PRINTED: 06-20-2006

P.T CLAIM DATA
PART 1 of 2

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: BULLARD

ALTERNATE NAMES:
LITTLE GIANT

YAVAPAI COUNTY MILS NUMBER: 109

LOCATION: TOWNSHIP 8 N RANGE 10 W SECTION 11 QUARTER N2
LATITUDE: N 34DEG 03MIN 57SEC LONGITUDE: W 113DEG 16MIN 23SEC
TOPO MAP NAME: SMITH PEAK - 7.5 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:
COPPER OXIDE
COPPER SULFIDE
SILVER
GOLD
SILICON
CALCIUM CALCITE

BIBLIOGRAPHY:
MAPS - FLAT STORAGE, 2ND DRAWER
ADMMR BULLARD MINE FILE & COLVO FILE
ADMMR INDEPENDENCE FILE
BLM MINING DISTRICT SHEET 341
USBM WAR MINERAL REPORT 1945 REPORT 453
CLAIMS ALSO IN SEC 1, 2, 3, 10 & 12
FOWLER, GEORGE M (EAGLE PITCHER) GEO FILE
TOVOTE, W. 1918 "CUNNINGHAM PASS", GEO FILE
AGSU OFR 92-1, MINERAL DEP. BULLARD MINERAL
DIST. . . ., 1992, SPENCER, J. AND REYNOLDS

teckcominco

Catherine Suda
Land Supervisor

This Copy, Copied from original Copy that, was not STRAIGHT
T.M. 5/2004

March 18, 2004

Karen Carter
Trustee, Margaret L. Krebs Trust
Carter Insurance and Pension Services
3422 N. 60th Street
Phoenix, AZ 85018-6702

Dear Ms. Carter:

Re: Bullard Mine Patented Claims Data

Enclosed you will find the copies you requested of the Bullard Mine exploration report generated during Cominco American Resources' work on the property in 1989-1990. This information was originally reported to NRG Resources Ltd. and Key Mineral, Inc., in accordance with our mineral lease on the property, which has since been relinquished.

I hope the data will help in your current exploration efforts on the property. Good luck in your exploration. If you find anything that you think may be of interest to us, please feel free to contact me again.

Sincerely,

Catherine Suda

Catherine Suda
Land Supervisor

encs.
cc: C. B. DiLuzio

Cominco American
Resources Incorporated

BULLARD PEAK PROJECT
YAVAPAI COUNTY, ARIZONA
1989–1990 FINAL PROJECT REPORT

Reno Exploration Office

BULLARD PEAK PROJECT

YAVAPAI COUNTY, ARIZONA

1989-1990 FINAL PROJECT REPORT

James M. Telford

Cominco American Resources Inc.

June 20, 1990

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1.0 SUMMARY AND RECOMMENDATIONS

The Bullard Peak project is an exploration program for gold in Yavapai County, Arizona. The project is funded and operated by Cominco American Resources Inc. (CARI) and managed by the Reno exploration office. The project area consists of approximately 5,820 acres of patented and unpatented mining claims. The Bullard Peak project is a product of Cominco's submittal evaluation program in Arizona.

During the 1989 exploration year CARI conducted a program of geologic mapping and sampling followed by 4,450 feet of conventional and reverse circulation drilling in 18 drill holes. The total 1989 expenditures for the project were approximately $125,000. Auriferous CuFeQtz vein systems were drill tested in the John Moore and the North Hill areas. Drill results from the John Moore area indicate little potential for a large tonnage bulk minable Au deposit along the John Moore structure. Drill results from the North Hill area, however, were very encouraging. Drill intercepts indicated a mineralized zone, with ore grade Au values, approaching 60 feet in width along the North Hill fault. The results from North Hill warranted an expanded program in 1990.

During 1990 CARI continued exploration in the North Hill area with 100 scale outcrop mapping, rock chip sampling, CS-AMT and IP geophysical surveys and 12,255 feet of reverse circulation drilling. The total 1990 expenditures for the project were approximately $175,000. Mapping, sampling and CS-AMT/IP surveys indicated a possible Cyprus-Copperstone analogue along the +3000 foot strike length of the North Hill fault which warranted an extensive drill test. Results from this drill program were not encouraging. Only 8 of 24 drill holes had intercepts of $\geq$ 0.01 opt Au.

The 1989 and 1990 exploration programs at Bullard Peak have not reach their planned objectives of multiple drill intercepts of $\geq$ 50 feet of 0.075 opt Au. Furthermore, the drill results are not vectoring the program into any new, promising areas. No further work is recommended nor warranted on the property.

2.0 INTRODUCTION

CARI became interested in the Bullard Peak area through field investigations by Noel Cousins. Acting on a property submittal forwarded from the Vancouver office of Cominco Ltd., N. Cousins made an initial reconnaissance of the area on 05-10/11-88 and a follow-up visit with a land status check on 06-24-88. N. Cousins recognized the Au potential of certain vein structures in the upper plate of the Bullard detachment fault and made recommendations for acquisition of the property. Successful negotiations were concluded with the signing of two separate mining leases on 09-30-88 with NRG Resources Ltd., Vancouver, B.C., Canada and with Mike Sansone, Phoenix, Arizona. These two leases covered the patented and unpatented ground, respectively, in the Bullard Peak area. The purpose of this report is to summarize the results of the 1989 and 1990 exploration programs on these two properties. For addition background information the reader is referred to the property evaluation reports with recommendations of N. Cousins dated 06-03-88 and 06-24-88 (CARI-REO files).

3.0 LAND STATUS

3.1 Location

The Bullard Peak project is located off the eastern end of the Harcuvar Mountains in southwestern Yavapai County, Arizona (Figure 1). The property is situated approximately ten miles north of the town of Aquila, Arizona in Sections 1,2,3,8,9,10,11,12,13,14,15,16,17,20 and 21, T8N, R10W. Access is provided via well-graded county and BLM dirt roads. Published map coverage is provided by the Smith Peak and Date Creek Ranch SW 7.5' USGS quadrangles.

3.2 Land Position

The Bullard Peak project consist of two separate but contiguous parcels of land (Figure 2). The core of the project consists of 28 patented claims (540 acres) leased from NRG Resourses (70%) and Key Mineral Services Inc (30%). These claims are surrounded on the east, south, and west by 299 unpatented claims (5,280 acres) leased from Mike Sansone. The Sansone unpatented claims are composed of the ACM and the MIN claim groups. The NRG and Key leases provide for a 4% NSR and a 1.7143% NSR, respectively. The Sansone lease carries a 5% NSR. The 5% NSR on the MIN claims is split 50:50 between Mike Sansone and Freeport-McMoran Gold Company.

4.0 PREVIOUS EXPLORATION

The most recent exploration in the Bullard Peak area was conducted by Freeport-McMoran Gold Company. Freeport leased the ACM claims from M. Sansone in July of 1986 and located the MIN claims in August of 1986. Freeport conducted a program of geologic mapping and sampling followed by ten reverse circulation drill holes. Freeport's drilling was designed to test the intersection of listric faults with the Bullard detachment fault. Results of the drilling program were negative and Freeport dropped the property in 1988. The MIN claims were quit claimed back to Sansone in 1988. Freeport did not lease the patented ground controlled by NRG and Key. A copy of the Freeport data is included with the CARI-REO files.

5.0 GENERAL GEOLOGY

The Bullard Peak property consists of a set of low relief hills made up of east-west striking, steeply dipping Tertiary volcanics and interbedded sediments on the upper plate of the Bullard detachment fault (BDF). The BDF is a regional, low-angle normal fault, extensional in origin, that outcrops along the southeast flank of the Harcuvar Mountains metamorphic core complex (Figures 3 and 4). Upper plate rocks are thought to have been displaced about 50 km to the northeast during middle to late Tertiary time (Reynolds and Spencer, 1985). The northeast-trending trace of the detachment fault runs along the extreme northwestern side of the property. While having a regional northeast dip the BDF exhibits a local 60 degree dip to the southeast on the property. This variation may be due to mega-grooves on the detachment surface or to post-extensional faulting. Brittle deformation of the upper plate has resulted in the development of listric faults (Freeport's target), low angle faults (Bullard mine and John Moore structures), high angle faults and occurrences of quartz stockwork along the North Hill fault (Figure 5). Mineralization consists of auriferous copper-hematite-quartz veins associated with portions of these structures and the stockwork. The mineralization is interpreted to be synorogenic. Fluid inclusion studies show minimum temperatures of 240 to 290 degrees C. Mineralizing fluids were saline brines with 13 to 17 wt.% NaCl (Roddy et al, 1988). Ore fluids are thought to have been derived from Tertiary orogenic basins. Upper plate andesitic volcanics have been K-metasomatized (10% K_2O, <0.4% Na_2O). The lower plate consists of chlorite breccia overlying mylonite and ductilely deformed mylonitic gneisses (Figure 5).

6.0 1989 EXPLORATION PROGRAM, EXPENDITURES AND RESULTS

6.1 Geology

Geologic mapping of the Bullard Peak properties was performed by J.M. Telford. Mapping data was plotted on a 1" = 500' topographic base map included with this report as Plate 1. Surface samples sites are plotted on Plate 1 and the analytical results are tabulated in Appendix 2.

6.2 Road and Drill Site Construction

Riggs Enterprise of Wickenburg, Az was contracted to build 1800 feet of new road, rehabilitate existing BLM roads, construct twelve drill sites and complete reclamation work on BLM land. The work was performed using a D-6 dozer.

6.3 Drilling

Twelve conventional down-hole hammer and six reverse circulation drill holes were completed on the project during 1989. Drill holes B-1 thru B-12 were completed using the SIMCO drilling equipment in the John Moore area. Drill holes B-13 and B-14 were drilled using the reverse circulation drilling rig purchase for Turkey in the North Hill area. Drill holes B-15 thru B-18 were completed using reverse circulation equipment under contract with Stevens Drilling Co. in the North Hill area. Total footage for the program was 4,450 feet. Cuttings were log initially at the drill site with relogging via binoc after the program was completed. Drill logs are found in Appendix 1. The drilling program is summarized in Table 1.

6.4 Assaying

Representative splits of each five-foot interval of drill cuttings were assayed for Au by Rocky Mtn. Geochemical Corp., SLC, UT (B-1 thru B-12 and B-15 thru B-18) and Chemex, Sparks, NV (B-13 and B-14). All samples were fire assayed with AA finish, one assay ton and a 2 ppb lower detection limit (5 ppb for Chemex). Results ≥ 1 ppm Au were rerun with a gravimetric finish. The results are plotted on the drill logs in Appendix 1. CARI standards were placed in the sample stream at random intervals.

6.5 Reclamation and Drill Hole Abandonment

Riggs Enterprise was contracted to perform reclamation work on drill sites and roads at the close of the exploration program. All reclamation work was conducted per BLM regulations. Both drill roads and sites were ripped using a D-6 dozer and seeded. Drill holes were plugged by CARI personnel per Arizona DWR regulations. All plugging and abandonment reports have been filed with the state of Arizona.

6.6 Total 1989 Expenditures

Total 1989 expenditures for the Bullard Peak project were $125,000.

6.7 1989 Exploration Results

Initial field investigations by N. Cousins indicated the possibility of multiply closed-spaced vein sets in the John Moore (JM) area of the project. Refer to Figure 6 for a location map of the JM area and the North Hill area. Sampling along the JM structure showed these CuFeQtz veins to be extremely auriferous. Field relationships were obscured by large amounts of covered ground and the exact geometry of the structure or structures could not be determined from outcrop. These supposed veins sets, collectively referred to as the JM structure, strike northwest and dip to the northeast at 20 to 50 degrees. From the outset the structural scenario of close-spaced vein sets and the JM structure in particular were the principal target of the exploration program (Plate 1). Following additional mapping and sampling a drilling program was designed to test this structure and the premise of multiply closed-spaced vein sets.

Drill holes B-1 thru B-6 were designed to test the JM structure and its bulk tonnage potential. Results from this drilling plus surface mapping demonstrates that the JM structure is not a set of close-spaced multiple veins. The structure is, in all likelihood, a single, narrow vein structure which has been repeated by various post-mineral faults. Further structural complications are shown in cross-sections through B-1/B-6 and B-2/B-5 (Figures 7 and 8, respectively) as the JM structure is truncated at depth by a post-mineral fault. Both drill holes B-1 and B-2 failed to cut the JM structure because of this post-mineral fault. This west-trending, south dipping post-mineral fault outcrops ±100 feet north of the B-1 collar. It appears that not only is the JM structure a singular feature but there is no down-dip continuity away from the outcrop. Drill hole B-3 was successful at intercepting the JM structure (40-45' @ 0.202 opt Au) but drill data from B-3 and B-4 further indicates that the structure is a singular feature not repeated in any way (Figure 9). Drill holes B-1 through B-6 have effectively tested the JM structure and have condemned any bulk mineable potential that it might have had.

After the negative results on drill holes B-1 thru B-6 had been received the decision was made to forego any additional drilling on the JM structure itself. Drill holes B-7 thru B-12 tested other similar CuFeQtz vein structures in the John Moore area which had yielded high Au values at the outcrop (Plate 1). This drilling was successful in testing these structures down dip but all intercepts proved to be thin and erratic in nature. These structures are isolated one from another and do not appear to be in closely-spaced sets. In all cases the outcrop values were much higher than the drill intercepts indicating erratic Au mineralization along the structure and possibly some surface enrichment. Cross-sections through B-7/B-8, B-9/B-10 and B-11/B-12 show the results of this drilling (Figures 10, 11, and 12, respectively).

Drill holes B-13 and B-14 tested high-grade CuFeQtz vein structures on the east side of North Hill (Plate 1). Small workings on these structures yielded dump/grab samples greater than 0.50 opt Au. Results from drill holes B-14 were encouraging with an intercept of 30 feet of 0.187 opt Au along the North Hill fault. Drill hole B-13 was sterile of any Au mineralization. Based on the B-14 results a 1,150 foot r.c. drilling program was designed to test the North Hill fault along strike and down dip from B-14 (Plate 2). Results from drill holes B-15 and B-16 indicated the potential for a 60 foot wide mineralized zone along the North Hill fault. Drill holes B-17 and B-18 indicated a somewhat narrower mineralized zone of 40 feet. These drill intercepts, along with outcrops of auriferous CuFeQtz stockwork on the east side of the fault, indicated good potential for the discovery of a bulk tonnage Au deposit along the North Hill fault. The 1989 drill results warranted further mapping, sampling and drilling during 1990.

7.0 1990 EXPLORATION PROGRAM, EXPENDITURES AND RESULTS

7.1 Geology

Geologic mapping continued in 1990 in the North Hill area to follow up the results of the 1989 program. Outcrop data was plotted on a 100 scale base map included with this report as Plate 3. Rock chip sample sites are plotted on Plate 3 and the analytical results are tabulated in Appendix 2.

7.2 Geophysics

Zonge Engineering and Research Organization, Inc., Tucson, Arizona was contracted to run 21,000 feet of CS-AMT and 14,000 feet of IP surveys at North Hill. The Zonge report on the results of these surveys is included as Appendix 3.

7.3 Road and Drill Site Construction

Riggs Enterprises of Wickenburg, AZ was contracted to build 3150 feet of new road, rehabilitate existing roads and to construct 24 drill site. All work was performed using a D-4H.

7.4 Drilling

During 1990 twenty-four reverse circulation drill holes totalling 11,255 feet were completed at North Hill. All 1990 drilling was done under contract with Drilling Services Company, Chandler, Arizona. Drill cuttings were initially logged at the site and relogged via binoc later in the program. Drill logs are included in Appendix 1. The 1990 drilling program is summarized in Table 2.

7.5 Assaying

Representative splits of each five-foot interval of drill cuttings were assayed for Au by Rocky Mountain Geochemical Corp., SLC, UT. All samples were fire assayed with a gravimetric finish, one assay ton and a 0.001 opt Au lower detection limit. The results are plotted on the drill logs in Appendix 1. CARI standards and duplicate samples were placed in the sample stream at random intervals.

7.6 Reclamation and Drill Hole Abandonment

Riggs Enterprizes was contracted to perform reclamation work on drill sites and roads, constructed on BLM ground, at the close of the program. All reclamation work was conducted per BLM regulations. Riggs was also hired to plug all 1990 drill holes per Arizona DWR regulations. All plugging and abandonment reports have been filed with the state of Arizona.

7.7 Total 1990 Expenditures

Total 1990 expenditures for the Bullard Peak Project were $175,000.

7.8 1990 Exploration Results

During the first quarter of 1990 one hundred scale outcrop mapping and rock chip sampling were conducted at North Hill (Plate 3). This work showed that the north-trending North Hill fault could be trace for approximately 2000 feet along the east flank of North Hill. Mapping also revealed occurrences of quartz stockwork (with Cu) developed in both the hanging wall and footwall of the structure. This stockwork was interpreted to indicate possible dilation zones at points of flexure along the structure. Twenty rock chip samples of CuFeQtz vein material from the North Hill fault and from the associated quartz stockwork yielded Au values ranging from 0.002 opt Au to 0.830 opt Au with an average of 0.263 opt Au (Appendix 2).

Following the geologic mapping a CS-AMT and IP survey was conducted at North Hill by Zonge Engineering. A final report by Zonge is included as Appendix 3. The results of the CS-AMT survey indicated a high resistivity zone approximately 700 feet wide parallel with and to the east of the North Hill fault (Figure 13 and Plate 4). The CS-AMT data also extended the North Hill fault an additional 1000 feet southward under covered ground. The resistivity high was open to the north and south. The main resistivity high was flanked on the east by a sharp resistivity low and a second resistivity high open to the north. The source of the resistivity highs was interpreted to be silicification and/or quartz stockwork developed along the North Hill fault or adjacent structures. The eastern most resistivity high could be explained by the outcrop of quartz stockwork and quartz-matrix fault breccia at 18100N, 16250E. The resistivity low was interpreted to be another structure running parallel to the North Hill fault. The results of the IP survey on lines 16000N and 17500N gave weak and ambiguous responses.

Geologic and geophysical work completed strongly indicated the possibility of a Cyprus Copperstone analogue at North Hill. The North Hill area displayed similar structure and vein mineralogy to that observed in the Copperstone pit. One notable difference at North Hill was the lack of large amounts of specular hematite.

Based on work completed a drill program was designed to test the North Hill fault with the associated quartz stockwork, the resistivity highs and the resistivity low under pediment cover. The program consisted of 11,255 feet of reverse circulation drilling in 24 drill holes (Plate 3 and Table 2). Cross sections, Figures 14 thru 22, summarize the geology and assays from this drilling.

Drill results at North Hill in 1990 were not encouraging. Eleven of 24 drill holes (45%) had detectable Au $\geq$ 0.001 opt. Of those 11 drill holes, only 8 (33%) had intercepts of $\geq$ 0.01 opt Au. Intercepts were thin, sporadic and low grade with no apparent continuity between drill holes. Au values encountered were restricted to intervals with CuFeQtz veining and/or stockwork. There was no tendency for Au mineralization to be associated with iron saturated zones adjacent to structures such as that observed at Cyprus Copperstone. The CS-AMT resistivity low was explained by the drilling as a water filled structure (drill hole B-21 was making $\pm$ 40 gpm). The CS-AMT resistivity highs were never adequately explained. The combined geology and geophysical targets, however, at North Hill are viewed as having been tested.

8.0 REFERENCES

Reynolds, S.J., and Spencer, J.E., 1984, Geologic Map of the Aguila Ridge-Bullard Peak Area, Eastern Harcuvar Mountains, West-Central Arizona: Arizona Bureau of Geology and Mineral Technology, Open-File Report 84-4, 2p.

Reynolds, S.J., and Spencer, J.E., 1985, Evidence for large-scale transport on the Bullard detachment fault, west-central Arizona: Geology, v.13, p.353-356.

Roddy, M.S., Reynolds, S.J., Smith, B.M., and Ruiz, J., 1988, K-metasomatism and detachment-related mineralization, Harcuvar Mountains, Arizona: Geol. Soc. Am. Bull., v.100, p.1627-1639.

Spencer, J.E., and Welty, J.W., 1986, Possible controls of base- and precious-metal mineralization associated with Tertiary detachment faults in the lower Colorado River trough, Arizona and California: Geology, v.14, p.195-198.

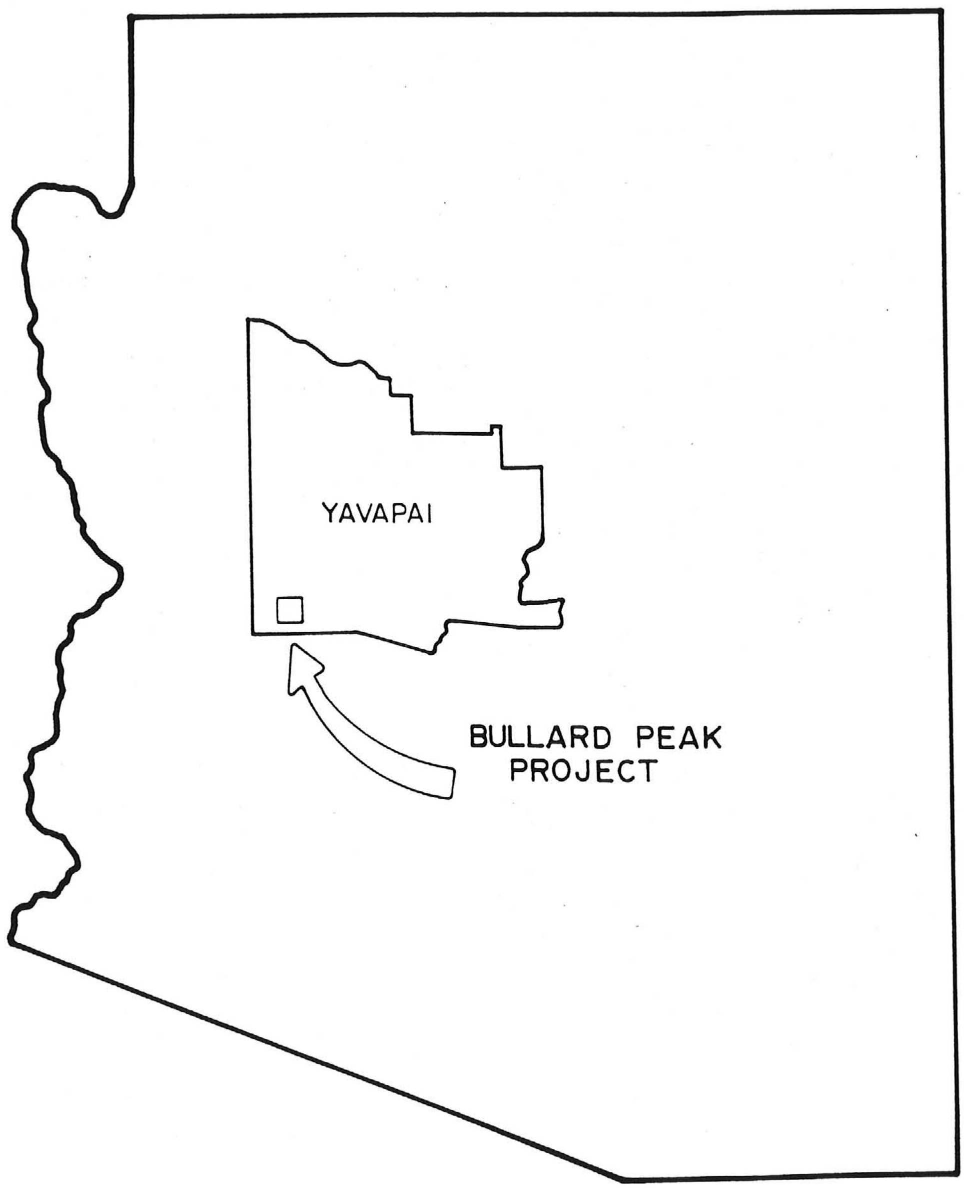
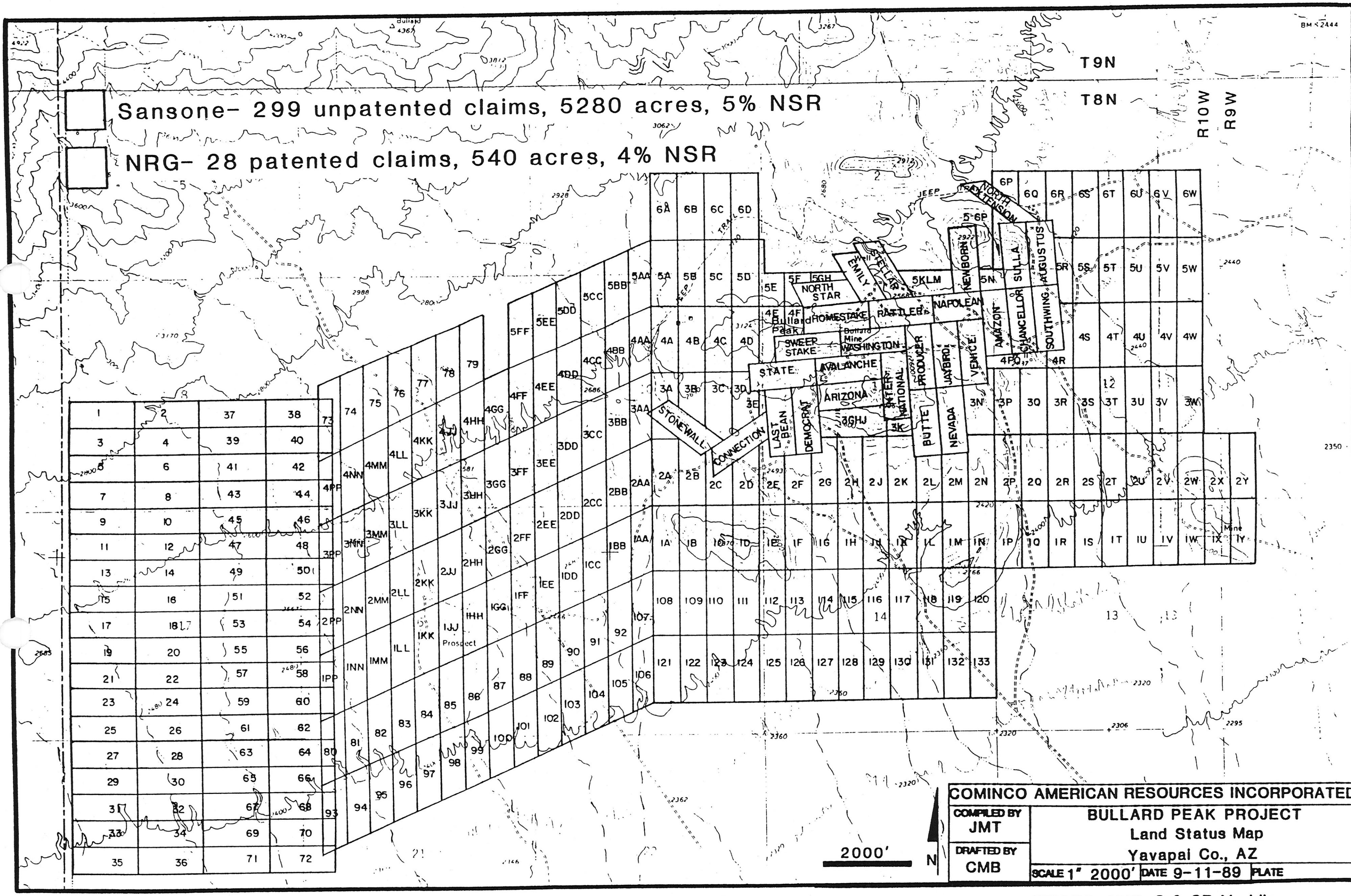


Figure 1

BULLARD PEAK PROJECT
YAVAPAI COUNTY, AZ



Date Creek Ranch SW, Smith Peak 7.5 minute quads

T8N,R9-10W G & SR Meridian

Figure 2

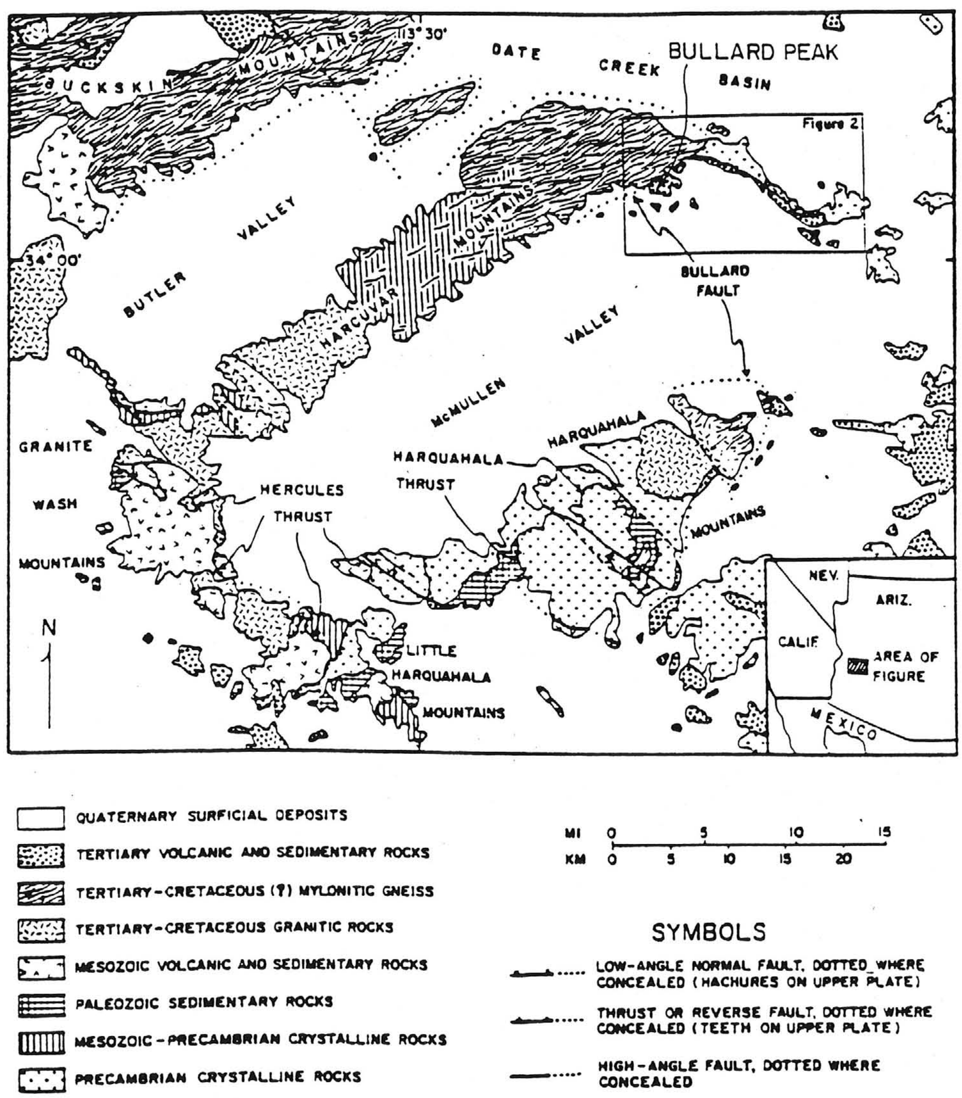


Figure 3 .**Simplified geologic map of McMullen Valley area. Sources of data include Rehrig and Reynolds (1980), Reynolds (1982), Reynolds and Spencer (1984), and unpublished mapping by S. J. Reynolds, S. M. Richard, and J. E. Spencer.**

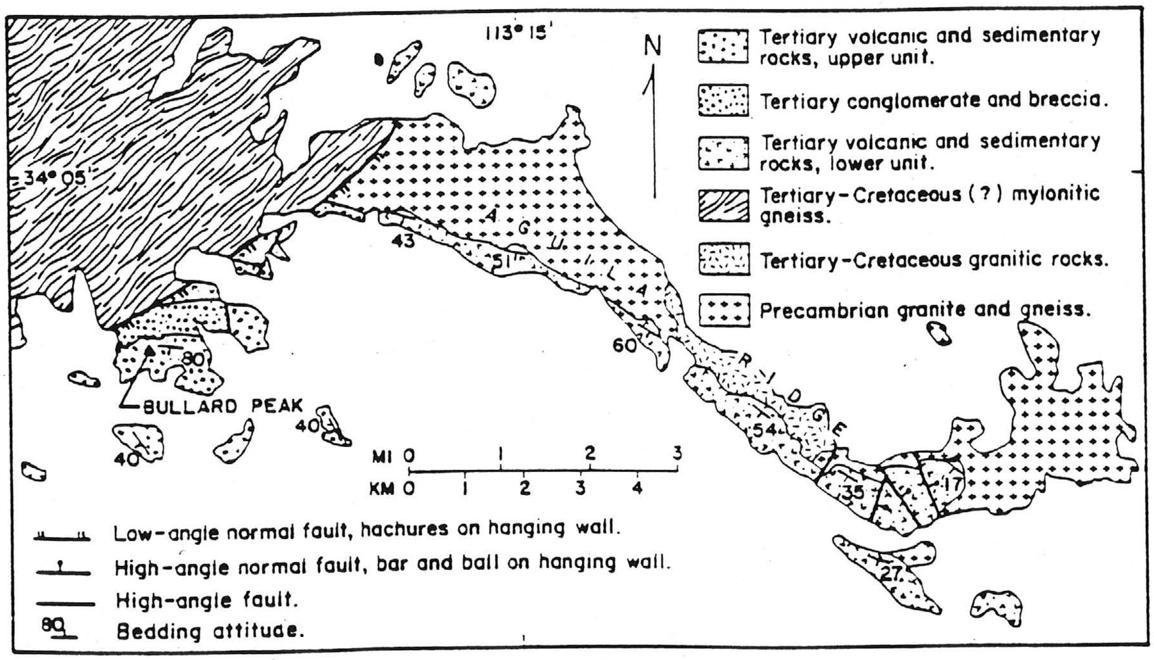


Figure 4. **Simplified geologic map of Aguila Ridge, Bullard Peak area, and easternmost Harcuvar Mountains. Areas without pattern are Quaternary surficial deposits. See Figure 1 for location of map area.**

REYNOLDS and SPENCER, 1987

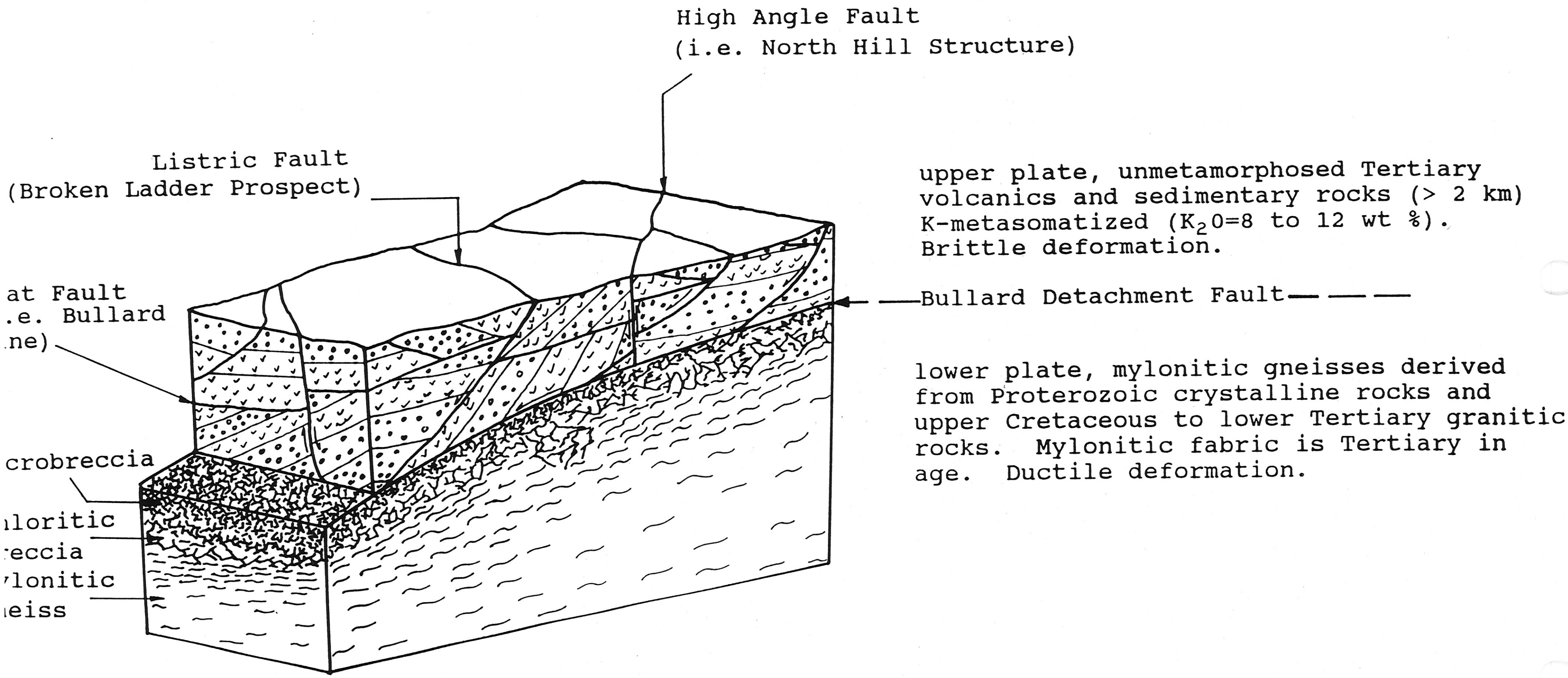


Figure 5
Schematic structural block diagram of Bullard Detachment Fault, Bullard Peak Area, Southeastern flank of Harcuvar Mountains metamorphic core complex, Yavapai County, Arizona.
Modified from Coney, 1980 and Rehrig and Reynolds, 1980.

