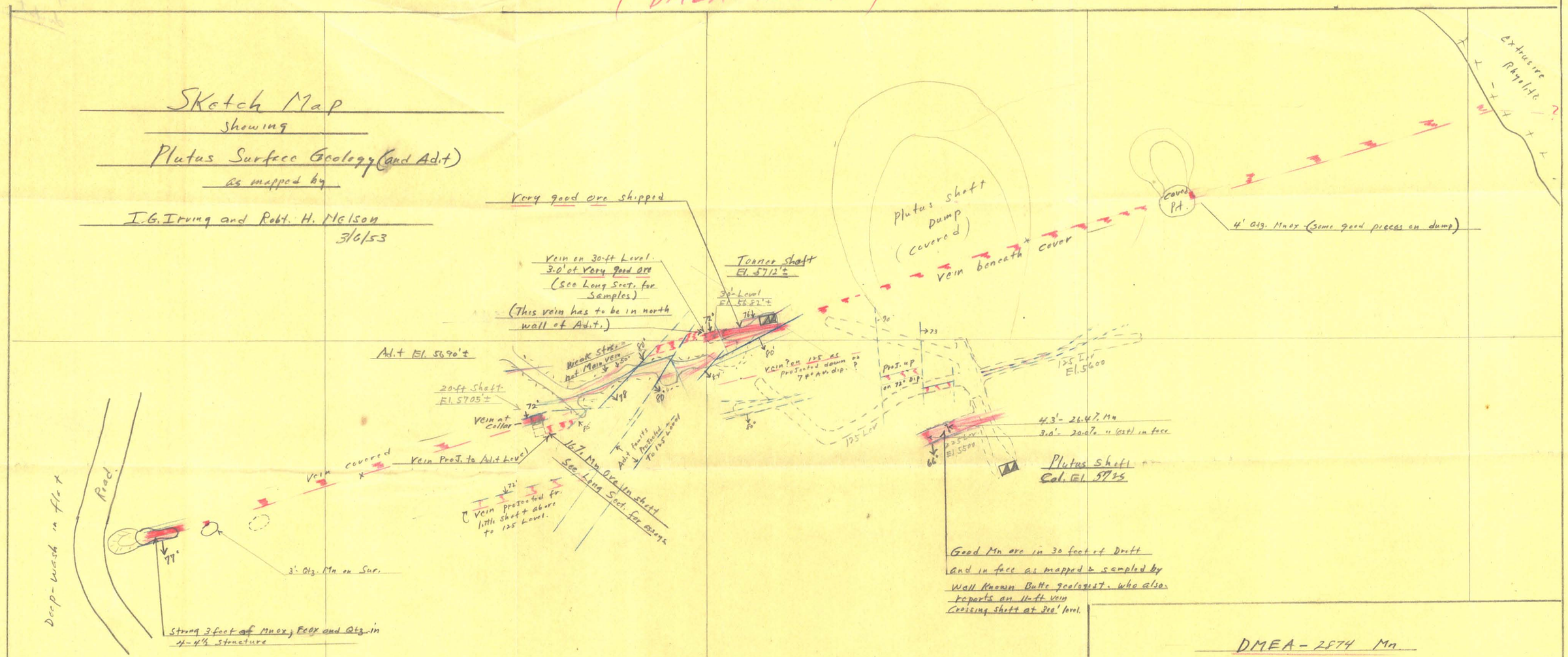
Plutus Mine
Butte, Montana

Intermediate Level
27' above 244 Lev.
1" = 20'-



(DMEA - No 2874)

Sketch Map
showing
Plutus Surface Geology (and Adit)
as mapped by
I.G. Irving and Robt. H. Nelson
3/6/53



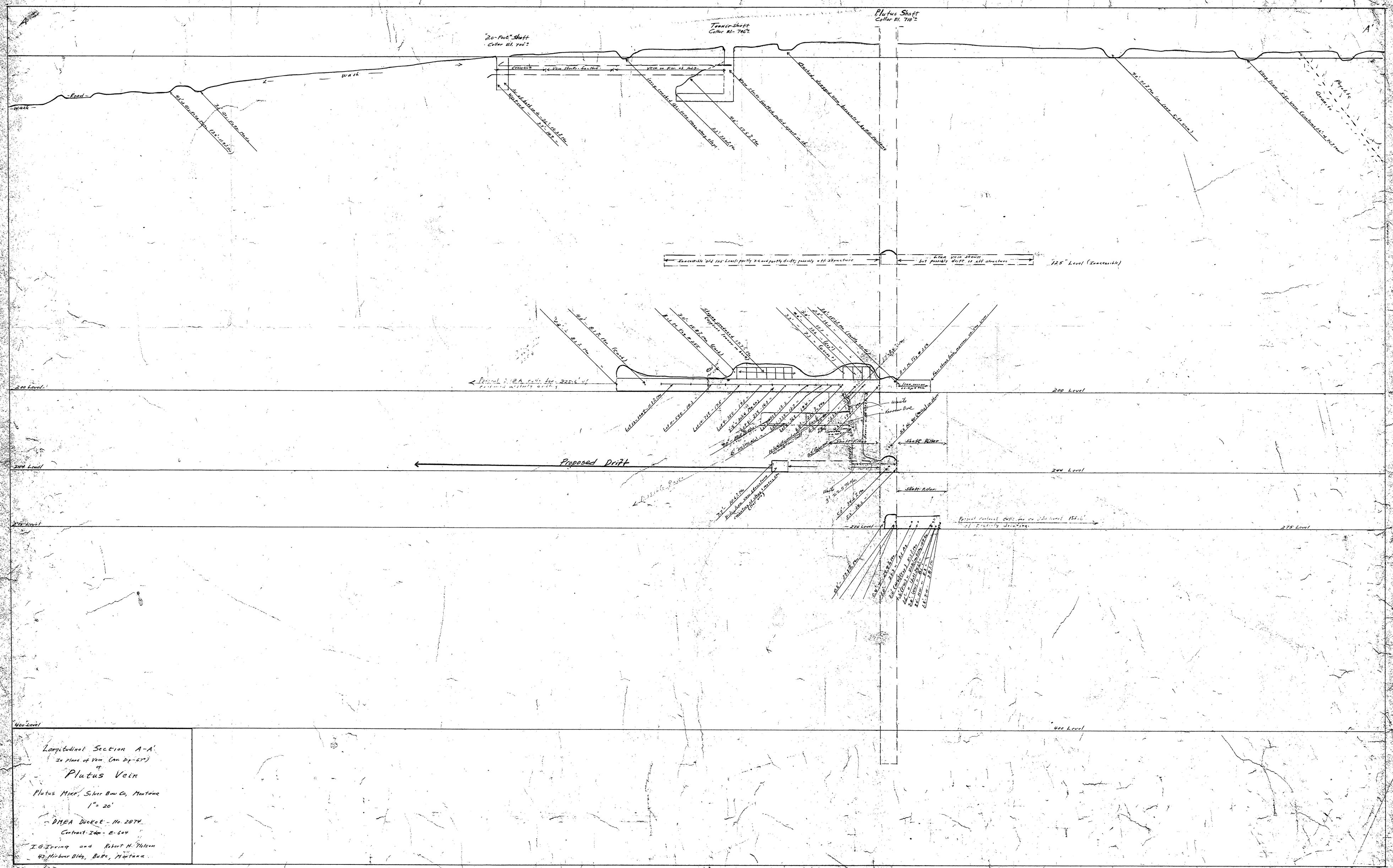
Good Mn ore in 30 feet of Drift and in face as mapped & sampled by Well Known Butte geologist, who also reports an 11-ft vein crossing shaft at 300' level.

DMEA - 2874 Mn

I.G. Irving and R.H. Nelson

Supplementary Map
of
Plutus Lode
Silver Bow Co., Montana
1" = 40'

I.G. Irving

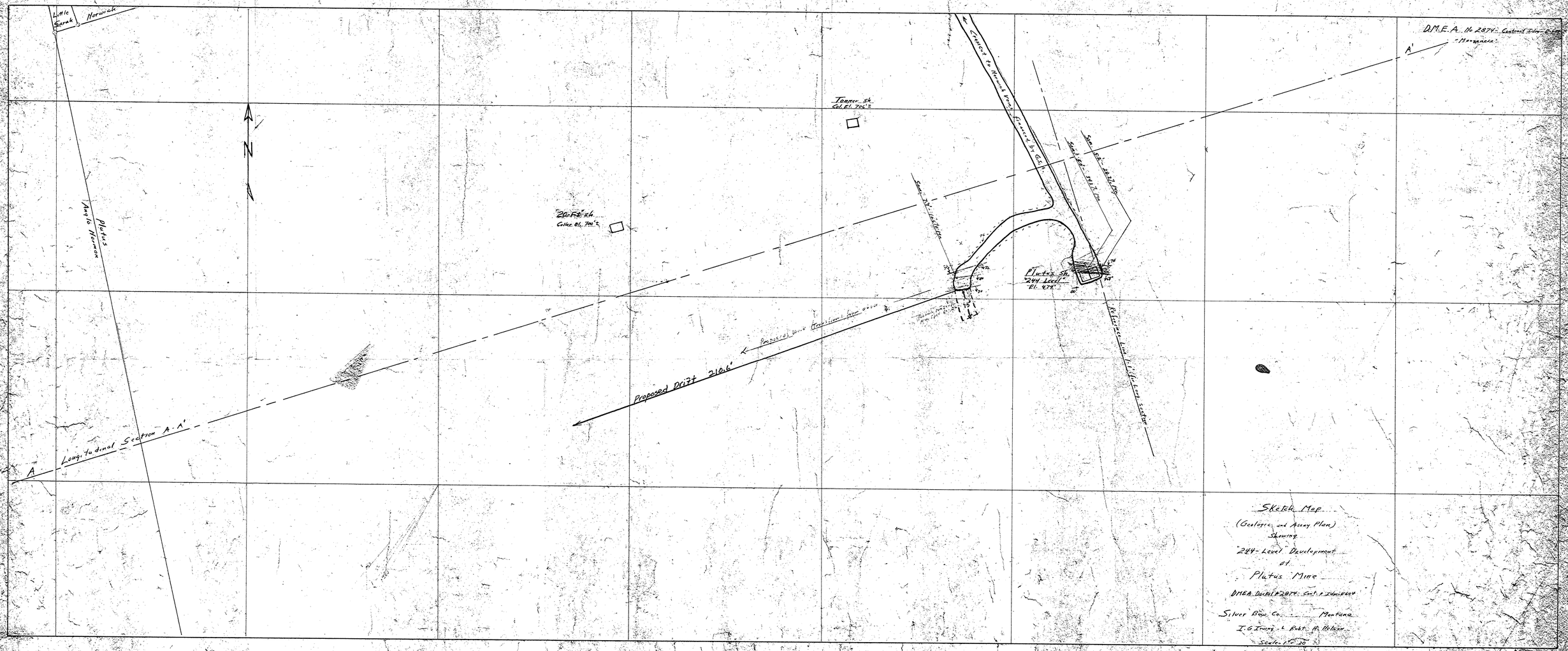


Longitudinal Section A-A'
In Plane of Vein (Av. Dip-67°)
of
Plutus Vein

Plutus Mine, Silver Bow Co, Montana
1" = 20'

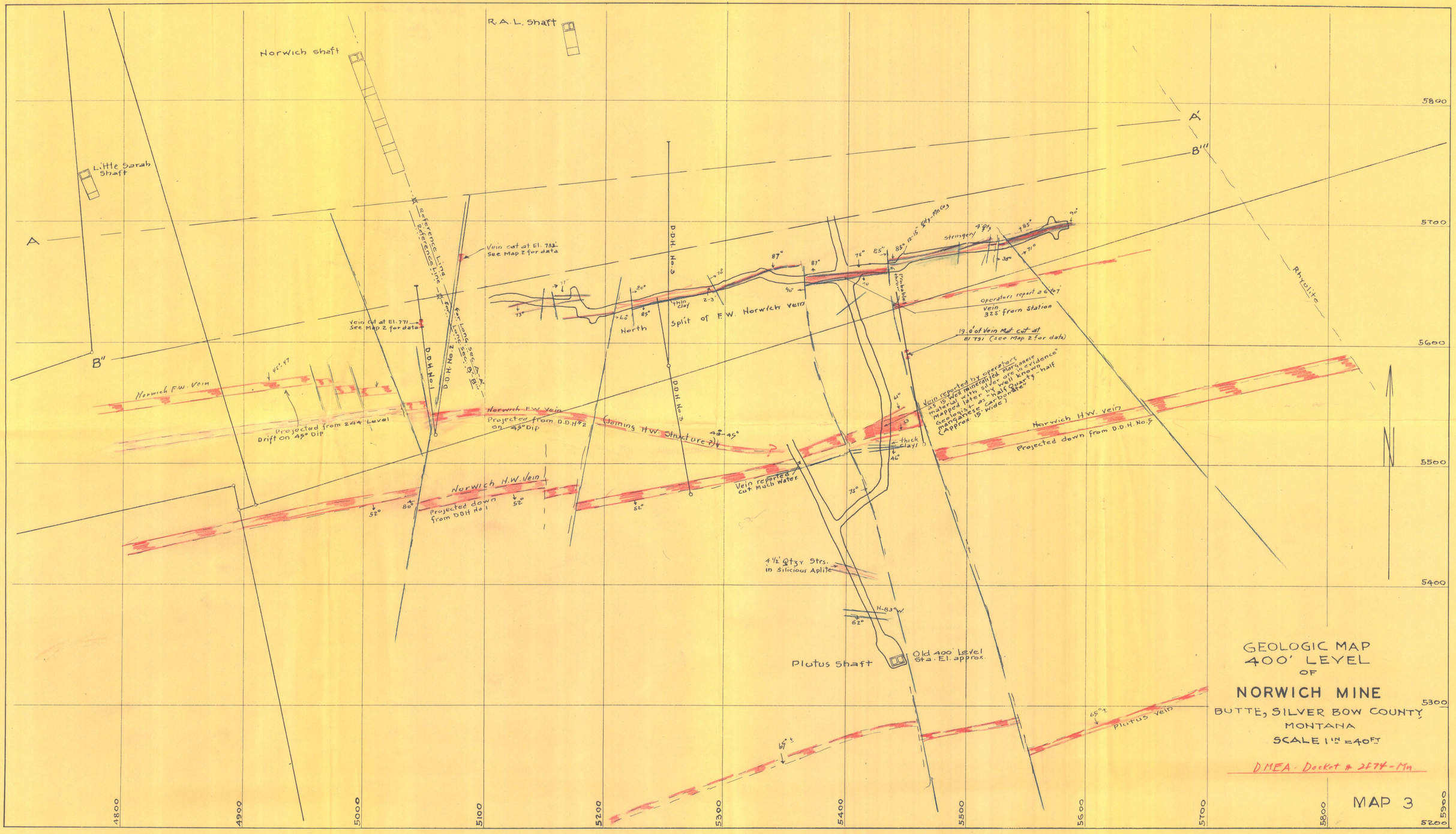
DMEA Docket - No. 2874
Contract Idm - E-604

I.G. Irving and Robert H. Nelson
43 Hirbour Bldg, Butte, Montana



Sketch Map
(Geologic and Assay Plan)
Showing
"244-Level" Development
of
Plutus Mine
D.M.E.A. Docket #2874 Cont. # 2Jan-8604
Silver Bow Co. Montana
I. G. Irving & Robt. B. Holzer
Scale 1" = 20'

SUR. NO MARLETON 995 LODE
SUR. NO 8095 LITTLE SARAH LODE
SUR. NO. 2724 NORWICH LODE
SUR. NO. 3018 PLUTUS LODE
SUR. NO. 2671 ANGLO NORMAN LODE
R.A.L. Shaft Col. El. 989.4'
Norwich Shaft Col. El. 964.4'
Little Sarah Shaft Col. El. 968.1'
82' Level El. 892.4'
110' Level El. 882.4'
135' Level El. 843.4'
170' Level El. 812.6'
Long Section Line
Norwich F.W. Vein
North Split Norwich F.W. Vein
Connecting Split
Norwich H.W. Vein
See Long Section A-A' for assays of drift on Norwich F.W. Vein in 303 D.W. and older workings above
Center of vein cut at El. 732' only 2% core recovery. Sludge showed 10.8' of 16.9% Mn.
Center of mineralization cut at El. 771' No core recovery at all. Sludge assay showed: 4.4' of 9.7% Mn. within overall sludge assay of 9.8'-7.2% Mn.
Center of 19.0' of vein cut at El. 791. Core recov. 199.6-203.2' only 39% sludge recov. 199.6-203.2' 12% (Sludge assay 11.3% Mn. No core; Hs. Sludge 203.2-214.7' - 214.7-219' Very poor recovery of core & sludge (under 30%) but sludge assay showed 21.3' 7.3% Mn.
Ver. both sides Xcut 4'-14.8% Mn. 2.8 Ag. 5.2' 14.2% Mn.
Center of vein cut at El. 733' Vein reported as Poor core recovery 10.3' of 11.9% Mn. Note: tener of actual vein revealed in Xcut 25' above
D.D.H. No. 1
D.D.H. No. 2
D.D.H. #3 Col. El. 965
D.D.H. No. 4 Col. El. 976
D.D.H. No. 5 Col. El. 984
D.D.H. No. 6 Col. El. 979
D.D. Holes 1 & 2 Col. El. 958.0
301 Xcut
302
Plutus 200' Level
See Long Section for Assays
Plutus 250' Sta. El. 750'
Plutus Shaft Col. El. 1000.0
Plutus Vein
Rhyolite Dike
Granite
Rhyolite
Bottom of Rhyolite met at El. 671'
A
A'
B''
B'''
5800
5700
5600
5500
5400
5300
5200
4800
4900
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
GEOLOGIC MAP
300' LEVEL
(Actually 243' below Collar)
NORWICH MINE
BUTTE, SILVER BOW COUNTY, MONTANA
SCALE 1 IN = 40 FT
Assay order wd in ft - % Mn - oz Ag.
DMEA Docket # 2874 Mn
MAP 2



GEOLOGIC MAP
400' LEVEL
OF
NORWICH MINE
BUTTE, SILVER BOW COUNTY
MONTANA
SCALE 1 IN = 40 FT

DMEA - Docket # 2874-Mn

MAP 3

LONGITUDINAL SECTION A-A'
NORWICH FOOTWALL VEIN
SCALE 1 IN = 40 FT.

