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JDS

ASARCO

Exploration Department
Southwestern United States Division

July 27, 1981

Mr. Don Harwood
Directional Drilling Division Manager
Christensen Diamin Tools, Inc.
P.O. Box 25068
Salt Lake City, Utah 84125

Request for
Directional Drilling Proposal
Trench Project -- DDH TCH-2
Santa Cruz County, Arizona

Dear Sir:

As discussed with you today and several weeks ago, we are presently drilling in Upper Alum Gulch about 12 miles south of Patagonia, Arizona. We wish to have another continuous-core intercept between 4000-4900 feet depth and from 200 to 400 feet in a westerly direction from the present intercept. We believe that by using the Navi-drill above 4000 feet we can avoid the expense and time of drilling an additional hole to the west from the surface.

Our DDH TCH-2 is being drilled by Joy Mfg. (Rob Gardner, Foreman) using a truck-mounted Joy 22 HD. To approximately 4100 feet the rock encountered is altered volcanic breccia and lava flows with a few intrusive sills -- all dipping to the north at 10 to 40°. A horizontal plan survey to 5350 feet by Mollen-Hauer is attached showing deviation of the hole. We believe the tendency of TCH-2 to deviate to the SSW at 4-7° is due to the NNE shallow dip of the volcanic strata as similar deviations were noted at similar depth in 2 previous holes.

TCH-2 was drilled NC to 2502 feet and cased with 3-1/16" I.D. NX casing, and drilled NX beyond to 4280 feet. When the hole is completed the NX casing will be temporarily left in place for the drill-out with open NX hole below 2502 feet. We expect that drilling, BX casing pulling, etc. will be completed and ready for a drill-out in mid to late August, but could be earlier or later depending on drilling conditions. We will try to give you at least a week's notice for mobilization.

Basically for this drill-out we would like to be continuous coring at 200 feet west (Point A) of the -4000 foot depth when the drill-out reaches -4000 feet and be at such an angle that we would be an additional 200 feet out when we are coring at 4750 feet (Point B). I calculate this angle at about 15° (tan 14.93° = 200/750). The attached horizontal plan and vertical cross-section present a possible path by Navi-drill and we would appreciate your comments on the feasibility of this option or others you might propose as well as a bid for this work.

We propose that you build up a 15° angle at 5°/100' over 300 feet of Navi-drilling. An additional 50-100 feet of core and Navi-drilling will probably be necessary to insure a straight hole. The hole would then be continuous-cored (NX) to depth at 15°. We would probably retain the Navi-drill on standby for several days so that the core-hole could be straightened if it seriously deviated from the 15° path.

My calculation of the actual horizontal deviation to be built-up is about 250 feet in a S75°W direction. Only 39 feet of this would be from Navi-drilling; the rest from core-drilling at a 15° angle. I calculate a kick-off-point at about 2916 feet. No account has been taken of the 2-3/4→3-1/2° deviation of the hole in the vicinity of the K.O.P. nor the additional 2-3° deviation up to 5-3/4° about S30°W that was built up in the present hole between 3000-4000 feet. We should be able to compensate for this during drilling.

As mentioned on the phone today, we had previously considered an "S"-shaped path with a build-up of a 25° angle over 500 feet, a drop-off of the built-up angle to 15° over the next 200 feet plus an additional 200-300 feet of core + Navi-drilling at 15°. However, a simple kick-out to 15° would be simpler, less costly, and sufficiently accurate for our present purposes.

We expect that this Navi-drill program will go at least several times faster than the Superior East program as the rock is much easier to drill. In May we drilled from 3000 to 4000 feet depth in TCH-2 in 14 three-shift days averaging 73.4 feet/day including bit changes and routine maintenance on the drill (vs. 31'/day at Superior East). Bits (NX) were changed at 3057, 3393, and 4099 feet. The 3393' bit was an impregnated bit and the other two were Truco conventional bits. Below 3200 feet local problems with lost circulation to vugs were encountered with 40-60% fluid return and local mud dilution in water courses. An additional problem for surveying could be the local presence of several percent magnetite from 3500-4000 feet.

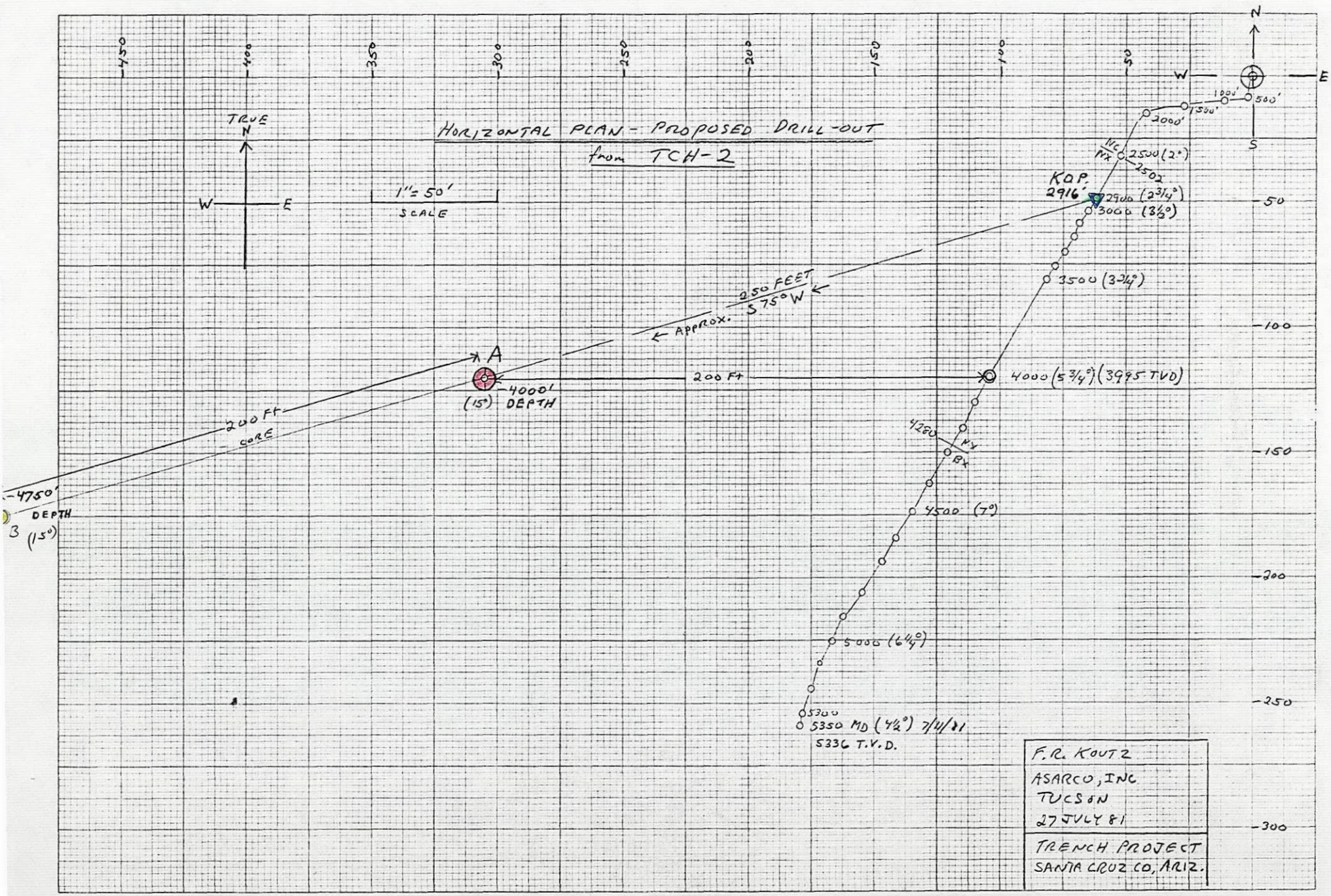
I understand that Jim Sell will not be needing the Navi-drill at Superior East until mid-late September, so this program could be completed before then. We would appreciate your proposal as soon as possible. Please call or arrange a meeting with us if you have any questions. Jim Sell is familiar with this proposal and will be in our Eureka, Utah office after July 31 (433-6394) for several weeks and could easily meet with you.

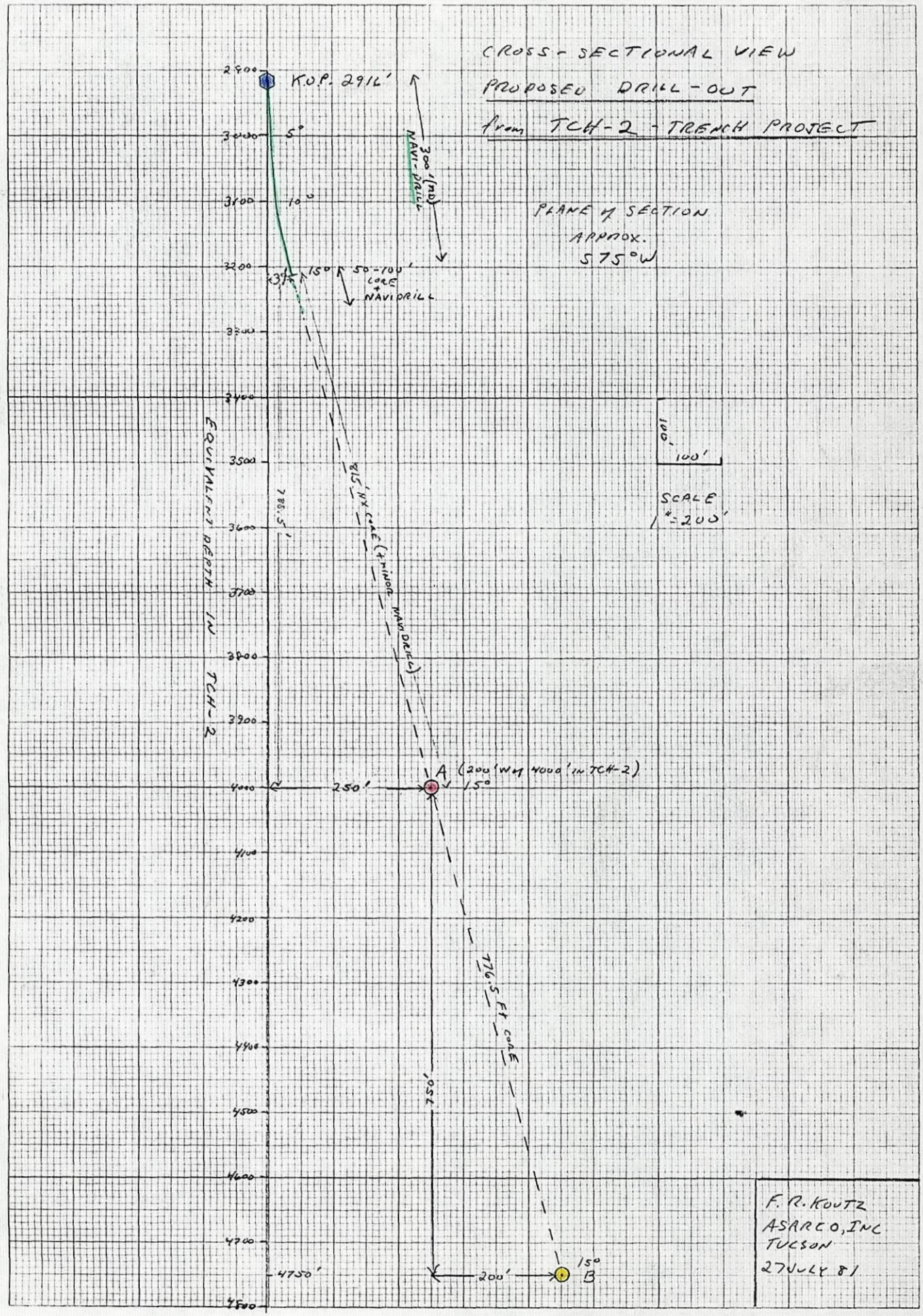
Very truly yours,

Fleetwood R. Koutz
Geologist

FRK:lb
Encs.

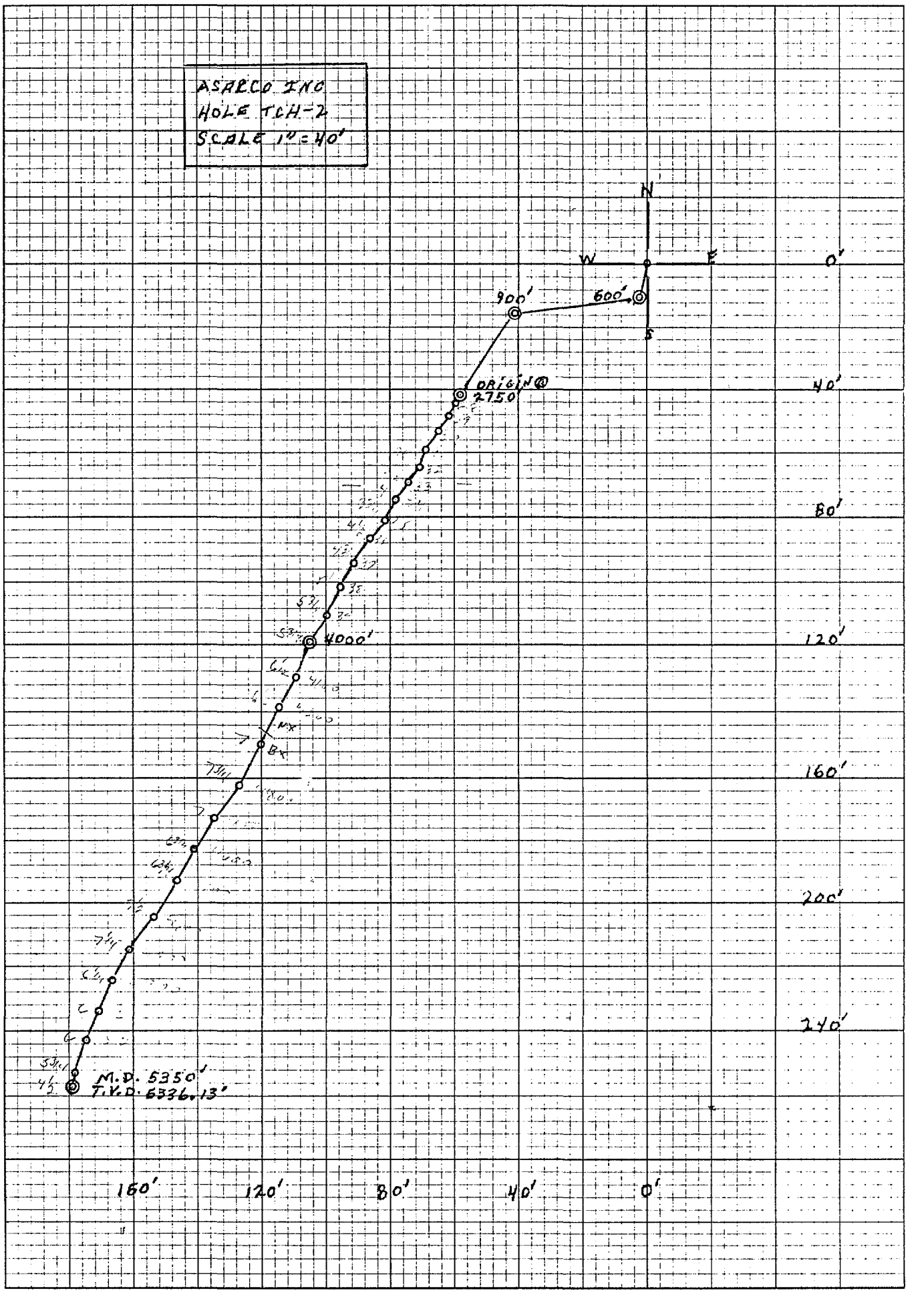
cc: WLKurtz/WDPayne - w/encs.
JDSell - w/encs.





13 JUN 84

ASARCO INC
HOLE TCH-2
SCALE 1" = 40'



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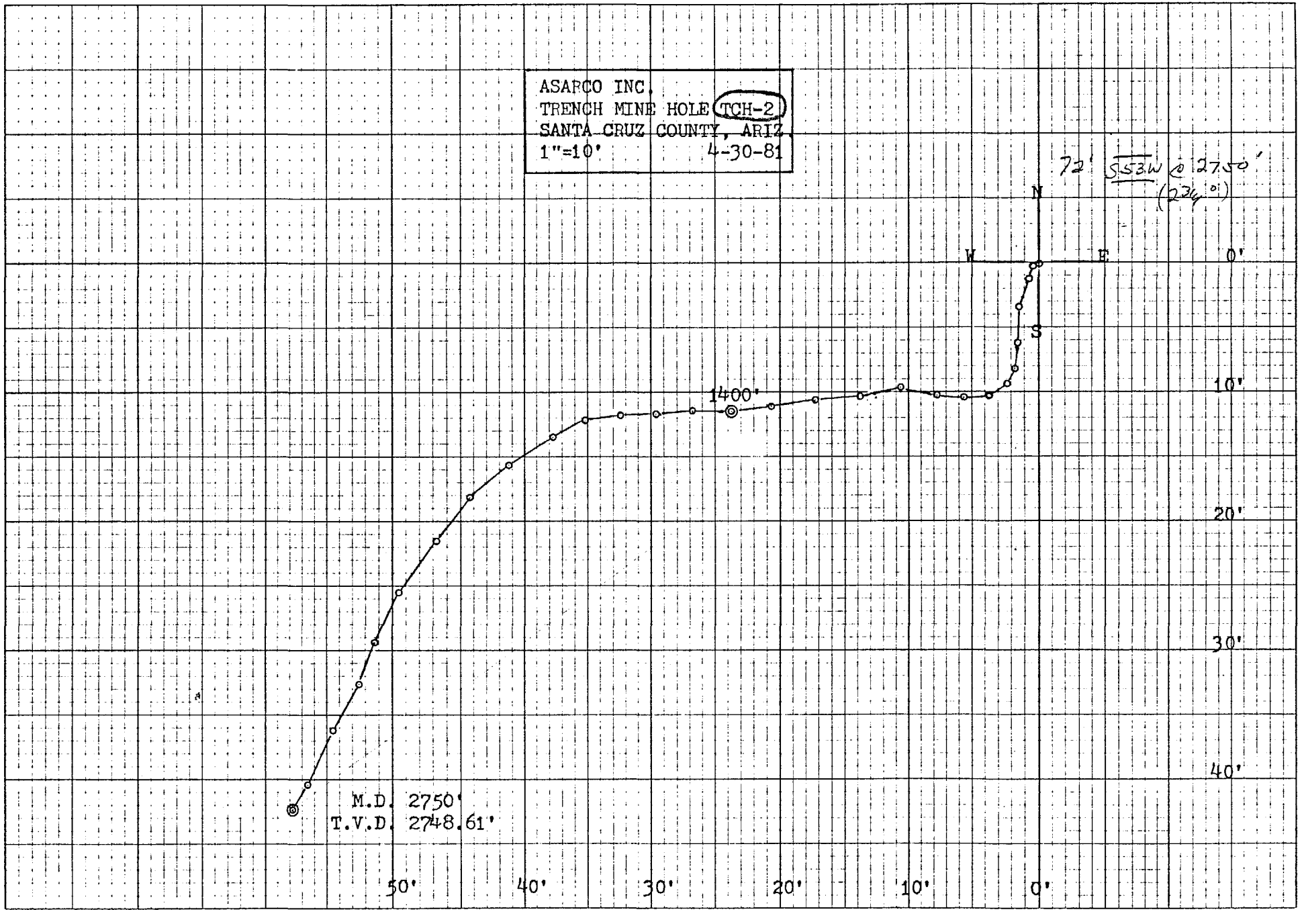

MOLLEN-HAUER SURVEYING COMPANY

COMPANY Asarco Inc JOB NO. 61927 PAGE OF

PROSPECT NO. TCH-2 LOCATION Trench Mine DATE 4-30-81

STATION NO.	MEASURED DEPTH	COURSE LENGTH	DRIFT ANGLE	VERTICAL DEPTH	TRUE VERTICAL DEPTH	SECTION	COURSE DEVIATION	DRIFT DIRECTION	COORDINATE DIFFERENCES NORTH	COORDINATE DIFFERENCES SOUTH	COORDINATE DIFFERENCES EAST	COORDINATE DIFFERENCES WEST	RECTANGULAR COORDINATES NORTH	RECTANGULAR COORDINATES SOUTH	RECTANGULAR COORDINATES EAST	RECTANGULAR COORDINATES WEST
	100	100	¼	100 00	100 00			S 78 W		09		43		09		43
	200		¾	99 99	199 99			S 25 W		1 19		55		1 28		98
	300		1 ¼	99 98	299 97			S 9 W		2 15		34		3 43		1 32
	400		1 ½	99 97	399 94			S 2 W		2 62		09		6 05		1 41
	500		1 ¼	99 98	499 92			S 9 W		2 15		34		8 20		1 75
	600		¾	99 99	599 91			S 26 W		1 18		57		9 38		2 32
	700		1	99 98	699 89			S 65 W		74		1 58		10 12		3 90
	800		1	99 98	799 87			S 84 W		18		1 74		10 30		5 64
	900		1 ¼	99 98	899 85			N 86 W	15			2 18		10 15		7 82
	1000		1 ¾	99 95	999 80			N 80 W	53			3 01		9 62		10 83
	1100		1 ¾	99 95	1099 75			S 76 W		74		2 96		10 36		13 79
	1200		2	99 94	1199 69			S 86 W		24		3 48		10 60		17 27
	1300		2	99 94	1299 63			S 83 W		43		3 46		11 03		20 73
	1400		1 ¾	99 95	1399 58			S 83 W		37		3 63		11 40		23 76
	1500		1 ¾	99 95	1499 53			S 89 W		05		3 05		11 45		26 81
	1600		1 ¾	99 95	1599 48			N 82 W		43		3 02		11 88		29 83
	1700		1 ½	99 97	1699 45			WEST		00		2 62		11 88		32 45
	1800		1 ½	99 97	1799 42			S 81 W		41		2 59		12 29		35 04
	1900		1 ¾	99 95	1899 37			S 67 W		1 19		2 81		13 48		37 85
	2000	100	2 ¼	99 92	1999 29			S 57 W		2 14		3 29		15 62		41 14

T-221-1

MOLLEN-HAUER SURVEYING COMPANY COMPANY Asarco Inc JOB NO. G1927 + G1943 PAGE OF

PROSPECT NO. TCH-2 LOCATION Trench Mine DATE 4-30-81 & 7-11-81

STATION NO.	MEASURED DEPTH	COURSE LENGTH	DRIFT ANGLE	VERTICAL DEPTH	TRUE VERTICAL DEPTH	SECTION	COURSE DEVIATION	DRIFT DIRECTION	COORDINATE DIFFERENCES NORTH	COORDINATE DIFFERENCES SOUTH	COORDINATE DIFFERENCES EAST	COORDINATE DIFFERENCES WEST	RECTANGULAR COORDINATES NORTH	RECTANGULAR COORDINATES SOUTH	RECTANGULAR COORDINATES EAST	RECTANGULAR COORDINATES WEST
	2100	100	2 1/4	99 92	2099 21			S 51 W		2 47		3 05		18 09		44 19
	2200		2 1/2	99 90	2199 11			S 38 W		3 44		2 69		21 53		46 88
	2300		2 3/4	99 88	2298 99			S 35 W		3 93		2 75		25 46		49 63
	2400		2 1/2	99 90	2398 89			S 22 W		4 04		1 63		29 50		51 26
	2500		2	99 94	2498 83			S 21 W		3 26		1 25		32 76		52 51
	2600		2 1/4	99 92	2598 75			S 32 W		3 33		2 08		36 09		54 59
	2700	100	2 3/4	99 88	2698 63			S 27 W		4 28		2 18		40 37		56 77
	2750	50	2 3/4	49 98	2748 61			S 30 W		2 08		1 20		42 45		57 97
1943 and survey	2800	50	2 3/4	49 98	2798 59			S 32 W		2 03		1 27		44 48		59 24
	2900	100	2 3/4	99 86	2898 47			S 32 W		4 07		2 54		48 55		61 78
	3000		3 1/2	99 81	2998 28			S 27 W		5 44		2 77		53 99		64 55
	3100		3 1/4	99 84	3098 12			S 38 W		4 47		3 49		58 46		68 04
	3200		3 3/4	99 79	3197 91			S 25 W		5 93		2 76		64 39		70 83
	3300		3 1/2	99 81	3297 72			S 34 W		5 06		3 41		69 45		74 24
	3400		4	99 76	3397 48			S 35 W		5 71		4 00		75 16		78 24
	3500		3 3/4	99 79	3497 27			S 31 W		5 61		3 37		80 77		81 61
	3600		4 1/2	99 69	3596 96			S 38 W		6 18		4 83		86 95		86 44
	3700		4 3/4	99 66	3696 67			S 34 W		6 87		4 63		93 82		91 67
	3800		5 1/4	99 58	3796 30			S 25 W		8 29		3 87		102 11		94 94
	3900	100	5 3/4	99 50	3895 70			S 29 W		8 76		4 86		110 87		99 50

MOLLEN-HAUER SURVEYING COMPANY COMPANY Asarco Inc JOB NO. 61943 PAGE OF

PROSPECT NO. TCH-2 LOCATION Trench Mine DATE 7-11-81

STATION NO.	MEASURED DEPTH	COURSE LENGTH	DRIFT ANGLE	VERTICAL DEPTH	TRUE VERTICAL DEPTH	SECTION	COURSE DEVIATION	DRIFT DIRECTION	COORDINATE DIFFERENCES NORTH	COORDINATE DIFFERENCES SOUTH	COORDINATE DIFFERENCES EAST	COORDINATE DIFFERENCES WEST	RECTANGULAR COORDINATES NORTH	RECTANGULAR COORDINATES SOUTH	RECTANGULAR COORDINATES EAST	RECTANGULAR COORDINATES WEST
	4000	100	5 3/4	99 50	3995 20			S 26 W		9 00		4 39		119 87		104 19
	4100		6 1/2	99 36	4094 56			S 27 W		10 09		5 14		129 96		109 33
	4200		6 1/2	99 36	4193 92			S 29 W		9 90		5 49		139 86		114 82
	4300		7	99 25	4293 17			S 26 W		10 95		5 34		150 81		120 16
	4400		7 3/4	99 09	4392 26			S 34 W		11 18		7 54		161 99		127 70
	4500		7	99 25	4491 51			S 34 W		11 18		7 54		173 17		135 24
	4600		6 3/4	99 31	4590 82			S 31 W		10 08		6 05		183 25		141 29
	4700		6 3/4	99 31	4690 13			S 33 W		9 86		6 40		193 11		147 69
	4800		7 1/2	99 14	4789 27			S 29 W		11 42		6 33		204 53		154 62
	4900		7 1/4	99 20	4888 47			S 34 W		10 46		7 06		214 99		161 08
	5000		6 1/4	99 41	4987 88			S 31 W		9 33		5 61		224 32		166 69
	5100		6	99 45	5087 33			S 24 W		9 55		4 25		233 87		170 94
	5200		6	99 45	5186 78			S 19 W		9 88		3 40		243 75		174 34
	5300	100	5 3/4	99 50	5286 28			S 22 W		9 29		3 75		253 04		178 09
	5350	50	4 1/2	49 85	5336 13			S 12 W		3 84		82		256 88		178 91

ASARCO

Exploration Department
Southwestern United States Division

June 8, 1981

Mr. Bill Lembeck, Manager
Skyline Labs, Inc.
1700 W. Grant Rd.
Tucson, Arizona 85705

Dear Bill:

Asarco is in the process of nearing completion of a hole designated TCH-2 which is encountering a moderate amount of skarn mineralization. As one might hope for, there are a lot of patches and blobs of high grade material. Accordingly, in order to assure reliable assay results, I would like to request the following standard operating procedures for sample preparation and assay.

1) Primary crush to -10 mesh all samples marked on the submittal sheet with an asterisk (*).
2) Take a second split and run an independent check assay on any copper samples >2%.
3) Fire assay any geochem Ag or Au greater than ½ oz. Ag or 0.1 oz. Au.
4) Assay any Pb or Zn geochem values >1% (some zones may be initially submitted for Pb or Zn assay).
5) Assay any Mo geochem values >500 ppm.

If you have any questions on the above, please give me a call. It will be about a week or two before any of the core is submitted. The project geologist is Fleetwood Koutz. Contact him if you have any questions during the course of your assaying. Also, I don't think he has had a tour through your lab before, and I think it would be beneficial to him if you could spare the time. Perhaps this could be arranged when the first batch of samples comes down.

Sincerely yours,

William D. Payne
Manager

WDP:lb

cc: FRKoutz

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703
1150 North 7th Avenue (602) 792-3010

ASARCO

Southwestern Exploration Division

October 26, 1981

To: W. D. Payne

From: F. R. Koutz

F. R. Koutz

Monthly Report - October, 1981
Trench Project (EA 0200)
Santa Cruz County, Arizona

Between September 26 and October 25 DDH TCH-2A advanced 1190 feet from 3694-4881'. The hole was surveyed to 4320' on October 8 and reduced from NX to BX on October 9 at 4355'. The drift angle at 4320' (4269'T.V.D.) was 20 1/4°, S 64° W. Projecting this to 4881' (4792' T.V.D.)this would mean that TCH-2A is 408', S 77° W of an equivalent depth in TCH-2. No significant drilling problems beyond broken zones and 20-50% circulation loss were encountered to about 4860'. From 4860-81'severe caving problems were encountered in broken, talcy carbonate cut by gypsum veins. At present cementing is in progress.

The section encountered this month was primarily Mesozoic welded tuffs and lava flows from 3694-4310'. A few zones between 3793' and 3875' may contain intrusive monzonite porphyry. Much of the Mesozoic section is porphyritic and shows flow texture but could be, in part, intrusive. From 3995' to 4003' a pyritic IBX zone was encountered. Alteration is characterized by chlorite, pyrite ± montmorillonite ± epidote ± K-feldspar with local strong, grey quartz-sericite flooding. From 4121-54' a zone of 15-20% disseminated pyrite was encountered with local zones up to 3 feet containing 1-3% sphalerite + chalcopyrite ± galena ± trace pink carbonate. Pyrite content of the Mesozoic section ranges from a few tenths to several percent pyrite with rare stringers of sphalerite and chalcopyrite. The high pyrite content, quartz-sericite alteration, and the lack of numerous veinlets of sphalerite ± chalcopyrite ± galena are distinctly different from TCH-2 only 150-280' to the ENE.

Skarn (garnet, chlorite, diopside (?)) with carbonate was entered at 4310'. This point is 164 feet below and 280 feet (horizontal)S.73° W. of the Paleozoic contact in TCH-2. The zone 4310' to 4357' contains 3-20% disseminated pyrite in cubes up to 1 cm with local zones of 1-2% cpy + sl± gn. Some of the host rock in this zone may be igneous. 4357 to 4403' consists of silty-sandy hornfels with several tenths sl+ cpy and about 1/2% py. The zone 4403-4467' is a silty, mottled-green,silty limestone skarn with a 10 foot zone of sheared green claystone of marble at the base. The limey sections contain several 0.5-1 foot zones to 2-5% py>cpy>sl with covellite on sulfides partially oxidized to hematite.

From 4467 to 4852' the section was mostly mottled-green, very fine-grained siltstone-quartzite, weakly crushed, with a few thin limey zones. IBX zones were encountered from 4611-22' and 4822-23' with the usual well-rounded quartz feldspar porphyry clasts. IBX mineralization is dominately pyritic. From 4852-4881 the rock was talc-rich, silty fine-grained carbonate with gypsum seams-all well broken and gougy.

The 571 feet of Paleozoic section encountered does not correlate well with the section in TCH-1, 2 or TM-13. The high-pyrite, dark green silicate alteration is more similar to TM-13 than either TCH-1 or 2. Apparent dips in core range from 10 to 40° and, even though the hole is inclined at 20 + degrees, it would be difficult to fit the 385' section of hornfels-quartzite into the sections in other holes unless the TCH-2 section is thickened or other sections are thinned and offset by faulting. There is ample evidence of faulting in the cores and offsets must exist since the Paleozoic sections TCH-2 and 2A are only 280-408' apart. The additional 619 feet of drilling planned to 5500' in TCH-2 will be critical in making a correlation. Since alteration is strong and Zn, Cu, Pb mineralization picks up in thin limey sections of TCH-2A, chances are very good for a significant mineralized incept if favorable thick carbonate sections are encountered. The individual pulps from 3 composite intervals in TCH-2 anomalous in tungsten were assayed and contained from 0.01 to 0.09% WO_3. The interval 4450-60' contained 0.42% WO_3. On checking the interval with UV light one 0.8 foot interval at 4459' shows 10% 2-10 mm scheelite blebs intergrown with calcite, sphalerite and chalcopyrite in dark green diopside-garnet skarn. Other intervals show only scattered 1-3 mm grains of scheclite.

S. A. Catlin has been familarized with the Trench Project and is presently doing the detailed logging on TCH-2A and describing thin sections from TCH-1. Several days were also spent familarizing J. H. Courtright with TCH-2 and other Trench developments. J. M. Wood is also testing the Scintrex magnetic suseptibility meter on all Trench core. A report on sulfide mineralogy and composition in TCH-2 was also finished during the month.

Estimated expenditures for the month are $53,314.00, leaving an estimated balance of $32,034.00.

FRK/mlm

cc: S. A. Catlin

ASARCO

Southwestern Exploration Division

December 1, 1981

TO: W.D. Payne

FROM: F.R. Koutz FRK

Monthly Report, November 1981
Trench Project (EA 0200)
Santa Cruz County, Arizona

Drilling this month at Trench was just slightly short of disastrous. When we left TCH-2A last month at 4881', Joy was attempting to drill out a burn-in bit crown and cement a Section of massive, caving talc with gypsum veins with a BX string. This and other attempts to drill BX were unsuccessful because of clogging of the annular space around the bit with the sticky material being drilled with resultant low-volume mud flow and high fluid pressures. The cement was finally placed with a 40 foot AX string on the end of BX rods, however after three days the cement had not set.

The bentonite and cellex-dextrid based mud was changed out to EZ-mud with a reduction in torque but no forward progress. After several attempts were made to drill BX or AX (40' on a BX string) with no success (including disintegration of a poorly manufactured AX core barrel head) in caving conditions from 4860'-4882', the BX rods were run as casing and drilling with an AX string was successfully started on October 10. Cement was successfully placed when the hole was at 4900', but after five days it had only set to a mush. Caving continues to impede drilling during round-trips for bit changes.

From October 10 to November 25 TCH-2A advanced 145 feet from 4882'-5027'. The hole was surveyed on November 25 by Whaley and Benavidez using an HF-acid vial on the AX wire line at 4350', 4600', 4800', and 5000'. Inclination of the hole was between 21° and 25° from vertical and has not increased appreciably.

The section encountered consisted of massive talc with gypsum veins from 4881'-4891.5' The interval 4891.5'-5018' was interbedded fine to medium-grained, banked marble with significant serpentine - talc zones and fine-grained quartzites (4926'-4931', 4932'-4943', 4946'-4949.5', 4988'-4989'). Beyond 5018' is broken quartzite. Only trace garnet and diopside were noted. A few 1" - 4" stringer zones contain 1-5% sl > gn > py > cpy. Apparent dip of the sediments in core is 50°-75° with 65°-70° being most common. This would suggest actual possible dips of 45°-90°.

Steve Catlin has logged TCH-2A down to 4879' and significant intervals have been split and assayed. The best interval is 40 feet starting at 4120' running 1.5% Cu, 0.3% Pb, 0.6% Zn, and 0.8% oz. Ag/T in volcanic host rock. In sedimentary host rock only several 10' sections approach or exceed 1% Cu + Pb + Zn, but Ag and Mo are relatively high ranging up to 34 and 46 ppm, respectively, over 10' intervals. Mr. Catlin has spent five days on TCH-2A this month and is presently assisting in petrographic and x-ray interpretation.

All of TCH-1 and TCH-2 has been logged, additional intervals split and submitted for geochemistry, and cross sections and reports are being drafted. The most significant findings, not previously reported, are the presence of at least ten

almost complete ash-flow tuff cooling units, each initiated with a basal sandstone in TCH-1. Because of alteration and the presence of 587' of intrusive quartz monzonite porphyry between 2249' and 2972' these cooling units cannot be directly correlated to TCH-2. TCH-1 also contains a section of QMP between 3180' and 3230'. The cross sections also suggest that many of the units in TCH-2 and TCH-2A are displaced 200'-400' down to the west relative to TCH-1, probably at the margin of the Chief Diatreme. The Paleozoic section in TM-13, TCH-1, TCH-2, and TCH-2A continue to defy close correlation to each other and the American Peak and Duquesne section in outcrop. The section in TCH-2A, however, suggests that drilling has not reached the equivalent 200 foot section that was mineralized in TCH-2, but should within the next several 100 feet.

Estimated expenses for the month are $26,495.00, leaving an estimated balance of $5,539.00.

FRK/mlm

c: S.A. Catlin

WDP

ASARCO

Southwestern Exploration Division

January 29, 1982

TO: W. D. Payne

FROM: F. R. Koutz

Monthly Report, January 1982
Trench Project (EA-0200)
Santa Cruz County, Arizona

From December 28, 1981 to January 15, 1982 Joy Mfg. Co. completed work on TCH-2A (5121'TD) and demobilized. All BX and all except 81' of AX casing (4800-81') was successfully recovered. An NX packer was set at 2970' and successfully cemented to 2860'. Cement was drilled out to 2900' and a good mud left in the hole. This leaves 2502' of NC Rods in the hole as NX casing on which we will pay rental of 5% of the value per month ($1023.05) starting on January 16 until drilling resumes. The 4" casing was capped and the site cleaned up.

All TCH-2A core has been logged, necessary sections split and submitted for assay and for thin sections. Completion of TCH-2A petrography, report writing and drafting will probably stretch into March by Catlin and Koutz. Figures for TCH-1, 2 and some of 2A are presently being drafted, and writing and revision is progressing. Specific recommendations for additional drilling will follow these reports.

Tony Benavidez spent several days in the Santa Cruz County Courthouse and in the Trench area checking for evidence of filing or location work by Gold Depository Loan Co. which has filed assessment work with the BLM for claims in upper Alum Gulch and in the OCCI group in joint venture with Kerr-McGee. He found no evidence of filing nor work on the ground and no field evidence has been noted of work by GDL on ASARCO ground by any ASARCO employee to date.

A reconnaissance geophysical survey of the greater Trench area has been planned using ground magnetometer and possibly other instruments by the SLC geophysical office for early February. A suite of core specimens from Trench drilling will also be sent to Zonge Engineering for testing.

Estimated expenditures for the month are $14,683.00, leaving an estimated overrun of $21,677.00.

F. R. Koutz

FRK:mek

cc: S. A. Catlin

ASARCO

Southwestern Exploration Division

February 25, 1982

TO: F. R. Koutz

FROM: S. A. Catlin

Monthly Report, February, 1982
Trench Project EA-0200
Santa Cruz County, Arizona

Twelve days in February were spent working on the Trench Project. This effort involved the study of thin sections and polished thin sections cut from Trench 2(A) drill core, the review and analysis of this petrographic data along with assay and core log data collected earlier, and the plotting of all this information on a graphic log diagram. One day was spent travelling with Fleetwood Koutz and Barney Mason to the Patagonia area to examine the Paleozoic sedimentary section exposed on Molly Gibson Hill and American Peak. This examination proved helpful in correlating the altered Paleozoic rocks cut in the Trench 2(A) and other Trench area drill holes.

The Trench 2(A) drill hole report is now being pieced together and will be completed in March.

Trench 2(A) Petrography

Thirty-three thin sections and five polished thin sections were cut from Trench 2(A) drill core. These were carefully examined to determine the mineralogy, alteration, and (where possible) primary lithology of each rock type encountered in the Trench 2(A) drill hole. An effort was made to correlate the skarn rocks encountered below 4310' with the known Paleozoic stratigraphy of southern Arizona.

From the wedge-off point at 2912' down to 4310' Trench 2(A) encountered a thick pile of felsic volcanic rocks. Minor andesite flows or dikes (thin sections 3122' and 3561'), intrusive quartz monzonite porphyry (2945'), and intrusive breccia (no sections taken above 4310', but sections at 4620'and 5094') were also present. Most of the volcanic rocks examined were rhyolitic to trachytic ash flow tuffs (many sections). A shear zone occurs from 4121' to 4157' and is strongly mineralized (sections 4130' and 4147'). Strong pyrite with significant chalcopyrite and sphalerite occur in a "grungy" matrix of quartz, K-feldspar, chlorite sericite, and clay.

Below 4310' three major skarn types occur. Ca-rich skarn with strong garnet, calcite, and other minerals is present from 4310' to 4469'

(several sections) and again from 4820' to 4840'. These Ca-skarns probably formed from original pure to silty limestone. They contain most of the significant mineralization present in Trench 2(A) skarn rocks. From 4469' to 4820' chloritic siltstone-hornfels occurs (sections 4502', 4592', 4694', and 4749'). These rocks formed from original dirty siltstones. From 4840' on serpentine marble (many sections) with minor siltstone interbeds (4930') and pods of wollastonite (5095' and 5098') occurs. This skarn presumably formed from dolomite with siltstone interbeds.

Stratigraphic Correlation

Remmant bedding in Trench 2(A) skarns indicates that the Paleozoic rocks were cored at an angle of 30° to the bedding. Their thicknesses have thus been exaggerated by a factor of 2. Taking this into account, it becomes apparent that the Paleozoic rocks encountered in Trench 2(A) consist of the lower to middle Epitaph Formation of Permian age. This is the only portion of the Arizona Paleozoic section which has a 175' thick siltstone underlain by a dolomite layer at least 140' thick and overlain by a silty limestone at least 80' thick.

Steve Catlin

S. A. Catlin

SAC/st

ASARCO

Southwestern Exploration Division

March 2, 1982

To: W. D. Payne

From: F. R. Koutz

Monthly Report, February 1982
Trench Project, EA-0200
Santa Cruz County, Arizona

During February work continued on Trench drilling reports. All figures have been completed and submitted for final drafting. All work with recommendations should be completed by early April. J. Yanez and H. M. Stone have spent part of two weeks locating and surveying in claim corners in the Mendosa, Trench, Thunder Mountain and 3-R common boundary with the Argentor Group of Commonwealth International, Inc. At least a week of work remains.

E. W. Perkins and J. R. Porter of the Salt Lake City Geophysical office spent 10 days in the northern Patagonia Mountains completing about 25 line-miles of ground magnetometer traverse and 5 man-days of VLF-EM work. The edges of the trachyandesite (diabase) and main quartz monzonite phase of the Patagonia stock as well as sulfide destruction of magnetite are well defined by magnetometer profiles. At this stage of data interpretation little is evident in the Trench-Sunnyside-Chief diatreme area from ground magnetometer profiles. Power lines and fences and lack of time prevented VLF-EM work in many areas of interest but the Harshaw Creek fault was traced in the Marsteller Mine area and a 300 foot long NE-striking conductor was located at the SE edge of the diatreme at the outcrop of quartz-feldspar porphyry. In March we will evaluate presently available aeromag. data with the ground magnetometer data and known geology to determine whether additional acromag. data would make a significant contribution to geologic interpretation. Twenty core samples from TCH-2, 2A, and 1 were submitted to Zonge Research for testing. When results are obtained we will decide with Barry Nicholls whether any IP-resistivity work would be profitable.

The attached report by S. A. Catlin summarizes petrographic and other activities. Our best interpretation at this time is that the TCH-2A section drilled is Lower Epitaph and as such would correlate with the bottom of TCH-2. This means that the Upper Epitaph section that was heavily mineralized in TCH-2 was either eroded or faulted away in TCH-2A. The vertical separation between equivalent beds of the Epitaph in TCH-2 and 2A is 800 feet which would require a 70°NE apparent dip between the two holes for correlation. This is reasonably consistent with dips in core of TCH-2A but would require minor folding or faulting of the section near TCH-2 to account for the 30-50° dips in TCH-2.

After drilling reports are completed, detailed fluid inclusion work is planned in the Trench-Sunnyside area to help to locate thermal and mineralizing centers and to define the environment of ore deposition.

Estimated expenditures for February are $25,571, giving an estimated overrun of $61,901.

F. R. Koutz

FRK/cg

cc: S. A. Catlin

Attachment: 2 pages.

ASARCO

Southwestern Exploration Division

April 29, 1982

To: J. D. Sell

From: F. R. Koutz

Monthly Report, April 1982
Trench Project, EA-0200
Santa Cruz County, Arizona

Much of April was spent revising reports for final typing. All reports including TCH-1, TCH-2 and TCH-2A have been completed although some are awaiting final typing. Drafting is being completed as time in the drafting room permits. During the month, S. A. Catlin assisted in completing reports and follow-up petrography.

Final reports on the VLF/magnetometer traverses by the SLC Geophysical Office have been received and a short memo will be prepared on their significance. The report from Zonge Engineering for E. B. Nicholls on IP-EM tests on Trench core is not yet completed.

T. C. Benavidez and H. M. Stone worked this month in the Trench area surveying with J. Yanez the boundary between the Argentor Group and our properties. This work is almost completed. Re-papering claims and re-establishing claim corners continues. Control points and drill holes are also being paneled for eventual aerial photography for a new topographic map to be flown by McLain. R. B. Crist is coordinating these efforts. T. C. Benavidez is also investigating possible routes to future drill holes in the area and will obtain contractor cost estimates and USFS approval.

Only minor work, including fluid inclusion studies, is planned for the next several months at Trench.

Estimated expenditures for the month of April are $3,231 leaving an estimated overrun of $65,785.

F. R. Koutz

FRK/cg

ANNUAL PROJECT PLANNING SHEET

DISTRICT: Southwestern

PROJECT NAME: Trench-Humboldt

PROJECT NUMBER: EA 0200

PROJECT SUPERVISOR: W.D.Payne

PROJECT GEOLOGIST: F.R.Koutz

PREPARED BY/DATE: FRK/2-19-82

EXPENDITURES

1. Month of April $3,231
2. Current Year Expenses to Date thru April $ 47,683
3. Budget for Current Year 1982 $
4. Thru previous year, since project began $607,102 [+ $72,267 @ Mendoza]

TYPE OF PROJECT

	Recon
X	Drilling
	Pre-Development
	Other

COST ESTIMATE & APPROPRIATION REQUEST

		Approval Dist. Geol.
Current Yr. Orig. Budget	$	
Current Yr. Add. Request @ ____	$	
Current Yr. Add. Request @ ____	$	
New Total	$	

OBJECTIVE: Complete reports from 1981 drilling. Plan future drilling out of TCH-2 to test for continuity of limestone replacement/skarn mineralization.

Progress for the Month of April

PLANNED TASKS	RESPONSIBILITY/TIME TO COMPLETE	TARGET DATE	% COMPLETE	PROGRESS TO DATE
1. Complete TCH-1 drill hole summary (drafting, typing).	FRK/2 weeks	3/15/82	99%	Report finished and typed; minor drafting revisions remain.
2. Complete TCH-2 drill hole summary (drafting, report).	FRK/3 weeks	4/1/82	95%	Ready for final typing; final drafting 1/3 done.
3. Complete TCH-2A drill hole summary (drafting, report).	SAC/FRK/3 weeks	4/1/82	100%	Typing/Drafting completed.
4. Complete recommendations report Trench area.	FRK/1 week	5/1/82	90%	Draft being revised for final typing.
5. Geophysical Recon. N.Patagonia Mtns.	SLC-Geophys./FRK			
a. Field work + report	/3 weeks	4/15/82	100%	Report submitted by SLC Geophysical Office.
b. TCH core analysis	Zonge/E.B.N./2 months?	7/1/82	90%	Comments forthcoming from FRK.
6. Fly & Topo Map - N.Patagonia Mtns.				
a. Establish control points	FRK/J.Yanez - 2 weeks	4/1/82	20%	See TM
b. Select Contractor & do work	FRK/WDP - 2 months	9/1/82		
7. File assessment work with Santa Cruz County and BLM (TCH-2A)	RBC/2 days	9/1/82	0%	TCH-2A - could be done anytime.
8. Fluid inclusion study - TCH cores	SAC/FRK/3 weeks	11/1/82	5%	Samples being selected for polished plates.