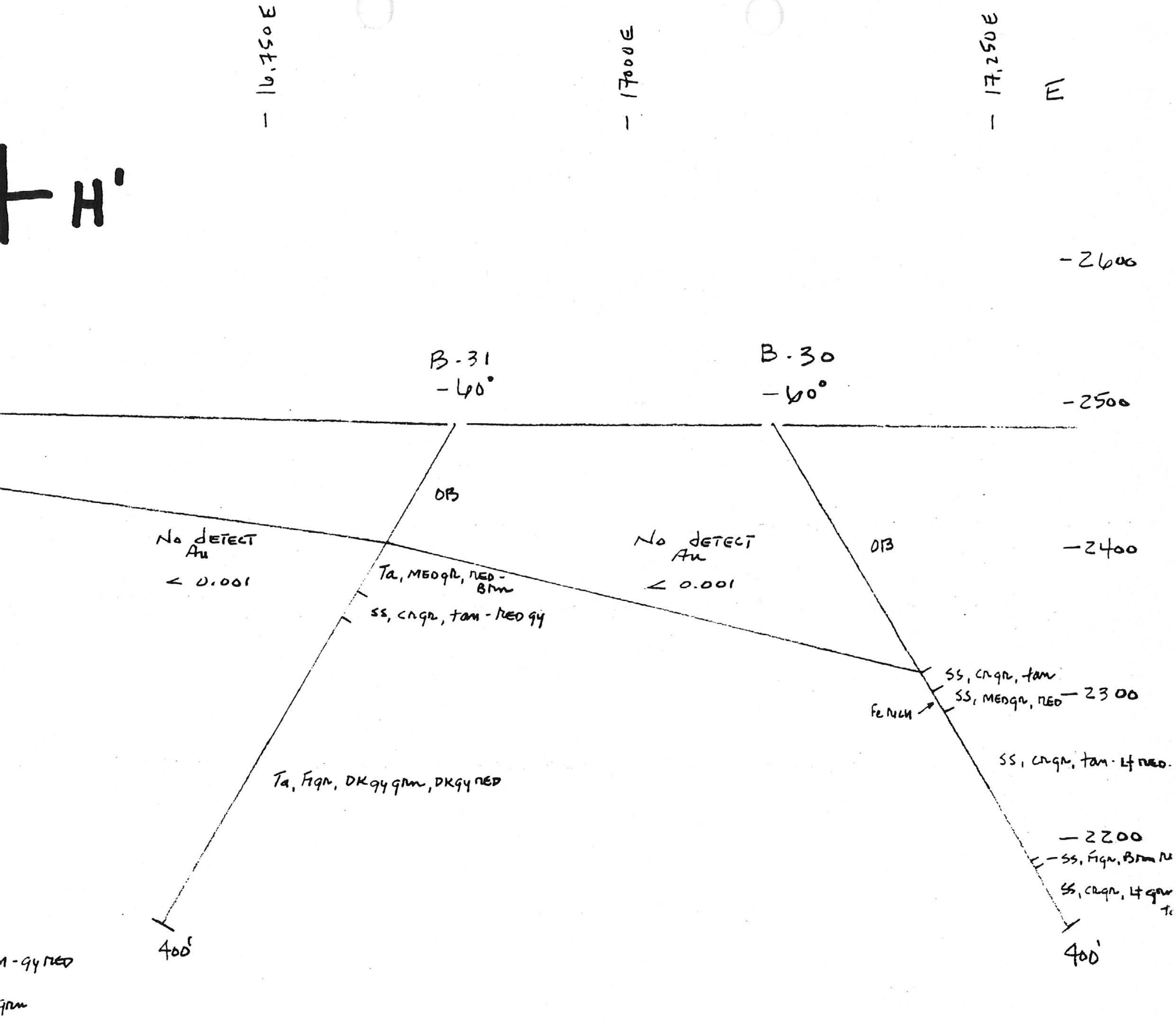
BULLARD PEAK PROJECT
1989 DRILLING SUMMARY
TABLE 1

DH	DATE	T.D.	INCLIN.	Azi.	Au MINERALIZATION AREA	CLAIM	TARGET	DRL. INT.	FA/AA
B-1	3/8/89	300'	-90°	---	J.Moore	State	J.Moore Struct.	255-60'	42ppb
B-2	3/9/89	300'	"	---	"	State	"	65-70'	280ppb
B-3	3/10/89	250'	"	---	"	ACM 3D	"	40-45' 45-50'	0.202 opt 585ppb
B-4	3/10/89	250'	"	---	"	ACM 3D	"	Scatt. Intervals	≤ 14ppb
B-5	3/11/89	250'	"	---	"	ACM 3D	"	Scatt. Intervals	≤8ppb
B-6	3/13/89	250'	"	---	"	Last Bean	"	Scatt. Intervals	≤6ppb
B-7	3/13/89	250'	"	---	"	Last Bean	N10W Structure	Scatt. Intervals	≤15ppb
B-8	3/14/89	155'	"	---	"	Democrat	"	30-35' 35-60'	250ppb 79ppb
B-9	3/15/89	250'	"	---	"	Last Bean	N30W Structure	135-40'	256ppb
B-10	3/15/89	250'	"	---	"	Last Bean	"	35-40'	290ppb
B-11	3/16/89	250'	"	---	"	Stonewall	N15W Structure	45-50'	775ppb
B-12	3/16/89	250'	"	---	"	Stonewall	"	Scatt. Intervals	≤9ppb
B-13	5/15/89	200'	"	---	North Hill	North Ext.	N25E Structure	Scatt. Intervals	≤5ppb
B-14	5/15/89	95'	"	---	"	"	North Hill Structure	See X-sections	
B-15	7/10/89	225'	-45°	90°	"	"	"	"	
B-16	7/11/89	350'	-65°	90°	"	"	"	"	
B-17	7/12/89	225'	-45°	270°	"	"	"	"	
B-18	7/12/89	350' 4,450'	-65°	270°	"	"	"	"	

J. Moore Area = 3005'
North Hill Area = 1445'

BULLARD PEAK PROJECT
1990 DRILLING SUMMARY
TABLE 2

DH	NORTHING	EASTING	INCLIN °	AZIMUTH °	TD	ELEVATION (+/-)	CLAIM	DATE
B-13	16,805	16,230	-90	----	200′	2545′	North Ext.	5/15/89
B-14	17,555	15,380	-90	----	95′	2560′	North Ext.	5/15/89
B-15	17,405	15,470	-45	270	225′	2565′	North Ext.	7/10/89
B-16	17,405	15,470	-65	270	350′	2565′	North Ext.	7/11/89
B-17	17,600	15,305	-45	90	225′	2565′	North Ext.	7/12/89
B-18	17,600	15,305	-65	90	350′	2565′	North Ext.	7/11/89
B-19	15,981	15,700	-60	90	735′	2570′	Sulla	3/16/90
B-20	16,000	16,240	-60	270	550′	2510′	Augustus	3/18/90
B-21	16,004	16,600	-60	270	600′	2515′	ACM 5R	3/20/90
B-22	17,425	16,365	-60	90	500′	2540′	ACM 6R	3/22/90
B-23	17,473	15,504	-60	90	750′	2560′	North Ext.	3/23/90
B-24	17,496	15,734	-90	----	400′	2560′	North Ext.	3/24/90
B-25	17,434	16,076	-60	90	400′	2540′	ACM 6R	3/30/90
B-26	16,982	16,011	-60	90	400′	2550′	Augustus	3/31/90
B-27	16,786	16,144	-60	90	400′	2550′	Augustus	4/1/90
B-28	16,501	16,094	-60	90	400′	2555′	Augustus	4/2/90
B-29	16,500	16,408	-60	90	400′	2520′	Augustus	4/3/90
B-30	15,500	17,093	-60	90	400′	2485′	ACM 5S	4/4/90
B-31	15,497	16,884	-60	270	400′	2485′	ACM 5S	4/4/90
B-32	15,000	16,421	-60	90	400′	2485′	Southwing	4/5/90
B-33	15,482	16,238	-60	90	500′	2500′	Southwing	4/6/90
B-34	15,788	15,882	-60	90	420′	2520′	Sulla	4/7/90
B-35	16,999	16,907	-60	90	400′	2525′	ACM 6S	4/8/90
B-36	16,987	16,506	-60	90	400′	2525′	ACM 6R	4/13/90
B-37	16,499	16,906	-60	90	400′	2515′	ACM 5S	4/13/90
B-38	16,001	17,150	-60	90	400′	2500′	ACM 5S	4/14/90
B-39	17,985	16,241	-60	90	420′	2555′	ACM 6Q	4/15/90
B-40	18,195	16,200	-60	90	380′	2555′	Vida 10	4/16/90
B-41	18,000	15,324	-60	90	400′	2565′	ACM 6P	4/17/90
B-42	16,982	16,010	-90	----	800′	2550′	Augustus	4/19/90



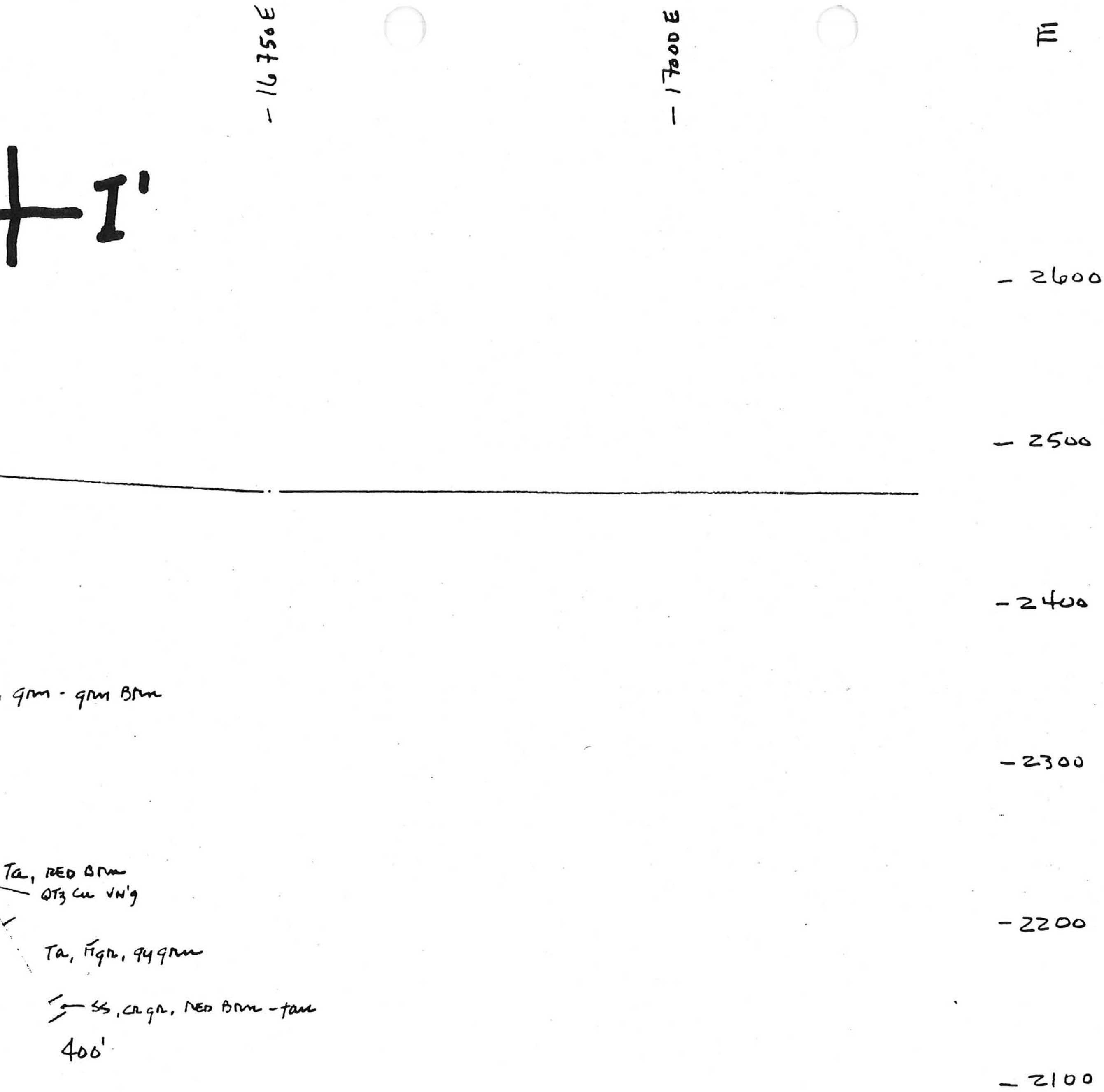
1"=100'

LINE 15,500 N

NORTH HILL AREA

BULLARD PEAK PROJECT

Fig. 21



1" = 100'

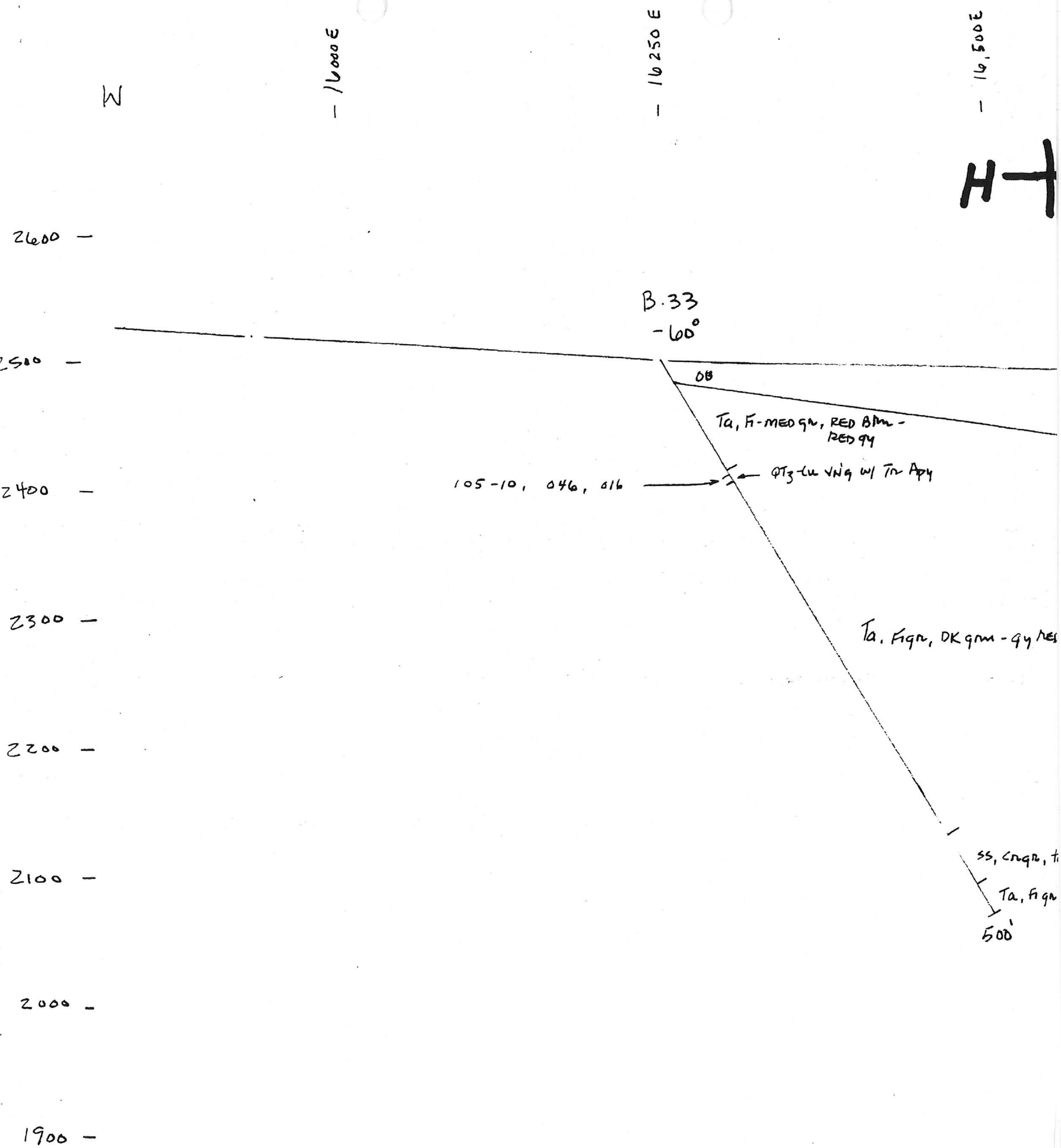
LINE 15000 N

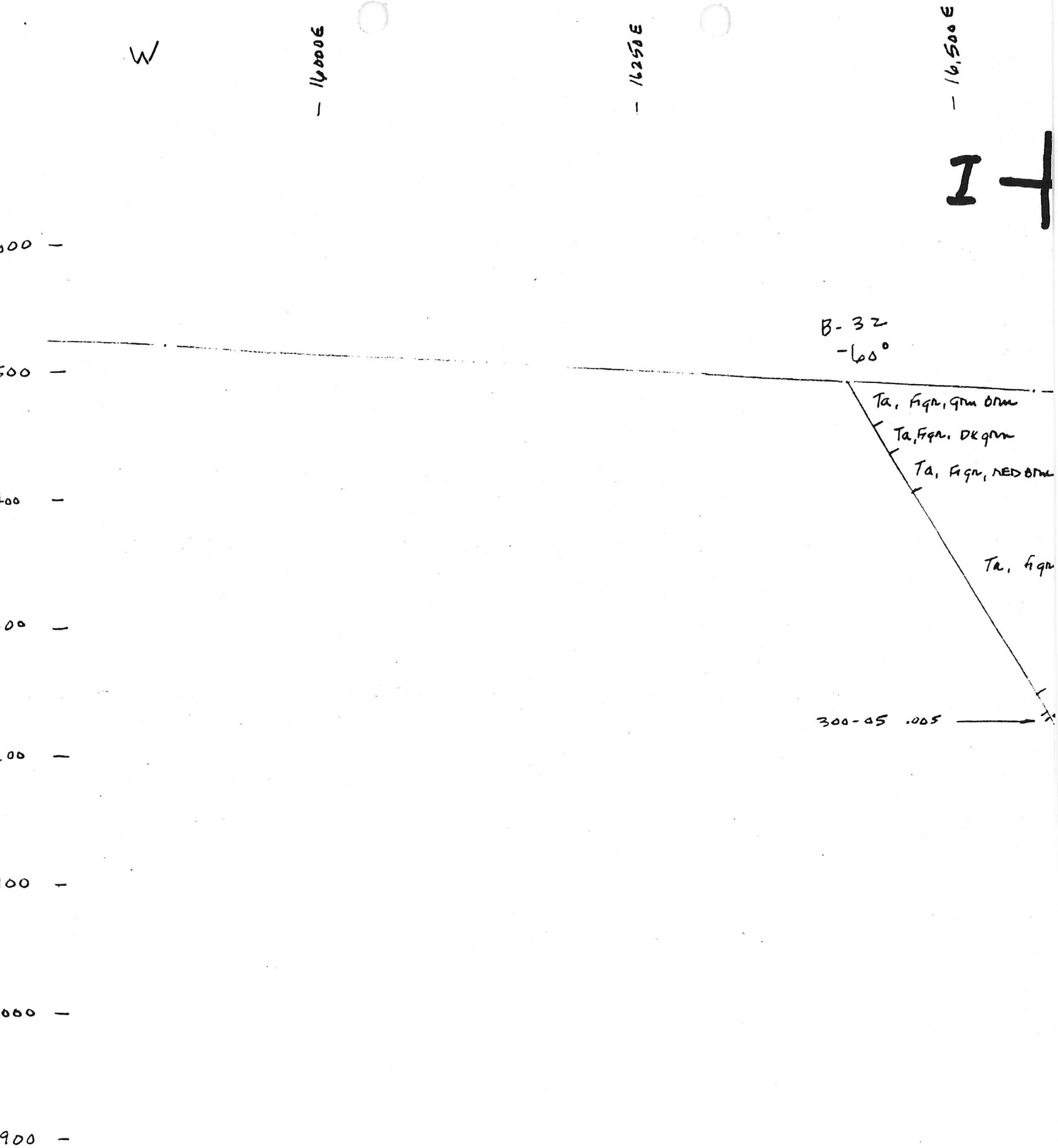
NORTH Hill AREA

BULLARD PEAK PROJECT

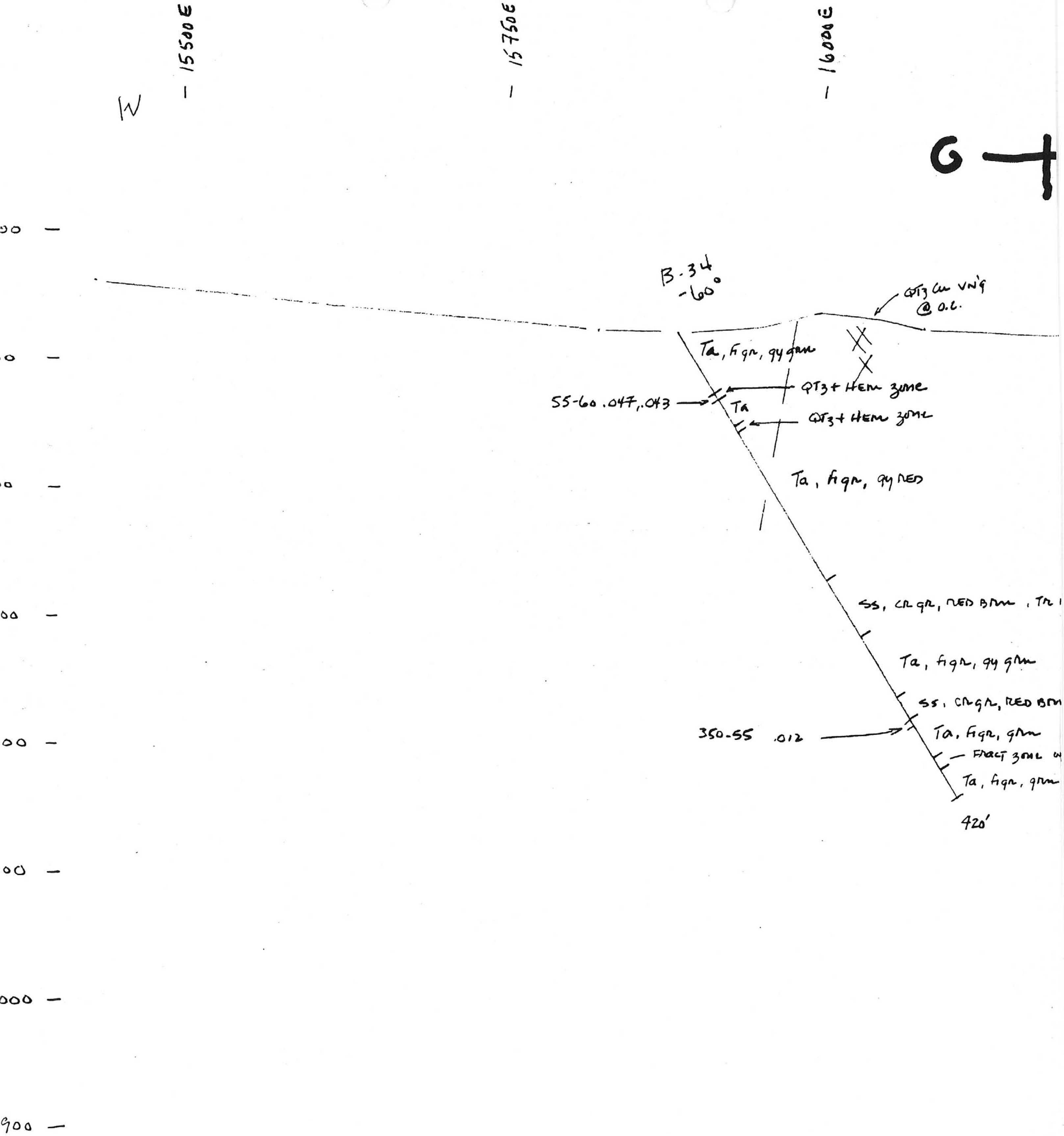
Fig. 22

4.15.90

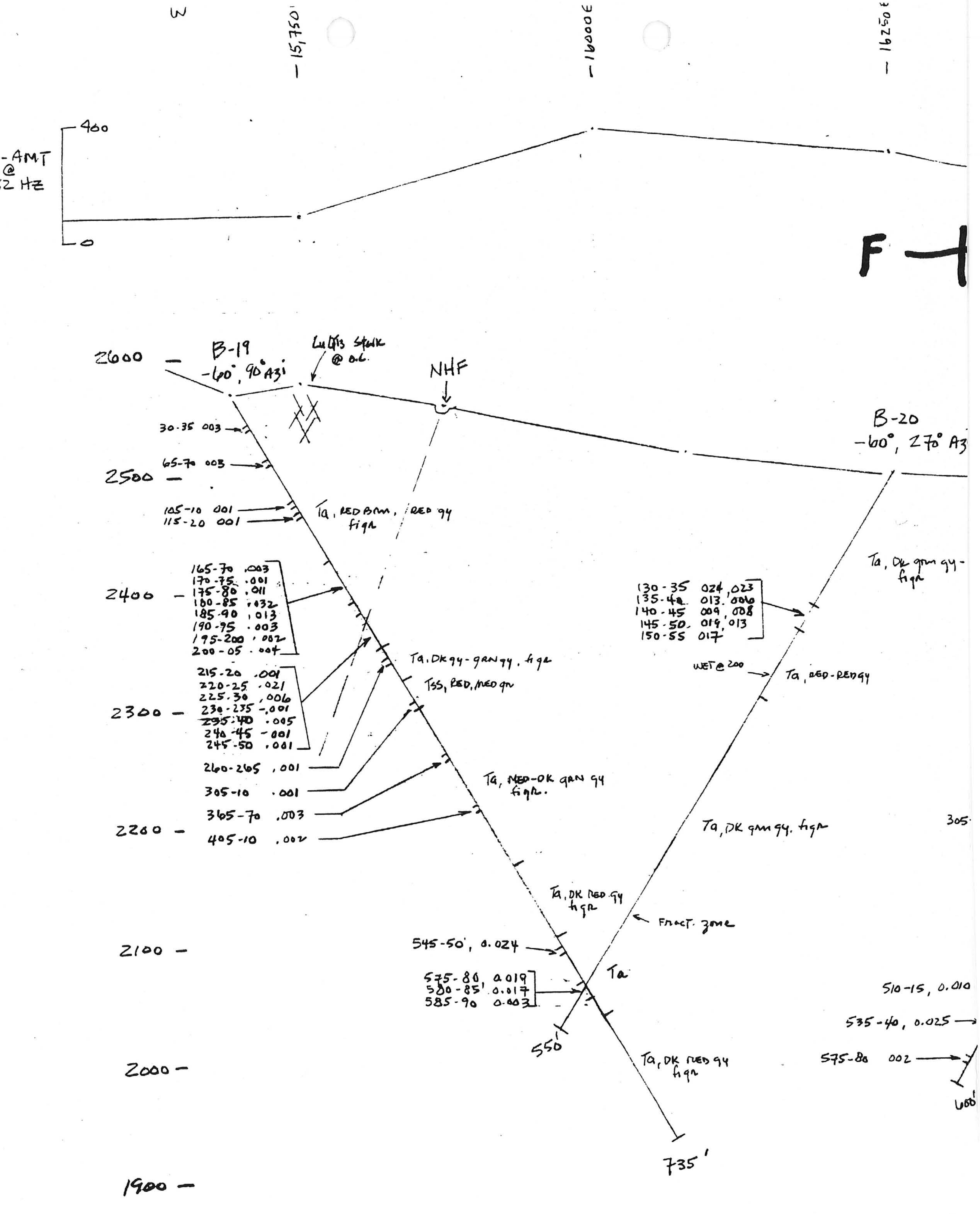

W
16000E
16250E
16,500E
H
2600
2500
2400
2300
2200
2100
2000
1900
B.33
-60°
OB
Ta, Fi-MED gn, RED Brn - RED gy
105-10, 046, 016
QTz-Cu VNg w/ Tr Apy
Ta. Figr, DK grn-gy
500'



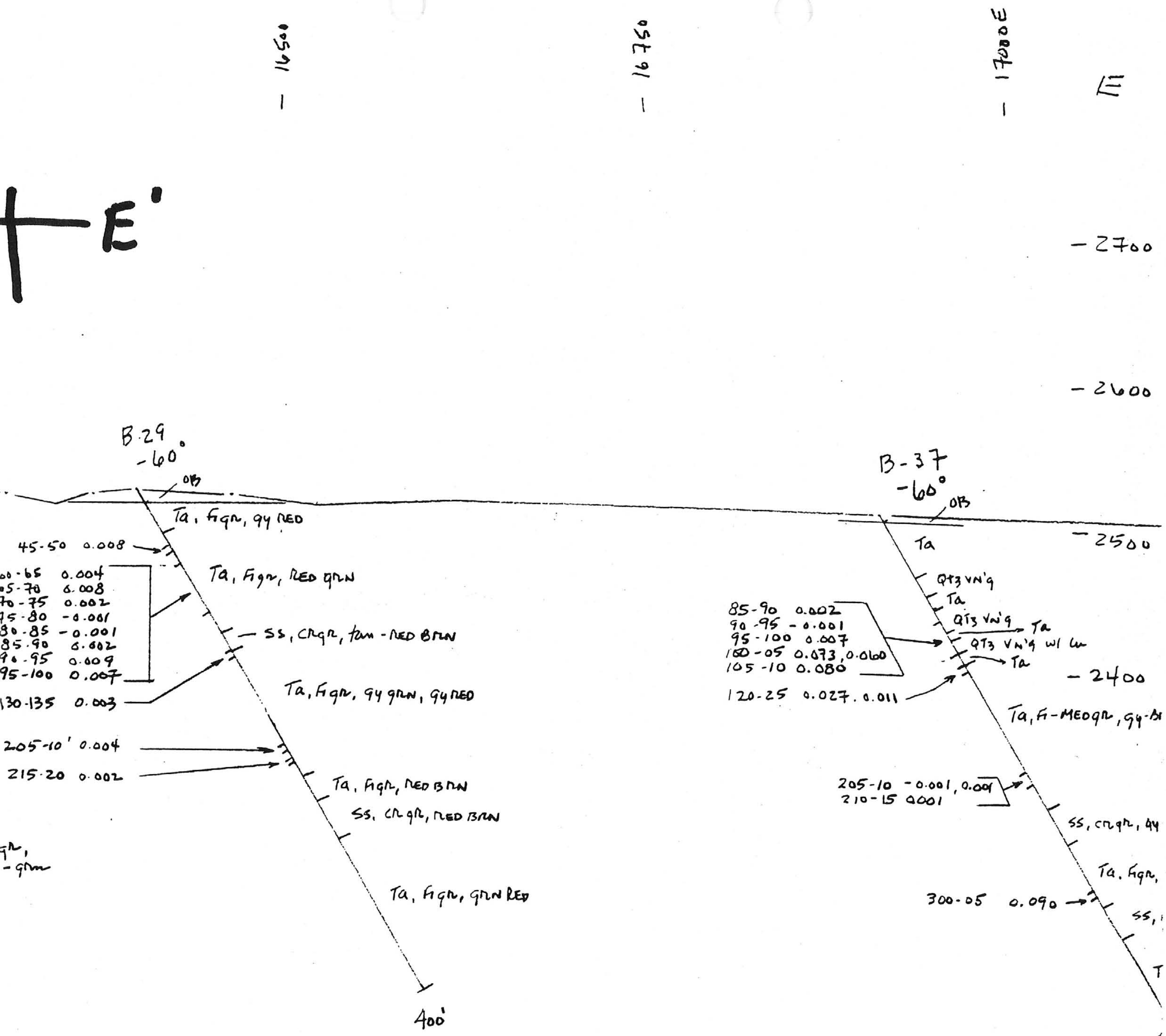
W
16000E
16250E
16,500E
I
B-32
-60°
300-05 .005



15500E
15750E
16000E
W
G
B-34
-60°
QTz Cu VN'g @ O.C.
Ta, fi gr, gy grn
QTz + HEM zone
55-60 .047, .043
Ta
QTz + HEM zone
Ta, figr, gy RED
SS, CR gr, RED BRN, TR
Ta, figr, gy grn
SS, CRgr, RED BRN
350-55 .012
Ta, Figr, grn
FRACT zone
Ta, figr, grn
420'



W
15,750
16000E
16250E
AMT @ HZ
400
0
F
2600
B-19
-60°, 90° Azi
@ o.c.
NHF
B-20
-60°, 270° Az
30-35 003
65-70 003
2500
105-10 001
115-20 001
Ta, RED BRN, RED gy figr
Ta, DK grn gy figr
165-70 .003
170-75 .001
175-80 .011
180-85 .032
185-90 .013
190-95 .003
195-200 .002
200-05 .004
2400
130-35 .024, .023
135-40 .013, .006
140-45 .009, .008
145-50 .019, .013
150-55 .017
Ta, DK gy - grn gy, figr
TSS, RED, MED gr
WET @ 200
Ta, RED - RED gy
215-20 .001
220-25 .021
225-30 .006
230-235 .001
235-40 .005
240-45 .001
245-50 .001
2300
260-265 .001
305-10 .001
365-70 .003
405-10 .002
Ta, MED-DK grn gy figr.
Ta, DK grn gy, figr
2200
305
Ta, DK RED gy figr
FRACT. zone
2100
545-50', 0.024
Ta
575-80, 0.019
580-85', 0.017
585-90 0.003
510-15, 0.010
535-40, 0.025
550'
2000
Ta, DK RED gy figr
575-80 002
600'
735'
1900



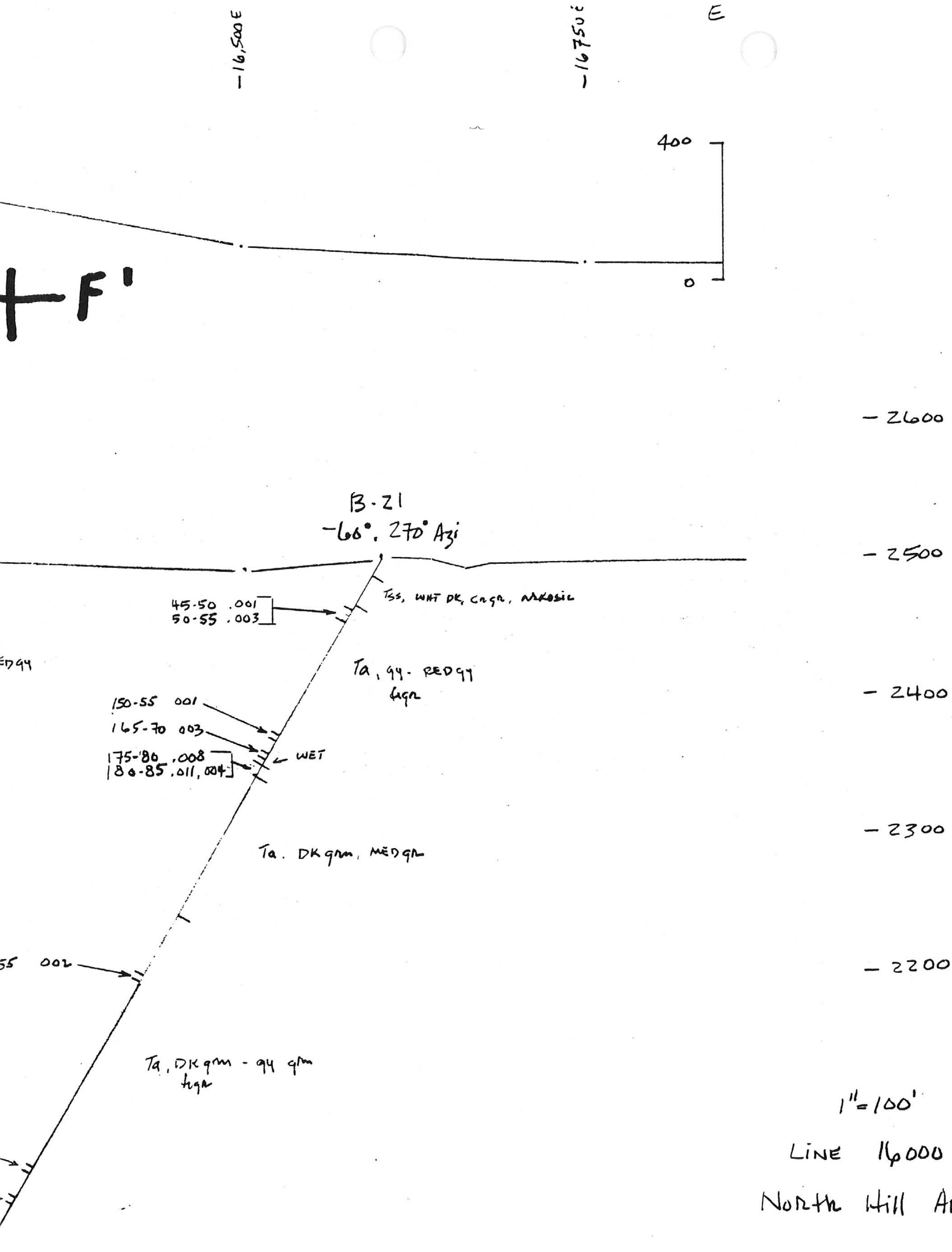
1" = 100'