~Note~

Measured (Proved) and Indicated (Probable) Blocks shown in red

Inferred or Prospective Ore - Blocks shown in purple

Ore Reserves -

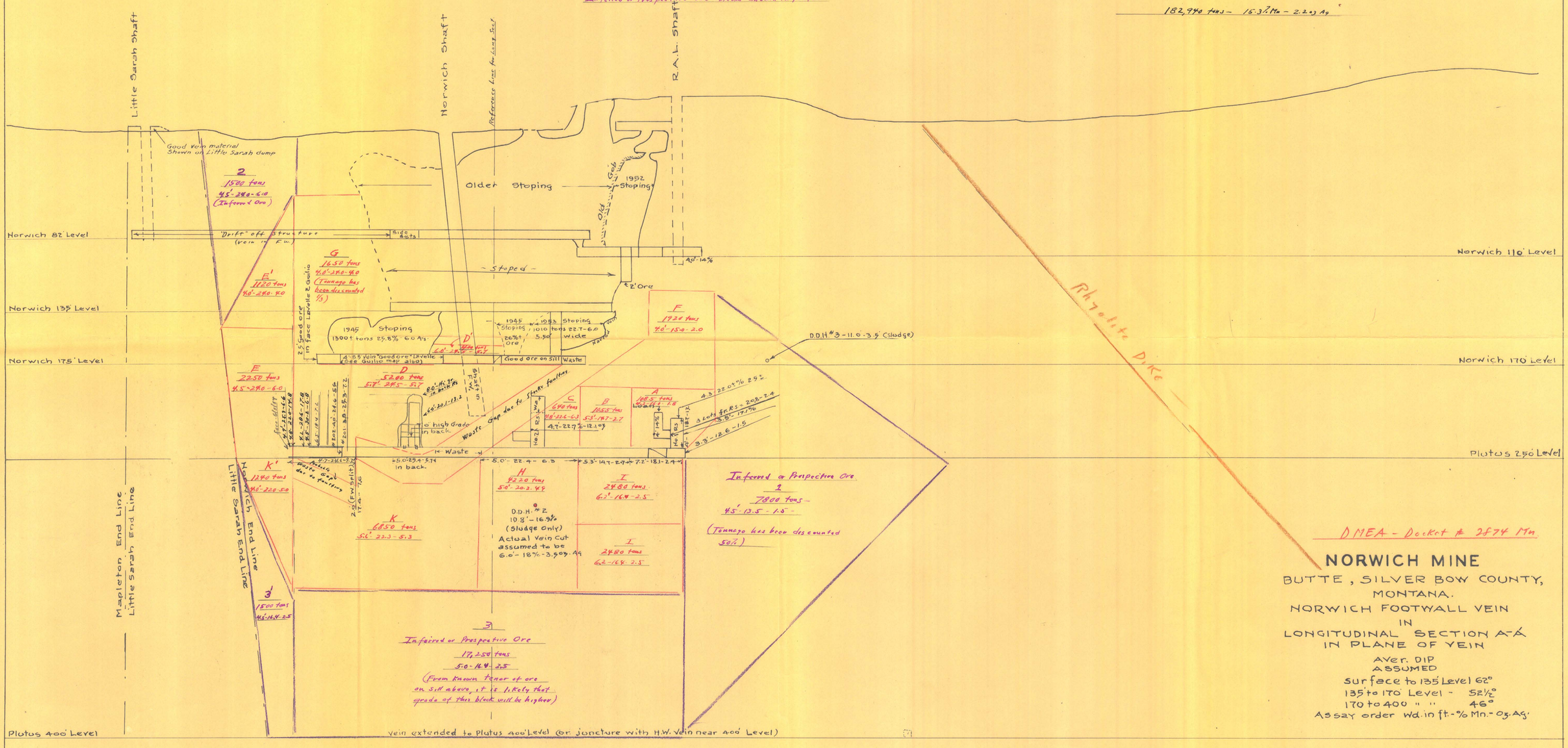
Summary of Blocks shown on Maps 4 & 5

A. Measured and Indicated Ore (as of 6/1/54) - 51,640 tons - 18.5% Mn - 3.5 oz Ag
(Includes 23,870 tons of Hi. grade - 22.7 " - 6.2 " "

B. Inferred or Prospective Ore - 131,300 tons - 14.0% Mn - 1.7 oz Ag

A & B. Combined

182,940 tons - 15.3% Mn - 2.2 oz Ag



DMEA - Docket # 2F74 Mn

NORWICH MINE

BUTTE, SILVER BOW COUNTY, MONTANA.

NORWICH FOOTWALL VEIN IN LONGITUDINAL SECTION A-A' IN PLANE OF VEIN

AVER. DIP ASSUMED

Surface to 135' Level 62°
135' to 170' Level - 52½°
170 to 400 " " 46°

Assay order Wd. in ft.-% Mn.-oz. Ag.

MAP 4

SECTION B''-B'''
NORWICH HANGINGWALL VEIN
IN PLANE OF VEIN (AV. DIP 52°)
SCALE 1IN = 40FT

Note

Measured (Proved) or Indicated (Probable) Blocks shown in red

Inferred or Prospective Ore blocks shown in purple

Ore Reserves

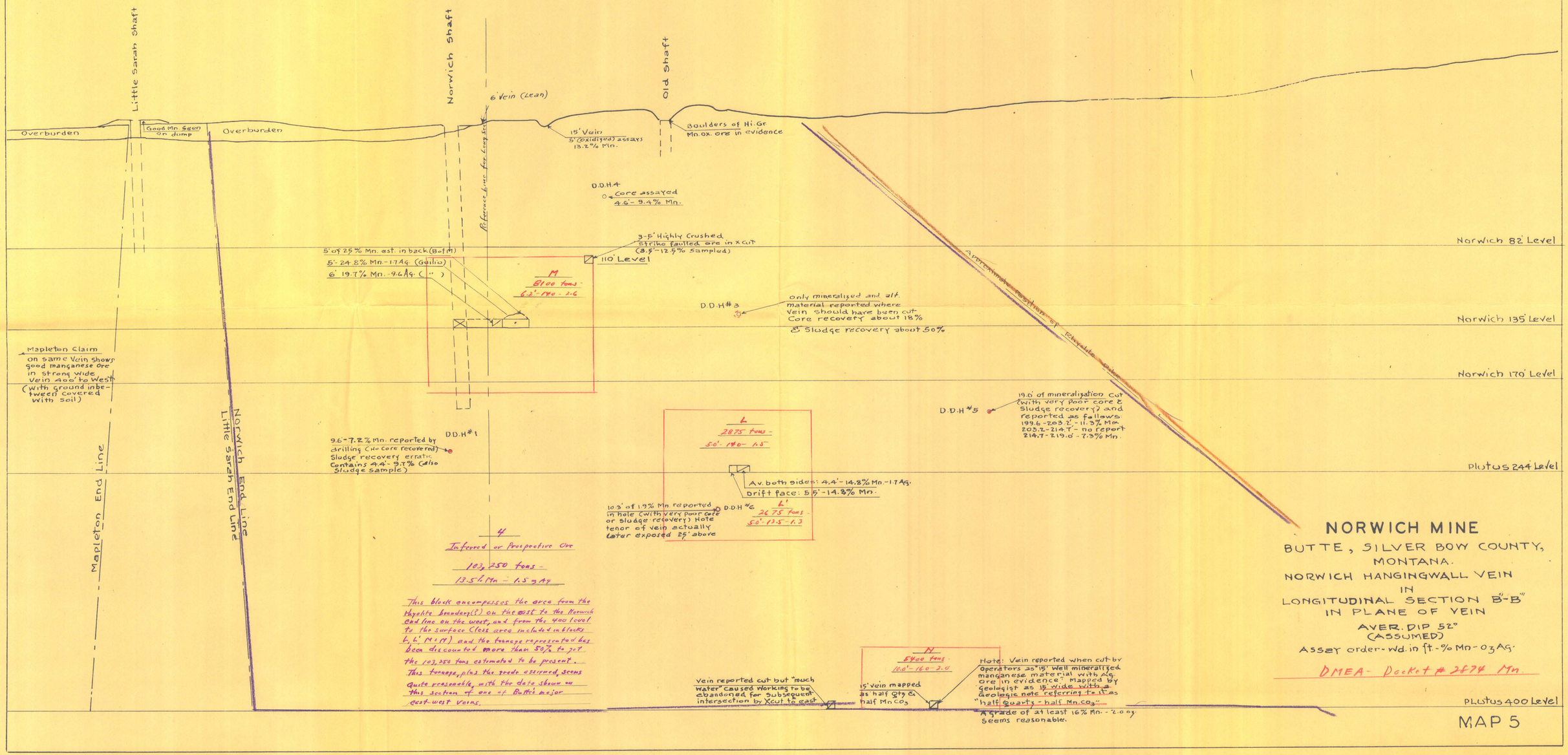
Summary of Blocks shown on Maps 4 & 5

A- Measured and Indicated Ore (as of 6/5/64) - 51,640 tons - 10.5% Mn - 3.5 oz Ag
(Includes - 23,570 tons of Hi grade - 22.7 " " - 5.2 " ")

B. Inferred or Prospective Ore - 131,300 tons - 14.0 " 1.7 "

A & B Combined

182,940 tons - 15.3% Mn - 2.2 oz Ag



NORWICH MINE

BUTTE, SILVER BOW COUNTY, MONTANA.

NORWICH HANGINGWALL VEIN IN LONGITUDINAL SECTION B''-B''' IN PLANE OF VEIN

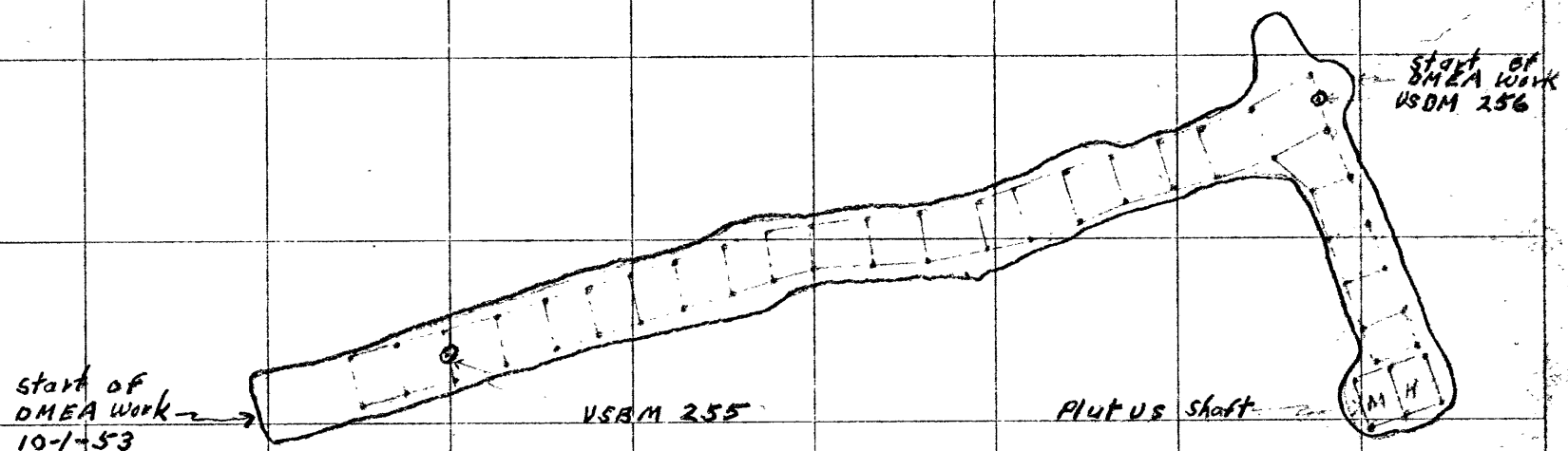
AVER. DIP 52° (ASSUMED)

ASSAY order - Wd. in ft. - % Mn - oz Ag.

DMEA - Docket # 2474 Mn.

MAP 5

PLUTUS MINE
200' Level
1" = 20'
Oct. 1, 1953



DMEA WORK

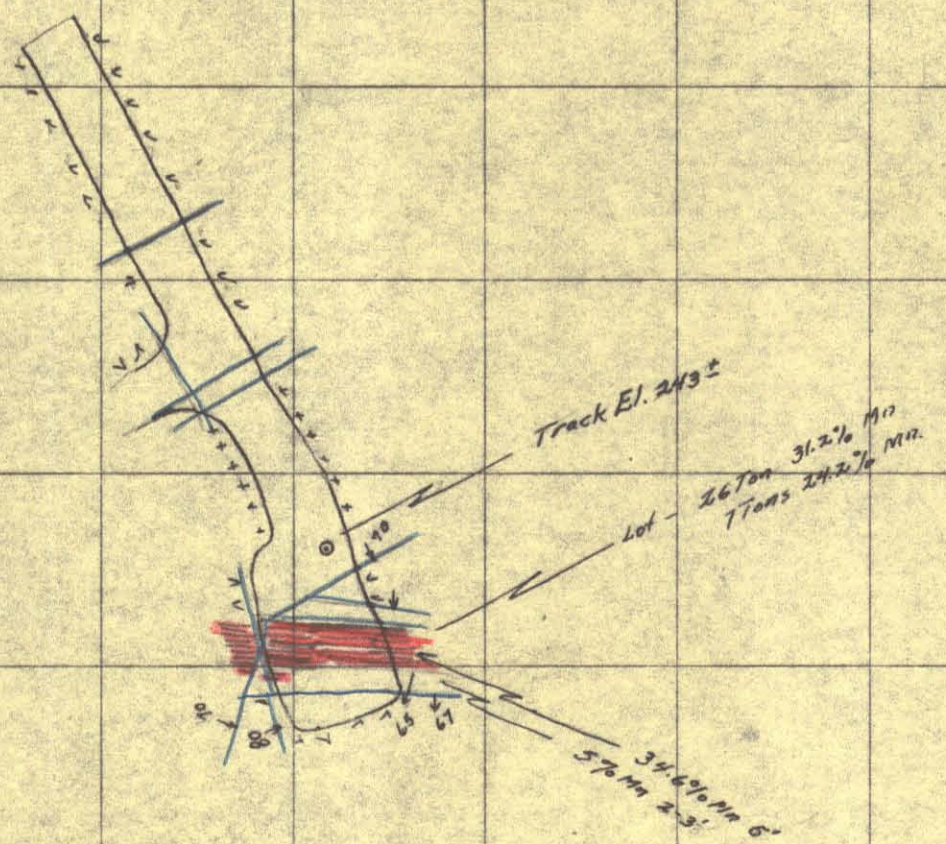
200 Drift West started 21' West of USBM 255

