UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
Box 431
Joplin, Missouri
May 23, 1958

Copy

DMEA Operating Committee
Department of the Interior
Washington 25, D. C.

Re: DMEA-4798(copper-lead)
American Zinc, Lead & Smelting Co.
Boss-Bixby project(Contract Idm-E1160)
Dent and Iron Counties, Mo.

Dear Sirs:

This is intended as further justification and Field recommendation for the contract amendment requested by this Operator in a letter I received and transmitted to you on April 21, 1958. A letter on April 24 (copy attached) from Dewey Amos, USGS, Carbondale, Illinois, indicated Field accord on this proposed Amendment No. 1(suggested draft furnished herewith). All pertinent literature and information available to this office, including much data furnished through the Operator's Joplin Office, have been reviewed since.

In brief, the proposed electromagnetic surveying of some Boss-Bixby prospect drill holes was recommended by Dr. Alan M. Bateman as a more effective guide for selecting the hole sites for the exploratory drilling to be started under this Contract. In view of results reportedly attained with this method of geophysical exploration on such deposits in Canada, this recommendation is based on his detailed relogging of all the Boss-Bixby prospect drill hole cores, his geologic research, and the petrographic laboratory reports of last fall and winter, while granting of the Contract was being awaited.

Thus, with a relatively modest outlay estimated not to exceed $2,010, the recommended geophysical exploration for the start of "Stage I" work is expected to save many times over that which unavoidably might be wasted by blindly drilling the holes as tentatively specified by the existing Contract on the basis of the geologic evidence alone but restricted to sites not less than 500 feet apart.

Following the first deep prospect drilling in 1956, the Operator also made a more detailed magnetometer survey of the project site. As also shown on the project map attached to the Contract, hole No. USA-2 then was drilled on the indicated magnetic "high"; hole J-1(A) was on the "shoulder" 1½ miles southwest along the apparent major axis (line A-A' on the Contract map) of the Boss-Bixby magnetic anomaly. A present employee of the Operator was with the Missouri Geological Survey on the reconnaissance magnetometer work which in about 1935 first disclosed the so-called Boss-Bixby magnetic anomaly as shown on the subsequently published State Magnetic Map.

A study of data from holes USA-2, -3 and -4 together with those from a hole drilled by St. Joseph Lead Co. far out on the west flank of that magnetic "high" and one on the east, indicates the Boss-Bixby anamoly to be identified with an inferred northeasterly trending buried PreCambrian ridge. It appears similar to those related to the recently discovered Courtois-Viburnum(DMSA-4582 and -4583) ore deposit 2 miles northeastward. With reference to the Contract map and logs furnished in the Application, hole USA-4 encountered the igneous basement

rock at only 44 feet below the top of the Bonneterre(Cambrian) dolomite which is normally about 300 feet thick in this locale; hole USA-2 hit the igneous rock 150 feet below that top; a full Bonneterre section was penetrated in hole USA-3 which entered the igneous rock only after further drilling through 55 feet of Lamotte(Lower Cambrian) sand. Thus the "sand pinchout" line on the southward "nose" of the Boss-Bixby PreCambrian "high" reasonably can be interpreted to be about 300 feet north of hole USA-3. No algal reef structures considered to have been favorable to mineralization, were noted in the cores but nevertheless, the core samples from the Bonneterre-Lamotte transition zone reportedly contained up to 1.16 percent lead. Although the possible lead deposit here inferred to be similar to, or an extension of the Courtois-Viburnum deposit, is only a passing target of secondary interest at this time, drilling of the next hole at a site about 250 feet north of USA-3 would appear to be well justified. Under the existing Contract stipulations, however, if this next hole(No. 1 under the subject Contract) were to be located instead 500 feet southwest of hole USA-2 on the line A-A', the above-suggested "passing" target along the ~~sand~~ pinchout line still might be hit satisfactorily, and the chances enhanced also for exploration success at greater depth in this and the others of the very limited number of drill holes. Thus the objective also would be satisfied by also reaching the "prime" target which is the copper-iron deposits at depths in the igneous basement rocks.

Such reasoning applied to the prospected area to the southwest end of line A-A' disclosed little likelihood of any "passing" ore target in the sedimentaries with the Lamotte sand found in thicknesses averaging nearly 300 feet in J-1(A) and surrounding holes. Nevertheless, beneath is the most lucritive, or the "prime" target for the exploration on this Project Contract. The copper-iron deposit was discovered there from 1,600 to 1,940 feet below the surface in the brecciated, metamorphosed and complex basement rocks penetrated by hole J-1.

The detailed logs by Dr. Bateman and the petrographic examination reports on some thin sections cut from core specimens he selected for further research, as copied for attachment hereto on holes J-1 and USA-2, are believed to be of concern to us at this time. The generalized core logs furnished with the application dated July 22, 1957, and supplemented a month later, as originally logged by Mr. David A. Schulz who was a new graduate in geology no longer in the employ of the Operator, appear adequate now for any foreseeable purpose on all the other holes. The logs, reports and correspondence on them from Dr. Bateman in the course of his study of the cores from all the holes, however, also are available to us in the Operator's Joplin Office.

The highlight of Dr. Bateman's study is inference of a quartz monzonite stock, the first discovered in Missouri, possibly with a radius of 500 feet around hole USA-2, in location obviously

synonymous with the Boss-Bixby magnetic "high" but not exactly on the PreCambrian "high". A porphyry copper, or Noranda-type deposit of the Laurentian Shield is suggested. Fluorspar was detected and selected samples assayed up to 2.35 percent. The concentrated mineralization expected on the periphery of the inferred stock might be found related to such breccia zones of ore minerals as was discovered by hole J-1.

That copper-iron zone of mineralization obviously may not be of commercial significance outside the brecciated zone which likewise obviously cannot be inferred on the basis of presently available data to have a width much in excess of 300 feet. In that and certain other respects, it appears similar to the great Pea Ridge iron deposit 45 miles to the north on which St. Joseph Lead Co. and Bethlehem Steel Co. jointly have launched a $20 million development program. That deposit could have been straddled by exploratory drill holes 400 feet apart.

The hole J-1 discovery at Boss-Bixby obviously is a brecciated zone of mineral concentration that on the basis of presently available data could have any of three general trends without having been intercepted by the existing very widely spaced deep prospect holes surrounding J-1, as perceptible with study of the Contract map. Although the close "hex-triangle" pattern of drilling employed by St. Joseph Lead Co., might have to be adopted for use

in the next exploratory steps to be taken around hole J-1 as well as USA-2, Dr. Bateman expressed the opinion that any ore trend through hole J-1 more than likely should be searched for first by a hole to be drilled on a line between holes J-2 and J-3, or line A-A' on the indicated major axis of the Ross-Fixby magnetic anomaly. Therefore, it is the consensus in the field that based on the best geologic premise alone, drilling of the next hole(No. 2 under the subject Contract) there at a site about 350 feet northeast of hole J-1 on line A-A' would be well justified.

For a conservative and logical confirmation of such a justification, however, at a very low cost as compared to that for each hole drilled here, Dr. Bateman recommended that consideration be given to electromagnetic surveying of two existing deep prospect holes as the initial exploration measure to determine the best ore-bearing trend for drilling. No doubt a great many holes would be required on fences at adequate intervals to accomplish the very minimum exploration of the presently inferred copper-iron ore trend from hole J-1 northeasterly along line A-A' to within 500 feet of hole USA-2, plus exploring the shallower lead ore target along the Lamotte shoreline on the flanks of the indicated Ross-Bixby Pre-Cambrian "high". It is furthermore the concensus in the field therefore, that on the basis of results attained reportedly under similar conditions particular on Canadian deposits, the proposed Contract Amendment No. 1 should be granted along the lines requested by the Operator last April 21.

The few pertinent trade journals and other technical publications available to the Field Team furnished little other than vague mention of electomagnetic surveying of bore holes. Any useful data or references that the reviewers in Washington might be able to furnish on the subject would be appreciated.

Upon our request through the Operator's Joplin District Office, a paper by Philip G. Hallof, Geophysicist, was received from the McPhar Geophysicists Ltd. outlining the theory and illustrating the method with some results of electomagnetic surveys made in diamond drill holes.

The paper concluded that since the lateral range of detection of the equipment is up to 400 feet, the use of the method permits wider spacings between drill holes in the preliminary phase of exploration without risk of missing sizeable mineral deposits.

A reprint of a similar but more detailed paper from the Canadian Mining Manual(with references to Elementary Mining Geophysics in the Northern Miner Press, 1954) by G. H. Ward and H. A. Harvey, Geophysicists, McPhar Geophysicists Ltd., Toronto, Ontario, presented at the Prospectors and Developers Association, Toronto in March 1954, entitled: Electromagnetic Surveying of Diamond Drill Holes for the Detection of Conductive Sulfide Mineralization, also furnished us information summarized below:

The electromagnetic surveying of diamond drill holes is said to be a practical method of exploring for massive sulfide mineralisation to depths as great as 2,500 feet within a radius up to 400 feet from the drill hole. The methods of testing both deep vertical and inclined drill holes were outlined and illustrated with field examples and results. The direction to conductive structures relative to the drill hole, and depths below the surface can be interpreted usually with reasonable accuracy. Field tests said to have been effective in the Sudbury basin both in drill holes passing through barren areas, and in holes in areas of known sulfides, were discussed. The method was shown to be useful in reducing the number of drill holes required to explore an area and in indicating the direction in which further drilling should be done. Appropriate application of the electromagnetic surveying method will indicate also whether a mineral occurrence actually intersected in a hole is localized, or if a zone of reasonable size exists within the cylinder 400 feet in radius around the hole. As for what is meant by reasonable size, several factors are involved such as shape and orientation of the mineralized zone which will effect the results. Experience showed that a million tons of ore in a slab-like form will be detected if 400 feet from the hole. The size of the conductor body that will give a like detectable anomalie decreases rapidly with proximity to the hole.

