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E-TR-47-DL

MX SITING INVESTIGATION
GEOTECHNICAL EVALUATION

DETAILED AGGREGATE RESOURCES STUDY

DRY LAKE VALLEY, NEVADA

Prepared for:

U.S. Department of the Air Force
Ballistic Missile Office
Norton Air Force Base, California 92409

Prepared by:

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29 May 1981

FOREWORD

This report is one of a series prepared for the Department of the Air Force, Ballistic Missile Office (BMO), in compliance with Contract No. F04704-80-C-0006, CDRL Item No. 004A2. These present the results of Detailed Aggregate Resources Studies within and adjacent to selected areas in Nevada and Utah that are under consideration for siting the MX missile system.

This volume contains the results of the aggregate resources evaluation for Dry Lake Valley. Results of this report are presented as text, appendices, and three drawings. This report has been prepared and submitted on the assumption that the reader is familiar with previous aggregate resources reports.

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EXECUTIVE SUMMARY

This report contains the Detailed Aggregate Resources Study (DARS) evaluation for Dry Lake Valley, Nevada. It is the second in a series of reports that contain detailed aggregate information on the location and quality of basin-fill and rock sources of road-base and concrete aggregates. Field reconnaissance, laboratory testing, and existing data from other Ertec Western, Inc. (formerly Fugro National, Inc) investigations and the Nevada Department of Highways provide the basis for the findings presented in this report.

ROAD-BASE AGGREGATES

Potential road-base aggregate sources were classified as follows:

Class RBIa -	Basin-fill or rock sources containing materials suitable for use as road-base aggregates; based on acceptable laboratory aggregate test results.
Class RBIb -	Basin-fill sources containing materials suitable for use as road-base aggregates; based on correlation with Class RBIa source areas.
Class RBII -	Potential basin-fill sources of materials suitable for use as road-base aggregates; based on photogeologic interpretations, field observations, and limited or inconclusive sieve analysis and/or abrasion data.

Assignment of an aggregate source to one of the above three classes was determined from laboratory test results (gradation, abrasion and, to a lesser extent, soundness), and geomorphological, and compositional correlations.

Results of this evaluation are presented on a 1:62,500 scale aggregate resources map (Drawing 2) and are summarized as follows:

Class RBIa Sources: Thirteen basin-fill sources consisting of good to high quality aggregates acceptable for use as road-base construction materials have been located on the east side of the valley. The 12 most extensive deposits are alluvial fans (Aaf).

Three crushed-rock sources which yielded good to high quality aggregates acceptable for use as road-base construction materials have been delineated within the study area. These sources are fairly extensive outcrops of undifferentiated carbonate rocks (Cau).

Class RBIb Sources: Fourteen basin-fill deposits within the study area are defined as potential sources of good to high quality, road-base aggregates. Geomorphological and compositional similarities were used to correlate these units to tested RBIa deposits. Deposits are nearly all alluvial fans and are confined to the east side of the valley.

Class RBII Sources: Several potential basin-fill aggregate sources are located throughout the study area. All of these sources are alluvial fans that have been classified on the basis of limited field and laboratory data.

CONCRETE AGGREGATES

A classification system consisting of five classes was developed for the concrete aggregates evaluation to present potential basin-fill and crushed-rock sources. Although most rock sources will supply coarse concrete aggregates, their delineation was not an objective of this study. Assignment of an aggregate source to one of the five classes was determined from laboratory test results (trial concrete mixes and gradation, abrasion, and soundness of aggregates) and geomorphological and compositional correlations. The emphasis of this study was the evaluation of the concrete-making properties (especially 28-day compressive strengths) of potential aggregates when used in trial concrete mixes.

Class CA1	Basin-fill or rock sources containing aggregates that produced trial mix concrete with 28-day compressive strengths equal to or greater than 6500 psi.
Class CA2	Basin-fill or rock sources containing aggregates that produced trial mix concrete with 28-day compressive strengths less than 6500 psi.
Class CB	Basin-fill or rock sources containing aggregates potentially suitable for use in concrete; based on acceptable laboratory aggregate test results.
Class CC1	Basin-fill or rock sources containing aggregates potentially suitable for use in concrete; based on correlation with Class CA1 and CA2 source areas.
Class CC2	Basin-fill sources containing aggregates potentially suitable for use in concrete; based on correlation with Class CB source areas.

The following three trial mixes were used to obtain a range of compressive strength values; however, only Mix 3 results were used to classify sources. In all three trial mixes, fly ash, as a pozzolan replaced 20 percent of the cement by weight.

- Mix 1 - 7.5 sacks of cement per cubic yard of concrete and 1.5-inches maximum aggregate size;
- Mix 2 - 8.5 sacks of cement per cubic yard of concrete and 1.5-inches maximum aggregate size; and
- Mix 3 - 8.5 sacks of cement per cubic yard of concrete, 0.75-inch maximum aggregate size, and a superplasticizer.

Results of this evaluation are presented on a 1:62,500 scale aggregate resources map (Drawing 3) and summarized as follows:

Class CA1 and Class CA2 Sources: Three basin-fill deposits in the area contained aggregates that, when used in Mix 3, produced 28-day compressive strengths greater than 6500 psi. These sources are all alluvial fans (Aaf) and are located on the east side of the valley.

Crushed-rock aggregates from one rock source in the study area produced a 28-day compressive strength in excess of 6500 psi. Another rock source supplied aggregates which produced a 28-day compressive strength less than 6500 psi. Both of these rock sources consist of undifferentiated carbonate rocks (Cau). Nearby fine aggregate sources used in conjunction with crushed rock in these concrete mixes had high magnesium sulfate soundness losses.

Sufficient quantities of fair to poor quality fine aggregates are available in most basin-fill deposits. High quality, fine aggregate sources are lacking or of limited extent within the study area.

Class CC1 Sources: Six alluvial fans in the study area are classified as potential sources of concrete aggregates. They are correlated to Class CA1 sources based on geomorphological and compositional similarities.

Class CB Sources: Eleven basin-fill deposits consisting of good to high quality aggregates, potentially acceptable for use as concrete construction materials, were delineated on the east side of the valley. All but one of these deposits are alluvial fans.

Class CC2 Sources: Alluvial units located along the eastern side of the valley are potential sources of aggregates suitable for use in concrete. They are correlated to Class CB units on the basis of geomorphological and compositional similarities.

CONCLUSIONS

Sufficient quantities of coarse and fine aggregates suitable for use as road-base and/or concrete construction material are available in Dry Lake Valley. Laboratory test results indicate that the quality of the coarse aggregates ranges from good to excellent and the quality of the fine aggregates ranges from poor to satisfactory. Most of the aggregate sources are confined to the east side of the valley.

RECOMMENDATIONS

Additional aggregate field investigations and laboratory testing will be required to further refine the physical and chemical characteristics of road-base and concrete aggregate sources as borrow areas prior to the initiation of construction.

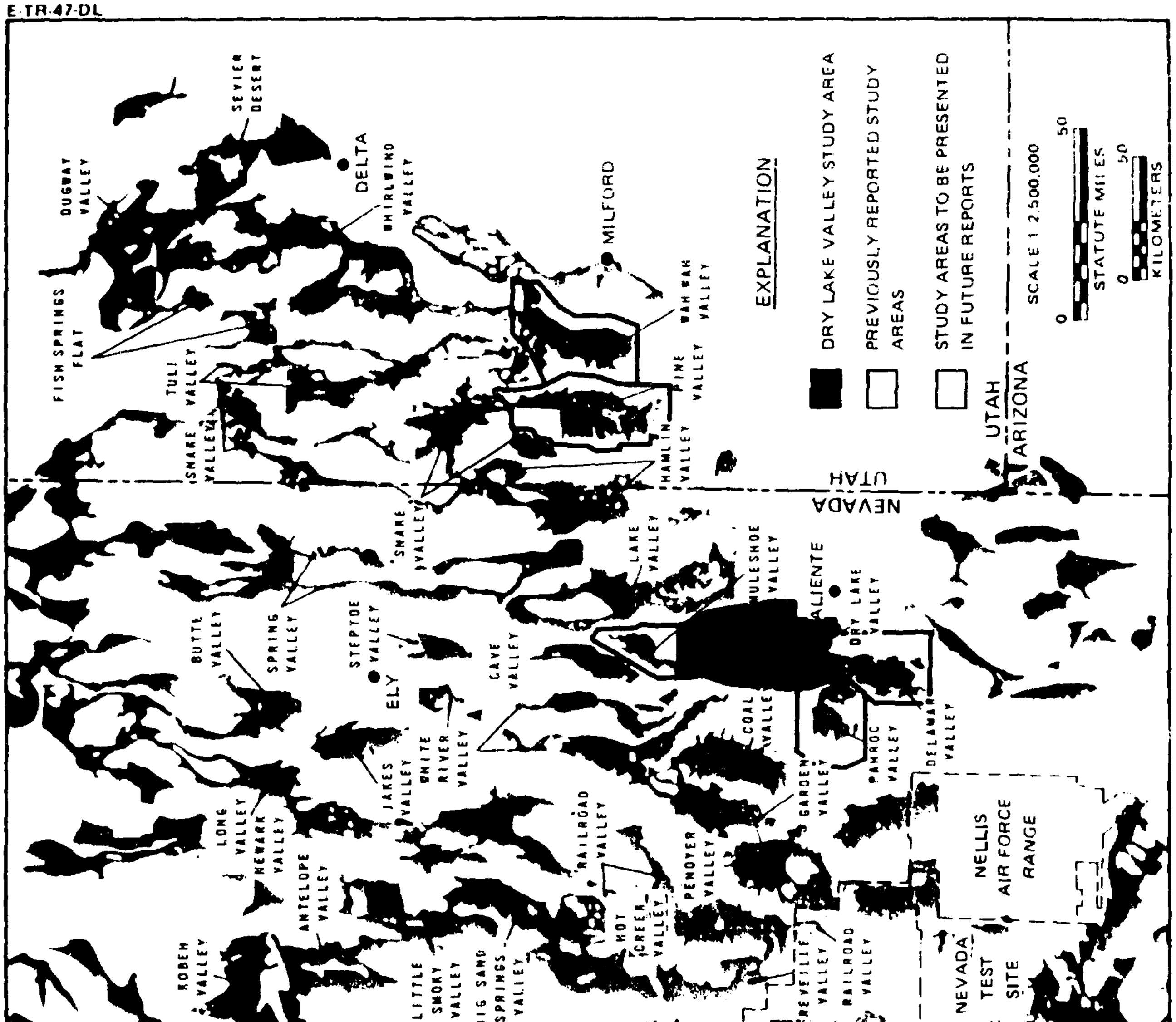
1.0 INTRODUCTION

1.1 STUDY AREA

This report presents the results of the Detailed Aggregate Resources Study (DARS) for Dry Lake Valley (Figure 1). Dry Lake Valley is located in central Lincoln County, Nevada. It is bounded on the west by the North Pahroc Range and on the east by the Burnt Springs, Ely Springs, Highland, Bristol, and West ranges. Muleshoe Valley lies to the north and Delamar Valley to the south. U.S. Highway 93 is the southern boundary of the study area and is the only paved road in the vicinity. A network of graded roads and four-wheel-drive trails provide access to most parts of the study area. Dry Lake Valley is mainly undeveloped desert rangeland administered by the Bureau of Land Management (BLM). Several active mining operations are located in the Bristol and Highland ranges. Caliente, Nevada, is located approximately 15 miles (24 km) east of Dry Lake Valley on U.S. Highway 93.

1.2 BACKGROUND

Aggregate resources studies for the MX program were introduced in 1977 with the investigation of Department of Defense (DoD) and BLM lands in California, Nevada, Arizona, New Mexico, and Texas (FN-TR-20D). Refinement of the MX siting area added portions of Utah and Nevada that were not evaluated in this initial Aggregate Resources Evaluation Investigation (AREI). This additional area, defined as the Utah-Nevada aggregate resources study area, was examined in the fall of 1979 and a



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DETAILED AGGREGATE RESOURCES STUDY
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE 1

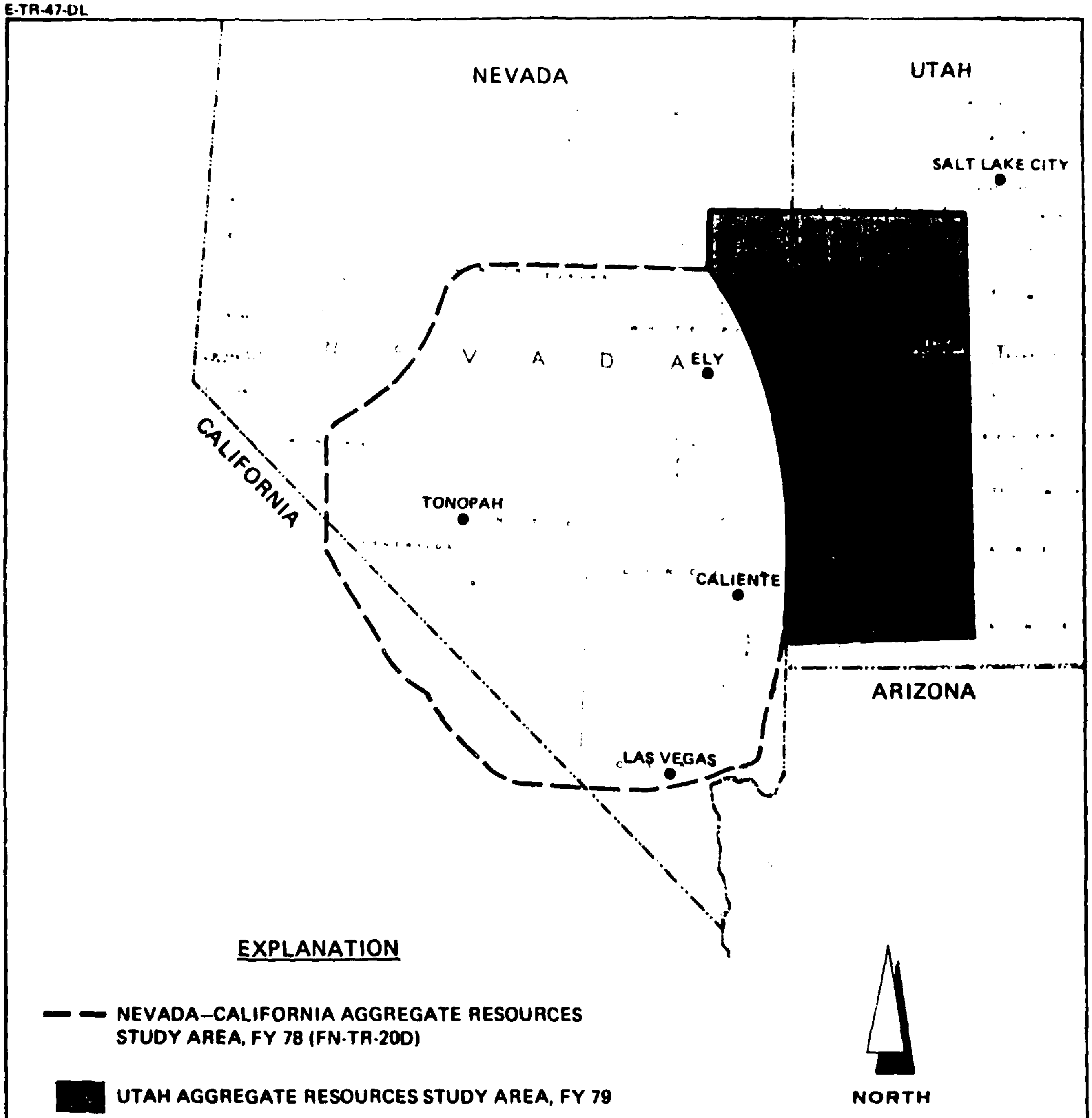
second regional aggregate resources report was submitted on 3 March 1980 (Figure 2).

Both regional aggregate investigations consisted of the compilation and evaluation of existing data with limited field reconnaissance, sample collection, and laboratory aggregate testing. Only general information on the location, quality, and quantity of aggregates was provided.

Subsequent to the regional studies, Valley-Specific Aggregate Resources Studies (VSARS) were started in FY 79. The primary objective of these studies is to provide additional information on potential aggregate sources in specified valleys and in the areas immediately surrounding them. Existing exposures of potential basin-fill and rock aggregate sources are sampled and subjected to a suite of laboratory tests. Results of these tests are used to classify coarse and fine basin-fill and crushed-rock aggregates for suitability as concrete and road base construction materials.

The aggregate sources presented in the VSARS are to be used as a guide for preliminary construction planning and the selection of areas for more detailed-aggregate evaluations. To date, field investigations have been completed for 16 valley areas with final reports submitted for 11 valley areas (Figure 3). Field investigations for remaining valleys in the designated deployment area are planned in FY 81 and FY 82.

The DARS were initiated in FY 81 to further analyze and refine potential sources of coarse and fine basin-fill and crushed-rock



EXPLANATION

— — NEVADA–CALIFORNIA AGGREGATE RESOURCES STUDY AREA, FY 78 (FN-TR-20D)

■ UTAH AGGREGATE RESOURCES STUDY AREA, FY 79

SCALE 1:5,000,000

0 50 100
STATUTE MILES

0 50 100
KILOMETERS

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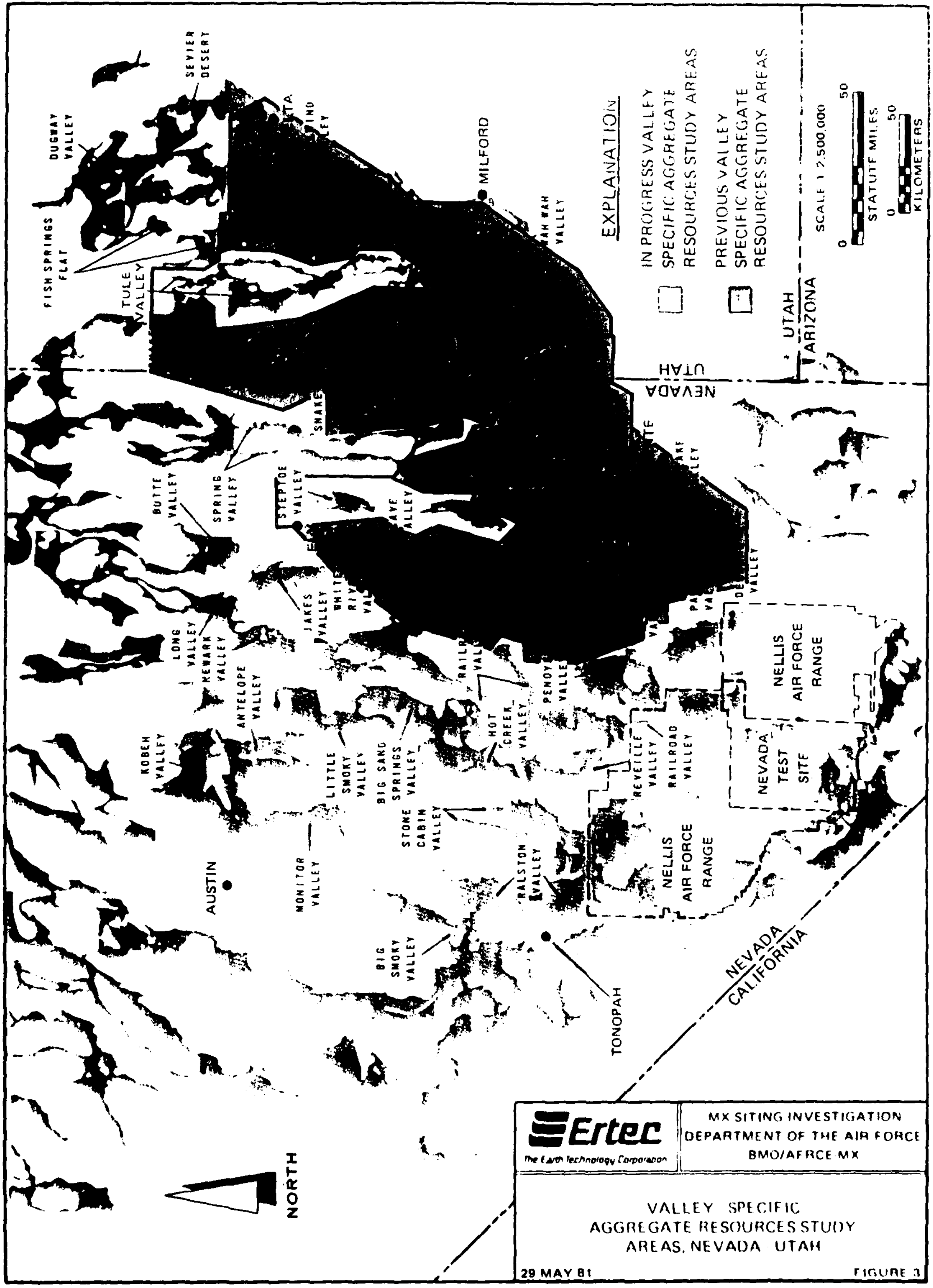
UTAH–NEVADA REGIONAL
AGGREGATE STUDIES

29 MAY 81

FIGURE 2



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VALLEY SPECIFIC
AGGREGATE RESOURCES STUDY
AREAS, NEVADA UTAH

29 MAY 81

FIGURE 3

aggregates identified during the VSARS. These studies consist of both road-base (Section 3.0) and concrete (Section 4.0) aggregate evaluations. The major consideration was to further evaluate basin-fill deposits as potential sources of road-base and concrete aggregates. Limited new data were developed on crushed-rock sources.

1.3 OBJECTIVES

The objectives of the Detailed Aggregate Resources Study are as follows:

Road-Base Aggregates Evaluation

- Refine potential basin-fill and rock sources (initially identified in VSARS) for road-base aggregates; and
- Provide additional laboratory test data on the general quality of basin-fill aggregates for use as road-base material.

Concrete Aggregates Evaluation

- Refine the areal extent of the most acceptable VSARS basin-fill and rock, concrete aggregate sources; and
- Provide additional laboratory testing information on the quality and the concrete-making properties of potential coarse and fine, basin-fill and crushed-rock aggregates.

1.4 SCOPE

The scope of the two evaluations required office and field studies and included the following:

a. Compilation and analysis of appropriate existing data on the quality and quantity of potential road-base and concrete aggregates. Major sources of data were other Ertec investigations for the siting of the MX system and the Nevada Department of Highways.

b. Initial and final basin-fill deposit differentiation based on geomorphology, grain size, lithology, and aerial photography and topographic map interpretation. Initial and final rock unit divisions based on evaluations of aerial photography and published geologic maps.

c. Staking and permitting on selected BLM lands. Appropriate basin-fill trench locations for samples of road-base and concrete aggregates were determined from items a and b and a brief field reconnaissance.

d. Backhoe excavation of staked and permitted basin-fill locations, sampling when gravel percentage exceeded 30 percent, or when suitable fine aggregates for concrete mixes were present. Selection and sampling of acceptable crushed-rock sources of coarse aggregates for concrete mixes.

e. Valley-wide field reconnaissance utilizing aerial photography and petrographic and grain-size analyses to determine lateral extent and acceptability of basin-fill deposits.

f. Laboratory tests to supplement available existing data for the determination of the suitability of specific basin-fill and rock units as sources of road-base or concrete aggregates. Trial (check) concrete mixes were made to evaluate the basic concrete-making properties of selected concrete aggregate sources as well as engineering properties of hardened concrete.

g. Development and application of road-base and concrete materials classification systems that textually and graphically depict the locations of the most suitable aggregate sources in the study area. The depiction and discussion of areas that are unsuitable or have a low probability for use were not done.

2.0 GEOLOGIC SETTING

2.1 PHYSIOGRAPHY

Dry Lake Valley lies within the Basin and Range Physiographic Province and exhibits characteristic north-south trending, block-faulted mountain ranges with an intervening alluvial basin. Elevations within the valley range from approximately 5300 feet (1615 m) at the northern end to approximately 4580 feet (1396 m) on the playa in the south-central part of the valley.

Mountain ranges flanking the basin are the North Pahroc on the west and the Burnt Springs, Ely Springs, Highland, West, and Bristol on the east. Dry Lake Valley is topographically open to Muleshoe Valley to the north and Delamar Valley to the south. Relief between mountain ridges and the basin is greatest along the eastern margin and varies from about 2500 to 4500 feet (762 to 1372 m). Dry Lake Valley is a closed drainage system with a large playa in the southern portion of the study area.

2.2 LOCATION AND DESCRIPTION OF GEOLOGIC UNITS

Paleozoic, Mesozoic, and Cenozoic rocks are found in bedrock outliers and in the mountains within and adjacent to the study area. The Paleozoic rocks consist predominantly of limestone and dolomite with interbedded sandstone, shale, and quartzite. These sediments crop out across the entire study area and, where not exposed, underlie younger geologic units. Unconformably overlying the Paleozoic rocks are Mesozoic deposits consisting predominantly of undifferentiated volcanic rocks and intravolcanic sedimentary rocks. Cenozoic rocks unconformably overlie

Paleozoic and Mesozoic units and consist of Tertiary intrusives and volcanics. Unconsolidated Cenozoic deposits lie unconformably above all older units and consist primarily of alluvial fan, lacustrine, and stream-channel and terrace deposits.

Specific Paleozoic, Mesozoic, and Cenozoic geologic units have been grouped into one rock and two basin-fill categories for use in discussing potential aggregate sources. The grouping of the units was based on similarities in physical and chemical characteristics and map scale limitations. The resulting categories simplify discussion and presentation without altering the conclusions of the study.

Additional geologic information is presented in previous Ertec Western reports (FN-TR-27-DL-I and II; FN-TR-37-a).

2.2.1 Rock Units

Carbonate rocks undifferentiated (Cau) are the primary potential source of crushed-rock aggregates in Dry Lake Valley. While all other rock units may locally supply aggregates, insufficient test data prohibit their consideration as major aggregate sources, and they will not be discussed.

Materials classified as undifferentiated carbonate rocks include thick, complex sequences of limestone and dolomite with thin interbeds of sandstone, shale, and siltstone. Principal formations in this unit are an unnamed Upper Cambrian limestone and dolomite, the Devonian Guilmette Formation, and an unnamed Pennsylvanian limestone. The unnamed Upper Cambrian carbonate rocks are exposed in the mountains on the east side of the valley, south of latitude 38°00' N. The Guilmette Formation crops out in the mountains on the east side of the valley, north of latitude 38°00' N and on the west side of the valley at scattered locations in the North Pahroc Range. The unnamed Pennsylvanian limestone crops out extensively along the western boundary of the study area in the North Pahroc Range. All of the undifferentiated carbonate rocks are typically light- to dark-gray in color, thin to very thick bedded, durable, locally silty or cherty, fossiliferous, and resistant cliff formers.

2.2.2 Basin-Fill Units

The basin-fill geologic units within the study area that are potential sources of coarse and fine aggregates are alluvial fan deposits (Aaf) and stream-channel and terrace deposits (Aal). All other basin-fill units may locally supply aggregates but are not considered major sources and will not be discussed in this report.

2.2.2.1 Alluvial Fan Deposits - Aaf

Alluvial fans that are potential sources of basin-fill aggregates occur in a fairly narrow band along most of the east side of the valley and at four scattered locations on the west side of the valley. Alluvial fan deposits are typically heterogeneous to poorly stratified mixtures of boulders, cobbles, gravel, sand, silt, and clay. On the east side of the valley, alluvial fan deposits consist predominantly of sandy gravel. Fan units on the west side are predominantly gravelly sand.

Most alluvial fan units have developed soil horizons consisting of silty, clayey sand a few inches (centimeters) to 1 foot (0.3 m) in thickness overlying a zone of carbonate accumulation (caliche). The caliche horizon generally ranges in thickness from 1 to 3 feet (0.3 to 1 m) and exhibits Stage I to IV development with Stage II to III being most common (Appendix F).

2.2.2.2 Stream Channel and Terrace Deposits - Aal

Stream-channel and terrace deposits are associated with the ephemeral streams in the valley. They range in composition from sandy gravel to gravelly sand near the mountain fronts to sandy silt near the valley center. Two Aal deposits have been delineated as potential aggregate sources in the study area. A small stream-channel deposit is located immediately north of latitude 37°45' N on the east side of the valley. A large terrace deposit is located in the north-central part of the valley.

3.0 ROAD-BASE AGGREGATES EVALUATION

3.1 STUDY APPROACH

The primary objective of the road-base aggregate study was to evaluate the suitability of basin-fill and rock aggregates for use as road base. Two important considerations were applied to basin-fill aggregate sources identified as potentially suitable in VSARS; refinement of source boundaries, and additional laboratory tests to further evaluate physical and chemical characteristics. Sources of crushed-rock aggregates were refined using only existing data, published geologic maps, and limited photogeologic interpretations. Information on potential rock sources for use as road-base aggregates was not specifically collected for this evaluation. Only existing VSARS data and data developed from the concrete aggregates evaluation (Section 4.0) were assessed.

The study approach for the road-base aggregates evaluation required a review of previous Ertec Verification (FN-TR-27-DL-I and II) and aggregate reports (FN-TR-20D and FN-TR-37-a) for Dry Lake Valley. This data base helped define the scope of the road-base materials investigation which included office and field photogeologic and topographic interpretations, field reconnaissance, and collection and laboratory testing of basin-fill samples.

3.1.1 Requirements for Road-Base Aggregates

For the purpose of this report, road-base aggregates are defined using the Nevada Department of Highways (1976) classification of

Type I Class A aggregate base. The requirements for aggregates suitable for such a base are as follows:

Gradation:

Sieve Size	Percent Passing by Weight
1.5 inches	100
1.0 inch	80-100
No. 4	30- 65
No. 16	15- 40
No. 200	2- 12

Fractured Faces	35 percent, minimum
Plasticity Index	3-15 percent
Liquid Limit	35 maximum
Resistance (R value)	70 minimum
Percent Wear (500 Rev.)	45 percent, maximum

During the road-base aggregate studies, gradation and percent wear were the two primary criteria used to evaluate potential source area. Magnesium sulfate ($M_{g}SO_{4}$) soundness tests were performed on selected aggregate samples to gain additional information related to the effects of weathering on aggregates. Soundness losses exceeding 18 percent were considered potentially unacceptable (American Society of Testing and Materials, 1978). The remaining requirements were not evaluated during this study.

3.1.2 Data Acquisition and Analysis

Office studies for the road-base aggregates evaluation required preliminary basin-fill and rock unit differentiation based on photogeologic interpretations and published topographic and geologic maps. All available data on basin-fill, grain-size gradations were compiled to estimate gravel content for the defined basin-fill units.

The field program involved backhoe excavation of 61 trenches selected during office studies and initial field reconnaissance. Trenches were excavated and sampled in groups of three, 0.1 to 0.2 mile (0.2 to 0.3 km) apart, to characterize individual basin-fill units. Completion depths ranged from 12 to 15 feet (3.7 to 4.6 m) and, where collected, representative samples averaged 100 pounds (45 kg) per trench.

Due to gradation variability in basin-fill deposits, field limits of 30 percent or more gravel and 20 percent or less silt and clay were established as basic aggregate grain-size distribution requirements. Gravel is defined as coarse aggregates which pass the 3.0-inch (75 mm) sieve and are predominantly retained on a No. 4 (4.75 mm) sieve. Aggregates larger than 3.0 inches (cobbles and boulders) were generally present in the materials investigated but were not included in the laboratory samples because of sample-size limitations. Silt and clay particles are defined as material passing through a No. 200 sieve (0.0029 inch [0.075 mm]).

Field studies also included 53 petrographic and grain-size data field stops and valley-wide photogeologic field reconnaissance. These analyses were performed to supplement and confirm office studies and to provide a data base for lithologic and gradation correlations of basin-fill units.

Laboratory testing that included 40 sieve analyses, 11 abrasion tests, and five M_gSO_4 soundness tests was performed to broaden the existing data base during the road-base aggregates evaluation. Confirmation test data (gradation, abrasion, and soundness tests) from the concrete aggregates evaluation (Section 4.0) were also used to supplement test data for the road-base aggregates evaluation.

The scope of the study did not allow sample collection and laboratory testing of all potential road-base aggregate sources. Existing data and field petrographic and grain-size analyses were used to correlate lithologic and gradation properties to basin-fill units which were not sampled. An important element of this correlation procedure was the use of aerial photography to help delineate the lateral extent of basin-fill deposits. Photogeologic and field observations ascertained geomorphological and topographical relationships of basin-fill units and the source rock lithology and distribution of predominantly gravelly materials.

3.1.3 Presentation of Results

Results of the road-base aggregates evaluation are presented in the form of text, figures, 1:62,500 scale drawings, and appendices. Drawing 1 shows the locations of all the data points used in the Detailed Aggregate Resources Study. The data points are grouped by study type and assigned categorized map numbers. VSARS data points are designated by map numbers 1 to 199 and correspond to map numbers in the appendix table of the Dry Lake area VSARS report (FN-TR-37-a). DARS data points are assigned map number groups 200 to 299 for trench locations and 300 to 399 for petrographic and grain-size data stop locations. Verification data points are assigned the map number group 400 to 599. Appendix Table G-1 converts map number to Dry Lake Verification Report (FN-TR-27-DL-I and II) activity type and number for direct reference.

Drawing 2 presents the locations of all potential road-base aggregate sources, DARS trenches, and field petrographic and grain-size data stops in the study area. Geologic unit symbols used in Drawing 2 relate to standard geologic nomenclature whenever possible. A conversion table relating these symbols to the geologic unit nomenclature used in other Ertec reports is contained in Appendix Table F-3.

A solid contact line separates basin-fill and rock units in Drawing 2 to differentiate these two basic material types. All rock contacts are from published data or limited air-photo interpretation and are dashed. Basin-fill contacts are derived from photogeological mapping with limited field reconnaissance and are also dashed.

Classifications of potential sources of basin-fill and crushed-rock road-base aggregates are distinguished by different patterns. Patterns for basin-fill and rock sources of the same classification are similar, with the basin-fill pattern emphasized by a dark background tone.

The appendices contain tables that summarize the basic field data collected during the course of the study and the subsequent laboratory test procedures and results. Appendices A and B include DARS trench data and petrographic and grain-size analysis data, respectively. Appendix C contains representative trench logs. Appendix Table D-1 presents a laboratory testing flow diagram for the road-base aggregates evaluation. Appendix F includes three tables describing soil classification, caliche development, and geologic unit cross reference.

3.1.4 Classification of Road-Base Aggregates

A classification system was designed to present the most likely locations of potential sources of basin-fill and crushed-rock road-base aggregates. It was developed from an evaluation as well as from an extrapolation of all available data.

This classification system is primarily based on laboratory test results (gradation and abrasion and, to a lesser extent, soundness) and geomorphological and compositional correlations. The classification is presented in hierarchy form; classification of the highest potential source areas is described first and classification of the lowest potential source areas is described last.

Class	Explanation
RBIa	Basin-fill or rock sources containing materials suitable for use as road-base aggregates; based on acceptable laboratory aggregate test results.

Class RBIa includes those source areas where the potential for suitable road-base aggregates is the highest. Each delineated area has been sampled and tested. In order to assign Class RBIa to a basin-fill deposit, the source must satisfy the overall requirements outlined in Section 3.1.1.

Class	Explanation
RBIb	Basin-fill sources containing materials suitable for use as road-base aggregates; based on correlation with Class RBIa source areas.

Class RBIb basin-fill deposits are correlated to tested RBIa deposits on the basis of limited laboratory sieve analysis data and field observations. Field observations included petrographic and grain-size analyses which provided data on lithology of adjacent source rock and general amounts and lithologies of gravel present in the basin-fill units. Photogeologic interpretations were also used to correlate Class RBIb deposits to RBIa deposits. Specific geomorphological parameters included surface texture, drainage patterns, relative relief, and topographic profiles.

Class	Explanation
RBII	Potential basin-fill sources of materials suitable for use as road-base aggregates; based on photogeologic interpretations, field observations, and limited or inconclusive sieve analysis and/or abrasion data.

Class RBII includes poorly defined basin-fill aggregate sources. Field observations and inconclusive field and laboratory data indicate these deposits may be potentially acceptable for use as road-base aggregate sources.

All classifications are based on limited data. Additional field reconnaissance, testing, and case history studies are needed to confirm adequacy, delimit exact areal boundaries, and refine chemical and physical characteristics.

3.2 SOURCES OF ROAD-BASE AGGREGATES

The potential basin-fill and rock units defined for use as coarse road-base aggregates in the Dry Lake Valley study area include alluvial fan deposits (Aaf), a stream-channel deposit (Aal), and undifferentiated carbonate rock (Cau).

3.2.1 Basin-Fill Sources

All three classes of road-base aggregates, RBIa, RBIb, and RBII, are present in the basin-fill units of Dry Lake Valley (Drawing 2).

