

SUSITNA HYDROELECTRIC PROJECT

INTERNAL REVIEW BOARD MEETING

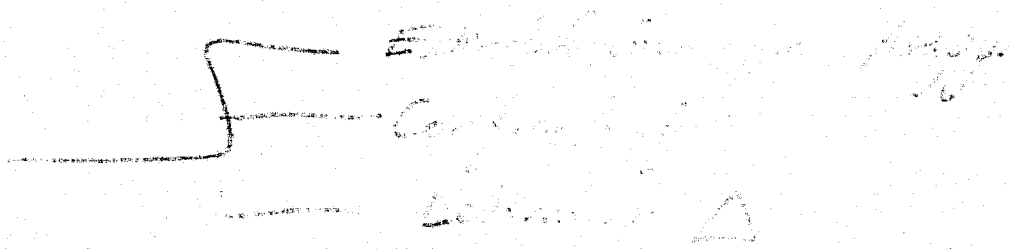
MEETING NO. 5

NOVEMBER 4, 1982

ACRES AMERICAN INCORPORATED
1000 Liberty Bank Building
Main at Court
Buffalo, New York 14202

OBJECTIVE OF
82 SUMMER PROGRAM

- DAMSITE



- WATANA RELICT CHANNEL

- BORROW AREA D

- FOG LAKES RELICT CHANNEL

BORROW AREA D

- DEFINE STRATIGRAPHY & EXTENT OF IDENTIFIED UNITS
- DEFINE GEOHYDROLOGY & PERMAFROST
- MATERIAL PROPERTIES

WATANA RELICT
CHANNEL

- DEFINE STRATIGRAPHY IN UPPER 200 FEET
- FURTHER DEFINE CHANNEL GEOMETRY
- DEFINE MATERIAL PROPERTIES
- DEFINE GEOHYDROLOGY
- DEFINE PERMAFROST CONDITIONS

FOG LAKES RELICT
CHANNEL

- DEFINE CHANNEL GEOMETRY

SCOPE OF 82-SUMMER
PROGRAM

- DRILLING
 - 16 BOREHOLES IN BORROW AREA D/RELICT CHANNEL
- SEISMIC REFRACTION SURVEY
 - 22,000 LF-DAM SITE
 - 16,000 LF-BORROW AREA D/RELICT CHANNEL
 - 45,000 LF-FOG LAKES
- GEOLOGIC MAPPING
 - DAM SITE
 - LOCAL
 - REGIONAL
 - BORROW SITE
 - D
 - E
 - I
- LABORATORY TESTING
 - ATTERBERG LIMITS
 - GRADATIONS
 - HYDROMETERS
 - MOISTURE CONTENTS
 - PROCTORS

EXISTING DIVERSION ARRANGEMENT

1. TWO - 38' Ø CONCRETE LINED TUNNELS
2. MULTI-LEVEL INTAKES
EL 1420
EL 1490
3. LOWER TUNNEL REDUCES WATER LEVEL IN COFFERDAM FOR CONSTRUCTION IN STANDING WATER.
4. LOWER TUNNEL AT DOWNSTREAM TO BE USED AS TAILRACE
5. HIGHER TUNNEL REQUIRED FOR FLOOD ONLY
6. HIGHER TUNNEL USED FOR LOW LEVEL RELEASE - MUST BE HIGH TO AVOID SILTING
7. LOWER TUNNEL IS PRESSURE TUNNEL.
8. CLOSURE STRUCTURES REQUIRED TO ENABLE PLUG AND LOW WATER RELEASE TO BE CONSTRUCTED.
9. LOCATION OF TUNNELS SET BETWEEN COFFERDAM AND "THE FINS" STRUCTURE.

ALTERNATIVE TO LOCATION OF
UPSTREAM DIVERSION PORTAL

1. LEAVE AT PRESENT LOCATION
2. LEAVE AT PRESENT LOCATION WITH MODIFICATIONS
3. LOCATE UPSTREAM OF "THE FINS"
4. LOCATE FURTHER DOWNSTREAM
5. LOCATE ON SOUTH ABUTMENT

LEAVE AT PRESENT LOCATION

ADVANTAGES

1. EXCAVATED ROCK CAN BE USED IN COFFERDAM CONSTRUCTION
2. GOOD HYDRAULIC LOCATION
3. REMOVED FROM MAIN CONSTRUCTION AREA

DISADVANTAGES

1. REQUIRES 300-FOOT HIGH CUTS
2. EXTENSIVE ROCK SUPPORT MAY BE REQUIRED
3. REQUIRES COMPLEX CONSTRUCTION COFFERDAM ARRANGEMENT
4. DIFFICULT ACCESS PROBLEMS

PRESENT POSITION WITH MODIFICATIONS

MODIFICATIONS

1. SEPARATE PORTALS AND STAGGERED CUT FACES
2. MOVE CUT FACES NEARER TO RIVER
3. REVERSE TUNNELS - MAKING LOWER TUNNEL ON SOUTH SIDE

MODIFICATION #1

ADVANTAGES

- MINIMIZES SIDE ROCK CUTS
- INCREASES WORK AREA

DISADVANTAGES

- LESS EXCAVATED MATERIAL FOR COFFERDAM
- INCREASES DIFFICULTY IN ACCESS TO NORTH TUNNEL

MODIFICATION #2

ADVANTAGES

- MINIMIZES ROCK CUTS
- IMPROVES CONSTRUCTION SCHEDULE
- BETTER CONSTRUCTION ACCESS

DISADVANTAGES

- REQUIRES LARGER CONSTRUCTION COFFERDAM AND GREATER RIVER CONSTRAINTS
- LESS EXCAVATED MATERIAL FOR COFFERDAM

MODIFICATION #3

ADVANTAGES

- LESS CONSTRUCTION PROBLEM FOR BOTH PORTALS
- REDUCES ROCK CUTS

DISADVANTAGES

- REDESIGN OF TAILRACE THAT COULD RESULT IN LOSS OF ENERGY AND/OR LARGER TAILRACE TUNNELS
- CONSTRUCTION PROBLEMS IN DOWNSTREAM PORTAL

PORTAL MOVED UPSTREAM

ADVANTAGES

- PORTAL WOULD BE ON FLATTER SLOPES
- REMOVES DIVERSION AS UPSTREAM CONSTRAINT ON DAM
- MOVES DIVERSION CONSTRUCTION AWAY FROM MAIN DAM
- INCREASED WORK AREA

DISADVANTAGES

- LENGTH OF TUNNEL
- LARGER DIAMETER TUNNEL
- POTENTIAL POOR GEOLOGY IN PORTAL AREA
- REQUIRES EXCAVATION THRU "THE FINS"
- POSSIBLE OVERBURDEN PROBLEM
- DIFFICULT ACCESS
- POORER TUNNEL ALIGNMENT
- IMPACTS CONSTRUCTION SCHEDULE

DOWNSTREAM PORTAL

ADVANTAGES

- BETTER ROCK CUTS
- SHORTER TUNNEL
- BETTER GEOLOGY
- EASIER ACCESS

DISADVANTAGES

- POOR HYDRAULIC ALIGNMENT
- INTERFERES WITH COFFERDAM
- REQUIRES THAT COFFERDAM (OR PART OF) BE INCLUDED IN MAIN DAM OR,
- REQUIRES FANCY INTAKE DESIGN
- PORTAL ALIGNMENT NOT AS FAVORABLE FOR GEOLOGY
- MAY INTERFERE WITH MAIN DAM CONSTRUCTION
- MAY REQUIRE UNDERWATER CHANNEL CUT

PORTAL ON SOUTH ABUTMENT

ADVANTAGES

- SEPARATED FROM ALL OTHER CONSTRUCTION ACTIVITIES
- NO LEAKAGE CONCERN TO UNDERGROUND STRUCTURES
- RELIEVES D/S PORTAL AND DOWNSTREAM COFFERDAM CONJESTION

