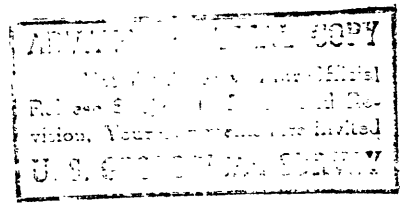
44-55

United States Department of the Interior
Geological Survey

Strategic Minerals Investigations
Preliminary Report



TOM CAT AND HANLEY PROSPECTS

Metaline Lead-Zinc District,
Pend Oreille County, Washington

by

C. D. Campbell and Irvin Gladstone

skip line between paragraphs

March 1944

Wash. Open File 1:24

Tom Cat and Hanley Prospects

Metaline District
Pend Oreille County, Washington

Contents

Illustrations

Geology and Ore Deposits of the Tom Cat and Hanley Prospects

Metaline District, Pend Oreille County, Washington

by C.D. Campbell and Irvin Gladstone

March 1944

Introduction

The Gardner group of claims (including the Tom Cat claim from which the area is here named) and the adjacent Hanley claim were mapped and examined not only because of lead and zinc surface showings, but because their general geologic setting is enough like that of the major zinc deposits near Metaline Falls 1/ to suggest that large zinc deposits may exist in the Tom Cat - Hanley area. The mapping was ~~used~~ to furnish a base for diamond drilling or other exploration.

The Tom Cat - Hanley area is located about nine miles due north from Metaline Falls, in sections 3 and 10 of T.42 N., R.43 E., W.M. It is reached by 13 miles of road, only two of which are paved. Although property lines are crossed, the Tom Cat and Hanley areas are treated as a unit because of their geologic similarity and proximity. It is limited by broad areas of overburden to north, west and south, and by the Pend Oreille River on the east. In the 2200 by 3200 foot area, elevations are from 1737 feet on the Pend Oreille River to 2512 near the Russian Creek road. The west and north parts of area include five of the eight and a fraction unpatented claims of the Gardner group belonging to E. O. Dressel of Metaline Falls. To the southeast is the Hanley patented claim belonging to Jerome L. Drumheller of Spokane, Washington, who has leased it to the Columbia Lead and Zinc Mining Co. (President, Dr. George B. Hampton, Sec.-Treas. Harold S. Johnston, Spokane).

The workings are shown on the surface map and can be described as follows:

A. Tom Cat Claim.
   1. Shaft, 26 feet vertical, with 14-foot drift northward from its foot.
   2. Trench 30 feet long, 2 to 3 feet wide and 2 to 4 feet deep, 20 feet north of the shaft.
   3. Several small pits and open cuts within 150 feet of the shaft.
   4. A 25-foot open cut, or hillside trench, 300 feet east of the shaft.

B. Champion Claim.
   1. A 25-foot adit.
   2. A shallow open cut 140 feet southwest of the adit.

C. Union Leader Claim. Two shallow cuts on the steep north-facing hillside just north beyond the map-area.

1/ Park, C.F.,Jr, and Cannon, R.S.,Jr, Geology and ore deposits of the Metaline Quadrangle, Washington: U.S. Geol. Survey, Prof. Paper 202, p. 50, 1943.

D. Ole Olson Claim. A small discovery cut in the narrow valley east of the Tom Cat workings, and southeast of U.S. Engineer Hole No. 2.
E. Hanley Claim. A 30-foot open cut, 6 feet wide and 15 feet deep at one end.

There has been no production from the Gardner claims, and although some high-grade lead-silver ore was cobbed and sent from the Hanley cut in the 1880's, exact figures are not available.

The party is indebted to Mr. E. O. Dressel of Metaline Falls, and to the Columbia Lead and Zinc Mining Co. of Spokane for permission to publish the geological results of this work. Mr. Dressel had thoughtfully preserved the cores and sludges of three diamond drill holes, and allowed the party to examine and sample them. The U. S. Engineer Office, through its Senior Engineer in Seattle and its Resident Engineer in Metaline Falls, granted permission to examine the diamond drill cores from its test holes near the river.

General Geology

Stratigraphy. The sedimentary rocks composing the Tom Cat area are middle Cambrian Metaline limestone 2/, Ordovician Ledbetter slate 3/, Tertiary Tiger formation 4/, and Quaternary glacial debris and alluvium. One 10-foot dike of a hornblendic basic rock was found, near the northwest base of the hill above the river.

Approximately 1750 feet, a little more than the upper half of the Metaline limestone, is believed to be exposed in the Tom Cat area. The actual top of the formation is not exposed. The overlying Ledbetter slate is exposed on the river's bank at and beyond the southeast edge of the map area, but this is in the downthrown block of the vertical No. 1 fault mapped by Park and Cannon 5/ on the east side of the river, and presumed to extend under the overburden on the west side. For two reasons, however, it is believed that the exposures of jasperoid and secondary dolomite on the Champion and Hanley claims are close to the top of the Metaline limestone. First, their lithologic character is such as is found in several other places in the Metaline Quadrangle immediately below the Ledbetter slate. Second, the valley immediately southwest of the Hanley mine suggests that easily-eroded slate underlies it.

The stratigraphic succession within the Metaline limestone of the Tom Cat - Hanley area is apparently as follows:

Top: Dense blue-black to light-gray jasperoid and medium-grained ($\frac{1}{2}$mm.) dark gray dolomite, interbedded. Thickness 300 feet, plus or minus 100 ft.

Middle: Dense weather-resistant limestone. In the Hanley area a few yards of cherty limestone occur near the top, and alternations of limestone with medium-grained ($\frac{1}{2}$mm.) "magnesian limestone" for 100 feet below this. At the base of the limestone are beds containing dull-red argillaceous lenses and veinlets roughly parallel to the bedding. Total thickness of gray limestone 500 feet, plus or minus 100 feet.

Lower: Sugary-grained light-gray dolomite with no sign of bedding, weathering to form forested lowlands to the north. Assuming dips parallel to those in overlying limestone, the indicated thickness is at least 750 ft.

Ledbetter slate containing Ordovician graptolites is exposed along the river's bank at the southeast corner of the area and for some distance beyond. Small angular masses of crumpled black slate were found along faults in carbonate rocks 650 feet southeast of the Hanley cut, and 450 feet northwest of it. These remnants were probably distorted and dragged to their present positions by fault movements.

The Tiger formation, probably of Tertiary age, is represented by black graywacke in three small areas of the Hanley cut. This rock consists of sub-angular sand-size grains of many of the rock types of the Metaline district, cemented by a hard fine-grained carbonaceous substance. There are a few large cavities in the rock, lined with close-set, half-inch, tan rhombohedrons of calcite.

2/ op. cit., pp. 17-19.

3/ op. cit., pp. 19-22.

4/ op. cit., p. 23.

5/ Park and Cannon, op. cit., Plate 1.

4.

4. Structure. Strikes observed in the Metaline limestone are from N.35° W. to due west; dips are southwest, from 25° to 55°, but average 30° to 35°. In the jasperoid-dolomite horizon, good bedding was seen only along the river, where there is well-defined alternation of these rock types. In the underlying limestone, bedding was measured on the south, dip-slope side of the hill north of the Hanley mine, and at several places northwest of this hill. No bedding readings were possible in the lower dolomites.

Four major normal faults are inferred in the Tom Cat - Hanley area. These are shown as heavy dashed lines on the surface map, and labeled No.1 Fault, etc. A number of minor faults showing slickensides were seen, and these are indicated on the map by short strike-lines with barbed dip-arrows. The inferred major faults are placed on the map from the following evidence:

No. 1 Fault, separating Ledbetter slate from Metaline limestone, has been mapped by Park and Cannon (as mentioned above) as visible and vertical east of the Pend Oreille River, but concealed west of the river. From the present work, it is assumed to pass in the southeast corner of the area beneath a crescentic beach of cobbles and, farther back from the river, beneath a thick overburden of glacial debris. In this latter part of its course, it probably has Ledbetter slate on both walls.

