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MX SITING INVESTIGATION GEOTECHNICAL EVALUATION OF LUKE BOMBING--ETC(U)
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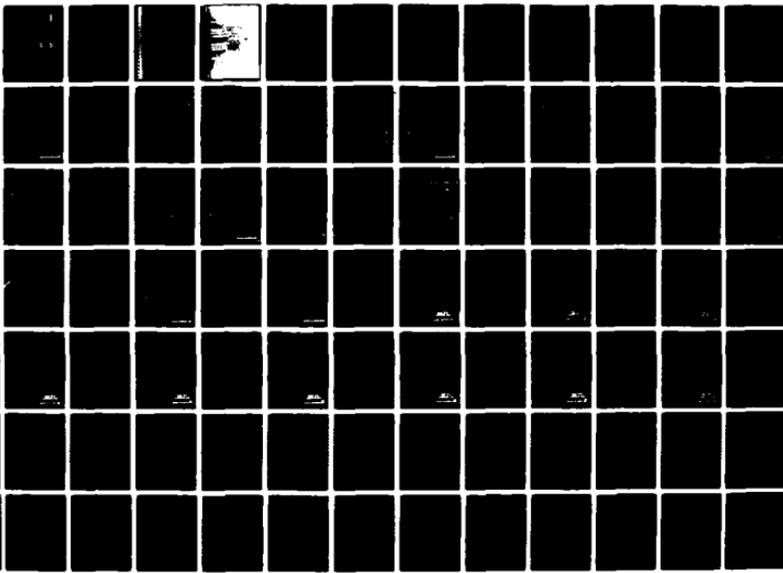
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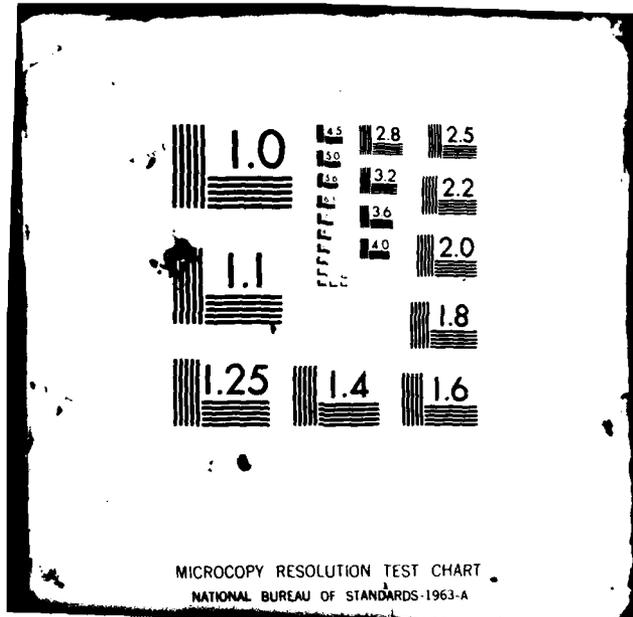
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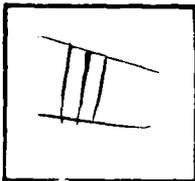


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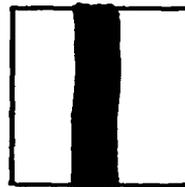
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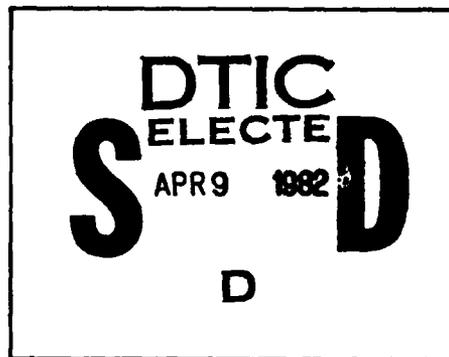
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GEOTECHNICAL EVALUATION OF
LUKE BOMBING AND GUNNERY RANGE
GEOTECHNICAL REPORT
LECHUGUILLA DESERT, ARIZONA
VOLUME III
APPENDIX B

Prepared for:

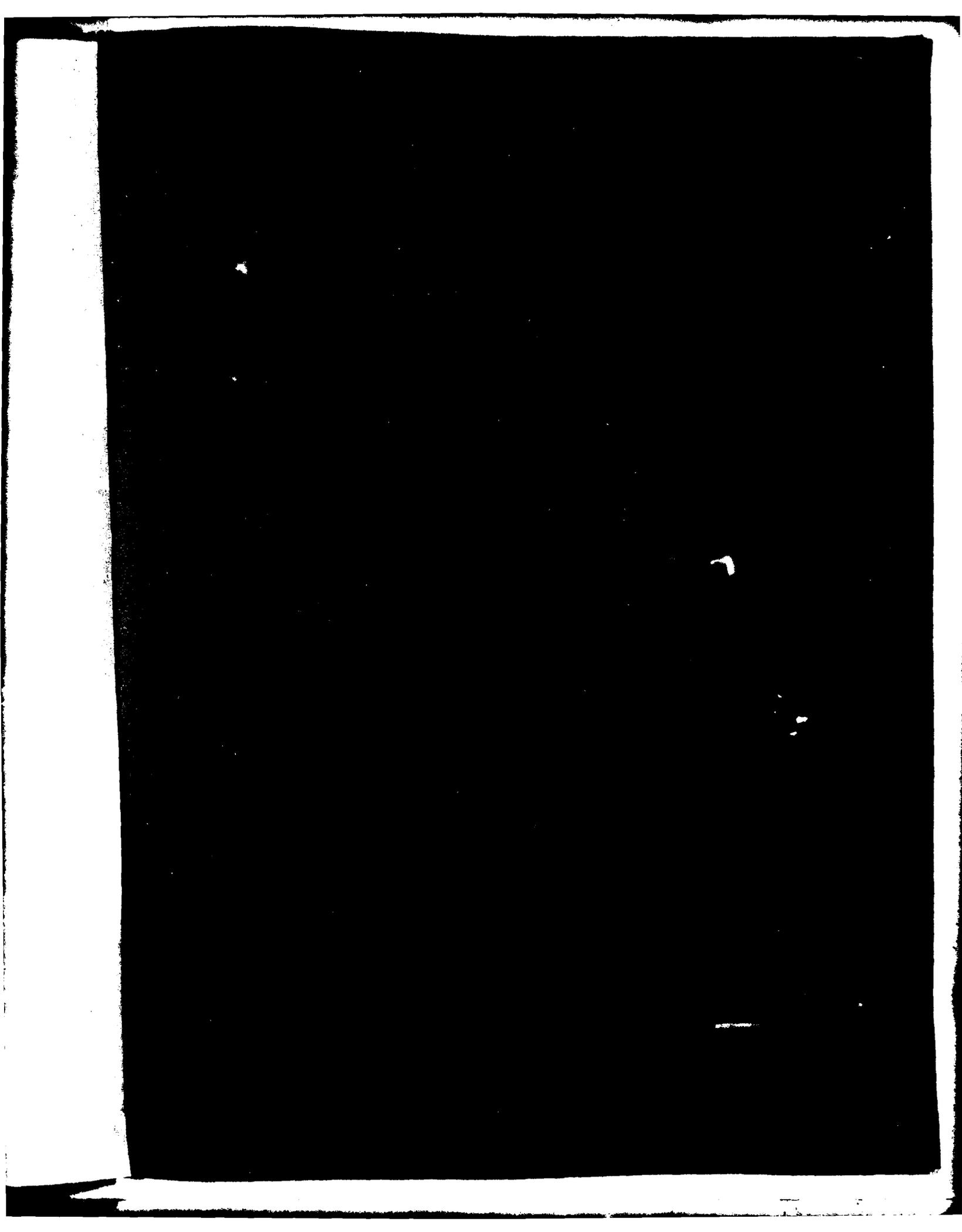
Space and Missile Systems Organization (SAMSO)
Norton Air Force Base, California

Prepared by:

Fugro National, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807

20 January 1978

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Max Siting Investigation, Geotechnical Evaluation of Luke AFB Bombing and Gunnery Range, Lechuguilla Desert, Arizona. Data includes Rock Descriptions, Geologic Cross Sections, Microrelief Profiles and physical Properties description.		



APPENDIX B

B.1 ROCK DESCRIPTIONS

Rocks were classified according to the Colorado School of Mines classification system (Travis, 1955). Descriptions of the major rock types in Lechuguilla Desert (Section 4.5) derived from macro- and microscopic examination of hand specimens are as follows (petrographic terminology after Williams and others, 1954):

B.1.1 INTRUSIVE IGNEOUS ROCK (I1)

Quartz monzonite, fine to medium grained with ten to 20 percent dark colored minerals, holocrystalline texture composed of euhedral to subhedral crystals. The Predominant mineral assemblage consists of plagioclase (9 to 36 percent), potash feldspar (26 to 50 percent), and quartz (27 to 39 percent). Accessory minerals include biotite, epidote, pyroxene, hornblende, and apatite. This rock ranges in composition from quartz monzonite to granite; is fresh to highly altered along structures, and copper mineralization is common along faults, joints, and dikes.

Available data (Wilson, 1933) and field data indicate that two joint sets cut both the igneous and metamorphic rocks. These joints strike generally N10W to N30W and north-south to N40E. Dips vary greatly, but most are near vertical (Tables B-2 and B-3). Some of the joints observed in the field do not fall within these general ranges, but strike generally east-west and dip moderately to steeply to the north or south. These may represent a third, less well developed joint system.

B.1.2 EXTRUSIVE IGNEOUS ROCK (I2)

Extrusive igneous rock does not crop out within the study area. However, olivine basalt/andesite was encountered in borings LD-C-5 and LD-D-2 at 255 feet (78 m) and 850 feet (250 m) respectively. Descriptions of these rocks are as follow:

LD-D-2: Generally fresh to moderately weathered, holohyaline, intersertal texture with interstices between grains filled with crystallites and cryptocrystalline material. Dark gray to black on fresh surface (color index approximately 90-95). Fine grained microcrystalline groundmass with large areas of brown glass in an advanced stage of devitrification. Predominant mineralogy is plagioclase, olivine, glass, and opaque oxide with accessory pyroxene and apatite.

LD-D-5: Moderately to very weathered, holohyaline, trachytic texture, light gray (color index approximately 70-75). Euhedral phenocrysts of olivine typically altered to red iddingsite. Abundant equigranular augite and plagioclase laths in a very fine-grained groundmass. Calcite fills cracks and small vesicles. Equidimensional to slightly lath shaped anhedral opaque oxide and olivine in the matrix. Predominant mineralogy is plagioclase, olivine, pyroxene, and opaque oxide with accessory apatite.

B.1.3 METAMORPHIC ROCKS (M)

Quartz biotite gneiss - gray to dark gray (color index 35-70), medium to coarse grained, well developed gneissic structure. Generally fresh with well developed patina. Predominant mineralogy consists of potassium feldspar (microcline B-2

and orthoclase), quartz, and plagioclase. Contains locally abundant hornblende, biotite, pyroxene and/or epidote. Numerous intrusions of pegmatite and aplite dikes composed predominantly of microcline and quartz with accessory garnet and chrysocholla.

Quartz-biotite schist - This rock is distinguished predominantly by its parallel orientation of lamellar mafic minerals (chiefly biotite). Pegmatite and aplite dikes are notably less abundant in the schist than in the gneiss.

In the Gila Mountains and Wellton Hills, foliation in the metamorphic rock varies greatly due to faulting. However, in the northern Copper Mountains, the strike of the foliation ranges from N65W to NS, and dips from 30 degrees NE to 20 degrees E.

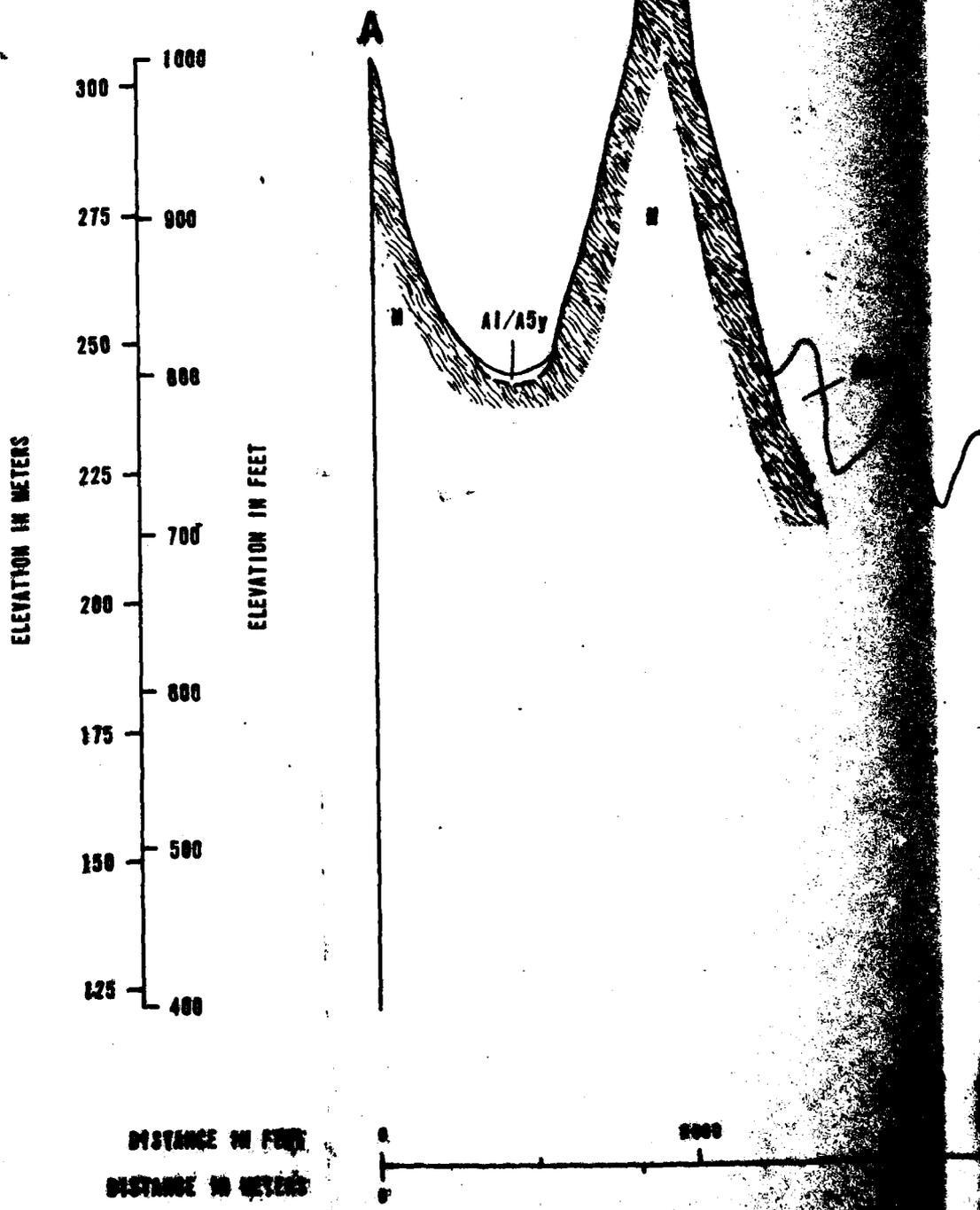
B.1.4 SEDIMENTARY ROCKS (S)

Granite-gneiss boulder conglomerate - Dark gray brown, poorly to non-stratified, subangular to rounded granite, gneiss and quartz monzonite cobbles and boulders in a matrix of light brown to red arkosic sandstone with generally indistinct bedding. Moderately to strongly cemented with silica and/or iron oxide, commonly exhibits cavernous weathering (Tafoni) and imbricate structure of platy cobbles and boulders.

Arkosic sandstone - Clastic texture, grayish brown to reddish brown, fine- to coarse-grained. Typically poorly to well defined bedding consisting mainly of angular to subangular grains with subangular to rounded cobbles and boulders of metamorphic (M) and igneous (I1) rock.

Predominant mineralogy is quartz, potash feldspar, plagioclase, and biotite with accessory magnetite, muscovite, and pyroxene. Biotite and feldspar are largely altered to clay. Calcite and clays are the predominant matrix minerals. Jointing is very poorly developed in the sedimentary rocks.

GILA MOUNTAINS



N 30. E



A5ec

A5ec

SECTION 27
SECTION

LD-9-73

LD-9-18
(PROJECTED)

A5ec ELDER BASIN P.M.

12-100-2'
(43.30)

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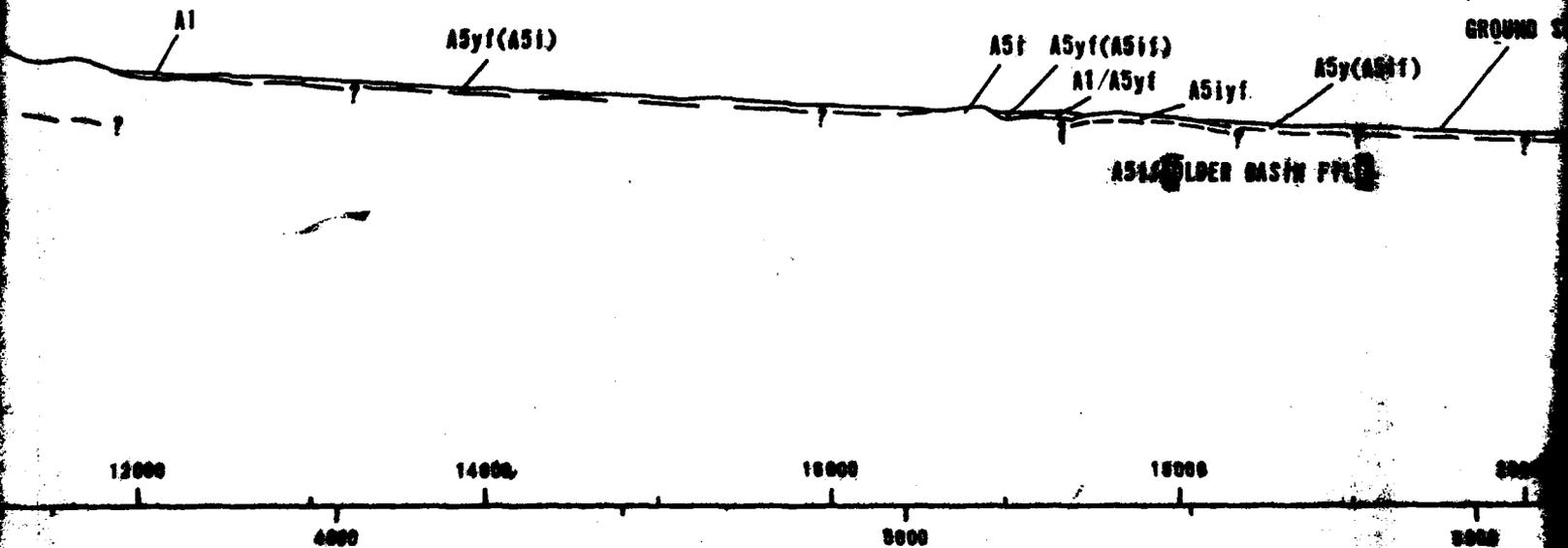
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GEOLOGIC CROSS SECTION LD-CS-AA'

N 70 E



N 75 E

GROUND SURFACE

A5yf(A5if)

A5yf(A5if)

BEND IN
SECTION
LD-C-2

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A54 [LBER BASTN FIL]

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22000

24000

26000

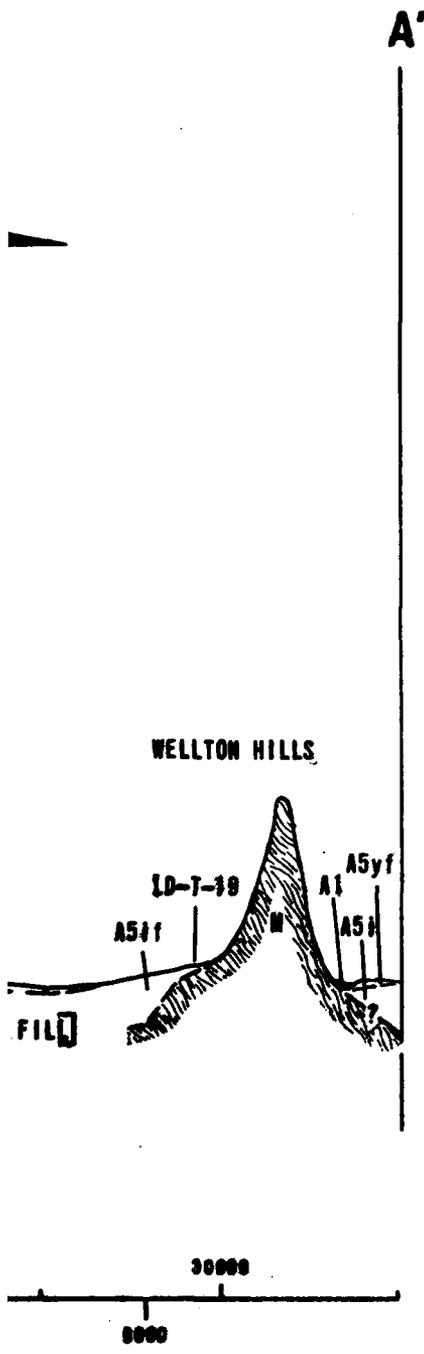
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2000

79 300.4'
(20. 30)

4



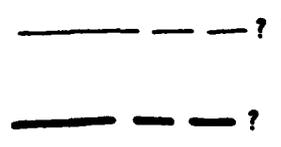
SURFICIAL B

- A1 S
- A2 T
- A3d E
- A3s E
- A5y Y
- A5yf F
- A5iy I
- A5iyf F
- A5iyc C
- A5i I
- A5if F
- A5ic C
- A5oc C

ROCK UNITS

- I1 I
- I2 I
- M M
- S S

SYMBOLS



- LD-S-1
- LD-A, B, C or D-1
- LD-T-1
- []

For complete descr

5

EXPLANATION

ARTIFICIAL BASIN-FILL UNITS

- Stream channel deposits
- Terrace deposits
- Eolian sand dune deposits
- Eolian sheet sand deposits
- Younger alluvial fan deposits
- Finer-grained A5y
- Intermediate-younger alluvial fan deposits
- Finer-grained A5iy
- Coarser-grained A5iy
- Intermediate alluvial fan deposits
- Finer-grained A5i
- Coarser-grained A5i
- Coarser-grained older alluvial fan deposits

ROCK UNITS

- Igneous, intrusive
- Igneous, extrusive
- Metamorphic
- Sedimentary

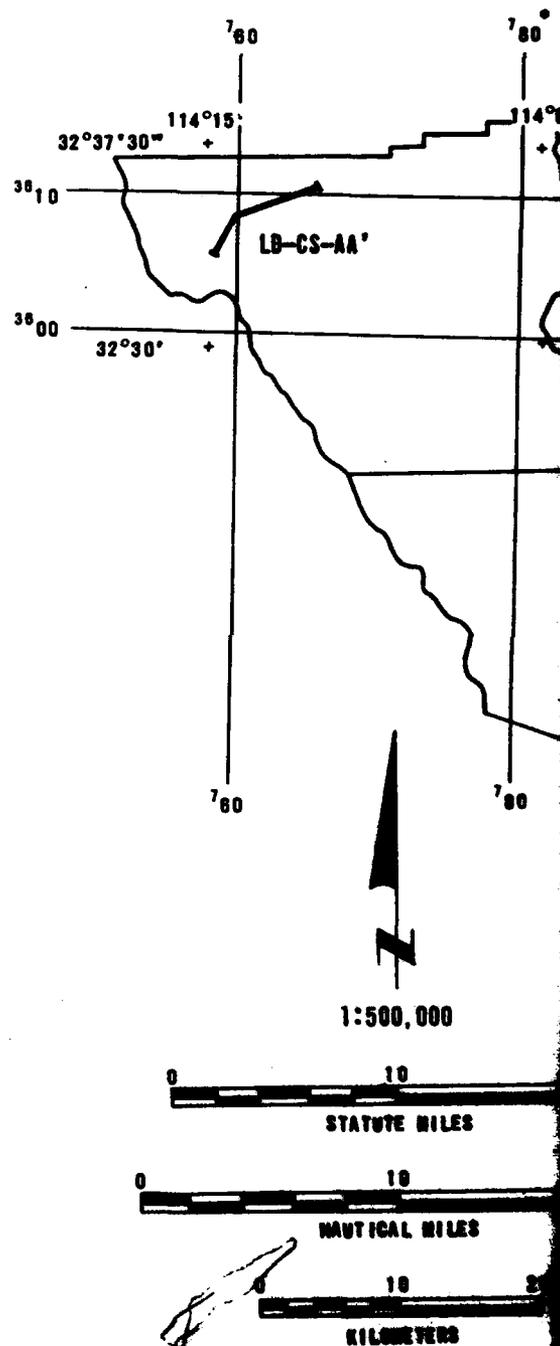
SYMBOLS

- ? Geologic contact; dashed where approximate, queried where extrapolated
- ? Fault; dashed where approximate, queried where extrapolated
- Seismic line (See Appendix A)
- Boring (See Appendix C)
- Trench (See Appendix C)
- Brackets denote underlying unit of unknown depth

description of geologic units, see Drawing 2.

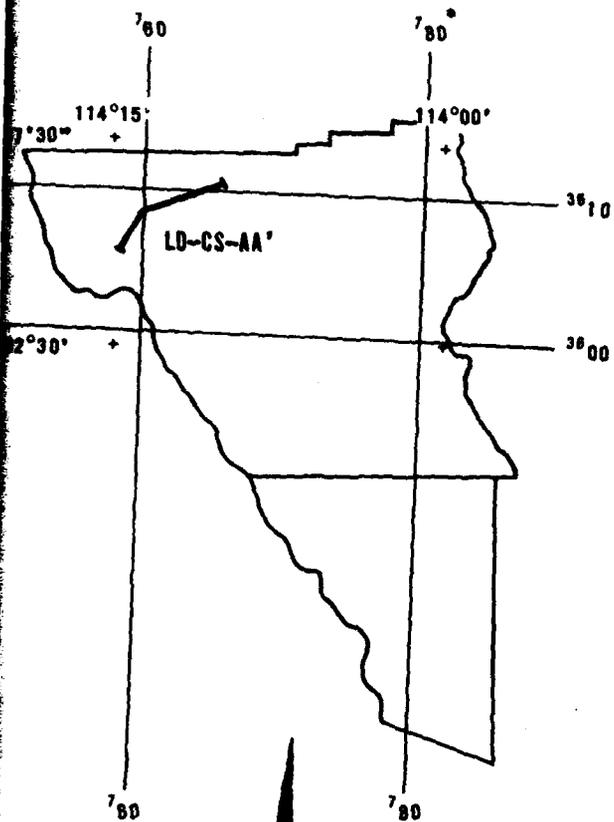
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LOCATION MAP

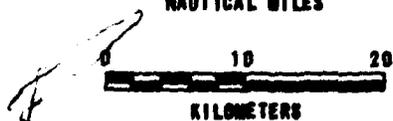


NOTE: See Drawing 2 and 3 for details of geologic units and symbols.

LOCATION MAP



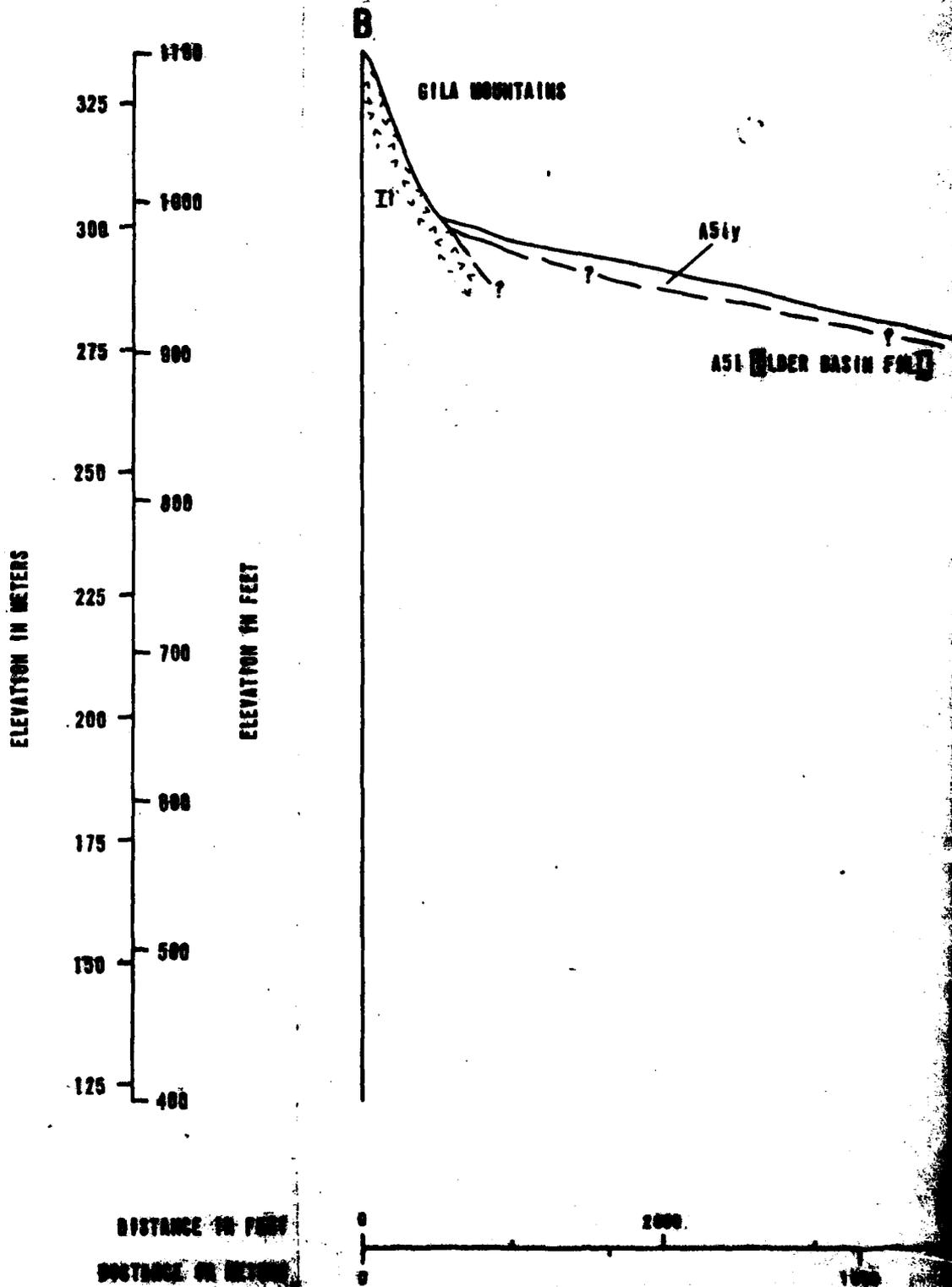
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NOTE: See Appendix page C-5 for explanation of Universal Transverse Mercator Grid System.