ASARCO

Southwestern Exploration Division

June 2, 1982

To: J. D. Sell

From: F. R. Koutz

Monthly Report, May 1982
Trench Project (EA-0200)
Santa Cruz Co., Arizona

During May all Trench reports were finalized. The TCH-1 report was passed out May 28. The TCH-2 report is waiting for the last histogram to be final-drafted. It is expected to be finished next week. The TCH-2A report was passed out May 14. Additional comments on the TCH-2A report were submitted for final typing on May 24. A memo on Trench Area Exploration was submitted on May 5. At the request of W. L. Kurtz this memo was revised and resubmitted on May 22. It now includes a "proposed drilling" overlay.

May 20 was spent panelling drill holes and claim corners in the Trench-Hardshell area. The area was successfully flown on May 23 by G. McLane. J. Yanez plans to have claim boundary problems in the Trench area and triangulation stations surveyed in for photogrammetry by the end of June. He will be assisted by T. C. Benavidez and H. M. Stone. They, by this time, should also have completed a tabulation with maps of the claim posts re-established and repapered by them this winter and spring.

A 2-3 day complex resistivity test by Zonge Research and Engineering is planned for the second week in June. This test at minimal cost to the company will determine if it is possible to detect skarn/sulfides at 3500-5000 foot depths and should also provide sulfide/alteration distribution above the Paleozoic.

Expenses for May are estimated to be $3,997. With the approval of the Supplemental Authorization Request, this leaves a balance of approximately $2,634.

F. R. Koutz

FRK/cg

ANNUAL PROJECT PLANNING SHEET

DISTRICT: Southwestern
PROJECT NAME: Trench-Humboldt
PROJECT NUMBER: EA 0200
PROJECT SUPERVISOR: W.D.Payne
PROJECT GEOLOGIST: F.R.Koutz
PREPARED BY/DATE: FRK/2-19-82

EXPENDITURES

1. Month of MAY $ 3,997
2. Current Year Expenses to Date thru MAY $ 51,264
3. Budget for Current Year May 1982 $72,000 S.A. approved
4. Thru previous year, since project began $607,102 [+ $72,267 @ Mendoza]

TYPE OF PROJECT

	Recon
X	Drilling
	Pre-Development
	Other

COST ESTIMATE & APPROPRIATION REQUEST

		Approval Dist. Geol.
Current Yr. Orig. Budget	$	
Current Yr. Add. Request @ ____	$	
Current Yr. Add. Request @ ____	$	
New Total	$	

OBJECTIVE: Complete reports from 1981 drilling. Plan future drilling out of TCH-2 to test for continuity of limestone replacement/skarn mineralization.

Progress for the Month of MAY 1982

PLANNED TASKS	RESPONSIBILITY/TIME TO COMPLETE	TARGET DATE	% COMPLETE	PROGRESS TO DATE
1. Complete TCH-1 drill hole summary (drafting, typing).	FRK/2 weeks	3/15/82	100%	Finally assembled & distributed May 28
2. Complete TCH-2 drill hole summary (drafting, report).	FRK/3 weeks	4/1/82	95%	Ready for final typing; last histogram being final drafted.
3. Complete TCH-2A drill hole summary (drafting, report).	SAC/FRK/3 weeks	4/1/82	100%	Distributed. Additional comments by FRK being final typed.
4. Complete recommendations report Trench area.	FRK/1 week	5/1/82	98%	Revised report being final typed
5. Geophysical Recon. N.Patagonia Mtns.	SLC-Geophys./FRK			
a. Field work + report	/3 weeks	4/15/82	100%	Memo on Patagonia geophysics completed. Zonge to do 2-3 day complex resistivity test @ Trench-TM first/second week of June.
b. TCH core analysis	Zonge/E.B.N./2 months?	7/1/82	100%	
6. Fly & Topo Map - N.Patagonia Mtns.				
a. Establish control points	FRK/J.Yanez - 2 weeks	4/1/82	85%	See TM, flown May 23
b. Select Contractor & do work	FRK/WDP- 2 months	9/1/82		
7. File assessment work with Santa Cruz County and BLM (TCH-2A)	RBC/2 days	9/1/82	0%	TCH-2A - could be done anytime.
8. Fluid inclusion study - TCH cores	SAC/FRK/3 weeks	11/1/82	5%	Samples being selected for polished plates.

ASARCO

Southwestern Exploration Division

July 1, 1982

To: J. D. Sell

From: F. R. Koutz

Monthly Report, June 1982
Trench Project (EA-0200)
Santa Cruz County, AZ

Most of the Trench work this month involved taking care of the final details of texts and drafting for the last of the TCH series of reports. All are now completed.

On June 9-10 I spent 1½ days orienting the Zonge complex resistivity crew (6 men) to the Trench area including their FM radio repeater site at USMM #1 (Hardshell) and IP transmitter site 8 miles SE of Trench near the Heady Asburn Ranch. After setting up they had considerable problems with electronic equipment breakdowns and collected semi-complete data from one site 50' N. of the TCH-2 collar (to avoid the casing) and partial data from a site 400' S60°W of their first site. Since they did not complete their work there will be no charge to us for their field expenses.

On June 29 I spent ½ hour discussing the results of their work with Dudley Emer, the Project Geophysicist. The following summarizes the results in the attached report. E. B. Nicholls was also sent a copy of Zonge's report and by copy of this I request that he determine if their interpretation is reasonable.

1. Mr. Emer determined that the resistivities under TCH-2 can be modeled by a relatively horizontal (±30°) 3 layer case. Weaker intermediate resistivity contrasts are evident but data from additional side stations will be necessary to refine their exact depths and dip.

2. The first contrast (70-300 ohm-m) occurs at about 100' depth which is attributed to the base of weathering, water table, etc. Such a contrast within a few hundred feet of the surface is normal and found in most situations according to Emer.

3. The second distinct contrast occurs at 3800' depth (300-500 ohm-m). The actual volcanic/carbonate (skarn) contact in TCH-2 occurs at 4094' TVD about 170' S45°W of TCH-2 collar and a contact at 3800', 50 feet N. of the TCH-2 collar given the known westerly dip of the contact between TCH-2 and 2A may be completely reasonable. Significant sulfides (IBX-QFP zone) also occur up to 60' above the upper carbonate contact. When pressed Emer stated that he was 95% confident (2 standard deviations) that the contrast was within 400 feet of 3800' depth. Although Mr. Emer knew that significant

change should take place between 3745 and 4045 feet depth in TCH-2 from the core measurements (Figure 3) the core data was not used to pick the 3800' contrast.

4. The most significant finding from the above work is that Zonge is apparently able to measure resistivities to at least the 5000 foot depth range and that a signal can be obtained through very low resistivity material (probably clays) (e.g.: TCH-2-1115', Figure 3) in the upper part of the section.

5. The "major conductor at >1000 feet depth about 400'WSW of the TCH-2 collar" I mentioned in my quarterly report from a preliminary statement by Mr. Emer is probably in error. He now feels that noise is responsible for this response since they did not collect a full set of data at this site before the equipment breakdown.

6. Because of commitments of crews and equipment it will be at least a month before they can return and complete the planned lines from TM-8 to east of TCH-2 and from TM-13 to TCH-1 which will provide a real test of the method. In summary the limited results obtained are much more encouraging than expected.

F. R. Koutz

FRK/cg

cc: E. B. Nicholls (w/o attach.)
E. W. Perkins (w/attach.)

ASARCO

Southwestern Exploration Division

August 11, 1981

To: D. E. Crowell

From: F. R. Koutz

Metallurgical Test Samples
DDH TCH-2, Trench Project
Santa Cruz County, Arizona

On August 6, I delivered to Bruce Apland two 2.15 lb. bags of 10 mesh crusher reject from two split intervals in DDH TCH-2. We would like preliminary metallurgical test work on these samples. We would particularly like to know the distribution of silver between the Pb or Zn concentrate and the tails and if any general concentration problems will be encountered since much of the sphalerite is darker near fractures and grain boundaries.

Assays on these samples are as follows:

	Cu%	Pb%	Zn%	Ag oz/T	Au oz/T	Mo ppm
4882-4891	1.36	1.82	25.00	17.98	.0047	<2
4767-4771	0.18	5.70	16.00	25.70	.0032	4

In addition the following analyses have been obtained, the second set being a composite of a larger interval.

percent	Mn	Fe_{total}	Al_2O_3	CuO	MgO	SiO_2	As	Sb
4882-4891	1.12	6.0	1.5	14.0	0.93	21.8	.002	.001
4767-4783	1.23	8.1	2.3	14.8	0.88	33.8	.006	.001

These samples contain sphalerite (with exsolved chalcopyrite), galena, chalcopyrite, pyrite, and minor hematite. Gangue minerals are primarily calcite, garnet and quartz with minor clays, diopside, chlorite and serpentine. Polished thin sections of core are available for microscopic work. If possible we would like this work to be completed by the beginning of September.

F. R. Koutz

cc: B.W. Apland
W.D. Payne

ASARCO

Mineral Beneficiation Department

September 3, 1981

Memorandum to: Mr. D. E. Crowell

Subject: Metallurgical Test Results
DDH TCH-2, Trench Project

Preliminary metallurgical test work has been completed on two samples from DDH TCH-2 of the Trench Project. These samples, delivered to us by Mr. F. R. Koutz on August 6 are identified as follows:

Sample	% Pb	% Cu	% Zn	opt Ag	opt Au	ppm Mo
Comp A(4767'-4771')	5.70	0.18	16.00	25.70	.0032	4
Comp B(4882'-4891')	1.82	1.36	25.00	17.98	.0047	< 2

Since only two pounds of each sample were available for test work, the scope of test work was limited. Each sample underwent two flotation tests.

The first test series consisted of a standard CuPb float followed by Zn flotation. No regrinding was done and each rougher concentrate was cleaned 2-3 times. Cleaner products were recombined as necessary to ensure enough product weight for complete analyses.

The second test series consisted of a standard Cu Pb float followed by Zn floation. Both the Cu Pb rougher concentrate and the Zn rougher concentrate were reground and cleaned twice. All flotation products from this second test series were separately assayed for the major elements of interest.

The individual test data sheets are attached. A listing of secondary element assays from the first test series is presented in Table I attached.

Based on results from the second test series, locked cycle metallurgical balances were predicted. These are presented in Table II and Table III attached.

Mr. Tony Kroha of Asarco's Southwest Ore Purchasing Department liquidated the predicted Pb and Zn concentrates. The following summarizes these liquidations:

Sample Comp A (4767' - 4771')

Pb 2nd Cleaner Concentrate has a ratio of concentration of 10.54.

% Pb	% Cu	% Zn	% Fe	opt Au	opt Ag
57.26	.40	12.80	5.34	.0137	257.67

Net Smelter Value = $2275.92 per ton concentrate or $215.93 per ton crude ore.

Zn 2nd Cleaner Concentrate has a ratio of concentration of 4.07.

% Pb	% Cu	% Zn	% Fe	opt Au	opt Ag
.94	.61	56.87	4.20	.0204	4.76

Net Smelter Value = $277.74 per ton concentrate or $68.24 per ton crude ore.
Total value of crude ore = $215.93 + $68.24 = $284.17 per ton.

Sample Comp B (4882' - 4891')

Pb 2nd Cleaner Concentrate has a ratio of concentration of 16.75.

% Pb	% Cu	% Zn	% Fe	opt Au	opt Ag
27.75	9.12	20.60	7.76	.0385	269.23

Net Smelter Value = $2223.58 per ton concentrate or $132.75 per ton crude ore.

Zn 2nd Cleaner Concentrate has a ratio of concentrate of 2.47.

% Pb	% Cu	% Zn	% Fe	opt Au	opt Ag
.44	1.60	58.40	3.47	.0079	2.38

Net Smelter Value = $273.17 per ton concentrate or $110.59 per ton crude ore.
Total value of crude ore = $132.75 + $110.59 = $243.34 per ton.

General Observations

Screen analyses of the Zn rougher tailings from each test indicate the following grinds:

Test No.	Wt.% Passing 200 Mesh (74 microns)
A-1	49.6
A-2	48.7
B-1	80.6
B-2	58.5

Sample A (4767' - 4771') was a very clean-floating ore. The Pb rougher concentrate contained some sulfides which were fine-locked in gangue. Regrinding this rougher concentrate helped to reject the gangue. Because of the higher Pb content of this sample, Zn contamination of the Pb concen-

trate was not a problem. The Zn was not highly activated. Addition of $CuSO_4$ did not bring up the Zn until the subsequent addition of collector. The Zn flotation froths were very heavily loaded and it was difficult to produce a loose, flowing froth. The Zn rougher scavenger float pulled some pyrite and also sulfides finely locked in gangue. Subsequent regrinding of the Zn rougher concentrate upgraded the 2nd cleaner concentrate from 52 to 61 percent Zn. Pyrite was readily rejected in the Zn cleaners.

Recovery of base metals was very good. The Ag in the ore is strongly associated with the Pb. The Au was fairly well divided among the sulfides. Approximately 75 percent of the Cu reported in the Zn concentrate (probably exsolved in sphalerite).

Sample B (4882' - 4891') was not as clean an ore as Sample A. In the Pb rougher, a reddish slime floated which took several cleanings to reject. This reddish slime may have been hematite. The Pb rougher concentrate also contained some sulfide fine-locked in gangue. This sample contained less Pb but more Cu than Sample A. Thus the Pb concentrate was more inclined to be contaminated with Zn (20%). Also the Cu was fairly well divided between the Pb concentrate and the Zn concentrate. The Cu in the Pb concentrate probably reflects Cu mineralization while much of the Cu in the Zn concentrate is probably in exsolution in the sphalerite. Again the Ag is strongly associated with the Pb. The Au is distributed throughout the sulfides but tends to concentrate somewhat in the Pb concentrate. Good base metal recovery was achieved. Regrinding of the Pb rougher concentrate improved the Pb concentrate grade. It was difficult to evaluate the effect of regrinding the Zn rougher concentrate since a finer primary grind was used in the test in which no regrinding was done. Again the Zn concentrate froths were heavily loaded and did not flow well.

Future test work should examine (a) the effect of primary grind on recovery and concentrate grade, (b) the effect of activator and collector amounts on Zn flotation, and (c) choice of frother for Zn flotation.

There was some question regarding the amount of Bi versus Ni in the concentrates. Assay results were conflicting and those reported reflect our best judgement based on spectographic analyses of the ore. The samples are currently undergoing re-assay at another lab to resolve the conflict.

The preliminary tests on samples from DDH TCH-2 were encouraging and no particular metallurgical difficulties were indicated.

Bruce W. Apland

Bruce W. Apland

BWA/ab
Attachments

cc: WDPayne, FRKoutz,
TDHenderson/File Misc 2F

AMERICAN SMELTING AND REFINING CO.

ORE TEST DATA SHEET

TESTED BY BWA UNIT AND ORE TREATED TCH-2 Comp A (4767-4771)

TEST NO. A-1 PROCESS OF TREATMENT Pb and Zn Flotation

DATE 8/7/81

NO. HRI 2383	AU	AG	PB %	CU %	ZN %	PPM MO						NON-SULFIDE PB %	CU %	ZN %
ASSAY OF HEADS	.0032	25.7	5.70	0.18	16.0	4	%	%	%	%	%	%	%	%

NO.	DESCRIPTION	DRY WEIGHTS GRAMS	DRY WEIGHTS % TOTAL	ASSAYS PERCENT Pb	Cu	Zn	Fe	Ag
	Pb Ro Conc.	60.1	12.8	39.5	.258	12.2	7.60	18232
	Zn 2nd Cl Conc.	107.2	22.9	0.68	0.56	52.0	2.36	3.76
	Zn Comb Cl Tail	54.1	11.5	1.34	0.138	2.40	26.4	8-08
calc	(Zn Ro Conc.)		(34.4)	(.90)	(0.42)	(35.42)	(10.40)	
	Zn Ro Tail	247.4	52.8	0.068	0.022	1.096	2.66	0.24
		468.8	100.0					

METAL CONTENTS

PRODUCT	Pb	Cu	Zn	Fe	Ag
CALC. HEAD	5.4023	0.1887	12.7962	5.9537	25.2067
Pb Ro Conc	5.0560	0.0330	1.5616	0.9728	23.2370
Zn 2nd Cl Conc	0.1557	0.1282	11.9089	0.5404	0.3610
Zn Comb Cl Tail	0.1541	0.0159	0.2760	3.0360	0.9292
Zn Ro Tail	0.0359	0.0116	0.0507	1.4045	0.1795

RECOVERIES

	Pb	Cu	Zn	Fe	Ag	
	100	100	100	100	100	100
Pb Ro Conc	93.60	17.49	11.32	16.24	92.22	
Zn 2nd Cl Conc	2.89	67.93	86.21	9.08	3.40	
Zn Comb Cl Tail	2.85	8.43	2.00	50.99	3.67	
Zn Ro Tail	0.66	6.15	0.37	23.59	0.71	

REAGENTS	GRIND	Pb Ro	Pb Scav	Pb Comb	Comb	Zn Ro	Zn Scav	1st Pb Cl	2nd Pb Cl	1st Zn Cl	2nd Zn Cl
472.7 gms dry ore @ 67 % solids											
MINUTES	3½'	4'	1'	7'	7'	4'	4'	4'	3'	4'	3'
pH		8.5		10.2			9.4	7.8		10.2	10.6
NaCN (.5%)	0.7								0.07		
ZnSO4·7H2O (5%)	1.4								0.14		
AF 404 (.5%)	0.06										
DF 250		½ dp						1 dp			
Z-11 (.5%)			0.02		0.15		0.09				
MIBC										1 dp	3 dps
CRQ (5%)				1.0%						4.02	5.02
Teresotin F						10 dps	3 dps			4 dps	4 dps
CuSO4·5H2O (5%)				2.25							

NOTES

Beige-colored gangue
Had to combine Pb products because not enough Cl Tail wt.
Pb locked w/ gangue 1st Cl Conc.
Further upgrading will require finer primary grind or a regrind
Not much Zn floated with Pb
Zn not activated until collector added to 2nd conditioner.
Final Zn Scav pulled sulfide locked in gangue.
Zn froths very tight and loaded - hard to loosen froth
Zn cleaners rejected pyrite.

AMERICAN SMELTING AND REFINING CO.
ORE TEST DATA SHEET

TESTED BY BWA UNIT AND ORE TREATED TCH-2 Comp A (4767-4771)

TEST NO. A-2 PROCESS OF TREATMENT Pb AND Zn FLOTATION AND REGRINDING

DATE 8/17/81

NO.	Au	Ag	Pb	Cu	Zn		ppm Mo					NON-SULFIDE Pb	NON-SULFIDE Cu	NON-SULFIDE Zn
			%	%	%	%	%	%	%	%	%	%	%	%
ASSAY OF HEADS	.0032	25.7	5.70	0.18	16.0		4							

NO.	DESCRIPTION	DRY WEIGHTS GRAMS	DRY WEIGHTS % TOTAL	ASSAYS PERCENT Pb	Cu	Zn	Fe	Insol	Au	Ag			
	Pb 2nd Cl Conc	35.3	7.72	57.3	.37	12.0	4.7	1.18	.012	260.6			
	Pb 2nd Cl Tail	7.3	1.60	21.1	.43	23.0	9.7	8.10	.025	70.0			
	Pb 1st Cl Tail	43.6	9.54	7.5	.29	18.0	12.4	15.3	.016	35.5			
	Zn 2nd Cl Conc	86.3	18.89	.59	.60	61.4	2.1	2.52	.016	2.52			
	Zn 2nd Cl Tail	3.8	.83	3.0	.60	36.9	6.5	15.5	.015	16.06			
	Zn 1st Cl Tail	41.2	9.04	.95	.09	3.0	23.0	27.8	.012	5.19			
	Zn Ro. Tail	239.4	52.32	.076	.017	.098	3.60	57.1	.002	0.16			
		457.0	100.00										

METAL CONTENTS

PRODUCT	Pb	Cu	Zn	Au	Ag	
CALC. HEAD	5.7387	.1984	15.2887	.0032	25.7787	
Pb 2nd Cl Conc	4.4236	.02856	.9264	.0009	20.1183	
Pb 2nd Cl Tail	.3376	.00628	.3680	.0004	1.1200	
Pb 1st Cl Tail	.7155	.02766	1.7172	.0015	3.3867	
Zn 2nd Cl Conc	.1114	.1132	16.5985	.0020	.4874	
Zn 2nd Cl Tail	.0349	.0050	.3063	.0001	.1323	
Zn 1st Cl Tail	.0259	.0081	.2712	.0011	.4639	
Zn Ro Tail	.0398	.0087	.0512	.0010	.0838	

RECOVERIES

	Pb	Cu	Zn	Au	Ag	
	100	100	100	100	100	100
Pb 2nd Cl Conc	77.09	14.39	6.02	11.25	77.98	
Pb 2nd Cl Tail	5.88	3.17	2.41	5.00	4.34	
Pb 1st Cl Tail	12.47	13.94	11.21	18.75	13.13	
Zn 2nd Cl Conc	1.94	57.11	76.11	37.50	1.89	
Zn 2nd Cl Tail	.43	2.52	2.01	1.25	.52	
Zn 1st Cl Tail	1.50	4.08	1.78	13.75	1.82	
Zn Ro Tail	.69	4.49	.34	12.50	.32	

REAGENTS

REAGENTS	GRIND	Pb Ro	Pb Cond	Pb Cond	Zn Ro	Pb Regrind	1st Pb Cl	2nd Pb Cl	Zn Regrind	1st Zn Cl	2nd Zn Cl
460.2 gms ore @ 67% solids											
MINUTES	3½'	6'	7'	7'	8'	4'	5'	3'	4'	3'	3'
pH		8.0		11.5				8.0		11.3	11.8
NaCN (1.5%)	.40							.04			
$ZnSO_4 \cdot H_2O$ (5%)	.20							.02			
AP 4.04 (1.5%)	.20	.10									
DF 250		1/2 drop									
Z-11		.06		.10	.05						
MIBC					3 dps						
CMD (5%)			2.17							2.17	2.17
Frother A					1/4 dps					2 dps	2 dps
$CuSO_4 \cdot 5H_2O$ (5%)			1.40								

NOTES

Collectors started to Ro and Scav floats.

Pb Ro Conc had some sulfides final. locked in gangue.

Sphalerite activated by Z-11 following Cu SO4 addition

Zn Ro froth tight and oval - activated, Marks Alot of fines.

Zn Scav Conc contained pyrite and locking of sulfide with gangue.

AMERICAN SMELTING AND REFINING CO.

ORE TEST DATA SHEET

TESTED BY BWA UNIT AND ORE TREATED TCH-2 Comp B (4882-4891)

TEST NO. B-1 PROCESS OF TREATMENT Pb and Zn Flotation

DATE 8/7/81

NO. HRI 2383	AU	AG	PB %	CU %	ZN %	PPM MO %				NON-SULFIDE PB %	CU %	ZN %
ASSAY OF HEADS	.0047	17.98	1.82	1.36	25.0	<2						

NO.	DESCRIPTION	DRY WEIGHTS GRAMS	DRY WEIGHTS % TOTAL	ASSAYS PERCENT Pb	Cu	Zn	Fe	Ag oz
	Pb 3rd Cl Conc	41.5	8.5	17.7	6.0	24.0	8.00	170.44
	Pb Comb Cl Tail	48.0	9.8	1.56	.82	14.3	7.2	10.98
			(18.3)	(9.06)	(3.23)	(18.20)	(7.57)	(85.04)
	Zn 2nd Cl Conc	170.6	35.1	.322	1.74	65.1	3.26	3.44
	Zn Comb Cl Tail	21.7	4.4	.39	.386	3.9	17.6	4.24
			(39.5)	(.330)	(1.589)	(58.22)	(4.86)	(3.53)
	Zn Ro Tail	206.2	42.2	.054	.026	.102	4.8	.68
		488.0	100.0					

METAL CONTENTS

PRODUCT	Pb	Cu	Zn	Fe	Ag oz	
CALC. HEAD	1.3104	1.2295	26.5061	5.3299	17.214	
Pb 3rd Cl Conc	1.5045	.5100	2.040	0.680	14.487	
Pb Comb Cl Tail	0.1529	.0814	1.4014	0.7056	1.076	
Zn 2nd Cl Conc	0.1120	.6107	22.8501	1.1443	1.2074	
Zn Comb Cl Tail	0.0172	.01698	0.1716	0.7744	0.1866	
Zn Ro Tail	0.0228	.01097	0.0430	2.2256	0.2870	

RECOVERIES

PRODUCT	Pb	Cu	Zn	Fe	Ag	
CALC. HEAD	100	100	100	100	100	100
Pb 3rd Cl Conc	83.10	41.49	7.70	12.76	84.02	
Pb Comb Cl Tail	8.45	6.64	5.29	13.24	6.24	
Zn 2nd Cl Conc	6.24	49.70	86.20	21.47	7.00	
Zn Comb Cl Tail	0.95	1.38	0.65	14.53	1.08	
Zn Ro Tail	1.26	0.89	0.16	38.07	1.66	

REAGENTS	GRIND	Pb Ro	Pb SCAV	Pb Comb	Pb Comb	Zn Ro	Zn SCAV	1st Pb Cl	2nd Pb Cl	3rd Pb Cl	1st Zn Cl	2nd Zn Cl
492.7 gms ore @ 67% solids												
MINUTES	5'	3'	1'	7'	7'	5'	3'	3'	3'	3'	3'	3'
pH		7.5		10.7				7.6			10.7	10.8
NaCN (5%) cc	.40							0.04	0.02			
$ZnSO_4 \cdot H_2O$ (5%) cc	.80							0.08	0.16			
AP404 (5%) cc	0.12											
DF250		1dp										
F-11 (5%)			0.06		0.10		0.05					
MIBC						7dps	2dps		1dp		3dps	5dps
CaO 5%				1.42							2.84	3.45
Tree-Rath A												1dp
$CuSO_4 \cdot 5H_2O$ 5%				1.40								

NOTES

Reddish colored gangue
Ore was over-ground
Reddish slime activated in Pb Ro. Took 3 cleanings to reject this reddish slime — may be hematite.
Appeared to be a lot of Cu in the Pb Conc.
Pyrite and sulfide locked w/ gangue rejected in Zn Cl.
Zn heavily — activated as soon as $CuSO_4$ added.
Tree-Rath A loosened froth well.

AMERICAN SMELTING AND REFINING CO.

ORE TEST DATA SHEET

TESTED BY BWR UNIT AND ORE TREATED TCH-2 Comp B (4882-4891)

TEST NO. B-2 PROCESS OF TREATMENT Pb and Zn Flotation

DATE 8/17/81

NO.	AU	AG	PB	CU	ZN	MO (ppm)					NON-SULFIDE PB	NON-SULFIDE CU	NON-SULFIDE ZN
			%	%	%	%	%	%	%	%	%	%	%
ASSAY OF HEADS	.0947	17.98	1.82	1.36	25.0	<2							

NO.	DESCRIPTION	DRY WEIGHTS GRAMS	DRY WEIGHTS % TOTAL	ASSAYS PERCENT Pb	Cu	Zn	Fe	Insol	Au	Ag
	Pb 2nd Cl Conc	20.8	4.26	29.5	8.4	20.0	7.8	1.12	.037	273.08
	Pb 2nd Cl Tail	15.9	3.25	6.0	3.4	27.0	6.1	5.16	.012	60.95
	Pb 1st Cl Tail	55.0	11.26	2.1	1.99	25.0	5.8	9.5	.008	23.93
	Zn 2nd Cl Conc	151.1	30.94	.35	1.43	52.7	2.8	.94	.008	1.35
	Zn 2nd Cl Tail	9.4	1.92	.86	.50	40.2	4.7	5.4	.002	2.22
	Zn 1st Cl Tail	25.8	5.28	.63	1.02	3.8	17.3	23.4	.003	6.12
	Zn Ro Tails	210.4	43.07	.084	.039	.14	5.2	40.8	.001	.48
		488.4	100.00							

METAL CONTENTS

PRODUCT	Pb	Cu	Zn	Au	Ag
CALC. HEAD	1.8825	1.2132	24.9766	.0060	17.4262
Pb 2nd Cl Conc	1.2567	.3578	.8520	.0016	11.6332
Pb 2nd Cl Tail	.1950	.1165	.8775	.0004	1.9209
Pb 1st Cl Tail	.2365	.2241	2.8150	.0009	2.1674
Zn 2nd Cl Conc	.1083	.4424	19.3774	.0025	.4177
Zn 2nd Cl Tail	.0165	.0096	.7718	.0000	.1705
Zn 1st Cl Tail	.0223	.0570	.2006	.0002	.3231
Zn Ro Tail	.0262	.0168	.0603	.0004	.2067

RECOVERIES

PRODUCT	Pb	Cu	Zn	Au	Ag	
CALC. HEAD	100	100	100	100	100	100
Pb 2nd Cl Conc	66.76	29.37	3.41	26.67	66.76	
Pb 2nd Cl Tail	10.36	9.07	3.51	6.67	11.37	
Pb 1st Cl Tail	12.56	18.40	11.27	15.00	15.46	
Zn 2nd Cl Conc	5.75	36.32	77.67	41.67	2.40	
Zn 2nd Cl Tail	.88	.79	3.09	0	0.98	
Zn 1st Cl Tail	1.77	4.68	0.80	3.33	1.85	
Zn Ro Tail	1.92	1.37	0.25	6.66	1.18	

REAGENTS	GRIND	Pb Ro	Pb Cond	Pb Cond	Zn Ro	Pb Regrind	Pb 1st Cl	Pb 2nd Cl	Zn Regrind	Zn 1st Cl	Zn 2nd Cl	NOTES
493.1 ores per @ 67% Solids												Collectors staged to Ro and Scav Floats
MINUTES	3½'	6'	7'	7'	5'	4'	3'	3'	4'	3'	3'	
pH		8.2	11.2				8.1	8.1		11.6	11.9	
NaCN (5%)	0.7											Reddish slime (Zn or gangue) floated with Pb. Also sulfides locked with gangue.
$ZnSO_4 \cdot H_2O$ (5%)	1.4											
AP 404 (1.5%)		.15										Sphalerite ACTIVATED AS SOON AS $CuSO_4$ was added but before subsequent collector addition
SF 250		1/2 dp										
Z-11 (5%)		.02		0.15	.05							
MIBC												
CAO (5%)			1.62							1.82	2.23	Pb 2nd Cl Conc contained some gangue locked with sulfide.
Treat with A					12 dps					8 dps	2 dps	
$CuSO_4 \cdot 5H_2O$ (5%)			2.25									Hard ja oat loose froth

TABLE I
Secondary Element Assays
Tests A-1 and B-1

Test No.	Product	%SiO_2	%Al_2O_3	%CaO	%As	%Sb	%Bi	%Ni	ppm Hg	%F	%MgO
A-1	Pb Ro. Conc.	4.7	0.28	1.33	0.030	0.0030	1.22	0.0028	1	ND	ND
A-1	Zn 2nd Cl. Conc.	6.1	0.38	0.54	0.008	0.0030	0.031	0.0010	2	ND	0.23
B-1	Pb 3rd Cl. Conc.	1.8	0.67	1.40	0.012	0.0032	1.30	0.0018	1	ND	ND
B-1	Zn 2nd Cl. Conc.	0.6	0.19	0.17	0.010	0.0036	0.025	0.0008	2	ND	0.10

TABLE II
Predicted Locked Cycle Results
From Test A-2
Sample Comp A

Product	Weight %	Assays %Pb	%Cu	%Zn	%Fe	Opt Au	Ag	Percent Distribution Pb	Cu	Zn	Fe	Au	Ag
Pb 2nd Cl. Conc.	9.49	57.26	.40	12.80	5.34	.0137	257.67	94.69	19.15	7.97	8.18	16.25	94.78
Zn 2nd Cl. Conc.	24.56	.94	.61	56.87	4.20	.0204	4.76	4.02	75.15	91.65	16.65	62.50	4.53
Zn Rougher Tails	65.95	.11	.017	.087	7.05	.0026	0.27	1.29	5.70	0.38	75.17	21.25	0.69
Calc. Heads	100.00	5.74	.198	15.24	6.19	.0080	25.80	100.00	100.00	100.00	100.00	100.00	100.00

Table III
Predicted Locked Cycle Results
From Test B-2
Sample Comp B

Product	Weight %	Assays %Pb	%Cu	%Zn	%Fe	Opt Au	Ag	Percent Distribution Pb	Cu	Zn	Fe	Au	Ag
Pb 2nd Cl. Conc.	5.97	27.75	9.12	20.60	7.76	.0385	269.23	88.00	44.69	4.92	8.26	38.33	92.23
Zn 2nd Cl. Conc.	40.54	.44	1.60	58.40	3.47	.0079	2.38	9.45	53.32	94.79	25.07	53.34	5.54
Zn Rougher Tails	53.49	.28	.045	.13	6.99	.0009	.72	2.55	1.99	.29	66.67	8.33	2.23
Calc. Heads	100.00	1.88	1.22	24.98	5.61	.0060	17.43	100.00	100.00	100.00	100.00	100.00	100.00

WDP's Copy

SKYLINE LABS, INC.

P.O. Box 50106 • 1700 West Grant Road
Tucson, Arizona 85703
(602) 622-4836

Rec'd 9 Oct 81 FDK

REPORT OF ANALYSIS

CORRECTED ANALYSIS

JOB NO. TAJ 106
October 7, 1981
SHIPMENT NO. TCH-2 COMP.

ASARCO INC.
Attn: Mr. Fleetwood Koutz
P.O. Box 5747
Tucson, AZ 85703

Analysis of 13 Composite Pulp Samples

ITEM		SAMPLE NO.	FIRE ASSAY Ag oz/t	ppm	Au ppm	Cu %	
1	9'	4046-4050	1.26	43.20	.23	1.60	
2	39'	4127-4166 COMP	.74	25.37	<.02	.75	.13 WO_3
3	20'	4195-4215 COMP	5.02	172.12	.05	1.91	
4	43'	4243-4286 COMP	1.94	66.51	<.02	.05	.09 WO_3
5	26'	4286-4312 COMP	1.18	40.45	<.02	.63	
6	40'	4450-4490 COMP	2.96	101.49	<.02	.11	.25 WO_3
7	26'	4653-4679 COMP	14.30	490.30	.05	1.79	
8	27'	4683-4710 COMP	7.92	271.54	<.02	.81	
9	13'	4767-4783 COMP	11.78	403.89	.09	.21	
10	18.4'	4785.6-4804 COMP	5.20	178.29	.07	.15	
11	33'	4804-4837 COMP	6.12	209.83	<.02	.16	
12	33'	4849-4882 COMP	7.34	251.66	.06	.15	
13	9'	4882-4891	17.56	602.06	.15	1.32	

Core all fluoresces from sol. vein mud! Prob scheelite!

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

SKYLINE LABS, INC.
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Tucson, Arizona 85703
(602) 622-4836

JOB NO. TAJ 106
October 7, 1981

ITEM	SAMPLE NO.	Pb %	Zn %	Fe %
1	4046-4050	.08	.13	15.6
2	4127-4166 COMP	.21	.21	15.1
3	4195-4215 COMP	1.67	1.20	12.4
4	4243-4286 COMP	1.56	1.20	9.9
5	4286-4312 COMP	3.75	6.05	6.1
6	4450-4490 COMP	1.50	1.28	9.1
7	4653-4679 COMP	5.40	14.20	6.3
8	4683-4710 COMP	4.10	10.60	4.8
9	4767-4783 COMP	2.18	12.90	8.8
10	4785.6-4804 COMP	.67	11.70	6.5
11	4804-4837 COMP	.77	19.00	9.0
12	4849-4882 COMP	.85	18.40	5.7
13	4882-4891	1.79	25.80	6.2

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JOB NO. TAJ 106
October 7, 1981

ITEM	SAMPLE NO.	Mn %	Sb %	As %
1	4046-4050	.26	.006	.017
2	4127-4166 COMP	1.52	.005	.005
3	4195-4215 COMP	1.13	.003	.005
4	4243-4286 COMP	1.47	.002	.005
5	4286-4312 COMP	1.14	.004	.005
6	4450-4490 COMP	3.30	.004	.005
7	4653-4679 COMP	.96	.002	.005
8	4683-4710 COMP	1.20	.002	.002
9	4767-4783 COMP	1.26	<.001	.010
10	4785.6-4804 COMP	1.70	<.001	.004
11	4804-4837 COMP	1.00	.002	.004
12	4849-4882 COMP	.86	.001	.002
13	4882-4891	1.11	.002	.005

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JOB NO. TAJ 106
October 7, 1981

ITEM	SAMPLE NO.	SiO2 %	Al2O3 %	S %
1	4046-4050	43.2	8.80	20.7
2	4127-4166 COMP	49.2	3.70	2.8
3	4195-4215 COMP	33.6	3.50	3.2
4	4243-4286 COMP	42.1	4.90	1.2
5	4286-4312 COMP	50.7	6.30	4.5
6	4450-4490 COMP	34.7	2.50	1.3
7	4653-4679 COMP	40.4	.89	10.0
8	4683-4710 COMP	30.2	1.40	6.8
9	4767-4783 COMP	34.8	2.10	10.7
10	4785.6-4804 COMP	27.7	2.50	7.3
11	4804-4837 COMP	30.2	1.90	10.1
12	4849-4882 COMP	42.4	1.30	10.6
13	4882-4891	20.9	1.50	15.3

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JOB NO. TAJ 106
October 7, 1981

ITEM	SAMPLE NO.	Mo ppm	MgO %	CaO %
1	4046-4050	55.	.43	.18
2	4127-4166 COMP	100.	.97	9.00
3	4195-4215 COMP	340.	.97	21.90
4	4243-4286 COMP	140.	1.00	20.00
5	4286-4312 COMP	180.	1.20	11.90
6	4450-4490 COMP	38.	2.10	25.10
7	4653-4679 COMP	<2.	.41	11.30
8	4683-4710 COMP	4.	.88	23.80
9	4767-4783 COMP	4.	.93	16.10
10	4785.6-4804 COMP	2.	1.80	23.60
11	4804-4837 COMP	2.	.49	19.20
12	4849-4882 COMP	2.	.66	12.40
13	4882-4891	<2.	.90	15.10

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JOB NO. TAJ 106
October 7, 1981

ITEM	SAMPLE NO.	Bi ppm	Bi/Ag ppm/ppm
1	4046-4050	170.	3.93
2	4127-4166 COMP	100.	3.94
3	4195-4215 COMP	2200.	12.78
4	4243-4286 COMP	280.	4.21
5	4286-4312 COMP	70.	1.73
6	4450-4490 COMP	330.	3.25
7	4653-4679 COMP	1100.	2.24
8	4683-4710 COMP	580.	2.13
9	4767-4783 COMP	970.	2.40
10	4785.6-4804 COMP	570.	3.20
11	4804-4837 COMP	960.	4.57
12	4849-4882 COMP	1800.	7.15
13	4882-4891	1600.	2.65

$\frac{208.98}{107.87} = 1.9$

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SKYLINE LABS, INC.
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JOB NO. TAJ 106
PAGE 1

ITEM NO. SAMPLE NO.
1 = 4046-4050
2 = 4127-4166 COMP
3 = 4195-4215 COMP
4 = 4243-4286 COMP
5 = 4286-4312 COMP
6 = 4450-4490 COMP
7 = 4653-4679 COMP
8 = 4683-4710 COMP

ITEM	1	2	3	4	5	6	7	8
ELEMENT								
Fe	15%	10%	10%	7%	7%	10%	5%	5%
Ca	.05%	5.%	7.%	7.%	5%	10.%	5.%	10.%
Mg	.15%	.3%	.2%	.3%	.3%	.7%	.1%	.2%
Ag	50	50	200	100	100	200	500	300
As	<500	<500	<500	<500	<500	<500	<500	<500
B	<10	<10	<10	<10	<10	<10	<10	<10
Ba	700	<10	<10	10	<10	<10	<10	<10
Be	<2	5	2	<2	3	3	<2	<2
Bi	100	30	2000	200	70	300	1500	1000
Cd	50	<50	50	70	500	50	1000	700
Co	50	20	20	7	50	15	100	70
Cr	30	20	15	30	50	30	30	30
Cu	>10000	>10000	>10000	1500	>10000	2000	>10000	>10000
Ga	<10	<10	<10	<10	<10	<10	<10	<10
Ge	<20	<20	<20	<20	<20	<20	<20	<20
La	100	<20	<20	<20	<20	<20	<20	<20
Mn	1500	>10000	>10000	>10000	>10000	>10000	10000	10000
Mo	50	100	500	100	300	30	<2	<2
Nb	30	30	30	20	30	30	<20	20
Ni	15	70	100	7	15	7	10	10
Pb	2000	5000	>10000	>10000	>10000	>10000	>10000	>10000
Sb	<100	<100	<100	<100	<100	<100	<100	<100
Sc	<10	<10	<10	<10	<10	<10	<10	<10
Sn	15	15	20	10	<10	<10	<10	<10
Sr	<100	<100	<100	<100	<100	<100	<100	<100
Ti	2000	500	700	2000	2000	700	150	500
V	20	30	30	50	50	70	15	20
W	<50	1000	200	700	150	2000	70	70
Y	20	10	<10	10	<10	<10	<10	<10
Zn	300	200	7000	10000	>10000	>10000	>10000	>10000
Zr	200	50	70	150	150	30	<20	50

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JOB NO. TAJ 106
PAGE 2

ITEM NO. SAMPLE NO.
9 = 4767-4783 COMP
10 = 4785.6-4804 COMP
11 = 4804-4837 COMP
12 = 4849-4882 COMP
13 = 4882-4891

ITEM	9	10	11	12	13
ELEMENT					
Fe	7%	7%	5%	7%	7%
Ca	7.%	10.%	7.%	10.%	7.%
Mg	.3%	.07%	.20%	.70%	.3%
Ag	500	300	300	300	500
As	<500	<500	<500	<500	<500
B	<10	<10	<10	<10	<10
Ba	<10	<10	<10	<10	<10
Be	<2	<2	<2	<2	<2
Bi	1000	500	1000	500	2000
Cd	1000	1500	1500	700	2000
Co	150	200	200	100	300
Cr	30	50	70	50	10
Cu	3000	2000	2000	2000	>10000
Ga	<10	<10	<10	<10	<10
Ge	<20	<20	<20	<20	<20
La	<20	<20	<20	<20	<20
Mn	10000	10000	10000	>10000	10000
Mo	<2	<2	<2	<2	<2
Nb	20	30	30	30	20
Ni	15	15	20	15	20
Pb	>10000	>10000	>10000	>10000	>10000
Sb	<100	<100	<100	<100	<100
Sc	<10	<10	<10	<10	<10
Sn	10	15	<10	<10	<10
Sr	<100	<100	<100	<100	<100
Ti	1000	500	500	1000	200
V	20	30	20	30	20
W	<50	100	<50	<50	<50
Y	<10	10	<10	<10	<10
Zn	>10000	>10000	>10000	>10000	>10000
Zr	100	70	70	100	<20

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ASARCO

Southwestern Exploration Division

October 8, 1981

TO: D.E. Crowell
Minerals Beneficiation Dept.

FROM: F.R. Koutz
SW Exploration Dept.

Check Assays
Metallurgical Test Results
DDH-TCH-2 Trench Project
Santa Cruz County, Arizona

The attached assays from Skyline Labs, of Tucson, for Bi, Ni, Cd, Co, Hg and Au are from the second-cleaner concentrates of Tests A-2 and B-2 of B.W. Apland's report to you of September 3. Emission spec. results are also attached.

These check assays were made since there was some question as to the relative Bi and Ni values in Pb and Zn cons. in Tests A-1 and A-2. The other assays are for possible by-products or deleterious elements. The emission spec. results check with the assays and indicate no other elements of interest. Te and Se analyses which I requested were sent to Skyline, of Denver, and it will be some weeks until the results are returned.

I am also attaching a copy of microprobe results of Trench minerals for your general information and files. These will be part of a larger report on Trench mineralogy in process and which you will be marked for a copy.

FRK/mlm

Attachments (4)

c: B.W. Apland
W.D. Payne

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REPORT OF ANALYSIS

JOB NO. TAJ 114
OCTOBER 3, 1981
SHIPMENT NO. TCH-MET

ASARCO INC.
Attn.: Mr. F.R. Koutz
P.O. Box 5747
Tucson, AZ 85703

Analysis of 4 Pulp Samples

ITEM	SAMPLE NO.	Bi ppm	Ni ppm	Cd ppm
1	A-2 Pb	47000.	5.	1100.
2	A-2 Zn	320.	<5.	2500.
3	B-2 Pb	24000.	<5.	740.
4	B-2 Zn	320.	<5.	2500.

ITEM	SAMPLE NO.	Co ppm	Hg ppm	Au ppm
1	A-2 Pb	120.	<.1	.46
2	A-2 Zn	280.	<.1	.12
3	B-2 Pb	130.	<.1	.80
4	B-2 Zn	390.	<.1	.08

William L. Lehmbeck
Manager

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REPORT OF SPECTROGRAPHIC ANALYSIS

JOB NO. TAJ 114
OCTOBER 3, 1981
SHIPMENT NO. TCH-MET

ASARCO INC.
Attn.: Mr. F.R. Koutz
P.O. Box 5747
Tucson, AZ 85703

Analysis of 4 Pulp Samples

The attached pages comprise this report of analysis. Values are reported in parts per million (ppm), except where otherwise noted, to the nearest number in the series 1, 1.5, 2, 3, 5, 7, 10, etc. within each order of magnitude. These numbers represent the approximate boundaries and midpoints of arbitrary ranges of concentration differing by the reciprocal of the cube root of ten. The 'accepted' value is considered to be within + or - 1 step of the range reported at the 68 % confidence level and within + or - 2 steps at the 95 % confidence level.

William L. Lehmbeck
Manager

10/5/81

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JOB NO. TAJ 114
PAGE 1

ITEM NO. SAMPLE NO.
1 = A-2 Pb
2 = A-2 Zn
3 = B-2 Pb
4 = B-2 Zn

ITEM	1	2	3	4
ELEMENT				
Fe	3%	.7%	3%	1%
Ca	.30%	.20%	.70%	.15%
Mg	<.02%	.03%	.05%	.02%
Ag	7000	100	5000	100
As	<500	<500	<500	<500
B	<10	<10	<10	<10
Ba	<10	<10	<10	<10
Be	<2	<2	<2	<2
Bi	>10000	300	>10000	200
Cd	1000	5000	1000	5000
Co	100	200	100	500
Cr	<10	<10	<10	<10
Cu	10000	10000	>10000	>10000
Ga	<10	<10	<10	<10
Ge	<20	<20	<20	<20
La	<20	<20	<20	<20
Mn	1000	3000	2000	3000
Mo	2	<2	<2	<2
Nb	<20	<20	30	<20
Ni	50	<5	30	<5
Pb	>10000	5000	>10000	5000
Sb	<100	<100	<100	<100
Sc	<10	<10	<10	<10
Sn	<10	<10	10	<10
Sr	<100	<100	<100	<100
Ti	150	150	30	50
V	<10	<10	10	<10
W	<50	<50	<50	<50
Y	<10	<10	<10	<10
Zn	>1000	>1000	>1000	>1000
Zr	50	30	<20	<20

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TCH-2 SULFIDE ANALYSES (MICROPROBE) — SEPTEMBER 15, 1981 — F.R. KOUTZ — TABLE B

	1 4664A	2	3	4	5	6	7	8	9	10 4664A	11 4891'	12	13	14*	15*	16	17	18	19	20	21	22	23 4891'	
	galena	gn	gn	gn	gn	sl	cpy	cpy	gn	gn	pyr	sl	sl	gn+ garnet	gn+ sl	gn	gn	pyr	cpy	gn	sl+cpy	gn	gn	
Pb	84.45	82.42	84.36	85.24	84.92	-	0.07	-	84.64	85.24	-	-	-	47.21	65.59	80.82	80.35	-	-	80.64	0.12	82.70	83.00	Pb
Zn	-	-	0.04	-	-	63.45	0.21	-	-	0.08	0.17	62.85	61.65	0.13	15.16	0.26	0.65	0.02	0.47	0.63	58.65	1.41	1.57	Zn
Cu	0.02	-	-	-	-	-	29.58	31.60	-	-	0.05	-	-	-	T	-	-	-	30.91	-	1.53	0.02	0.00	Cu
Ag	0.99	0.94	1.01	0.92	0.97	T	T	T	1.00	1.05	0.02	T	0.01	2.60	2.33	2.49	2.74	-	-	2.40	0.04	1.55	2.16	Ag
Bi	1.24	2.59	1.67	1.25	1.40	-	0.14	0.08	1.30	1.15	0.08	0.01	0.08	7.02	4.28	4.60	4.63	-	-	4.13	-	-	3.46	Bi
Sb	T	-	T	0.05	-	-	0.09	-	-	-	-	0.05	-	T	-	0.07	-	-	-	-	0.02	-	0.02	Sb
As	-	-	-	-	-	0.03	0.17	0.12	-	-	0.30	T	0.12	T	-	-	-	0.31	0.17	-	0.11	-	-	As
Mn	-	T	T	T	T	0.48	-	0.01	-	-	-	0.44	0.25	0.60	0.46	0.02	0.03	0.02	-	-	0.10	0.03	0.04	Mn
Fe	T	0.06	-	-	0.06	1.63	28.56	29.42	0.03	-	47.09	1.71	1.39	4.89	0.03	T	0.05	45.71	28.47	0.03	2.04	0.16	0.02	Fe
S	10.84	10.74	10.74	10.72	10.54	32.61	34.29	34.46	10.68	10.84	52.99	32.98	32.73	8.46	9.76	10.98	10.90	53.46	34.44	11.08	32.97	11.01	11.03	S
Se	0.18	0.19	0.19	0.23	0.08	0.02	T	0.03	0.20	0.17	-	0.08	T	0.15	0.22	0.17	0.21	0.05	-	0.26	0.02	0.27	0.22	Se
Total	97.72	96.94	98.01	98.41	97.97	98.22	93.11	95.72	97.85	98.53	100.70	98.12	96.23	71.07	97.83	99.41	99.56	99.56	94.46	99.19	95.60*	100.05	101.52	Total

*Probe beam on several minerals.