LINE 16,500 N

NORTH Hill AREA

Bullard Peak Project

Fig. 18



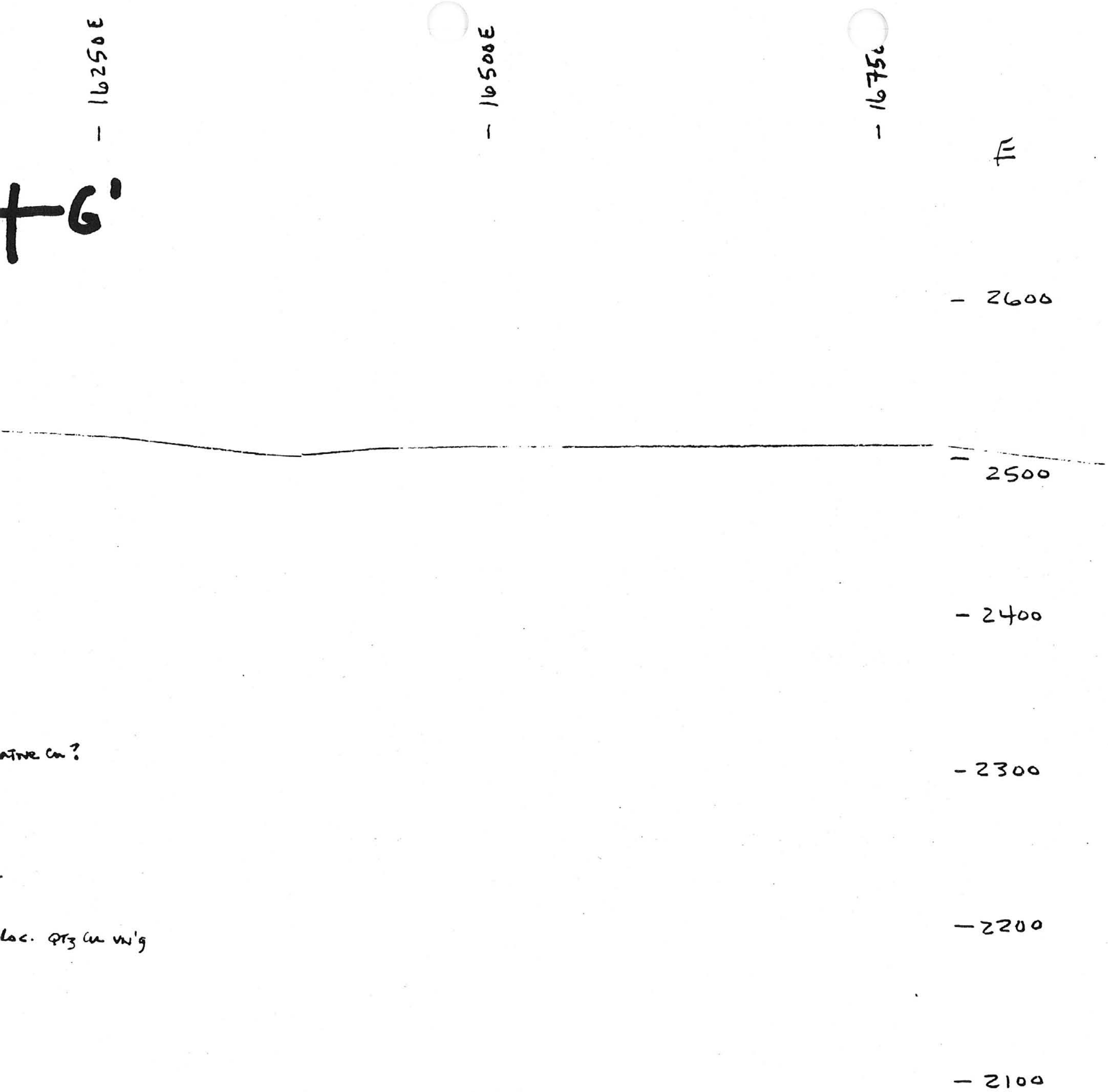
1"=100'

LINE 16000 N

North Hill AREA

Bullard Peak Project

Fig. 19



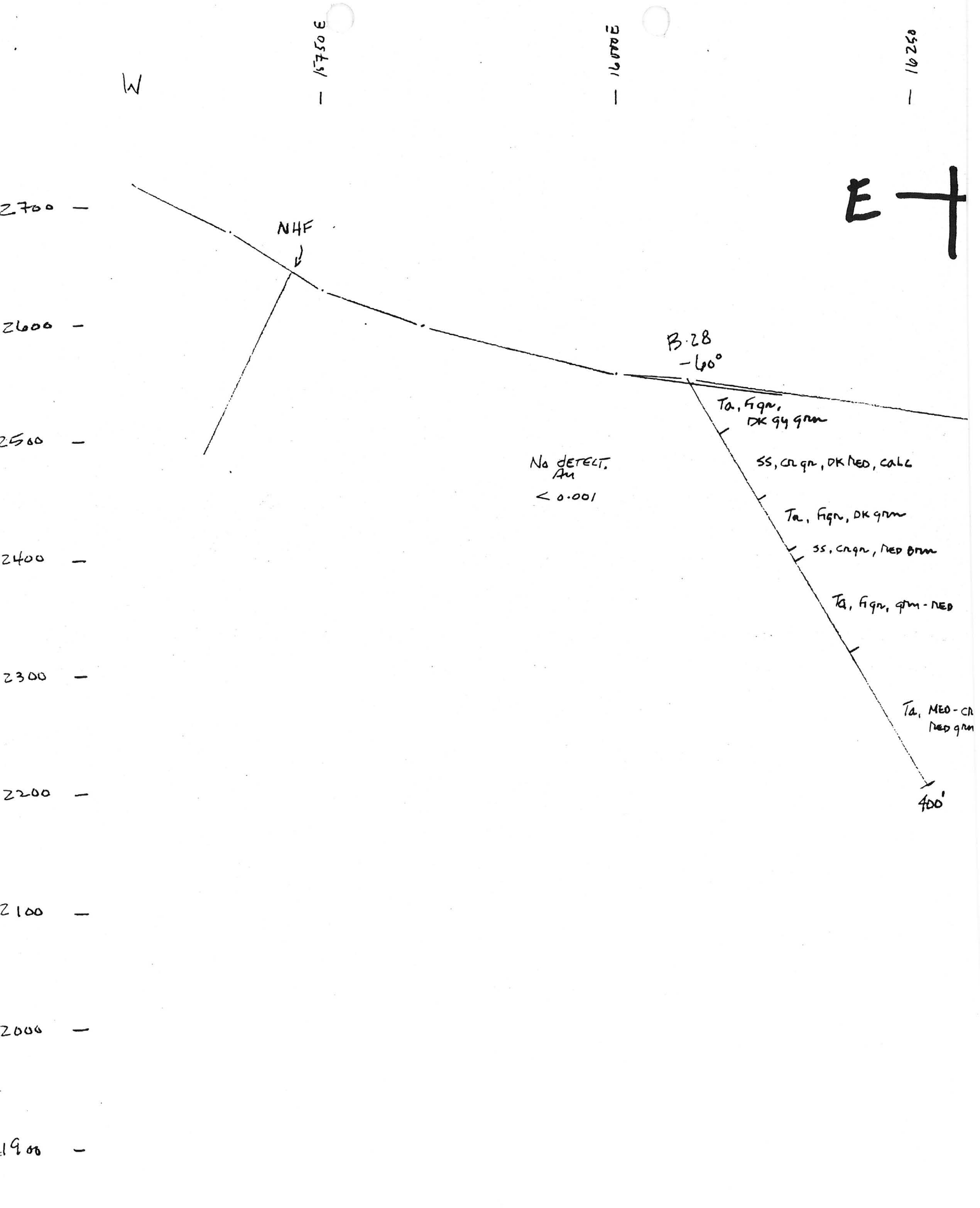
1" = 100'

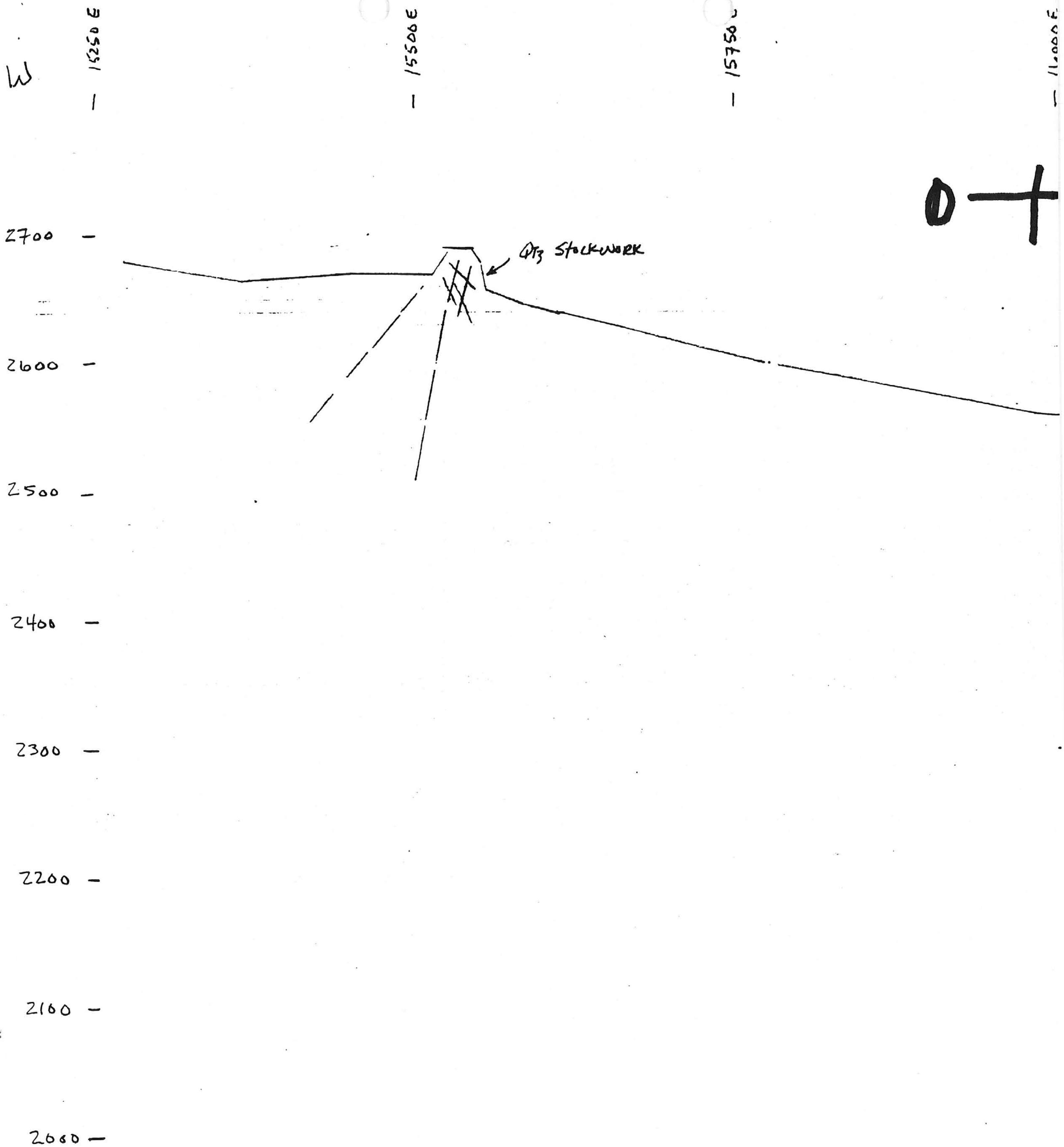
LINE 15,790 N

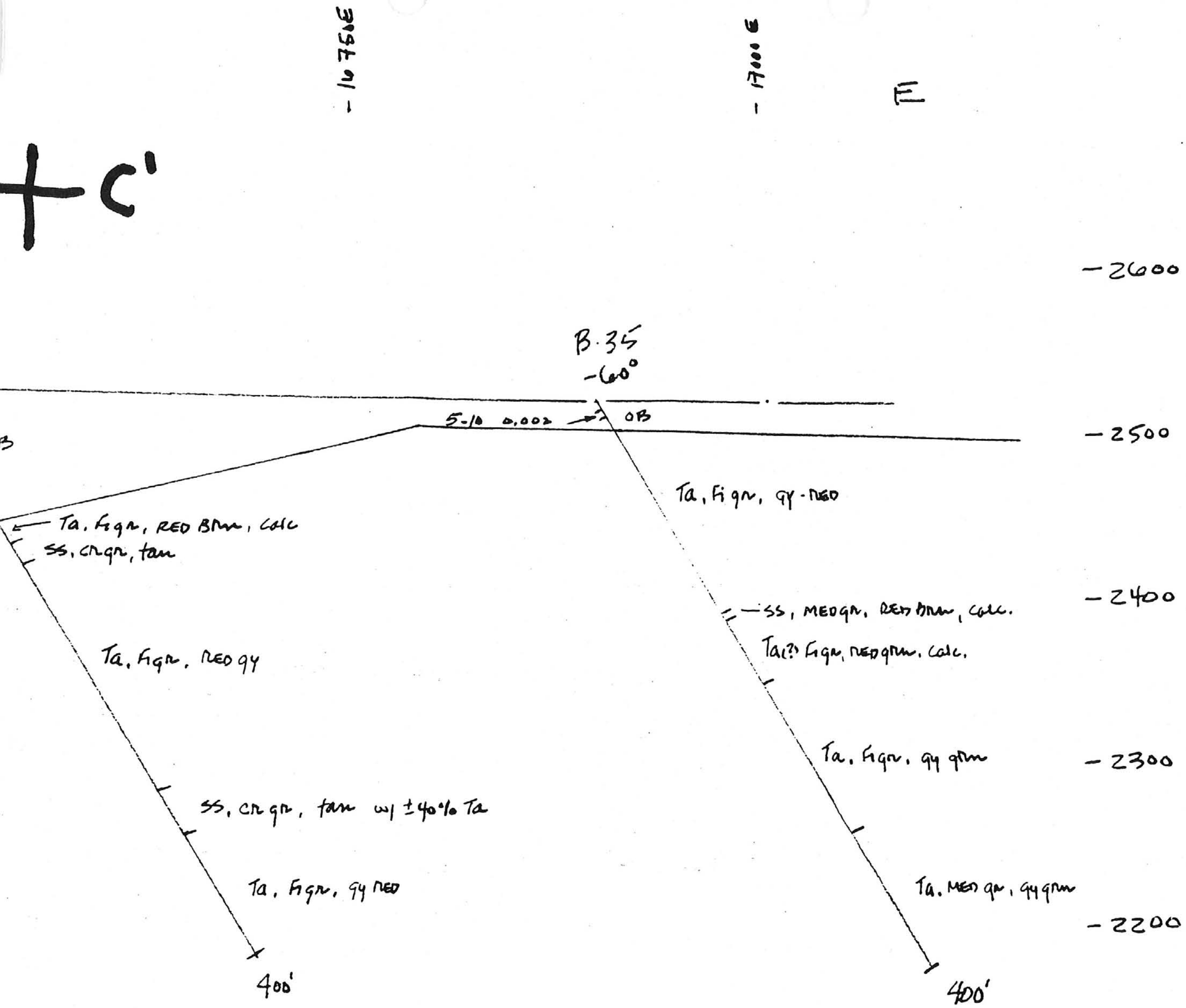
NORTH Hill AREA

Bullard Peak Project

Fig. 20


W
15750 E
16000 E
16250
E
2700
2600
2500
2400
2300
2200
2100
2000
1900
NHF
B-28
-60°
Ta, Fgn,
DK gy grn
SS, Cr gn, DK RED, calc
Ta, Fgn, DK grn
SS, Crgn, RED Brn
Ta, Fgn, grn-RED
Ta, MED-Cr
RED grn
400'
No detect.
Au
< 0.001


W
15250 E
15500 E
2700
2600
2500
2400
2300
2200
2100
2000
QTZ STOCKWORK



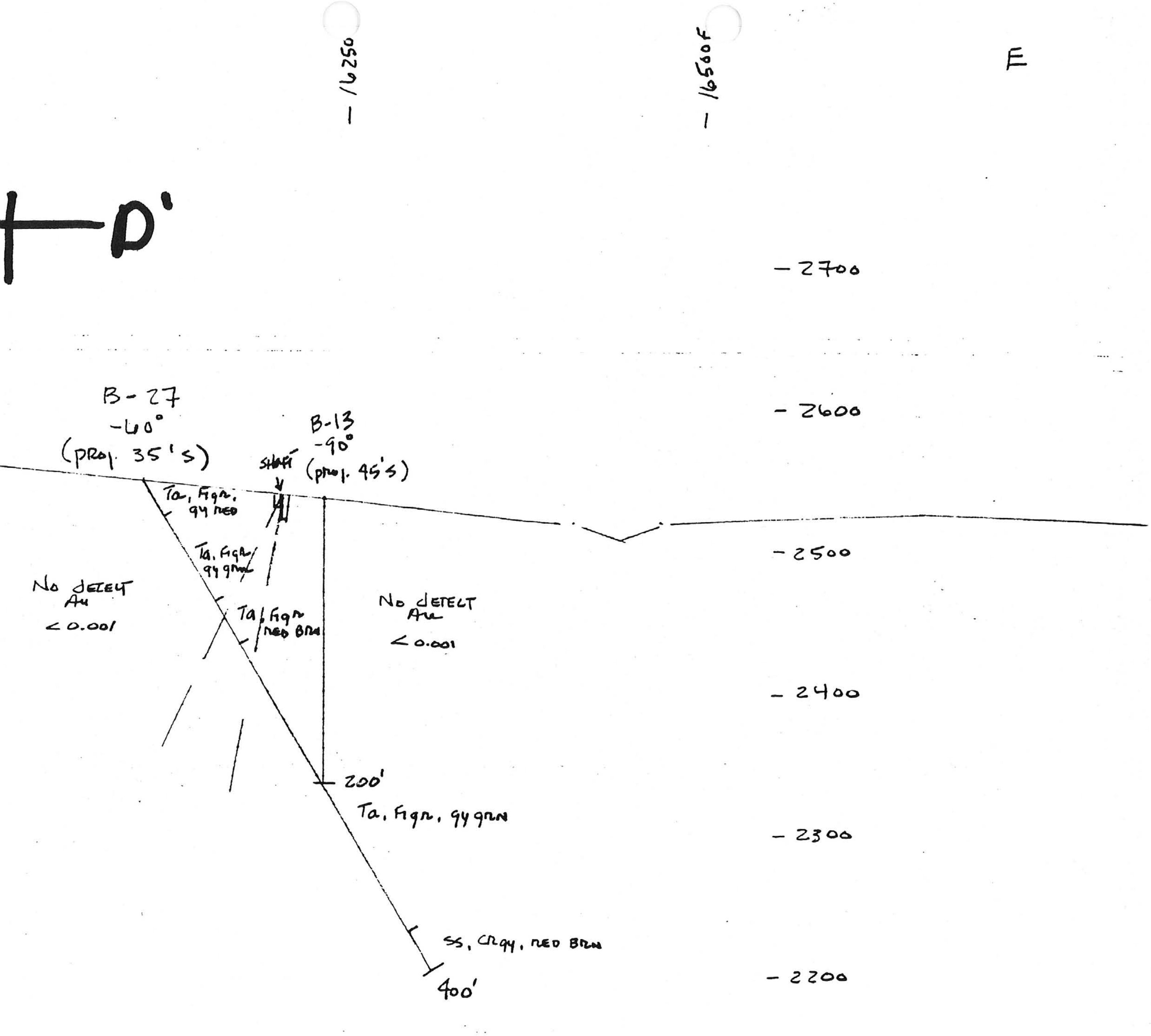
1" = 100'

LINE 17,000 N

NORTH Hill AREA

BULLARD PEAK PROJECT

Fig. 16



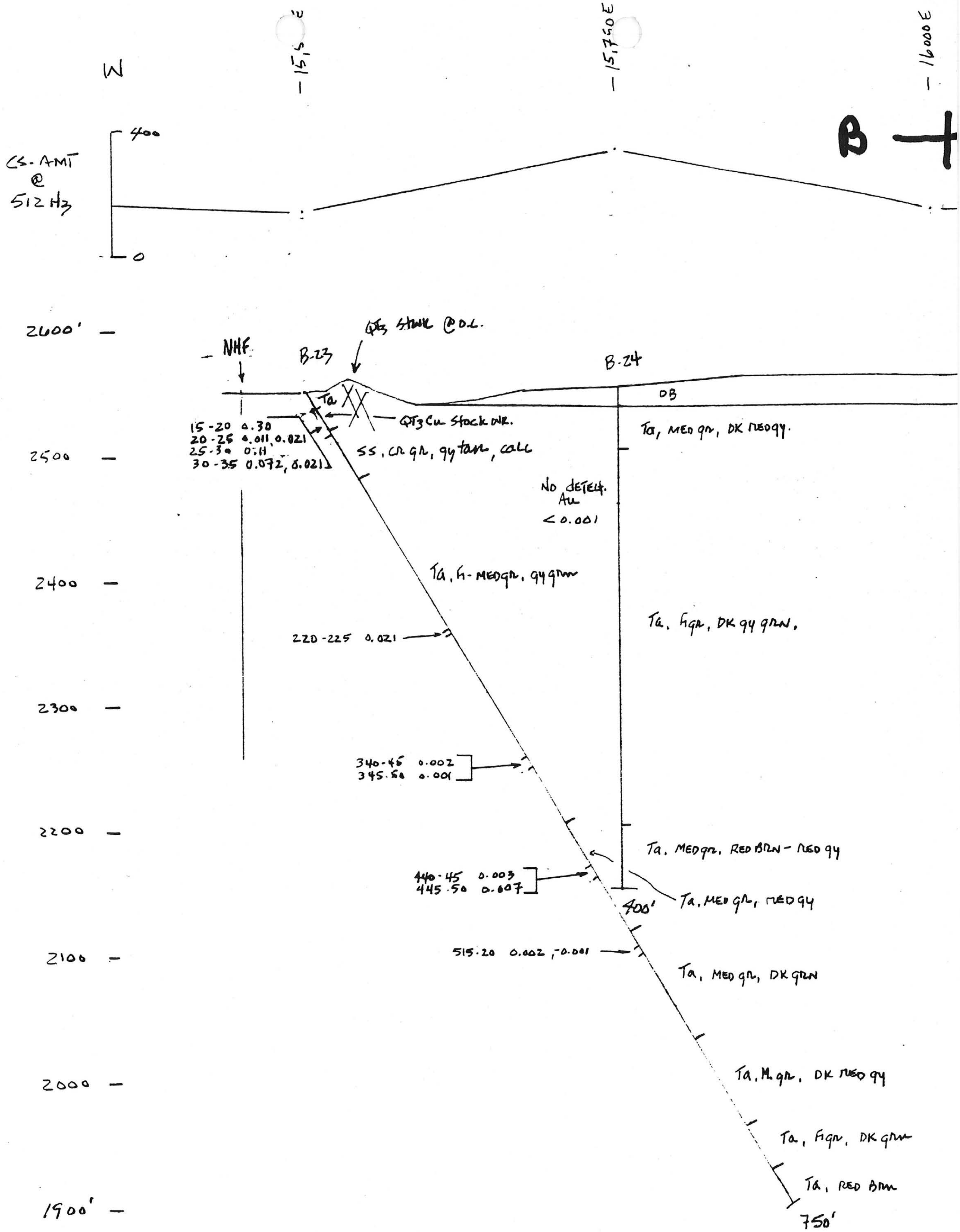
1" = 100'

LINE 16,765 N

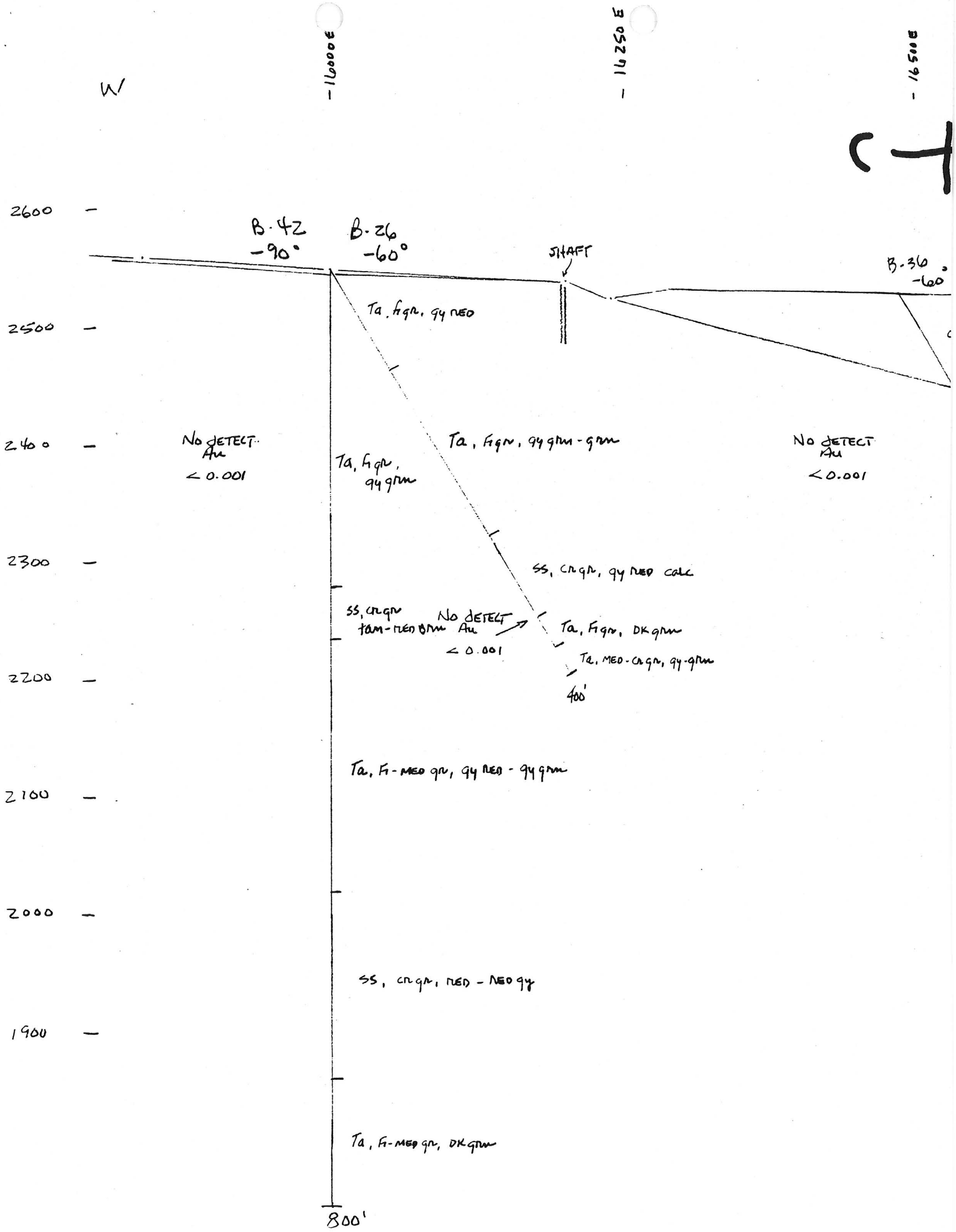
NORTH Hill AREA

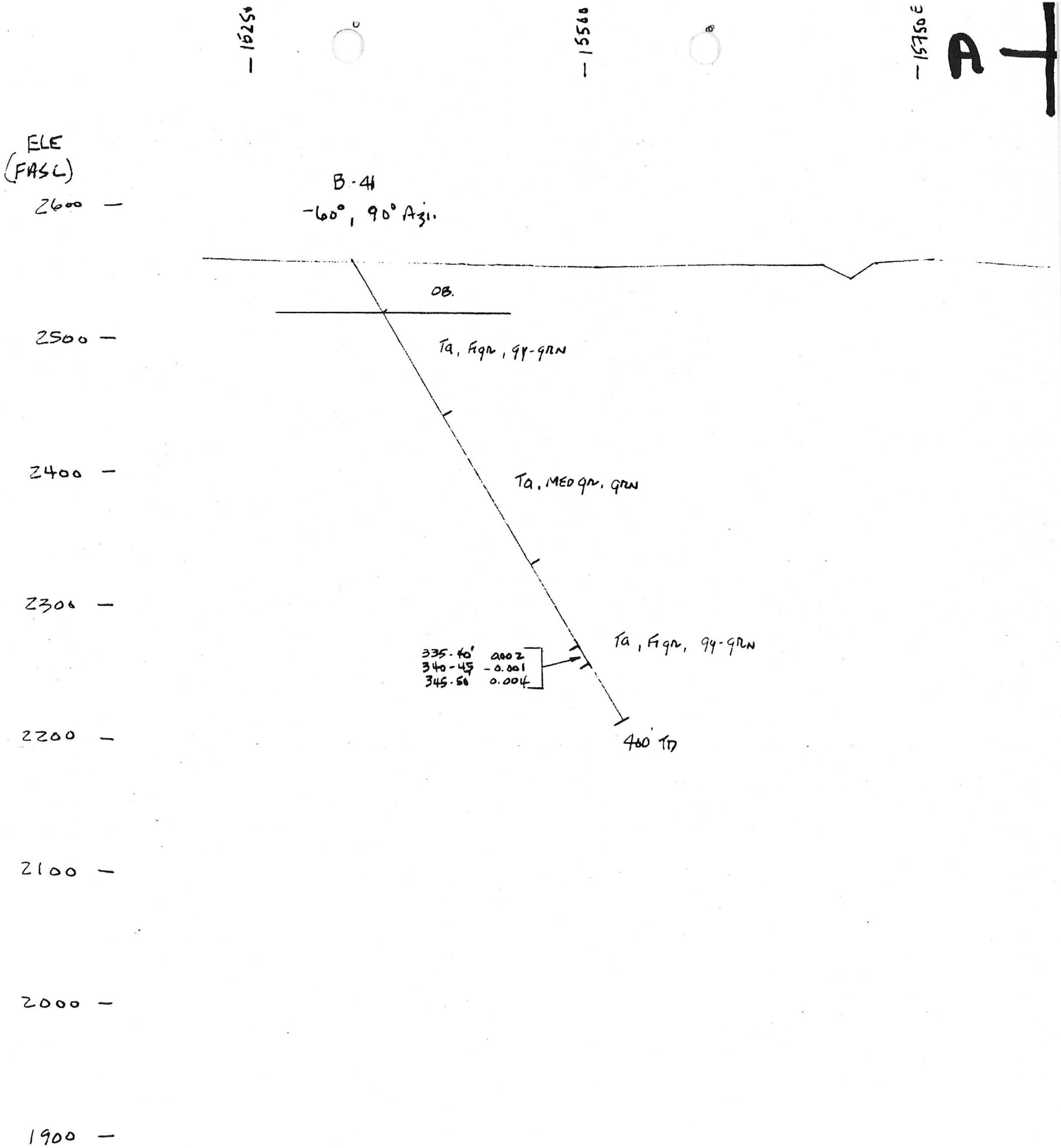
BULLARD PEAK PROJECT

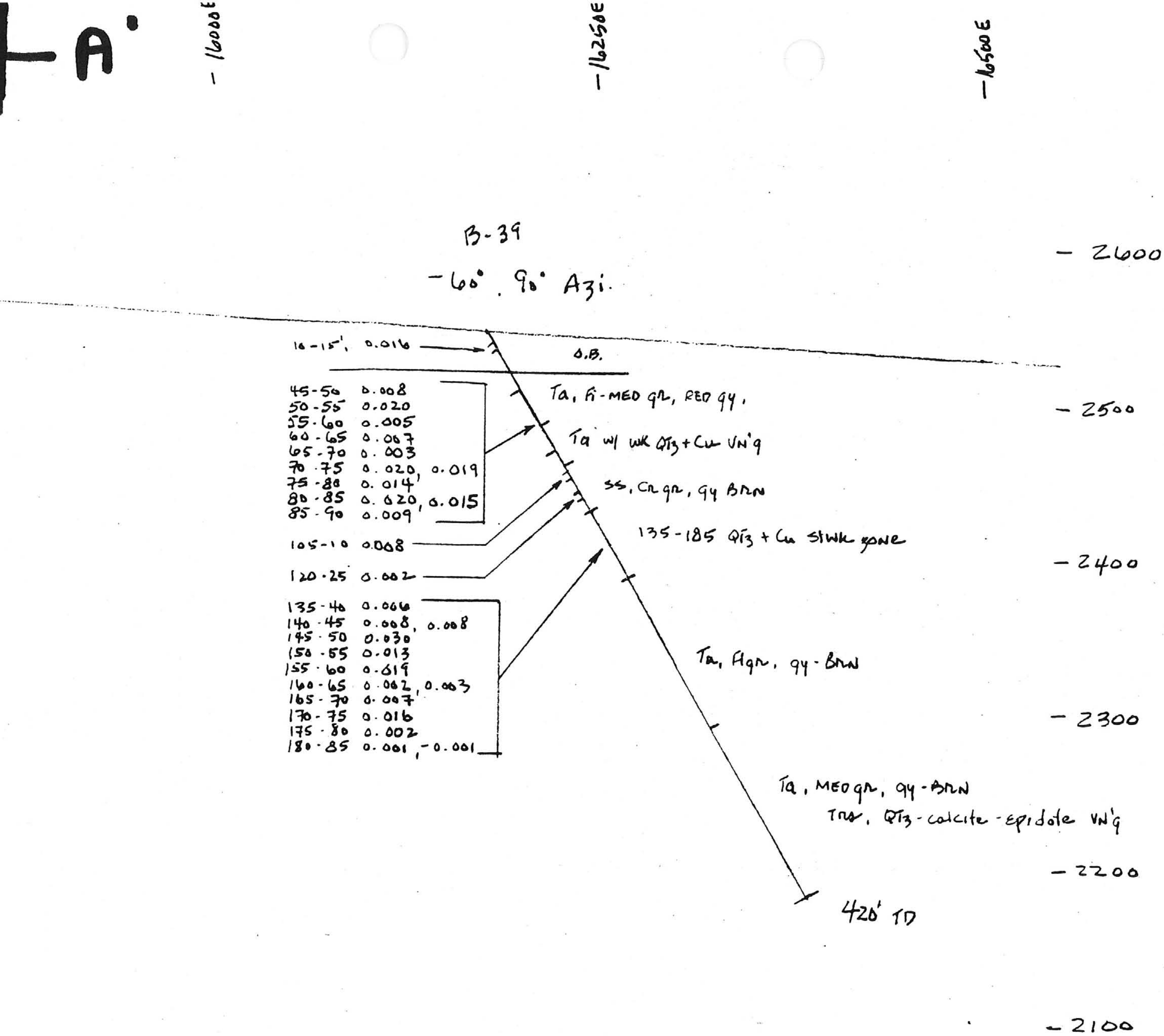
Fig. 17



W
15,5
15,750 E
16000 E
B
CS-AMT @ 512 Hz
400
0
2600'
2500
2400
2300
2200
2100
2000
1900'
NHF
B-23
QTz Stwk @ D.L.
B-24
OB
Ta
QTz Cu Stock wk.
15-20 0.30
20-25 0.011, 0.021
25-30 0.11
30-35 0.072, 0.021
SS, CR gr, gy tan, calc
Ta, MED gr, DK MED gy.
No detect. Au <0.001
Ta, f-MED gr, gy grn
Ta, fgr, DK gy grn.
220-225 0.021
340-45 0.002
345-50 0.001
Ta, MED gr, RED BRN - MED gy
440-45 0.003
445-50 0.007
400'
Ta, MED gr, MED gy
515-20 0.002, -0.001
Ta, MED gr, DK grn
Ta, M. gr, DK MED gy
Ta, fgr, DK grn
Ta, RED Brn
750'