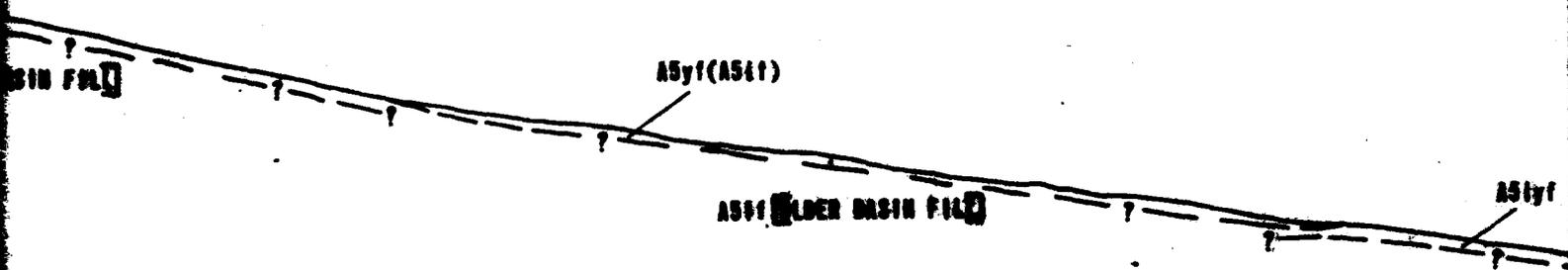
GEOLOGIC CROSS SECTION LD-CS-AA' LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMS	FIGURE 2-1

PS-72-40

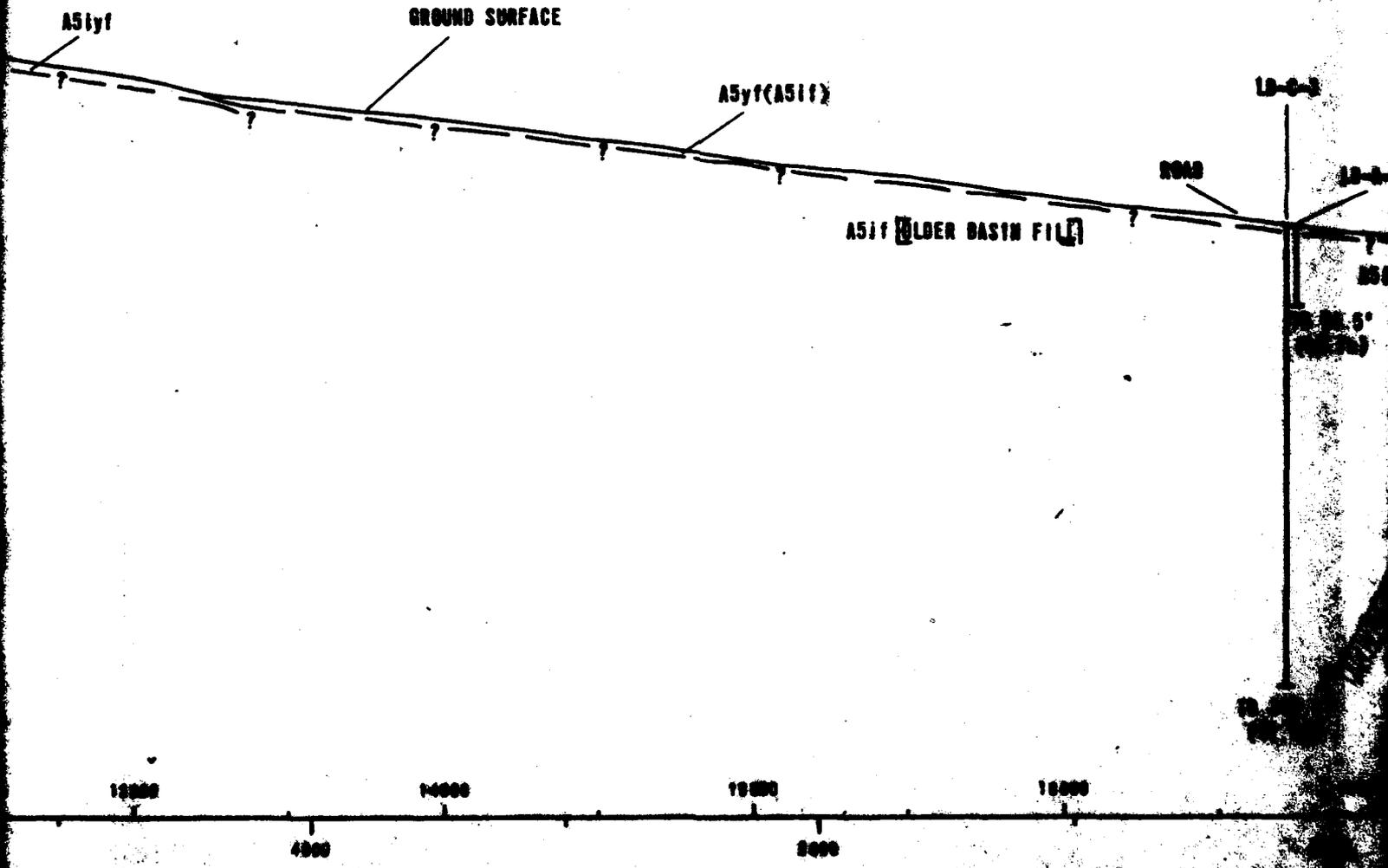


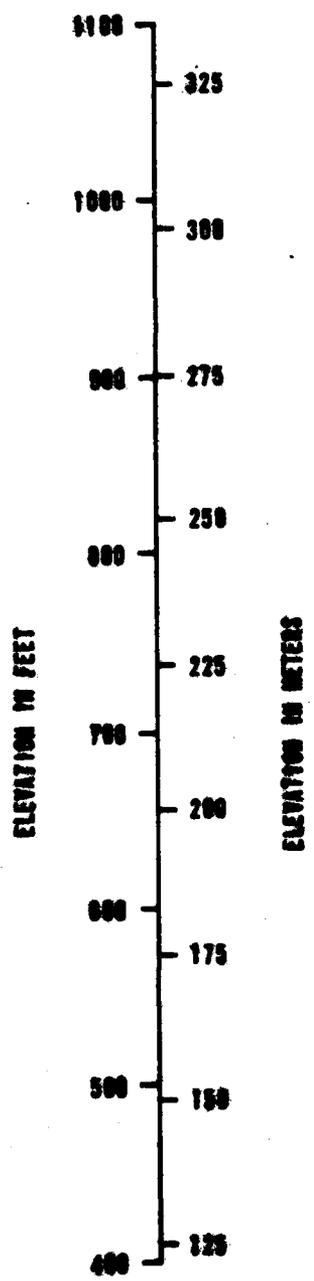
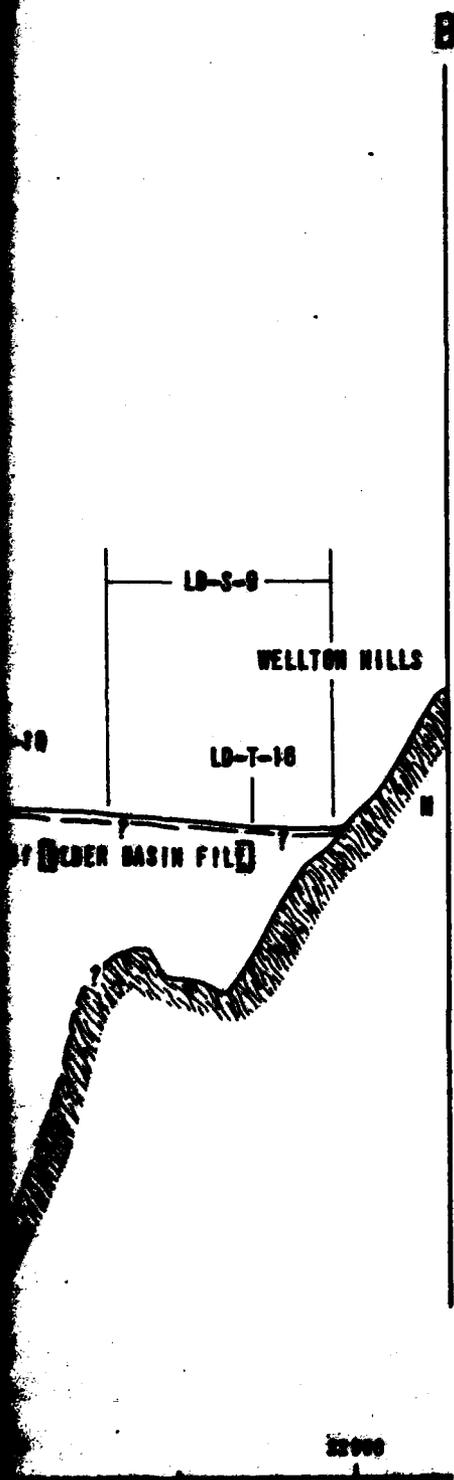
GEOLOGIC CROSS SECTION

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SECTION LB-CS-BB





SURFICIAL DEPOSITS

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- Co
- Int
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- Co
- Co

ROCK UNITS

- Z1
- Z2
- H
- S

SYMBOLS

- ?
- ?

LD-S-8
 LD-T-18
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 For []

EXPLANATION

AL BASSIN-FILL UNITS

- Stream channel deposits
- Terrace deposits
- Eolian sand dune deposits
- Eolian sheet sand deposits
- Younger alluvial fan deposits
- Finer-grained A5y
- Intermediate-younger alluvial fan deposits
- Finer-grained A5iy
- Coarser-grained A5iy
- Intermediate alluvial fan deposits
- Finer-grained A5i
- Coarser-grained A5i
- Coarser-grained older alluvial fan deposits

UNITS

- Igneous, intrusive
- Igneous, extrusive
- Metamorphic
- Sedimentary

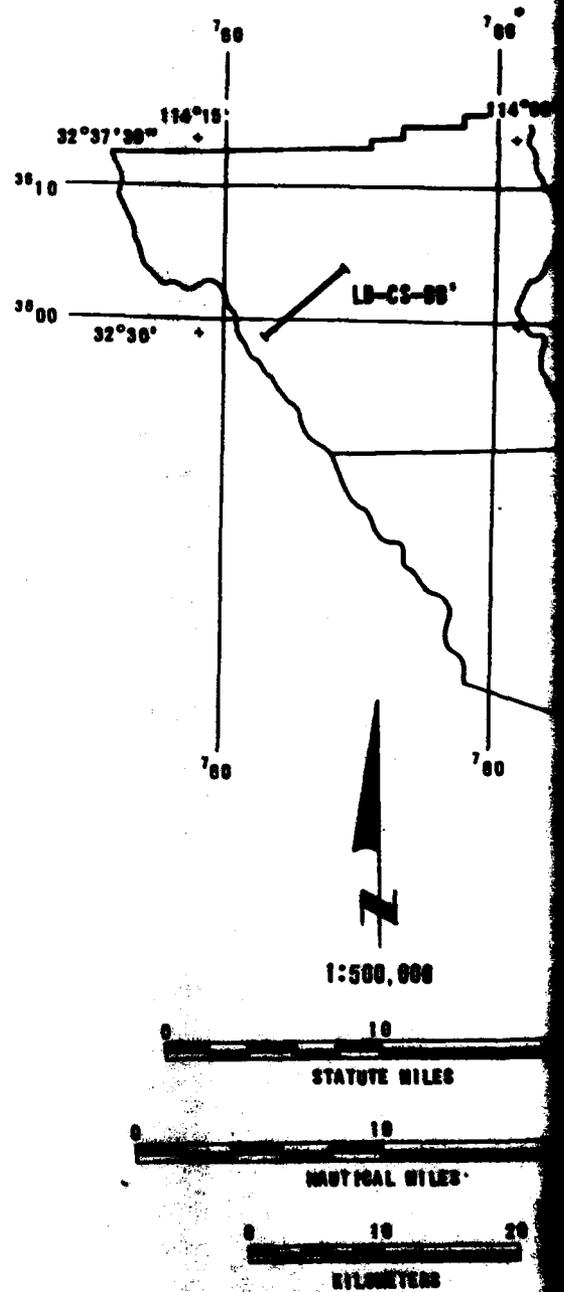
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- ? Geologic contact; dashed where approximate, queried where extrapolated
- ? Fault; dashed where approximate, queried where extrapolated
- Seismic line (See Appendix A)
- Boring (See Appendix C)
- Trench (See Appendix C)
- Brackets denote underlying unit of unknown depth

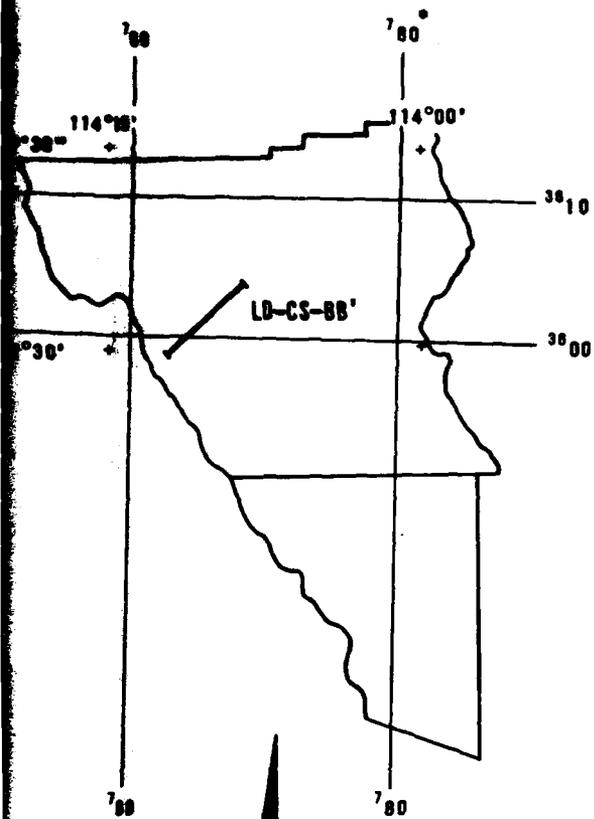
Description of geologic units, see Drawing 2.

VERTICAL EXAGGERATION: 10X

LOCATION MAP



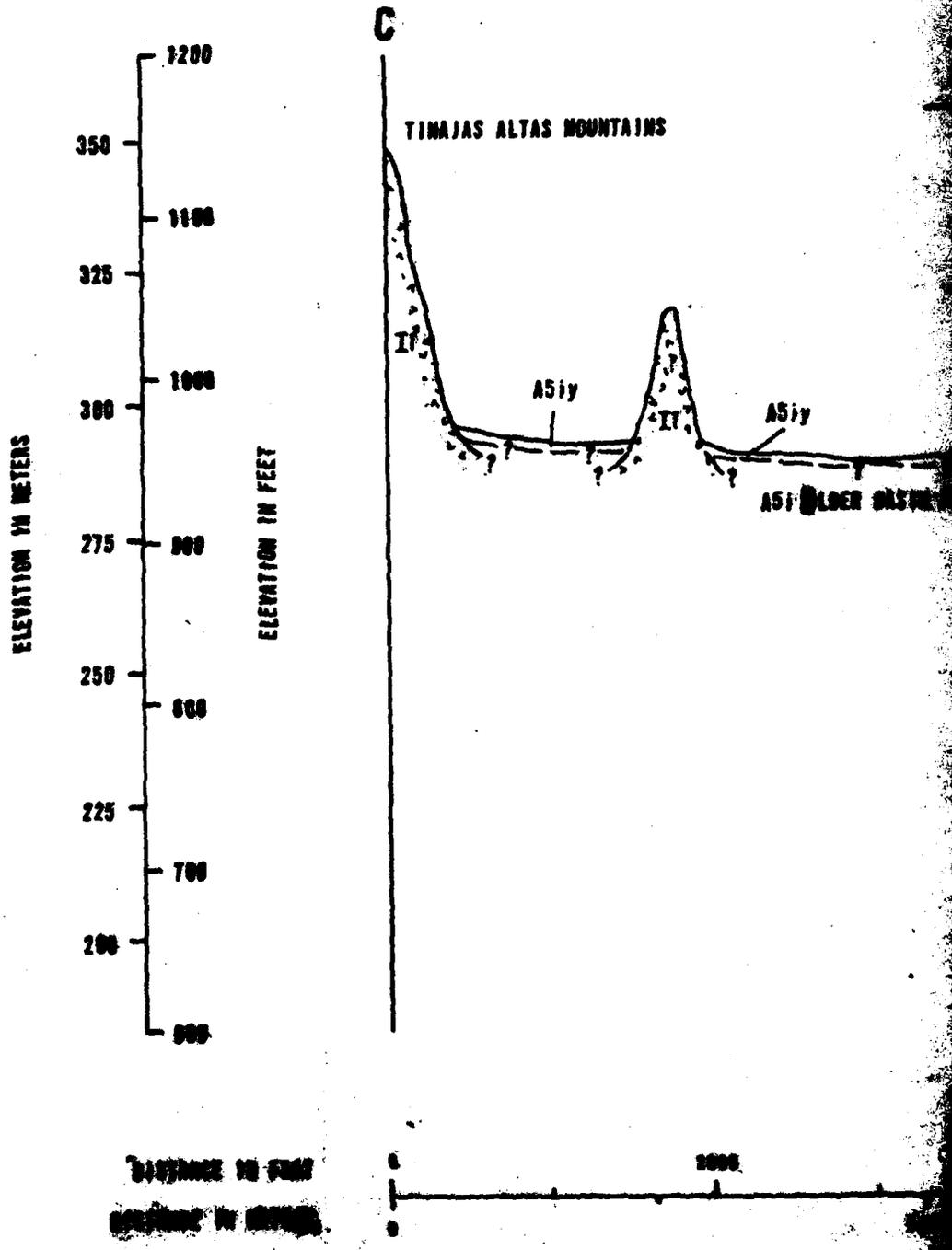
LOCATION MAP



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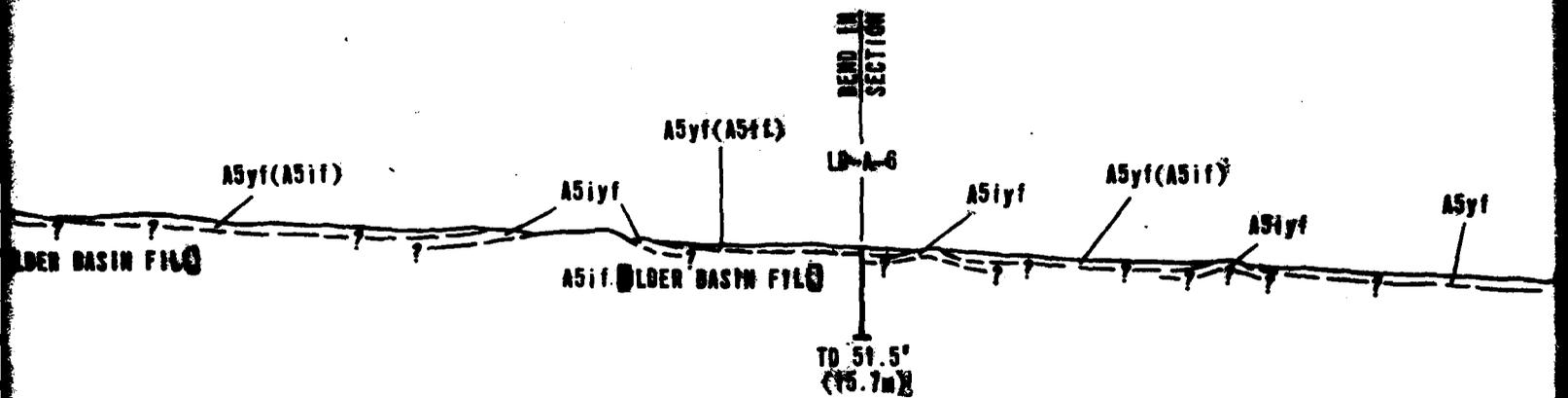
GEOLOGIC CROSS SECTION LD-CS-88' LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAABD	FIGURE 2



GEOLOGIC CROSS SECTION LD-86-0C

DUE E

S 8



EXPLANATION

SURFICIAL BASIN-FILL UNITS

A1	Stream channel deposits
A2	Terrace deposits
A3d	Eolian sand dune deposits
A3s	Eolian sheet sand deposits
A5y	Younger alluvial fan deposits
A5yf	Finer-grained A5y
A5iy	Intermediate-younger alluvial fan deposits
A5iyf	Finer-grained A5iy
A5iyc	Coarser-grained A5iy
A5i	Intermediate alluvial fan deposits
A5if	Finer-grained A5i
A5ic	Coarser-grained A5i
A5oc	Coarser-grained older alluvial fan deposits

ROCK UNITS

I1	Igneous, intrusive
I2	Igneous, extrusive
M	Metamorphic
S	Sedimentary

SYMBOLS

— — — ? Geologic contact; dashed where approximate, queried where extrapolated

— — — ? Fault; dashed where approximate, queried where extrapolated

LD-S-1 Seismic line (See Appendix A)

LD-A, B, C or D-1 Boring (See Appendix C)

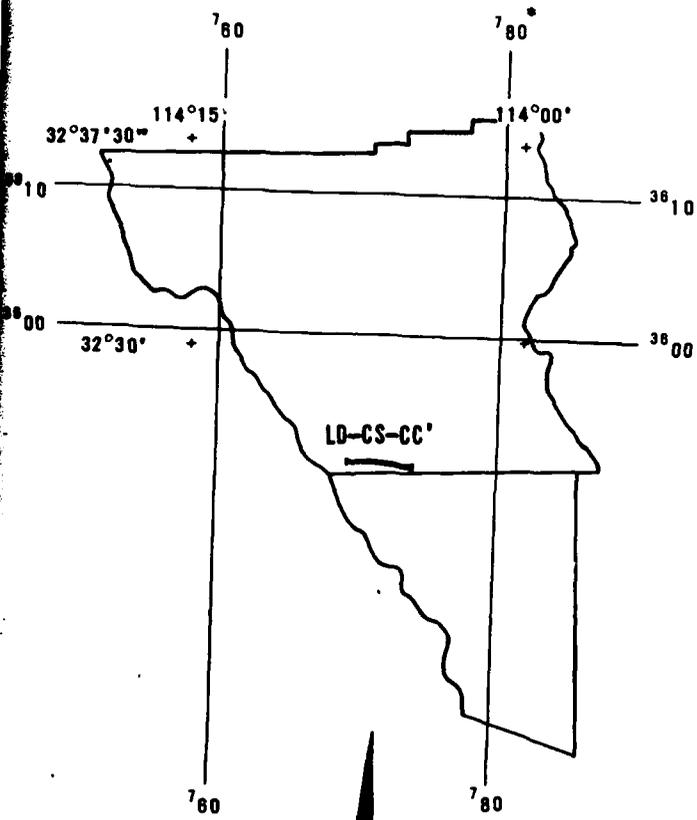
LD-T-1 Trench (See Appendix C)

[] Brackets denote underlying unit of unknown depth

For complete description of geologic units, see Drawing 2.

VERTICAL EXAGGERATION: 10X

LOCATION MAP



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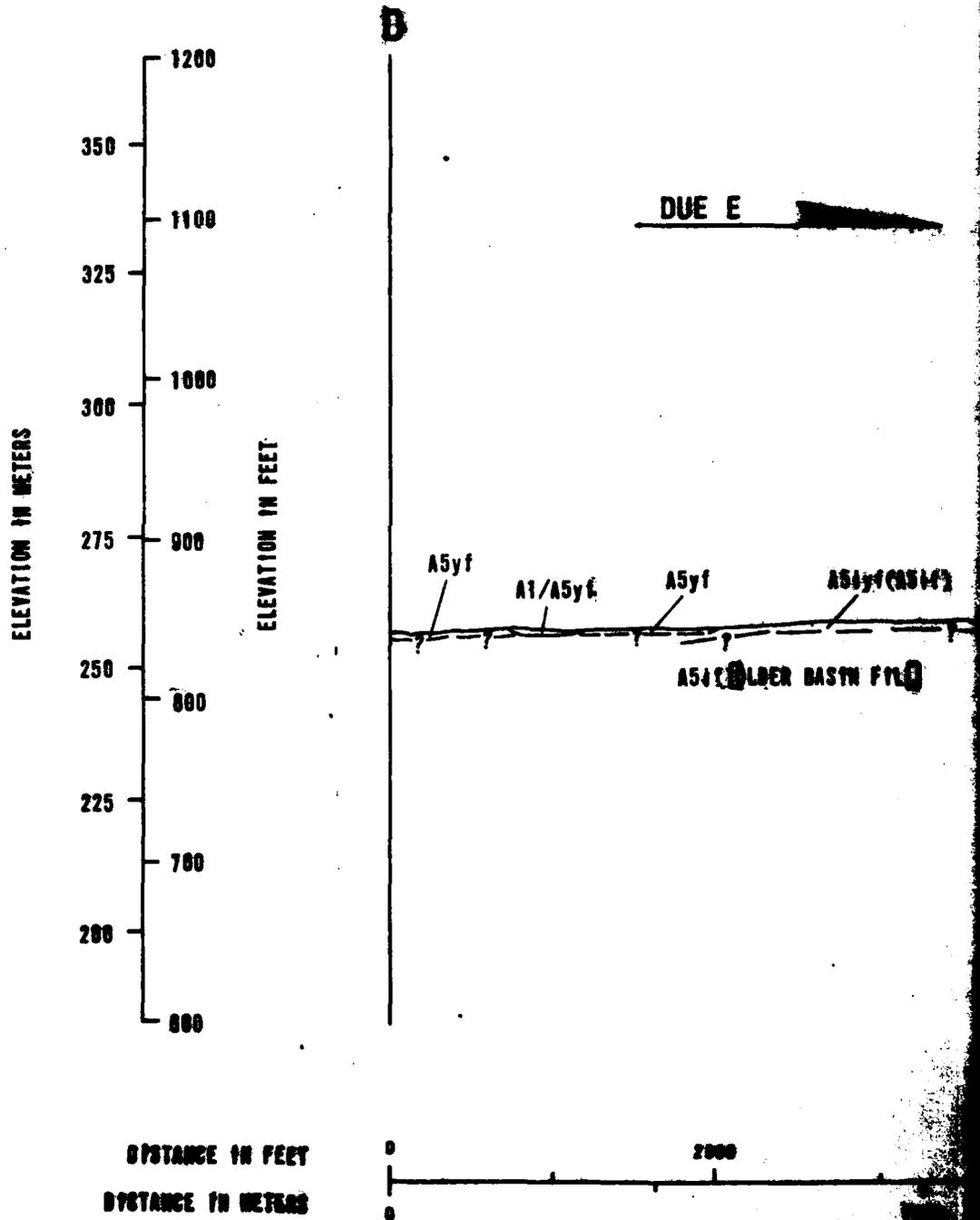
**GEOLOGIC CROSS SECTION
LD-CS-CC'
LECHUGUILLA DESERT, ARIZONA**

MX SITING INVESTIGATION
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*NOTE: See Appendix page C-5 for explanation of Universal Transverse Mercator Grid System.

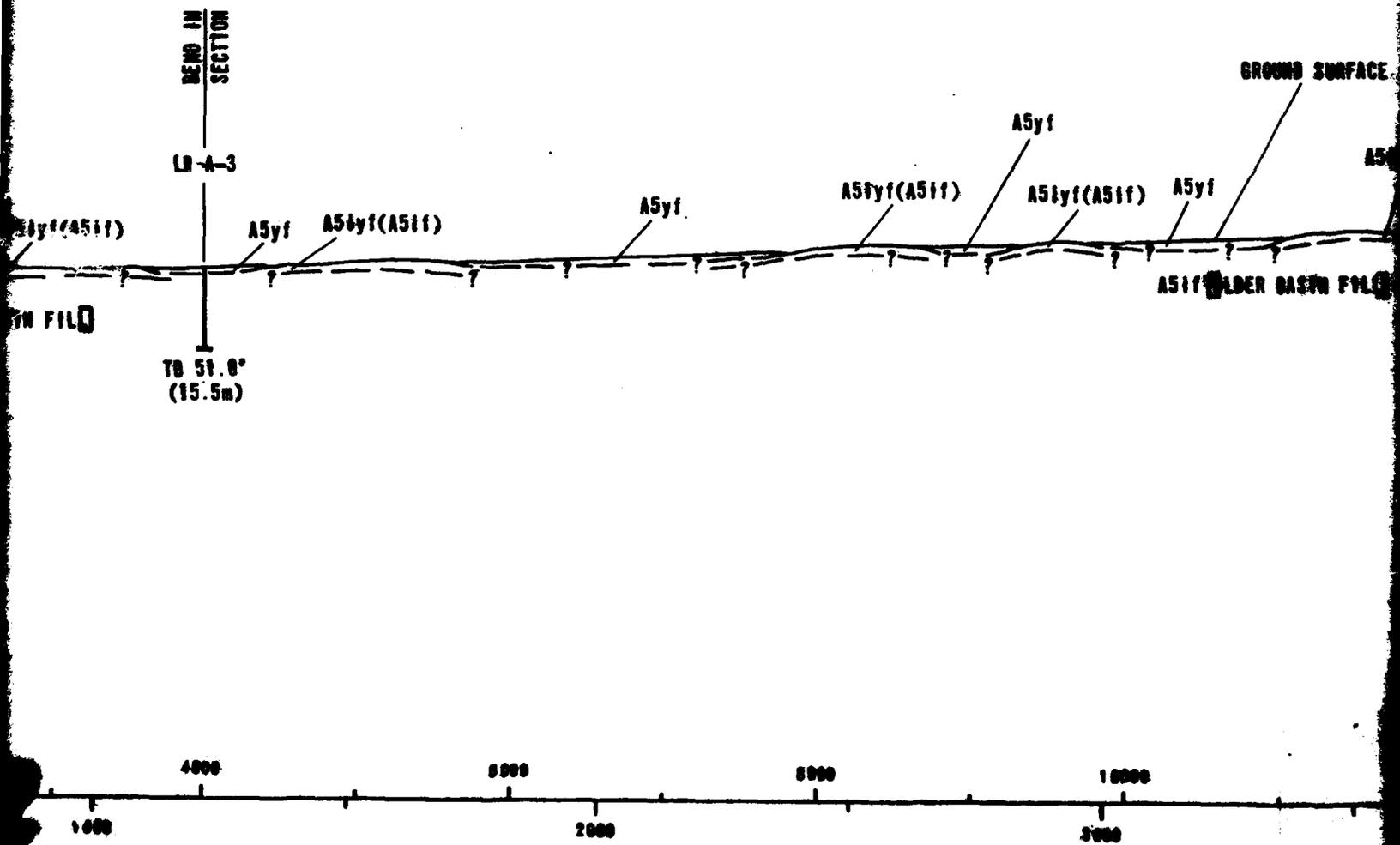
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GEOLOGIC CROSS SECTION LB-C

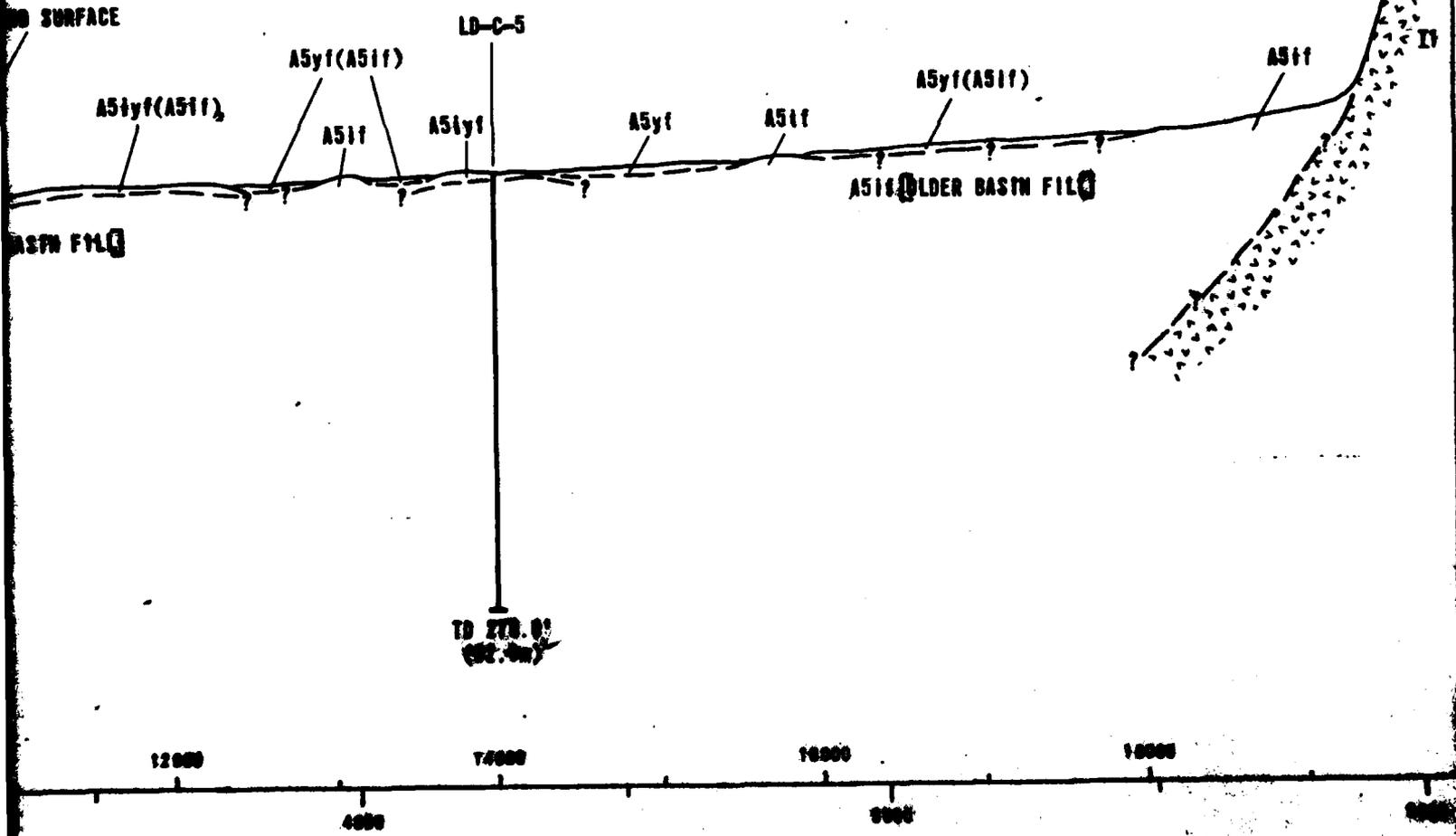
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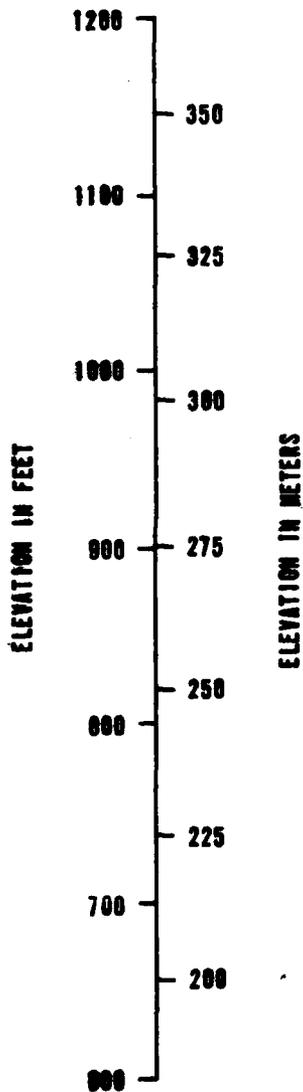
LD-CS-00'

N 80 E

COPPER MOUNTAINS



3



EXPLANATION

SURFICIAL BASIN-FILL UNITS

A1	Stream channel deposits
A2	Terrace deposits
A3d	Eolian sand dune deposits
A3s	Eolian sheet sand deposits
A5y	Younger alluvial fan deposits
A5yf	Finer-grained A5y
A5iy	Intermediate-younger alluvial
A5iyf	Finer-grained A5iy
A5iyc	Coarser-grained A5iy
A5i	Intermediate alluvial fan depos
A5if	Finer-grained A5i
A5ic	Coarser-grained A5i
A5oc	Coarser-grained older alluvial

ROCK UNITS

I1	Igneous, intrusive
I2	Igneous, extrusive
M	Metamorphic
S	Sedimentary

SYMBOLS

— — — ?	Geologic contact; dashed where queried where extrapolated
— — — ?	Fault; dashed where approximated queried where extrapolated

LD-S-1 Seismic line (See Appendix A)

LD-A, B, C or D-1 Boring (See Appendix C)

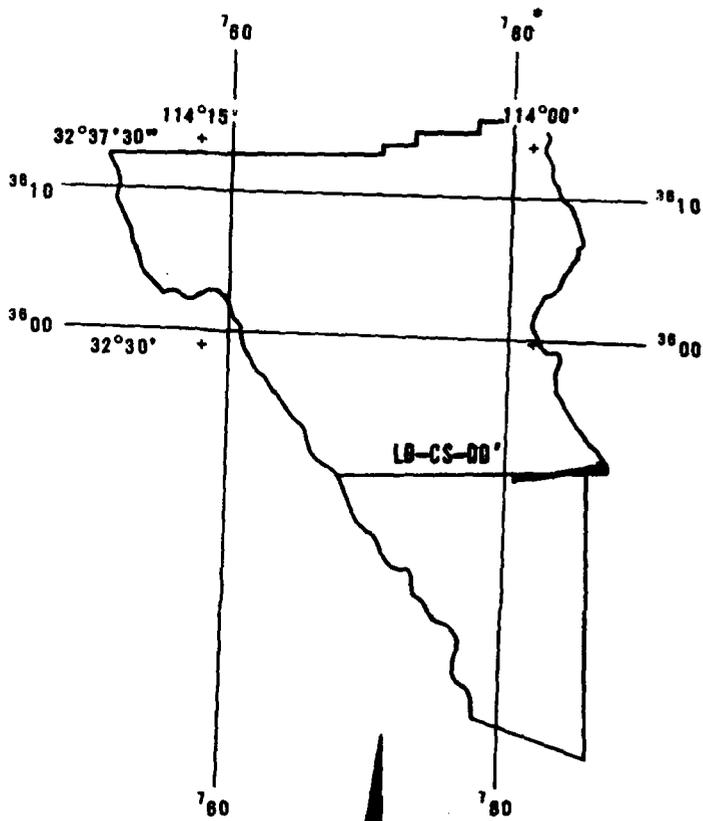
LD-T-1 Trench (See Appendix C)

[] Brackets denote underlying unit

For complete description of geologic units, see

VERTICAL EXAGGERATION: 10X

LOCATION MAP



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NOTE: See Appendix page G-3 for explanation of United States Transverse Mercator Grid System.