DISADVANTAGES

- LONG TUNNEL
- POOR GEOLOGY
- POTENTIAL PERMAFROST
- ACCESS REQUIRES BRIDGE
- IMPACTS CONSTRUCTION SCHEDULE
- LARGE ROCK CUTS AT U/S PORTAL
- POOR HYDRAULICS
- POTENTIAL IMPACT WITH COFFERDAM CONSTRUCTION
- REQUIRES ADDITIONAL TAILRACE TUNNEL

WATANA RELICT
CHANNEL CONCERNS

- POTENTIAL RESERVOIR LEAKAGE
- POTENTIAL PIPING
- POTENTIAL LIQUEFACTION
- POTENTIAL SETTLEMENT DUE TO SATURATION AND PERMAFROST THAWING

WINTER GEOTECHNICAL
PROGRAM

DAMSITE

OBJECTIVES

OBTAIN DESIGN LEVEL DATA TO FINALIZE GENERAL
ARRANGEMENT TO ESTABLISH CONSTRUCTION COSTS
AND SCHEDULES

DATA TO BE OBTAINED:

- ENGINEERING PROPERTIES OF BEDROCK & ALLUVIUM
- THICKNESS OF ALLUVIUM
- DAMSITE GEOLOGY
- GEOHYDROLOGY

SCOPE

APPROXIMATELY 2000-LF HAMMER DRILLING

- COFFERDAM
- MAIN DAM
- DOWNSTREAM COFFERDAM
- U/S PORTAL
- PLUNGE POOL

APPROXIMATELY 15,000-LF SEISMIC REFRACTION SURVEYS

- U/S COFFERDAM
- MAIN DAM
- D/S COFFERDAM
- U/S PORTAL
- PLUNGE POOL

WINTER
GEOTECHNICAL
PROGRAM

RELICT CHANNEL/BORROW AREA D

OBJECTIVES

OBTAIN DESIGN LEVEL DATA TO DETERMINE ENGINEERING AND DESIGN REQUIREMENTS AND TO DETERMINE CONSTRUCTION COSTS AND SCHEDULE.

SCOPE

- DRILLING APPROXIMATELY 4,300-LF BY HAMMER DRILLING
- INSTALL PIEZOMETERS AND THERMISTORS
- INSTALL WELLS
- PERFORM FIELD PERMEABILITY TESTING

SUMMER 1983
GEOTECHNICAL
PROGRAM

OBJECTIVE

TO CONTINUE IN OBTAINING DESIGN LEVEL DATA

SCOPE

TECHNIQUES TO BE CONSIDERED:



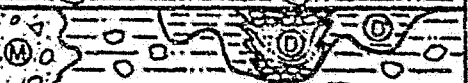
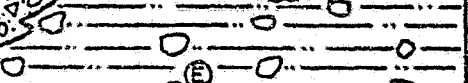
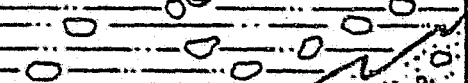
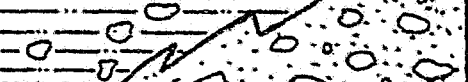

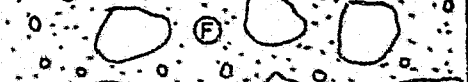

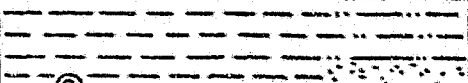
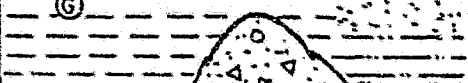




- MAPPING
- REMOTE SENSING
- DRILLING
 - PLUG/PROBE
 - CORING (VERTICAL TO HORIZONTAL)
 - OVERBURDEN SAMPLING
- EXCAVATION
 - TEST TRENCHING
 - TEST PIT/BLAST
 - CAISSON/SHAFT
 - ADIT
- SURFACE GEOPHYSICS
 - SEISMIC REFRACTION
 - SEISMIC REFLECTION
 - RESISTIVITY
 - RADAR
 - ETC.
- DOWNHOLE INSTRUMENTATION
 - THERMAL
 - PIEZOMETRIC
 - DEFORMATION

- DOWNHOLE TESTING
 - PERMEABILITY
 - SEISMIC VELOCITY
 - IMAGERY
 - DENSITY/MOISTURE
 - MODULUS
 - HARDNESS
 - IN-SITU STRESS
 - INCLINATION DEFORMATION
- MATERIAL TESTING
 - ROUTINE SOIL & ROCK TESTING
 - DYNAMIC TESTING
 - CONCRETE TESTING

DAMSITE

- EXTENDED GEOLOGIC MAPPING
- CONFIRM & REFINE GEOLOGIC INTERPRETATION
- DETERMINE ROCK CONDITIONS & OVERBURDEN DEPTH
BENEATH PROPOSED MAJOR CIVIL STRUCTURES

STRATIGRAPHIC COLUMN WATANA RELICT CHANNEL AND BORROW SITE D AREA

UNIT	TYPE	EVENT	COLUMN
(A/B)	SURFICIAL DEPOSITS	EROSION & FROST HEAVING	
(C)	ICE DISINTEGRATION	ABLATION & MELTING	
(D)	ALLUVIUM	INTERGLACIAL	
(D')	LACUSTRINE	PONDING LAKES INTERGLACIAL	
(M)	BASAL TILL	ADVANCE	
(E)	OUTWASH	MELTING & RETREAT	
(F)	OUTWASH	RETREAT	
(G)	GLACIOLACUSTRINE & WATERLAIN TILL	LAKES & FLOATING ICE	
(G')	BASAL TILL	ADVANCE	
(H)	ALLUVIUM	INTERGLACIAL	
(I)	OUTWASH (TILL ?)	RETREAT READVANCE MELTING & RETREAT	
(J')	LACUSTRINE &/OR STRATIFIED DEPOSITS	MELTING	
(J)	TILL	ADVANCE	
(K)	ALLUVIUM	FLOWING WATER	
(BR)	BEDROCK		