W
16000E
16250E
16500E
C
2600
2500
2400
2300
2200
2100
2000
1900
B-42
-90°
B-26
-60°
SHAFT
B-36
-60°
Ta, f gr, gy red
Ta, f gr, gy grn-grn
No detect Au
< 0.001
Ta, f gr, gy grn
No detect Au
< 0.001
ss, cr gr, gy red calc
ss, cr gr tan-red brn
No detect Au
< 0.001
Ta, f gr, dk grn
Ta, med-cr gr, gy-grn
400'
Ta, f-med gr, gy red - gy grn
ss, cr gr, red - red gy
Ta, f-med gr, dk grn
800'


15250
15500
15750 E
A
ELE
(FASL)
2600
B-41
-60°, 90° Azi.
OB.
2500
Ta, Fgr, gy-grn
2400
Ta, MED gr, grn
2300
Ta, Fgr, gy-grn
335-40' 0.002
340-45 -0.001
345-50 0.004
2200
400' TD
2100
2000
1900

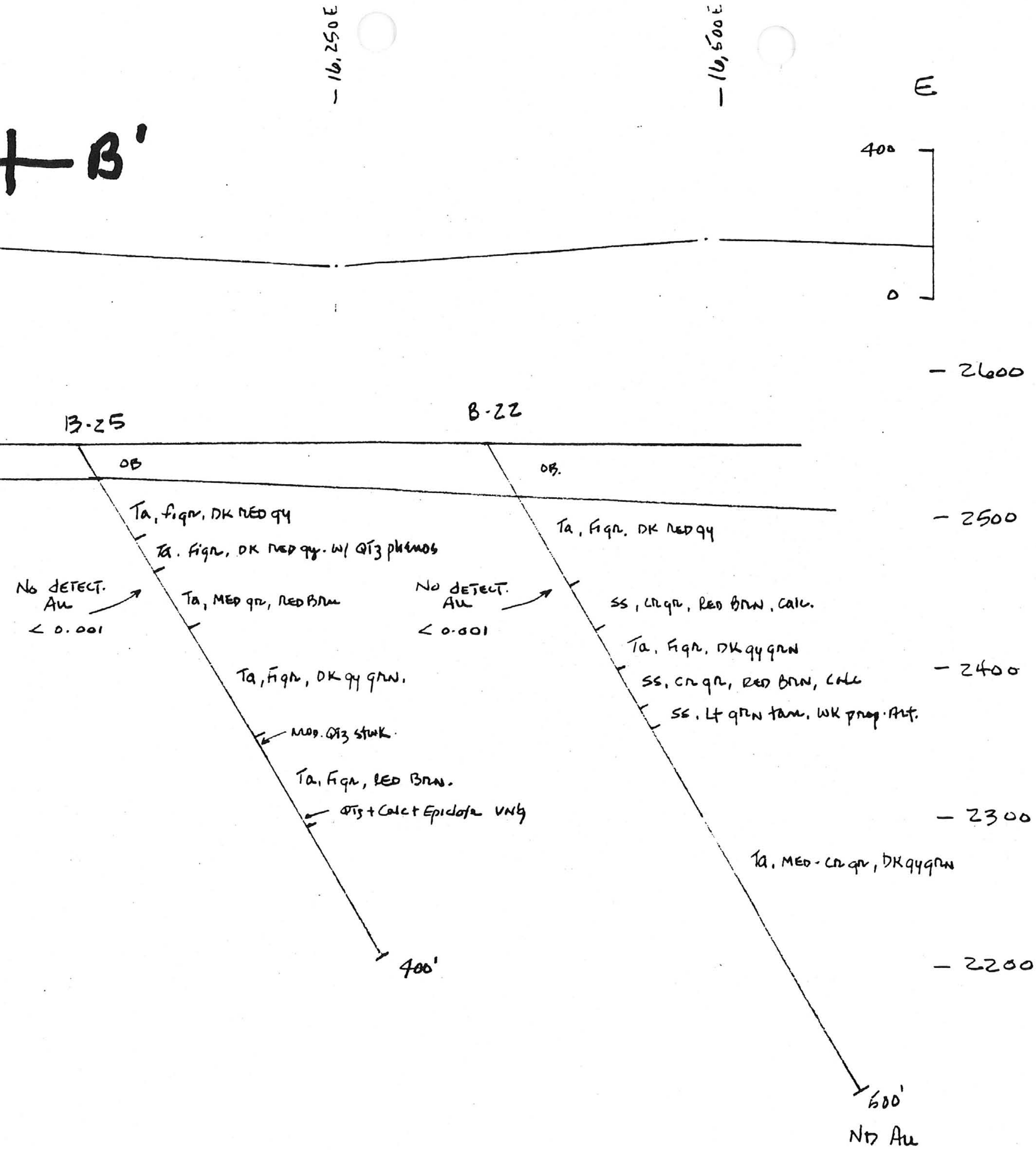


1"=100'

LINE 18000 N
NORTH Hill AREA

Bullard PEAK Project

Fig. 14



1"=100

LINE 17500 N

NORTH HILL AREA

BULLARD PEAK PROJECT

Fig. 15

4-7-90

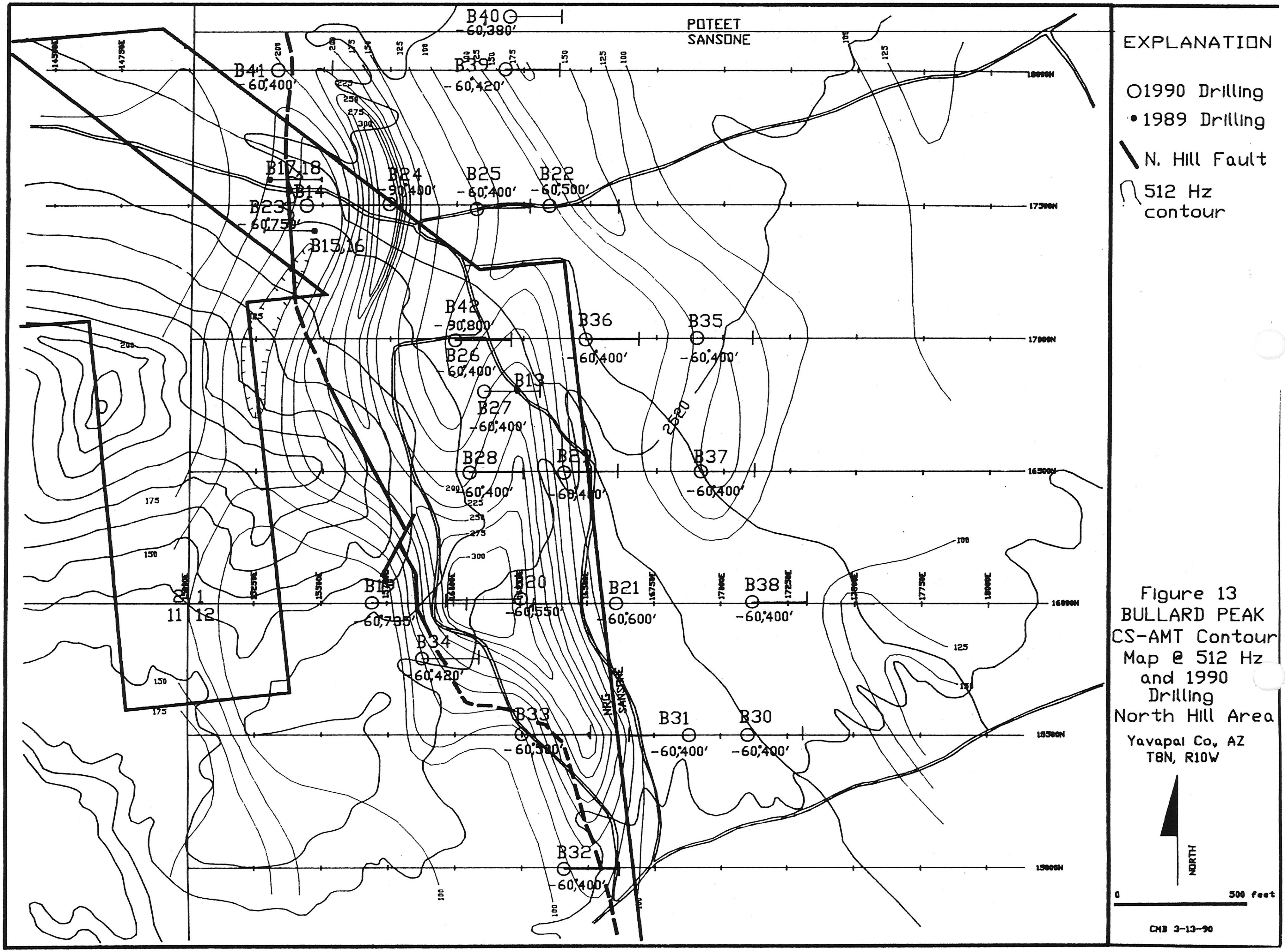
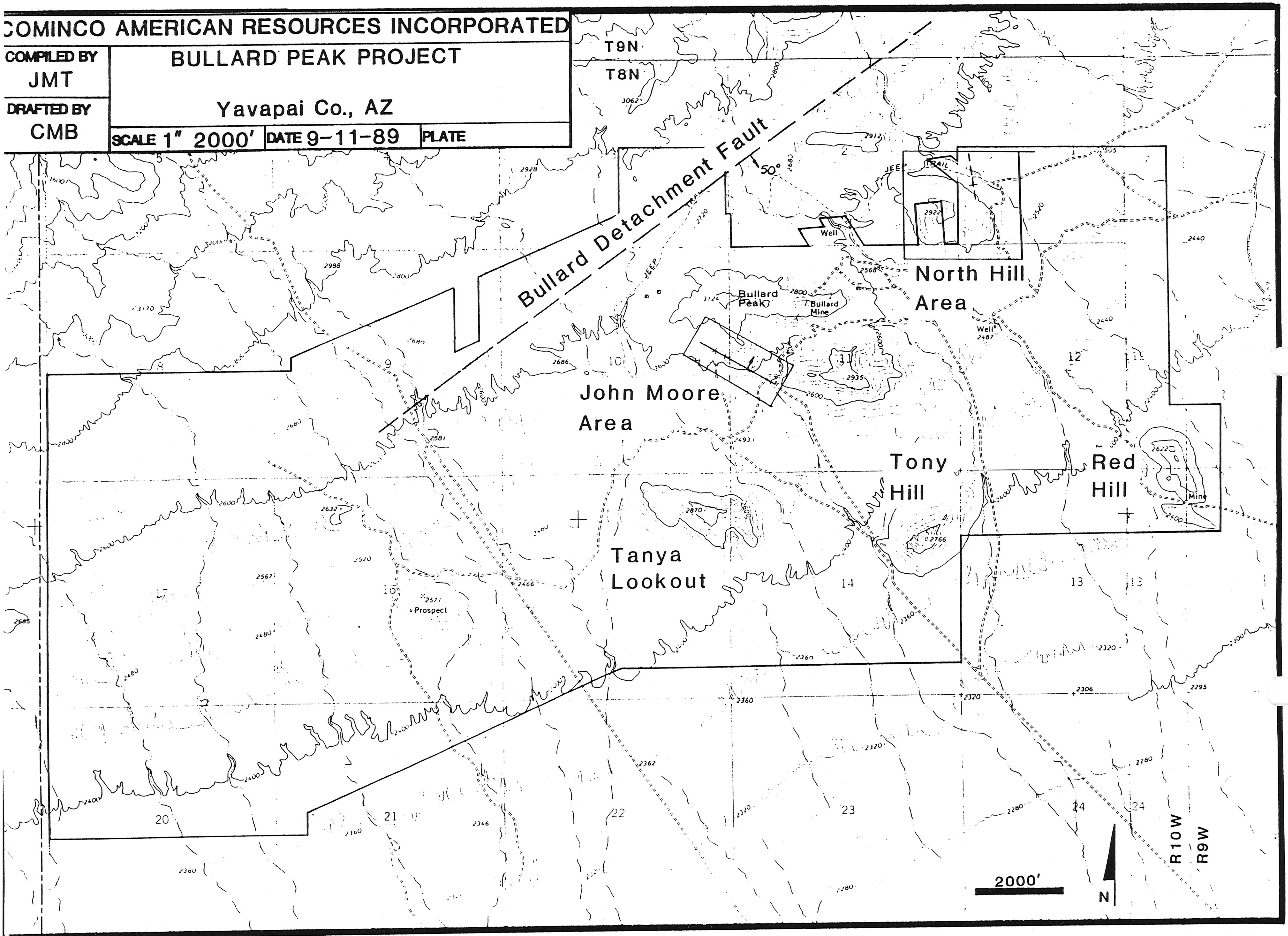
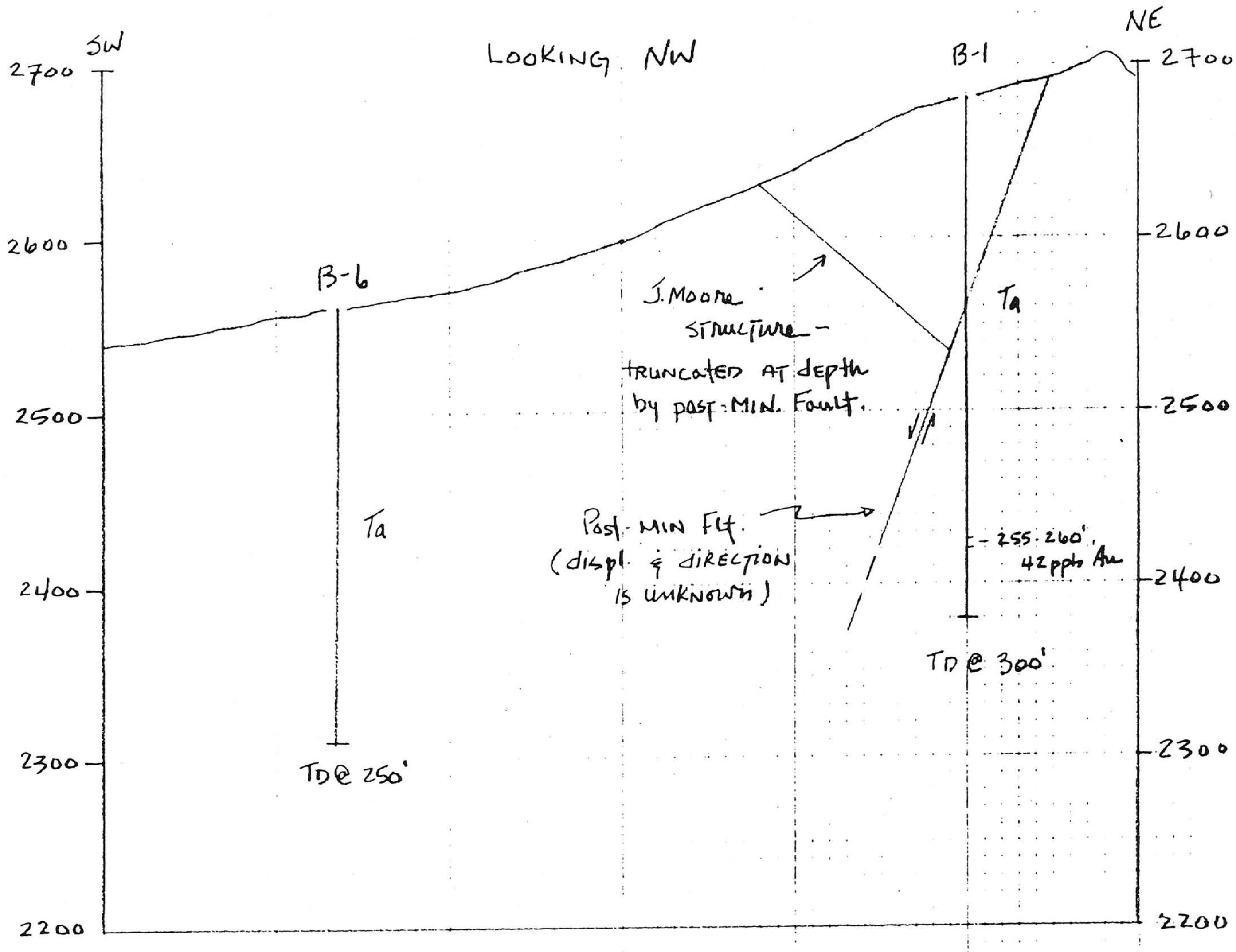


Figure 13
BULLARD PEAK
CS-AMT Contour
Map @ 512 Hz
and 1990
Drilling
North Hill Area



Date Creek Ranch SW, Smith Peak 7.5 minute quads

T8N,R10W G&SR Meridian



B1 / B6 Cross Section

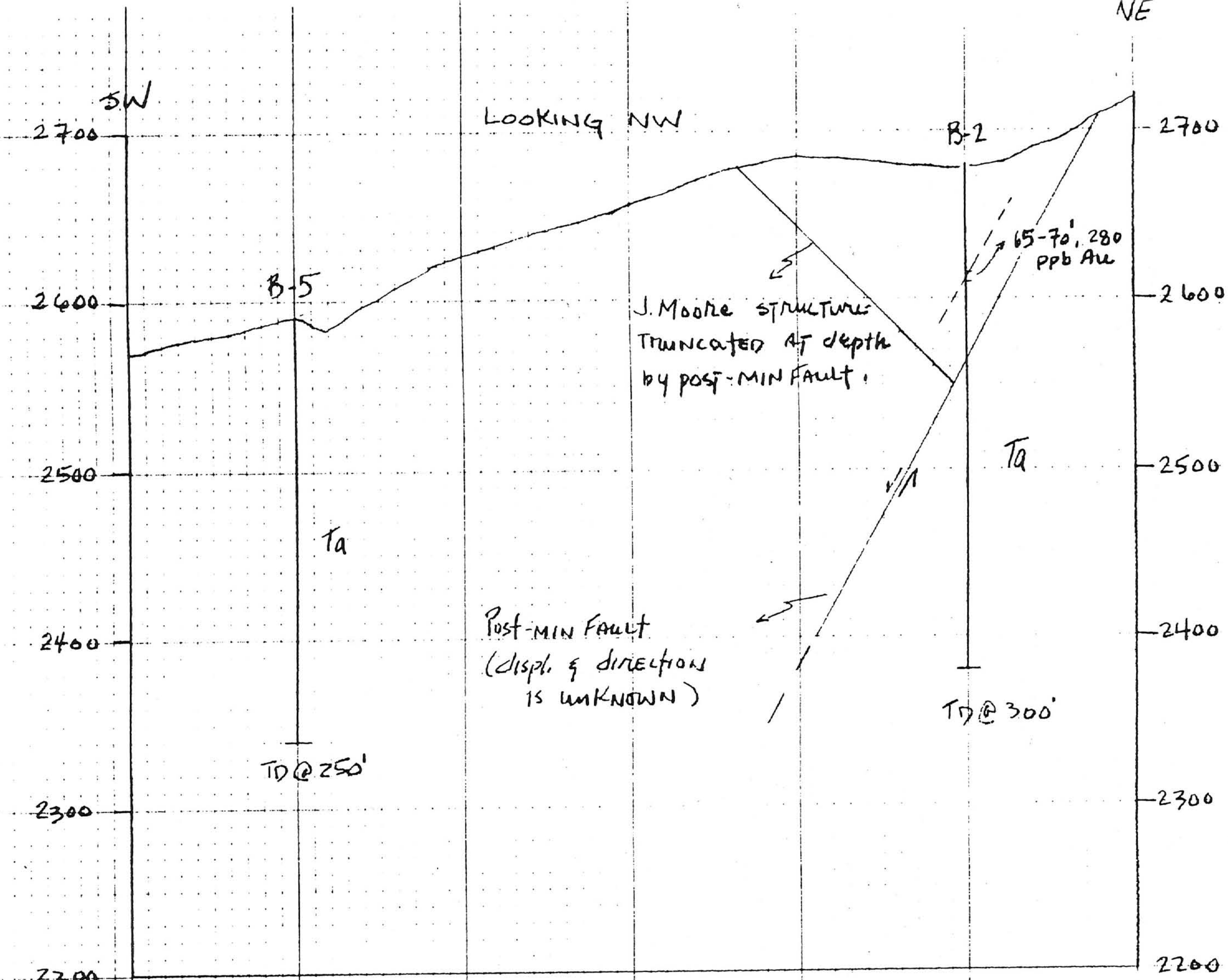
John Moore Area

1" = 100'

Fig. 7

Bullard Peak Project

JWT 5-17-89



B2 / B5 CROSS SECTION

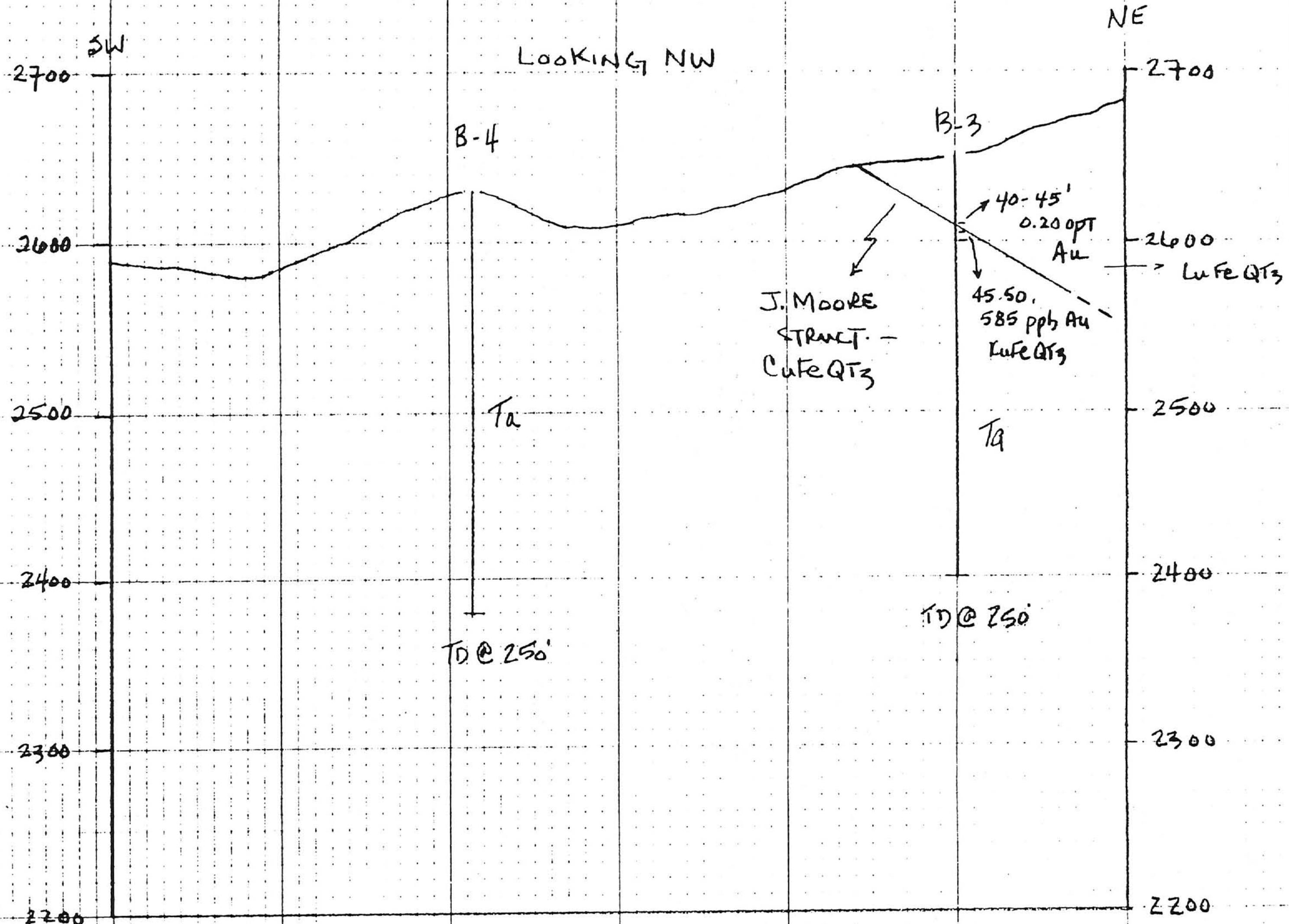
JOHN MOORE AREA

1" = 100'

Fig. 8

BULLARD PEAK PROJECT

JMT 5-17-89



B3 / B4 CROSS SECTION

JOHN MOORE AREA

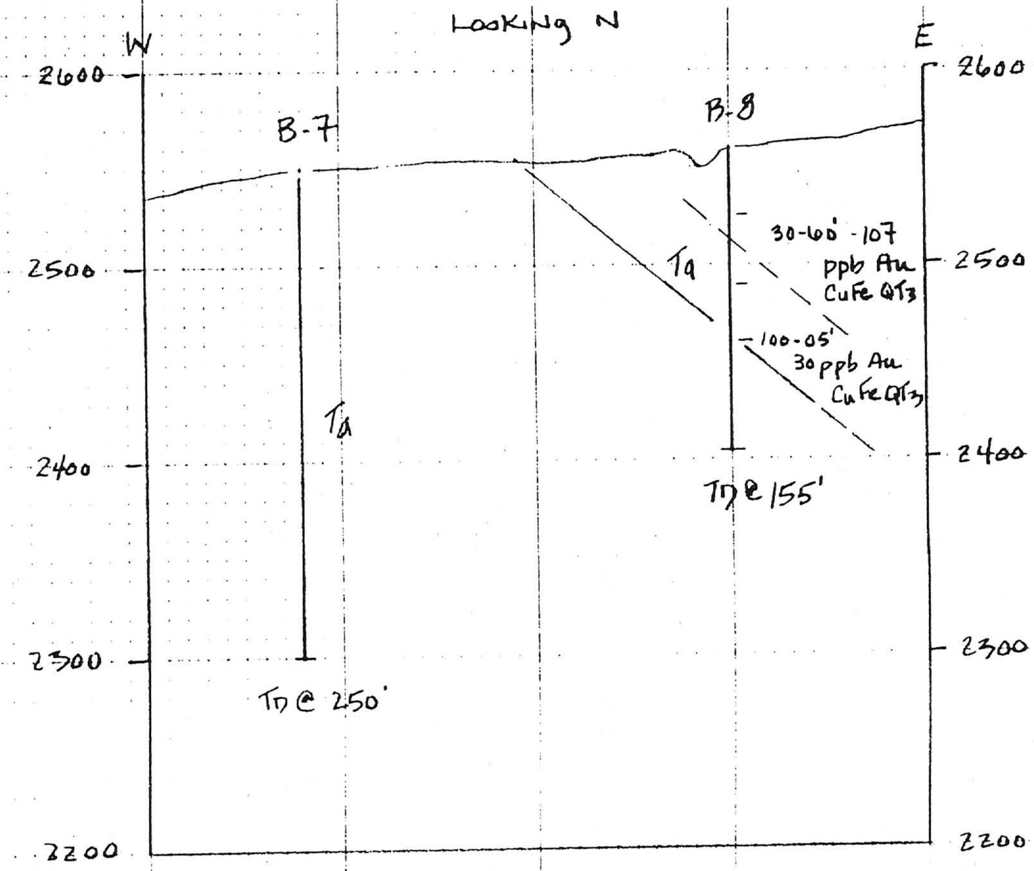
1" = 100'

Fig. 9

BULLARD PEAK PROJECT

JMT

5-17-90



B7 / B8 Cross Section

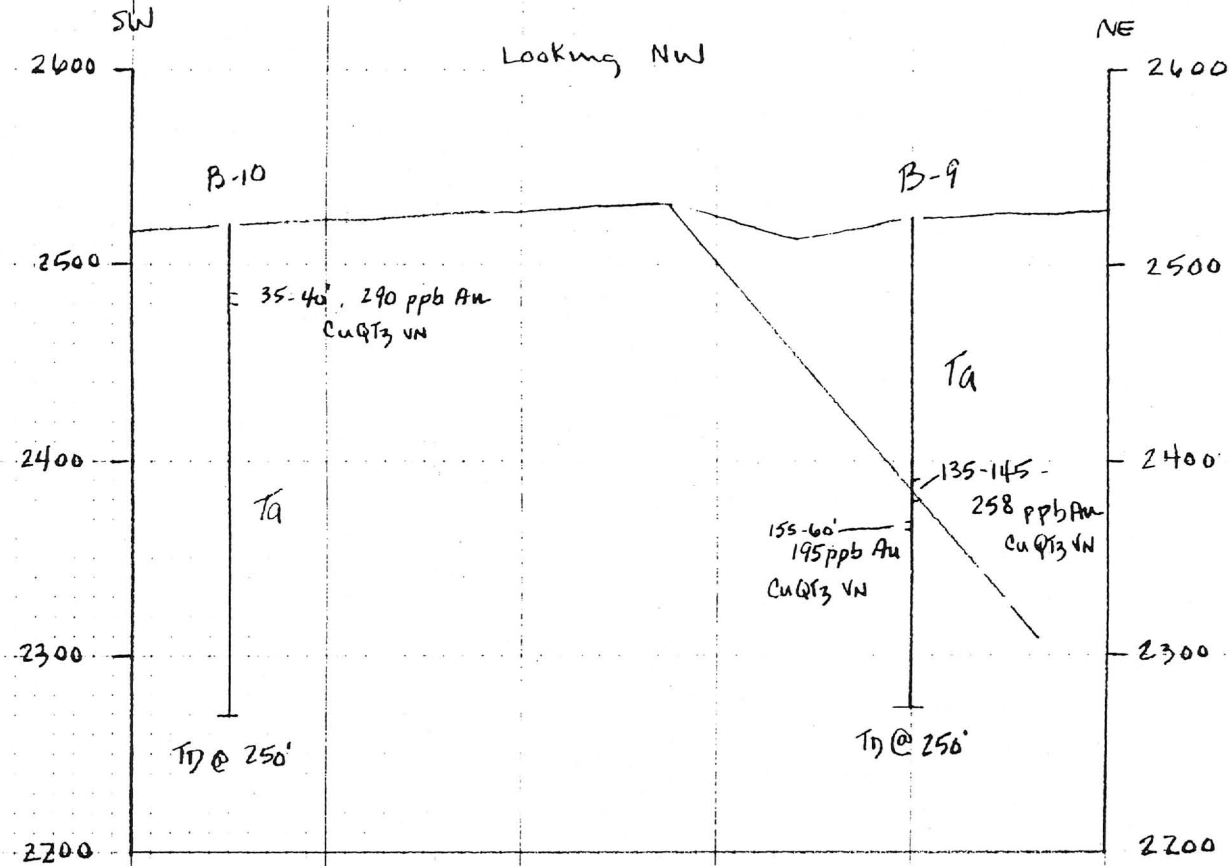
John Moore Area

1" = 100'

Fig. 10

Bullard Peak Project

JMT 5-17-89



B9 / B10 CROSS SECTION

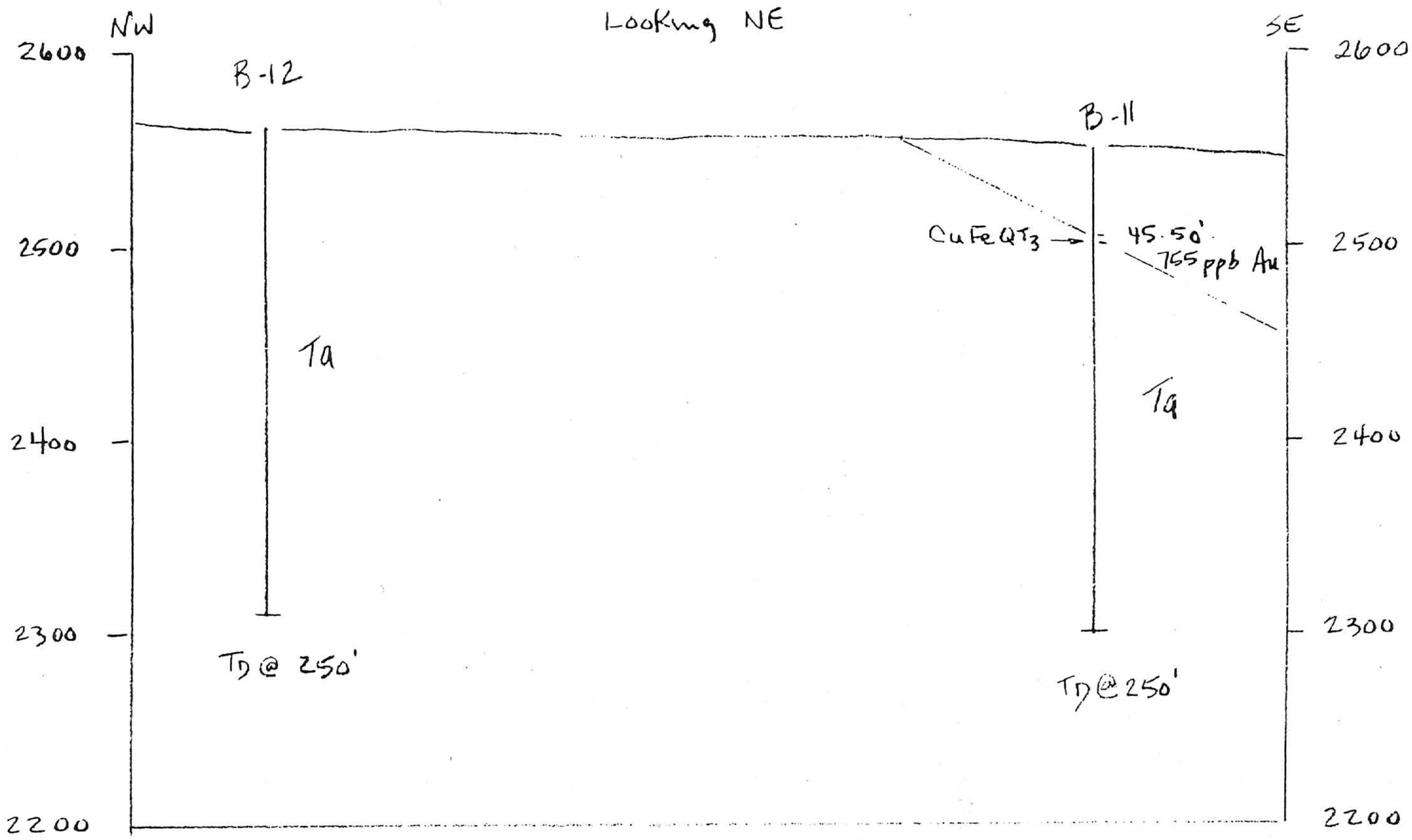
JOHN MOORE AREA

1" = 100'

Fig. 11

BULLARD PEAK PROJECT

JMT 5-17-89



B11 / B12 Cross Section
John Moore Area
1" = 100'

Fig. 12

Bullard Peak Project

JMT 5.17.89

PRINTED: 06-20-2006

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: BULLARD

ALTERNATE NAMES:
LITTLE GIANT

YAVAPAI COUNTY MILS NUMBER: 109

LOCATION: TOWNSHIP 8 N RANGE 10 W SECTION 11 QUARTER N2
LATITUDE: N 34DEG 03MIN 57SEC LONGITUDE: W 113DEG 16MIN 23SEC
TOPO MAP NAME: SMITH PEAK - 7.5 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:
COPPER OXIDE
COPPER SULFIDE
SILVER
GOLD
SILICON
CALCIUM CALCITE

BIBLIOGRAPHY:
MAPS - FLAT STORAGE, 2ND DRAWER
ADMMR BULLARD MINE FILE & COLVO FILE
ADMMR INDEPENDENCE FILE
BLM MINING DISTRICT SHEET 341
USBM WAR MINERAL REPORT 1945 REPORT 453
CLAIMS ALSO IN SEC 1, 2, 3, 10 & 12
FOWLER, GEORGE M (EAGLE PITCHER) GEO FILE
TOVOTE, W. 1918 "CUNNINGHAM PASS", GEO FILE
AGSU OFR 92-1, MINERAL DEP. BULLARD MINERAL
DIST. . . ., 1992, SPENCER, J. AND REYNOLDS

Cominco American
Resources Incorporated

BULLARD PEAK PROJECT
APPENDIX 2 AND APPENDIX 3

Reno Exploration Office

BULLARD PEAK PROJECT

APPENDIX 2

ROCK CHIP SAMPLE DATA INVENTORY

Cominco American

GEOCHEMICAL SAMPLING

:EA: Bullard Peak Project - 1989

LLECTOR: JM. Telford

TE: 2/7/89 thru 4/25/89

SAMPLE NUMBER	LOCATION Samp. loc. on plate 1	REMARKS	TYPE	Au ppb	Au opt							
				LAB. ANALYSIS								
305 633	@ T-22 - J. Moore A.	CuFeQtz VN m Ta	RK	+3.0 ppm	0.301							
634	@ T-20 - J. Moore A.	4' chip, CuFeQtz VN m Ta	"	61	-							
635	@ T-21 - J. Moore A.	3' chip, CuFeQtz VN m Ta	"	345	-							
636	@ T-21 - J. Moore A.	3.5' chip, CuFe Qtz VN m Ta	"	118	-							
637	@ T-17 - J. Moore A.	10.0' chip, CuFeQtz VN m Ta	"	1.3 ppm	-							
638	@ T-18 - J. Moore A.	7.0' chip, CuFe Qtz VN m Ta	"	>3 ppm	0.129							
639	@ T-18 - J. Moore A.	2.0' chip, CuFe Qtz VN m Ta	"	>3 ppm	0.159							
305 640	@ T-24 - Red Hill A.	Flt zone, Gr. ss, Abu $CaCO_3$	"	4	-							
641	@ T-31 - Red Hill A.	Qtz + MnOx + $CaCO_3$ VN	"	12	-							
642	@ T-46 - Tony Hill A.	Flat Flt, Hy FeOx, minor Qtz	"	74	-							
643	@ T-50 - Tony Hill A	CuFeQtz VN m Ta	"	49	-							
644	@ T-57 - Stage House A.	CuFe Qtz VN m Ta	"	>3 ppm	0.144							
645	@ T-58 - Stage House A.	CuFe Qtz VN m Vol. clastic	"	>3 ppm	0.145							
646	@ T-60 - J. Moore A.	CuFe Qtz VN m Vol. clastic	"	>3 ppm	0.124							
647	@ T-61 - J. Moore A.	CuFe Qtz VN	"	195	-							
648	@ T-66 - North Hill A.	CuFe Qtz VN	"	1.03 ppm	0.038							
649	@ T-67 - North Hill A	CuFe VN, w/o Qtz	"	100	-							
305 650	@ T-68 - North Hill A.	CuFe VN, w/o Qtz	"	4	-							
305 695	@ T-72 - North Hill A.	CuFe Qtz VN	RK	>3 ppm	0.540							
696	@ T-74 - North Hill A.	CuFe Qtz VN	"	>3 ppm	0.369							
697	@ T-76 - North Hill A.	CuFe Qtz VN	"	>3 ppm	0.688							
698	@ T-77 - NW Sec 2	Ta, Silic, Py, FeOx	"	11	-							
305 699	@ T-78 - NW Sec 2	Ta, Silic, Py, FeOx	"	-2	-							

G.B.F.