No. 2 Fault seems to be the structural control for the high cliff which plunges down to the river above U.S. Engineers Hole 4, and also for the lower bluffs 1000 feet to the northwest. It cuts across the promontory to the southeast of the cliff, and is exposed along a vertical cliff above ~~the rapids~~ as a nearly vertical fault with a branch dipping southwest. From this branch northeastward past the main fault, the limestone is locally altered to light-gray sugary dolomite, and much of the limestone and secondary dolomite is stained a light tan.

The presence of No. 3 Fault is attested ~~by the offset of the sedimentary contacts just mentioned~~, by the presence of large masses of very coarse white calcite along the west face of the hill on the footwall side of the fault and in U.S. Engineers Hole 2, and by the presence of a narrow deep valley along the course of the fault. The calcite is assumed to be a filling of cavities leached out along the fault, and therefore not far away from it. This being assumed, the dip of the fault, though not directly evident, must ~~have been slightly greater than~~ the present slope of the hillside on which the calcite is now found. The hill-slope is 40°, and the fault may dip at 50°. The vertical displacement along Fault No. 3 was at least 350 feet; for the sedimentary contact between jasperoid horizon and gray limestone, with a 25° dip, was offset laterally at least 500 feet (though probably not much more: No. 4 Fault prevents a closer estimate).

No. 4 Fault, dipping 60° to the southwest, is exposed near the river south of U.S. Engineers drill hole 1. The gray limestone near it is dolomitized, but not so extensively as it is near No. 2 Fault.

It is possible that No. 4 Fault does not extend beyond No. 3 and that the latter is not offset as mapped. This seems quite possible because of the lack of a strong topographic break along the supposed west extension of No. 4 near the Champion tunnel. If this is the case, the slate-limestone contact probably bends around the west exposures in the Hanley area. Some difficulty is met in trying to match this contact on either side of No. 3 Fault, and therefore the alternative was chosen, No. 4 Fault being extended west and offsetting No. 3 as mapped.

If the structural relations are as mapped, the data about the faults are as follows:

Fault	Dip (approx.)	Apparent vertical displacement
1	90°	Not known
2 main	90°	180 feet
2 SW branch	50°	Not known
3	50°	350 feet
4	60°	400 feet

The displacement along these faults was probably oblique rather than down the dip. but there is no exact information to prove this.

Ore Occurrence

Structural and stratigraphic control of ore deposition. In the Metaline district the major ore deposits occur near faults in the upper beds of the Metaline limestone. Probably ore solutions rose along fault zones to the favorable beds, and possibly were dammed by the over-lying Ledbotter slate 6/ The upper limestone, where not altered, was found to be a soft gray mottled limestone, according to Park and Cannon, but in most places it has been altered to jasperoid (fine-grained hydrothermal quartz) and sugary dark gray dolomite. Sphalerite and galena were deposited later, largely in association with jasperoid and coarse calcite. In general, the more highly silicified rocks are apt to have the most and best grade ore.

This set of conditions for ore deposition seems to occur in the Tom Cat - Handley area. The overlying slate, though not actually seen, is indicated just south of the known mineralized rocks which dip toward the supposed slate area. The mineralization occurs in silicified rocks, or jasperoid, of the type associated with ore elsewhere in the Metaline district, and considerable faulting is suggested by the outcrop pattern, as discussed in the preceding section.

Ore Minerals. Spalerite occurs in disseminated crystals in jasperoid and dolomite. Their diameter is from 0.1 to about 10 mm. The larger crystals are zoned, having pale rosin-yellow cores and fairly dark reddish-brown shells separated by transitional boundaries. This relation suggests an increasing iron content of the ore solutions. Most of the smaller sphalerite grains are reddish-brown, though there is some very pale rosin jack in the Tom Cat cuts. It is believed that much sphalerite has been leached out, leaving cavities lined or filled with buff powdery smithsonite ($ZnCO_3$) and calamine ($(ZnOH)_2SiO_3$) tinted by limonite. Veinlets and pockets of this oxidized zinc aggregate are abundant near the discovery cut of the Tom Cat claim, but material similar in appearance in the Champion tunnel proved to contain no zinc. No method was evolved for recognizing in the field whether a buff powdery mass was zinc-bearing or not. For example, sample TCS 1 assayed 10.1 per cent oxide zinc, while similar material in sample #4A had none.

Galena occurs in scattered coarse crystals, some of them over an inch across. On the Tom Cat and Hanley properties, galena is associated with minute sphalerite crystals in white quartz. The best showings of galena are at the northwest end of the Tom Cat trench and in the Hanley cut. The galena seems to be very little altered.

The gangue minerals are coarse gray secondary dolomite, medium to dark jasperoid and white quartz. The white quartz is everywhere subordinate to the others. On the Tom Cat claim, almost all the rock seen is silicified, whereas most of the rock on the Champion and Hanley claims is dolomite. A little coarse calcite was found in a few places in the mineralized areas.

6/ Park and Cannon, op. cit., p. 52.

Results of sampling

The sampling program detailed on the following pages was planned by the Geological Survey and carried out jointly with the Bureau of Mines. Only the better mineralized exposures were sampled but the best of these in the Tom Cat area ran only 4.6% for combined lead and zinc. The average of the mineralized samples is between 2 and 3% combined metals. Most of the Tom Cat outcrops show some evidence of lead or zinc, and many more samples could have been cut but probably they would not change the general grade picture. Apparently the mineralization was so erratic as to prevent the recognition of a trend to the ore in this area. The relative proportions of lead and zinc are variable but the average may be nearly equal.

The Champion Tunnel appeared barren but it was sampled for proof.

The Hanley outcrops show fair mineralization in and around the cut. Five samples average nearly 7% combined lead and zinc, with a slight preponderance of zinc. The sampling could be extended on surface exposures. Widths are indefinite and the full zone may not be exposed.

The assaying was done by several commercial firms that could give prompt results. The results are not always in close agreement, but the discrepancies are not of any economic importance. In adjusting the results of two unequal assays the authors used the arithmetic mean, unless the mineral content observed in the field suggested a preference.

Oxidation and probable leaching of the ore minerals now exist in most samples. The general effect can be considered probably giving a conservative picture of the grade.

Tom Cat Area

Sample number	Location	Description		Assay* (in percent) ML	UAO	ADJ.
1 A	Northeast side of Tom Cat discovery cut, 110 feet northwest of shaft.	6-foot channel, sloping southeast from a point 4 feet above the floor in the face.	Zn Pb	1.00 0.1	0.8 0.8	0.9 0.8
1 B	"	7-foot channel southeast from 1A, and curving to cross the threshold of the cut, at the floor. ~~6-foot~~	Zn Pb	1.5 0.1	1.25 0.2	1.37 0.2
2 A	West half of trench just north of shaft.	5-foot horizontal channel just below overburden, around north side of enlarged west end of trench.	Zn Pb	1.1 0.1	1.2 1.0	1.15 1.0
2 B	"	8-foot channel on floor of trench, separated from 1A by 4 feet of unsampled overburden.	Zn Pb	1.1 3.7	1.1 3.1	1.1 3.4
2 C	"	7-foot channel, floor of trench east from 2B.	Zn Pb	1.7 0.1	1.7 0.4	1.7 0.3
3 A	West wall of 14-foot drift north from foot of shaft.	6-foot channel, waist-high, southward from face of drift.	Zn Pb	0.3 nil		0.3 nil
3 B	"	5-foot channel next south from 3A.	Zn Pb	0.2 nil		0.2 nil
3 C	"	7-foot channel next south from 3B.	Zn Pb	nil nil		nil nil
TCS 1	Rock cut 150 feet northeast of shaft.	Selected pieces of leached, buff-colored rock and oxidized zinc minerals.	Zn Pb	10.6 (oxide Zn 10.1) nil	10.2	10.4 nil
TCS 2	Pit at east of trench sampled as #2 A.B.C.	Grid sample, north side of pit. 1-foot interval.	Zn Pb	0.71 0.10	0.2	0.5 0.1
4 A	Champion tunnel, north wall.	6-foot channel, waist-high, eastward from face.	Zn Pb	nil nil		nil nil
4 B	"	5-foot channel eastward from 4A.	Zn Pb	nil nil		nil nil

* ML Metallurgical Laboratory, Seattle. Adj. - Adjusted Average.
UAO Union Assay Office, Salt Lake City.