200 Drift East started 3' East of USBM 256

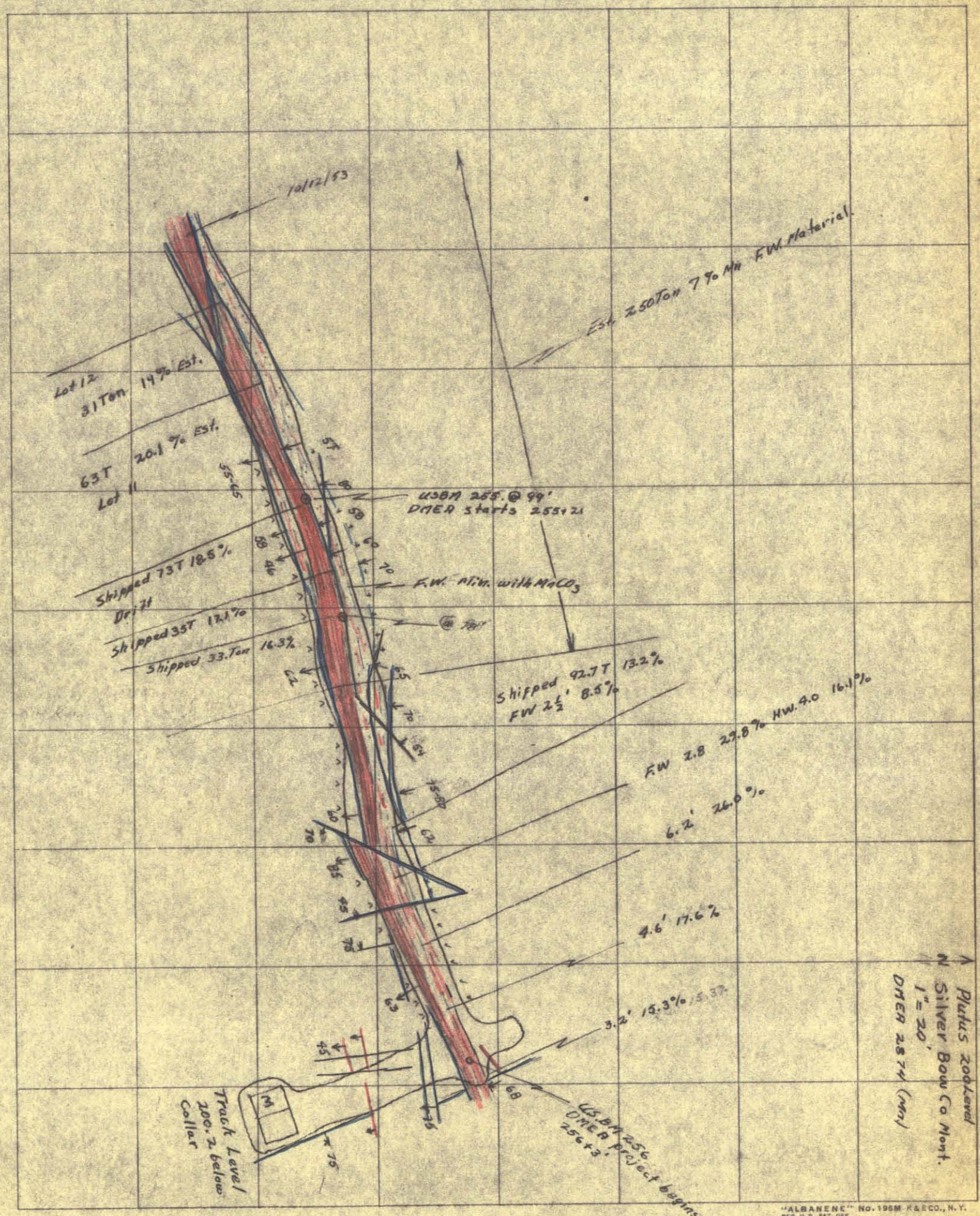
starting Date: Oct. 1, 1953

"ALBANENE" No. 196M K&E CO., N.Y.
MADE IN U.S.A. PAT. OFF

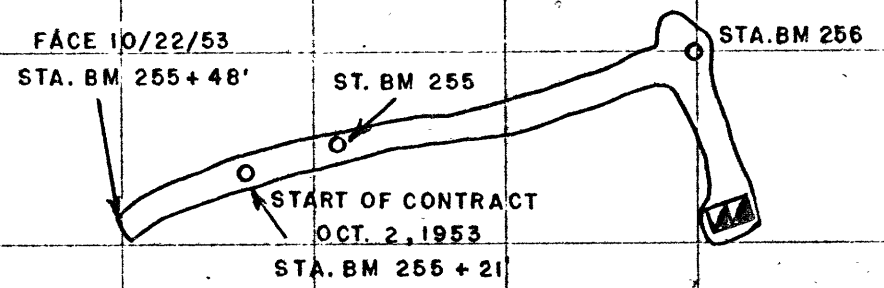
Plotus 243 Level
Silver Bow Co Mont.
1" = 20'
DMEA 2874



"ALBANENE" No. 1068 K&E CO., N.Y.



"ALBANENE" No. 195M K&E CO., N.Y.
REG. U.S. PAT. OFF.



200 LEVEL, PLUTUS MINE

SILVER BOW COUNTY, MONTANA

Docket No. DMEA 2874

Contract No. Idm-E604

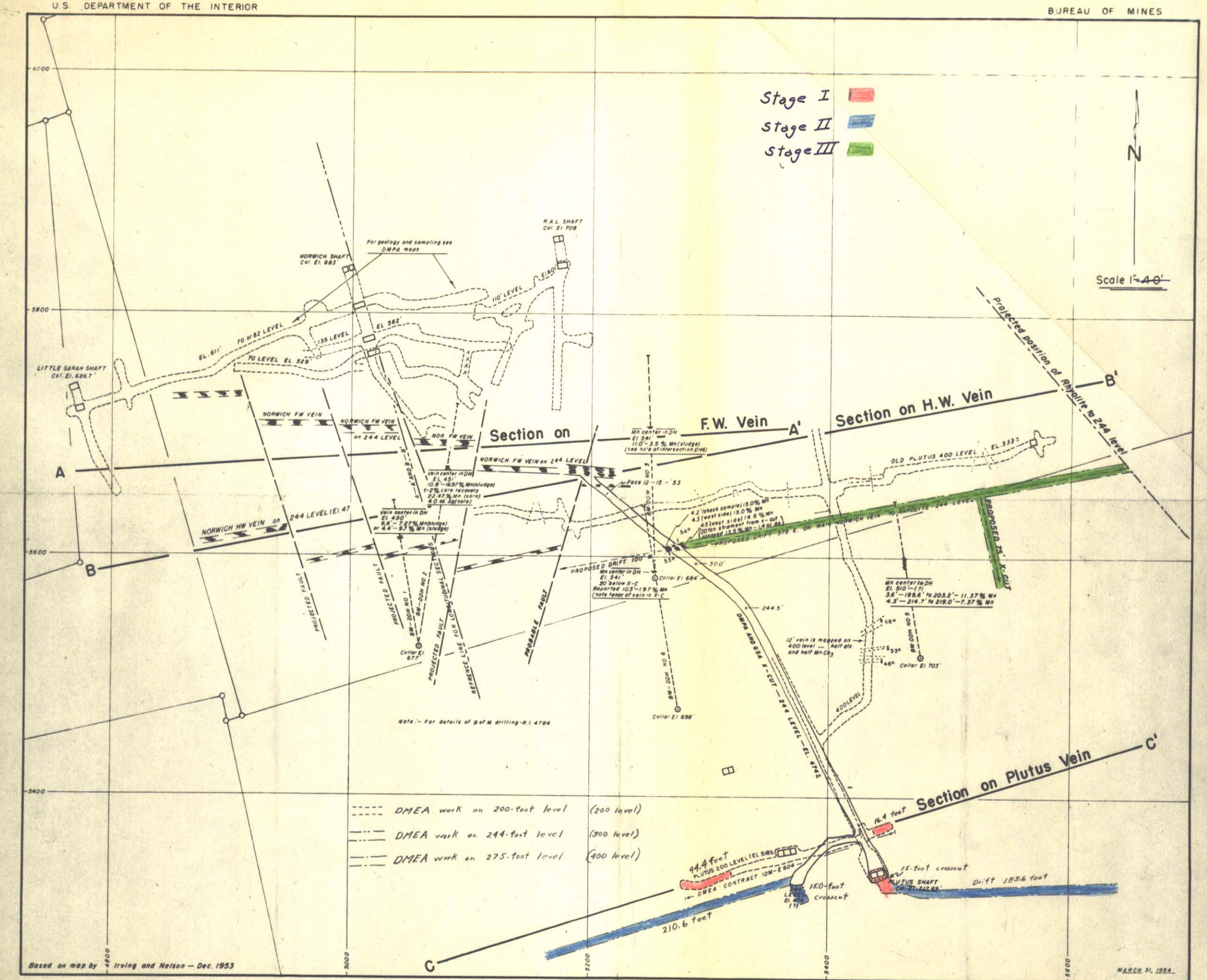
SCALE 1" = 40'

JDB

"ALBANENE" NO. 196M K&E CO., N.Y.
REG. U.S. PAT. OFF.

U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF MINES



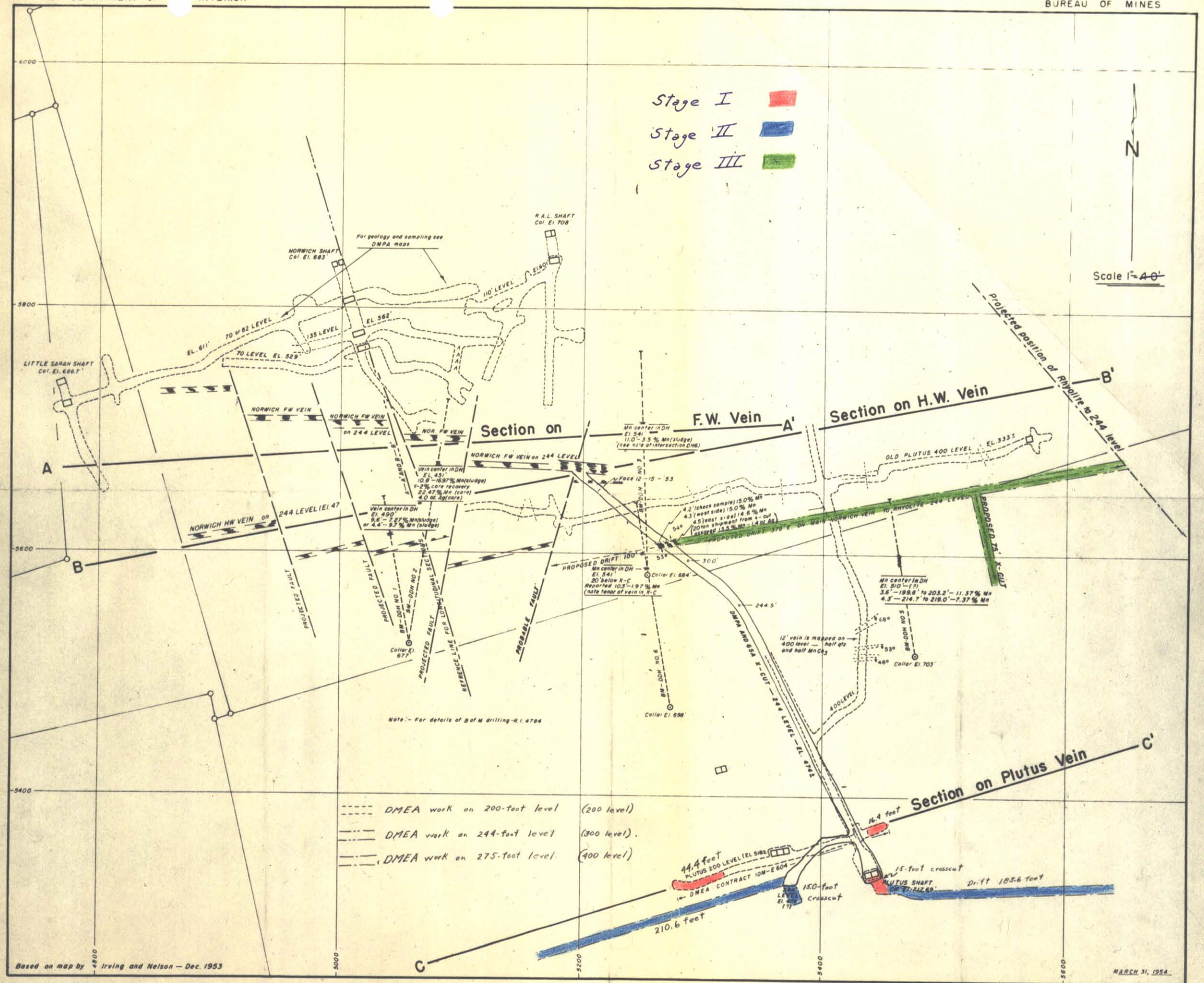
NORWICH-PLUTUS MINE, SILVER BOW COUNTY, MONTANA.

NELSON AND IRVING, BUTTE, MONTANA

COMPOSITE PLAN - MAP I.

U.S. DEPARTMENT OF THE INTERIOR

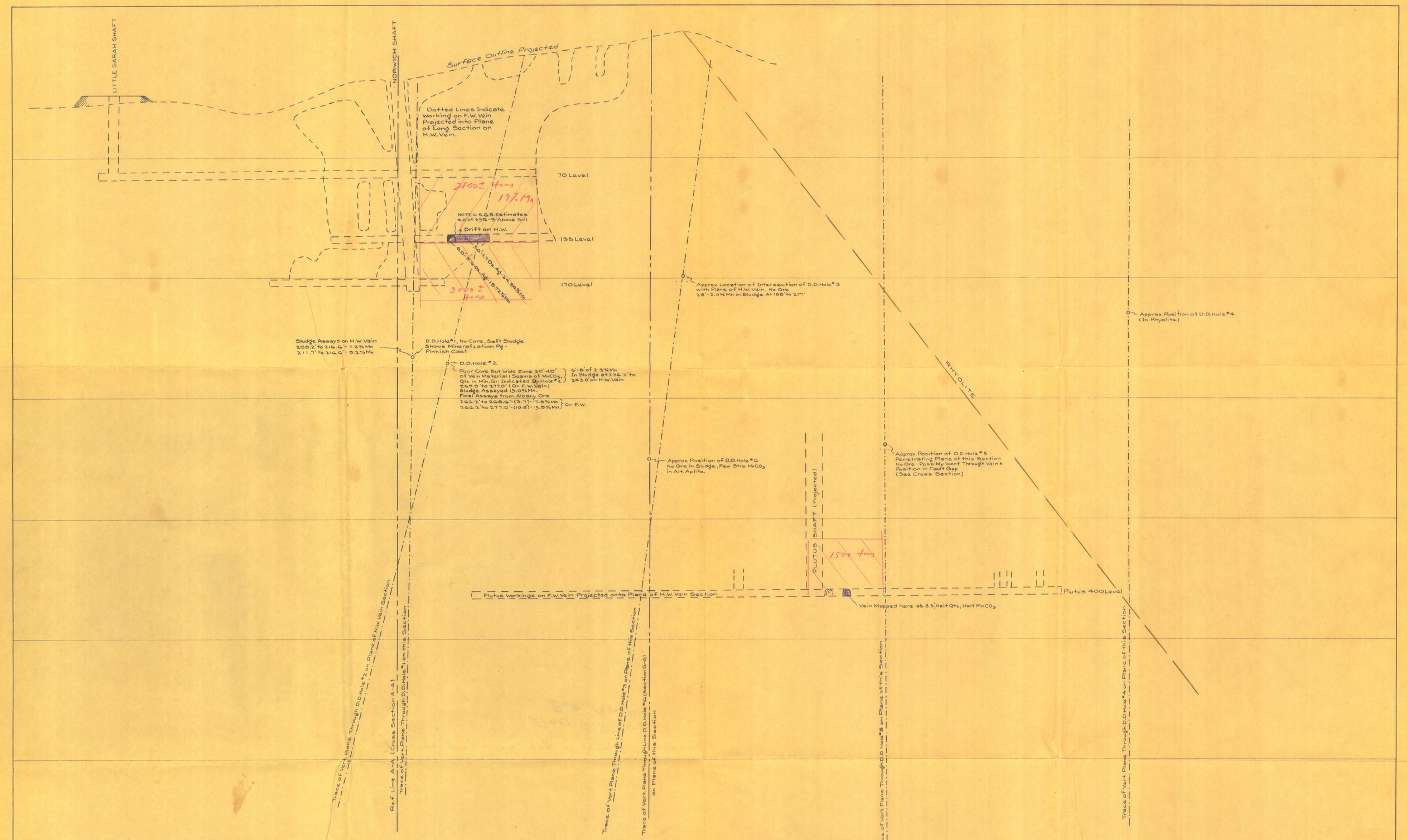
BUREAU OF MINES



NORWICH-PLUTUS MINE, SILVER BOW COUNTY, MONTANA.

NELSON AND IRVING, BUTTE, MONTANA

COMPOSITE PLAN - MAP I.



HANGING WALL VEIN

NORWICH MINE

LONGITUDINAL SECTION (In Plane of Vein) D'-D'

LOOKING NORTHERLY - LINE OF SECTION N.80° E.

SCALE: 1 IN. = 40 FT.