BORROW SITE D RELICT CHANNEL

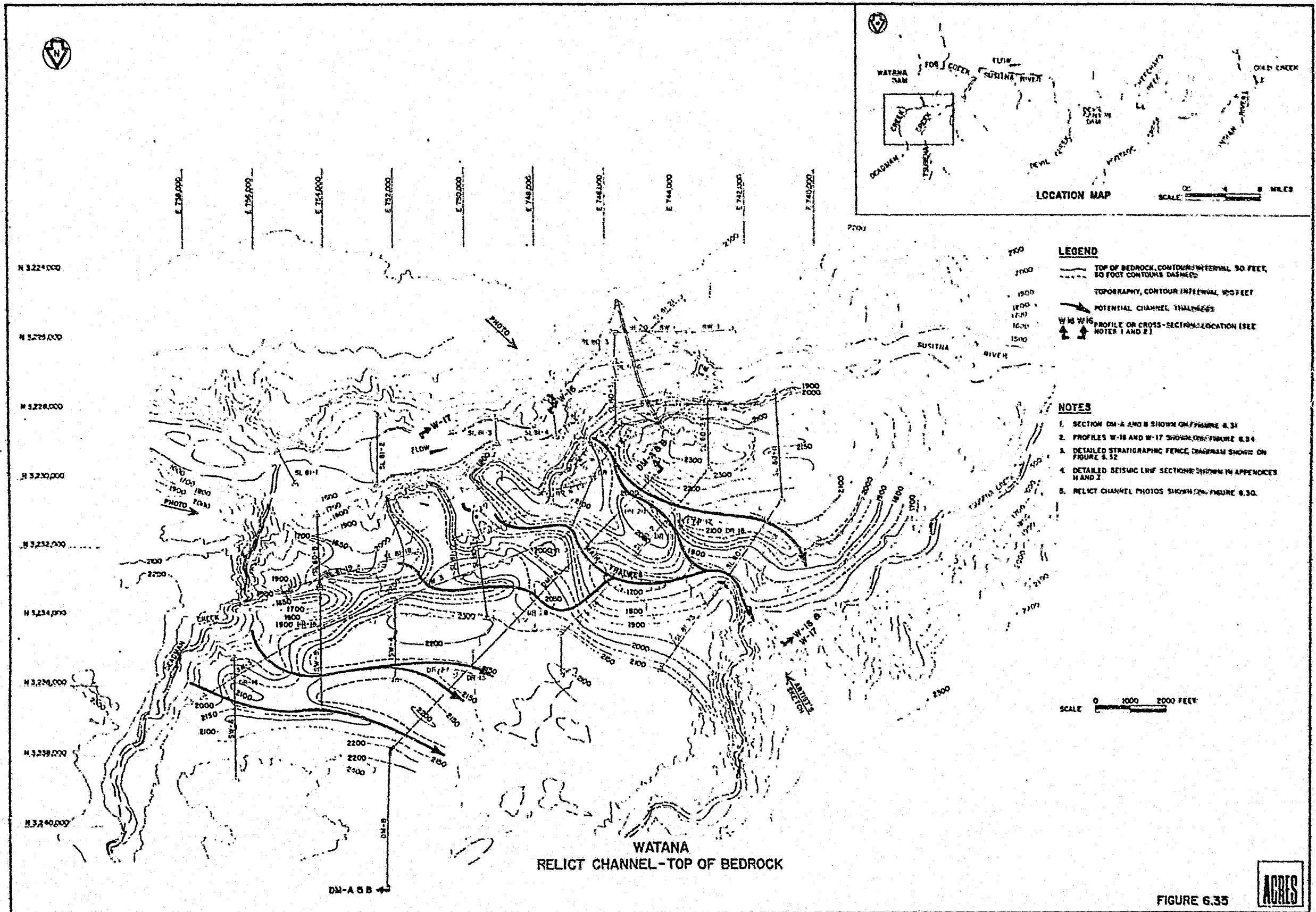
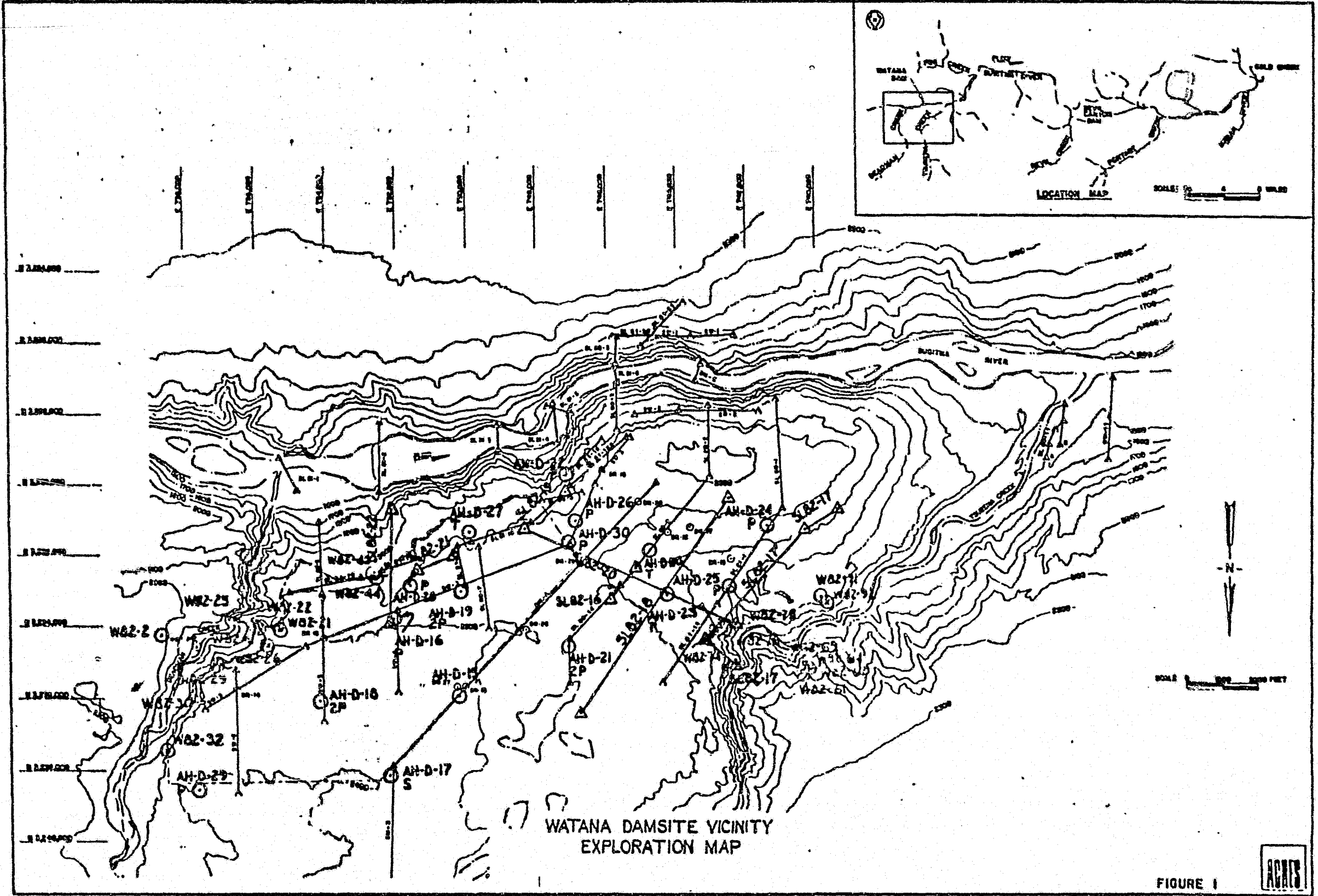