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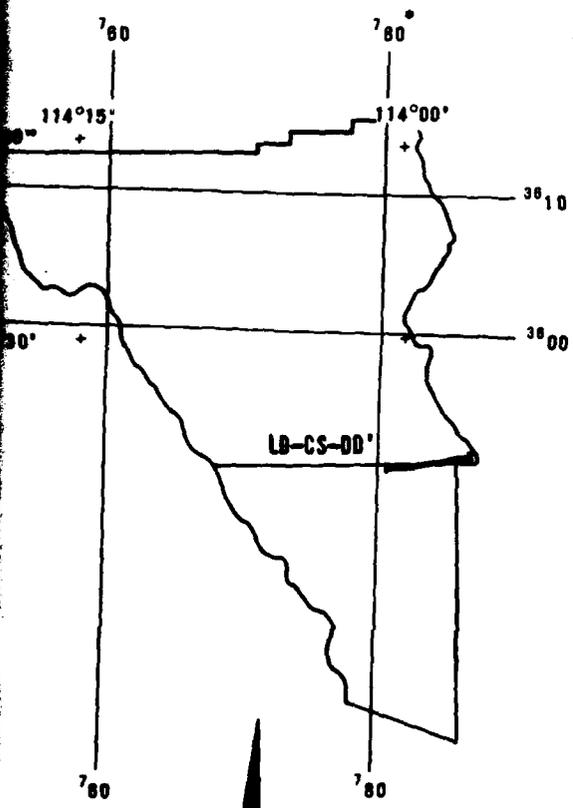
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LOCATION MAP

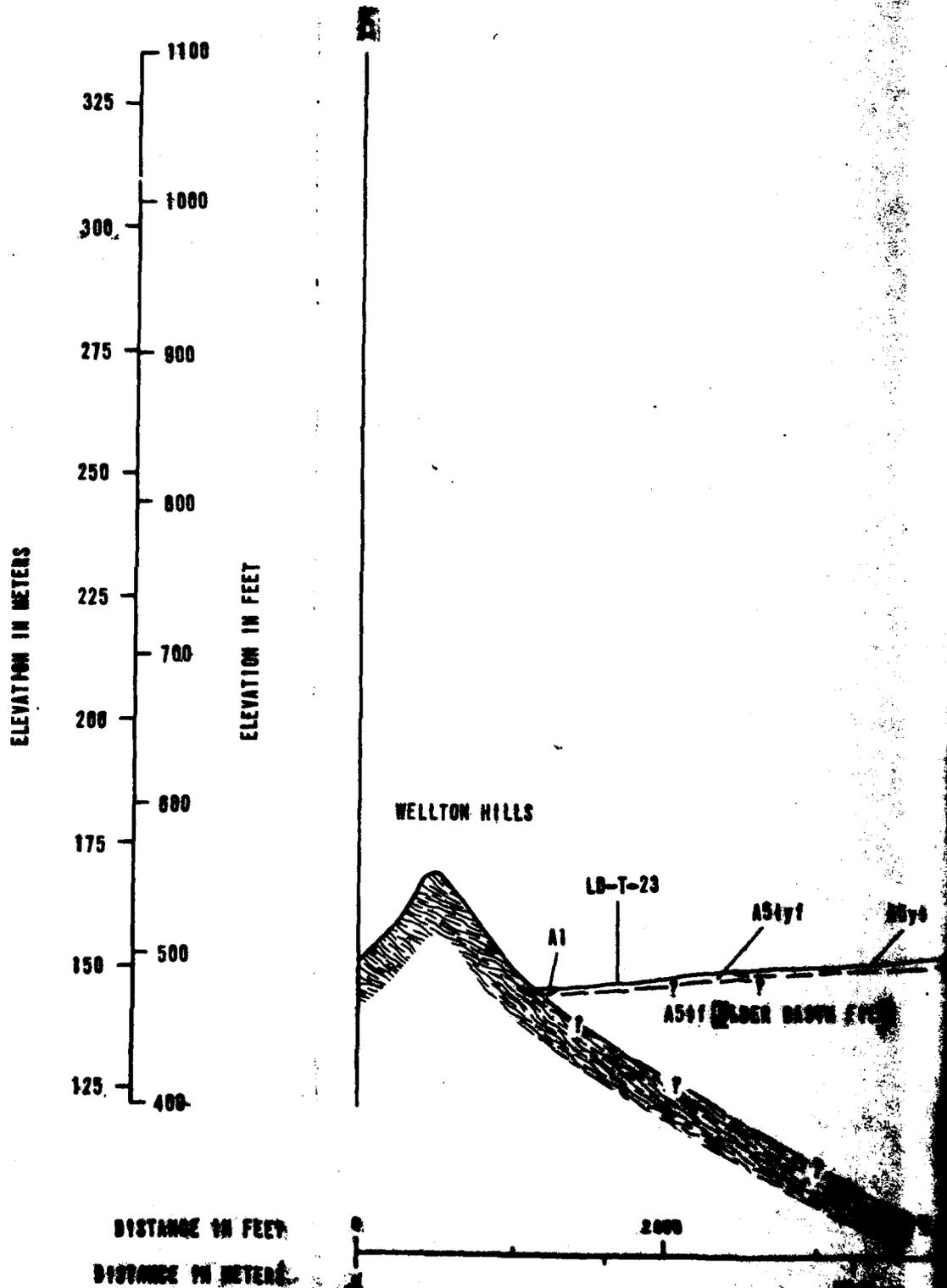


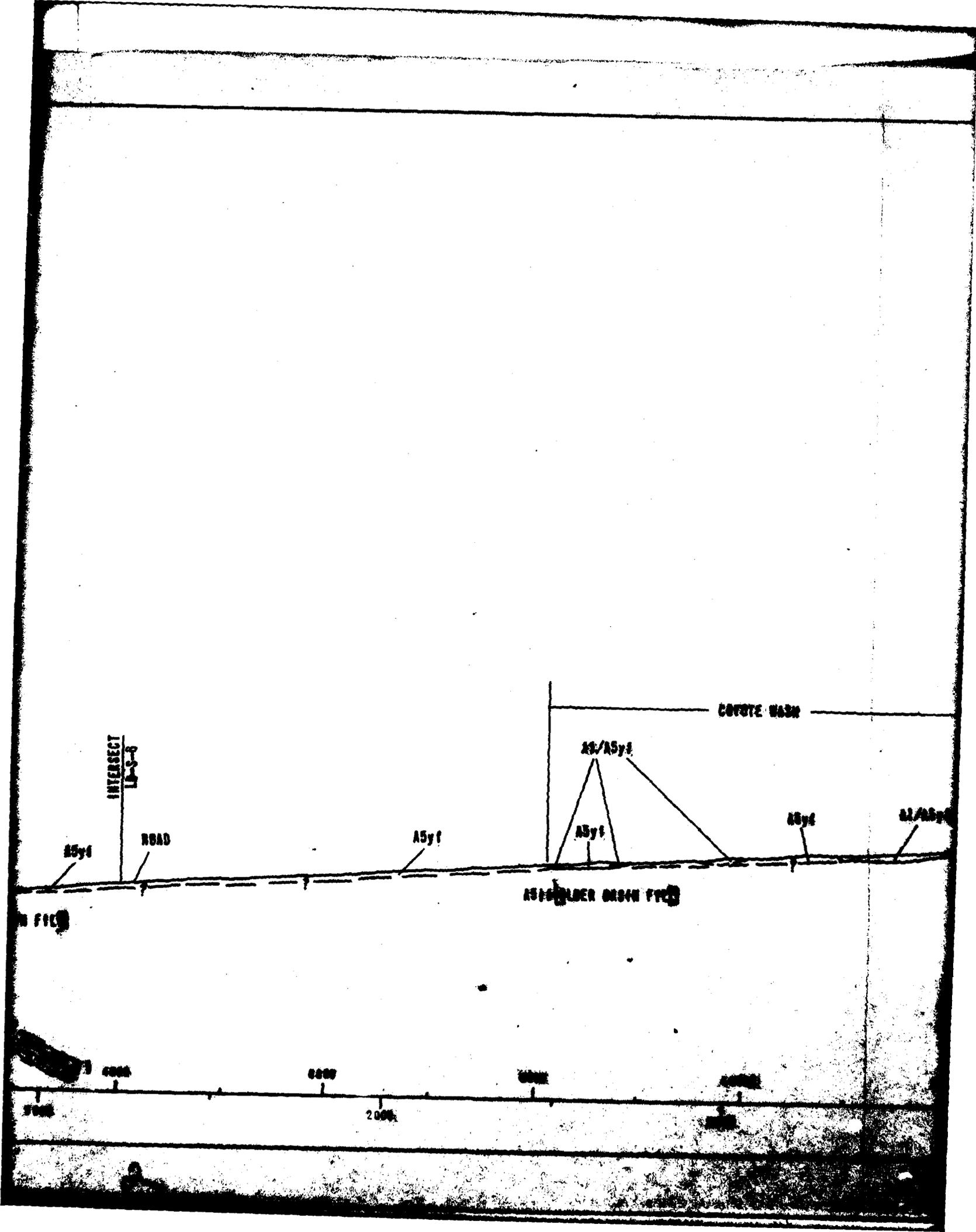
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GEOLOGIC CROSS SECTION LB-CS-00' LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	FLOOR 04

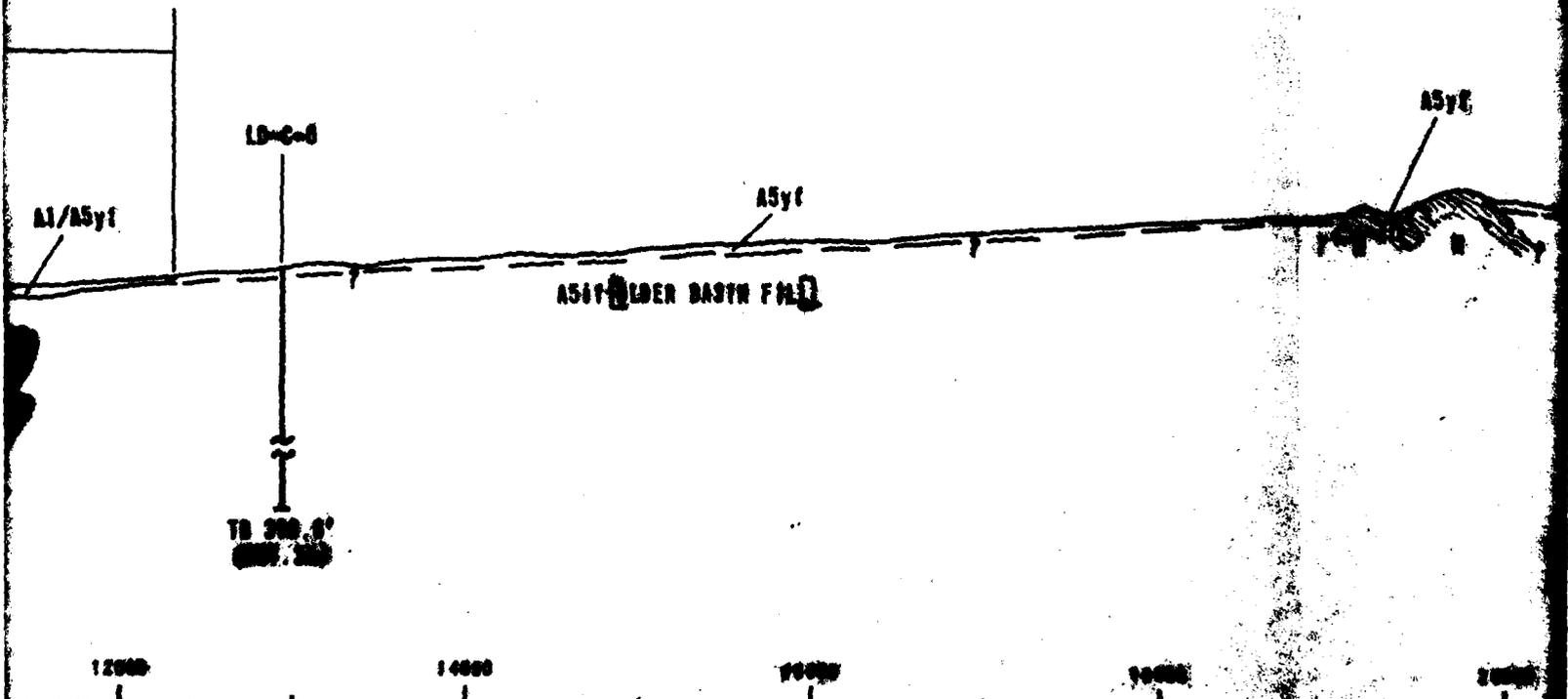
See Appendix page C-5 for explanation Universal Transverse Mercator Grid System.





WELLS CROSS SECTION LD-27-02

S 50 E



GROUND SURFACE

A3yf

A511 (ELDER BASIN FIL)

A512 (ELDER BASIN)

22000

24000

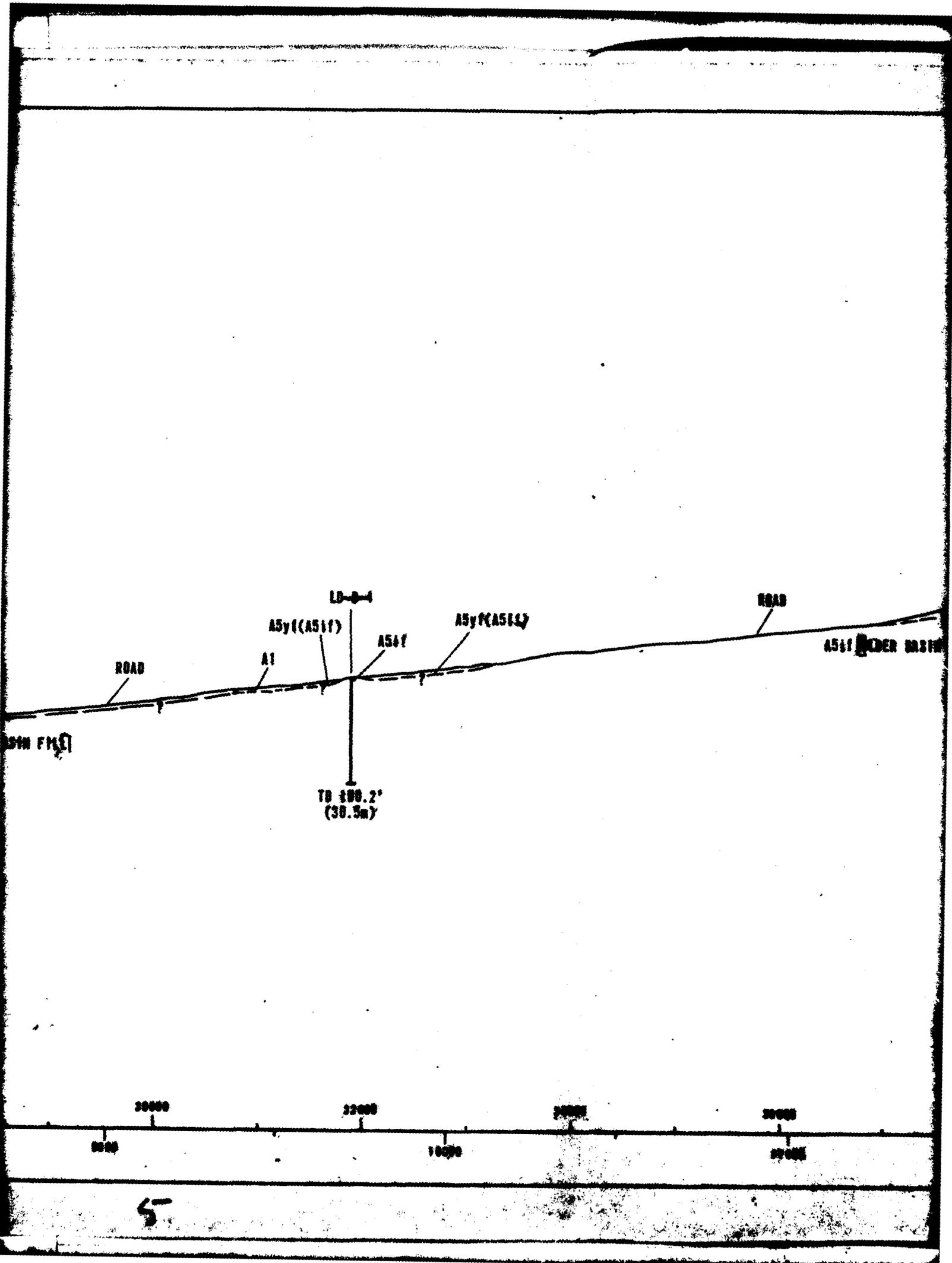
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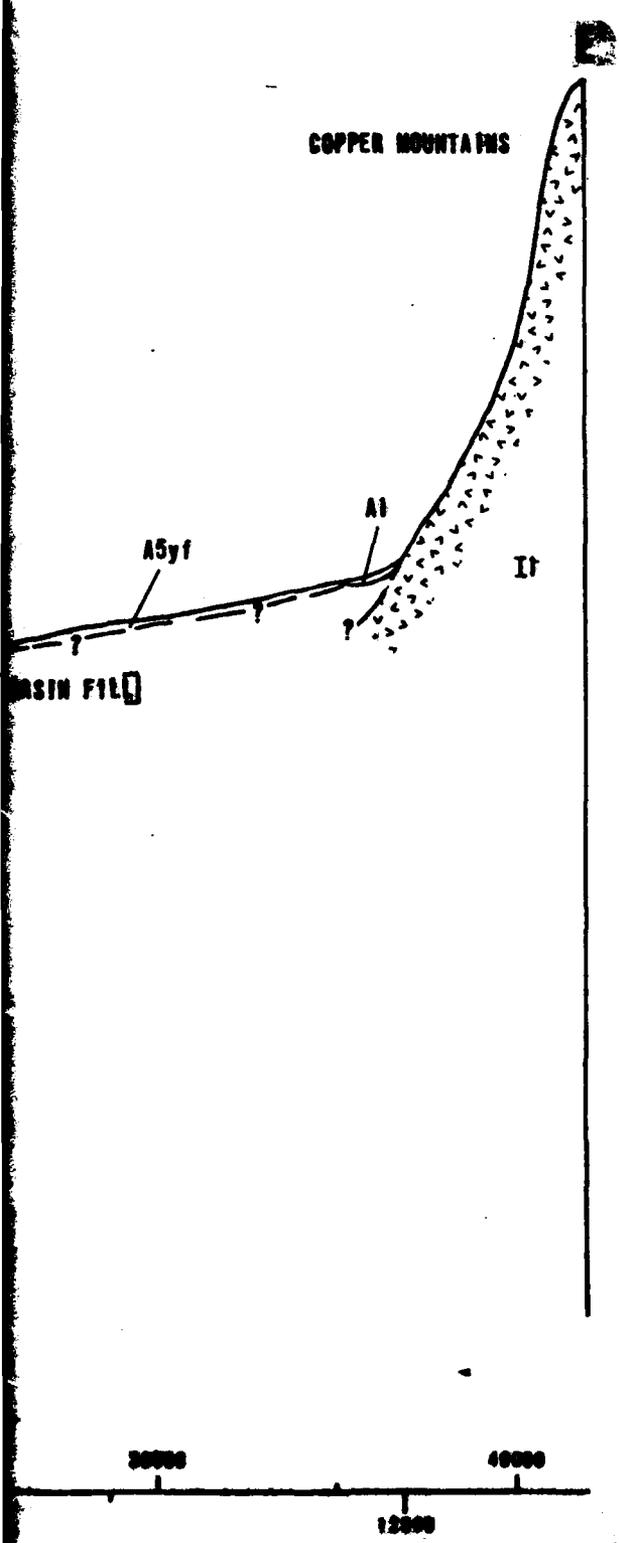
23000

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4





SURFACE

- A1
- A2
- A3d
- A3s
- A5y
- A5yf
- A5iy
- A5iyf
- A5iyc
- A5i
- A5if
- A5ic
- A5oc

ROCK

- I1
- I2
- N
- S

SYMBOLS

- — — — —
- — — — —
- LD-S-1
- LD-A, B, C or D-1
- LD-T-1
- []

For complete

EXPLANATION

SURFICIAL BASIN-FILL UNITS

- A1 Stream channel deposits
- A2 Terrace deposits
- A3d Eolian sand dune deposits
- A3s Eolian sheet sand deposits
- A5y Younger alluvial fan deposits
- A5yf Finer-grained A5y
- A5iy Intermediate-younger alluvial fan deposits
- A5iyf Finer-grained A5iy
- A5iyc Coarser-grained A5iy
- A5i Intermediate alluvial fan deposits
- A5if Finer-grained A5i
- A5ic Coarser-grained A5i
- A5oc Coarser-grained older alluvial fan deposits

ROCK UNITS

- I1 Igneous, intrusive
- I2 Igneous, extrusive
- M Metamorphic
- S Sedimentary

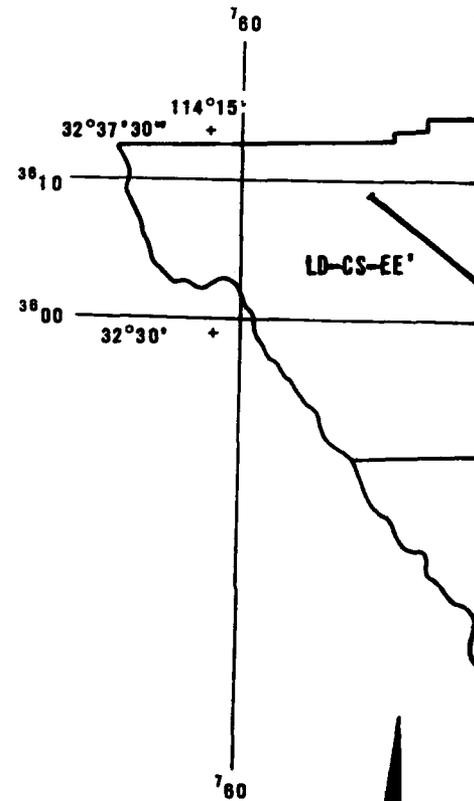
SYMBOLS

- — — ? Geologic contact; dashed where approximate, queried where extrapolated
- — — ? Fault; dashed where approximate, queried where extrapolated
- LD-S-1 Seismic line (See Appendix A)
- or D-1 Boring (See Appendix C)
- LD-T-1 Trench (See Appendix C)
- [] Brackets denote underlying unit of unknown depth

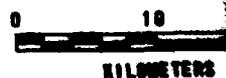
Complete description of geologic units, see Drawing 2.

VERTICAL EXAGGERATION: 10X

LOCATION MAP

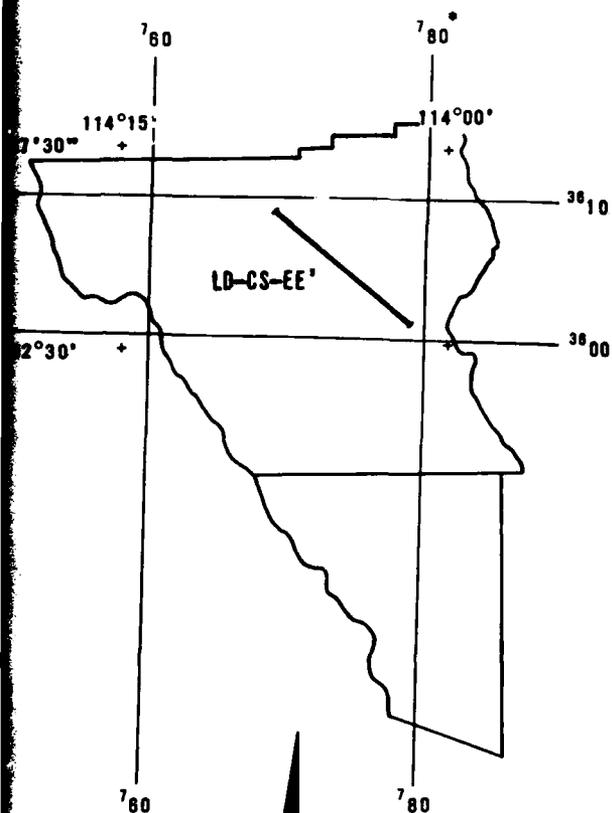


1:500,000



NOTE: See Appendix page C-5 for a
Transverse Mercator Grid

LOCATION MAP



1:500,000



STATUTE MILES



NAUTICAL MILES



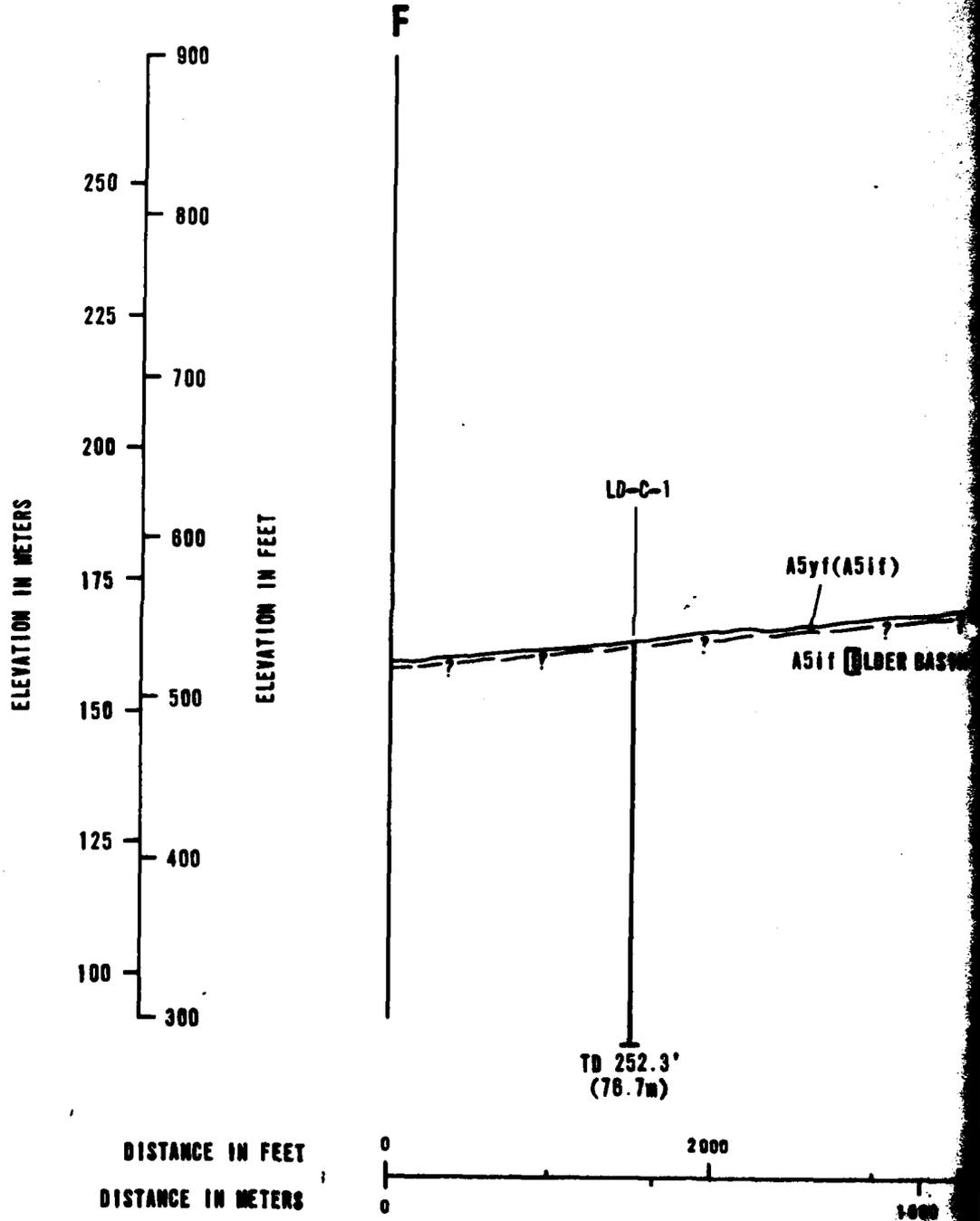
KILOMETERS

GEOLOGIC CROSS SECTION LD-CS-EE' LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	FIGURE B-5

See Appendix page C-5 for explanation of Universal Transverse Mercator Grid System.

FUGRO NATIONAL, INC.