Major
Ca
T:Al

Ni=T-
Cd=.19 Cd=.10
Te=0.0

- Below detection limit: 0.00%
T Trace: 0.01%

Cu. values about 10% low - probably from bad calibration.

Analyses 1-10: TCH-2: 4664'(A)
11-23: TCH-2: 4891'

ASARCO

Southwestern Exploration Division

October 23, 1981

REPORT ON: Sulfide Mineralogy and Compositions
DDH TCH-2
Trench Project
Santa Cruz County, Arizona

BY: F.R. Koutz

F.R. Koutz

Introduction and Summary

The following reports results of petrographic observations on 25 polished thin sections from sulfide intercepts in DDH TCH-2 and microprobe analyses on 4 of those sections. The primary purpose of this study was to identify the minerals present, especially silver-bearing phases, and their textural interrelationships which might effect beneficiation. Initial petrographic examination did not disclose the location of silver of relatively high grade for skarn-related mineralization. Consequently, two days (August 17 and September 15) of semi-quantitative and quantitative microprobe work solved the location and much of the nature of the contained silver. Preliminary metallurgical test work was requested from the Minerals Beneficiation Department and completed September 3. This test work is very encouraging with no particular difficulties indicated (Apland, 1981).

This study shows that 90-95% of the silver is contained in galena but, at the .2-1 micron visual level, a distinct silver-bearing phase in the galena cannot be identified. The very low As and Sb and relatively high Bi and Ag content in galena would suggest a finely divided Bi-sulfosalt in the galena. Relatively constant Bi/Ag ratios and similar occurrences detailed in the literature would suggest that the silver is in a matildite ($AgBiS_2$) component in solid solution with galena.

A secondary purpose of these studies is to contribute to the geologic understanding of the depositional environment of these minerals and of location of this hole to other mineralization remaining to be drilled at Trench. Nothing was found during this study to indicate that mineralization encountered in TCH-2 is an isolated occurrence.

Mineralogy

Sulfides were examined in polished thin sections of core from the following depths in TCH-2:

Table 1

4049	4479	4664A	4767	4786B
4209	4502	4664B	4770	4870
4270	4559	4686	4779	4822
4306	4529	4698	4835	4889
4463	4622	4758	4786A	4891

The following sulfides were identified in approximate order of abundance: sphalerite, galena, chalcopyrite, pyrite, molybdenite and trace covellite and chalcocite (?). Both specular and red hematite are also intimately associated with sulfides. Other gangue minerals are calcite, garnet, chlorite, diopside (?), quartz and several unidentified green calc-silicates and clays. A brief description of the textural interrelationships of these minerals follows.

Sphalerite is light honey-colored to dark reddish-brown in both hand specimen and transmitted light. Cleavage surfaces and rims of sphalerite grains tend to be considerably darker compared to cut or polished surfaces of crystal interiors. Although the rim portions appear to be somewhat richer in iron and contain more exsolved chalcopyrite, and fractures often contain chalcopyrite veinlets, the exact cause of dark sphalerite rims is uncertain and was not completely investigated. Some late, dark chloritic material sometimes coats sphalerite surfaces and may be partially responsible.

Grain size of sphalerite is widely variable from about 0.1 to 5mm but averages 1-3 mm. Sphalerite is one of the earlier sulfides but may cut or engulf pyrite and sometimes chalcopyrite. Sphalerite contains about 1-5% exsolved chalcopyrite blebs and veinlets. The exsolved chalcopyrite ranges in grain size from about 1 mm to below the lower limit of resolution at 1400 x magnification (about 0.2 micron). A considerable percentage of this chalcopyrite is below 40 microns in diameter and probably cannot be liberated by grinding. Grain size of the chalcopyrite interlocked with sphalerite is generally directly dependent on sulfide grain size in the sample: chalcopyrite is coarser if other sulfides are. A minor amount of galena also replaces and veins sphalerite.

Galena is the latest common sulfide and is often coarse grained: up to 3-5 mm. Galena replaces or veins chalcopyrite, sphalerite and sometimes pyrite and is often intergrown with sphalerite and especially chalcopyrite. Many late quartz-calcite veins contain galena and in a few cases galena is sheared along faults to a "steely" texture. Galena lines the exterior portion of many carbonate, clay, hematite-lined vugs. The outer rims and some cleavages of galena may be intergrown and replaced by both specularite blades and red, earthy hematite. Galena often has a steel-blue iridescence on fresh cleavages-probably from submicron coatings of covellite. A few 1-2 micron coatings of covellite were noted on galena, especially around vugs rich in hematite.

Galena was closely examined at 1400 x with an oil immersion lens and no textural or color irregularities were noted that might indicate finely divided sulfosalts or other silver-bearing minerals in the galena. However, no etching or other chemical tests were performed.

Chalcopyrite as mentioned under sphalerite varies widely in grain size. Chalcopyrite commonly forms coarse-grained aggregates which appear to replace sphalerite but there are many ambiguous sphalerite-chalcopyrite exsolution - replacement textures. Chalcopyrite commonly replaces pyrite along fractures and often only relict skeletons of pyrite remain in "exploded bomb" textures. Chalcopyrite definitely cuts and etches green garnet. Although a few 1-2 micron rims of covellite (?) on chalcopyrite were noted and one or two coatings which may be chalcocite, no significant copper enrichment was noted. A very minor amount of brown iron oxide and hematite etch chalcopyrite and, in turn, may be coated by calcite or quartz.

Pyrite is volumetrically one of the least common sulfides especially in zones of heavy Zn-Pb mineralization; most of the iron is in calc-silicates, sphalerite or hematite. In the upper part of the carbonate/skarn zone with heavy hematite, pyrite is much more common but there is little evidence visible major selective oxidation of pyrite to hematite or other iron oxides. Pyrite may be almost massive-in grains up to 2 cm but is more common in the 0.5-3 mm size-range. Pyrite cubes down to 5-50 microns are not uncommon and in marbles are often associated with graphite-chlorite (?) bands and blebs. These pyrite cubes often have pressure shadows which suggest in situ growth during marble recrystalization, migration of graphite bands and marble flow. Pyrite is always the earliest sulfide and cut by all other sulfides. Pyrite clearly cuts green garnet and other calc-silicates.

Molybdenite is rare and is generally related to late calcite $\pm$ quartz $\pm$ sphalerite $\pm$ galena veinlets or may be disseminated in recrystalized calcite. Molybdenite is spatially associated with intrusive breccia zones in limestones, both in the carbonate matrix and in igneous breccia clasts with chalcopyrite $\pm$ bornite $\pm$ magnetite $\pm$ specularite $\pm$ sphalerite $\pm$ galena. Molybdenite in intrusive breccia zones has not yet been studied under the microscope.

Covellite and possible chalcocite have been mentioned above. Possible arsenopyrite grains up to 1-2 mm have been noted megascopically in the upper cpy-py-hematite zone of the skarn but none have been observed in polished section. The low Sb and As content would generally preclude the possibility of sulfosalts rich in these elements.

Hematite is more or less ubiquitous, in at least trace amounts, throughout the skarn section. In the upper vuggy, chalcopyrite-pyrite zone pervasive disseminated red hematite may locally make up 5-10% of the

core; at least a few tenths percent is common in high-sulfide areas. The percentage of hematite is usually higher in the upper portions of sulfide zones surrounded by barren marble and/or calc-silicates, in vuggy areas or zones with high galena or high silver contents.

In polished section, as mentioned above, hematite as bladed specularite and earthy aggregates etches and coats sulfides, especially galena, and fills vugs. Specularite is often coated with calcite or quartz while earthy red hematite soaks surrounding calc-silicates. In all cases hematite is later than sulfides. In some cases hematite has as its source oxidized sulfides, particularly pyrite, and small disseminated red hematite cubes pseudomorphous after pyrite are common in soft calc-silicate and marble matrices. Only trace magnetite has been noted in the skarn section but some hematite may be after magnetite. Other hematite may be from the oxidation of iron-rich calc-silicates. Much hematite, however, may be primary, that is precipitated from oxidizing solutions.

The close correlation of silver content with hematite originally suggested that silver may be directly associated or occluded in hematite. This could be due to oxidation and enrichment by late-stage hypogene processes or by supergene processes with later overprint by high temperature solutions. Since hematite is the stable iron oxide phase relative to goethite above 170° C, the only indication is that the iron oxides have been subjected at least to this temperature. Microprobe work showed no relation of silver to hematite. Nevertheless, the close association of silver, galena and hematite merits further investigation.

Little time was spent in examination of calc-silicates, carbonates and other gangue minerals in the polished thin sections. Green garnet is common as is chlorite. A pyroxene-probably diopside was noted in several sections. Minor epidote-zoisite and trace wollastonite were noted. A serpentine-talc-like mineral was also noted. No attempt was made to identify fine-grained minor, local clay minerals. Quartz generally occurs in veins or intergrown with sulfides with grain size seldom over 1 mm. Quartz is more common than megascopic examination would indicate and is probably the second most common gangue mineral. Calcite is the most common gangue mineral. Some of the later carbonates, filling vugs, are light-pink and may be rhodochrosite.

All transparent minerals were scanned for the presence of fluid inclusions. Fluid inclusions were locally very common in quartz often imparting a milky color megascopically. Calcite also locally contains minor populations of fluid inclusions, especially where coarse-grained. A few inclusions were noted in sphalerite and garnet but they were relatively rare. Most fluid inclusions were small - in the 0.5-5 micron size range although in dense inclusion populations in quartz

a few inclusions up to 20 microns were noted. Most inclusions except for those in calcite appear to be primary. Most inclusions are 2-phase, liquid-rich with the vapor bubble about 20-45 volume percent of the inclusion. Very few inclusions contained daughter minerals-which were birefringent and therefore not halite. At higher magnification (1250x) many of the inclusions in quartz seemed to have a second outer rim to the vapor bubble which may be liquid CO_2 or may be just a very strong becke line. Since quartz is relatively common in the TCH-2 mineralized section (possibly from remobilized chert) additional fluid inclusion study will prove to be valuable in understanding this ore occurrence.

Location of Silver - Microprobe work

No specific silver mineral was identified in mineragraphic work. In an attempt to isolate the location of silver two high-silver sample intervals (4767-71' and 4882-91') were submitted (Aug. 6) to the Minerals Beneficiation Department for preliminary metallurgical test work. Emission spectrograph analyses were also requested from Skyline Labs on a series of composites. On August 17, four hours were spent analysing two polished thin sections on the electron microprobe at the University of Arizona. An additional 5 hours was spent on 2 additional microprobe samples on September 15.

Three main methods were used on the electron microprobe to identify and quantify mineral compositions: 1. Scanning electron beam x-ray backscatter imagery ("rastor scans") for various elements at various magnifications shown on figures 1-5. 2. Semi-Quantitative Energy Dispersive (EDX) spectral scans for all elements above Atomic Number 9. 3. Wave-length dispersive x-ray emission counts calibrated to standards for individual elements and for up to 11 elements simultaneously. These analyses were corrected for matrix effects by the ZAF program. In general, counting statistics indicate a precision of 3-5% of the amount present for each element at the +0.1% range. Each set of quantitative analyses also had a simultaneous semi-quantitative (EDX) spectral scan so that almost no major elements would be missed. Analyses for Ag and a few other elements are given on Table 2. Twenty-three complete analyses (Sept 15) are given on Table 3 as are bulk assays for the three intervals containing the four analysed polished thin sections.

From the first microprobe EDX scans it became clear that a major portion (up to several percent) of silver was contained in galena. No other mineral showed Ag in the EDX scans. (Several tenths percent is the lower limit of detection with no interferences in the EDX mode). Galena showed no detectable Sb, As or Cu. Sphalerite showed several percent Fe and Fe/Mn of 3-5 to 1. Garnet was primarily a CaFe-type (andradite) with detectable Ti. Some of the garnet rims, however, did have a minor Al (grossularite component).

A series of rastor scans (figures 1-3) was made to determine the distribution of Ag and other elements. All scans were made on sample TCH-2:4664B. The scale bar provides scale rather than the magnification indicated on polaroid photos-reduced here for presentation.

Photo set A on Figure 1 shows Fe and Ag x-ray distribution in bladed hematite (in a late calcite matrix). The AgL x-rays show no particular Ag distribution. Ag is actually at or below background (± 100 ppm). Note that the AgL scan was run 3 times as long as the FeK scan.

Set B shows Cu, Pb, Fe, Ag, Sb and As distribution at a galena/ chalcopyrite interface. Note that Ag is distinctly concentrated in galena with only a faintly higher than background Sb and As concentration in galena. By noting exposure times it is evident that the Ag content is much too high relative to Sb and As to be contained a simple As or Sb-sulfosalt.

Set C shows a sphalerite, pyrite, chalcopyrite junction. Silver distribution is relatively uniform and low (80 sec. exposure) except for a slight increase in a vug at the junction. This may be an artifact of geometry and not an actual increase in Ag.

Set D (Figure 2) shows a banded zone of sphalerite, chalcopyrite and galena. Note the relatively high Ag concentration in galena.

Set F (Figure 2) shows a galena vein cutting sphalerite. (Much of matrix in NE and SW corners is calcite). Hematite coats galena and sphalerite and also floods some calcite. Silver is mainly concentrated in galena. Part of the copper in the galena is from thin films of covellite and minor chalcopyrite. There are also exsolved blebs of chalcopyrite in sphalerite. Note the very slight increase in Sb in galena - but not enough to account for Ag in a Sb-sulfosalt.

Set E (Figure 3) shows chalcopyrite exsolution blebs in sphalerite - which increase toward the upper right margin and a vertical chalcopyrite vein. The iron content however, is not enough to account for the strong honey-to-dark-brownish-black color change from the interior to rims of sphalerite crystals.

Set G (Figure 3) shows that Ag distribution in galena is relatively even at high magnification suggesting that if silver is in a specific phase in galena it is finely divided.

Table 2 shows silver content in galena (0.5-1.8%) and other minerals in TCH-2:4664B and 4770. These results suggest that about 95% of the silver at Trench is in galena but is so finely divided that it can not be distinguished. Ramdohr (1980, p646) states that about 0.1% Ag is the maximum that can be contained in actual solid solution in galena without separate, distinct phases being present.

The solution to the location of the silver came in late August with emission spectrograph results on composites. The raw ore contains up to 2000 ppm bismuth. Apland (1981) also reported that lead concentrates from TCH-2 ran up to 1.3% Bi. Bismuth was not scanned for or quantitively analysed on the microprobe on August 17 because it was not noted in the EDX scans. Unfortunately, the peak for Bi is so close to Pb and S that in galena several percent Bi was easily masked by broad Pb and S peaks with the usual EDX detector slit window used.

A second period (September 5) of microprobe work confirmed the presence of Bi with Ag in galena. These results are presented on Tables 2 and 3 and Figures 3-5.

Figure 3 (Set A) shows the distribution of Bi and Ag in galena in TCH-2:4664A with several times more Bi than Ag.

Figure 4 (Set B) shows intergrown galena and chalcopyrite with a late carbonate infilling. Note the presence of Ag, Bi, Se and trace Zn and Ni in galena while As and Sb are evenly distributed at background levels. The carbonate is manganoan calcite. Figure 5 shows that Au in the "B" field of view is very slightly higher in galena but at very low concentration levels. The lower portion of Table 2 presents quantitative Ag, Bi and other elemental analyses from photo Set B.

Figure 5 (Set C) shows elemental distribution at a galena, sphalerite junction, while Bi and Ag are mostly confined to galena. Table 3 presents 23 complete sulfide analyses from samples 4664A and 4891. Of particular interest are the Ag, Bi, and Se contents of galena and Fe, Mn and Cd contents of sphalerite and the As content of chalcopyrite and pyrite.

DISCUSSION

The actual form of Ag in galena is unknown but the results would suggest a silver-bismuth sulfosalt. Ramdohr (1980) suggests that the silver in Bi-rich galenas is in the form of a $AgBiS_2$ (matildite or schapbachite) component in PbS. This $AgBiS_2$ component has the galena lattice and dimentions above 210-225° and has considerable solubility (up to 11% Bi and 6% Ag noted) in galena. Ramdohr (1980, p657 and 667) states:

> "High contents of $AgBiS_2$ form schapbachite by unmixing, moderate amounts cause abnormal birefringence, but relatively considerable amounts still remain dissolved and can not be discerned by microscopy.

> "As far as mineral dressing is concerned, the miscibility of PbS and $AgBiS_2$ at high temperatures is of great interest. It explains the occurrence of galena very rich in silver which does not show a 'silver-bearer' under the microscope. It is characteristic in these cases that the Ag is almost always coupled with considerable amounts, in part almost exactly equivalent amounts of (undesirable) Bi. In the case of essentially equivalent amounts of Ag-and Bi-content in galena of high to intermediate temperature of formation you will search in vain with the microscope for the silver-bearing mineral."

The weight ratio of Bi/Ag in matildite is 1.94 - reasonably close to the Bi/Ag ratios of analysed galenas on Table 3 - which suggest only a slight excess of Ag. Composites of assay pulps from TCH-2:4046-4891 have a Bi/Ag ratio of 1.73 to 12.78 with a mean of about 3.4. The excess Bi, if all Ag is considered in a matildite component, would suggest other Bi-bearing phases in the ores. At this point, little would be gained in the search for additional phases when the main phase can not be isolated above visible limits. Minor variation in Ag and Bi contents across galena crystals may suggest incipient unmixing but several hours of searching at 1400x magnification could not discern the faintest hint of the rhombic exsolution lamallae of matildite illustrated in Ramdohr (1980).

The occurrence of matildite is widespread with Pb-Zn-Cu ores. Ramdohr lists 16 described occurrences. Chapman and Stevens (1933) describe a similar situation to Trench of Ag and Bi-bearing galenas from Leadville. Examination of SW Ore Purchasing Records from the Patagonia Mountains shows Bi contents of Duquesne Pb concentrates of 0.63 - 1.63% (1.2% mean), Flux Mine (1950's): 0.10-50% (0.25% mean) and Trench - Josephine/January-Norton veins (1940's) of 0.10-.32% (0.18% mean). The exact Bi, Sb, As and Ag content of galenas is unknown from these mines but considerable amounts of Sb-As sulfosalts exist. In the Patagonia Mountains Bi content may be higher in skarns than vein-type ones. Little is known on Bi zoning in the Patagonia Mountains. Ramdohr (1980) suggests that high Bi contents compared to Sb and As in galena may be more common in deeper ores - relatively consistent to the depths from which the TCH-2 galenas were sampled.

The presence of even this amount of bismuth should present only a minor metallurgical problem. The SW Ore Purchasing Department states that 0.05% Bi is allowed free in Pb concentrates and additional Bi is deducted at the rate of $0.50 per pound. 1.3% or 26 lbs/ton bismuth would only mean a deduction of $13 from a lead concentrate from Trench worth several thousand dollars per ton. The only other metallurgical problem encountered was the presence of hematite intergrown with galena which required several cleanings to reject the resultant red slime.

Much work remains to be done to understand the deep Trench ore occurance. There is considerable zoning of metals sulfides and calc-siliates within individual mineralized zones and among favorable horizons in the total Paleozoic section intercepted. Considerable petrographic and minor microprobe work of silicates and sulfides will be part of this. Fluid inclusion populations, temperatures and salinities should provide guides to the location of favorable intrusives and help to understand the late hematite stage of mineralization.

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Chapman, E.P. and Stevens, R.E. 1933, Silver and Bismuth-Bearing Galena from Leadville: Econ. Geol. v28, p628-685.

Ramdohr, Paul, 1980, The Ore Minerals and their Intergrowths, 2nd Ed., Pergamon Press, 1207p.

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cc: S.A. Catlin
D.E. Crowell
F.T. Graybeal

TABLE 2

TCH-2 SULFIDE ANALYSES (MICROPROBE) PARTIAL ANALSES

All values in percent
- Below detection limit 0.01%
T Trace: About 0.01%

Microprobe Beam: 3-5 microns
August 17, 1981

TCH-2: 4664' (B)	Ag(%)
gn	0.64
	0.50
	1.11
cpy	-
	-
gn	1.22
sl	0.05
qtz	0.02
sl	-
gn	0.97
sl	T

TCH-2 -4770'	Ag(%)
py	-
qtz	-
sl	-
gn	1.78
	1.73 (0.01Sb)
py	T
sl	0.02
gn	1.51
	1.53
sl	T
sl	-
gn	1.61 (-Sb, -As)

TCH-2:4770'- Ag% (5 micron spots in single galena crystals)

1.60, 1.66, 1.65, 1.40, 1.46, 1.61, 1.62
1.04, 1.12, 1.22, 1.12
1.40, 1.23, 1.15, 1.34, 1.30

} All ± 3% of amount present
STD. Dev. Counting Error

- No As or Sb detected in Energy Dispensive (EDX) spectral scans in most galena
- Fe Mn in sphalerite (1-3%Fe, 0.3-0.8%Mn). Zoning in sl not clear.
- CaFe (Andradite) more common than CaAl (Grossularite) garnet but there is local zoning. Several tenths % Ti in garnet. Plus a rare CaTi mineral probably sphene ($CaTiO_3$).

4664' (A) All values % (from figure 4, set B) September 15, 1981

cpy: Ag, - Bi, T: As, 29.7 Cu (low)
gn: 1.03Ag, 1.37Bi, 84.4Pb, 0.16Se, - As, T:Cu, - Mn, - Au, T:Te, 10.8S
gn: 0.95Ag, 1.53Bi
0.92Ag, 1.47Bi
0.83Ag, 1.00Bi

TCH-2 SULFIDE ANALYSES (MICROPROBE) — SEPTEMBER 15, 1981 — F.R. KOUTZ — TABLE 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14*	15*	16	17	18	19	20	21*	22*	23*	
	4664A ←								→	4664A	4891' ←												→ 4891'	
	galena	gn	gn	gn	gn	sl	cpy	cpy	gn	gn	pyr	sl	sl	gn+ garnet	gn+ sl	gn	gn	pyr	cpy	gn	sl+cpy	gn+sl	gn+sl	
Pb	84.45	82.42	84.36	85.24	84.92	-	0.07	-	84.64	85.24	-	-	-	47.21	65.59	80.82	80.35	-	-	80.64	0.12	82.70	83.00	Pb
Zn	-	-	0.04	-	-	63.45	0.21	-	-	0.08	0.17	62.85	61.65	0.13	15.16	0.26	0.65	0.02	0.47	0.63	58.65	1.41	1.57	Zn
Cu	0.02	-	-	-	-	-	29.58	31.60	-	-	0.05	-	-	-	T	-	-	-	30.91	-	1.53	0.02	0.00	Cu
Ag	0.99	0.94	1.01	0.92	0.97	T	T	T	1.00	1.05	0.02	T	0.01	2.60	2.33	2.49	2.74	-	-	2.40	0.04	1.55	2.16	Ag
Bi	1.24	2.59	1.67	1.25	1.40	-	0.14	0.08	1.30	1.15	0.08	0.01	0.08	7.02	4.28	4.60	4.63	-	-	4.13	-	2.90	3.46	Bi
Sb	T	-	T	0.05	-	-	0.09	-	-	-	-	0.05	-	T	-	0.07	-	-	-	-	0.02	-	0.02	Sb
As	-	-	-	-	-	0.03	0.17	0.12	-	-	0.30	T	0.12	T	-	-	-	0.31	0.17	-	0.11	-	-	As
Mn	-	T	T	T	T	0.48	-	0.01	-	-	-	0.44	0.25	0.60	0.46	0.02	0.03	0.02	-	-	0.10	0.03	0.04	Mn
Fe	T	0.06	-	-	0.06	1.63	28.56	29.42	0.03	-	47.09	1.71	1.39	4.89	0.03	T	0.05	45.71	28.47	0.03	2.04	0.16	0.02	Fe
S	10.84	10.74	10.74	10.72	10.54	32.61	34.29	34.46	10.68	10.84	52.99	32.98	32.73	8.46	9.76	10.98	10.90	53.46	34.44	11.08	32.97	11.01	11.03	S
Se	0.18	0.19	0.19	0.23	0.08	0.02	T	0.03	0.20	0.17	-	0.08	T	0.15	0.22	0.17	0.21	0.05	-	0.26	0.02	0.27	0.22	Se
Total	97.72	96.94	98.01	98.41	97.97	98.22	93.11	95.72	97.85	98.53	100.70	98.12	96.23	71.07	97.83	99.41	99.56	99.56	94.46	99.19	95.60	100.05	101.52	Tota
Bi/Ag	1.25	2.75	1.65	1.36	1.44	-	-	-	1.30	1.10	4.00	Cd=.31	8.00 Cd=.28	2.70 Major Ca T:Al	1.84	1.85	1.69	-	-	1.72	-	1.87 Ni=T- Cd=.19 Te=0.0	1.60 Cd=.10	Bi/Ag

\- Below detection limit: 0.00%
T Trace: 0.01%

Cu. values about 10% low - probably from bad calibration.

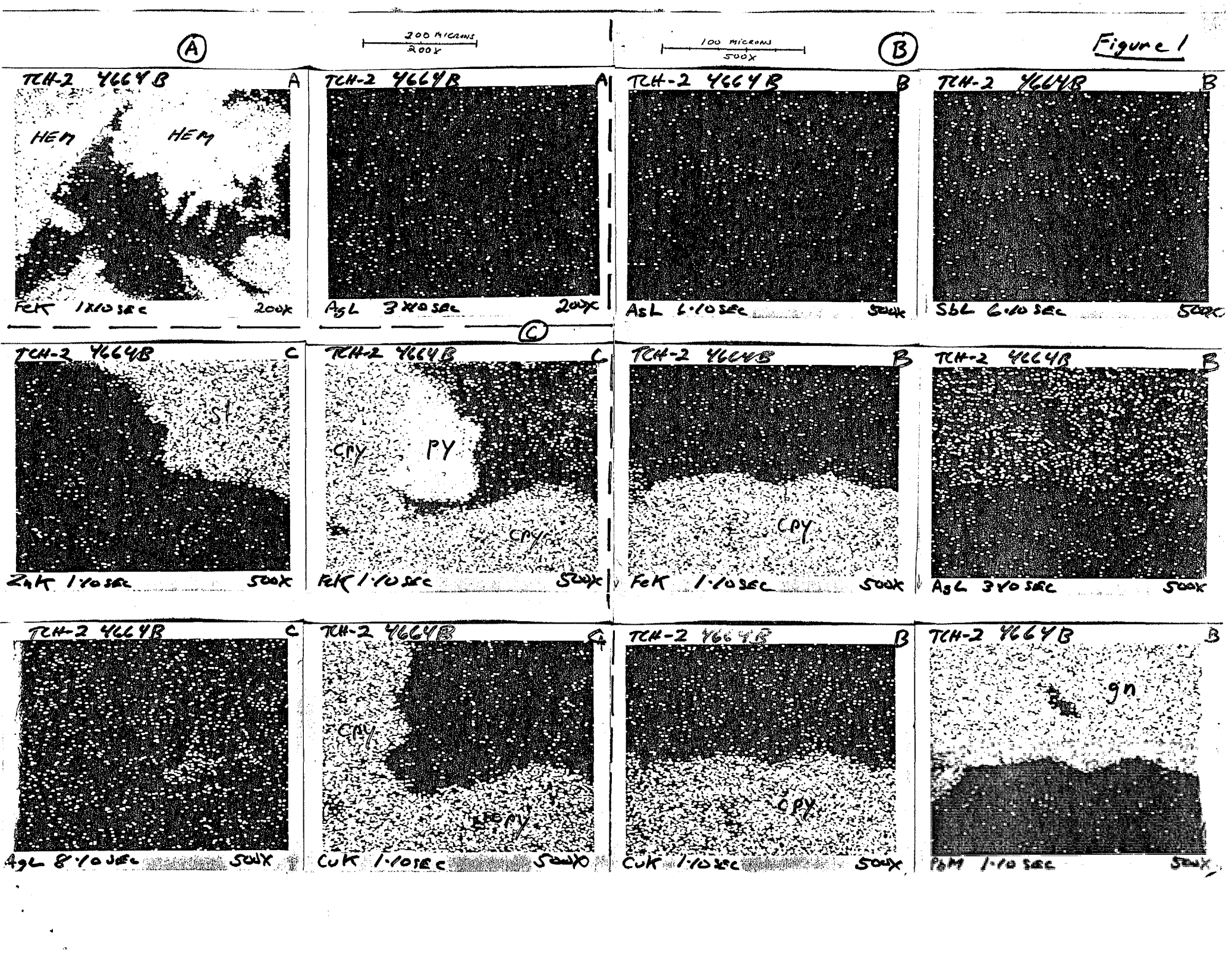
*Probe beam on several minerals.

Analyses 1-10: TCH-2: 4664'(A)
11-23: TCH-2: 4891'

SAMPLE	INCLUSIVE ASSAYFOOTAGE	Ag oz/T	Cu%	Pb%	Zn%	Mo ppm	Au oz/T
4664'	4662-4666	33.86	3.64	10.80	26.80	<2	0.0018
4770'	4767-4771	25.70	0.18	5.70	16.00	4	0.0032
4891'	4882-4891	17.98	1.36	1.82	25.00	<2	0.0020

SAMPLE	INCLUSIVE ASSAYFOOTAGE	Fe%	Mn%	Sb%	As%	Bi%	S%	SiO_2%	Al_2O_3%	CaO%	MgO%
4664'	4653-4679	6.3	0.96	.002	.005	0.110	10.0	40.0	0.89	11.30	0.41
4770'	4767-4783	8.8	1.26	<.001	.010	0.097	10.7	34.8	2.10	16.10	0.93
4891'	4882-4891	6.2	1.11	.002	.005	0.160	15.3	20.9	1.50	15.10	0.90

Figure 1


A
200 MICRONS
200X
100 MICRONS
500X
B
TCH-2 4664B A
HEM
HEM
FeK 1X10 SEC 200X
TCH-2 4664B A
AgL 3X10 SEC 200X
TCH-2 4664B B
AsL 6·10 SEC 500X
TCH-2 4664B B
SbL 6·10 SEC 500X
C
TCH-2 4664B C
SI
ZnK 1X10 SEC 500X
TCH-2 4664B C
CPY
PY
CPY
FeK 1·10 SEC 500X
TCH-2 4664B B
CPY
FeK 1·10 SEC 500X
TCH-2 4664B B
AgL 3X10 SEC 500X
TCH-2 4664B C
AgL 8·10 SEC 500X
TCH-2 4664B C
CPY
CPY
CuK 1·10 SEC 500X
TCH-2 4664B B
CPY
CuK 1·10 SEC 500X
TCH-2 4664B B
gn
PbM 1·10 SEC 500X

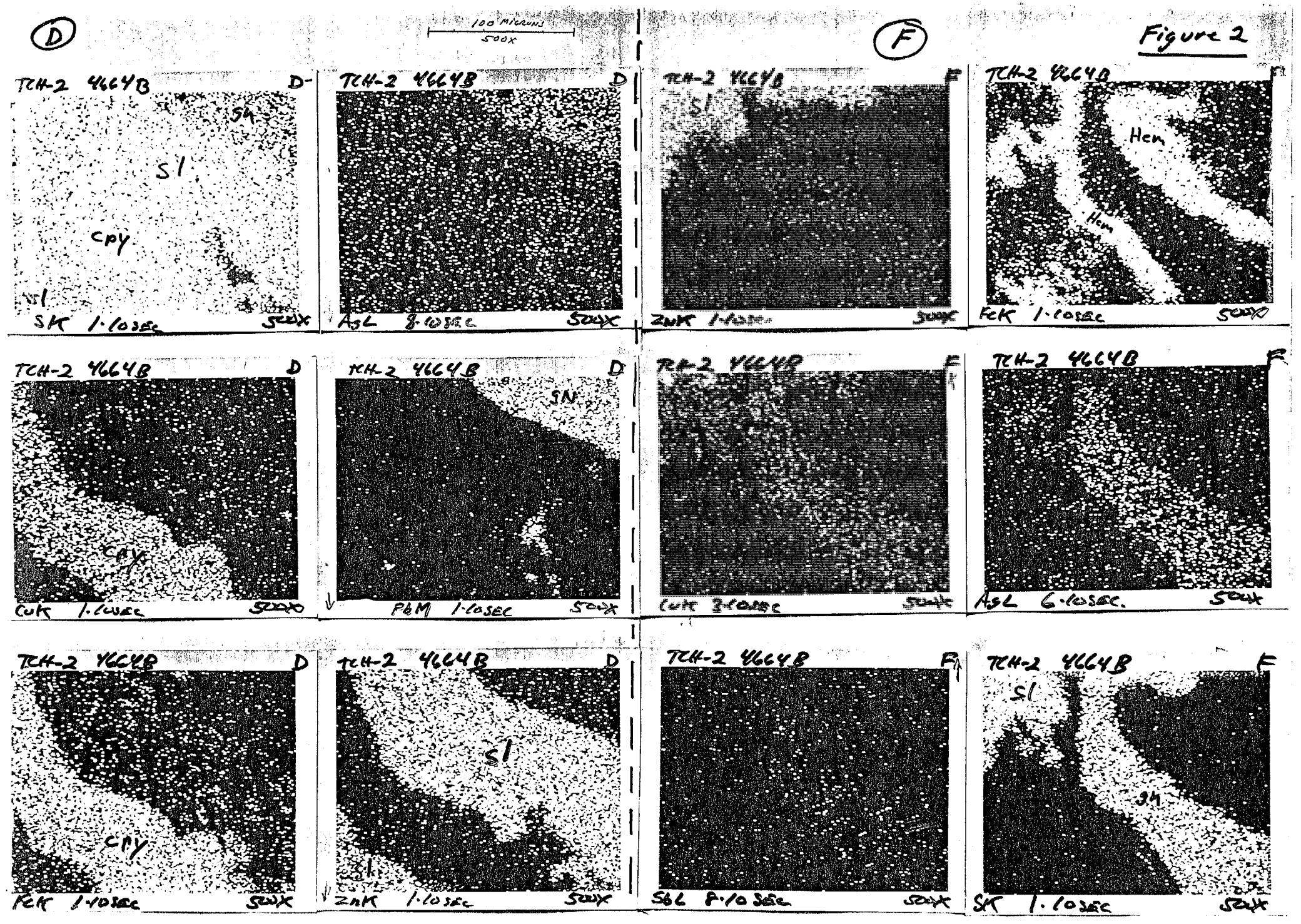
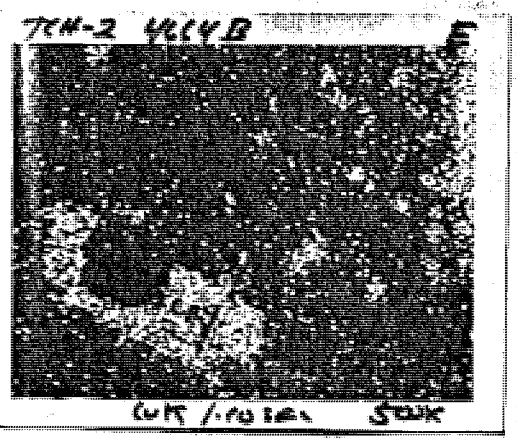
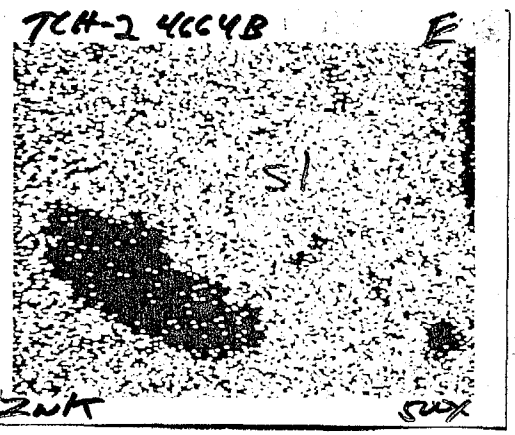
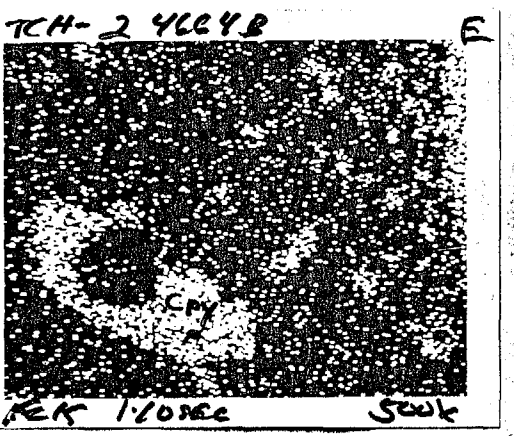

D
100 MICRONS
500X
F
Figure 2
TCH-2 4664B D
S4
S1
CPY
NS1
SK 1.10SEC
500X
TCH-2 4664B D
AGL 8.00SEC
500X
TCH-2 4664B F
S1
ZNK 1-10SEC
500X
TCH-2 4664B F
Hem
Hem
FCK 1.10SEC
500X
TCH-2 4664B D
CPY
CUK 1.10SEC
500X
TCH-2 4664B D
SN
PBM 1.10SEC
500X
TCH-2 4664B F
CUK 3.00SEC
500X
TCH-2 4664B F
AGL 6.10SEC.
500X
TCH-2 4664B D
CPY
FCK 1.10SEC
500X
TCH-2 4664B D
S1
ZNK 1.10SEC
500X
TCH-2 4664B F
SBL 8.10SEC
500X
TCH-2 4664B F
S1
S4
SK 1.10SEC
500X

FIGURE 3

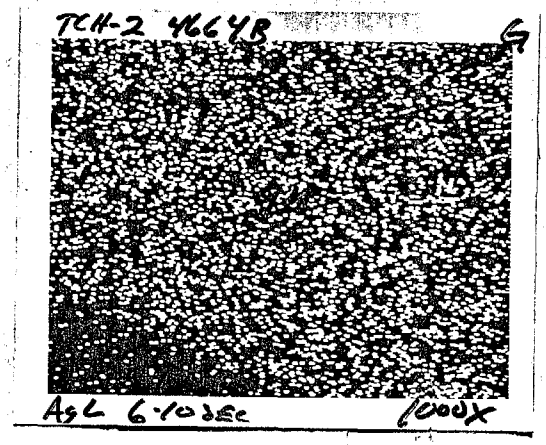


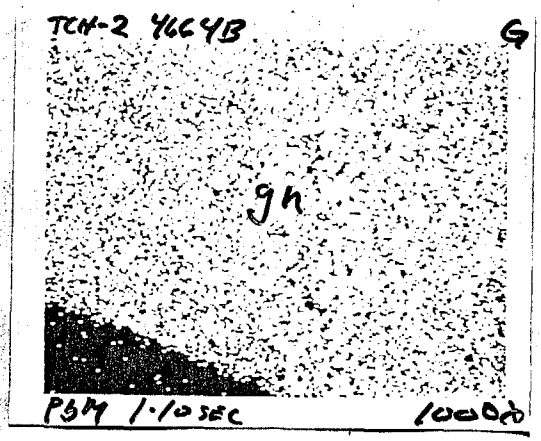


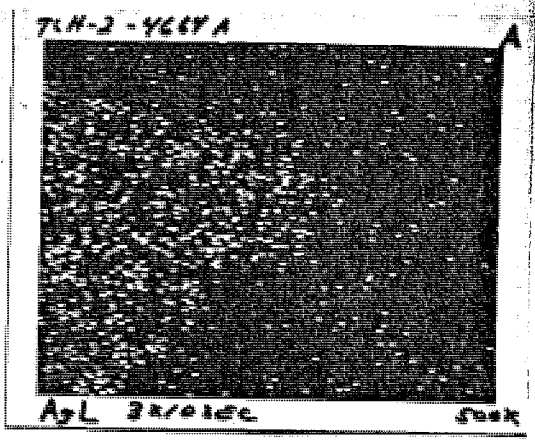


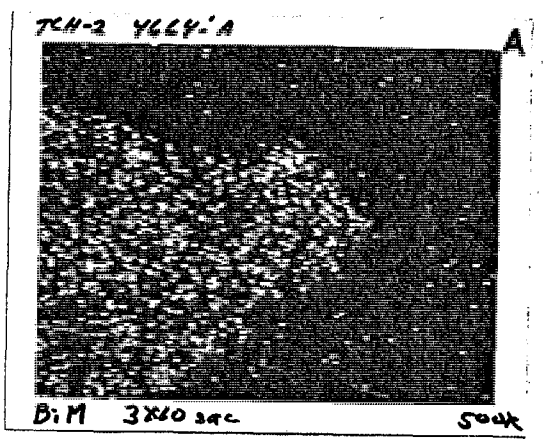
100 MICRONS
500X

40 MICRONS
1000X









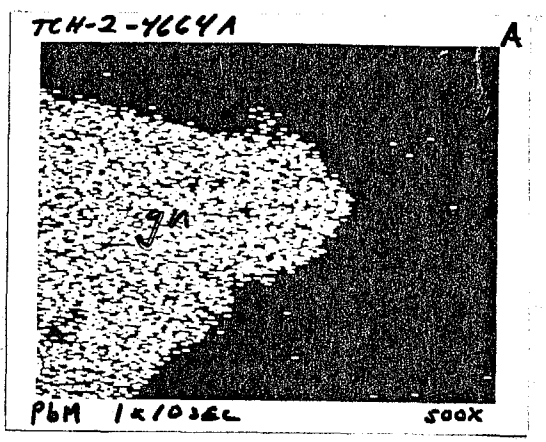


FIGURE 4

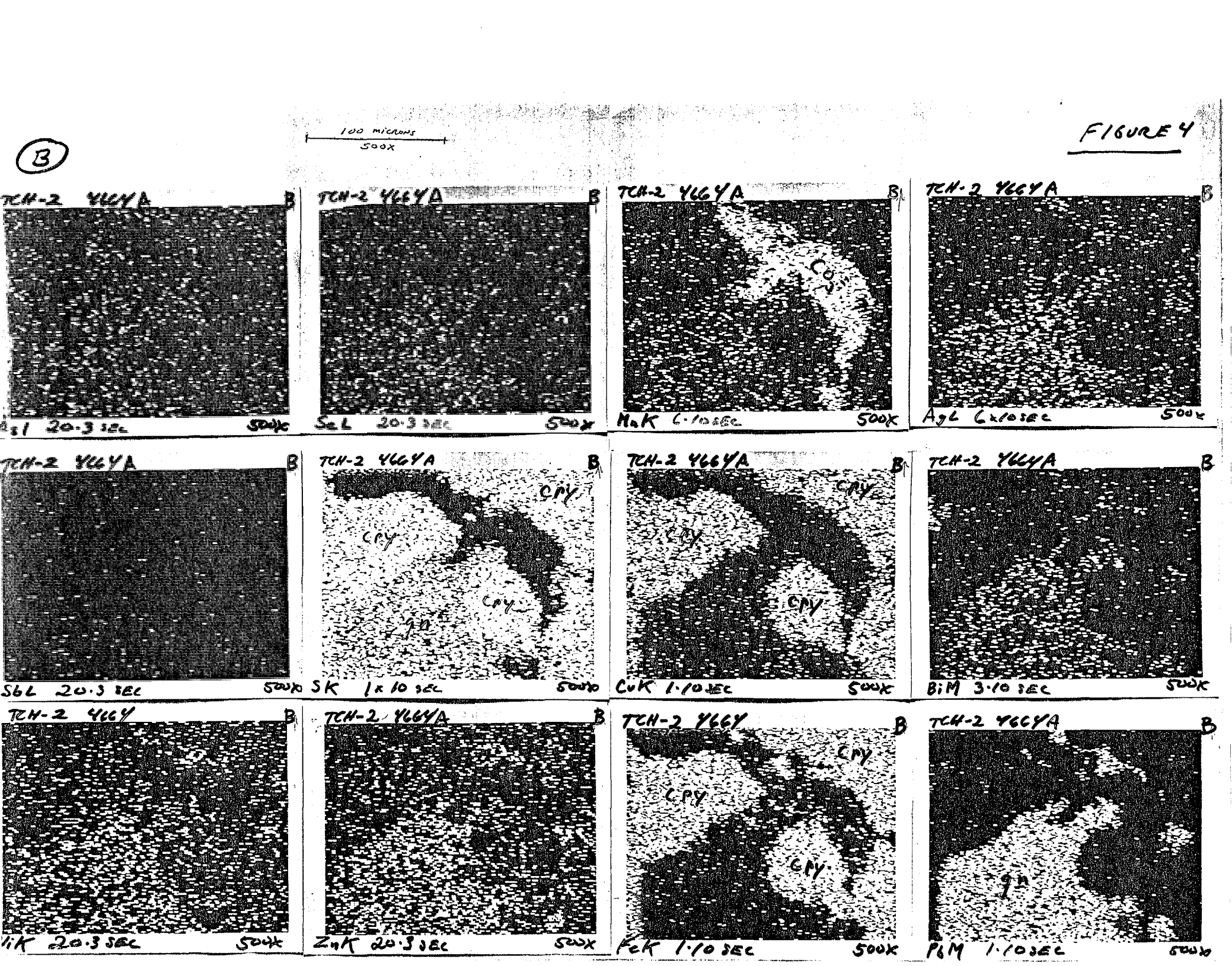
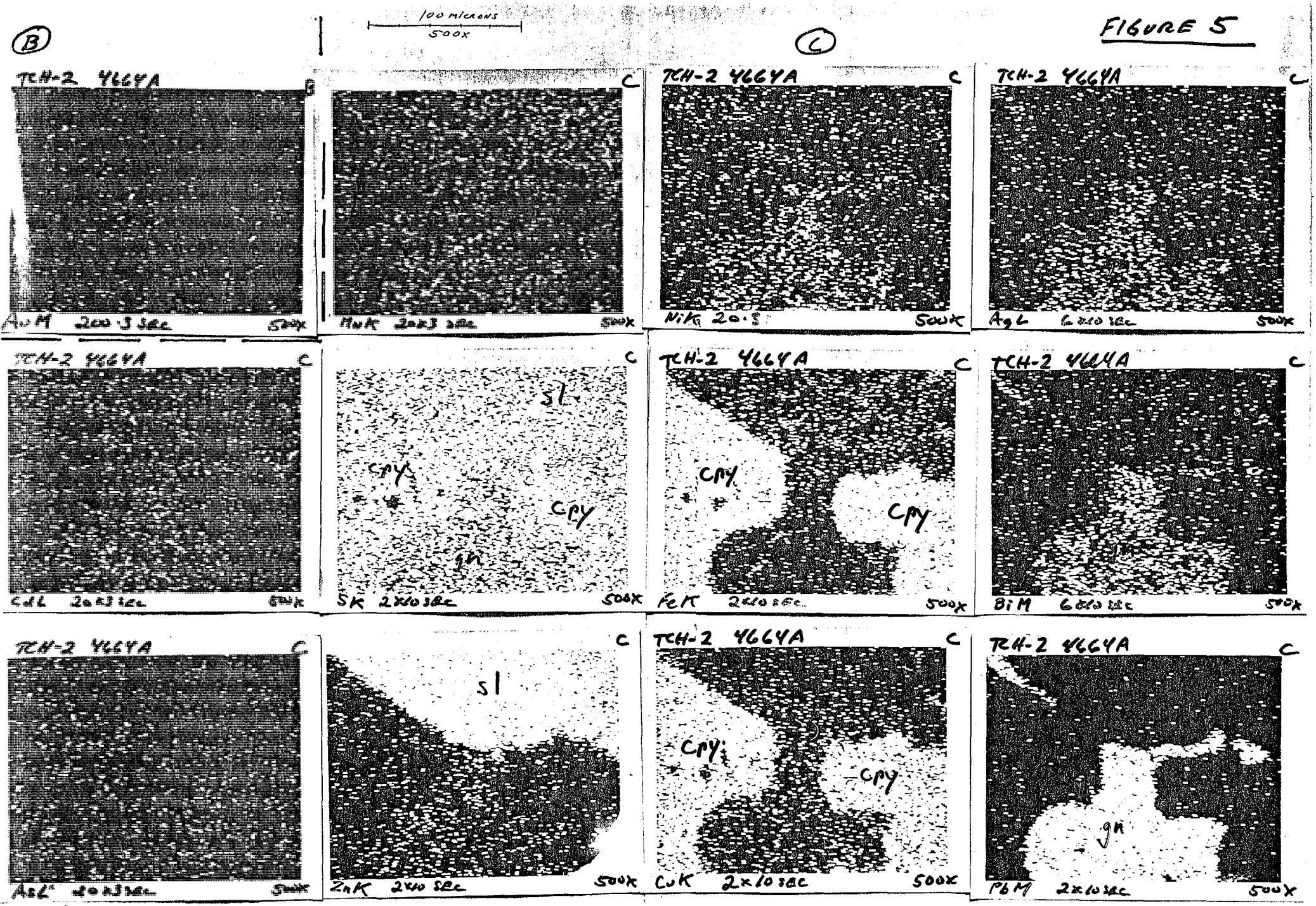

(B)
100 MICRONS
500X
TCH-2 Y66YA B
SiL 20.3 SEC 500X
TCH-2 Y66YA B
SeL 20.3 SEC 500X
TCH-2 Y66YA B
Cu
MoK 1·10 SEC 500X
TCH-2 Y66YA B
AgL 1·10 SEC 500X
TCH-2 Y66YA B
SbL 20·3 SEC 500X
TCH-2 Y66YA B
CPY
CPY
CPY
Zn
SK 1x10 SEC 500X
TCH-2 Y66YA B
CPY
CPY
CPY
CuK 1·10 SEC 500X
TCH-2 Y66YA B
BiM 3·10 SEC 500X
TCH-2 Y66Y B
TiK 20·3 SEC 500X
TCH-2 Y66YA B
ZnK 20·3 SEC 500X
TCH-2 Y66Y B
CPY
CPY
CPY
FeK 1·10 SEC 500X
TCH-2 Y66YA B
Zn
PbM 1·10 SEC 500X

FIGURE 5


(B)
100 MICRONS
500X
(C)
TCH-2 466YA
AuM 200 3 sec 500X
MnK 2x3 sec 500X
NiK 20 s 500X
AgL 6x10 sec 500X
CdL 2x3 sec 500X
SK 2x10 sec 500X
sl
cpy
gn
FeK 2x10 sec 500X
BiM 6x10 sec 500X
AsL 2x3 sec 500X
ZnK 2x10 sec 500X
CuK 2x10 sec 500X
PbM 2x10 sec 500X

ASARCO

Southwestern Exploration Division

JDS

January 8, 1982

TO: W.D. Payne

FROM: F.R. Koutz

F.R. Koutz

Performance/Cost Summary
Navi-drill Operations (2912-3270')
TCH-2A (EA-0200-02)
Trench Project
Santa Cruz County, Arizona

Between August 31 and September 16, 1981, the offset drill-out to TCH-2: TCH-2A was completed between 2912 feet (kick-off point) and 3270 feet depth (resumption of continuous coring operations). Between August 10 and 18 an NX packer, manufactured by Van Ruth Products, Kalgoorlie, W. Australia and supplied by Boyles, had been set at 3002' in TCH-2 through NX rods, the hole flushed with detergent and cemented with a 7/1 Portland/$CaCl_2$ mixture through BX rods to about 2851'. After six days of curing, the cement was drilled out to 2912'. TCH-2 is cased with NC rods from 0-2502'.