FIGURE 6.35

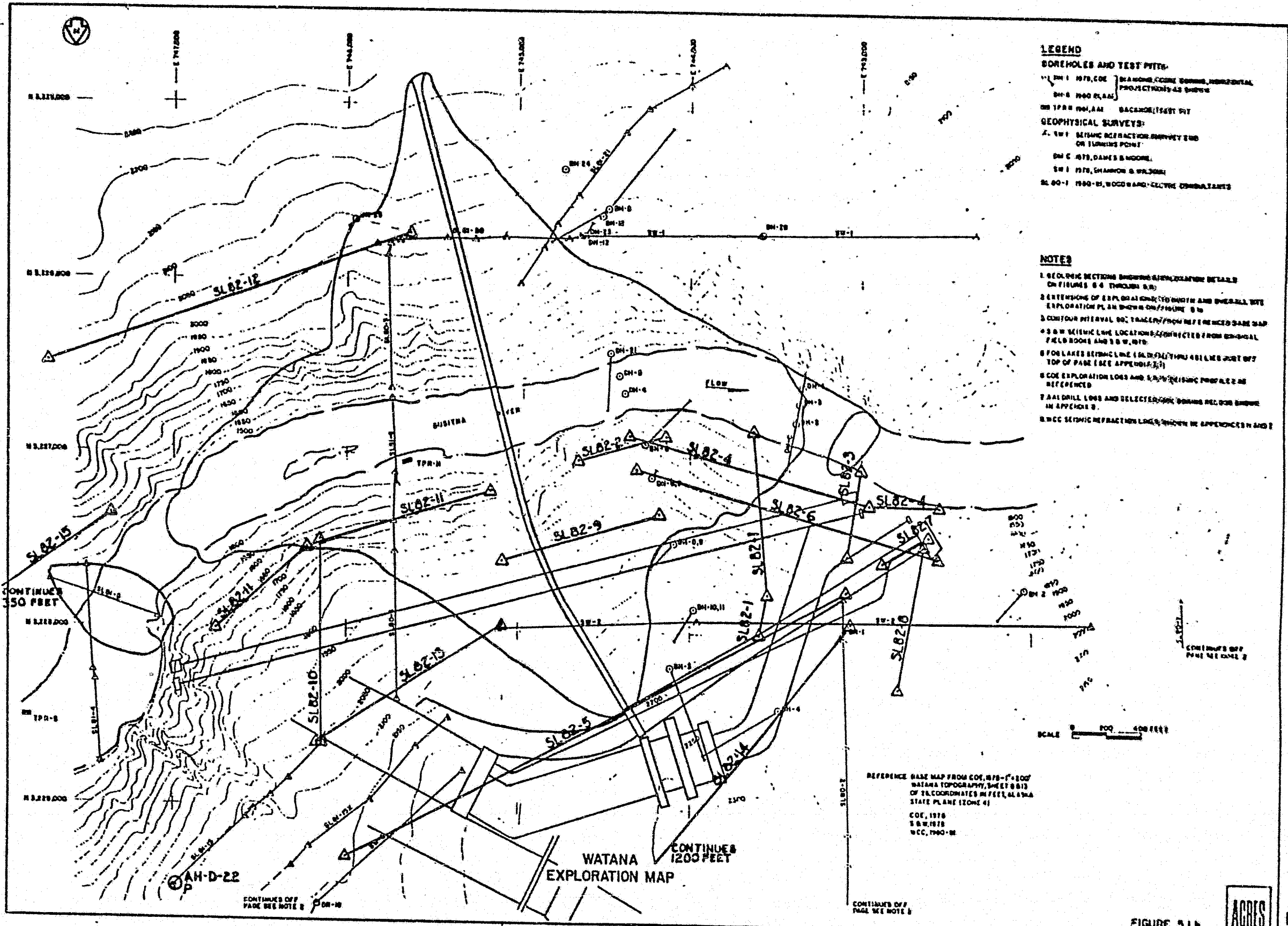




PREPARED BY WOODWARD-CLYDE CONSULTANTS

FIGURE 1





LEGEND

BOREHOLES AND TEST PITS:

BH 1 1970, COE } SHAWMOS, COE SURVEY, HORIZONTAL PROJECTIONS AS SHOWN

BH 6 1960, AAL

BH 17 1961, AAL } BACKSCATTER TEST PIT

GEOPHYSICAL SURVEYS:

TR 1 1971 SEISMIC REFRACTION SURVEY END ON TURNING POINT

BH C 1978, DAVIS & MOORE

BH I 1978, SHAWMOS & WILSON

SL 80-1 1960-61, WOODWARD-CLYDE CONSULTANTS

NOTES

1. GEOLOGIC SECTIONS SHOWN IN ENCLAVES DETAIL ON FILMS 8-4 THROUGH 8-9

2. EXTENSIONS OF EXPLORATION (EXTENT AND OVERALL TEST EXPLORATION PLAN SHOWN ON FIGURE 8-10

3. CONTOUR INTERVAL 50', TRACES FROM REFERENCED BASE MAP

4. 3" W. SECTION LINE LOCATIONS CONNECTED FROM ORIGINAL FIELD BOOKS AND 3" W. NTS

5. FOR LATER SEISMIC LINE (SLB2-1) 40' LINE JUST OFF TOP OF PAGE (SEE APPENDIX 2)

6. COE EXPLORATION LOGS AND 3" W. SEISMIC PROFILES ARE REFERENCED

7. ALL DRILL LOGS AND SELECTED LOGS SHOWN BELOW SHOWN IN APPENDIX 2

8. COE SEISMIC REFRACTION LOGS SHOWN IN APPENDICES 1 AND 2

SCALE 0 100 400 FEET

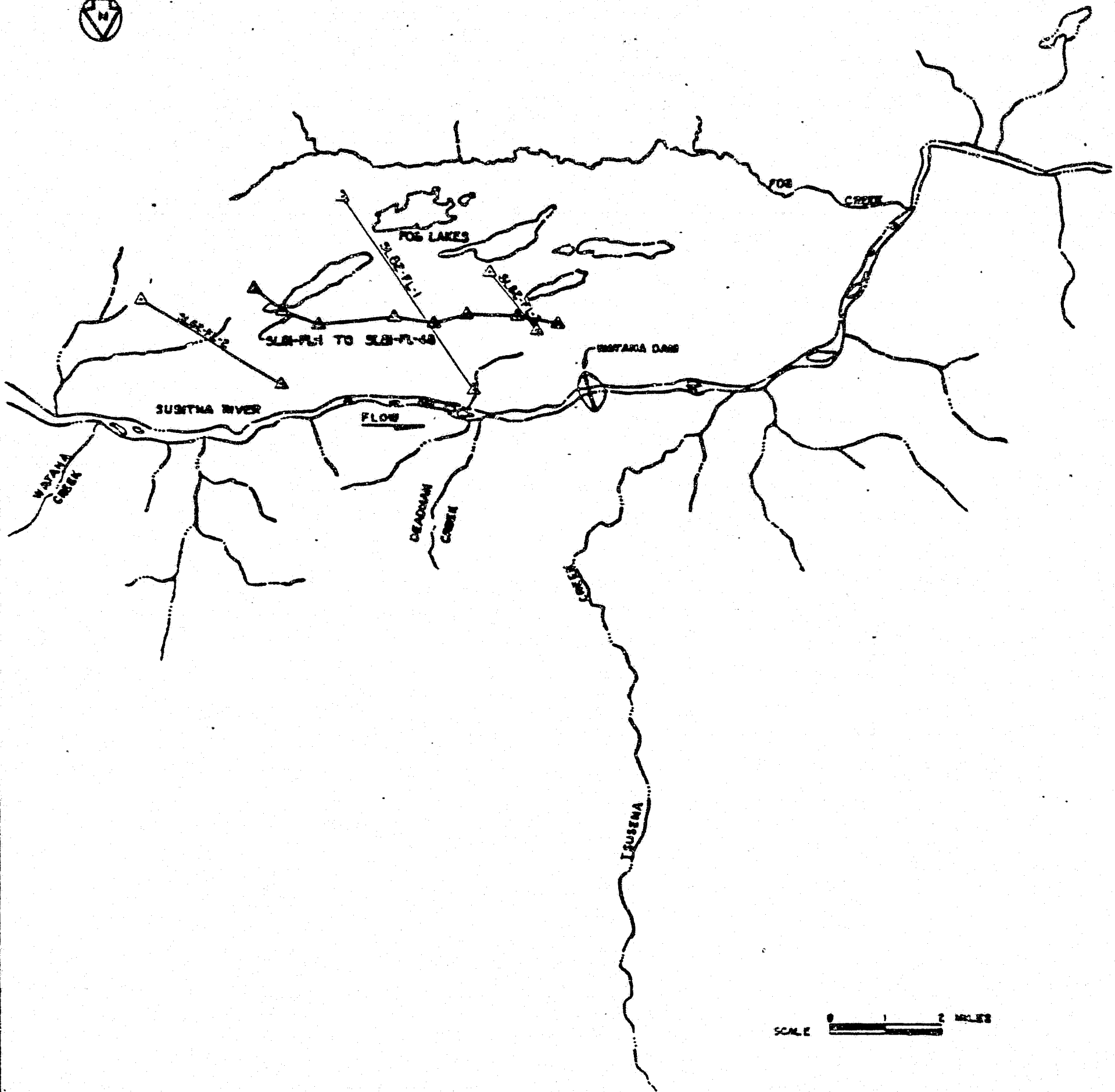
REFERENCE BASE MAP FROM COE, 1978-1-100
 WATANA TOPOGRAPHY, SHEET 8813
 OF 24 COORDINATES IN FEET, ALABAMA
 STATE PLANE (ZONE 4)