▭ Workings Actually on H.W. Vein

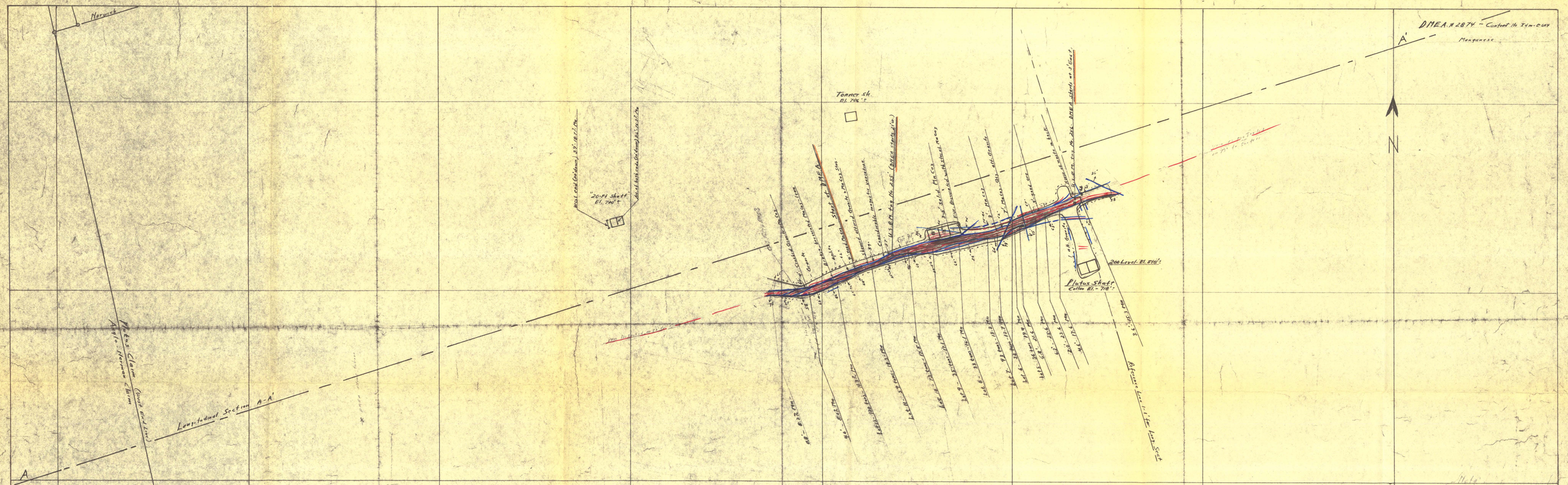
NOTE: Copied from Map prepared by I.G. Irving Showing information from U.S. Bureau of Mines and other sources

June 1950

Duplicate maps borrowed from DMA 1790
Please return when no longer needed

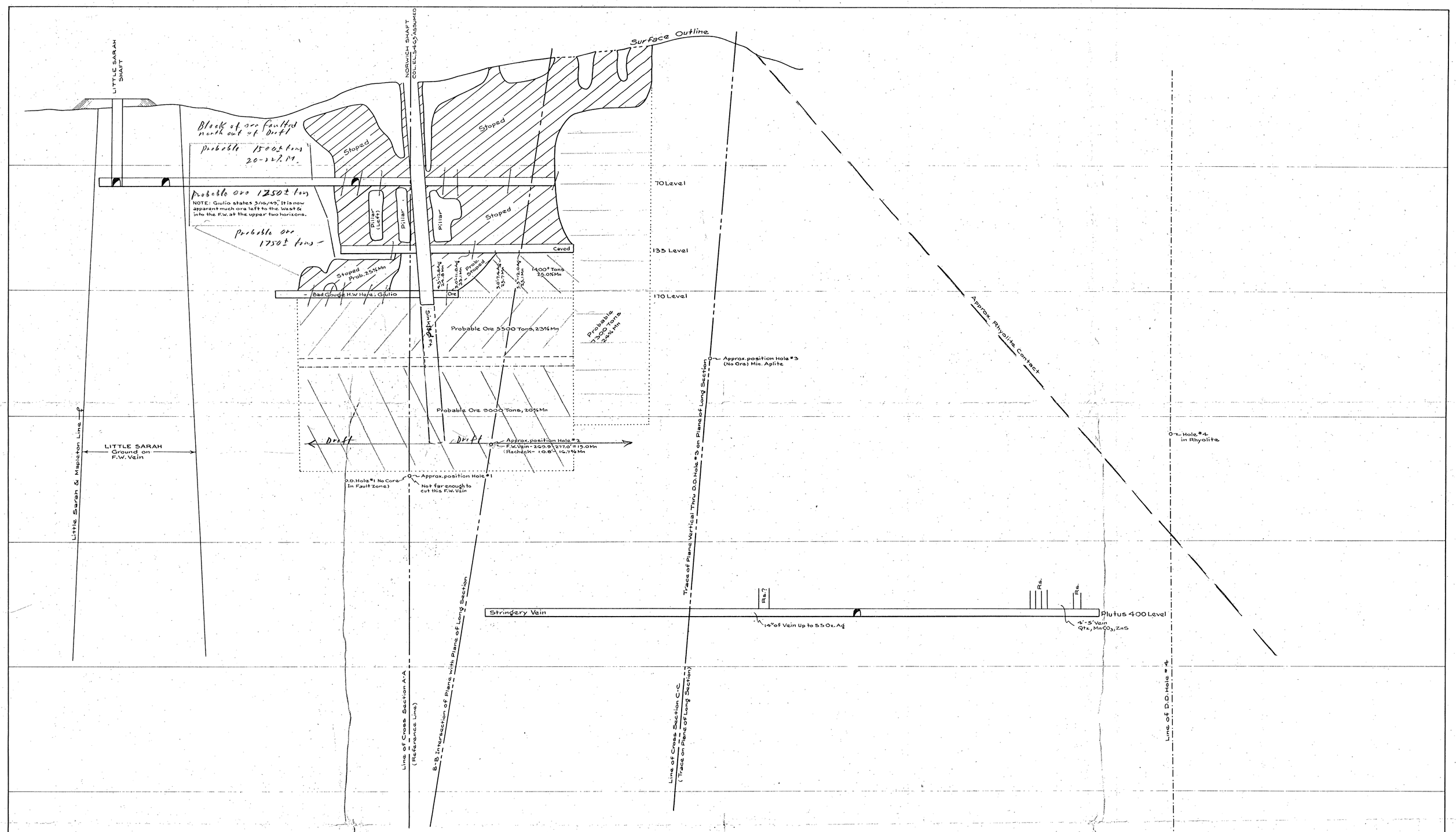
Case "C" 0-9

Sketch Map
(Geologic and Assy Plan)
Showing
Surface & Cuts
at
Plutus Mine
DMEA Docket No 2874
Contract No Tom-E604
Silver Bow Co Montana
IG Irving & Robt. H. Nelson
Scale-1" = 20'
DMEA # 2874 - Contract No Tom-E604
Manganese
Rhyolite
Granite
Decomposed Gr.
Note
These bulldozer cuts
not in subsequent
to application
Reference Line 1-1' for Long Sect.
Plutus Sh.
Col. El. 718'
Tonner Sh.
Col. El. 700'
"20-Ft" Sh.
Collar El. 700'
Wash
Poor
Good
Longitudinal Section A-A'
A
A'



Sketch Map
(Geologic and Assay Plan)
Showing
200 Level Development
at
Plutus Mine
DMEA Docket No. 2874
Contract No. IJm-E604
Silver Bow Co. Montana
I G Irving & Robt. H. Nelson
Scale 1" = 20'

Please return to
I G Irving
43 Hibbon Bldg
Butte, Montana



FOOTWALL VEIN
NORWICH MINE

LONGITUDINAL SECTION (In Plane of Vein) **D-D**

LOOKING NORTHERLY - LINE OF SECTION N.80°E.

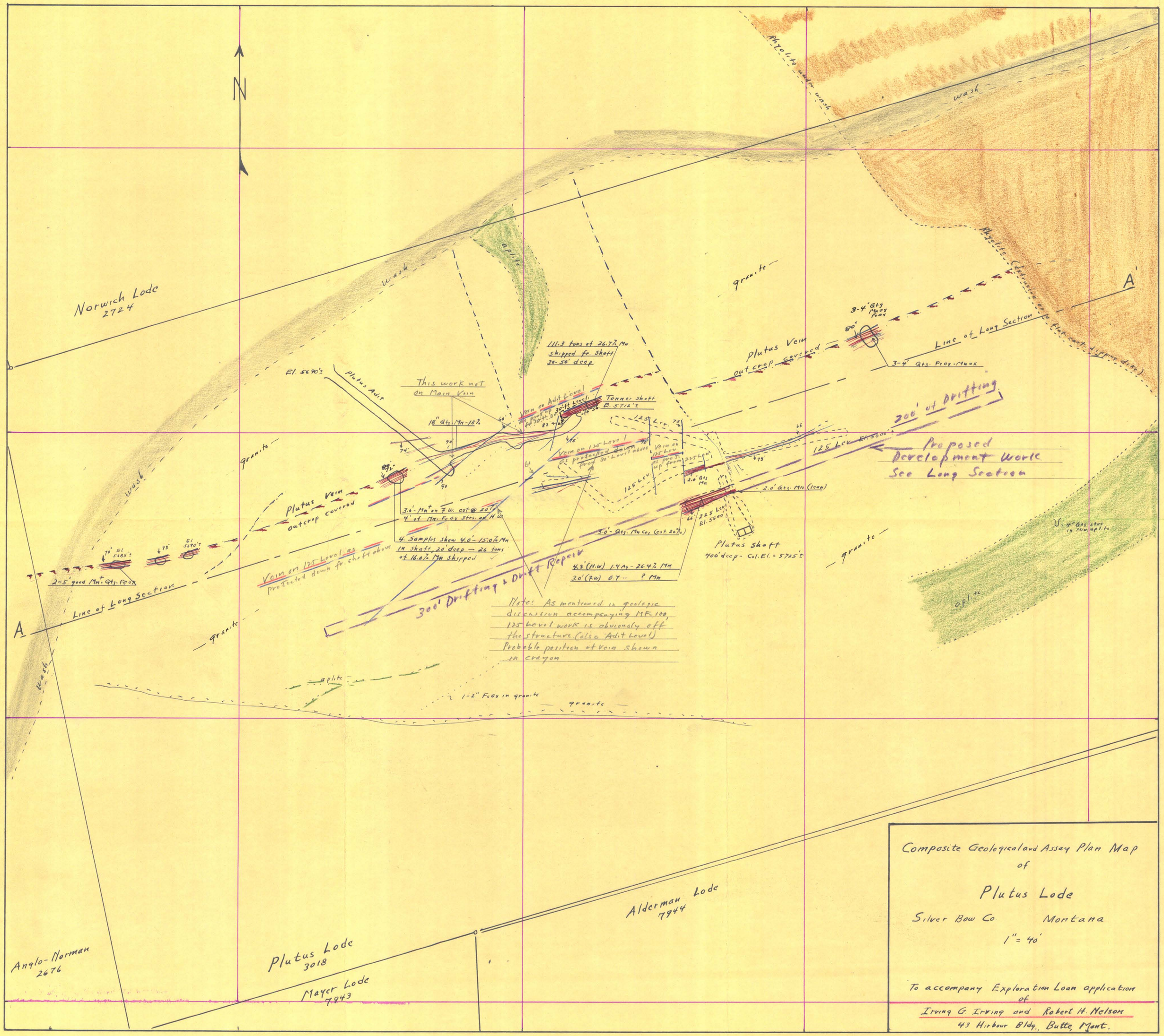
SCALE: 1 IN. = 40 FT.

NOTE: Copied from Map prepared by I.G. Irving
Showing information from U.S. Bureau of Mines
and other sources

June 1950

Duplicate Maps borrowed from Docket DMA 1790
Please return when no longer required

Case "C" 0-9



Composite Geological and Assay Plan Map
of

Plutus Lode

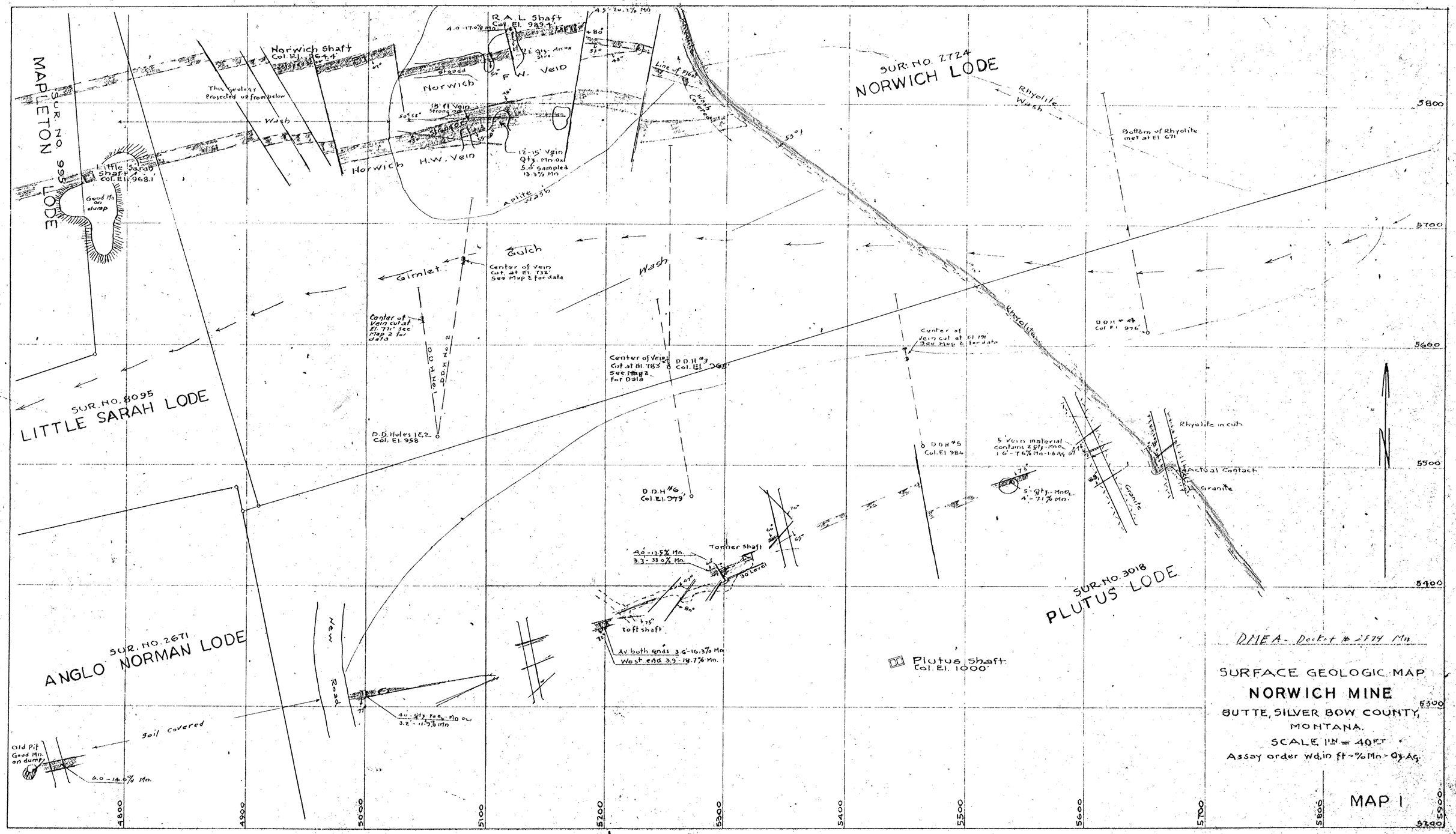
Silver Bow Co. Montana

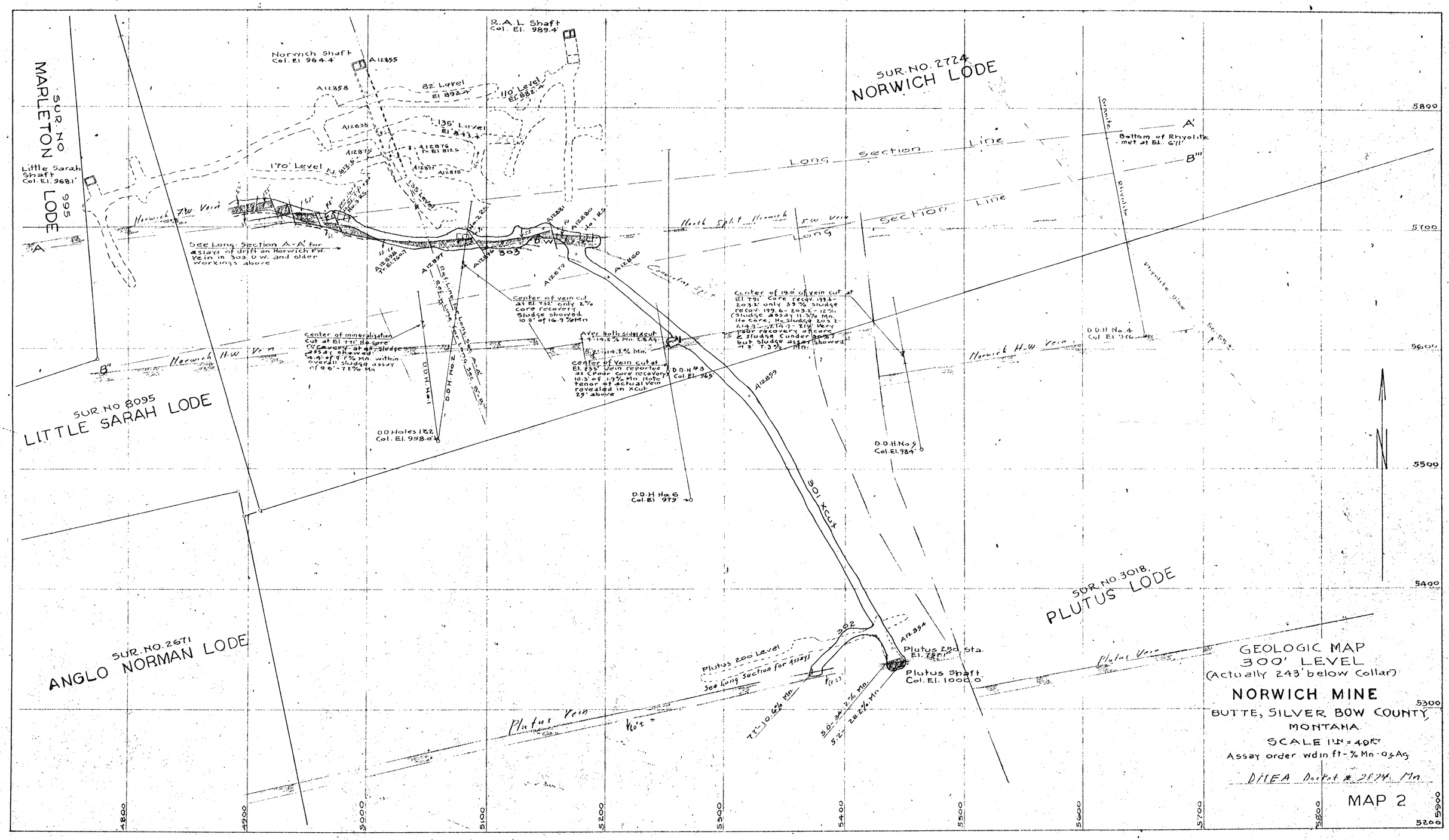
1" = 40'