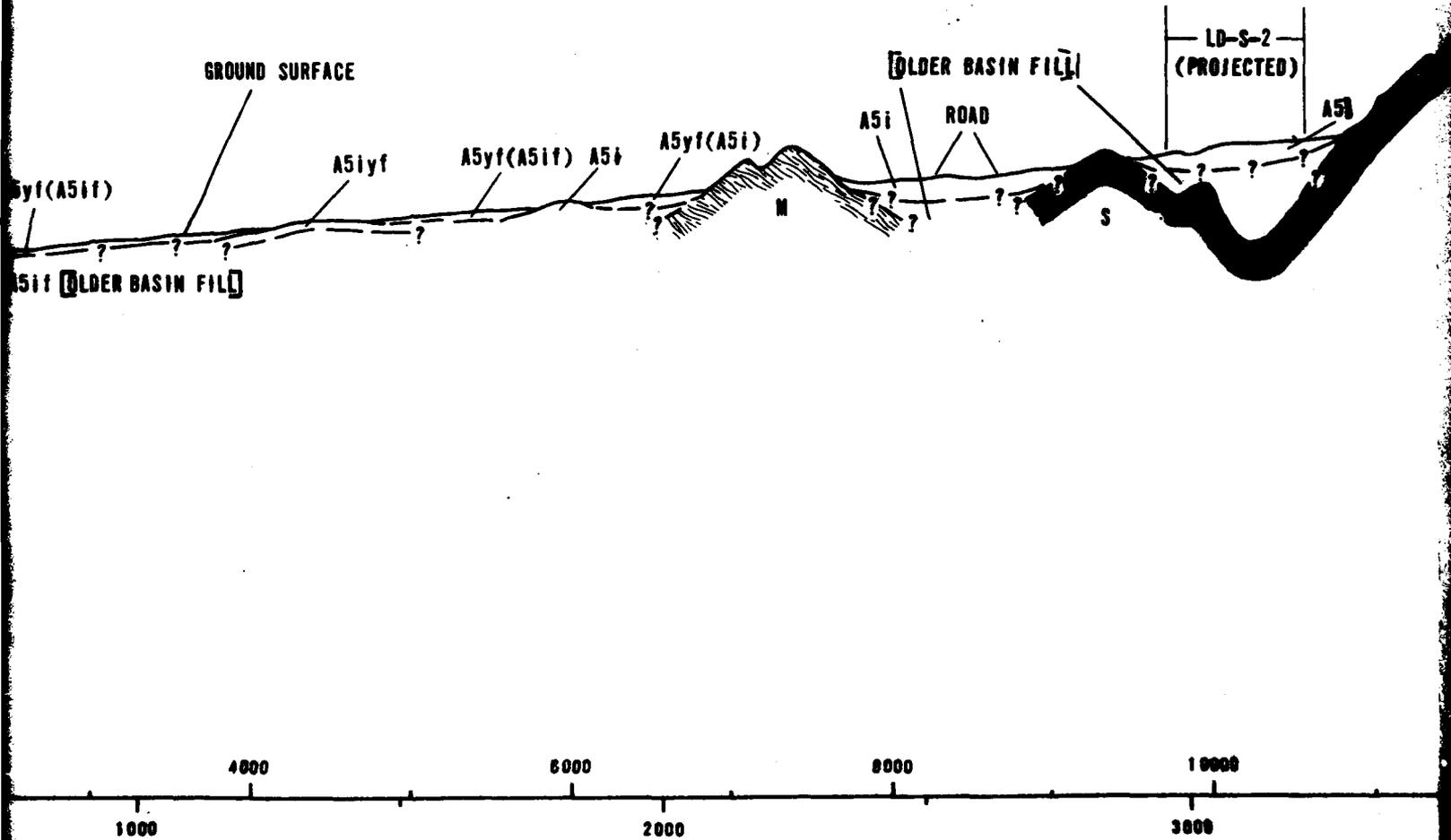
8



GEOLOGIC CROSS SECTION LD-CS-FF'

S 45 E

COPPER MOUNTAIN



EXPLANATION

SURFICIAL BASIN-FILL UNITS

- A1 Stream channel deposits
- A2 Terrace deposits
- A3d Eolian sand dune deposits
- A3s Eolian sheet sand deposits
- A5y Younger alluvial fans
- A5yf Finer-grained A5y
- A5iy Intermediate-younger alluvial fans
- A5iyf Finer-grained A5iy
- A5iyc Coarser-grained A5iy
- A5i Intermediate alluvial fans
- A5if Finer-grained A5i
- A5ic Coarser-grained A5i
- A5oc Coarser-grained older alluvial fans

ROCK UNITS

- I1 Igneous, intrusive
- I2 Igneous, extrusive
- M Metamorphic
- S Sedimentary

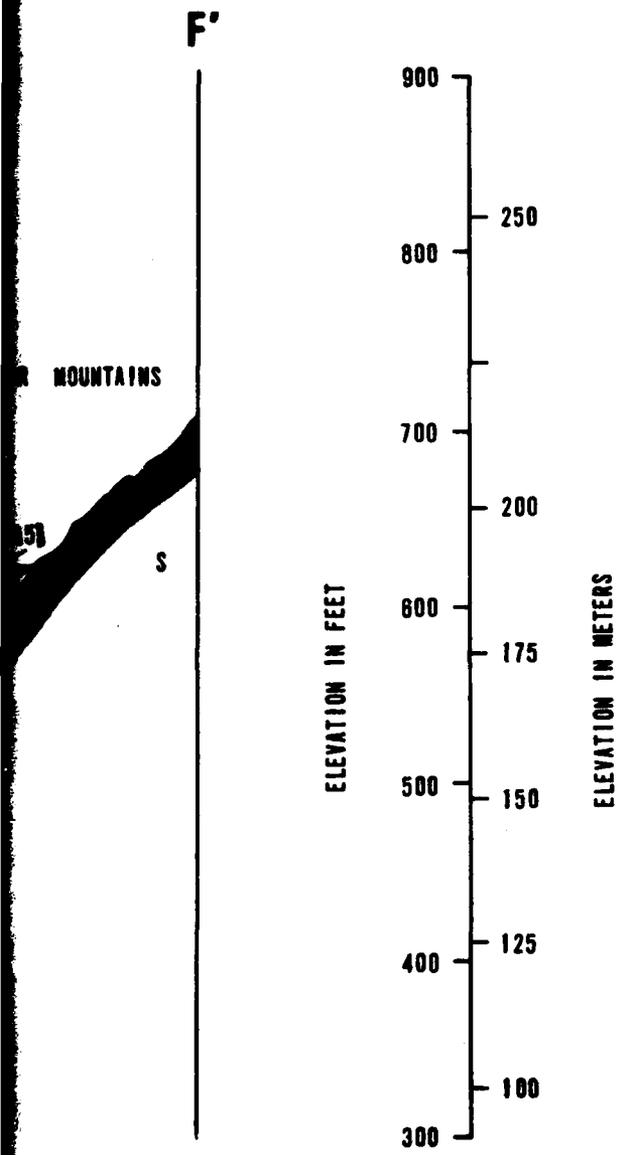
SYMBOLS

- — — ? Geologic contact; dashed where extrapolated
- — — ? Fault; dashed where extrapolated

- LD-S-1 Seismic line (See Appendix A)
- LD-A, B, C or D-1 Boring (See Appendix B)
- LD-T-1 Trench (See Appendix C)
- [] Brackets denote underground

For complete description of geologic units, see Appendix D.

VERTICAL EXAGGERATION



EXPLANATION

UNITS

- channel deposits
- deposits
- dune deposits
- flat sand deposits
- fluvial fan deposits
- bed A5y
- late-younger alluvial fan deposits
- bed A5iy
- bed A5iy
- late alluvial fan deposits
- bed A5i
- bed A5i
- bed older alluvial fan deposits

intrusive

intrusive

c

y

contact; dashed where approximate,
are extrapolated

bed where approximate,
are extrapolated

me (See Appendix A)

Appendix C)

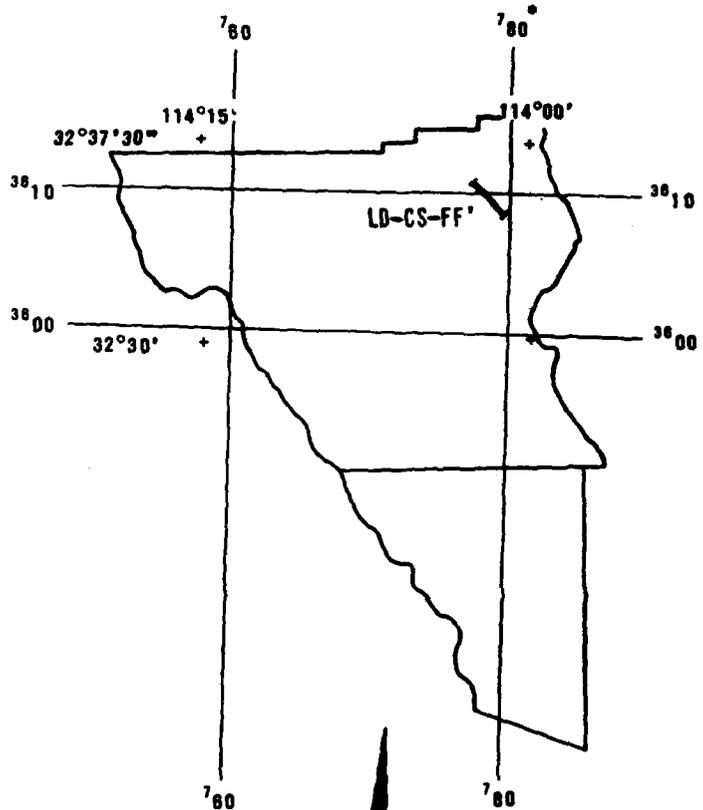
Appendix C)

note underlying unit of unknown depth

geologic units, see Drawing 2.

EXAGGERATION: 10X

LOCATION MAP

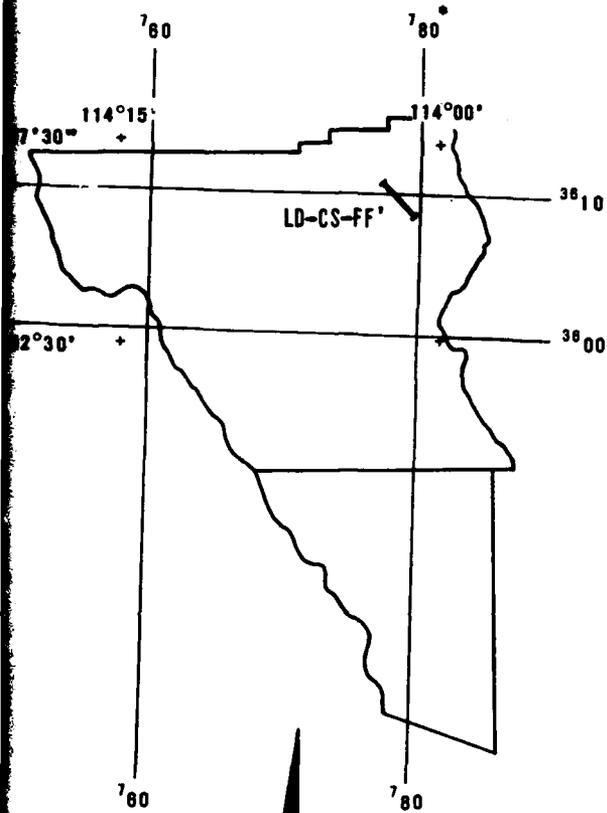


1:500,000



*NOTE: See Appendix page C-5 for explanation Universal Transverse Mercator Grid System.

LOCATION MAP



1:500,000



GEOLOGIC CROSS SECTION LD-CS-FF' LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	FIGURE B-6
FUGRO NATIONAL, INC.	

NOTE: See Appendix page C-5 for explanation Universal Transverse Mercator Grid System.

5

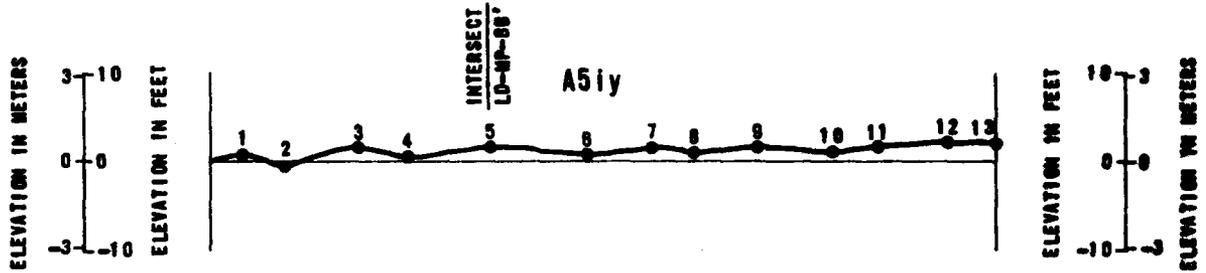
DATA TABLE

MICRO-RELIEF PROFILE	GEOLOGIC UNIT(S) TRANSVERSED	DATA SHEET (in Data Bank)	ASSOCIATED FIELD STATION
LD-MP-AA'	A5iy	206A	LD-FS-3
LD-MP-BB'	A5iy	206B	LD-FS-3
LD-MP-CC'	A5i	206C	LD-FS-25
LD-MP-DD'	A5yf(A5if)	206D	LD-FS-27
LD-MP-EE'	A5i	206E	LD-FS-43
LD-MP-FF'	A5i	206F	LD-FS-49
LD-MP-GG'	A5oc	206G	LD-FS-75
LD-MP-HH'	A5iyc, A1/A5y	206H	LD-FS-77
LD-MP-II'	A5i	206I	LD-FS-91
LD-MP-JJ'	A5iy	206J	LD-FS-93
LD-MP-KK'	A5i	206K	LD-FS-78
LD-MP-LL'	A5oc, A5i(A5oc)	206L	LD-FS-95
LD-MP-MM'	A5yf(A5if)	206M	LD-FS-4
LD-MP-NN'	A5i	206N	LD-FS-6
LD-MP-OO'	A5i	206O	LD-FS-6
LD-MP-PP'	A5iy, A1/A5y	206P	LD-FS-12
LD-MP-QQ'	A5ic	206Q	LD-FS-22
LD-MP-RR'	A5iy	206R	LD-T-18
LD-MP-SS'	A5oc	206S	LD-FS-97
LD-MP-TT'	A5yf, A3d	206T	LD-FS-102
LD-MP-UU'	A5iyf	206U	LD-FS-105
LD-MP-VV'	A1/A5yf	206V	LD-FS-100
LD-MP-WW'	A5iyf, A5yf(A5if)	206W	LD-T-15
LD-MP-XX'	A5if, A5yf(A5if)	206X	LD-FS-40
LD-MP-YY'	A5if	206Y	LD-FS-110
LD-MP-ZZ'	A5yf	206Z	LD-FS-100
LD-MP-A ₁ A ₂ '	A5yf, A5iyf(A5if)	206AA	LD-FS-158

1 LD-
2 LD-
3 LD-
4 LD-
5 LD-
6 LD-
7 LD-
8 LD-
9 LD-
10 LD-
11 LD-
12 LD-
13 LD-
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24 LD-

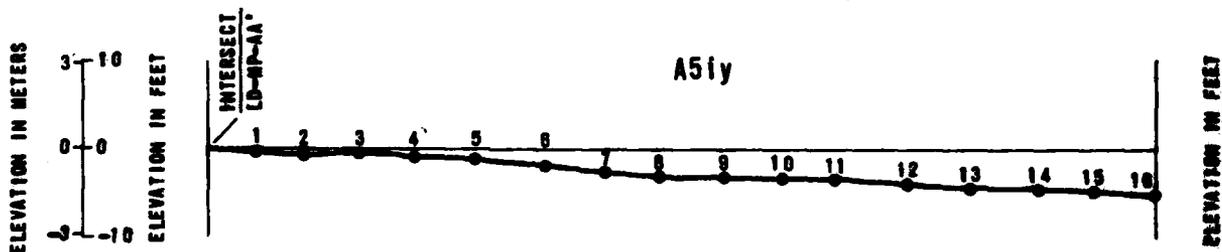
MICRORELIEF PROFILE LD-MP-AA'

N15E



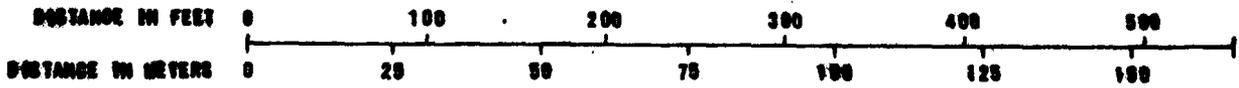
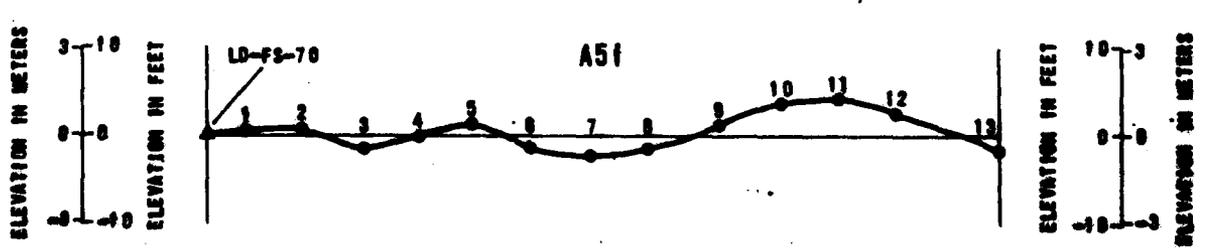
MICRORELIEF PROFILE LD-MP-BB'

N62W



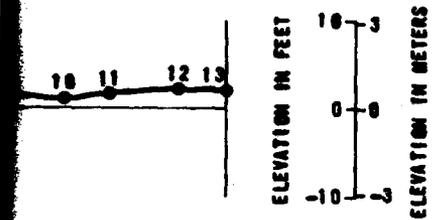
MICRORELIEF PROFILE LD-MP-CC'

N30E

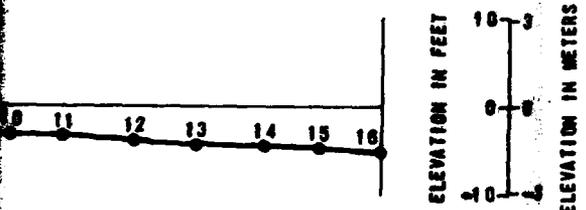


VERTICAL EXAGGERATION: ON ASSUMED ORIGIN = 0

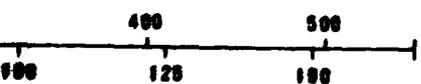
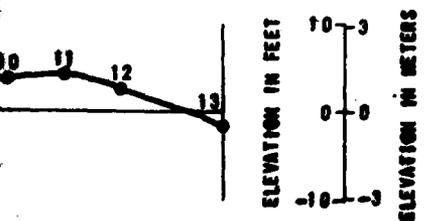
AA'



LD-MP-BB'



MP-CC'



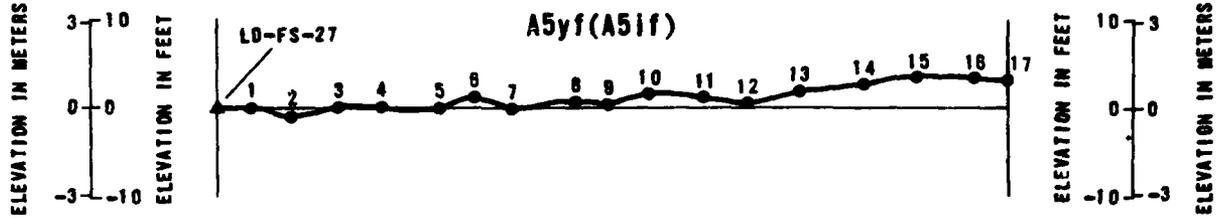
NOTES:

1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.

		FIGURE
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO		

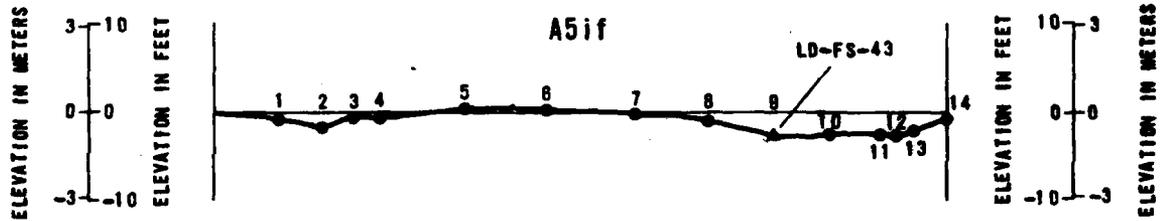
MICRORELIEF PROFILE LD-MP-DD'

S27E



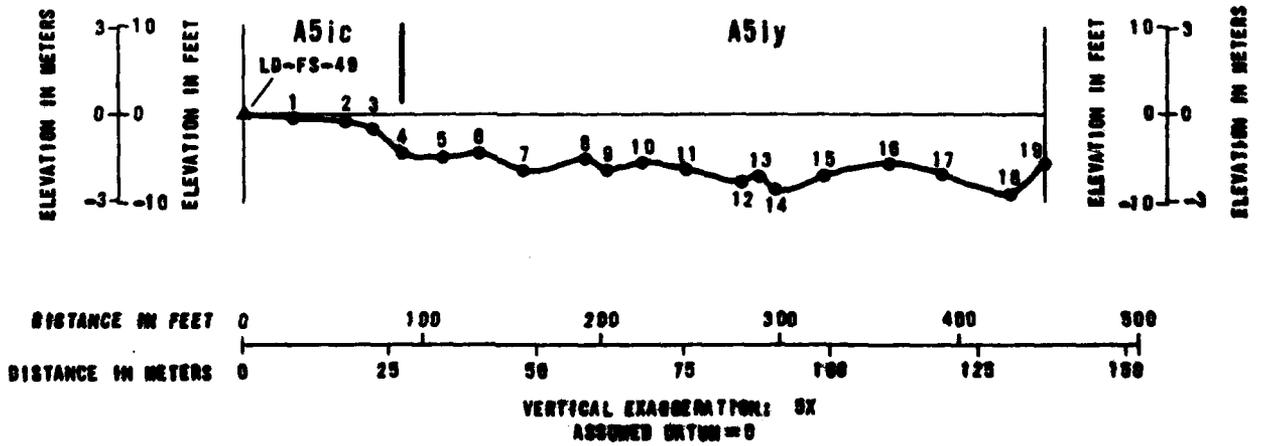
MICRORELIEF PROFILE LD-MP-EE'

S25W

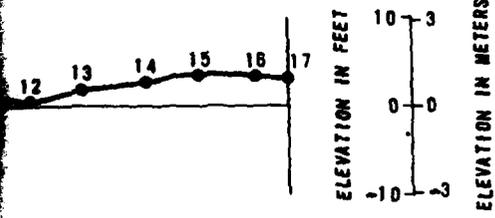


MICRORELIEF PROFILE LD-MP-FF'

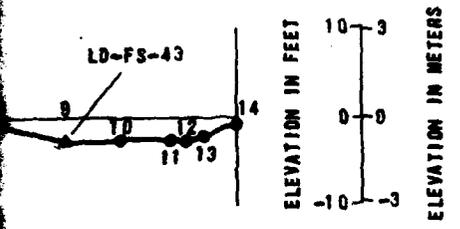
S60W



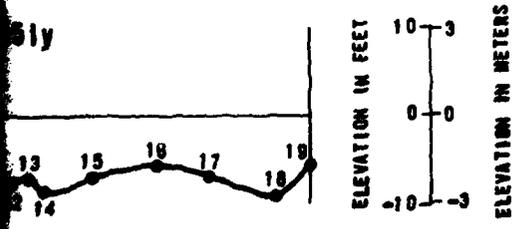
D-MP-DD'



MP-EE'

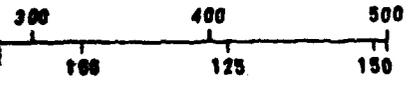


LD-MP-FF'



NOTES:

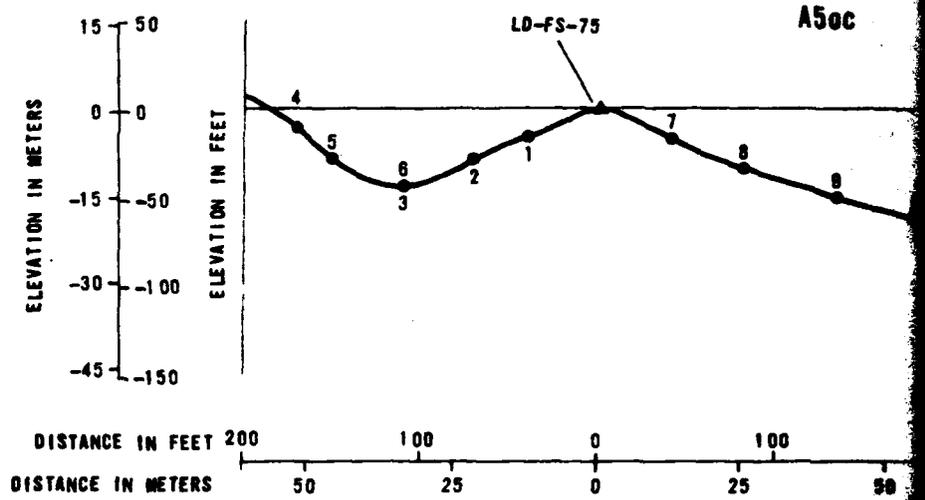
1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.



MS 5X

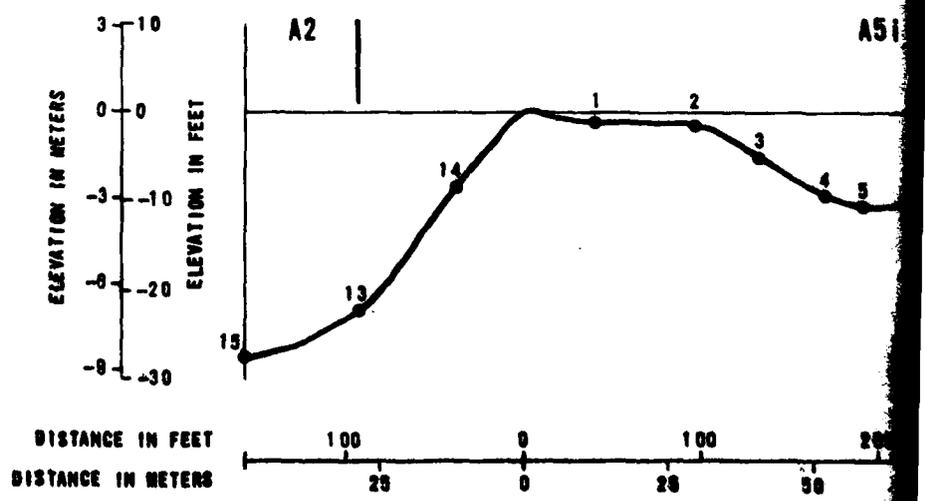
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	FIGURE
INTERNATIONAL INC.	

MICRORELIEF PROFILE N55W



NO VERTICAL EXAGGERATION
ASSUMED DATUM = 0

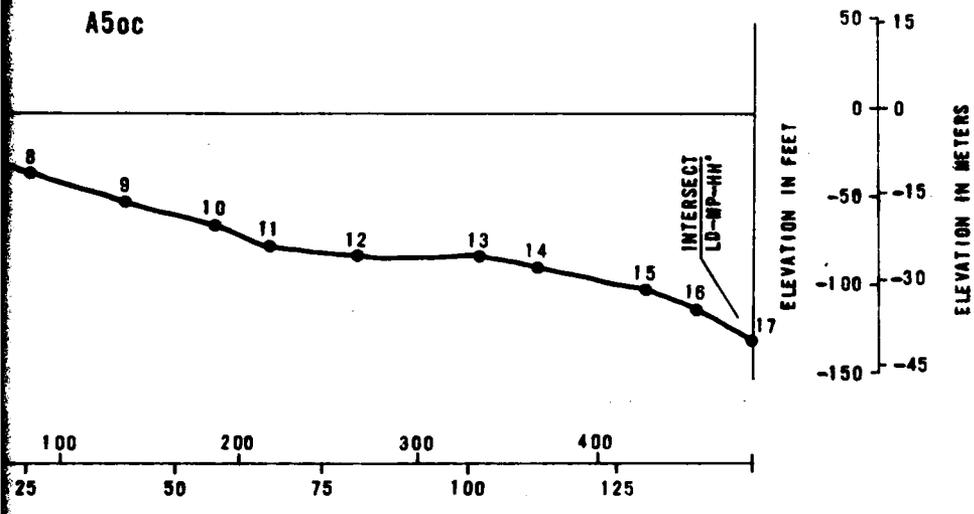
MICRORELIEF PROFILE N71W



VERTICAL EXAGGERATION
ASSUMED DATUM = 0

RELIEF PROFILE LD-MP-GG'
N55W

A5oc



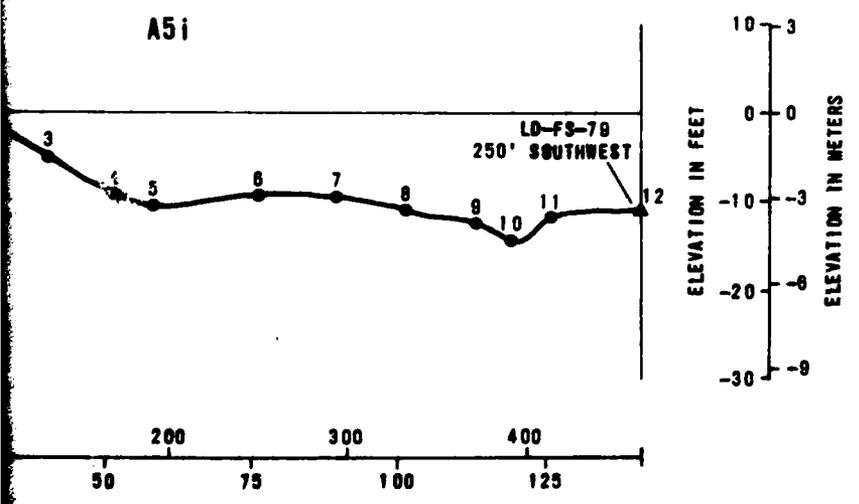
VERTICAL EXAGGERATION
 ASSUMED DATUM = 0

NOTES:

1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols
3. Profiles not in alphabetical order.

RELIEF PROFILE LD-MP-KK' (3)
N71W

A5i

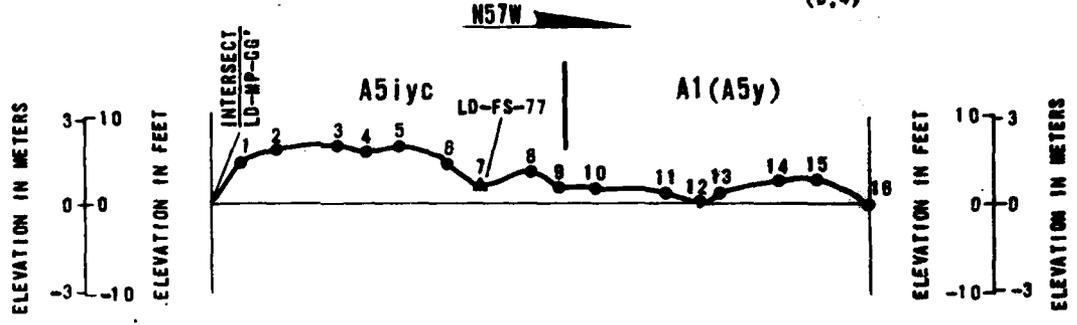


VERTICAL EXAGGERATION: 5X
 ASSUMED DATUM = 0

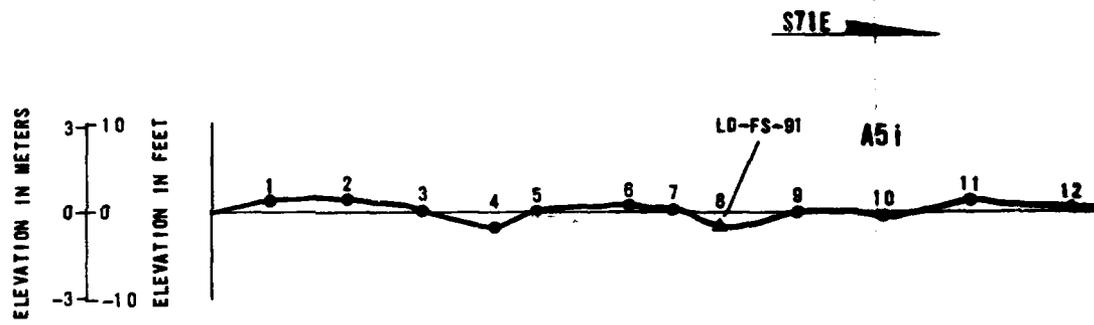
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO		FIGURE 1
INTERNATIONAL		

2

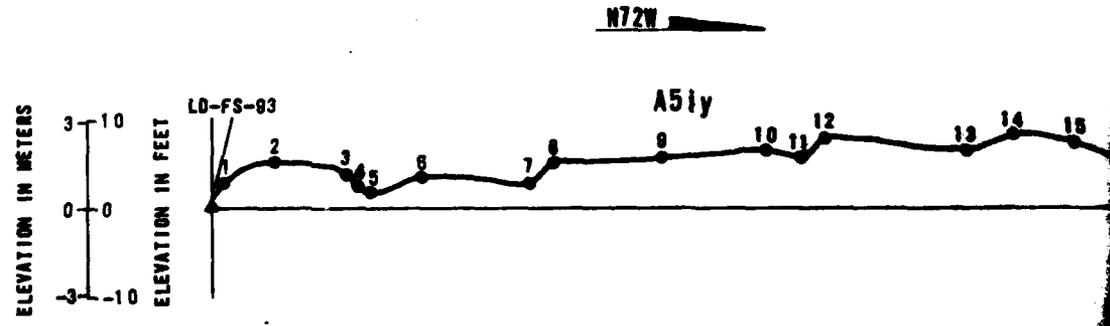
MICRORELIEF PROFILE LD-MP-HH⁰ (3,4)



MICRORELIEF PROFILE LD-MP-II'



MICRORELIEF PROFILE LD-MP-JJ'

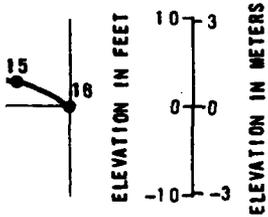


DISTANCE IN FEET 0 100 200 300 400

DISTANCE IN METERS 0 25 50 75 100 125 150

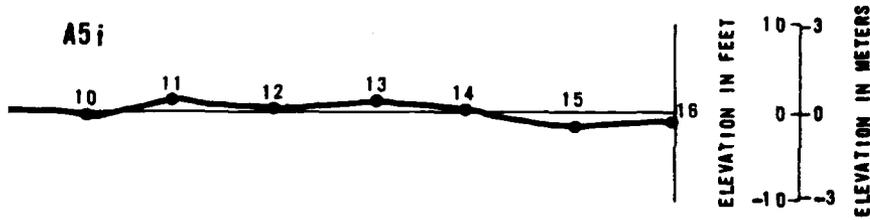
VERTICAL EXAGGERATION: SIX
ASSUMED SLOPE = 0

(3,4)



'PROFILE LD-MP-11'

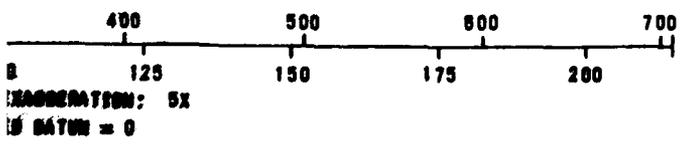
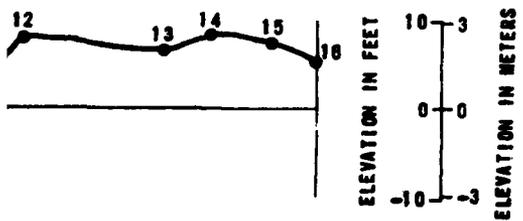
1E



NOTES:

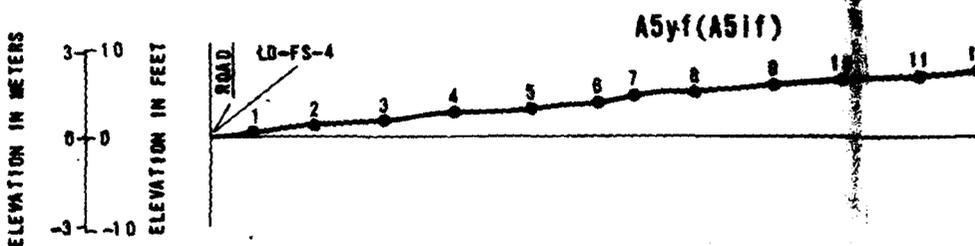
1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.
3. Profiles not in alphabetical order.
4. See Figure B-10 for Profile LD-MP-66'.