Cominco American

GEOCHEMICAL SAMPLING

REA: Bullard Peak Project - 1990
OLLECTOR: J.M. Telford
ATE: 1-19-90 thru 1-24-90

SAMPLE NUMBER	LOCATION Samp loc. on Plate 3	REMARKS	TYPE	LAB. ANALYSIS Au ppm	Au opT
305748	N. Hill Area, T-12	CuQTz Fe VN	RK	+3.0	0.684
749	N. Hill Area, T-2	QTz VN'g w/ Tr Cu	"	1.8	0.053
305750	N Hill Area, T-3	QTz Stockwork	"	215ppb	0.006
330482	N. Hill Area, T-4	QTz Stockwork	RK	220 ppb	0.005
483	N. Hill Area, T-5	QTz VN'g, Tr Cu, Ta	"	1.6	0.053
484	N Hill Area, T-6	QTz CuFe VN	"	1.9	0.041
485	N Hill Area	QTz CuFe VN m Ta	"	2.0	0.055
486	N. Hill Area	QTz VN'g m Ta, Tr Cu	"	+3.0	0.509
487	N. Hill Area	QTz CuFe VN m Ta	"	+3.0	0.212
488	N. Hill Area	Bx w/ SiO_2 Fill	"	185ppb	0.005
489	N. Hill Area	QTz CuFe VN	"	+3.0	0.083
330 490	N. Hill Area	QTz VN m Ta, Tr Cu	"	765ppb	0.020
491	N. Hill Area, T-9	QTz VN, Tr Cu	"	12ppb	—
492	N. Hill Area, T-9	QTz VN, Tr Cu	"	18ppb	—
493	N. Hill Area, T-10	Cu QTz VN	"	+3.0	0.201
494	N. Hill Area, T-11	Cu QTz ± $CaCO_3$ VN'g	"	+3.0	0.249
495	N. Hill Area,	QTz Stockwork	"	1.19	0.033
496	N. Hill Area, T-12	CuQTzFe Stockwork	"	+3.0	0.812
330 497	N. Hill Area,	QTz MTX Bx, No Cu, Fe	"	88ppb	—
223801	N. Hill Area	QTz Stwk w/ tr Cu, Cpy, $BaSO_4$		–	0.005
802	N. Hill Area	Int. Sil & QTz Bx, rare Cu, $BaSO_4$		–	0.016
803	N. Hill Area	QTz Bx w/ Abu Cu, occ $BaSO_4$		–	0.187
804	N. Hill Area	Wht cr XL QTz, 1% Cu, Bx		–	0.047
805	N. Hill Area	Int. Sil & banded QTz VN'g		–	0.014
223 806	N Hill Area	Int. Sil. & Bx, tr Cu, Cpy		–	0.075

G.B.F.

BULLARD PEAK PROJECT

APPENDIX 3

ZONGE CS-AMT AND IP REPORT

LOGISTICS REPORT

CSAMT/IP SURVEY
BULLARD PEAK
Yavapai County, Arizona

for
COMINCO AMERICAN RESOURCES, INC.

Issue date: 9 Feb 1990

Zonge Engineering & Research Organization, Inc.
3322 East Fort Lowell Road, Tucson, AZ 85716
Phone (602)327-5501
Fax (602)325-1588
Telex 165532 CEERHO TUC

Contents

List of Figures & Plates

FIGURES

PLATES (in back pocket of this report)

Logistics Summary

In January 1990, Zonge Engineering & Research mobilized a crew to Aguila, Arizona to conduct a combination CSAMT and IP survey requested by Cominco American Resources, Inc.. The CSAMT survey covered seven 3000 foot long lines at a station spacing of 250 feet. The IP survey added additional coverage to two of the CSAMT lines. The objective of the survey was geologic mapping, with an emphasis on locating conductive zones.

The CSAMT data were obtained in CSAET mode (four electric-field measurements for every magnetic-field measurement). The electric-field dipoles were 250 feet long. The CSAMT data were processed, static-corrected, and then modeled using our smooth-model inversion process. The results are displayed as contoured pseudosections (located in the back pocket of this report).

The IP data were collected using a seven-spread dipole-dipole array. A dipole length of 500 feet was used with data collected at n-spacings of one to six. The IP results are presented as contoured pseudosections of apparent resistivity, 1/8 Hz phase, and three-point D.C. phase.

The data from this survey show clear trends in the area's electrical response. Both resistive and conductive features can be tracked from line to line in a north-west - south-east trend. A final interpretation in conjunction with known geology should provide a guide to further exploration.

Project Logistics

At the request of Dutch Van Blaricom of Cominco American Resources, Inc., Zonge Engineering mobilized a geophysical crew to Aguila, Arizona for a combination CSAMT and IP survey. The objective of the survey was to map geology on the Bullard Peak property. The CSAMT survey parameters were adjusted to provide a 1500 foot depth of investigation. Dipole-dipole IP was used as follow up to CSAMT. The 500 foot IP dipole length gave a depth of investigation of about 1000 feet at a n-spacing of six.

The four-man crew was headed by Zonge Engineering crew chief Bill Clapper. The crew drove to Aguila on January 16, 1990. They arrived in midafternoon, checked into their motel, and then proceeded to the survey area to scout out the transmitter site. The transmitter antenna was set up on January 17th, but heavy rain delayed the start of data collection. Work on the 18th was washed out by continuing heavy rain. The rain had abated somewhat on the 19th and CSAMT data collection got underway. The CSAMT lines were finished on January 21st and the transmitter antenna was picked up on the morning of the 22nd. The crew proceeded with the IP phase of the survey by setting up a 7-spread dipole-dipole array on line 16000N. They finished the first IP line on the 23rd and went on to line 17500N. They completed the second IP line on January 24th and returned to Tucson that evening.

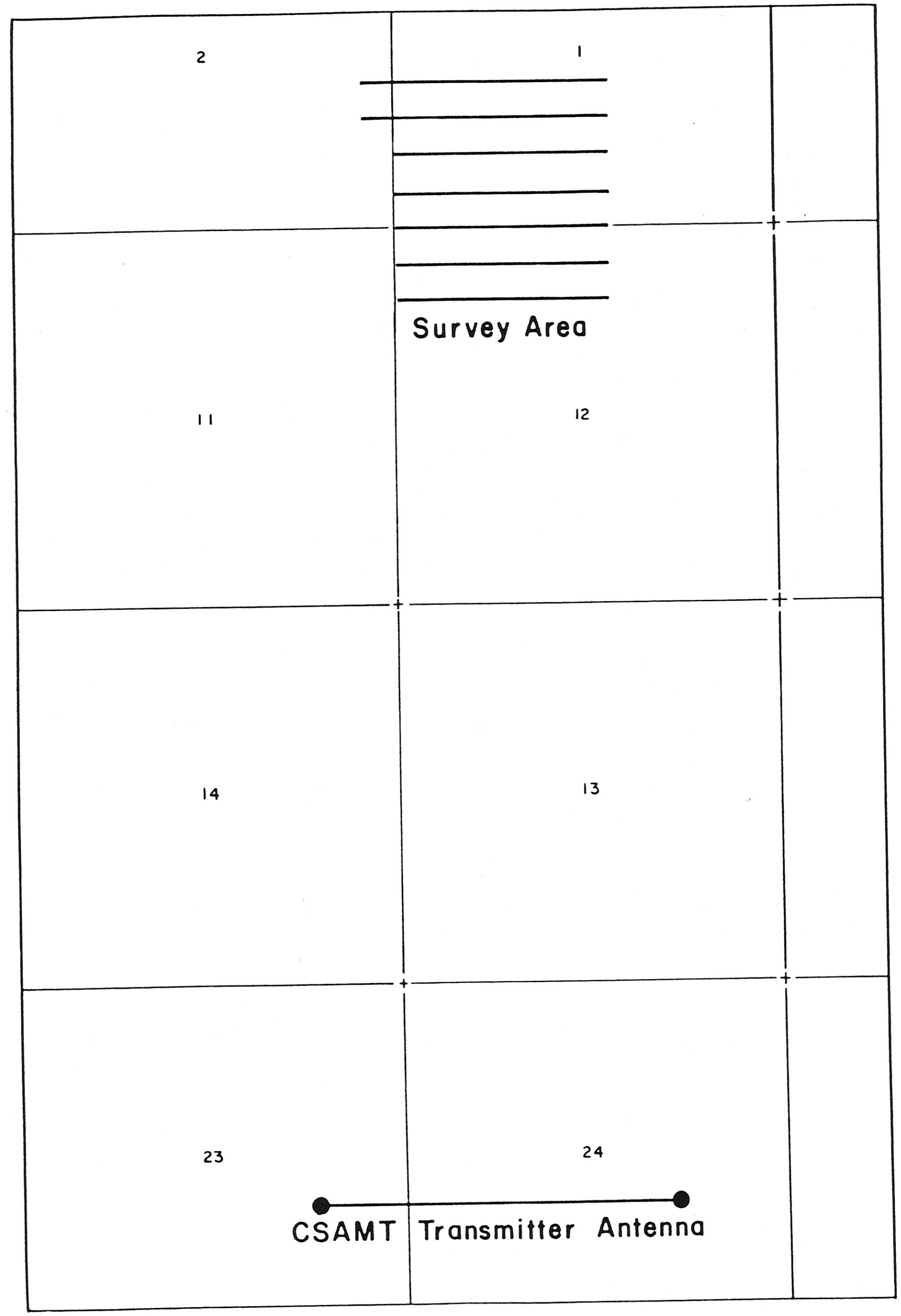
Bill Clapper did a commendable job in completing this survey. The crew collected excellent quality data and got good production. After a delay due to heavy rain on the first few days of the project, the crew stayed on schedule. There were no significant delays due to equipment breakdown. Apart from weather, the project went smoothly.

CSAMT Field Procedure

One transmitter bipole location was used for the CSAMT work (Figure 1). Current electrodes were moistened with salt water to reduce contact resistance. The 1500 meter long transmitter antenna was oriented east-west and placed about 4 km south of the survey lines.

CSAMT data were read using four electric-field dipoles and one magnetic-field component on each setup ("CSAET" mode). Electric-field dipoles were oriented parallel to the source bipole and the magnetic-field antenna was oriented perpendicular to the source. An electric-field dipole length of 250 feet was used for all of the CSAMT survey. Data were collected along seven lines (Figure 2).

Electric-field electrodes consisted of porous pots filled with a copper sulfate solution. Contract resistances were moderate, varying from one to two k-ohms. There were no problems associated with high contact resistance.



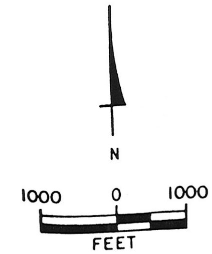


Figure 1

CSAMT / IP SURVEY

LOCATION MAP

Bullard Peak Project

T8N R10W

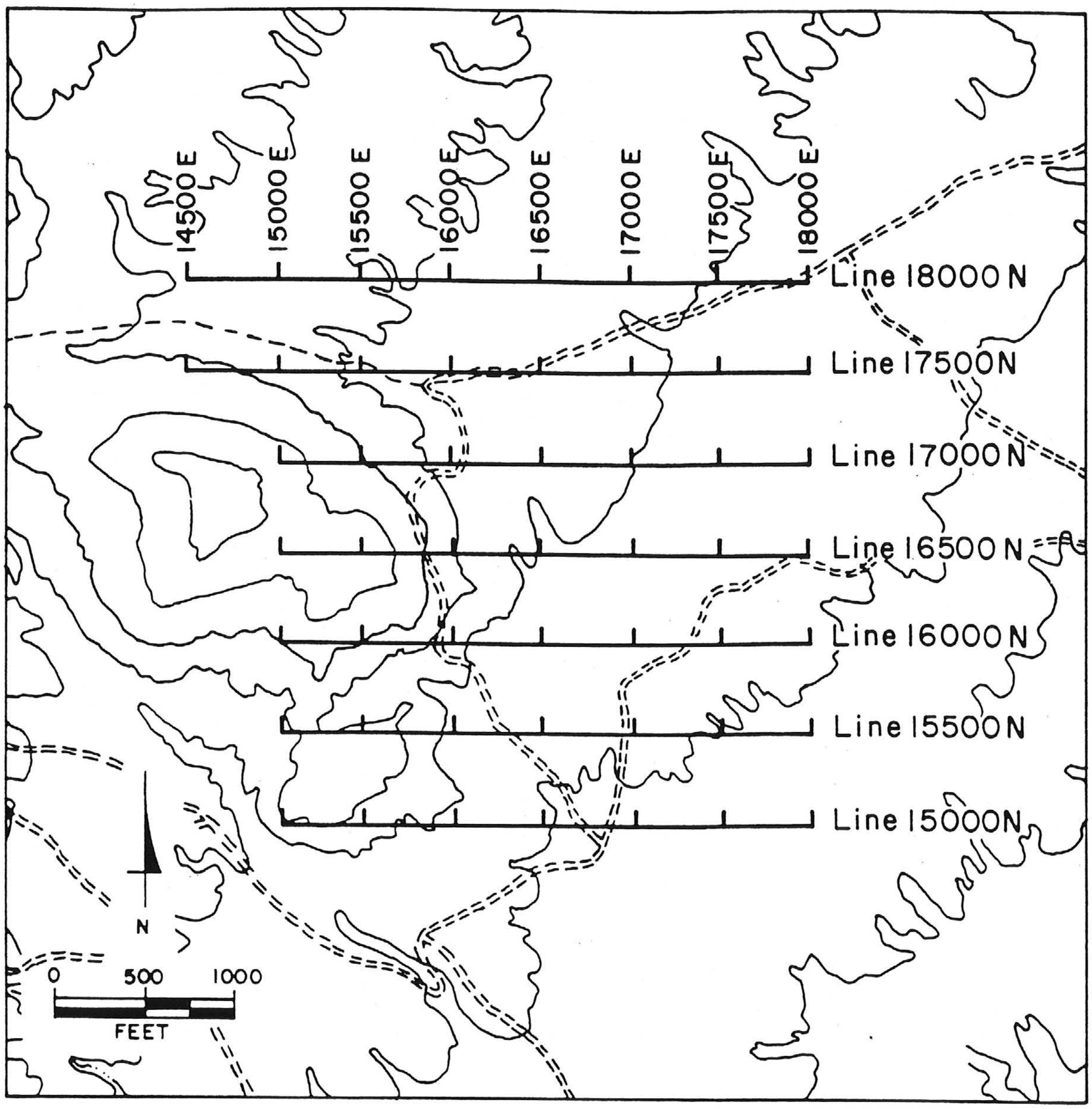
Yavapai Co., Arizona

for

COMINCO AMERICAN RESOURCES INC.

ZONGE ENGINEERING
& RESEARCH ORGANIZATION
Tucson, Arizona USA

Figure 2



CSAMT / IP SURVEY
LOCATION MAP

Bullard Peak Project

Yavapai Co., Arizona

for

COMINCO AMERICAN RESOURCES INC.

ZONGE ENGINEERING
& RESEARCH ORGANIZATION
Tucson, Arizona USA

Job 925 2/90

Single conductor wire was used for the pot lines. The magnetic-field antenna was located twenty feet away from the receiver, near the center of the electric-field array. When a reading was completed, the pot lines were pulled 1000 feet to the next setup location. The porous pots were planted and connected at the new locations and another set of readings commenced. This roll-along procedure was varied to suit field conditions.

CSAMT source fields were transmitted at frequencies ranging from 32 Hz to 8 kHz. Signal frequency at the transmitter was controlled by a crystal oscillator in a transmitter controller box. This oscillator was synchronized daily to an identical oscillator in the receiver, so that phase coherency could be maintained. Typical drift between the two oscillators was less than 0.5 milliradian per day at 0.125 Hz. However, due to the use of relative phase between E and H, absolute phase drift does not affect CSAMT data.

IP Field Procedure

The IP work was done along two lines, 16000N and 17500N. Both lines were covered with a single seven spread array using 500 foot dipoles. The crew set out an array of seven transmitting electrodes for each IP line. They then measured voltage differences across three receiver dipoles at a time. They covered the complete seven-spread array with four setups. Data were taken from n=1 to n=8, with complete coverage down to n=5 and one missing point at n=6.

Voltages were measured using non-polarizable porous pots. There were no problems with high contact resistance. Moderate resistances of one to two k-ohms were measured throughout the survey.

IP signals were transmitted at 0.125 Hz. Moderate contact resistances allowed current levels of five to ten amperes for the IP survey. Road access was good enough to allow transmitter placement near the center of the seven electrode transmitter array on both IP lines.

Harmonic IP Data Acquisition and Decoupling

The IP data were acquired using a harmonic complex resistivity algorithm developed by Zonge Engineering. The algorithm works as follows: A 0.125 Hz squarewave is injected into the ground with precise current control. The squarewave contains a series of sinusoidal harmonics at odd multiples of the fundamental frequency (i.e. the first, third, fifth,...harmonics). By transmitting a 0.125 Hz squarewave, one can measure a series of harmonics:

1st harmonic (n=1)	1 x 0.125 Hz = 0.125 Hz
3rd harmonic (n=3)	3 x 0.125 Hz = 0.375 Hz
5th harmonic (n=5)	5 x 0.125 Hz = 0.625 Hz
7th harmonic (n=7)	7 x 0.125 Hz = 0.875 Hz
9th harmonic (n=9)	9 x 0.125 Hz = 1.125 Hz

This process is the frequency-domain analog of measuring a time-domain decay curve. We can transmit at a single fundamental frequency and measure data at five harmonic frequencies. Simultaneously collecting data at multiple frequencies speeds up data collection considerably.

Multiple frequency data allows us to remove an effect known as electromagnetic coupling. EM coupling can produce "false" IP anomalies, which might lead to misinterpretation of the IP results.

EM coupling arises due to interaction of time-varying magnetic fields with receiver dipole wires. The effect is usually not of interest on an IP survey. It obscures the real parameter of interest - ground polarization. The relationships of these parameters can be approximated as:

PHASE DATA = EM COUPLING + POLARIZATION

To make IP survey results more useful, we must remove the EM inductive coupling component from the data in order to look at the true ground polarization response. This is a process known as "decoupling".

The best way to decouple IP data, in our view, is the procedure of Zonge (Zonge and Wynn, 1975; Wynn and Zonge, 1975). However, this is a computationally-intensive solution that is used more often in broadband surveys where discrimination of mineralization types (such as pyrite versus chalcopyrite) is sought. Fortunately, in reconnaissance IP, a simpler quadratic extrapolation technique (Hallof, 1974) works quite nicely. This method uses the principle that inductive EM coupling is strongly frequency-dependent, whereas polarization is not. As frequency decreases, inductive coupling tends to decrease proportionally, while polarization stays relatively constant. Therefore one can extrapolate the phase at 0.625, 0.375, and 0.125 Hz back to 0 Hz in order to remove inductive coupling and get a first-order estimate of the true ground IP response. This "three-point" extrapolation technique was used on this data set to obtain estimates of the decoupled IP response.

Instrumentation

The survey used a 30 kW power system as a current source. The transmitter was the GGT-30, which generates a constant current (±0.5% stability) squarewave at up to 40 amperes or 1000 volts. Transmitter electrode contact resistance was moderate. Ten ampere currents were achieved at frequences up to 2048 Hz. At higher frequencies, the impedance of the transmitter antenna limited transmitter output to eight amperes at 2048 Hz, six amperes at 4096 Hz, and two amperes at 8196 Hz.

The receiver was the GDP-16, a programmable, broad-band, multi-purpose, eight-channel digital receiver manufactured by Zonge Engineering. The GDP-16 runs all types of controlled-source electrical surveys. It stores the measurements in internal solid-state memory. Data can be displayed in the field in either graphic or tabular form. Real-time measurement statistics and graphical display assures the best possible data quality. The data are transferred to a portable computer each night for further processing.

Data Quality

The overall quality of the data is excellent. For 32 to 2048 Hz CSAMT data, the relative apparent resistivity error is less than one percent. Data at 4096 Hz repeated to within two percent. Data at 8192 Hz shows more variation, with an average relative error of five percent.

The CSAMT phase data are also of good quality. Repeated readings show less than ten milliradians of variation in impedance phase for frequencies of 4096 Hz and lower. The 8196 Hz data is more noisy. Repeats show standard deviations of ten to thirty milliradians at 8196 Hz. In general, phase measurements are more sensitive to noise than apparent resistivity measurements. However, this data set is quite clean.

The IP data are also of good quality. Apparent resistivity is repeatable to about five percent. Raw (0.125 Hz) phase is generally repeatable to better than ±0.2 milliradians. The most noise-sensitive parameter is three-point phase. Repeats show that variation in three-point D.C. phase is typically less than ±0.5 milliradians.

Cultural Contamination

The only metallic structure reported was a grounded fence crossing line 18000N. The fence crossed the line at 17715E, trending N60W. The fence had no discernable effect on the data.

Topographic Effects

Overall, the survey area is relatively flat. There are some mountains on the western edge of the survey area, but the data are not significantly affected by topography. Topographic effects are relatively independent of frequency and can be mostly mitigated by static-correction procedures.

Static Effects

Some of the CSAMT resistivity data show evidence of static shift due to near-surface inhomogeneities. The consistency of patterns in apparent resistivity from line to line indicates that the static shift is due to near-surface geology with appreciable strike extent. Applying a static-correction procedure to the CSAMT data removes much of the lateral variation in Cagniard apparent resistivity. A five-point trimmed-moving-average filter at a correction frequency of 8196 Hz was used for this data set. The static corrected data are included as black and white pseudosections in the back pouch. The static-corrected data show the pattern of deeper geology after the effects of near-surface features are removed.

Near-Field Effects

The transmitter-receiver separation of four kilometers was adequate to keep the data in the far-field for all frequencies used in the survey. Assuming a background resistivity of 100 ohm-meters, we were more than four skin depths away from the transmitter at 32 Hz. We always attempt to run CSAMT surveys in the far-field zone in order to avoid the complications of near-field saturation and transition-zone behavior.

CSAET Effects

CSAET assumes a smoothly varying magnetic field. A smoothly varying magnetic field does not have to be measured at as many points as the more rapidly varying electric field. This allows efficient collection of good reconnaissance data, but the assumption of smooth variation must be checked.

Plots of magnetic-field amplitude for this survey show smooth variation from setup to setup. No localized TE-mode current channeling effects are present. The magnetic field was sampled sufficiently for good quality data.

Data Presentation

The data are displayed as contoured pseudosections. The pseudosection plates are stored in the back pockets of this report (see page 3 for a list of plates).

The basic CSAMT data is represented as Cagniard apparent resistivity and phase difference (impedance phase). Black and white pseudosections are included for each of the seven CSAMT lines. The horizontal coordinate on the pseudosections is the east-west grid location. The vertical coordinate is frequency. Measured values for each station and frequency are posted and contoured on the pseudosections. Resistivities are given in ohm-meters and phase difference in milliradians.

A second representation of the CSAMT data is given by the smooth-model inversion results. The results of smooth-model inversion are presented as color pseudosections. Again the horizontal coordinate is east-west grid location in feet, but the vertical coordinate is depth in feet. The smooth-model procedure takes apparent resistivity and phase difference as input data and returns a vertical profile of resistivity. Model resistivities to depths of 1500 feet are contoured on the colored CSAMT plates. The contour interval is logarithmic with warm colors signifying conductors and cool colors signifying resistive geology.

The IP data includes apparent resistivity, raw (0.125 Hz) phase angle, and three-point decoupled phase angle. The data are presented as contoured pseudosections with posted data values. The contoured IP data for line 16000N and 17500N are located in the back pockets as plates 3E and 6E respectively. Resistive areas are colored with cool colors and conductive areas are colored with warm colors. Phase is colored so that higher phase responses are red, orange, and yellow.

Modeling

The smooth-model inversion algorithm is designed to economically produce an inversion of entire CSAMT data sets. Instead of predicting sharp boundaries, which can be misleading, smooth-modeling produces a smoothly-varying resistivity cross-section, a cross-section that graphically represents the diffuse nature of electrical measurements.

The modeling program calculates a sequence of thin layers (two per frequency) which provide a best fit to the data. The calculated resistivities of these layers are then plotted against layer depth to produce the final smooth-model cross-section.

Smooth-model resistivity is much more representative of the ground response than apparent resistivity. **Near-field and transition-zone data are explicitly modeled by the program.** The result is substantially more reliable than the Bostick transformation or other far-field inversion schemes and the result is readily interpretable in geologic terms.

Figure 3 is a plot of log(resistivity) versus depth for one station on line 15500N. Three approaches to modeling are presented in figure 3. The smooth-model result is marked by the profile with small stars. It starts with a surface resistivity of 87 ohm-meters and gradationally drops to 20 ohm-meters at a depth of 200 feet. An alternative approach is a layered-earth model. The model profile with a sharp transition at 140 feet was generated by the program CSINV. CSINV attempts to fit the data with a model with the fewest possible number of layers. Finally, the results of a Bostick transformation are shown by the model profile with open circles. The Bostick transformation is only applicable to far-field data. In this case, the Bostick approximation gives consistently higher resistivities than either smooth or layered models, particularly for the low-frequency data.

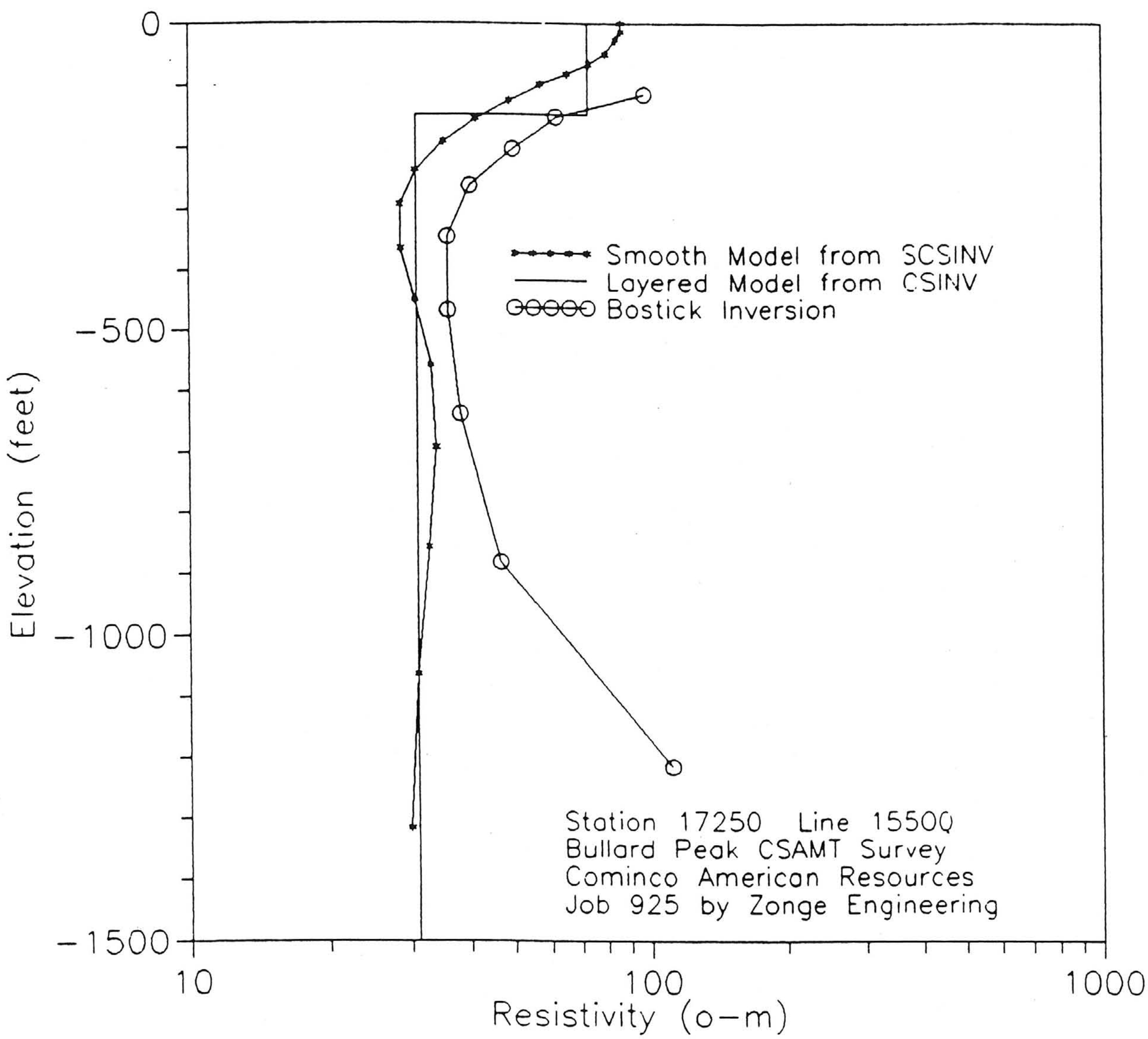


Figure 3: Three approaches to modeling, smooth-model inversion, layered-earth, and the Bostick transformation. Smooth-model inversion generates a model with many layers, but resistivity is constrained to vary smoothly from layer to layer. Layered-earth inversion generates a model with the fewest possible number of layers. The Bostick transformation is a first-order approximation to inversion which is valid only for far-field data.

Conclusions

The survey successfully delivered good quality data. Apart from the early delay due to heavy rain, the crew kept to a good production schedule. The CSAMT data show NW - SE trends which are consistent from line to line. The IP data support the CSAMT results with the addition of information on polarizablity. We hope that this data set is useful to Cominco American Resources in its exploration effort.

References

Hallof, P.G., 1974, The IP phase measurement and inductive coupling: Geophysics, 39, 650-665.

Wynn, J.C., and Zonge, K.L., 1975, EM coupling, its intrinsic value, its removal and the cultural coupling problem: Geophysics, 40, 831-850.

Zonge, K.L., and Wynn, J.C., 1975, Recent advances and applications in complex resistivity measurements: Geophysics, 40, 851.

Scott MacInnes
Geophysicist

Steve Wilds
Geophysicist

APPENDIX A

About Zonge Engineering

Zonge Engineering is a high-technology company specializing in the design and construction of state-of-the-art geophysical instrumentation, providing geophysical field surveys, and geophysical consulting. The company is active in solving a wide range of exploration and geotechnical problems, including exploration for precious metals, industrial/base minerals, coal, oil, gas, geothermal resources, and mapping sources of groundwater contamination.

Founded in 1972 by a small group of geophysicists and engineers, Zonge Engineering has emerged as the leader in innovative, high-quality geophysical services. The company has pioneered in such geophysical breakthroughs as mineral type discrimination in disseminated sulfide deposits (1972), introduction of the world's first backpackable digital geophysical receiver (1976), first commercial development of the CSAMT electromagnetic sounding technique (1978), and development of early-time TEM and metal detector equipment (1989). Today, the company is actively involved in continually expanding the capabilities of electrical techniques in energy and environmental applications.

Zonge Engineering and its affiliate, Zonge Engineering Australia Pty., Ltd., are solutions-oriented companies which are meeting the challenges of today's changing exploration needs.

Instrumentation

Instrumentation includes digital, backpackable receivers, ranging from simple, inexpensive devices to multi-function, multi-channel receivers of impressive flexibility. The company offers a complete product line of geophysical transmitters, power sources, and auxiliary gear. The equipment is backed by an expanding international service network and a complete software support package.

Field Surveys

Field services include the entire range of electrical techniques, from simple SP, VLF, magnetics, and gravity, to more sophisticated techniques such as MT, CSAMT, TEM, IP, and CR. In thousands of line-kilometers of data acquired worldwide, Zonge Engineering field crews have gained a superior reputation for innovation and attention to detail. This commitment produces data of consistently superior quality.

Typical field applications include:

Precious Metals
- Mapping silicification
- Mapping pyrite when associated with mineralization
- Mapping structure & lithology

Sulfides
- Direct mapping of mineralization
- Mapping structure and alteration
- Discriminating types of mineralization
- Monitoring in-situ leaching processes
- Mapping ground water systems
- Detecting pond leaks and ground water contamination

Coal
- Mapping sulfur content in coal seams when sulfur is associated with pyrite
- Monitoring coal gasification & fires

Industrial, Strategic, & Base Minerals
- Mapping structure (faults, fractures, voids, etc.) and lithology
- Mapping alteration

Ground Water Contamination
- Mapping hazardous waste spills and leaks from storage tanks, pipelines, drums, injection wells, etc.
- Detecting leaks in the liners of waste-containment ponds
- Detecting buried drums in landfills
- Mapping fractures and porosity to guide monitoring well drilling
- Determining depths to confining layers and basement
- Mapping seawater brine incursion into fresh on-shore aquifers

Engineering & Geotechnical Applications
- Mapping leaks and corrosion in dams
- Detecting surface voids and structures beneath concrete and pavement
- Detecting buried pipes
- Mapping shallow clay layers
- Mapping structure, lithology, and water for mine planning and for enhanced recovery of oil, sulfides, and coal

Ground Water Exploration
- Detecting and mapping ground water
- Mapping structure and porosity
- Mapping ground water salinity

Petroleum Exploration & Development
- Structure and lithology mapping prior to more costly seismics, especially in "difficult" seismic areas (volcanics, clinkers, weathered surface, overthrust)
- Joint electrical/seismic interpretation for statics, lithology, etc.
- Mapping possible near-surface electrochemical alteration due to upward petroleum diffusion
- Surface monitoring of fracture & steam-flood secondary recovery operations
- Mapping and monitoring petroleum and brine leaks from injection wells, refineries, tanks, pipelines, etc.