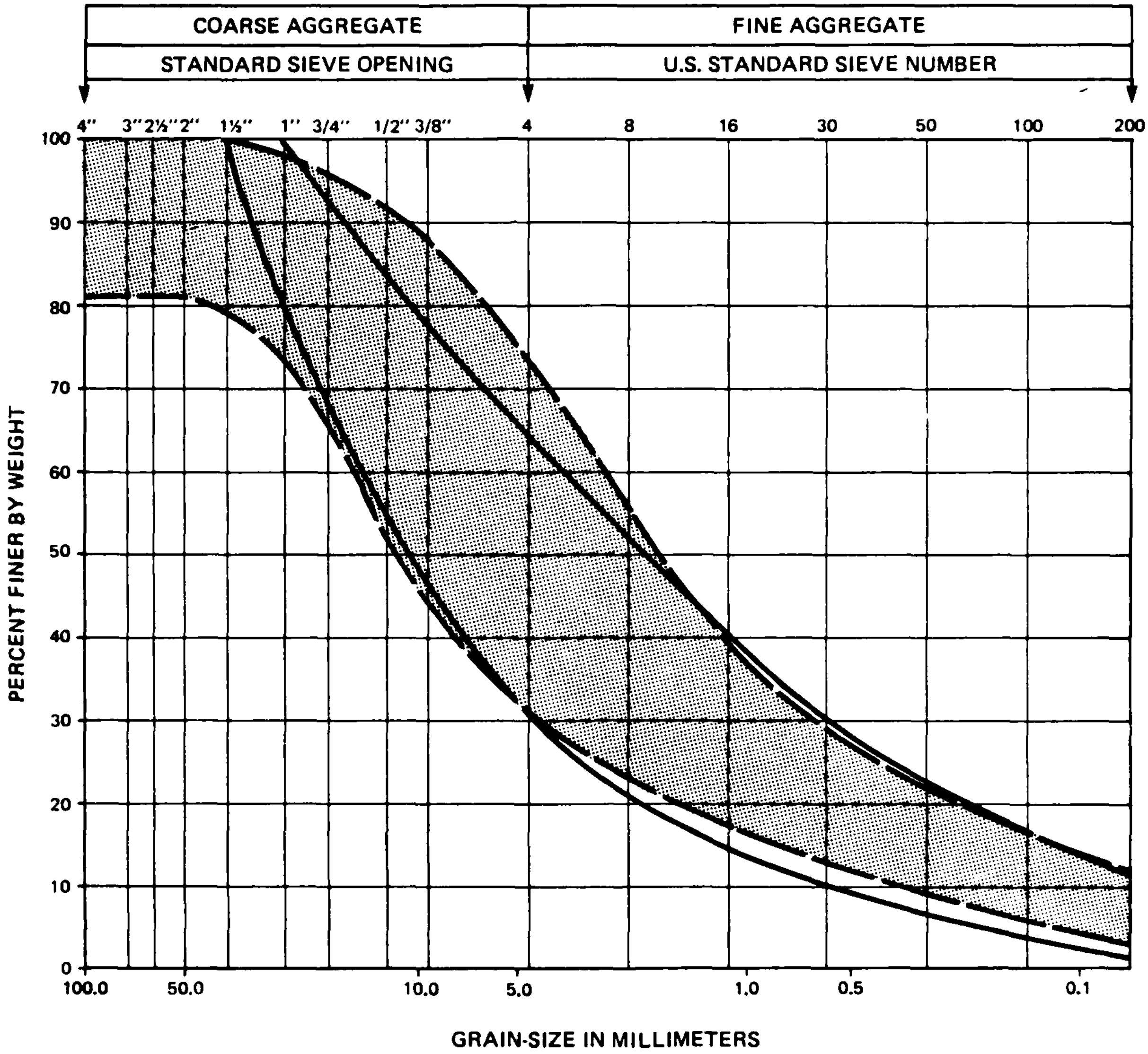
3.2.1.1 Class RBIa

All Class RBIa deposits within the study area are located along the eastern margin of the valley adjacent to the Burnt Springs, Highland, Ely Springs, Bristol, and West ranges. The small Class RBIa deposit located against the southern boundary of the study area is actually the northern extension of a Class RBIa unit in Delamar Valley and is discussed in the Delamar Valley DARS report (E-TR-47-DM).

There are 13 Class RBIa basin-fill deposits; 12 are alluvial fan units (Aaf) and one is a stream-channel unit (Aal). Although alluvial fans commonly exhibit a greater degree of caliche development (Stage II to III), there are no significant compositional or lithological differences between the stream-channel and the alluvial fan units.

The Class RBIa basin-fill deposits generally consist of poorly to well-graded, subangular to subrounded, sandy gravel and gravelly sand. The gravel content of these deposits ranges from a low of 30 percent to a high of 70 percent but is generally 50 to 60 percent. Sand content ranges from 30 to 60 percent. The silt and clay content of individual Class RBIa deposits (below the overburden layer) ranges from a low of one percent to a high of 20 percent but is generally between five and 10 percent. Class RBIa basin-fill deposits commonly consist of 50 to 95 percent carbonate clasts, five to 40 percent volcanic clasts, and less than 15 percent quartzite clasts. The southernmost Class RBIa basin-fill deposit, adjacent to the Burnt Springs Range, differs from all other Class RBIa deposits by containing a slightly higher percentage of volcanic clasts than carbonate clasts.

The gradation of Class RBIa deposits approximates the grain-size distribution requirements stated in Section 3.1.1 (Figure 4). The different RBIa deposits generally share the same gradation characteristics; some coarse gravels and cobbles (oversize material) are present, gravels passing the 1.5- to 1-inch sieves are deficient, and fine gravel and sand passing the 1-inch to No. 200 sieves are within design gradation requirements. There are two exceptions to the gradation trend of RBIa deposits. The southernmost RBIa deposit on the east side of the valley contains an excess of fine gravel and coarse sand passing sieve



▨ REQUIRED GRAIN-SIZE DISTRIBUTION ENVELOPE FOR TYPE I CLASS A, ROAD-BASE AGGREGATES (NEVADA STATE DEPARTMENT OF HIGHWAYS, 1976).

▨ GRAIN-SIZE DISTRIBUTION ENVELOPE OF BASIN–FILL AGGREGATES POTENTIALLY SUITABLE FOR ROAD BASE.

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GRAIN-SIZE DISTRIBUTION ENVELOPES
ROAD-BASE AGGREGATES, CLASS RBIa
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FIGURE 4

sizes from 0.75 inch to No. 8, and the RBIa deposit sampled at locations 228 thru 232 (southeastern part of the valley) is coarser than the design gradation requirements in all gravel fractions (1.5 inch thru No. 4). Minor processing of all RBIa deposits will be necessary to conform to the gradation requirements.

It has been observed that variations in grain-size gradations occur within a deposit depending on sample location. In general, gradations within a deposit are finer near the valley axis and coarser near mountain fronts. Due to access restrictions, samples were generally collected at distal and medial locations within each deposit.

Laboratory abrasion tests performed on samples from all Class RBIa deposits show a fairly narrow range of 23.3 to 32.6 percent wear. Laboratory $MgSO_4$ soundness tests performed on samples from most of the Class RBIa deposits yielded results ranging from 2.4 to 13.4 percent loss. These test results are well below the maximum acceptable values for abrasion and soundness.

The areal extent of Class RBIa deposits generally ranges from approximately 0.3 to 3.5 mi^2 (0.8 to 9.1 km^2). There is one Class RBIa deposit, located west of the Highland Range with a surface area of 12 mi^2 (31.1 km^2). Excluding the variable Aal deposit, the thickness of these Class RBIa deposits is estimated to be at least 25 feet (7.6 m). Generally, 70 to 90 percent of the material in these deposits will be suitable for use as road-base aggregates.

3.2.1.2 Class RBIb

Class RBIb basin-fill aggregate sources consist of alluvial units that have been correlated to Class RBIa deposits and, therefore, are considered to contain material acceptable for use as road-base aggregates. These deposits occur only on the east side of the valley, adjacent to the Burnt Springs, Highland, Ely Springs, and Bristol ranges. Thirteen alluvial fan units (Aaf) and one stream-channel unit (Aal) are included in this classification.

Since Class RBIb basin-fill deposits are correlated to Class RBIa deposits, they possess the same general characteristics as the RBIa deposits; poorly to well-graded, durable, subangular to subrounded, sandy gravel and gravelly sand, consisting predominantly of carbonate clasts and secondary volcanic and quartzite clasts.

Although variations in grain-size gradations will occur, depending on sample location within the deposit and the proximity of the deposit to its source area, Class RBIb deposits are interpreted to have gradation distributions similar to RBIa deposits.

The Class RBIb deposits range in surface area from approximately 0.34 to 2 mi^2 (0.88 to 5.2 km^2). Excluding the variable Aal deposit, the thickness of these deposits is estimated to be at least 25 feet (7.6 m). Generally, from 70 to 90 percent of the material in the Class RBIb deposits will be suitable for use as road-base aggregates.

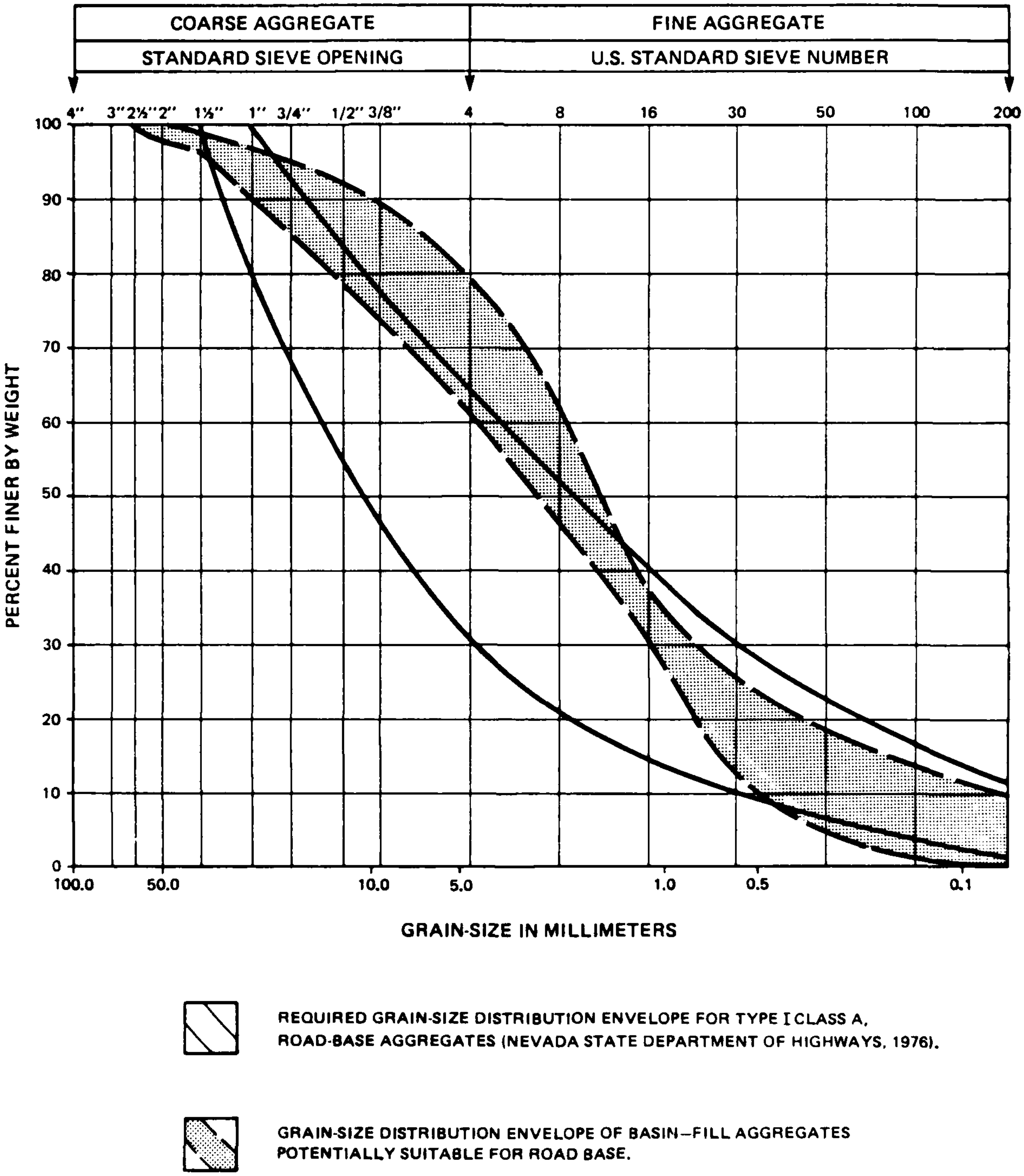
3.2.1.3 Class RBII

Class RBII basin-fill aggregate sources are alluvial units that are potentially acceptable for use as road base. These deposits have been classified on the basis of limited field and laboratory data collected during this and other Ertec studies.

Class RBII deposits are located along the east side of the valley adjacent to the Burnt Springs, Highland, Ely Springs, Bristol, and West ranges and on the west side of the valley at four widely spaced locations adjacent to the North Pahroc Range. All of the Class RBII deposits are alluvial fan units (Aaf).

Limited laboratory and field data used to define the Class RBII deposits on the east side of the valley indicate that they are compositionally similar to Class RBIa and RBIb deposits on the east side of the valley, consisting of sandy gravel and gravelly sand composed predominantly of carbonate clasts with secondary volcanic and quartzite clasts. However, there may be considerable variations from this general description within individual deposits.

The Class RBII deposits on the west side of the valley are known, on the basis of limited field and laboratory data, to be gravelly sand composed predominantly of volcanic clasts with lesser amounts of carbonate and quartzite clasts. Two of the Class RBII alluvial fans on the west side of the valley were sampled and tested during the DARS. Gradation test results indicate that these deposits do not meet the requirements outlined in Section 3.1.1 (Figure 5). The fine gravel and coarse



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GRAIN-SIZE DISTRIBUTION ENVELOPES
ROAD-BASE AGGREGATES, CLASS RBII
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FIGURE 5

sand fractions passing sieve sizes from 0.75 inch to No. 16 are excessive. In addition, the gravel content of the southernmost source on the west side of the valley falls below 30 percent of the total deposit. A laboratory abrasion test performed on a sample from this deposit yielded a value of 43 percent wear. These particular Class RBII deposits are considered only marginally suitable for use as road-base aggregates.

The areal extent of all Class RBII deposits ranges from approximately 0.1 to 1.9 mi^2 (0.3 to 4.9 km^2).

3.2.2 Rock Units

The study approach used to evaluate road-base aggregates emphasized the analysis of basin-fill deposits and dictated that only previously tested crushed-rock sources be discussed and classified. As a consequence, other rock units potentially suitable as sources of crushed-rock, road-base aggregates are not included or described in this study.

Sources of crushed rock for use as road-base aggregates are undifferentiated carbonate rocks (Cau) classified as RBIa. These sources are located at three widely spaced locations within the Dry Lake Valley study area. On the east side of the valley the Class RBIa crushed rock sources are located in the Burnt Springs and the Ely ›prings ranges. On the west side of the valley, a Class RBIa crushed-rock source is located in the North Pahroc Range, 5 miles (8 km) north of latitude 38°00'N.

Results of laboratory abrasion tests performed on samples from the Class RBIa carbonate rocks range from 22.3 to 29.5 percent wear. Laboratory M_gSO_4 soundness test results range from 1.1 to 2.9 percent loss. These test results are well within the acceptable ranges for road-base aggregates.

4.0 CONCRETE AGGREGATES EVALUATION

4.1 STUDY APPROACH

The purpose of the concrete aggregates evaluation is to determine the suitability of aggregates within Dry Lake Valley for use in concrete. To accomplish this, two objectives have been established:

- Evaluate the basic physical and chemical characteristics of the aggregates; and
- Determine the concrete making properties of the aggregates.

The study approach required to achieve these objectives included a review of previous Ertec Verification (FN-TR-27-DL-I and II) and aggregate reports (FN-TR-20D and FN-TR-37-a). This data base helped define the scope of the concrete aggregates investigation and included office and field photogeologic and topographic interpretations, field reconnaissance, and collection and laboratory testing of basin-fill and rock samples.

4.1.1 Requirements for Concrete Aggregates

The following requirements for aggregates and concrete (made using these aggregates) were established using criteria from the American Society of Testing and Materials (1979), the "Concrete Manual" prepared by the United States Department of the Interior (1975), and Milos Polivka (1981, personal communication).

1. Aggregates

   - Gradation - The aggregate gradation specifications used by the American Society of Testing and Materials (1979; C 33) were selected for evaluating the samples tested. These grading specifications follow.

Coarse Aggregates

Sieve Size	Percent Passing by Weight	Sieve Size	Percent Passing by Weight
2 inches	100	1 inch	100
1.5 inches	95-100	0.75 inch	90-100
1 inch	---	0.5 inch	---
0.75 inch	35-70	0.375 inch	20-55
0.50 inch	---	No.4	0-10
0.375 inch	10-30	No.8	0-5
No.4	0-5		

Fine Aggregates

Sieve Size	Percent Passing by Weight
0.375 inch	100
No.4	95-100
No.8	80-100
No.16	50-85
No.30	25-60
No.50	10-30
No.100	2-10
No.200	

- Abrasion - Los Angeles Machine abrasion losses for coarse aggregates are not to exceed 50 percent.

- Soundness - Five-cycle magnesium sulfate ($MgSO_4$) soundness losses are not to exceed 18 percent and 15 percent for coarse and fine aggregates, respectively. Although not a requirement for the evaluation, five-cycle sodium sulfate ($NaSO_4$) soundness tests are performed on samples that failed $MgSO_4$ testing. Resultant losses are not to exceed 12 percent and 10 percent for coarse and fine aggregates, respectively.

- Reactivity - Aggregates are to be nonreactive to alkali-silica and alkali-carbonate rock tests. Results are incomplete and will be submitted as an addendum to this report.

2. Concrete

- Compressive Strength - The primary concrete requirement is a 28-day compressive strength equal to or greater than 6500 psi.

- Static Modulus of Elasticity values of 3 to 6 million psi at 28 days.
- Splitting Tensile Strength of 10 percent or less of the compressive strength value at 28 days.
- Ultimate drying shrinkage values of 0.03 to 0.10 percent (300 to 1000 millionths).

4.1.2 Data Acquisition and Analysis

4.1.2.1 Office Studies

Office studies for the concrete aggregates evaluation required preliminary basin-fill and rock unit differentation based upon photogeologic interpretations and published topographic and geologic maps. All available data on basin-fill, grain-size gradations were compiled to estimate gravel content for the defined basin-fill units. All available test data on the aggregate properties of basin-fill and rock units were compiled to select sample locations in units previously tested and found preliminarily acceptable for use as concrete aggregate sources.

4.1.2.2 Field Studies

The field program involved backhoe excavation of 15 trenches selected during office studies and initial field reconnaissance; 14 trenches were excavated to obtain samples of coarse and fine aggregates (gravel and sand), and one was excavated to obtain samples of fine aggregates (sand).

Due to gradation variability in basin-fill deposits, field limits of 30 percent or more gravel and 15 percent or less silt and clay were established as basic aggregate grain-size distribution requirements. Gravel is defined as coarse aggregates which pass the 3.0-inch (75-mm) sieve and are predominantly retained on a No. 4 (4.75 mm) sieve. Silt and clay particles are defined as material passing through a No. 200 sieve (0.0029 inch [0.075 mm]).

The 14 trenches excavated to collect basin-fill samples for concrete aggregate evaluations were grouped into two sets of five and one set of four (150 feet apart [46 m]) to characterize individual basin-fill units. A single trench was excavated to investigate a fine aggregate source. Trenches were excavated to depths ranging from 12 to 15 feet (3.7 to 4.6 m). Bulk representative samples averaged 400 pounds per trench. The sample from the fine aggregate trench weighed approximately 800 pounds. Two bulk samples of surface rock, weighing about 1200 pounds each, and one additional sample of fine aggregate, weighing about 800 pounds, were collected manually.

Field studies also included 53 petrographic and grain-size data field stops and valley-wide photogeologic field reconnaissance. These analyses were performed to supplement and confirm the office studies and to provide a broader data base for lithologic and gradation correlations of basin-fill units.

4.1.2.3 Laboratory Testing

The laboratory aggregate testing program was performed in two phases. The first phase consisted of standard tests for determining the basic properties of the aggregates and included the following:

- Unit Weights and Voids in Aggregates;

- Standard Specifications for Concrete Aggregates;
- Soundness of Aggregates, Magnesium Sulfate ($MgSO_4$) and Sodium Sulfate ($NaSO_4$);
- Sieve Analysis by Washing, less than No. 200 fraction;
- Fineness Modulus;
- Specific Gravity and Absorption, Coarse and Fine Aggregates;
- Resistance to Abrasion, Los Angeles Machine;
- Sieve Analysis, Coarse and Fine Aggregates; and
- Petrographic Examination of Aggregates for Concrete.

Generally, these tests were performed on aggregates from different locations within the same sources previously tested and identified as the most promising in the VSARS program. This repetitive testing was done to confirm the suitability of aggregates for concrete (see Section 4.1.1, requirements for Concrete Aggregates). Table 1 lists the number of tests completed in Dry Lake Valley.

The second phase of the testing consisted of an evaluation of the concrete-making properties of the aggregates when used in the following three trial (check) concrete mixes.

Mix 1 - 7.5 sacks (94 pounds per sack) of cement per cubic yard of concrete with 1.5-inches maximum aggregate size.

Mix 2 - 8.5 sacks (94 pounds per sack) of cement per cubic yard of concrete with 1.5-inches maximum aggregate size.

Mix 3 - 8.5 sacks (94 pounds per sack) of cement per cubic yard of concrete with 0.75-inch maximum aggregate size and a superplasticizer.

	ASTM STANDARD TEST	AGGREGATE AND CONCRETE TEST DESCRIPTIONS[1]	TOTAL NUMBER OF TESTS*			
			BASIN-FILL		ROCK	
			CA	FA	ROCK	FA
AGGREGATE	C29	UNIT WEIGHT AND VOIDS IN AGGREGATE	3		2	
	C33	STANDARD SPECIFICATIONS FOR CONCRETE AGGREGATE	3		2	
	C88	SOUNDNESS OF AGGREGATE; $MgSO_4/NaSO_4$	3/–	3/3	2/–	2/2
	C117	SIEVE ANALYSIS BY WASHING, < # 200 FRACTION	6		–	2
	C125	FINENESS MODULUS	–	3	–	2
	C127	SPECIFIC GRAVITY/ABSORPTION, COARSE AGGREGATE	18/6	–/–	12/4	–/–
	C128	SPECIFIC GRAVITY/ABSORPTION, FINE AGGREGATE	–/–	9/3	–/–	6/2
	C131	RESISTANCE TO ABRASION, LOS ANGELES MACHINE	3	–	2	–
	C136	SIEVE ANALYSIS, COARSE AND FINE AGGREGATE	20	17	4	4
	C295	PETROGRAPHIC EXAM. OF AGGREGATES FOR CONCRETE	3	3	2	2
CONCRETE	C39	COMPRESSIVE STRENGTH OF CYLINDRICAL CONCRETE SPECIMENS	72		48	
	C138	UNIT WEIGHT, YIELD, AIR CONTENT OF CONCRETE	9		6	
	C143	SLUMP OF PORTLAND CEMENT CONCRETE	12		8	
	C157	LENGTH CHANGE OF HARDENED CEMENT MORTAR AND CONCRETE	90		60	
	C173	AIR CONTENT OF CONCRETE, VOLUMETRIC METHOD	9		6	
	C192	MAKING AND CURING CONCRETE SPECIMENS	9		6	
	C227	POTENTIAL ALKALI-SILICA REACTIVITY, MORTAR-BAR METHOD	–	1 (IP)	–	1 (IP)
	C469	STATIC MODULUS OF ELASTICITY, POISSONS RATIO OF CONCRETE IN COMPRESSION	72		48	
	C496	SPLITTING TENSILE STRENGTH OF CYLINDRICAL CONCRETE SPECIMENS	18		12	
	C684	MAKING AND TESTING ACCELERATED CURE CONCRETE COMPRESSION TEST SPECIMENS	18		12	
	222-1-77[2]	SELECTING PROPORTIONS FOR NORMAL AND HEAVY WEIGHT CONCRETE	9		6	
	PROP.[3]	POTENTIAL ALKALI-CARBONATE ROCK REACTIVITY, LENGTH CHANGE METHOD	1 (IP)		1 (IP)	
	C39-55[4]	COEFFICIENT OF LINEAR THERMAL EXPANSION OF CONCRETE	18 (IP)		12 (IP)	

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (1978)
2. AMERICAN CONCRETE INSTITUTE (1977)
3. MIELENZ (1980) PROPOSED ASTM STANDARD TEST
4. UNITED STATES ARMY CORPS OF ENGINEERS (1977)

(IP) - TEST IN PROGRESS

- BASIN-FILL SOURCES SUPPLIED BOTH COARSE AND FINE AGGREGATES FOR CONCRETE MIX. LEDGE-ROCK SOURCES SUPPLIED COARSE AGGREGATES; LOCAL SAND SOURCES (GENERALLY COLLECTED WITHIN A FEW MILES OF CORRESPONDING LEDGE-ROCK SOURCES) SUPPLIED FINE AGGREGATES FOR CONCRETE MIX.

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AGGREGATE AND TRIAL MIX TESTS
CONCRETE AGGREGATES EVALUATION
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TABLE 1

In all three trial mixes, fly ash as a pozzolan replaced 20 percent of the cement by weight. All concrete trial mix design criteria are presented in Table 2. Samples were collected for a total of five trial mixes; three basin fill (coarse and fine aggregates) and two rock (coarse aggregates) and basin fill (fine aggregates). Material greater than 1.5 inches was crushed to conform to gradation requirements. If necessary, coarse and fine aggregates were processed to conform to gradation requirements.

The following tests were performed to evaluate fresh and hardened properties of concrete made from Dry Lake Valley aggregates:

Fresh Properties

- Unit Weight, Yield and Air Content of Concrete;
- Slump of Portland Cement Concrete;
- Air Content of Concrete, Volumetric Method;
- Making and Curing Concrete Speciments;
- Making and Testing Accelerated Cure Concrete Compression Test Specimens; and
- Selection Proportions for Normal and Heavyweight Concrete.

Hardened Properties

- Compressive Strength of Cylindrical Concrete Specimens;
- Length Change of Hardened Cement Mortar and Concrete;
- Potential Alkali-Silica Reactivity, Mortar-Bar Method;
- Static Modulus of Elasticity of Concrete in Compression;
- Splitting Tensile Strength of Cylindrical Concrete Specimens;

CONCRETE CONSTITUENTS AND PROPERTIES	CONCRETE TRIAL MIX DESIGN CRITERIA					
	MIX 1 7.5/1.5 IN.[1]		MIX 2 8.5/1.5 IN.[1]		MIX 3 8.5/0.75 IN.; SUPER.[1]	
	VOLUME	WEIGHT	VOLUME	WEIGHT	VOLUME	WEIGHT
CEMENT, NEVADA TYPE II (LOW ALKALI; FT^3, LBS)	2.87	564	3.25	639	3.25	639
FLY ASH, WESTERN (REPLACES 20% OF CEMENT BY WEIGHT; FT^3, LBS)	0.99	141	1.12	160	1.12	160
SUPERPLASTICIZER (WRDA 19; OZ/CWT)[2]	—	—	—	—	15	—
WATER REDUCER (WRDA 79; OZ/CWT)	5	—	5	—	5	—
AIR ENTRAINMENT ADMIXTURE (DARAVAIR: OZ/CWT [FT^3])	1.5 - 3.0 [1.08]	—	1.25 - 3.0 [1.08]	—	1.75 - 3.0 [1.08]	—
SLUMP, MAXIMUM (INCHES)	3 - 4		3 - 4		0 - 1[3]	
AIR CONTENT, RANGE (PERCENT)	4 - 6		4 - 6		4 - 6	
WATER/CEMENT RATIO (BY WEIGHT)	0.36		0.32		0.33	
CEMENT FACTOR (SCY)[4]	7.5		8.5		8.5	

1. SACKS OF CEMENT PER CYD / MAXIMUM AGGREGATE SIZE
2. OZ/CWT = OUNCES/100 POUNDS OF CEMENT AND FLY ASH
3. SLUMP BEFORE ADDITION OF SUPERPLASTICIZER
4. SCY = SACKS OF CEMENT/CUBIC YARD OF CONCRETE

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CONCRETE TRIAL MIX DESIGN CRITERIA
DRY LAKE VALLEY, NEVADA

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TABLE 2

- Potential Alkali-Carbonate Rock Reactivity, Length Change Method; and
- Coefficient of Linear Thermal Expansion of Concrete.

The results of all tests summarized in Table 1 are important to the concrete aggregates evaluation, but hardened concrete properties are considered the most significant (see Section 4.1.1, Requirements for Concrete Aggregates). Although the primary requirement for concrete is a 28-day compressive strength of 6500 psi, one-day (accelerated), seven-day, and 90-day tests were done to determine the range of compressive strength values. In order to compare different aggregate sources, 28-day compressive strengths of Mix 3 were always used.

Occasionally, fresh concrete properties varied from design concrete specifications and may have affected hardened concrete test results. If known or significant, the causative factor and its effect on test results are mentioned in the discussions on sources of concrete aggregates (Sections 4.2.1 and 4.2.2).

The scope of the study did not allow sample collection and laboratory testing of all potential basin-fill and rock concrete aggregate sources. Existing data and field petrographic and grain-size analyses were used to correlate lithologic and gradation properties to basin-fill units which were not sampled. An important element of this correlation procedure was the use of aerial photography to help delineate the lateral extent of basin-fill deposits. Photogeologic field observations ascertained geomorphological and topographical relationships of basin-fill units and the source rock lithology and distribution of predominantly gravelly materials.

Limited laboratory and field data prevented most correlations of data from tested to untested rock units. Potential aggregate sources were confined to the limits of tested or correlated outcrops as determined from existing data, limited photogeological interpretation, and field reconnaissance.

4.1.3 Presentation of Results

Results of the concrete aggregates evaluation are presented in the form of text, tables, figures, 1:62,500 scale drawings, and appendices. Drawing 1 is a location map showing the position in the study area of all data points used in the Detailed Aggregate Resources Study. All data points are grouped by study type and assigned categorized map numbers (see Section 3.1.3).

Drawing 3 presents the locations of the potential concrete aggregate sources, basin-fill sources of fine aggregate that were mixed with crushed rock, DARS trenches, and field petrographic and grain-size data stops in the study area. Geologic unit symbols used in Drawing 3 relate to standard geologic nomenclature whenever possible. A conversion table relating these symbols to the geologic unit nomenclature used in other Ertec reports is contained in Appendix Table F-3.

A solid contact line separates basin-fill and rock units in Drawing 3 to differentiate these two basic material types. All rock contacts are taken from published data or limited air-photo interpretation and are dashed. Basin-fill contacts are derived from photogeological mapping with limited field reconnaissance and are also dashed.

Classifications of potential basin-fill and rock concrete aggregate sources are distinguished by different patterns. Patterns for basin-fill and rock sources of the same classification are similar, with the basin-fill pattern emphasized by a dark background tone.

The appendices contain tables that summarize the basic field data collected during the course of the study and the subsequent laboratory test procedures and results. Appendices A and B contain DARS trench data and petrographic and grain-size data, respectively. Appendix C contains representative trench logs. Appendix Table D-2 presents a laboratory testing flow diagram for the concrete aggregates evaluation. Appendix E presents the chemical analyses of cement, fly ash, and water used in making all concrete trial mixes. Appendix F includes three tables describing soil classification, caliche development, and geologic unit cross reference.

4.1.4 Classification of Concrete Aggregates

A classification system was designed to present the most likely basin-fill and crushed-rock concrete aggregate sources. It was developed from an evaluation as well as from an extrapolation of all available data. Data include laboratory test results (compressive strength of concrete and grain-size, abrasion, and soundness of aggregates), and geomorphological and compositional correlations.

The classification system groups potential aggregate sources into three categories:

1. Aggregate sources which were used in concrete mixes - Class CA1 and Class CA2;
2. Aggregate sources which were subjected to basic aggregate tests - Class CB; and
3. Untested aggregate sources which were correlated to Classes CA1, CA2, or CB - Class CC1 and Class CC2.

The classification is presented in hierarchy form; classification of the highest potential source areas is described first, and classification of the lowest potential source areas is described last.

Class	Explanation
CA1	Basin-fill or rock sources containing aggregates that produced trial mix concrete with 28-day compressive strengths equal to or greater than 6500 psi using Mix 3 (Section 4.1.2).
CA2	Basin-fill or rock sources containing aggregates that produced trial mix concrete with 28-day compressive strengths less than 6500 psi using Mix 3 (Section 4.1.2).

The Classes CA1 and CA2 describe those specific sources where basin-fill or crushed-rock aggregates have been collected and used in making trial mix batches of concrete. Following appropriate ASTM standards, concrete cylinders containing the collected aggregates were made, cured, and tested for various hardened concrete properties. The class is divided into two categories by 28-day compressive strength test results.

Generally, aggregates from each potential source area have been tested previously during the VSARS program. Confirmation testing that includes gradation, abrasion, and soundness tests was performed when applicable to ensure the continued acceptability of a sample for use in concrete. Abrasion and $MgSO_4$ soundness values do not exceed coarse aggregate requirements specified in Section 4.1.1. Tested samples of fine aggregate used in the concrete trial mixes consistently have $MgSO_4$ soundness losses exceeding the required 15 percent maximum, however, N_aSO_4 soundness losses generally do not exceed 10 percent.

Class	Explanation
CB	Basin-fill or rock sources containing aggregates potentially suitable for use in concrete; based on acceptable laboratory aggregate test results.

The Class CB describes those source areas that have been sampled and tested only for grain-size gradation, abrasion, and magnesium sulfate soundness. Trial concrete mixes were not made. Gradation, abrasion, and soundness values specified in Section 4.1.1 were used to assign this classification to an aggregate source.

Class	Explanation
CC1	Basin-fill or rock sources containing aggregates potentially suitable for use in concrete; based on correlation with Class CA1 or CA2 areas.

CC2	Basin-fill sources of aggregates potentially suitable for use in concrete; based on correlation with Class CB areas.

Untested Class CC deposits are correlated to tested Class CA or CB deposits on the basis of field observations and limited field and laboratory test results. Class CC basin-fill deposits consist of units of the same apparent relative age as Class CA and CB deposits. Class CC1 rock deposits are additional nearby outcrops of the same unit as Class CA deposits.

Field observations and petrographic and grain-size analyses provided correlative data on lithology of adjacent source rock and lithology and general amounts of gravel present in the basin-fill units. Photogeologic interpretations were also used to correlate Class CC basin-fill deposits to Class CA or CB basin-fill deposits. Specific geomorphological parameters correlated during the procedure included surface texture, drainage patterns, relative relief, and topographic profiles.

All classifications are based on limited data. Additional field reconnaissance, testing, and case history studies are needed to confirm adequacy, delimit exact areal boundaries, and refine chemical and physical properties.

4.2 SOURCES OF CONCRETE AGGREGATES

4.2.1 Basin-Fill Sources

Basin-fill sources of concrete aggregates are grouped into four classes. Deposits defined on the basis of laboratory test data are included in Class CA1 and Class CB. Untested basin-fill deposits correlated to deposits with test data are in Classes CC1 and CC2.

4.2.1.1 Class CA1

There are three Class CA1 basin-fill concrete material sources within the study area. These sources are located on the east side of the valley adjacent to the Burnt Springs, Ely Spring, and West ranges.

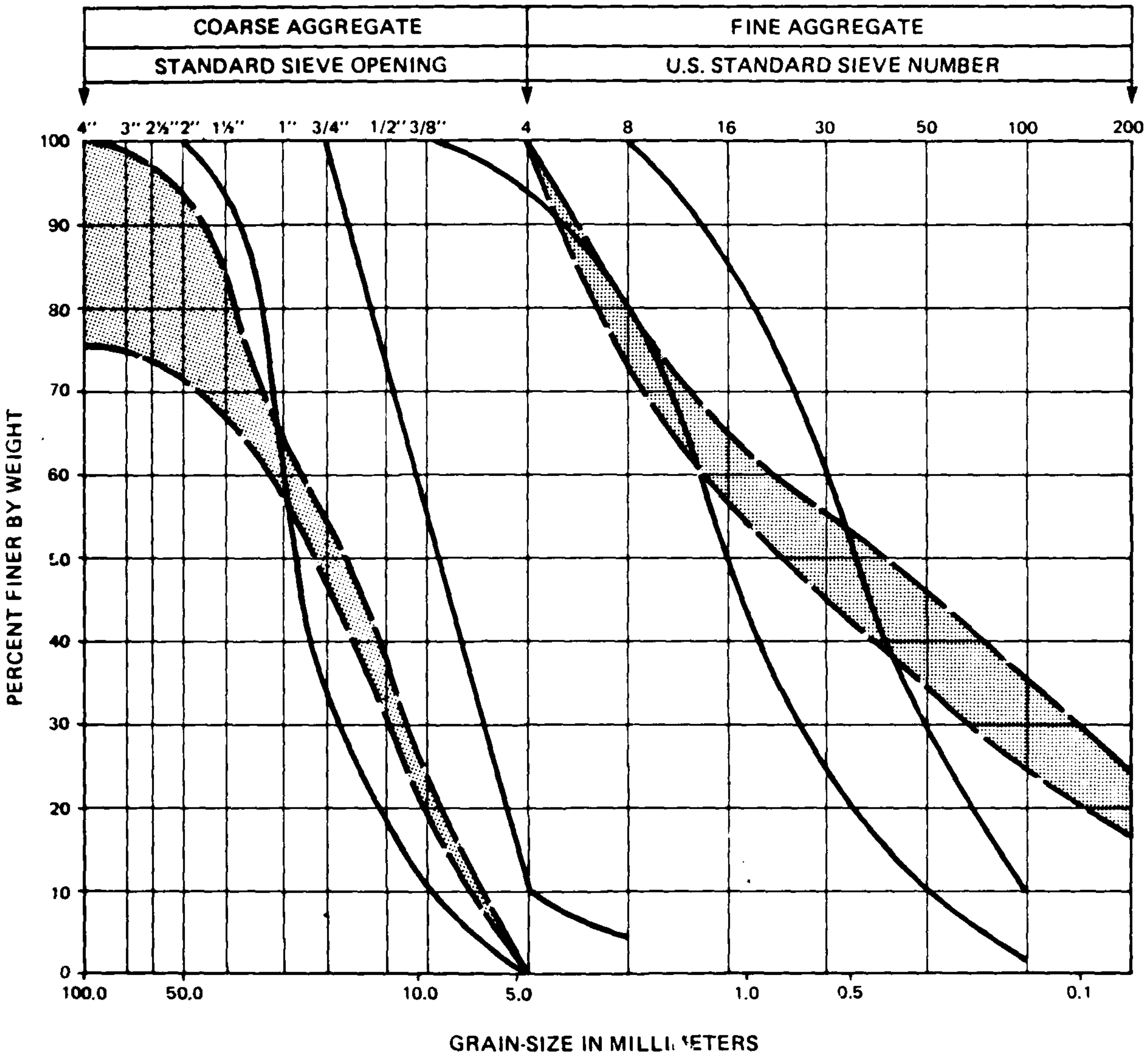
1. The southernmost Class CA1 basin-fill source is an alluvial fan deposit (Aaf) located adjacent to the Burnt Springs Range at latitude 37°45' N (Drawing 3). This deposit consists of poorly graded sandy gravel. The gravel ranges from 58 to 64 percent of the deposit (excluding cobbles and boulders), and the sand ranges from 28 to 34 percent. Cobbles and boulders comprise about 10 percent of the total material within the deposit. Silt and clay comprise from six to nine percent of the deposit.