Since electromagnetic and most other electrical exploration methods respond to the total conductivity difference between the anomalous zone and host rock, conductors such as graphitic zones and shears filled with saline electrolytes will under some conditions also cause anomalies. No indication of ore grade, or changes of grade can be interpreted for the same reason.

Only uncased portions of drill holes can be surveyed with the drill hole EM method.

In this method, a detecting or receiving coil is used to measure the amount of distortion of a primary(applied) electromagnetic field caused by secondary fields associated with currents induced in subsurface electrical conductors such as sulfide bodies. The receiving coil is lowered into the hole. It is wound so that turns of wire lie in a plane normal to the hole; consequently, it will detect only that part of the field that is parallel to the drill hole. It is ordinarily lowered into the holes in 100-foot intervals while the transmitting coil on the surface is tilted for each of those recording positions until there is a zero voltage signal from the receiver. The magnitude and direction of the differences between the measured and calculated zero positions constitute the anomalies. Measurements thus actually in terms of dip angles of the resulting magnetic field make possible the detection of buried conductors or bodies of sulfides, magnetite, graphite or salines, often with sufficient accurracy to estimate the size, shape and depth of the body by comparison of the readings with scale-model data.

The EM surveys of drill holes have been useful to several mining companies in the vicinity of Noranda, Quebec. Several of the ore locations are at considerable depth and associated with particular geologic structures. The mineralization found on the property of the Lake Dufault Mines Ltd. near Noranda was found to be controlled by the upper or lower margins of a quartz-feldspar-porphy sill several hundred feet in thickness and ranging in depths from 500 to 1,500 feet. The mineralization is mostly pyrite and pyrrhotite but in places ore-grade copper and zinc are present irregularly.

In the planning that the Operator reports in progress to move a churn drill to this project at the earliest possible moment, I have advised that preparation be completed to either start cleaning out and recasing whatever existing hole Dr. Lateman and McPhar geophysicists will recommend for the start of the geophysical surveying if DMEA grants the requested Amendment No. 1, or start churn drilling on the suggested first new hole south or southwest of USA-2 when approved by the Field Team, before the June 7 deadline set by the Contract.

Therefore, with the addition of the foregoing summary, justifications and Field recommendations, should any data still be found lacking in your files on this docket to facilitate your prompt decision or advice on this requested amendment, please wire me immediately. If considerable more time will be required to

render a decision, then please consider granting an amendment effective by June 7 to extend that starting deadline set in the subject Contract.

Sincerely yours,

Clinton C. Knox

CCK/ic

Clinton C. Knox
Executive Officer
DMRA Field Team, Region IV

Attach. 4

cc: DMRA Op.Com.(2)
King,USGS,Denver w/3 attach.
Knox,DMRA,Carbondale w/3 "
4798 file

EXPLORATION PROJECT CONTRACT NO. IDM-E1160
AMERICAN ZINC, LEAD AND SMELTING COMPANY
DOCKET NO. DMEA-4798 (COPPER AND LEAD)

Suggested Draft

AMENDMENT NO. 1

It is agreed this 20th day of May, 1958, between the United States of America, acting through the Department of the Interior, Defense Minerals Exploration Administration, and the American Zinc, Lead and Smelting Company, parties to Exploration Project Contract IDM-E1160(Docket DMEA-4583) dated April 7, 1958, that said Contract is hereby amended effective April 21, 1958, as follows:

1. In Exhibit "A", under the heading --
Description of the Work

(a) The following sentence is added to the first paragraph: "With prior written approval of the Government, two of the deep prospect holes drilled prior to the date of this Contract may be reopened, recased and geophysically surveyed by a recognized and sound standard electromagnetic methods as the initial part of the exploration project work under this Contract.

(b) The sixth paragraph, starting with: "No drill holes shall be located closer than 500 feet....," is deleted and entirely replaced by the following:

"No drill holes shall be located closer than 200 feet to a property boundary, and except with prior written approval of the Government, none shall be located closer than 500 feet from another hole."

2. In Exhibit "A", page 2, under the heading --
Estimated Costs of the Project
Actual Costs

Stage 1, Category (1) Independent Contracts hereby is changed to the following, with parts A and B:

Part A - Exploration Geophysics

Moving, cleaning out two previously drilled holes, and reinstallation of casings, estimated 90 hours @$400/hr.----------$ 360.00

Geophysical surveys of two previously drilled holes by the electromagnetic method including furnishing all such equipment, personnel, subsistence, travel, transportation, and rendition of acceptable and complete reports with data on the results, $750.00 ea.-----
$1,650.00
$2,010.00

Part I - Exploration Drilling

Churn drilling(five holes to an estimated depth of 500 Feet each) 2,500 feet @$2.50/ft. ——— $6,250.00

Diamond drilling(AX-size or larger) to deepen each of five holes to 1,000 feet in depth(an estimated 500 feet/hole) 2,500 feet @ $3.75/ft. ——— $9,375.00

Diamond drilling(AX-size or larger) to deepen each of five holes to 1,500 feet in depth(an estimated 500 feet/hole) 2,500 feet @$4.75/ft. ——— 11,875.00

Diamond drilling(AX-size or larger) to complete each of five holes beyond 1,500 feet up to a maximum estimated depth of 2,500 feet but altogether not to exceed 2,200 feet @$5.50/ft ——— 12,100.00

Diamond drilling AX-size(in lieu of above) @$5.25/ft.*

Reaming and casing, or cementing and redrilling during diamond drilling, estimated 110 hours @$7.70/hr. ——— 847.00

Churn drill moving and pulling casing 1/ 80 hours @$4.00/hr. ——— 320.00

$42,777.00

This amendment shall not be construed to increase the estimated cost of the project or the aggregate amount which the Government may be required to contribute.

Executed in quintuplicate as of the day and year first above written.

THE AMERICAN ZINC, LEAD AND SMELTING CO.

By XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Title XXXXXXXXXXXXXXXXXXXXX

THE UNITED STATES OF AMERICA

By XXXXXXXXXXXXXXXXXXXXXXXX

Title XXXXXXXXXXXXXXXX

1/ Casing left in hole at request of Operator is not an allowable cost of the project.

* Hole depths in excess of 1,500 feet.

DRILL HOLE RECORDS
American Zinc, Lead and Smelting Company
St. Louis, Missouri

Hole No.:	USA-2
Land:	Federal Land
Location:	1055 feet West and 1520 South of Northeast corner of Section 9, T 34 N, R 2 W, Dent County, Missouri
Elevation:	1280 Feet (TM)
Hole Begun:	October 6, 1956 Struck Water: 130 Feet
Hole Completed:	December 8, 1956 Lost Water: 1268 Feet
Casing Used:	95 ft. 8", 130 ft. 6-1/4", 460 ft. 3" pipe
Contractor:	L. Goggins: Churn Drill from 0' to 460' Diamond Drill from 460' to 2000'

Depth	Thickness	Lithology	Formation
0 - 95	95	Red soil and boulders	Residuals
95 - 415	320	Gray brown cherty dolomite	Potosi
415 - 524	109	Light gray porous dolomite	Derby Doerun
524 - 673	149	Blue banded shale	Davis
673 - 771	98	Gray dolomite, traces of pyrite	Lonneterre
771 - 823	52	Talus breccia, cemented with dolomite	Lonneterre
823		TOP OF PRE-CAMBRIAN	
823 - 868	45	Gray to reddish brown altered quartz monzonite. Lath shaped feldspar, abudent reddish-brown feldspar. (Quartz?). Traces of fine disseminated magnetite and hematite, specks to traces of fluorite. Slightly brecciated. Traces of pyrite from 830' - 836'. Phases of almost pure feldspar.	
868 - 885	17	As above, except finer grained and with inclusion of felsite. Little breccia. Traces of epidote and some fluorite from 878' - 884'.	
885 - 893	8	As above, except less reddish brown feldspar. some chlorite and littel fluorite,	
893 - 900	7	As above, except finer grained and non-magnetic, some chlorite.	
900 - 960	60	As above. (Depth adjusted from 950' - 954', 8.6' of core?). Some magnetite along fracture planes, plus disseminated magnetite. Traces of fluorite.	

Depth	Thickness	Lithology			
900 - 960	(cont'd)				
		CHALCOPYRITE, pyrite, specks of Bornite	from	to	
		specks-traces	900	960	6'
		assayed	906	914	8'
		specks	914	922	8'
		fair-good traces	922	924	2'
		assayed	924	934	10'
		fair traces	938	944	6'
		assayed?	944	960?	16'
		Box marked 950'-954' contains 8.6 ft. of core of which 4.6 ft. have not been sampled.			
960 - 977	17	As above with felsite phases, moderate breccia,			
		CHALCOPYRITE & pyrite	from	to	
		Specks-traces	960	977	17'
977 - 1020	23	Black to greenish brown granular felsite (andesite?), fine disseminated magnetite. Some breccia with magnetite from 977'-992'. Quartz monzonite phase from 992'-1002'. Red stained shearplanes from 995'-999'. Good breccia with magnetite from 995'-998'. Appearing like welded agglomerate with replacement magnetite from 1018'-1020'.			
		CHALCOPYRITE & pyrite	from	to	
		specks	977	982	5'
		specks	987	990	3'
		traces	997	1000	3'
		scattered specks	1000	1020	
1020 - 1132	112	Gray to reddish brown quartz monzonite, abudent reddish brown feldspar, little fine dessimated magnetite, traces of fluorite, slightly brecciated, Breccia like welded agglomerate with magnetite from 1020'-1022'. 4" magnetite veinlet at 1022'. Felsetic phases from 1044'-1132'. Fair breccia with magnetite from 1065'-1132'.			
		CHALCOPYRITE & pyrite	from	to	
		traces	1020	1022	2'
		scattered specks	1022	1030	
		specks-traces	1030	1044	14'
		scattered specks	1044	1104	
		assayed	1104	1110	6'
		scattered specks	1110	1122	
		assayed	1122	1132	10'
1132 - 1182	50	Gray-black felsite (andesite?), some coarser grained phases (monzonite?), fine disseminated			

Depth	Thickness	Lithology
1132 - 1182 (con'td)		magnetite. Good breccia from 1164'-1168'.