Hanley Area

Sample number	Location	Description	Assay* (in percent)	ML	Mc	Adjusted
H 1	Hanley cut	6 by 6 foot grid on face of cut. Chip sample.	Zn	4.78		4.78
			Pb	0.76	0.4	0.58
H 2	Hanley cut	5 by 5 foot grid on west wall adjoining H1. Chip sample.	Zn	2.22		2.22
			Pb	0.13	0.1	0.12
H 3	Hanley cut	5 by 5 foot grid on wall adjoining H2. Chip sample.	Zn	3.31		3.31
			Pb	2.57	2.8	2.68
H 4	Hanley cut	Dump sample: 60 pieces broken from large rocks.	Zn	3.37		3.37
			Pb	2.31	2.7	2.50
H 5	Hanley cut	Dump sample: Fine material, ½ to 1 inch pieces, on same dump.	Zn	5.96		5.96
			Pb	9.29	9.5	9.40

* ML Metallurgical Laboratory, Seattle
Mc Richard McCarthy, Butte

Results of drill core examination

The cores and sludges from diamond drilling in 1940 on the Tom Cat claim have been preserved by the owner, Mr. Dressel. The locations of the three holes ~~is~~ shown on the surface map. The data from the core examination, together with assay returns from selected sludges and core are shown in the logs of the holes. Core samples are marked "C" and sludge samples "S".

The U. S. Engineers drilled three holes near the Pend Oreille River on the Tom Cat-Hanley map-area late in 1943. These holes were sunk as bedrock tests for a proposed damsite and spillway site. The logs of cores from holes 1 and 2 are detailed below . Hole 3 is east of the river and is not included in this report. Hole 4 did not reach bedrock, so no core was obtained.

Dressel diamond drill hole 1.
Tom Cat claim, Metaline district, Washington.
Drilled in October 1940 by R.S. McClintock Co., Spokane, Washington.
Located at southwest corner of Tom Cat shaft.
Vertical hole. Ax core. Collar elevation 2417.
Objective: extension of mineralization in discovery cut 100 feet to northwest

Footage From	To	Recovery Core (estim.%)	Sludge	Description	Assays Zn	Pb	c=core s=sludge
0	41	0	0	Overburden.			
41	55	90	23	Dark-gray dolomite of ½ mm. grain size. Locally abundant quartz veinlets; also breccia cemented (41-44). Locally veins of buff dolomite.			
55	60	50	9	Same dolomite, no quartz. 10 to 15% buff dolomite veinlets.	c 1.5 s 0.2	0.2 0.1	
60	65	65	20	Jasperoid with 1/8 to 1 in. vugs of gray quartz crystals. At 63: fragment of slate			
65	71	25	15	Jasperoid; quartz 75%. Estimated 3 to 5% Pb as coarse galena. Zn ½ to 1½% (richer from 65 to 66), as coarse sphalerite (finer from 65-66).	c 0.5 s 0.1	3.4 0.1	
71	110	1	10	Three round dolomite fragments containing 25% quartz at 104, and one at 110. Driller reported "clay, sand and gravel mineralized", but lost water at 98 feet.	s 0.1 (70-75 ft.)	0.6	
	End of hole						

Discussion of Dressel hole 1--Dressel's hole No. 1 did not reach the bottom of the jasperoid-dolomite horizon. Below the best mineralization was loose material, but too much water was lost to permit sludge recovery. This zone may be a zone of leaching along a nearly vertical fault followed by the drill. The zone of cemented dolomite breccia at 41 to 44 is in line with a fault seen in the face of the drift off the shaft, about 35 feet up a 38 degree dip. In the drift, this fault has 10 inches of black silicified gouge, with soft yellow paste above it.

The buff dolomite veinlets in and above the upper assayed section may contain oxidized zinc.

Dressel's diamond drill hole 2
Tom Cat claim, Metaline district, Washington

Drilled in Nov. 1940. Vertical hole. By R.S. McClintock Co., Spokane, Wash. Collar elevation 2385. Located 130 feet east of hole 1. Ax core from 0 to 24 feet, ex core from 24 to 150 feet.
Objective: lateral extension of mineralization in Tom Cat cuts and hole 1.

Footage From	To	Recovery Core (estim.%)	Sludge	Description	Assays	Zn	Pb
					c=core s=sludge		
0	10	0	0	Overburden.			
10	18	60	32	Fine-brecciated dolomite with 1% of soft dark (slate?) fragments. 20% of white quartz cement.	s	0.9 (10'-15')	0.1
18	47	20	36	Dark gray dolomite, mottled from 31 to 54. 75% of rock is bunchy quartz from 24-31, 34-39, 41-47.	s	0.1 (45'-50')	0.1
47	54	20	57	Dolomite veinlets and less quartz.	c	0.4 (47'-51')	nil
54	63	15	20	Breccia of dolomite fragments (40%) cemented by quartz (60%).	s	0.2 (50'-55')	0.1
63	82	55	27	Mottled dolomite with 50 to 75% of quartz as veinlets and bunches.			
82	93	70	15	Mottled dolomite, 15% quartz veinlets, sparse sphalerite in $\frac{1}{2}$mm. grains. Zinc estimated 0.5%.	s	0.1 (80'-85')	trace
93	118	40	30	Dolomite. Faint thin banding (bedding?) dips 20° at 93 and 100.	c	0.5 (100'-104')	nil
				Quartz 40%, and at 112-118 coarse calcite veins 10%.	s	0.3 (100'-105')	0.2
118	120	25	0	Dark dolomite interbedded in 1mm. beds with light calcite; dip is 30°.			
120	121	25	18	Breccia with calcite cement.			
121	150	30	26	Dark-gray dolomite. Banding at 127 feet, dips 30°. Mottled 128-150, with some brecciation below 144. Abundant calcite veinlets. Vugs of dolomite crystals at 128, and of calcite at 140.			
	End of hole.						

Discussion of Dressel hole 2: Hole 2 did not penetrate to the bottom of the dolomite-jasperoid horizon. The dolomite of the upper 112 feet of hole is cut by an abundance of quartz veinlets, while below 118, calcite is the vein mineral. Between 112 and 118, both are found. The elevation of the top of the 6-foot transition zone between the upper zone of quartz veins and the lower one of calcite veins is 2273 (compare 2288 for hole 3). Mineralization is insignificant.

Dressel's diamond drill hole 3
Tom Cat claim, Metaline district, Washington

Drilled in Nov. 1940 by R.S. McClintock Co., Spokane, Washington
Vertical hole. Collar elevation 2415 feet. Located 130 feet southeast of hole 1. AX core to 105 feet and 126 to 137; EX core 105 to 126 and 137 to 253. Objective: down-dip extension of mineralization in cuts and holes 1.