The gravel clasts sampled from the southernmost Class CA1 deposit are typically subangular and equidimensional to thick-tabular in shape. Approximately 77 percent of the gravel clasts are of satisfactory physical quality; 21 percent are porous, weak, and internally fractured and are of fair physical quality; and about two percent are soft or highly porous and are of poor quality. The collected gravel sample is composed of 68 percent dolomite, 29 percent limestone and dolomitic limestone, and three percent coating material, chert, and tuff. Approximately 48 percent of the gravel clasts are partially or completely coated by calcareous material. The dolomite and dolomitic limestone clasts may be susceptible to a deleterious degree to the alkali-carbonate reaction. The gravel is not susceptible to the alkali-silica reaction.

The sand particles sampled from the southernmost Class CA1 deposit are typically subangular to angular and are generally similar in composition and quality to the gravel clasts within the deposit. The sand may be susceptible to a deleterious degree to the alkali-carbonate reaction but is not susceptible to the alkali-silica reaction.

The percentages of No. 4 to 1 inch coarse aggregates within the southernmost Class CA1 deposit conform to design gradation requirements. The percentages of 1- to 2-inch coarse aggregates within the deposit are outside design gradation requirements (Figure 6). There is an abundance of over-size aggregates that will require crushing to meet design requirements. The percentages of fine aggregates do not conform to design gradation requirements. There is a deficiency of coarse sand passing the No. 8 sieve and an excess of fine sand passing the No. 30 to No. 200 sieves. Processing will be necessary to bring the deposit within gradation requirements. Variations in grain-size gradations will occur within the deposit depending on proximity to the source area. In general, this source is relatively fine-grained near the valley axis and coarser grained adjacent to the mountain fronts.

A coarse aggregate sample from the southernmost Class CA1 deposit was subjected to laboratory abrasion and $MgSO_4$ soundness tests and yielded losses of 31.2 and 2.4 percent, respectively. These values for abrasion and soundness are well within acceptable ranges for coarse aggregate for concrete-construction-material use. The fine aggregate sample was subjected to both



▨ REQUIRED GRAIN-SIZE DISTRIBUTION ENVELOPES FOR COARSE AND FINE AGGREGATES USED IN CONCRETE (AMERICAN SOCIETY FOR TESTING AND MATERIALS, 1978, C 33; THE RECOMMENDED GRADATIONS FOR AGGREGATES WITH 1.5 AND 0.75 INCH MAXIMUM SIZE ARE COMBINED INTO ONE ENVELOPE).

▩ GRAIN-SIZE DISTRIBUTION ENVELOPES OF BASIN–FILL COARSE AND FINE AGGREGATES POTENTIALLY SUITABLE FOR CONCRETE.

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GRAIN-SIZE DISTRIBUTION ENVELOPES
CONCRETE AGGREGATES, DL-A- (28-32)
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE 6

$MgSO_4$ and $NaSO_4$ soundness tests. The sample failed the $MgSO_4$ soundness test with a 15.6 percent loss but passed the $NaSO_4$ soundness test with a 4.5 percent loss.

Concrete (Mix 3) made using the aggregates from the southernmost Class CA1 deposit had a 28-day compressive strength of 7690 psi and a 90-day compressive strength of 9765 psi. Concrete trial Mixes 1 and 2 yielded strengths of 4865 psi and 5380 psi, respectively (Table 3-1). The air content of Mix 1 (6.6 percent) was slightly higher than the maximum air content as specified by the mix design (6.0 percent) and may have caused a lowering of the compressive strengths of this mix. Fresh concrete properties and hardened concrete test results (chord modulus of elasticity, splitting tensile strength, drying shinkage) are also included in Table 3-1. The test results for hardened concrete are within or exceed the requirements mentioned in Section 4.1.1.

The areal extent of the southernmost Class CA1 deposit is approximately 1.5 mi^2 (3.9 km^2). It is estimated that the material sampled from this deposit and described above extends to a depth of at least 25 feet (7.6 m). It is also estimated that, where sampled, this deposit has a yield of 65 to 80 percent after gradation deficiencies and handling, poor quality constituents, and silt and clay losses.

2. The central Class CA1 source is an alluvial fan deposit (Aaf) located immediately southwest of the Ely Springs Range (Drawing 3). The deposit consists mainly of poorly to well graded sandy gravel. The gravel ranges from 54 to 67 percent of the deposit (excluding cobbles and boulders), and

AGGREGATE SOURCE[1]	FIELD STATION	CONCRETE MIX DESIGN CRITERIA[2] SACKS OF CEMENT/CYD / MAX. AGG. SIZE	FRESH CONCRETE PROPERTIES					
			SLUMP[3] (IN.)	AIR CONTENT (%)	UNIT WEIGHT (PCF)	WATER/CEMENT RATIO	CEMENT FACTOR (SCY)	ASTM STANDARD TES
BASIN – FILL	DL-A- (28-32)	MIX 1 7.5/1.5 IN.	4.0	6.6	146.2	0.34	7.42	COMPRESSIVE STRENGTH, A (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, (PSI)
								DRYING SHRINKAGE, AST (PERCENT)
	DL-A- (28-32)	MIX 2 8.5/1.5 IN.	4.0	8.0	146.6	0.34	8.34	COMPRESSIVE STRENGTH, A (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, (PSI)
								DRYING SHRINKAGE, AST (PERCENT)
	DL-A- (28-32)	MIX 3 8.5/0.75 IN., SUPER-PLASTICIZER	1 BEF. 4 AFT.	5.5	147.6	0.31	8.56	COMPRESSIVE STRENGTH, A (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, (PSI)
								DRYING SHRINKAGE, AST (PERCENT)

1. BASIN-FILL SOURCES SUPPLIED BOTH COARSE AND FINE AGGREGATES FOR CONCRETE MIX. LEDGE-ROCK SOURCES SUPPLIED COARSE AGGREGATES; LOCAL SAND SOURCES (GENERALLY COLLECTED WITHIN A FEW MILES OF CORRESPONDING LEDGE-ROCK SOURCES) SUPPLIED FINE AGGREGATES FOR CONCRETE MIX.
2. ASTM AND ACI SPECIFICATIONS AND PROCEDURES WERE FOLLOWED IN THE MIX DESIGN AND BATCHING OF THE CONCRETE TRIAL MIXES. THE CONCRETE MIXES CONSISTED OF COARSE AND FINE AGGREGATES, LOW ALKALI CEMENT, FLY ASH (20% BY WEIGHT REPLACEMENT OF CEMENT), SUPERPLASTICIZER, AIR-ENTRAINING ADMIXTURE, AND WATER REDUCER.
3. BEF. – SLUMP BEFORE ADDITION OF SUPERPLASTICIZER.
   AFT. – SLUMP AFTER ADDITION OF SUPERPLASTICIZER.
4. COMPRESSIVE AND TENSILE STREN CYLINDERS. DRYING SHRINKAGE MENS; TIMETABLE INCLUDES A SEV

HARDENED CONCRETE TEST RESULTS

M STANDARD TEST [4]	TIMETABLE			
	1 DAY (ACCELERATED)	7 DAYS	28 DAYS	90 DAYS
IVE STRENGTH, ASTM C 39 (PSI)	2320	4130	4865	6475
LUS OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.40	4.03	4.75	5.42
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	505	—

	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
SHRINKAGE, ASTM C 157 (PERCENT)	0.00	0.015	0.022	0.032	0.033

IVE STRENGTH, ASTM C 39 (PSI)	2570	4360	5380	6860
US OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.27	4.38	4.87	5.71
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	480	—

	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
SHRINKAGE, ASTM C 157 (PERCENT)	0.00	0.014	0.021	0.031	0.031

IVE STRENGTH, ASTM C 39 (PSI)	3745	6445	7690	9765
S OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.92	4.35	4.91	5.62
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	635	—

	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
HRINKAGE, ASTM C 157 (PERCENT)	0.00	0.020	0.030	0.041	0.042

ND TENSILE STRENGTH VALUES ARE AVERAGES OBTAINED FROM TWO TESTED
YING SHRINKAGE VALUES ARE AVERAGES OBTAINED FROM TWO TESTED SPECI-
LE INCLUDES A SEVEN DAY MOIST CURE.

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CONCRETE TRIAL MIX TEST RESULTS
DL-A-(28-32)
DRY LAKE VALLEY, NEVADA

29 MAY 81

TABLE 3 1

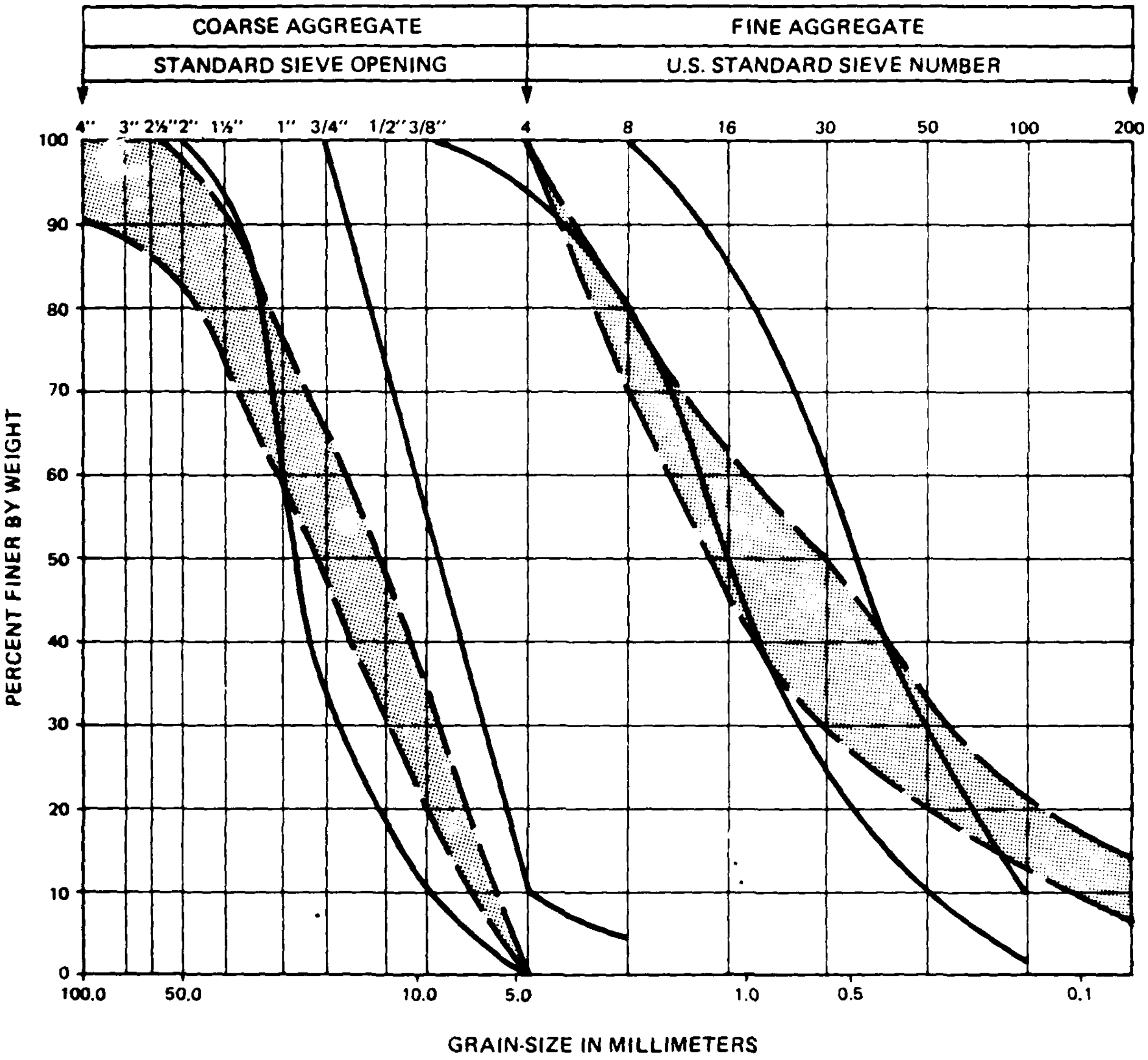
> the sand ranges from 31 to 40 percent. Cobbles and boulders comprise about four percent of the total material within the deposit. Silt and clay comprise from four to nine percent of the deposit.

The gravel clasts sampled from the central Class CA1 deposit are typically well rounded to subangular and approximately equidimensional to thick-tabular in shape. Approximately 62 percent of the gravel clasts are of satisfactory physical quality; 36 percent are porous, weak, or internally fractured and are of fair physical quality; and two percent are soft or highly porous and are of poor physical quality. The collected gravel sample consists of about 40 percent dolomite, 38 percent limestone and dolomitic limestone, 12 percent volcanics and ten percent metagraywacke, quartzite, and chert. Approximately 54 percent of the gravel clasts are partially or completely coated by calcareous material. The dolomite and dolomitic limestone clasts may be susceptible to a deleterious degree to the alkali-carbonate reaction, and the volcanic clasts may be susceptible to a deleterious degree to the alkali-silica reaction.

The sand particles sampled from the central Class CA1 basin-fill deposit are typically subangular to angular. Approximately 58 percent of the sand clasts are of satisfactory physical quality; 35 percent are porous, weak, or internally fractured and are of fair physical quality; and about seven percent are soft, highly porous particles of calcareous coating material and are of poor quality. The sand is composed of 61 percent dolomite and limestone, 16 percent volcanics, 12 percent quartzite (concentrated in the fine sand fractions), and 11 percent coating material, chert, and other constituents. The volcanic sand clasts may be susceptible to a deleterious degree to the alkali-silica reaction. The carbonate clasts within the sand may be susceptible to a deleterious degree to the alkali-carbonate reaction.

The percentages of No. 4 to 1-inch coarse aggregates within the central Class CA1 deposit conform to design gradation requirements (Figure 7). The percentages of 1- to 2-inch coarse aggregates are outside design gradation requirements. Also, there should be enough oversize material that can be crushed to provide a sufficient quantity of additional aggregates. The percentages of fine aggregates within the deposit do not conform to design gradation requirements (Figure 7). There is a deficiency of coarse sand passing the No. 8 sieve and an excess of fine sand passing the No. 50 to No. 200 sieves. Processing will be necessary in order for the fine aggregates to conform to the gradation requirements. Variations in grain-size gradations will occur within the deposit depending on proximity to the source area. In general, this source is relatively finer grained near the valley axis and coarser grained adjacent to the mountain fronts.

Two samples of coarse aggregate from the central CA1 basin-fill deposit were subjected to laboratory abrasion tests and yielded results of 27.2 and 28.2 percent wear. Two M_gSO_4 soundness tests performed on the coarse aggregate yielded results of 2.7 and 4.5 percent loss. These test data are well within acceptable ranges for coarse aggregate for concrete construction



▨ REQUIRED GRAIN-SIZE DISTRIBUTION ENVELOPES FOR COARSE AND FINE AGGREGATES USED IN CONCRETE (AMERICAN SOCIETY FOR TESTING AND MATERIALS, 1978, C 33; THE RECOMMENDED GRADATIONS FOR AGGREGATES WITH 1.5 AND 0.75 INCH MAXIMUM SIZE ARE COMBINED INTO ONE ENVELOPE).

▨ GRAIN-SIZE DISTRIBUTION ENVELOPES OF BASIN-FILL COARSE AND FINE AGGREGATES POTENTIALLY SUITABLE FOR CONCRETE.

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GRAIN-SIZE DISTRIBUTION ENVELOPES
CONCRETE AGGREGATES, DL-A- (7-10)
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE 7

material use. The fine aggregate sample was subjected to both $MgSO_4$ and $NaSO_4$ soundness tests. It failed the $MgSO_4$ soundness test with a 18.9 percent loss, but passed the $NaSO_4$ test with a 2.9 percent loss.

Concrete (Mix 3) made using the aggregates from the central Class CA1 deposit had a 28-day compressive strength of 8615 psi (Table 3-2). Concrete trial Mixes 1 and 2 also produced 28-day compressive strengths in excess of 6500 psi (6505 psi and 6825 psi respectively). Fresh concrete properties and hardened concrete test results (chord modulus of elasticity, splitting tensile strength, drying shrinkage) are also included in Table 3-2. Test results for hardened concrete are within or exceed the requirements mentioned in Section 4.1.1.

The areal extent of the central Class CA1 deposit is approximately 2.9 mi^2 (7.5 km^2). It is estimated that the material sampled from this deposit and described above extends to a depth of at least 25 feet (7.6 m). Where sampled, this deposit has an estimated yield of 60 to 75 percent after gradation deficiencies and handling, poor quality constituents, and silt and clay losses.

3. The northernmost Class CA1 source is an alluvial fan deposit (Aaf) adjacent to the West Range and just north of latitude 38°00' N. This deposit consists mainly of poorly graded, sandy gravel. The gravel ranges from 50 to 61 percent of the deposit (excluding cobbles and boulders), and the sand ranges from 30 to 43 percent. Cobbles and boulders comprise about 10 percent of the deposit, and silt and clay comprise from six to 12 percent of the deposit.

AGGREGATE SOURCE[1]	FIELD STATION	CONCRETE MIX DESIGN CRITERIA[2] SACKS OF CEMENT/CYD / MAX. AGG. SIZE	FRESH CONCRETE PROPERTIES					ASTM STANDARD TEST[4]
			SLUMP[3] (IN.)	AIR CONTENT (%)	UNIT WEIGHT (PCF)	WATER/ CEMENT RATIO	CEMENT FACTOR (SCY)	
BASIN – FILL	DL-A-(7-10)	MIX 1 7.5/1.5 IN.	1	3.0	148.9	0.36	7.69	COMPRESSIVE STRENGTH, ASTM (PSI)
								CHORD MODULUS OF ELASTICITY, AS (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, AST (PSI)
								DRYING SHRINKAGE, ASTM C (PERCENT)
	DL-A-(7-10)	MIX 2 8.5/1.5 IN.	2	3.0	153.4	0.32	8.96	COMPRESSIVE STRENGTH, ASTM (PSI)
								CHORD MODULUS OF ELASTICITY, AS (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, AST (PSI)
								DRYING SHRINKAGE, ASTM C (PERCENT)
	DL-A-(7-10)	MIX 3 8.5/0.75 IN., SUPER-PLASTICIZER	0 BEF. 8 AFT.	4.0	146.9	0.32	8.65	COMPRESSIVE STRENGTH, ASTM (PSI)
								CHORD MODULUS OF ELASTICITY, A (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, AS (PSI)
								DRYING SHRINKAGE, ASTM C (PERCENT)

1. BASIN-FILL SOURCES SUPPLIED BOTH COARSE AND FINE AGGREGATES FOR CONCRETE MIX. LEDGE-ROCK SOURCES SUPPLIED COARSE AGGREGATES; LOCAL SAND SOURCES (GENERALLY COLLECTED WITHIN A FEW MILES OF CORRESPONDING LEDGE-ROCK SOURCES) SUPPLIED FINE AGGREGATES FOR CONCRETE MIX.
2. ASTM AND ACI SPECIFICATIONS AND PROCEDURES WERE FOLLOWED IN THE MIX DESIGN AND BATCHING OF THE CONCRETE TRIAL MIXES. THE CONCRETE MIXES CONSISTED OF COARSE AND FINE AGGREGATES, LOW ALKALI CEMENT, FLY ASH (20% BY WEIGHT REPLACEMENT OF CEMENT), SUPERPLASTICIZER, AIR-ENTRAINING ADMIXTURE, AND WATER REDUCER.
3. BEF. – SLUMP BEFORE ADDITION OF SUPERPLASTICIZER.
   AFT. – SLUMP AFTER ADDITION OF SUPERPLASTICIZER.
4. COMPRESSIVE AND TENSILE STRENGTH
   CYLINDERS. DRYING SHRINKAGE VAL
   MENS; TIMETABLE INCLUDES A SEVEN

HARDENED CONCRETE TEST RESULTS

STANDARD TEST[4]	TIMETABLE			
	1 DAY (ACCELERATED)	7 DAYS	28 DAYS	90 DAYS
VE STRENGTH, ASTM C 39 (PSI)	3015	5240	6505	7335
JS OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.30	3.83	4.46	4.95
ISILE STRENGTH, ASTM C 496 (PSI)	—	—	470	—

HRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.020	0.032	0.038	0.044

IVE STRENGTH, ASTM C 39 (PSI)	3320	5405	6825	7830
JS OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.45	4.08	4.45	5.33
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	400	—

SHRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.023	0.035	0.041	0.046

IVE STRENGTH, ASTM C 39 (PSI)	3330	6125	7400	8615
JS OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.11	3.90	438	484
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	615	—

SHRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.028	0.041	0.047	0.054

AND TENSILE STRENGTH VALUES ARE AVERAGES OBTAINED FROM TWO TESTED
RYING SHRINKAGE VALUES ARE AVERAGES OBTAINED FROM TWO TESTED SPECI-
BLE INCLUDES A SEVEN DAY MOIST CURE.

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CONCRETE TRIAL MIX TEST RESULTS
DL-A-(7-10)
DRY LAKE VALLEY, NEVADA

29 MAY 81

TABLE 3.2

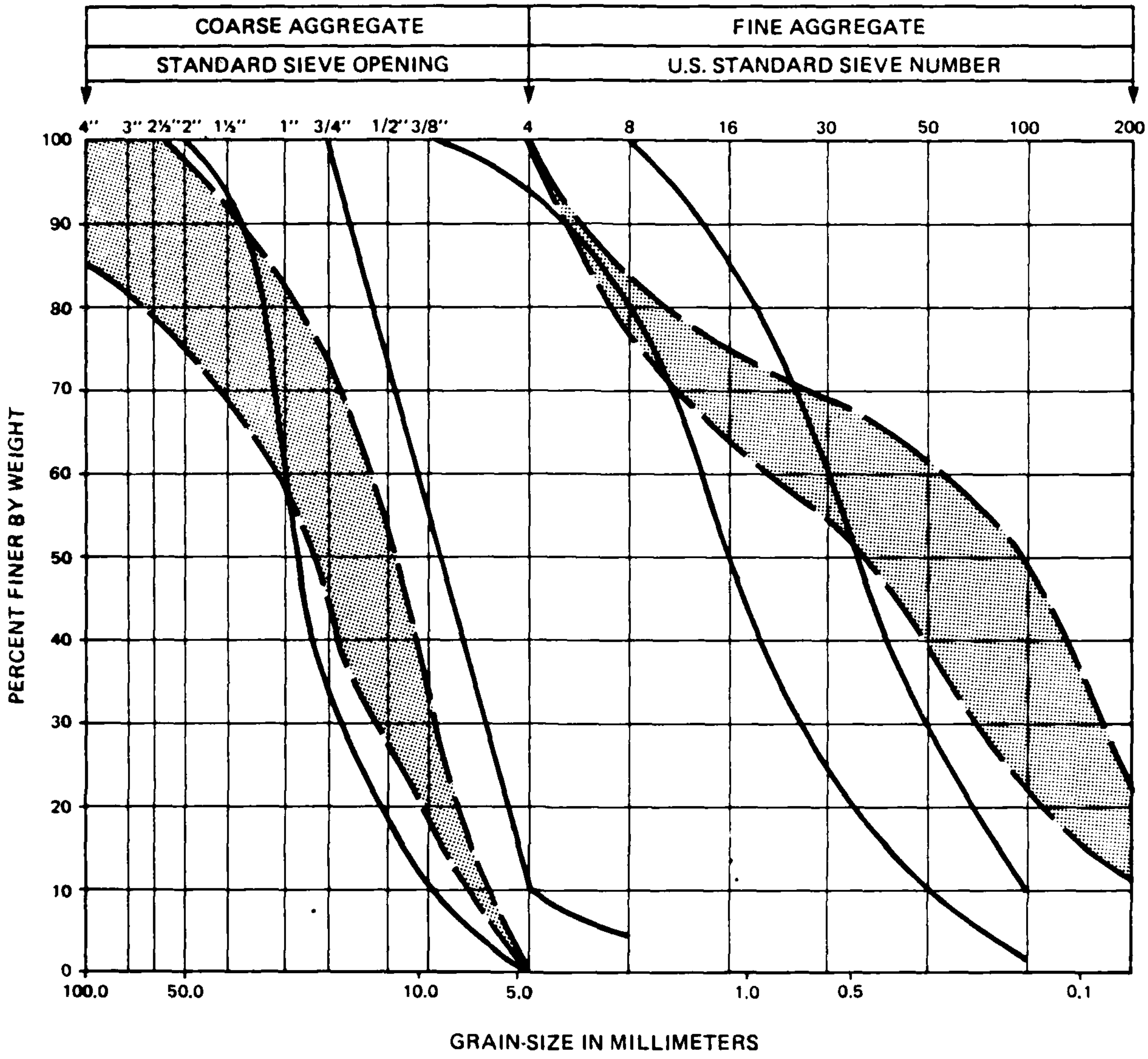
The gravel clasts sampled from the northernmost Class CA1 deposit are typically subangular and approximately thick-tabular to cubic or flat in shape. Approximately 69 percent of the gravel clasts are of satisfactory physical quality; 28 percent are porous, weak, or internally fractured and are of fair physical quality; and three percent are soft or highly porous and are of poor physical quality. The collected gravel sample is composed of about 95 percent dolomite and five percent quartzite and limestone. Approximately 78 percent of the gravel clasts are partially or completely coated by calcareous material. The gravel clasts are not susceptible to the alkali-carbonate or the alkali-silica reactions.

The sand particles sampled from the northernmost Class CA1 basin-fill deposit are typically subangular to angular. Approximately 62 percent of the particles are of satisfactory physical quality; 17 percent are porous, weak, or internally fractured and are of fair physical quality; and 21 percent are soft or highly porous and are of poor physical quality. The sand is composed of about 55 percent dolomite, 17 percent quartzite, 17 percent calcareous coating material, and 11 percent volcanics. The coarse sand fractions are mainly dolomites and the finer sand fractions are predominantly quartzite and volcanics. The volcanic constituents of the sand may be susceptible to a deleterious degree to the alkali-silica reaction.

The percentages of No. 4 to 1.0-inch coarse aggregates within the northernmost Class CA1 deposit conform to design gradation requirements (Figure 8). The percentages of 1.0- to 2-inch coarse aggregates generally are outside design gradation requirements. Also, oversize material is present and may be crushed to produce additional aggregates. The percentages of fine aggregates within the deposit do not conform to design gradation requirements. There is a slight deficiency of coarse sand passing the No. 8 sieve and a significant excess of fine sand passing the No. 30 to No. 100 sieves. Processing will be necessary in order for the fine aggregates to conform to the gradation requirements. Variations in grain-size gradations will occur within the deposit depending on proximity to the source area. In general, this source is relatively finer grained near the valley axis and coarser grained near the mountain fronts.

A sample of coarse aggregate from the northernmost Class CA1 deposit was subjected to laboratory abrasion and $MgSO_4$ soundness tests and yielded losses of 23.3 and 3.7 percent, respectively. A fine aggregate sample from this deposit was subjected to both $MgSO_4$ and $NaSO_4$ soundness tests and yielded values of 13.7 and 5.9 percent loss, respectively. All of these test results are within the acceptable ranges for coarse and fine aggregates for concrete construction material use.

Concrete (Mix 3) made using the aggregates from the northernmost Class CA1 deposit had a 28-day compressive strength of 6800 psi and a 90-day compressive strength of 8265 psi (Table 3-3). In addition to Mix 3, Mix 2 also produced a 28-day compressive



▨ REQUIRED GRAIN-SIZE DISTRIBUTION ENVELOPES FOR COARSE AND FINE AGGREGATES USED IN CONCRETE (AMERICAN SOCIETY FOR TESTING AND MATERIALS, 1978, C 33; THE RECOMMENDED GRADATIONS FOR AGGREGATES WITH 1.5 AND 0.75 INCH MAXIMUM SIZE ARE COMBINED INTO ONE ENVELOPE).

▨ GRAIN-SIZE DISTRIBUTION ENVELOPES OF BASIN–FILL COARSE AND FINE AGGREGATES POTENTIALLY SUITABLE FOR CONCRETE.

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GRAIN-SIZE DISTRIBUTION ENVELOPES
CONCRETE AGGREGATES, DL-A- (46-50)
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE 8

AGGREGATE SOURCE[1]	FIELD STATION	CONCRETE MIX DESIGN CRITERIA[2] SACKS OF CEMENT/CYD / MAX. AGG. SIZE	FRESH CONCRETE PROPERTIES					
			SLUMP[3] (IN.)	AIR CONTENT (%)	UNIT WEIGHT (PCF)	WATER/ CEMENT RATIO	CEMENT FACTOR (SCY)	ASTM STANDARD TEST
BASIN – FILL	DL-A- (46-50)	MIX 1 7.5/1.5 IN.	3.5	7.0	146.4	0.35	7.39	COMPRESSIVE STRENGTH, AST (PSI)
								CHORD MODULUS OF ELASTICITY, (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, A (PSI)
								DRYING SHRINKAGE, ASTM (PERCENT)
	DL-A- (46-50)	MIX 2 8.5/1.5 IN.	3.0	5.3	148.9	0.30	8.51	COMPRESSIVE STRENGTH, AST (PSI)
								CHORD MODULUS OF ELASTICITY, (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, A (PSI)
								DRYING SHRINKAGE, ASTM (PERCENT)
	DL-A- (46-50)	MIX 3 8.5/0.75 IN., SUPER-PLASTICIZER	1.25 BEF. 8 AFT.	8.0	145.8	0.31	8.42	COMPRESSIVE STRENGTH, AST (PSI)
								CHORD MODULUS OF ELASTICITY, (PSI x 10^6)
								SPLITTING TENSILE STRENGTH, A (PSI)
								DRYING SHRINKAGE, ASTM (PERCENT)

1. BASIN-FILL SOURCES SUPPLIED BOTH COARSE AND FINE AGGREGATES FOR CONCRETE MIX. LEDGE-ROCK SOURCES SUPPLIED COARSE AGGREGATES; LOCAL SAND SOURCES (GENERALLY COLLECTED WITHIN A FEW MILES OF CORRESPONDING LEDGE-ROCK SOURCES) SUPPLIED FINE AGGREGATES FOR CONCRETE MIX.
2. ASTM AND ACI SPECIFICATIONS AND PROCEDURES WERE FOLLOWED IN THE MIX DESIGN AND BATCHING OF THE CONCRETE TRIAL MIXES. THE CONCRETE MIXES CONSISTED OF COARSE AND FINE AGGREGATES, LOW ALKALI CEMENT, FLY ASH (20% BY WEIGHT REPLACEMENT OF CEMENT), SUPERPLASTICIZER, AIR-ENTRAINING ADMIXTURE, AND WATER REDUCER.
3. BEF. – SLUMP BEFORE ADDITION OF SUPERPLASTICIZER.
   AFT. – SLUMP AFTER ADDITION OF SUPERPLASTICIZER.
4. COMPRESSIVE AND TENSILE STRENG
   CYLINDERS. DRYING SHRINKAGE V
   MENS; TIMETABLE INCLUDES A SEVE

HARDENED CONCRETE TEST RESULTS

M STANDARD TEST [4]	TIMETABLE			
	1 DAY (ACCELERATED)	7 DAYS	28 DAYS	90 DAYS
SIVE STRENGTH, ASTM C 39 (PSI)	2570	4465	5720	6715
LUS OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.77	4.25	4.52	5.39
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	475	—

SHRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.015	0.020	0.033	0.033

SIVE STRENGTH, ASTM C 39 (PSI)	2930	5010	6530	7815
LUS OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.63	4.57	5.12	6.20
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	570	—

SHRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.018	0.023	0.037	0.037

SIVE STRENGTH, ASTM C 39 (PSI)	2760	5165	6800	8265
US OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.21	3.88	4.18	4.83
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	595	—

SHRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.026	0.045	0.055	0.058

AND TENSILE STRENGTH VALUES ARE AVERAGES OBTAINED FROM TWO TESTED
RYING SHRINKAGE VALUES ARE AVERAGES OBTAINED FROM TWO TESTED SPECI-
BLE INCLUDES A SEVEN DAY MOIST CURE.

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CONCRETE TRIAL MIX TEST RESULTS
DL-A-(46-50)
DRY LAKE VALLEY, NEVADA

29 MAY 81
TABLE 3 3

strength in excess of 6500 psi yielding a strength of 6530 psi. Mix 1, however, produced a 28-day compressive strength of 5720 psi. The air content of Mixes 1 and 3 (7.0 and 8.0 percent) was higher than the maximum air content as specified by the concrete mix design (6.0 percent) and may have caused a significant lowering of the compressive strengths. Fresh concrete properties and hardened concrete test results (chord modulus of elasticity, splitting tensile strength, drying shrinkage) are also included in Table 3-3. Test results for hardened concrete are within or exceed the requirements stated in Section 4.1.1.

The areal extent of the northernmost Class CA1 source is approximately 3 mi^2 (7.8 km^2). It is estimated that the material sampled from this deposit and described above extends to a depth of at least 25 feet (7.6 m). It is also estimated that where sampled this deposit has an ultimate yield of 50 to 65 percent after gradation deficiencies and handling, poor quality constitutents, and silt and clay losses.

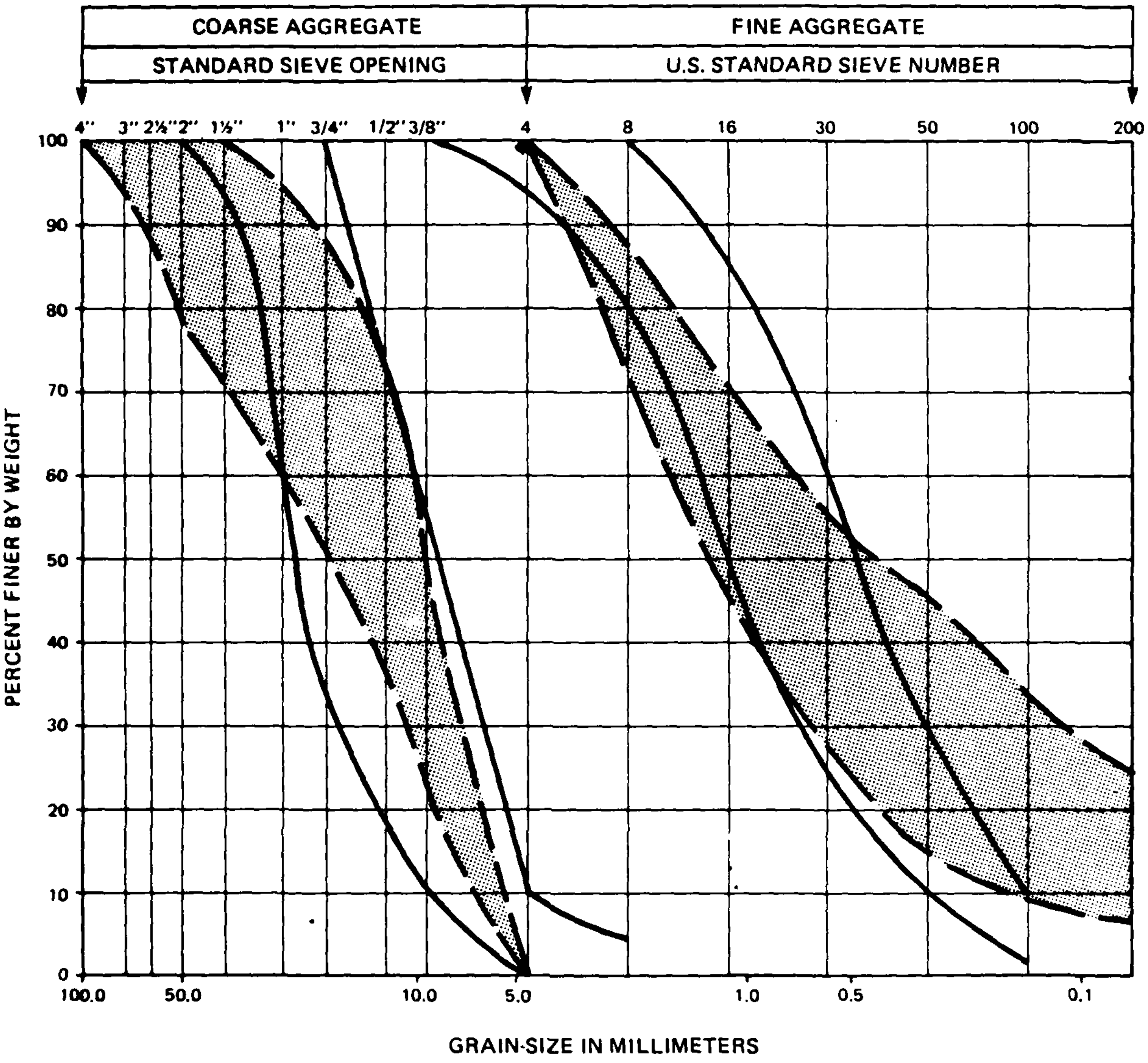
4.2.1.2 Class CB

Class CB basin-fill aggregate sources are alluvial deposits that have been sampled and laboratory tested and, on the basis of the test results, are considered to be potential concrete materials sources. Class CB aggregates have not been used in trial concrete mixes. Test results show that these deposits contain at least 30 percent gravel clasts of all sizes (No. 4 sieve size to 3 inches), have less than 50 percent abrasion wear, and, where applicable, have less than 18 percent loss when subjected to a MgSO4 soundness test.