Geothermal Exploration and Development
- Mapping reservoir fluids
- Mapping faults and fractures
- Mapping basement, intrusives, and other lithology
- Mapping magmatic heat sources
- Mapping hydrothermal alteration zones
- Monitoring steam development, fluid depletion, and fluid movement in producing reservoirs

Zonge Engineering maintains a four-crew capability for work throughout the world, with primary emphasis on North America and Australasia. Our client list now includes over 220 companies and organizations. Typical clients include:

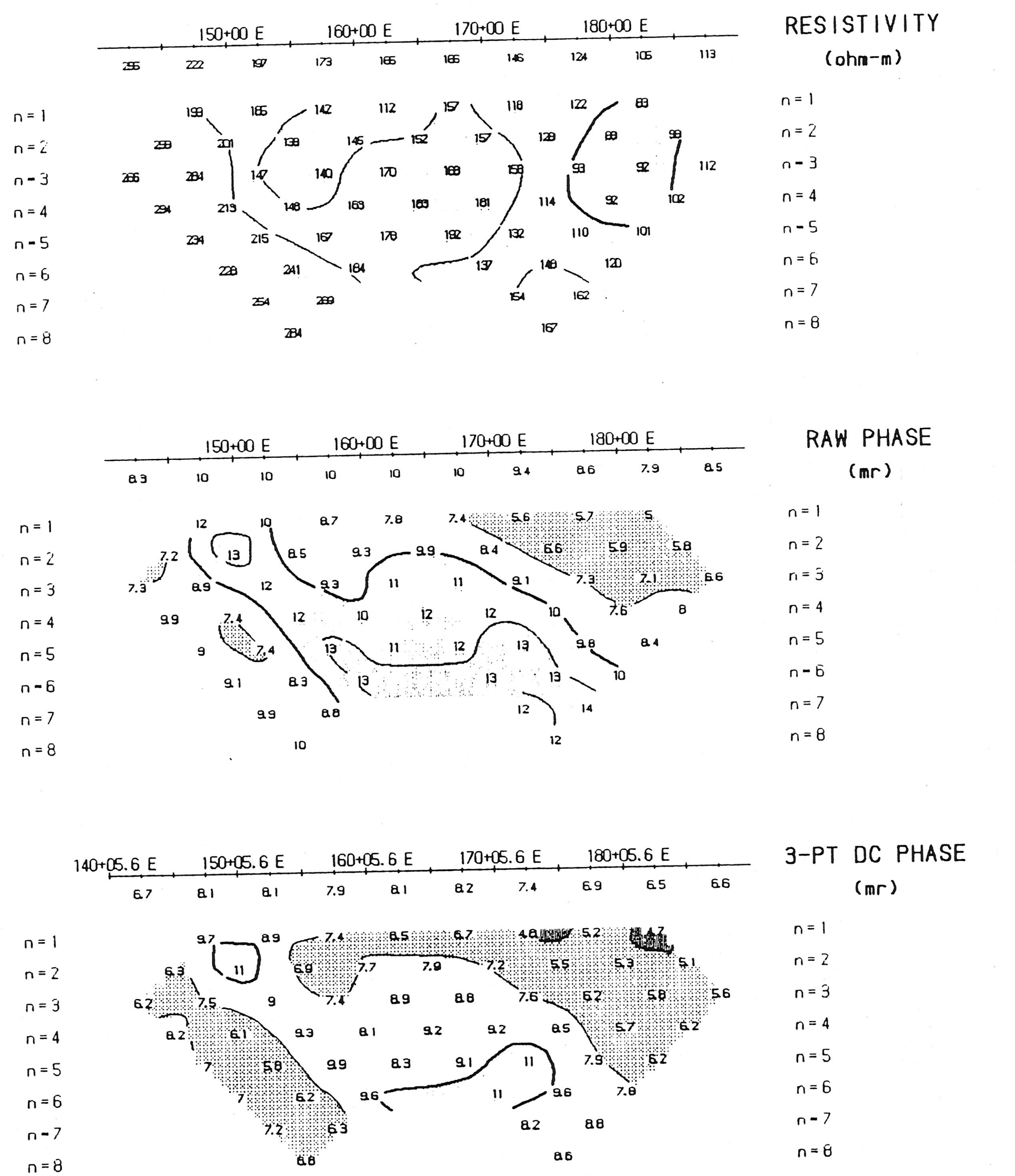
Mining
AMAX
Anaconda
Asamera
ASARCO
Billiton
BHP
Chevron
Cominco
Freeport-McMoran
Goldfields
Kerr-McGee
Magma Copper
Newmont
Phelps-Dodge
Santa Fe Mining
Teck Explorations
Tenneco
Texasgulf Minerals
U.S. Borax
Western Mining

Environmental
(numerous industry clients)
Engineering Ent.
ENSCO
Geraghty & Miller
HydroGeo Chem
Pacific Power & L
So. Calif. Edison

Petroleum/Geothermal
ARCO
Conoco
Exxon
Gulf
Marathon Oil
Milestone
Mobil R&D
Phillips
Sun
Texaco

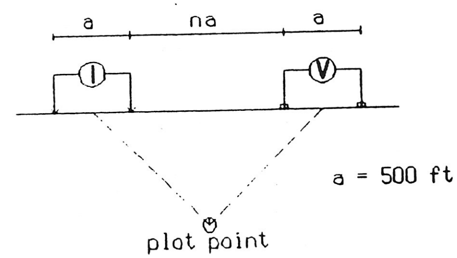
Geophysical Consulting

Consulting services are available for research and development projects, establishing in-house geophysics programs within exploration and consulting companies, and the development of practical software for data acquisition and analysis. We also offer a program in which we re-process and re-interpret data collected by other companies or contractors.



Line 17500 N

Dipole-Dipole Array



Logarithmic Contours 1, 1.5, 2, 3, 5, 7.5, 10, ...

Plate 6E

Scale 1:15240

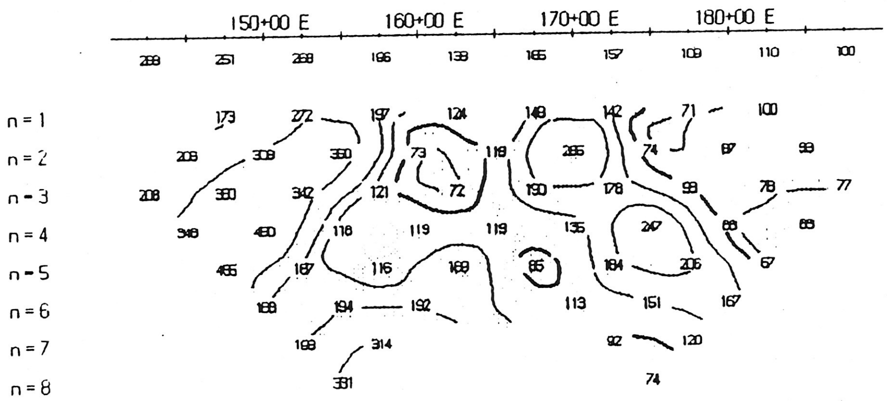
500 0 500 1000 1500 2000
(feet)

COMINCO AMERICAN

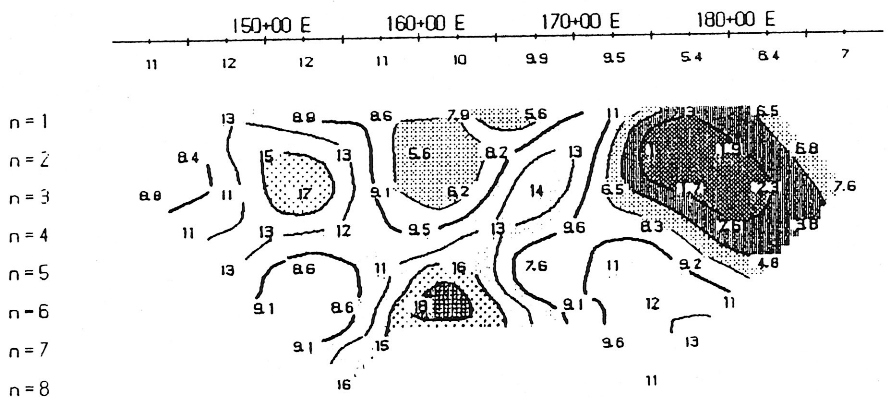
INDUCED POLARIZATION SURVEY
Job925
Bullard Peak

Date: 90/02/06

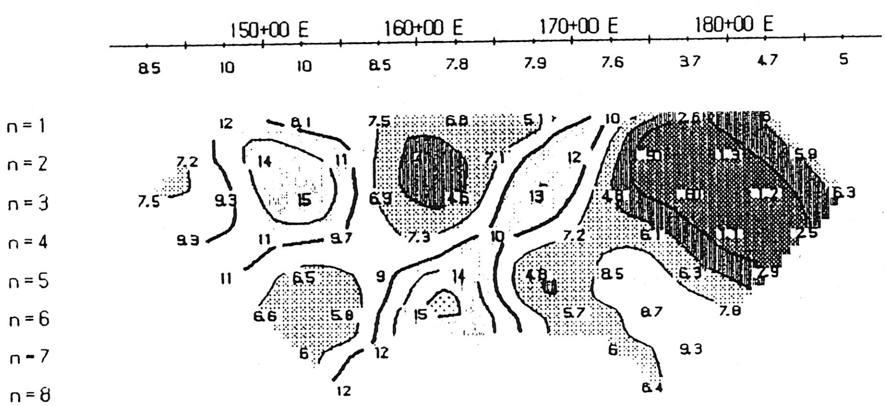
by Zonge Engineering



RESISTIVITY
(ohm-m)



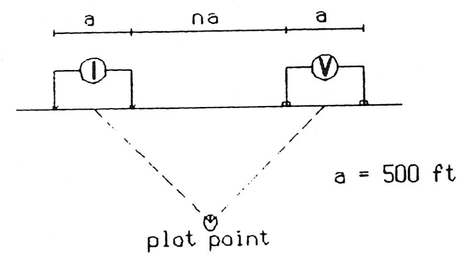
RAW PHASE
(mr)



3-PT DC PHASE
(mr)

Line 16000 N

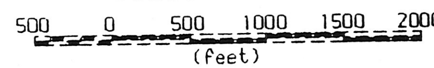
Dipole-Dipole Array



Logarithmic Contours 1, 1.5, 2, 3, 5, 7.5, 10, . . .

Plate 3E

Scale 1:15240

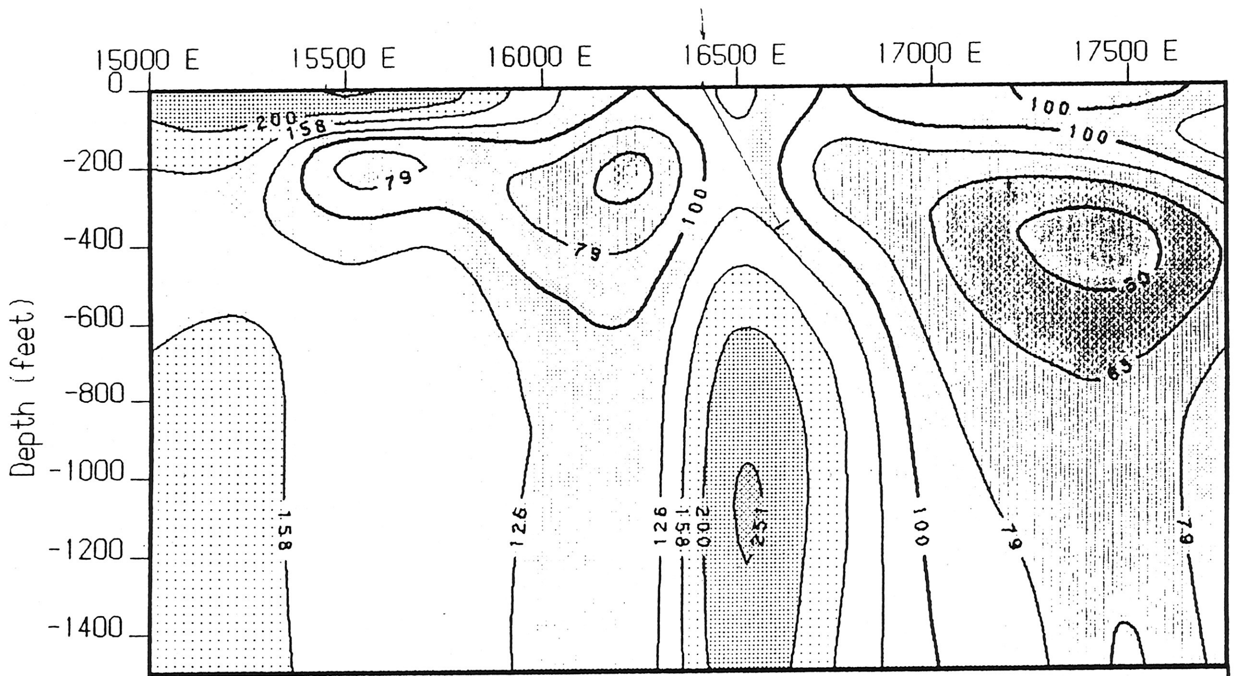


COMINCO AMERICAN

INDUCED POLARIZATION SURVEY
Job925
Bullard Peak

Date: 90/02/06

by Zonge Engineering

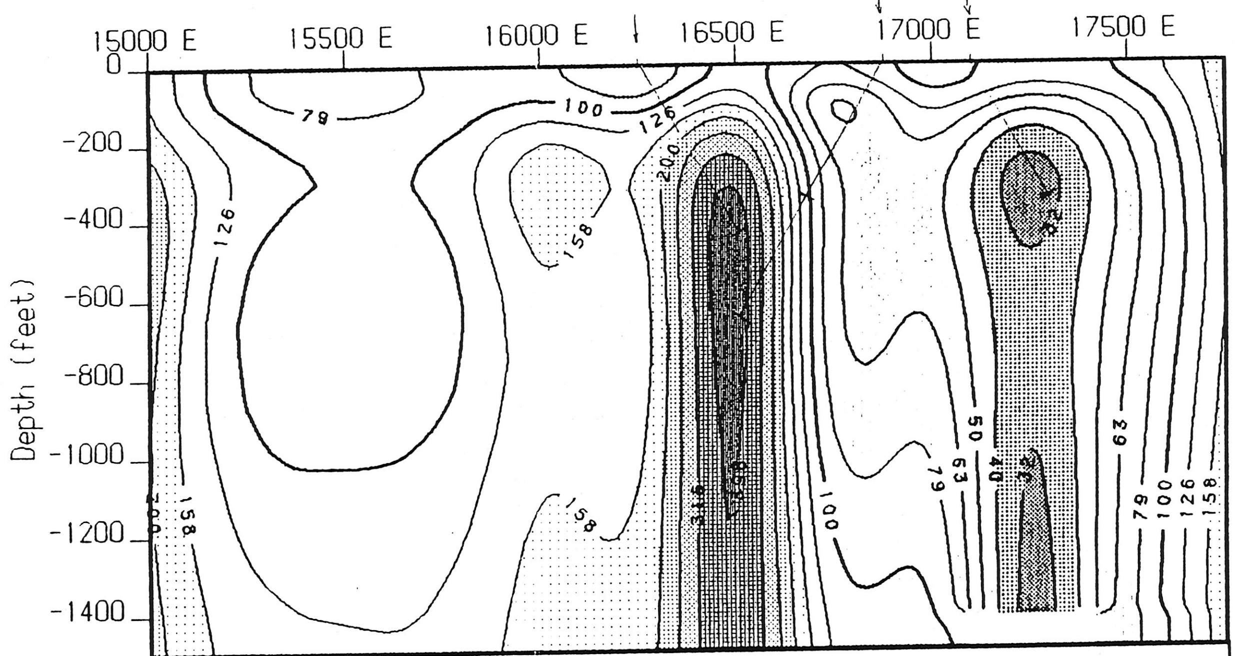


Bullard Peak Line 15000N

Smooth-model Inversion of Cagniard Resistivity

For Cominco American, Job 925 by Zonge Engineering

Plate 1D

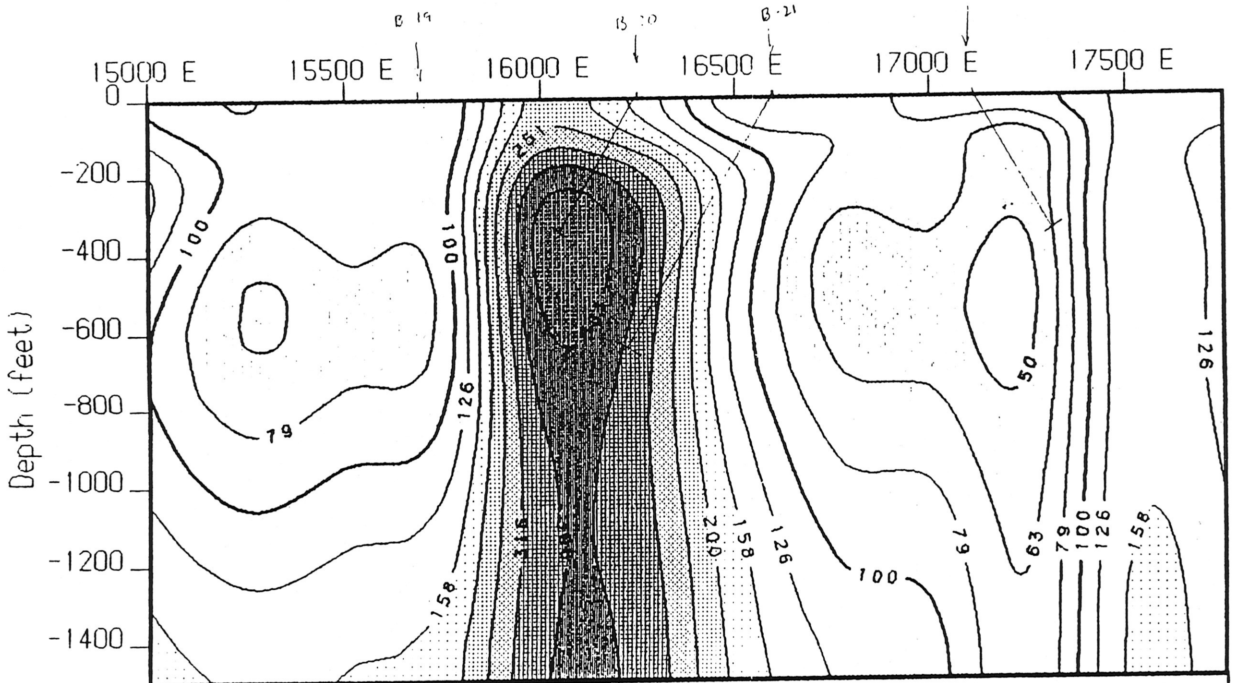


Bullard Peak Line 15500N

Smooth-model Inversion of Cagniard Resistivity

For Cominco American, Job 925 by Zonge Engineering

Plate 2D

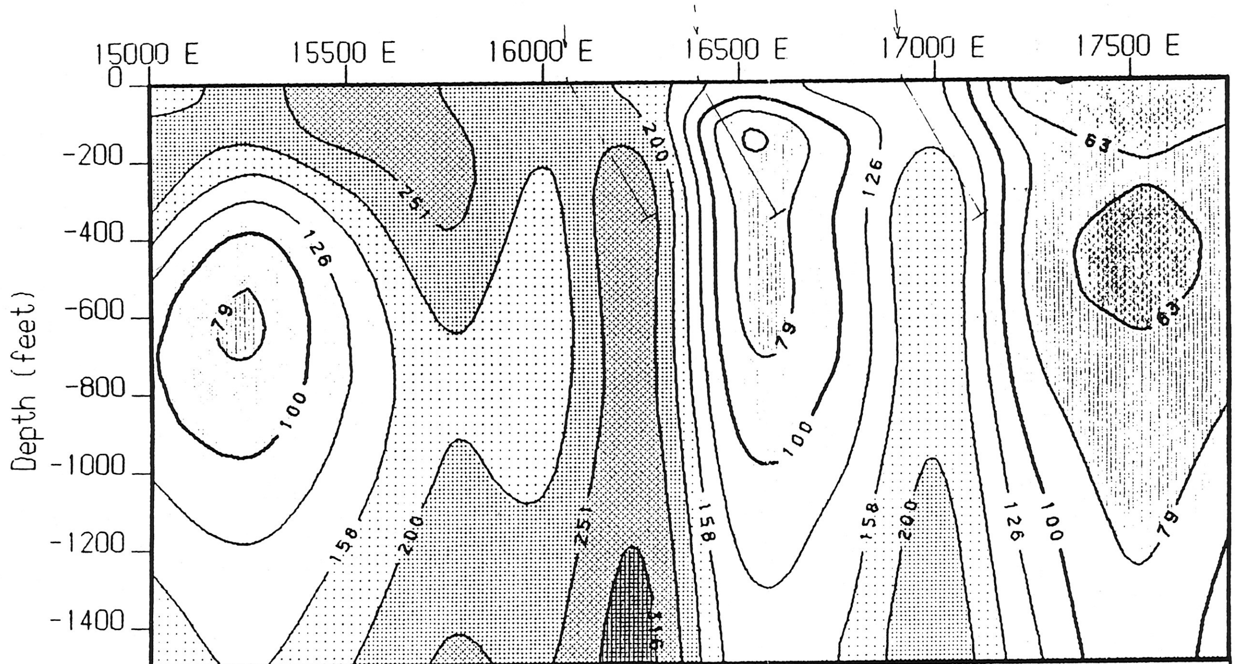


Bullard Peak Line 16000N

Smooth-model Inversion of Cagniard Resistivity

For Cominco American, Job 925 by Zonge Engineering

Plate 3D

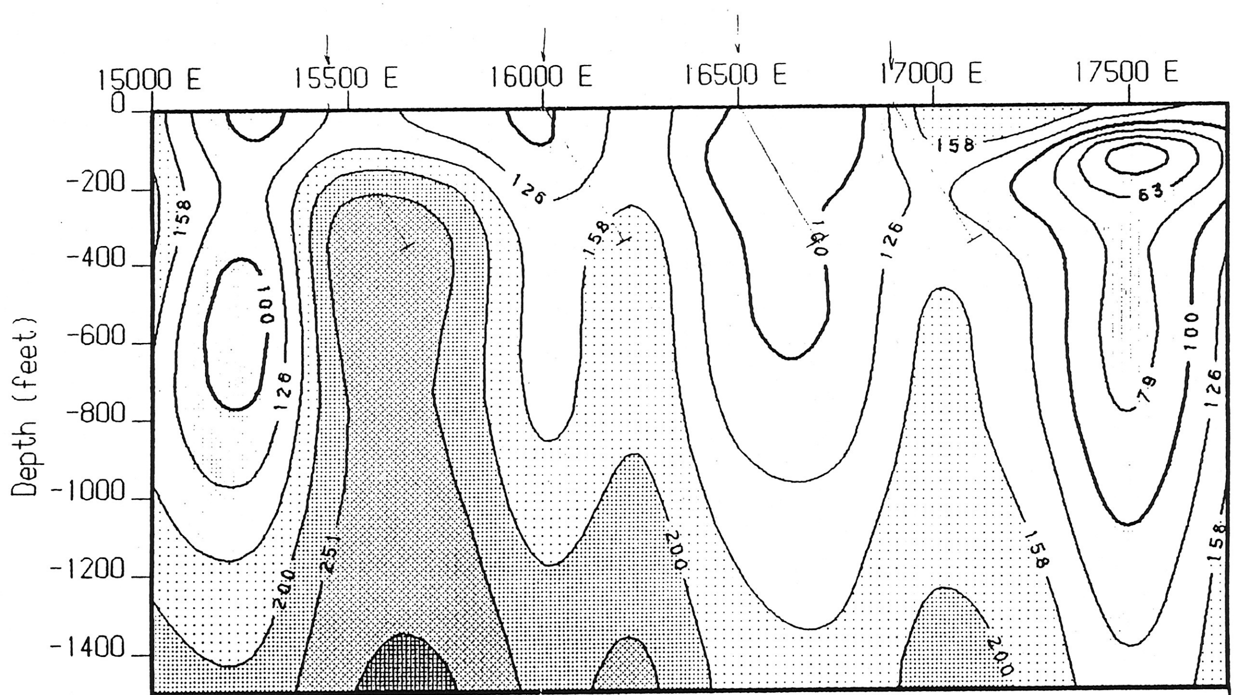


Bullard Peak Line 16500N

Smooth-model Inversion of Cagniard Resistivity

For Cominco American, Job 925 by Zonge Engineering

Plate 4D 1" = 500'



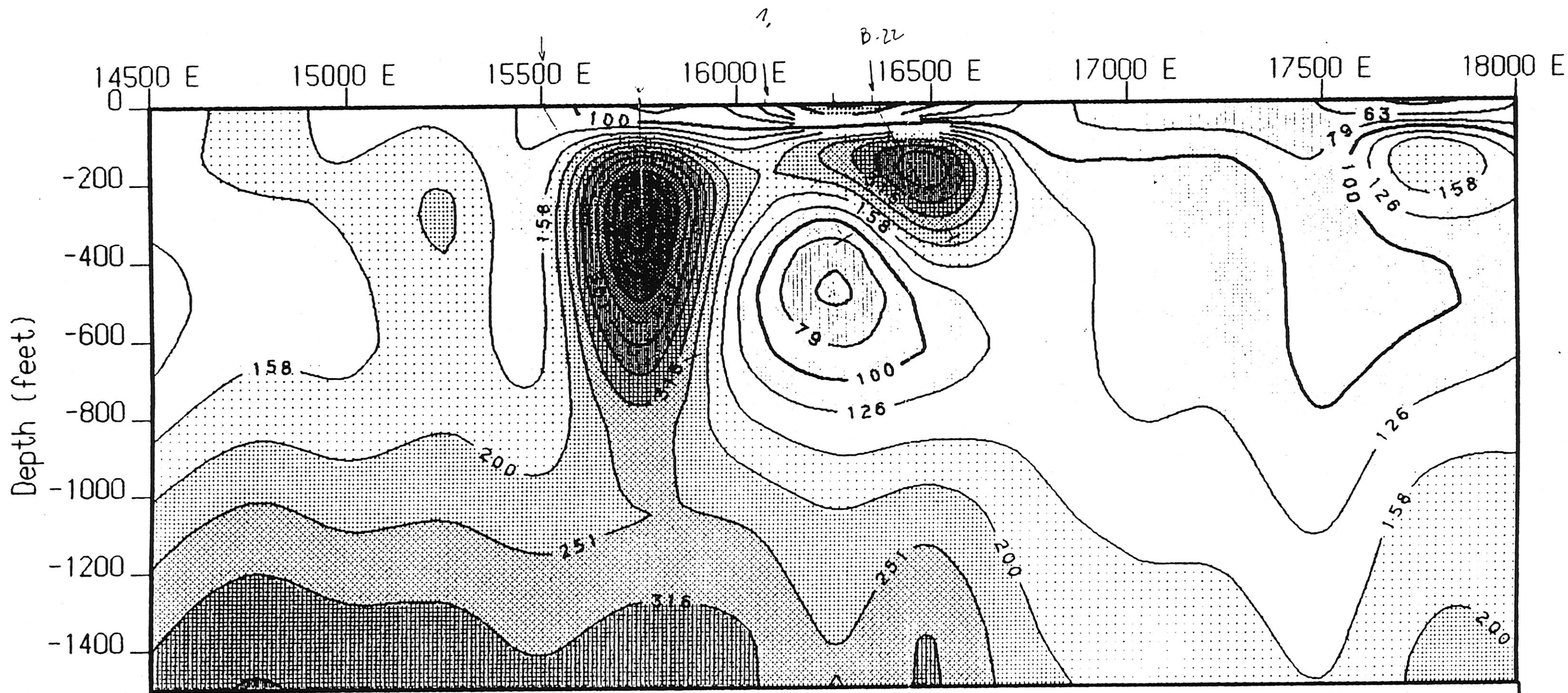
Bullard Peak Line 17000N

Smooth-model Inversion of Cagniard Resistivity

For Cominco American, Job 925 by Zonge Engineering

Plate 5D

1" = 500'



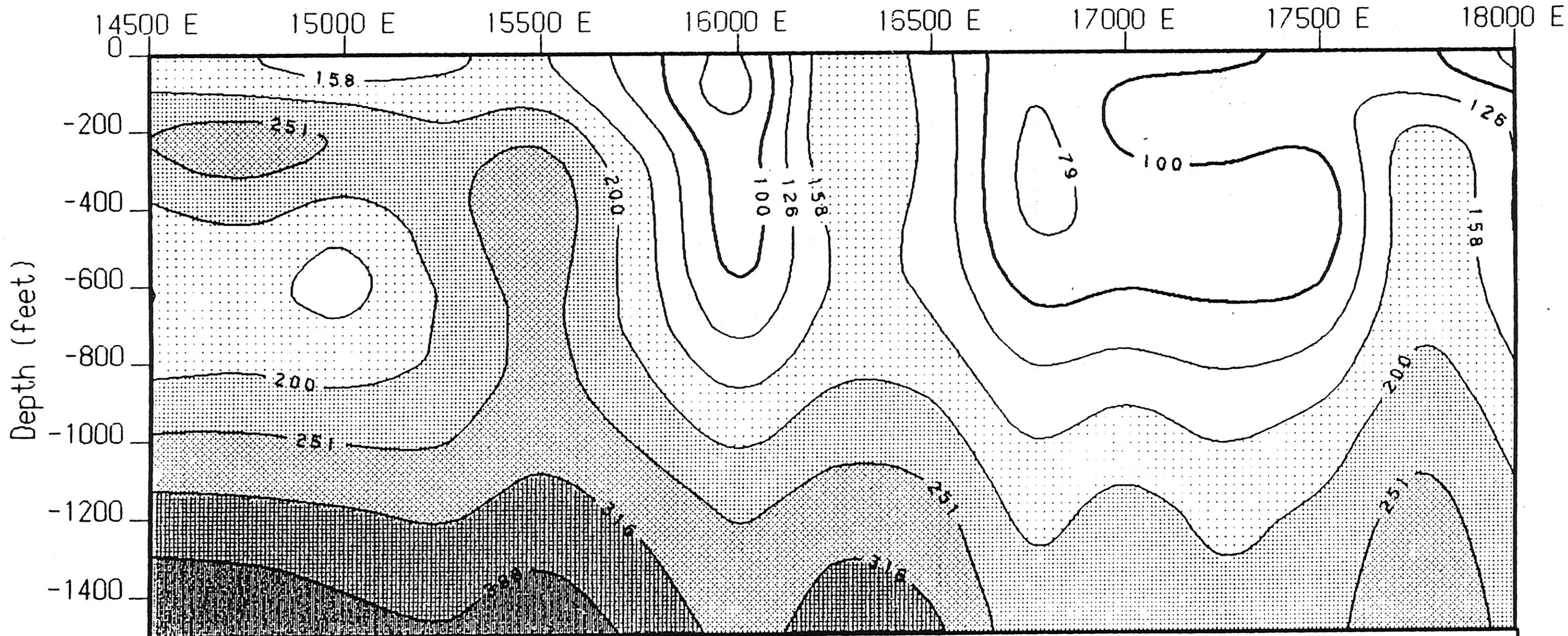
Bullard Peak Line 17500N

Smooth-model Inversion of Cagniard Resistivity

For Cominco American, Job 925 by Zonge Engineering

Plate 6D

1" = 500'



Bullard Peak Line 18000N

Smooth-model Inversion of Cagniard Resistivity

For Cominco American, Job 925 by Zonge Engineering

Plate 7D

Line 18000
Bullard Peak
for
COMINCO AMERICAN

CSAMT SURVEY DATA
STATIC-CORRECTED RESISTIVIT
5-PT. TMA FILTER AT 8192 HZ

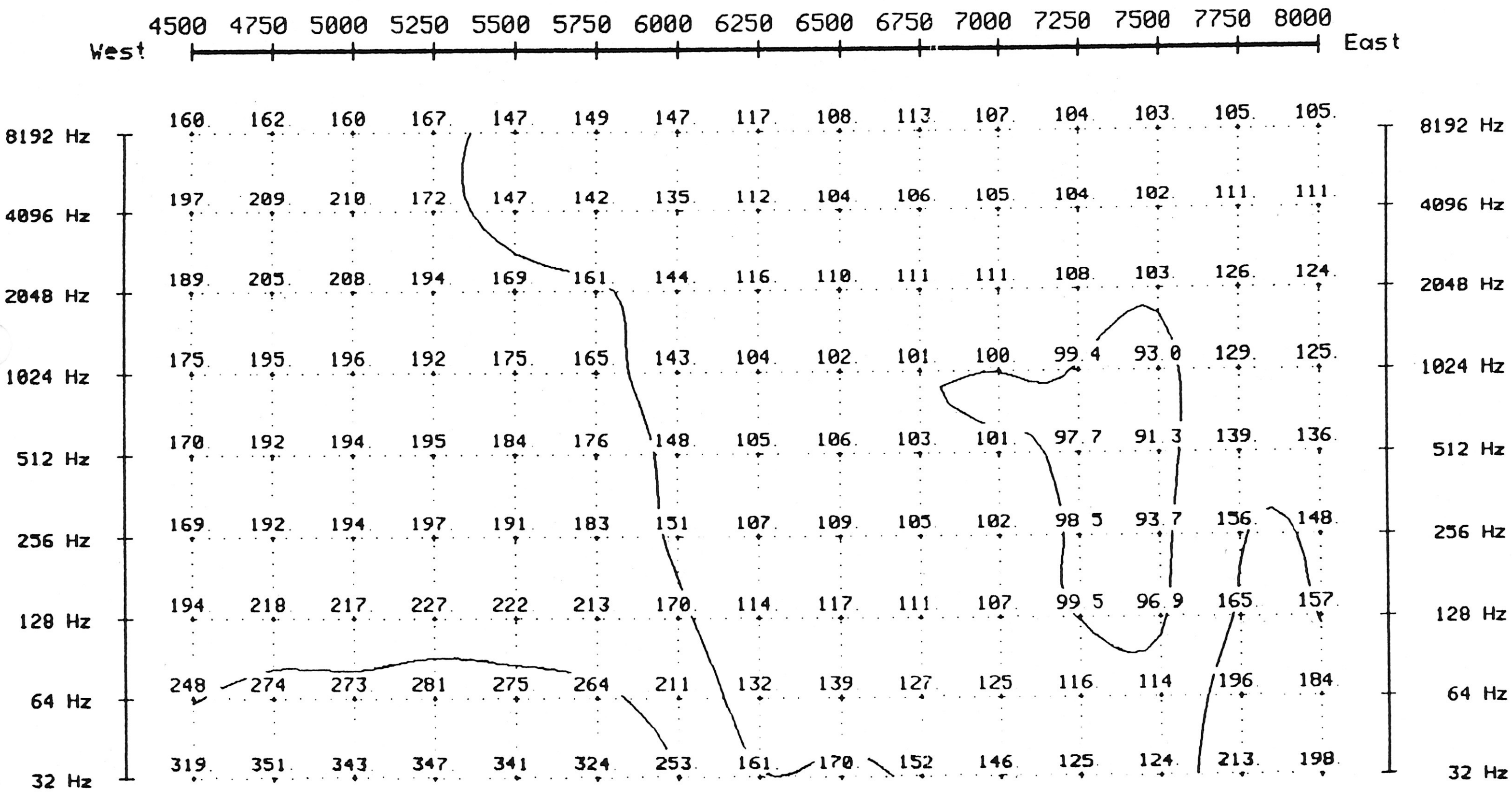
[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[89.5]
100
158
251
[351.]

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

SurveYed= 012090

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 3.0 mi
Rx to Tx= South

Field Job 925
CPLOT 5.53
Plotted 31 Jan 90



	4500	4750	5000	5250	5500	5750	6000	6250	6500	6750	7000	7250	7500	7750	8000
8192 Hz	160	162	160	167	147	149	147	117	108	113	107	104	103	105	105
4096 Hz	197	209	210	172	147	142	135	112	104	106	105	104	102	111	111
2048 Hz	189	205	208	194	169	161	144	116	110	111	111	108	103	126	124
1024 Hz	175	195	196	192	175	165	143	104	102	101	100	99.4	93.0	129	125
512 Hz	170	192	194	195	184	176	148	105	106	103	101	97.7	91.3	139	136
256 Hz	169	192	194	197	191	183	151	107	109	105	102	98.5	93.7	156	148
128 Hz	194	218	217	227	222	213	170	114	117	111	107	99.5	96.9	165	157
64 Hz	248	274	273	281	275	264	211	132	139	127	125	116	114	196	184
32 Hz	319	351	343	347	341	324	253	161	170	152	146	125	124	213	198

Plate 7C

Line 18000
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPLOT 5.53
P[illegible]ed 29 Jan 90

CSAMT SURVEY DATA
PHASE DIFFERENCE (E - H)

values in milli-radians

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   Dipole= East

Surveyed= 012090

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 3.0 mi
Rx to Tx= South

[Plot limits] and ARITHMETIC CONTOURS
(Interval: 100.00)
[119.]
200.
300.
400.
500.
600.
700.
[755.]