COE, 1978
 S & W, 1978
 WCC, 1960-61

WATANA
 EXPLORATION MAP

FIGURE 5.1b



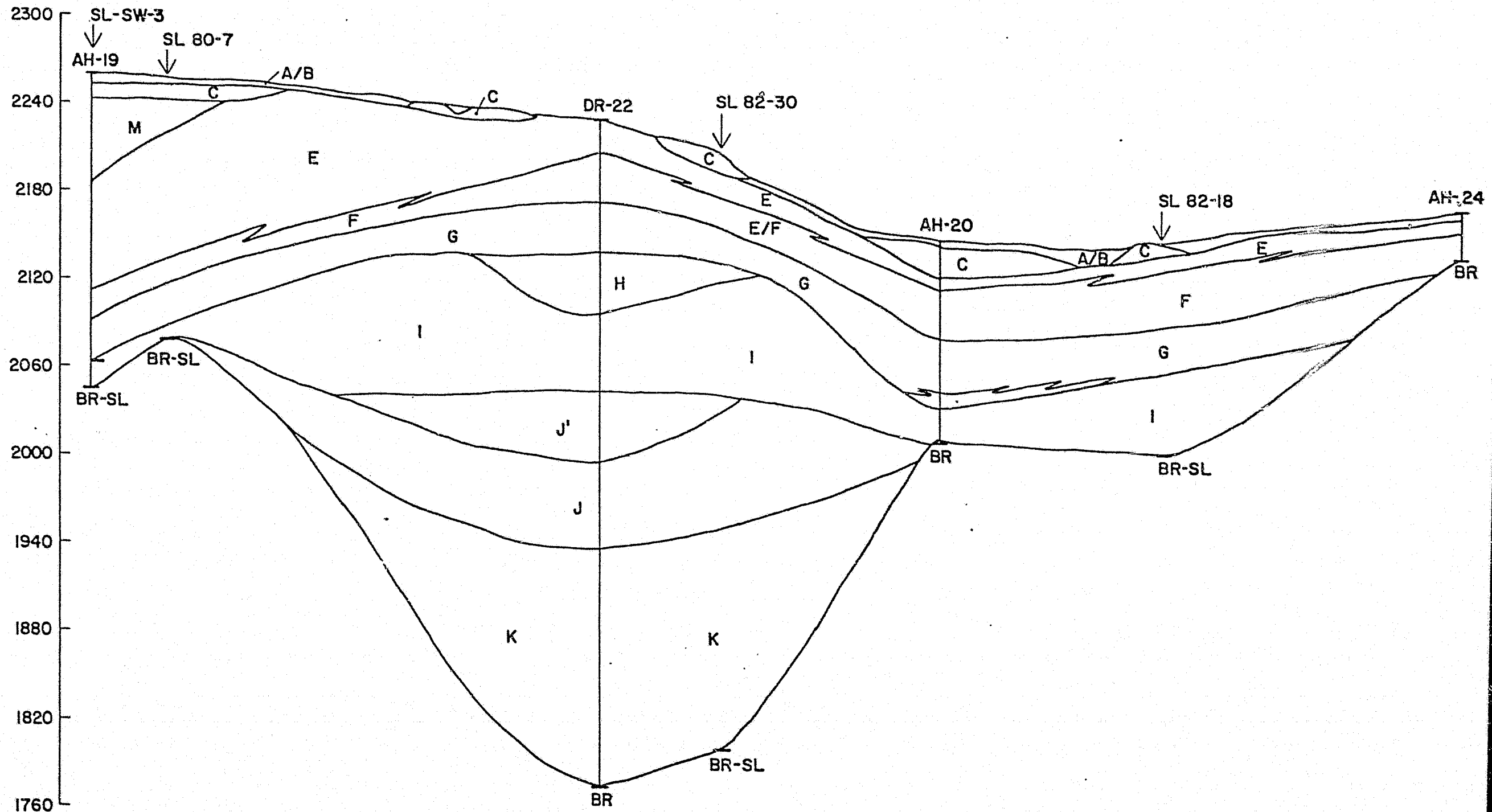


SCALE 0 1 2 MILES

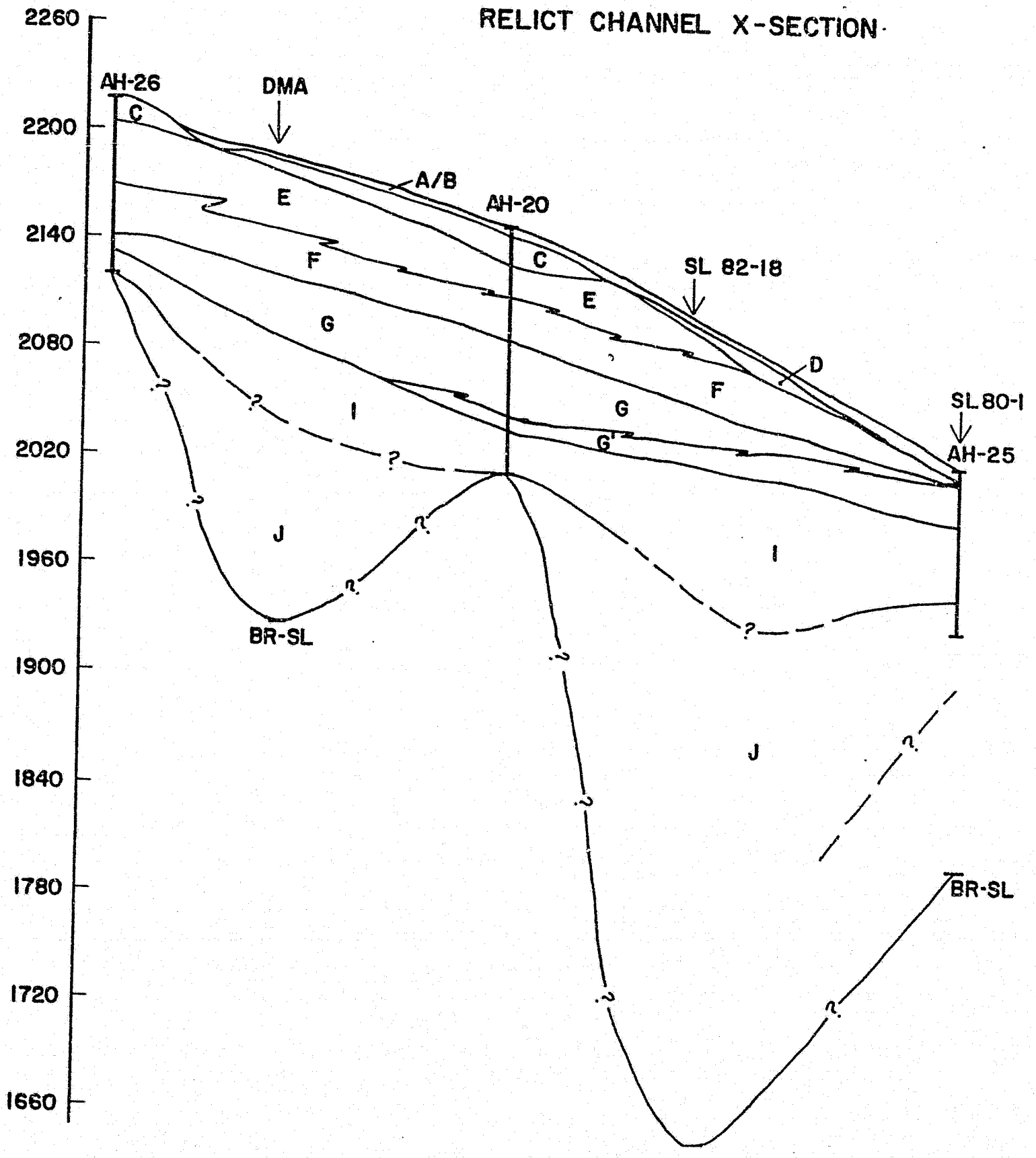
FOG LAKES RELICT CHANNEL
EXPLORATION MAP