All Class CB deposits are located adjacent to the Burnt Springs, Highland, Ely Springs, and Bristol ranges along the east side of the valley. There are 11 Class CB deposits within the study area, 10 are alluvial fan deposits (Aaf) and one is a stream-channel deposit (Aal). There are no significant differences between the alluvial fan deposits and the stream-channel deposit.

Class CB basin-fill deposits generally consist of poorly to well-graded, subangular to subrounded, sandy gravels. The gravel content of most Class CB deposits ranges from 50 to 60 percent and the silt content ranges from five to 10 percent. Most deposits are composed of 50 to 95 percent carbonate clasts, five to about 40 percent volcanic clasts, and less than 15 percent quartzite clasts. The southernmost Class CB deposit, adjacent to the Burnt Springs Range, differs from all other Class CB deposits by containing a greater percentage of volcanic clasts than carbonate clasts.

The percentages of No. 4 through 1-inch coarse aggregates within the Class CB deposit conform to design gradation requirements (Figure 9). The percentages of 1.0- to 2-inch coarse aggregates generally are outside design gradation requirements. Also, oversize material is available for crushing to provide additional smaller aggregates. Although the percentages of fine sand passing the No. 50 to No. 100 sieves are excessive, percentages of other fine aggregates are close to design gradation requirements. Variations in grain-size gradations will occur within the deposit depending on proximity to the source area.



▨ REQUIRED GRAIN-SIZE DISTRIBUTION ENVELOPES FOR COARSE AND FINE AGGREGATES USED IN CONCRETE (AMERICAN SOCIETY FOR TESTING AND MATERIALS, 1978, C 33; THE RECOMMENDED GRADATIONS FOR AGGREGATES WITH 1.5 AND 0.75 INCH MAXIMUM SIZE ARE COMBINED INTO ONE ENVELOPE).

▨ GRAIN-SIZE DISTRIBUTION ENVELOPES OF BASIN–FILL COARSE AND FINE AGGREGATES POTENTIALLY SUITABLE FOR CONCRETE.

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GRAIN-SIZE DISTRIBUTION ENVELOPES
CONCRETE AGGREGATE, CLASS CB
DRY LAKE VALLEY, NEVADA

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FIGURE 9

In general, the deposits are relatively finer grained near the valley axis and coarser grained near the mountain fronts.

Laboratory abrasion tests performed on samples from all Class CB units resulted in a fairly narrow range of values, 24.7 percent to 32.6 percent wear. Laboratory M_gSO_4 soundness tests performed on five of the Class CB samples resulted in values ranging from 2.4 to 13.4 percent loss.

The areal extent of Class CB deposits ranges from 0.3 to 12.0 mi^2 (0.8 to 31.1 km^2). It is estimated that the material sampled from these deposits extends to a depth of at least 25 feet (7.6 m) and will have a yield of 60 to 80 percent.

4.2.1.3 Class CC1

Class CC1 deposits within the study area are located in the southeastern part of the valley adjacent to the Burnt Springs Range. These six alluvial deposits have been correlated to the southernmost Class CA1 concrete aggregate source on the basis of geomorphological and compositional similarities.

Class CC1 deposits are therefore considered to be potential sources of concrete aggregates consisting of poorly graded, subangular to angular, sandy gravel of generally satisfactory physical quality. The lithology of the sandy gravel is estimated to be predominantly limestone with minor dolomite, dolomitic limestone, and trace amounts of other rock types. The areal extent of the Class CC1 deposits ranges from 0.1 to 0.6 mi^2 (0.3 to 1.6 km^2).

4.2.1.4 Class CC2

Class CC2 basin-fill aggregate sources are alluvial deposits that have been correlated to Class CB concrete aggregate sources on the basis of geomorphological and compositional similarities. Class CC2 deposits are therefore assumed to contain material similar in size and composition to Class CB deposits. These deposits are located along the east side of the valley adjacent to the Burnt Springs, Highland, Ely Springs, and Bristol ranges. The areal extent of the eight Class CC2 deposits ranges from 0.1 to 1.6 mi^2 (0.3 to 4.1 km^2).

4.2.2 Rock Sources

Rock concrete aggregate sources are grouped into four classes. Rock defined on the basis of laboratory test data are included in classes CA1, CA2, and CB. Class CC1 contains rocks correlated to tested rock units.

4.2.2.1 Class CA1

One Class CA1 crushed-rock coarse aggregate source was delineated within the study area. This rock source is located on the east side of the study area and comprises a large area of the Ely Springs Range. Class CA1 rocks belong to the undifferentiated carbonate rock geologic unit (Cau) and were sampled during the present study. The fine aggregate used in conjunction with the Class CA1 rock is from a basin-fill unit located approximately 1 mile (1.6 km) northwest of the Class CA1 rock unit.

The Class CA1 rock sample used in the concrete trial mix consisted of dark-gray, hard to weak, microcrystalline to aphanitic limestone and dolomitic limestone. When crushed, this rock produced fragments that were generally angular and approximately cubic to thick-tabular in shape.

Approximately 62 percent of the crushed-rock fragments are only fair in physical quality because of internal fracturing and porosity due to the oxidation of original crystals of pyrite within the dolomitic limestone. About 35 percent of the crushed rock fragments are of satisfactory physical quality and only three percent are soft or highly porous and of poor quality. Portions of this sample were slightly weathered and this may have produced the generally inferior quality crushed-rock fragments. A completely fresh sample may yield crushed-rock fragments of significantly better quality. The dolomitic limestone fragments from the Class CA1 crushed-rock source may be susceptible to a deleterious degree to the alkali-carbonate reaction.

The sand sample used in conjunction with the Class CA1 rock source is from an alluvial fan deposit (Aaf) which consists of poorly graded, subangular to angular, gravelly sand. Approximately 75 percent of the sand particles are of satisfactory physical quality; 23 percent are porous, weak, or internally fractured and are of fair quality; and only two percent are soft, highly porous particles of calcareous coating material and are of poor quality. The sand is composed of 53 percent dolomite and limestone, 23 percent volcanics, 14 percent quartz and quartzose clasts (concentrated in the finer fractions), and 10 percent chert, coating material, and heavy minerals. The limestones and dolomitic limestones within the sand may be susceptible to a deleterious degree to the alkali-carbonate reaction. The volcanic constituents in the sand may be susceptible to a deleterious degree to the alkali-silica reaction.

The crushed rock aggregates from the Class CA1 deposit were subjected to a laboratory abrasion test which yielded a result of 29.5 percent wear. A $MgSO_4$ soundness test performed on the crushed rock yielded a result of 2.0 percent loss. These results are well within the maximum allowable values for abrasion wear and soundness loss for coarse aggregate concrete construction materials. The fine aggregate used in conjunction with the crushed rock was subjected to both $MgSO_4$ and $NaSO_4$ soundness tests. The fine aggregate failed the $MgSO_4$ soundness test with a 20.2 percent loss but passed the $NaSO_4$ test with a 5.0 percent loss.

A 28-day compressive strength of 8795 psi was obtained from concrete trial Mix 3 using Class CA1 crushed rock (Table 3-4). This same mix had a 90-day compressive strength of 10,530 psi. Concrete Mixes 1 and 2, using Class CA1 crushed rock, produced 28-day compressive strengths of 6295 psi and 5990 psi, respectively. The air content of these two mixes (6.5 percent) was slightly higher than the maximum air content as specified by the concrete mix design (6.0 percent) and may have caused a lowering of the compressive strength of these mixes. Fresh

AGGREGATE SOURCE[1]	FIELD STATION	CONCRETE MIX DESIGN CRITERIA[2] SACKS OF CEMENT/CYD MAX. AGG. SIZE	FRESH CONCRETE PROPERTIES					
			SLUMP[3] (IN.)	AIR CONTENT (%)	UNIT WEIGHT (PCF)	WATER/ CEMENT RATIO	CEMENT FACTOR (SCY)	ASTM STANDARD T
LEDGE ROCK AND SAND	DL-R-1 & DL-FA-1	MIX 1 7.5/1.5 IN.	2.0	6.5	144.7	0.36	7.40	COMPRESSIVE STRENGTH, (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH (PSI)
								DRYING SHRINKAGE, AST (PERCENT)
	DL-R-1 & DL-FA-1	MIX 2 8.5/1.5 IN.	4.5	6.5	141.9	0.36	8.14	COMPRESSIVE STRENGTH, (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH (PSI)
								DRYING SHRINKAGE, AST (PERCENT)
	DL-R-1 & DL-FA-1	MIX 3 8.5/0.75 IN., SUPER-PLASTICIZER	0 BEF. 3.5 AFT.	4.0	146.1	0.30	8.53	COMPRESSIVE STRENGTH, (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH (PSI)
								DRYING SHRINKAGE, AST (PERCENT)

1. BASIN-FILL SOURCES SUPPLIED BOTH COARSE AND FINE AGGREGATES FOR CONCRETE MIX. LEDGE-ROCK SOURCES SUPPLIED COARSE AGGREGATES; LOCAL SAND SOURCES (GENERALLY COLLECTED WITHIN A FEW MILES OF CORRESPONDING LEDGE-ROCK SOURCES) SUPPLIED FINE AGGREGATES FOR CONCRETE MIX.
2. ASTM AND ACI SPECIFICATIONS AND PROCEDURES WERE FOLLOWED IN THE MIX DESIGN AND BATCHING OF THE CONCRETE TRIAL MIXES. THE CONCRETE MIXES CONSISTED OF COARSE AND FINE AGGREGATES, LOW ALKALI CEMENT, FLY ASH (20% BY WEIGHT REPLACEMENT OF CEMENT), SUPERPLASTICIZER, AIR-ENTRAINING ADMIXTURE, AND WATER REDUCER.
3. BEF. – SLUMP BEFORE ADDITION OF SUPERPLASTICIZER.
   AFT. – SLUMP AFTER ADDITION OF SUPERPLASTICIZER.
4. COMPRESSIVE AND TENSILE STRE
   CYLINDERS. DRYING SHRINKAGE
   MENS. TIMETABLE INCLUDES A SE

HARDENED CONCRETE TEST RESULTS

M STANDARD TEST [4]	TIMETABLE 1 DAY (ACCELERATED)	7 DAYS	28 DAYS	90 DAYS
IVE STRENGTH, ASTM C 39 (PSI)	2465	4895	6295	7870
US OF ELASTICITY, ASTM C 469 (PSI x 10^6)	2.88	3.83	4.23	4.78
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	490	—

SHRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.018	0.031	0.036	0.040

	1 DAY (ACCELERATED)	7 DAYS	28 DAYS	90 DAYS
IVE STRENGTH, ASTM C 39 (PSI)	2330	4480	5990	7470
US OF ELASTICITY, ASTM C 469 (PSI x 10^6)	2.59	3.71	3.80	4.69
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	480	—

SHRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.020	0.036	0.042	0.045

	1 DAY (ACCELERATED)	7 DAYS	28 DAYS	90 DAYS
IVE STRENGTH, ASTM C 39 (PSI)	3720	7070	8795	10,530
US OF ELASTICITY, ASTM C 469 (PSI x 10^6)	3.24	4.01	4.45	4.85
NSILE STRENGTH, ASTM C 496 (PSI)	—	—	555	—

SHRINKAGE, ASTM C 157 (PERCENT)	7 DAYS	14 DAYS	21 DAYS	28 DAYS	35 DAYS
	0.00	0.027	0.043	0.049	0.051

AND TENSILE STRENGTH VALUES ARE AVERAGES OBTAINED FROM TWO TESTED
RYING SHRINKAGE VALUES ARE AVERAGES OBTAINED FROM TWO TESTED SPECI-
LE INCLUDES A SEVEN DAY MOIST CURE.

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CONCRETE TRIAL MIX TEST RESULTS
DL-R-1 AND DL-FA-1
DRY LAKE VALLEY, NEVADA

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TABLE 3-4

concrete properties and hardened concrete test results (chord modulus of elasticity splitting tensile strength, drying shrinkage) are also included in Table 3-4. Test results for hardened concrete are within or exceed the required limits stated in Section 4.1.1.

4.2.2.2 Class CA2

Class CA2 concrete aggregate sources contain rock that when crushed and used in concrete trial Mix 3 produced a 28-day compressive strength less than 6500 psi.

One Class CA2 rock source has been delineated within the study area. This source is a large rock outlier located on the west side of the valley about 5 miles (8 km) north of latitude 38°00' N. This Class CA2 rock belongs to the undifferentiated carbonate rock geologic unit (Cau). The fine aggregate used in conjunction with the Class CA2 rock is from an extensive basin-fill unit located about 1 mile (1.6 km) east of the Class CA2 rock unit.

The Class CA2 rock sample used in the concrete trial mix consisted of dark-gray to black, hard to moderately hard, microcrystalline to aphanitic limestone. When crushed, this rock produced fragments that are angular and generally irregular in shape. Approximately 63 percent of the fragments are of satisfactory physical quality; 36 percent contained clay filled stylolite seams or fractures and are of fair physical quality; and one percent are soft, highly porous particles of calcareous coating material and are of poor physical quality. The crushed rock is not susceptible to a deleterious degree to either the alkali-silica or the alkali-carbonate reactions.

The Class CA2 rock source was also sampled and tested during the VSARS. This sample came from a thick interval of dolomite underlain and overlain by limestone beds. The fine-grained dolomite was hard, thinly stratified, and slightly weathered.

The sand sample used in conjunction with the Class CA2 rock unit is from a stream-terrace deposit (Aal) and consists of poorly to well-graded, subangular to angular, gravelly sand. The gravel within this deposit ranges from one to 20 percent of the total material, and the silt ranges from five to 25 percent. Approximately 47 percent of the sand particles are of satisfactory physical quality; 47 percent of the sand particles (mostly volcanics) are moderately weathered or internally fractured and are of fair physical quality; and only six percent of the particles are soft, highly porous particles of calcareous coating material and are of poor physical quality. The sand sample is composed of 63 percent volcanics, 22 percent quartz (concentrated in the fine fractions), eight percent carbonates, and seven percent coating material, chert, and feldspar. The volcanic and chert constituents in the sand may be susceptible to a deleterious degree to the alkali-silica reaction. The sand is not susceptible to the alkali-carbonate reaction.

Both the DARS and VSARS samples were subjected to abrasion tests and to $MgSO_4$ soundness tests. The limestone used in the concrete trial mix underwent 24.3 percent wear due to abrasion and a two percent loss as a result of the soundness test. The dolomite sampled during the VSARS study had test results of 22.3 percent wear for abrasion and 1.1 percent loss for soundness. These test results are well below the allowable maximum limits for abrasion wear and soundness loss for coarse aggregate concrete construction material. The dolomite collected during the VSARS study was also subjected to an alkali-silica reactivity test and proved to be nonsusceptible to this reaction.

The nearby source of fine aggregate used with the Class CA2 crushed rock was subjected to both a $MgSO_4$ soundness test and a $NaSO_4$ soundness test. The fine aggregate failed both tests with high values of 52.9 and 22.3 percent loss, respectively. These poor soundness characteristics may have been responsible for producing slightly lower compressive strength values.

A 28-day compressive strength of 6260 psi was obtained from concrete trial Mix 3 using Class CA2 crushed rock (Table 3-5). Mix 3 produced a 90-day compressive strength of 7715 psi. Concrete trial Mixes 1 and 2 using Class CA2 crushed rock produced 28-day compressive strengths of 4830 and 5045 psi, respectively. Fresh concrete properties and hardened concrete test results (chord modulus of elasticity, splitting tensile strength, drying shrinkage) are also given in Table 3-5. Test results for hardened concrete are within the acceptable limits mentioned in Section 4.1.1.

AGGREGATE SOURCE[1]	FIELD STATION	CONCRETE MIX DESIGN CRITERIA[2] SACKS OF CEMENT/CYD / MAX. AGG. SIZE	FRESH CONCRETE PROPERTIES					
			SLUMP[3] (IN.)	AIR CONTENT (%)	UNIT WEIGHT (PCF)	WATER/CEMENT RATIO	CEMENT FACTOR (SCY)	ASTM STANDARD TE
LEDGE ROCK AND SAND	DL-R-2 & DL-FA-2	MIX 1 7.5/1.5 IN.	2.0	6.0	141.9	0.33	7.40	COMPRESSIVE STRENGTH, (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH (PSI)
								DRYING SHRINKAGE, AST (PERCENT)
	DL-R-2 & DL-FA-2	MIX 2 8.5/1.5 IN.	2.0	3.0	144.2	0.32	8.44	COMPRESSIVE STRENGTH, (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH (PSI)
								DRYING SHRINKAGE, AST (PERCENT)
	DL-R-2 & DL-FA-2	MIX 3 8.5/0.75 IN., SUPER-PLASTICIZER	1 BEF. 6.25 AFT.	4.0	142.2	0.27	8.50	COMPRESSIVE STRENGTH, (PSI)
								CHORD MODULUS OF ELASTICIT (PSI x 10^6)
								SPLITTING TENSILE STRENGTH (PSI)
								DRYING SHRINKAGE, AST (PERCENT)

1. BASIN-FILL SOURCES SUPPLIED BOTH COARSE AND FINE AGGREGATES FOR CONCRETE MIX. LEDGE-ROCK SOURCES SUPPLIED COARSE AGGREGATES; LOCAL SAND SOURCES (GENERALLY COLLECTED WITHIN A FEW MILES OF CORRESPONDING LEDGE-ROCK SOURCES) SUPPLIED FINE AGGREGATES FOR CONCRETE MIX.
2. ASTM AND ACI SPECIFICATIONS AND PROCEDURES WERE FOLLOWED IN THE MIX DESIGN AND BATCHING OF THE CONCRETE TRIAL MIXES. THE CONCRETE MIXES CONSISTED OF COARSE AND FINE AGGREGATES, LOW ALKALI CEMENT, FLY ASH (20% BY WEIGHT REPLACEMENT OF CEMENT), SUPERPLASTICIZER, AIR-ENTRAINING ADMIXTURE, AND WATER REDUCER.
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   AFT. – SLUMP AFTER ADDITION OF SUPERPLASTICIZER.
4. COMPRESSIVE AND TENSILE STRE
   CYLINDERS. DRYING SHRINKAGE
   MENS; TIMETABLE INCLUDES A S

<table>
<tr><th colspan="21">HARDENED CONCRETE TEST RESULTS</th></tr>
<tr><th rowspan="2">TM STANDARD TEST [4]</th><th colspan="20">TIMETABLE</th></tr>
<tr><th colspan="5">1 DAY (ACCELERATED)</th><th colspan="5">7 DAYS</th><th colspan="5">28 DAYS</th><th colspan="5">90 DAYS</th></tr>
<tr><td>SSIVE STRENGTH, ASTM C 39 (PSI)</td><td colspan="5">2060</td><td colspan="5">3800</td><td colspan="5">4830</td><td colspan="5">6095</td></tr>
<tr><td>ULUS OF ELASTICITY, ASTM C 469 (PSI x 10^6)</td><td colspan="5">2.80</td><td colspan="5">3.61</td><td colspan="5">3.84</td><td colspan="5">4.37</td></tr>
<tr><td>TENSILE STRENGTH, ASTM C 496 (PSI)</td><td colspan="5">—</td><td colspan="5">—</td><td colspan="5">380</td><td colspan="5">—</td></tr>
<tr><td rowspan="2">G SHRINKAGE, ASTM C 157 (PERCENT)</td><td colspan="4">7 DAYS</td><td colspan="4">14 DAYS</td><td colspan="4">21 DAYS</td><td colspan="4">28 DAYS</td><td colspan="4">35 DAYS</td></tr>
<tr><td colspan="4">0.00</td><td colspan="4">0.031</td><td colspan="4">0.041</td><td colspan="4">0.049</td><td colspan="4">0.050</td></tr>
<tr><td>SSIVE STRENGTH, ASTM C 39 (PSI)</td><td colspan="5">2430</td><td colspan="5">4660</td><td colspan="5">5045</td><td colspan="5">6645</td></tr>
<tr><td>ULUS OF ELASTICITY, ASTM C 469 (PSI x 10^6)</td><td colspan="5">2.93</td><td colspan="5">3.79</td><td colspan="5">4.20</td><td colspan="5">4.72</td></tr>
<tr><td>TENSILE STRENGTH, ASTM C 496 (PSI)</td><td colspan="5">—</td><td colspan="5">—</td><td colspan="5">465</td><td colspan="5">—</td></tr>
<tr><td rowspan="2">G SHRINKAGE, ASTM C 157 (PERCENT)</td><td colspan="4">7 DAYS</td><td colspan="4">14 DAYS</td><td colspan="4">21 DAYS</td><td colspan="4">28 DAYS</td><td colspan="4">35 DAYS</td></tr>
<tr><td colspan="4">0.00</td><td colspan="4">0.031</td><td colspan="4">0.045</td><td colspan="4">0.052</td><td colspan="4">0.054</td></tr>
<tr><td>SSIVE STRENGTH, ASTM C 39 (PSI)</td><td colspan="5">2755</td><td colspan="5">495[illegible]</td><td colspan="5">6260</td><td colspan="5">7715</td></tr>
<tr><td>LUS OF ELASTICITY, ASTM C 469 (PSI x 10^6)</td><td colspan="5">2.88</td><td colspan="5">3.49</td><td colspan="5">3.97</td><td colspan="5">4.59</td></tr>
<tr><td>TENSILE STRENGTH, ASTM C 496 (PSI)</td><td colspan="5">—</td><td colspan="5">—</td><td colspan="5">475</td><td colspan="5">—</td></tr>
<tr><td rowspan="2">G SHRINKAGE, ASTM C 157 (PERCENT)</td><td colspan="4">7 DAYS</td><td colspan="4">14 DAYS</td><td colspan="4">21 DAYS</td><td colspan="4">28 DAYS</td><td colspan="4">35 DAYS</td></tr>
<tr><td colspan="4">0.00</td><td colspan="4">0.032</td><td colspan="4">0.046</td><td colspan="4">0.053</td><td colspan="4">0.055</td></tr>
</table>

E AND TENSILE STRENGTH VALUES ARE AVERAGES OBTAINED FROM TWO TESTED
DRYING SHRINKAGE VALUES ARE AVERAGES OBTAINED FROM TWO TESTED SPECI-
ABLE INCLUDES A SEVEN DAY MOIST CURE.

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CONCRETE TRIAL MIX TEST RESULTS
DL-R-2 AND DL-FA 2
DRY LAKE VALLEY, NEVADA

29 MAY 81

TABLE 3-5

4.2.2.3 Class CB

Class CB crushed-rock sources are rock units that have been sampled and laboratory tested and, on the basis of the test results, are considered to be potential concrete aggregate sources. Class CB rocks have not been used in concrete trial mixes.

The Class CB rock source within the study area is located in the Bristol Range just south of latitude 37°45' N and is an undifferentiated carbonate rock (Cau). The sampled interval consists of a very extensive outcrop of dark-gray, hard, medium-grained, thinly bedded limestone.

A laboratory abrasion test performed on the Class CB crushed rock yielded a result of 26.5 percent wear. When subjected to a magnesium sulfate soundness test, the crushed rock exhibited only 2.9 percent loss. These results are well below the maximum allowable abrasion wear of 50 percent and soundness loss of 18 percent for coarse aggregate used as concrete construction material.

4.2.2.4 Class CC1

Class CC1 potential concrete aggregate sources are untested rock outcrops of the undifferentiated carbonate rock geologic unit (Cau). Published geologic maps were used to delineate these extensive and widespread outcrops. These sources are part of the same geologic unit as the Class CA1 and CA2 sources and have essentially the same lithologies; limestone, dolomitic limestone, and dolomite.

5.0 CONCLUSIONS

Results of the Detailed Aggregate Resources Study indicate that there are sufficient quantities of aggregates available for the construction of the MX missile system in the Dry Lake Valley study area.

Good to high quality basin-fill and crushed-rock coarse aggregates are present along the east side of the valley. Sufficient quantities of fair quality, fine aggregates are present in basin-fill deposits in the valley. After shelter layouts are finalized, potential borrow areas can be delineated based on the results of this study.

Although most rock will supply acceptable coarse aggregates, limited sources are delineated in this study. Sufficient quantities of basin-fill aggregates within the valley will probably make processing of crushed-rock aggregates unnecessary.

As discussed in the report, field studies placed an arbitrary cut-off limit of a minimum of 30 percent gravel for the source to be considered for road-base or concrete aggregates. Nevertheless, basin-fill deposits with less than 30 percent gravel are also probably potentially suitable for use as aggregates. However, yield from such sources will be low and extensive processing and/or blending will be required to satisfy the gradation requirements.

5.1 ROAD-BASE AGGREGATES

5.1.1 Class RBIa Sources

Thirteen basin-fill deposits consisting of good to high quality coarse aggregates acceptable for road base have been located within the study area. The 12 most extensive deposits are alluvial fan units (Aaf) confined to the east side of the valley. Their total areal extent is approximately 35 mi^2 (91 km^2).

Gradation results indicate that, where sampled, the deposits approximate ASTM standards and DARS requirements. Sand and fine gravel sizes are within design gradation requirements. Gravels greater than the 1- to 1.5-inch sieve size are excessive. Crushing and blending the abundant coarse gravels and cobbles should bring individual deposits within design gradation requirements. In addition, grain-size variations will occur depending on sample location within the deposit. Generally, finer-grained material can be obtained nearer the valley axis and coarser-grained material can be obtained near mountain front source areas.

Abrasion and soundness results on tested samples are also within ASTM standards and DARS requirements.

Three good to high quality coarse aggregate crushed-rock sources which are acceptable for use as road-base aggregates have been delineated within the study area. These sources are fairly extensive outcrops of undifferentiated carbonate rocks (Cau). Samples from these rock sources yielded test results for gradation, abrasion, and soundness well within acceptable ranges as specified by ASTM standards and DARS requirements.

5.1.2 Class RBIb Sources

Fourteen basin-fill deposits within the study area are defined as potential sources of good to high quality coarse aggregates for use as road-base construction material. Geomorphological and compositional similarities were used to correlate these units to tested RBIa deposits. The units are nearly all alluvial fan units (Aaf) confined to the east side of the valley. Their total areal extent is approximately 13 mi^2 (34 km^2).

5.1.3 Class RBII Sources

Several potential road-base aggregate sources defined by limited field and laboratory data are present throughout the study area. All deposits are alluvial fans, consist predominantly of sandy gravel or gravelly sand and are compositionally similar to Class RBIa and RBIb deposits. These deposits have a total areal extent of approximately 19 mi^2 (49 km^2).

5.2 CONCRETE AGGREGATES

5.2.1 Class CA1 Sources

Three basin-fill deposits consisting of good to high quality aggregates that produced concrete with 28-day compressive strengths equal to or greater than 6500 psi have been delineated within the study area. Chord modulus of elasticity, splitting tensile strength, and drying shrinkage results generally conform to the standard concrete requirements.

Gradation results indicate that, where sampled, the deposits approximate ASTM standards and DARS requirements. Typically, percentages of fine and medium gravel (to 1-inch) conform to gradation specifications, but there is an excess of coarse gravel (to 2-inches). The fine aggregate samples generally contain a deficiency of coarse sand passing the No. 8 sieve, and an excess of fine sand passing the No. 50 to No. 200 sieves. Processing of basin-fill deposits can be used to bring gradations within design requirements. Crushing of over-sized materials will produce more gravel and sand of all sizes. In addition, variations in grain-size gradation will occur within the deposit depending on proximity to the source area. Aggregates are relatively finer grained near the valley axis and coarser grained near the mountain fronts.

Abrasion and soundness tests performed on coarse aggregates from Class CA1 deposits are also within specified ASTM and DARS requirements. The fine aggregates within these deposits are generally of lower quality (high $MgSO_4$ soundness losses) but results are inconclusive regarding their use as concrete construction material. Class CA1 basin-fill deposits are all alluvial fan units (Aaf) located on the east side of the valley. Their total areal extent is approximately 7 mi^2 (18 km^2).

One Class CA1 rock source (Cau) was delineated on the east side of the study area. The crushed-rock coarse aggregates from this source have acceptable abrasion and soundness test results, but the local sand (fine aggregates) used in the mix had a high $MgSO_4$ soundness loss.

5.2.2 Class CA2 Sources

A crushed rock source (Cau) delineated on the west side of the study area produced a concrete with a 28-day compressive strength of less than 6500 psi. Abrasion and soundness tests performed on coarse aggregates from this rock yielded test results well within acceptable ranges as specified by ASTM standards and DARS parameters. However, the local sand (fine aggregates) used in the mix had a high $MgSO_4$ soundness loss.

5.2.3 Class CB Sources

Eleven basin-fill deposits consisting of good to high quality coarse aggregates potentially acceptable for use as concrete construction material were delineated within the study area. These deposits are nearly all alluvial fan units (Aaf) and are confined to the east side of the valley. Their total areal extent is approximately 28 mi^2 (73 km^2). No concrete trial mixes were made, but gradation, abrasion, and soundness test results on samples from these deposits were well within acceptable ranges as specified by ASTM standards and DARS requirements.

5.2.4 Class CC1 Sources

Six basin-fill alluvial fan units in the study area are classified as potential sources of concrete aggregates. The units were correlated to Class CA1 sources based on geomorphological and compositional similarities. These deposits have a total areal extent of approximately 2 mi^2 (5 km^2).

5.2.5 Class CC2 Sources

Several alluvial units located along the east side of the valley are classified as potential sources of concrete aggregates. Units were correlated to Class CB sources on the basis of geomorphological and compositional similarities. They have a total areal extent of approximately 10 mi^2 (26 km^2).

6.0 RECOMMENDATIONS FOR FUTURE STUDIES

The conclusions of this Detailed Aggregate Resources Study of Dry Lake Valley, as enumerated in Section 5.0, are based on limited field and laboratory test results. However, the results presented in this report provide sufficient data for selecting potential borrow areas. After selection of the borrow areas, more extensive studies are required to further determine the characteristics of the aggregates.

6.1 SOURCES OF ROAD-BASE AGGREGATES

It is recommended that additional field exploration (backhoe or drilling) and detailed laboratory testing be performed. The laboratory tests should consist of sieve analysis, resistance to abrasion, CBR, and other appropriate tests as deemed necessary by the designers.

6.2 SOURCES OF CONCRETE AGGREGATES

It is recommended that additional field investigations (backhoe or drilling) and detailed laboratory testing be performed. The aggregate samples should be subjected to the following tests:

- Sieve Analysis;
- Resistance to Abrasion;
- Soundness;
- Specific Gravity and Absorption; and
- Petrographic Examination of Aggregates for Concrete.

In addition, the following detailed tests using concrete made from these aggregates should be performed:

- Compressive Strength;
- Splitting Tensile Strength;
- Flexural Strength;
- Shrinkage;

- Thermal Expansion;
- Modulus of Elasticity;
- Potential Alkali-Silica Reactivity;
- Potential Alkali-Carbonate Rock Reactivity; and
- Resistance of concrete to rapid freezing and thawing.

In addition, it is recommended that concrete trial mixes with different size aggregates and admixtures be made in order to assess the variation in compressive strength, durability, shrinkage, and thermal properties of concrete.

Verification studies (FN-TR-27-DL) performed in Dry Lake Valley indicate that potential for sulfate attack of soils on concrete ranges from "negligible" to "mild." It is recommended that additional studies be made to evaluate the potential for sulfate attack of soils on concrete which will dictate the type of cement to be used in concrete.

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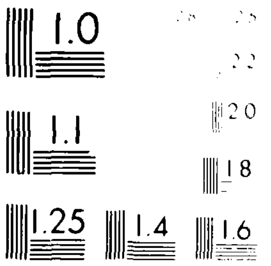

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PERSONAL COMMUNICATION

Polivka, Milos, 1981, Consulting Civil Engineer, Berkeley, California.

APPENDIX A

SUMMARY OF FIELD AND LABORATORY TEST DATA

FIELD AND LABORATORY TEST DATA

Field observations and laboratory test data on samples collected at selected stations are presented in Table A-1. Field stations were established at various locations throughout the study area where detailed descriptions of potential basin-fill, fine aggregate, and crushed-rock sources were recorded. Detailed explanations for the column headings of Table A-1 are as follows:

COLUMN HEADING	EXPLANATION
MAP NUMBER	Map numbers are sequentially arranged identifiers of field stations occupied during the course of the aggregate study.
FIELD STATION	These designations are internal DARS identifiers of all field stations. Each one consists of a two-letter valley abbreviation followed by the letter A (aggregate trench), FA (fine aggregate trench), or R (ledge rock).
LOCATION	The location column lists the geographic portion of the valley in which the field station is located (e.g., NE-northeast).
GEOLOGIC UNIT	The geologic unit listed is a term used to differentiate basin-fill deposits based on geomorphology and rock units based on existing geologic maps. A geologic unit cross reference, outlining all units used, is included as Table F-3.
MATERIAL DESCRIPTION	Material descriptions are based on either field or laboratory USCS classifications using appropriate ASTM standards for basin-fill deposits and existing references and Travis (1955) for rock units. Coarse and fine aggregate gradations used in concrete trial mix designs are included at the end of each concrete aggregate trench group.
USCS SYMBOL	Appropriate field or laboratory ASTM standards are used to classify sampled

material. The Unified Soil Classification System is used in this study. Table F-1 contains detailed information on the USCS.

FIELD OBSERVATIONS

Boulders and/or Cobbles	The estimated occurrence of boulders and cobbles is based on an appraisal of the entire deposit. Cobbles have an intermediate diameter of 3 to 12 inches (8 to 30 cm); boulders have an intermediate diameter of 12 inches (30 cm) or more. Because of sample-size limitations, boulders were not generally sampled. Cobbles were representatively sampled for concrete aggregate evaluations but only generally sampled for road-base aggregate evaluations. Field observations of boulders and cobbles are important considerations for in-situ gradations only. Number percentages are equated to the following equivalent dry weight terms: Rare - 1 - 4 percent Few - 5 - 20 percent Some - > 20 percent
Gravel	Coarse aggregate particles that pass a 3-inch (76-mm) sieve but are predominantly retained on a No. 4 (4.75 mm) sieve.
Sand	Fine aggregate particles that almost entirely pass a No. 4 sieve but are predominantly retained on a No. 200 (0.075 mm) sieve.
Fines	Soil particles that pass a No. 200 sieve (silt and clay).
Overburden Thickness (Feet)	Surficial soil overlying a usable aggregate deposit. Material generally consists of silt and sand with low concentrations of gravel. Numbers presented indicate thickness of deposit in feet.
Total Trench Depth (Feet)	Depth, in feet, of trench excavation used to collect aggregate samples. Depth followed by the letter R indicates that depth below which soil strength exceeded excavation capability. The common conditions for refusal (R) are calcium carbonate accumulation (caliche) and/or presence of oversized material.

Deleterious Materials (Material/Depth/Stage)

Deleterious materials are substances that are potentially detrimental to concrete in service. Substances that may be present include: organic impurities, low density materials (ash, vesicles, pumice, cinders), amorphous silica (opal, chert, chalcedony), volcanic glass, caliche and clay coatings, mica, gypsum, pyrite, chlorite, friable materials, and aggregates that may react chemically or be affected chemically by other external influences. The most common deleterious material is calcium carbonate accumulation (caliche). When it is abundant, the interval(s) at which it occurs and the stage of development (Table F-2) are listed. Caliche can occur disseminated throughout a deposit, as lenses, and as discrete layers. The depth space is left blank when caliche is present throughout the deposit.

Plasticity (Index)

Plasticity index (PI) is the range of water content, expressed as a percentage of the weight of the oven-dried soil (less than No. 40 sieve material), through which a soil behaves plastically . It is defined as the liquid limit minus the plastic limit. Field terms used to approximate plasticity index range include the following.

Plasticity	PI	Wet Consistency
Slight	(4-15)	Slightly sticky; after pressure, soil adheres to both thumb and finger but comes off cleanly. Does not appreciably stretch.
Medium	(15-30)	Sticky; after pressure, soil adheres to both thumb and finger and tends to stretch somewhat before pulling apart from either digit.
High	(>30)	Very sticky; after pressure, soil adheres strongly to both digits and is markedly stretched when digits are separated.