Footage From	To	Recovery Core (estim. %)	Sludge	Description	Assays Zn	Pb	c=core s=sludge
0	15	0	0	Overburden			
15	105	30	37	Dark-gray dolomite with 5 to 25% of quartz veinlets and (15 to 40 ft.) a little late dolomite in vugs. Fragments of basic dikes at 16, 20 and 34 feet. Two inches of galena core at 33.5 feet. Sparse sphalerite in 1 to 2 mm. crystals at 40 to 45 feet. Coarse galena at 42 and 44. Broken ground from 15 to 38, 71 to 113.	c0.9	15.3 (29'-34')	
					s0.2	2.2 (30'-35')	
					c1.8	0.2 (40'-45')	
					s0.9	0.1 (40'-45')	
105	127	5	28	Lumps of dark gray-green fault gouge with dark-gray dolomite. Lost water at 121.	s0.3	0.1 (45'-50')	
127	140	20	8	Dark-gray dolomite with scarce quartz and calcite veinlets; fine-broken core 130 to 137 feet.			
140	253	50	13	Dark-gray dolomite with calcite veinlets throughout but very abundant downward from a pure mass at 193 to 194. Jasperoid 10 to 50% from 197 to 204. Graphite veinlets 246 to 253, at a 95% maximum at 252. Lost water at 150	cnil	nil (215'-220')	
					s0.2	0.1 (225'-230')	
					cnil	nil (234'-238')	
					cnil	nil (245'-250')	
End of hole				Last barrel	s0.4	0.8	

Discussion of Dressel hole 3--Hole 3 failed to reach the bottom of the jasperoid-dolomite horizon. It was in dark-gray dolomite entirely. The distribution of quartz and calcite veins resembles that in hole 2. Quartz veins occur above 127 feet, and calcite veins below 140 feet; and both occur sparingly between 127 and 140 feet. The elevation of the top of this transition zone is 2288 (compare with 2273 for hole 2). This relation of quartz to calcite is probably due in some way to faulting rather than to bedding, for the transition zone dips northeast at a low angle, whereas the beds dip southwest. More exact data on the attitude of this zone would have been available if hole 1 had been deep enough to reach it. The small dike fragments at 16, 20 and 34 feet are the only dike rocks seen in the area, except for the dike mapped ~~1550 feet~~ N.80°E. ~~of~~ the shaft.

Mineralization is best near the lead stringer at 33.5 feet, and suggests that this and other galena drill holes are in the foot wall of the best ore. By the same token, new drill holes should be placed farther southwest toward the uneroded higher beds of the Metaline limestone.

U. S. Engineers hole 1
Hanley claim, Metaline district, Washington
Drilled Nov. 1943. Vertical hole. Collar elevation 1740.5 .
Located on the west edge of Pend Oreille River, 700 feet S. 75° E. of the Hanley Hill. BX core to 9.6 feet; AX from 9.6 to 151 feet.
Objective: to test character of rock as a damsite.

Footage From	To	Recovery Core (estim. %)	Sludge	Description
0	6	75	0	Dense light-gray limestone. Gouge at 3 and 6 feet, 3/4 inch each.
6	26	60	0	Same with gray chert nodules at a 10% maximum between 14 and 17 feet. Breccia zones at 19, 22 and 24 to 26.
26	33	70	0	Dense gray limestone. Limonitic gouge at 31-32. Pink and brecciated 30 to 31 and 32 to 33.
33	126.5	65	0	Medium-gray magnesian limestone of ½ to 1 mm. grain size. Locally tan. Veins and bunches of buff calcite common, increasing downward; forms breccia cement at 124.5 to 125. Rusty cavities at 55, 93, 105 and 107 feet.
126.5	132	90	0	Dense light-gray limestone with some iron-staining in cracks.
132	146	90	0	Coarse gray magnesian limestone with pockets of calcite; stylolites prominent from 139 to 141.
146	151	95	0	Close alternation of dense limestone with coarse magnesian limestone. Coarse calcite 146 to 147; iron stains 148.

Discussion of U. S. Engineers Hole 1: U.S. Engineers Hole 1 is entirely in what is mapped as "fine-grained gray limestone", the cherty phase of which occurs in the upper 26 feet of the hole. Actually over two-thirds of the rock drilled is a medium to coarse grained (recrystallized) "magnesian limestone": one which effervesces with cold 7:1 HCl much less readily than does calcite limestone, but more so than dolomite. This rock may be an intimate mixture of calcite and dolomite grains.

The presence of coarse calcite, and signs of brecciation may be the results of adjusting movements in the block between Faults 1,2, and 4.

U. S. Engineers hole 2
Tom Cat area, Metaline district, Washington

Drilled in Nov. 1943. Vertical hole. BX core 45 to 49.5; AZ core from 49.5 to bottom. Collar elevation 1987.6 feet.
Located on valley floor 120 feet NW of discovery post of Ole Olson claim, about midway between Tom Cat and Hanley workings.
Objective: to test rock foundation and depth of overburden for proposed spillway dam.

Footage From	To	Recovery Core (estim. %)	Sludge	Description
0	45	0	0	Overburden.
45	65	60	0	Medium-grained gray "magnesian limestone" with coarse calcite as follows: At 45.5 : 6 inches. At 47.5 ; 6 inches. At 49: 6 inches. At 50: 2 feet, buff colored. At 53: 1 foot. At 60: 6 inches. The remaining limestone has many smaller calcite stringers in it.

End of hole.

Discussion of U. S. Engineers Hole 2: The abundance of coarse calcite (between 1/3 and 1/2) in the "magnesian limestone" strongly suggests a near-lying fault: Fault No. 3. As mapped, the hole reaches bedrock in the foot wall of No. 3, although the exact position of this fault is not known, its presence and ~~45 to 50 degree~~ dip ~~having~~ been inferred from the occurrence of areas of coarse calcite similar to that in the hole, on the hill side to the east.

Discussion of U. S. Engineers Hole 3 — 4?

Drilled in Nov. 1943. Vertical hole 150 feet deep. No core. Collar elevation about 1735 feet(not surveyed at time of this work). Located at edge of low water, at foot of northeast-facing cliff 1000 feet north of Hanley workings.

Hole 3 did not reach bedrock. It passed through coarse sand and pea-size gravel left in the backwater below and to the side of the rapids northeast of the Hanley claim.

The depth of the bedrock here may be due to the easy removal of the hanging wall rock from the surface of Fault No. 2, by eddy currents in the river; or it may be a residual feature caused by ice erosion.

Ore Possibilities

The possibility of ore in the Tom Cat and Hanley areas is based, not on any developed reserves, but on geologic conditions analogous to the producing areas in the Metaline District. Stratigraphy, structure, mineralogy, and alteration are similar. At present, no estimate can be made even of inferred ore in this area, but the objective can be described as an ore shoot similar to those in the operating mines of the Metaline District. Their order of magnitude has frequently been some hundreds of thousands of tons averaging 5 to 8% combined lead and zinc. Additional shoots are being found in the vicinity of the producing stopes. In most cases the surface exposures were no better than those in the Tom Cat-Hanley area, so all in all, some optimism should be allowable.

The Tom Cat area shows 2 or 3 per cent combined zinc and lead disseminated in scattered outcrops over an area measuring 400 by 400 feet. The exposures are not of ore grade by any means, but their geologic setting suggests the possibility of better grade at higher, more favorable horizons. No local structural control is apparent now, but the area actually exposed in outcrops is small. Apparently the present Tom Cat workings are in a horizon 200 to 300 feet below the top of the Metaline limestone formation. In the operating mines and drilled areas, that top 200 feet has been productive, and it presents an objective for exploration.

It is possible that valuable ore shoots may be duplicated here. With sufficient demand for zinc and lead, exploration of this possibility should be a worthwhile risk. In anticipation of such a situation, several drill holes have been proposed for the Tom Cat area to test the top of the Metaline limestone. They are shown on the accompanying map and sections, and they are described in the following chapter on Exploration.