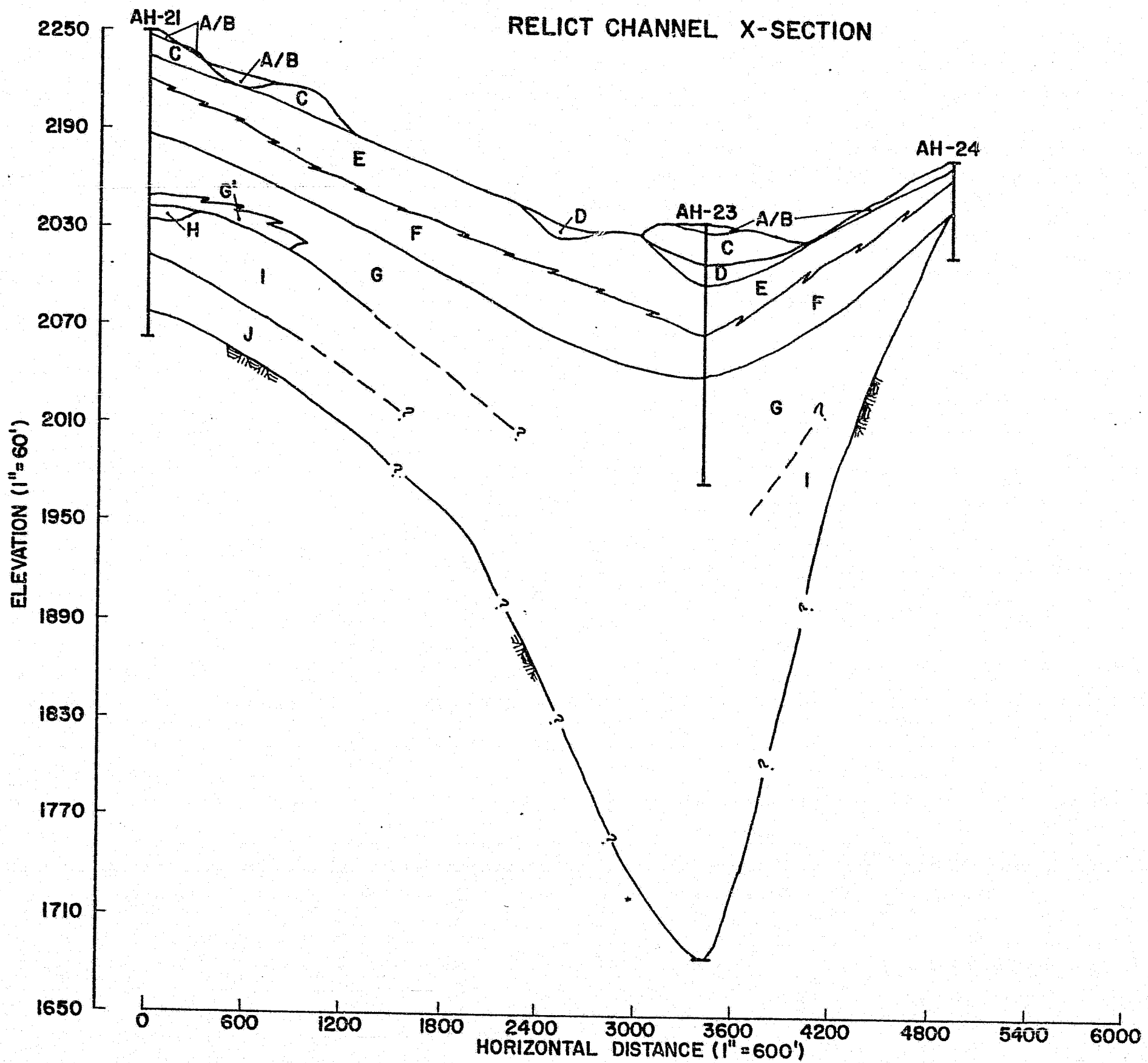
RELICT CHANNEL X-SECTION



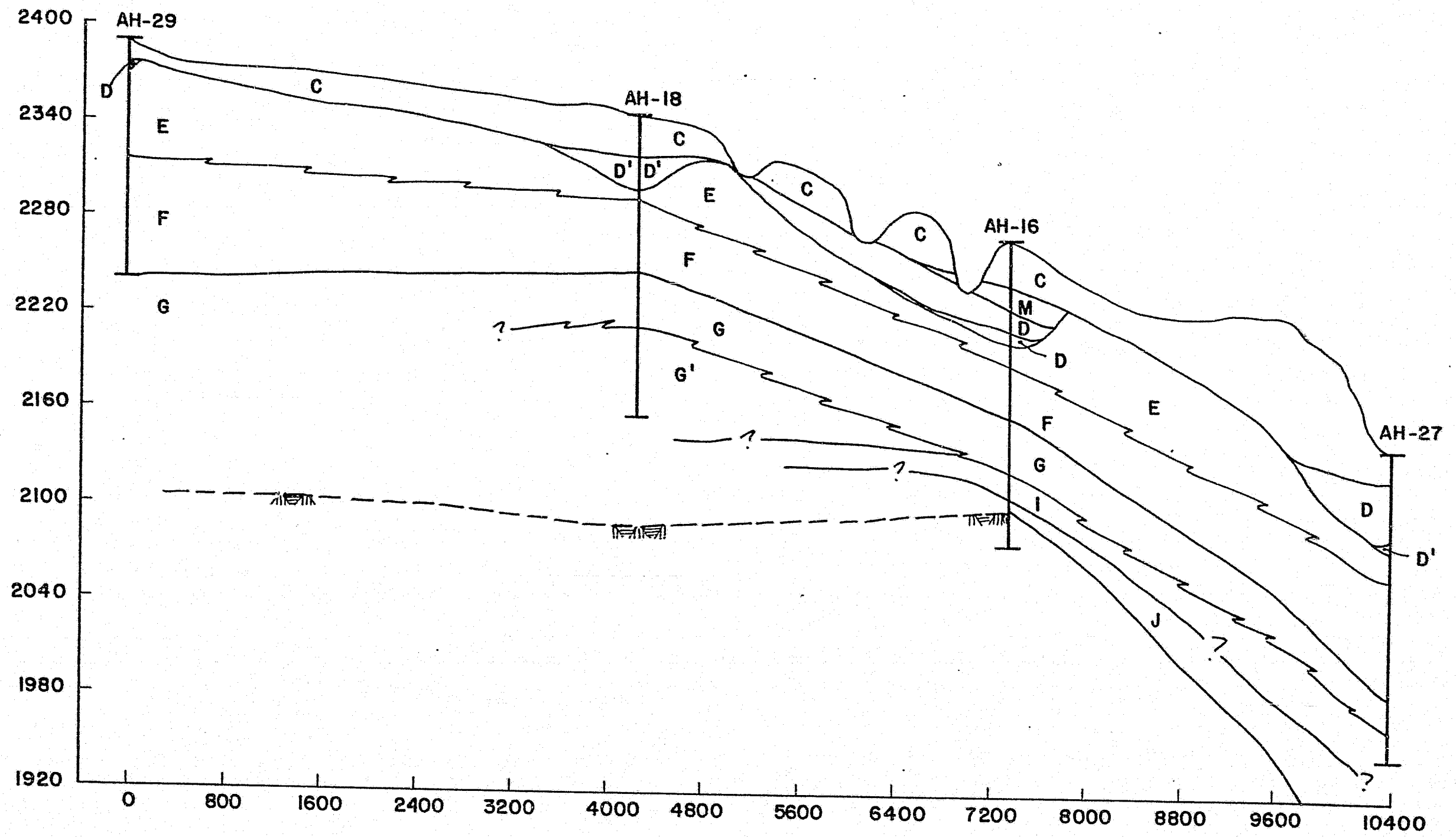
RELICT CHANNEL X-SECTION



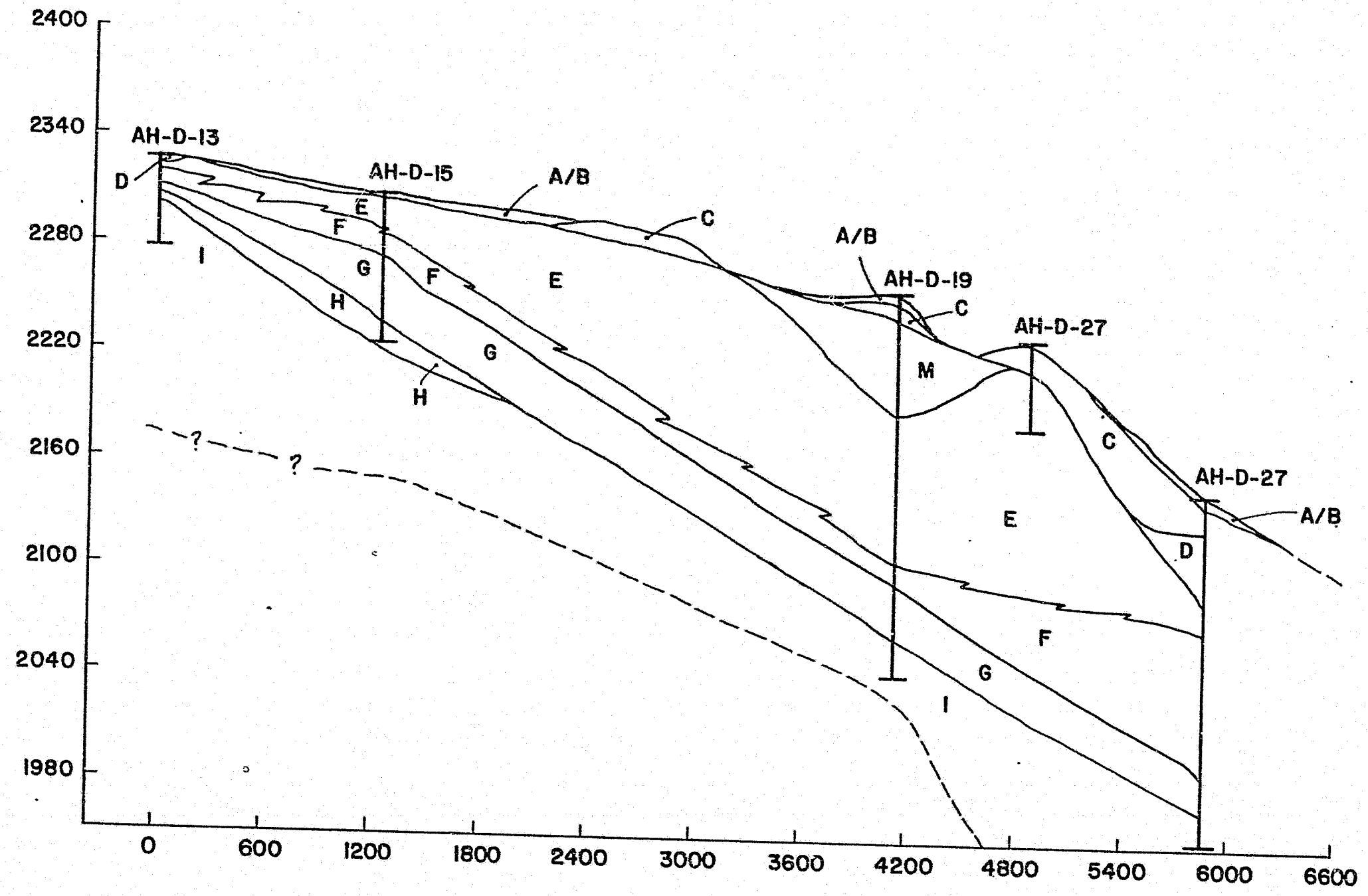