Hardness

Hardness determination is a field test used to identify materials that are soft or poorly bonded by estimating their resistance to crushing by impact with a rock hammer. Classification terms used include:

Soft	Hammer point indents deeply with firm blow.
Moderately Hard	Hammer point indents only shallowly with firm blow.
Hard	Hammer breaks hand-held sample with one firm blow.
Very Hard	Hammer breaks intact sample with many blows.
Weathering	Weathering is defined as any changes in color, texture, strength, chemical composition, or other properties of rock due to the effects of various atmospheric conditions. Field terms used to classify degree of weathering include: fresh, slight(ly), moderate(ly), or very weathered.

LABORATORY TEST DATA

Sieve Analysis (ASTM C 136)	A sieve analysis is the determination of the proportions of particles existing within certain size ranges in granular material by separation on sieves of different size openings, expressed as a weight percent of the total sample. Numbers presented represent the percent of the sample passing through the stated sieve size. Sieve sizes include: 3-inch (75-mm), 2 1/2-inch (63-mm), 2-inch (50-mm), 1 1/2-inch (38.1-mm), 1-inch (25-mm), 3/4-inch (19-mm), 1/2-inch (12.5-mm), 3/8-inch (9.5-mm), No. 4 (4.75 mm), No. 8 (2.36 mm) No. 16 (1.18 mm) No. 30 (0.6 mm), No. 50 (0.3 mm), No. 100 (0.15 mm), No. 200 (0.075 mm).
Specific Gravity and Absorption (ASTM C 127 and 128)	In general, specific gravity is defined as the ratio of the weight in air of a unit volume of material to the weight in air of an equal volume of water. Absorption is the process by which a liquid is drawn into and tends to fill permeable pores in a porous solid body, also, the increase in weight of a porous

	solid body resulting from the penetration of a liquid into its permeable pores. Specific definitions of bulk, bulk saturate-surface-dry (SSD), and apparent specific gravity, as well as absorption are contained in ASTM-E 12-70 and C 125, respectively.
Fineness Modulus	Fineness modulus is an empirical factor obtained by adding the total percentages of a sample of aggregate, retained on each of a specified series of sieves, and dividing the sum by 100.
Unit Weight	Unit weight is the weight of a unit volume of dry, rodded aggregate, commonly expressed as pounds per cubic foot (pcf).
Abrasion Test (ASTM C 131)	The abrasion test is a method for testing resistance to wearing away by rubbing and friction, by placing a specified quantity of aggregates in a steel drum (the Los Angeles testing machine), rotating the drum 500 times, and determining the percent of material worn away.
Soundness Test (ASTM C 88)	Soundness tests are used to determine resistance to large or permanent volume changes of aggregates by placing samples in saturated solutions of magnesium or sodium sulfate. The test furnishes information useful in studying resistance to weathering action, particularly when adequate service records of the material tested are not available. For concrete aggregate tests, magnesium sulfate soundness tests are run first. If the material fails this test, sodium sulfate soundness tests are performed.
Petrographic Examination (ASTM C 295)	A petrographic examination is a procedure used to identify the physical and chemical properties of aggregates that have a bearing on the quality of the material in consideration of its intended use. Typical properties analyzed include: description and classification of constituents, relative amounts of constituents, particle coatings, rock type, particle condition

and particle shape, texture and structure, color, mineral composition and heterogeneities, and presence of constituents known to cause deleterious chemical reactions in concrete.

Alkali Reactivity

Alkali-Silica ASTM C 227	A potential alkali-silica reactivity test evaluates the susceptibility of cement-aggregate combinations to expansive reactions involving the alkalies sodium and potassium by measurement of the increase (or decrease) in length of mortar bars containing the combination during storage under prescribed conditions of test.
Alkali-Carbonate ASTM Proposed Standard	A potential alkali-carbonate reactivity test evaluates the susceptibility of cement-aggregate combinations to expansive reactions involving the carbonates of dolomite (in certain calcitic dolomites and dolomitic limestones) by measurement of the increase (or decrease) in length of concrete specimens (prisms) containing the combination during storage under prescribed conditions of test. This test is a proposed ASTM standard and has not been formally approved by the American Society of Testing and Materials.

AGGREGATE USE CLASSIFICATION

Road Base Aggregate	RBIa	Basin-fill or rock sources containing materials suitable for use as road-base aggregates; based on acceptable laboratory aggregate test results.
	RBIb	Basin-fill sources containing materials suitable for use as road-base aggregates; based on correlation with Class RBIa areas.
	RB II	Potential basin-fill sources of materials suitable for use as road-base aggregates; based on photogeologic interpretations, field observations, and limited or inconclusive sieve analysis and/or abrasion data.

Concrete Aggregate	CA1	Basin-fill or rock sources containing aggregates that produced trial mix concrete with 28-day compressive strengths equal to or greater than 6500 psi.
	CA2	Basin-fill or rock sources containing aggregates that produced trial mix concrete with 28-day compressive strengths less than 6500 psi.
	CB	Basin-fill or rock sources containing aggregates potentially suitable for use in concrete; based on acceptable laboratory aggregate test results.
	CC1	Basin-fill or rock sources containing aggregates potentially suitable for use in concrete; based on correlation with Class CA1 or CA2 source areas.
	CC2	Basin-fill sources containing aggregates potentially suitable for use in concrete; based on correlation with Class CB source areas.
	FA	Basin-fill sources containing fine aggregates used with crushed-rock samples for certain concrete trial mixes.

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	MATERIAL DESCRIPTION	USCS SYMBOL	BOULDERS AND/OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)		
							GRAVEL	SAND	FINES
201	DL-A-1	Dry Lake Valley, S	Aaf	Gravelly Sand	SW-SM	-/Rare			
202	DL-A-2	Dry Lake Valley, S	Aaf	Gravelly Sand	SP-SM	-/Rare	38	54	8
203	DL-A-3	Dry Lake Valley, S	Aaf	Gravelly Sand	SW-SM	-/Few			
	DL-A-(1,3)			Gravelly Sand	SP-SM				
204	DL-A-4	Dry Lake Valley, S	Aaf	Gravelly Sand	SW-SM	Rare/ Few			
205	DL-A-5	Dry Lake Valley, S	Aaf	Sandy Gravel	GW	-/Rare			
206	DL-A-6	Dry Lake Valley, S	Aaf	Gravelly Sand	SW-SM	-/Rare			
	DL-A-(4, 5, 6)			Gravelly Sand	SP-SM				
207	DL-A-7	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	-/Few			
208	DL-A-8	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	Rare/ Few			
209	DL-A-9	Dry Lake Valley, E	Aaf	Sandy Gravel	GP	-/Rare			
210	DL-A-10	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	-/Few			
211	DL-A-11	Dry Lake Valley, E	Aaf						

FIELD OBSERVATIONS													
STRIBUTION OF ATERIAL FINER THAN COBBLES (PERCENT)			OVERBURDEN THICKNESS (FEET)	TOTAL TRENCH DEPTH (FEET; R= REFUSAL DEPTH)	DELETERIOUS MATERIALS (MATERIAL/DEPTHS/ STAGE)	PLASTICITY	HARDNESS	WEATHERING	SIEV				
GRAVEL	SAND	FINES							3 IN.	2½ IN.	2 IN.	1½ IN.	I
			1.0	13.0	Caliche/1-2.5/II	None					100	98.8	96
38	54	8	1.0	13.0	Caliche/1-2.5/II	None							
			1.0	13.0	Caliche/-/I,II	None				100	99.4	97.9	94
											100	99.3	97
			1.0	13.0	Caliche/1-3/II	None					100	98.9	97
			1.0	13.0	Caliche/1-4/II	None						100	97
			1.0	12.5	Caliche/1-3/II	None				100	97.4	94.8	89
											100	97.4	93
			1.0	13.0	Caliche/1-3.5/II	Slight			90.6	90.6	89.2	82.8	75
			1.0	13.0	Caliche/1-3/II	Slight			96.8	96.8	96.8	93.1	87
			1.0	13.0	Caliche/1-2.5/II	Slight			97.5	96.0	94.8	92.5	87
			1.0	12.5	Caliche/1-2/II	Slight			99.9	99.9	99.9	94.2	86
			1.0	3.0(R)	Caliche/1-3/III								

LABORATOR

	SIEVE ANALYSIS, ASTM C 136 (PERCENT PASSING)														SPECIFIC GRAVITY ASTM C 12			
															COARSE AGGREGATE			
															SPECIFIC GRAVITY			ABSORP (PERCENT)
.	2½ IN.	2 IN.	1½ IN.	1 IN.	¾ IN.	½ IN.	⅜ IN.	NO. 4	NO. 8	NO. 16	NO. 30	NO. 50	NO. 100	NO. 200	BULK	BULK SSD	APPARENT	
		100	98.8	96.4	94.2	88.7	83.6	67.8	54.4	40.0	28.1	18.0	11.6	7.9				
	100	99.4	97.9	94.4	92.4	87.3	82.0	64.3	46.7	30.1	19.5	12.7	9.1	6.9				
		100	99.3	97.2	94.6	90.5	86.5	73.3	57.2	39.9	27.7	19.5	14.5	11.6				
		100	98.9	97.3	93.3	84.3	74.6	56.2	40.9	29.3	20.3	12.5	8.7	6.2				
			100	97.5	94.3	85.2	74.4	49.9	35.8	23.5	15.0	9.1	5.7	3.8				
	100	97.4	94.8	89.3	85.7	79.3	73.8	58.4	44.4	31.9	22.6	15.4	10.6	7.2				
		100	97.4	93.8	90.0	81.6	72.8	54.2	45.3	35.0	25.2	16.4	10.7	7.0				
6	90.6	89.2	82.8	75.0	67.4	56.7	49.1	36.3	29.7	23.4	18.3	12.6	8.0	5.0				
8	96.8	96.8	93.1	87.2	82.3	73.5	64.2	45.4	34.2	25.4	18.8	14.1	8.4	5.4				
5	96.0	94.8	92.5	87.7	80.9	73.0	64.5	45.0	32.9	21.6	14.0	9.0	6.1	3.8				
9	99.9	99.9	94.2	86.5	77.2	62.7	53.6	38.0	29.0	22.6	17.3	11.9	8.3	5.7				

LABORATORY TEST DATA

SPECIFIC GRAVITY AND ABSORPTION, ASTM C 127 AND C 128							FINENESS MODULUS (PERCENT)	UNIT WEIGHT (PCF)	ABRASION TEST ASTM C 131 (PERCENT WEAR)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PETI EXA AS
SE AGGREGATE			FINE AGGREGATE							COARSE AGGREGATE		FINE AGGREGATE		
C GRAVITY		ABSORP. (PERCENT)	SPECIFIC GRAVITY			ABSORP. (PERCENT)								
ULK SSD	APPARENT		BULK	BULK SSD	APPARENT					$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$	
									32.6					
									30.5	13.4		27.4		

SS TEST, ASTM C 88 (RCENT LOSS)			PETROGRAPHIC EXAMINATION ASTM C 295	ALKALI REACTIVITY		AGGREGATE USE CLASSIFICATION
E	FINE AGGREGATE			SILICA METHOD, ASTM C 227 (LENGTH CHANGE, PERCENT)	CARBONATE METHOD, PROP. ASTM (LENGTH CHANGE, PERCENT)	
O4	$MgSO_4$	$NaSO_4$				
						RBIa,CB
						RBIa,CB
						RBIa,CB
						RBIa,CB
						RBIa,CB
						RBIa,CB
	27.4					
						RBIa,CA1
						RBIa,CA1
						RBIa,CA1
						RBIa,CA1
						RBIa,CA1

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SUMMARY OF FIELD AND LABORATORY
TEST DATA
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE A 1 PAGE 1 OF 8

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	MATERIAL DESCRIPTION	USCS SYMBOL	BOULDERS AND/OR COBBLES	DISTRIBUTION O MATERIAL FINE THAN COBBLES (PERCENT)		
							GRAVEL	SAND	FINES
	DL-A-(7, 8,9,10)			1.5in-0.75in					
	DL-A-(7, 8,9,10)			0.75in-No.4					
	DL-A-(7, 8,9,10)			Blend(1.5in-No.4)					
	DL-A-(7 8,9,10)			No.4-No.200					
212	DL-A-12	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	-/Rare	55	37	8
213	DL-A-13	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	-/-	64	30	6
214	DL-A-14	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	-/Rare	55	35	10
215	DL-A-15	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	-/Rare	55	35	10
216	DL-A-16	Dry Lake Valley, C	Aaf	Sandy Gravel	GW-GM	-/Few			
217	DL-A-17	Dry Lake Valley, C	Aaf	Sandy Gravel	GW-GM	-/Few			
218	DL-A-18	Dry Lake Valley, C	Aaf	Sandy Gravel	GW-GM	-/Rare			
	DL-A-(16, 17, 18)			Sandy Gravel	GP-GM				
219	DL-A-19	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	-/Some			

FIELD OBSERVATIONS												
DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)			OVERBURDEN THICKNESS (FEET)	TOTAL TRENCH DEPTH (FEET; R= REFUSAL DEPTH)	DELETERIOUS MATERIALS (MATERIAL/DEPTHS/ STAGE)	PLASTICITY	HARDNESS	WEATHERING				
GRAVEL	SAND	FINES							3 IN.	2½ IN.	2 IN.	1½ IN.
												100
												100
55	37	8	1.0	8.0(R)	Caliche/1-8/II	Slight						
64	30	6	1.0	6.0(R)	Caliche/1-6/III	Slight						
55	35	10	1.0	13.0	Caliche/1-3/II	Slight						
55	35	10	.0	13.0	Caliche/1-3.5, 7.5-8.5/III	Slight						
			1.0	13.0	Caliche lenses/-/II	Slight			96.3	96.3	94.7	89.3
			1.0	13.0	Caliche/5-6/II	Slight			96.5	94.5	92.7	89.5
			1.0	13.0	Caliche lenses/-/I	Slight			96.4	96.4	95.3	89.2
									96.3	94.5	93.0	90.7
			1.0	10.0(R)	Caliche/1-3,5-6/II	Slight			100	97.2	95.1	91.4

LABORATORY TE

SIEVE ANALYSIS, ASTM C 136 (PERCENT PASSING)														SPECIFIC GRAVITY AND ASTM C 127 AND				
														COARSE AGGREGATE				
														SPECIFIC GRAVITY			ABSORP. (PERCENT)	SPE
2½ IN.	2 IN.	1½ IN.	1 IN.	¾ IN.	½ IN.	⅜ IN.	NO. 4	NO. 8	NO. 16	NO. 30	NO. 50	NO. 100	NO. 200	BULK	BULK SSD	APPARENT		BUL
		100	55.9	6.2	0.9	0.5	0.4							2.63	2.66	2.71	1.1	
				100	73.5	51.8	5.2							2.59	2.63	2.71	1.7	
		100	78	53	37	26	3											
							100	77.9	54.2	35.7	23.8	8.8	2.9					2.56
6.3	94.7	89.3	83.3	75.8	65.8	57.3	43.8	35.7	29.1	23.9	18.0	12.6	8.0					
4.5	92.7	89.5	82.7	73.6	65.3	57.9	43.6	33.6	26.9	21.8	16.5	11.7	7.7					
6.4	95.3	89.2	82.2	74.9	65.6	59.0	42.4	28.7	20.4	15.2	10.6	7.5	5.3					
4.5	93.0	90.7	86.4	81.0	71.7	64.3	43.1	34.6	27.9	22.6	16.9	11.8	8.7					
7.2	95.1	91.4	82.5	73.7	63.0	54.8	39.2	30.1	24.3	20.3	16.4	12.2	8.1					

LABORATORY TEST DATA

SPECIFIC GRAVITY AND ABSORPTION, ASTM C 127 AND C 128							FINENESS MODULUS (PERCENT)	UNIT WEIGHT (PCF)	ABRASION TEST ASTM C 131 (PERCENT WEAR)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PET EXA AS
ARSE AGGREGATE			FINE AGGREGATE							COARSE AGGREGATE		FINE AGGREGATE		
FIC GRAVITY		ABSORP. (PERCENT)	SPECIFIC GRAVITY			ABSORP. (PERCENT)								
BULK SSD	APPARENT		BULK	BULK SSD	APPARENT					$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$	
2.66	2.71	1.1												Per
2.63	2.71	1.7						102.2						Per
								102.7	28.2	4.5				
			2.56	2.61	2.69	2.0	3.0					18.9	2.9	Per
									27.2	2.7		18.2		

ST, ASTM C 88 T LOSS)		PETROGRAPHIC EXAMINATION ASTM C 295	ALKALI REACTIVITY		AGGREGATE USE CLASSIFICATION
FINE AGGREGATE			SILICA METHOD, ASTM C 227 (LENGTH CHANGE, PERCENT)	CARBONATE METHOD, PROP. ASTM (LENGTH CHANGE, PERCENT)	
$MgSO_4$	$NaSO_4$				
		Performed			
		Performed			
				In Progress	
18.9	2.9	Performed		In Progress	
					RBIa,CB
					RBIa,CB
					RBIa,CB
					RBIa,CB
					RBIa,CA1
					RBIa,CA1
					RBIa,CA1
18.2					
					RBIa,CB

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SUMMARY OF FIELD AND LABORATORY
TEST DATA
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE A 1 PAGE 2 OF 8

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	MATERIAL DESCRIPTION	USCS SYMBOL	BOULDERS AND/OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)		
							GRAVEL	SAND	FINES
220	DL-A-20	Dry Lake Valley, E	Aaf	Sandy Gravel	GP-GM	-/Few			
221	DL-A-21	Dry Lake Valley, E	Aaf	Sandy Gravel	GW-GM	-/Few			
	DL-A-(19, 29, 21)			Sandy Gravel	GP-GM				
222	DL-A-22	Dry Lake Valley, S	Aal	Sandy Gravel	GP	-/Rare			
223	DL-A-23	Dry Lake Valley, S	Aal	Sandy Gravel	GW-GM	-/Rare			
224	DL-A-24	Dry Lake Valley, S	Aal	Gravelly Sand	SP	-/Rare			
	DL-A-(22, 23, 24)			Sandy Gravel	GP				
225	DL-A-25	Dry Lake Valley, S	Aaf	Gravelly Sand	SW	-/Rare			
226	DL-A-26	Dry Lake Valley, S	Aaf	Gravelly Sand	SW-SM	-/Rare			
227	DL-A-27	Dry Lake Valley, S	Aaf	Gravelly Sand	SW-SM	-/Rare			
	DL-A-(25, 26, 27)			Gravelly Sand	SW-SM				
228	DL-A-28	Dry Lake Valley, S	Aaf	Sandy Gravel	GP-GM	Rare/ Few			
229	DL-A-29	Dry Lake Valley, S	Aaf	Sandy Gravel	GP-GM	Few/ Some			

FIELD OBSERVATIONS												
DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)			OVERBURDEN THICKNESS (FEET)	TOTAL TRENCH DEPTH (FEET; R= REFUSAL DEPTH)	DELETERIOUS MATERIALS (MATERIAL/DEPTHS/ STAGE)	PLASTICITY	HARDNESS	WEATHERING				
GRAVEL	SAND	FINES							3 IN.	2½ IN.	2 IN.	1½ IN
			1.0	13.0	Caliche/3-4/II	Slight			100	97.9	96.8	92.
			1.0	12.5	Caliche/1-2/II	Slight				100	98.6	96.
									100	93.8	93.8	93.
			1.0	13.5	- / - / -	Slight			97.5	93.0	91.8	85.
			1.0	13.5	- / - / -	Slight				100	93.9	90.
			2.0	13.0	- / - / -	Slight			100	97.7	91.1	87.
									100	93.2	89.6	87.
			2.0	12.8	Caliche lenses/-/ I,II	Slight			97.9	97.0	95.9	92.
			2.5	13.7	Caliche/8.5/II	Slight				100	98.2	97.
			1.5	13.2	Caliche lenses/-/I	Slight			100	97.7	96.3	92.
									96.9	95.3	94.1	92.
			1.5	14.0	Caliche/1.5-4/II	Slight			90.7	87.7	84.7	80.
			1.0	12.5	Caliche/1-2.5/II	Slight			88.4	86.1	83.6	82.

LABORATORY TE

SIEVE ANALYSIS, ASTM C 136 (PERCENT PASSING)														SPECIFIC GRAVITY AND ASTM C 127 AND				
														COARSE AGGREGATE				
														SPECIFIC GRAVITY			ABSORP (PERCENT)	SPEC
2½ IN.	2 IN.	1½ IN.	1 IN.	¾ IN.	½ IN.	⅜ IN.	NO. 4	NO. 8	NO. 16	NO. 30	NO. 50	NO. 100	NO. 200	BULK	BULK SSD	APPARENT		BULK
7.9	96.8	92.0	86.8	80.7	70.4	61.0	42.8	32.1	24.4	19.6	15.3	11.4	7.6					
0	98.6	96.9	90.9	86.2	78.0	70.6	55.0	39.9	30.4	24.8	20.5	16.3	11.1					
3.8	93.8	93.2	88.2	83.4	73.6	66.3	49.7	36.8	28.9	23.7	19.1	14.7	10.2					
3.0	91.8	85.5	77.5	71.0	62.3	55.8	42.4	35.6	29.9	23.1	12.8	6.0	3.0					
0	93.9	90.9	82.8	76.5	67.5	61.8	49.4	36.9	25.8	17.6	11.4	8.0	5.6					
97.7	91.1	87.7	83.1	80.3	74.8	70.0	59.2	51.6	40.4	26.9	14.4	7.8	4.9					
93.2	89.6	87.3	80.4	74.5	66.7	60.5	48.4	39.8	30.7	21.4	12.2	7.1	4.5					
97.0	95.9	92.3	89.9	86.7	81.5	76.6	63.0	47.1	30.8	17.8	9.1	5.8	4.6					
00	98.2	97.7	95.0	92.4	86.1	83.8	76.8	55.9	37.5	23.5	13.7	9.0	6.7					
97.7	96.3	92.6	88.1	84.3	79.6	75.7	64.2	53.2	37.5	23.8	13.2	8.0	5.7					
95.3	94.1	92.6	89.9	87.5	83.6	79.8	68.6	54.0	37.9	23.7	13.4	8.5	5.9					
87.7	84.7	80.8	74.2	67.2	57.2	49.7	35.6	28.2	23.3	20.0	16.9	12.9	8.9					
86.1	83.6	82.4	73.8	66.7	57.0	49.7	35.9	27.1	20.8	16.7	12.9	9.4	6.6					

LABORATORY TEST DATA

SPECIFIC GRAVITY AND ABSORPTION, ASTM C 127 AND C 128							FINENESS MODULUS (PERCENT)	UNIT WEIGHT (PCF)	ABRASION TEST ASTM C 131 (PERCENT WEAR)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PETRO EXAM ASTN
SE AGGREGATE			FINE AGGREGATE							COARSE AGGREGATE		FINE AGGREGATE		
C GRAVITY		ABSORP. (PERCENT)	SPECIFIC GRAVITY			ABSORP. (PERCENT)								
ULK SSD	APPARENT		BULK	BULK SSD	APPARENT					$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$	
									29.3					
									30.2	4.4		20.0		
									29.2					

U

NDNESS TEST, ASTM C 88 (PERCENT LOSS)			PETROGRAPHIC EXAMINATION ASTM C 295	ALKALI REACTIVITY		AGGREGATE USE CLASSIFICATION
RSE GATE	FINE AGGREGATE			SILICA METHOD, ASTM C 227 (LENGTH CHANGE, PERCENT)	CARBONATE METHOD, PROP. ASTM (LENGTH CHANGE, PERCENT)	
NaSO4	MgSO4	NaSO4				
						RBIa,CB
						RBIa,CB
						RBIa,CB
						RBIa,CB
						RBIa,CB
	20.0					
						RBIa,CB
						RBIa,CB
						RBIa,CB
						RBIa,CA1
						RBIa,CA1

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SUMMARY OF FIELD AND LABORATORY
TEST DATA
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE A 1

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	MATERIAL DESCRIPTION	USCS SYMBOL	BOULDERS AND/ OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)		
							GRAVEL	SAND	FINES
230	DL-A-30	Dry Lake Valley, S	Aaf	Sandy Gravel	GP-GM	Few/ Some			
231	DL-A-31	Dry Lake Valley, S	Aaf	Sandy Gravel	GP-GM	Few/ Some			
232	DL-A-32	Dry Lake Valley, S	Aaf	Sandy Gravel	GW-GM	Few/ Some			
	DL-A-(28,29, 30,31,32)			1.5in-0.75in					
	DL-A-(28,29, 30,31,32)			0.75in-No.4					
	DL-A-(28,29 30,31,32)			Blend(1.5in-No.4)					
	DL-A-(28,29, 30,31,32)			No.4-No.200					
233	DL-A-33	Dry Lake Valley, SW	Aaf	Gravelly Sand	SW	-/Rare			
234	DL-A-34	Dry Lake Valley, SW	Aaf	Gravelly Sand	SP	-/Some			
235	DL-A-35	Dry Lake Valley, SW	Aaf	Gravelly Sand	SP	-/Few			
	DL-A-(33, 34,35)			Gravelly Sand	SP				
236	DL-A-36	Dry Lake Valley, W	Aaf	Gravelly Sand	SP-SM	- / -	30	63	7
237	DL-A-37	Dry Lake Valley, W	Aaf	Gravelly Sand	SW-SM	- / -			

FIELD OBSERVATIONS									SI			
DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)			OVERBURDEN THICKNESS (FEET)	TOTAL TRENCH DEPTH (FEET; R= REFUSAL DEPTH)	DELETERIOUS MATERIALS (MATERIAL/DEPTHS/ STAGE)	PLASTICITY	HARDNESS	WEATHERING				
GRAVEL	SAND	FINES							3 IN.	2½ IN.	2 IN.	1½ IN.
			1.5	13.0	Caliche/1.5-3.0/II	Slight			90.7	89.3	88.5	84.7
			1.0	13.5	Caliche/1-2.5,7-8/II	Slight			80.6	80.6	80.6	77.8
			2.0	12.0	Caliche/2-3/II	Slight			100	97.5	96.6	90.6
												100
												100
			1.0	13.0	Caliche/1-5/II; Chert	None					100	99.2
			0.5	12.7	Caliche/0.5-3/III; Chert	None				100	98.7	98.2
			1.0	13.0	Caliche/1-5/III; Chert	None					100	98.8
										100	98.5	97.4
30	63	7	1.0	7.0(R)	Caliche/1-3,7/II							
			1.0	12.5	Caliche/1-2/II					100	97.7	95.9

LABORATOR

SIEVE ANALYSIS, ASTM C 136 (PERCENT PASSING)														SPECIFIC GRAVITY ASTM C 127			
														COARSE AGGREGATE			
														SPECIFIC GRAVITY			ABSORP. (PERCENT)
2½ IN.	2 IN.	1½ IN.	1 IN.	¾ IN.	½ IN.	⅜ IN.	NO. 4	NO. 8	NO. 16	NO. 30	NO. 50	NO. 100	NO. 200	BULK	BULK SSD	APPARENT	
89.3	88.5	84.7	77.9	70.0	57.2	48.1	33.0	26.4	21.4	18.0	14.7	11.3	7.6				
80.6	80.6	77.8	73.2	67.8	58.7	48.6	30.2	22.4	17.7	14.7	11.9	8.3	5.8				
97.5	96.6	90.6	79.7	73.6	64.9	57.6	41.8	32.1	24.8	19.8	15.4	11.7	8.1				
		100	59.5	1.2										2.77	2.78	2.79	0.3
				100	70.6	46.6	2.2	1.1						2.72	2.75	2.80	1.1
		100	80	51	35	23	1										
							100	77.8	52.0	34.3	20.7	11.2	5.4				
	100	99.2	96.5	94.9	90.6	85.4	69.3	51.4	33.5	18.5	7.5	2.6	0.5				
100	98.7	98.2	96.7	94.7	91.3	86.5	79.1	56.1	31.0	13.6	4.5	1.3	0.4				
	100	98.8	97.4	96.1	92.8	89.3	77.7	58.6	37.2	18.7	6.7	2.0	0.2				
100	98.5	97.4	95.3	94.3	90.1	86.7	75.9	58.4	38.9	21.2	8.5	3.0	0.6				
100	97.7	95.9	90.3	86.9	81.7	77.0	59.9	46.2	33.2	24.9	17.9	12.9	10.0				

LABORATORY TEST DATA

SPECIFIC GRAVITY AND ABSORPTION, ASTM C 127 AND C 128							FINENESS MODULUS (PERCENT)	UNIT WEIGHT (PCF)	ABRASION TEST ASTM C 131 (PERCENT WEAR)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PET EX A
ARSE AGGREGATE			FINE AGGREGATE							COARSE AGGREGATE		FINE AGGREGATE		
FIC GRAVITY		ABSORP. (PERCENT)	SPECIFIC GRAVITY			ABSORP. (PERCENT)								
BULK SSD	APPARENT		BULK	BULK SSD	APPARENT					$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$	
2.78	2.79	0.3												Pe
2.75	2.80	1.1						101.3						Pe
								104.4	31.2	2.4				
			2.62	2.66	2.74	1.7	3.04					15.6	4.5	Pe
									43.0					
									24.7					

SION ST C 131 ENT R)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PETROGRAPHIC EXAMINATION ASTM C 295	ALKALI REACTIVITY		AGGREGATE USE CLASSIFICATION
	COARSE AGGREGATE		FINE AGGREGATE			SILICA METHOD, ASTM C 227 (LENGTH CHANGE, PERCENT)	CARBONATE METHOD, PROP. ASTM (LENGTH CHANGE, PERCENT)	
	$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$				
								RBIa,CA1
								RBIa,CA1
								RBIa,CA1
					Performed			
					Performed			
2	2.4							
			15.6	4.5	Performed			
								RBII,-
								RBII,-
								RBII,-
0								
								RBII,-
7								RBII,-

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SUMMARY OF FIELD AND LABORATORY
TEST DATA
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MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	MATERIAL DESCRIPTION	USCS SYMBOL	BOULDERS AND/ OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)		
							GRAVEL	SAND	FINES
238	DL-A-38	Dry Lake Valley, W	Aaf	Gravelly Sand	SP-SM	-/Rare	30	60	10
239	DL-A-39	Dry Lake Valley, C	Aaf	Sandy Gravel	GP-GM	Rare/ Few			
240	DL-A-40	Dry Lake Valley, C	Aaf	Sandy Gravel	GP-GM	Rare/ Some			
241	DL-A-41	Dry Lake Valley, C	Aaf	Sandy Gravel	GP-GM	Rare/ Some			
	DL-A-(39, 40,41)			Sandy Gravel	GP-GM				
242	DL-A-42	Dry Lake Valley, E	Aaf	Sandy Gravel	GM	- / -	50	35	15
243	DL-A-43	Dry Lake Valley, E	Aaf	Gravelly Sand	SM	-/Few	35	50	15
244	DL-A-44	Dry Lake Valley, NE	Aaf	Sandy Gravel	GP-GM	-/Few	48	42	10
245	DL-A-45	Dry Lake Valley, NE	Aaf	Gravelly Sand	SP-SM	-/Few	42	48	10
246	DL-A-46	Dry Lake Valley, N	Aaf	Sandy Gravel	GP-GM	-/Few			
247	DL-A-47	Dry Lake Valley, N	Aaf	Sandy Gravel	GP-GM	-/Some			
248	DL-A-48	Dry Lake Valley, N	Aaf	Sandy Gravel	GP-GM	-/Some			
249	DL-A-49	Dry Lake Valley, N	Aaf	Sandy Gravel	GP-GM	-/Few			

FIELD OBSERVATIONS													
OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)			OVERBURDEN THICKNESS (FEET)	TOTAL TRENCH DEPTH (FEET; R= REFUSAL DEPTH)	DELETERIOUS MATERIALS (MATERIAL/DEPTHS/ STAGE)	PLASTICITY	HARDNESS	WEATHERING				
	GRAVEL	SAND	FINES							3 IN.	2½ IN.	2 IN.	
are	30	60	10	1.5	11.5(R)	Caliche lenses/1.5-11/III							
e/				1.0	13.0	Caliche/1-2.5/II						100	9
e/ e				1.0	13.2	Caliche/1-2/II				100	96.2	91.9	8
e/ e				1.0	13.5	Caliche/4.5-6/II						100	9
										97.7	97.7	96.6	9
-	50	35	15	1.0	4.5(R)	Caliche/1-4.5/III							
ew	35	50	15	1.0	7.0(R)	Caliche/1-3,5-7/III							
ew	48	42	10	1.0	13.6	Caliche lenses/-/II							
ew	42	48	10	0.1	11.0(R)	Caliche lenses/-/I-II							
ew					14.0	- / - / -	Slight			100	98.5	97.5	9
me				2.0	13.0	Caliche lenses/-/II	Slight				100	98.3	9
me				1.0	13.0	Caliche/1.5-3,7-8/II	Slight			100	98.9	97.1	9
ew				1.5	13.5	Caliche/3-4.5/III	Slight			100	98.7	96.9	9

LABORAT

SIEVE ANALYSIS, ASTM C 136 (PERCENT PASSING)															SPECIFIC GRAV ASTM C COARSE AGGREGATE			
															SPECIFIC GRAVITY			ABSORP.
3 IN.	2½ IN.	2 IN.	1½ IN.	1 IN.	¾ IN.	½ IN.	⅜ IN.	NO. 4	NO. 8	NO. 16	NO. 30	NO. 50	NO. 100	NO. 200	BULK	BULK SSD	APPAR ENT	
		100	97.6	93.3	85.9	83.3	63.8	46.4	33.0	24.9	20.2	15.8	10.7	6.3				
100	96.2	91.9	87.2	76.9	70.1	61.3	53.4	38.4	30.0	24.6	21.1	17.2	12.4	7.7				
		100	97.7	91.8	87.4	78.2	70.2	50.7	37.0	29.8	25.7	21.1	15.8	10.8				
97.7	97.7	96.6	94.9	87.8	82.4	73.3	65.5	46.6	37.3	31.0	26.8	22.0	15.9	10.3				
00	98.5	97.5	94.1	89.1	84.8	76.3	67.0	48.6	37.8	32.6	28.1	19.3	10.8	6.1				
	100	98.3	95.0	90.0	82.5	72.1	63.3	47.1	37.0	30.8	26.6	20.1	12.2	6.4				
00	98.9	97.1	93.2	87.3	82.0	73.3	65.2	48.2	38.9	33.0	28.8	23.1	15.6	8.4				
00	98.7	96.9	90.2	79.9	72.4	61.9	53.4	39.3	32.6	28.9	26.8	23.7	17.6	9.3				

LABORATORY TEST DATA

SPECIFIC GRAVITY AND ABSORPTION, ASTM C 127 AND C 128							FINENESS MODULUS (PERCENT)	UNIT WEIGHT (PCF)	ABRASION TEST ASTM C 131 (PERCENT WEAR)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PE EX
ARSE AGGREGATE			FINE AGGREGATE							COARSE AGGREGATE		FINE AGGREGATE		
FIC GRAVITY		ABSORP. (PERCENT)	SPECIFIC GRAVITY			ABSORP. (PERCENT)								
BULK SSD	APPARENT		BULK	BULK SSD	APPARENT					$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$	
									26.4	2.4		18.4		

ESS TEST, ASTM C 88 ERCENT LOSS)			PETROGRAPHIC EXAMINATION ASTM C 295	ALKALI REACTIVITY		AGGREGATE USE CLASSIFICATION
'E	FINE AGGREGATE			SILICA METHOD, ASTM C 227 (LENGTH CHANGE, PERCENT)	CARBONATE METHOD, PROP. ASTM (LENGTH CHANGE, PERCENT)	
SO_4	$MgSO_4$	$NaSO_4$				
						RBII,-
						RBIa,CB
						RBIa,CB
						RBIa,CB
	18.4					
						PBII,-
						RBII,-
						RBIa,CB
						RBIa,CB
						RBIa,CA1
						RBIa,CA1
						RBIa,CA1
						RBIa,CA1

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SUMMARY OF FIELD AND LABORATORY
TEST DATA
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE A 1

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	MATERIAL DESCRIPTION	USCS SYMBOL	BOULDERS AND/ OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)		
							GRAVEL	SAND	FINES
250	DL-A-50	Dry Lake Valley, N	Aaf	Sandy Gravel	GP-GM	-/Some			
	DL-A-(46,47, 48,49,50)			1.5in-0.75in					
	DL-A-(46,47, 48,49,50)			0.75in-No.4					
	DL-A-(46,47, 48,49,50)			Blend(1.5in-No.4)					
	DL-A-(46,47, 48,49,50)			No.4-No.200					
251	DL-A-51	Dry Lake Valley, NE	Aaf	Sandy Gravel	GP-GM	Few/ Some			
252	DL-A-52	Dry Lake Valley, NE	Aaf	Sandy Gravel	GW	Rare/ Some			
253	DL-A-53	Dry Lake Valley, NE	Aaf	Sandy Gravel	GP-GM	-/Some			
	DL-A-(51, 52, 53)			Sandy Gravel	GP-GM				
254	DL-A-54	Dry Lake Valley, NE	Aaf	Sandy Gravel	GP-GM	Rare/ Some			
255	DL-A-55	Dry Lake Valley, NE	Aaf	Gravelly Sand	SP-SM	-/Few			
256	DL-A-56	Dry Lake Valley, NE	Aaf	Sandy Gravel	GP-GM	-/Few			
	DL-A-(54, 55,56)			Sandy Gravel	GP-GM				