In the Hanley area, similar facts and reasoning apply. The exposures are not so widespread, but they are higher in grade. Some structural alignment is noticeable and serves as an objective for drilling. Present exposures are probably near the top of the Metaline limestone, but any drilling should be planned to cut some of the overlying Ledbetter slate so as to be sure of the stratigraphy. With this in mind, several possible drill holes are described in the following chapter and shown on the accompanying surface map and sections.

Exploration

In the Tom Cat-Hanley area, seven holes have been proposed on the assumption that the imminent exhaustion of the Tri-State District justifies new risks in exploration. This drilling is expected to amount to at least 3100 feet, and encouraging results may demonstrate the need for a total of 5000 feet in this program. The holes are shown on the accompanying sections and surface map.

The maximum depth of drilling is expected to be 600 feet and the minimum 300 feet. In some places overburden, consisting of glacial debris or glacial lake deposits, may reach a thickness of several score feet. All holes would be from the surface, and the season of passable roads is May through October. Vertical holes are suggested because of the lack of detailed geology in the proposed drilling area. When more information is at hand, some saving could probably be made by drilling inclined holes at right angles to the beds.

Medium-size bits are suggested not only because of better coring, but because of the value of larger samples in assaying erratic mineralization. Also intensive work in the Metaline District is demonstrating the need for preserving at least a split half of all core for later re-examination in view of new ideas on ore controls.

The first proposed hole, "A", in the Tom Cat area would be located about 500 feet west of the mineralized exposures and on strike from them in about the same stratigraphic position. It is only 300 feet deep and would not test the very top of the Metaline formation. For that reason it is less desirable than the other holes, but it would explore a large unknown area and give some information on stratigraphy. This short hole might help to plan succeeding holes to better advantage, in addition to testing a possible extension of the mineralized outcrops. Its position would be similar to that of the Dressel holes shown on Sections A-A' and E-E'.

The second proposed hole, "B", would be located about 300 feet south of "A" and is planned to cut some of the Ledbetter slate in order to be relatively sure of the top of the Metaline limestone. This hole might go to 600 feet. It should test the possible southwesterly extension of the mineralized area. Holes "C" and "D" have purposes similar to "B", and are located 300 to 400 feet apart and each might reach a depth of 500 feet in covering the possible southerly and southeasterly extension of mineralization. They are shown on Sections "A-A' and E-E'".

The area to the east of the Tom Cat workings is notable for a few outcrops and these are barren. The possibilities seem poor in that direction for an improvement in mineralization amounting to ore grade. The Tom Cat exposures are low grade but widespread, whereas in this easterly area the outcrops are altogether barren. To the north the favorable beds are eroded; so northerly and easterly directions are omitted from this preliminary program.

Thus four holes totalling 1900 feet are proposed as a minimum to prospect for an ore shoot in the vicinity of the Tom Cat workings. If these holes give encouraging results, then an additional 1000 feet of drilling might be advisable.

In the Hanley pit samples of the walls ranged from 2.35% to 5.88% combined lead and zinc in a zone of irregular veinlets of galena and sphalerite. Dump samples were 5.88% and 15.25% combined metals. This mineralization shows a weak fracture system striking roughly north-south and standing about vertical. The projected intersection of this fracturing with the top of the Metaline limestone is the site of hole "E", the first one proposed for this area. It, also, should cut some of the overlying Ledbetter slate so as to be fairly sure of the top of the limestone. The depth might be 400 feet.

Similar holes, "F" and "G", 400 feet deep are proposed at 200 feet on each side of "E". These are spaced somewhat closely for such long-shot prospecting, but it is thought that the Hanley mineralized zone may be relatively small and high-grade, on the basis of present exposures. However, the results of the initial hole should influence the location of the others. If results are encouraging, another 1000 feet could probably be drilled here to good advantage as part of a preliminary exploration program.

If the results in the Tom Cat and Hanley areas are favorable, then some attention should be given to the intervening ground. Cross-sections B-B' and C-C' have been drawn through a possible wildcat hole "X" to show the expected geology. This geology, however, is based on so little genuine evidence that such a hole is not actually proposed at this time.

Economic conclusions and recommendations

Present exposures of mineralization in the Tom Cat area are scattered over an area of 400 by 400 feet, but they average at best only 2 or 3 percent combined metals. These exposures are, however, probably 200 to 300 feet stratigraphically below the top of the Metaline limestone, but elsewhere in the district the upper 200 feet has been very productive. The normal situation might be repeated in this vicinity and that is the possibility on which an exploration program is based. Several drill holes totaling at least 1900 feet have been proposed to test this widespread mineralization in the projection of the most favorable conditions in the Tom Cat area. The projections are from considerable distances and hence may be wrong. But the need for zinc and lead as strategic metals may justify the risk. It is a long-shot proposal, but under the circumstances, the exploration program is recommended.

The Hanley exposures, 2000 feet to the east, are in a different geographic unit but show similar geologic conditions. The area of mineralized outcrops is about 300 by 100 feet in the main portion, and the grade is somewhat higher. The walls of the cut average only 4 or 5 per cent combined metals, but the high-grade was cobbed out and shipped many years ago. A north-south vertical alignment of the ore zone is also apparent and helps guide the search for more material. Several drill holes totaling at least 1200 feet have been proposed.

The choice between the Tom Cat and Hanley prospects is a fine one. If either is undertaken, probably the other should be also. Since they are so much alike, they have been treated in this report as one area. A minimum of 3100 feet of drilling is proposed and allowance should be made for a possible total of 5000 feet.

Respectfully submitted,

C. D. Campbell
Field Geologist for lead and Zinc
U. S. Geological Survey

Colville, Washington
March 8, 1944

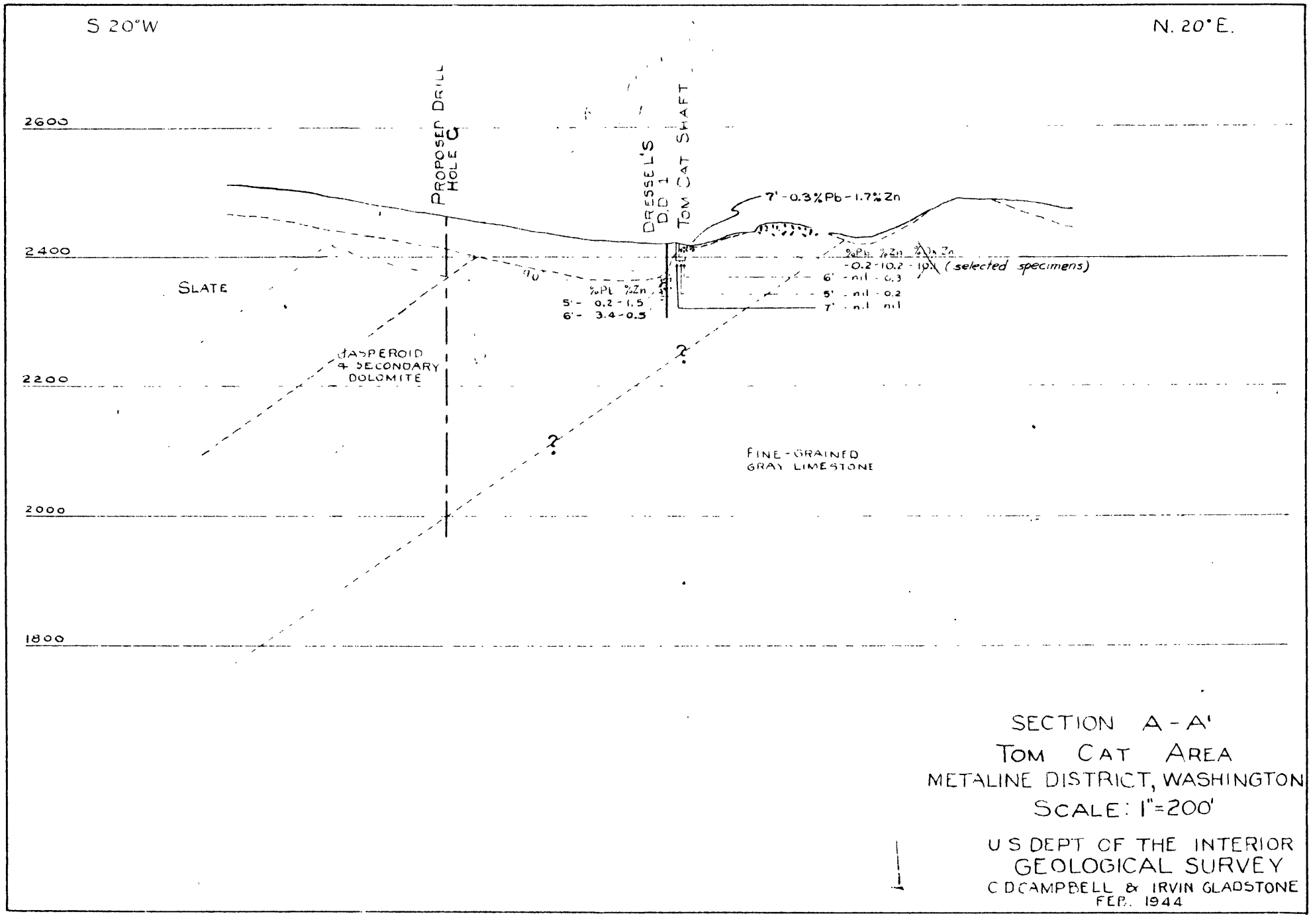
Distributed to:

U.S.G.S.

Commodity Geologist	6
Spokane	3
Metaline Falls	3
Campbell	1
Gladstone	1

U.S.B.M.

Washington D.C. (from Commodity Geologist)	1
Salt Lake City	1
Spokane	1
Metaline Falls	1



SECTION A - A'

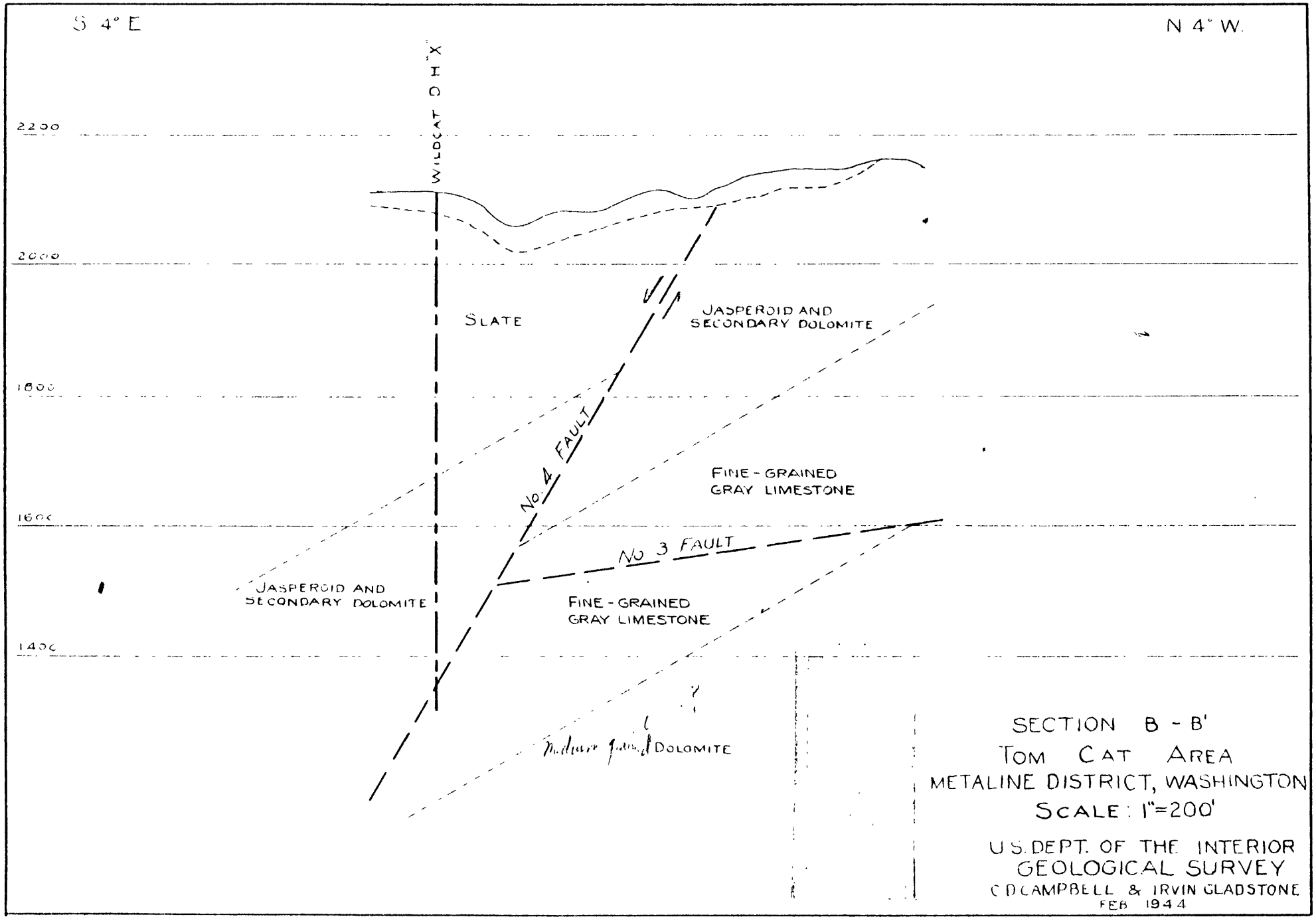
TOM CAT AREA

METALINE DISTRICT, WASHINGTON

SCALE: 1" = 200'

U S DEPT OF THE INTERIOR
GEOLOGICAL SURVEY

C D CAMPBELL & IRVIN GLADSTONE
FEB. 1944



SECTION B - B'