CHALCOPYRITE & pyrite	from	to	
specks	1132	1158	26'
specks	1165	1180	15'
traces	1158	1165	7'

Depth	Thickness	Lithology
1182 - 1217	35	Pink rhyolite phorophyry, slightly sheared, some chlorite. (Thin section at lower contact)
1217 - 1324	107	Gray to reddish brown quartz monzonite, phases with almost felsitic ground mass, abudent reddish brown feldspar, fine disseminated magnetite, traces of fluorite. Slightly brecciated with little magnetite from 1244'-1254', 1284'-1304', 1307'-1324'. Pyrite traces from 1244'-1284', 1292'-1303, 1304'-1305'. Quartz stringers at 1307' and 1316'.

CHALCOPYTIRE & pyrite	from	to	
specks-traces	1252	1254	2'
specks	1282	1284	2'
assayed	1228	1234	6'
specks-traces	1217	1228	11'
assayed	1284	1292	8'
traces	1303	1304	1'
scattered specks	1305	1324	

Depth	Thickness	Lithology
1324 - 1474	150	Medled agglomerate?, most quartz monzonite, phases of altered rhyolite and andesite? Sheared and slightly brecciated from 1341'-1367', 1374'-1380'. Slightly brecciated with little magnetite from 1395-1434', 1452'-1456', 1460'-1474'. Traces of pyrite from 1352'-1354', 1390'-1398', 1403'-1423'.

CHALCOPYRITE & pyrite	from	to	
specks	1352	1354	2'
scattered specks	1364	1374	
traces	1374	1376	2'
scattered specks	1376	1382	
scattered specks	1387	1388	
assayed	1428	1434	6'
specks	1434	1447	13'
traces	1447	1449	2'
specks	1449	1461	12'
traces	1461	1474	13'

Depth	Thickness	Lithology
1474 - 1632	158	Gray quartz monzonite, with andesite phases and phases having abundent reddish brown feldspar, phases appearing to be agglomerate, fine disseminated magnetite and specks to traces of pyrite. Slightly brecciated with little magnetite, from 1474'-1510', 1530'-1578'.

Depth	Thickness	Lithology
1474 - 1632(cont'd)		Slightly brecciated from 1607'-1632'.

CHALCOPYRITE & pyrite	from	to	
specks-traces	1474	1494	20'
fair traces	1494	1499	5'
traces	1499	1508	9'
good traces	1508	1510	2'
specks to traces	1518	1524	6'
traces	1524	1534	10'
traces	1546	1548	2'
specks	1548	1552	4'
scattered specks	1583	1592	
specks	1612	1632	20'

1632 - 1802	170	Gray quartz monzonite, phases of almost felsitic ground mass, phases with reddish brown feldspar fine disseminated magnetite, specks of pyrite, traces of fluorite. Slightly brecciated with little magnetite from 1632'-1692'. 4" magnetite vein with fluorite at 1657'. Abudent reddish feldspar (agglomerate?) from 1730'-1740', 1784'-1791'. Sheared with slick planes (gouge?) from 1749'-1756'.
1802 - 2000	198	Dark gray quartz monzonite, with varying texture phases, phases appearing to be agglomerate; amygdules with quartz, magnetite and fluorite; scattered specks to traces of pyrite; fine disseminated magnetite. Fair breccia from 1826'-1832'. Reddish phases from 1915'-1921' and 1943'-1978'. Aplite stringers 1/4" at 1851', 1857', 1860', 1883', 1899', 1901', 1906', 1911', and 1949'. Specks of chalcopyrite from 1901'-1906'.

T.D. 2000 Feet

ASSAY BY FAIRMONT LABORATORY

American Zinc, Lead and Smelting Company

Hole No. USA-2

DEPTH	THICKNESS	FE	CU	S	CaF_2
906 - 908	2.0	12.5	1.15	1.02	
908 - 910	2.0	13.1	2.58	2.62	
910 - 912	2.0	13.1	.94	1.16	
912 - 914	2.0	10.9	.90	1.15	
914 - 916					
924 - 926	2.0	11.7	.76	.95	
926 - 928	2.0	12.5	.84	1.00	.62
928 - 930	2.0	16.4	2.11	2.16	
930 - 932	2.0	11.9	.74	1.84	
932 - 934	2.0	12.1	.62	1.79	
944 - 946	2.0	11.0	.41	.59	
946 - 948	2.0	9.6	.28	.40	
948 - 950	2.0	11.5	.50	.72	
950 - 952	2.0	9.6	.05	.18	
952 - 954	2.0	11.6	.23	.37	
954 - 956	2.0	24.6	.74	.79	
956 - 958	2.0	26.4	1.84	2.59	
958 - 960	2.0	24.2	.87	1.26	1.93
1104 - 1106	2.0	12.0	.06	.08	
1106 - 1108	2.0	14.3	.12	.87	.65
1108 - 1110	2.0	12.5	.12	.21	
1122 - 1124	2.0	16.0	.43	.85	2.35
1124 - 1126	2.0	18.4	1.36	7.30	
1126 - 1128	2.0	20.4	1.67	5.81	
1128 - 1130	2.0	10.8	1.46	3.02	
1130 - 1132	2.0	13.1	.22	.58	
1228 - 1230	2.0	10.7	.25	.42	
1230 - 1232	2.0	23.9	.40	.32	1.23
1232 - 1234	2.0	12.4	.19	3.20	
1284 - 1286	2.0	11.2	.04	.78	
1286 - 1288	2.0	13.4	.03	1.81	
1288 - 1290	2.0	15.4	.03	4.51	
1290 - 1292	2.0	12.1	.03	1.50	
1428 - 1430	2.0	16.8	.63	1.03	
1430 - 1432	2.0	12.8	.48	.66	
1432 - 1434	2.0	16.0	.43	.63	

Avg. .75% Cu

AMERICAN ZINC, LEAD AND SMELTING COMPANY

PETROGRAPHIC EXAMINATIONS OF THIN SECTIONS
By Mr. Carr and Mr. Matt Walton
under the direction of Dr. Alan M. Bateman

HOLE NO.: USA-2

Slide 8

Location: Hole USA-2, 929.8 feet.

Name: Microgranite or rhyolite.

Texture: Inequigranular, laths of orthoclase in a fine matrix that is interstitial.

Composition: Quarts and potash feldspar-indeterminate
chlorite and muscovite 2%
ore minerals 13%

Remarks: The larger crystals of orthoclase have undergone recrystallization to a fine grained indeterminate aggregate, probably a volcanic.

Slide 9

Location: Hole USA-2, 1217 feet.

Name: Rholite porphyry or agglomerate.

Texture: Fine grained aggregate.

Composition: So intensely altered that composition is indeterminate. Some larger grains are potassium feldspar. Some chlorite and sericite aggregates are present.

Slide 10

Location: Hole USA-2, 1496.5 feet.

Name: Too complexly altered to determine--rather unique rocks, possibly related to micx peridotite.

Texture: Indeterminate.

Composition: Indeterminate--mostly ore minerals; green biotite, muscovite, much fluorite.

Remarks: Intensely altered--not a straight igneous rock but complex--metamorphic and hydrothermal alteration.

Slide 11

Location: Hole USA-2, 1625.5 feet.

Name: Trachyte

Texture: and Composition: Inequigranular, orthoclase laths in a ground mass of potassium feldspar some quarts and ore (9%). Little quartz or plagioclase discernable; Intense alteration to sericite and muscovite.

Slide 12

Location: Hole USA-2, 1914 feet.

Name: Andesite.

Texture: Andesine laths in fine-grained ground mass, which is opaque because of dust of magnetote in it. The dusted aggregates have semi-crystal outlines.

Composition: Opaque dusted groundmass with vugs or vesicles of quartz, fluorite and chlorite, with a little muscovite and biotite

DRILL HOLE RECORD

American Zinc, Lead and Smelting Company
St. Louis, Missouri

Hole No.:	J-1		
Land:	Jimmerson Farm, Bess, Missouri		
Location:	1775 feet South and 790 feet West of Northeast corner of Section 17, T 34 N, R 2 W, Dent County, Missouri		
Elevation:	1205 feet (RM)	Struck water:	100 feet
Hole Begun:	June 6, 1956	Lost Water:	804 feet
Casing used:	120 ft 6-1/4"; 400 ft 5"; 580 ft 3" pipe		
Contractor:	L. Goggins, Churn Drill 0-580 feet L. Goggins, Diamond Drill 580 - 1971 feet		

Depth	Thickness	Lithology	Formation
0 - 50	50	Red soil and boulders.	Residuals
50 - 153	103	Light gray to tan cherty dolomite.	Eminence
153 - 553	400	Light gray dolomite, druses.	Potosi
553 - 636	83	Gray brown dolomite, calcite.	Derby-Doerun
636 - 827	191	Blue banded shale.	Davis
827 - 1094	267	Light gray glauconitic dolomite.	Bonneterre
		GALENA scattered specks from 1102 to 1120	
1094 - 1286	192	Clean white sand.	
1286 - 1290	4	Red sand	Lamotte
1290		TOP OF PRE-CAMBRIAN	
1290 - 1317	27	Dark gray-brown weathered felsite, with considerable hematite. 4" granite sill at 1306'.	
1317 - 1332	15	Weathered pinkish granite.	
1332 - 1398	66	Pink chlorite granite, partly altered, biotite and muscovite present, slightly sheared.	
1398 - 1403	5	Gray micro granite, with faint traces of magnetite.	
1403 - 1407	4	Pink chlorite granite, with biotite.	
1407 - 1436	29	Dark gray micro granite, some quartz phenocrysts visbile, sheared, slightly brecciated, traces of magnetite. Extremely altered from 1430'-1440'. Pink altered granite from and at 1417', 1419' (core ground), 1430' and 1431'-1432'.	
1436 - 1439	3	Pink granite, few dark minerals.	