FIELD OBSERVATIONS												
BOULDERS AND/ OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)			OVERBURDEN THICKNESS (FEET)	TOTAL TRENCH DEPTH (FEET, R= REFUSAL DEPTH)	DELETERIOUS MATERIALS (MATERIAL/DEPTHS/ STAGE)	PLASTICITY	HARDNESS	WEATHERING			
	GRAVEL	SAND	FINES							3 IN.	2½ IN.	2 IN.
'Same				3.0	12.5	Caliche/1.5-4/II	Slight			90.3	90.3	87.0
w/ me				1.5	12.5	Caliche/1-5-4/III	Slight				100	98.6
re/ me				1.0	12.5	Caliche/1-3/III	Slight			96.9	95.4	94.9
'Same				1.0	12.5	Caliche/1-2/II	Slight				100	97.9
										100	100	96.7
re/ me				1.0	9.2(R)		Slight			100	97.9	97.9
Few				1.0	8.5(R)		Slight				100	97.3
Few				1.0	11.0(R)		Slight					100
											100	98.9

LABORATORY TES

SIEVE ANALYSIS, ASTM C 136 (PERCENT PASSING)														SPECIFIC GRAVITY AND A ASTM C 127 AND C				
														COARSE AGGREGATE				F
														SPECIFIC GRAVITY			ABSORP (PERCENT)	SPECI
½ IN.	2 IN.	1½ IN.	1 IN.	¾ IN.	½ IN.	⅜ IN.	NO. 4	NO. 8	NO. 16	NO. 30	NO. 50	NO. 100	NO. 200	BULK	BULK SSD	APPARENT		BULK
0.3	87.0	83.6	77.6	70.2	62.3	56.4	45.3	37.6	33.7	31.5	27.7	20.3	11.8					
		100	52.9	0.7										2.76	2.78	2.81	0.6	
				100	75.6	47.1	1.1	0.5						2.69	2.73	2.79	1.3	
		100	77	50	38	24	1											
							100	81.2	61.0	47.0	26.9	12.4	3.3					2.61
0	98.6	96.6	90.4	82.7	74.8	67.2	50.7	41.1	31.4	21.1	12.1	7.7	5.1					
5.4	94.9	92.8	90.8	83.4	77.0	68.5	50.9	37.5	25.8	15.2	7.6	4.3	2.6					
0	97.9	93.9	89.2	86.8	77.9	67.2	48.0	39.1	25.3	19.6	15.1	11.5	8.0					
0	96.7	93.9	88.1	83.1	75.7	68.1	51.2	40.1	29.7	20.4	13.0	8.9	5.9					
7.9	97.9	93.8	86.5	79.8	68.1	58.4	39.4	28.9	22.4	19.8	15.8	13.2	9.5					
0	97.3	93.2	86.0	81.7	75.3	69.8	55.8	46.8	39.8	35.5	31.7	19.1	10.0					
	100	99.0	93.0	86.3	70.2	61.2	43.2	31.5	23.3	19.2	16.6	14.3	10.7					
0	98.9	97.9	92.3	86.0	76.2	67.4	49.8	38.3	30.2	25.7	22.4	16.3	10.8					

LABORATORY TEST DATA

SPECIFIC GRAVITY AND ABSORPTION, ASTM C 127 AND C 128							FINENESS MODULUS (PERCENT)	UNIT WEIGHT (PCF)	ABRASION TEST ASTM C 131 (PERCENT WEAR)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PETROG EXAMIN ASTM
E AGGREGATE			FINE AGGREGATE							COARSE AGGREGATE		FINE AGGREGATE		
GRAVITY		ABSORP. (PERCENT)	SPECIFIC GRAVITY			ABSORP. (PERCENT)								
LK D	APPARENT		BULK	BULK SSD	APPARENT					$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$	
8	2.81	0.6												Perfor
3	2.79	1.3						99.4						Perfor
								106.6	23.3	3.7				
			2.61	2.66	2.75	2.0						13.7	5.9	Perfor
									28.4	5.5		13.7		
									27.4					

M C 88		PETROGRAPHIC EXAMINATION ASTM C 295	ALKALI REACTIVITY		AGGREGATE USE CLASSIFICATION
FINE REGATE			SILICA METHOD, ASTM C 227 (LENGTH CHANGE, PERCENT)	CARBONATE METHOD, PROP. ASTM (LENGTH CHANGE, PERCENT)	
	NaSO4				
					RBIa,CA1
		Performed			
		Performed			
	5.9	Performed	In Progress		
					RBIa,CB
					RBIa,CB
					RBIa,CB
					RBIa,CB
					RBIa,CB
					RBIa,CB

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SUMMARY OF FIELD AND LABORATORY
TEST DATA
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE A 1 PAGE 6 OF 8

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	MATERIAL DESCRIPTION	USCS SYMBOL	BOULDERS AND/OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)		
							GRAVEL	SAND	FINES
257	DL-A-57	Dry Lake Valley, NE	Aaf	Silty Sand	SM	- / -	15	60	25
258	DL-A-58	Dry Lake Valley, W	Aaf	Gravelly Sand	SP-SM	- / -	30	63	7
259	DL-A-59	Dry Lake Valley, W	Aaf	Gravelly Sand	SP-SM	-/Few	30	60	10
260	DL-A-60	Dry Lake Valley, NE	Aaf	Sandy Gravel	GP-GM	-/Few	60	30	10
261	DL-A-61	Dry Lake Valley, NE	Aaf	Gravelly Sand	SM	- / -	30	55	15
262	DL-FA-1	Dry Lake Valley, C	Aaf	Gravelly Sand	SP	-/Some			
	DL-FA-1								
263	DL-FA-2	Dry Lake Valley, NW	Aal	Gravelly Sand	SP	- / -			
	DL-FA-2								
264	DL-R-1	Dry Lake Valley, E	Cau	Limestone					
	DL-R-1			1.5in-0.75in					
	DL-R-1			0.75in-No.4					
	DL-R-1			Blend(1.5in-No.4)					
265	DL-R-2	Dry Lake Valley, NW	Cau	Limestone					

FIELD OBSERVATIONS									SIE			
DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)			OVERBURDEN THICKNESS (FEET)	TOTAL TRENCH DEPTH (FEET; R= REFUSAL DEPTH)	DELETERIOUS MATERIALS (MATERIAL/DEPTHS/ STAGE)	PLASTICITY	HARDNESS	WEATHERING				
GRAVEL	SAND	FINES							3 IN.	2½ IN.	2 IN.	1½ IN.
15	60	25	1.0	9.0(R)	Caliche/1-9/II	Slight						
30	63	7	1.0	7.0(R)	Caliche/1-3, 7/II							
30	60	10	1.5	11.5(R)	Caliche lenses/ 1.5-11.5/II,III							
60	30	10	1.0	6.0(R)	Caliche/1-6/III							
30	55	15	1.0	3.5(R)	Caliche/1-3.5/III							
										100	98.8	93.9
			2	11.0(R)	Caliche/11/III						100	97.7
							Hard	Slight				
												100
												100
							Very Hard	Slight				

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	SIEVE ANALYSIS, ASTM C 136 (PERCENT PASSING)														SPECIFIC GRAVIT ASTM C 1			
															COARSE AGGREGATE			
															SPECIFIC GRAVITY			ABSORP. (PERCENT)
N.	2½ IN.	2 IN.	1½ IN.	1 IN.	¾ IN.	½ IN.	⅜ IN.	NO. 4	NO. 8	NO. 16	NO. 30	NO. 50	NO. 100	NO. 200	BULK	BULK SSD	APPAR-ENT	
	100	98.8	93.9	89.4	85.3	78.3	71.5	55.2	39.0	25.7	15.3	7.8	4.7	3.3				
								100	84.8	57.4	31.9	11.3	3.1	0.9				
		100	97.7	95.9	93.1	90.1	87.6	80.1	65.9	46.3	25.5	10.7	5.8	4.6				
								100	86.2	60.5	34.5	14.6	6.9	4.8				
			100	67.3	6.8										2.65	2.67	2.71	0.7
					100	49.1	26.7	3.3							2.64	2.67	2.71	0.9
			100	84	53	25	13	2										

LABORATORY TEST DATA

SPECIFIC GRAVITY AND ABSORPTION, ASTM C 127 AND C 128								FINENESS MODULUS (PERCENT)	UNIT WEIGHT (PCF)	ABRASION TEST ASTM C 131 (PERCENT WEAR)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)			
COARSE AGGREGATE				FINE AGGREGATE							COARSE AGGREGATE		FINE AGGREGA	
SPECIFIC GRAVITY			ABSORP. (PERCENT)	SPECIFIC GRAVITY			ABSORP. (PERCENT)							
BULK	BULK SSD	APPARENT		BULK	BULK SSD	APPARENT					MgSO4	NaSO4	MgSO4	Na
				2.60	2.66	2.76	2.12	3.12					20.2	5.
				2.44	2.52	2.65	3.3	2.97					52.9	22
2.65	2.67	2.71	0.7											
2.64	2.67	2.71	0.9						90.5					
									93.6	29.5	2.0			

SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PETROGRAPHIC EXAMINATION ASTM C 295	ALKALI REACTIVITY		AGGREGATE USE CLASSIFICATION
COARSE AGGREGATE		FINE AGGREGATE			SILICA METHOD, ASTM C 227 (LENGTH CHANGE, PERCENT)	CARBONATE METHOD, PROP. ASTM (LENGTH CHANGE, PERCENT)	
$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$				
							-,-
							RBII,-
							RBII,-
							RBIa,CB
							-,-
							-,FA
		20.2	5.0	Performed		In Progress	
							-,FA
		52.9	22.3	Performed	In Progress		
						In Progress	RBIa,CA1
				Performed			
				Performed			
2.0							
							RBIa,CA1

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SUMMARY OF FIELD AND LABORATORY
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29 MAY 81 TABLE A 1 PAGE 7 OF 8

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	MATERIAL DESCRIPTION	USCS SYMBOL	BOULDERS AND/OR COBBLES	DISTRIBUTION O MATERIAL FINE THAN COBBLES (PERCENT)		
							GRAVEL	SAND	FINES
	DL-R-2			1.5in-0.75in					
	DL-R-2			0.75in-No.4					
	DL-R-2			Blend(1.5in-No.4)					

FIELD OBSERVATIONS												
BOULDERS AND/ OR COBBLES	DISTRIBUTION OF MATERIAL FINER THAN COBBLES (PERCENT)			OVERBURDEN THICKNESS (FEET)	TOTAL TRENCH DEPTH (FEET; R= REFUSAL DEPTH)	DELETERIOUS MATERIALS (MATERIAL/DEPTHS/ STAGE)	PLASTICITY	HARDNESS	WEATHERING	3 IN.	2½ IN.	2 IN.
	GRAVEL	SAND	FINES									

LABORA

SIEVE ANALYSIS, ASTM C 136 (PERCENT PASSING)															SPECIFIC GRA ASTM			
															COARSE AGGREGATE			
															SPECIFIC GRAVITY			ABSORP
3 IN.	2½ IN.	2 IN.	1½ IN.	1 IN.	¾ IN.	½ IN.	⅜ IN.	NO. 4	NO. 8	NO. 16	NO. 30	NO. 50	NO. 100	NO. 200	BULK	BULK SSD	APPARENT	
			100	79.4	11.1	2.3									2.69	2.70	2.71	0
					100	44.8	21.0	1.8							2.68	2.69	2.71	0

LABORATORY TEST DATA

SPECIFIC GRAVITY AND ABSORPTION, ASTM C 127 AND C 128							FINENESS MODULUS (PERCENT)	UNIT WEIGHT (PCF)	ABRASION TEST ASTM C 131 (PERCENT WEAR)	SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PE E
OARSE AGGREGATE			FINE AGGREGATE							COARSE AGGREGATE		FINE AGGREGATE		
CIFIC GRAVITY		ABSORP. (PERCENT)	SPECIFIC GRAVITY			ABSORP. (PERCENT)								
BULK SSD	APPARENT		BULK	BULK SSD	APPARENT					$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$	
2.70	2.71	0.3												P
2.69	2.71	0.4						92.6						P
								95.4	24.3	1.5				

SOUNDNESS TEST, ASTM C 88 (PERCENT LOSS)				PETROGRAPHIC EXAMINATION ASTM C 295	ALKALI REACTIVITY		AGGREGATE USE CLASSIFICATION
COARSE AGGREGATE		FINE AGGREGATE			SILICA METHOD, ASTM C 227 (LENGTH CHANGE, PERCENT)	CARBONATE METHOD, PROP. ASTM (LENGTH CHANGE, PERCENT)	
$MgSO_4$	$NaSO_4$	$MgSO_4$	$NaSO_4$				
				Performed			
				Performed			
1.5							

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APPENDIX B

SUMMARY OF FIELD PETROGRAPHIC AND GRAIN-SIZE ANALYSES

FIELD PETROGRAPHIC AND GRAIN-SIZE ANALYSES

Field petrographic observations are presented in Table B-1. Field stations were established at various locations throughout the study area where detailed petrographic descriptions of potential basin-fill sources of aggregates were recorded. Detailed explanations for the column headings of Table B-1 are as follows:

COLUMN HEADING	EXPLANATION
MAP NUMBER	Map numbers are sequentially arranged identifiers of field petrographic stations occupied during the course of the aggregate study.
FIELD STATION	These designations are internal DARS identifiers of field petrographic designations.
LOCATION	The location column lists the geographic portion of the valley in which the field station is located (e.g., NE-northeast).
GEOLOGIC UNIT	The geologic unit listed is a term used to differentiate basin-fill deposits based on geomorphology. A geologic unit cross reference, outlining all units used, is included as Table F-3.
FIELD OBSERVATIONS	
Clast Count	Clast or petrographic counts are the main data collected during the field petrographic analysis. Data collected include lithology and percent present by size. Categorization by lithology is done to determine general percentages of nondeleterious and deleterious materials.
Other Deleterious Clasts Present	This column is reserved for recording additional types of materials present that are of poor quality for use as aggregate. Items mentioned include samples of rock types not sieved, counted, and described under clast count, such as: amorphous silica

	(chert, opal, chalcedony), volcanic glass, mica, chlorite, friable materials, low density clasts (ash, vesicles, pumice, cinders), gypsum, pyrite, organic material, and coatings (clay and caliche).
<u>Size Distribution</u>	The estimated occurrence of boulders and cobbles is based on the appraisal of an entire deposit only if the materials are observed in the banks of prominent stream channels. Size distribution information for gravel was generally recorded only at trench locations. Any gravel values given are expressed as a percent of the total amount of less than 3.0-inch material present. The numeral zero is used to indicate a size fraction not observed, and the letter R is used to indicate the rare occurrence of a size fraction (one to four percent).
<u>Gradation</u>	Gradation information was recorded at trench locations only.
<u>Maximum Particle Size</u>	Maximum particle size is defined as the intermediate diameter length of the most frequently occurring clast present in a deposit (in centimeters). Erratic oversized materials (boulders, large cobbles) are generally not represented as the maximum particle size.
<u>Particle Shape</u>	Shape of clasts are classified into the following six categories.
Angular (ANG)	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Sub-angular (SA)	Particles are similar to angular but have somewhat rounded edges.
Sub-rounded (SR)	Particles exhibit nearly plane sides but have well-rounded corners and edges.
Rounded (R)	Particles have smoothly curved sides and no edges.
Platey (P)	Particles are thin and flat with either rounded or nonrounded corners and edges.
Elongate (E)	Particles are several times longer than they are wide with rounded corners and edges.

Remarks	This column is used to describe the general site location of petrographic field stations; location terms used include: surface, shallow wash, stream channel bank or bottom, borrow pit, and road cut. Surface indicates analysis was performed on top of the stated geologic unit. Shallow wash indicates analysis was performed on top of the unit but at the bottom of a small swale. Stream channel bank or bottom indicates analysis was performed in an exposed section (incision) or within a minor stream channel deposit, respectively.

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	CLAST COUNT, > 1 IN. TO ≤ 3 IN. DIAMETER (							
				NON-DELETERIOUS						DELE	
				Qtz	Ls	Do	Gr	Vu	Vb	CALICHE	CHERT
301	DL-1	Dry Lake Valley, S	Aaf	10	32	28		26	4		
302	DL-2	Dry Lake Valley, S	Aaf		60	6		18	14	2	
303	DL-3	Dry Lake Valley, S	Aaf	2	70	12		6	6	4	
304	DL-4	Dry Lake Valley, S	Aaf	2	36	28		14	10	10	
305	DL-5	Dry Lake Valley, S	Aaf	2	58	6		28	6		
306	DL-6	Dry Lake Valley, S	Aaf	2	36	6		54			
307	DL-7	Dry Lake Valley, S	Aaf		88			12			
308	DL-8	Dry Lake Valley, S	Aaf		52			28	20		
309	DL-9	Dry Lake Valley, S	Aaf	2	70	8		10	10		
310	DL-10	Dry Lake Valley, S	Aaf	2	74	6		10	8		
311	DL-11	Dry Lake Valley, S	Aaf	10	58	6		24	2		
312	DL-12	Dry Lake Valley, S	Aaf	10	14	48		18	10		

FIELD OBSERVATIONS

TO ≤ 3 IN. DIAMETER (PERCENT)						CLAST COUNT, > ½ IN. TO ≤ 1 IN. DIAMETER (PERCENT)										
	DELETERIOUS					NON-DELETERIOUS						DELETERIOUS				
Vb	CALICHE	CHERT	TUFF	GLASS	OTHER	Qtz	Ls	Do	Gr	Vu	Vb	CALICHE	CHERT	TUFF	GLASS	OTHER
4							44	6		34	16					
14	2						56	10		18	14			2		
6	4						80	4		16						
10	10					6	66	10		18						
6							54	18		22	6					
			2				54	20		24				2		
							82			10	8					
20						4	68	8		12	4					4
10						6	70			14	10					
8						6	72	10		10	2					
2						4	58	8		10	16		4			
10						10	36	24		8	22					

VATIONS

ERCENT)			OTHER DELETERIOUS CLASTS PRESENT	SIZE DISTRIBUTION			GRADATION	MAXIMUM PARTICLE SIZE (CM)	PARTICLE SHAPE	REMARKS
TERIOUS				PERCENT OF TOTAL		< 3 %				
UFF	GLASS	OTHER		BOULDERS	COBBLES	GRAVEL				
			Caliche					7	SA,SR	Stream Channel,Bott
2			Caliche					5	SA,SR	Shallow Wash
			Caliche					8	SA,SR	Stream Channel
			Caliche					10	SA,SR	Stream Channel,Bank
			Chalcedony, Caliche					11	SA,SR	Shallow Wash
2			Caliche					4	SA,SR	Shallow Wash
			Chert, Caliche					4	SA,SR	Shallow Wash
		4	Chalcedony, Opal, Caliche					4	SA,SR	Shallow Wash
			Caliche					10	SA,SR	Stream Channel,Bott
			Caliche					7	SA,SR	Stream Channel
			Caliche					8	SA,SR	Stream Channel
			Caliche					5	A,SA,PL	

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SUMMARY OF FIELD
AND GRAIN SIZI
DRY LAKE VALL

29 MAY 81
TABLE E

PARTICLE SHAPE	REMARKS
SA,SR	Stream Channel,Bottom
SA,SR	Shallow Wash
SA,SR	Stream Channel
SA,SR	Stream Channel,Bank
SA,SR	Shallow Wash
SA,SR	Shallow Wash
SA,SR	Shallow Wash
SA,SR	Shallow Wash
SA,SR	Stream Channel,Bottom
SA,SR	Stream Channel
SA,SR	Stream Channel
A,SA,PL	

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SUMMARY OF FIELD PETROGRAPHIC
AND GRAIN-SIZE ANALYSES
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE B 1

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	CLAST COUNT, > 1 IN. TO ≤ 3 IN. DIAMETER (PE								
				NON-DELETERIOUS						DELETI		
				Qtz	Ls	Do	Gr	Vu	Vb	CALICHE	CHERT	TU
313	DL-13	Dry Lake Valley, S	Aaf		74	22			2			
314	DL-14	Dry Lake Valley, S	Aaf		78	22						
315	DL-15	Dry Lake Valley, S	Aaf		58	42						
316	DL-16	Dry Lake Valley, SE	Aaf	4	54	30		10			2	
317	DL-17	Dry Lake Valley, S	Aaf	14	40	10		16	20			
318	DL-18	Dry Lake Valley, S	Aaf	6	38	16		8	28			
319	DL-19	Dry Lake Valley, E	Aaf	6	48	14		16	16			
320	DL-20	Dry Lake Valley, E	Aaf	4	22	16		32	16		4	
321	DL-21	Dry Lake Valley, C	Aaf	44	26	8		12	10			
322	DL-22	Dry Lake Valley, E	Aaf	2	74	22					2	
323	DL-23	Dry Lake Valley, E	Aaf	2	78	14					6	
324	DL-24	Dry Lake Valley, E	Aaf		94	6						

FIELD OBSERVATIONS

TO ≤ 3 IN. DIAMETER (PERCENT)						CLAST COUNT, > ½ IN. TO ≤ 1 IN. DIAMETER (PERCENT)											DE CLAS
	DELETERIOUS					NON-DELETERIOUS						DELETERIOUS					
Vb	CALICHE	CHERT	TUFF	GLASS	OTHER	Qtz	Ls	Do	Gr	Va	Vb	CALICHE	CHERT	TUFF	GLASS	OTHER	
2			2				72	28									Calic
							68	32									Calic
							32	68									Calic
		2				2	64	20		12			2				Chert
20						4	60	8		4	22		2				Calic
28			4			4	56	8		8	24						Calic
16						6	60	2		16	14		2				Chalc Calic
16		4	6			4	28	4		30	34						Chalc Calic
10						28	28			32	12						Calic
		2				8	84	6					2				Chalc Calic
		6					80	20									Calic
							94	6									Calic

LD OBSERVATIONS

METER (PERCENT)				OTHER DELETERIOUS CLASTS PRESENT	SIZE DISTRIBUTION			GRADATION	MAXIMUM PARTICLE SIZE (CM)	PARTICLE SHAPE	REMA
DELETERIOUS					PERCENT OF TOTAL		< 3" %				
CHERT	TUFF	GLASS	OTHER		BOULDERS	COBBLES	GRAVEL				
				Caliche					17	A,SA,SR	Stream Chann
				Caliche					17	A,SA,SR	Stream Chann
				Caliche					15	A,SA,SR	Stream Chann
2				Chert,Caliche					12	A,SA,SR	Shallow Wash
2				Caliche					17	A,SA,SR	Shallow Wash
				Caliche					8	A,SA,SR	
2				Chalcedony, Caliche,Obsidian					9	A,SA,SR	Shallow Wash
				Chalcedony, Caliche					7	A,SA,SR	Stream Chann
				Caliche					8	SA,SR	Stream Chann
2				Chalcedony, Caliche					4	SA,SR	Stream Chann
				Caliche	0	10			4	SA,SR	Stream Chann
				Caliche	0	10				SA,SR	

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SUMMARY O
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29 MAY 81

UM LE	PARTICLE SHAPE	REMARKS
	A,SA,SR	Stream Channel
	A,SA,SR	Stream Channel
	A,SA,SR	Stream Channel
	A,SA,SR	Shallow Wash
	A,SA,SR	Shallow Wash
	A,SA,SR	
	A,SA,SR	Shallow Wash
	A,SA,SR	Stream Channel,Bottom
	SA,SR	Stream Channel,Bank
	SA,SR	Stream Channel,Bank
	SA,SR	Stream Channel,Bank
	SA,SR	

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SUMMARY OF FIELD PETROGRAPHIC
AND GRAIN-SIZE ANALYSES
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE B-1 PAGE 2 OF 5

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	CLAST COUNT, > 1 IN. TO ≤ 3 IN. DIAMETER (P								
				NON-DELETERIOUS						DELET		
				Qtz	Ls	Do	Gr	Vu	Vb	CALI-CHE	CHERT	T
325	DL-25	Dry Lake Valley, E	Aaf	4	90	6						
326	DL-26	Dry Lake Valley, E	Aaf	42	58							
327	DL-27	Dry Lake Valley, E	Aaf	8	72	20						
328	DL-28	Dry Lake Valley, C	Aaf	44	42	14						
329	DL-29	Dry Lake Valley, E	Aaf	8	64	22						
330	DL-30	Dry Lake Valley, E	Aaf	42	36	6			8	8		
331	DL-31	Dry Lake Valley, NE	Aaf	2	78	4			16			
332	DL-32	Dry Lake Valley, N	Aaf	8	76	16						
333	DL-33	Dry Lake Valley, N	Aaf	2	32	62		2				
334	DL-34	Dry Lake, Valley, NE	Aaf	2	10	88						
335	DL-35	Dry Lake Valley, N	Aaf	4	70	18						
336	DL-36	Dry Lake Valley, N	Aaf	4	64	12		20				
337	DL-37	Dry Lake Valley, NE	Aaf		66	4		14	16			

FIELD OBSERVATIONS

N. TO ≤ 3 IN. DIAMETER (PERCENT)							CLAST COUNT, > ½ IN. TO ≤ 1 IN. DIAMETER (PERCENT)											
		DELETERIOUS					NON-DELETERIOUS						DELETERIOUS					
'u	Vb	CALI-CHE	CHERT	TUFF	GLASS	OTHER	Qtz	Ls	Do	Gr	Vu	Vb	CALICHE	CHERT	TUFF	GLASS	OTHER	CL
								96	2					2				C
							18	82										C
							14	64	22									C
							34	32	34									C
				6			8	38	24			20	2				8	C
	8	8					36	42	8		2	4	6	2				C
	16						2	76	4			16					2	C
							8	28	62				2					C
2						2	8	26	66									C
							6	26	68									C
						8	2	90	8									C
20							8	80	4			8						C
4	16							76			14	8			2			S

ERVATIONS

(PERCENT)			OTHER DELETERIOUS CLASTS PRESENT	SIZE DISTRIBUTION			GRADATION	MAXIMUM PARTICLE SIZE (CM)	PARTICLE SHAPE	REMARKS
ETERIOUS				PERCENT OF TOTAL		< 3" %				
TUFF	GLASS	OTHER		BOULDERS	COBBLES	GRAVEL				
			Chert,Caliche	0	15			6	SA,SR	Stream Channel,Ban
			Caliche	0	20			8	SA,SR	Stream Channel
			Chert,Caliche	5	30			8	SA,SR	Stream Channel,Ban
			Caliche					10	A,SA	Shallow Wash
		8	Caliche	5	10			10	SA	Stream Channel,Ban
			Opal,Caliche					11	SA,SR	Shallow Wash
		2	Caliche					9	SA,SR	Stream Channel,Ban
			Caliche					8	A,SA	Surface
			Caliche					7	A,SA	Stream Channel,Ba
			Caliche					7	A,SA	Shallow Wash
			Caliche					7	SA,SR	Stream Channel,Ba
			Caliche					5	SA,SR	Stream Channel,Ba
2			Sulfur,Caliche					4	SA,SR	Stream Channel,Bo

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SUMMARY OF FIE
AND GRAIN-S
DRY LAKE VA

29 MAY 81 TABL

IMUM TICLE IZE M)	PARTICLE SHAPE	REMARKS
6	SA,SR	Stream Channel,Bank
8	SA,SR	Stream Channel
8	SA,SR	Stream Channel,Bank
	A,SA	Shallow Wash
	SA	Stream Channel,Bank
	SA,SR	Shallow Wash
	SA,SR	Stream Channel,Bank
	A,SA	Surface
	A,SA	Stream Channel,Bank
	A,SA	Shallow Wash
	SA,SR	Stream Channel,Bank
	SA,SR	Stream Channel,Bank
	SA,SR	Stream Channel,Bottom

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SUMMARY OF FIELD PETROGRAPHIC
AND GRAIN-SIZE ANALYSES
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE B 1 PAGE 3 OF 5

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	CLAST COUNT, > 1 IN. TO ≤ 3 IN. DIAMETER (PE								
				NON-DELETERIOUS						DELET		
				Qtz	Ls	Do	Gr	Vu	Vb	CALI-CHE	CHERT	T
338	DL-38	Dry Lake Valley, NE	Aaf		88	2		4	6			
339	DL-39	Dry Lake Valley, NE	Aaf	16	26	14		10	26	8		
340	DL-40	Dry Lake Valley, NE	Aaf	4	80	6				4		
341	DL-41	Dry Lake Valley, NE	Aaf	4	92	2				2		
342	DL-42	Dry Lake Valley, NE	Aaf	10	74	8			8			
343	DL-43	Dry Lake Valley, NE	Aaf		92	2				6		
344	DL-44	Dry Lake Valley, NE	Aaf	10	76	10				4		
345	DL-45	Dry Lake Valley, NE	Aaf		72	26				2		
346	DL-46	Dry Lake Valley, NE	Aaf		76	20				4		
347	DL-47	Dry Lake Valley, NE	Aaf	4	62	32				2		
348	DL-48	Dry Lake Valley, NE	Aaf	14	62	2		16			2	
349	DL-49	Dry Lake Valley, NE	Aaf		28	8		22				
350	DL-50	Dry Lake Valley, NW	Aaf		16			18	60	6		

FIELD OBSERVATIONS

1 IN. TO ≤ 3 IN. DIAMETER (PERCENT)							CLAST COUNT, > [illegible] IN. TO ≤ 1 IN. DIAMETER (PERCENT)											
US		DELETERIOUS					NON-DELETERIOUS						DELETERIOUS					
Vu	Vb	CALICHE	CHERT	TUFF	GLASS	OTHER	Qtz	Ls	Do	Gr	Vu	Vb	CALICHE	CHERT	TUFF	GLASS	OTHER	C
4	6						8	76	6		8	2						Cl
10	26	8					14	48	6		12	18	2					Ca
		4				6	10	82	4								4	Ca
		2					4	90	6									Ca
	8						4	78	10		4	4						Ca
		6						86	8				6					
		4					8	62	16				14					Ca
		2					12	78	10									Ca
		4					4	74	18				4					Cl
		2					12	54	24				10					Ca
6			2		4		12	64	4		10		4	6				Ch Ch
22				40	2		8	40	12		20	2		2	16			Gl
18	60	6					2	10			36	18	34					Ca

VATIONS										
ERCENT)			OTHER DELETERIOUS CLASTS PRESENT	SIZE DISTRIBUTION			GRADATION	MAXIMUM PARTICLE SIZE (CM)	PARTICLE SHAPE	REMARKS
TERIOUS				PERCENT OF TOTAL		< 3" %				
UFF	GLASS	OTHER		BOULDERS	COBBLES	GRAVEL				
			Clay, Caliche					8	A,SA,SR	Shallow Wash
			Caliche					10	A,SA,SR	Stream Channel
		4	Caliche					8	A,SA,SR	Shallow Wash
			Caliche					3	SA,SR	Stream Channel
			Caliche					4	SA,SR	Shallow Wash
								4	SA,SR	Stream Channel,Bank
			Caliche					3	SA,SR	Stream Channel,Bank
			Caliche					4	SA,SR	Shallow Wash
			Clay, Caliche					4	SA,SR	Shallow Wash
			Caliche					8	SA,SR	Shallow Wash
			Chalcedony, Chert,Caliche					3	A,SA,SR	Shallow Wash
5			Glass,Caliche					5	SA	Shallow Wash
			Caliche					5	SA	Shallow Wash

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SUMMARY OF FIELD PET
AND GRAIN-SIZE AN
DRY LAKE VALLEY, I

29 MAY 81
TABLE B 1

ON	MAXIMUM PARTICLE SIZE (CM)	PARTICLE SHAPE	REMARKS
	8	A,SA,SR	Shallow Wash
	10	A,SA,SR	Stream Channel
	8	A,SA,SR	Shallow Wash
	3	SA,SR	Stream Channel
	4	SA,SR	Shallow Wash
	4	SA,SR	Stream Channel,Bank
	3	SA,SR	Stream Channel,Bank
	4	SA,SR	Shallow Wash
	4	SA,SR	Shallow Wash
	8	SA,SR	Shallow Wash
	3	A,SA,SR	Shallow Wash
	5	SA	Shallow Wash
	5	SA	Shallow Wash

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BMO/AFRCE-MX

SUMMARY OF FIELD PETROGRAPHIC
AND GRAIN-SIZE ANALYSES
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE B-1

MAP NUMBER	FIELD STATION	LOCATION	GEOLOGIC UNIT	CLAST COUNT, > 1 IN. TO ≤ 3 IN. DIAMETER (PE							
				NON-DELETERIOUS						DELET	
				Qtz	Ls	Do	Gr	Vu	Vb	CALI-CHE	CHERT
351	DL-51	Dry Lake Valley, W	Aaf		10			10	46		6
352	DL-52	Dry Lake Valley, W	Aaf		12			8	52		
353	DL-53	Dry Lake Valley, NW	Aaf	26	6	6		34			

FIELD OBSERVATIONS

TO ≤ 3 IN. DIAMETER (PERCENT)						CLAST COUNT, > ½ IN. TO ≤ 1 IN. DIAMETER (PERCENT)											DE CLAS
	DELETERIOUS					NON-DELETERIOUS						DELETERIOUS					
Vb	CALICHE	CHERT	TUFF	GLASS	OTHER	Qtz	Ls	Do	Gr	Vu	Vb	CALICHE	CHERT	TUFF	GLASS	OTHER	
46		6	28			10	20			68			2				Opal
52			28			2				30	50			18			Chal Pumi
			28			4		6		48	16		6	20			Cali

NS									
T)		OTHER DELETERIOUS CLASTS PRESENT	SIZE DISTRIBUTION			GRADATION	MAXIMUM PARTICLE SIZE (CM)	PARTICLE SHAPE	REMARKS
US			PERCENT OF TOTAL		< 3" %				
LASS	OTHER		BOULDERS	COBBLES	GRAVEL				
		Opal,Caliche					12	A,SA	Stream Channel,Bank
		Chalcedony, Pumice,Caliche					9	A,SA	Shallow Wash
		Caliche,Ash					4	A,SA	Shallow Wash

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SUMMARY OF FIELD PETROG
AND GRAIN-SIZE ANALY
DRY LAKE VALLEY, NEVA

29 MAY 81 TABLE B 1

PARTICLE SHAPE	REMARKS
A,SA	Stream Channel,Bank
A,SA	Shallow Wash
A,SA	Shallow Wash

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SUMMARY OF FIELD PETROGRAPHIC
AND GRAIN-SIZE ANALYSES
DRY LAKE VALLEY, NEVADA

29 MAY 81 TABLE B-1

APPENDIX C

TRENCH LOGS

EXPLANATION OF TRENCH LOGS

Trench logs were completed for excavated trenches. Each log presented in this appendix is chosen from a group of trench logs so that it represents the general aggregate conditions and properties of that entire group. Occasionally, the full compliment of trenches in a group was not excavated due to low gravel percentages and/or advanced caliche development found in the first one or two trenches of that group. Detailed explanations of the trench logs headings are as follows:

COLUMN HEADING		EXPLANATION
BULK SAMPLE		Representative samples were obtained by channel sampling a trench wall. Overburden and, in some trenches, dense caliche layers were avoided during the sampling procedure.
	II -	100 lb. sample (2 bags) for road-base aggregate testing.
	III -	400 lb. sample (55 gallon barrel) for concrete aggregate testing.
DEPTH		Depth corresponds to depth below ground surface in meters and feet.
LITHOLOGY		Graphic representation of soil types present in excavation.
USCS		Unified Soil Classification System symbols. For detailed information see Table F-1.
CONSISTENCY		The consistency of the in-situ deposit was estimated by visual observation of the soil in the trench walls, ease (or difficulty) of excavation of the trench, and trench-wall stability. Consistency descriptions of coarse-grained soils (GW, GP, GM, GC, SW, SP, SM, SC) are as follows:

	DESCRIPTION
Very Loose (VL)	Will not hold vertical cut (when dry).

Loose (L)	Will hold vertical cut, but caves if disturbed.
Medium Dense (MD)	Holds vertical cut, even when disturb easily excavated.
Dense (D)	Holds vertical cut, difficult to excavate.
Very Dense (VD)	Very difficult to impossible to excavate.

SOIL DESCRIPTION

Except in cases where samples were classified based on laboratory data, the descriptions are based on visual classification. The procedures outlined in ASTM D 2487-69, Classification of Soils for Engineering Purposes and D 2488-69, Description of Soils (Visual-Manual Procedure) were followed. Solid lines across the column indicate known changes in the strata at the depth shown.

Definitions of some of the terms and criteria used to describe soils and conditions encountered during the excavation follow:

Descriptive Name	Name of soil, as determined by USCS, preceded by an adjective indicating the size range of the most abundant secondary material present.
Particle Size	For coarse-grained soils (sands and gravels) the size range of the particles visible to the unaided eye was estimated as fine, medium, coarse, or a combined range (e.g., fine to medium). These terms approximately correspond to the following sieve sizes:

Gravel	Fine	No. 4 to 3/4-inch sieve
	Coarse	3/4-inch to 3-inch sieve
Sand	Fine	No. 200 to No. 40 sieve
	Medium	No. 40 to No. 10 sieve
	Coarse	No. 10 to No. 4 sieve

Particle Shape	See Appendix B explanation pages.
Gradation	Gradations listed are those determined from percent amounts of boulders, cobbles, and gravel present. Descriptive terms used include: poor and well.