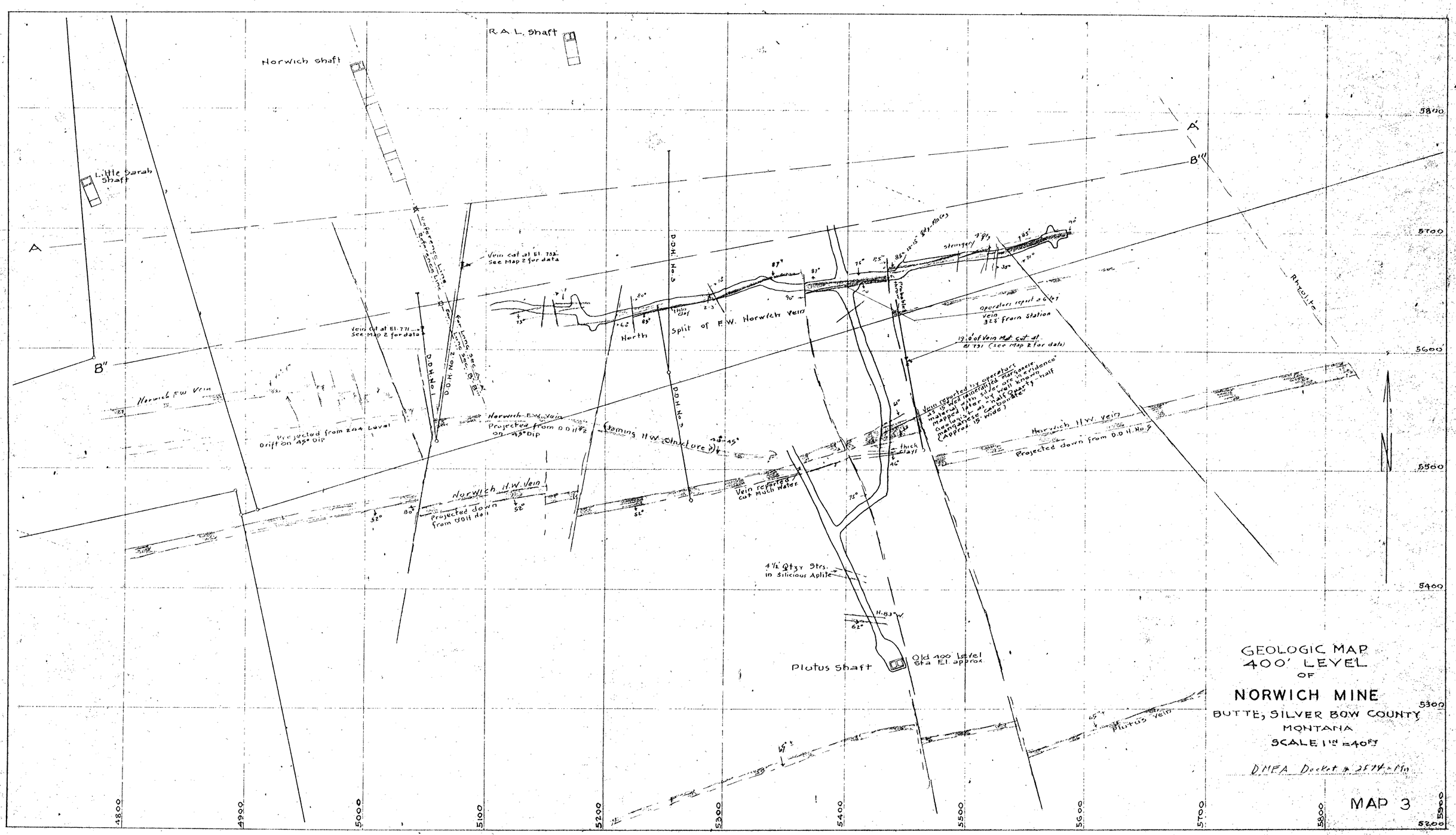
To accompany Exploration Loan application
of

Irving G. Irving and Robert H. Nelson

43 Hirbour Bldg., Butte, Mont.


SURVEY NO. 2724
NORWICH LODE
SUR. NO. 995
MAPLETON LODE
SUR. NO. 8095
LITTLE SARAH LODE
SUR. NO. 2671
ANGLO NORMAN LODE
SUR. NO. 3018
PLUTUS LODE
Norwich Shaft
Col. El. 964.4'
R.A.L. Shaft
Col. El. 989.4'
Little Sarah Shaft
Col. El. 968.1'
Norwich F.W. Vein
Norwich H.W. Vein
Norwich
Wash
Thin geology projected up from below
Good Mn on dump
Aplite Wash
Rhyolite Wash
Line of Flat
Wash Coverage
Bottom of Rhyolite met at El. 671
Gulch
Gimlet
Wash
Center of Vein cut at El. 732' See Map 2 for data
Center of Vein cut at El. 711' See Map 2 for data
Center of Vein cut at El. 783' See Map 2 for data
Center of Vein cut at El. 191' See Map 2 for data
D.D.H. #1 Col. El. 958
D.D.H. #2
D.D.H. #3 Col. El. 968'
D.D.H. #4 Col. El. 976'
D.D.H. #5 Col. El. 984
D.D.H. #6 Col. El. 979'
5' Vein material contains 2 Qtz-MnO2 1.6'-16% Mn-1.6 Ag oz
5' Qtz.-MnO2 4'-7.1% Mn.
Rhyolite in cut
Intrusional Contact
Granite
Tanner Shaft
Toft shaft
Av. both ends 3.6'-16.3% Mn
West end 3.9'-18.7% Mn.
Plutus Shaft Col. El. 1000'
New Road
Soil covered
Old Pit Good Mn. on dump
6.0'-14.6% Mn.
5800
5700
5600
5500
5400
5300
5200
5100
5000
4900
4800
DMEA - Docket # 2174 Mn
SURFACE GEOLOGIC MAP
NORWICH MINE
BUTTE, SILVER BOW COUNTY, MONTANA.
SCALE 1" = 40 FT
Assay order Wd. in ft - % Mn - Oz. Ag.
MAP I


SUR. NO. MARLETON LODE 595
SUR. NO. 2724 NORWICH LODE
SUR. NO. 8095 LITTLE SARAH LODE
SUR. NO. 2671 ANGLO NORMAN LODE
SUR. NO. 3018 PLUTUS LODE
R.A.L. Shaft Col. El. 989.4'
Norwich Shaft Col. El. 964.4'
Little Sarah Shaft Col. El. 968.1'
Plutus Shaft Col. El. 1000.0
82' Level El. 892.4'
110' Level El. 882.4'
135' Level El. 843.4'
170' Level El. 812.6'
155' Level
Norwich F.W. Vein
Norwich H.W. Vein
North Split Norwich F.W. Vein
Long Section Line
Granite
Rhyolite
Rhyolite Dike
Bottom of Rhyolite met at El. 6'11'
See Long. Section A-A' for assays of drift on Norwich F.W. Vein in 303' D.W. and older workings above
Center of mineralization Cut at El 771' No core recovery at all. Sludge assay showed 4.4' of 9.7% Mn. within overall sludge assay of 9.6'-7.2% Mn
Center of vein cut at El 732' only 2' core recovery Sludge showed 10.8' of 16.9% Mn
Center of 19.0' of vein cut at El 791' Core recov. 197.6-203.3' only 33% sludge recov. 199.6-203.3'-12% (Sludge assay 11.3% Mn. No core, No sludge 203.2-214.3'-214.7'-21% Very poor recovery of core & sludge (under 30%) but sludge assay showed 4.3' 7.3% Mn.
Over both sides of cut 4'-14.8% Mn. 6.8 Ag.
5.2'-14.2% Mn.
Center of vein cut at El. 833' Vein reported as Cpoor core recovery 10.3' of 1.3% Mn. Note tenor of actual vein revealed in Xcut 23' above
D.D.H. #3 Col. El. 765'
D.D.H. No. 1
D.D.H. No. 2
D.D.H. No. 4 Col. El. 976'
D.D.H. No. 5 Col. El. 984'
D.D.H. No. 6 Col. El. 979'
D.D.H. Holes 1&2 Col. El. 958.0'
301 Xcut
302
Plutus 200 Level
See Long Section for assays
Plutus Vein
Plutus 200 Sta. El. 1000'
T.T.-10.6% Mn.
30-34' 2% Mn.
5'-2'-28.2% Mn.
5800
5700
5600
5500
5400
5300
5200
4800
4900
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
GEOLOGIC MAP
300' LEVEL
(Actually 243' below Collar)
NORWICH MINE
BUTTE, SILVER BOW COUNTY
MONTANA
SCALE 1" = 40 FT
Assay order wd in ft - % Mn - oz Ag
DIEA Docket # 2274 Mn
MAP 2



GEOLOGIC MAP
400' LEVEL
OF
NORWICH MINE
BUTTE, SILVER BOW COUNTY
MONTANA
SCALE 1" = 40 FT

DMEA Docket # 2274-Min

MAP 3

LONGITUDINAL SECTION A-A'
NORWICH FOOTWALL VEIN
SCALE 1 IN = 40 FT.

— Note —
Measured (Proved) and Indicated (Probable) Blocks shown in red
Inferred or Prospective Ore Blocks shown in purple

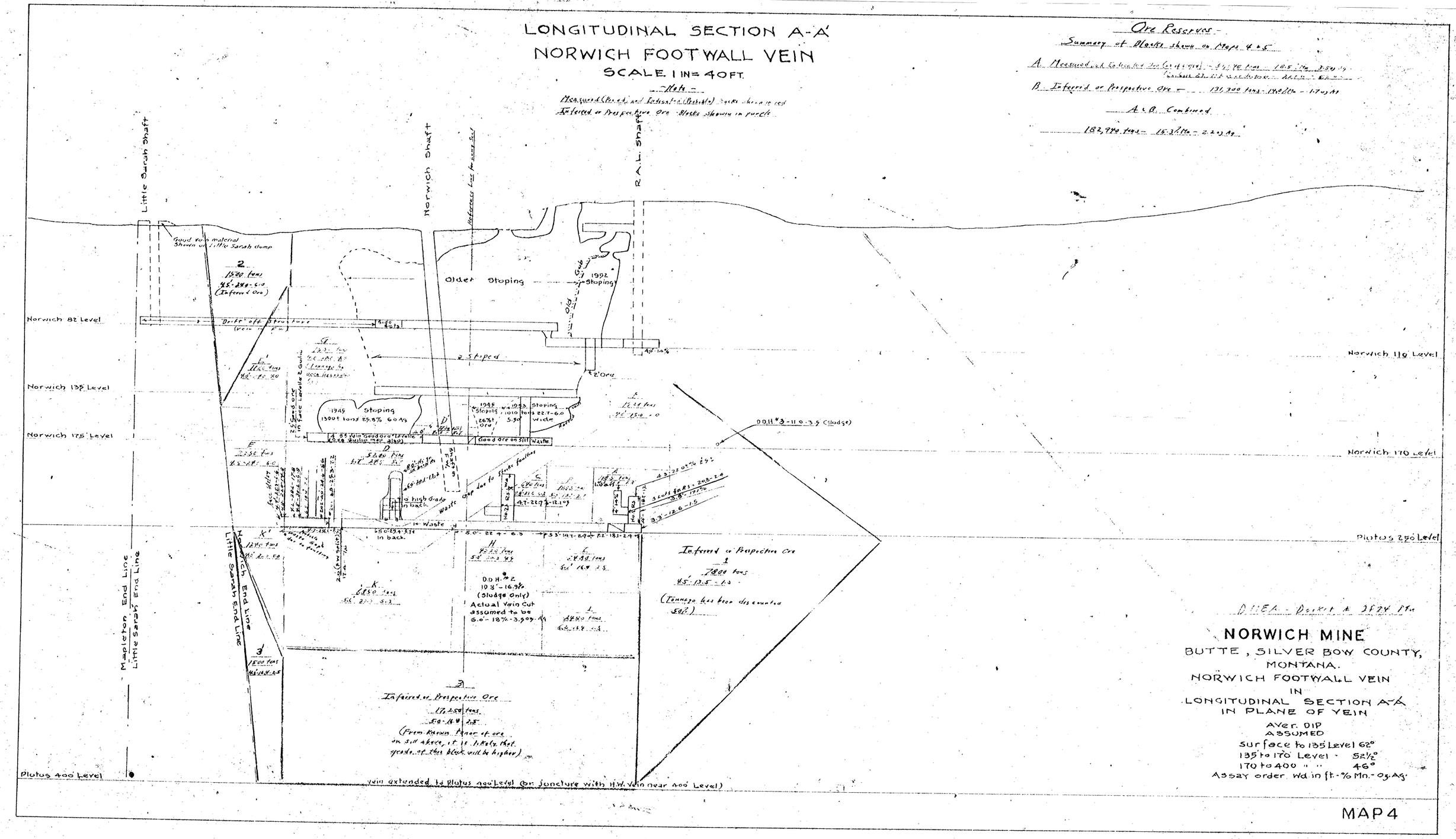
— Ore Reserves —
Summary of Blocks shown on Maps 4 & 5

A. Measured and Indicated Ore (as of 4-1-54) — 84,980 tons 18.5 oz/ton 2.54 oz/ton
(Includes 21,000 tons [illegible] 28.0 oz/ton [illegible])

B. Inferred or Prospective Ore — 131,300 tons 14.0 oz/ton — 1.70 oz/ton

A & B. Combined

182,980 tons — 15.7 oz/ton — 2.20 oz/ton



D.H.E. - Dockit # 2874 Pl.

NORWICH MINE
BUTTE, SILVER BOW COUNTY, MONTANA.
NORWICH FOOTWALL VEIN
IN
LONGITUDINAL SECTION A-A'
IN PLANE OF VEIN

AVER. DIP
ASSUMED
Surface to 135 Level 62°
135 to 170 Level - 52½°
170 to 400 " " 46°
Assay order Wd in ft.-% Mn.-oz. Ag.