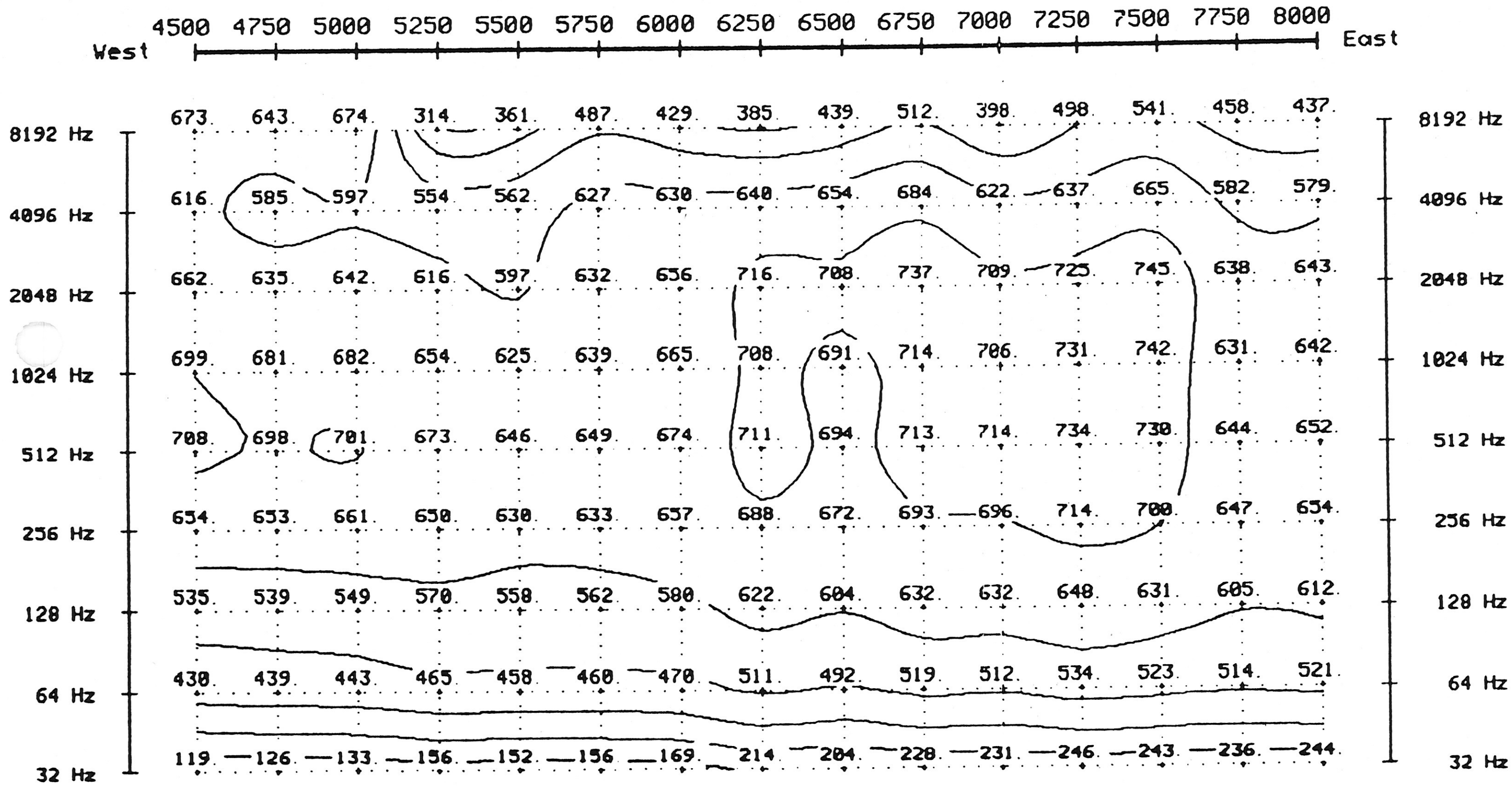


Plate 7B

Line 18000
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPLOT 5.53
P ed 29 Jan 90

CSAMT SURVEY DATA
CAGNIARD RESISTIVITY

values in ohm-meters

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

Surveyed= 012090

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 3.0 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[72.5]
100.
158.
251.
398.
[417.]

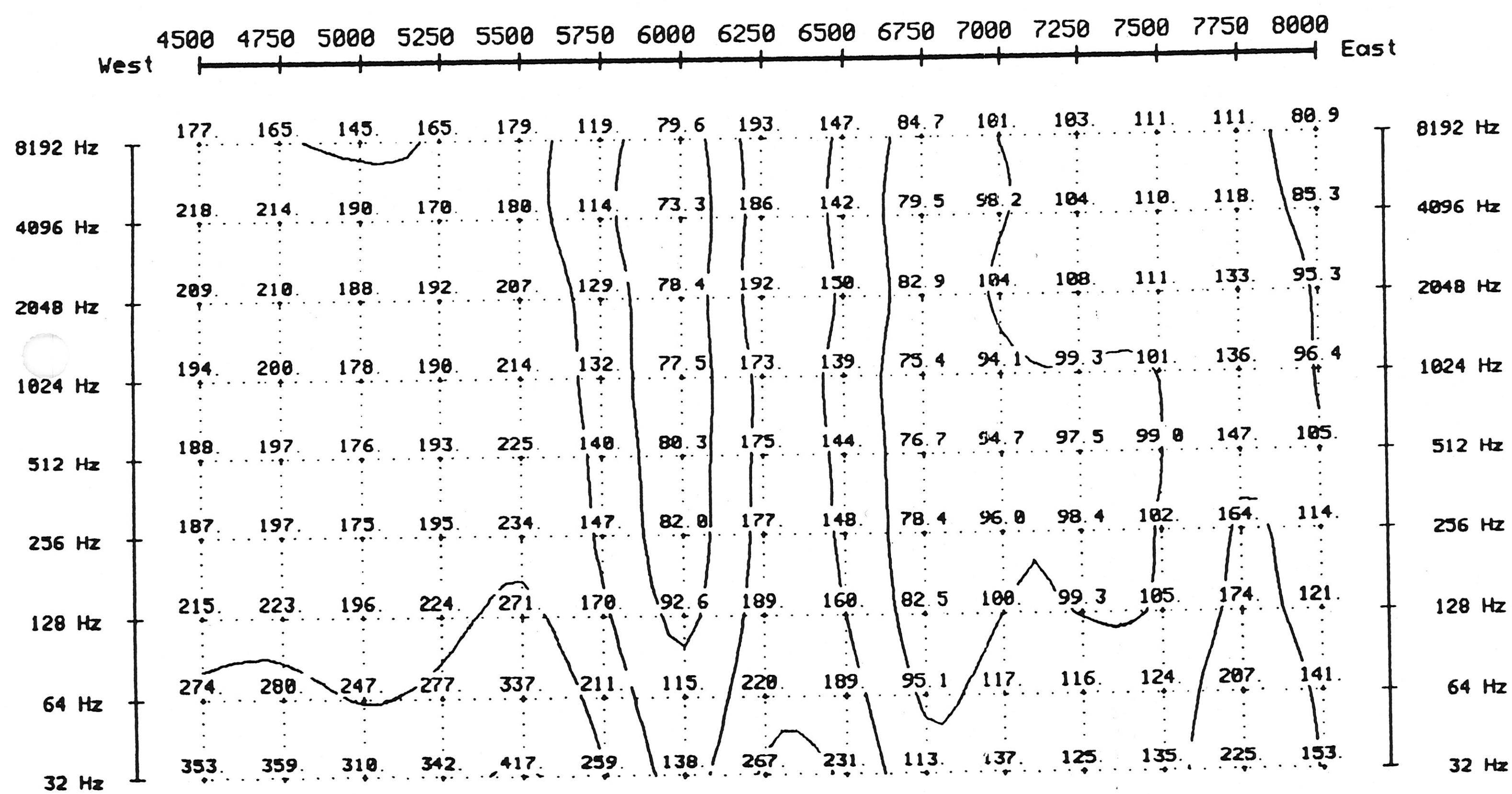


Plate 7A

Line 17500
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPLOT 5.53
lotted 31 Jan 90

CSAMT SURVEY DATA
STATIC-CORRECTED RESISTIVIT
5-PT. TMA FILTER AT 8192 HZ

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

SurveYed= 011990

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 3.0 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[67.8]
100
158.
251.
398.
631.
[672.]

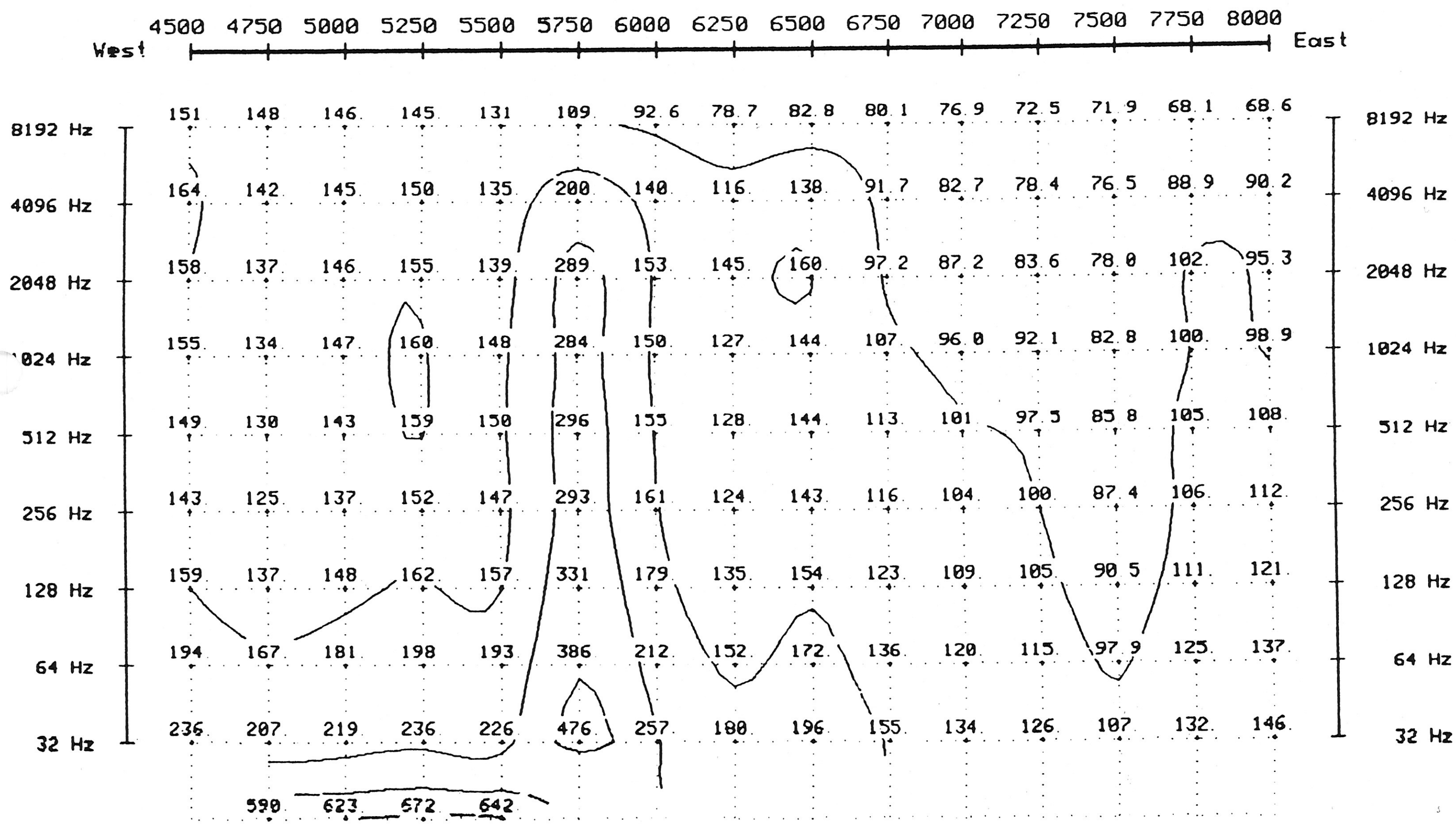


Plate 6C

Line 17500
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPL . 53
Plot 29 Jan 90

CSAMT SURVEY DATA
PHASE DIFFERENCE (E - H)

values in milli-radians

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 011990

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 3.0 mi
Rx to Tx= South

[Plot limits] and ARITHMETIC CONTOURS
(Interval: 100.00)
[125.]
200.
300.
400.
500.
600.
700.
800.
[865.]

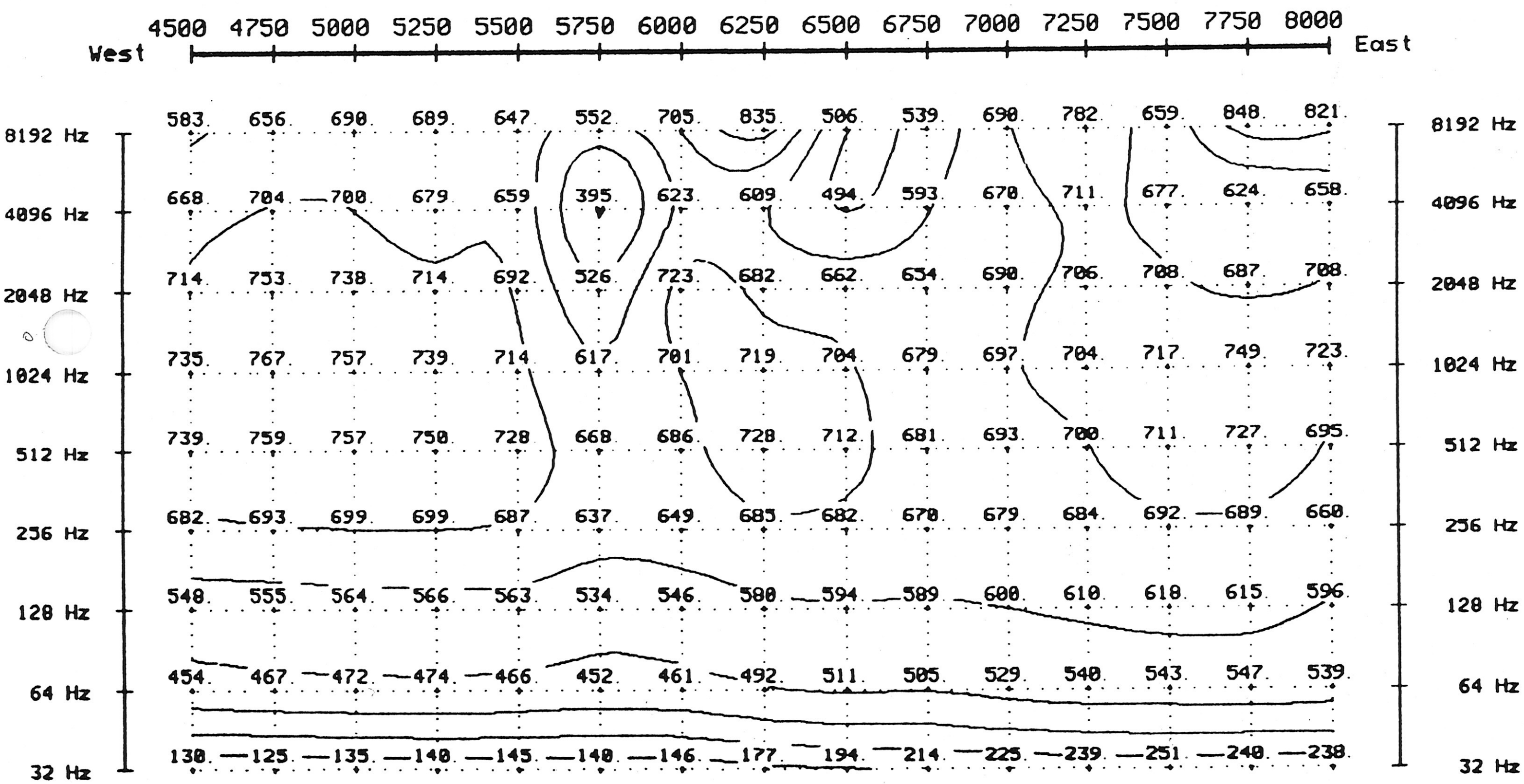


Plate 6B

Line 17500
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
C[illegible]T 5.53
P[illegible]ted 29 Jan 90

CSAMT SURVEY DATA
CAGNIARD RESISTIVITY

values in ohm-meters

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

SurveYed= 011990

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 3.0 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[53.3]
63.1
100.
158.
251.
398.
[533.]

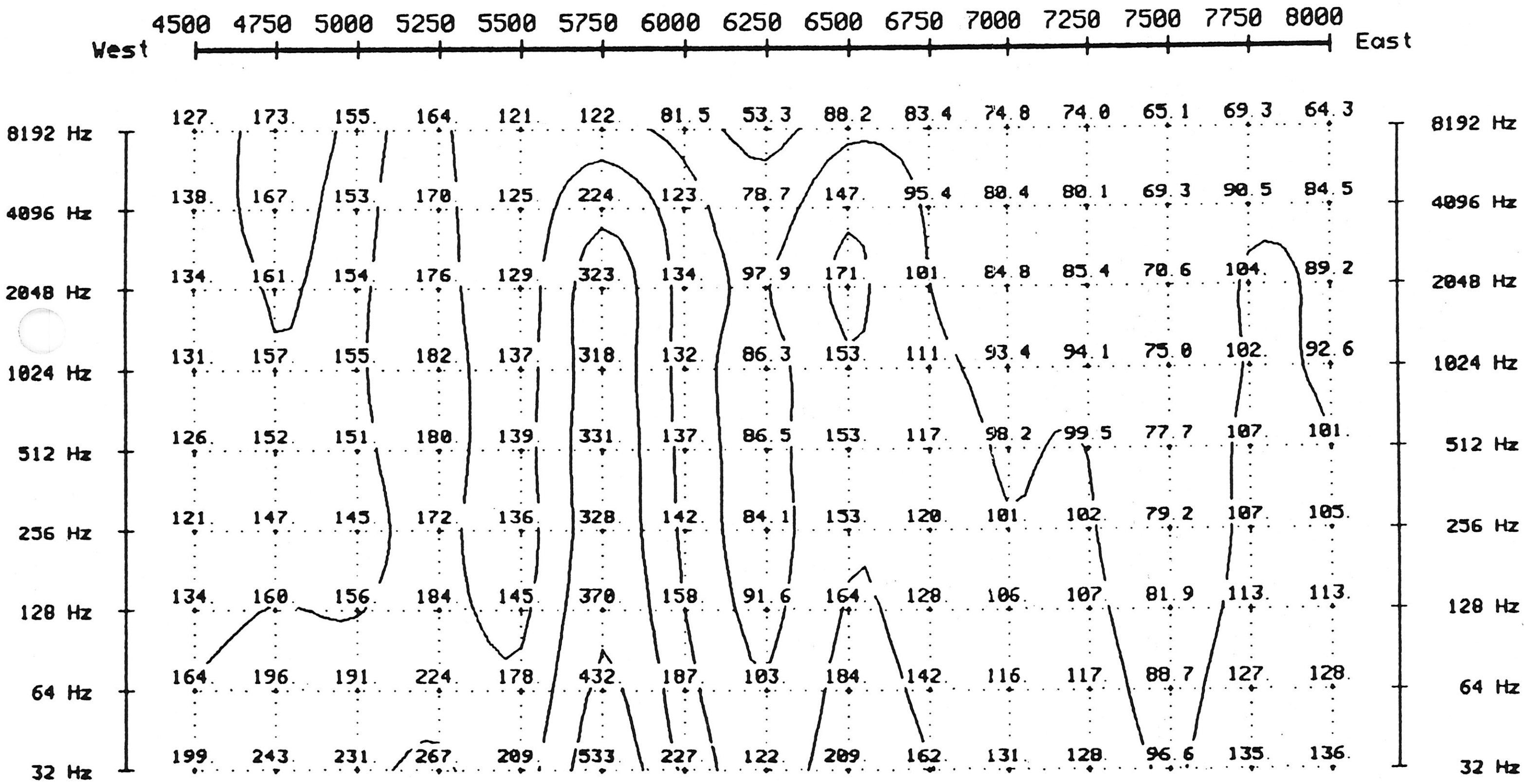


Plate 6A

Line 17000
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
PLOT 5.53
Plotted 31 Jan 90

CSAMT SURVEY DATA
STATIC-CORRECTED RESISTIVIT

5-PT. TMA FILTER AT 8192 HZ

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

Surveyed= 012090

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.8 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[78.0]
100.
158.
251.
[330.]

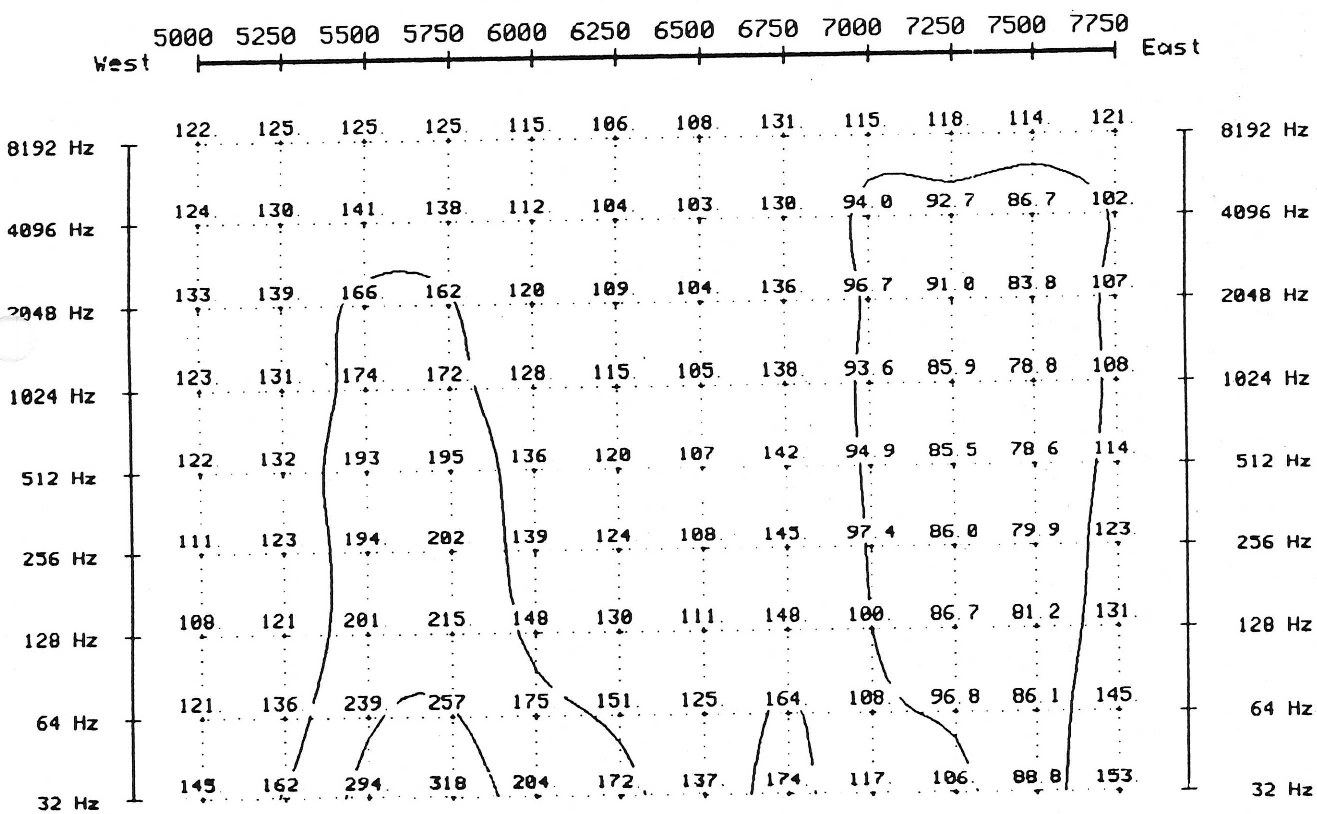


Plate 5C

Line 17000
Bullard Peak
for
COMINCO AMERICAN

CSAMT SURVEY DATA
PHASE DIFFERENCE (E - H)

values in milli-radians

[Plot limits] and ARITHMETIC CONTOURS
(Interval: 100.00)
[171.]
200.
300.
400.
500.
600.
700.
800.
[822.]

RECEIVER DATA
Length = 76. m Line = East
SPacing= 76. m DiPole= East

SurveYed= 012090

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.8 mi
Rx to Tx= South

ield Job 925
PLC .53
Plotted 29 Jan 90

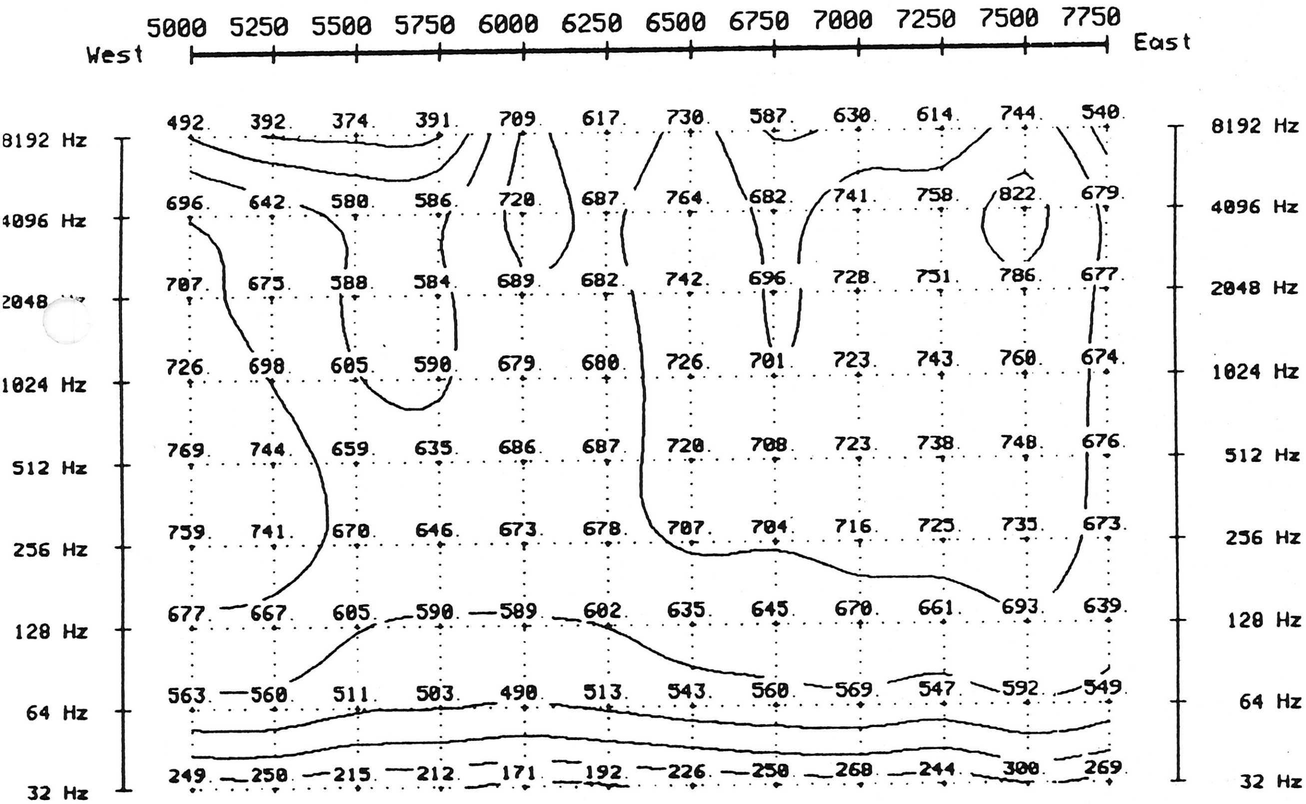


Plate 5B

Line 17000
Bullard Peak
for
COMINCO AMERICAN

CSAMT SURVEY DATA
CAGNIARD RESISTIVITY

values in ohm-meters

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[64.2]
100.
158.
251.
[371.]

Field Job 925
CP 5.53
Pl ed 29 Jan 90

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 012090

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.8 mi
Rx to Tx= South

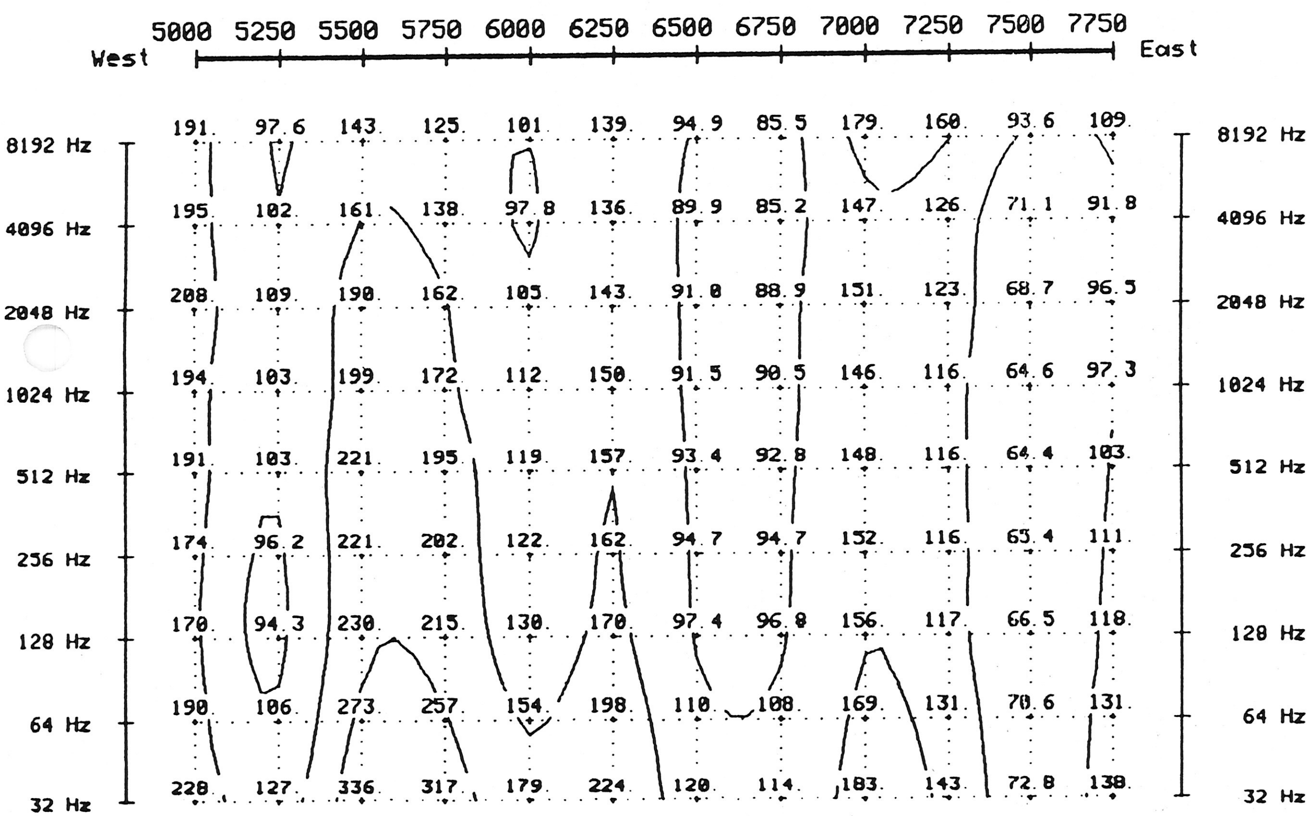


Plate 5A

Line 16500
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
PLOT 5.53
Plotted 31 Jan 90

CSAMT SURVEY DATA
STATIC-CORRECTED RESISTIVIT

5-PT. TMA FILTER AT 8192 HZ

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.7 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval 0 20)
[70 9]
100
158
251
[321.]

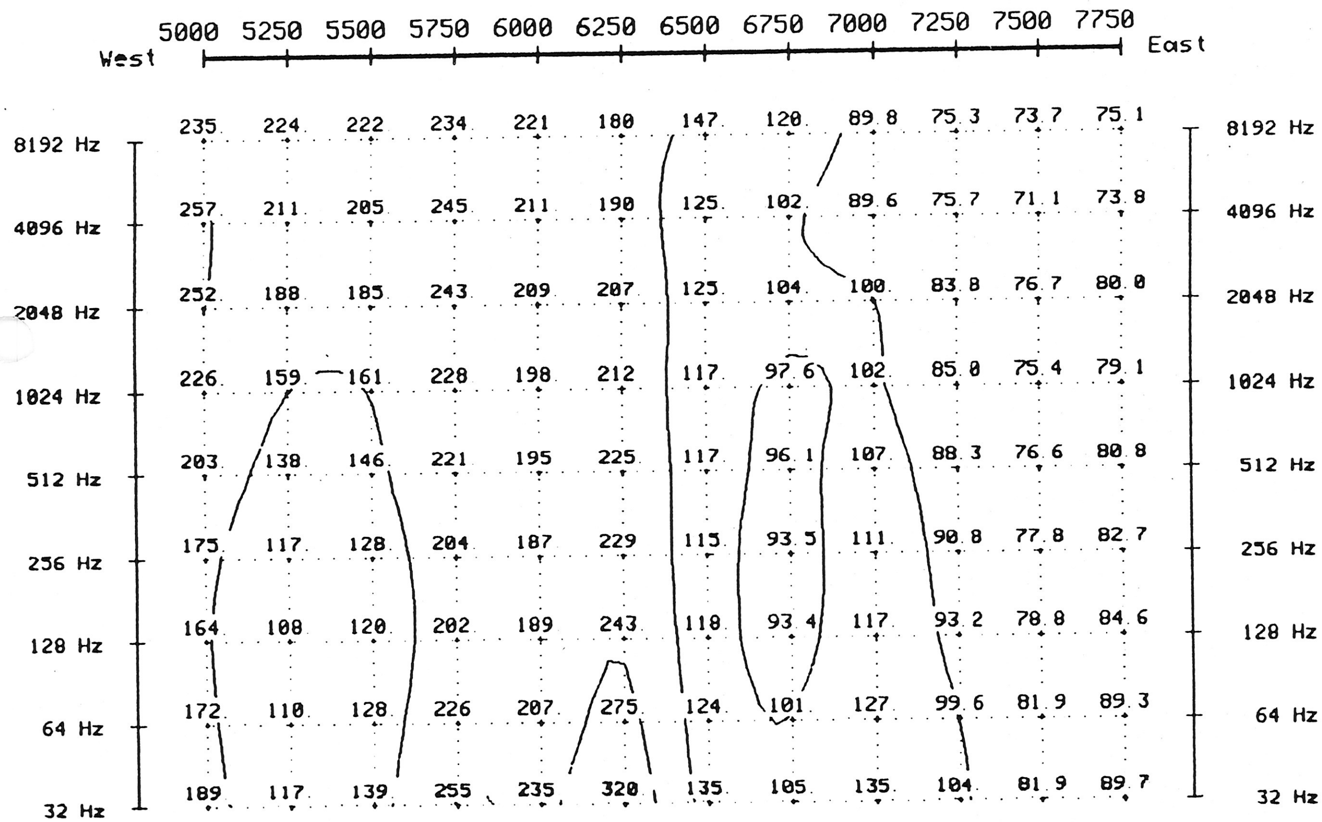


Plate 4C

Line 16500
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPL .53
Plo..d 29 Jan 90

CSAMT SURVEY DATA
PHASE DIFFERENCE (E - H)
values in milli-radians

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.7 mi
Rx to Tx= South

[Plot limits] and ARITHMETIC CONTOURS
(Interval: 100.00)
[190.]
200.
300.
400.
500.
600.
700.
800.
[883.]

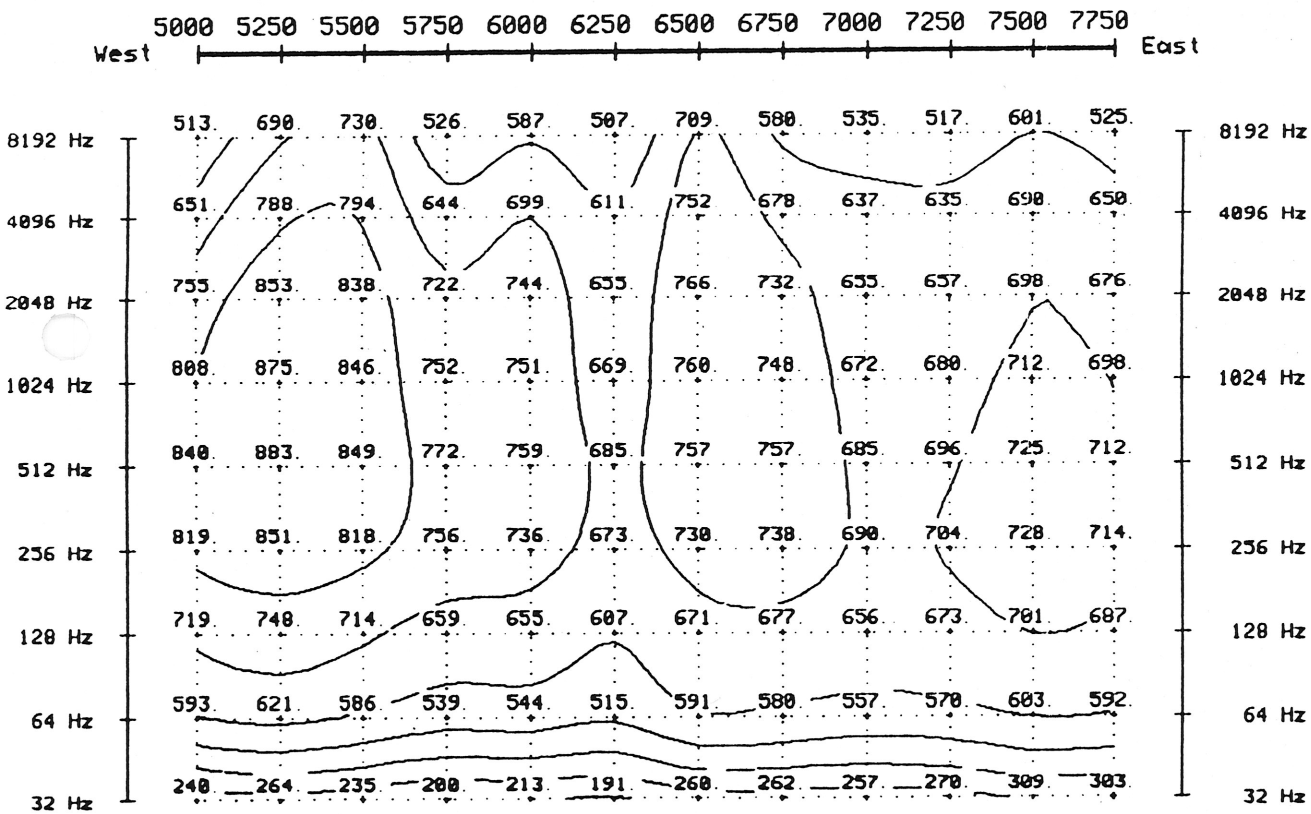


Plate 4B

Line 16500
Bullard Peak
for
COMINCO AMERICAN

Fie Job 925
CPL 3.53
Plotted 29 Jan 90

CSAMT SURVEY DATA
CAGNIARD RESISTIVITY

values in ohm-meters

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.7 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[51.3]
63.1
100.
158.
251.
[369.]