Navi-drilling using Boyles Bros. tools and technician and Joy Manufacturing crews and 22HD rig on a 2 X 12 hour shift basis was commenced on August 31, after Boyles mobilization from Salt Lake City on August 29. We had planned to build up a 15° drift angle at 5°/100' over 300 feet of Navi-drilling in a S75°W direction and retain the Navi-drill on standby for several days after continuous coring resumed to correct any significant deviation from 15°.

We Navi-drilled 345' out of 358' traversed. Three diamond set and five diamond impregnated NX bits were used on the Navi-drill with bit changes at 2943', 2983', 3022', 3076', 3121', 3189', 3237'. Spot cores (with reaming to gauge) were taken at 2943-45', 3022-3023', 3122-3123', and 3261-3270'. By 2943', after 31 of Navi-drilling, TCH-2A was out of the cement filling TCH-2. Some problems were encountered in getting TCH-2A to kick-out initially to S75°W (TCH-2 was 2 3/4° S32W at 2900') and to build up drift angle at a full 5°/100'. Consequently, after progressing 358' to 3270' we had built up only 13½° of drift angle in a S68°W direction. At 3270' on Sept. 16, we decided to resume continuous NX coring since the inner radial bearing of the Navi-drill motor had worn out and shipping and installation of new parts would take at least a day. By 3440' on September 19, the drift angle during NX coring had increased somewhat to about 14° so the Navi-drill was demobilized after two full days of standby time. Navi-drill demobilization was completed September 22. 327 drilling hours (including rigging, tripping, survey, spot coring, and Joy standby) were used to advance the 358' (1.09'/hour). (Sept. 7, 19 and 20 were not worked by pre-arrangement.) This was only slightly better than the 21'/day average for the Superior East A-12 drill-out from March to June, in spite of much better rock coring conditions in TCH-2 and TCH-2A vs. A-11 and A-12.

Some of the Navi-drill problems with TCH-2A were due to spotty disseminated magnetite in the rock which gave slightly erroneous drift direction readings on the Eastman camera used to orient the Navi-drill and measure progress.

ASARCO

Southwestern Exploration Division

February 19, 1982

To: W. D. Payne

From: F. R. Koutz

Casing Rental/Purchase
DDH TCH-2
Trench Project (EA-0200)
Santa Cruz County, AZ

When drilling was completed on TCH-2A on Dec. 23, 1981 it was decided to leave the 2502' of NC rods (NX casing) in the main hole (TCH-2) and set a packer and cement the hole to be ready for another drill-out ("TCH-2B") from 2900 feet depth when drilling funds again became available. All of this demobilization work was completed on Jan. 15, 1982 and casing rental started on January 16.

Our agreement with Joy calls for monthly rental charge of 5% ($1,023.05) of the value of casing (2502' NX casing @ $8.00/ft. = $20,016.00) plus casing shoe ($445.00) until drilling resumes. Yesterday, I received a copy of Joy's 1982 casing usage policy (2/5/82) which states that the maximum rental period for casing in any hole is 12 months. After 12 months we will be billed for the full value of the casing with no credit for monthly rental. This means that if we do not start drilling in TCH-2 by Jan. 16, 1983, we will have to spend 160% of the value of the casing and shoe ($32,737.60).

The next hole to be drilled in the Trench area will probably be on Thunder Mountain ground ("TM-14") because of a $50,000 work commitment this year. Funds for "TM-14" will probably only be forthcoming by summer at the earliest. It does not seem probable with limited funds that we will be able to re-enter TCH-2 by Jan. 16, 1983 and drill "TM-14." I strongly recommend that we purchase the 2502 feet of NX casing from Joy at once to avoid any further rental charges since we will probably end up buying it anyway.

There is also a strong possibility that we will drill more than one additional hole out of TCH-2 and with time, the likelihood of recovery of significant amounts undamaged, uncorroded casing which Joy will credit to us decreases.

I contacted J. H. Koontz, General Manager of Joy's Contract Drill Division, today who confirmed the casing usage policy as stated. He also stated that if another contractor enters a hole within 12 months we must buy the casing when drilling starts. Koontz stated that they were willing to discuss and revise the policy on an individual project basis, but their major problem was that corrosion in high-sulfide areas often left the casing unusable after 12 months. He stated that if we would buy the casing in the next

ASARCO

Southwestern Exploration Division

March 9, 1982

To: F. R. Koutz

From: S. A. Catlin

S. A. Catlin

Scherrer Quartzite Petrography
Trench Project, EA-0200
Santa Cruz Co., AZ

During February Fleetwood Koutz, Barney Mason and I toured the Arizona Paleozoic stratigraphic section exposed on Molly Gibson Hill and American Peak in the Patagonia Mountains. Several samples were taken for thin sectioning including two from the basal quartzite member of the Permian Scherrer Quartzite. This 85' to 105' thick basal quartzite layer is sufficiently distinct to act as a marker bed in correlating the altered Paleozoic rocks encountered in Trench project drilling. A pure quartzite generally does not alter much during skarn formation.

Thin section examination showed that the basal Scherrer Quartzite contains approximately 96% quartz as intergrown (not rounded) grains 75 to 300 micrometers across. The remaining 4% of the rock is interstitial sericite-clay plus trace zircon, opaque, limonite, rutile (?), and glauconite (?).

In the four Trench area holes TM-13, TCH-1, TCH-2, and TCH-2(A) only two of the various sections logged as siltstone, sandstone, or quartzite seem to closely match the above description for the basal Scherrer. These intervals are in TCH-1 from 4688' to 4818' (thin section 4705') and in TCH-2 from 4312' to 4450' (thin sections 4316' and especially 4376'). Section 3821' from TM-13 is a good quartzite but is fine-grained and is from a thin quartzite lens present in marble. Other quartz-rich rocks in the Trench holes contain 10 to 40% chlorite, calcite, or calc-silicate cement.

SAC:mek

cc: W. D. Payne

ASARCO

Southwestern Exploration Division

March 24, 1982

TO: W. D. Payne

FROM: F. R. Koutz

Performance/Cost Summary
Post-Navi-Drill Operation
(3270-5121'TD)
TCH-2A (EA-0200-02)
Trench Project
Santa Cruz County, Arizona

From Sept. 17 to Dec. 21, 1981 the offset drill-out from TCH-2: TCH-2A advanced 1881 feet from 3270' depth to 5121' where drilling was terminated due to high costs and extremely poor drilling conditions. Navi-drill operations (2912-3270') in TCH-2A were covered in the Summary of Jan. 8, 1982, but costs for Navi-drilling are included in totals below.

TCH-2A was drilled NX to 4355', BX to 4881' and AX to 5121'TD. When drilling reached 4881' a bit was burnt-in in montmorillonite-rich, caving ground starting a string of drilling problems. After two weeks of unsuccessful attempts to cement or advance BX, we were forced to reduce to AX. In the next 6 weeks only 270 additional feet were attained, almost totally due to horrible conditions from about 4860 to 4892' and other zones below and the small core diameter. Those interested in details of the number of lost and sanded-in bits, unsuccessful cementing attempts, circulation blockages, mud problems, twist-offs, fishing stories and other tales of woe should consult the Oct., Nov., and Dec. Trench monthly reports and the TCH-2A daily drilling sheets.

Joy Manufacturing (R.A. Gardner, Foreman) used 72, 8-hour shifts on a 2 or 3 shift/day basis to advance the 1611 feet from 3270-4881' or 22.4'/shift. It required 112 shifts to complete the hole (2.4'/shift), but 182' of the last 270' of the hole were drilled without the "bad-rock clause" (+ 8 feet/shift). 22 additional shifts were used to cut and pull casing (only 81' of AX casing: 4800-4881' were lost), set a packer (@ 2970'), cement and drill cement to 2900' (ready for a new drill-out by Navi-drill), and demobilize. NC rods, which we have purchased, remain in the hole from 2 to 2502' as NX casing. Core recovery was 99.7% from 3270-4881' and 87.7% from 4881-5121'.

The hole was surveyed by Mollen-Hauer to 3425', 4350' and 4875'. At 4875' the hole had drifted S60°W at an 18 3/4° angle but had been up to 20 3/4° at 4500'; drift direction had been between S68° and S60°W from 3225'. HF acid vial surveys in the AX hole indicated that by 5120' drift angle had decreased somewhat to about 18°. At TD TCH-2A is about 450' WSW of an equivalent TVD in TCH-2 or about 690' S60°W of the collar of TCH-2. Temperature at 4875' was 138½°F.

ASARCO

Southwestern Exploration Division

March 30, 1982

DIAMOND DRILL HOLE SUMMARY

DDH#: TCH-2A (2912' to 5121') [drilled out of TCH-2]

Drill Date: 8/81 to 1/82

Project/Account: Trench (0200)

Logged by: S.A. Catlin

Location: Santa Cruz Co., AZ

Summary by: S.A. Catlin, F.R. Koutz

SUMMARY

TCH-2A, a drill-out from TCH-2, was drilled in the fall of 1981 to test for a western continuation of the limestone replacement/skarn mineralization encountered in the TCH-2 drill hole. TCH-2A drill-out began at a depth of 2912' and continued to 5121' total depth. The rocks above 4310' in the hole are igneous--mainly rhyolitic to trachytic ash flow tuffs. Below 4310' altered Paleozoic sedimentary rocks (skarns) are present. Two significant sulfide zones were penetrated: the first, 40' of 1.48% Cu, 0.31% Pb, 0.60% Zn, and 2.20 ounces/ton Ag, occurs in a shear zone in felsic volcanics between 4120' and 4160'. The second, 27' of 1.22% Cu, 0.67% Pb, 0.33% Zn, and 4.05 ounces/ton Ag, is present immediately below the volcanic rocks at the upper contact of Paleozoic limestones between 4310' and 4337'. Chemical and petrographic data indicate that the altered Paleozoic rocks encountered in TCH-2A correlate with the Permian lower to middle Epitaph formation. The upper Epitaph, which hosts the TCH-2 mineralization, was not cut by TCH-2A. A second offset hole, TCH-2B, aimed to the northeast of TCH-2 is recommended to test the upper Epitaph.

INTRODUCTION

In the early summer of 1981 drill hole TCH-2 intercepted major mineralization in the Paleozoic carbonate rocks below the surficial volcanics on Asarco's Humboldt-Mendoza property. This mineralization included a number of significant sections between 4000' and 5000', most notably 57' of 1.21% Cu, 4.97% Pb, 12.3% Zn, and 10.8 ounces/ton Ag from 4653'-4710' and 124' assaying 0.23% Cu, 0.86% Pb, 14.1% Zn, and 7.4 ounces/ton Ag from 4767'-4891'. An offset hole, TCH-2A, was planned to test for a continuation of this mineralization several hundred feet to the west-southwest side of TCH-2.

On August 31, Joy drilling crews employing a Navi-drill angled off from TCH-2 at a depth of 2912'. They drilled in a west-southwesterly direction to a depth of 3261' with the Navi-drill, taking spot NX core samples at 2943'-2945', 3022'-3023', and 3122'-3123'. Continuous NX coring started at 3261'. BX coring began at 4355' and continued to 4882'. The hole was finished with AX to 5121' where inordinate drilling problems prevented further footage.

ASARCO

Southwestern Exploration Division

May 4, 1982

To: W. L. Kurtz
J. D. Sell

From: F. R. Koutz

Expenditures - Trench
Thunder Mountain Area
Santa Cruz County, Arizona

Expenditures to date (May 1, 1982) total:

0057-	Mendoza Option	$ 72,267	(3732.24 remaining)
0200-00	Trench (TCH-1)	190,000	
0200-01	(TCH-2)	224,000	
0200-02	(TCH-2A)	175,000	
0200-02	Overrun (May 1, 1982)	65,785	
	Trench Total:	$654,785	
	Trench & Mendoza Total:	$727,052	

TM-13 Cost (NPW)	$150,221.69	
TCH-1 Cost (Jan. 12, 1981, NPW)	196,427.78	
TCH-2 Cost (Nov. 13, 1981, FRK)	224,409.02	
TCH-2A Cost (March 24, 1982, FRK)	215,916.00	(through Feb. 82)

From cost/performance summaries

0042-	Thunder Mountain (to Oct. 1, 1978)	$233,146.44	(00-05 (part))
0042-05	(Part past Oct. 1, 1978)	71,853.56	
0042-06		40,000.00	
0042-06	Overrun (1 May 1982)	29,352.73	
	Total since Oct. 1, 1978	$141,206.29	(confirmed by Acc't. Dept.)

*Note: the $158,000 figure for TM since Oct. 1978, often mentioned, is probably the total cost of TM-13 which was started previous to Oct. 1978. I do not know if all TM-13 expenditures were included in the post-Oct. 1, 1978 figure.

Future planned and possible TM charges:

J. Yanez (surveying)	$ 1,200
SLC Geophysics (1/3 of ground mag. + all VLF work)	5,000
G. McLain (aerial photog.)	1,000
G. McLain (map making)	2,000
Repapering and paneling (TCB+HMS+?)	3,000
New road and drill site on Jesse 23 from TM-13	12,000
	$24,200

F. R. Koutz

FRK/cg
cc: RBCrist

*R. B. Crist says that the contract amendment date for figuring the $1,000,000 expenditure by Oct. 1, 1984 is from Dec. 1, 1977. We have expended $174,352.73 from Dec. 1, 1977 to May 1, 1982. This leaves $25,647.27 to be spent by Oct. 1, 1982.

Copy for KCB GMC JDS ~~WAP~~/FRK RBC

+ need informed Jones we could look at core from TCH-1, but we can not withhold his request regarding TCH-2

KCB July 13, 1981

KERR-McGEE CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

July 8, 1981

ASARCO, Inc.
P. O. Box 5747
Tuscon, AZ 85703

Attention: W. L. Kurtz, Manager
Western Exploration

RE: Thunder Mt., Arizona Property
1980-81 Assessment Work

Dear Bill:

This will acknowledge receipt of your letter of June 30 pertaining to the proposal to drill a hole on adjoining properties for assessment requirements on our Thunder Mountain claim group. I understand from your letter that in your opinion, the hole will benefit the Thunder Mountain claims.

I have signed and am returning your letter giving our approval of your request. This approval, of course, is conditioned on our being able to receive the basic information on the proposed drill hole and log the drill core at some later time. I believe that we still need to log the drill hole completed last year for assessment purposes, and perhaps we can arrange to log both holes at the same time. We will arrange to log these holes if you will advise us when hole TCH-2 is completed.

We will look forward to hearing from you upon completion of the proposed hole.

Very truly yours,

Everett E. Jones
Director - Joint Operations
Mineral Exploration Division

EEJ/vb

cc: H. W. Holmberg

JDS

ASARCO

Exploration Department
Western USA
W. L. Kurtz
Manager

June 30, 1981

Mr. E. E. Jones
Director of Coal & Minerals Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

Dear Mr. Jones:

As you recall, we applied drill hole TCH-1 to satisfy the 1979-80 assessment work requirements on the Thunder Mtn. claims. For the 1980-81 assessment requirements we plan to use drill hole TCH-2 (see attached map for location), currently being drilled. Naturally the costs of this hole would not apply towards our joint venture work commitments, but it certainly is well positioned to benefit the Thunder Mtn. claim group.

As you recall, Mr. Crist sent a letter dated April 16, 1980 notifying Kerr-McGee that we had spent $158,437.37 in completing the $100,000 work commitment which accrued on 1 Oct. 80. The excess expenditure will fulfill the $50,000 1 Oct. 80-1 Oct. 81 work commitment.

Please sign and return the duplicate copy if the above is satisfactory.

Sincerely yours,

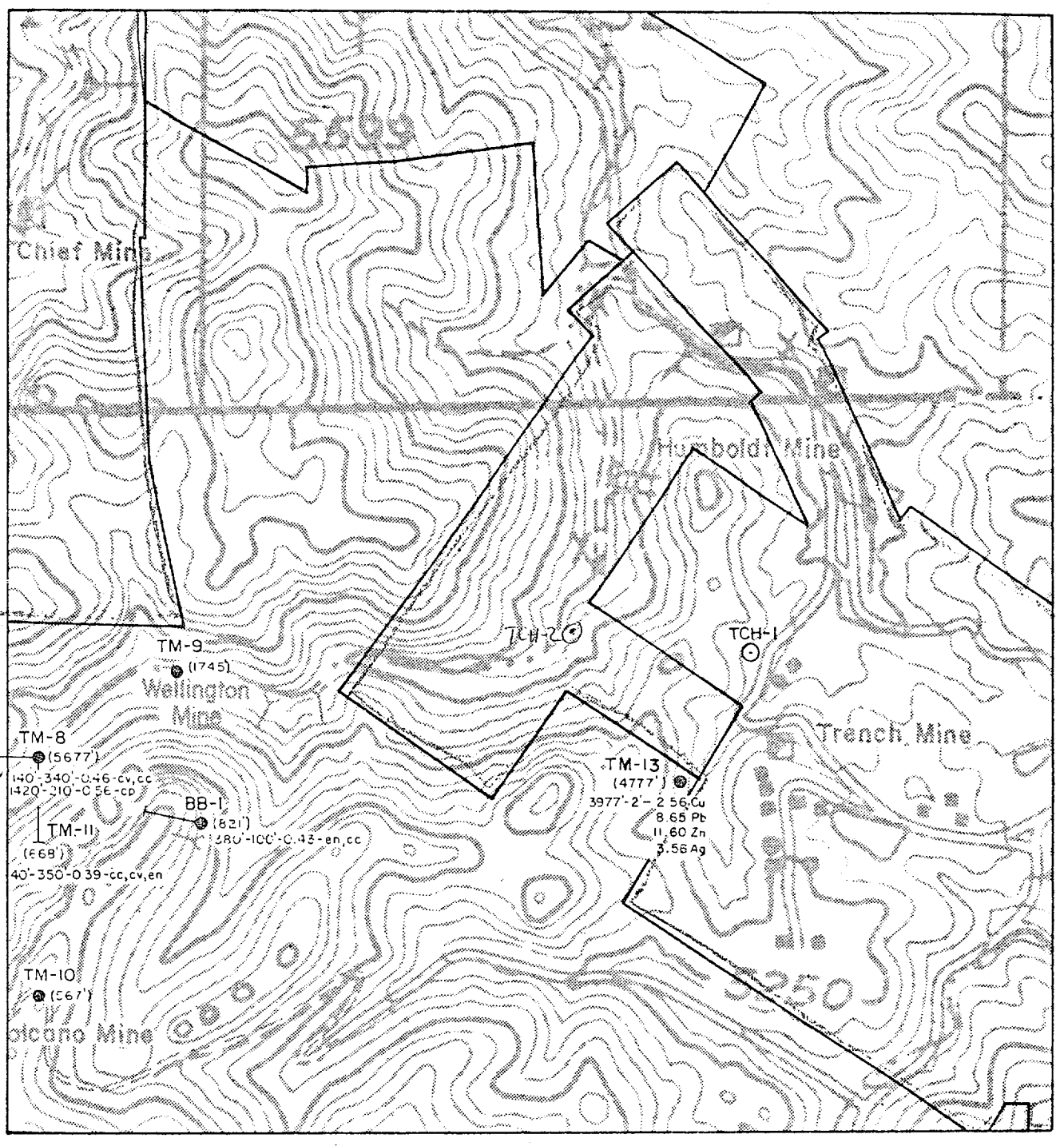
W. L. Kurtz

W. L. Kurtz

Kerr-McGee Corporation

WLK:lb
Att.

cc: RBCrist
WDPayne



EXPLANATION

- ASARCO INC.
- Kerr-McGee—Thunder Mtn.
- Anaconda-3R
- Mendoza-Humboldt
- Kerr-McGee-Red Mtn.
- Lichty-Argentor

(821') BB-1 — Drill hole showing depth

⊙ Proposed drill hole

ASSAY DATA KEY

depth-length-%Cu-mineral

3860'-350'-0.59-cp

GEOLOGIC LEGEND

cp-chalcopyrite
cv-covellite
cc-chalcocite
en-enorgite

Jan 31, 1981
W.L.K

DRILL MAP

THUNDER MTN. PROJECT

PATAGONIA MTNS.

Santa Cruz County, Arizona

SCALE: 1" = 1000'

FTG Feb 1978

FORM 302-MB (9/79)

New York No. .....

APPLICATION FOR SUPPLEMENTAL EXPLORATION APPROPRIATION

.....19.... Originating Office .... S.W.E.D. - ... Tucson .....

Application is hereby made for supplemental Appropriation to cover cost, in excess of original estimate, of work authorized by New York.

0042-00 thru THUNDER MTN (Kern-McGee) PROJECT

No. ..0042-06..... Santa Cruz County, Arizona

Present total Estimated Cost (Form 302-MA attached)	$ ..395,000
Amount previously authorized (date 10/11/72 Thru 7.11.179....)	$ .345,000.
Balance for which Authorization is now requested	$ ...50,000..

ADDITIONAL WORK CONTEMPLATED:

EXPLANATION OF INCREASED COST:

Reviewed by ..... ACCT. MGR. OR CHIEF ACCNT.

Recommended by ..... SUPERVISOR

Approved by ..... CONTROLLER

Account Chargeable to ..... TO BE FILLED IN BY CONTROLLER

Approved by ..... VICE PRESIDENT

Approved by Advisory Committee

..... 19.....

Approved by Board of Directors

..... 19.....

..... SECRETARY

PRINTED IN U.S.A.

-04 200000
-05: 105,000
-06: 40,000
345,000

Thunder Mtns, Santa Cruz Co. Az EA-0042-
-06 $40,000 July 11, 1979

Agree to spend 50,000/year

Accounting March 0042-04 overrun of (26,652.73)
(2,699.00)
29,351.73

159 claims to do assessment work on.

~~Sept 81~~	~~204.53~~
Oct	70.00
~~Dec.~~	~~117.54~~
Jan 82	768.50
Feb	2,014.01
March	2,698.29
April Est.	2,699.00

66600
(53000)
13,600
2,700
16,300

Janey Surveying est. 3000
Support ASARCO 1500
Road construction & drill pad or ~~20~~ 15,000.00 ~~5,000.00~~ (W of TM-13) ~~if we go to Wollaston.~~
Geology? Muse 1000

TM-13 cat work. Leakrity
$20,000

Sept 1980

FRK estimate 6000' hole @ 250,000.00

Aug 1979 Since Sept 1977 we have spent approx 158,000 305,000 (Aug 79)
plus 16,000 16,000
4/82 174,000 321,000

The Thunder Mountain hole TM-13 encountered strongly altered carbonate rocks. ~~Hole~~ Hole TM-13 coupled with the adjacent ~~TM~~ TCH- holes to the north and northwest, which encountered ~~Cu~~-Pb-Zn-Ag-~~Cu~~ mineralization in skarn altered ~~lime~~ carbonates, jiustifies the drilling of an additional Thunder Mountain hole (TM-14) westerly from TM-13 to test for similar ~~Cu~~-Pb-Zn-Ag-~~Cu~~ carbonate-hosted mineralization.

~~Favorable target for massive Pb-Zn-Ag-Cu replacement mineralization~~
A supplemental authorization for $50,000 is requested to cover Additional drill road and drill pad construction, claim work, surveying, ~~and~~ support geologic work and ~~overrun~~ accrued overrun plus possible top hole drilling ~~to expend~~ for the 1982 ~~$50,000/year~~ expenditures agreement.

ASARCO

Exploration Department
Western USA

May 19, 1982

J. D. Sell
Tucson Office

I have reviewed Koutz's May 5 memorandum on Trench Area Exploration and am in general agreement with many of his recommendations and proposals. However I think the report could be more concise and made easier to read. Koutz has a tendency to ramble and include so many facts that it is difficult to read and follow his thoughts.

One thing he, and everyone else, should do is put his summary, conclusions and recommendations at the start of the report/memo.

I have spent a couple hours and redrafted Koutz's report for yours and his consideration, which I attach.

W. L. Kurtz

WLK/cg

Attachment

cc: RLBrown (w/o Attachment)
FRKoutz (w/Attachment)

Memo critiqued again with WLK thoughts & all discussed w/ Fleet. Draft appears much better w/ sections etc now included. (6/2)

ASARCO

Southwestern Exploration Division

May 19, 1982

To: J. D. Sell

From: F. R. Koutz

Trench Area Exploration
Trench (0200), Thunder
Mountain (0042) and Three-R
(0040) Projects
Santa Cruz County, Arizona

Summary, Conclusions, Recommendations

Over a period of years a number of companies have completed # drill holes of which _____ are in the main Trench-Sunnyside area. A deep submarginal porphyry copper exists beneath the Sunnyside diatreme centered to the north of drill hole TR-10. Associated skarn alteration and Zn-Ag-Pb-Cu mineralization exists to the east with ore grade mineralization intersected in TCH-2. Structural complications are indicated within the skarn zone because Navi-drill hole TCH-2A failed to intersect the favorable TCH-2 units.

The large size and strength of the hydrothermal system justify additional drill holes in the skarn zones.

I recommend two drill-outs, one to the NNW and one to the NNE from TCH-2 to test for continuation, in the same stratigraphic horizon, of the mineralization encountered in TCH-2. The next hole on the Thunder Mountain ground should be located in Alum Gulch near the Humboldt boundary to test the Paleozoic rocks nearer to the QFP boundary. Additional holes might be located..... Lower priority targets are ..... targets.

General

The geology and mineralization in the subject project areas have been discussed in various company reports by Graybeal and Koutz. The purpose of this ~~their~~ (report or memo?) is to point out various salient features and how they relate to continued exploration. The Kerr-McGee/Thunder Mountain agreement calls for $50,000 work per year with a total expenditure of $1 million by October 1, 1984. To date $174,350 has been spent leaving $25,650 yet to be spent by October 1, 1982 and $825,650 by October 1, 1984. Necessary work on the other areas is limited to assessment work.

Discussion

There appears to be general agreement that additional drilling in the copper deposit is not warranted due to the submarginal grades indicated to date and no currently known geologic reason to expect better grades.

The overall size and strength of hydrothermal alteration and mineralization suggests that major skarn ore bodies can occur in the Sunnyside area. The skarn mineralization encountered in holes TM-13, TCH-1, TCH-2, and TCH-2A does warrant additional exploration. One phase of this exploration is to offset (follow the ore) the best mineralization encountered in TCH-2. Our first offset hole to the west (TCH-2A) entered the Paleozoic units stratigraphically below the most favorable units in TCH-2. Thus the westward dip we assumed is incorrect and either folding and/or faulting occurs between the two holes. Figure 2 portrays our present preferred interpretation. With this interpretation I believe the best area to "follow the ore" is northerly toward the N65E line of outcropping QFP. This would presumable cross the NE-trending structure which controls the drainage and possibly intrusions at depth. Using the Navi-drill and a kickoff point at 2900 feet in TCH-2 several northerly holes could be drilled to intersect the favorable units as much as 1,000 feet away from TCH-2. I presently favor the hole as shown on Figure __ to make an intersection about 300 feet away. This drill-out would determine where to place the next one. These drill holes would be my first priority and if they meet with success I would follow them up with additional offset holes.

The next hole on Kerr-McGee ground might be located in Alum Gulch immediately west of the Mendoza property boundary (see Fig. 2) where it would be expected to intersect ..... and will be below the TCH-2 units. This hole would contain higher copper content since it will be closer to the QFP--hopefully it will not be totally within the QFP.

Another alternative site on Kerr-McGee ground would be 600 feet due south of TCH-2 collar. This in effect would be an offset hole to intersect the favorable TCH-2 units and might be Navi-drilled out of TCH-2.

At this point your other more nebulous drill holes should be included.

I think that maybe an overlay to the geology map that shows your possible interpretation of outline of Paleozoic rocks might be good. This overlay should include the proposed drill holes.

Talked to Perkins & Porter 3 June
Today. Will send them data
packet (my May 21 memo on 1982
Assessment work) + 1974 Monsanto
IP data. We will talk on 7-8
June on specifics of work. They
plan 1 wk-10 days starting
14 June but could leave as
Early As 9 June. I will
check out collar conditions
@ Ventura NEXT week while
Zonge et al are in the field.

— — —

Perkins suggested that the
managers involved & Accountants
get together & decide how the
Bids are going to be. Do you
want a certificate of actual cost,
cost with "rental" of our equipment
OR "padded cost" of what it would
have cost if we had contracted it
out??

Jack

Return to JDS

JDS

See notes

for FTG

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

I called FTG + he is out to 16 June. His secy will ask him if 200-300 m.t @ 0.3 Cu and 0.01 Mo is OK for Sunnyside.

FTG

May 20, 1982

Mr. James D. Sell, Manager
Southwestern Exploration Division
Tucson Office

Trench Project, Arizona

Dear Mr. Sell:

Thank you for sending the summary report on Hole TCH-2A prepared by Mr. Koutz and Mr. Catlin. The report is well written and appears to be complete. When time permits would you please have the Drafting Department prepare a copy of the actual drill log from which this report was prepared and send it to me. Please also include the detailed drill log with all future summary drill reports.

will be with additional comments

I have no particular quarrel with any of the observations or conclusions advanced in this report. I might point out that the dips of the carbonate rocks in TCH-2A are notably steeper than the dips encountered in TCH-1, 2, or TM-13. Although neither Mr. Koutz nor Mr. Catlin are bothered by this change in dip if we assume that the direction of dip is approximately parallel to the section line in Figure 3 of their report, then it would appear that the Paleozoic section has steepened notably to the south. If this near-vertical inclination persists to the south of TCH-2, it will make it difficult for vertical holes drilled south of TCH-2 to test very much of the Paleozoic section. In addition, a vertical hole drilled in an unfavorable rock type might stay in that rock type for a great length and not provide much information as to the mineral potential. Nevertheless, steep dips would bring the basal portion of the Paleozoic section to the contact between the Paleozoic and the overlying diatreme or Mesozoic volcanic rocks within about 2000-2500 ft. south of TCH-2, an area which might still be within the range of influence of the quartz feldspar porphyry stock. Previously the lower portions of the Paleozoic section had been considered to be too deep to be within drilling distance of the surface-collared drill hole.

FTG is somewhat bothered

Mr. Koutz and Mr. Catlin report an assay of 2.20 oz. of Ag for the 40 ft. interval between 4120-4160 ft. This same interval is reported in the first quarter report for 1982 as

OK. for Ag #

This is AA Ag #

FRK - ?

as 0.77 oz. of Ag and I will assume that the Koutz/Catlin figure is correct.

2.2 is Fire Ag
0.77 is AA
I would believe Fire # - The Figure on the March 14 report map should have been 2.20z (That's what it says now)

I do not yet have drill hole summaries for TCH-1, 2, V-37, or V-38. I presume these are largely complete and waiting only for drafting.

Being typed

Very truly yours,

F. T. Graybeal

cc: WLKurtz

ASARCO

Southwestern Exploration Division

JDS

May 24, 1982

To: J. D. Sell

From: F. R. Koutz

Trench Area Exploration
Trench (0200), Three-R (0040),
& Thunder Mountain (0042) Projects
Santa Cruz County, Arizona

Summary, Conclusions and Recommendations

Over the past twenty years a number of companies have completed 24 drill holes (+1000 feet depth) on the subject properties. Asarco has drilled ten of these deep holes in the main Trench-Sunnyside area. A deep submarginal porphyry copper deposit of an estimated 450 million tons @ 0.34% Cu (0.25% Cu cut-off) and .012% Mo with apex below 3700 feet depth exists beneath the west side of the Sunnyside diatreme centered to the north of DDH TR-10. Associated skarn alteration and Zn-Ag-Pb-Cu mineralization exists to the northeast with ore grade mineralization consisting of more than 57 and 124 feet of 15-18% Σ(Zn>Pb>Cu) with 7-11 oz. Ag/T intersected in TCH-2. Structural complications are indicated within the skarn zone because Navi-drill hole TCH-2A failed to intersect the favorable units mineralized in TCH-2.

The large size and strength of the hydrothermal system generated by the quartz-feldspar porphyry intrusive justify additional drill holes to follow TCH-2 mineralization and to test the limits of skarn zones around the margin of the mineralizing quartz-feldspar-porphyry.

I recommend two drill-outs from TCH-2, first to the NNW and then to the NNE to test for the continuation of stratigraphy and mineralization encountered in TCH-2 and related to the northeast-trending QFP intrusive zone in Upper Alum Gulch. The next hole on Thunder Mountain ground should be located in Upper Alum Gulch near the Trench (Humboldt-Mendoza) boundary to test deeper Paleozoic rocks nearer to the main QFP boundary. Additional holes on Thunder Mountain ground might be located about 1500 feet SW of TM-13 and 600 feet S to 1500 feet SW of TCH-2 also to test the carbonate section cut by QFP intrusives. A hole 1000-2000 feet north to NNE of TCH-2 should test the outer limits of skarn zones and help to evaluate the carbonate-hosted mineralization potential of competitor ground to the north. Lower priority targets, on Three-R ground, are from 500 to 4000 feet north of TM-9 and beneath the Flux mine. Limestones east of Trench along the January-Norton-Alta-Hardshell zone also deserve deep testing.

General

The geology and mineralization in the subject project areas have been discussed in various company reports by Graybeal and Koutz. The purpose of

ASARCO

Southwestern Exploration Division

JDS

May 24, 1982

To: J. D. Sell

From: F. R. Koutz

Trench Area Exploration
Trench (0200), Three-R (0040),
& Thunder Mountain (0042) Projects
Santa Cruz County, Arizona

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ASARCO

Southwestern Exploration Division

June 2, 1982

To: F. T. Graybeal

From: J. D. Sell

Geophysical Reconnaissance
Program
Patagonia Mountains
Santa Cruz County, Arizona

Attached is Koutz's memo of May 21, without the geophysical department maps, as only one set was submitted to this office, to give you the gist of what has been done.

Also attached is his memo of May 18 on the electrical geophysical tests on the Trench ground. Zonge sent their instrument into the field for a check run last week and burned out a coil. They now intend to return in the middle of this week and do the work as outlined.

James D. Sell

JDS/cg

Attachments

ASARCO

Southwestern Exploration Division

June 3, 1982

To: F. T.Graybeal

From: J. D. Sell

Summary Report, DDH TCH-1
Trench Project, EA-0200
Santa Cruz County, Arizona

Mr. Fleetwood Koutz's report on TCH-1 is enclosed. His detailed study of the alteration-mineralization has helped the overall interpretation of the area.

As noted, this report is the first of a number of summary reports which will be integrated into an exploration target summary report.

James D. Sell

JDS/cg

Attachment

ASARCO

Southwestern Exploration Division

June 3, 1982

To: F. T. Graybeal

From: J. D. Sell

Summary Report, DDH TCH-1
Trench Project, EA-0200
Santa Cruz County, Arizona

Mr. Fleetwood Koutz's report on TCH-1 is enclosed. His detailed study of the alteration-mineralization is a firm point in the overall interpretation of the area.

It would appear that the overall evaluation is that the hole is in the outer edge of the large diatreme system and moving inward as TCH-2 suggested to be within the overall pervasive alteration zone where any attendant mineralization can then occupy any stratigraphy is a goal for the program in the area.

James D. Sell

JDS/cg

Attachment

revised
this not sent

ASARCO

Southwestern Exploration Division

June 2, 1982

To: J. D. Sell

From: F. R. Koutz

Transmittal Letter
DDH TCH-1 Summary Report
Trench Project (EA-0200-00)
Santa Cruz County, Arizona

Attached is my Summary Report on DDH TCH-1, the first hole of the actual Trench project. This hole was successful in encountering 4.5' of limestone-replacement mineralization, starting at 3907 feet and grading 2.6% Cu, 12.7% Pb, 14.5% Zn and 1.8 oz Ag/T in the upper part of 1744 feet of heavily altered Paleozoic section. More importantly a number of intrusive breccia (IBX) zones were spatially associated with replacement mineralization and contained well altered and mineralized clasts of the quartz-feldspar-porphyry (QFP) phase of the Patagonia stock. The best mineralized IBX interval (4068-4072') ran 0.18% Cu and 0.014% Mo.

This mineralization suggested the site for our successful next hole, TCH-2, 1300 feet west next to QFP outcrops, which encountered over 280 feet of strongly Zn, Ag, Pb, Cu mineralized skarns, the best two intervals of which started at 4653' with 57' of 1.3% Cu, 5.0% Pb, 12% Zn and 11 oz Ag/T and at 4767' with 124' of 0.2% Cu, 0.9% Pb, 14% Zn and 7.4 oz Ag/T.

This is the first of four reports discussing the results of TCH-1, 2 and 2A. This report discusses, in some detail, lithologic, stratigraphic, structural, alteration and mineralization features important in interpreting subsequent drill holes and defining ore controls and future targets. Partially important are Trench mine geology which led us to drill TCH-1 at its site, newly defined Mesozoic ash-flow tuff cooling units, possibly part of a late Cretaceous cauldron moat between Hardshell and the later Chief diatreme area and metasomatic alteration of the host Permian Concha to Upper Epitaph Formation: jasperoid/wollastonite vs. garnet-diopside skarns, and intrusive breccias. Since this report was written amythystine jasperoid cores to wollastonite-rimmed chert nodules were noted at Mission Mine and provide an analog to the association with sulfide replacement mineralization in TCH-1. Amythystine jasperoid also shows a close association with mineralization at the Flux Mine and was used as a drilling guide in 1955-57.

Recommendations for future drilling are included in the final report of this series. This report points out, however, that an alternative site for TCH-1 might have been west to southwest of DDH TM-13, the first hole drilled for carbonate-hosted mineralization. Such an alternative hole,

using the same reasoning as TCH-2: moving closer to the QFP/carbonate contact, is still recommended. This area, out from the center of the Sunnyside hydrothermal system might be expected to have higher Ag-Pb contents rather than Cu-Mo as has been found in close proximity to the QFP in TCH-2.

Fleetwood R. Koutz

FRK/cg

Attachment

ASARCO

Southwestern Exploration Division

June 3, 1982

To: J. D. Sell

From: F. R. Koutz

Transmittal Letter
Summary Report, DDH TCH-2
Trench Project (EA-0200-01)
Santa Cruz County, Arizona

I hereby transmit my Summary Report on DDH TCH-2. The report is rather long and detailed--the consequence of considerable study of probably the best mineralized hole ever drilled in the Patagonia Mountains. To ease the reader's way through this report his attention is directed to the Table of Contents on page 33, the Summary on page 1 and the Discussion section from pages 24-31. Mineralized intervals are summarized on Figure 1, the drilling/property map of the Trench area, and Figure 2, a cross-section through TCH-1, 2 and 2A. Reference to the geologic plan map and cross section from the previous TCH-1 report will be very helpful. Much of the detailed lithologic, structural and mineralogic discussion is summarized on the graphic logs, Figures 3 and 4 of this report. Your attention is drawn to three previous reports on TCH-2:

B. W. Apland, Metallurgical Test Results DDH TCH-2, Trench Project, Sept. 3, 1981.

F. R. Koutz, Check Assays, Metallurgical Test Results, TCH-2, Oct. 8, 1981.

F. R. Koutz, Sulfide Mineralogy and Compositions, DDH TCH-2, Oct. 23, 1981.

Besides recommendations included in this report, your attention is also directed to the recommendations made at the end of the TCH-2A, Additional Comments on TCH-2A, and Trench Area Exploration reports. I suggest that a moderate level of mineralogic compositional, zoning, fluid inclusion and geophysical study continue on Trench area cores. Many more holes will be necessary to fully evaluate the extent of TCH-2 mineralization and further study will greatly aid in this effort.

Fleetwood R. Koutz

FRK/cg

Attachment

ASARCO

Southwestern Exploration Division

May 13, 1982

To: J. D. Sell

From: F. R. Koutz

Summary Report
DDH TCH-2
Trench Project (EA-0200-01)
Santa Cruz County, Arizona

SUMMARY

DDH TCH-2 (5830' TD) was collared in Upper Alum Gulch on Asarco's Humboldt-Mendoza claim group about 1300 feet west and northwest of TCH-1 and TM-13, respectively, to test for limestone replacement mineralization encountered in TCH-1 and TM-13, nearer to the suspected source--the quartz feldspar porphyry (QFP). TCH-2 cut 394 feet of lithic lapilli tuff of the Chief diatreme. The ash-flow breccias and tuffs of the Cretaceous Hardshell Group extended from 394 to 4100 feet depth but between 2249 and 2972 feet depth were cut by major intervals of quartz monzonite porphyry (QMP) totalling 585 feet thickness. Tuff breccias were rare below 1730 feet depth and no limestone conglomerate was encountered. Below 4100 feet TCH-2 cut the limestones, siltstones, quartzites and dolomites of the basal Concha, the complete Scherrer and most of the Epitaph Formations. A 3-foot dike of quartz feldspar porphyry (QFP) in an intrusive breccia (IBX) zone was cut at 4038 feet. 38 feet of IBX were cut in the Hardshell Group, mostly near the margins of the QMP. In the Paleozoic 24.5 total feet of IBX in 3 zones were cut between 5348-5588 feet depth. Exotic clasts included QMP, QFP and one or two types of equigranular igneous intrusives of probably original quartz monzonitic to granodioritic composition.

The section dips at 20 to 50°, is strongly faulted near many lithologic contacts and is all at least weakly crushed and fractured.

The complete section cut in TCH-2 is moderately to strongly altered and mineralized. High-level covellite > chalcocite mineralization on pyrite, chalcopyrite, and enargite-tennantite is associated with kaolinite-alunite-illite-quartz alteration. Deeper (sl > gn > cpy) ± pyrite veinlet swarms containing quartz, K-feldspar, chlorite ± epidote ± sericite ± montmorillonite ± rhodochrosite are usually associated with margins of the QMP. Pyrite > cpy > MoS_2 (± sl ± gn) mineralization is associated with IBX zones, the QFP and the Mesozoic/Paleozoic contact. Associated alteration in felsic rocks is K-feldspar + quartz-sericite ± epidote ± chlorite and in carbonates calcic garnet-diopside-chlorite skarns with pervasive carbonate recrystallization and sanding. The first 100 feet of skarns/sulfides in the Paleozoic has been strongly oxidized to hematite and hydrothermally leached.

Massive, zoned sl > gn ≥ py > cpy garnet-dominated skarns occur from 4209 to 4891 feet depth in the Silty Limestone Member of the Epitaph Formation. Of this 682 foot interval 280 feet (41%) is moderately to strongly mineralized. The 3 best mineralized intervals in TCH-2 are as follows:

Depth	Feet	Cu %	Pb %	Zn %	Ag oz/T	Mo %	
4195-4209'	14	2.32	0.73	0.09	5.9	.050	cf Table 2
4653-4710'	57	1.30	4.97	12.2	10.8	.000	? < 2 ppm
4767-4891'	124	0.23	0.86	14.1	7.4	.000	? ± < 2 ppm

Alteration in the siltstones below is dominated by recrystallization of silica and development of fine-grained pyroxene, garnetite and chlorite with local K-feldspar and epidote. The dolomites are replaced by serpentine-talc, chlorite, montmorillonites and minor muscovite and phlogopite. Alteration and mineralization of IBX igneous clasts includes K-feldspar-biotite-quartz ± chlorite ± sericite with disseminated py > cpy >> MoS_2 ± trace bn and local specularite. The IBX zones in and just above the Paleozoic have a strong Mo geochemical halo as well as locally strong wall-rock bleaching, mostly from sericite and clays.

Metallurgical/mineralogical studies indicate that the massive Zn, Pb, Cu, Ag mineralization makes both a good lead and zinc concentrate with high recoveries. Most of the silver is contained in galena probably as an unexsolved matildite ($AgBiS_2$) component.

TCH-2 is different from TCH-1 and TM-13 in that alteration associated with ore-grade mineralization is dominated by calc-silicates rather than jasperoid. In all holes the Mesozoic/Paleozoic contact is an important control of mineralization; however in TCH-2 the thick basal Mesozoic sandstone is missing and the contact zone is well brecciated. Former silty and cherty limestones in TCH-2 are much better host rocks than pure limestones, dolomites or siltstones but the position, including unlike lithologic contacts, as well as the composition of the carbonate host rocks are important ore controls.

Future exploration should immediately concentrate on defining mineralization and ore controls from 200-1000 feet from the TCH-2 intercept by several angle drill-outs from the upper portion of TCH-2. The first of these drill-outs should be directed toward the QFP center located about 4000 feet to the west-southwest. Several additional new holes from the surface will be necessary to test for mineralization and its exact relationship to stratigraphy and the QMP from 1000 to 2000+ feet to the west, south and north of TCH-2. The exact sequence of drilling these holes will depend on results from previous holes but it is clear that the thick, high-grade intervals encountered in TCH-2 demand a major evaluation effort in Trench Area.