'-MP-JJ'

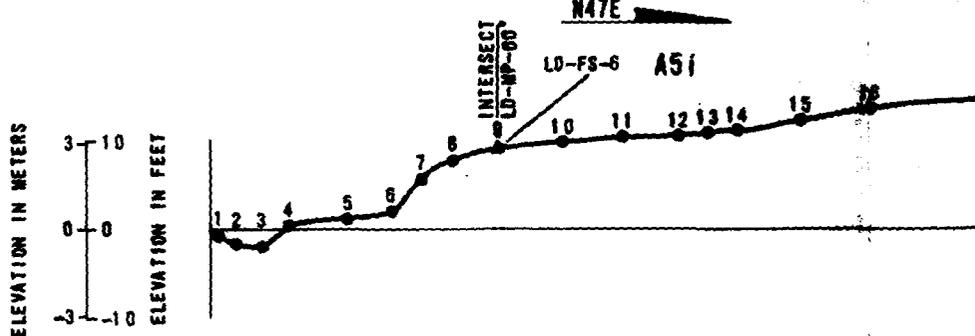


MX SITING INVESTIGATION		FIGURE
DEPARTMENT OF THE AIR FORCE - SANSO		1
GENERAL NATIONAL		

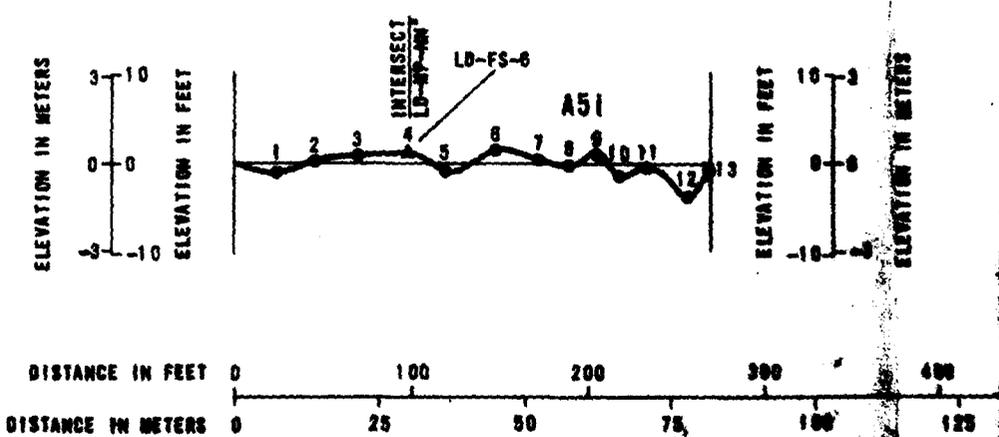
MICRORELIEF PROFILE LD-MP-MM'
S74W



MICRORELIEF PROFILE LD-MP-MM'
N47E



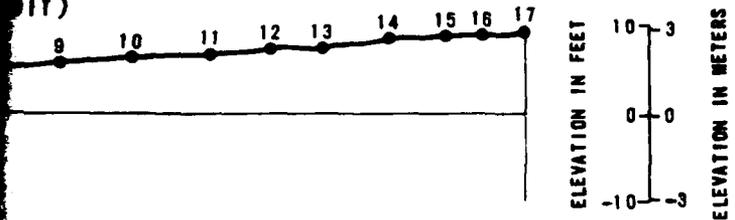
MICRORELIEF PROFILE LD-MP-00'
S20E



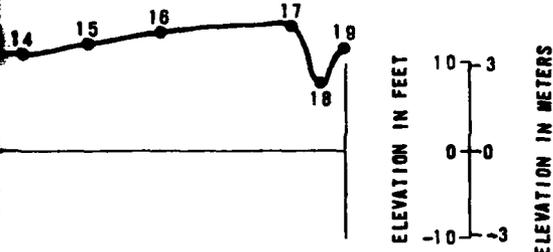
VERTICAL EXAGGERATION: 2X
ASSUMED DATA: 0

FILE LD-MP-MM'

if)

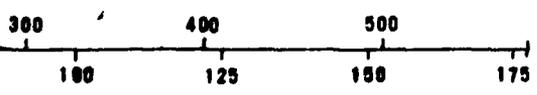
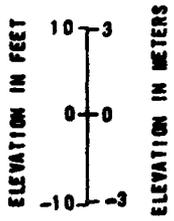


LD-MP-NN'



NOTES:

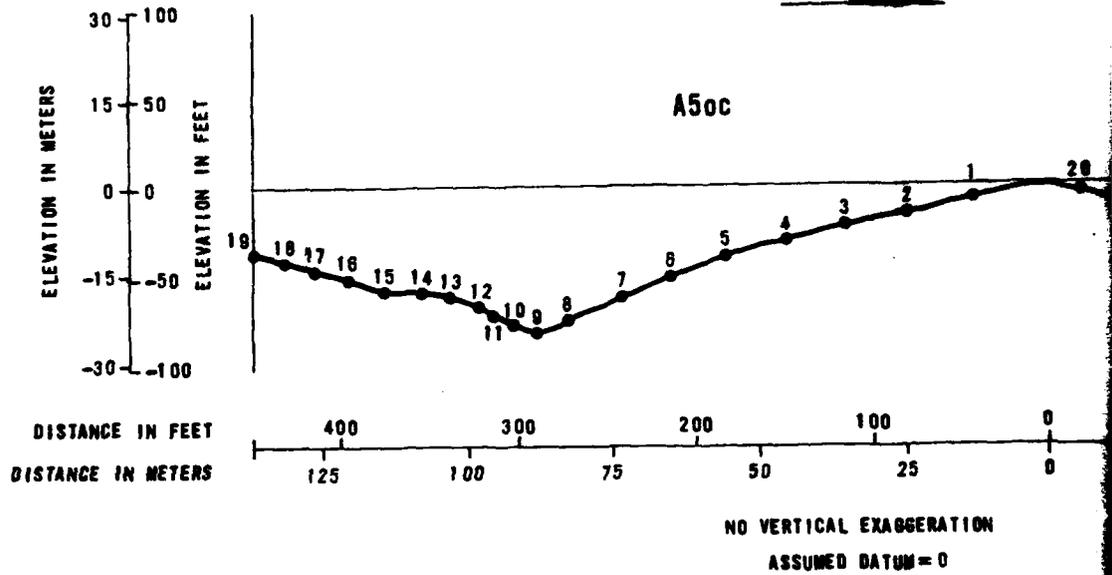
1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.



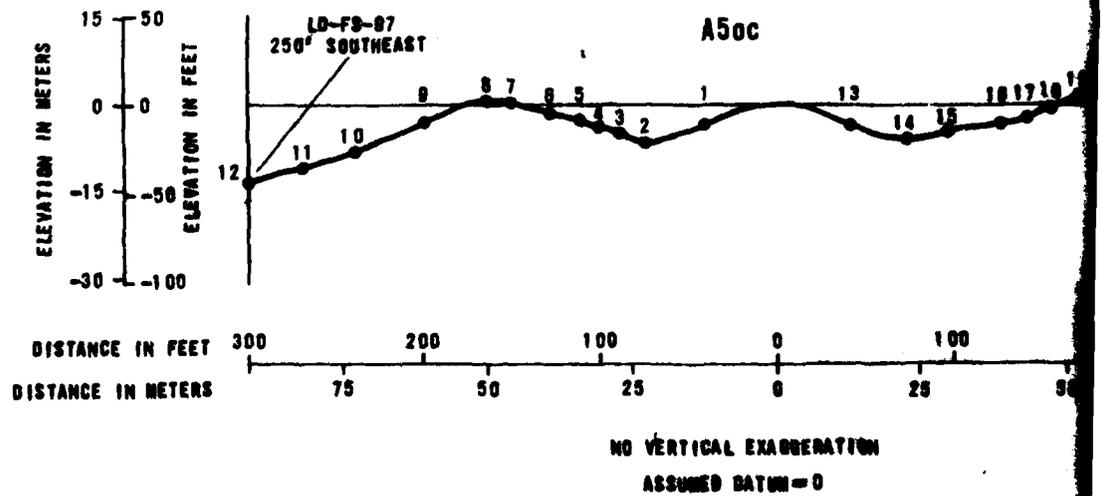
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANDS		FORM 8 1-64
--	--	----------------

TON: 5X

MICRORELIEF PROFILE LD-MP-LL^o
N55W

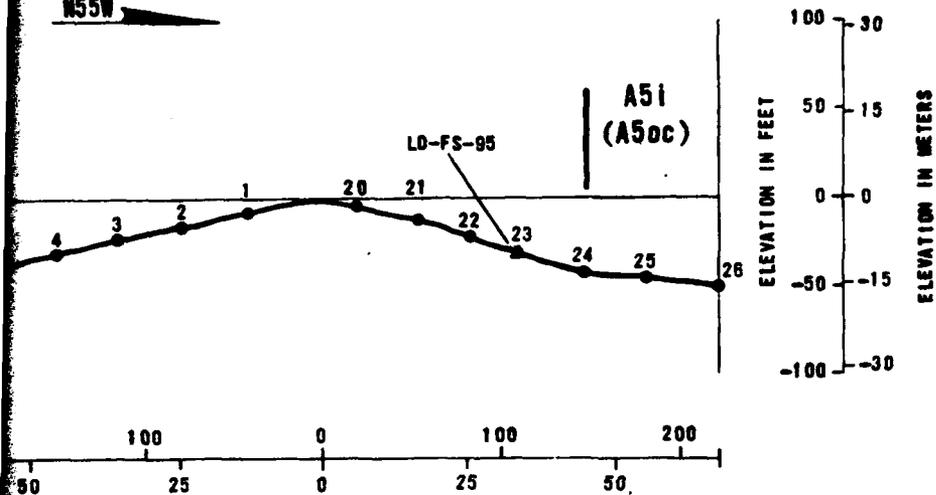


MICRORELIEF PROFILE LD-MP-SS^o (3,4)
N45W



PROFILE LD-MP-LL'

N55W

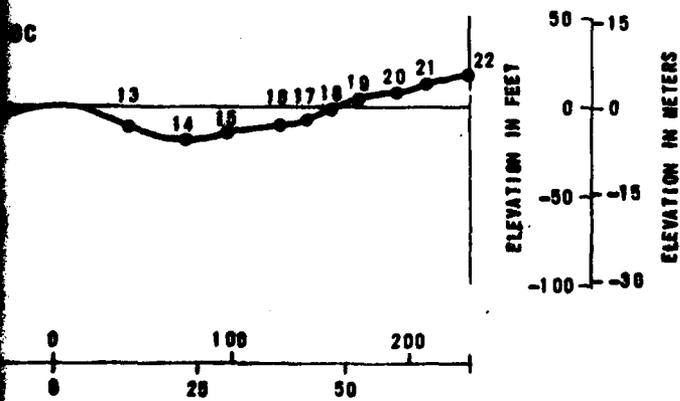


VERTICAL EXAGGERATION
ASSUMED DATUM = 0

NOTES:

1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.
3. Profiles not in alphabetical order.
4. See Figure B-15 for Profile LD-MP-RR'

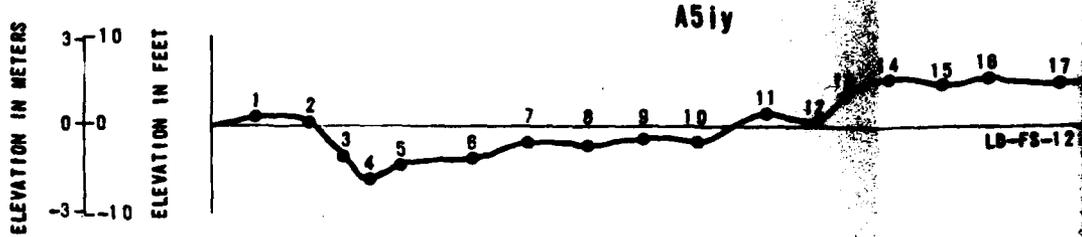
FILE LD-MP-SS' (3,4)



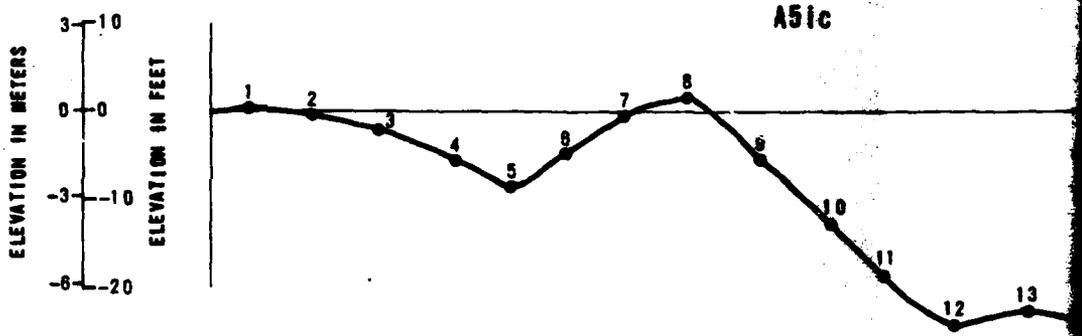
EXAGGERATION
DATUM = 0


MR SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SASSO
FIGURE

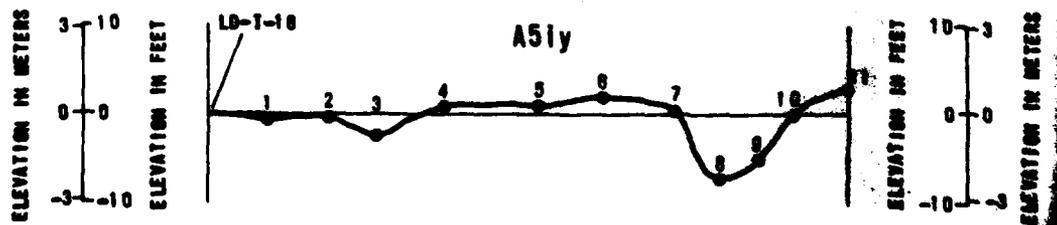
MICRORELIEF PROFILE LD-PP'
N83W



MICRORELIEF PROFILE LD-MP-QQ'
S50E

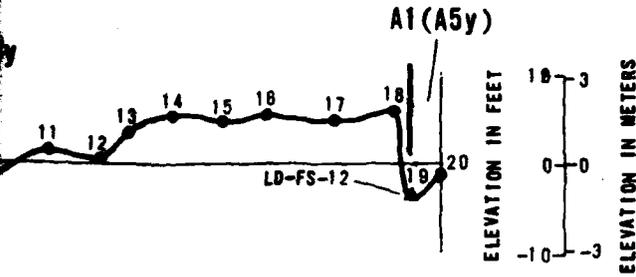


MICRORELIEF PROFILE LD-MP-RR'
N23W



DISTANCE IN FEET 0 100 200 300 400
 DISTANCE IN METERS 0 25 50 75 100 125
 VERTICAL EXAGGERATION: 5x
 HORIZONTAL EXAGGERATION: 1x

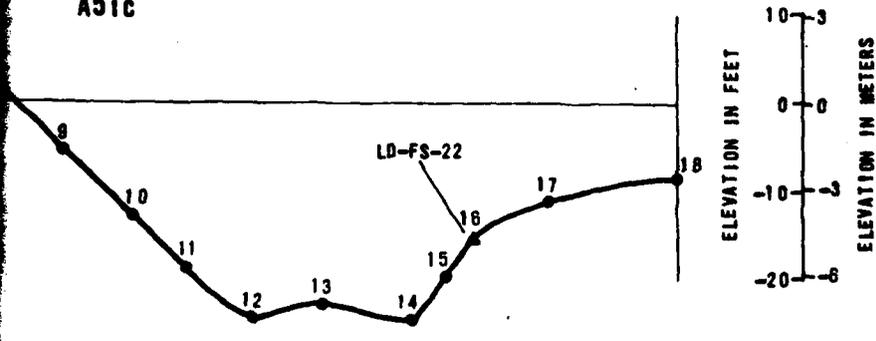
FILE LD-MP-PP'



PROFILE LD-MP-QQ'

S50E

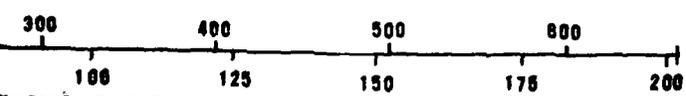
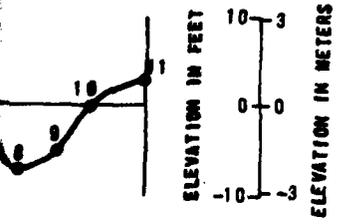
A5ic



NOTES:

1. See Drawing D-1 for locations of profiles relative to geologic units.
2. See Figure D-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.

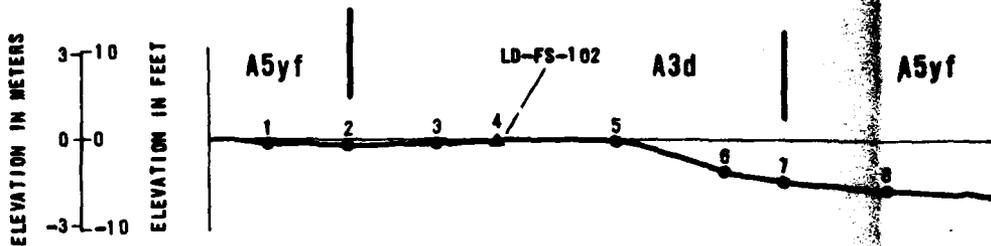
P-RR'



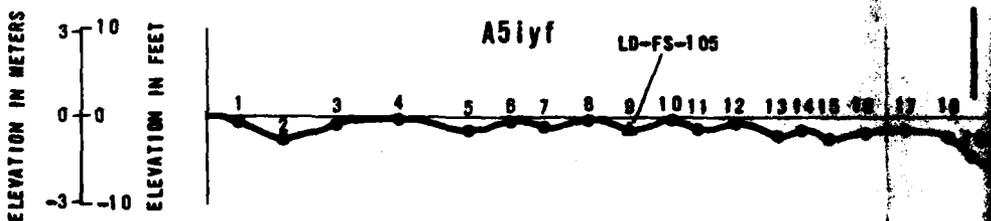
VERTICAL EXAGGERATION: 5X
ASSUMED DATUM = 0

AN SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANDS

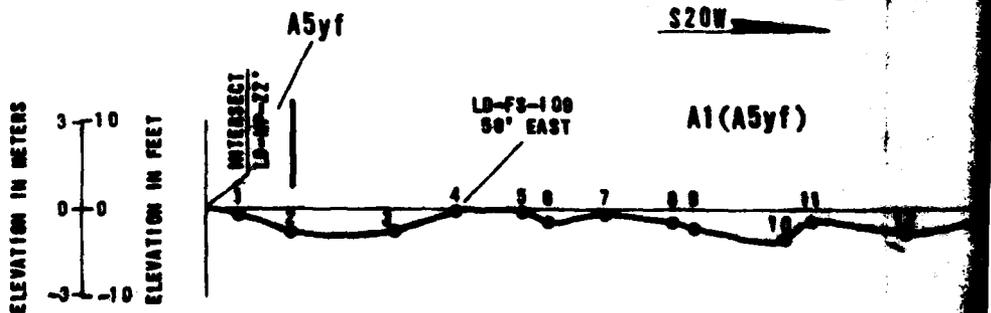
MICRORELIEF PROFILE LD-MP-TT'
S7E



MICRORELIEF PROFILE LD-MP-UU'
S45W



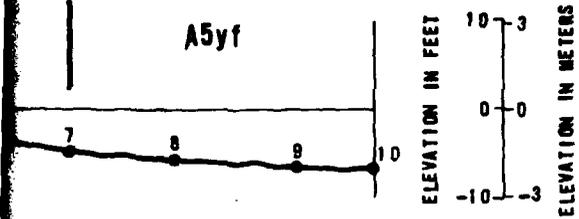
MICRORELIEF PROFILE LD-MP-VV'
S20W



VERTICAL EXAGGERATION: 2X
 ASSUMED DATUM = 0

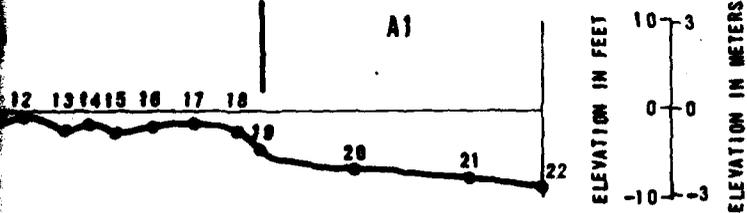
LD-MP-TT'

A5yf



PROFILE LD-MP-UU'

A1

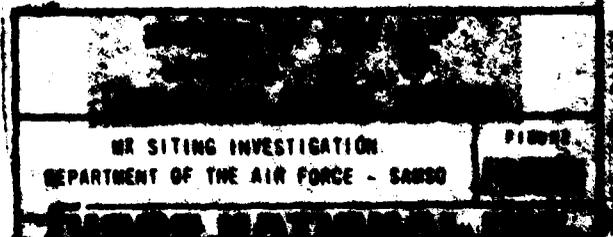
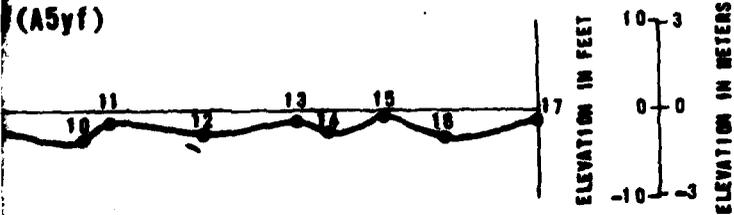


NOTES:

1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.

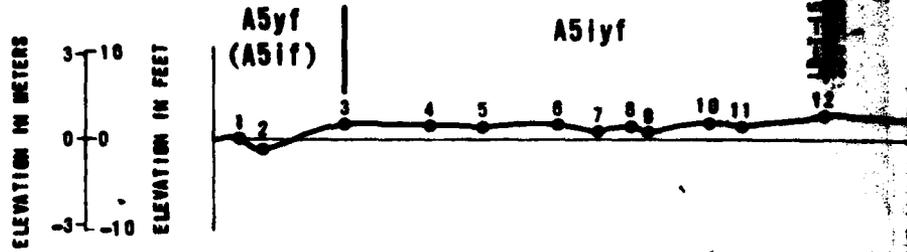
PROFILE LD-MP-VV'

(A5yf)



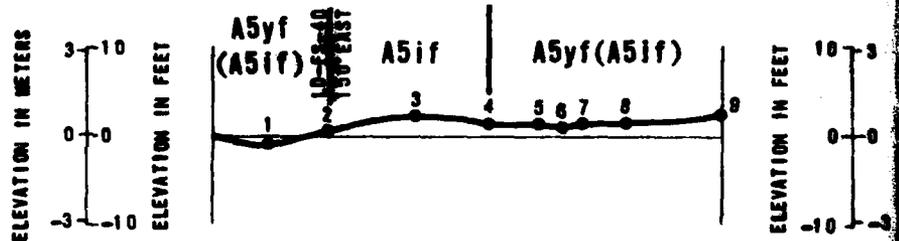
MICRORELIEF PROFILE

N33W



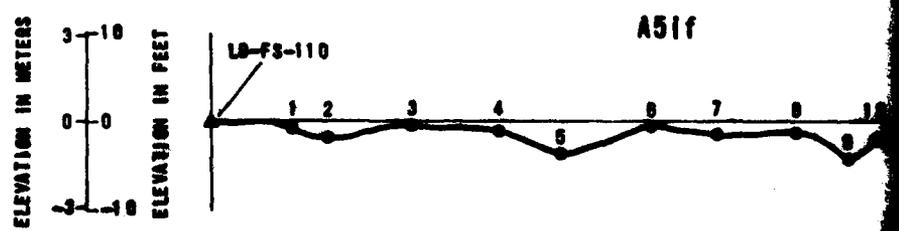
MICRORELIEF PROFILE LD-MP-XX'

N20W



MICRORELIEF PROFILE LD-MP-

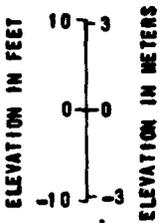
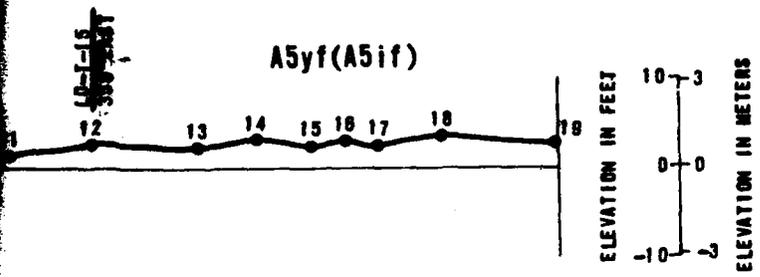
N3W



DISTANCE IN FEET 0 100 200 300
 DISTANCE IN METERS 0 25 50 75 100
 VERTICAL EXAGGERATION:
 HORIZONTAL SCALE = 1"

PROFILE LD-MP-WW'

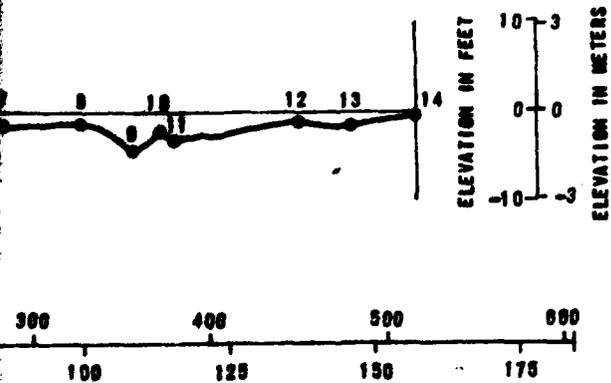
A5yf(A5if)



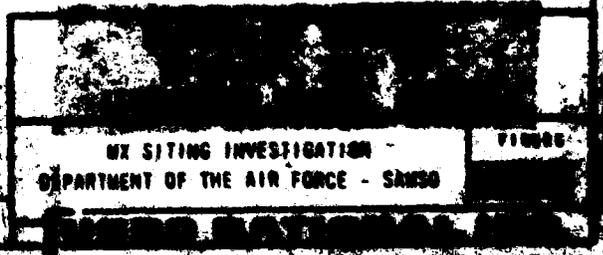
NOTES:

1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.

PROFILE LD-MP-YY'



EXAGGERATION: 5X
 RED DATUM: 0'

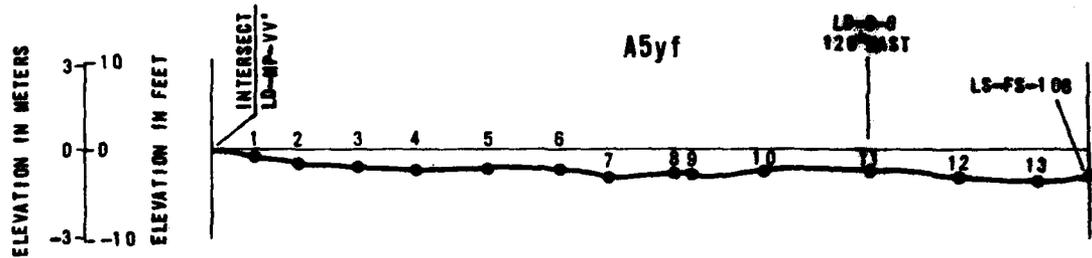


MX SITING INVESTIGATION -
 DEPARTMENT OF THE AIR FORCE - SANSO

FIGURE

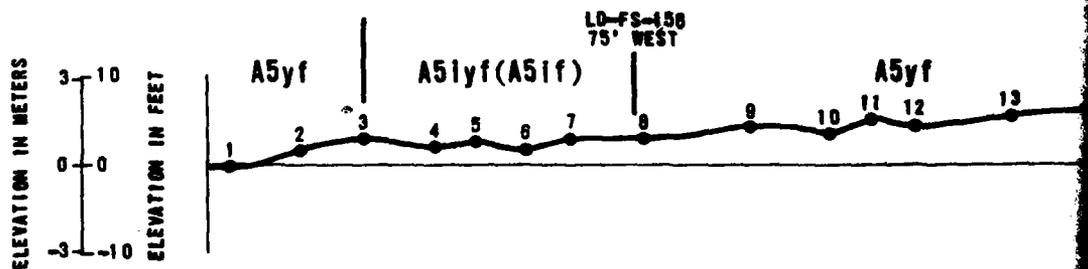
MICRORELIEF PROFILE LD-MP-ZZ'

N20E



MICRORELIEF PROFILE LD-MP-A₁A₁'

S30E



DISTANCE IN FEET 0 100 200 300 400

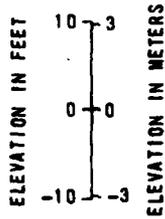
DISTANCE IN METERS 0 25 50 75 100 125

VERTICAL EXAGGERATION: 5X
ASSUMED DATUM = 0

LD-MP-ZZ'

LD-B-8
126° EAST

LS-FS-108

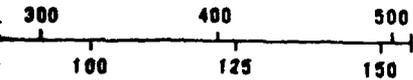
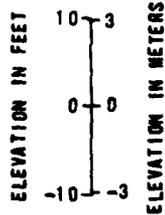


NOTES:

1. See Drawing B-1 for locations of profiles relative to geologic units.
2. See Figure B-7 for list of associated geologic field stations, for locations of individual profiles, and for explanation of profile symbols.

LE LD-MP-A₁A₁'

A5yf



Scale: 5X

MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO		FIGURE
GENERAL		

2

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	APPROXIMATE	
							COBBLES BOULBERS (% OF TOTAL)	G
LD-FS-1	A5iy	Sand w/silt and gravel	SP	Mod	None	Cobble	<1	
LD-FS-2	A5oc	Sandy Gravel w/ boulders and cobbles	GP	Poor	None	Boulder	60	
LD-FS-3	A5iy	Sand w/silt and gravel	SP	Mod	None	Boulder	<5	
LD-FS-4	A5yf (A5if)	Silty Sand	SM	Mod	None	Gravel	0	
LD-FS-6	A5i	Sand w/silt	SP	Mod	None	Cobble	<5	
LD-FS-7	A5iy	Sand w/silt	SP	Mod	None	Cobble	<1	
LD-FS-8	A5iyf	Gravelly Sand w/silt	SP	Mod	None	Fine Gravel	0	
LD-FS-10	A5yf (A5if)	Sand w/silt	Sp	Mod	None	Coarse Gravel	0	
LD-FS-12	A5iy	Silty Sand w/ gravel	SM	Mod	None	Cobble	<2	
LD-FS-12	A5i (buried)	Gravelly Sand w/silt	SP	Mod	None	Cobble	5-10	
LD-FS-13	A5iy	Sandy Gravel w/silt, cobbles and boulders	GP	Mod	None	Boulder	20	
LD-FS-14	A5ic	Silty Sand	SM	Poor	Low	Cobble	--	
LD-FS-15	A5if	Silty Sand w/gravel	SM	Poor	Low	Coarse Gravel	0	
LD-FS-22	A5ic	Gravelly Sand w/silt, cobbles and boulders	SP	Mod	None	Boulder	10	

NOTES: ① Includes only complete data steps designated by symbol (▲) on Drawing 2.

② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), Igneous intrusive (I1), or igneous extrusive (I2).