TOM CAT AREA

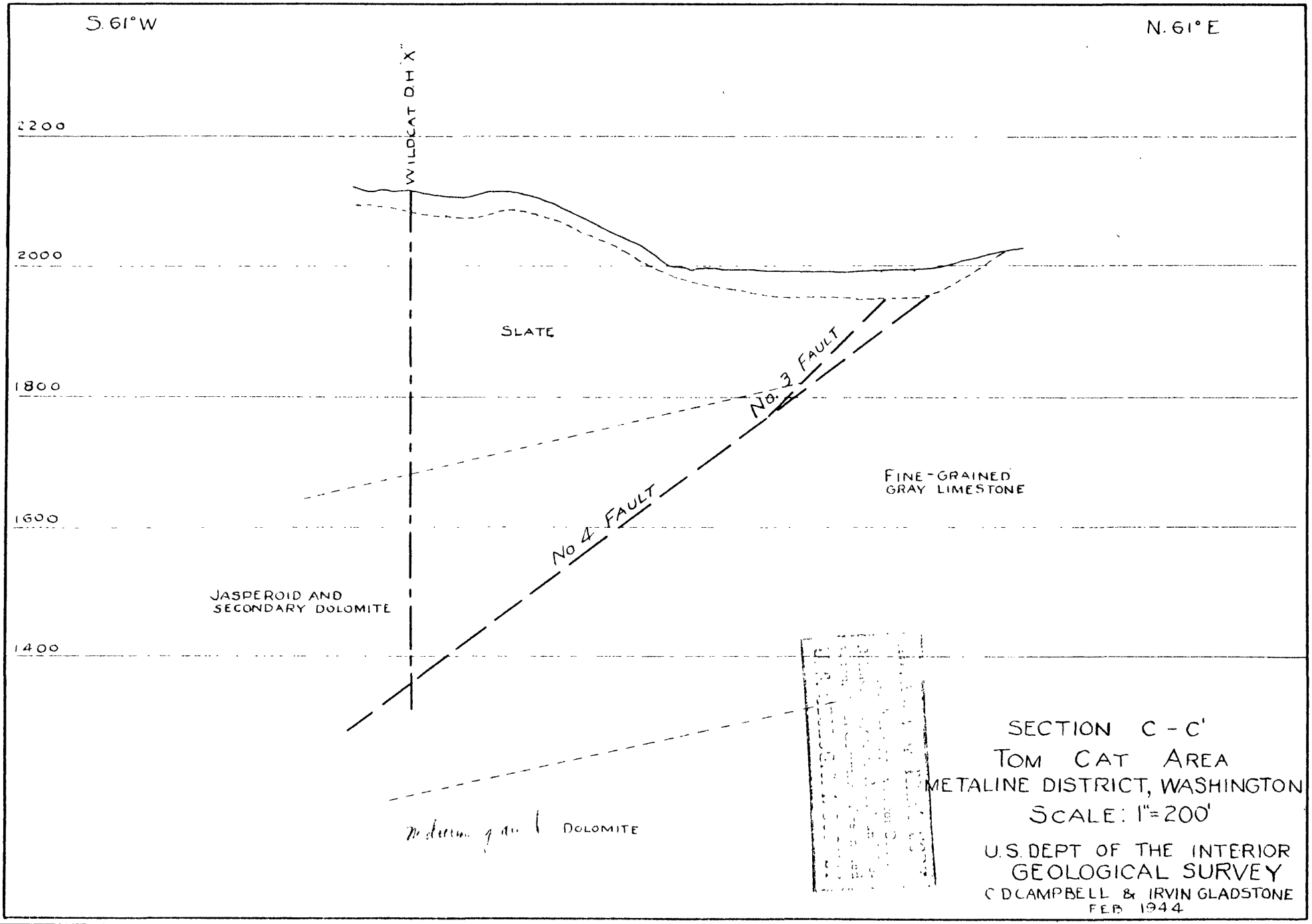
METALINE DISTRICT, WASHINGTON

SCALE: 1"=200'