Depth	Thickness	Lithology	Formation
1439 - 1465	26	Dark gray micro granite, some garnet visible, sheared.	
1465 - 1472	7	Zone of gray micro granite marbeled with aplite, traces of garnet and epidote.	
1472 - 1557	85	Dark gray micro granite. Brecciated from 1514'-1520'. Epidote traces at 1509' and 1545'. Granite sill at 1556'. Vertical granite contact from 1500'-1502'.	
1557 - 1561	4	Pink biotite granite.	
1561 - 1578	17	Gray rhyolite? (Contact metamorphosed siltstone). Slightly magnetic, traces of epidote. Aplite sills from and at 1562'-1563', and 1577'. Granite porphyry sill from 1565'-1566'.	
1578 - 1583	5	Pink chlorite granite.	
1583 - 1600	17	Gray-reddish quartz porphyry. Quartz phenocrysts abudent, traces of chlorite and epidote. Slightly brecciated with faint traces of magnetite	
1600 - 1606	6	Gray quartz porphyry (assayed)	
1606 - 1720	114	Gray-red-brown very altered rock. (Contact metamorphosed). with chlorite, epidote and garnet. (see assays and report on thin sections)	
1720 - 1734	14	Pink biotite granite.	
1734 - 1754	20	Zone of gray micro granite with considerable fine disseminated magnetite, cut by several granite and aplite sills and stringers.	
		CHALCOPYRITE — from — to Traces — 1734 — 1735 Specks to traces — 1736 — 1739 Specks — 1740 — 1750 Good traces — 1750 — 1754 (est.20% Fe)	
1754 - 1760	6	Pink biotite granite.	
1760 - 1787	27	Zone of gray micro granite, cut by granites.	
		CHALCOPYRITE — from — to Specks — 1773 — 1775 Specks to traces — 1776 — 1782	
1787 - 1880	93	Gray micro granite, with considerable fine disseminated magnetite, some brecciation. Aplite sill from 1822'-1824'.	

Depth	Thickness	Lithology			
1787 - 1880	93	(Cont'd)			
		CHALCOPYRITE and specks of bornite	from	to	
		Assayed	1787	1803	16'
		Good but spotty traces (est. 4% Cu)	1803	1838	35'
		Assayed	1838	1850	12'
		Good but spotty tr aces (est. 4% Cu)	1850	1880	30'
1880 - 1881	1	Pink chlorite granite			
1881 - 1952	71	Gray micro granite, with considerable fine disseminated magnetite, traces of chlorite. Granit sills from and at 1902', 1909'-1915' 1932', 1934', 1938', 1945'. Magnetite est. 25% Fe from 1920'-1932'.			
		CHALCOPYRITE and specks of bornite	from	to	
		fair but spotty traces (est. .2%-.3%Cu)	1881	1934	53'
		Assayed	1934	1940	6'
1952 - 1956	4	Pink chlorite-biotite granite.			
1956 - 1966	10	Gray micro granite, with little disseminated magnetite.			
1966 - 1969	3	Pink chlorite granite.			
1969 - 1971	2	Altered gray micro granite.			

T.D. 1971 feet

ASSAY BY FAIRMONT LABORATORY

AMERICAN ZINC, LEAD AND SMELTING COMPANY

1606-1720
114' @ 1.3% Cu

Hole No. J-1

DEPTH	THICKNESS	FE,	CU	S
1600 - 1602	2.0	5.7	.07	.20
1602 - 1604	2.0	11.5	.07	.34
1604 - 1606	2.0	8.7	.07	.32
1606 - 1608	2.0	11.1	.56	.37
1608 - 1610	2.0	18.9	.89	.72
1610 - 1612	2.0	20.0	1.58	1.29
1612 - 1614	2.0	21.4	1.91	1.75
1614 - 1616	2.0	11.7	.40	.33
1616 - 1618	2.0	19.5	2.57	1.80
1618 - 1620	2.0	15.1	.63	.53
1620 - 1622	2.0	12.0	.88	.78
1622 - 1624	2.0	7.9	.73	.70
1624 - 1626	2.0	7.5	.53	.50
1626 - 1628	2.0	18.3	1.12	1.00
1628 - 1630	2.0	18.7	1.39	1.12
1630 - 1632	2.0	15.4	.63	.53
1632 - 1634	2.0	14.2	.66	.59
1634 - 1636	2.0	15.5	.69	.62
1636 - 1638	2.0	14.3	.88	.81
1638 - 1640	2.0	14.6	1.02	.93
1640 - 1642	2.0	15.9	1.34	1.12
1642 - 1644	2.0	16.0	1.82	1.59
1644 - 1646	2.0	16.8	.59	.49
1646 - 1648	2.0	14.8	1.02	.84
1648 - 1650	2.0	13.7	.43	.37
1650 - 1652	2.0	18.2	.92	.82
1652 - 1654	2.0	14.3	.73	.63
1654 - 1656	2.0	24.5	.79	.66
1656 - 1658	2.0	14.7	.66	.41
1658 - 1660	2.0	13.5	1.85	1.05
1660 - 1662	2.0	16.2	2.15	1.99
1662 - 1664	2.0	27.2	3.23	3.05
1664 - 1666	2.0	20.9	2.21	1.72
1666 - 1668	2.0	19.7	2.53	2.03
1668 - 1670	2.0	13.8	1.45	1.12
1670 - 1672	2.0	21.8	1.88	1.74
1672 - 1674	2.0	13.9	.81	.76
1674 - 1676	2.0	27.1	2.24	2.45
1676 - 1678	2.0	20.9	2.43	1.49
1678 - 1680	2.0	11.5	.96	.81
1680 - 1682	2.0	19.9	2.51	2.35
1682 - 1684	2.0	8.6	1.45	1.25
1684 - 1686	2.0	8.4	1.85	1.66
1686 - 1688	2.0	4.5	.13	.19
1688 - 1690	2.0	3.2	.07	.06

ASSAYS (Cont'd) Hole No: J-1

DEPTH	THICKNESS	FE	CU	S
1690 - 1692	2.0	6.0	.07	.02
1692 - 1694	2.0	6.9	.07	.02
1694 - 1696	2.0	5.6	.53	.38
1696 - 1698	2.0	5.1	.59	.46
1698 - 1700	2.0	9.3	1.98	1.58
1700 - 1702	2.0	5.6	1.06	.83
1702 - 1704	2.0	5.3	.69	.60
1704 - 1706	2.0	4.7	1.12	.97
1706 - 1708	2.0	8.8	1.65	1.46
1708 - 1710	2.0	11.6	1.85	1.67
1710 - 1712	2.0	21.2	3.04	2.68
1712- 1714	2.0	16.7	4.39	3.71
1714 - 1716	2.0	9.5	2.33	2.01
1716 - 1718	2.0	7.6	1.19	.89
1718 - 1720	2.0	9.7	.89	.70
Cuttings, 1600-1670, North Side		15.3	1.09	.91
Cuttings, 1600-1670, South Side		16.8	1.35	1.17
Cuttings, 1670-1690, North Side		16.0	1.52	1.35
Cuttings, 1670-1690, South Side		16.6	.92	.84
1787 - 1788	2.0	29.0	.43	
1788 - 1790	2.0	30.7	.45	
1790 - 1792	2.0	27.8	.65	
1792 - 1793	1.0	20.3	1.04	
1793 - 1794	1.0	26.1	.49	
1794 - 1798	4.0	18.6	.48	
1798 - 1803	5.0	21.4	.31	
1838 - 1840	2.0	12.5	.32	.48
1840 - 1842	2.0	22.1	1.91	1.92
1842 - 1844	2.0	23.4	1.12	1.24
1844 - 1846	2.0	15.3	.35	.38
1848 - 1850	2.0	15.2	.40	.49
1846 - 1848	2.0	14.9	.72	.82
1934 - 1937	3.0	18.6	.51	
1937 - 1940	3.0	13.5	.31	

AMERICAN ZINC, LEAD AND SMELTING COMPANY

PETROGRAPHIC EXAMINATIONS OF THIN SECTIONS

By Mr. Carr and Mr. Matt Walton
Under the direction of Dr. Alan M. Bateman

Hole No.: J-1

Slide 2

Location: Hole J-1, 1407 feet.

Name: Microgranite in contact with granite.

Texture: Slide is in two parts, a medium grained part and a coarse grained part. The latter has same texture and composition as Slide 1 (USA-1), but less plagioclase. It is probably a variant of the same rock unit as slide 1.

Composition: The medium grained part has
Quartz 65%
Microcline 15%
Plagioclase 4%
Biotite 1%
Ore minerals 1.5%
This medium grained part might also be a felsysithized contact rock or sandstone inclusion.

Slide 3

Location: Hole J-1, 1566.5 feet.

Name: Rhyloite or a contact-metamorphic siltstone.

Texture: Finely granular with evidence of stratification or layering.

Composition: A point count shows
light minerals 72%
ore minerals 23%
chlorite and muscovite 5%

The light minerals are estimated to be
microcline 60%
quartz 35%
plagioclase 5%

Slide 4

Location: Hole J-1, 1641.5 feet.

Name: Garnet rock--not an igneous rock.

Texture: Inequigranular. Ragged porphyroblasts of golden garnet, with ore minerals inter-granular.