RELICT CHANNEL X-SECTION



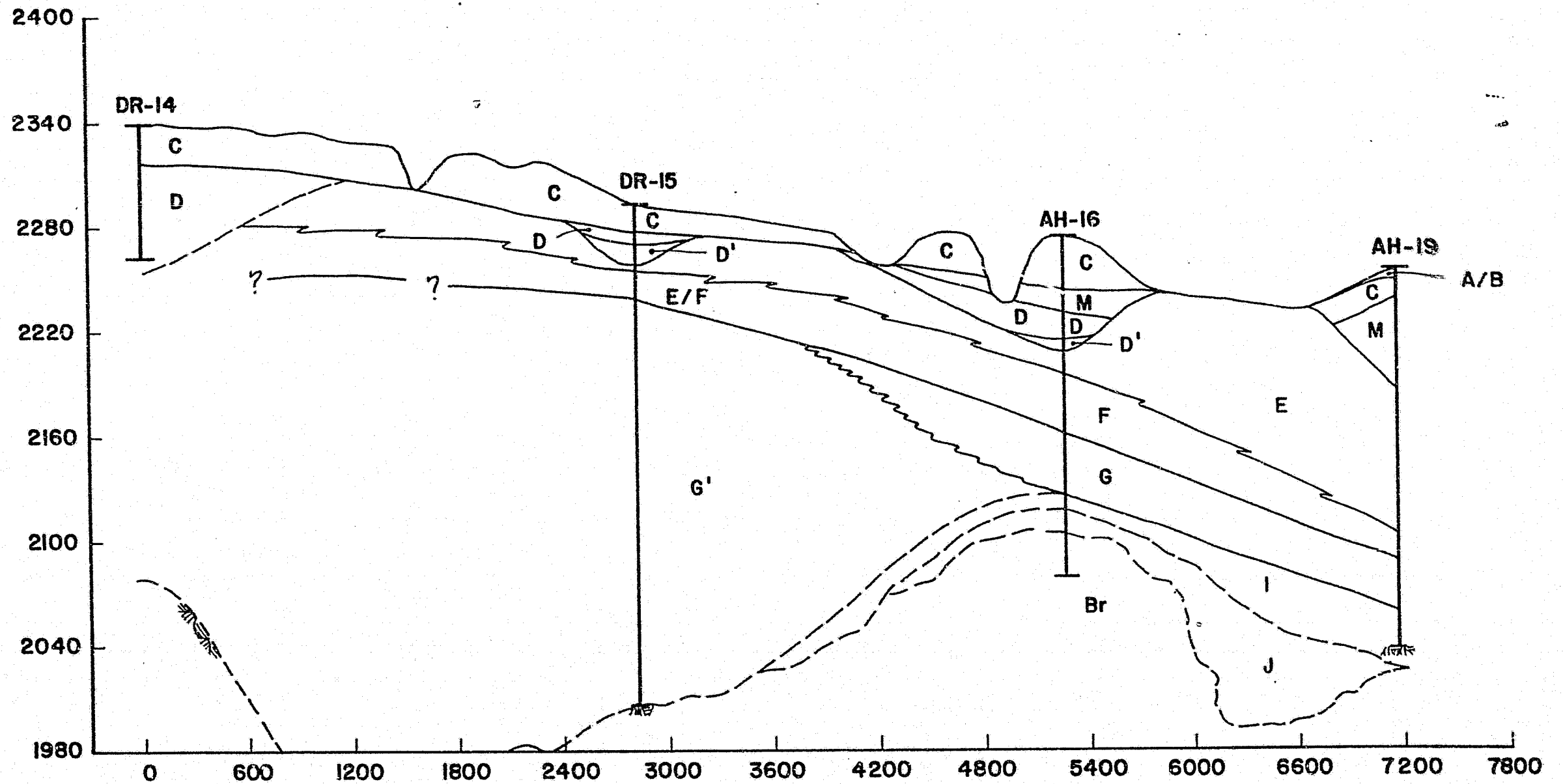
BORROW 'D' X-SECTIONS

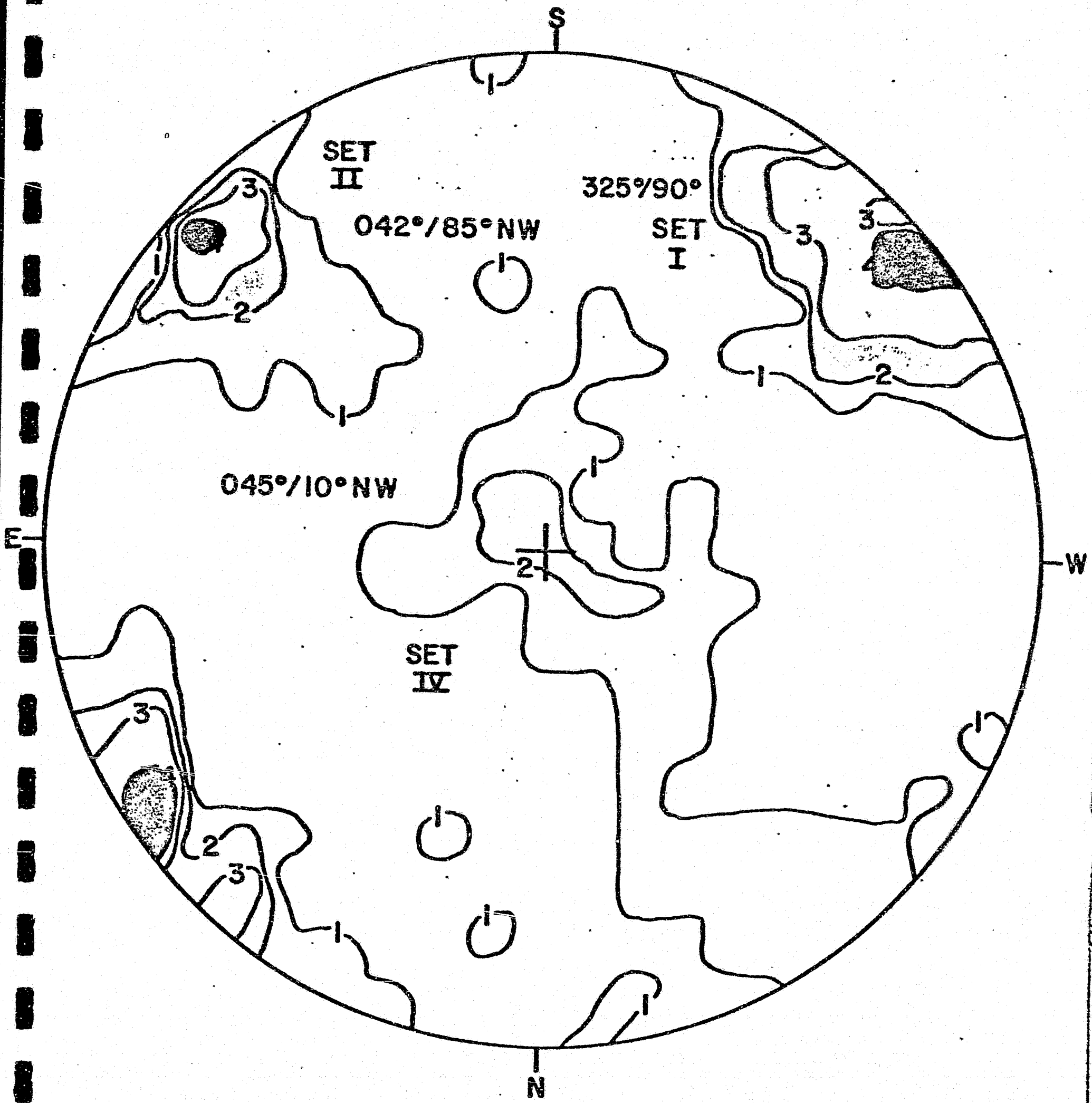