④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

MATERIAL PROPERTIES

SAMPLE NO.	APPROXIMATE SIZE DISTRIBUTION			ROCK TYPE(S) (3)	GRAIN SHAPE	MUNSELL COLOR	MOISTURE CONTENT	CONSISTANCY	WEATHERING (3)	STRUCTURE	CEMENTATION
	OF FRACTION										
	GRAVEL	SAND	FINES								
<1	10	80	10	Il,M	Ang-Subrnd	10YR 6/4	Dry	Loose	Fresh-Slight	Nonstrat	None
60	80	18	2	M	Subang-Subrnd	10YR	Dry	Dense	Mod-Very	Strat (weak)	Mod
<5	10	80	10	M,Il	Ang-Rnd	2.5YR 4/8	Dry	Dense	Mod-Very Some Fresh	Strat (Mod)	Mod
0	1	85	14	---	Subang-Subrnd	10YR 6/4	Dry	Loose-Dense	---	Strat	Weak
<5	<5	85	10	M	Ang-Subang	7.5YR 5/4	Dry	Med Dense	Slight-Mod	Nonstrat	Mod
<1	5	85	10	M	Subang	7.5YR 6/4	Dry	Med Dense	Fresh-Slight	Nonstrat	Weak
0	20	70	10	M	Subang-Subrnd	7.5YR 6/4	Dry	Med Dense	Mod	Nonstrat	Weak
0	5	85	10	---	Subang	7.5YR 6/10	Dry	Med Dense	---	Nonstrat	Weak
<2	10	70	20	M	Subrnd	10YR 6/4	Dry	Med Dense	Mod-Very	Upr Non-Lwr Strat	Weak
-10	15	75	10	M	Subrnd	10YR 6/2	Dry	Dense-V. Dense	Mod-Very	Strat (w/lenses)	St
20	60	30	10	M,Il	Subang-Subrnd	---	Dry	Dense	Mod	Nonstrat	Weak Mod
--	5	80	15	M	Subang	7.5YR 6/6	Dry	Med Dense	Mod-Very	Nonstrat	Weak
0	10	70	20	Il,M	Ang-Subrnd	7.5YR 6/6	Dry	Med Dense	Mod-Very	Nonstrat	Weak
10	20	70	10	M	Subang-Subrnd	7.5YR 6/6	Dry	Dense	Very	Nonstrat	Mod

(3) Measured from USGS Topographic Maps (1:24000, 1:62500) in general vicinity of data point.

2.

RING	STRUCTURE	CEMENTATION	SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY			
			PAVEMENT PATINA	B HORIZON	CALICHE ④ DEPTH / STAGE INCHES(mm) / (TABLE E-4)	SLOPE (°) ⑤	MAXIMUM MICRO-RELIEF FEET (METERS)	INCISION DEPTH WIDTH FEET (METERS)	STREAM GRADIENT (%) ⑤
ht	Nonstrat	None	Poor/ None	None	None	1.5	3(0.9)	20 (6.11)/ 100 (30.5)	---
Very Very	Strat (weak)	Mod	Poor/ Poor	None	--- / II-III	---	---	9.8 (3)/ 65.6 (20)	3.2
	Strat (Mod)	Mod	--/ --	---	--- / II	---	2(0.6)	10 (3)/ 125 (38.1)	---
	Strat	Weak	Poor/ None	None	0 / I	0.9	---	None	---
at-	Nonstrat	Mod	Well/ Fair	Poor	1(25) / II	---	3.5 (0.8)	-----	3.2
at	Nonstrat	Weak	Fair/ Poor	None	--- / II	1.5	---	1.5 (.5)/ 15 (4.6)	---
d	Nonstrat	Weak	Poor- Fair/ None	None	8(203) / II	1.0	---	-----	1.0
	Nonstrat	Weak	Poor/ None	None	--- / I	1.3	<1 (0.3)	None	---
Very	Upr Non- Lwr Strat	Weak	Fair- Poor/ Poor	None	56(1422) / I-II	1.0	4(1.2)	1-3 (0.3-1) 10-15 (3-5)	1.0
Very	Strat (w/lenses)	Strong	--/ --	---	--- / I-II	---	---	-----	---
d	Nonstrat	Weak- Mod	Fair/ Fair	Poor	--- / I	1.6	---	8 (2.4)/ 25 (7.6)	---
Very	Nonstrat	Weak	Fair- Well/ Fair	None	0 / II	2.0	---	-----	---
Very	Nonstrat	Weak	Well/ Well	Poor	--- / II	---	---	7 (2.1)/ 25 (7.6)	---
ry	Nonstrat	Mod	Well/ Well	None	4 (102) / II	---	10(3)	20 (6.1)/ 195 (59.4)	1.6

PHYSICAL PROPERTIES COMPILED FROM
FIELD OBSERVATIONS - PAGE 1 OF 9
LECHUGUILLA DESERT, ARIZONA

WX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAUSO

TABLE
B-1

FUGRO NATIONAL, INC.

3

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	APPROXIMATE	
							COBBLES BOULDERS (% OF TOTAL)	GRA
LD-FS-23	A5i	Sand w/gravel, cobbles and boulders	SP	Poor	None	Boulder	15	1
LD-FS-26	A5if	Silty Sand	SM	Mod	None	Coarse Gravel	0	<
LD-FS-27	A5yf (A5if)	Sand	SP	Mod	None	Cobble	<1	<
LD-FS-28	A5yf (A5if)	Silty Sand	SM	Mod	None	Coarse Gravel	0	
LD-FS-33	A5if	Sand w/silt	SP	Poor	Low	Gravel	0	<
LD-FS-34	A5iyf (A5if)	Silty Sand	SM	Mod	None	Fine Gravel	0	
LD-FS-35	A5yf	Sand w/silt	SP	Mod	None	Gravel	0	<
LD-FS-36	A5yf (A5if)	Silty Sand	SM	Mod	None	Fine Gravel	0	
LD-FS-38	A5iyf (A5if)	Silty Sand	SM	Mod	None	Coarse Gravel	0	
LD-FS-40	A5if	Sand w/gravel	SP	Poor	None	Fine Gravel	0	
LD-FS-41	A5if	Silty Sand	SM	Poor	None	Cobble	<1	
LD-FS-42	A5iy	Silty Sand w/gravel	SM	Mod	None	Fine Gravel	0	
LD-FS-43	A5if	Silty Sand w/gravel	SM	Mod	None	Cobble	<1	
LD-FS-44	A5iy	Silty Sand w/gravel	SM	Mod	None	Boulder	5	

NOTES: ① Includes only complete data steps designated by symbol (▲) on Drawing 2.

② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), Igneous intrusive (I), or Igneous extrusive (E).

④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

MATERIAL PROPERTIES

SIZE	APPROXIMATE SIZE DISTRIBUTION				ROCK TYPE(S) ③	GRAIN SHAPE	MUNSELL COLOR	MOISTURE CONTENT	CONSISTANCY	WEATHERING ③	STRUCTURE	GENERAL CHARACTERISTICS
	COBBLES BOULDERS (% OF TOTAL)	OF FRACTION ≤ 3 INCHES (76mm)										
		GRAVEL	SAND	FINES								
	15	10	85	5	M	Ang-Subrnd	---	Dry	Med Dense	Mod	Nonstrat	
	0	<5	75	20	M	Subang	7.5YR 6/6	Dry	Dense	Fresh	Nonstrat	Se
	<1	<1	97	<3	M	Subang-Subrnd	10YR 6/4	Dry	Med Dense	Fresh	Nonstrat	W
	0	5	80	15	M	Subang-Subrnd	10YR 6/6	Dry	Med Dense	Fresh	Nonstrat	W
	0	<1	90	10	---	Ang-Subrnd	7.5YR 6/6	Dry	Loose-Dense	Very	Nonstrat	M St
	0	5	80	15	---	Subang	7.5YR 6/6	Dry	Med Dense-Dense	---	Nonstrat	W M
	0	<5	85	10	M	Subang-Subrnd	7.5YR 6/8	Dry	Med Dense	---	Nonstrat	W
	0	5	75	20	---	Subang-Rnd	7.5YR 6/6	Dry	Loose - Med Dense	---	Nonstrat	W
	0	5	80	15	M	Subang-Subrnd	7.5YR 6/6	Dry	Med Dense	---	Nonstrat	W
	0	10	85	5	---	Ang-Subang	5YR 6/6 7.5YR 6/6	Dry	Med Dense	Mod	Nonstrat	
	<1	5	65	30	---	Ang-Subang	7.5YR 6/4	Dry	Loose-Med Dense	Slight	Nonstrat	
	0	10	75	15	I1	Ang-Subang	7.5YR 7/6	Dry	Med Dense	None	Nonstrat	W
	<1	10	70	20	M,I1	Subang-Subrnd	7.5YR 7/4	Dry	Med Dense	Mod-Very	Nonstrat	W
	5	10	75	15	I1	Ang-Subrnd	7.5YR	Dry	Med Dense	Mod-Very	Nonstrat	W

③ Measured from USGS Topographic Maps (1:24000, 1:62500) in general vicinity of data point.

Base
Boulders:
Dry (S).
Igneous

depth
buried
upper unit.

2

SITING	STRUCTURE	CEMENTATION	SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY			
			PAVEMENT PATINA	B HORIZON	CALICHE ④ DEPTH / STAGE INCHES(mm) / (TABLE E-4)	SLOPE (:) ⑤	MAXIMUM MICRO-RELIEF FEET (METERS)	INCISION DEPTH WIDTH FEET (METERS)	STREAM GRADIENT (:) ⑤
sd	Nonstrat	Mod	Fair/Well	None	--- / II	---	2(0.6)	12 (3.7) / 40 (12.2)	---
sh	Nonstrat	Strong	Fair/None	None	--- / II	1.3	---	1 (.3) / 5 (1.5)	1.2
sh	Nonstrat	Weak	None/None	None	None	0.8	2(0.6)	None	0.8
sh	Nonstrat	Weak	None/None	None	--- / None - I	1.0	---	None	---
ty	Nonstrat	Mod-Strong	Poor/None	Poor	--- / II	0.7-	---	0.5 (.2) / 5 (1.5)	---
---	Nonstrat	Weak-Mod	Fair/None	None	--- / II	---	---	1 (.3) / 3 (1)	---
---	Nonstrat	Weak	None	None	None	0.7	1(0.3)	None	---
---	Nonstrat	Weak	None/None	None	--- / None	1.0	---	None	---
---	Nonstrat	Weak-Mod	Fair/None	None	13 (330) / II	0.8	---	-----	---
sd	Nonstrat	Mod	Fair/None	None	<1 (25) / II	---	0.5 (0.2)	1 (.3) / 20 (6.1)	---
ht	Nonstrat	Mod	Fair/Poor	None	--- / II	1.2	---	2 (.6) / 5 (1.5)	---
se	Nonstrat	Weak	Poor/None	None	None	2.7	---	2-3 (0.6-0.9) / 15-30(4.6-9.1)	---
very	Nonstrat	Weak	Fair/Fair-Poor	Poor	--- / II	---	2.5 (0.8)	4 (1.2) / 15 (4.6)	---
very	Nonstrat	Weak	Fair/None	None	None	---	---	8 (2.4) / 100 (30.5)	---

PHYSICAL PROPERTIES COMPILED FROM
FIELD OBSERVATIONS - PAGE 2 OF 8
LECHUGUILLA DESERT, ARIZONA

VI SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAUSO

TABLE
B-1

FUGRO NATIONAL, INC.

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	APPROXIMATE	
							COBBLES BOULDERS (% OF TOTAL)	PER
LD-FS-46	A5yf (A5if)	Silty Sand w/ gravel	SM	Mod	None	Coarse Gravel	0	
LD-FS-47	A5iy	Fine Sand w/ silt	SP	Mod	None	Cobble	<1	
LD-FS-48	A5if	Sand	SP	Mod	None	Cobble	<5	
LD-FS-49	A5ic	Sand w/ silt, cobbles and boulders	SP	Poor	None	Boulder	10	
LD-FS-50	A5iyf (A5if)	Sand	SP	Mod	None	Cobble	<1	
LD-FS-54	A5iyf	Sand w/silt	SP	Mod	None	Gravel	0	
LD-FS-55	A5i	Sand	SP	Mod	None	Cobble	<5	
LD-FS-56	A5iyf	Sand	SP	Mod	None	Gravel	0	
LD-FS-57	A5if	Silty Sand	SM	Mod	None	Coarse Gravel	0	
LD-FS-58	A5if	Sand	SP	Mod	None	Fine Gravel	0	
LD-FS-60	Al on A5iy (A5i)	Sand	SP	Mod	None	Cobble	<1	
LD-FS-61	A5if	Silty Sand	SM	Mod	Low	Cobble	<5	
LD-FS-62	A5iy	Sand	SP	Mod	None	Coarse Gravel	0	
LD-FS-64	A5iyf	Sand	SP	Mod	None	Fine Gravel	0	

NOTES: ① Includes only complete data steps designated by symbol (▲) on Drawing 2.

② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), Igneous intrusive (I1), or igneous extrusive (I2).

④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

MATERIAL PROPERTIES

SIZE	APPROXIMATE SIZE DISTRIBUTION				ROCK TYPE(S) ③	GRAIN SHAPE	MUNSELL COLOR	MOISTURE CONTENT	CONSISTANCY	WEATHERING ③	STRUCTURE	CEMENTATION
	COBBLES BOULDERS (% OF TOTAL)	% OF FRACTION ≤ 3 INCHES (76mm)										
		GRAVEL	SAND	FINES								
0	10	75	15	Il	Subang-Subrnd	7.5YR 6/6	Dry	Med Dense	Fresh	Nonstrat		
<1	5	85	10	M,Il	Subang-Subrnd	7.5YR 6/4	Dry	Med Dense	Fresh	Nonstrat		
<5	5	85	5-10	M,Il	Subang-Subrnd	5YR 6/6	Dry	Med Dense	Fresh-Mod	Nonstrat		
10	<5	85	10	M	Ang-Subrnd	5YR 5/6	Dry	Loose	Mod-Very	Nonstrat		
<1	5	85-90	5-10	M,Il	Subrnd	---	Dry	Med Dense	Fresh-Slight	Nonstrat		
0	5	85	10	---	Subang-Subrnd	7.5YR 7/6	Dry	Med Dense	Fresh	Nonstrat		
<5	<1	95	<5	Il,M	Ang-Subang	5YR 5/6	Dry	Loose-Med Dense	Mod	Nonstrat		
0	5	85-90	5-10	---	Subang-Subrnd	7.5YR 6/6	Dry	Med Dense	Fresh	Nonstrat		
0	<1	80-85	15-20	M	Subang	2.5YR 5/6	Dry	Med Dense	Fresh	Nonstrat		
0	5	90	5	Il	Ang-Subrnd	7.5YR 6/6	Dry	Med Dense	---	Nonstrat		
<1	1	98	1	---	Subang-Subrnd	10YR 8/2 - 8/1	Dry	V. Loose Med Dense	Fresh-Slight	Lensed		
<5	<1	85	15	S,M	Ang-Subang	10YR 7/8	Dry	Loose-Med Dense	Mod	Nonstrat		
0	5	85	5-10	Il	Subang-Subrnd	7.5YR 7/4	Dry	Med Dense	Fresh	Nonstrat		
0	5	90	5	Il	Ang-Subang	7.5YR 7/4	Dry	Med Dense	---	Nonstrat		

③ Measured from USGS Topographic Maps (1:24000, 1:62500) in general vicinity of data point.

Source symbols: S, M, I, L, A, G, C, O, P, S, I, G, N, E, O, U, S, for igneous

Depth in buried upper unit.

WINDING	STRUCTURE	CEMENTATION	SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY			
			PAVEMENT PATINA	B HORIZON	CALICHE ^④ DEPTH / STAGE INCHES(mm) / (TABLE E-4)	SLOPE (%) ^⑤	MAXIMUM MICRO-RELIEF FEET (METERS)	INCISION DEPTH WIDTH FEET (METERS)	STREAM GRADIENT (%) ^⑤
sh	Nonstrat	Weak	None/None	None	None	1.5	3(1.0)	None	---
sh	Nonstrat	Weak	Poor/None	None	0 / I	---	---	1 (0.3) / 5 (1.5)	---
Mod	Nonstrat	Weak	Fair/None	None	--- / II	1.6	---	2 (.6) / 8 (2.4)	---
Very	Nonstrat	Weak	Mod/Mod	Good	3(≈76) / II	4.0	---	-----	---
sh-ht	Nonstrat	Weak	Fair/None	None	--- / II	1.5	---	1 (.3) / 6 (1.8)	---
sh	Nonstrat	Weak	Poor-Fair/None	None	None	---	---	-----	---
d	Nonstrat	Mod-Strong	Well/Fair	Good	--- / II	1.2	---	-----	---
sh	Nonstrat	Weak	Poor-Fair/None	None	None	---	---	1 (.3) / 4 (1.2)	---
sh	Nonstrat	Mod	Fair/None	None	--- / II	0.7	---	None	---
sh	Nonstrat	Mod	Fair/None	None	1 (25) / I	---	---	1 (.3) / 3 (1)	---
sh-ht	Lensed	Weak	None/None	None	None	---	---	-----	1.3
sh	Nonstrat	Weak	Well/Well	None	0 / I	---	---	None	---
sh	Nonstrat	Weak	Poor/None	None	None	---	---	1 (.3) / 3 (1)	---
sh	Nonstrat	Weak	Fair/None	None	None	1.0	---	1 (.3) / 6 (1.8)	---

PHYSICAL PROPERTIES COMPILED FROM
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LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SANSO

TABLE
B-1

UGRO NATIONAL, INC.

3

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	APPROX
							COBBLES BOULDER (% OF TOP)
LD-FS-66	A5if	Sand	SP	Mod	None	Fine Gravel	0
LD-FS-68	A5if	Sand	SP	Mod	None	Fine Gravel	0
LD-FS-70	A5iy	Silty Sand	SM	Mod	Low	Cobble	<1
LD-FS-71	A5i (layer 2)	Gravel w/ silt and sand	GP-GM	Mod	None	Boulder	5
LD-FS-71	A5i (layer 1)	Gravelly Sand	SP	Mod	None	Cobble	<1
LD-FS-71	A2 (buried)	Clay Layers	CL-CH	Poor	High	Silt	0
LD-FS-71	A2 (buried)	Silt Layers	ML-MH	Poor	Low	Sand	0
LD-FS-71	A2 (buried)	Sand Layers	SP	Poor	None	Gravel	0
LD-FS-72	A5i	Sand	SP	Mod	None	Cobble	<1
LD-FS-73	A5i (A5oc)	Sandy Gravel/ Gravelly Sand	GP-SP	Mod	None	Cobble	--
LD-FS-74	A5yf (A5if)	Silty Sand	SM	Mod	None	Fine Gravel	0
LD-FS-75	A5oc	Sandy Gravel	GP	Mod	None	Boulder	<1
LD-FS-76	A5yf	Silty Sand	SM	Mod	None	Coarse Gravel	0
LD-FS-77	A5iyc	Gravelly Sand	SP	Poor	None	Boulder	---

NOTES: ① Includes only complete data steps designated by symbol (▲) on Drawing 2.

② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), Igneous intrusive (I), or igneous extrusive (E).

④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

	(% OF TOTAL)	GRAVEL	SAND	FINES	(3)							
Level	0	5	90	5	Il	Ang-Subang	7.5YR 6/6	Dry	Med Dense	---	Nonstrat	W
Level	0	5	90	5	Il	Ang-Subrnd	5YR 5/8	Dry	Med Dense	---	Nonstrat	M
	<1	<5	85	10-15	Il	Subang	7.5YR 6/6	Dry	Med Dense	Fresh-Slight	Nonstrat	W
	5	80	10	10	Il,M	Subang-Subrnd	----	Dry	Dense	Fresh-Very	Strat	Mod Str
	<1	20	80	0	Il,M	Subang-Subrnd	10YR 7/3	Dry	Dense	Fresh-Very	Strat	Mod Str
	0	0	0	100	---	-----	10YR 7/4	Dry	Dense	---	Lensed	
	0	0	5	95	---	-----	10YR 7/4	Dry	Dense	---	Lensed	
	0	5	95	0	---	-----	5 YR 5/8	Dry	Dense	---	Lensed	
	<1	<5	85-90	5-10	Il	Ang-Subang	7.5YR 6/8	Dry	Med Dense-Dense	Fresh-Slight	Nonstrat	W
	--	50	45-50	<5	Il,M	Subang	10YR 7/4	Dry	Med Dense-Dense	Fresh-Very	Strat (weak-mod)	
Level	0	5	75-80	15-20	---	Subang-Subrnd	7.5YR 7/6	Dry	Med Dense	---	Nonstrat	W
	<1	60	35	15	M,Il	Ang	7.5YR	Dry	Med Dense-Dense	Fresh-Very	Nonstrat	
	0	<5	80	15	---	Ang-Subrnd	7.5YR 7/6	Dry	Med Dense	---	Strat (weak)	W
	---	20	80	<1	M,Il	Subang	10YR 6/4	Dry	Med Dense	Fresh-Very	Nonstrat	M

(3) Measured from USGS Topographic Maps (1:24000, 1:62500) in general vicinity of data point.

Base
 Levels:
 Dry (S).
 Igneous

depth
 buried
 upper unit.

2

			SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY			
WEATHERING ③	STRUCTURE	CEMENTATION	PAVEMENT PATINA	B HORIZON	CALICHE ④ DEPTH / STAGE INCHES(mm) / (TABLE E-4)	SLOPE (%) ⑤	MAXIMUM MICRO- RELIEF FEET (METERS)	INCISION DEPTH WIDTH FEET (METERS)	STREAM GRADIENT (%) ⑤
---	Nonstrat	Weak	Fair/ None	None	6 (15) / I-II	---	---	2 (.6) / 6 (1.8)	---
---	Nonstrat	Mod	Fair/ None	Good	1 (25) / II	---	---	1.5 (.5) / 4 (1.2)	---
fresh- light	Nonstrat	Weak	Fair/ None	None	None	---	---	4 (1.2) / 30 (9.1)	---
fresh- dry	Strat	Mod- Strong	Mod/ Mod	Poor	5 (127) / II	---	---	35 (10.7) / 2000 (609.6)	---
fresh- dry	Strat	Mod- Strong	---/ ---	---	-----	---	---	-----	---
---	Lensed	Mod	---/ ---	---	-----	---	---	-----	---
---	Lensed	Mod	---/ ---	---	-----	---	---	-----	---
---	Lensed	Mod	---/ ---	---	-----	---	---	-----	---
fresh- light	Nonstrat	Weak	Fair/ None	Poor	1 (25) / I-II	---	---	4 (1.2) / 20 (6.1)	---
fresh- dry	Strat (weak-mod)	Mod	Well/ Well	Poor	--- / II-III	---	1 (0.3)	-----	---
---	Nonstrat	Weak	None/ None	---	46 (1168) / II	1.1	1 (0.3)	None	---
fresh- dry	Nonstrat	Mod	None/ Poor	---	--- / II	20.0	---	130 (39.6) / 400 (121.9)	---
---	Strat (weak)	Weak	Poor/ None	None	None	0.8	<1 (0.3)	None	---
fresh- dry	Nonstrat	None- Weak	Poor/ None	None	--- / I	---	4.5 (1.4)	-----	---

PHYSICAL PROPERTIES COMPILED FROM
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ON SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SANSO

Table
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FUGRO NATIONAL, INC.

3

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	COBBLES (OF)
LD-FS-79	A5i	Sandy Gravel	GP	Mod	None	Cobble	
LD-FS-80	A1/A5yf	Sand	SP	Poor	None	Gravel	
LD-FS-81	A5oc	Sandy Gravel w/ cobbles and boulders	GP	Mod	None	Boulder	15
LD-FS-82	A5yf (A5if)	Silty Sand	SM	Mod	None	Gravel	
LD-FS-83	A5oc	Sand Gravel w/cobbles	GP	Poor	None	Cobble	
LD-FS-84	A5yf (A5if)	Silty Sand	SM	Mod	None	Coarse Gravel	
LD-FS-86	A5yf (A5if)	Silty Sand	SM	Mod	None	Gravel	
LD-FS-88	A5yf (A5if)	Silty Sand	SM	Mod	None	Fine Gravel	
LD-FS-89	A2	Gravelly Sand w/silt	SP-SM	Mod	Low	Gravel	
LD-FS-90	A5yf (A5if)	Silty Sand	SM	Mod	None	Coarse Gravel	
LD-FS-91	A5i	Gravelly Sand w/silt	SP	Mod	None	Cobble	
LD-FS-92	A5yf (A5if)	Silty Sand	SM	Mod	None	Fine Gravel	
LD-FS-93	A5iy	Sandy Gravel	GP	Mod	None	Cobble	

NOTES: ① Includes only complete data steps designated by symbol (▲) on Drawing 2.

② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), Igneous intrusive (I1), or igneous extrusive (I2).

④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

MATERIAL PROPERTIES

MAXIMUM GRAIN SIZE	APPROXIMATE SIZE DISTRIBUTION				ROCK TYPE(S) ③	GRAIN SHAPE	MUNSELL COLOR	MOISTURE CONTENT	CONSISTANCY	WEATHERING ③	STRUCTURE
	COBBLES BOULDERS (% OF TOTAL)	OF FRACTION ≤ 3 INCHES (76mm)									
		GRAVEL	SAND	FINES							
Fine Gravel	0	<5	90	5	---	Ang-Subang	7.5YR 6/6	Dry	Med Dense-Dense	---	Nonstr
Cobble	---	60	35	<5	M	Subang	7.5YR 7/6	Dry	Dense	Very	Nonstr
Gravel	0	5	90	5	Il	Subang-Subrnd	7.5YR 7/4	Dry	Med Dense	---	Nonstr
Boulder	15-20	60	35	5	Il,M	Ang	7.5YR 7/4	Dry	Med Dense-Dense	Fresh-Very	Nonstr
Gravel	0	5	80	15	Il	Subang-Subrnd	7.5YR 7/4	Dry	Med Dense	---	Nonstr
Cobble	---	85	15	0	M,Il	Subang-Subrnd	10YR	Dry	Med Dense-Dense	Fresh-Very	Strat (weak)
Coarse Gravel	0	5	80	15	Il	Subang-Subrnd	7.5YR 7/4	Dry	Med Dense	---	Nonstr
Gravel	0	<5	80	15-20	---	Ang-Subrnd	7.5YR	Dry	Med Dense	---	Nonstr
Fine Gravel	0	<5	70	25	---	Ang-Subang	7.5YR 7/4	Dry	Med Dense	---	Nonstr
Gravel	0	15	70	<15	M	Subang	10YR 6/3	Dry	Med Dense	Mod	Nonstr
Coarse Gravel	0	<5	80-85	15	---	Ang-Subang	7.5YR 7/4	Dry	Med Dense-Dense	---	Nonstr
Cobble	---	20	70	10	M,Il	Ang-Subang	7.5YR 7/4	Dry	Med Dense	Very	Nonstr
Fine Gravel	0	5	80	15	---	Subang-Subrnd	7.5YR 6/4	Dry	Med Dense	---	Nonstr
Cobble	---	80	20	<1	M	Subrnd	---	Dry	Med Dense	Slight	Nonstr Imbrication

③ Measured from USGS Topographic Maps (1:24000 1:62500) in general vicinity of data point.

and coarse
type symbols:
Sedimentary (S),
(I), or igneous

Indicate depth
caliche in buried
present in upper unit.

			SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY			
ERING	STRUCTURE	CEMENTATION	PAVEMENT PATINA	B HORIZON	CALICHE ④ DEPTH / STAGE INCHES(mm) / (TABLE E-4)	SLOPE (°) ⑤	MAXIMUM MICRO-RELIEF FEET (METERS)	INCISION DEPTH WIDTH FEET (METERS)	STREAM GRADIENT (:) ⑤
	Nonstrat	Weak	Fair/ None	None	1 (25) / II	0.8	---	1.5 (0.5) / 6 (1.8)	---
	Nonstrat	Weak- Mod	Well/ Well	Good	--- / II	1.2	---	None	---
	Nonstrat	Weak	None/ None	None	None	0.5	---	2 (0.6) / 5 (1.5)	---
sh- y	Nonstrat	---	Well/ Well	None	--- / II	8.0	---	20 (6) / 100 (30)	2.0
	Nonstrat	Weak	None/ None	None	[29 (736) / II]	1.5	1(0.3)	None	---
sh- y	Strat (weak)	Mod	---/ ---	---	--- / II	32.0	---	-----	---
	Nonstrat	Weak	None/ None	None	[31 (787) / II]	1.5	1(0.3)	None	---
	Nonstrat	Weak	None/ None	None	[18 (457) / II]	0.9	0.5 (0.2)	None	0.9
	Nonstrat	Weak	None/ None	None	[32 (813) / II]	1.0	0.5 (0.2)	None	---
d	Nonstrat	Weak	Well/ Fair	None	--- / ---	---	---	-----	---
	Nonstrat	Weak	None/ None	None	[32 (813) / II]	1.2	0.7 (0.2)	None	---
Y	Nonstrat	Weak	Well/ Well	Poor	6 (152) / II	0.8	3(0.9)	14 (4.3) / 75 (22.9)	---
	Nonstrat	Weak	None/ None	None	[22 (559) / ---]	1.2	1(0.3)	None	1.2
ght	Nonstrat Imbrica- tion	None	Fair/ Poor	None	None	0.8	3(0.9)	7 (2.1) / 300 (91.4)	---

PHYSICAL PROPERTIES COMPILED FROM
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ON SITE INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAWSO

TABLE
B-1

FUGRO NATIONAL, INC.

3

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	APPROXIMATE
							COBBLES BOULDERS (% OF TOTAL)
LD-FS-94	A5if	Sand	SP	Mod	None	Cobble	<1
LD-FS-96	A5i	Gravelly Sand/ Silty Sand	SP-SM	Mod	None	Boulder	10
LD-FS-97	A5oc	Sandy Gravel w/ cobbles and boulders	GP	Mod	None	Boulder	40
LD-FS-98	A5iyf	Gravelly Sand w/ silt and cobbles	SP-SW	Mod	None	Cobble	15
LD-FS-99	A1/A5y	Sandy Gravel	GP	Mod	None	Boulder	---
LD-FS-100	A5yf	Silty Sand	SM	Poor	None- Low	Fine Gravel	0
LD-FS-101	A5iyf (A5if)	Silty Sand	SM	Poor	None	Gravel	0
LD-FS-102	A3d	Sand	SP	Poor	None	Sand	0
LD-FS-103	A5iyf	Silty Sand w/ gravel	SM	Mod	None	Cobble	---
LD-FS-105	A5iyf	Silty Sand	SM	Mod	None	Coarse Gravel	0
LD-FS-106	A5if	Sand	SP	Mod	None	Coarse Gravel	0
LD-FS-107	A5iyf	Sand	SP	Poor	None	Gravel	0
LD-FS-108	A5yf	Fine Sand	SP	Poor	None	Gravel	0
LD-FS-109	A1/A5yf	Sand	SP	Poor	None	Sand	0

NOTES: ① Includes only complete data steps designated by symbol (▲) on Drawing 2.

② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), Igneous intrusive (I1), or Igneous extrusive (I2).

④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

MATERIAL PROPERTIES

MAXIMUM GRAIN SIZE	APPROXIMATE SIZE DISTRIBUTION				ROCK TYPE(S) ③	GRAIN SHAPE	MUNSELL COLOR	MOISTURE CONTENT	CONSISTANCY	WEATHERING ③	STRUCTURE
	COBBLES BOULDERS (% OF TOTAL)	OF FRACTION IN 3 INCHES (76mm)									
		GRAVEL	SAND	FINES							
Gravel	<1	<5	85-90	5-10	M	Ang-Subrnd	5YR 5/8	Dry	Dense	Slight	Nonstrat
Boulder	10	30	50	20	M, I2	Subang	5YR 6/6	Dry	Med Dense-Dense	Very	Nonstrat
Boulder	40	80	20	<1	M, I1	Ang-Subang	---	Dry	Dense	Fresh-Very	Strat (weak)
Gravel	15	30	60	10	M	Subang-Subrnd	7.5YR 6/4	Dry	Med Dense	Mod	Nonstrat
Boulder	---	70	25	5	M	Subang-Subrnd	10YR	Dry	Loose	Fresh	Nonstrat
Fine gravel	0	<1	75	25	I1	---	10YR 6/4	Dry	Loose-Med Dense	---	Nonstrat
Gravel	0	<1	85	15	I1	---	10YR 6/4	Dry	Med Dense-Dense	---	Nonstrat
Sand	0	0	>95	<5	--	Subrnd	10YR 6/4	Dry	Med Dense	---	Strat (weak); Lensed
Gravel	---	15	70	15	I1	Ang-Subang	10YR 6/4	Dry	Dense	Fresh-Mod	Nonstrat Strat (weak)
Coarse gravel	0	5	80	15	I1	Subang	10YR 6/4	Dry	Med Dense	Mod	Nonstrat
Coarse gravel	0	<1	95	5	I1	Ang-Subang	10YR 6/4-7.5YR 6/6	Dry	Med Dense	Mod	Strat (weak)
Gravel	0	1	98	<1	I1	Subrnd	---	Dry	Med Dense-Dense	---	Strat; Lensed (weak)
Gravel	0	<1	95	<5	---	Subang-Subrnd	10YR 6/6	Dry	Med Dense	---	Strat (weak)
Sand	0	<1	>99	0	---	Subrnd	10YR 6/4	Dry	Loose	---	Strat (well)

③ Measured from USGS Topographic Maps (1:24000, 1:62500) in general vicinity of data point.

and coarse
Type symbols:
Sedimentary (S),
I1), or igneous

Grain size depth
Depth in buried
unit in upper unit.