Composition: Golden garnet, iron-rich epidote, chlorite.
- garnet 43%
- quartz-orthoclase 35%
- ore minerals 18%
- other minerals 4%

Remarks: This is certainly not an igneous rock. The ragged golden garnet is not an igneous mineral. The garnet along with epidote suggests a contact metamorphosed ferruginous and calcareous siltstone or argillite.

Slide 5

Location: Hole J-1, 1659 feet.

Name: Contact metamorphosed calcareous argillite.

Texture: Porphyroblastic in finer ground mass.

Composition: Golden colored garnet; actinolite, epidote, orthoclase, quartz, chlorite, fox-red biotite
- garnet 35%
- orthoclase and quartz 48%
- ore minerals 14%
- other minerals 3%

Remarks: The golden garnet, actinolite, and epidote, along with magnetite, and the porphyroblastic texture are typically contact metamorphic.

Slide6

Location: Hole J-1, 1721.5 feet.

Name: Muscovite granite.

Texture: Allotromorphic, equigranular, muscovite is poikilitic.

Composition:
- Quartz 36%
- Microcline 36%
- Plagioclase, An_{27}, 12%
- Muscovite 6%
- Chlorite 4%
- ore minerals 6%

Slide 6(cont'd)

Remarks: Muscovite is altering to chlorite. This rock could be a separate unit, or a facies of slides 1 and 2.

Slide 7

Location: Hole J-1, 1729 feet.

Name: Muscovite granite, with altered inclusion?

Texture: Same as slide 6 for coarse part; fine - grained material is allotriomorphic, granular, with poikilitic muscovite showing some alteration to chlorite.

Composition: Coarse material, potash feldspar and quartz 77%
ore minerals 18%
muscovite and chlorite 5%

Remarks: The fine-grained material may be an inclision or a piece of contact-metamorphosed siltstone.

REC'D

MAR 1 6 1959

Box 431
Joplin, Missouri

AIRMAIL

March 4, 1959

OME Operating Committee
Room 4457
Department of the Interior
Washington 25, D. C.

Re: DMEA-4798(copper-lead)
American Zinc, Lead & Smelting Co.
Boss-Bixby Project
Dent & Iron Counties, Mo.
Contract Idm-81160

Dear Sirs:

Submitted herewith are four copies of the Interim Report received February 25 from Dewey Amos, USGS, Carbondale, covering the joint Field Team inspection of the subject project he and I made February 17.

Also, responding to your March 2 Telegram, herewith is a Memorandum in quintuplicate intended as the Field Team's joint Justification Report and recommendation for proposed Contract Amendment No. 3 as per request "A" only in the Operator's February 18 letter of which copies were sent you then. I realize that I may have the delegated authority to grant this recommended part of the request but under the circumstances, which our Justification Report has gone on to great length to inform you fully, we felt you might want to counsel the Field Team. Three sections and a map borrowed from the Operator's Joplin Office, also are enclosed for your information.

In addition, for your more complete information, one of your copies of the Operator's January Report(excepting the NF-104 Voucher) is enclosed.

Sincerely yours,

CCK/ind

Clinton C. Knox
Executive Officer
OME Field Team, Region IV

encl. 13

CC: OME O.Com.(3)
Amos w/cys both rpts
King, w/cy 1st rpt
4798 file

Box 431
Joplin, Missouri

March 4, 1959

Memorandum

To: OME Operating Committee, Room 4457, Department of the Interior, Washington 25, D. C.

From: Field Team, Region IV, Joplin, Missouri

Subject: Justification Report for proposed Amendment No. 3,
Ross-Bixby Project Contract Idm-K1160
Dent and Iron Counties, Mo.
American Zinc, Lead & Smelting Co.
DMEA-4798(copper-lead)

Photocopies of the Operator's February 18 letter of request for further amendment of the Contract immediately were made and forwarded to you without comments or recommendations of the Field Team. Following one of our infrequent meetings for a Field Team trip in eastern Missouri the next day, Dewey Amos, USGS, and I began consideration of these formal requests by the Operator, and while making the Field Team inspection of this project that morning of February 19 we discussed the requests there with the Operator's representatives, Messrs. Charles A. Dobbel, Supervising Engineer, and Erich Egli, Project Geologist of the Operator's St. Louis Office. Upon my return to Joplin February 20, I also explained the tentative opinions we had formulated to Mr. Dan R. Stewart, District Manager for the Operator. Later, a rough draft for this report was exchanged by mail between Amos and I so that we are in agreement with the substance herein, notwithstanding exceptions taken to our opinions by the Operator's representatives.

I had drawn rough sections for study of possible relationship between the drill hole results. During our project inspection,

the Operator's Project Geologist showed us his detailed graphic logs, three sections, and a map he had drawn as a guide to selecting the initial Stage II hole site. Copies of the large-scale colored graphic logs almost duplicate the written geologic logs and would be difficult to reproduce or mail. We did not consider that they, the three sections, or map adequately justified the J-7 site approval finally requested in the Operator's February 18 letter.

Upon receiving your March 2 telegram, however, Mr. Stewart loaned me his copy of those three sections and map which are enclosed herewith, but attached as a part of this report is a print of a section I had drawn which you may find more nearly meets your request. You may want to return his prints after they have served your purpose.

During previous discussions, Mr.Stewart had showed me a recent letter with recommendations from the Geological Consultant, Dr. Alan M. Bateman. His first choice for the initial Stage II hole site was 250 feet northwest of hole J-4 if Contract Amendment No. 2 could ~~not~~ be so further amended; otherwise, 500 feet (J--7A1 or J-7A2 as shown in green on the Operator's map), ~~or~~ following a phone call he then had made to Dr. Hallof in Toronto, on the basis of the latest E-M surveys, 250 feet, or 500 feet northwest of hole J-6(J-7B1 or J-7B2). The Operator's St. Louis Office had favored the tentatively proposed J-7 site 500 feet northeast of J-6, to be followed by the others also shown in red on the map.

I suggested that selection of any Stage II hole site in that area should await results of drilling hole J-6 then in progress, but that in the meantime I would favor starting Stage II by drilling a

hole 500 feet northwestward from USA-5. It virtually had been a miss both by proving to be too far inshore to hit the Bonneterre target strata for lead ore along the Lamotte sand pinchout line, and with only traces of copper found was evidently off the significant copper-bearing zone at depth in the Pre-Cambrian. Mr. Stewart stated that in view of all the down-the-hole E-M survey results proving a complete disappointment for reliable guidance in drill hole site selections, and with the recent disastereus slump in the domestic zinc and lead mining business his company no longer could afford to risk drilling holes very far from the J-1, J-4 and J-5 ore discovery holes until that possible ore trend is more clearly determined geologically by a section of closer-spaced drill holes. All attempted lithologic and structural correlations to date appear equally baffling. Therefore, he phoned Dr. Bateman and obtained concurrence in the request to spot the initial Stage I hole for churn drilling to start as soon as possible at a point about 200 feet S22°E of J-5, as then formally requested in the February 18 letter. Instead, I believed a hole site 500 feet eastward from J-5 perhaps could be justified.

The Field Team recognized that orderly continuity from Stage I to Stage II holes is almost mandatory for maintaining low-cost churn and diamond drilling subcontracts, and that we ought to be permitted under the Contract to approve at least one Stage II hole site far enough in advance of completion of diamond drilling the five Stage I holes to permit that orderly

continuity of the justified project work. Thus, a Stage II hole would be "sleeve" churn drilled ready for the diamond drill to move onto upon completion of the approved fifth Stage I hole(USA-6) so that all possible further standby time by the subcontractors would be eliminated.

Obviously, from the results of the three Stage I holes completed to date (J-4, J-5 and USA-5) eventual Field Team approvals undoubtedly will be justified for all the allowable five Stage II holes to attain the Contract objectives. Of course, the Field Team has contended since the DMEA application was being prepared that the proposed total not to exceed 10 holes under both stages of the Contract could not be expected to realistically explore the inferred ore targets in some 5,000 acres included thereunder, but the Operator's financial circumstances also must be given consideration on such a venture. These circumstances likewise must be recognized in considering that only three holes have been completed in the year that the Contract now has been in the Operator's hands. As Mr. Stewart pointed out, however, much of the time and costs from last March until October was lost while arranging for, and conducting the first down-the-hole E-M surveys.

Therefore, prompt amendment of the Contract as per request "A" of the Operator's February 18 letter, is recommended by the Field Team so that the churn drilling subcontractor will not be required to stand by until results of all five Stage I holes become available and are studied. We suggest that the proposed Amendment No. 3 delete

the phrase: "Upon the completion of Stage I," in the last paragraph, page 1, of Amendment No. 1; and replace it with: "Upon justification during Stage I drilling,....".

In accordance with the existing Contract Amendment No. 2, however, the Field Team does not recommend changing it at this time to permit Government approval for any requested additional drill hole sites at spacings less than 500 feet from any previously drilled hole. In the foreseeable future at least, any holes deemed necessary at closer spacing should be drilled entirely at the Operator's expense. Therefore, however, the Field Team eventually should grant a further Contract amendment, if requested by the Operator and if and as needed, to extend the Contract expiration date beyond July 7, 1959.

Thus, while the Field Team is not in agreement with the Operator on its proposed initial Stage II drill hole site (J-7, about 200 feet S22°E of hole J-5), we recognize that should a more adequate justification arise later near contract completion time, we still might deem granting of an eventual further Contract amendment to be in the best interests of the Government to approve the final one or two Stage II hole sites at closer than 500-foot spacings. Mr. Stewart pointed out that since the Contract gave the privilege, subject to Government approval, to locate all Stage I holes closer than 500 feet, but only three are to be drilled so, a Contract amendment should be granted which in lieu thereof would allow approving the proposed J-7 site as the initial Stage II hole.