MAP 4

SECTION B"-B"
NORWICH HANGINGWALL VEIN
IN PLANE OF VEIN (AV. DIP 52°)
SCALE 1" = 40 FT

Note

Measured (Blocked) or Proven Ore Blocks shown in red

Inferred or Prospective Ore Blocks shown in purple

Ore Reserves

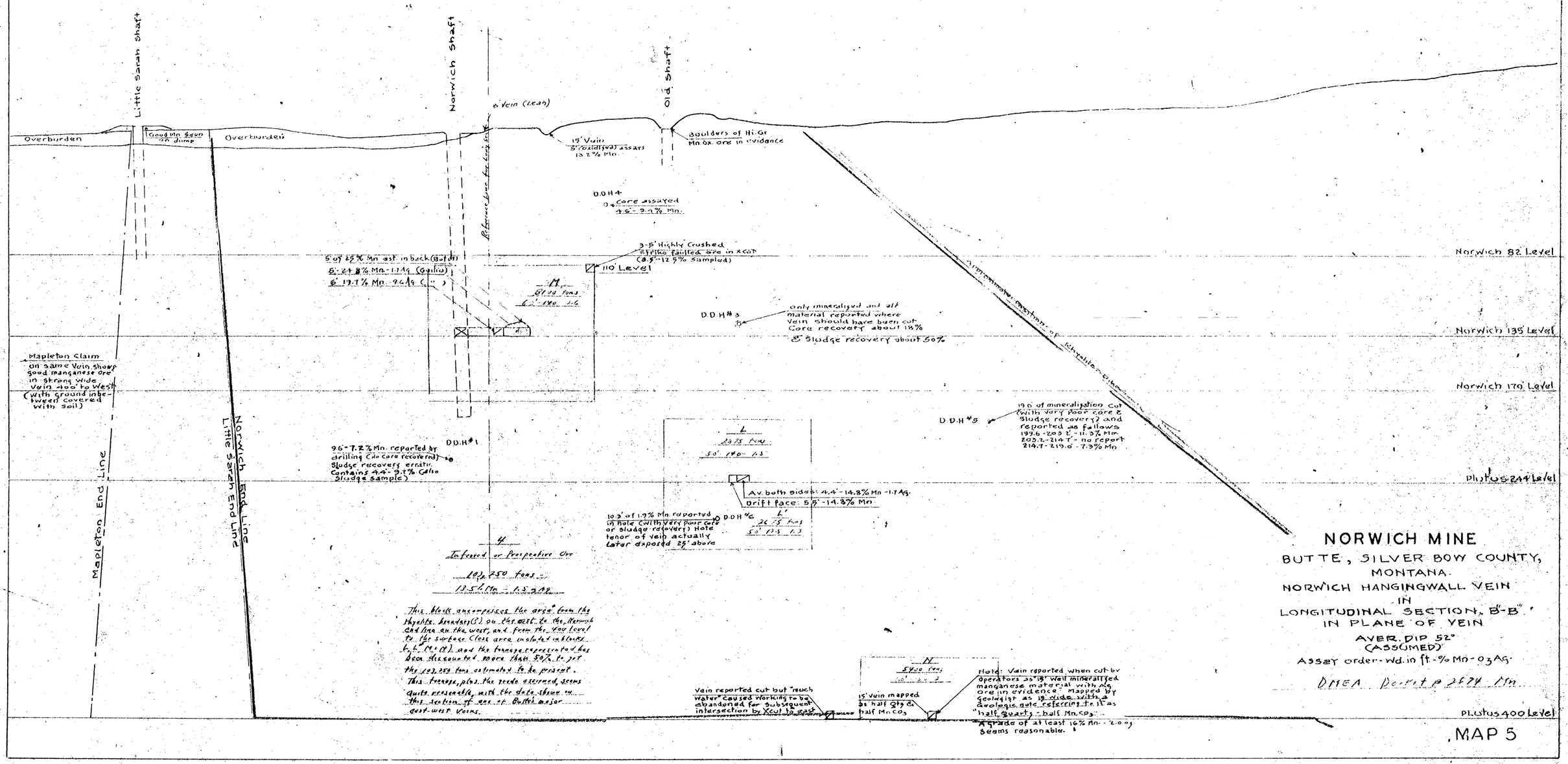
Summary of Blocks shown on Maps 4 & 5

A. Measured & Indicated Ore (Blocks) - 51,640 tons 18.3% Mn - 3.0 oz Ag
(with 20.5% the ultimate dist. ...)

B. Inferred or Prospective Ore - 131,300 tons 14.0 - 1.7

A + B Combined

182,940 tons - 15.3% Mn - 2.2 oz Ag



NORWICH MINE

BUTTE, SILVER BOW COUNTY, MONTANA.

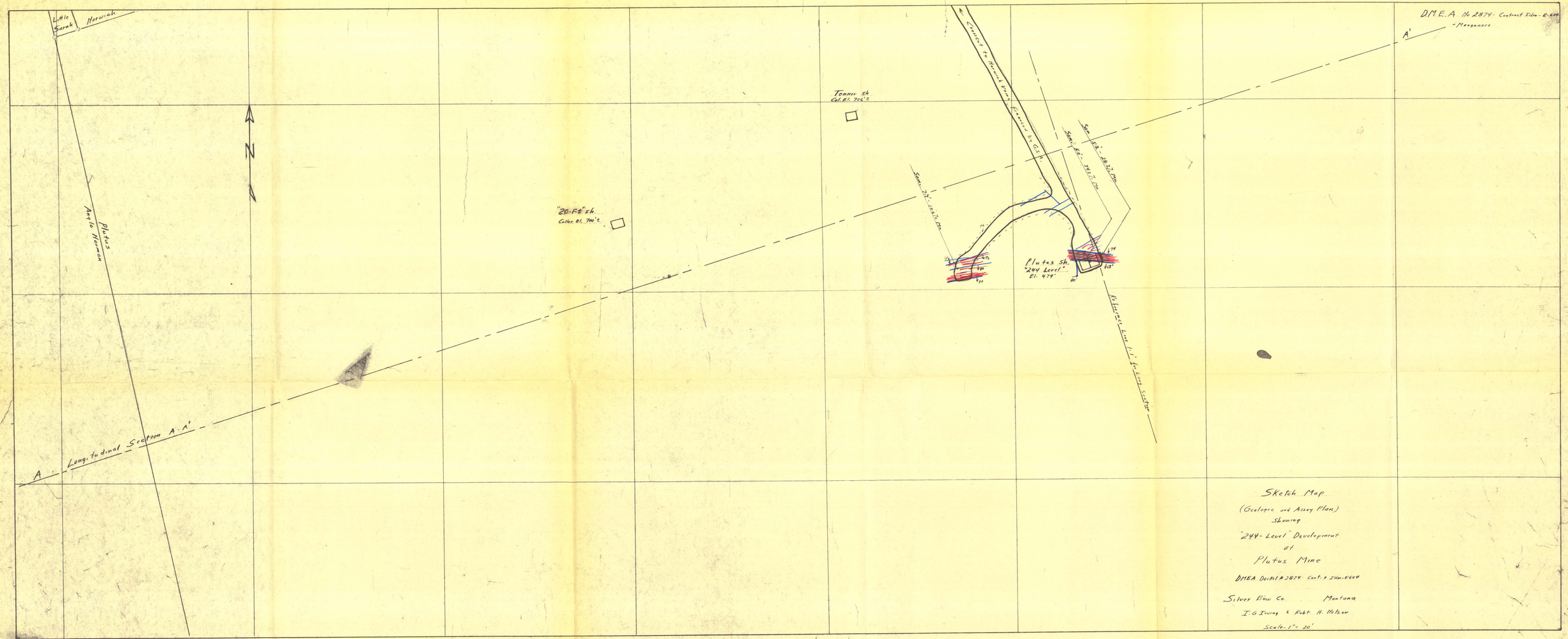
NORWICH HANGINGWALL VEIN IN LONGITUDINAL SECTION, B"-B" IN PLANE OF VEIN

AVER. DIP 52° (ASSUMED)

ASSAY order - Wd. in ft - % Mn - oz Ag.

DMEA Docket # 2674 Pat.

MAP 5



Sketch Map
(Geologic and Assay Plan)
Showing
"244-Level" Development
at
Plutus Mine

DMEA Docket # 2874 - Cont. & Iron-E604

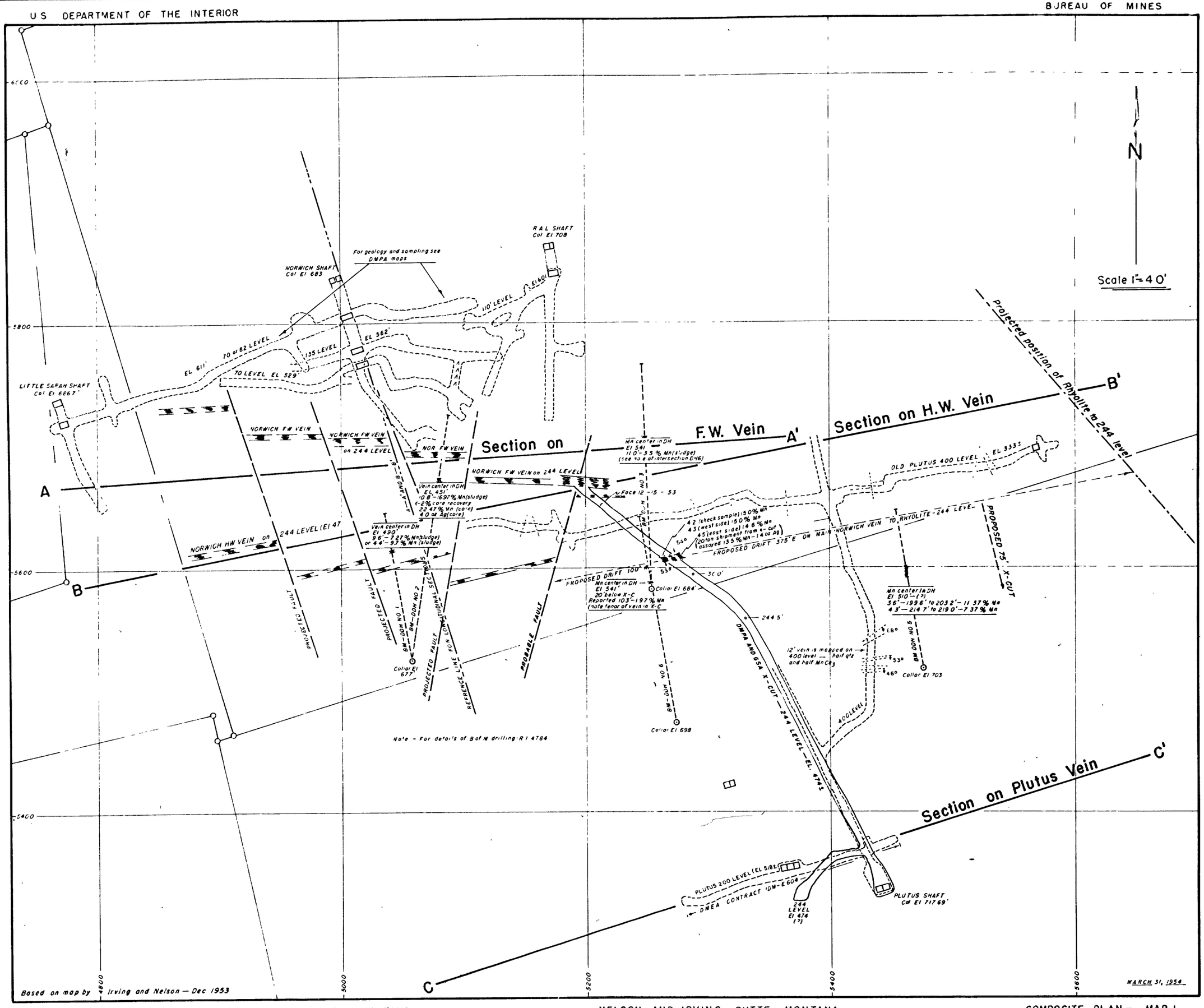
Silver Bow Co. Montana

I. G. Irving & Robt. H. Nelson

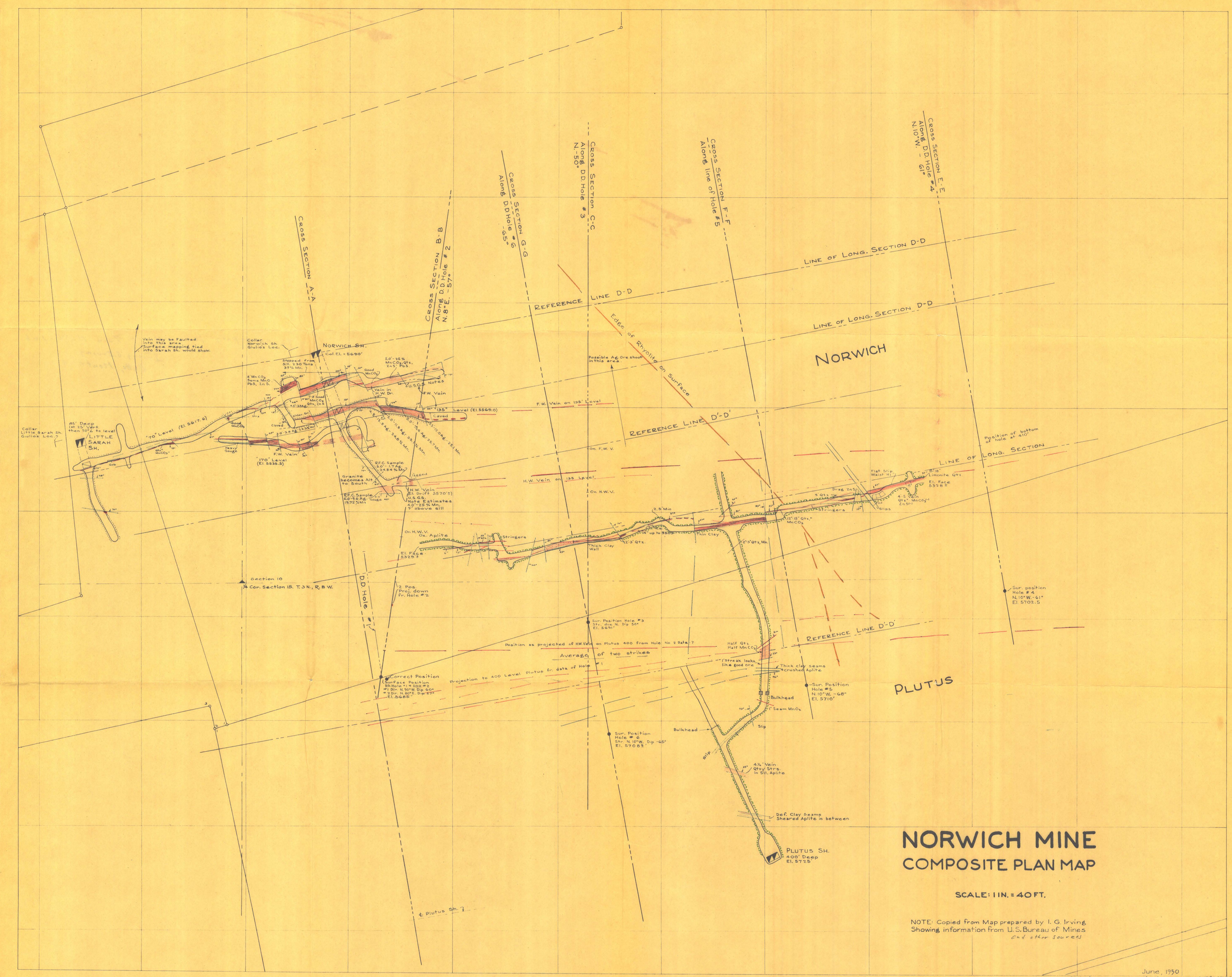
Scale - 1" = 20'

U S DEPARTMENT OF THE INTERIOR

BUREAU OF MINES



NORWICH-PLUTUS MINE, SILVER BOW COUNTY, MONTANA. — NELSON AND IRVING, BUTTE, MONTANA — COMPOSITE PLAN - MAP I.



NORWICH MINE
COMPOSITE PLAN MAP

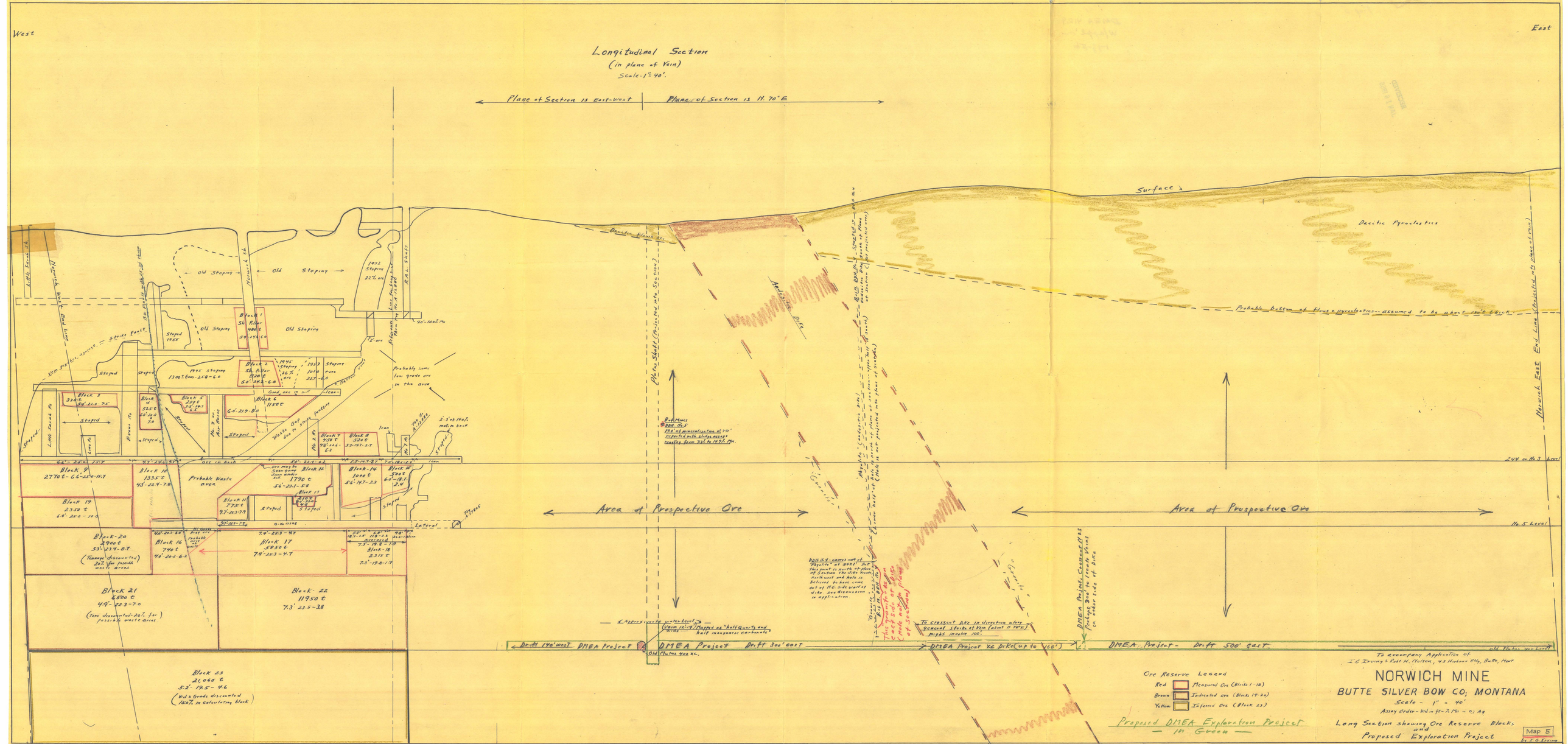
SCALE: 1 IN. = 40 FT.