U.S. DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY

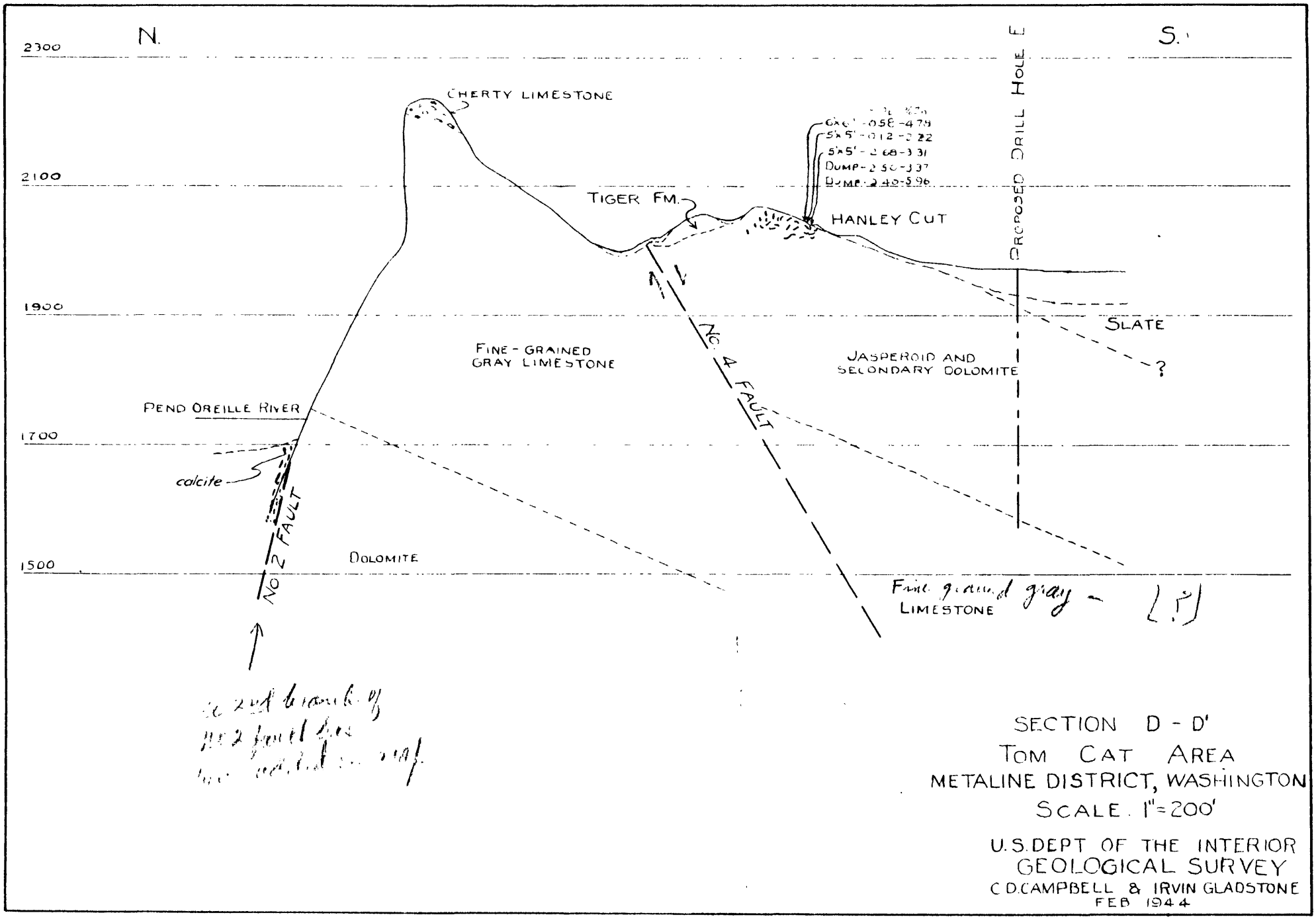
C.D. CAMPBELL & IRVIN GLADSTONE

FEB 1944



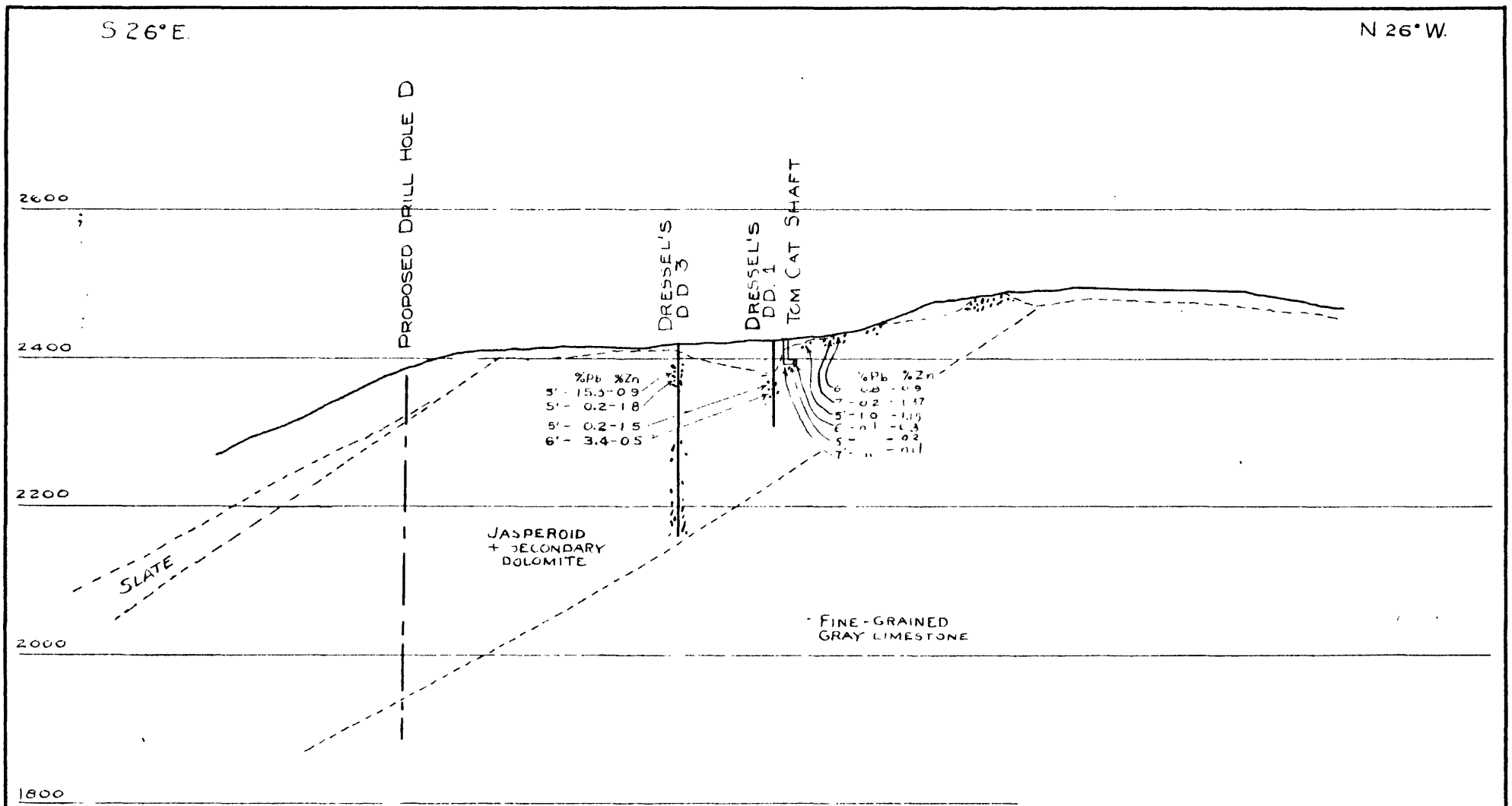
SECTION C - C'
TOM CAT AREA
METALINE DISTRICT, WASHINGTON
SCALE: 1" = 200'

U.S. DEPT OF THE INTERIOR
GEOLOGICAL SURVEY
C D CAMPBELL & IRVIN GLADSTONE
FEB 1944



SECTION D - D'
TOM CAT AREA
METALINE DISTRICT, WASHINGTON
SCALE 1" = 200'

U.S. DEPT OF THE INTERIOR
GEOLOGICAL SURVEY
C.D. CAMPBELL & IRVIN GLADSTONE
FEB 1944



SECTION E - E'

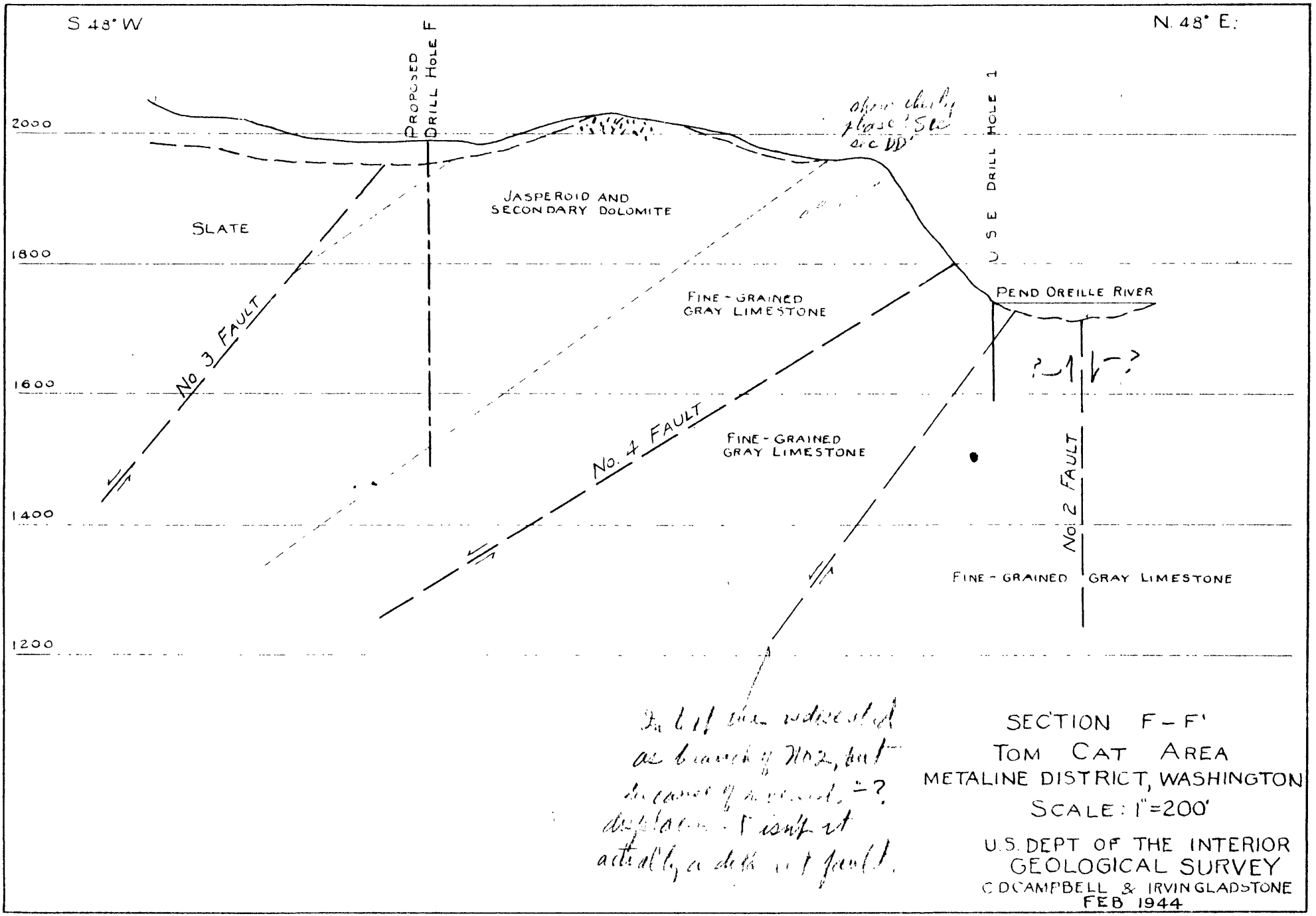
TOM CAT AREA

METALINE DISTRICT, WASHINGTON

SCALE: 1" = 200'

U S DEPT OF THE INTERIOR
GEOLOGICAL SURVEY

C D CAMPBELL & IRVIN GLADSTONE
FEB 1944


S 48° W
N. 48° E.
PROPOSED DRILL HOLE F
U S E DRILL HOLE 1
2000
1800
1600
1400
1200
SLATE
JASPEROID AND SECONDARY DOLOMITE
FINE-GRAINED GRAY LIMESTONE
FINE-GRAINED GRAY LIMESTONE
FINE-GRAINED GRAY LIMESTONE
PEND OREILLE RIVER
No 3 FAULT
No. 4 FAULT
No. 2 FAULT
?
SECTION F-F'
TOM CAT AREA
METALINE DISTRICT, WASHINGTON
SCALE: 1"=200'
U.S. DEPT OF THE INTERIOR
GEOLOGICAL SURVEY
C.D. CAMPBELL & IRVIN GLADSTONE
FEB 1944