As I believe my attached rough section will illustrate adequately for you, Mr. Stewart pointed out that results of the original magnetometer surveys, and results of drill holes J-1 and J-5 clearly imply that the indicated copper-iron deposit of probable commercial significance lies in a thick zone either: 1) with a steep dip to the southward; or 2) with a fault displacement of some 330 feet downward to the south between the two holes. An east strike is said to be indicated by the steep-gradient contours of magnetic intensity (See Contract Map). This would tend to further justify the above-mentioned possibly logical hole site 500 feet eastward from J-5 which discovered possible ore, and 500 feet southward from J-3 which also showed significant amounts of ore minerals. I expressed the opinion that this structural inference from results of holes J-1 and J-5 soon may be satisfactorily confirmed for the time, at least indirectly, by the results of drilling hole J-6 now in progress and said to have encountered traces of copper at about 1,400 feet. Furthermore, granite predominated throughout most of holes S-2 and USA-1, both of which must have been bottomed possibly 1,000 feet too shallow to have reached the brecciated porphyritic host rock for the inferred copper-iron zone of holes J-1, J-4 and J-5 if it is dipping steeply. Thus, the proposed hole J-7 might be expected to be similar to USA-1 or S-2. But if the copper-iron zone is flat-lying southward from hole J-5, it seems that USA-1 and S-2 should have penetrated it; if on the

inferred dip, that zone might not be reached by the proposed hole J-7 shallower than 2,500 feet. Such depth would seem of minor commercial interest at this time, particularly in view of the Operator's exploration budget limitations, and the shallower targets yet to be explored.

Therefore, pending receipt of results from completion of hole J-6, expected in about 3 weeks, the Field Team would hesitate to approve any new site in this west half of the project area, but we expect hole J-6 to justify approval of the initial Stage II hole under the Contract either at a site 500 feet northeast of J-6, or 500 feet eastward from J-5. I do not understand Dr. Bateman's expressed belief that the copper-iron discovery in holes J-1, J-4 and J-5 may trend northwestward, but in view of the significant amounts of copper minerals even found in holes S-1 and J-2, undoubtedly a second Stage II hole well might eventually be justified 500 feet northwest of J-6.

There is still a strong likelihood that the shape of this inferred Boss-Bixby ore deposit may be found to be an irregular mass such as other Pre-Cambrian deposits of Missouri(Iron Mountain, USBM, I.C. 7807, October 1957). Magnetite with a little hematite in a few instances was found in all the holes in the project area except in the numerous barren dikes, sills or other intrusives indicated in the cores, and to a minimum extent in the predominately granitic rocks. Chalcopyrite and some bornite in most of the holes in the west half of the project area, particularly hole J-5, are shown to be at least half as widespread. Although this may not

prove to constitute a commercial-grade copper ore deposit at this depth, the possibility that a recoverable iron-ore concentrate of 10 times as much magnetite and hematite as copper would make it commercially attractive. Besides the relatively small amount of iron contained as sulfides in the chalcopyrite, bornite, and traces of pyrite present, possibly 10 times as much iron-ore concentrate as copper would be found available if beneficiation proves feasible to separate the sulfides, apatite, fluorspar, and other iron ore contaminates. The finely disseminated minerals, particularly the mixtures of magnetite and bornite, have made estimating of copper content very unreliable while visually logging the cores. Thus, the Operator has hesitated to spend money and time on sampling and analytical determinations in some instances. Also, the laboratory is very slow in furnishing reports on samples analyzed. Likewise the most careful visual geologic logging of cores has failed to furnish much structural implication with exception to some insignificant-appearing signs of shearing noted in logs of a few of the holes, particularly more impressive at 1,600 to 1,800 feet in hole S-2, and at 2,000 feet in hole USA-1.

I explained, however, that these Field Team opinions are subject to review and any action deemed appropriate by the Washington Office of OME. Therefore, we of the Field Team and the Operator would appreciate being advised at the earliest possible moment on what action, if any, will be taken.

Clinton C. Knox

Clinton C. Knox
Executive Officer

CCK/imd

Attach. 1

sc: Cp.Com.(3) w/attach.
Amos,USGS,Carbondale
King,USGS,Denver
4798 file

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
Box 431
Joplin, Missouri
April 21, 1958

APR 23 Rec'd

DMEA Operating Committee
Department of the Interior
Washington 25, D. C.

Re: DMEA-4798(copper-lead)
American Zinc, Lead & Sm. Co.
Boss-Bixby project
Dent and Iron Counties, Mo.
Project Contract Idm-E1160

Dear Sirs:

Transmitted herewith are the two Washington copies of the subject Contract executed and received from the Operator today. The appropriate copy is furnished the Finance Officer with a copy of this letter, the Field Team's copy is retained here. One of the extra copies of this Contract attachments furnished with your December 27 letter was sent to Amos, USGS Field examiner, on December 30, and the other today is being furnished King, Survey Member of the Field Team, Denver.

Also enclosed for your consideration are two copies of this Operator's letter transmitting the executed Contract and formally requesting an amendment to divert a small portion($1,940) of the allowable project costs to geophysical exploration work tentatively scheduled for next month. I am not familiar with this geophysical exploration method nor qualified to make recommendations regarding this request, but copies of this letter and the Operator's amendment request are being furnished both King and Amos, Survey Members of this Field Team for any comments they might be able to furnish for your and my guidance.

Sincerely yours,

CCK/di

Clinton C. Knox
Executive Officer
DMEA Field Team, Region IV

encl. 4

cc: DMEA Op.Com.
Finance Officer,USBM,Bartlesville w/cy Contract
King,USGS,Denver w/cy encls.
Amos,USGS,Carbondale w/cy ltr encl.
4798 file

King-USGS-Denver

RECEIVED
DIVISION OF MINERAL
TECHNOLOGY

DEC 30 1957

BUREAU OF MINES
JOPLIN, MO.

EXPLORATION PROJECT CONTRACT
AMERICAN ZINC, LEAD AND SMELTING COMPANY
DOCKET NO. DMSA-4798

ANNEX I

The land referred to in Article 2 of the contract consists of 5,195.25 acres, situated on both sides of the county line between Dent and Iron Counties, Missouri. The Operator's possessory rights are as follows:

(1) A portion of the land is held under Prospecting Permits from the United States Department of the Interior, Bureau of Land Management, to prospect for lead, zinc, iron, and related minerals (specifically excluding oil and gas, oil shale, coal, phosphate, sodium, potassium, and sulfur), as follows:

No. BLM-A-060200	1520 acres	(dated December 1, 1955)
No. BLM-A-061773	2300 acres	(dated February 1, 1957)
Total	3820 acres	

The permits are for two-year periods, renewable for one two-year term.

(2) The balance of the land is held under mineral purchase option contracts with private individuals as follows:

Landowner	Contract date	Acres
Edgar Hedrick and Ruby Hedrick, his wife	1/28/56	220.00
R. L. Stark and Rosa Stark, his wife	1/28/56	110.00
Oscar E. Ray and Opal Ray, his wife	1/28/56	385.25
Ira Sellers and Gladys Sellers, his wife	2/13/56	138.80
W. A. Sellers and Effie Sellers, his wife	2/18/56	121.20
G. W. Nelson and Mintie Nelson, his wife	2/21/56	140.00
Bob E. Jimmerson and Vinita Jimmerson, his wife	3/ 3/56	60.00
Edgar Pryor and Effie Pryor, his wife	3/17/56	40.00

Landowner	Contract Date	Acres
Otis G. Pryor and Dorothy Pryor, his wife	3/17/56	40.00
Louis Pryor and Hilda Pryor, his wife	10/19/56	80.00
(Miss) Coral Andrews	2/4/57	40.00
(Total Mineral Purchase Options)		1,315.15 acres

The option agreements are for one year periods, renewable twice, with a provision for purchase of the mineral rights.

All of the lands pertaining to the contract are shown on the attached map entitled "Bees-Pinky Area, Dent & Iron Counties, Missouri".

Copies of all documents identified above are filed in DMEA Docket No. 4798, and the land descriptions therein are incorporated herein by reference.

SPECIAL AGREEMENT CONCERNING LAND

1. Production of minerals that are excluded from the prospecting permits and mineral purchase option contracts set forth above are excluded from the royalty provisions of this contract, provided that if a permit or mineral purchase option contract is revised to include an excluded mineral, said mineral shall be subject to the royalty provisions of the contract.

2. In the event the Operator at any time during the period expiring ten years from the date of this Contract acquires any interest, title, or equity in any land contiguous to the premises described in this Contract, it is agreed that such contiguous lands shall thereupon become subject to the provisions of this Contract and the parties hereto shall promptly execute amendments to this Contract listing such contiguous lands as included in this Contract.

3. It is further agreed that the Operator may, at any time before the expiration of sixty days following the conclusion or termination of exploration work under this Contract, request the Government to delete from this Contract such lands described in the option contracts listed in this Annex I, or by any amendments thereto, as have no known value for mineral production. The Government will promptly prepare amendments removing the specified lands from the Contract, which amendments shall provide that the Operator:

(a) certifies the lands have no known value for mineral production;

(b) has, prior to the execution of the respective amendment, surrendered or otherwise disposed of all its interest, title, and equity in such lands, and any minerals produced therefrom, including any option, lease or permit thereto, without any consideration whatsoever, including future compensation, for such surrender or disposition other than relief from the cost of maintaining such interest;

(c) agrees that no benefit from such lands or any production of minerals therefrom will accrue to the Operator or to any of its subsidiaries, directly or indirectly, during the period expiring thirty years from the date of this Contract;

(d) agrees that if the Operator or any of its subsidiaries acquires any interest, title, or equity in such lands or any minerals produced therefrom, or derives any benefit therefrom, before the expiration of thirty years from the date of this Contract, the lands with respect to which such interest, title, or equity is acquired, and any minerals produced therefrom, shall be deemed subject to this Contract and any certification from the date that the Operator or its subsidiaries acquired such interest, title, or equity, or any benefit therefrom, until the expiration of thirty years from the date of this Contract, or until the total net amount contributed by the Government without interest is fully repaid, whichever occurs first.