Poor(ly)	Predominantly one size or a range of sizes, with some intermediate sizes missing.
Well	Wide range in grain sizes present, with substantial amounts of most intermediate sizes.
Secondary Material	Percentage present by dry weight. Trace 5-12 percent Little 13-20 percent Some > 20 percent (e.g., Some slightly plastic silt)
Plasticity of Fines	See Appendix A explanation pages
HCL Reaction	As an aid for identifying calcium carbonate coatings and cementation, soil samples were tested in the field for their reaction to dilute hydrochloric acid. The intensity of the HCL reaction was described as none, weak, or strong.
Caliche	Caliche is a term applied to calcareous material of secondary accumulation. In this study, the definition includes both the soluble calcium (and other) salts and the clastic material (gravel, sand, silt or clay) in which the salts exist. See Table F-2 for a description of the stages of caliche development.
Cobbles and Boulders	See Appendix A explanation pages.
Lithology	The various rock types found in an excavated deposit are listed in order of decreasing abundance.
Remarks	This column was provided for comments regarding difficulty of excavation, caliche development, and backhoe refusal. Refusal indicates the inability of a JCB 3DIII backhoe (Case 680 equivalent) with a 2-foot wide bucket to excavate a trench to completion.
SIEVE ANALYSIS	The numbers cited represent the percentage by dry weight of each of the following soil components.

GR	Coarse aggregate particles that pass a 3-inch (75 mm) sieve but are predominantly retained on a No. 4 (4.75 mm) sieve.
SA	Fine aggregate particles that almost entirely pass a No. 4 sieve but are predominantly retained on a No. 200 (0.075 mm) sieve.
FI	Soil particles that pass a No. 200 sieve (silt and clay).

All percentages shown on logs are the result of laboratory testing.

E-TR-47-DL

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
		2		SM	medium dense	GRAVELY SAND, stage II caliche throughout.				
	1 2 3	4 6 8 10 12		SW-SM	medium dense	GRAVELLY SAND, fine to coarse, subrounded, well graded; some fine to coarse, subangular to subrounded gravel; trace non - plastic silt; strong HCl reaction; trace stage I caliche; rare cobble; volcanics, limestone/dolomite.		32	60	8
	4 5 6	14 16 18 20				'TOTAL DEPTH 13.0 ft. (4.0m)				

TRENCH DETAILS

SURFACE ELEVATION	4920 ft. (1450m)
DATE EXCAVATED	20 October 1980
SURFACE GEOLOGIC UNIT	Aafs
TRENCH LENGTH	17 ft. (5.2m)
TRENCH ORIENTATION	NE - SW

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TRENCH LOG OF DL-A-1
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-1

E-TR-47-DL

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
		2		GP-GM	medium dense	SANDY GRAVEL, stage II caliche throughout.				
	1 2 3	4 6 8 10 12		SW-SM	medium dense	GRAVELLY SAND, fine to coarse, subrounded, well graded; some fine to coarse, subrounded gravel; trace non - plastic silt; strong HCl reaction; stage II caliche in lenses; few cobbles; rare boulder; limestone/dolomite, volcanics.		44	50	6
	4 5 6	14 16 18 20				TOTAL DEPTH 13.0 ft. (4.0m)				

TRENCH DETAILS

SURFACE ELEVATION	4920 ft. (1450m)
DATE EXCAVATED	20 October 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	N - S

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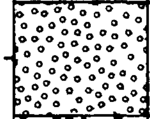
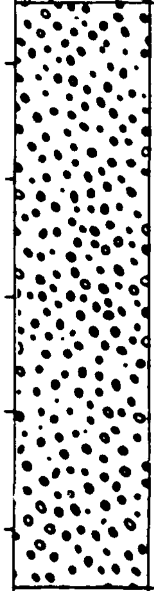
TRENCH LOG OF DL-A-4
DRY LAKE VALLEY, NEVADA

29 MAY 1981

FIGURE C-2

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
		2		GM	medium dense	SANDY GRAVEL, stage II caliche throughout.				
▥	1 2 3	4 6 8 10 12		GP-GM	medium dense	SANDY GRAVEL, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded sand; trace slightly plastic silt; strong HCl reaction; few cobbles, rare boulder; limestone/dolomite, quartzite, trace volcanics.		55	45	5
	4 5 6	14 16 18 20				TOTAL DEPTH 13.0 ft. (4.0m)				

TRENCH DETAILS

SURFACE ELEVATION	: 4960 ft. (1512m)
DATE EXCAVATED	: 21 October 1980
SURFACE GEOLOGIC UNIT	: Aafg
TRENCH LENGTH	: 16 ft. (4.9m)
TRENCH ORIENTATION	: E - W

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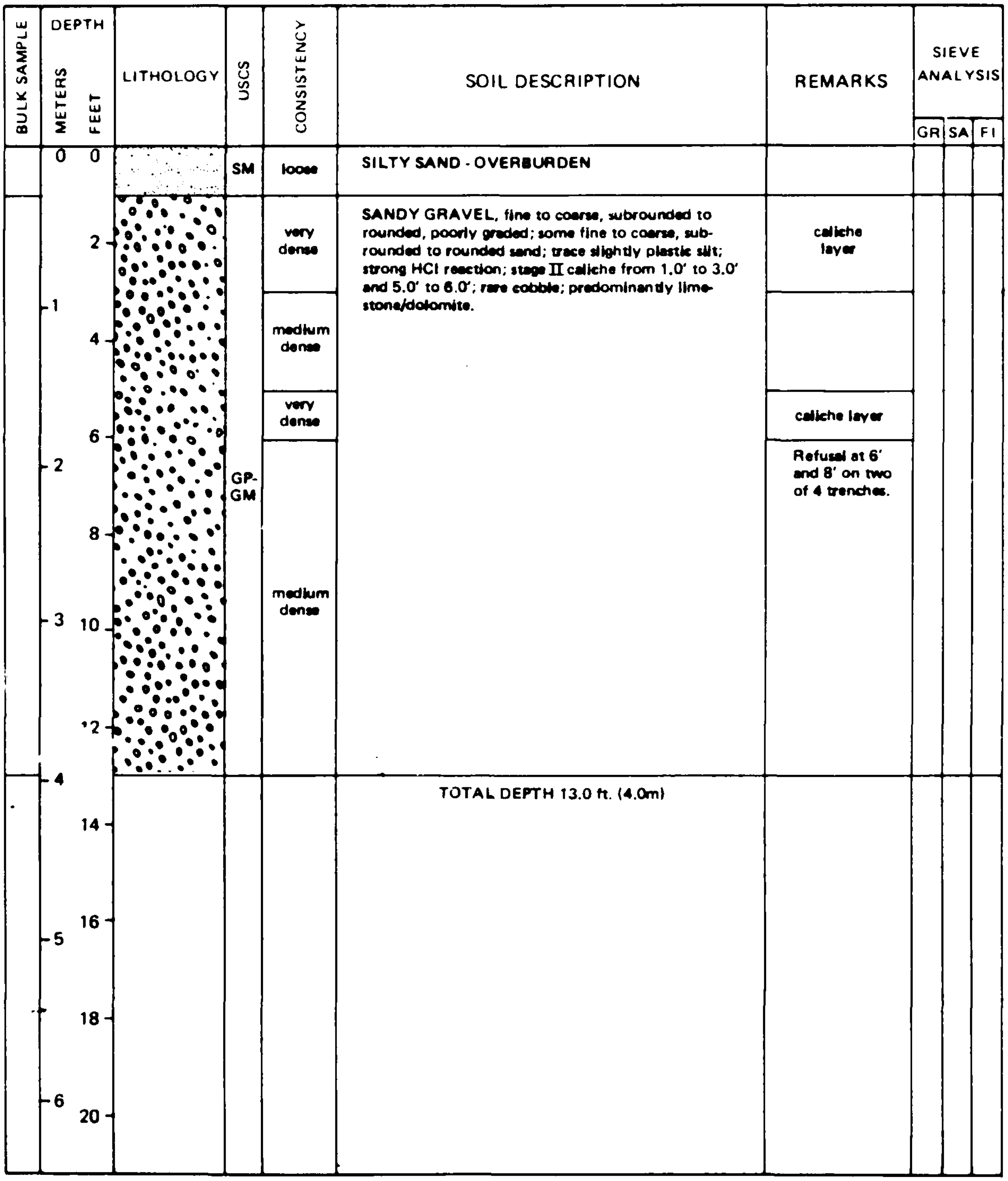
BMO/AFRCE-MX

TRENCH LOG OF DL-A-8
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-3

E-TR-47-DL



BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
		2		GP-GM	very dense	**SANDY GRAVEL**, fine to coarse, subrounded to rounded, poorly graded; some fine to coarse, subrounded to rounded sand; trace slightly plastic silt; strong HCl reaction; stage II caliche from 1.0' to 3.0' and 5.0' to 6.0'; rare cobble; predominantly limestone/dolomite.	caliche layer			
	1	4			medium dense					
		6			very dense		caliche layer			
	2	8			medium dense		Refusal at 6' and 8' on two of 4 trenches.			
	3	10								
		12								
	4					TOTAL DEPTH 13.0 ft. (4.0m)				
		14								
	5	16								
		18								
	6	20								

TRENCH DETAILS

SURFACE ELEVATION	5575 ft. (1699m)
DATE EXCAVATED	22 October 1980
SURFACE GEOLOGIC UNIT	Aaf
TRENCH LENGTH	16 ft. (4.9m)
TRENCH ORIENTATION	E - W

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TRENCH LOG OF DL-A-14
DRY LAKE VALLEY, NEVADA

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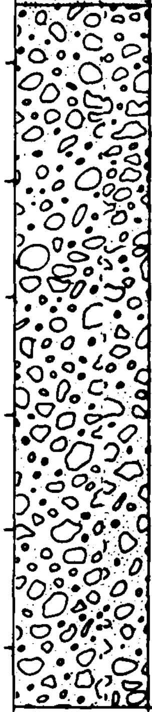
FIGURE C-4

E-TR-47-DL

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	GRAVELLY SAND, silty - OVERBURDEN				
	1 2 3	2 4 6 8 10 12		GW-GM	medium dense	SANDY GRAVEL, fine to coarse, subrounded, well graded; some fine to coarse, subrounded sand; trace slightly plastic silt; strong HCl reaction; several lenses of stage II caliche; few cobbles; limestone/dolomite, quartzite.		55	37	8
	4 5 6	14 16 18 20				TOTAL DEPTH 13.0 ft. (4.0m)				

TRENCH DETAILS

SURFACE ELEVATION	4760 ft. (1451m)
DATE EXCAVATED	28 October 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	N - S

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TRENCH LOG OF DL-A-16
DRY LAKE VALLEY, NEVADA

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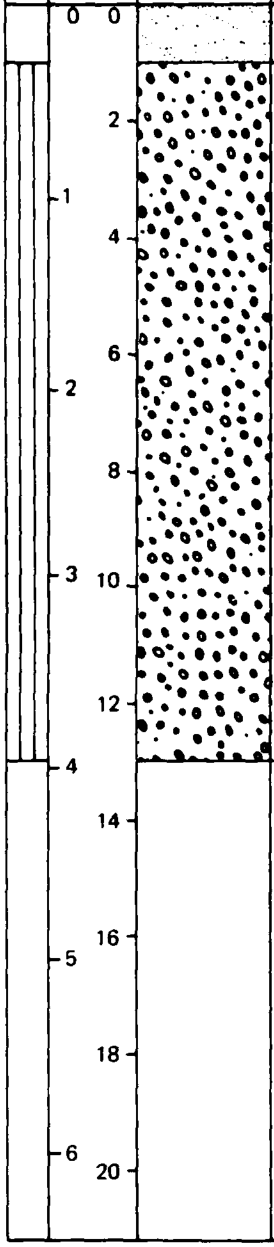
FIGURE C-5



BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	**SILTY SAND - OVERBURDEN**				
				GP-GM		**SANDY GRAVEL**, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded sand; trace slightly plastic silt; strong HCl reaction; stage II caliche from 3′ to 4′; few cobbles; limestone/dolomite, quartzite.		57	34	9
					dense		caliche layer			
					medium dense					
						TOTAL DEPTH 13.0 ft. (4.0m)				

TRENCH DETAILS

SURFACE ELEVATION	5065 ft. (1544m)
DATE EXCAVATED	28 October 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	N - S

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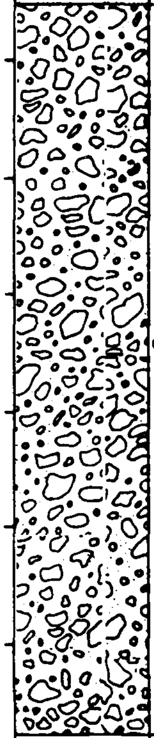
TRENCH LOG OF DL-A-20
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C 6

E-TR-47-DL

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
	1 2 3 4	2 4 6 8 10 12		GW-GM	medium dense	SANDY GRAVEL, fine to coarse, subrounded, well graded; some fine to coarse, subrounded sand; trace slightly plastic silt; strong HCl reaction; rare cobble; limestone/dclomite, quartzite, volcanics.		50	44	6
	5 6	14 16 18 20				TOTAL DEPTH 13.5 ft. (4.1m)				

TRENCH DETAILS

SURFACE ELEVATION	4810 ft. (1466m)
DATE EXCAVATED	28 October 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	16 ft. (4.9m)
TRENCH ORIENTATION	NE - SW

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TRENCH LOG OF DL-A-23
DRY LAKE VALLEY, NEVADA

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FIGURE C-7

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
		2		SM	medium dense	GRAVELLY SAND, stage II caliche throughout.				
	1 2 3 4	4 6 8 10 12		SW-SM	medium dense	GRAVELLY SAND, fine to coarse, subrounded, well graded; some fine to coarse, subrounded gravel; trace slightly plastic silt; strong HCl reaction; stage II caliche from 8.5' - 9.0'; rare cobble; limestone/dolomite, quartzite, volcanics.	caliche layer	23	70	7
	5 6	14 16 18 20				TOTAL DEPTH 13.7 ft. (4.2m)				

TRENCH DETAILS

SURFACE ELEVATION	4820 ft. (1469m)
DATE EXCAVATED	29 October 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	16 ft. (4.9m)
TRENCH ORIENTATION	N - S

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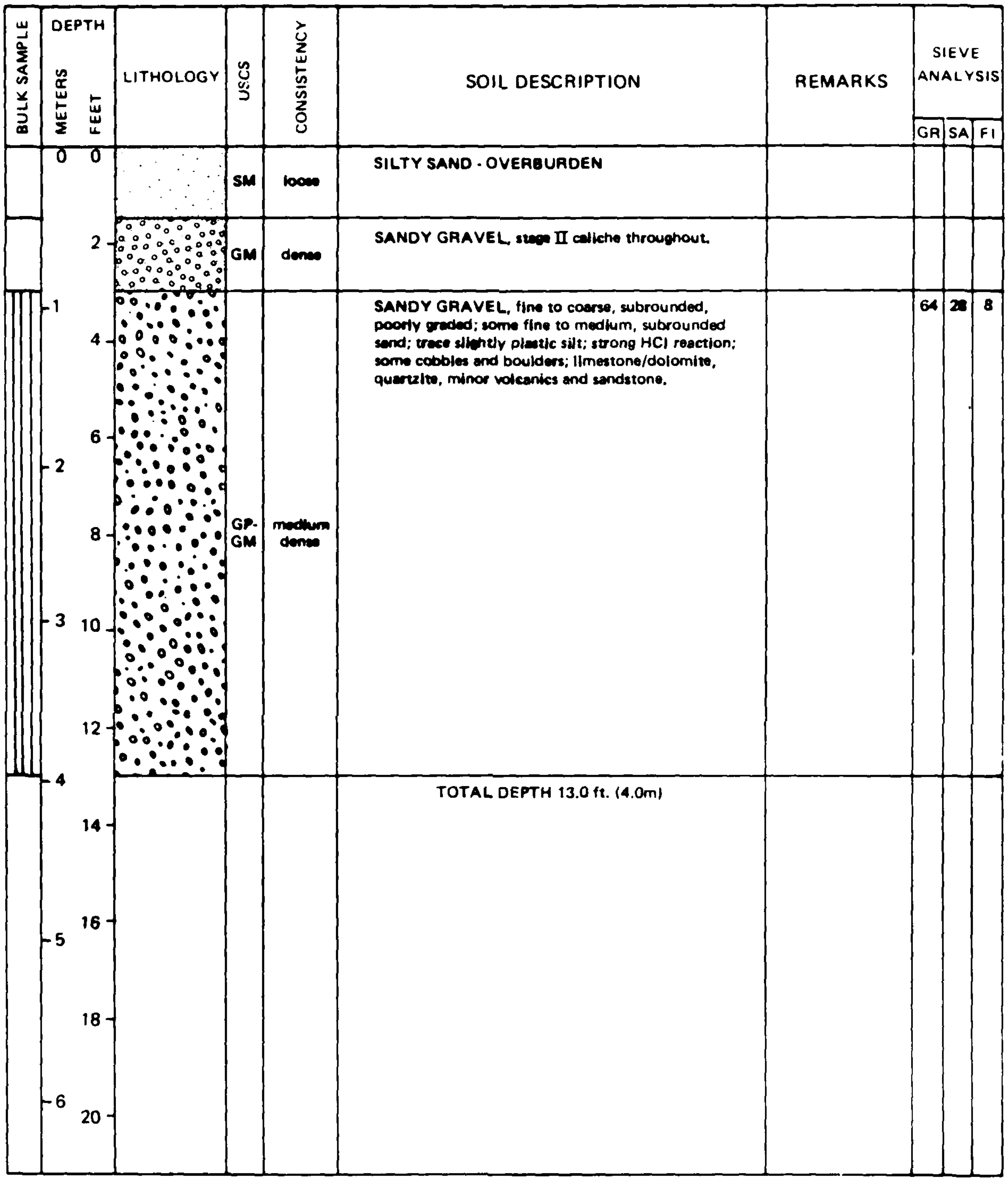
TRENCH LOG OF DL-A-26
DRY LAKE VALLEY, NEVADA

29 MAY 1981

FIGURE C-8

E-TR-47-DL



BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	**SILTY SAND - OVERBURDEN**				
		2		GM	dense	**SANDY GRAVEL**, stage II caliche throughout.				
	1	4		GP-GM	medium dense	**SANDY GRAVEL**, fine to coarse, subrounded, poorly graded; some fine to medium, subrounded sand; trace slightly plastic silt; strong HCl reaction; some cobbles and boulders; limestone/dolomite, quartzite, minor volcanics and sandstone.		64	28	8
	4					TOTAL DEPTH 13.0 ft. (4.0m)				

TRENCH DETAILS

SURFACE ELEVATION	4930 ft. (1503m)
DATE EXCAVATED	29 October 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	NE - SW

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TRENCH LOG OF DL-A-30
DRY LAKE VALLEY, NEVADA

29 MAY 1981

FIGURE C-9

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	**SILTY SAND - OVERBURDEN**				
		2		SM	dense	**GRAVELLY SAND**, stage III caliche throughout.				
	1 2 3	4 6 8 10 12		SP	medium dense	**GRAVELLY SAND**, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded gravel; strong HCl reaction; stage I caliche in several thin layers; some cobbles; predominantly volcanics, minor limestone and quartzite.		21	78	1
	4 5 6	14 16 18 20				TOTAL DEPTH 12.7 ft. (3.9m)				

TRENCH DETAILS

SURFACE ELEVATION	5130 ft. (1564m)
DATE EXCAVATED	31 October 1980
SURFACE GEOLOGIC UNIT	Aafs
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	N - S

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TRENCH LOG OF DL-A-34
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-10

BULK SAMPLE*	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI
	0	0	░	SM	loose	**SILTY SAND - OVERBURDEN**				
		2	░	SM	medium dense	**GRAVELLY SAND,** stage II caliche throughout.				
	1 2	4 6	░	SP-SM	medium dense very dense	**GRAVELLY SAND,** fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded gravel; trace silt; strong HCl reaction; some stage I caliche, stage II caliche from 6' to 7'; predominantly volcanics; little limestone/dolomite, quartzite, chert.	refusal			
	3 4 5 6	8 10 12 14 16 18 20				TOTAL DEPTH 7.0 ft. (2.1m)				

TRENCH DETAILS

SURFACE ELEVATION	5100 ft. (1554m)
DATE EXCAVATED	1 November 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	14 ft. (4.3m)
TRENCH ORIENTATION	N - S

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TRENCH LOG OF DL-A-36
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-11

BULK SAMPLE	DEPTH		LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS		
	METERS	FEET						GR	SA	FI
	0	0	▨	SM	loose	SILTY SAND, stage II caliche from 1.0' to 1.5' - OVERBURDEN.				
	1 2	2 4 6 8	▨	SW-SM	medium dense	GRAVELLY SAND, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded gravel; trace silt; strong HCl reaction; some stage II caliche in lenses; some cobbles; predominantly volcanics, some limestone/dolomite, minor chert.				
	3	10	▨	SM	dense very dense	GRAVELLY SAND, stage III caliche throughout.	difficult excavation refusal			
	4 5 6	12 14 16 18 20				TOTAL DEPTH 11.5 ft. (3.5m)				

TRENCH DETAILS

SURFACE ELEVATION	4880 ft. (1487m)
DATE EXCAVATED	1 November 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	N - S

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TRENCH LOG OF DL-A-38
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-12

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI
	0	0	▨	SM	loose	**SILTY SAND**, stage II caliche from 1.0' to 1.5' - OVERBURDEN.				
	1 2	2 4 6 8	▨	SW-SM	medium dense	**GRAVELLY SAND**, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded gravel; trace silt; strong HCl reaction; some stage II caliche in lenses; some cobbles; predominantly volcanics, some limestone/dolomite, minor chert.				
	3	10	▨	SM	dense very dense	**GRAVELLY SAND**, stage III caliche throughout.	difficult excavation refusal			
	4 5 6	12 14 16 18 20				TOTAL DEPTH 11.5 ft. (3.5m)				

TRENCH DETAILS

SURFACE ELEVATION	4880 ft. (1487m)
DATE EXCAVATED	1 November 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	N - S

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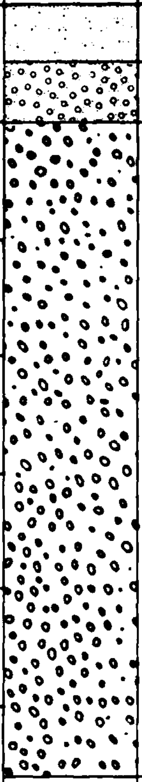
TRENCH LOG OF DL-A-38
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-12



BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	GRAVELLY SAND, silty - OVERBURDEN				
				GM	dense	SANDY GRAVEL, stage II caliche throughout.				
		2		GP-GM	medium dense	SANDY GRAVEL, fine to coarse, subrounded poorly graded; some fine to coarse, subrounded sand; trace silt; strong HCl reaction; stage II caliche from 5.0′ to 5.5′; some cobbles, rare boulders; limestone, dolomite, quartzite.	caliche layer	62	30	8
	4					TOTAL DEPTH 13.2 ft. (4.0m)				

Depth scale: METERS 0, 1, 2, 3, 4, 5, 6; FEET 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

TRENCH DETAILS

SURFACE ELEVATION	4840 ft. (1475m)
DATE EXCAVATED	1 November 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	NW - SE

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TRENCH LOG OF DL-A-40
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-13

E-TR-47-DL

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
		2		SM	dense	GRAVELLY SAND, stage III caliche throughout.				
	1	4		GP-GM	medium dense	SANDY GRAVEL, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded *gravel; trace silt; strong HCl reaction; few cobbles;* limestone/dolomite, quartzite, volcanics.				
	2	6		SM	very dense	GRAVELLY SAND, stage III caliche throughout.	refusal			
	3 4 5 6	8 10 12 14 16 18 20				TOTAL DEPTH 7.0 ft. (2.1m)				

TRENCH DETAILS

SURFACE ELEVATION	5200 ft. (1585m)
DATE EXCAVATED	1 November 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	12 ft. (3.7m)
TRENCH ORIENTATION	NW - SE

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TRENCH LOG OF DL-A-43
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-14

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI
	0	0 2		SP-SM	medium dense	**GRAVELLY SAND**, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded gravel; trace silt; strong HCl reaction; some stage II caliche; some cobbles; limestone/dolomite, volcanics				
	1	4		GP-GM	very dense	**SANDY GRAVEL**, stage III caliche throughout.				
	2 3	6 8 10		SP-SM	medium dense very dense	**GRAVELLY SAND**, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded gravel; trace silt; strong HCl reaction; some stage III caliche from 8' to 9' and at 11'; some cobbles; limestone/dolomite, volcanics.	caliche layer refusal			
	4 5 6	12 14 16 18 20				TOTAL DEPTH 11.0 ft. (3.3m)				

TRENCH DETAILS

SURFACE ELEVATION	5145 ft. (1568m)
DATE EXCAVATED	2 November 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	16 ft. (4.9m)
TRENCH ORIENTATION	N - S

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TRENCH LOG OF DL-A-45
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-15

AD-A113 125 ERTEC WESTERN INC. LONG BEACH CA F/G 8/7
DETAILED AGGREGATE RESOURCES STUDY, DRY LAKE VALLEY, NEVADA.(U)
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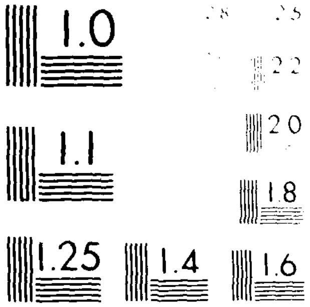
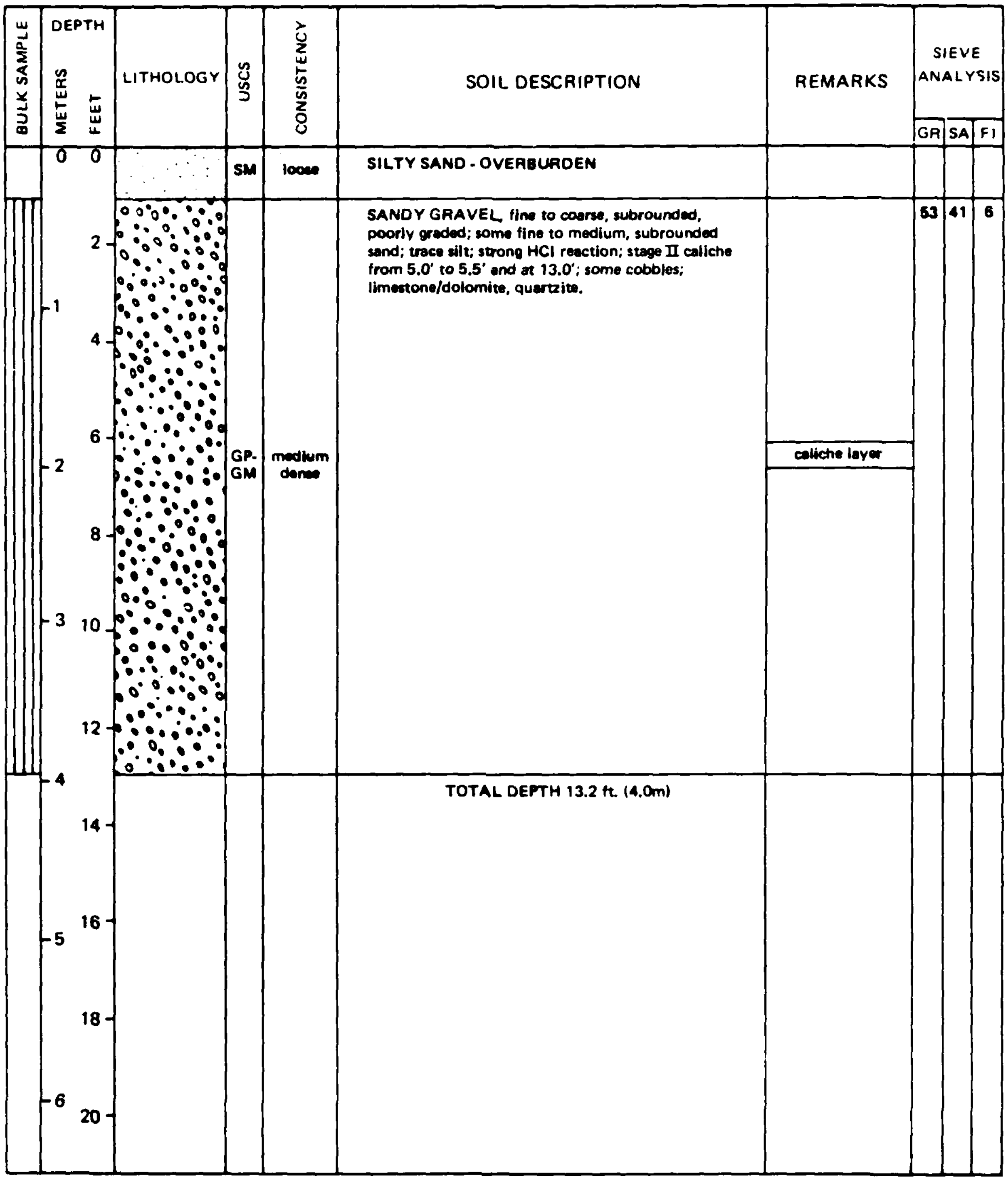

1.0
2.8
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6



BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
				GP-GM	medium dense	SANDY GRAVEL, fine to coarse, subrounded, poorly graded; some fine to medium, subrounded sand; trace silt; strong HCl reaction; stage II caliche from 5.0' to 5.5' and at 13.0'; some cobbles; limestone/dolomite, quartzite.	caliche layer	53	41	6
						TOTAL DEPTH 13.2 ft. (4.0m)				

TRENCH DETAILS

SURFACE ELEVATION : 4995 ft. (1522m)
DATE EXCAVATED : 2 November 1980
SURFACE GEOLOGIC UNIT : Aafg
TRENCH LENGTH : 17 ft. (5.2m)
TRENCH ORIENTATION : E - W

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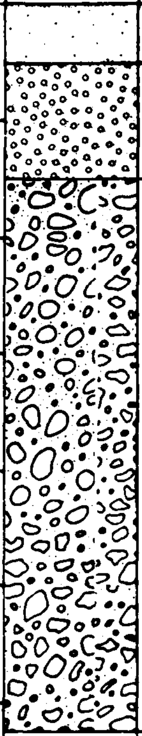
TRENCH LOG OF DL-A-47
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-16

E-TR-47-DL



BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
		2		GM	dense	SANDY GRAVEL, stage III caliche throughout.				
	1 2 3	4 6 8 10 12		GW	medium dense	SANDY GRAVEL, fine to coarse, subrounded, well graded; some fine to coarse, subrounded sand; strong HCl reaction; trace stage I caliche, stage II caliche from 5.0' to 5.5'; some cobbles, rare boulder; limestone/dolomite, quartzite, minor volcanics.		49	48	3
	4 5 6	14 16 18 20				TOTAL DEPTH 12.5 ft. (3.8m)				

TRENCH DETAILS

SURFACE ELEVATION	5515 ft. (1681m)
DATE EXCAVATED	3 November 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	15 ft. (4.6m)
TRENCH ORIENTATION	N - S

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TRENCH LOG OF DL-A-52
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-17

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
		2		GM	very dense	SANDY GRAVEL, silty, stage III caliche throughout.				
	1 2	4 6 8		GP-GM	medium dense	SANDY GRAVEL, fine to coarse, subrounded, poorly graded; some fine to medium, subrounded sand; trace silt; strong HCl reaction; some cobbles, rare boulder; predominantly limestone/dolomite, little quartzite. mite, little quartzite.		61	29	10
				GP-GM	very dense	SANDY GRAVEL, stage III caliche.	refusal			
	3 4 5 6	10 12 14 16 18 20				TOTAL DEPTH 9.2 ft. (2.8m)				

TRENCH DETAILS

SURFACE ELEVATION	5695 ft. (1736m)
DATE EXCAVATED	3 November 1980
SURFACE GEOLOGIC UNIT	Aafg
TRENCH LENGTH	14 ft. (4.3m)
TRENCH ORIENTATION	NW - SE

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TRENCH LOG OF DL-A-54
DRY LAKE VALLEY, NEVADA

29 MAY 1981

FIGURE C-18

E-TR-47-DL

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	SILTY SAND - OVERBURDEN				
	1	2		SM	very dense	GRAVELLY SAND, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded gravel; little silt; stage III caliche throughout.				
	2	4 6 8		SM	medium dense	SILTY SAND, fine, subrounded, poorly graded; some slightly plastic silt; little gravel; strong HCl reaction; stage I caliche throughout; limestone/dolomite, volcanics, quartzite.				
	3 4 5 6	10 12 14 16 18 20				TOTAL DEPTH 9.0 ft. (2.7m)				

TRENCH DETAILS

SURFACE ELEVATION	5585 ft. (1702m)
DATE EXCAVATED	3 November 1980
SURFACE GEOLOGIC UNIT	Aafs
TRENCH LENGTH	13 ft. (4.0m)
TRENCH ORIENTATION	NE - SW

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TRENCH LOG OF DL-A-57
DRY LAKE VALLEY, NEVADA

29 MAY 81

FIGURE C-19

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SIEVE ANALYSIS SA	SIEVE ANALYSIS FI
	0	0		SM	loose	**SILTY SAND, fine to medium, subrounded, poorly graded; some slightly plastic silt; strong HCl reaction; stage II caliche from 1.5' to 2.0'**				
	1 2 3	2 4 6 8 10		SP	medium dense	**GRAVELLY SAND, fine to coarse, subrounded, poorly graded; some fine to coarse, subrounded gravel; strong HCl reaction; little stage II caliche; volcanics, limestone/dolomite, quartzite, chert.**		20	76	4
					v. dense	**stage III caliche**	**refusal**			
	4 5 6	12 14 16 18 20				**TOTAL DEPTH 11.0 ft. (3.3m)**				

TRENCH DETAILS

SURFACE ELEVATION : 5100 ft. (1554m)
DATE EXCAVATED : 3 November 1980
SURFACE GEOLOGIC UNIT : Aals
TRENCH LENGTH : 15 ft. (4.6m)
TRENCH ORIENTATION : N - S

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TRENCH LOG OF DL-FA-2
DRY LAKE VALLEY, NEVADA