2

			SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY			
WEATHERING ③	STRUCTURE	CEMENTATION	PAVEMENT PATINA	B HORIZON	CALICHE ④ DEPTH / STAGE INCHES(mm) / (TABLE E-4)	SLOPE (%) ⑤	MAXIMUM MICRO- RELIEF FEET (METERS)	INCISION DEPTH WIDTH FEET (METERS)	STREAM GRADIENT (%) ⑥
Slight	Nonstrat	Mod	Well/ Fair	None	2 (51) / II	1.5	---	1 (0.3) / ---	---
Very	Nonstrat	Mod	Well/ Well	Poor	5 (127) / II	1.3	---	-----	---
Fresh- Very	Strat (weak)	Mod- Strong	None/ Poor	None	--- / ---	---	---	40 (12.2) / 150 (45.7)	---
Mod	Nonstrat	Mod	Fair/ Poor- Fair	None	7 (178) / II	1.2	---	5 (1.5) / 100 (30.5)	1.2
Fresh	Nonstrat	None	None/ None	None	None	---	---	-----	---
---	Nonstrat	None	None/ None	None	None	0.6	---	None	---
---	Nonstrat	None	Poor- None/ None	None	6 (152) / II	---	---	5 (1.5) / 25 (7.6)	---
---	Strat (weak); Lensed	None	None/ None	None	None	---	---	None	---
Fresh- Mod	Nonstrat- Strat (weak)	None	Fair- Well/ None	None	None	3.2	---	-----	---
Mod	Nonstrat	None	Fair/ None	None	None	---	2.5 (0.8)	5 (1.5) / 150 (45.7)	---
Mod	Strat (weak)	Mod	Mod/ Poor	Poor	10 (254) / II	---	1-2 (0.3- 0.6)	None	---
---	Strat; Lensed (weak)	None-weak	Fair/ None	None	None	1.3	3(0.9)	None	---
---	Strat (weak)	None	None/ None	None	None	1.0	1 (0.3)	None	---
---	Strat (well)	None	None/ None	None	None	0.4	3(0.9)	-----	---

PHYSICAL PROPERTIES COMPILED FROM
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LECHUGUILLA DESERT, ARIZONA

WX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAUSO

TABLE
B-1

FUGRO NATIONAL, INC.

3

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	APPROX
							COBBLES BOULDERS (% OF TOTAL)
LD-FS-110	A5if	Sand	SP	Mod	None	Gravel	0
LD-FS-111	A5iyf	Sand	SP	Poor	None	Cobbles	<5
LD-FS-112	A5yf	Sand	SP	Poor	None-Low	Fine Gravel	0
LD-FS-113	A5if	Sand	SP	Mod	None	Cobble	<1
LD-FS-114	A5iy	Sand	SP	Mod	None	Cobble	<1
LD-FS-115	A1/A5yf	Sand	SP	Poor	None	Sand	0
LD-FS-120	A5iyf	Sand w/silt	SP	Poor	None	Gravel	0
LD-FS-121	A5if	Silty Sand w/ gravel	SM	Poor	None	Coarse Gravel	0
LD-FS-123	A5yf (A5if)	Gravelly Sand w/silt	SP	Mod	None	Gravel	0
LD-FS-124	A5if	Gravelly Sand w/ silt and cobbles	SP	Mod	None	Cobble	15
LD-FS-127	A5yf (A5if)	Sand	SP	Poor-Mod	None	Cobble	<1
LD-FS-128	A5ic	Sandy Gravel	GP-GW	Mod	None	Boulder	6
LD-FS-130	A5yf (A5if)	Sand	SP	Poor	None	Sand	0
LD-FS-131	A5if (M)	Sandy Gravel	GP	Mod	None	Cobble	5

NOTES: ① Includes only complete data steps designated by symbol (▲) on Drawing 2.

② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), Igneous intrusive (I¹), or Igneous extrusive (I²).

④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

MATERIAL PROPERTIES

SIZE	APPROXIMATE SIZE DISTRIBUTION				ROCK TYPE(S) ③	GRAIN SHAPE	MUNSELL COLOR	MOISTURE CONTENT	CONSISTANCY	WEATHERING ③	STRUCTURE	CEMENTATION
	COBBLES BOULDERS (% OF TOTAL)	OF FRACTION ≤ 3 INCHES (76mm)										
		GRAVEL	SAND	FINES								
	0	<5	≈95	<5	Il	Subang	7.5YR 6/6	Dry	Med Dense-Dense	Mod	Nonstrat	M
	<5	5	95	<1	Il	Subang-Subrnd	10YR 7/4	Dry	Med Dense	Mod-Very	Strat (well)	M
avel	0	<1	95	<5	Il	Subang	10YR 6/4	Dry	Loose-Med Dense	---	Nonstrat	M
	<1	<5	95	<5	Il,M	Subang	7.5YR 6/6	Dry	Loose-Med Dense	Mod-Very	Nonstrat	M
	<1	<5	>95	<5	Il	Subang-Subrnd	10YR 7/4	Dry	Loose-Med Dense	Fresh-Mod	Strat (weak)	M
	0	0	95	<5	Il	Ang-Subang	10YR 6/4	Dry	Med Dense	---	Strat	M
	0	<1	90	10	Il	Subang	10YR 6/4	Dry	Med Dense	---	Nonstrat	M
	0	15	70	15	Il	Subang	7.5YR 5/6	Dry	Med Dense-Dense	Mod	Nonstrat	Weak
	0	15	75	10	Il	Subang-Subrnd	10YR 6/4	Dry	Med Dense-Dense	---	Nonstrat	None
	15	15-20	65-70	15	Il,M	Subang-Subrnd	7.5YR 6/4	Dry	Dense	Slight-Very	Nonstrat	Weak Strat
	<1	≈5	>85	<10	Il,M	Subang	10YR 6/4	Dry	Med Dense-Dense	Mod	Strat (weak)	M
	6	55	40	<5	M	Ang-Subang	10YR 6/4	Dry	Med Dense-Dense	Fresh-Mod	Nonstrat	-

SLOPE (%)	MAXIMUM MICRO-RELIEF FEET (METERS)	SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY		
		INCISION DEPTH FEET (METERS)	WIDTH FEET (METERS)	STREAM GRADIENT (%)	PAVEMENT PATINA	B HORIZON	CALICHE ④ DEPTH INCHES(mm) / STAGE (TABLE E-4)
1.6	3.5 (1.1)	3 (0.9) / <20 (6.1)	---	---	Fair/None-Poor	Poor	2 (51) / II
---	3(0.9)	3-4 (0.9-1.2) / <20 (6.1)	---	---	None/None	None	None
0.9	2(0.6)	None	---	---	None/None	None	None
---	3(0.9)	5-6 (1.5-1.8) / 30 (9.1)	---	---	Poor-Fair/None	Poor	7 (25) / I-II
---	---	5-10 (1.5-3) / 75 (22.9)	---	---	Poor/None	None	None
0.5	---	3-4 (0.9-1.2) / 40-50(12.2-15.2)	---	---	None/None	None	None
---	---	2 (0.6) / 10 (3.0)	---	---	Poor/None	None	None
10.0	4(1.2)	5-6 (1.5-1.8) / 100 (30.5)	---	---	Fair/None-Poor	Poor	12 (305) / II
1.6	2 (0.6)	None	---	---	Well/None	----	[9 (229) / ---]
---	2.5 (0.8)	4-5 (1.2-1.5) / 30 (9.1)	---	---	Fair-Well/Poor	Poor	16 (406) / I-II
---	4(1.2)	None	---	---	None/None	None	None
6.4	2(0.6)	4-5 (1.2-1.5) / 20-25 (6.1-7.6)	---	---	Well/Fair-well	None	None
1.5	3(0.9)	None	---	---	Fair/Poor	None	[4 (102) / II]
3.2	2(0.6)	4-5 (1.2-1.5) / 20-25 (6.1-7.6)	---	---	Well/Fair-Well	Poor	3 (76) / II

PHYSICAL PROPERTIES COMPILED FROM
FIELD OBSERVATIONS - PAGE 7 OF 9
LECHUGUILLA DESERT, ARIZONA

UX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAUSO

TABLE
B-1

FUGRO NATIONAL, INC.

3

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	APP
							COBBLE BOULDER (% OF T)
LD-FS-133	A5iyf	Sand	SP	Poor-Mod	None	Gravel	0
LD-FS-134	A5i	Gravelly Sand w/cobbles and boulders	SP-SW	Mod	None	Boulder	16
LD-FS-136	A5if	Gravelly Sand	SP	Poor-Mod	None	Cobble	<1
LD-FS-137	S	Sandy Gravel w/silt, boulders & cobbles	GM	Poor-Mod	None	Boulder	55
LD-FS-139	A3s	Fine Sand	SP	Poor	None	Cobble on Surface	—
LD-FS-140	A5if	Sand	SP	Mod	None	Cobble	<5
LD-FS-142	A5if	Sand	SP	Mod	None	Cobble	<1
LD-FS-143	A5if	Sand	SP	Poor	None	Gravel	0
LD-FS-144	A5if	Gravelly Sand w/silt	SP	Mod	None	Coarse Gravel	0
LD-FS-145	A5if	Sand	SP	Poor	Low	Coarse Gravel	0
LD-FS-148	A5if	Sand w/gravel	SP	Mod	None	Coarse Gravel	0
LD-FS-149	A5if	Sand w/silt	SP	Poor-Mod	None	Gravel	0
LD-FS-150	A5if	Sand	SP	Mod	None	Coarse Gravel	0
LD-FS-151	A5iyf	Sand	SP	Poor-Mod	None	Coarse Gravel	0

NOTES: ① Includes only complete data stops designated by symbol (▲) on Drawing 2.

② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), igneous intrusive (I?), or igneous extrusive (E?).

④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

MATERIAL PROPERTIES

SIZE	APPROXIMATE SIZE DISTRIBUTION			ROCK TYPE(S) ③	GRAIN SHAPE	MUNSELL COLOR	MOISTURE CONTENT	CONSISTANCY	WEATHERING ③	STRUCTURE	CE	
	COBBLES BOULDERS (% OF TOTAL)	OF FRACTION ≤ 3 INCHES (76mm)										
		GRAVEL	SAND									FINES
	0	<5	90	5-10	M	Ang-Subang	10YR 6/4	Dry	Dense	----	Nonstrat	
	16	30	65	5	M	Subang-Subrnd	10YR 7/4	Dry	Med Dense-Dense	Mod	Strat (weak)	
	<1	15-20	70-75	<10	M	Subang-Subrnd	7.5YR 6/6	Dry	Med Dense	Mod	Nonstrat	
	55	50	35	15	Il,M	Ang-Subrnd	----	Dry	Dense-V. Dense	Very	Nonstrat	
	---	<5	>95	0	M	Subrnd-Rnd	10YR 6/4	Dry	Dense	Mod	Nonstrat	
	<5	5	90	5	M	Subang-Subrnd	2.5YR 5/8	Dry	Med Dense	Slight	Nonstrat	
	<1	<5	90	5-10	M	Ang-Subrnd	5YR 6/4	Dry	Med Dense	Slight-Mod	Nonstrat	
	0	<5	>95	<5	M	Subrnd	10YR 6/4	Dry	Med Dense	Fresh-Mod	Nonstrat	
	0	25	65	10	M	Subang	7.5YR 7/4	Dry	Med Dense	---	Nonstrat	
	0	<1	90	<10	---	Subang-Subrnd	5YR 5/6	Dry	Med Dense-Dense	---	Nonstrat	
	0	10	85	5	---	Subang-Subrnd	7.5YR 6/4	Dry	Loose-Med Dense	---	Nonstrat	
	0	<5	≈90	≈10	M	----	7.5YR 5/6	Dry	Dense	---	Nonstrat	
	0	5-10	80-90	5-10	---	Ang-Subang	7.5YR 7/4	Dry	Med Dense	Fresh	Nonstrat	
	0	<1	95	5	M	Subang	10YR 6/4	Dry	Med Dense	---	Nonstrat	

③ Measured from USGS Topographic Maps (1:24000, 1:62500) in general vicinity of data point.

These
symbols:
Dry (S),
Igneous

depth
buried
upper unit.

2

			SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY			
WEATHERING ③	STRUCTURE	CEMENTATION	PAVEMENT PATINA	B HORIZON	CALICHE ④ DEPTH / STAGE INCHES(mm) / (TABLE E-4)	SLOPE (%) ⑤	MAXIMUM MICRO- RELIEF FEET (METERS)	INCISION DEPTH WIDTH FEET (METERS)	STREAM GRADIENT (%) ⑤
----	Nonstrat	None- Weak	Poor/ None	None	None	0.7	3 (0.9)	6-8 (1.8-2.4) / 50 (15.2)	0.6
Mod	Strat (weak)	Weak- Mod	Well/ Poor- Fair	Poor	5 (127) / I-II	---	---	15 (4.6) / 50 (15.2)	---
Mod	Nonstrat	Weak	Well/ Fair- Well	Poor	5 (127) / I	---	3 (0.9)	3-5 (0.9-1.5) / 20 (6.1)	---
Very	Nonstrat	Weak- Mod	---/ ---	---	---- / ---	---	---	-----	---
Mod	Nonstrat	Mod	Poor/ None	None	4 (102) / I-II	---	---	5 (1.5) / -----	---
Slight	Nonstrat	Weak- Mod	Well/ Poor	Good	11 (279) / II	---	---	3 (0.9) / 10 (3.0)	---
Slight- Mod	Nonstrat	Weak- Mod	Fair/ Poor- Fair	None	1 (25) / II	3.1	---	3-4 (0.9-1.2) / 10-15 (3.0-4.6)	3.1
Fresh- Mod	Nonstrat	Weak- Mod	Poor/ Poor	Poor	--- / II	---	4 (1.2)	-----	---
---	Nonstrat	Mod	Fair/ Poor	None	10 (254) / II	---	---	2 (0.6) / 4 (1.2)	---
---	Nonstrat	Mod	Poor- Fair/ None	Good	0 / II	---	0.5 (0.2)	None	---
---	Nonstrat	Weak- Mod	Fair/ None	None	2 (51) / II	---	---	1-2 (0.3-0.6) / 4-6 (1.2-1.8)	---
---	Nonstrat	Mod- Strong	Fair/ Poor	Poor	--- / II	2.0	1 (0.3)	None	---
Fresh	Nonstrat	Weak- Mod	Fair/ None	None	1 (25) / II	1.0	---	None	---
---	Nonstrat	None	Poor/ None	None	None	1.5	---	None	---

PHYSICAL PROPERTIES COMPILED FROM
FIELD OBSERVATIONS - PAGE 8 OF 9
LECHUGUILLA DESERT, ARIZONA

WE SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAUSO

TABLE
B-1

FUGRO NATIONAL, INC.

3

STATION NUMBER ①	ENGINEERING GEOLOGY UNIT ②	DESCRIPTIVE NAME(S)	USCS SYMBOL(S)	GRADATION	PLASTICITY OF FINES	MAXIMUM GRAIN SIZE	APPROXIMATE	
							COBBLES BOULDERS (% OF TOTAL)	GR
LD-FS-152	A5yf (A5if)	Silty Sand	SM	Mod	None	Coarse Gravel	0	
LD-FS-154	A5yf (A5if)	Silty Sand	SM	Mod	None	Coarse Gravel	0	
LD-FS-166	A5if	Silty Sand	SM	Mod	None	Coarse Gravel	0	
LD-FS-170	A5yf (A5if)	Silty Sand	SM	Mod	None	Fine Gravel	0	
LD-FS-177	A5iyf	Sand w/silt and gravel	SP	Poor-Mod	None	Cobble	<1	
LD-FS-182	A1/A5yf	Sand w/silt	SP	Poor	None	Coarse Cobble	0	
LD-FS-184	A5i	Gravelly Sand w/cobbles	SP	Mod	None	Cobble	10	
LD-FS-186	A5i	Sandy gravel w/cobbles and boulders	GP	Mod	None	Boulder	30-50	

- NOTES: ① Includes only complete data stops designated by symbol (▲) on Drawing 2.
- ② Where buried or mixed unit symbol occurs data are on unit listed first except where second unit is underlined. Where more than one layer is distinguished within one unit, numbering is from base to top.

- ③ Boulders, cobbles, and coarse gravel only. Rock type symbols: Metamorphic (M), Sedimentary (S), Igneous Intrusive (I1), or igneous extrusive (I2).
- ④ Data in brackets indicate depth to and stage of caliche in buried unit. Caliche absent in upper unit.

MATERIAL PROPERTIES

MAXIMUM SIZE	APPROXIMATE SIZE DISTRIBUTION			ROCK TYPE(S) ③	GRAIN SHAPE	MUNSELL COLOR	MOISTURE CONTENT	CONSISTANCY	WEATHERING ③	STRUCTURE	
	COBBLES BOULDERS (% OF TOTAL)	% OF FRACTION ≤ 3 INCHES (76mm)									
		GRAVEL	SAND								FINES
fine silt	0	<1	85-90	10-15	---	Ang- Subang	7.5YR 7/4	Dry	Med Dense- Dense	---	Nonstrat
fine silt	0	<1	85-90	10-15	---	Ang- Subang	7.5YR 7/4	Dry	Med Dense	---	Lensed
fine silt	0	5	80	15	Il	Subang- Subrnd	5YR 6/6	Dry	Med Dense- Dense	---	Nonstrat
fine silt	0	2	78	20	---	Subang- Subrnd	7.5YR 6/6	Dry	Loose- Med Dense	---	Nonstrat
fine silt	<1	10	80	10	Il	Subang	10YR 6/4	Dry	Med Dense	Mod	Nonstrat
fine silt	0	5	85	10	---	Subang- Subrnd	7.5YR 7/4	Dry	Loose- Med Dense	---	Lensed
fine silt	10	20	75	5	Il	Subang- Subrnd	5YR 5/6	Dry	Med Dense- Dense	Mod	Nonstrat
clay silt	30-50	70	25	5	M, Il	Ang- Subrnd	-----	Dry	V. Dense	Mod Very	Strat (weak)

③ Measured from USGS Topographic Maps (1:24000, 1:62500) in general vicinity of data point.

and coarse
type symbols:
metamorphic (S),
(I), or igneous
bedrock depth
shown in buried
in upper unit.

			SURFACE SOIL DEVELOPMENT			SURFACE MORPHOLOGY			
WEATHERING (1)	STRUCTURE	CEMENTATION	PAVEMENT PATINA	B HORIZON	CALICHE (4) DEPTH / STAGE INCHES(mm) / (TABLE E-4)	SLOPE (%) (5)	MAXIMUM MICRO- RELIEF FEET (METERS)	INCISION DEPTH WIDTH FEET (METERS)	STREAM GRADIENT (%) (5)
---	Nonstrat	Weak	None/ None	None	[19(482.6) / II]	0.9	0.5 (0.2)	None	---
---	Lensed	Weak	None/ None	None	[30(762.0) / II]	0.8	1(0.3)	None	---
---	Nonstrat	Mod	Well/ None	None	1 (25) / II	---	---	1-2 (0.3-0.6) / 3-8 (0.9-2.4)	---
---	Nonstrat	Weak	None/ None	None	[37(939.8) / ---]	1.5	1(0.3)	None	---
Mod	Nonstrat	None	Poor/ None	None	None	1.8	3(0.9)	5 (1.5) / 40 (12.2)	---
---	Lensed	Weak	None/ None	None	None	0.7	---	---	0.7
Mod	Nonstrat	Mod	Well/ Fair	None	4(102) / II	2.0	---	1 (0.3) / 4 (1.2)	---
Mod Very	Strat (weak)	Strong	Poor/ Poor	----	0 / II-III	10.0	---	10-20(3.0-6.1) / 50-60(15.2-18.3)	1.4

PHYSICAL PROPERTIES COMPILED FROM
FIELD OBSERVATIONS - PAGE 9 OF 9
LECHUGUILLA DESERT, ARIZONA

ON SITE INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAUSO

TABLE
B-1

FUGRO NATIONAL, INC.

AD-A113 449

FUGRO NATIONAL INC LONG BEACH CA

F/6 8/7

MX SITING INVESTIGATION GEOTECHNICAL EVALUATION OF LUKE BOMBING--ETC(U)

JAN 78

F04704-77-C-0010

UNCLASSIFIED

FN-TR-19D-VOL-3-APP-B

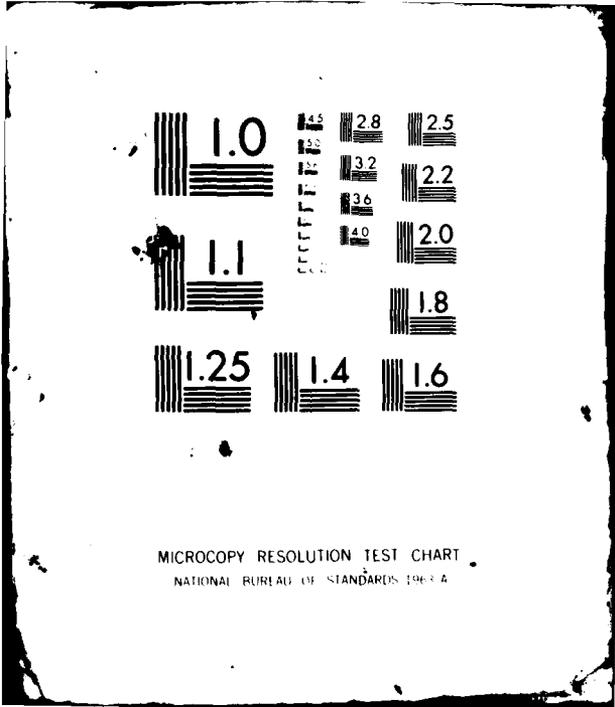
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FD 2
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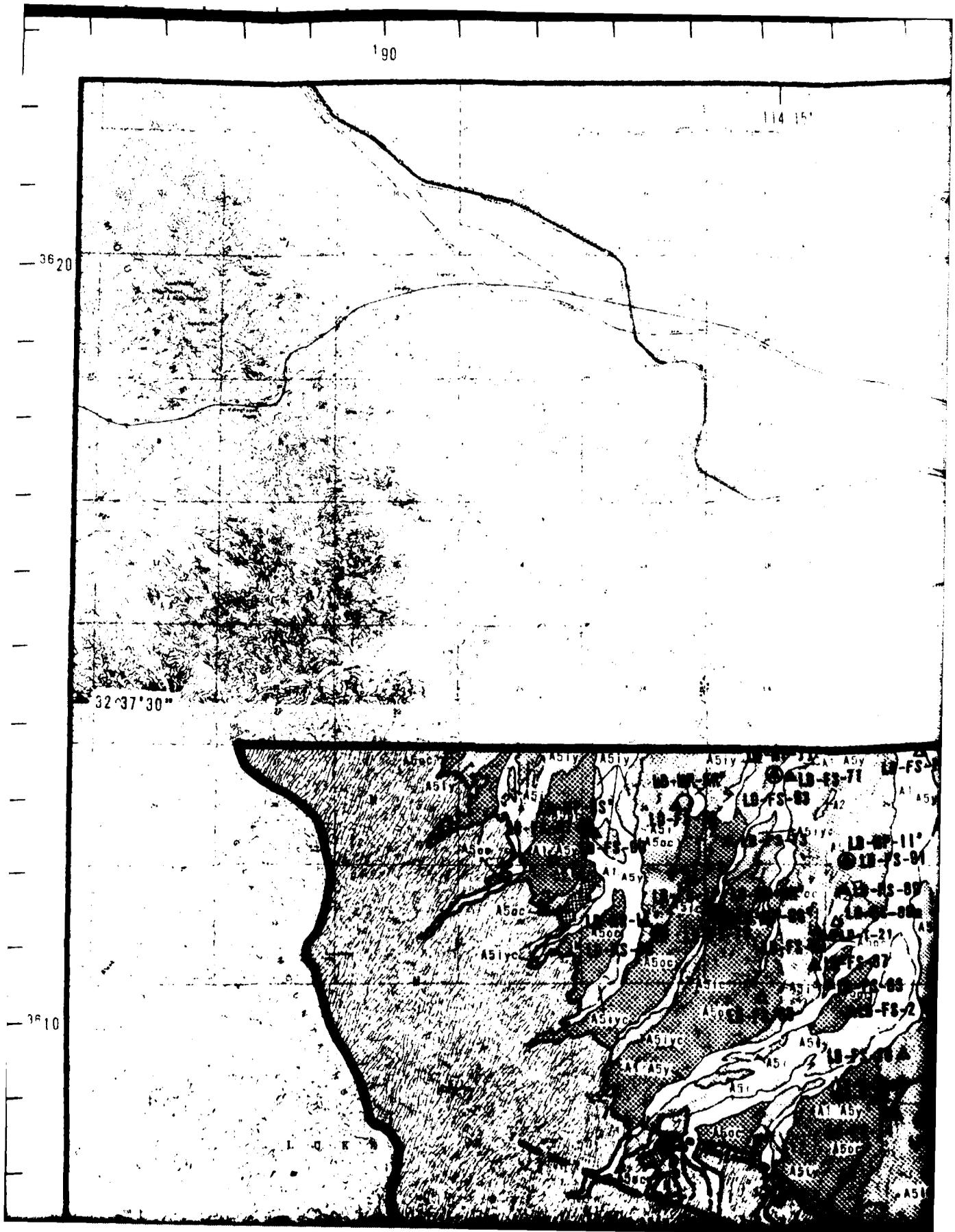


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DATE
FILMED
5 82
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A



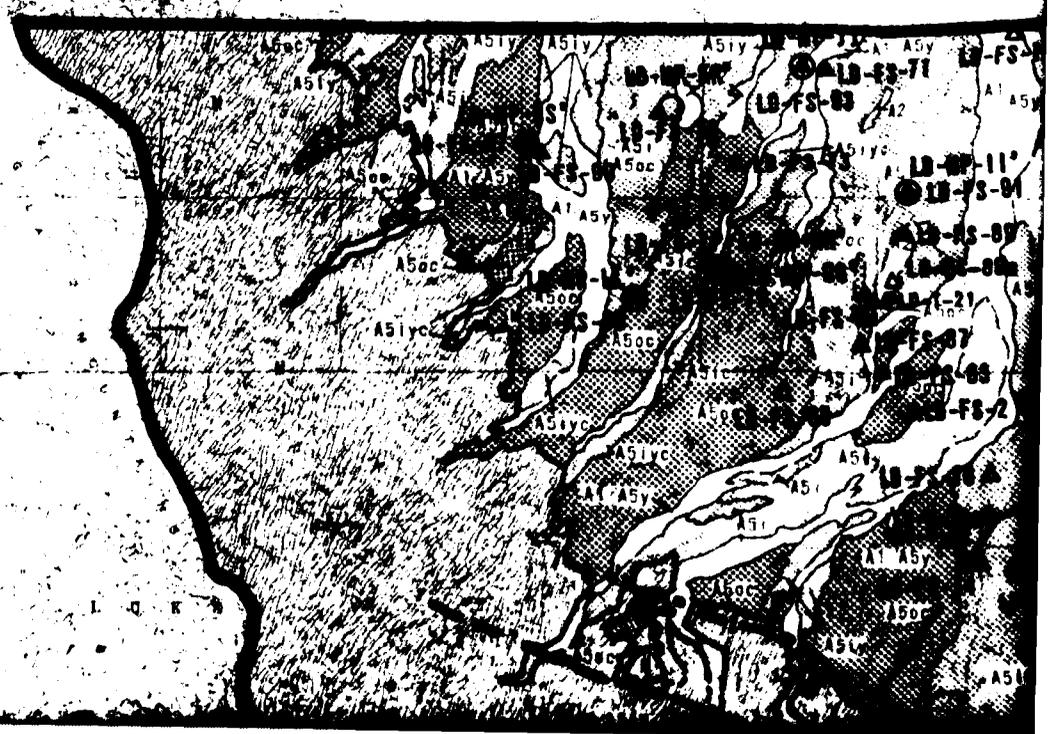
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114 15'

3620

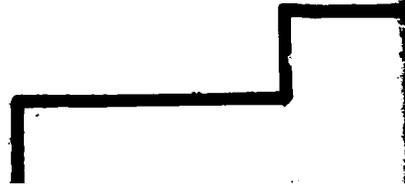
32°37'30"

3610



14 7'30"

LD-FS-190



14 00

LD-8-1

ASIV

LD-8-11

LD-8-1

LD-FS-17

LD-FS-1

LD-8-5

LD-FS-1

LD-FS-9

ASIV

LD-8-6

ASIV

T-2

LD-C-1

LD-8-11

ASIV

LD-8-2

ASIV

ASIV

ASIV (AAL)

30 37

4

EXPLANATION

LD-FS-122
▲

Geologic Field Station; Denotes a complete data stop, including data sheets, photographs, and detailed field observations.

LD-FS-13
△

Geologic Field Station; Denotes a supplemental data stop for photographs and/or detailed field observations.

LD-MP-AA'
○

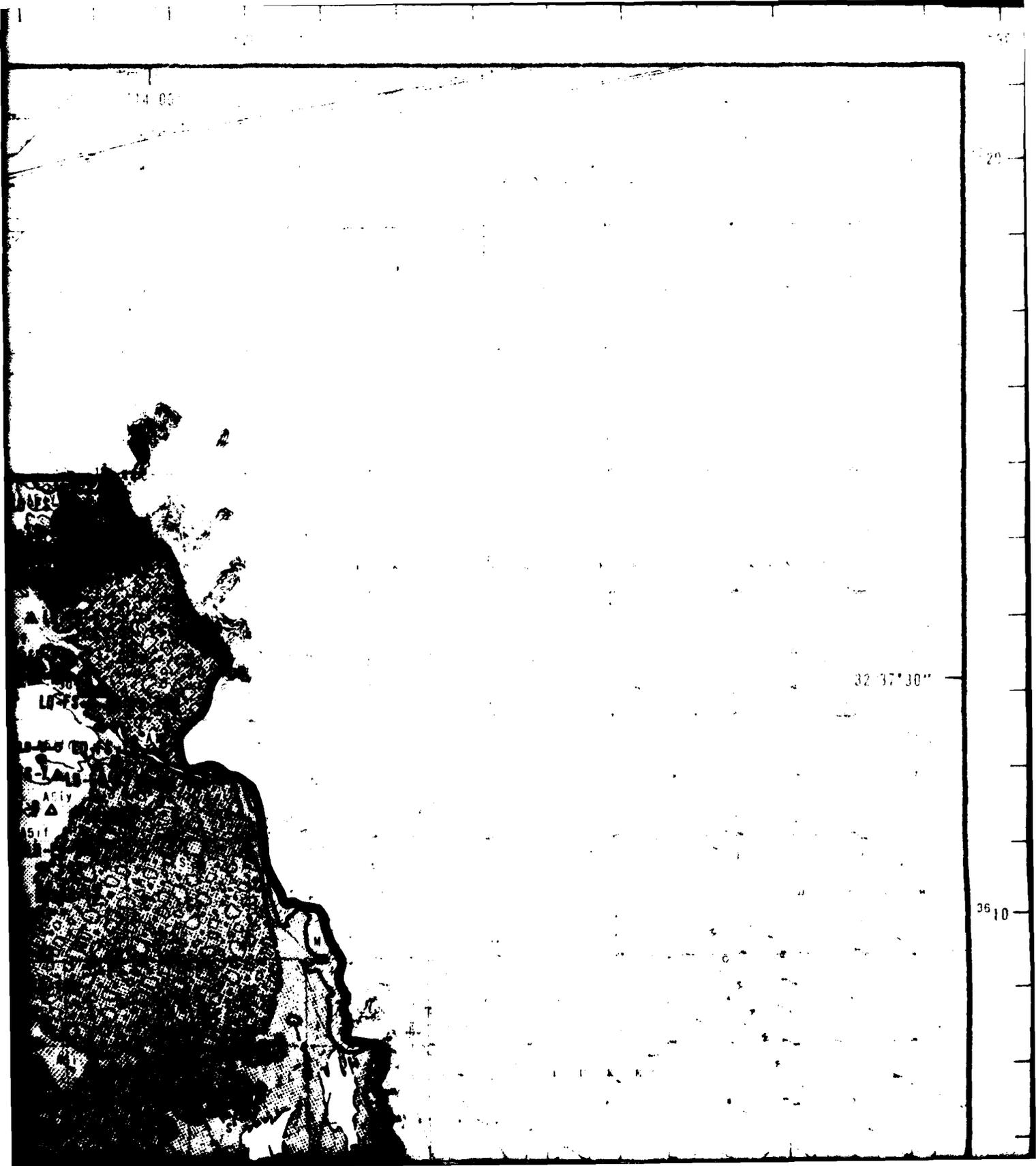
Microrelief Profiles; Denotes location which may coincide with geologic field stations.

A ——— A'
LD-CS-AA'

Line of Geologic Cross Section.

LD-A, B, C, D, T, OR S-1
●

Activity locations (borings, trenches, shallow seismic refraction lines).