ASARCO

Southwestern Exploration Division

JDS

June 7, 1982

To: J. D. Sell

From: F. R. Koutz

Additional Comments
DDH TCH-2A (EA-0200-02)
Trench Project
Santa Cruz County, Arizona

Summary

For completeness, additional detail is provided to the DDH TCH-2A drill hole summary by Catlin and Koutz to allow the hole to be more closely compared to previous Trench area exploration. Additional lithologic, structural and correlation comments including alternate fault interpretations between TCH-2 and 2A are provided. The increased amount of K-feldspar-dominated alteration and differences in carbonate, magnetite, and MgO metasomatism are important differences from previous holes. The contrast in the reduced mineralization intensity to TCH-2 and a detailed description of the two pyrite-chalcopyrite mineralized zones suggest both a strong lithological and structural control of Trench area mineralization. Major ore controls include the location and geometry of the quartz-feldspar-porphyry, the depth and attitude of the Mesozoic/Paleozoic contact and the lithology, sequence and attitude (structure) of the Paleozoic host rocks. This report suggests that detailed mineralogical and texture logging aided by petrographic and x-ray diffraction work and character assays are the best exploration tool we have in the Trench area and such detailed work will be necessary in the future.

Introduction

The following includes a few additional comments to amplify the TCH-2A drill hole summary (March 30, 1982) primarily written by S. A. Catlin and edited by myself. Detailed logging and petrography on TCH-2A were done by Catlin. However I examined all TCH-2A core, thin and polished sections, in at least a reconnaissance fashion and in many instances, in mineralized and complexly altered areas, in considerably more detail than Catlin. The logging by Catlin was not done in the detail (perhaps too much detail) that TCH-1 and 2 were logged in, consequently it is somewhat difficult to compare certain features among the holes. This should not detract from the very good logging by Catlin but it was rather difficult for him to realize the significance of many features observed after only a few days introduction to the project compared to the half-year I had spent on it. Very few of the features pointed out below are due to differences of

ASARCO

Southwestern Exploration Division

March 30, 1982

DIAMOND DRILL HOLE SUMMARY

DDH#: TCH-2A (2912' to 5121')
[drilled out of TCH-2]

Drill Date: 8/81 to 1/82

Project/Account: Trench (0200)

Logged by: S.A. Catlin

Location: Santa Cruz Co., AZ

Summary by: S.A. Catlin, F.R. Koutz

SUMMARY

TCH-2A, a drill-out from TCH-2, was drilled in the fall of 1981 to test for a western continuation of the limestone replacement/skarn mineralization encountered in the TCH-2 drill hole. TCH-2A drill-out began at a depth of 2912' and continued to 5121' total depth. The rocks above 4310' in the hole are igneous--mainly rhyolitic to trachytic ash flow tuffs. Below 4310' altered Paleozoic sedimentary rocks (skarns) are present. Two significant sulfide zones were penetrated: the first, 40' of 1.48% Cu, 0.31% Pb, 0.60% Zn, and 2.20 ounces/ton Ag, occurs in a shear zone in felsic volcanics between 4120' and 4160'. The second, 27' of 1.22% Cu, 0.67% Pb, 0.33% Zn, and 4.05 ounces/ton Ag, is present immediately below the volcanic rocks at the upper contact of Paleozoic limestones between 4310' and 4337'. Chemical and petrographic data indicate that the altered Paleozoic rocks encountered in TCH-2A correlate with the Permian lower to middle Epitaph Formation. The upper Epitaph, which hosts the TCH-2 mineralization, was not cut by TCH-2A. A second offset hole, TCH-2B, aimed to the northeast of TCH-2 is recommended to test the upper Epitaph.

INTRODUCTION

In the early summer of 1981 drill hole TCH-2 intercepted major mineralization in the Paleozoic carbonate rocks below the surficial volcanics on Asarco's Humboldt-Mendoza property. This mineralization included a number of significant sections between 4000' and 5000', most notably 57' of 1.21% Cu, 4.97% Pb, 12.3% Zn, and 10.8 ounces/ton Ag from 4653'-4710' and 124' assaying 0.23% Cu, 0.86% Pb, 14.1% Zn, and 7.4 ounces/ton Ag from 4767'-4891'. An offset hole, TCH-2A, was planned to test for a continuation of this mineralization several hundred feet to the west-southwest side of TCH-2.

On August 31, Joy drilling crews employing a Navi-drill angled off from TCH-2 at a depth of 2912'. They drilled in a west-southwesterly direction to a depth of 3261' with the Navi-drill, taking spot NX core samples at 2943'-2945', 3022'-3023', and 3122'-3123'. Continuous NX coring started at 3261'. BX coring began at 4355' and continued to 4882'. The hole was finished with AX to 5121' where inordinate drilling problems prevented further footage.

Eutaxitic and/or flow banding features are visible in much of the volcanic material above 4310'. Dips in the core range from 10° to 45° with most in the 30° to 45° range (0° is horizontal). Because TCH-2A was actually drilled at 20° off vertical the true dips lie in the range 0° to 65°. The lower values are more likely.

Bedding in the altered sedimentary rocks below 4310' is variable but generally is steep. The most common dip displayed is between 60° and 70°. Because of the angle of the drill hole, this measured dip could represent an actual dip of 40° to 90°.

ALTERATION

Hydrothermal alteration in the igneous rocks of TCH-2A is dominantly phyllic-propylitic in style and possesses no prominent zoning pattern. Virtually all rocks above 4310' in the hole display pervasively disseminated sericite-pyrite alteration along with veinlet-controlled quartz-sericite-pyrite. Silicified haloes up to several centimeters wide surround the veinlets, which themselves are just one to a few millimeters wide. Total sericite contents logged range from 2 to 20% (thin section study indicates these log estimates are somewhat low). Except for a strong spike near the shear zone from 4121' to 4157', the higher sericite values occur shallower in the volcanics. Pyrite contents average 0.5%--about evenly split between vein and disseminated occurrences. Again, values near the shear zone are anomalously high.

Epidote and chlorite are present in small quantities throughout the igneous rocks. Most values are in the range from a few tenths to 2 or 3 percent, with some rocks containing up to 10 percent of one mineral or the other. Below 3900' depth both minerals diminish, except for high chlorite values in the shear zone. Typically, epidote and chlorite are disseminated.

Clay and secondary K-feldspar are present only locally. The core from 3620' to 3780' shows a small percentage of secondary K-spar as pink selvages around quartz-filled fractures. Many thin sections show K-spar occurring as rims on, and replacements of, plagioclase grains. The high potassium values present in TCH-2A igneous rocks (recall the 8.4% K_2O value in the whole rock analysis mentioned earlier) may, however, be evidence of some K-metasomatism which is not easily detectable in hand specimen or even thin section.

Clay contents range from nothing up to 2.5% in most of the core. In the shear zone values do reach up to 4%.

The alteration in the sedimentary rocks below 4310' has already been described. The calc-silicate-rich rocks from 4310' to 4469' and from 4820' to 4840' represent the products of strong Fe and Si addition to somewhat silty or argillaceous limestones. Base metal and S values were also added. Minor Mg and Al were probably present in the primary rocks, because these 2 elements are less mobile and are not generally added in significant amounts during skarn generation.

The siltstone-hornfels rocks are not strongly altered. The detrital quartz grains present in the original siltstone remained essentially unchanged in the final hornfels; some new minerals formed from detrital feldspar and from the calcite cement of the original siltstone.

The Ca-Mg skarns do not reflect as strong an alteration as the Ca skarns. The Ca-Mg-rich rocks appear to represent nearly isochemical conversions of original dolomite with siltstone interbeds. The resultant serpentine marbles, siltstone-hornfels, and wollastonite pods have approximately the same overall chemistry as the original rocks, except possibly for minor addition of Si and of base metals and S.

Fossils and other original fine textural features present in the primary rocks were destroyed during skarn formation.

Intrusive breccias throughout the TCH-2A hole display alteration correlative to the igneous rocks already described. Much of the alteration is pre-brecciation.

Fluid inclusions are relatively scarce in TCH-2A thin sections, but a few were found in quartz and wollastonite. Most had gas bubbles comprising 5 to 20% of the inclusion by area, though a few had much larger bubbles. No daughter crystals were detected.

MINERALIZATION

Unfortunately, TCH-2A failed to intercept mineralization comparable in size and grade to that encountered in TCH-2. However, two sizeable zones containing approximately 1% Cu and 2 to 4 ounces/ton Ag were drilled and numerous smaller shows of mineralization were also noted.

A shear zone through the felsic volcanic rocks between 4121' and 4157' hosts important mineralization. The 40' from 4120' to 4160' assayed:

1.48% Cu,
0.31% Pb
0.60% Zn
2.20 ounces/ton Ag.

In hand specimen the rock containing these values appears to consist of nearly massive pyrite set in a matrix of quartz, chlorite, sericite, and clay. Only in polished thin section can one see the abundant chalcopyrite and lesser galena and sphalerite which occur interstitial to and in veins in the pyrite. Small blebs of exsolution chalcopyrite are present in sphalerite.

The altered sedimentary rocks immediately below the volcanic material are also distinctly mineralized. The 27' from 4310' to 4337' assayed:

1.22% Cu
0.67% Pb
0.33% Zn
4.05 ounces/ton Ag.

The host rock for these values is Ca-rich skarn containing abundant garnet, chlorite, calcite, pyrite, and hematite. The Cu, Pb, and Zn sulfides are only rarely coarse enough to be seen in hand specimen. Some weaker mineralization is also present in the extreme lowermost volcanic rocks. It is likely these volcanics acted as a low-permeability cap rock which dammed hydrothermal fluids in the uppermost Paleozoic carbonate rocks and lead to the formation of mineralization there.

Several other smaller shows are scattered throughout the core; most are within carbonate host rocks. The 30' interval from 4820' to 4850' ran 0.041% Cu, 0.093% Pb, 0.23% Zn, and 0.47 ounces/ton Ag. Here again, Ca skarn is the host rock and the mineralized zone lies immediately below a low permeability layer--in this case the siltstone hornfels.

Mo, Pb, Zn, and Ag show higher geochemical values in the sedimentary rocks than in the volcanics; Cu displays the opposite trend (see Figure 1). Zn shows the highest values of any metal in areas outside of the two major mineralized zones, averaging several tenths of a percent Zn present in much of the core. Metal values are higher in the Ca and Ca-Mg skarns than in the siltstone-hornfels.

Mo content is generally low and follows Pb, Zn, and Ag in its highs and lows. Au was rarely detected; traces (0.18 ppm at best) in the two major mineralized zones were the only significant "kicks."

DISCUSSION

Stratigraphic correlation. Remnant bedding in TCH-2A skarns indicates that the Paleozoic rocks were cored at an angle of 30° to the bedding; their thicknesses have thus been exaggerated by a factor of 2 (coring at 90° would give true thickness). Taking this factor into account, TCH-2A cut the following types and thicknesses of sedimentary rock:

		From	To
silty or argillaceous limestone (Ca skarn)	80'	4310'	4469'
siltstone or silty limestone (hornfels)	175'	4469'	4820'
limestone (Ca skarn)	10'	4820'	4840'
dolomite with siltstone interbeds (Ca-Mg skarn)	140'	4840'	5121'

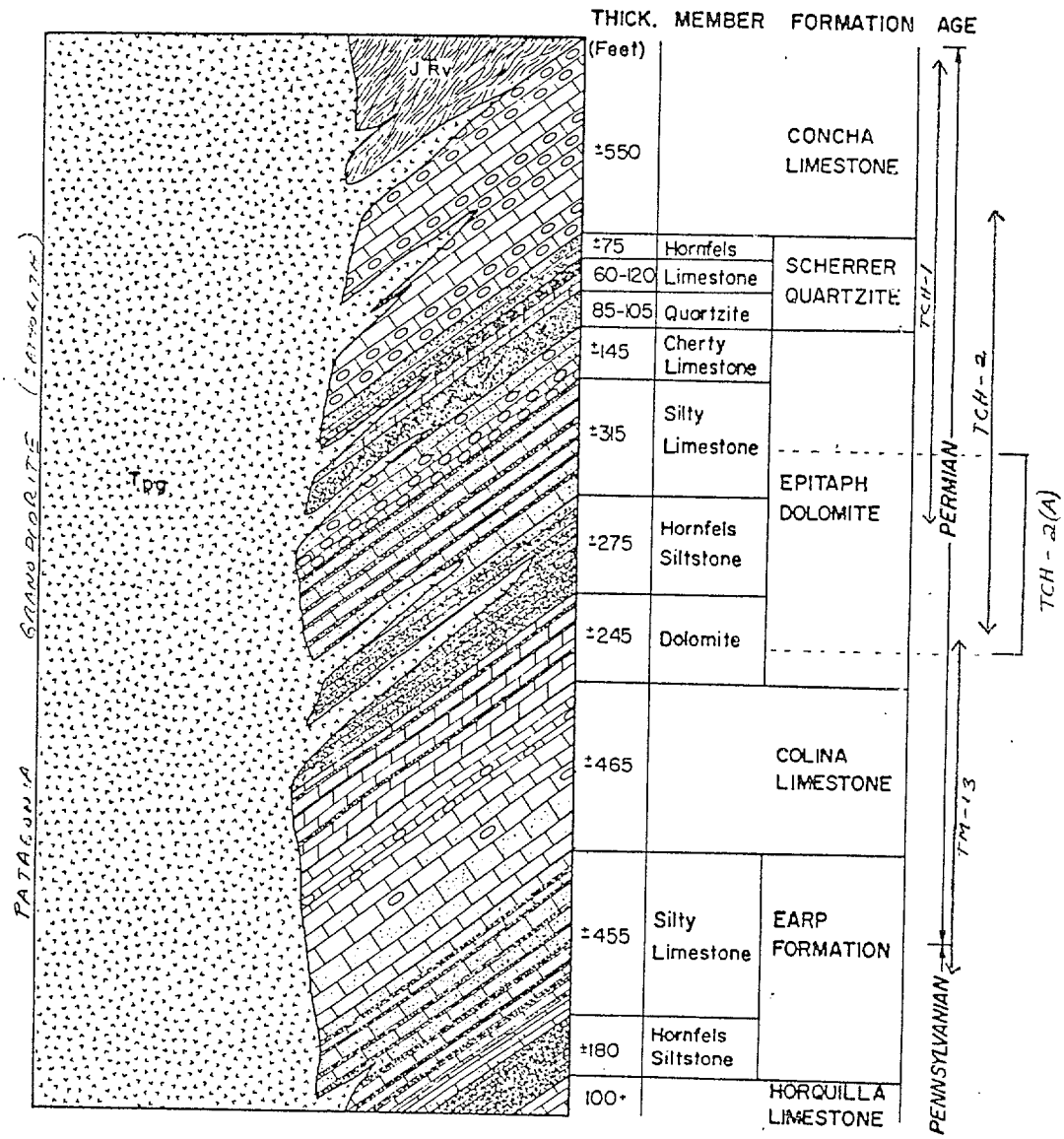
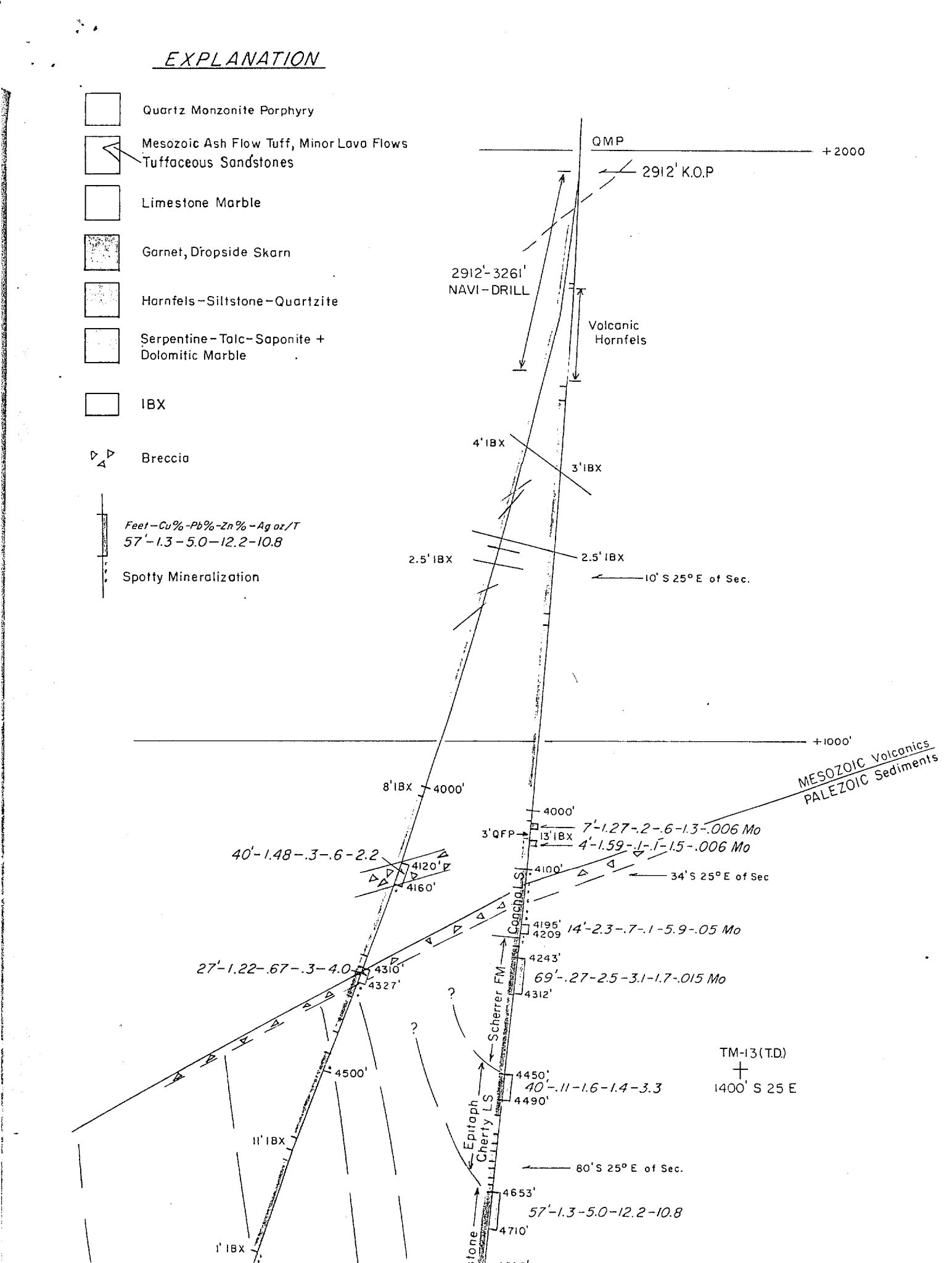
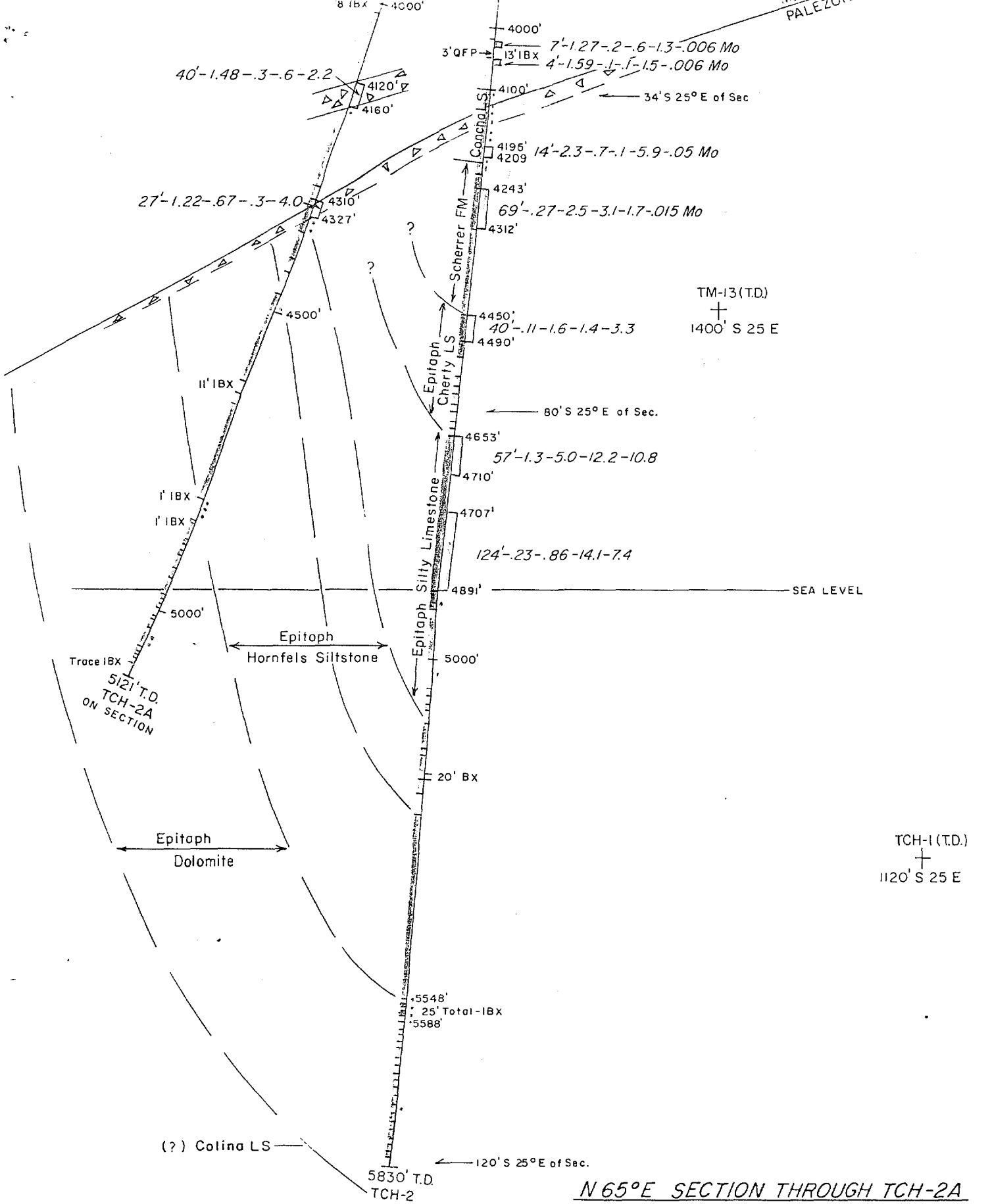


Figure 2. Paleozoic Stratigraphy in the Washington Camp-Duquesne District. (Lehman, 1978)

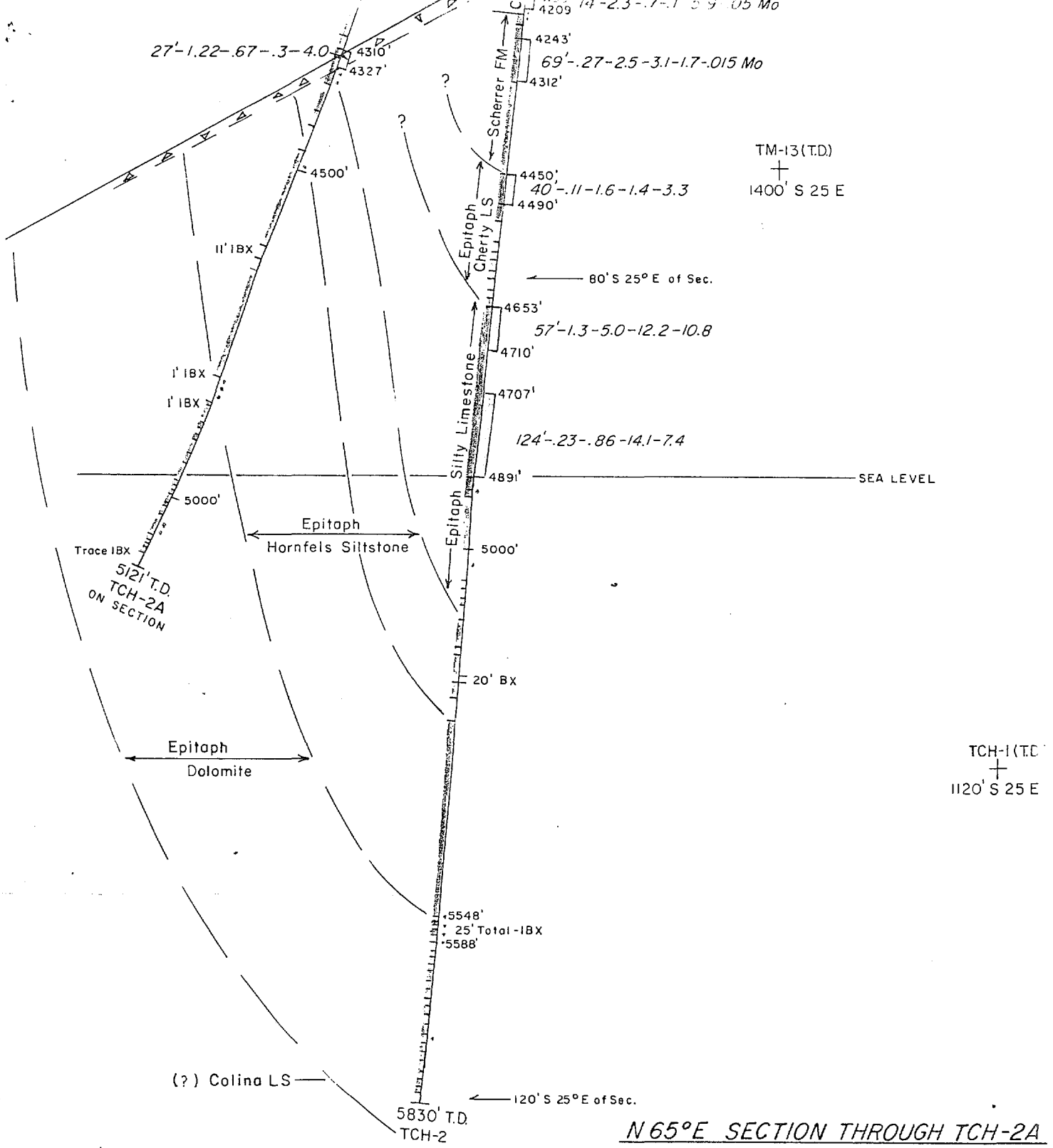

EXPLANATION
Quartz Monzonite Porphyry
Mesozoic Ash Flow Tuff, Minor Lava Flows
Tuffaceous Sandstones
Limestone Marble
Garnet, Dropside Skarn
Hornfels-Siltstone-Quartzite
Serpentine-Talc-Saponite +
Dolomitic Marble
IBX
Breccia
Feet-Cu%-Pb%-Zn%-Ag oz/T
57'-1.3-5.0-12.2-10.8
Spotty Mineralization
QMP
+2000
2912' K.O.P
2912'-3261'
NAVI-DRILL
Volcanic
Hornfels
4'IBX
3'IBX
2.5'IBX
2.5'IBX
10' S 25° E of Sec.
+1000'
MESOZOIC Volcanics
PALEZOIC Sediments
8'IBX
4000'
4000'
3'QFP
13'IBX
7'-1.27-.2-.6-1.3-.006 Mo
4'-1.59-.1-.1-1.5-.006 Mo
40'-1.48-.3-.6-2.2
4120'
4160'
4100'
34' S 25° E of Sec
Concha LS
4195'
4209
14'-2.3-.7-.1-5.9-.05 Mo
4243'
69'-.27-2.5-3.1-1.7-.015 Mo
4312'
27'-1.22-.67-.3-4.0
4310'
4327'
Scherrer FM
?
?
TM-13 (T.D.)
1400' S 25 E
4500'
4450'
40'-.11-1.6-1.4-3.3
4490'
11'IBX
Epitaph
Cherty LS
80' S 25° E of Sec.
4653'
57'-1.3-5.0-12.2-10.8
4710'
1'IBX



N 65°E SECTION THROUGH TCH-2A
TCH-2 PROJECTED TO SECTION
Looking NNW

TRENCH PROJECT
Santa Cruz County, Arizona

TO ACCOMPANY TCH-2A
REPORT
DATED MAR 30 1982



N 65°E SECTION THROUGH TCH-2A
TCH-2 PROJECTED TO SECTION

Looking NNW

TRENCH PROJECT

Santa Cruz County, Arizona

SCALE : 1" = 200'

F.R. Koutz March, 1982

TO ACCOMPANY TCH-2A REPORT
DATED MAR 30, 1982
BY S.A. CATLIN, F.R. KOUTZ

FIG 3

MVK-539

Trench

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

June 23, 1982

Mr. J. D. Sell, Manager
Southwestern Exploration Division
Tucson Office

Geophysical Reconnaissance
Patagonia Mountains, Arizona

Dear Mr. Sell:

I have your letter of June 2 which attaches several memoranda by Mr. Koutz on the above subject. I recall having extensive discussions with Mr. Nicholls in 1979 or so regarding this same subject and his conclusion was that geophysics could do very little for us in the Patagonia Mountains regarding the refinement of drill targets. I hope I'm not being overly curt by suggesting that the work described in Mr. Koutz's memorandum of May 21 confirms the previous conclusion. It seems as though all responses which showed a positive correlation to geology could have been predicted in advance by a study of the outcrops.

I don't mean to imply that geophysics isn't useful, but I'm not convinced given the present state of the art that it can do us a lot of good in the Patagonia Mountains. I hope the costs on the ZERO program were not excessive although the time spent by Mr. Koutz would appear to contribute substantially to the overall cost of the program. Although you weren't involved the geophysical program completed sounds like a fairly substantial effort and I guess in the future I would like to know about such programs in advance. I suspect that if the time spent by Mr. Koutz in consultation with ZERO, Mr. Nicholls, and writing these reports, as well as the contribution to ZERO's field expenses had been converted into dollars, we might have drilled a number of feet which, at this stage of exploration in the Patagonia Mountains, I think will contribute more to our understanding of distribution of mineralization than will geophysical data.

Fleet. Take Note.

Finally, I assume that the specimens submitted to ZERO for complex resistivity measurements will be retrieved. If they have not been, would you please ask Mr. Koutz to do so.

Very truly yours,

F. T. Graybeal

xc: FRK 6/28
cc: WLKurtz

RECEIVED
JUN 28 1982
S. W. U. S. EXPL. DIV.

JDS

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

July 7, 1982

Mr. J. D. Sell, Manager
Southwestern Exploration Division
Tucson Office

Drill Hole Summary of TCH-1
Trench Area Exploration
Sunnyside Project, Arizona

Dear Mr. Sell:

I have read the reports by Mr. Koutz on the above subjects and find they are well organized and thorough. Given Mr. Koutz's attention to detail, I doubt that anything of significance was overlooked. His recognition of amethystine jasperoid and its close association to sulfide mineralization is particularly interesting and should be useful as we interpret future intersections of altered Paleozoic carbonate rocks. The details of his logging are very effectively summarized on his graphic logs which are considerably more detailed than the ones I prepared for the holes drilled farther to the west. I might suggest that in the future an arithmetic scale be used to plot metal analyses. Use of the logarithmic scale tends to conceal the metal abundances in high concentration regions which are of greatest interest. I would also like to encourage Mr. Koutz to be more speculative and use the remarks column for general comments which might apply across several hundred feet of core, rather than for descriptions of individual assay intervals as previously discussed with Mr. Koutz. Finally, several assays of the mineralized quartz feldspar porphyry clasts in hole TCH-1 should have been made. An assay of the aggregate intrusive breccia interval is of much less exploration importance than an assay of the actual mineralization which might be the target of a future exploration drill hole.

Mr. Koutz's general comments on future exploration targets in the Trench area are interesting. There is no doubt that a great number of potential target areas exist, although in my mind the best targets are clearly in the limestone section, either adjacent to the quartz feldspar porphyry stock under the diatreme or between the Trench and the Hardshell deposits. It is likely that sulfide replacement of limestone will be more pervasive and widespread adjacent to the contact of the quartz feldspar porphyry stock than between the Trench and the Hardshell

deposits where replacement may be more selective and related to steep structures which can't be predicted because they are of a prevolcanic age. Therefore, more can be learned about the mineralization with the probability of encountering more sulfide intersections in an individual hole by drilling closer to the quartz feldspar porphyry contact. Certainly, the pervasive alteration in TCH-1 and TM-13 indicates that the potential for mineralization east of the Trench mine is very high and it is difficult to see how the large inventory of metal in the Hardshell deposit could have been deposited without leaving some of the sulfide behind in the complete section of underlying Paleozoic carbonates.

Unless we are able to convince Kerr-McKee to extend work requirements on the Thunder Mountain ground, we will have to begin a drill hole some time this summer within the limits of the Thunder Mountain claim block. The only logical choice would be the site labeled TM-14 on Mr. Koutz's plastic overlay accompanying his Trench area exploration report dated May 24, 1982. This overlay shows that TM-14 is located very close to the Humboldt claim boundary in the bottom of Alum Canyon, about 1500 ft. west of hole TCH-2. I understand we have approximately $25,000 of work required on the Thunder Mountain ground to be completed by October 1, 1982, and whether this work is completed with an air hammer hole or a large diameter diamond drill hole is of less importance than that the hole be located on the Thunder Mountain ground and that it be capped for subsequent reentry. I would forget any further geophysical work in this area.

When time permits this winter, it might be useful to construct a cross section from TR-11 to a point somewhat east of the Hardshell-Hermosa area. This section would put the distribution of the carbonate rocks into a better perspective with regard to the quartz feldspar porphyry stock, which is unquestionably the center and source of all the mineralization in the area, and the outermost zone of strong metal deposition to the east in the Hardshell-Hermosa area.

As you know I am not convinced the final word on this metal-bearing system is yet in. I find the presence of mineralization in skarns somewhat worrisome with regard to developing large continuous zones of massive sulfide mineralization and the presence of high-grade silver within the skarn aureole is somewhat atypical. In addition, the distribution of metals in the massive sulfide intersections in the limestones is not entirely what would be predicted from classic zoning theory in that the copper-silver ratio appears to increase to the east away from the quartz feldspar porphyry. This pattern is also the opposite to that detected in my metal zoning study of this area.

Very truly yours,

F. T. Graybeal

ASARCO

Southwestern Exploration Division

August 16, 1982

TO: F. T. Graybeal
New York

FROM: J. D. Sell

Trench Area Drilling
Santa Cruz County, AZ

Your comments of drill hole TCH-2 by Mr. F. R. Koutz have been received and copies distributed to Mr. Koutz and Mr. Courtright (along with the report).

Yes, we have a copy of the Hunt Thesis as well as Cooper's Johnson Camp work and I'll have Mr. Koutz send you a copy of each. (You may have to return the Hunt tome if he sends the Library copy.)

Fleet also asks that I inquire if you'll return the original assay certificates for the TR-10 thru TR-13 drill holes. The assays are on the drill logs, but he would like the certificates for the general file sheets. Thanks.

It is planned that following the close-down of the General Exploration work in Utah around Thanksgiving Day time, that Mr. Koutz will again have time to think about the total overall Patagonia problems and utilize all the thoughts. I feel he should try to quantify the type and amount of alteration in the various units for each hole, and with the realization of equal but different as rock changes occur. Then I believe this problem of multiple centers and where they are, and the influence of favorable stratigraphy and zoning patterns, can be analyzed to our advantage in future drilling.

James D. Sell

James D. Sell

JDS:mek

cc: W. L. Kurtz
F. R. Koutz

copy for this area File

also copy to FRK

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

July 16, 1982

Mr. J. D. Sell, Manager
Southwestern Exploration Division
Tucson Office

Trench Area Drilling
Santa Cruz County, Arizona

Dear Mr. Sell:

It took several sessions, but I have worked my way through the summary report on drill hole TCH-2 by Mr. F. R. Koutz dated May 13, 1982. The report is well written and is probably the most exhaustive discussion of a single drill hole in my experience, an effort certainly justified by the expenditure and the results obtained. I have no major disagreements with anything in the report, but after spending a substantial period of time reading and studying the graphic logs I would like to offer a number of comments on various specific points. The occurrence of quartz monzonite porphyry, described on page 7, is of some interest. Mr. Koutz notes that most of the contacts are moderate to high angle and it is therefore probable that the actual volume of quartz monzonite porphyry is relatively small. The area of quartz monzonite shown on cross section Y-Y is probably accurate but may give the impression of a far greater volume than actually exists within the area of this cross section. For some reason the quartz monzonite - granodiorite pluton which forms the core of the Patagonia Mountains has failed to generate any significant dike swarms in the adjacent wall rocks. I am therefore inclined to believe that the masses cut by TCH-2 are relatively small and probably have little influence on mineralization.

I had at one point wondered whether the skarn and possibly some accompanying chalcopyrite might have been formed by initial intrusion of quartz monzonite porphyry with later superimposed lead-zinc-silver mineralization having been generated by the quartz feldspar porphyry. To date, however, we have no real evidence that the quartz monzonite porphyry has generated any significant mineralization in this area and it is likely that the quartz feldspar porphyry is the causative mineralizer. Mr. Koutz's observation on page 7 that the presence of abundant quartz monzonite porphyry clasts in intrusive breccias suggest that the quartz monzonite porphyry is considerably thicker to the west is not convincing because it is likely that the intrusive

RECEIVED
JUL 21 1982
S. W. U. S. EXPL. DIV.

breccias followed quartz monzonite porphyry dikes and therefore picked up a much greater proportion of this rock than is actually present in the area.

On page 8 Mr. Koutz notes that correlations in the Paleozoic section are difficult because the section is expanded due to tilting. Another factor which will likely complicate correlations based on thickness is the possible reduction in volume of carbonate units in the Paleozoic due to the very strong silication. John Cooper discussed this effect in the Johnson Camp area in a GSA paper about 30 years ago and it might be worth rereading that paper if the details of volume reduction were not considered. When possible I would appreciate receiving a xerox copy of Cooper's paper for my own review. v. 68, #5, p. 577-610 (1957)

Moving on to considerations of structure, Mr. Koutz suggests on page 10 that the gouge zones in TCH-2 are thicker apparently because of a more pervasive alteration in the adjacent wall rocks. It was my impression from logging TM-13 that most of the faults were pre-mineral and the increased thickness of gouge in faults in TCH-2 may simply result from movement of increased volumes of hydrothermal fluid through them with the development of wider and more pervasive alteration envelopes. Mr. Koutz also discusses the brecciation at the top of the Paleozoics along the contact with overlying volcanic rocks and suggests that one possible cause of the brecciation is enplacement of Hardshell volcanics. The brecciation may also be caused by volume reduction, as discussed earlier, along an unconformity which has obviously controlled the flow of a great deal hydrothermal fluid.

Mr. Koutz gives a good discussion of hydrothermal alteration and notes the abundance of potassium feldspar particularly in and around intrusive breccias. I presume that he has confirmed that this is potassium feldspar either by stain or x-ray and that it is not untwinned albite which has a similar appearance. Mr. Koutz notes on page 13 that pervasive sericite and clay alteration decrease with depth and become more fracture-controlled. This may be a function of rock type rather than vertical alteration zoning. The ash component of the lapilli tuff appears to have been a highly susceptible to alteration and it also appears to be uniformly disseminated throughout the tuff. Its apparent abundance in the lapilli tuff as contrasted to the underlying Hardshell volcanics may explain why sericite is more abundant nearer the surface. The overall distribution of micas and various clay mineral types will be a difficult problem and Mr. Koutz has obviously made a great deal of progress in this regard. I recall someone was going to acquire the thesis by John Hunt concerning alteration in the U.S. and Lark mines at Bingham, and when this thesis is available I would like the opportunity to read it (the work was done at Berkeley under Meyer).

float

On page 18 Mr. Koutz discusses four different types of mineralization. This breakdown is clearly significant, but for the purposes of discussion and report writing I would strongly suggest that he not describe these assemblages in abstract terms (Type 1, Type 2, Type 3, etc.). It will be much easier for people unfamiliar with a project which is likely to continue for many years to describe the mineralization in specific terms such as covellite-chalcocite instead of Type 1, or massive sphalerite-galena replacement instead of Type 4.

On page 20 Mr. Koutz notes that the covellite-chalcocite mineralization is coincident with the lower levels of the Trench and January-Norton mines. I consider this to be coincidental and probably irrelevant because the covellite-chalcocite mineralization is almost entirely confined to the lapilli tuff. Mr. Koutz goes on to suggest that the covellite is probably supergene. Although there may be some supergene covellite in TCH-2, in the other holes farther to the west it is clearly hypogene and I suspect that the presence of associated fracture zones with covellite in TCH-2 is coincidental. The covellite-chalcocite in TCH-2, although present in both the Hardshell volcanics and the lapilli tuffs, occurs at virtually the same elevation as the covellite-chalcocite in holes farther to the west, far below the top of the existing water table and unleached sulfides. I am sure that the hypogene (in my opinion) covellite-chalcocite blanket will be the subject of future interesting discussions.

Also on page 20 Mr. Koutz notes that the sphalerite-galena-chalcopyrite veins are spatially associated with the quartz monzonite porphyry and suggests that the quartz monzonite porphyry was the genetic source of this mineralization. I am not ready to agree with this idea because identical mineralization occurs throughout the area far from known occurrences of the quartz monzonite porphyry (although I'm not sure if this point is all that significant).

On page 22 Mr. Koutz notes the occurrence of anglesite and cerrusite in the strong slaggy hematite mineralization between 4100-4209 ft. He doesn't say whether or not these minerals are hypogene and I guess I'd like to think a little bit more about that myself. He does point out farther down page 22 that this hematitic mineralization was initially thought to have been a supergene phenomenon, although I never thought it was supergene and I didn't realize anyone else ever did either.

On page 24 Mr. Koutz attempts to assuage my concern about massive sulfide mineralization in skarn and points out that major lead-silver deposits in skarn can be just as large as those of the Tintic or Leadville type, and cites tables in a paper by Einaudi et.al. in the 75th SEG Anniversary Volume, as evidence. I have reviewed those tables briefly and for the most part the tonnages cited for skarn deposits containing abundant lead are generally small. More importantly, the tables

do not provide information on the form or continuity of the individual orebodies. It is certainly possible to aggregate a significant tonnage, but do it in so many small, disconnected, and unpredictable zones that mining is marginally economic. Although I will give this subject considerable thought, I still maintain that major limestone replacement deposits containing abundant lead and silver as well as zinc and copper do not typically occur in skarn. At the depths encountered in our Trench drilling, we will certainly need continuous mineralization on a very large scale to develop an ore deposit.

On page 29 Mr. Koutz recommends that I reconsider the quartz feldspar porphyry as a single stock from which the various irregular dikes have been emplaced. I apparently never wrote it down, but by 1975 I had rejected the two stock idea illustrated on a cross section on my 1973 report. This stock may be elliptical in shape and at sea level elevation probably extends considerably south of the known surface outcrops. If the northerly dips in the Paleozoic carbonate rocks are relatively consistent, the area 1500-2500 ft. south of TCH-2 may bring favorable basal Paleozoic rocks into contact with altered quartz feldspar porphyry at relatively modest depths and this area, which lies entirely on Thunder Mountain project land, should be considered a prime target for drilling in the future.

Regarding Mr. Koutz's comment about geophysics on page 30, I believe that the expense of drilling in the Trench area means that money should not be wasted on a geophysical program which would be largely experimental and which would locate nothing more than dozens of unexplainable anomalies requiring further refinement. At our current stage of exploration in this area, and in view of the depths involved we need something which can locate base and precious metals, not sulfides. The drill is clearly our most reliable, effective and specific exploration tool for that purpose.

Please extend my compliments to Mr. Koutz for his very substantial effort which has clearly enhanced our understanding of the very complex geology and mineralogy in the altered carbonates of this area. His work will provide us with an excellent background when we are again able to begin deep drilling for additional mineralization. Please also route a copy of Mr. Koutz's report and this letter to Mr. Courtright for comment.

Done 11/21/82 cg

Very truly yours,

F. T. Graybeal

cc: WLKurtz

Trench File

ASARCO

Southwestern Exploration Division

September 18, 1982

To: J. D. Sell

From: F. R. Koutz

Review and Comparison to
Trench: J. P. Hunt Thesis, 1957
U.S. and Lark Mines
Bingham Mining District
Salt Lake County, Utah

The following is a revision of notes made last April from a Ph.D. thesis by John P. Hunt on "Rock Alteration, Mica, and Clay Minerals in Certain Areas of the United States and Lark Mines, Bingham, Utah," Univ. of California, Berkeley, 1957. The thesis was xeroxed for us by C. N. Alpers, now a graduate student at Berkeley. At my request several of the "cookbook" analytical-methodology chapters were not copied. Also included for the library are three articles on Bingham (mostly from the Highland Boy area) from Trans. AIME, V 70, 1924:

R. N. Hunt: "Ores in Limestones at Bingham, Utah"

A. N. Winchell: "Petrographic Studies of Limestone Alteration at Bingham"

O. P. Peterson: "Some Geological Features and Court Decisions of the Utah Apex-Utah Consolidated Controversy, Bingham District, Utah."

F. T. Graybeal had suggested last March that the descriptions of clay and other alteration of the carbonate-hosted Pb-Zn ores described by Hunt might be useful in the study of Trench area carbonate-hosted mineralization. Although I was familiar with the descriptions of "Non-Porphyry Ores of the Bingham District" by Rubright and Hart in the 1968 AIME Graton-Sales Volume, I found Hunt's work to be very useful with a great number of analogs to the alteration encountered in DDH TCH-1, 2 and especially 2A. Since all reports on these holes had been completed or were undergoing final typing and were long enough already no comparison to Hunt's work was made. For a full comparison considerable additional x-ray diffraction work would be required beyond the relatively minor amounts done for the TCH-series reports, including mineral separations, specific mineral orientations and personal attention beyond the routine contract work we have had done at the University of Arizona. The following summarizes some relevant features of carbonate-hosted mineralization at Bingham and comparisons to that at Trench. The interested reader will find the detailed descriptions of altered limestones and quartzites and analytical methods followed as well as the crystal chemistry/mineralogy of the layer-lattice silicates provided by Hunt to be quite informative. Recent work in the Bingham area by Anaconda (e.g. 1975

Trench

June 27 '84

AFFIDAVIT OF LABOR PERFORMED
AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

J. R. Stringham, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

Name of Claim	Book	Page	Docket	Page	BLM Serial No.
South Humbolt	22	4	25	158	A MC 50226
" " Amend.			343	228 and 229	" "
Humbolt	1	627	25	159	" 50227
" Amend.			343	210 and 211	" "
Silverleaf	6	572	25	160	" 50228
" Amend.			343	230 and 231	" "
Good Luck #2	22	7	25	161	" 50229
" " " Amend.			343	208 and 209	" "
Indian Chief	4	309	25	162	" 50230
" " Amend.			343	212 and 213	" "
Monoca	22	161	25	163	" 50231
" Amend.			343	216 and 217	" "
Good Luck	4	300	25	164	" 50232
" " Amend.			343	206 and 207	" "

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1983 and May 31, 1984, in excess of $1,000 worth of work and improvements were done and performed for the benefit of each of the aforementioned claims. Work and improvements consisted of drilling with diamond drill rig by Joy Manufacturing Company, 707 Boyd Blvd., La Porte, Indiana 46350.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements

and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more than One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1984.

ASARCO Incorporated

By _____
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 27th day of June, 1984, by J. R. Stringham.

_____
Notary Public

My Commission Expires:

My Commission Expires March 4, 1985

JDS

6/11/85

FROM: J. D. SELL

TO: J. P. Turnham

Jerry Yancy can in this afternoon to see you. He saw a note in a real estate brochure that "homesites" were for sale at the Trench Mine & he was wondering if that was true..?

Is it?

J D S

ANNUAL PROJECT PLANNING SHEET

DISTRICT: Southwestern
PROJECT NAME: Trench-Humboldt
PROJECT NUMBER: EA 0200
PROJECT SUPERVISOR: W.D.Payne
PROJECT GEOLOGIST: F.R.Koutz
PREPARED BY/DATE: FRK/2-19-82

EXPENDITURES

1. Month of March $ 3,845
2. Current Year Expenses to Date thru March $ 62,929
3. Budget for Current Year 1982 $
4. Thru previous year, since project began $607,102 [+ $72,267 @ Mendoza]

TYPE OF PROJECT

	Recon
X	Drilling
	Pre-Development
	Other

COST ESTIMATE & APPROPRIATION REQUEST

		Approval Dist. Geol.
Current Yr. Orig. Budget	$	
Current Yr. Add. Request @ ____	$	
Current Yr. Add. Request @ ____	$	
New Total	$	

OBJECTIVE: Complete reports from 1981 drilling. Plan future drilling out of TCH-2 to test for continuity of limestone replacement/skarn mineralization.