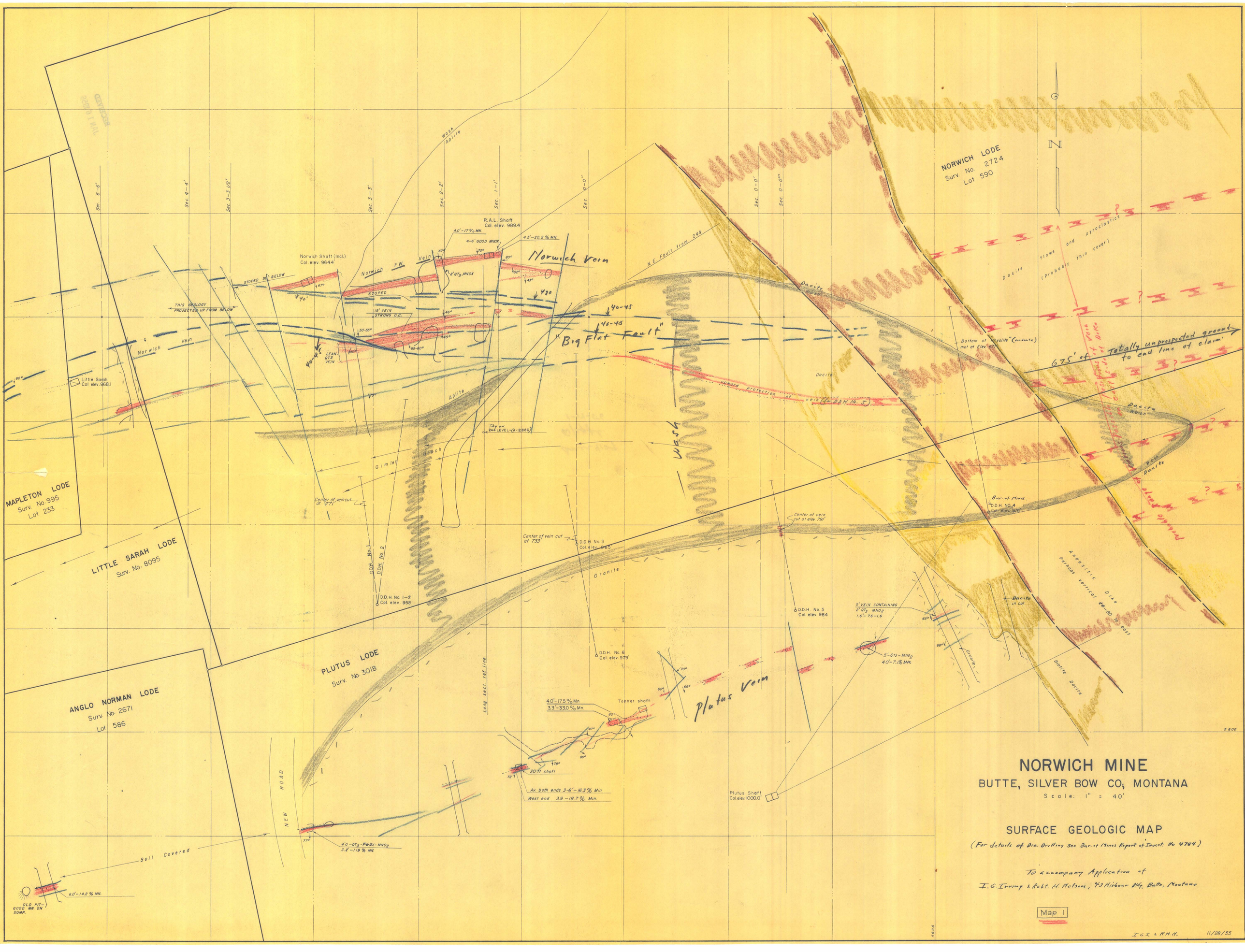
NOTE: Copied from Map prepared by I. G. Irving
Showing information from U.S. Bureau of Mines
and other sources

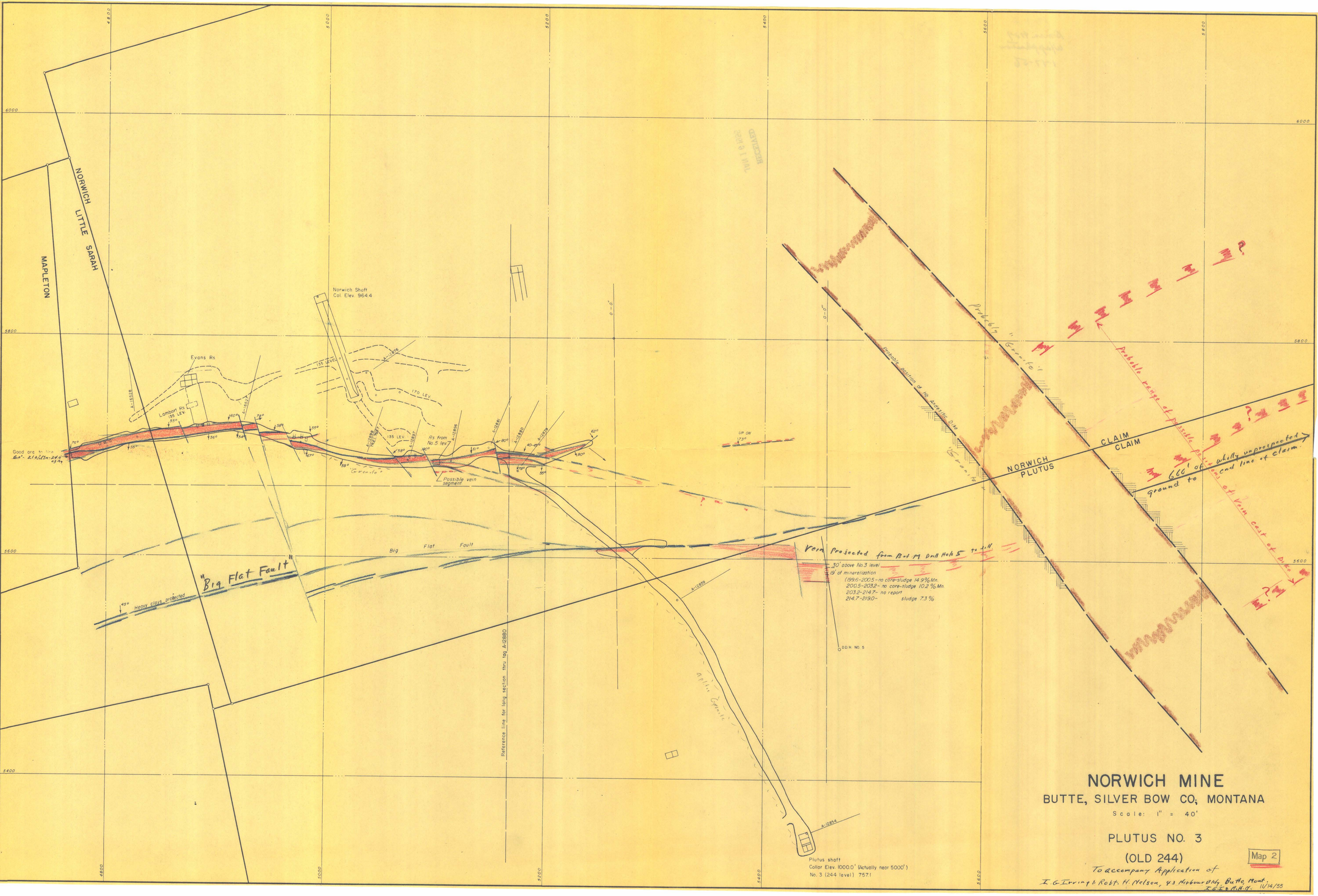
June, 1950

Duplicate maps borrowed from Docket DMA 1790
Please return when no longer needed

Case "C" 0-9


West
East
Longitudinal Section
(in plane of Vein)
Scale - 1" = 40'.
Plane of Section is East-West
Plane of Section is N. 70° E
Surface
Dacitic Pyroclastics
Probable bottom of flows & pyroclastics - assumed to be about 1000' thick
Old Stoping
Old Stoping
1952 Stoping 227' ore
Stoped 1958
Old Stoping
Block 1 Sh. Pillar 480 t 54'-24'-6.0
Block 2 Sh. Pillar 820 t 60'-24'-6.0
1945 Stoping 1300 t Ions - 258-6.0
1945 Stoping 126 t ore
1957 1010 tons 227-6.0
Stoped
Probably some low grade ore in this area
Good ore in sill
Block 6 1158 t
6.0'-219-8.0
Block 3 232 t 60'-21.0-25
Block 4 625 t 60'-21.5-7.0
Block 5 259 t 45-20.0-6.0
Block 7 958 t 48'-22.6-6.3
Block 8 326 t 53'-19.7-2.7
Block 9 2770 t - 6.6'-25.0-16.7
Block 10 1335 t 45'-22.4-7.8
Probable Waste area
Block 12 1790 t 56'-23.1-5.8
Block 13
Block 14 1000 t 56'-19.7-2.3
Block 15 502 t 60'-18.1-2.4
Block 11 775 t 37'-20.3-7.7
Block 19 2350 t 6.0'-25.0-10.0
Block 20 4900 t 53'-23.4-8.7 (Tonnage discounted 20% for possible waste areas)
Block 16 746 t 46'-20.2-6.2
Block 17 5850 t 74'-25.3-4.7
Block 18 2315 t 7.3'-19.8-1.7
Block 21 6500 t 49'-22.3-7.0 (Tons discounted 20% for possible waste areas)
Block 22 11950 t 7.3' 23.5-38
Block 23 21,060 t 5.2'-19.5-4.6 (Wd & Grade discounted 150% in calculating block)
Area of Prospective Ore
Area of Prospective Ore
244 or No. 3 Level
No. 5 Level
Drift 140' West DMEA Project
DMEA Project
Drift 300' East
DMEA Project xc Dike (up to 160')
DMEA Project - Drift 500' East
Old Workings
Norwich East End Line (Projected into plane of vein)
Ore Reserve Legend
Red Measured Ore (Blocks 1-18)
Brown Indicated ore (Blocks 19-22)
Yellow Inferred Ore (Block 23)
Proposed DMEA Exploration Project
— 1th Green —
To accompany Application of
L.G. Irving & Robt H. Nelson, 43 Hickson Blk, Butte, Mont
NORWICH MINE
BUTTE SILVER BOW CO; MONTANA
Scale - 1" = 40'
Assay Order - Wd in ft - % Pb - oz Ag
Long Section showing Ore Reserve Blocks and Proposed Exploration Project
Map 5
L.G. Irving


NORWICH MINE
BUTTE, SILVER BOW CO., MONTANA
Scale: 1" = 40'
SURFACE GEOLOGIC MAP
(For details of Dia. Drilling see Bur. of Mines Report of Invest. No 4784)
To accompany Application of
I. G. Irving & Robt. H. Nelson, 43 Harbour Bldg, Butte, Montana
Map I
I.G.I. & R.H.N.
11/28/55
NORWICH LODE
Surv. No. 2724
Lot 590
MAPLETON LODE
Surv. No. 995
Lot 233
LITTLE SARAH LODE
Surv. No. 8095
ANGLO NORMAN LODE
Surv. No. 2671
Lot 586
PLUTUS LODE
Surv. No. 3018
Norwich Vein
Plutus Vein
"Big Flat Fault"
N.E. Fault from 244
Wash Aplite
Norwich Shaft (Incl.)
Col. elev. 9644'
R.A.L. Shaft
Col. elev. 989.4
Little Sarah
Col. elev. 968.1
STOPED 30' BELOW
STOPED
THIS GEOLOGY PROJECTED UP FROM BELOW
15' VEIN STRONG O.G.
LEAN QTZ VEIN
Norwich Vein
Norwich FW Vein
4.0'-17% MN
4-6' GOOD MNOX
4.5'-20.2% MN
2' QTZ, MNOX
40-45
Aplite
Gimlet Gulch
Tagon 244 LEVEL-(A-12,880)
Center of vein cut at 771'
D.D.H. No. 1
D.D.H. No. 2
D.D.H. No. 1-2
Col. elev. 958
Center of vein cut at 733'
D.D.H. No. 3
Col. elev. 965
Granite
D.D.H. No. 6
Col. elev. 979'
Long. sect. ref. line
Center of vein cut at elev. 791'
D.D.H. No. 5
Col. elev. 984
Tonner shaft
40'-17.5% Mn
3.3'-33.0% Mn.
20' ft shaft
Av. both ends 3-6'-16.3% Min.
West end 3.9-18.7% Min.
Plutus Shaft
Col. elev. 1000.0'
Wash
Dacite
Dacite flows and pyroclastics (probably thin cover)
Bottom of "rhyolite" (andesite) met at Elev. 6
Upward projection of vein (to D.D.H. No. 5)
675' of Totally unprospected ground to end line of claim
Bur. of Mines D.D.H. No. 4
Col. Elev. 976
Dacite in cut
Andesitic Dike Perhaps vertical 70-80 to east
5' VEIN CONTAINING 2' QTZ MNO2 1.6'-7.6-1.6
5'-Qtz-MnO2 4.0'-7.1% Mn.
Granite
Biotite Dacite
NEW ROAD
4.0-QTZ-FeOX-MNO2 3.2'-11.9% MN.
Soil Covered
6.0'-14.2% MN.
OLD PIT-GOOD MN. ON DUMP.
5800
5600



NORWICH MINE

BUTTE, SILVER BOW CO., MONTANA

Scale: 1" = 40'

PLUTUS NO. 3

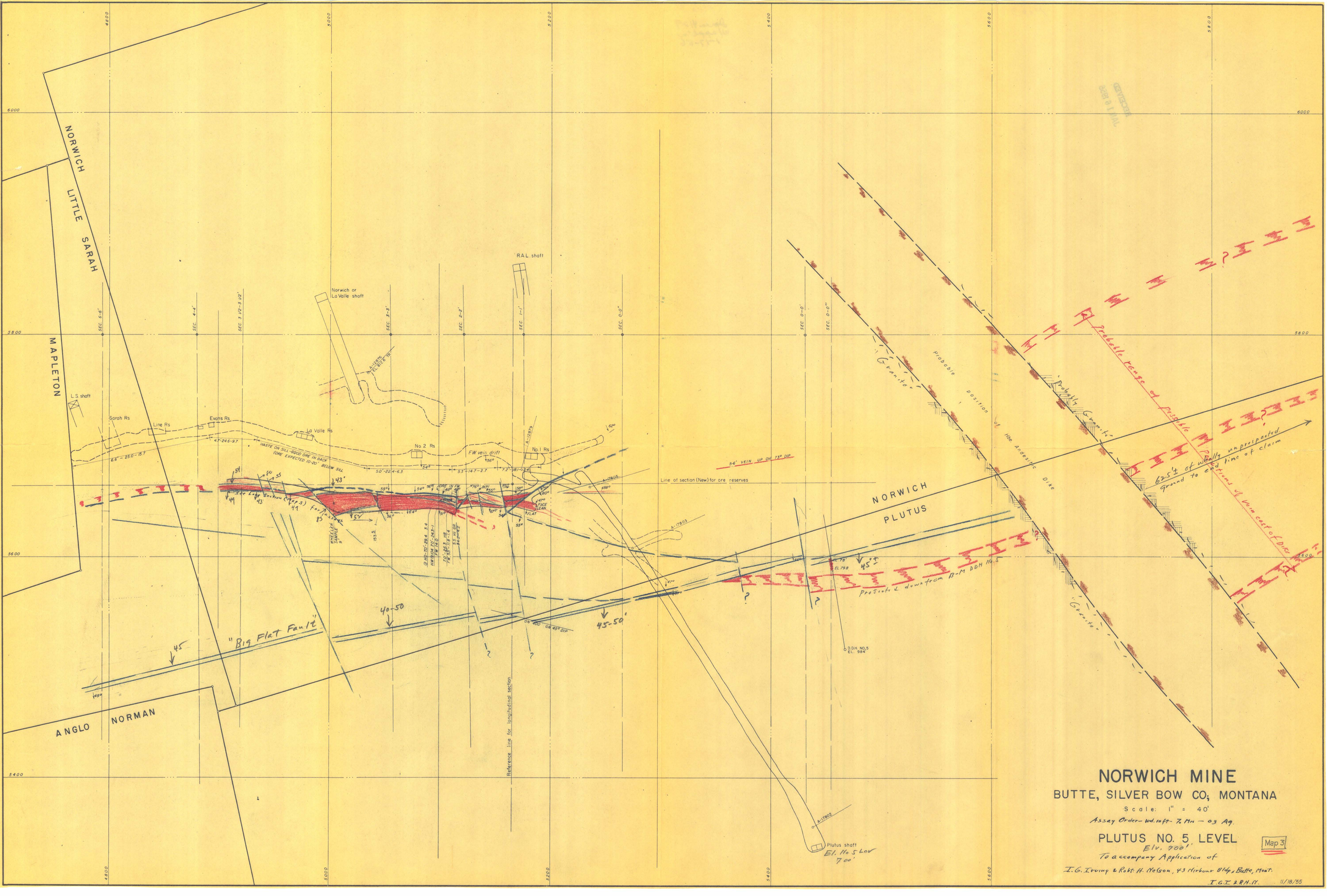
(OLD 244)