EXPLORATION PROJECT CONTRACT
AMERICAN ZINC, LEAD AND SMELTING COMPANY
DOCKET NO. DMEA-4798

EXHIBIT "A"

Description of the Work

The purposes of the project are first, to explore for copper in the Precambrian basement rocks, and second, to explore for any ores of lead, possibly containing auxiliary metals, in overlying Cambrian strata. The exploration shall be performed by diamond drilling (plus necessary overburden churn drilling estimated at 500 feet per hole).

It is estimated that ten vertical drill holes, aggregating 20,000 feet of churn and diamond core drilling will be required. The work is divided into two 5-hole stages, each totaling 10,000 feet. The locations of the holes of Stage I are roughly indicated on the attached map entitled "Drilling Map, Bess-Bixby Project," but the actual location of each hole is subject to prior Government approval. Upon the completion of Stage I, as much of Stage II drilling shall be performed as is approved in advance by the Government, such approval dependent upon favorable results having been obtained under the Stage I work.

All diamond drilling shall be with AX size or larger coring bits, except where it may become necessary to use an EX size bit in order to complete a hole. All drill holes shall be logged and cores made available to the Government for examination. All significantly mineralized core, in lengths not to exceed six feet, shall be split, properly sampled, and the samples assayed for copper, iron, lead, zinc, sulfur, phosphorous, nickel or cobalt, as deemed advisable.

Incomplete or lost churn drill holes will not be accepted as an allowable cost under the contract.

Drill holes shall be reamed and cased or cemented and redrilled as necessary.

No drill holes shall be located closer than 500 feet distant from another hole, nor closer to a property boundary than 200 feet.

All assays shall be reported monthly to the Government, accompanied by drill logs and adequate maps and sections showing the progress of the work and sample locations.

The project work shall be adequately supervised by a competent engineer or geologist.

Estimated Costs of the Project
Actual Costs

Stage I

Category (1) Independent Contracts

Churn drilling (5 holes, estimated 500 feet per hole) 2,500 feet @ $2.50/ft.	$ 6,250.00	
Diamond drilling (AX size or larger) to hole depth of 1,000 feet (estimated 500 feet per hole, five holes), 2,500 feet @ $3.75/ft.	9,375.00	
Diamond drilling (AX size or larger) to hole depths of 1,000 to 1,500 feet (estimated 500 feet per hole, five holes), 2,500 feet @ $4.75/ft.	11,875.00	
Diamond drilling (AX size or larger) to hole depths in excess of 1,500 feet (estimated 500 feet per hole, five holes), 2,500 feet @ $5.50/ft.	13,750.00	
Diamond drilling EX @ $5.25/ft.		
Reaming and casing, or cementing and redrilling, estimated 110 hours @ $7.70/hr.	847.00	
Moving and pulling casing 1/ 170 hours @ $4.00/hr.	680.00	$42,777.00

Category (2) Personal Services

(a) and (b) Supervision and technical services		
1 Geologist, half time, six months $550.00 monthly base (3 x $550.00)	1,650.00	
(c) Labor	1,200.00	2,850.00

Category (3) Materials and Supplies

None except:

Drill hole casing	$ 1,590.00	
Core boxes and sample cans	250.00	$ 1,840.00

Categories (4) through (6)

None

Category (7) Miscellaneous

Drill hole site preparation and hole plugging where necessary 5 locations @ $65.00/each	325.00	
Assaying, 1,875 determinations @ $1.00/each	1,875.00	
Core storage rental (6 months @ $10.00/month)	60.00	
Drafting, office engineering, and accounting (5 drill holes @ $100.00/each)	500.00	
Vehicle operation (6 months, 15 days monthly @ $5.00/day (90 x $5.00))	450.00	
Payroll taxes and insurance	293.00	3,503.00
Estimated Total Cost Stage I		$50,970.00

STAGE II

Category (1) Independent Contracts

Churn drilling (five holes, estimated 500 feet per hole), 2,500 feet @ $2.50/ft.	6,250.00	
Diamond drilling (AX size or larger) to hole depth of 1,000 feet (estimated 500 feet per hole, five holes) 2,500 feet @ $3.75/ft.	9,375.00	

Diamond drilling (AX size or larger) to hole depths of 1,000 to 1,500 feet (estimated 500 feet per hole, five holes), 2,500 feet @ $4.75/ft.	$11,875.00	
Diamond drilling (AX size or larger) to hole depths in excess of 1,500 feet (estimated 500 feet per hole, five holes), 2,500 feet @ $5.50/ft.	13,750.00	
Diamond drilling EX @ $5.25/ft.**		
Reaming and casing, or cementing and redrilling, estimated 110 hours @ $7.70/hr.	847.00	
Moving and pulling casing, 1/ 170 hours @ $4.00/hr.	680.00	$42,777.00
Category (2) Personal Services		
(a) and (b) Supervision and technical services		
1 Geologist, half time, six months, $550.00 monthly base, (3 x $550.00)	1,650.00	
(c) Labor	1,000.00	2,650.00
Categories (3) through (6)		
None		
Category (7) Miscellaneous		
Drill hole site preparation and hole plugging where necessary, 5 locations @ $65.00/each	325.00	
Assaying, 1,875 determinations @ $1.00/each	1,875.00	
Core storage rental (6 months @ $10.00/month)	60.00	
Drafting, office engineering and accounting (5 drill holes 3 $100.00/each)	500.00	

Vehicle operation (6 months, 15 days monthly, @ $5.00 daily (90 x $5.00)	$ 450.00*	
Payroll taxes and insurance	263.00	$ 3,473.00
Estimated Total Cost of Stage II		$48,900.00

S U M M A R Y

Estimated Total Cost of Stage I	$50,970.00	
Estimated Total Cost of Stage II	$48,900.00	
Estimated Total Cost of Project		$99,870.00
Government Participation @ 50%		$49,935.00

1/ Casing left in hole at request of Operator is not an allowable cost of the project.

* Indicates maximum in addition to maxima specified in Article 6(a).

** Hole depths in excess of 1,500 feet.

American Zinc, Lead and Smelting Company

HOWARD I. YOUNG
PRESIDENT

RECEIVED
DIVISION OF MINERAL
TECHNOLOGY

APR 21 1958

BUREAU OF MINES
JOPLIN, MO.

1600 PAUL BROWN BUILDING
SAINT LOUIS 1, MISSOURI

April 10, 1958

Mr. Clinton C. Knox
Executive Officer
Region 4
Defense Minerals Exploration Administration
U. S. Department of Interior
Box 431
Joplin, Missouri

Dear Mr. Knox: Re: Boss-Bixby Exploration Project
DMEA - 4798

We wish to acknowledge receipt of your letter of April 7, 1958 plus the attached original and four copies of the above captioned proposed D.M.E.A. exploration contract, being returned for our signature. We note from your letter that you have been authorized to change the effective date of the contract from December 27, 1957, to April 7, 1958, but that you have been advised by your Washington office that present D.M.E.A. policy will not allow a commencement date for the project to exceed sixty (60) days from the effective date of the contract, which will place the project commencement date on or before June 7, 1958. We have signed all copies and are enclosing four copies.

As you know, the Boss-Bixby exploration project, situated in Dent and Iron Counties, Missouri, was designed for a two-fold prospecting purpose: (1) to investigate by deep drilling, 2,000 feet or more, the mineral possibilities of the pre-Cambrian igneous rock associated with a large magnetic anomaly, and (2) to check the possibility of disseminated lead ores occurring in the Bonne Terre formation overlying the basement rocks. This project was commenced by our company during April, 1956 and was temporarily suspended in July, 1957 to await the decision regarding our application for a D.M.E.A. exploration project, dated July 22, 1957. During this period we completed a total of nine (9) drill holes, having a combined footage of 19,110 feet. The results of our initial drilling have shown the presence of a very unusual and complex occurrence of copper mineralization in the pre-Cambrian

rocks, plus considerable encouragement toward the possible discovery of a disseminated lead deposit in the Bonne Terre formation.

Due to the uniqueness of this pre-Cambrian copper discovery and to the known complexities of the pre-Cambrian rocks of the Ozark region, a very detailed study of the various igneous rock types and ore minerals from our drill hole cores was commenced during September, 1957. Surface examination of the pre-Cambrian floor is impossible since these rocks are situated from 740 to 1,449 feet beneath a sedimentary rock cover in this area. In order to obtain the best possible advice regarding the pre-Cambrian rocks and ore deposits this study has been placed under the direction of Dr. Alan M. Bateman, who has acted in a consulting capacity.

As a result of this additional geological study, it now seems advisable to try to anew electromagnetic geophysical technique developed by the McPhar Geophysics Limited of Toronto, Canada, in order to gain additional information regarding the possible extent and trend of our copper discovery. This geophysical method utilizes a receiving coil placed in a drill hole and a transmitting coil placed on the surface. Results obtained by this method have been very satisfactory in pre-Cambrian ore deposits at Falconbridge, International Nickel, and Noranda. To use this equipment will require the reopening and cleaning out of the drill holes to be tested. If this process is amenable to the physical conditions at Boss-Bixby, it should provide a more intelligent planning for drill hole locations and result in a general over-all saving of exploration costs through the possible elimination of poorly placed drill holes. This work can be started in thirty to sixty days.

In order to use to the fullest extent every practical means to determine, at the least cost, the direction and extent of the copper mineralization we have encountered, it appears that this geophysical work is fully warranted.