Progress for the Month of March '82

PLANNED TASKS	RESPONSIBILITY/TIME TO COMPLETE	TARGET DATE	% COMPLETE	PROGRESS TO DATE
1. Complete TCH-1 drill hole summary (drafting, typing).	FRK/2 weeks	3/15/82	99%	Report finished and typed; about 1 week final drafting remains
2. Complete TCH-2 drill hole summary (drafting, report).	FRK/3 weeks	4/1/82	90%	Draft written, being typed; final drafting 1/3 done.
3. Complete TCH-2A drill hole summary (drafting, report).	SAC/FRK/3 weeks	4/1/82	85%	Draft under revision by SAC; final drafting not started.
4. Complete recommendations report Trench area.	FRK/1 week	5/1/82	50%	First draft being written.
5. Geophysical Recon. N.Patagonia Mtns.	SLC-Geophys./FRK			
a. Field work + report	/3 weeks	4/15/82	90%	Report being written by SLC Geophysical Office.
b. TCH core analysis	Zonge/E.B.N./2 months?	7/1/82	80%?	
6. Fly & Topo Map - N.Patagonia Mtns.				
a. Establish control points	FRK/J.Yanez - 2 weeks	4/1/82	10%	See TM
b. Select Contractor & do work	FRK/WDP- 2 months	9/1/82		
7. File assessment work with Santa Cruz County and BLM (TCH-2A)	RBC/2 days	9/1/82	0%	TCH-2A - could be done anytime.
8. Fluid inclusion study - TCH cores	SAC/FRK/3 weeks	11/1/82	5%	Samples being selected for polished plates.

ANNUAL PROJECT PLANNING SHEET

WDP

DISTRICT: Southwestern
PROJECT NAME: Trench-Humboldt
PROJECT NUMBER: EA 0200
PROJECT SUPERVISOR: W.D.Payne
PROJECT GEOLOGIST: F.R.Koutz
PREPARED BY/DATE: FRK/2-19-82

EXPENDITURES

1. Month of _____ $_____
2. Current Year Expenses to Date thru _____ $_____
3. Budget for Current Year 1982 $_____
4. Thru previous year, since project began $607,102 [+ $72,267 @ Mendoza]

TYPE OF PROJECT

	Recon
X	Drilling
	Pre-Development
	Other

COST ESTIMATE & APPROPRIATION REQUEST

		Approval Dist. Geol.
Current Yr. Orig. Budget	$	
Current Yr. Add. Request @ ____	$	
Current Yr. Add. Request @ ____	$	
New Total	$	

OBJECTIVE: Complete reports from 1981 drilling. Plan future drilling out of TCH-2 to test for continuity of limestone replacement/skarn mineralization.

Progress for the Month of _____

PLANNED TASKS	RESPONSIBILITY/TIME TO COMPLETE	TARGET DATE	% COMPLETE	PROGRESS TO DATE
1. Complete TCH-1 drill hole summary (drafting, typing).	FRK/2 weeks	3/15/82		
2. Complete TCH-2 drill hole summary (drafting, report).	FRK/3 weeks	4/1/82		
3. Complete TCH-2A drill hole summary (drafting, report).	SAC/FRK/3 weeks	4/1/82		
4. Complete recommendations report Trench area.	FRK/1 week	5/1/82		
5. Geophysical Recon. N.Patagonia Mtns.	SLC-Geophys./FRK			
a. Field work + report	/3 weeks	4/15/82		
b. TCH core analysis	Zonge/E.B.N./2 months?	7/1/82		
6. Fly & Topo Map - N.Patagonia Mtns.				
a. Establish control points	FRK/J.Yanez - 2 weeks	4/1/82		
b. Select Contractor & do work	FRK/WDP- 2 months	9/1/82		
7. File assessment work with Santa Cruz County and BLM (TCH-2A)	RBC/2 days	9/1/82		
8. Fluid inclusion study - TCH cores	SAC/FRK/3 weeks	11/1/82		

ANNUAL PROJECT PLANNING SHEET

WDP

DISTRICT: Southwest

PROJECT NAME: Trench-Humboldt

PROJECT NUMBER: 0200

PROJECT SUPERVISOR: W.D.Payne

PROJECT GEOLOGIST: F.R.Koutz

PREPARED BY/DATE: FRK/6-1-81

EXPENDITURES

1. Month of 12/81 $ 12,533.00
2. Current Year Expenses to Date thru 12/81 $ 401,494.00
3. Budget for Current Year 1981 $ 200,000
4. Thru previous year, since project began $ 273,075

TYPE OF PROJECT

	Recon
X	Drilling
	Pre-Development
	Other

COST ESTIMATE & APPROPRIATION REQUEST

			Approvals: Dist. Geol.	Approvals: West. U.S.
Current Yr. Orig. Budget		$200,000*		
Current Yr. Add. Request @	8/81	$175,000#		
Current Yr. Add. Request @		$		
New Total		$375,000		

OBJECTIVE: Test for continuity of limestone replacement/skarn mineralization and porphyry copper mineralization at the margin of the Sunnyside diatreme. Drill test to 5500 feet - TCH-2A offset to test continuity/grade TCH-2.

Progress for the Month of December 1981

*Also used for annual work and assessment requirements for Thunder Mountain.

#Reflected in Task #8, below.

PLANNED TASKS	RESPONSIBILITY/TIME TO COMPLETE	TARGET DATE	% COMPLETE	PROGRESS TO DATE
1) Log and assay TCH-1 (1980) including petrography and Drill Hole Summary.	FRK/3 weeks	7-31-81	99	Report being revised, figures in drafting room.
2) Plan TCH-2 drilling program.	FRK-WLK/1 week	3-1-81	100	
3) Site preparation. Notify and trip with USFS.	FRK-HMS/1 week FRK-RBC/1 day	3-15-81 3-1-81	100 100	
4) Drill 1 DDH:5500' TCH-2.	FRK-Joy Mfg./5 months	8-15-81	100	
5) Log and assay TCH-2. Petrography - Drill Hole Summary.	FRK/3 weeks	9-15-81	98	Report being written, figures in drafting room.
6) File assessment work with Santa Cruz County and BLM.	RBC/2 days	11-30-81	100	
7) Annual progress report with exploration recommendations for Trench-Humboldt-NE Thunder Mtn. area.	FRK/1 week	12-31-81	na	The results of TCH-2 preclude the necessity of this report. However, recommendations for TCH-2B: a drill-out from TCH-2 to the North, TM-14 and TR-18 will be a separate report.
8) Drill-out of TCH-2 (TCH-2A) a) Planning b) Drill: 2900-5500' c) Logging/drill hole summary	 FRK-WDP-WLK-JDS/2 weeks GWP-FRK/4 months SAC/FRK/3 weeks	 8-15-81 12-15-81 1-15-82	 100 85.4 85	 Drilling terminated at 5121'; casing being pulled; packer to be set for 2900' drill-out. S.A. Catlin: TCH-2A logging, TCH-1 petrography completed; some figures ready for drafting.

WDP

ASARCO MONTHLY DRILLING SUMMARY

DISTRICT Southwest U.S.

Project Trench Project No. EA-0200 State Arizona County Santa Cruz Month December Year 1981 Page 1

Hole No.	Collar location	Bearing	Dip	Footage drilled			Remarks (significant intersections, geology and/or assay intervals, etc.)
				From	To	Feet	
TCH-2A	TCH-2 5360N 4881' 3516E	About S60W	18-19°	5027'	5121' TD	94'	Average 76.5% recovery. Interbedded quartzite-siltstones and serpentine - "talc" (montmorillonite) dolomitic marbles. Weak disseminated py±sl±cpy±gn. Alteration changes from weak skarn dominated to weak jasperoid/wallostonite dominated at about 5064'. Trace IBX @ 5094'.
TCH-2A	Assays			4310'	4337'	27'	1.21% Cu, 0.67% Pb, 0.32% Zn, .002 oz. Au/T, 0.0017% Mo. 4.02 oz. Ag/T. Top of Paleozoic interval. Garnet-diopside-chlorite skarn.

ASARCO MONTHLY DRILLING SUMMARY

DISTRICT Southwest U.S.

Project Trench Project No. 0200 State Arizona County Santa Cruz Month November Year 1981 Page 1/1

Hole No.	Collar location	Bearing	Dip	Footage drilled From	To	Feet	Remarks (significant intersections, geology and/or assay intervals, etc.) (Preliminary log by FRK).
TCH-2A	(TCH-2) 5360N 3516E 4888' (corrected)	about S65W	21°-25°	4881	-4891.5	10.5	Massive talc with gypsum veins, sheared, crumbly and caving.
				4891.5	-4926	34.5	Marble:f.-m.g. with serpentine-talc zones to 2', banded, dip 60°-75°.
				4926	4958	32	Interbedded mg. marble with serpentine-talc zones, and limey quartzites-quartzite (4926'-4931', 4932'-4943', 4946'-4949.5'). Banding 60°-75° @ 4933', 3" 5% sl> cpy + T gn + py. @ 4935', 1" 3% sl> cpy, T py + gn. 4943'-4946':1-2% sl > py > gn > cpy.
				4958	4978	20	Yellow-green serpentine-talc and marble. Banding 60°.
				4978	5014	36	Interbedded f.g. marble, dolomitic chalky siltstone, serpentine-talc + minor quartzite. @ 4986': 4" 5-8% string, sl > gn > py > cpy, 10% to core. @ 5012'-5014': 1/2-1% sl + cpy = py in chloritic stringers.
				5014	5018	4	Black - dark green serpentine (probably contains diopside-garnet) with .1-1% cpy blebs in chl(?).
	At 5027' TCH-2A is 429' S75W of an equivalent TVD (4958') in TCH-2			5018	5027	9	Light grey quartz with a few selenite-calcite veins, well broken 60-95% recovery.
	At 5027' TCH-2A is 650' WSW of the collar of TCH-2						
TCH-2A	Assays			4120	4160	40	1.48% Cu, 0.31% Pb, 0.60% Zn, 0.77 oz. Ag/T, 0.002 oz. Au/T, 0.003% Mo.

c: S.A. Catlin

ASARCO MONTHLY DRILLING SUMMARY

DISTRICT _____

Project Trench Project No. EA-0200 State Arizona County Santa Cruz Month October Year 1981 Page 1/1

1190' for month

Hole No.	Collar location	Bearing	Dip	Footage drilled From	To	Feet	Remarks (significant intersections, geology and/or assay intervals, etc.)
TCH-2A	3225 E. Trench 5350 N. Unit Grid 4876.02' (USGS)	@ 3700 S.66° W.	15½°	3694'	3811'	106'	Flow Banded Porphyry. % welded tuff decreases with depth into lava flows(?). one to two % maximum dissem. pyrite. Chl ± epid. ± Kfs blebs and veins. Qtz.-ser. flooding increases strongly below 3811'. [Mixed zone of 40° MP dikes plus strong Q - S.]
				3811'	3818'	7'	
	Collar TCH-2 above			3818'	3995	177'	Flow Banded Porphyry, with possible Mp zones. DK to Lt.gy matrix. Chl ± epid. ± Kfs. Strong Kfs halos (1 - 5 mm) to veins. 3863-3875': V. strong pink Kfs halos + epidote-chlorite pyrite veins (1-3% pyr.) Local yellow montm.(?) Alt. beyond veins. 3875-3895': V.Strong q-s-py (1-2%). Weak BX with 10-20% phenocrysts in porphyry.
	K.O.P. TCH-2A @2912' in TCH-2 (1960 MSL)			3395'	4003'	8'	IBX: QFP clasts to 10 cm (1 cm avg.): well rounded. Strong qtz-ser.(grey)matrix. Pyritic + chloritic. [Flow Banded Porphyry (@ 35-40°). Strong q-s-py flooding on Chl ± epid. ± Kfs ± py replacement of phenos + halo. Local strong Kfs halos + yellow montm. in Fs beyond.
				4003'	4123'	120'	
	K.O.P. at 3163 E. 5301 N.			4123'	4154'	31'	Porphyry, Flow Banded(?) 5-50% dissem. pyr. (15-20% avg.) + up to 3' zones with 1-3% sl ± cpy ± gn. Strong ser. + Kfs + Chl ± epid.
				4154'	4310'	156	Flow Banded Porphyry. 10-15% phenos or ghosts + Kfs + Chl + py. ± clay. Mottled green with local Kfs on Fx. 1-2% dissem. pyr. Q-s-py. increases below 4276', V. strong qtz.-ser. + Kfs flood below 4303'. Lower contact about 20°.
	NX-BX 4355'	@ 4320' S. 64° W.	20¼°	4310'	4357'	47'	Skarn, partially igneous host but strong interstitial calcite. Lt. to dk. green Chl + diops. + lt. green garnet. 3-20% pyr. dissem. in grains to 1 cm. Local 1-2% dissem. cpy. + sl. Rare dissem. bands of gn. ± rhodochrosite.
				4357'	4403'	36'	Hornfels, silty-sandy. Mottled lt. green + white, .1-.2% local sl. + cpy. + .5% py. - all dissem. Local hem., part after pyr. [silty limestone - skarn. Mostly f.g. grey with local gr. mottling. Dissem. sulf. stringers 4421-4423', 4442.5-4443.3: py. + cpy.+ sl. + cov. ± hem. (4403-4404' gougy silicificed zone, strong bleach: fault(?) @ 30°+ 80°).
				4403'	4457'	54'	
				4457'	4467'	10'	Limey Claystone. dk. green → wh. and well sheared @ 80-90° (fault ?)
				4467'	4611'	144'	Siltstone - Hornfels, tan to v. dk. green .1-.3 dissem. pyr. + local bk. sl. blebs (5% over 1-4 cm.). Foliation 60-90°- 4588-4594: sugary marble + jasperoid - about 1% pyr. wk.BX in SiO_2.
				4611'	4622'	11'	IBX: most frags. angular but some well rounded QFP. v. strong dk. green chl. + qtz.-ser. matrix ½-2% pyr. + .1-.2 cpy. + sl.
				4622'	4680'	58'	Siltstone - Quartzite with local white marble esp. 4632-4648'. Mottled green with local gypsum on Fx. All weakly crushed and vuggy @ 4678', 3" of 2% sl. + cpy. + gn.
				4680'	4815'	135'	V.F.G. Quartzite - Siltstone, weakly crushed @ 60-80°- up to 3% vugs. Mottled lt.- dk. green with bleached Fx. .1-.3 pyr. mostly dissem. on Fx. with calc. + gyp. ± trace sl. + gn.
				4815'	4852'	37'	Marble, silty-sandy, mottled skarn with garnet + diops. stringers, local BX (4822-4823' IBX @ 55°) Local zones less than 1% sl. + cpy + gn. Sulfides pick up in marbles. (0.8' gouge + crush @ 4852')
	Estimated @ 4881' : 408', S. 77 W. of TCH-2			4852'	4881	29'	V.F.G. talcy carbonate (+ serpentine ?) with local 1-2' granular garnet zones. Well Broken below 4862' with about 15% .1-2 cm. cyp. zones. Very slippery - cave.

(S.A. Catlin: detailed logging to 3720'. F.R. Koutz: recon. logging to 4881'.)

WDP - MVK 5266

ASARCO MONTHLY DRILLING SUMMARY

DISTRICT Southwestern U.S.

Project Trench Project No. EA 0200 State Arizona County Santa Cruz Month September Year 1981 Page 1

Hole No.	Collar location	Bearing	Dip	Footage drilled			Remarks (significant intersections, geology and/or assay intervals, etc.)
				From	To	Feet	
TCH-2A	3225 E. Trench 5350 N. unit grid 4876.02' (USGS)	@ K.O.P S 29 W.	3½°	2912	3270	358	Navi-drill spot cores @ 2943 - 2945', 3022 - 3023', 3122 - 3123', 3261 - 3270'.
	Collar TCH-2 above K.O.P. TCH-2A @ 2912' in TCH-2 (1960' MSL) 3163 E. TCH-2A 5301 N. K.O.P.	@ 3425' S 67 W.	14°	3270	3694	424	2912 - 3694': Corral Canyon Volcanic Sequence: ash flow tuffs and lava flows. Early Chl ± Ep ± Kfs ± Co_3 = (+ py). Py repl. mgt. Later qtz-ser-pyr. IBX @ 3389 - 3391, 3394 - 3395.8', 3472 (2"), 3500 - 3502', 3539' (3"), NX core Sept. 17-25 (3855', 8 p.m. Sept. 30) 5553 - 5557' (?), 3595 - 3598', 3651' (1") and 3676.5' (2"). Local clasts of Mp and Qmp in IBX, IBX qtz-ser-pyr. Flooded with only trace cpy ± sl. 1 - 8 mm cpy py veinlet stringers @ 3676'.

WDP - MVK 5266

ASARCO MONTHLY DRILLING SUMMARY

DISTRICT Southwestern U.S.

Project Trench Project No. (EA 0200) State Arizona County Santa Cruz Month August Year 1981 Page 1 of 1

Hole No.	Collar location	Bearing	Dip	Footage drilled			Remarks (significant intersections, geology and/or assay intervals, etc.)
				From	To	Feet	
	3525E Trench	S30W	4½	5658	5830 TD	172	Interbedded quartzite - siltstone and marble and serpentine; beds 2 to 20' thick; dip 5 to 40°. Quartzites well fractured; marble bleached to weak zebroid texture. Few tenths % disseminated pyr.; a few stringers disseminated gn ± Sl. Possibly Upper Earp Formation.
				3002 packer	2912 K.O.P.	90 -Navi-drill	Cemented.
	Assays returned in August			5216	5217	1	.04% Cu, 1.7% Pb, 2.1% Zn, 1.6 oz. Ag/T, 14 ppm Mo. Other zones 10 - 20' with several .01% Pb or Zn.
				5583	5588	5	800 ppm Cu, 165 ppm Pb, 360 ppm Zn, 1.6 ppm Ag, 170 ppm Mo. IBX - best interval.

WDP – MVK 5266

ASARCO MONTHLY DRILLING SUMMARY

DISTRICT Southwestern US

Project Trench Project No. 0200 State Arizona County Santa Cruz Month July Year 1981 Page 1

Hole No.	Collar location	Bearing	Dip	Footage drilled			Remarks (significant intersections, geology and/or assay intervals, etc.) June assay summary on monthly drill map.
				From	To	Feet	
TCH-2	3525E Trench 5350N Unit Grid 4876.02' (USGS)	S30W	4½-6°	5135	5658	523	Dominantly alternating limy and sandy hornfels with minor dolomitic marble/serpentine (exceptions below). (Prob. Earp Fm.) Disseminated pyrite-locally oxidized to hem. Local trace sl±gn±MoS_2.
				(5160 (5548	5251) 5588)	61 40	Dolomitic marble zone -- zebra-banded plus serpentine (basal Epitaph?) 3 zones (24.5' total) IBX: 5-20% well round. equigran. ign. clasts w/biot., Kfs, several tenths MoS_2, cpy. 70-90% angle with hornfels -- 20-40 ft. bleached halo.

WDP – MVK 5266

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

September 11, 1985

Mr. Dean Bibles
State Director
Bureau of Land Management
U.S. Dept. of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Group (7)
A MC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claim serial numbers, as recorded in the Santa Cruz County Recorder's office in Docket 406, Pages 480 and 481, for the assessment year ending September 1, 1985.

Please return acknowledgement in the enclosed envelope.

Very truly yours,

J. R. Stringham
Assistant to the
Manager, SWED

JRS:mek
enc.

cc: R. L. Brown
H. E. Kelshaw (w/enc.)
A. J. Robles (w/enc.
J. D. Sell (w/enc.)

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

J. R. Stringham, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

Name of Claim	Recording Data Book	Page	BLM Serial Number
South Humbolt	007	360	A MC 50226
" " Amended	380	682 and 683	"
Humbolt	007	358	50227
" Amended	380	684 and 685	"
Silver Leaf	007	364	50228
" " Amended	380	686 and 687	"
Good Luck #2	007	366	50229
" " " Amended	380	688 and 689	"
Indian Chief	007	368	50230
" " Amended	380	690 and 691	"
Monoca	007	362	50231
" Amended	380	692 and 693	"
Good Luck	4	300	50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1984 and August 28, 1985, in excess of $800 worth of work and improvements were done and performed for the benefit of the aforementioned claims. Work and improvements consisted of drilling by Joy Manufacturing Company, 707 Boyd Blvd., La Porte, Indiana 46350.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements

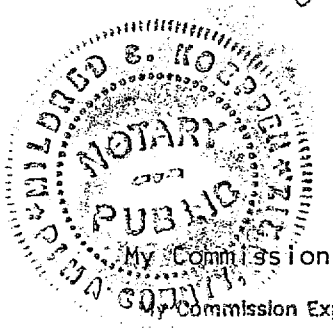
and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more than One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1985.

ASARCO Incorporated

By _____

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 4th day of September, 1985, by J. R. Stringham.

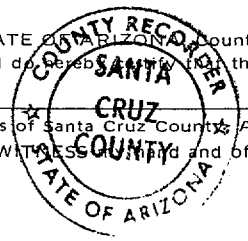


Mildred C Koeppen
Notary Public

My Commission Expires:
My Commission Expires Nov. 28, 1988

FEE NO. 05555

STATE OF ARIZONA, County of Santa Cruz — SS.
I do hereby certify that the within instrument was filed and recorded at the request of ASARCO Incorporated on SEP 6 '85 -10 00 AM Docket No. 406 Page 480-481
Records of Santa Cruz County, Arizona.
WITNESS my hand and official seal the day and year first above written.



MARY LOU G. SAINZ, COUNTY RECORDER
By Margarita Vizcaya
Deputy

ASARCO

Southwestern Exploration Division

JDS

June 20, 1986

To: W. D. Gay

From: J. D. Sell

File Assessment Work
Year Ending Sept. 1, 1986

The following SWED Projects have had the necessary funds expended in geologic studies and evaluation. Please file the assessment work records to the proper authorities. The blanks in the following paragraph are given below for the projects:

> ...; that between September 1, 1985 and _____, 1986, in excessof $_____ worth of geologic studies, evaluation, and improvements were done and performed for the benefit of the described claims. The studies, evaluation, and improvements were performed by _____, ASARCO Incorporated, Tucson, AZ. ...

1. Three R Project, AZ
   June 15, 1986
   $4,900
   F.R. Koutz, T. Dalla Vista, and J.D. Sell

2. Trench Project, AZ (par~~t of 3-R)~~ error. Trench (Humboldt-Mendoza) separate
   June 15, 1986
   $700
   F.R. Koutz, T. Dalla Vista, and J.D. Sell

3. Brown's Ranch Project, CA
   June 1, 1986
   $7,000
   F.R. Koutz, T. Dalla Vista, H.G. Kreis

4. Cady Project, CA
   March 1, 1986
   $4,600
   H.G. Kreis, F.R. Koutz, T. Dalla Vista

5. Castle Project, CA
   February 1, 1986
   $2,000
   F.R. Koutz, and T. Dalla Vista

Please double check that the expenditure figure is the claim number figure times $100.

James D. Sell

JDS:mek

cc: W. L. Kurtz

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

July 10, 1986

Mr. Dean Bibles
State Director
Bureau of Land Management
U.S. Dept. of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Group (7)
A MC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claim serial numbers, as recorded in the Santa Cruz County Recorder's office in Docket 427, Pages 23 and 24, for the assessment year ending September 1, 1986.

Please return acknowledgement in the enclosed envelope.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer

WDG:mek
enc.

cc: R. L. Brown
H. E. Kelshaw (w/enc.)
A. J. Robles (w/enc.)
J. D. Sell (w/enc.)

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

NAME OF CLAIM	RECORDING DATA BOOK	PAGE	BLM SERIAL NO.
South Humbolt	007	360	A MC 50226
" " Amended	380	682 and 683	"
Humbolt	007	358	A MC 50227
" Amended	380	684 and 685	"
Silver Leaf	007	364	A MC 50228
" " Amended	380	686 and 687	"
Good Luck #2	007	366	A MC 50229
" " " Amended	380	688 and 689	"
Indian Chief	007	368	A MC 50230
" " Amended	380	690 and 691	"
Monoca	007	362	A MC 50231
" Amended	380	692 and 693	"
Good Luck	4	300	A MC 50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1985 and June 15, 1986, in excess of $700.00 worth of geologic studies, evaluation and improvements were done and performed for the benefit of the described claims. The studies, evaluation, and improvements were performed by F.R. Koutz, T. Dalla Vista, and J.D. Sell, ASARCO Incorporated, Tucson, Arizona.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more that One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1986.

ASARCO Incorporated

By W. D. Gay

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 25th day of June, 1986, by William D. Gay.

Kathleen Henriksen
Notary Public

My Commission Expires:
My Commission Expires July 7 1988

FEE NO. 03468

STATE OF ARIZONA, County of Santa Cruz — SS.
I do hereby certify that the within instrument was filed and recorded at the request of ASARCO Inc.
on JUL 03 '86-10 10 AM Docket No. 427 Page 23-24
Records of Santa Cruz County, Arizona.
WITNESS my hand and official seal the day and year first above written.

COUNTY RECORDER SANTA CRUZ COUNTY STATE OF ARIZONA

MARY LOU G. SAINZ, COUNTY RECORDER
By Margarita Vergara
Deputy

PATAGONIA DOCUMENT BOOK

DOC. NO.	DIGEST OF LEASES, TITLES, ETC.
1-FF	Letter to Kerr-McGee stating that Asarco has fulfilled minimum expenditures ($100,000 required to continue the Operating Agreement beyond October 1, 1980. Yearly Expenditures.
1-G	Plat and exhibit of mining claims existing prior to 9/1978, in accordance with ARS 27-210 (Thunder Mountain).
	Amendment notices as filed October 22, 1980, with Santa Cruz County Recorder Doc. 288, pgs. 552-576. (Note: "Mendoza" claims will hereafter be included with Hardshell claims - and handled by Mining Department).
	Skidmore 7/21/82. They have NOT been doing the work nor recording the "Mendoza" claims with their Hardshell claim group. JGS.
1-H	Fourth Amendment to Kerr-McGee ASARCO Operating Agreement dated 9/1/72.
1-I	Gold Depository and Loan Company, Inc. Quit Claim to Kerr-McGee and Asarco unpatented mining claims in Harshaw Mining District, Santa Cruz Co., July 16, 1982.
1-J	Juan Chavez, Impossible Dream Ltd., Quit Claim Deed to Kerr-McGee Corporation and ASARCO Incorporated, Jointly, in unpatented mining claims in Harshaw Mining District, Santa Cruz County, AZ, March 2, 1983.
1-K	ASARCO Incorporated Quit Claim Deed to Kerr-McGee of unpatented mining claims, Orb 8, Orb 9, Orb 10, Calvin Coolidge, Abraham Lincoln, Bryan in the Harshaw Mining District, Santa Cruz County, AZ. Dated May 13, 1983.
	ASARCO Incorporated Quit Claim Deed to Kerr-McGee of unpatented mining claims, Welington, Lafayette, Copper Dyke, Warren Harding, Roosevelt, Orb #7 in the Harshaw Mining District, Santa Cruz County, AZ, June 13, 1983.
1-L	Surface Boundary Line Agreement by and between Argentor Mining Corp., ASARCO INc., and Kerr-McGee Corp., dated May 23, 1983.
1-M	Fifth Amendment, dated 7/1/83, to Kerr-McGee and Asarco Operating Agreement of 10/1/72 - "Initial Exploration Period" extended to 10/1/90 & Asarco is obligated to spend $1,000,000 between 12/1/77 and 10/1/90.
	Letter Agreement, dated 8/5/83, between Asarco & Kerr McGee - re purchase of lease of Manchester Property, N.J.
1-N	Sixth Amendment, dated 3/20/84, to Kerr-McGee and Asarco Operating Agreement of 10/1/72 - Orb #10 added to Exhibit A of Agreement.
1-O	Seventh Amendment, dated 6/25/85, to Kerr-McGee and Asarco Operating Agreement of 10/1/72 - claims to be excluded Exhibit C, claims to be retained Exhibit B, which replaces claims in Exhibit A to Agreement.

Re: MENDOZA claims (Humbolt et al)

Hereafter these claims will be included with the HARDSHELL claims, and handled by the Mining Dept. (entered into their document book).

ASARCO

Southwestern Exploration Division

August 11, 1987

To: F.R. Koutz

From: J.D. Sell

Total Cost of Humbolt Block
Patagonia Mountains
Santa Cruz County, AZ

The Humbolt block of claims include the:

Humbolt
South Humbolt
Good Luck
Good Luck 2 (partial)
Monoca
Indian Chief
Silver Leaf.

This block is outlined on the attached sheet.

I need the total costs Asarco has incurred on this block. Such as:

a. Cost of securing the claims
b. Date of securing the claims
c. Annual assessment costs charged to these claims
d. Total cost of drill hole TCH-2, including logging, assaying, etc.
e. Cost of drill hole TCH-1 which lies within the Humbolt block
f. Other costs?

This is a high priority job and should be done during your stay in Tucson. Work with Coy on items he can help with.

Break out the costs as above as subtotals so that each item can be integrated in the final cost.

If you know that EA-0200 (Trench and Humbolt) has only the costs incurred on the Humbolt block and no costs charged to the patented Trench group, then I believe that Coy's figures for the EA-0200 will be sufficient and you do not have to go through all of the above. Except those costs chargeable to the Mendoza claims which were charged as EA-0057 (the "Mendoza" claims are now called the "Humbolt" group) should be added in as the total. Apparently the EA-0057 was used while buying the unpatented claims from Mr. Mendoza, but in early 1980's they changed the charges to EA-0200 when the deed was transferred to Asarco.

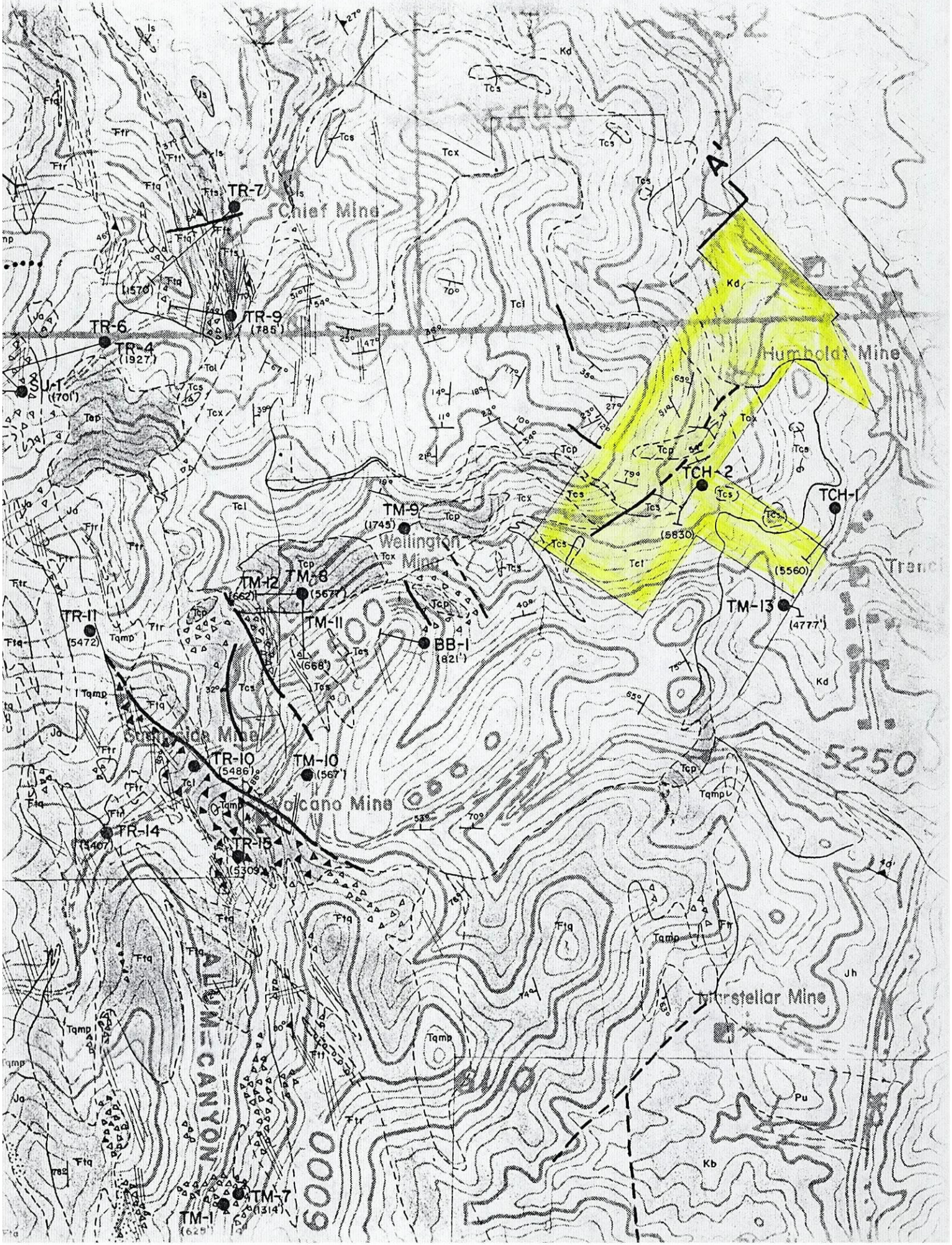
JDS:mek
Att.

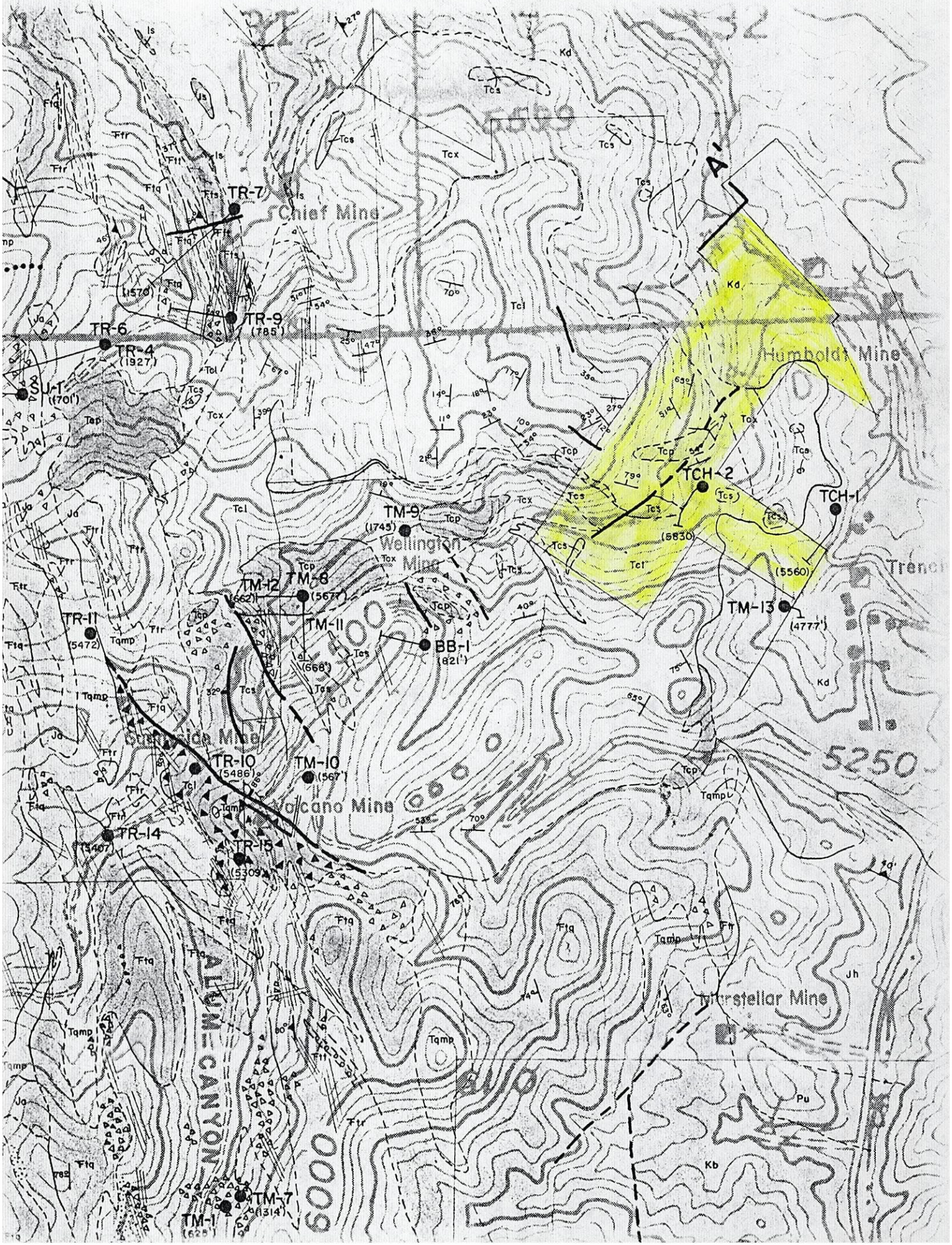
James D. Sell

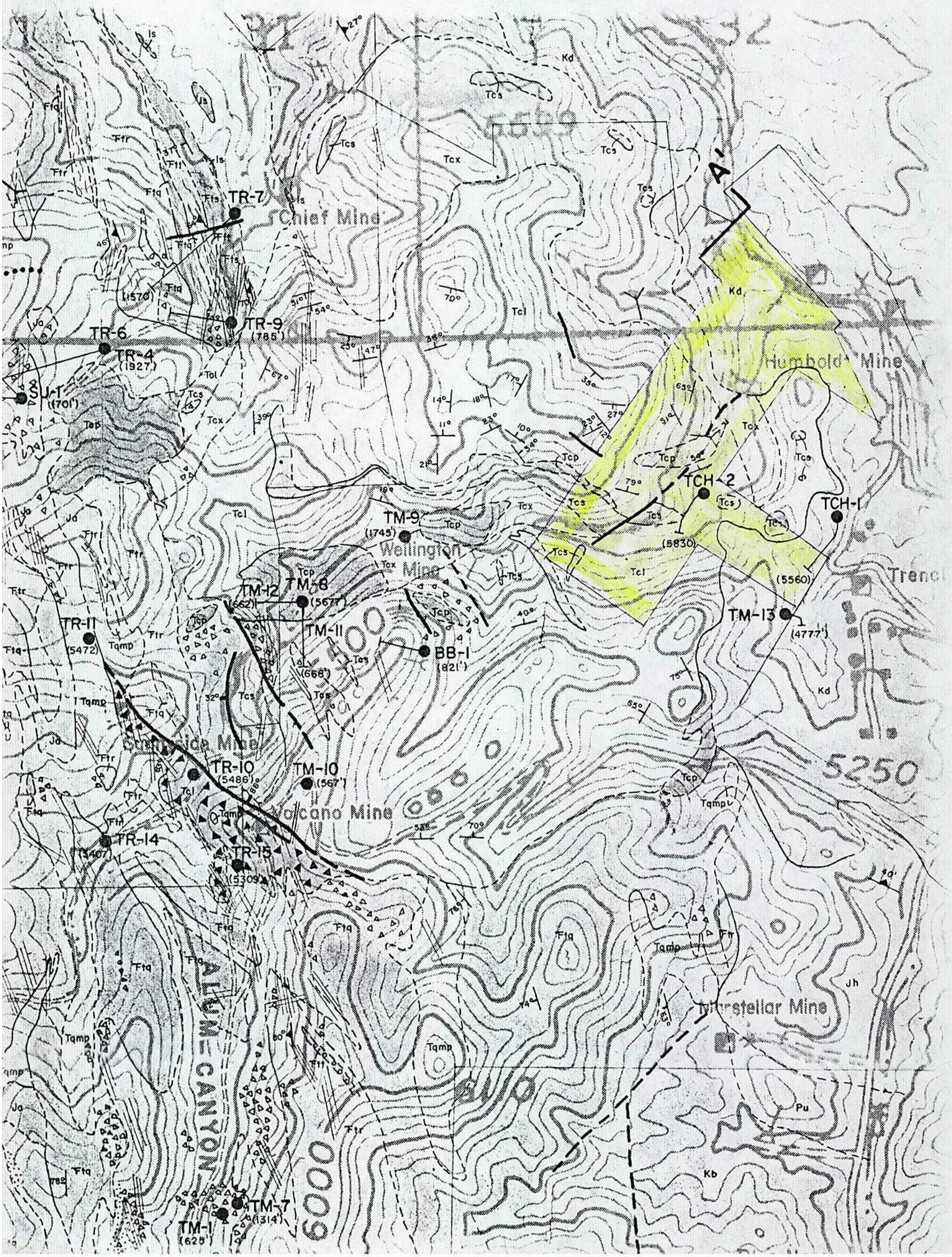
cc: W.L. Kurtz, W.D. Gay, C.L. Snow

Not sent out, as WLK et al have already done this — see my note to RLB of 8/17 a12 w/attachments.

The D was mailed for a copy of the July 13 memo. I did not receive it as it was placed in the accounting office file! Good thing I talked to WLK at lunch!


A
A'
Chief Mine
Humboldt Mine
Wellington Mine
Volcano Mine
Interstellar Mine
TR-7
TR-9
(785')
TR-6
TR-4
(1927')
SU-1
(1701')
TR-11
(5472')
TR-10
(5486')
TR-14
(5407')
TR-15
(5309')
TM-12
(662')
TM-8
(567')
TM-11
(668')
TM-9
(1745')
TM-10
(567')
TM-7
(1314')
TM-1
(625')
BB-1
(821')
TCH-2
(5830')
TCH-1
(5560')
TM-13
(4777')
5500
5250
6000
Kd
Tcs
Tcx
Tcl
Tcp
Ftr
Ftq
Ftt
Tqmp
Jh
Pu
Kb
Ja
Jd
Jvs
Trac


A
A'
Chief Mine
Humboldt Mine
Wellington Mine
Volcano Mine
Interstellar Mine
Trench
TR-7
TR-9
(785')
TR-6
TR-4
(1927')
SU-1
(1701')
TR-11
(5472')
TR-10
(5486')
TR-14
(5407')
TR-15
(5309')
TM-1
(625')
TM-7
(1314')
TM-12
(662')
TM-8
(567')
TM-11
(668')
TM-10
(567')
TM-9
(1745')
BB-1
(821')
TCH-2
(5830')
TCH-1
(5560')
TM-13
(4777')
ALUM-CANYON
6000
5500
5250



A'
TR-7
Chief Mine
TR-9
(785')
(1570')
TR-6
TR-4
(1927')
SU-1
(701')
Humboldt Mine
TCH-2
(5830)
TCH-1
(5560)
Trench
TM-13
(4777')
TM-9
(1745')
Wellington Mine
TM-12
(662')
TM-8
(5677')
TM-11
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BB-1
(821')
TR-11
(5472)
TR-10
(5486')
TM-10
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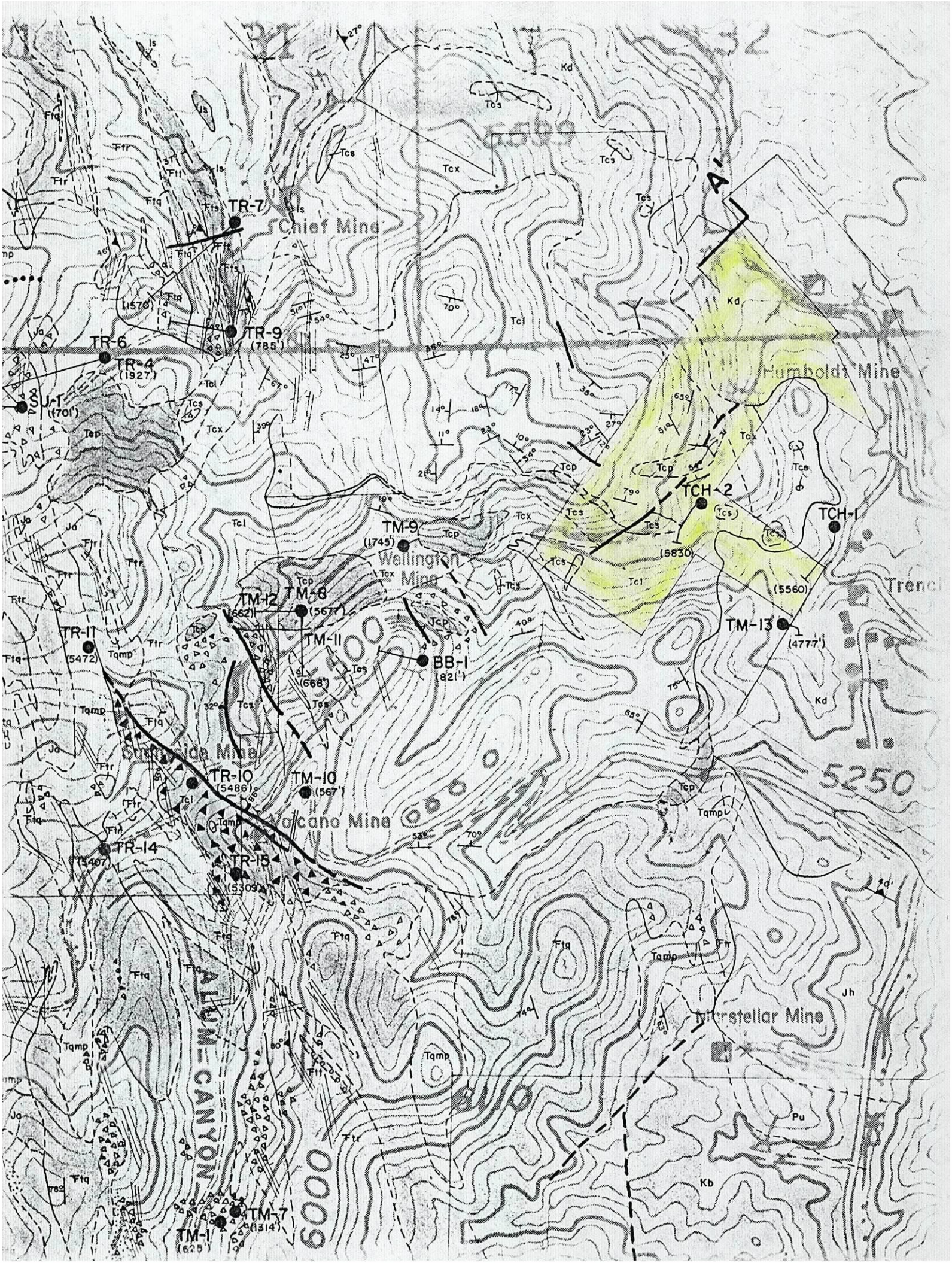
Volcano Mine
TR-14
TR-15
(5309')
5250
ALUM CANYON
6000
TM-7
(1314')
TM-1
(625')


A
A'
TR-7
Chief Mine
TR-9
(785')
TR-6
TR-4
(1927')
SU-1
(701')
Humboldt Mine
TCH-2
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(5830')
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Mine
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(662')
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(567')
TM-11
(668')
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TR-11
(5472')
BB-1
(821')
TR-10
(5486')
TM-10
(567')
Volcano Mine
TR-14
(5467')
TR-15
(5309')
Interstellar Mine
TM-7
(1314')
TM-1
(625')
6000
5250
5500

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

September 4, 1987

Mr. Dean Bibles
State Director
Bureau of Land Management
U.S. Department of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Group (7)
BLM Serial Nos.
A MC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claim serial numbers, as recorded in the Santa Cruz County Recorder's office in Docket 455, Pages 107 and 108, for the assessment year ending September 1, 1987.

Please return acknowledgement in the enclosed envelope.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
encs.

cc: R.L. Brown
W.A. Bennis (w/enc.)
J.D. Sell (w/enc.)
C.L. Snow (w/enc.)

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

NAME OF CLAIM	RECORDING DATA BOOK	PAGE	BLM SERIAL NO.
South Humbolt	007	360	A MC 50226
" " Amended	380	682 and 683	"
Humbolt	007	358	A MC 50227
" Amended	380	684 and 685	"
Silver Leaf	007	364	A MC 50228
" " Amended	380	686 and 687	"
Good Luck #2	007	366	A MC 50229
" " " Amended	380	688 and 689	"
Indian Chief	007	368	A MC 50230
" " Amended	380	690 and 691	"
Monoca	007	362	A MC 50231
" Amended	380	692 and 693	"
Good Luck	4	300	A MC 50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1986 and July 29, 1987, in excess of $700.00 worth of work and improvements were done and performed for the benefit of the described claims. Work and improvements consisted of drilling performed by Joy Manufacturing Company, 707 Boyd Blvd., La Porte, Indiana 46350.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more that One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1987.