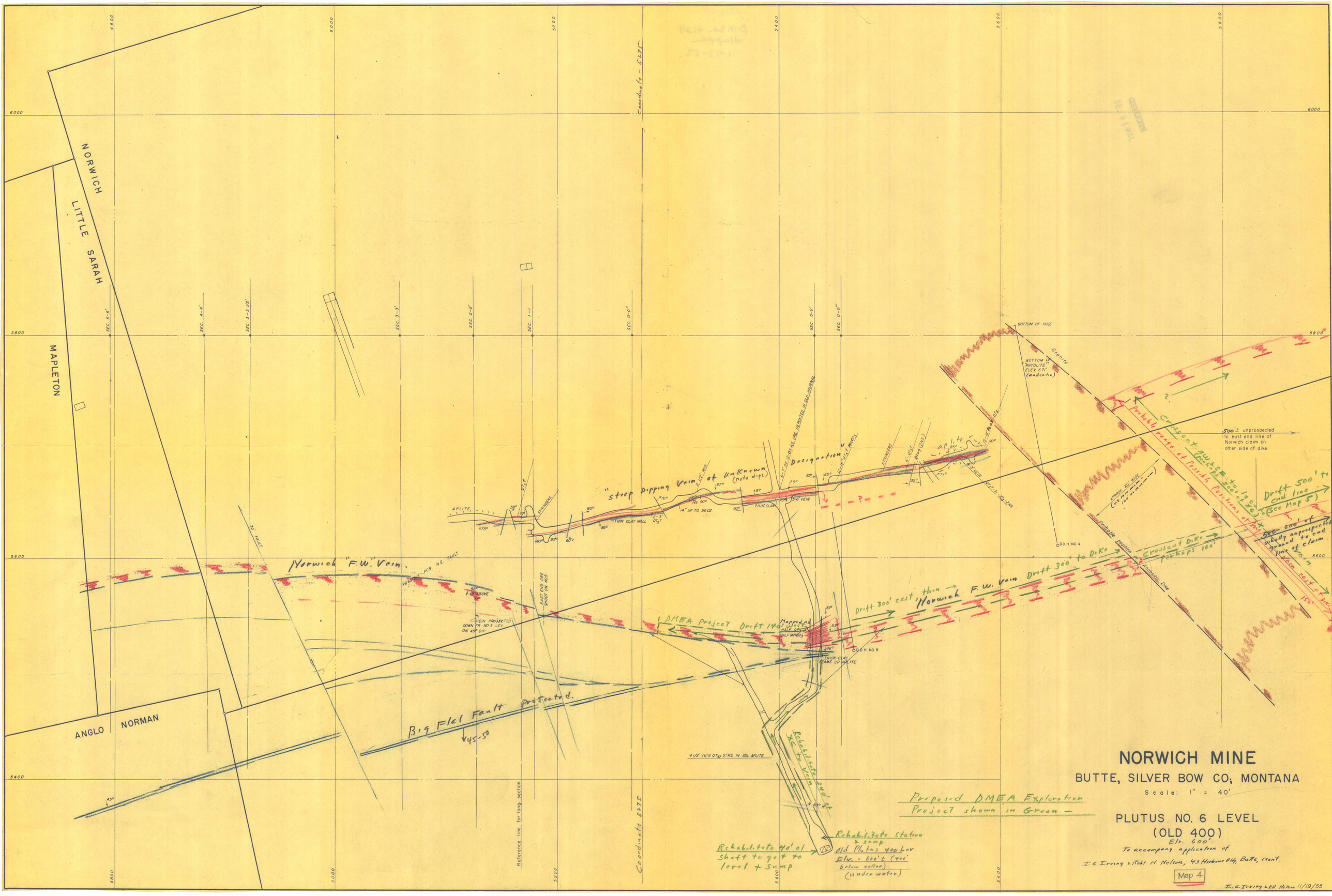
Map 2

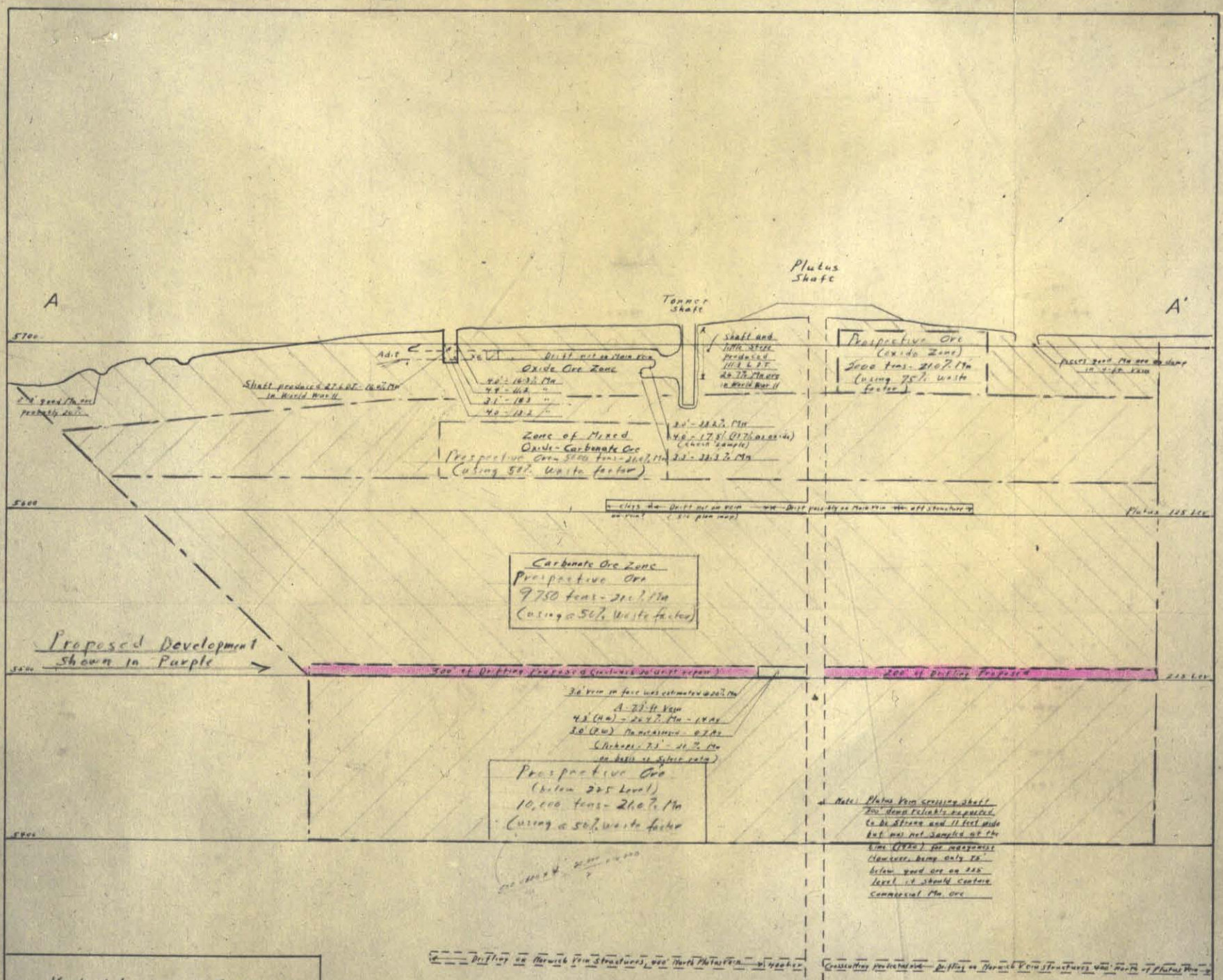
To accompany Application of

I. G. Irving & Robt. H. Nelson, 43 Harbour Bldg, Butte, Mont.

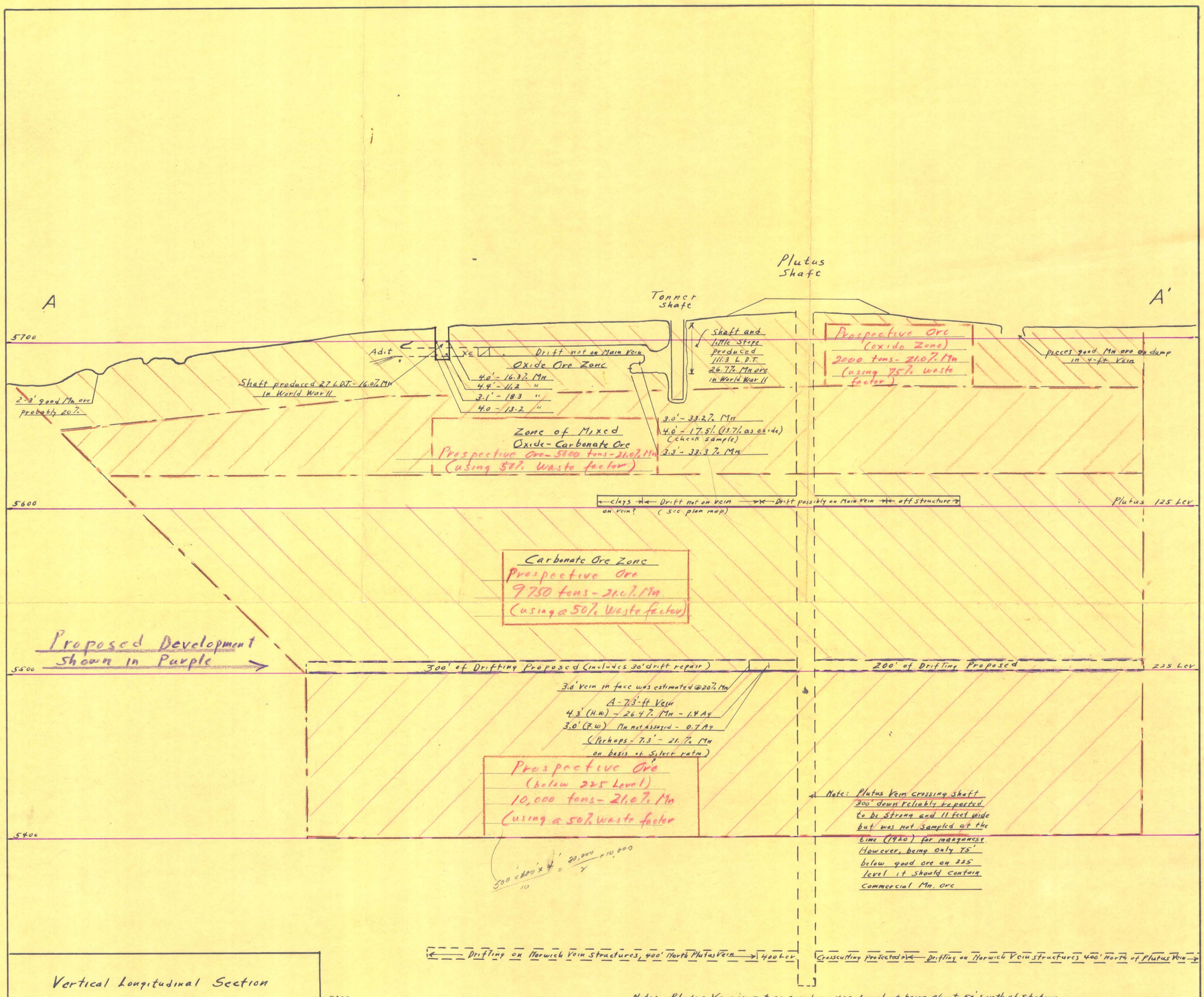
I.G.I. & R.H.N. 11/14/55


NORWICH
LITTLE SARAH
MAPLETON
ANGLO NORMAN
NORWICH
PLUTUS
L.S shaft
Sarah Rs
Line Rs
Evans Rs
La Valle Rs
No. 2 Rs
No. 1 Rs
F.W. vein drift
Norwich or La Valle shaft
R.A.L. shaft
WASTE ON SILL-GOOD ORE IN BACK (ORE EXPECTED 10-20' BELOW SILL)
Line of section (New) for ore reserves
Reference line for longitudinal section
"Big Flat Fault"
Granite
probable position of the Andesitic Dike
Probable range of position
Projected downfrom B-M DDH No. 5
D.D.H. NO. 5 EL. 984
Plutus shaft
El. No 5 Lev
700'
NORWICH MINE
BUTTE, SILVER BOW CO; MONTANA
Scale: 1" = 40'
Assay Order- Wd. inft- % Mn - oz Ag.
PLUTUS NO. 5 LEVEL
Elv. 700'
To accompany Application of
I. G. Irving & Robt. H. Nelson, 43 Harbour Bldg, Butte, Mont.
I.G.I & R.H.N.
11/18/35
Map 3


NORWICH
LITTLE SARAH
MAPLETON
ANGLO NORMAN
Coordinate 5275
4800
5000
5200
5400
5600
5800
6000
SEC. 5-5'
SEC. 4-4'
SEC. 3-3 1/2'
SEC. 3-3'
SEC. 2-2'
SEC. 1-1
SEC. 0-0"
SEC. 0-0'
SEC. 0-0"
BOTTOM OF HOLE
BOTTOM OF "RHYOLITE" ELEV 671' (andesitic)
Granite
Probable range of Potosi Pertains of Mt
Crescent plus SE to 1950' to SE
500'± unprospected to east end line of Norwich claim on other side of dike.
Drift 500' to end line (See Map 5)
500' of wholly unprospected ground to end line of claim
Vein east of dike
150'
APPROX. 80' WIDE (25 pyr. veins) (Qz stringers)
Probable position of Andesitic Dike
Crescent Dike perhaps 160'
D.D.H. NO. 4
D.D.H. NO. 5
"steep Dipping Vein of Unknown" (note dips)
"F.W." Designation
APLITE
STRINGERS
THIN CLAY WALL
14" UP TO 55 OZ
THIN CLAY
5-6 VEIN
4-5 VEIN
Qz 32.1 Mill.
Qz 5.6 Mill.
Qz 1.1 Mill.
Qz 1.7 Mill.
30' FAULT
Norwich "F.W." Vein.
POSSIBLE POS. N.E. FAULT
VEIN PROJECTED DOWN TO NO. 5 LEV ON 45° DIP
EAST END ORE SHOOT ON NO. 5
DMEA Project Drift 140' West
Marmoreal HALF QZ HALF MINERAL
THICK CLAY SEAMS OR WALLS
Drift 300' east, then Norwich F.W. Vein. Drift 300' to Dike
Big Flat Fault Protected.
45-50
4 1/2' VEIN QTZ STRS. IN SOL. APLITE
Rehabilitate XC to Vein 240' West
Reference line for long. section
Coordinate 5275
Rehabilitate 40' of Shaft to get to level + Sump
Rehabilitate Station & sump
Old Plutus 400 Lev.
Elev. = 600'± (400' below collar)
(under water)
Proposed DMEA Exploration Project shown in Green —
NORWICH MINE
BUTTE, SILVER BOW CO., MONTANA
Scale: 1" = 40'
PLUTUS NO. 6 LEVEL
(OLD 400)
Elv. 600'
To accompany application of
I. G. Irving & Robt. H. Nelson, 43 Hibbons Bldg, Butte, Mont.
Map 4
I. G. Irving & R.H. Nelson 11/19/55



Vertical Longitudinal Section of Plutus Vein Showing Present Workings, Assays and Proposed Development (Possible Tonnages also Indicated) 1" = 40'



Vertical Longitudinal Section

of

Plutus Vein

Showing

Present Workings, Assays and Proposed Development

(Possible Tonnages also Indicated)

1" = 40'