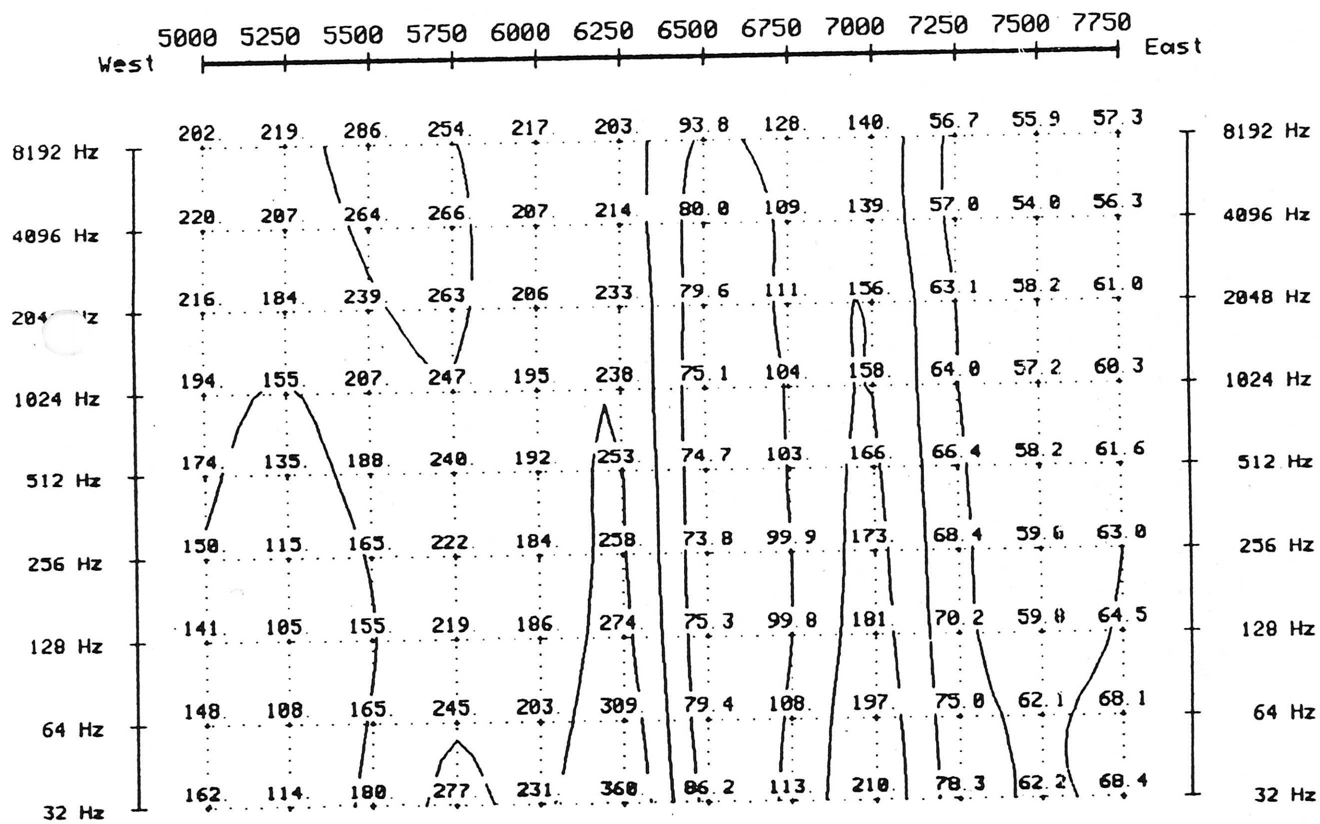


Plate 4A

Line 16000
Bullard Peak
for
COMINCO AMERICAN

CSAMT SURVEY DATA
STATIC-CORRECTED RESISTIVIT

5-PT. TMA FILTER AT 8192 HZ

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[57.9]
63.1
100.
158.
[248.]

Field Job 925
CPLOT 5.53
Plotted 31 Jan 90

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

SurveYed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.6 mi
Rx to Tx= South

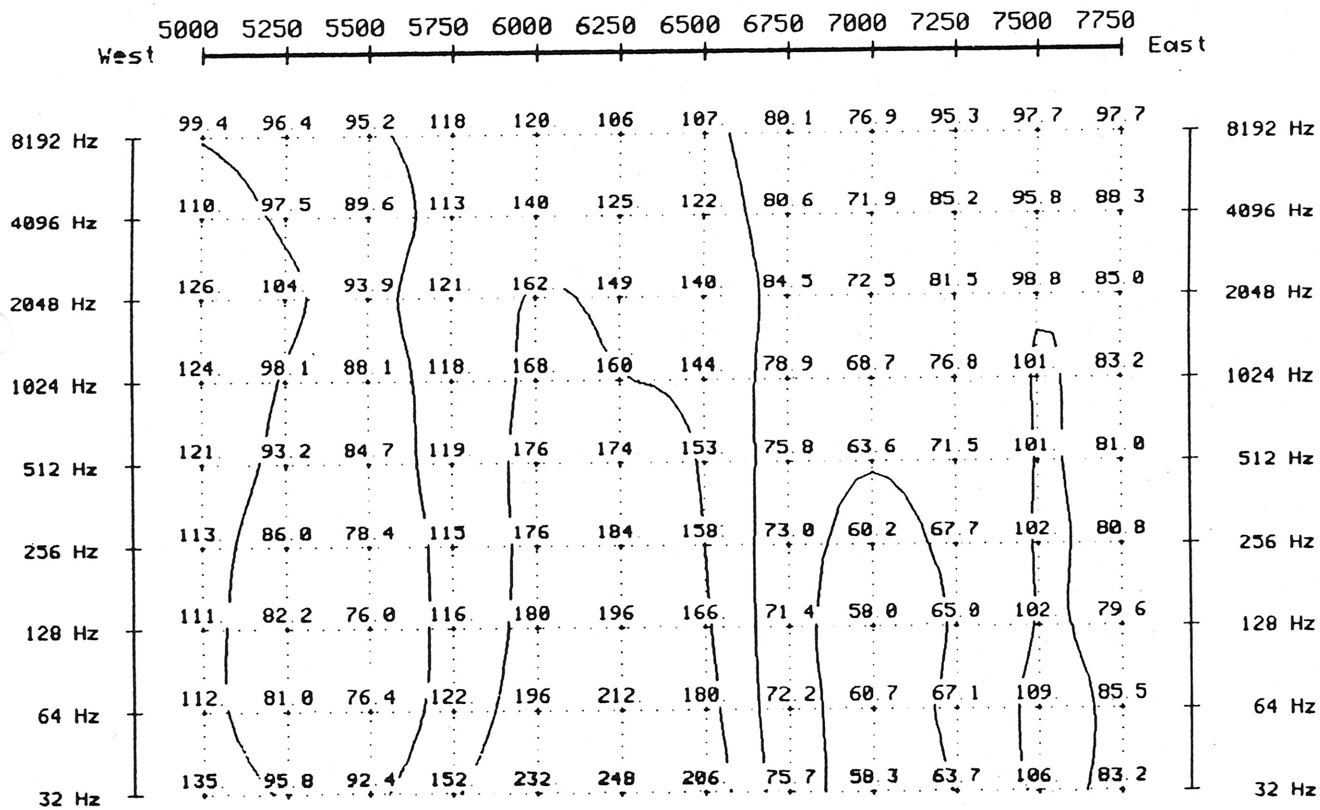


Plate 3C

Line 16000
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
PLOT 5.53
Plotted 29 Jan 90

CSAMT SURVEY DATA
PHASE DIFFERENCE (E - H)
values in milli-radians

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.6 mi
Rx to Tx= South

[Plot limits] and ARITHMETIC CONTOURS
(Interval: 100.00)
[194.]
200.
300.
400.
500.
600.
700.
800.
[829.]

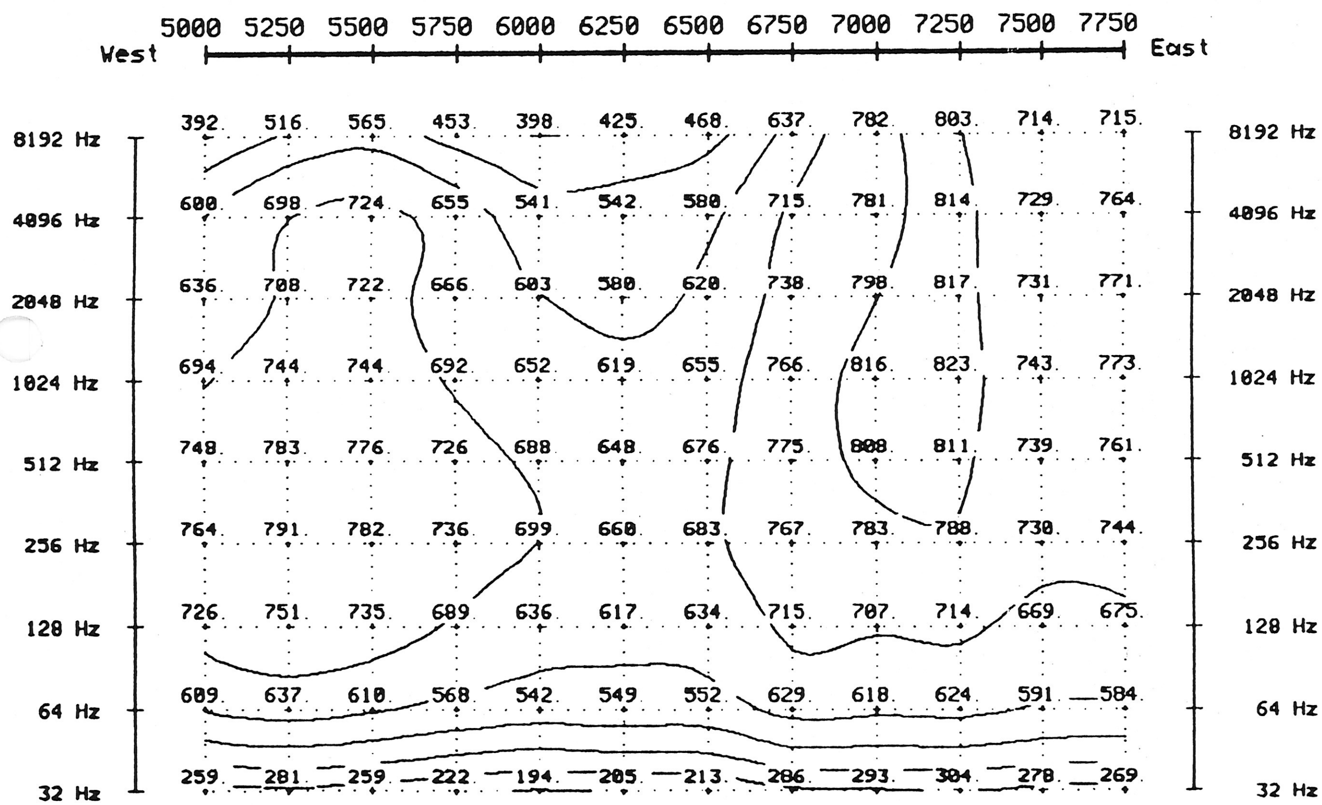


Plate 3B

Line 16000
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
PLOT 5.53
Plotted 29 Jan 90

CSAMT SURVEY DATA
CAGNIARD RESISTIVITY
values in ohm-meters

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.6 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[49.8]
63.1
100.
158.
251.
398.
[572.]

West — East

	5000	5250	5500	5750	6000	6250	6500	6750	7000	7250	7500	7750	
8192 Hz	104.	82.3	102.	87.3	266.	181.	74.1	71.4	85.1	77.4	136.	138.	8192 Hz
4096 Hz	115.	83.2	96.1	83.5	311.	213.	83.9	71.9	79.6	69.2	133.	124.	4096 Hz
2048 Hz	132.	88.8	101.	89.8	361.	254.	96.6	75.3	80.2	66.1	137.	120.	2048 Hz
1024 Hz	130.	83.7	94.4	87.5	373.	271.	99.6	70.4	76.0	62.4	140.	117.	1024 Hz
512 Hz	126.	79.4	90.8	88.1	391.	296.	106.	67.7	70.4	58.0	140.	114.	512 Hz
256 Hz	118.	73.4	84.1	85.0	390.	312.	109.	65.1	66.6	55.0	141.	114.	256 Hz
128 Hz	116.	70.1	81.5	85.4	401.	333.	114.	63.7	64.2	52.0	141.	112.	128 Hz
64 Hz	117.	69.1	82.0	90.1	436	360	124.	64.4	67.2	54.5	151.	121.	64 Hz
32 Hz	142.	81.7	99.0	113.	515.	422.	142.	67.5	64.5	51.8	146.	117.	32 Hz

Plate 3A

Line 15500
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPLOT 5.53
Plotted 31 Jan 90

CSAMT SURVEY DATA
STATIC-CORRECTED RESISTIVIT

5-PT. TMA FILTER AT 8192 HZ

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.5 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[40.5]
63.1
100.
158.
251.
[307.]

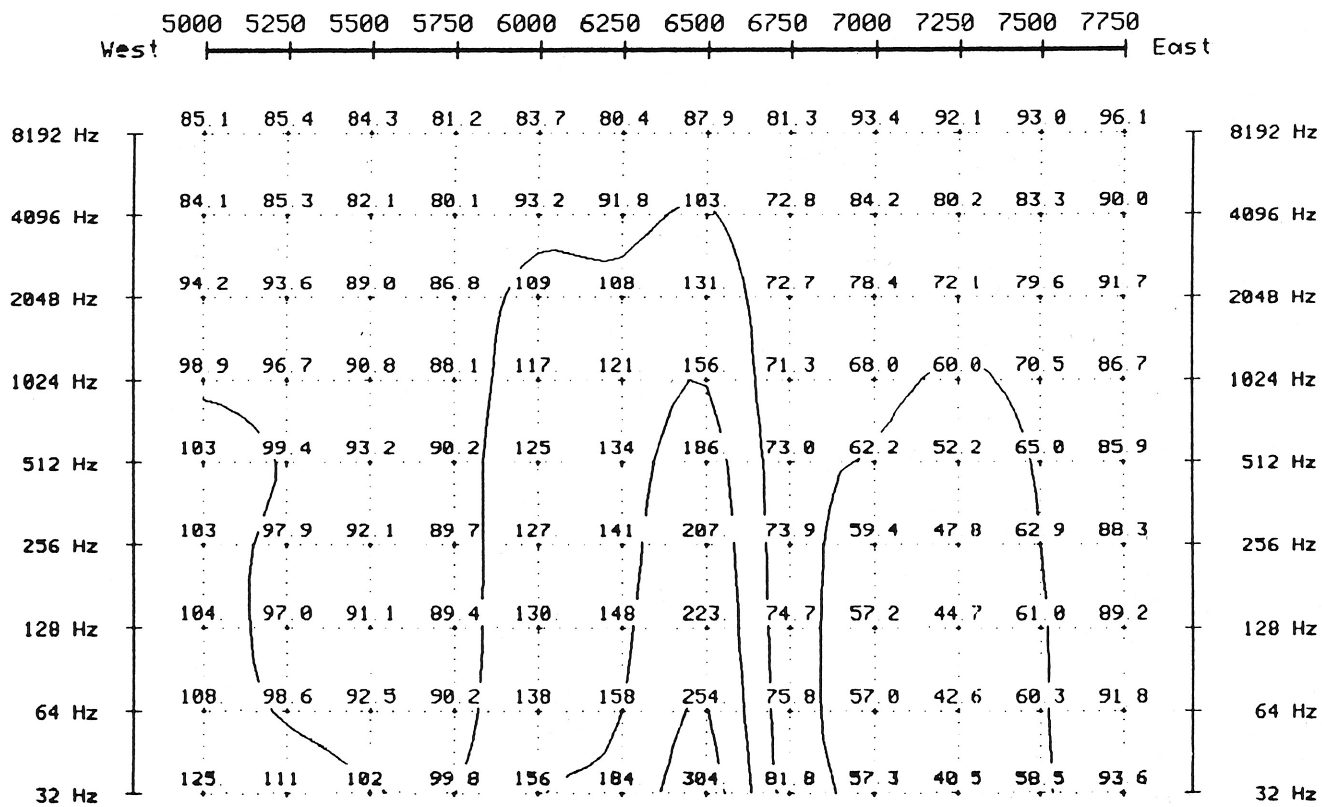


Plate 2C

Line 15500
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPLOT 5.53
Plotted 29 Jan 90

CSAMT SURVEY DATA
PHASE DIFFERENCE (E - H)

values in milli-radians

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.5 mi
Rx to Tx= South

[Plot limits] and ARITHMETIC CONTOURS
(Interval: 100.00)
[166]
200.
300.
400.
500.
600.
700.
800.
[880.]

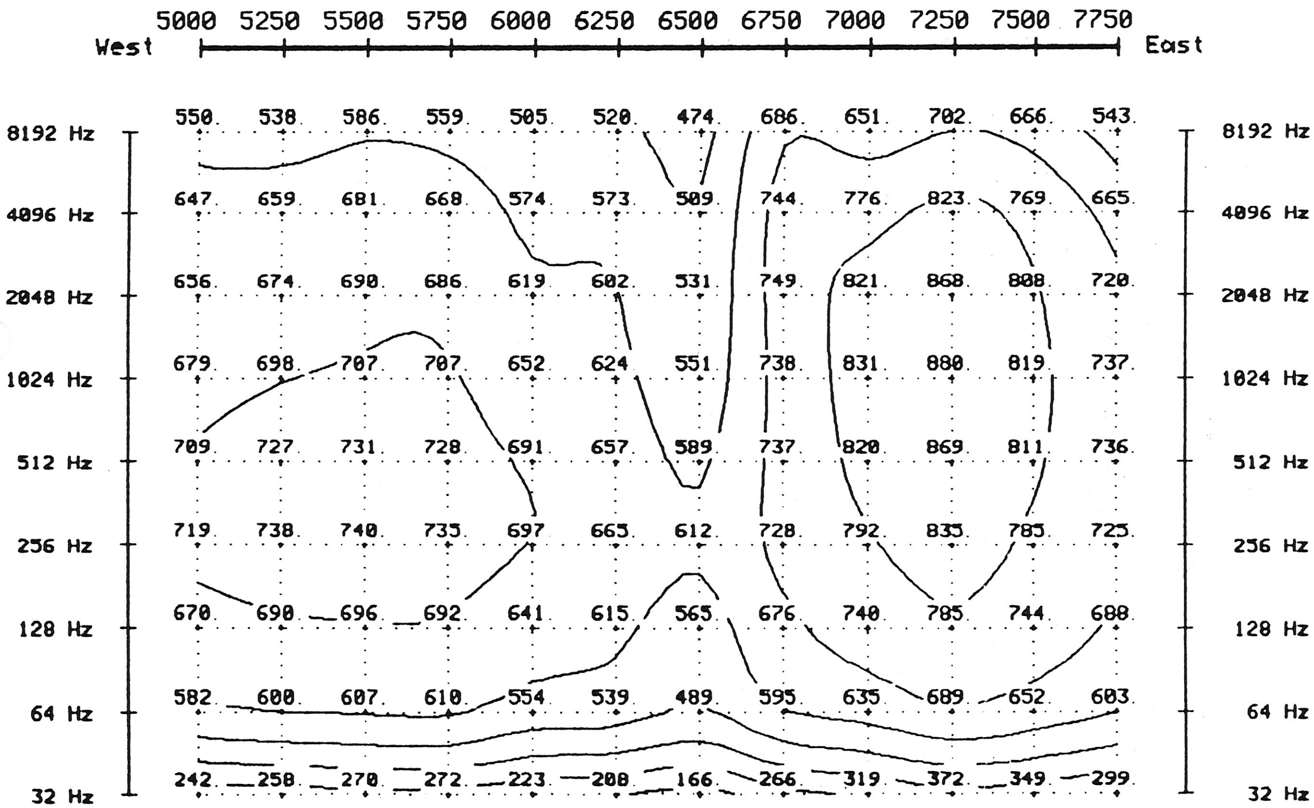


Plate 2B

Line 15500
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
PLOT 5.53
Plotted 29 Jan 90

CSAMT SURVEY DATA
CAGNIARD RESISTIVITY

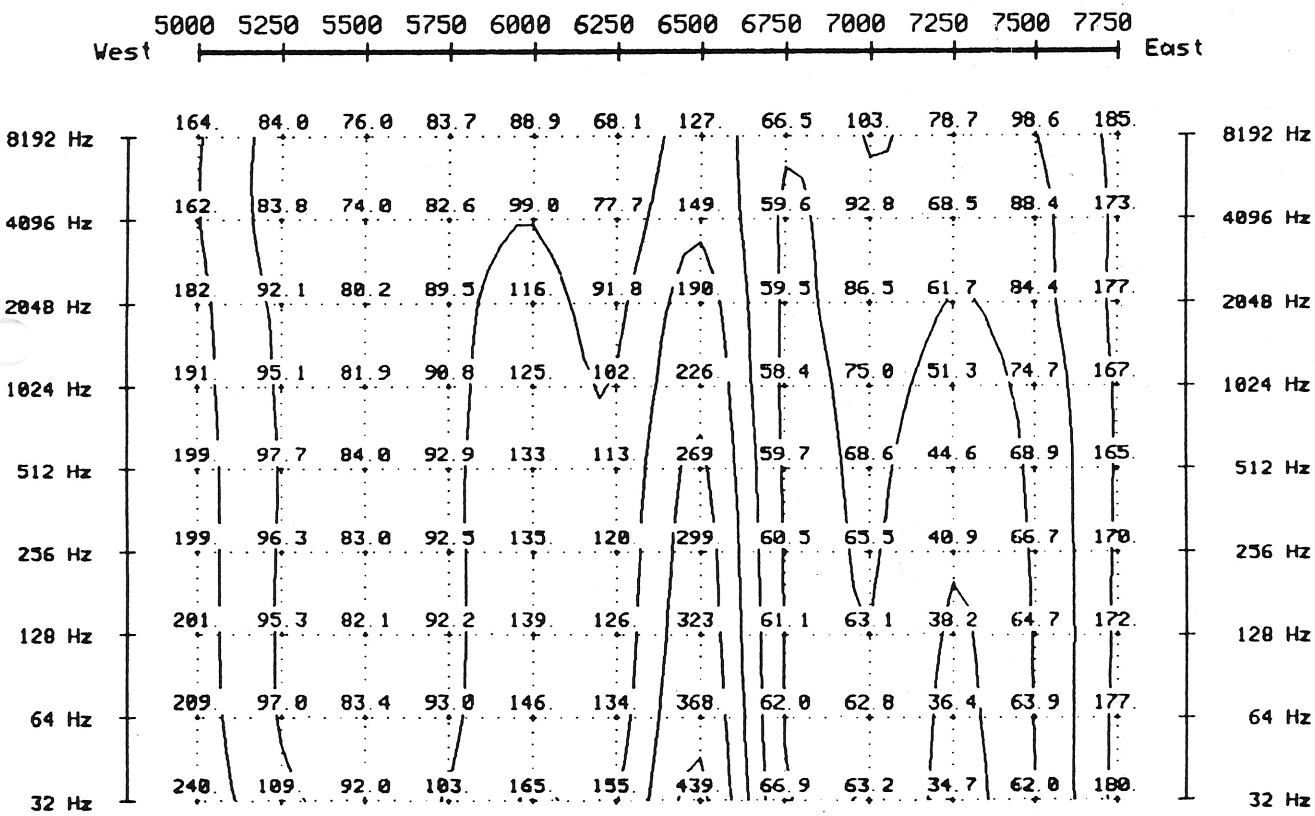
values in ohm-meters

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.5 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[34.6]
39.8
63.1
100.
158.
251.
398.
[439.]



Hz	5000	5250	5500	5750	6000	6250	6500	6750	7000	7250	7500	7750
8192	164.	84.0	76.0	83.7	88.9	68.1	127.	66.5	103.	78.7	98.6	185.
4096	162.	83.8	74.0	82.6	99.0	77.7	149.	59.6	92.8	68.5	88.4	173.
2048	182.	92.1	80.2	89.5	116.	91.8	190.	59.5	86.5	61.7	84.4	177.
1024	191.	95.1	81.9	90.8	125.	102.	226.	58.4	75.0	51.3	74.7	167.
512	199.	97.7	84.0	92.9	133.	113.	269.	59.7	68.6	44.6	68.9	165.
256	199.	96.3	83.0	92.5	135.	120.	299.	60.5	65.5	40.9	66.7	170.
128	201.	95.3	82.1	92.2	139.	126.	323.	61.1	63.1	38.2	64.7	172.
64	209.	97.0	83.4	93.0	146.	134.	368.	62.0	62.8	36.4	63.9	177.
32	240.	109.	92.0	103.	165.	155.	439.	66.9	63.2	34.7	62.0	180.

Plate 2A

Line 15000
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPLOT 5.53
Plotted 31 Jan 90

CSAMT SURVEY DATA
STATIC-CORRECTED RESISTIVIT

5-PT. TMA FILTER AT 8192 HZ

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.4 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[64.1]
100
158
[181.]

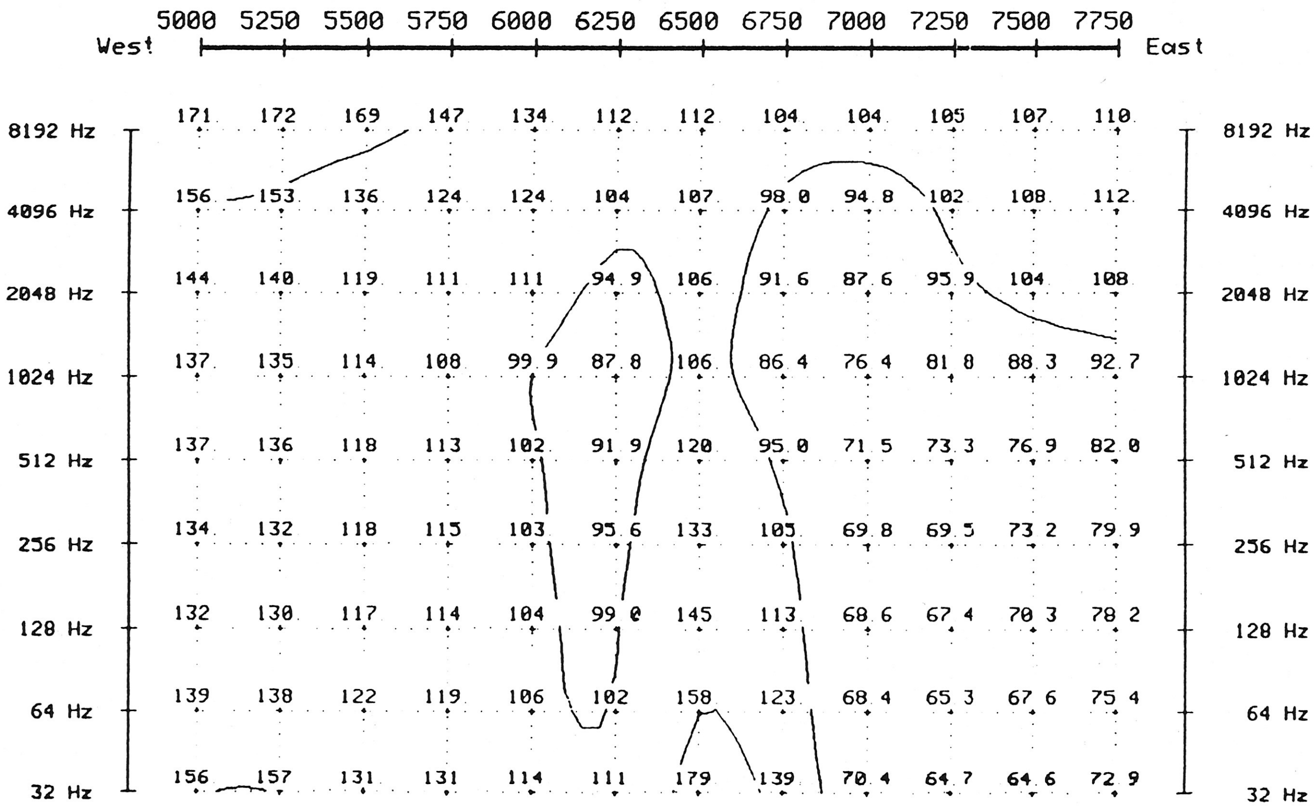


Plate 1C

Line 15000
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
LOT 5.53
Plotted 29 Jan 90

CSAMT SURVEY DATA
PHASE DIFFERENCE (E - H)

values in milli-radians

RECEIVER DATA
Length = 76. m Line = East
Spacing= 76. m DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.4 mi
Rx to Tx= South

[Plot limits] and ARITHMETIC CONTOURS
(Interval: 100.00)
[196.]
200.
300.
400.
500.
600.
700.
800.
[859.]

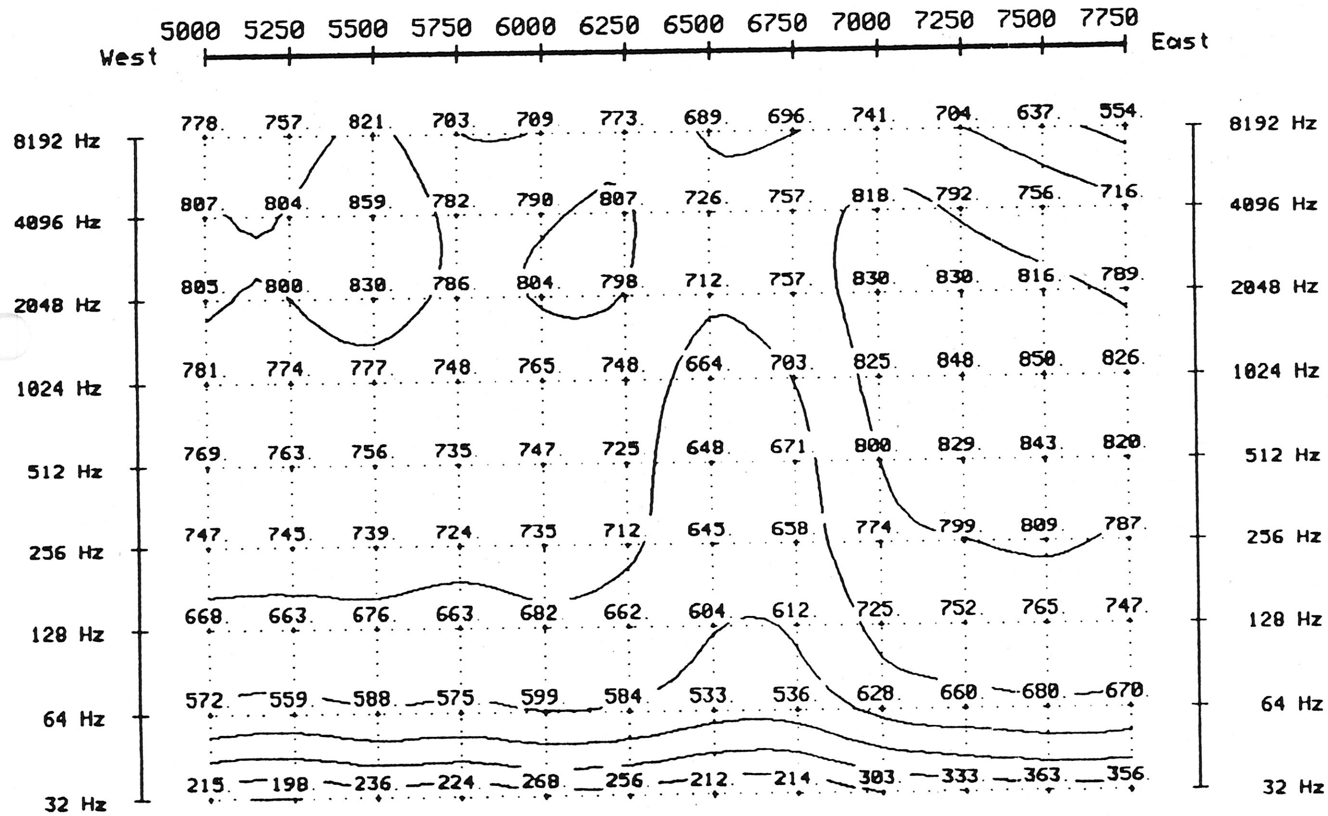


Plate 1B

Line 15000
Bullard Peak
for
COMINCO AMERICAN

Field Job 925
CPLOT 5.53
Plotted 29 Jan 90

CSAMT SURVEY DATA
CAGNIARD RESISTIVITY

values in ohm-meters

RECEIVER DATA
Length = 76. m   Line = East
Spacing= 76. m   DiPole= East

Surveyed= 012190

TRANSMITTER DATA
Length = 5000 ft
Orient. = East
Distance= 2.4 mi
Rx to Tx= South

[Plot limits] and LOGARITHMIC CONTOURS
(Interval: 0.20)
[59.2]
63.1
100.
158.
[209.]

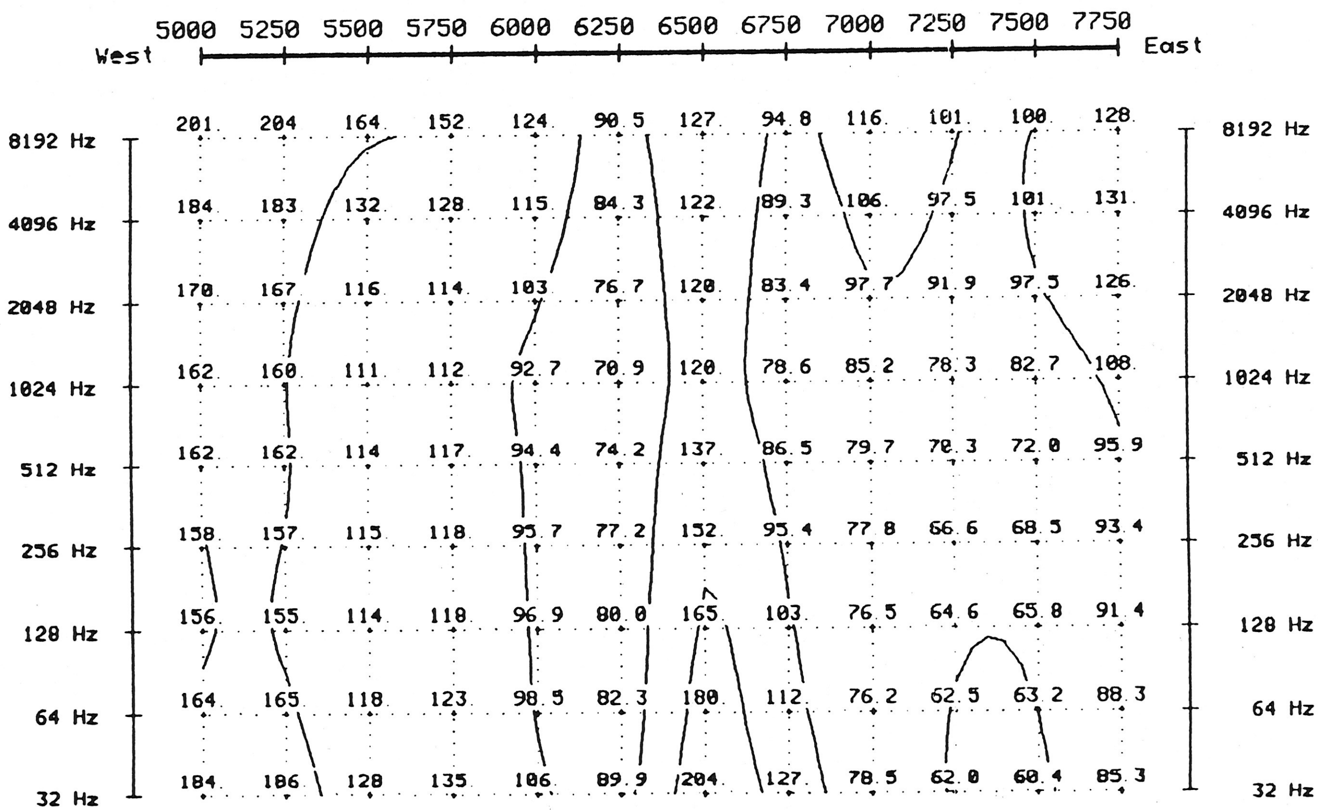


Plate 1A