ASARCO Incorporated

By W. D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 18th day of August, 1987, by William D. Gay.

Kathleen Flanagan
Notary Public

My Commission Expires:
My Commission Expires July 7, 1988

COUNTY RECORDER SANTA CRUZ COUNTY STATE OF ARIZONA

FEE NO. 875080

STATE OF ARIZONA, County of Santa Cruz — SS.
I do hereby certify that the within instrument was filed and recorded at the request of ASARCO Incorporated
on AUG 24 '87-10 05 Docket No. 455 Page 107-108
Records of Santa Cruz County, Arizona.
WITNESS my hand and official seal the day and year first above written.

MARY LOU G. SAINZ, COUNTY RECORDER

By Sofia Reynoso
Deputy

ASARCO

Southwestern Exploration Division

May 6, 1982

R. L. Brown
Vice President of Exploration
New York Office

Supplemental Exploration
Authorization Request
Trench Project, EA-0200
Santa Cruz County, Arizona

Dear Sir:

The extended drilling in TCH-2A, petrographic studies, and assay work has accrued an overrun of $66,000. Additional Asarco work for the year for report compilation, claim work, and surveying, is estimated at $6,000 for a total supplemental exploration authorization request of $72,000.

I submit form 302-MB covering the above $72,000 request for your approval.

James D. Sell

J. D. Sell

JDS/cg

Attachment

cc: WLKurtz (w/attachment)
RBCrist (w/attachment)
CDNewton(w/attachment)
FRKoutz (w/o attachment)

FORM 302-MB (9/79)

New York No. 0200-03

APPLICATION FOR SUPPLEMENTAL EXPLORATION APPROPRIATION

May 6 19 82 Originating Office SWED - Tucson

Application is hereby made for supplemental Appropriation to cover cost, in excess of original estimate, of work authorized by New York.

No. 0200-00 through 0200-02 TRENCH PROJECT Santa Cruz County, Arizona

Present total Estimated Cost (Form 302-MA attached)	$ 661,000
Amount previously authorized (date 12/79 thru 6/81)	$ 589,000
Balance for which Authorization is now requested	$ 72,000

ADDITIONAL WORK CONTEMPLATED:

Report evaluation, claim work, and surveying.

EXPLANATION OF INCREASED COST:

Overrun of previous budget due to extended core drilling and associated problems in drill hole TCH-2A, and extensive petrographic studies for stratigraphic correlation.

Reviewed by ..... ACC'T. MGR. OR CHIEF ACCN'T.

Recommended by James E. Sell SUPERVISOR

Approved by ..... CONTROLLER

Account Chargeable to ..... TO BE FILLED IN BY CONTROLLER

Approved by ..... VICE PRESIDENT

Approved by Advisory Committee

..... 19.....

Approved by Board of Directors

..... 19.....

..... SECRETARY

PRINTED IN U.S.A.

ASARCO

New York Office
Office of the Secretary

RECEIVED
JUN 23 1982
EXPLORATION DEPT.

June 21, 1982

Mr. R. L. Brown, Jr.:

The following is an extract from the minutes of the Advisory Committee meeting held May 19, 1982:

Exploration Appropriation #0200-03
Arizona
Trench Project

The Trench Project covers deep Cu-Pb-Zn-Ag replacement mineralization in Paleozoic limestone. The most recent test of this mineralization was in hole TCH-2A which intersected two zones of mineralization as follows:

Interval	Length	Copper	Silver
4,120-4,160 ft.	40 ft.	1.48%	0.77 oz.
4,310-4,337 ft.	27 ft.	1.21%	4.02 oz.

Drilling problems resulted in an overrun of $66,000. A supplemental exploration appropriation for $72,000 is requested to cover the overrun and $6,000 for 1982 holding costs.

There was approved a supplemental exploration appropriation of $72,000 to cover the cost of an overrun and 1982 holding costs at the Trench Project, Arizona.

F. J. Goldthwait
Assistant Secretary

FJG:dap
Enc.
cc: S. P. McCandless - w/enc.
R. J. O'Keefe - w/enc.
J. D. Sell

RECEIVED
JUN 25 1982
S. W. U. S. EXPL. DIV.

XC: FRK
Trench Fig
6/25/82

Trench

00 190,000
01 224,000
02 175,000
589.000

March 82	(62,553.93)
April Est	(3,231.00)
	(65,784.93)

72000

Report evaluation
BE Patagonia basin up 5000
Overrun

3000
1500
Support 1500
8000

Extended core drilling associated problems in Navi-drilled TCH-2A and extensive petrographic studies for stratigraphic correlation ~~purposes~~ resulted in an overrun of

235

ASARCO

Exploration Department
Southwestern United States Division

March 15, 1988

Mr. Jerry Deiter, District Ranger
Sierra Vista Range District
769 N. Highway 90 Bypass
Sierra Vista, AZ 85635

Dear Mr. Deiter:

Enclosed is a map of the Shell Claims that you requested. Our Mining Department takes care of these claims and the person to contact is:

Mr. David Skidmore
ASARCO Incorporated
P.O. Box 5747
Tucson, AZ 85703

Telephone: (602) 792-3010

If you need anything further from me, please call.

Very truly yours,

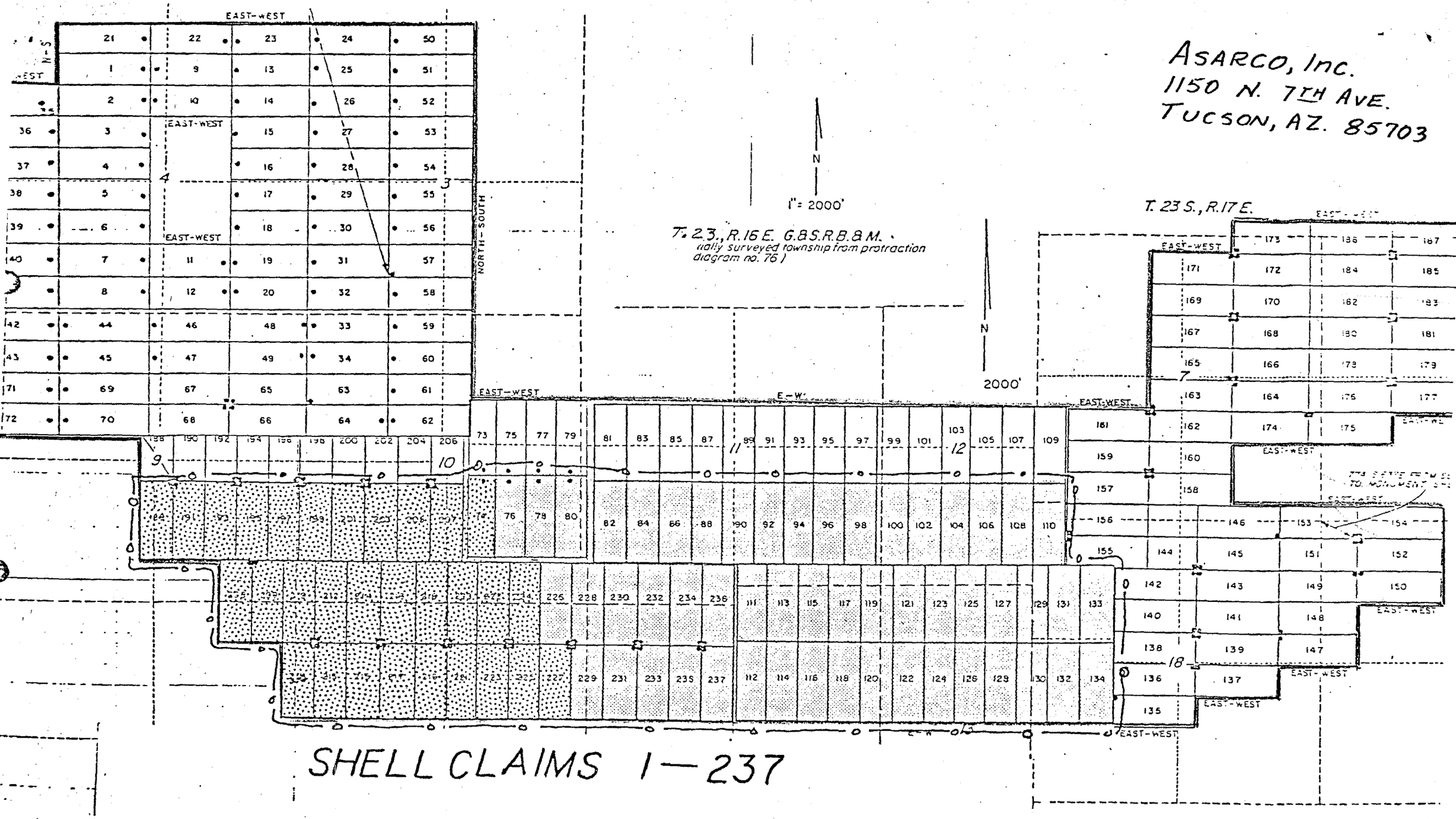
William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Enc.

cc: J.D. Sell
W.L. Kurtz

ASARCO, Inc.
1150 N. 7TH AVE.
TUCSON, AZ. 85703



SHELL CLAIMS 1—237

each claim corner, end center and point of location is monumented on the ground with rock cairn. All claims are east—west

Location Monument (•)

ASARCO

Southwestern Exploration Division

JDS

April 25, 1988

Mr. R.L. Brown
Vice President of Exploration
New York Office

Supplemental Exploration
Appropriation Request
Trench Project (EA-0200)
Santa Cruz County, Arizona

The last hole drilled on the Trench claims proper was TCH-2A in 1982. This drilling confirmed the deep Cu-Pb-Zn-Ag replacement mineralization in Paleozoic limestones with several intervals of mineralization, one of which at 4,310-4,337 feet (27 feet) of 1.21% copper and 4.02 opt silver.

Since that time SWED has performed the necessary assessment work off the block but for the benefit of the block of seven (7) Humbolt-Mendoza claims in the Trench Project.

We will continue to do the work off the claims in the foreseeable future by working on the adjacent Thunder Mountain and/or Ventura blocks of claims.

Over the past six years we have accumulated an overrun of some $3,499 on the Project and will slowly add to this deficit through assessment filing fees and other holding costs for the seven claims.

Funds are requested in the amount of $4,000 to clear this overrun account at this time.

Five copies of Form 302-MB are attached as well as the index and claim/drill hole maps.

If you approve of this expenditure please request a Supplemental Exploration Appropriation for the Trench Project.

James D. Sell

JDS:mek
Atts.

cc: W.L. Kurtz
W.D. Gay
C.L. Snow (w/Form 302-MB)

FORM 302-MB (9/79)

New York No. .....

APPLICATION FOR SUPPLEMENTAL EXPLORATION APPROPRIATION

April 25, 19 88 Originating Office Tucson, SWED

Application is hereby made for supplemental Appropriation to cover cost, in excess of original estimate, of work authorized by New York.

No. EA-0200, Trench Project, Santa Cruz Co., AZ

Present total Estimated Cost (Form 302-MA attached)		$ 665,000
Amount previously authorized (date May 6, 1982)	EA-0200-03	$ 661,000
Balance for which Authorization is now requested		$ 4,000

ADDITIONAL WORK CONTEMPLATED:

Assessment filing fees and other holding costs for the seven Humbolt-Mendoza claims in the Project.

EXPLANATION OF INCREASED COST:

Clearing of overrun from the previous six years.

Reviewed by ..... ACCT. MGR. OR CHIEF ACCN'T.

Recommended by James D. Sell SUPERVISOR

James D. Sell

Approved by ..... CONTROLLER

Account Chargeable to ..... TO BE FILLED IN BY CONTROLLER

Approved by ..... VICE PRESIDENT

Approved by Advisory Committee

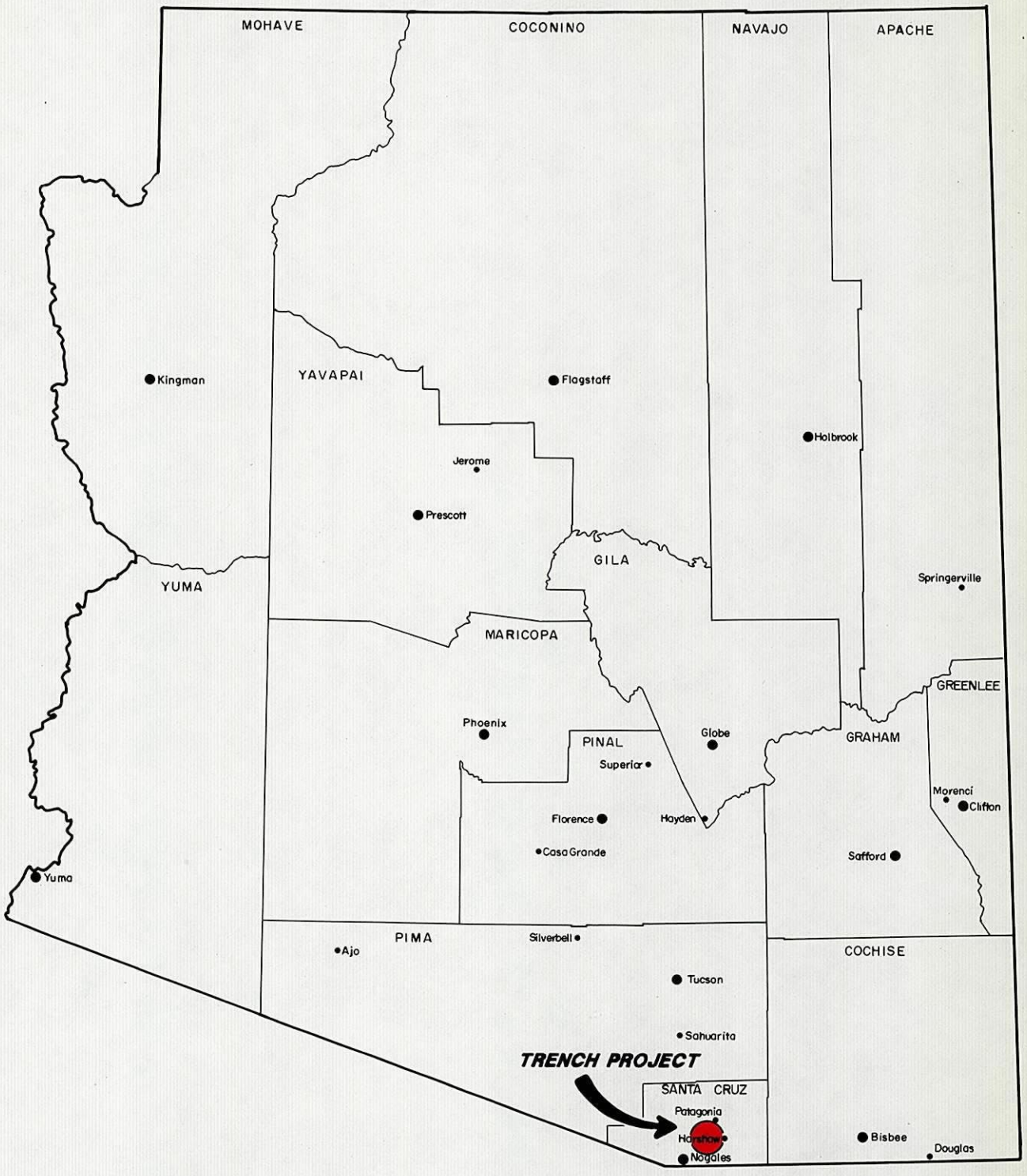
..... 19.....

Approved by Board of Directors

..... 19.....

..... SECRETARY

PRINTED IN U.S.A.



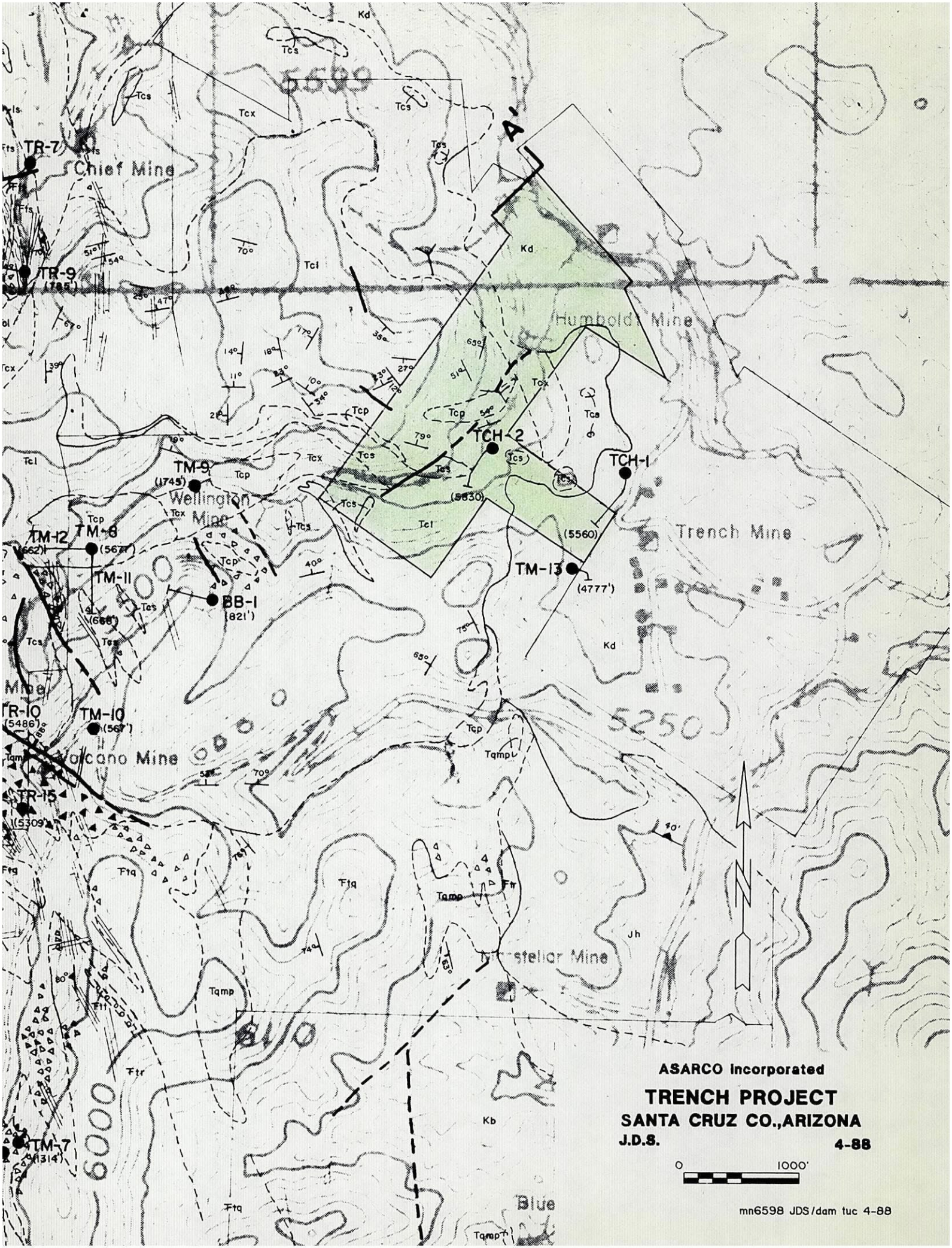
ASARCO Incorporated

INDEX MAP

TRENCH PROJECT
SANTA CRUZ CO., ARIZONA
J.D.S. 4-88

0 50
MILES

mn6601 JDS/dam tuc 4-88



ASARCO Incorporated

TRENCH PROJECT

SANTA CRUZ CO., ARIZONA

J.D.S. **4-88**

0 1000'

mn6598 JDS/dam tuc 4-88

ASARCO

JDS

Exploration Department
R. L. Brown
Vice President

June 17, 1988

Mr. J. D. Sell
Tucson Office

Trench (Humboldt-Mendoza) Project
Arizona

Dear Mr. Sell:

I attach hereto a copy of Form 302-MB for the Trench Project. Please note that this form has been processed by the Controllers Department and that the approval by Mr. T. C. Osborne is indicated.

Yours very truly,

R. L. Brown

RLB:mc
Att.

cc: E. J. Franko (w/att.)
W. L. Schoonmaker (w/att.)

cc: C.L. Snow (w/att. 6/24/88)

FORM 302-MB (9/79)

New York No. 0200-04

APPLICATION FOR SUPPLEMENTAL EXPLORATION APPROPRIATION

April 25, 19 88 Originating Office Tucson, SWED

Application is hereby made for supplemental Appropriation to cover cost, in excess of original estimate, of work authorized by New York.

No. EA-0200, Trench Project, Santa Cruz Co., AZ

Present total Estimated Cost (Form 302-MA attached)	$ 665,000
Amount previously authorized (date May 6, 1982) EA-0200-03	$ 661,000
Balance for which Authorization is now requested	$ 4,000

ADDITIONAL WORK CONTEMPLATED:

Assessment filing fees and other holding costs for the seven Humbolt-Mendoza claims in the Project.

EXPLANATION OF INCREASED COST:

Clearing of overrun from the previous six years.

Reviewed by ..... ACCT MGR OR CHIEF ACCN'T

Approved by R.J. O'KEEFE ..... CONTROLLER

Account Chargeable to EXPLORATION EXPENSE ..... TO BE FILLED IN BY CONTROLLER

Recommended by ..... SUPERVISOR
James D. Sell

Approved by ..... VICE PRESIDENT
JUN 9 '88

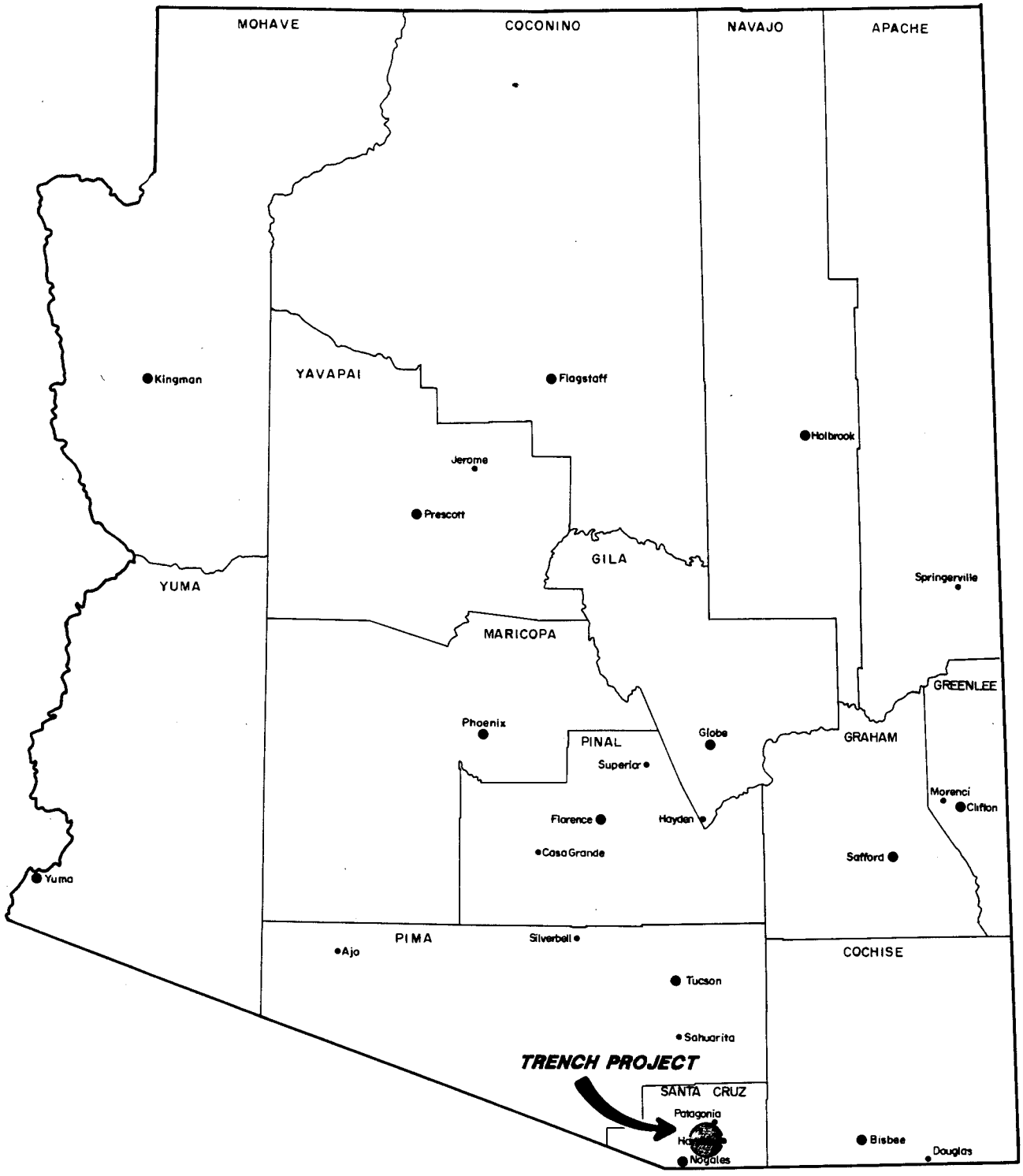
Approved by Advisory Committee 19

T. C. O.

Approved by Board of Directors T. C. O. 19

..... SECRETARY

PRINTED IN U.S.A.



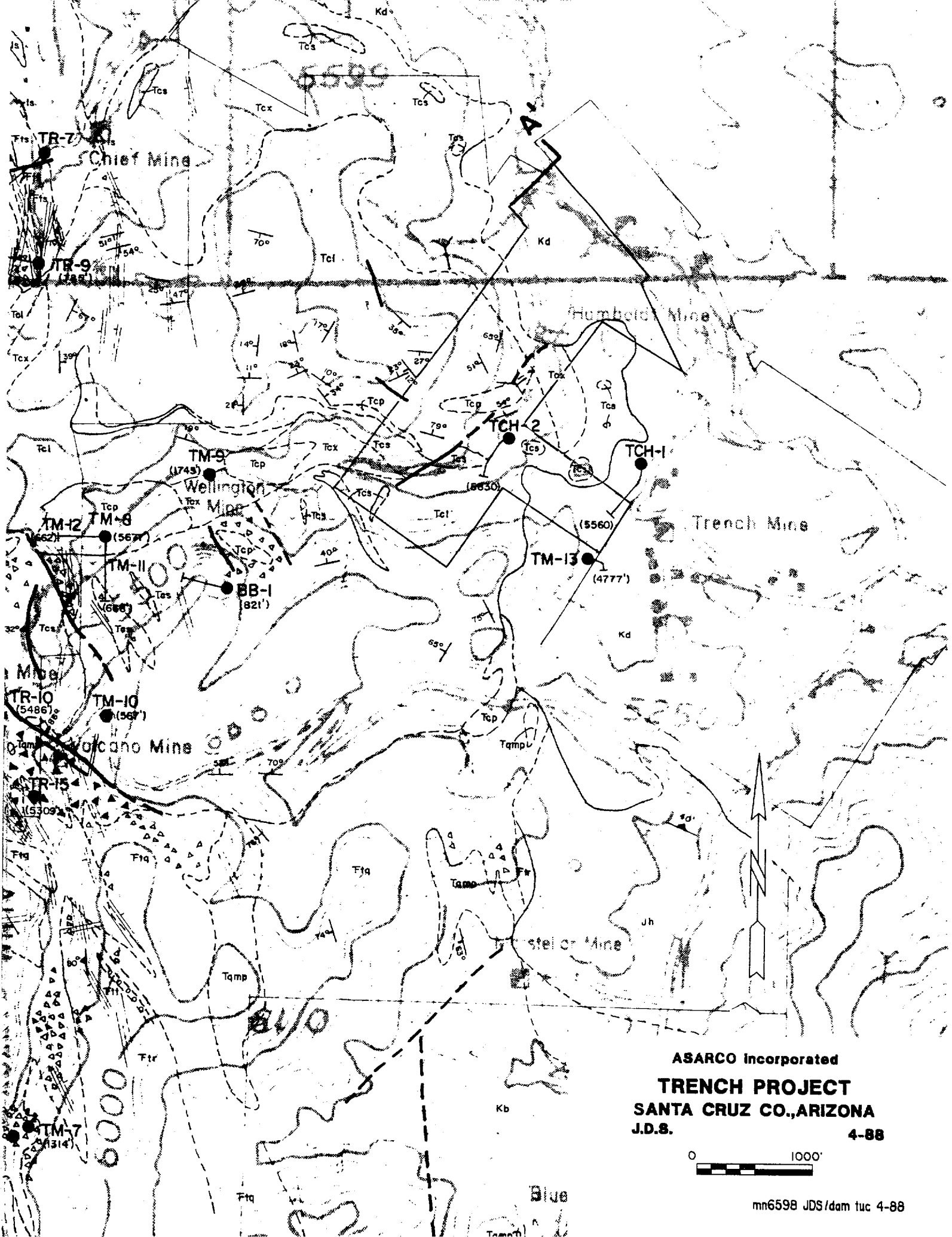
ASARCO Incorporated

INDEX MAP

TRENCH PROJECT
SANTA CRUZ CO., ARIZONA
J.D.S. 4-88

0 50
MILES

mn6601 JDS/dam tuc 4-88



ASARCO Incorporated

TRENCH PROJECT

SANTA CRUZ CO., ARIZONA

J.D.S. **4-88**

0 1000'

mn6598 JDS/dam tuc 4-88

ASARCO

Exploration Department
Southwestern United States Division

August 1, 1988

Mr. W.K. John
Manager-Mineral Land
KERR-McGEE CORPORATION
Kerr-McGee Center
P.O. Box 25861
Oklahoma City, Oklahoma 73125

Humbolt Claims
Thunder Mountain Project
Santa Cruz County, Arizona

Dear Mr. John:

As requested in your letter of July 14, 1988 to Mr. R.L. Brown, enclosed are the following:

1. Map of the Humbolt group.
2. Original and amended location notices.
3. 1986-87 Affidavit of Labor. A copy of the Affidavit of Labor for 1987-88 will be sent to you when the assessment work has been completed.

If you need any additional documents or information, please call me.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
encs.

cc: R.L. Brown
W.L. Kurtz
J.D. Sell

Trench Aug 31, 1988

ATTENTION

RETAIN THE ATTACHED PHOTOCOPY AS IT IS YOUR OFFICIAL ACKNOWLEDGEMENT OF RECEIPT

In an effort to expedite the acknowledgement procedure, we have time-stamped and photocopied what was submitted to this office. This DOES NOT mean it has been reviewed or processed, only that it was received.

As a reminder, if you have elected to file a notice of intention to hold, do not forget to record such notices of intention to hold for lode and placer claims (not mill or tunnel sites) and all affidavits of labor, amendments and transfers of ownership with the proper county recorder.

Always include the A MC serial numbers assigned to each of your claims when filing affidavits and other documents. For large groups of mining claims, it would help us a great deal to process them if you would list them in serial number order consecutively. Also, please keep us advised as to your current mailing address.

Bureau of Land Management
Arizona State Office
Mining Claims Section
3707 North 7th Street
Phoenix, Arizona 85014
Phone: (602) 241-5550

Mailing Address:
Bureau of Land Management
Arizona State Office
Mining Claims Section
P. O. Box 16563
Phoenix, Arizona 85011

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

October 26, 1988

Mr. Dean Bibles
State Director
Bureau of Land Management
U.S. Departmen of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Group (7)
BLM Serial Nos.
A MC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claim serial numbers, as recorded in the Santa Cruz County Recorder's office in Docket 483, Pages 663 and 664, for the assessment year ending September 1, 1988.

Please return acknowledgment in the enclosed envelope.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
enc.

cc: R.L. Brown (w/enc.)
W.A. Bennis (w/enc.)
J.D. Sell (w/enc.)
Kerr-McGee Corporation (w/enc.)

DOCK 483 PAGE 663

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

NAME OF CLAIM	RECORDING DATA BOOK	PAGE	BLM SERIAL NO.
South Humbolt	007	360	A MC 50226
" " Amended	380	682 and 683	"
Humbolt	007	358	A MC 50227
" Amended	380	684 and 685	"
Silver Leaf	007	364	A MC 50228
" " Amended	380	686 and 687	"
Good Luck #2	007	366	A MC 50229
" " " Amended	380	688 and 689	"
Indian Chief	007	368	A MC 50230
" " Amended	380	690 and 691	"
Monoca	007	362	A MC 50231
" Amended	380	692 and 693	"
Good Luck	4	300	A MC 50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by Kerr-McGee Corporation and ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1987 and September 1, 1988, in excess of $700.00 worth of work and improvements were done and performed for the benefit of the described claims. Work and improvements consisted of drilling performed by JOY-CBC DRILLING, 707 Boyd Blvd., La Porte, Indiana 46350.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more that One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1988.

ASARCO Incorporated

By William D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 14th day of October, 1988, by William D. Gay.

Mildred C. Koeppen
Notary Public

My Commission Expires:
My Commission Expires Nov. 28, 1988

RECEIVED
B.L.M. AZ STATE OFFICE
NOV 01 1988
7:45 A.M.
PHOENIX, ARIZONA

2

INSTRUMENT # 886872
OFFICIAL RECORDS OF
SANTA CRUZ COUNTY
MARY LOU G. SAINZ
REQUEST OF :
ASARCO, INC.
DATE: 10/19/88 TIME: 10.15
FEE: 12.00
BOOK 483 PAGE 663 PAGES: 2

ASARCO

Exploration Department
Southwestern United States Division

November 10, 1988

Mr. W.K. John
Manager - Mineral Land
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

Trench Claim Group
Santa Cruz County, AZ
Affidavit of Assessment

Dear Mr. John:

Enclosed for your records is a copy of the 1988 Affidavit of Labor for the Trench Claim Group (7) which has been recorded in Santa Cruz County and acknowledged as received by the Bureau of Land Management, Arizona State Office, Phoenix, Arizona on November 1, 1988.

Sincerely yours,

William D. Gay/mek

WDG:mek
enc.

William D. Gay
Land Engineer, SWED

cc: J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

Trench - ~~Hay~~ Humbolt
1989 Assessment

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

NAME OF CLAIM	RECORDING DATA BOOK	PAGE	BLM SERIAL NO.
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" Amended	380	684 and 685	"
Silver Leaf	007	364	A MC 50228
" " Amended	380	686 and 687	"
Good Luck #2	007	366	A MC 50229
" " " Amended	380	688 and 689	"
Indian Chief	007	368	A MC 50230
" " Amended	380	690 and 691	"
Monoca	007	362	A MC 50231
" Amended	380	692 and 693	"
Good Luck	4	300	A MC 50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by Kerr-McGee Corporation and ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1988 and October 22, 1988, in excess of $700.00 worth of work and improvements were done and performed for the benefit of the described claims. Work and improvements consisted of drilling performed by JOY-CBC DRILLING, 707 Boyd Blvd., La Porte, Indiana 46350.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more that One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1989.

ASARCO Incorporated

By William D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 5th day of January, 1989, by William D. Gay.

Kathleen Corrigan
Notary Public

My Commission Expires:

My Commission Expires July 6, 1992

ASARCO

Exploration Department
Southwestern United States Division

February 17, 1989

Mr. W.K. John
Manager - Mineral Land
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

Trench Claim Group
Santa Cruz County, AZ
Affidavit of Assessment
Year ending Sept. 1, 1989

Dear Mr. John:

Enclosed for your records is a copy of the 1989 Affidavit of Labor for the Trench Claim Group (7) which has been recorded in Santa Cruz County. Also enclosed is a copy of the Bureau of Land Management's Receipt and Accounting Advice, dated Jan. 19, 1989, for this affidavit.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
encs.

cc: J. D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

Form 1370-41
(March 1984)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

RECEIPT AND ACCOUNTING ADVICE

NO. 1544136

Subject: AFFIDAVITS (7) MG/AZ JAN 19 89 0 13 12 3

Applicant:
ASARCO INC
BOX 5747
TUCSON AZ 85703-0747

Remitter: SAME

Assignor:

SERIAL NO.
AMC 50226 THRU 50232

REFER TO THE ABOVE CASE SERIAL NUMBER IN ALL CORRESPONDENCE. PLEASE INFORM THIS OFFICE OF A CHANGE IN ADDRESS.

NOTE: This notice is a receipt for monies paid the United States. If these monies are for required fees in connection with y application to lease, purchase, enter, or otherwise acquire an interest in public lands or resources, this receipt is not an auth zation to utilize the land applied for and it does not convey any right, title, or interest in the land for which application is ma

T.E.S.
JAN 23 1989

cc: R.L. Brown
W.A. Bennis
J.D. Sell
Kerr-McGee Corp.

BUR. MINING REG.
JAN 2[illegible]89
TUCSON

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

January 18, 1989

Mr. Dean Bibles
State Director
Bureau of Land Management
U.S. Department of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Group (7)
BLM Serial Nos.
A MC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claim serial numbers, as recorded in the Santa Cruz County Recorder's office in Docket 491, Pages 370 and 371, for the assessment year ending September 1, 1989.

Also enclosed is Asarco's check of $35 in payment of service charge of $5 for each claim (7).

Please return acknowledgment in the enclosed, stamped envelope.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
encs.

cc: R.L. Brown (w/enc.)
W.A. Bennis (w/enc.)
J.D. Sell (w/enc.)
Kerr-McGee Corporation (w/enc.)
C.L. Snow (w/o enc.)

AFFIDAVIT OF LABOR PERFORMED
AND IMPROVEMENTS MADE

INDEXED MICROFILMED

DOCK 491 PAGE 370

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

NAME OF CLAIM	RECORDING DATA BOOK	PAGE	BLM SERIAL NO.
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Monoca	007	362	A MC 50231
" Amended	380	692 and 693	"
Good Luck	4	300	A MC 50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by Kerr-McGee Corporation and ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1988 and October 22, 1988, in excess of $700.00 worth of work and improvements were done and performed for the benefit of the described claims. Work and improvements consisted of drilling performed by JOY-CBC DRILLING, 707 Boyd Blvd., La Porte, Indiana 46350.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more that One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1989.

ASARCO Incorporated

By William D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 5th day of January, 1989, by William D. Gay.

Kathleen Flanagan
Notary Public

My Commission Expires:

My Commission Expires July 6, 1992

2

INSTRUMENT # 890190
OFFICIAL RECORDS OF
SANTA CRUZ COUNTY
MARY LOU G. SAINZ
REQUEST OF :
ASARCO, INC.
DATE: 01/09/89 TIME: 10.45
FEE: 13.00
BOOK 491 PAGE 370 PAGES: 2

ASARCO

Exploration Department
Southwestern United States Division

March 6, 1989

Mr. W.K. John
Manager - Mineral Land
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

South Humbolt, et al Claims
Trench Claim Group
Affidavit of Assessment
Year ending South. 1, 1989

Dear Mr. John:

Enclosed for your records is a copy of the 1989 Affidavit of Labor for the South Humbolt, et al claims (Trench Group) (7) which has been recorded in Santa Cruz County and officially acknowledged and stamped "Received" by the B.L.M. Arizona State office on January 19, 1989.

We previously sent you, on February 17, 1989, a copy of the recorded Affidavit with a copy of the Bureau of Land Management's Receipt and Accounting Advice.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
enc.

cc: J.D. Sell

cc: R.L. Brown
W.A. Bennis
J.D. Sell
Kerr-McGee Corp.
(3/6/89)

ATTENTION

RETAIN THE ATTACHED PHOTOCOPY AS IT IS YOUR OFFICIAL ACKNOWLEDGEMENT OF RECEIPT

In an effort to expedite the acknowledgement procedure, we have time-stamped and photocopied what was submitted to this office. This DOES NOT mean it has been reviewed or processed, only that it was received.

As a reminder, if you have elected to file a notice of intention to hold, do not forget to record such notices of intention to hold for lode and placer claims (not mill or tunnel sites) and all affidavits of labor, amendments and transfers of ownership with the proper county recorder.

Always include the A MC serial numbers assigned to each of your claims when filing affidavits and other documents. For large groups of mining claims, it would help us a great deal to process them if you would list them in serial number order consecutively. Also, please keep us advised as to your current mailing address.

Bureau of Land Management
Arizona State Office
Mining Claims Section
3707 North 7th Street
Phoenix, Arizona 85014
Phone: (602) 241-5550

Mailing Address:
Bureau of Land Management
Arizona State Office
Mining Claims Section
P. O. Box 16563
Phoenix, Arizona 85011

AFFIDAVIT OF LABOR PERFORMED
AND IMPROVEMENTS MADE

INDEXED

MICROFILMED

DOCK 491 PAGE 370

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

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The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by Kerr-McGee Corporation and ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1988 and October 22, 1988, in excess of $700.00 worth of work and improvements were done and performed for the benefit of the described claims. Work and improvements consisted of drilling performed by JOY-CBC DRILLING, 707 Boyd Blvd., La Porte, Indiana 46350.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more that One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1989.

ASARCO Incorporated

By William D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 5th day of January, 1989, by William D. Gay.

Kathleen Kerrigan
Notary Public

My Commission Expires:
My Commission Expires July 6, 1992

RECEIVED
B.L.M. AZ STATE OFFICE
JAN 19 1989
7:45 A.M.
PHOENIX, ARIZONA

INSTRUMENT # 890190
OFFICIAL RECORDS OF
SANTA CRUZ COUNTY
MARY LOU G. SAINZ
REQUEST OF :
ASARCO, INC.
DATE: 01/09/89 TIME: 10.45
FEE: 13.00
BOOK 491 PAGE 370 PAGES: 2

Trench-Humbolt

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

September 25, 1990

Ms. Mary Lou G. Sainz
Santa Cruz County Recorder
P.O. Box 1150
Nogales, Arizona 85628

Affidavits of Labor
Palmetto & Harshaw
Mining Districts
Santa Cruz Co., AZ

Dear Ms. Sainz:

Enclosed is Asarco's check of $52.00 as the recording fee for the attached four Affidavits of Labor for the following unpatented Lode claims:

Claim Names	No. of Pages	Fee
TM, Welington, etc.	3	$13.00
Boot, Flux, Rockney	3	$13.00
South Humbolt, Humbolt, etc.	2	$13.00
West	3	$13.00
Total		$52.00

Also enclosed is a return envelope.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
enc.

cc: J.D. Sell
C.N. Snow

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

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ASARCO Incorporated

By William D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 31st day of September, 1990, by William D. Gay.

Kathleen Harrington
Notary Public

My Commission Expires:

My Commission Expires July 6, 1992

ASARCO

Exploration Department
Southwestern United States Division

October 31, 1990

Mr. W.K. John
Manager - Mineral Land
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, Oklahoma 73125

South Humbolt, et al Claims
Trench Claim Group
Affidavit of Assessment
Year ending Sept. 1, 1990

Dear Mr. John:

Enclosed for your records is a copy of the 1990 Affidavit of Labor for the South Humbolt, et al claims (Trench Group) (7) which has been recorded in Santa Cruz County and officially acknowledged and stamped "Received" by the B.L.M. Arizona State office on October 10, 1990. Also enclosed is a copy of the Bureau of Land Management's Receipt and Accounting Advice dated October 10, 1990 on this Affidavit.

Sincerely yours,

William D. Gay

William D. Gay

WDG:mek
encs.

cc: J.D. Sell

Form 1370–41
(March 1984)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Trench (Humboldt)

RECEIPT AND ACCOUNTING ADVICE

7 Claims

NO. 1661304 04

BF/AZ 10/10/90

Subject: AFFIDAVIT OF LABOR (7) 2 36 12 35.00

Applicant:

ASARCO INC.
P.O. BOX 5747
TUCSON, AZ 85703-0747

Remitter: SAME - CK #03937
792-3010

ASARCO Incorporated
OCT 15 1990
SW Exploration

Assignor:

SERIAL NO.
AMC 50226-50231

REFER TO THE ABOVE CASE SERIAL NUMBER IN ALL CORRESPONDENCE. PLEASE INFORM THIS OFFICE OF ANY CHANGE IN ADDRESS.

NOTE: This notice is a receipt for monies paid the United States. If these monies are for required fees in connection with your application to lease, purchase, enter, or otherwise acquire an interest in public lands or resources, this receipt is not an authorization to utilize the land applied for and it does not convey any right, title, or interest in the land for which application is made.

cc: R.L. Brown
P. Donato, Contract Files NYO
J.D. Sell
Kerr-McGee Corporation
C.L. Snow
W.D. Gay

Rick

Bob

RECEIPT

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

October 9, 1990

Mr. Dean Bibles
State Director
Bureau of Land Management
U.S. Department of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Group (7)
BLM Serial Nos.
AMC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claim serial numbers, as recorded in the Santa Cruz County Recorder's Office in Docket 537, Pages 754 and 755, for the assessment year ending September 1, 1990.

Also enclosed is Asarco's check of $35 in payment of service charge of $5 for each claim (7).

Please return acknowledgment in the enclosed, stamped envelope.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
encs.

cc: R.L. Brown (w/enc.)
P. Donato, Contract Files NYO (w/encs.)
J.D. Sell (w/enc.)
Kerr-McGee Corporation (w/enc.)
C.L. Snow

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ATTENTION

PLEASE RETAIN, THIS IS YOUR OFFICIAL ACKNOWLEDGEMENT OF RECEIPT FROM BLM

In an effort to expedite the acknowledgement procedure, we have time-stamped and photocopied what was submitted to this office. This DOES NOT mean it has been reviewed or processed, only that it was received.

As a reminder, if you have elected to file a notice of intention to hold, do not forget to record such notices of intention to hold for lode and placer claims (not mill or tunnel site) and all affidavits of labor, amendments and transfers of ownership with the proper county recorder.

Always include the A MC serial numbers assigned to each of your claims when filing affidavits and other documents. For large groups of mining claims, it would help us a great deal to process them if you would list them in serial number order consecutively. Also, please keep us advised as to your current mailing address.

Bureau of Land Management
Arizona State Office
Branch of Mining
Law Administration
3707 North 7th Street
Phoenix, Arizona 85014
Phone: (602) 241-5550

Mailing Address:
Bureau of Land Management
Arizona State Office
Branch of Mining
Law Administration
P.O. Box 16563
Phoenix, Arizona 85011

RECEIVED
B.L.M. AZ STATE OFFICE

OCT 15 1990

7:45 A.M.
PHOENIX, ARIZONA

INSTRUMENT # 907837
OFFICIAL RECORDS OF
SANTA CRUZ COUNTY
MARY LOU G. SAINZ
COUNTY RECORDER
REQUEST OF :
ASARCO, INC.
DATE: 09/27/90 TIME: 11.25
FEE: 13.00
BOOK 537 PAGE 754 PAGES: 2

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

MICROFILMED INDEXED
DOCK 537 PAGE 754
OCT 15 1990
SW Exploration

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

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ASARCO Incorporated

By William D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 21st day of September, 1990, by William D. Gay.

Notary Public

My Commission Expires:

My Commission Expires July 6, 1992

RECEIVED
B.L.M. AZ STATE OFFICE
OCT 10 1990
7:45 A.M.
PHOENIX, ARIZONA

ASARCO

Southwestern Exploration Division

June 4, 1991

T.E. Scartaccini

Patagonia Unknown
Mineral - X-Ray
Diffraction Analysis

The attached data is the X-Ray Diffraction Analysis of the unknown mineral found by T. Dalla Vista near the Trench Mine. The mineral has been identified as hexahydrite $MgSO_4.6H_2O$; a hydrated magnesium sulfate. Cost of the analysis was $50 and the invoice is also attached.