BORROW 'D' X-SECTIONS

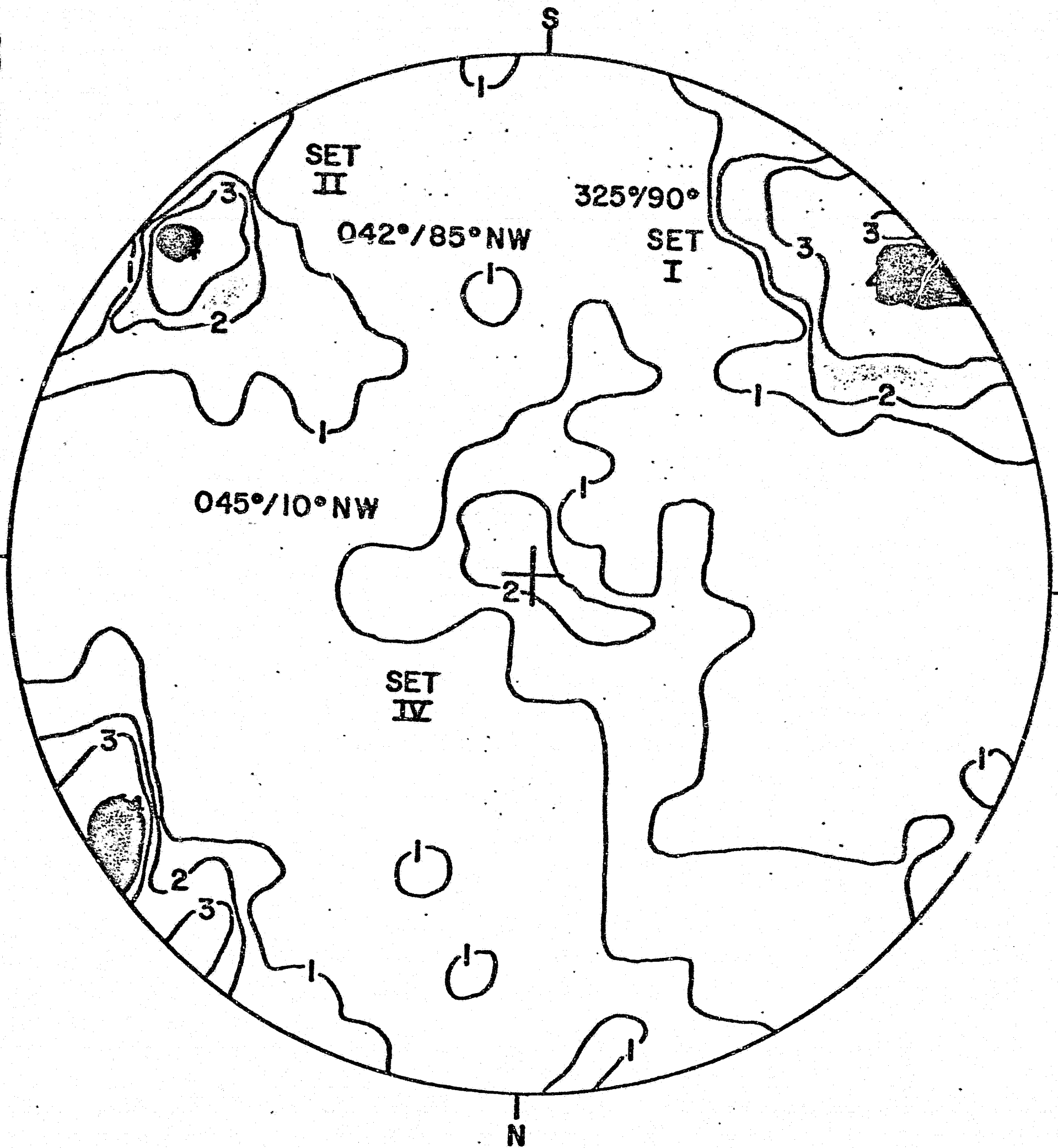


BORROW 'D' X - SECTIONS





JOINT PLOT
UPSTREAM PORTAL AREA



JOINT PLOT
 UPSTREAM PORTAL AREA