114 00

35

20

32 37' 30"

36 10

MAP

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ACTY

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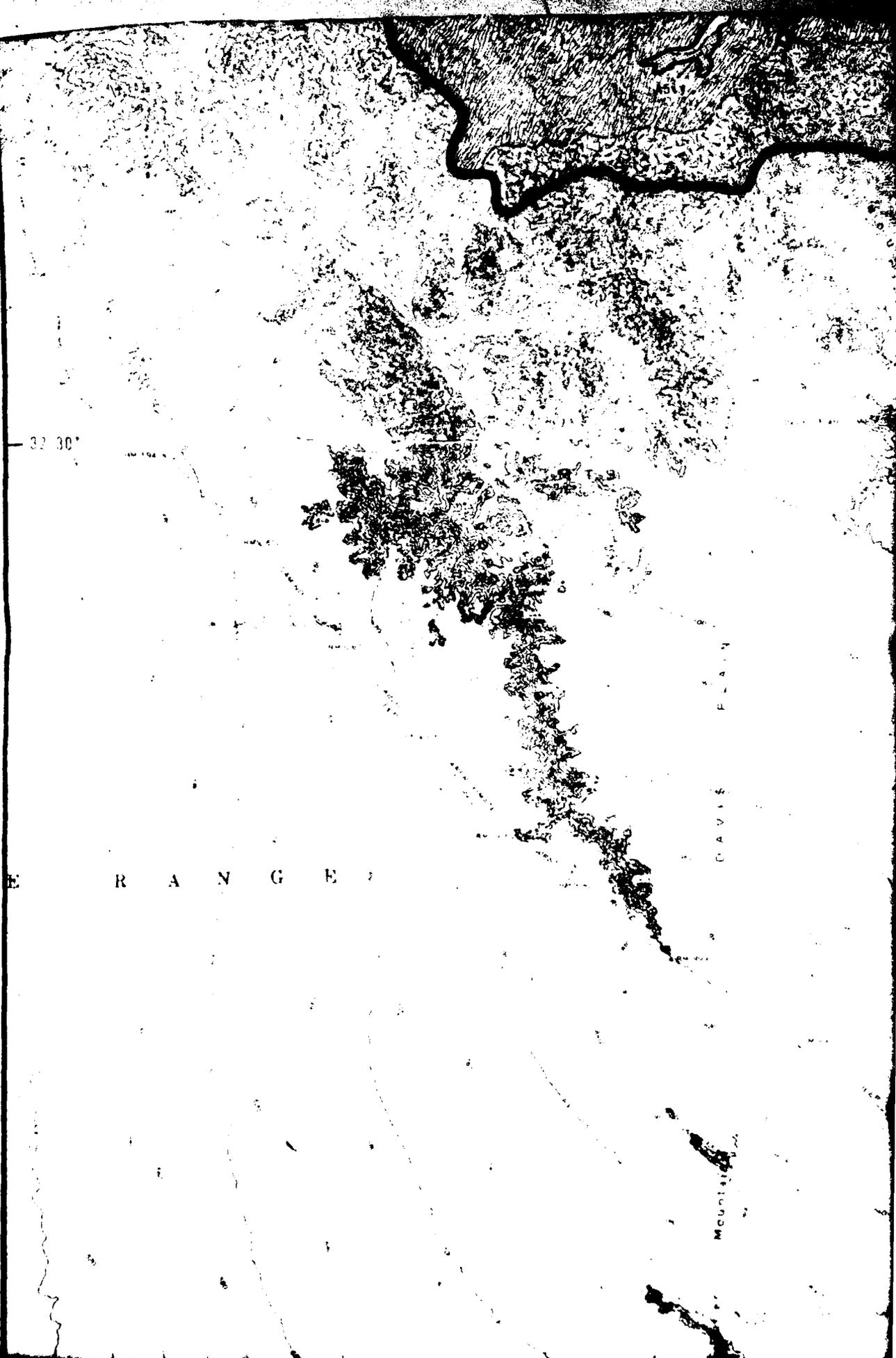
6

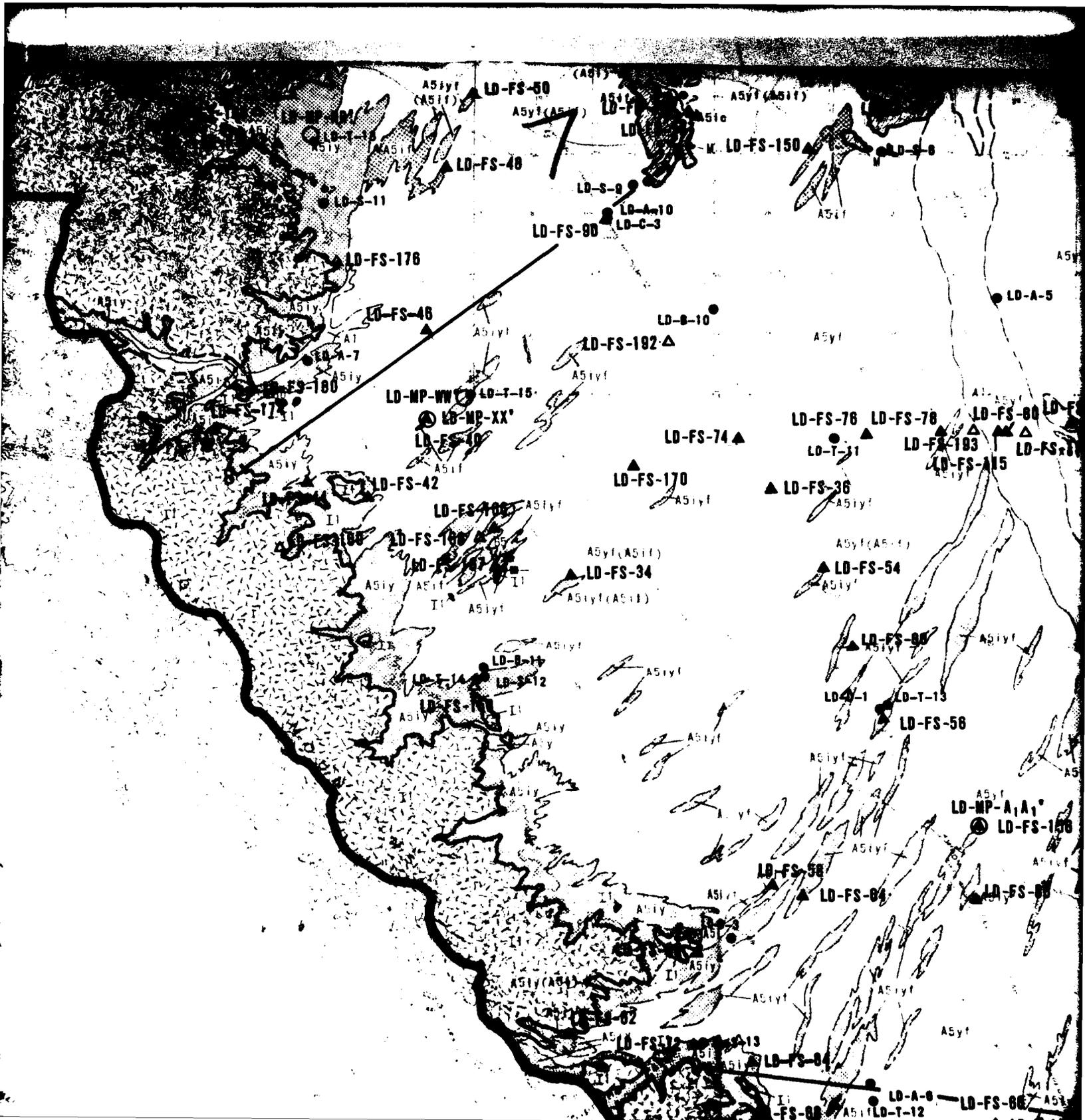
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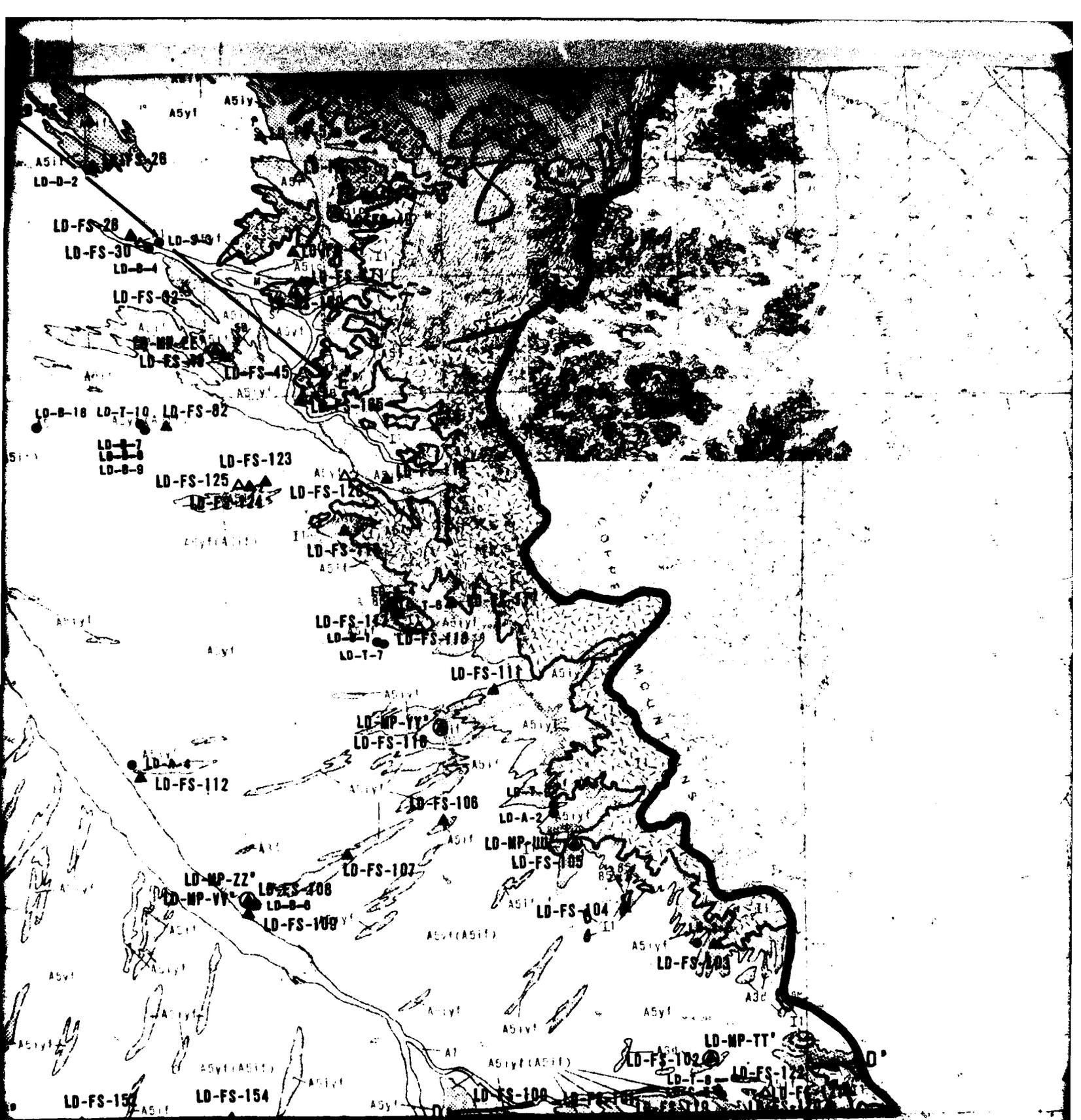
32 30'

E R A N G E

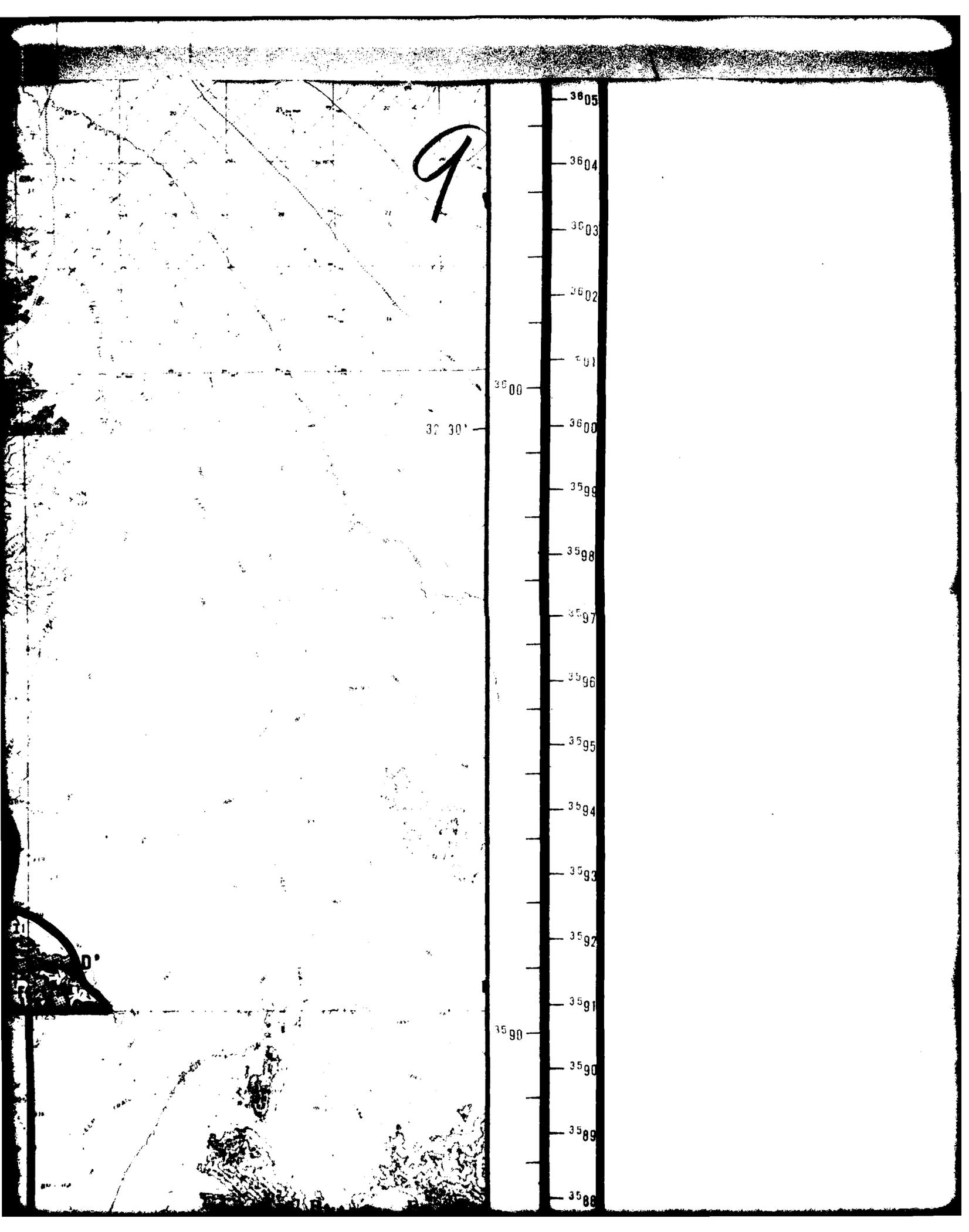
CAVIS PLAIN
Mountains







CABEZA PRIETA GAME RANGE EXTENSION



9

32 30'

3605
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32°22'30"

3580

32°15'

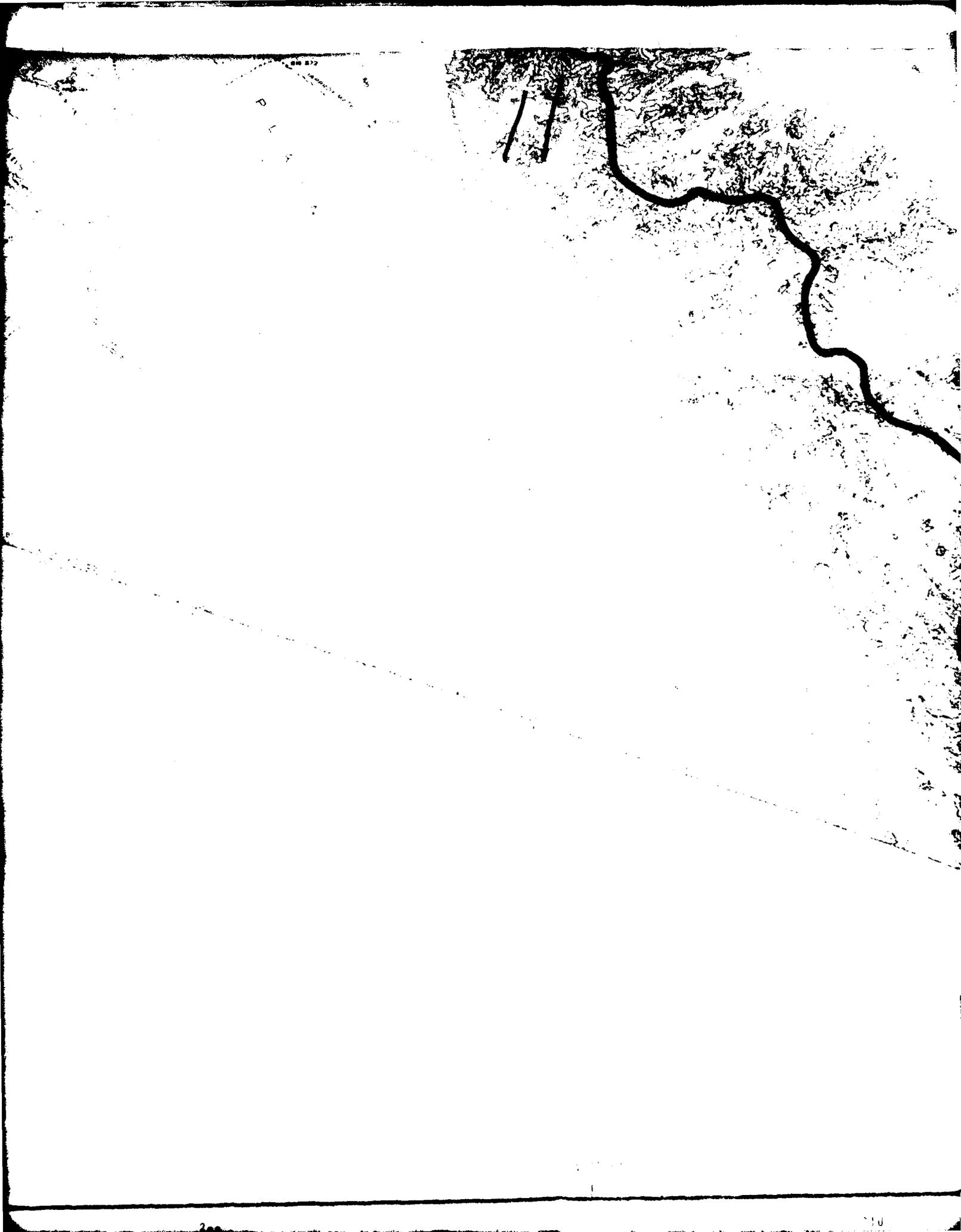
3570 000 N
3580 000 N
184 000 E

YUMA CO

YUMA
LESER

114°15'





12

TECHUGUILLA

DESERT

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San Juan de los Rios

TECHUGUILLA

DESERT

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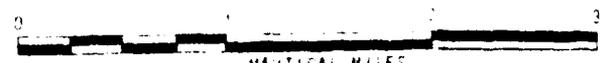
YUMA
DESERT

YUMA CO

35 30



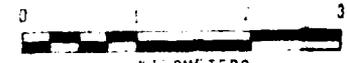
STATUTE MILES



NAUTICAL MILES



FEET



KILOMETERS

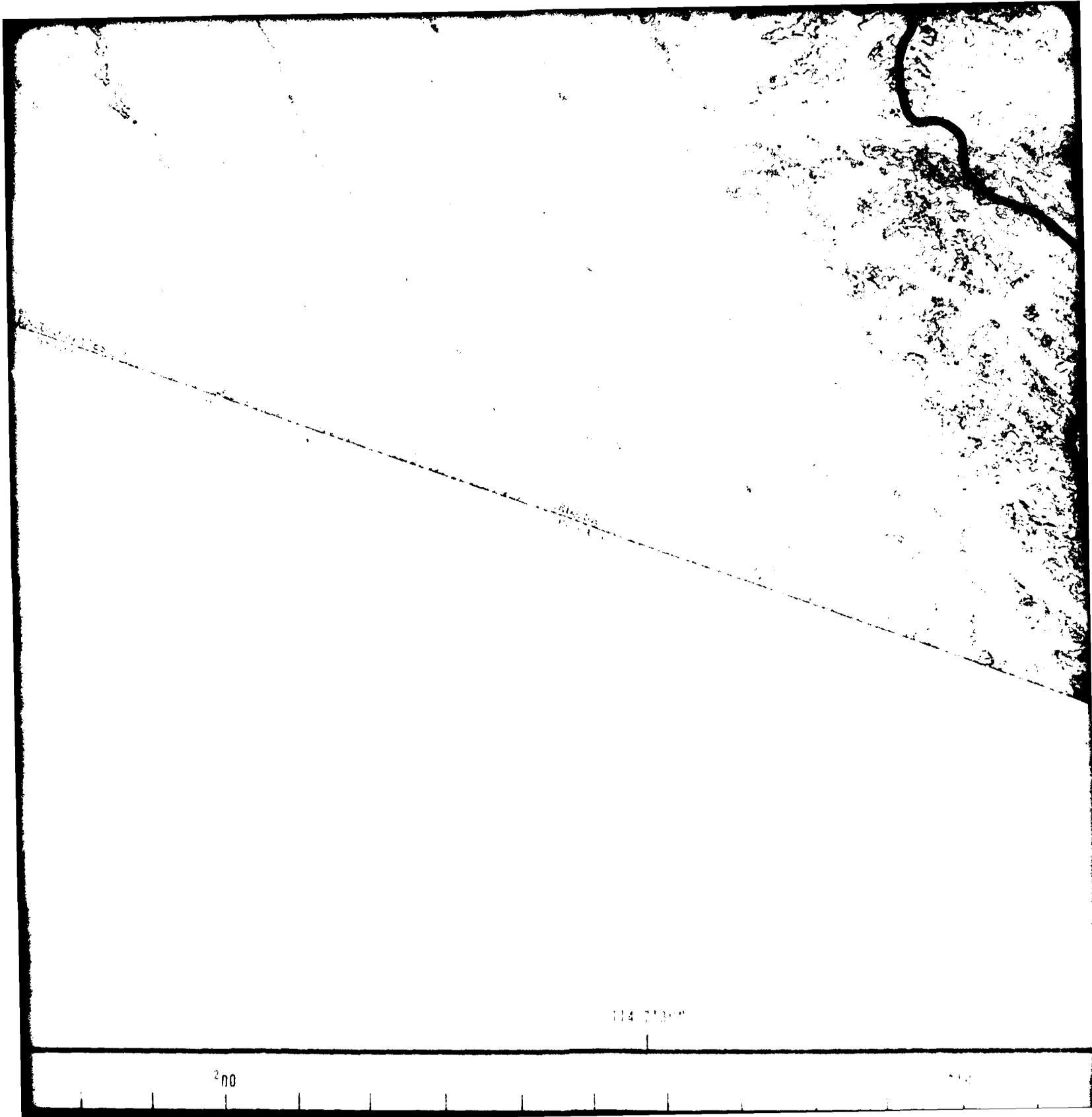
32 15'

35 00' N

114 00' E

114 00'

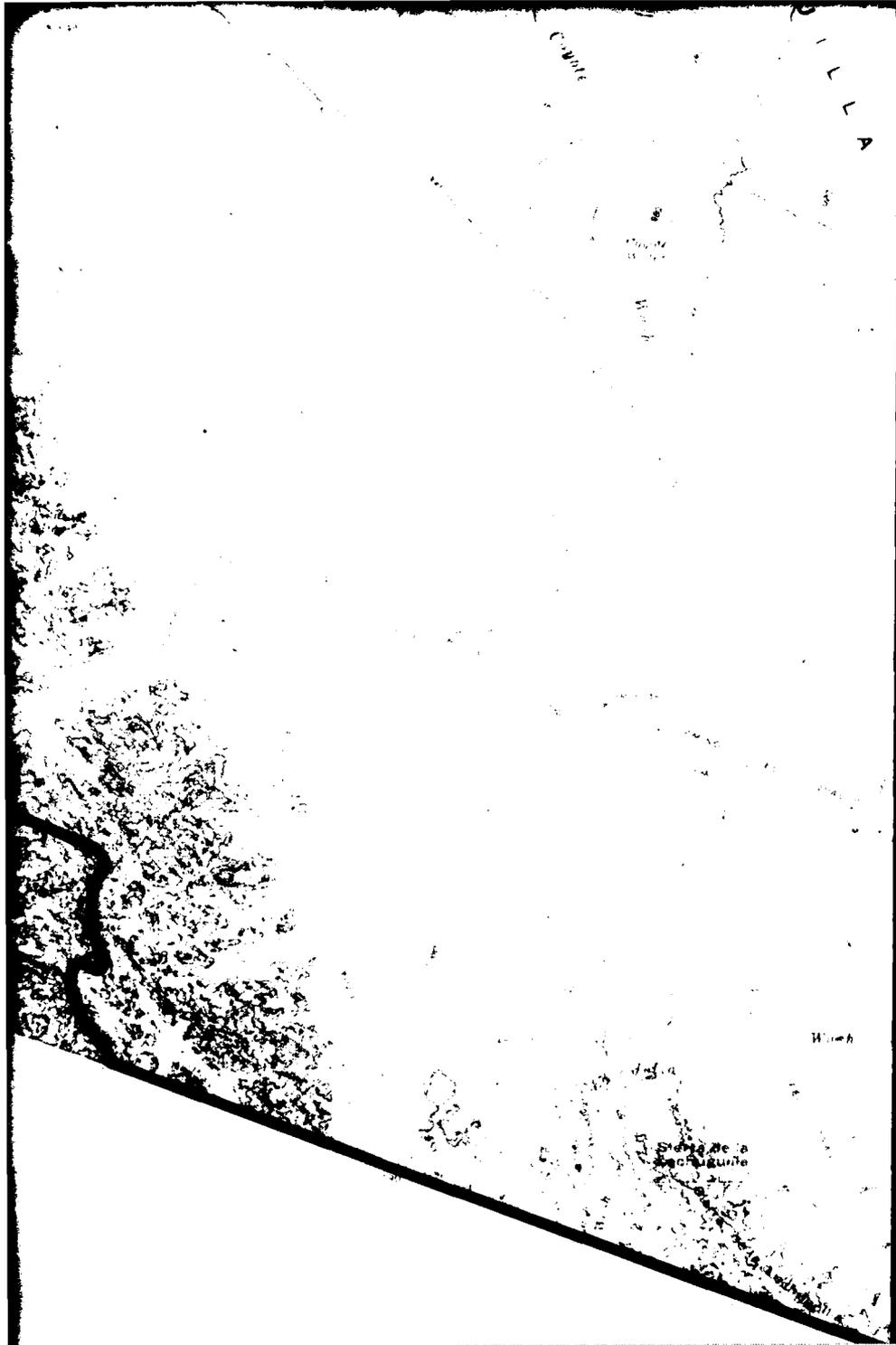
114 00'



114 210"

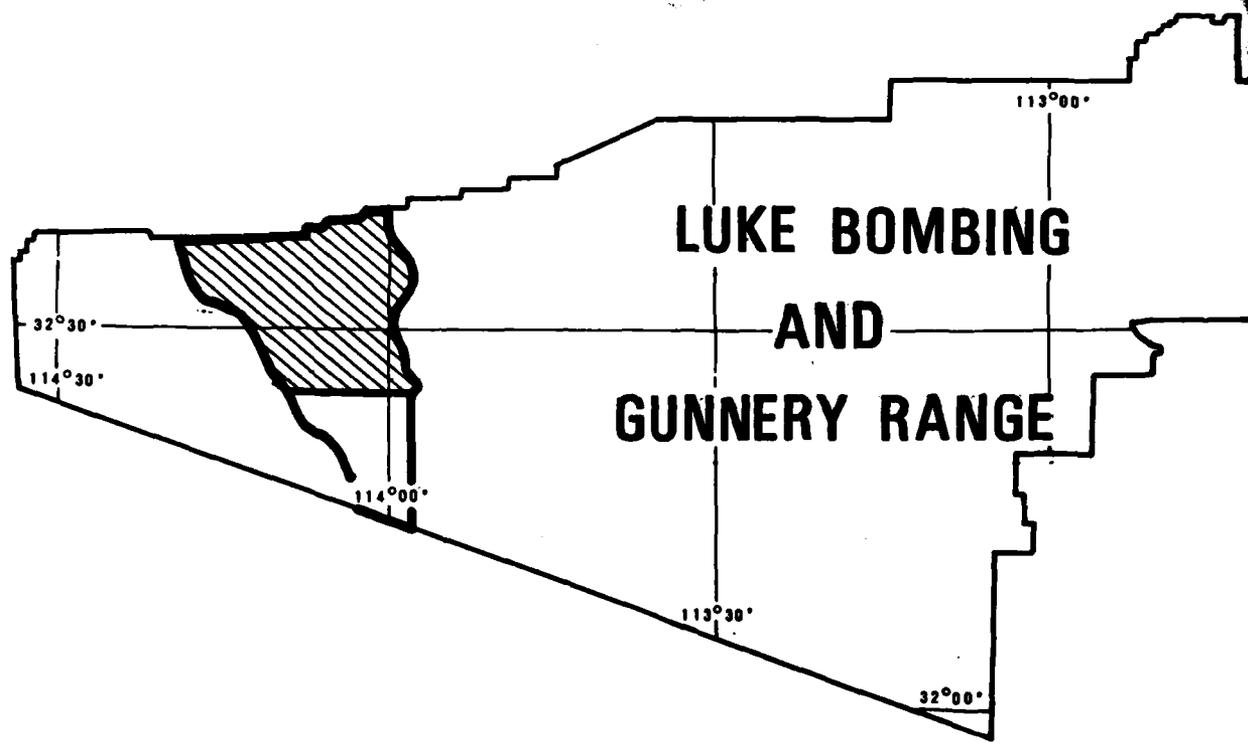
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110



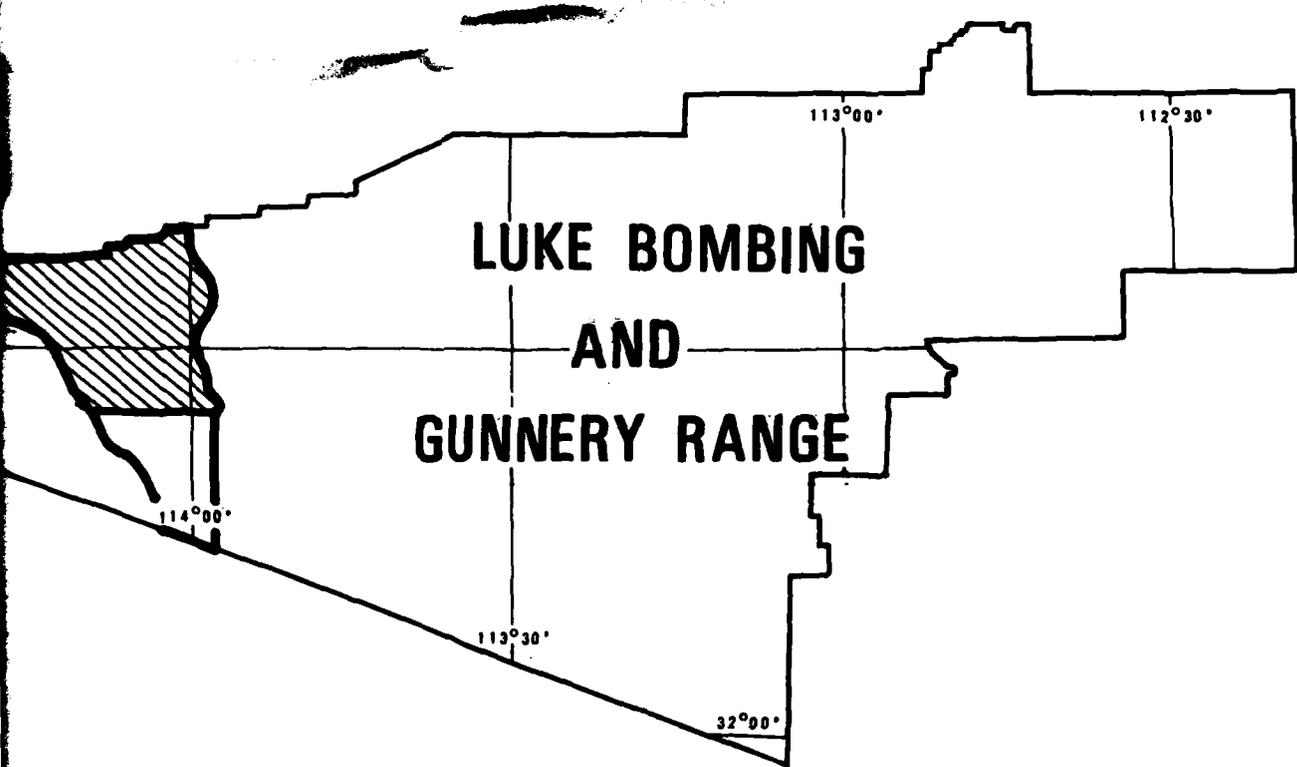
16

NOTE: Explanation of geologic units is contained on Drawing 1 Geologic Map of Lechuguilla Desert, Arizona



ACTIVITY
LECHUGUILLA

Note: Explanation of symbols used is contained on drawing 1. GEOLOGIC MAP OF
Lechuguilla Desert, Arizona



ACTIVITIES LOCATION MAP LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO	DRAWING B-1
FUGRO NATIONAL INC.	

**DAT
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