Mark A. Miller

MAM:mek
Atts.

cc: J.D. Sell

Sample rec'd from Mark A. Miller
May 23, 1991

DISPLAY DATA AS 2-THETA OR D [D:D] > 2-theta
ENTER ELEMENT SYMBOL FOR RADIATION [D:CU]>
2J H ASARCO 1

1	7.480	4	21	30.400	36	41	45.780	4
2	14.600	2	22	30.800	35	42	46.900	3
3	15.280	5	23	31.700	5	43	48.450	8
4	16.250	36	24	32.080	16	44	48.800	8
5	17.380	34	25	33.350	14			
6	17.720	10	26	34.450	5			
7	18.180	27	27	34.800	6			
8	19.500	10	28	35.500	13			
9	20.200	100	29	36.300	4			
10	21.320	13	30	38.500	5			
11	22.000	41	31	39.180	8			
12	22.450	5	32	39.450	13			
13	22.800	8	33	40.500	2			
14	24.620	19	34	41.000	4			
15	25.720	14	35	41.800	2			
16	26.250	14	36	42.200	2			
17	27.080	3	37	43.700	6			
18	27.880	13	38	44.100	2			
19	29.420	10	39	44.950	8			
20	30.100	12	40	45.400	4			

ENTER RETURN TO CONTINUE >

diffraction angles in degrees 2-Theta

2J H ** OBSERVED PATTERN DISPLAY **

DISPLAY DATA AS 2-THETA OR D [D:D] >
2J H ASARCO 1

1	11.819	4	21	2.940	36	41	1.982	4
2	6.067	2	22	2.903	35	42	1.937	3
3	5.799	5	23	2.823	5	43	1.879	8
4	5.455	36	24	2.790	16	44	1.866	8
5	5.102	34	25	2.687	14			
6	5.005	10	26	2.603	5			
7	4.880	27	27	2.578	6			
8	4.552	10	28	2.529	13			
9	4.396	100	29	2.475	4			
10	4.168	13	30	2.338	5			
11	4.040	41	31	2.299	8			
12	3.960	5	32	2.284	13			
13	3.900	8	33	2.227	2			
14	3.616	19	34	2.201	4			
15	3.464	14	35	2.161	2			
16	3.395	14	36	2.141	2			
17	3.293	3	37	2.071	6			
18	3.200	13	38	2.054	2			
19	3.036	10	39	2.017	8			
20	2.969	12	40	1.998	4			

ENTER RETURN TO CONTINUE >

d-spacings

FOM = Figure of Merit. The Lower the number the better the match.

```
2J H    **  SEARCH/MATCH **
2J H    ASARCO 1                    NUMBER OF MATCHED CARDS:   117
                    NAME                      PDF NO.        FOM
              HEXAHYDRITE SYN                 24- 719          1
              PEARCEITE  CUPRIAN               8- 130          7
              EPIDOTE                         17- 514          7
              JOHNBAUMITE                     33- 265          8
              BIANCHITE                       12-  16          8
              ORTHOERICSSONITE                29- 185          8
              IRIDARSENITE SYN                14- 411          8
              NITROMAGNESITE SYN              14- 101          9
              MOORHOUSEITE                    16- 304         10
              JOAQUINITE                      26-1034         10
              ONORATOITE                      21-  52         10
              MELANTERITE SYN                 22- 633         11
              FERROHEXAHYDRATE                15- 393         11
              PHOSGENITE                      12- 218         12
              UREA SYN                        28-2015         12
              REALGAR  HIGH SYN               25-  57         12
              BROCKITE                        15- 248         12
              DONNAYITE                       29-1445         12
              ARAGONITE SYN                    5- 453         13
              LAUNAYITE                       20- 568         13

DISPLAY CARDS? Y/N [D:N] >
```

These minerals are in the Hexahydrite group.

Best Match

```
ENTER ELEMENT SYMBOL FOR RADIATION [D:CU]>
2J H 24  719    MG S 04 . 6 H2 O                    I/IC=    .00    QM= *
              HEXAHYDRITE SYN
  1   14.632    6    21   30.105    4
  2   15.272    8    22   30.385   30
  3   15.873    4    23   30.816   30
  4   16.263   50    24   31.636    4
  5   17.384   45    25   32.037    8
  6   17.694    4    26   32.277   12
  7   18.175   30    27   32.777    2
  8   19.466    8    28   33.288    8
  9   20.227  100    29   33.458    8
 10   21.358   35    30   34.529    4
 11   21.998   45    31   34.819    6
 12   22.839   10    32   35.560   12
 13   24.660   20    33   36.381    2
 14   24.941    2    34   36.821    2
 15   25.751   14    35   37.191    2
 16   26.312   12    36   38.523    4
 17   27.072    4    37   38.843    2
 18   27.903   16    38   39.053    1
 19   28.814    4    39   39.253    2
 20   29.434    8    40   39.523    8

  ENTER RETURN TO CONTINUE; R TO REDISPLAY >
```

ENTER ELEMENT SYMBOL FOR RADIATION (D:CU)
2J H 8 130 (AG, CU)16 AS2 S11 I/IC= .00 QM= I

PEARCEITE CUPRIAN

1	28.704	10	21	60.775	10
2	29.274	20	22	62.176	20
3	30.085	100	23	63.448	10
4	31.957	90	24	64.379	10
5	36.371	60	25	67.042	10
6	38.462	50	26	68.423	5
7	39.163	60	27	69.765	10
8	40.634	5	28	71.026	5
9	41.816	30	29	74.270	5
10	43.067	5	30	77.244	10
11	43.727	10	31	78.526	10
12	44.408	20	32	80.589	10
13	45.529	50	33	82.431	10
14	47.951	10	34	83.383	10
15	49.022	20	35	85.005	5
16	49.913	60	36	86.037	5
17	50.624	5	37	90.874	10
18	54.768	30	38	92.407	5
19	55.559	5	39	94.010	5
20	59.273	10	40	97.797	5

ENTER RETURN TO CONTINUE; R TO REDISPLAY)

ENTER ELEMENT SYMBOL FOR RADIATION (D:CU)
2J H 33 265 CA5 (AS O4)3 (O H) I/IC= .00 QM=

JOHNBAUMITE

1	10.489	30	21	50.774	10
2	16.564	10	22	51.545	5
3	18.245	20	23	52.626	30
4	22.328	50	24	54.348	35
5	24.871	5	25	55.599	20
6	25.671	50	26	58.002	10
7	27.703	20	27	58.652	5
8	28.424	20	28	60.074	20
9	30.886	100	29	61.175	25
10	31.726	70	30	62.827	30
11	31.987	70	31	63.448	10
12	33.388	45	32	67.642	10
13	34.589	10	33	71.968	15
14	38.643	20	34	74.060	5
15	39.393	20	35	74.951	5
16	40.785	30	36	75.722	10
17	44.538	40	37	79.077	5
18	48.442	45	38	80.018	5
19	49.022	15	39	80.999	10
20	49.683	10			

ENTER RETURN TO CONTINUE; R TO REDISPLAY)

ENTER ELEMENT SYMBOL FOR RADIATION [D:CU])

2J H 12 16 (ZN, FE) S 04 . 6 H2 O I/IC= .00 QM= I

BIANCHITE

1	15.142	50	21	35.810	20
2	16.203	70	22	36.321	10
3	17.314	30	23	37.001	40
4	17.805	40	24	38.112	10
5	18.175	30	25	38.833	10
6	20.086	100	26	39.634	60
7	21.358	40	27	40.574	20
8	22.048	90	28	40.985	20
9	22.919	10	29	42.146	10
10	23.980	10	30	43.617	20
11	24.660	60	31	44.198	20
12	26.282	40	32	45.059	30
13	27.913	40	33	45.339	50
14	29.615	50	34	50.234	30
15	30.135	80	35	50.864	30
16	30.706	80	36	51.695	30
17	31.416	20	37	52.015	30
18	32.217	30	38	52.926	20
19	33.328	30	39	53.657	20
20	34.669	40	40	54.378	20

ENTER RETURN TO CONTINUE; R TO REDISPLAY)

ENTER ELEMENT SYMBOL FOR RADIATION [D:CU])

2J H 29 185 BA MN2 FE SI2 O8 (O H) I/IC= .00 QM= I

ORTHOERICSSONITE

1	8.667	5	21	40.014	2
2	17.454	60	22	41.375	2
3	21.247	5	23	42.106	10
4	22.559	8	24	42.576	12
5	24.050	3	25	42.897	5
6	24.660	20	26	43.327	3
7	25.371	10	27	43.948	5
8	26.362	100	28	44.608	15
9	27.012	5	29	45.559	2
10	27.273	10	30	46.170	2
11	30.375	15	31	47.901	5
12	31.166	10	32	48.142	5
13	31.777	15	33	51.175	5
14	33.388	25	34	52.396	3
15	34.409	5	35	52.826	3
16	35.390	35	36	53.317	3
17	35.770	5	37	54.098	3
18	37.452	2	38	54.378	2
19	37.832	3	39	55.049	5
20	39.253	5	40	55.159	5

ENTER RETURN TO CONTINUE; R TO REDISPLAY)

ENTER ELEMENT SYMBOL FOR RADIATION [D:CU]>
2J H 14 101 MG (N 03)2 . 6 H2 O I/IC= .00 QM= *

NITROMAGNESITE SYN

1	14.332	6	21	34.219	10
2	15.172	45	22	34.819	6
3	15.933	4	23	35.620	2
4	19.416	6	24	36.911	2
5	20.036	55	25	37.992	20
6	20.407	25	26	38.312	2
7	21.408	35	27	38.863	10
8	23.790	2	28	39.343	4
9	25.011	20	29	41.005	10
10	27.052	100	30	41.575	4
11	27.963	35	31	42.686	15
12	28.564	4	32	43.567	30
13	28.874	6	33	44.498	4
14	29.264	8	34	45.129	6
15	30.065	2	35	45.919	2
16	30.555	75	36	46.220	2
17	30.876	4	37	47.391	6
18	31.406	25	38	48.272	4
19	32.187	16	39	48.802	5
20	33.328	35			

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

ENTER ELEMENT SYMBOL FOR RADIATION [D:CU]>
2J H 16 304 CO S 04 . 6 H2 O I/IC= 1.30 QM= *

MOORHOUSEITE

1	14.732	6	21	28.794	1
2	15.142	25	22	28.984	4
3	15.903	4	23	29.374	2
4	16.263	30	24	29.575	8
5	17.414	25	25	29.675	8
6	17.845	20	26	30.295	6
7	17.985	4	27	30.475	6
8	18.285	16	28	30.615	18
9	19.546	6	29	30.846	18
10	20.267	100	30	31.116	2
11	21.458	18	31	31.416	6
12	22.108	55	32	31.656	4
13	22.919	6	33	32.097	8
14	24.590	14	34	32.307	1
15	24.871	16	35	32.507	4
16	25.741	2	36	32.928	4
17	25.821	8	37	33.128	1
18	26.442	8	38	33.368	8
19	27.012	2	39	33.508	6
20	28.053	8	40	34.509	2

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

```
ENTER ELEMENT SYMBOL FOR RADIATION [D:CU] )
2J H 22  633    FE S O4 . 7 H2 O                          I/IC=    .00     QM= *
            MELANTERITE SYN
 1   13.031    8     21   29.164    6
 2   15.062    2     22   29.685    6
 3   15.933    8     23   29.985    2
 4   16.143   12     24   30.435    4
 5   16.383    4     25   30.776    2
 6   16.624    8     26   31.967   10
 7   18.095  100     27   32.287    8
 8   18.215   50     28   32.467    8
 9   19.466   10     29   32.787   10
10   21.147    2     30   33.128    2
11   22.058   14     31   33.628    4
12   23.559   60     32   33.838    8
13   23.840   20     33   33.908   10
14   26.262    8     34   34.149    8
15   27.092   16     35   34.989    2
16   27.383    5     36   35.460    4
17   27.793   12     37   35.520    4
18   28.564    8     38   36.100    4
19   28.634    6     39   36.291    4
20   28.944    4     40   36.631    2

 ENTER RETURN TO CONTINUE; R TO REDISPLAY )
```

```
2J H    **  SEARCH/MATCH **
2J H    ASARCO 1                    NUMBER OF MATCHED CARDS:     41
                    NAME                    PDF NO.       FOM
            HEXAHYDRITE SYN                 24- 719         1
            PHOSGENITE                      12- 218         5
            PEARCEITE  CUPRIAN               8- 130         7
            EPIDOTE                         17- 514         7
            JOHNBAUMITE                     33- 265         8
            ORTHOERICSSONITE                29- 185         8
            IRIDARSENITE SYN                14- 411         8
            BIANCHITE                       12-  16         9
            ONORATOITE                      21-  52        10
            MOORHOUSEITE                    16- 304        11
            MELANTERITE SYN                 22- 633        11
            PENTLANDITE                      8-  90        13
            FRONDELITE                       8-  83        14
            NITRATITE                        7- 271        15
            PIGEONITE                       13- 421        15
            BROCKITE                        15- 248        16
            UMBOZERITE  HE                  26-1384        16
            RICHTERITE  POTASSIAN           25- 675        16
            CARBONATE HYDROXLAPATIT         19- 272        17
            LAUNAYITE                       20- 568        19

DISPLAY CARDS? Y/N [D:N] )
```

ENTER ELEMENT SYMBOL FOR RADIATION [D:CU]>
2J H 22 633 FE S 04 . 7 H2 O I/IC= .00 QM= *
MELANTERITE SYN

diffraction angles
2Ø

1	13.031	8	21	29.164	6
2	15.062	2	22	29.685	6
3	15.933	8	23	29.985	2
4	16.143	12	24	30.435	4
5	16.383	4	25	30.776	2
6	16.624	8	26	31.967	10
7	18.095	100	27	32.287	8
8	18.215	50	28	32.467	8
9	19.466	10	29	32.787	10
10	21.147	2	30	33.128	2
11	22.058	14	31	33.628	4
12	23.559	60	32	33.838	8
13	23.840	20	33	33.908	10
14	26.262	8	34	34.149	8
15	27.092	16	35	34.989	2
16	27.383	5	36	35.460	4
17	27.793	12	37	35.520	4
18	28.564	8	38	36.100	4
19	28.634	6	39	36.291	4
20	28.944	4	40	36.631	2

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

2J H DISPLAY DATA AS D OR 2-THETA [D:D] >
2J H 22 633 FE S 04 . 7 H2 O I/IC= .00 QM= *
MELANTERITE SYN

d-spacing

1	6.794	8	21	3.062	6
2	5.882	2	22	3.010	6
3	5.562	8	23	2.980	2
4	5.491	12	24	2.937	4
5	5.411	4	25	2.905	2
6	5.333	8	26	2.800	10
7	4.902	100	27	2.773	8
8	4.870	50	28	2.758	8
9	4.560	10	29	2.731	10
10	4.201	2	30	2.704	2
11	4.030	14	31	2.665	4
12	3.776	60	32	2.649	8
13	3.733	20	33	2.644	10
14	3.394	8	34	2.626	8
15	3.291	16	35	2.564	2
16	3.257	5	36	2.532	4
17	3.210	12	37	2.527	4
18	3.125	8	38	2.488	4
19	3.118	6	39	2.475	4
20	3.085	4	40	2.453	2

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

24-719

24-718A

d	4.39	5.45	5.10	6.05
I/I_1	100	50	45	6

$MgSO_4 \cdot 6H_2O$

Magnesium Sulfate Hydrate (Hexahydrite)

Rad. $CuK\alpha_1$ λ 1.5405 Filter Dia. Guinier
Cut off 50Å I/I_1 Photometer $I/I_{cor.}$
Ref. Technisch Physische Dienst, Delft, Holland

Sys. Monoclinic S.G. A2/a (15)
a_0 24.442 b_0 7.216 c_0 10.119 A 3.3871 C 1.4023
α 90.00 β 98.28° γ 90.00 Z 8 Dx 1.718
Ref. Ibid.

nα 1.426 nωβ 1.453 nγ 1.456 Sign -
2V 38° D 1.757 mp Color Colorless
Ref. Dana's System of Mineralogy 7th Edition

Lab. prep.

See following card

d A	I/I_1	hkl	d A	I/I_1	hkl
6.05	6	400	2.968	4	$31\bar{3}$
5.80	8	$11\bar{1}$	2.941	30	602
5.58	4	111	2.901	30	$22\bar{2}$
5.45	50	$21\bar{1}$	2.828	4	$32\bar{2}$
5.10	45	211	2.793	8	222
5.01	4	002	2.773	12	$80\bar{2}$
4.88	30	$20\bar{2}$	2.732	2	$51\bar{3}$
4.56	8	311	2.691	8	620
4.39	100	$41\bar{1}$,202	2.678	8	322
4.16	35	$40\bar{2}$	2.597	4	811
4.04	45	411,600	2.576	6	413
3.893	10	$51\bar{1}$	2.524	12	$91\bar{1}$,$20\bar{4}$
3.610	20	402,020	2.469	2	$62\bar{2}$
3.569	2	120	2.441	2	$40\bar{4}$,$71\bar{3}$+
3.459	14	$61\bar{1}$,220	2.417	2	522,1000
3.387	12	$60\bar{2}$	2.337	4	031,$13\bar{1}$
3.293	4	320	2.318	2	820,131
3.197	16	611	2.306	<1	$10\bar{1}\bar{1}$
3.098	4	420,$71\bar{1}$	2.295	2	$81\bar{3}$
3.034	8	$21\bar{3}$,013	2.280	8	622,$60\bar{4}$+

FORM M-2

8

856

24-719A

24-720

d	4.39	5.45	5.10	6.05
I/I_1	100	50	45	6

$MgSO_4 \cdot 6H_2O$

Magnesium Sulfate Hydrate (Hexahydrite)

Rad. λ Filter Dia.
Cut off I/I_1 $I/I_{cor.}$
Ref.

Sys. S.G.
a_0 b_0 c_0 A C
α β γ Z Dx
Ref.

nα nωβ nγ Sign
2V D mp Color
Ref.

See preceding card

d A	I/I_1	hkl	d A	I/I_1	hkl
2.268	2	$33\bar{1}$	1.800	4	140,$82\bar{4}$
2.225	2	331	1.783	4	1202+
2.205	4	404,$43\bar{1}$	1.763	4	$73\bar{3}$,340
2.198	2	$82\bar{2}$	1.729	2	440+
2.157	2	431,920+	1.709	<1	$10\bar{3}\bar{1}$+
2.143	2	713,722	1.697	4	042+
2.134	2	$53\bar{1}$	1.654	2	$10\bar{3}\bar{1}$+
2.069	4	$22\bar{4}$,$92\bar{2}$+	1.622	2	$10\bar{1}\bar{5}$+
2.051	<1	$32\bar{4}$,$63\bar{1}$			
2.020	2	822,$42\bar{4}$			
2.012	8	813,1020			
1.993	4	631			
1.979	4	$52\bar{4}$			
1.947	2	$10\bar{2}\bar{2}$+			
1.928	2	$62\bar{4}$,015			
1.879	8	$10\bar{0}\bar{4}$+			
1.865	6	$53\bar{3}$,215+			
1.858	2	$12\bar{1}\bar{1}$			
1.833	2	$11\bar{2}\bar{2}$			
1.819	4	$13\bar{1}\bar{1}$+			

FORM M-2

8

857

Opt. In transmitted light, colorless.

Orientation	n (California) [1]	
X	1.528 ± 0.003	Biaxial negative (−).
Y	1.537 ± 0.003	$2V$ rather large.
Z	1.545 ± 0.003	$r > v$.

Chem. Ferrous sulfate pentahydrate, $FeSO_4 \cdot 5H_2O$ (?). The water content is uncertain, and the natural material may be the tetrahydrate. Analysis gave:

	FeO	SO_3	H_2O	Total
1.	29.70	33.10	37.20	100.00
2.	30.0	34.3	[34.0]	[98.3]

1. $FeSO_4 \cdot 5H_2O$. 2. Idria. On a few milligram weight sample. Fe_2O_3 31.7 per cent as residue after ignition.

Occur. Originally found with melanterite at Idria, Gorizia, Italy. Also reported as an alteration of melanterite from an unstated locality [1] in California, and from the Mt. Diablo mercury mine, Contra Costa County, California.[2]

Artif.[3] The existence of $FeSO_4 \cdot 5H_2O$ as an artificial compound is doubtful; the tetrahydrate is ordinarily formed by dehydration of the heptahydrate or by crystallization from water at temperatures (56° to 64°) above those affording the heptahydrate.

Name. From *σίδηρος, iron,* and *τίλος, fiber,* in allusion to its composition and structure.

Ref.

1. Larsen (134, 1921). Dehydrated artificial $FeSO_4 \cdot 7H_2O$ is said to have identical optical properties.
2. Ross, *U. S. Geol. Sur., Bull. 922B,* 44 (1940).
3. Mellor (14, 249, 1935).
4. On the morphology of the artificial salt see Marignac, *Ann. mines,* 9, 11 (1856).

29.6.5.3 **Pentahydrite** [$MgSO_4 \cdot 5H_2O$]. Epsomite *Hobbs* (*Am. Geol.,* 36, 184, 1905). Double Sulphate of Copper and Magnesium *Keller* (*Proc. Am. Phil. Soc.,* 47, 81, 1908). Pentahydrite *Frondel* (priv. comm., 1948). Magnesium sulfate pentahydrate.

Minerals probably identical with artificial triclinic $MgSO_4 \cdot 5H_2O$ and isostructural with chalcanthite have been described from several localities. An "epsomite" found with alunogen at Cripple Creek, Colorado, corresponds in composition with the pentahydrate (anal. 2) but is not otherwise described.[1] A light blue mineral found with chalcanthite at Copaquire, Tarapacá Province, Chile,[2] apparently is a cuprian variety with Cu:Mg ~ 1:1.5 (anal. 3). A granular pseudomorphous dehydration product of epsomite from The Geysers, Sonoma County, California,[3] is essentially pure $MgSO_4 \cdot 5H_2O$ (anal. 4). A mineral found with pickeringite as a deposit on mine timbers in the Comstock Lode, Nevada,[4] is close to (Mg,Cu,Zn,-Fe,Mn)$SO_4 \cdot 5H_2O$ with Mg:Cu:Zn:Fe:Mn = 1:5:17:27:50 (anal. 5). The latter mineral is massive with a fine-granular or slightly platy texture; color light greenish blue; optically negative with nX 1.495, nY 1.512, nZ 1.518, $2V$ 55°, dispersion $r < v$.

Anal.

	1	2	3	4	5
MgO	19.15	19.35	11.39	17.91	9.40
CuO			12.43		9.00
ZnO					5.60
FeO			1.01	0.23	1.36
MnO			0.32	0.14	0.30
NiO			0.06	0.11	
SO_3	38.07	38.51	35.70	38.13	35.07
H_2O	42.78	42.03	38.38	42.97	[39.07]
Rem.				0.13	0.20
Total	100.00	99.89	99.29	99.62	[100.00]

1. $MgSO_4 \cdot 5H_2O$. 2. Cripple Creek, Colorado.[1] 3. Copaquire, Chile.[2] 4. Sonoma County, California.[3] Rem. is CaO. 5. Comstock Lode, Nevada.[4] Rem. is insol.

Artif.[5] $MgSO_4 \cdot 5H_2O$ is triclinic pinacoidal, with $a:b:c = 0.621:1:0.5605$; α 98°30′, β 109°00′, γ 75°05′. Observed forms: b 010, a 100, m 110, u $1\bar{1}0$, q 011, x $0\bar{1}1$, w $\bar{1}11$, ξ $\bar{1}21$. Crystals are elongated [001] with a and w prominent. No cleavage. G. 1.718. Optically negative (−), with nY 1.491, $2V$ 45°08′, $r < v$. Obtained [6] in crystals together with the hexahydrate and tetrahydrate by evaporation over H_2SO_4 of a solution of magnesium sulfate containing added H_2SO_4 or magnesium chloride; also reported by dehydration over H_2SO_4 of the heptahydrate.

Ref.

1. Hobbs (1905).
2. Keller (1908).
3. Allen and Day, *Carnegie Inst. Washington Publ.,* 378, 42 (1927).
4. Milton and Johnston, *Econ. Geol.,* 33, 749 (1938).
5. Wyrouboff, *Bull. soc. min.,* 12, 371 (1889).
6. Mellor (4, 523, 1923) and Wyrouboff (1889).

Cobalt-chalcanthite *Larsen* and *Glenn* (*Am. J. Sc.,* 50, 225, 1920). A name given to triclinic (?) $CoSO_4 \cdot 5H_2O$ formed by the partial dehydration of bieberite or of artificial $CoSO_4 \cdot 7H_2O$ or $6H_2O$. Biaxial negative (−), $2V$ medium, with nX 1.531, nY 1.549, nZ 1.552; faintly pleochroic with X eosine-pink and Z pale rose-pink; dispersion not strong. There is no evidence that this compound has formed directly in nature.

29.6.6 HEXAHYDRITE GROUP

MONOCLINIC; PRISMATIC—2/m

	$a:b:c$	β
Hexahydrite, $MgSO_4 \cdot 6H_2O$	1.4018:1:3.3890	98°14′
Bianchite, (Zn,Fe)$SO_4 \cdot 6H_2O$	1.3847:1:3.3516	98 12 [$ZnSO_4 \cdot 6H_2O$]

The minerals of this group, not yet analyzed structurally, are isostructural with the monoclinic artificial hexahydrated sulfates and selenates of Mg, Co, Ni, and Zn. Several of these compounds have tetragonal polymorphs isostructural with retgersite. The pure Fe″ member is not known artificially, although Fe″ substitutes for Zn to a considerable extent in bianchite.

29.6.6.1 **HEXAHYDRITE** [$MgSO_4 \cdot 6H_2O$]. *Johnston (Geol. Sur. Canada, Sum. Rep., 1910, 256, 1911).*

Cryst.[1] Monoclinic; prismatic—$2/m$.

$a:b:c = 1.4018:1:3.3890$; β 98°14′; $p_0:q_0:r_0 = 2.4176:3.3541:1$

$r_2:p_2:q_2 = 0.2981:0.7208:1$; μ 81°46′; p_0' 2.4428, q_0' 3.3890, x_0' 0.1447

Forms:

	ϕ	ρ	ϕ_2	$\rho_2 = B$	C	A
c 001	90°00′	8°14′	81°46′	90°00′	.....	81°46′
a 100	90 00	90 00	0 00	90 00	81°46′	.....
m 110	35 47	90 00	0 00	35 47	85 12	54 13
σ $\bar{1}04$	−90 00	24 59	114 59	90 00	33 13	114 59
ρ $\bar{1}02$	−90 00	47 07	137 07	90 00	55 21	137 07
o 112	38 52½	65 19½	36 12½	44 58½	60 20½	55 13½
ξ $\bar{1}11$	−34 08½	76 16½	156 29	36 29	80 59	123 02½
w $\bar{1}12$	−32 26	63 31½	137 07	40 56	68 08	118 41½
y $\bar{1}14$	−28 48½	44 02	114 59	52 28½	48 26	109 31½

Structure cell.[2] Space group $C2/c$. a_0 10.04 kX, b_0 7.15, c_0 24.34; β 98°34′; $a_0:b_0:c_0 = 1.404:1:3.404$. Cell contents $Mg_8(SO_4)_8 \cdot 48H_2O$.

Habit. Coarse columnar to delicately fibrous. Rarely in good crystals, and then usually thick tabular {001}.

Twinning.[3] (*a*) On {001}. (*b*) On {110}.

Phys. Cleavage {100}, perfect. Fracture conchoidal. G. 1.757;[4] 1.745 (calc.). Colorless to white, sometimes pale greenish. Luster pearly to vitreous. Transparent; usually white and opaque. Taste bitter, salty.

Opt.[3] In transmitted light, colorless.

Orientation		n	
$X \wedge c$	−25°	1.426	Biaxial negative (−).
Y b		1.453	$2V$ 38° (meas.).
Z		1.456	

Chem. A hydrated sulfate of magnesium, $MgSO_4 \cdot 6H_2O$.

Anal.

	1	2	3	4
MgO	17.64	17.15	17.88	17.28
SO_3	35.04	34.52	34.64	34.27
H_2O	47.32	46.42	47.32	48.57
Rem.		1.78	0.13	
Total	100.00	99.87	99.97	100.12
G.		1.757	1.71	1.756

1 $MgSO_4 \cdot 6H_2O$ 2. Bonaparte River, British Columbia.[4] Rem. is insol. 3. Near Oroville, Okanogan County, Washington.[5] Rem. is $(Al,Fe)_2O_3$ 0.10, insol. 0.03. 4. Kelčany, Moravia.[6]

Occur. Found sparingly as a dehydration product of epsomite, sometimes as pseudomorphs. Also, rarely, as a direct deposit in salt lakes. First found at a locality on the Bonaparte River, British Columbia. As an efflorescence on epsomite near Oroville, Washington. Pseudomorphous after epsomite at Kelčany, Moravia, and Kladno, Bohemia. In spear-shaped crystals with halite in the Saki salt lakes, Crimea.[3]

Alter. Reported to rehydrate to epsomite in most air.[7]

Artif. Crystallizes from an aqueous solution between 48° and 69°. At lower temperatures the heptahydrate, epsomite, and at higher the monohydrate, kieserite, are formed. The hexahydrate has been reported as a metastable crystalline phase in contact with solution from 0° to 48° and 69° to 100°.[8]

Name. Named in allusion to the water content.

Ref.

1. Elements and symmetry from structure cell. Form list from Dolivo-Dobrovolsky, *Mem. soc. russe min.*, [2], 58, 3 (1929). Transformation: Dolivo-Dobrovolsky to new elements, 100/010/002. See also Groth (2, 422, 1908).
2. Ide, *Naturwiss.*, 26, 411 (1938), on artificial material.
3. Dolivo-Dobrovolsky (1929).
4. Johnston (1911).
5. Walker and Parsons, *Univ. Toronto Stud., Geol. Ser.*, 24, 21 (1927).
6. Kokta, *Publ. Fac. Sc. Univ. Masaryk*, Brno, 166 (1935).
7. Walker and Parsons (1927).
8. Seidell, *Solubilities of Inorg. Comp.*, New York, 1, 985 (1940).

29.6.6.2 **BIANCHITE** [$ZnSO_4 \cdot 6H_2O$]. *Andreatta (Acc. Linc., Rend., [6], 11, 760, 1930).*

Cryst.[1] *Monoclinic; prismatic—$2/m$.*

$ZnSO_4 \cdot 6H_2O$

$a:b:c = 1.3847:1:3.3516$; β 98°12′; $p_0:q_0:r_0 = 2.4205:3.3173:1$

$r_2:p_2:q_2 = 0.3014:0.7296:1$; μ 81°48′; p_0' 2.4455, q_0' 3.3516, x_0' 0.1441

$(Zn,Fe)SO_4 \cdot 6H_2O$ with Zn:Fe = 2:1

$a:b:c = 1.3788:1:3.3324$; β 98°30′; $p_0:q_0:r_0 = 2.4169:3.2958:1$

$r_2:p_2:q_2 = 0.3034:0.6333:1$; μ 81°30′; p_0' 2.4437, q_0' 3.3324, x_0' 0.1495

Forms:[2] (Artificial crystals):

c 001 a 100 m 110 σ $10\bar{1}$ ξ $11\bar{1}$ w $11\bar{2}$ ζ $11\bar{3}$ y $11\bar{4}$ r 102

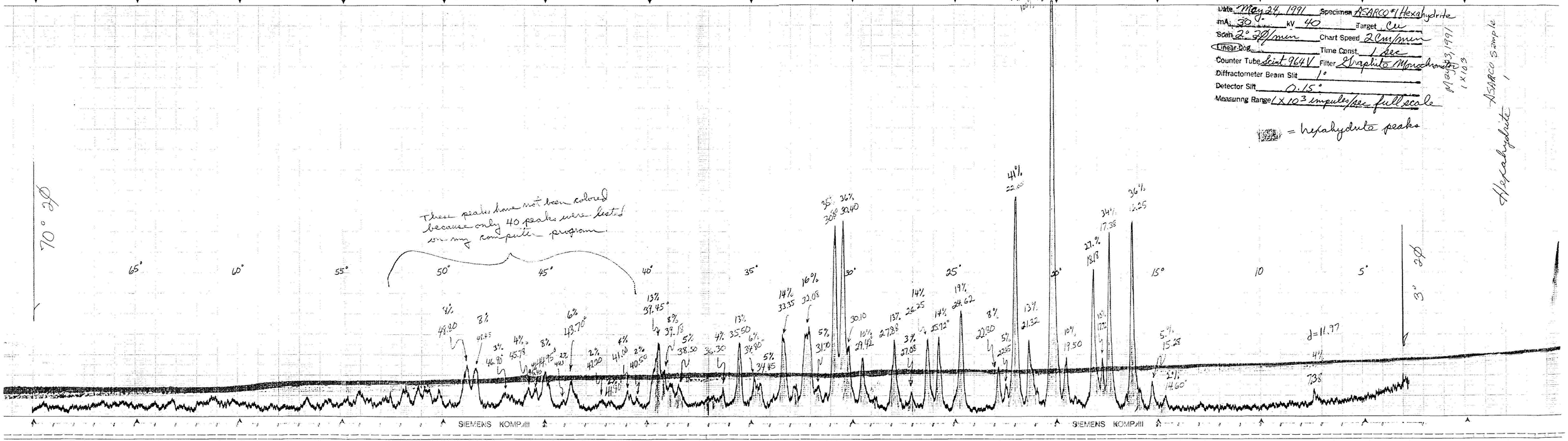
Habit. As crusts of indistinct crystals. Artificial crystals are tabular {001} with {110} and {112} prominent.

Twinning. On {001}, common in artificial material.

Phys. H. ~2½. G. 2.07 (for $ZnSO_4 \cdot 6H_2O$),[3] 2.031 (for $(Zn,Fe)SO_4 \cdot 6H_2O$ with Zn:Fe = 2:1). Color white, becoming yellowish on oxidation of the iron. Luster vitreous. Transparent.

Opt. In transmitted light, colorless.

Orientation		n (for Zn:Fe ~ 2:1)	
$X \wedge c$	−26°	1.465	Biaxial negative (−).
Y b		1.494	$2V$ 10° (meas.).
Z		1.495	


Dat.: mm/
Date May 24, 1991 Specimen ASARCO #1 Hexahydrite
mA 30 kV 40 Target Cu
Scan 2° 2θ/min Chart Speed 2cm/min
Linear Log Time Const. 1 sec
Counter Tube Scint. 964V Filter Graphite Monochrometer
Diffractometer Beam Slit 1°
Detector Slit 0.15°
Measuring Range 1 X 10³ impulses/sec full scale
= hexahydrite peaks
ASARCO Sample 1
Hexahydrite
May 23, 1991
1 X 10 3
70° 2θ
3° 2θ
65° 60° 55° 50° 45° 40° 35° 30° 25° 20° 15° 10 5°
These peaks have not been entered because only 40 peaks were listed running computer program.
d=11.77
SIEMENS KOMP.III
SIEMENS KOMP.III

THE UNIVERSITY OF ARIZONA
Tucson

62383

INVOICE

Date 5/28/91

Invoice No. 62383

Mark A. Miller, Geologist
ASARCO Incorporated
P.O. Box 5747
Tucson, Arizona 85703

Please make check payable to
THE UNIVERSITY OF ARIZONA and mail to Department of: Geosciences Rm 208
Gould-Simpson Bldg #77
Tucson, AZ 85721

X-Ray diffraction analysis and pattern determination.....$50.00

TOTAL AMOUNT DUE $50.00

Please return one copy of invoice with your check.

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

June 7, 1991

State Director
Bureau of Land Management
U.S. Department of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Project
Santa Cruz County, AZ
South Humbolt, etc. Claims (7)
BLM Serial Numbers:
AMC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claims serial numbers, as recorded in the Santa Cruz County Recorder's office in Book 557, Pages 666 and 667, for the assessment year ending September 1, 1991.

Also enclosed is Asarco's check for $35 in payment of service charge of $5 for each claim (7 claims).

Please return acknowledgment in the enclosed, stamped envelope.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
encs.

cc: R.L. Brown (w/enc.)
P. Donato, Contract File NYO (w/enc.)
J.D. Sell (w/enc.)
C.L. Snow (w/o enc.)
Kerr-McGee Corporation (w/enc.)

INSTRUMENT # 914352
OFFICIAL RECORDS OF
SANTA CRUZ COUNTY
MARY LOU G. SAINZ
COUNTY RECORDER
REQUEST OF :
ASARCO INCORPORATED
DATE: 05/30/91 TIME: 12.00
FEE: 13.00
DOCK 557 PAGE 666 PAGES: 2

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

INDEXED
MICROFILMED
DOCK 557 PAGE 666

RECEIVED
B.L.M. AZ STATE OFFICE
JUN 10 '91
9:00 A.M.
PHOENIX, ARIZONA

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

NAME OF CLAIM	RECORDING DATA BOOK	PAGE	BLM SERIAL NO.
South Humbolt	007	360	A MC 50226
" " Amended	380	682 and 683	"
Humbolt	007	358	A MC 50227
" Amended	380	684 and 685	"
Silver Leaf	007	364	A MC 50228
" " Amended	380	686 and 687	"
Good Luck #2	007	366	A MC 50229
" " " Amended	380	688 and 689	"
Indian Chief	007	368	A MC 50230
" " Amended	380	690 and 691	"
Monoca	007	362	A MC 50231
" Amended	380	692 and 693	"
Good Luck	4	300	A MC 50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

That all of said mining claims are owned by Kerr-McGee Corporation and ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1990 and April 9, 1991, in excess of $700.00 worth of work and improvements were done and performed for the benefit of the described claims. Work and improvements consisted of drilling performed by CBC DRILLING, 707 Boyd Blvd., La Porte, Indiana 46350.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more that One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1991.

ASARCO Incorporated

By William D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 22nd day of May, 1991, by William D. Gay.

Kathleen Flanagan
Notary Public

My Commission Expires:

My Commission Expires July 6, 1992

RECEIVED
B.L.M. AZ STATE OFFICE
JUN 10 '91
9:00 A.M.
PHOENIX, ARIZONA

Form 1370-41
(March 1984)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Trench Project

RECEIPT AND ACCOUNTING ADVICE

NO. 1665991 04

LH/AZ 06/10/91

Subject: AFFIDAVITS OF ASSESSMENT WORK (7) 2 18 12 35.00

Applicant:

ASARCO, INC.
P.O. BOX 5747
TUCSON, AZ. 85703

SAME-CK#05857

Remitter:

Assignor:

SERIAL NO.
AMC50226-32

REFER TO THE ABOVE CASE SERIAL NUMBER IN ALL CORRESPONDENCE. PLEASE INFORM THIS OFFICE OF ANY CHANGE IN ADDRESS.

NOTE: This notice is a receipt for monies paid the United States. If these monies are for required fees in connection with your application to lease, purchase, enter, or otherwise acquire an interest in public lands or resources, this receipt is not an authorization to utilize the land applied for and it does not convey any right, title, or interest in the land for which application is made.

cc: R.L. Brown
P. Donato, Contract File NYO
J.D. Sell
C.L. Snow
Kerr-McGee Corporation
W.D. Gay

ASARCO Inc.

JUN 12 1991

SW Exploration

ASARCO

Exploration Department
Southwestern United States Division

June 12, 1991

Mr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

South Humbolt, et al Claims
Trench Claim Group
Affidavit of Assessment
Year ending Sept. 1, 1991

Dear Mr. Holmberg:

Enclosed for your records is a copy of the 1991 Affidavit of Labor for the South Humbolt, et al claims (Trench Group) which has been recorded in Santa Cruz County and officially acknowledged and stamped "Received" by the B.L.M. Arizona State Office on June 10, 1991. Also enclosed is a copy of the Bureau of Land Management's Receipt and Accounting Advice dated June 10, 1991 on this Affidavit.

Sincerely yours,

William D. Gay

WDG:mek
encs.

William D. Gay
Land Engineer, SWED

cc: J.D. Sell

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

ASARCO

Exploration Department
Southwestern United States Division

October 14, 1992

Mr. Harold W. Holmberg
Director of Metal Exploration
Kerr-McGee Corporation
P.O. Box 25861
Oklahoma City, OK 73125

South Humbolt, et al Claims
Trench Claim Group
Affidavit of Assessment
Year ending Sept. 1, 1992

Dear Mr. Holmberg:

Enclosed for your records is a copy of the 1992 Affidavit of Labor for the South Humbolt, et al claims (Trench Group) which has been recorded in Santa Cruz County and officially acknowledged and stamped "Received" by the B.L.M. Arizona State Office on October 8, 1992.

Also enclosed is a copy of the Bureau of Land Management's Receipt and Accounting Advice dated October 8, 1992 on this Affidavit.

Sincerely yours,

William D. Gay

WDG:mek
encs.

William D. Gay
Land Engineer, SWED

cc: J.D. Sell

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

(March 1984)

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

RECEIPT AND ACCOUNTING ADVICE

CP/AZ NO. 1925807

Subject: AFFIDAVITS OF ASSESSMENT WORK (7) 2 3 12 35.00

Trench Project
EA 0200

Applicant:
ASARCO INC., ET AL
BOX 5747
TUCSON, AZ 85703

SAME - CK #01538

Remitter:

Assignor:

SERIAL NO.
AMC 50226, ET AL

REFER TO THE ABOVE CASE SERIAL NUMBER IN ALL CORRESPONDENCE. PLEASE INFORM THIS OFFICE OF ANY CHANGE IN ADDRESS.

NOTE: This notice is a receipt for monies paid the United States. If these monies are for required fees in connection with your application to lease, purchase, enter, or otherwise acquire an interest in public lands or resources, this receipt is not an authorization to utilize the land applied for and it does not convey any right, title, or interest in the land for which application is made.

cc: G.D. Van Voorhis
P. Donato, Contract File NYO
J.D. Sell
W.D. Gay
Kerr-McGee Corporation

ACK - CP

ASARCO Incorporated
OCT 13 1992
SW Exploration

RECEIPT

ATTENTION

PLEASE RETAIN, THIS IS YOUR OFFICIAL ACKNOWLEDGEMENT OF RECEIPT FROM BLM

In an effort to expedite the acknowledgement procedure, we have time-stamped and photocopied what was submitted to this office. This DOES NOT mean it has been reviewed or processed, only that it was received.

As a reminder, if you have elected to file a notice of intention to hold, do not forget to record such notices of intention to hold for lode and placer claims (not mill or tunnel site) and all affidavits of labor, amendments and transfers of ownership with the proper county recorder.

Always include the A MC serial numbers assigned to each of your claims when filing affidavits and other documents. For large groups of mining claims, it would help us a great deal to process them if you would list them in serial number order consecutively. Also, please keep us advised as to your current mailing address.

Bureau of Land Management
Arizona State Office
Branch of Mining
Law Administration
3707 North 7th Street
Phoenix, Arizona 85014
Phone: (602) 640-5550

Mailing Address:
Bureau of Land Management
Arizona State Office
Branch of Mining
Law Administration
P.O. Box 16563
Phoenix, Arizona 85011

ASARCO

Exploration Department
Southwestern United States Division

CERTIFIED MAIL
RETURN RECEIPT

October 7, 1992

State Director
Bureau of Land Management
U.S. Department of the Interior
P.O. Box 16563
Phoenix, AZ 85011

Mining Claim Annual Recordation
Trench Project
Santa Cruz County, AZ
South Humbolt, etc. Claims (7)
BLM Serial Numbers:
AMC 50226 thru 50232

Dear Sir:

In accordance with the Federal Land Policy and Management Act (43 CFR, Part 3833.2), enclosed is an exact reproduction of the affidavit of assessment work, with mining claims serial numbers, as recorded in the Santa Cruz County Recorder's office in Book 594, Pages 129 and 130, for the assessment year ending September 1, 1992.

Also enclosed is Asarco's check for $35 in payment of service charge of $5 for each claim (7 claims).

Please return acknowledgment in the enclosed, stamped envelope.

Very truly yours,

William D. Gay

WDG:mek
encs.

William D. Gay
Land Engineer, SWED

cc: G.D. Van Voorhis (w/enc.)
P. Donato, Contract File NYO (w/enc.)
J.D. Sell (w/enc.)
C.L. Snow (w/o enc.)
Kerr-McGee Corporation (w/enc.)

RECEIVED
B.L.M. AZ STATE OFFICE

OCT 8 '92

9:00 A.M.
PHOENIX, ARIZONA

INSTRUMENT # 927618
OFFICIAL RECORDS OF
SANTA CRUZ COUNTY
MARY LOU G. SAINZ
COUNTY RECORDER
REQUEST OF:
ASARCO INCORPORATED
DATE: 09/21/92 TIME: 11.30
FEE: 13.00
DOCK 594 PAGE 129 PAGES: 2

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

INDEXED
DOCK 594 PAGE 129

STATE OF ARIZONA)
) ss
County of Pima)

William D. Gay, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Harshaw Mining District, Santa Cruz County, Arizona, the names and books and pages of record in the office of the County Recorder of Santa Cruz County, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

NAME OF CLAIM	RECORDING DATA BOOK	PAGE	BLM SERIAL NO.
South Humbolt	007	360	A MC 50226
" " Amended	380	682 and 683	"
Humbolt	007	358	A MC 50227
" Amended	380	684 and 685	"
Silver Leaf	007	364	A MC 50228
" " Amended	380	686 and 687	"
Good Luck #2	007	366	A MC 50229
" " " Amended	380	688 and 689	"
Indian Chief	007	368	A MC 50230
" " Amended	380	690 and 691	"
Monoca	007	362	A MC 50231
" Amended	380	692 and 693	"
Good Luck	4	300	A MC 50232
" " Amended	382	575 and 576	"

The above described unpatented lode mining claims are located in Section 32 of Township 22 South, Range 16 East, and Section 5 of Township 23 South, Range 16 East, G&SRB&M.

7 of

RECEIVED
B.L.M. AZ STATE OFFICE

Oct 8 '92

9:00 A.M.
PHOENIX, ARIZONA

DOCK 594 PAGE 130

That all of said mining claims are owned by Kerr-McGee Corporation and ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between August 3, 1992 and August 29, 1992 in excess of $700.00 worth of work and improvements were done and performed for the benefit of the described claims. Work and improvements consisted of drilling performed by CBC DRILLING, 750 East Evans Blvd., Tucson, AZ 85713 and road work by Dave Martin Excavating, P.O. Box 451, Patagonia, AZ 85624.

Said labor was performed and improvements made at the expense of ASARCO Incorporated for the benefit of each and all of said mining claims comprising said contiguous groups as part of a general plan of exploration, improvements and development, and they tend to explore, improve and develop each and all of said mining claims. The amount expended for and the value of said labor and improvements is more than One Hundred Dollars ($100.00) for each of the mining claims and at least said amount was allocated to each of the mining claims. Said expenditure was made in good faith for the purpose of exploring, improving and developing said contiguous groups of mining claims, and was intended as annual labor and improvements for each and all of the above-described unpatented lode mining claims for the assessment year ending at 12:00 o'clock Meridian, September 1, 1992.

ASARCO Incorporated

By William D. Gay
Agent

STATE OF ARIZONA)
) ss
County of Pima)

The foregoing instrument was acknowledged before me this 17th day of September, 1992, by William D. Gay.

Notary Public
PIMA COUNTY, ARIZONA

Mildred C. Koeppen
Notary Public

My Commission Expires:

My Commission Expires Nov. 28, 1992

Trench mine
Reclamation Project

The Trench Mine was operated by Asarco from 1939 through 1957. A total of 950,000 tons of sulfide ore was treated in the unit mill. This included production from the Trench Mine as well as ore from the Flux Mine and custom ore from local mining claims in the area.

Mill tailings were pumped into four tailing ponds/dams areas for disposal. Rock retaining dikes were constructed below dams #2 and #4 and four retention ponds were built below tailing dam #3. These structures were successful in retaining the erosional solids from the pond area, but didn't control seepage.

A two-year program of complete reclamation of the area was undertaken from late 1989 thru mid-1991.

The following phases were involved:

1. Cleaning of the ponds below dam #3 and place material on pond #3.

2. Level and recontour all pond surfaces and dam faces to non-erodible slopes.

3. Construction of drainage ditch around entire area to prevent excess water from entering pond areas.

4. Removal of 12 waste dumps in area, totally 70,000 cubic yards of material, and spreading on pond surfaces and faces for a depth averaging 2.5 feet. At the same time, some of the waste material was used to cover some of the mine openings.

5. Placing of 61,000 cubic yards of soil and subsoil on ponds and stabilized faces to a depth of 3-5 feet, recontouring all for best, non-erodible drainage.

6. Stabilizing major drainages from area.

7. Seeding 32 acres of recontoured surface with:

   Weeping Lovegrass
   Cochise Lovegrass
   Sideoat Grama
   Blue Grama
   Yellow Bluestem
   Green Sprangletop
   along with clover and rye grass.

8. For stability on steeper slopes, several native evergreens were transplanted. The trees included Chihuahua, Arizona and pinon pines, junipers, sycamore and cottonwoods. Also a variety of deciduous plants, primarily "trees of heaven" (Ailanthus Altissima) which rapidly spread by self-seed and growth along sucker roots which spread laterally.

9. All disturbed areas, shafts, dumps, soil, etc. were fenced with 3-strand barbed wire, and posted with Mine Inspector signs.

10. The ponds below dam #3 were recontoured, seeded, planted with cattails and other water plants, and the water-using cottonwoods planted in the drainage.

11. Monitor activities continue.

2/9/94