We, therefore, ask you to give consideration to the following change to our D.M.E.A. contract:

To include our proposed geophysical test work as a portion of the project costs so that Government participation can commence within the 60-day contract limitation. The costs for this work to include the testing of two drill holes are as follows:

Estimated Cost Geophysical Surveys

Opening and Cleaning Out Drill Holes

Drill Rig Cost @ $44.00 per 9-hour shift, estimated time for 2 drill holes - 10 shifts @ $44.00	$ 440.00

Geophysical Work

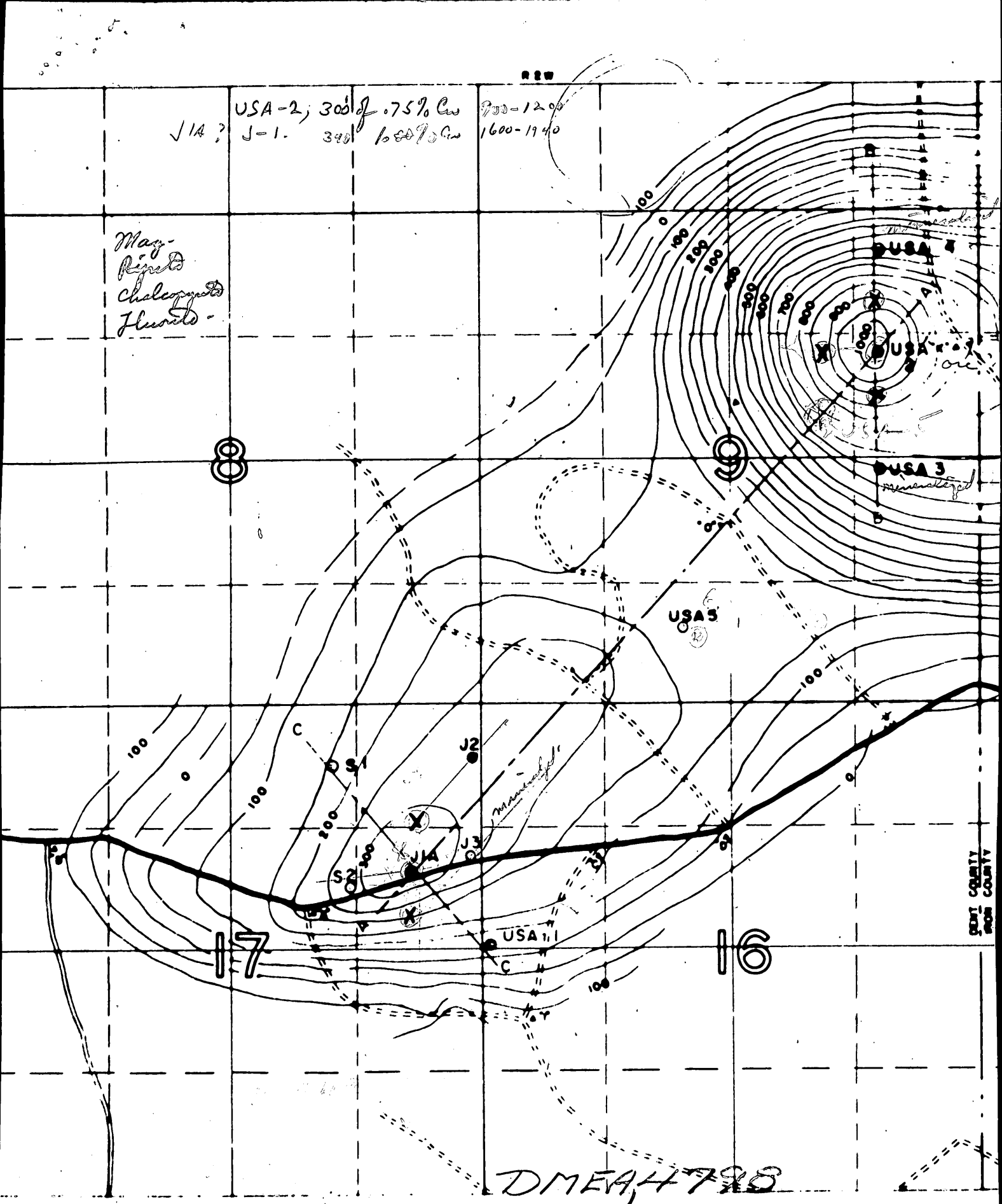
Contract Price by McPhar Geophysics Limited, Toronto, Canada, for E. M. Survey in two drill holes, including Fees, Living Expense, and Transportation	1,500.00
Total Cost Geophysical Work	$1,940.00

We shall appreciate hearing from you at your earliest convenience concerning this amendment, and can assure you that, with approval, the geophysical work can commence within sixty days and that the drilling portion of the project can be started during the third quarter of 1958.

Very truly yours,

AMERICAN ZINC, LEAD AND SMELTING COMPANY

Howard Young
President



CONTOURS SHOW MAGNETIC INTENSITY

Fifth Principal Meridian

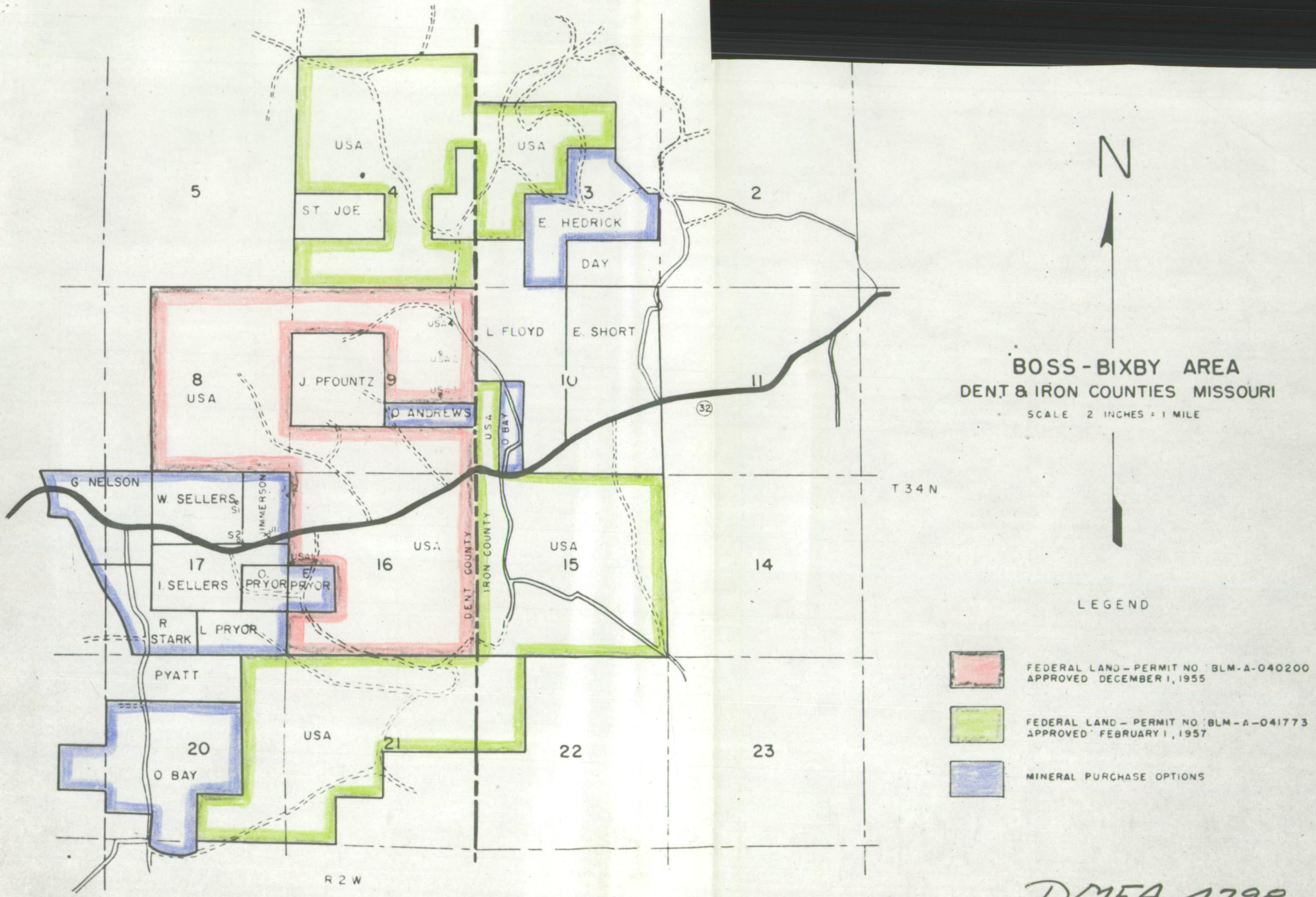
DRILLING MAP

BOSS-BIXBY PROJECT

DENT COUNTY, MISSOURI

SCALE IN FEET

(X) PROPOSED DRILL HOLE ⊙ BEING DRILLED ○ UNCOMPLETED ⊙ COMPLETE


N
BOSS - BIXBY AREA
DENT & IRON COUNTIES MISSOURI
SCALE 2 INCHES = 1 MILE
T 34 N
R 2 W
USA
ST JOE
E HEDRICK
DAY
L FLOYD
E. SHORT
J PFOUNTZ
D ANDREWS
O BAY
G NELSON
W SELLERS
IMMERSON
I. SELLERS
O. PRYOR
E. PRYOR
R STARK
L PRYOR
PYATT
DENT COUNTY
IRON COUNTY
LEGEND
FEDERAL LAND - PERMIT NO. BLM-A-040200
APPROVED DECEMBER 1, 1955
FEDERAL LAND - PERMIT NO. BLM-A-041773
APPROVED FEBRUARY 1, 1957
MINERAL PURCHASE OPTIONS

DMEA 4798