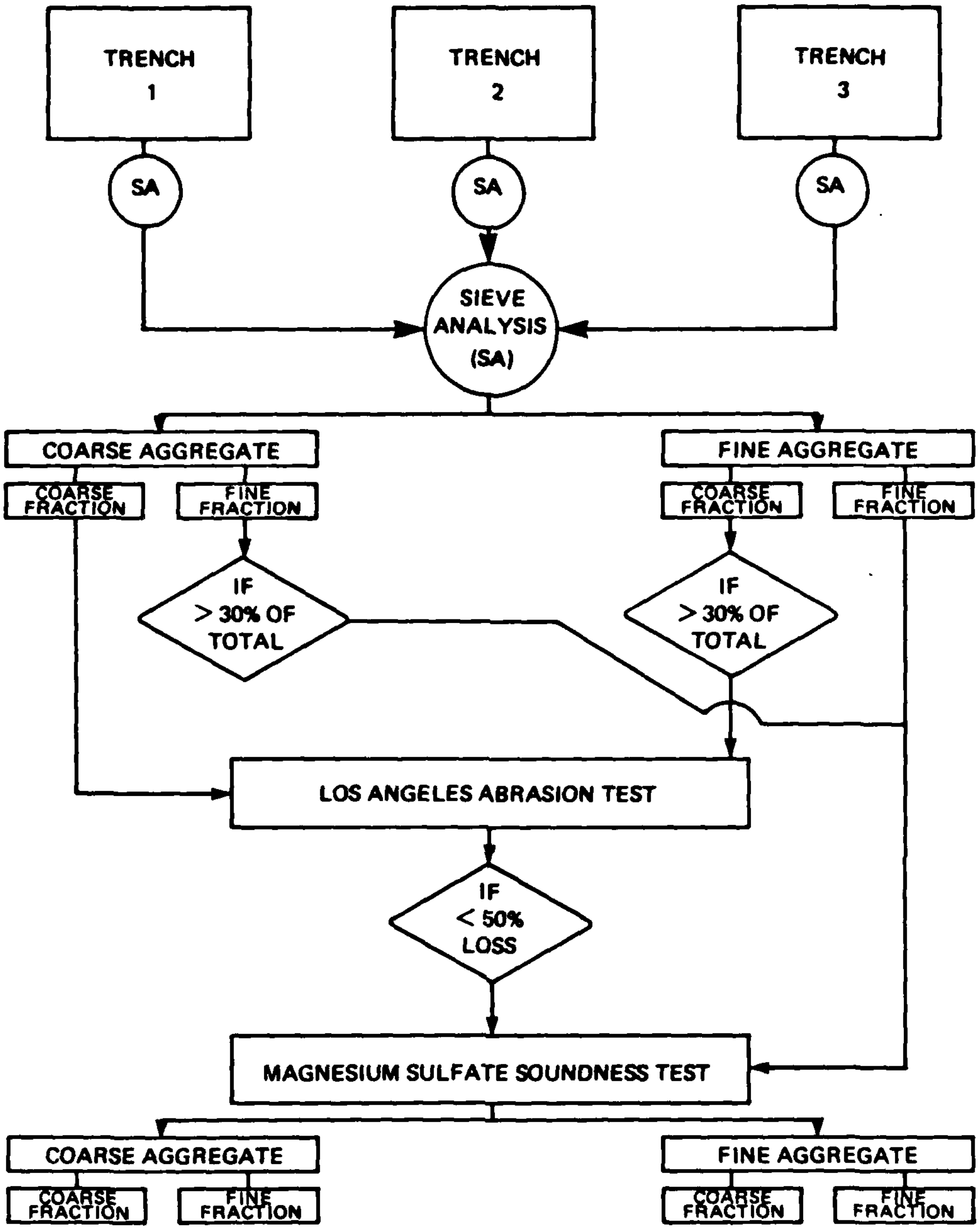
29 MAY 81

FIGURE C-20

APPENDIX D

FLOW DIAGRAM - ROAD-BASE AGGREGATES TESTING

FLOW DIAGRAM - CONCRETE TRIAL MIX DESIGN AND TESTING



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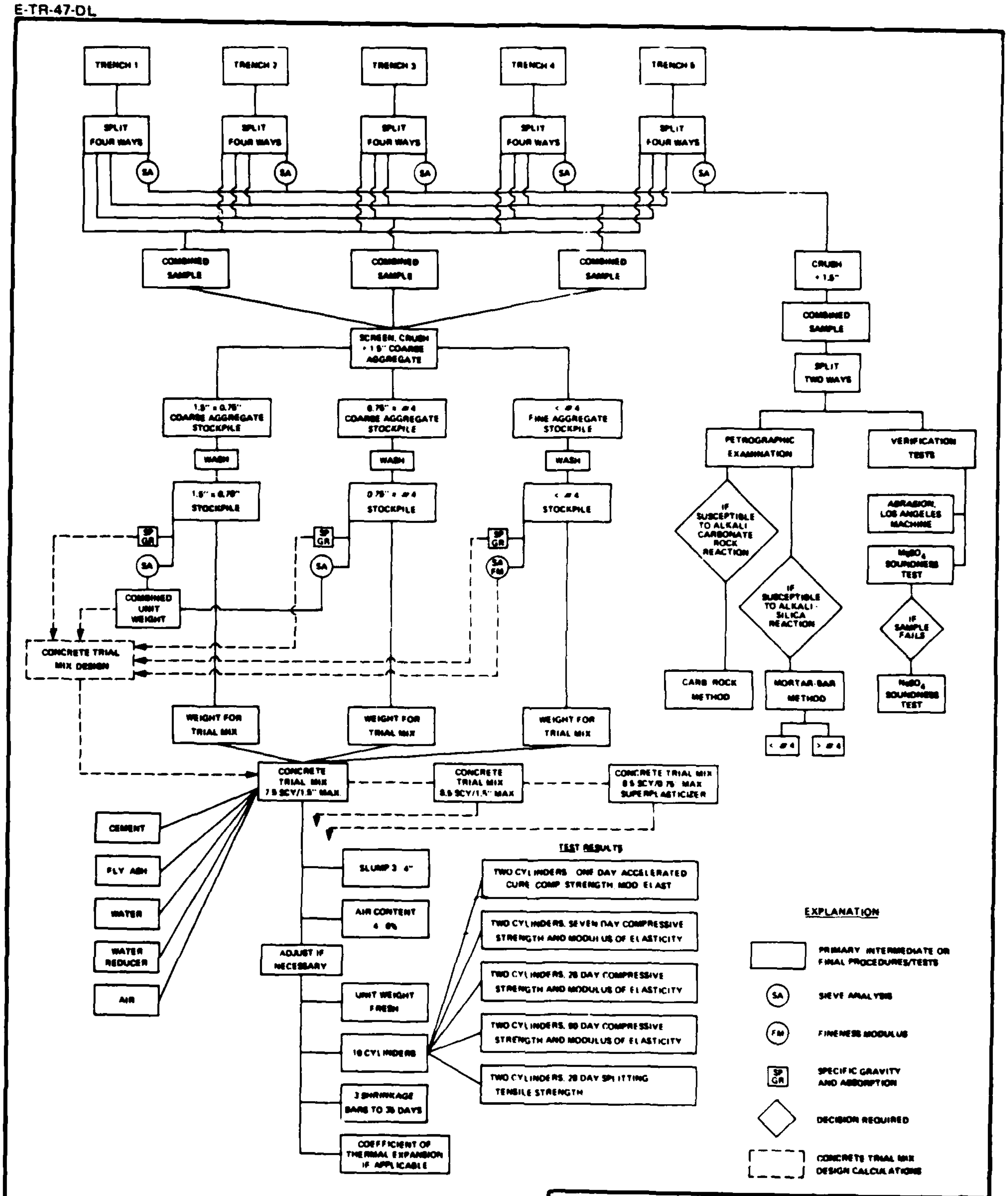
FLOW DIAGRAM —
ROAD-BASE AGGREGATES
TESTING

29 MAY 81

FIGURE D-1



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FLOW DIAGRAM – CONCRETE TRIAL MIX DESIGN AND TESTING

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FIGURE D-2

APPENDIX E

CHEMICAL ANALYSES OF CEMENT, FLY ASH, AND WATER USED IN CONCRETE TRIAL MIXES

	PROPERTY ANALYZED	TOTAL PERCENTAGE OF SAMPLE	MINIMUM OR MAXIMUM REQUIREMENTS
CEMENT ASTM C 150, TYPE II	SiO_2	26.8	20.0 MIN.
	AL_2O_3	1.95	6.0 MAX.
	Fe_2O_3	2.71	6.0 MAX.
	MgO	1.57	6.0 MAX.
	ALKALIES (Na_2O + 0.658 K_2O)	0.53	0.60 MAX.
	LOSS ON IGNITION	0.56	3.0 MAX.
	SO_3	1.97	3.0 MAX.
	INSOLUBLE RESIDUE	0.61	0.75 MAX.
FLY ASH ASTM C 618, CLASS F	SiO_2	67.7	–
	AL_2O_2	17.2	–
	Fe_2O_3	8.34	–
	TOTAL	93.24	70.0 MIN.
	MgO	1.69	5.0 MAX.
	SO_3	0.14	5.0 MAX.
	Na_2O (OPTIONAL)	1.68	1.5 MAX.
	MOISTURE	0.08	3.0 MAX.
	LOSS ON IGNITION	0.63	12.0 MAX.
WATER CALIF. DEPT. TRANS. SEC. 90 - 2.03	pH	7.5	–
	COLOR	0 - 5	–
	SO_4	8 ppm	1300 ppm
	Cl	10.6 ppm	650 ppm
	OIL AND GREASE	NONE	NONE

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CHEMICAL ANALYSES OF CEMENT,
FLY ASH, AND WATER USED IN
CONCRETE TRIAL MIXES

29 MAY 81

TABLE E-1

APPENDIX F

UNIFIED SOIL CLASSIFICATION SYSTEM

SUMMARY OF CALICHE DEVELOPMENT

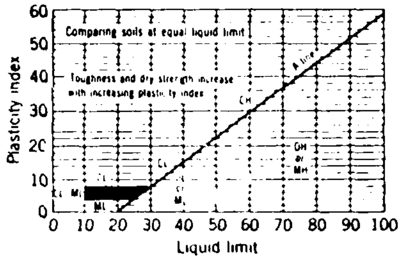
ERTEC WESTERN GEOLOGIC UNIT CROSS REFERENCE

APPENDIX F

UNIFIED SOIL CLASSIFICATION SYSTEM

SUMMARY OF CALICHE DEVELOPMENT

ERTEC WESTERN GEOLOGIC UNIT CROSS REFERENCE

Field Identification Procedures (*Excluding particles larger than 3 in. and basing fractions on estimated weights*)						Group Symbols[a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria		
Coarse-grained soils More than half of material is *larger* than No. 200 *sieve size*[b] (The No. 200 sieve size is about the smallest particle visible to naked eye)	Gravels More than half of coarse *fraction* is *larger* than No. 4 sieve size (For visual classification, the ¼ in. *size* may be used as equivalent to the No. 4 sieve size)	Clean gravels (little or no fines)	Wide range in grain size and *substantial* amounts of all intermediate particle sizes			*GW*	*Well graded gravels*, gravel-sand mixtures, little or no fines	Give typical name, indicate approximate *percentages of sand* and gravel, maximum size, angularity, surface condition, and hardness of the coarse grains, local or geologic name and other pertinent descriptive information, and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly, about 20%, hard, angular gravel particles ¼-in maximum size, rounded and subangular sand grains coarse to fine, about 15% non-*plastic fines* with low dry strength, well compacted and moist in place, alluvial sand, (*SM*)	Use grain size curve in identifying the *fractions* as given under field identification Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than No. 200 *sieve size*) *coarse grained* soils are classified as follows Less than 5% GW, GP, SW, SP More than 12% GM, GC, SM, SC 5% to 12% *Borderline* cases requiring use of dual symbols	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing			*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines			Not meeting all gradation requirements for *GW*	
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)			*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures			Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)			*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures			Atterberg limits above "A" line, with *PI* greater than 7	
	Sands More than half of coarse *fraction* is *smaller* than No. 4 sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle *sizes*			*SW*	Well graded sands, gravelly sands, little or no fines			$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a *range of sizes* with some intermediate sizes missing			*SP*	Poorly graded sands, gravelly sands, little or no fines			Not meeting all gradation requirements for *SW*	
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)			*SM*	Silty sands, poorly graded sand-silt mixtures			Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)			*SC*	Clayey sands, poorly graded sand-clay mixtures			Atterberg limits below "A" line with *PI* greater than 7	
	Identification Procedures on Fraction Smaller than No. 40 Sieve Size										
Fine-grained soils More than half of material is *smaller* than No. 200 sieve *size*			Dry Strength (*crushing* characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)						
	Silts and clays liquid limit less than 50		None to slight	Quick to slow	*None*	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with *slight* plasticity	Give typical name, indicate degree and character of plasticity, amount and maximum size of coarse grains, colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and *remoulded* states, moisture and drainage conditions Example: *Clayey silt*, brown, slightly plastic, small percentage of fine sand, numerous vertical root holes, firm and dry in place, loess, (*ML*)		 Plasticity chart for laboratory classification of fine grained soils	
			Medium to high	None to very slow	Medium	*CL*	*Inorganic* clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
			Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-*clays of low plasticity*				
	Silts and clays liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts				
			High to very high	None	*High*	*CH*	Inorganic clays of high plasticity, fat clays				
			Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity				
Highly Organic Soils			Readily identified by colour, odour, spongy *feel* and *frequently* by *fibrous* texture			*Pt*	Peat and other highly organic soils				

From Wagner, 1957.

[a] *Boundary classifications* Soils possessing characteristics of two groups are designated by combinations of group symbols For example *GW-GC*, well graded gravel-sand mixture with clay binder.

[b] All sieve sizes on this chart are U S standard

Field Identification Procedure for Fine Grained Soils or Fractions

These procedures are to be performed on the minus No. 40 sieve size particles, approximately $\frac{1}{64}$ in For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests

Dilatancy (Reaction to shaking)

After removing particles larger than No 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy When the sample is squeezed between the fingers, the water and gloss *disappear from* the surface, the pat stiffens and finally it cracks or crumbles The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil

Very fine clean sands give the quickest and most distinct reaction whereas *a plastic clay has no reaction* Inorganic silts, such as a typical rock flour, show a moderately quick reaction

Dry Strength (Crushing characteristics)

After removing particles larger than No. 40 sieve size, mould a pat of soil to the consistency of putty, adding water if necessary Allow the pat to dry *completely by oven, sun or air drying*, and then test its strength by breaking and crumbling between the fingers This strength is a measure of the character and quantity of the colloidal fraction contained in the soil The dry strength increases with increasing plasticity

High dry strength is characteristic for clays of the CH group A typical inorganic silt possesses only very slight dry strength Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen Fine sand feels gritty whereas a typical silt has the *smooth feel of flour*

Toughness (Consistency near plastic limit)

After removing particles larger than the No 40 sieve *size*, a *specimen of* soil about one half inch cube in size, is moulded to the consistency of putty If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation Then the specimen is rolled out by hand on a smooth surface or *between the palms* into a thread about one-eight inch in diameter The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles

The tougher the thread near the plastic limit and the stiffer the lump when *it finally crumbles, the more potent is the* colloidal clay fraction in the soil Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line

Highly organic clays have a very weak and spongy feel at the plastic limit.

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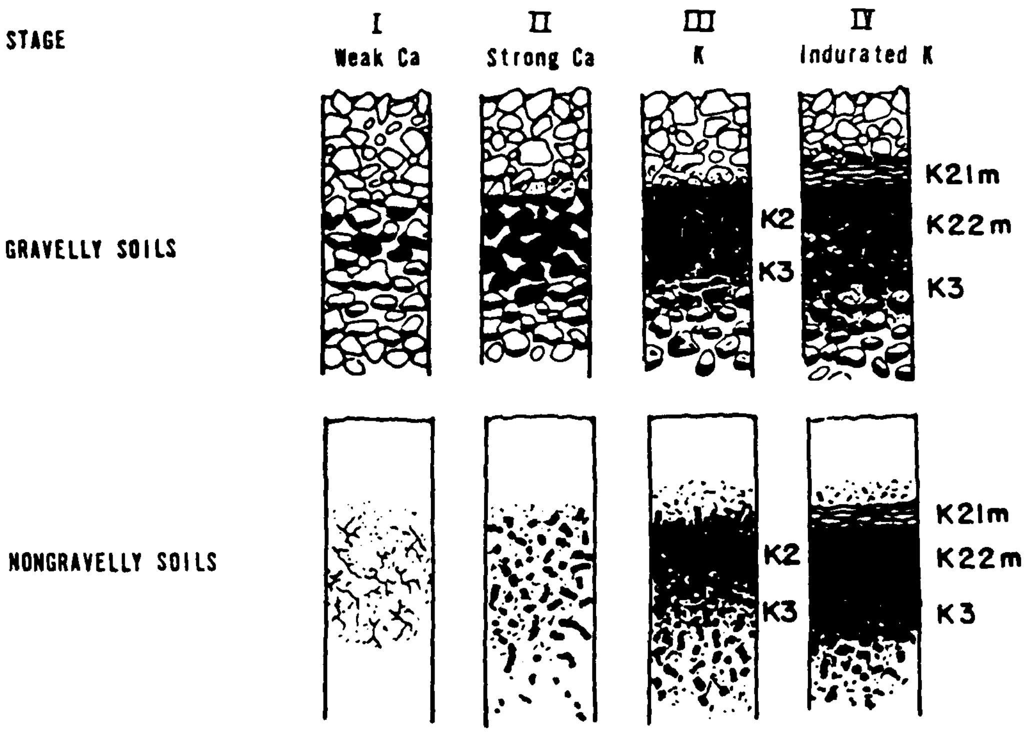
UNIFIED SOIL CLASSIFICATION SYSTEM

29 MAY 81

FIGURE F-1

DIAGNOSTIC CARBONATE MORPHOLOGY

STAGE	GRAVELLY SOILS	NONGRAVELLY SOILS
I	Thin, discontinuous pebble coatings	Few filaments or faint coatings
II	Continuous pebble coatings, some interpebble fillings	Few to abundant nodules, flakes, filaments
III	Many interpebble fillings	Many nodules and internodular fillings
IV	Laminar horizon overlying plugged horizon	Laminar horizon overlying plugged horizon



Stages of development of a caliche profile with time. Stage I represents incipient carbonate accumulation, followed by continuous build-up of carbonate until, in Stage IV, the soil is completely plugged.

Reference: Gile, L.G. Peterson, F.F., and Grossman, R.B., 1965, The K horizon: A master horizon of carbonate accumulation: Soil Science, v. 99, p. 74-82.

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SUMMARY OF CALICHE DEVELOPMENT

29 MAY 81

FIGURE F-2

UARSA POTENTIAL AGGREGATE SOURCE SYMBOLS	ERTEC WESTERN GENERAL GEOLOGIC UNIT EXPLANATION	
		ROCK
		Shown in regions where rock is exposed. The areally predominant (greater than 50 percent) rock type is indicated. In those areas where two rock types occur, the predominant rock type is shown followed by the subordinate rock type (e.g., S_{2}/I_{4}). Rock may be subdivided into [illegible] (e.g., [illegible]).
	I	IGNEOUS (UNDIFFERENTIATED) - Rocks formed by solidification of a molten or partially molten mass.
GR	I_1	Intrusive (Plutonic) - rocks formed by solidification of molten material beneath the surface (e.g., granite, granodiorite, diorite, gabbro).
Vu	I_2	Extrusive (intermediate and acidic) - Volcanic rocks of intermediate and acidic composition formed by solidification of molten material at or near the surface (e.g., rhyolite, latite, dacite, andesite).
Vb	I_3	Extrusive (basic) - Volcanic rocks of basic composition generally formed by solidification of molten materials at or near the surface (e.g., basalt).
Vu	I_4	Extrusive (pyroclastic) - Rocks formed by accumulation of volcanic ejecta (e.g., ash, tuff, welded tuff, agglomerate).
Su	S	SEDIMENTARY (UNDIFFERENTIATED) - Rocks formed by accumulation of clastic solids, organic solids and/or chemically precipitated minerals.
Su, Qtz	S_1	Arenaceous and/or Siliceous Rocks - Composed of sand size particles (e.g., sandstone, orthoquartzite) or of cryptocrystalline silica (e.g., [illegible], chert).
Ls, Do, Cau	S_2	Carbonate Rocks - Composed predominantly of calcium carbonate detritus or chemical precipitates (e.g., limestone, dolomite, chalk).
	S_3	Argillaceous Rocks - Composed of clay and silt sized particles (e.g., siltstone, shale, claystone).
	S_4	Evaporite Rocks - Precipitated from solution as a result of evaporation (e.g., halite, gypsum, anhydrite, sylvite).
Su	S_5	Coarse Clastic Rocks - Composed of gravel sized or larger clasts (e.g., conglomerate, breccia).
Mu	M	METAMORPHIC (UNDIFFERENTIATED) - Rocks formed through recrystallization in the solid state of preexisting rocks by heat and pressure.
Mu	M_1	Coarse grained - rocks formed by higher-grade regional metamorphism, either banded or granular (e.g., gneiss, granulite, amphibolite).
Mu	M_2	Fine grained, schistose - rocks formed by lower grade regional metamorphism (e.g., schist, slate, phyllite).
Mu	M_3	Nonfoliated - rocks formed chiefly by contact metamorphism (e.g., hornfels, marble).
Qtz	M_4	Metaquartzite - rocks formed by metamorphism of highly siliceous rocks.
		BASIN-FILL
	A	BASIN-FILL DEPOSITS - Fine- to coarse-grained materials deposited principally by wind, water or gravity.
Aal	A_1	Younger Fluvial Deposits - Major modern stream channel and flood plain deposits.
Au, Aal	A_2	Older Fluvial Deposits - Older incised stream channel and flood-plain deposits in elevated terraces bordering major modern drainages.
Au	A_3	Eolian Deposits - Wind-blown deposits of sand occurring as either thin sheets (A_{3s}) or dunes (A_{3d}).
Aol	A_4	Playa and Lacustrine Deposits - Deposits occurring in modern, active playas (A_4) or in either inactive playas or older lake beds and abandoned shorelines associated with extinct lakes (A_{4o}).
Aaf	A_5	Alluvial Fan Deposits - Alluvial deposits consisting of debris flow and water laid alluvium near mountain fronts, grading into predominantly water laid silts [illegible] deposited in shifting distributary channels near the basin center. Younger (A_{5y}), intermediate (A_{5i}) and older (A_{5o}) alluvial fans are differentiated by surface soil development, terrain conditions and present depositional/erosional environment.
Au	$A_1 A_5$	Mixed non-rock units. Most areally extensive unit is listed first.
Aaf	A_{5y} (A_{5i})	Parenthetic unit underlies thin veneer of overlying mapped unit.

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ERTEC WESTERN GEOLOGIC UNIT CROSS REFERENCE

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FIGURE F-3

APPENDIX G

CROSS REFERENCE FROM MAP NUMBER TO VERIFICATION ACTIVITY

CROSS REFERENCE FROM MAP NUMBER TO VERIFICATION ACTIVITY

Included in this appendix is one table that is presented to allow cross reference to be made from this aggregate resources study to an appropriate verification study. Map numbers in the number series 400 to 599 on Drawing 1 are keyed to the published Verification report of Dry Lake Valley, Nevada (FN-TR-27-DL-I and II). If detailed information is required from a verification activity, the following search procedure can be used: determine the location of the activity required on Drawing 1, note the map number, refer to that map number in Table G-1, read from that table the verification activity type and number, refer to the appropriate verification report for the data required.

MAP NUMBER	ACTIVITY LOCATION	MAP NUMBER	ACTIVITY LOCATION
401	P - 1	423	GS - 36
402	CS - 21	424	GS - 25
403	CS - 19	425	GS - 39
404	CS - 18	426	GS - 38
405	P - 2	427	T - 3
406	P - 3	428	P - 6
407	CS - 13	429	CS - 29
408	CS - 1	430	P - 7
409	GS - 32	431	GS - 24
410	T - 2	432	B - 7
411	CS - 4	433	CS - 32
412	P - 8	434	T - 11
413	B - 1	435	GS - 37
414	T - 10	436	GS - 40
415	B - 4	437	GS - 42
416	P - 9	438	GS - 41
417	CS - 8	439	CS - 46
418	CS - 22	440	T - 5
419	GS - 29	441	T - 6
420	GS - 28	442	CS - 38
421	T - 9	443	CS - 37
422	T - 4	444	CS - 36

T - TRENCH
B - BORING
P - TEST PIT
CS - SURFACE SAMPLE
GS - GEOLOGIC STATION

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CROSS REFERENCE FROM MAP NUMBER
TO VERIFICATION ACTIVITY
DRY LAKE VALLEY, NEVADA

29 MAY 81

TABLE G-1 1 OF 3

MAP NUMBER	ACTIVITY LOCATION	MAP NUMBER	ACTIVITY LOCATION
445	P - 12	467	GS - 47
446	B - 10	468	P - 26
447	GS - 43	469	GS - 52
448	T - 16	470	GS - 50
449	P - 23	471	GS - 51
450	GS - 44	472	P - 17
451	P - 24	473	T - 13
452	GS - 45	474	CS - 85
453	GS - 20	475	GS - 11
454	T - 12	476	P - 21
455	CS - 60	477	CS - 76
456	GS - 26a	478	P - 22
457	GS - 26b	479	B - 14
458	GS - 18	480	GS - 10
459	GS - 17	481	CS - 70
460	GS - 15	482	CS - 69
461	T - 8	483	GS - 9
462	GS - 13	484	GS - 8
463	B - 6	485	T - 7
464	CS - 55	486	GS - 53
465	T - 17	487	P - 29
466	CS - 57	488	GS - 6

T - TRENCH
B - BORING
P - TEST PIT
CS - SURFACE SAMPLE
GS - GEOLOGIC STATION

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CROSS REFERENCE FROM MAP NUMBER
TO VERIFICATION ACTIVITY
DRY LAKE VALLEY, NEVADA

29 MAY 81

TABLE G-1 2 OF 3

MAP NUMBER	ACTIVITY LOCATION	MAP NUMBER	ACTIVITY LOCATION
489	GS - 7		
490	GS - 5		
491	GS - 2		
492	GS - 4		
493	GS - 1		
494	CS - 84		
495	P - 28		
496	CS - 80		
497	P - 27		
498	GS - 56		
499	GS - 55		
500	B - 16		

T - TRENCH
B - BORING
P - TEST PIT
CS - SURFACE SAMPLE
GS - GEOLOGIC STATION

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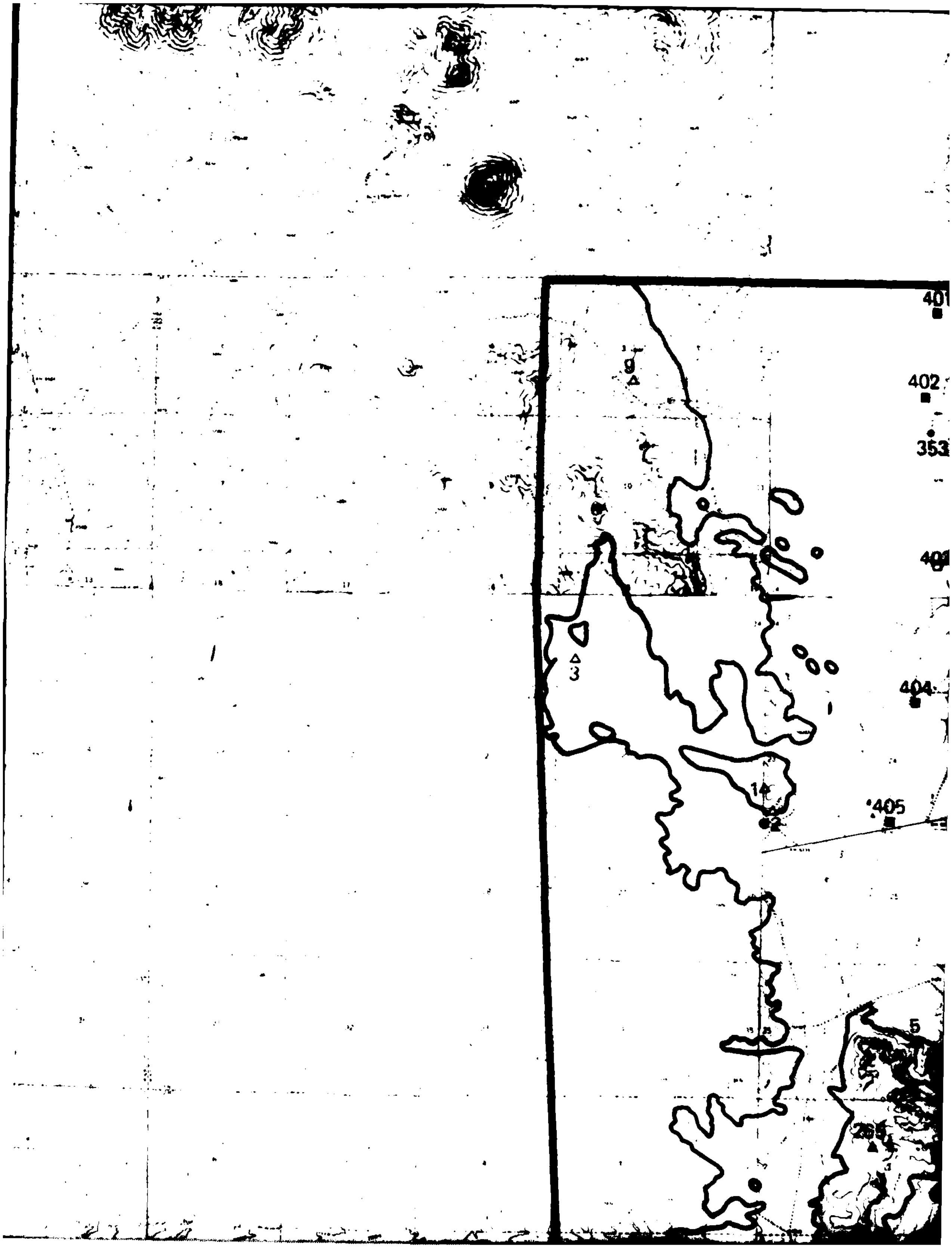
CROSS REFERENCE FROM MAP NUMBER
TO VERIFICATION ACTIVITY
DRY LAKE VALLEY, NEVADA

29 MAY 81

TABLE G-1 3 OF 3



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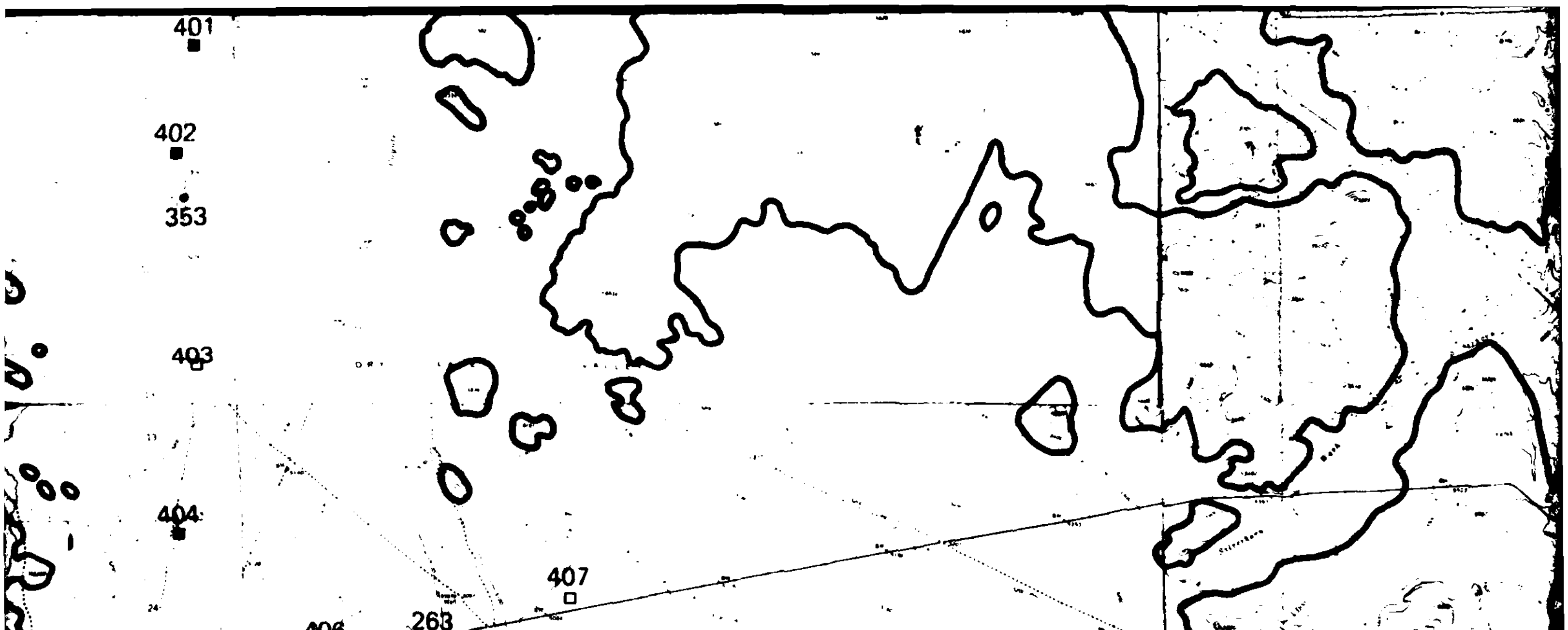
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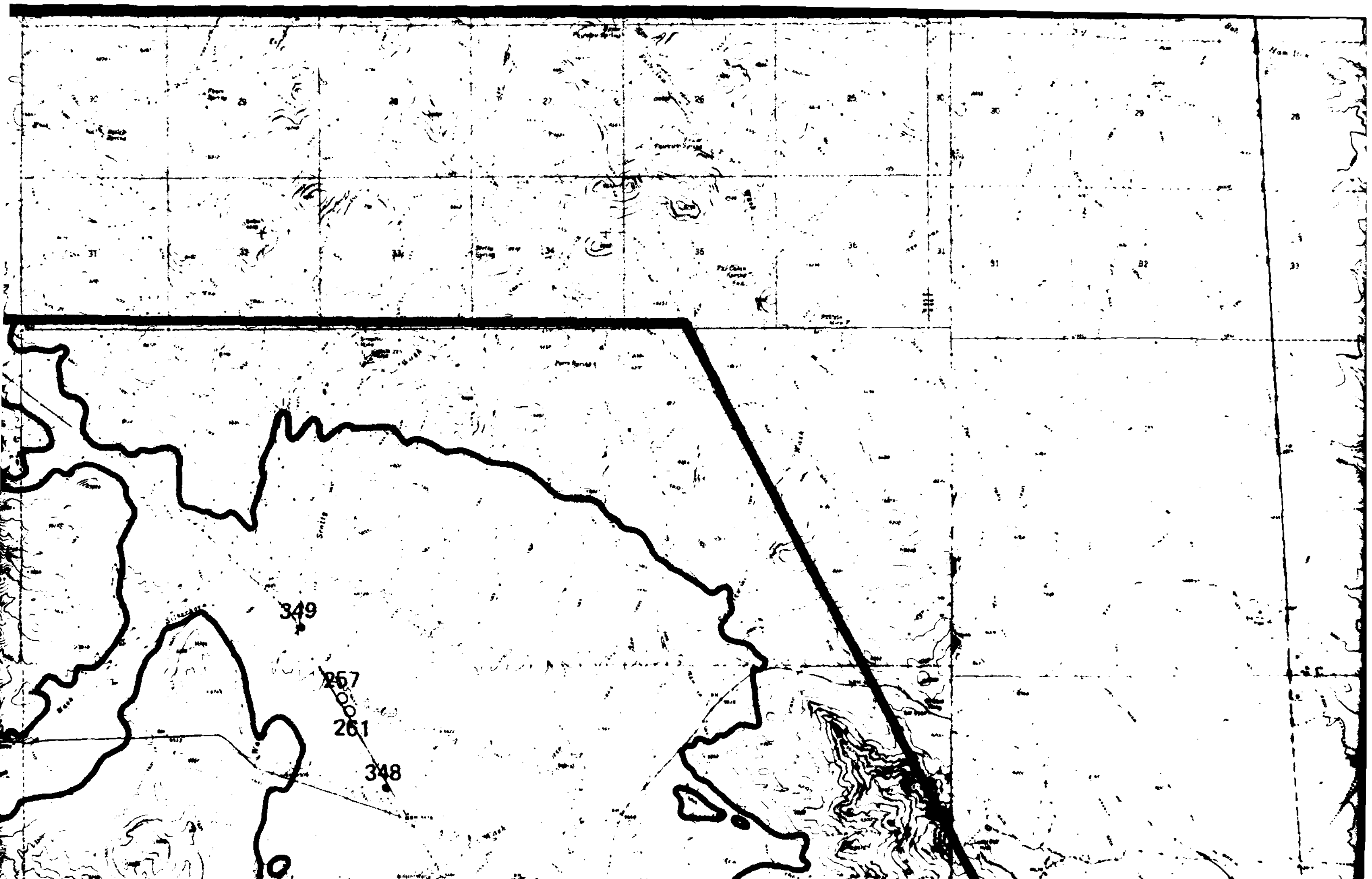
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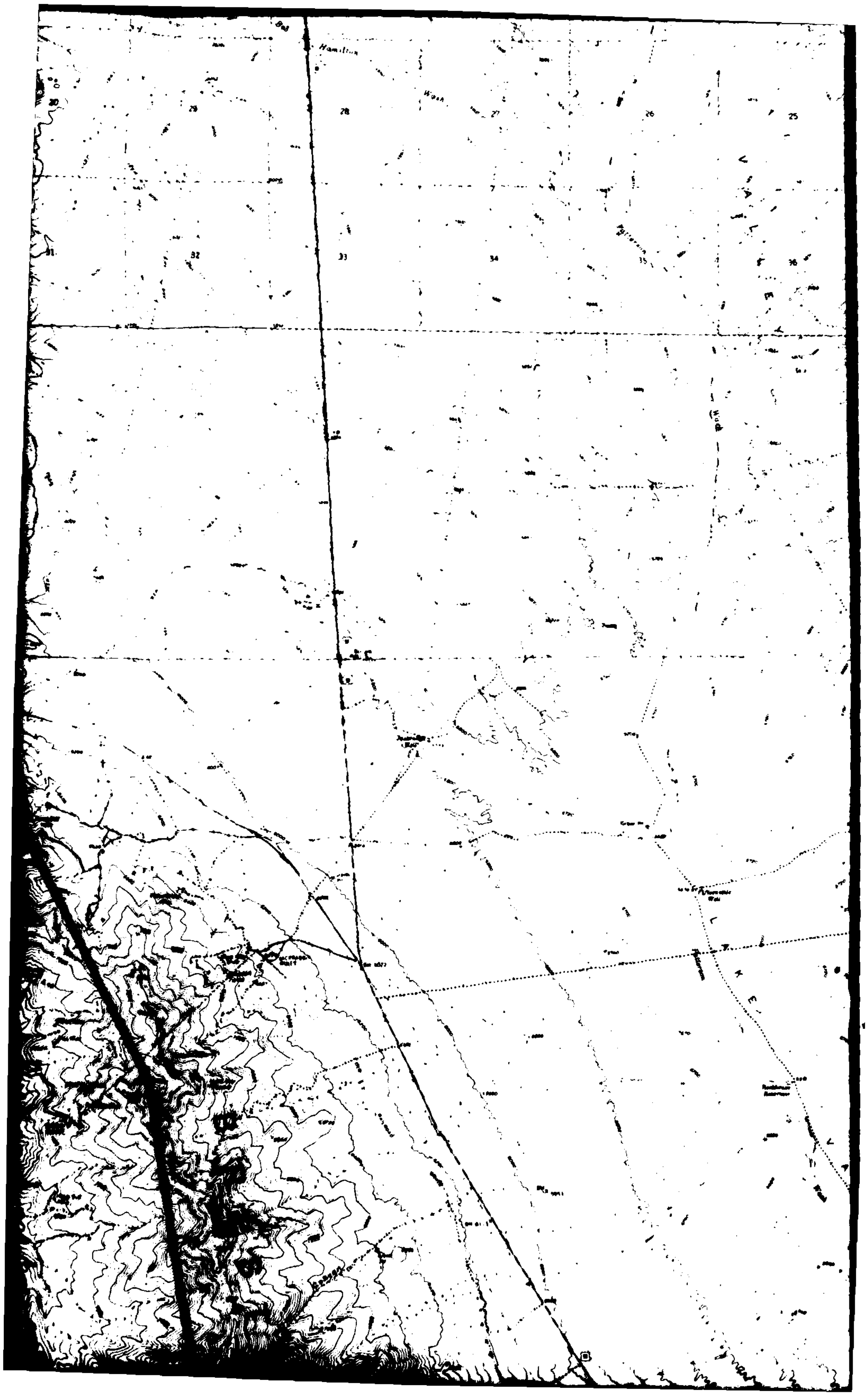
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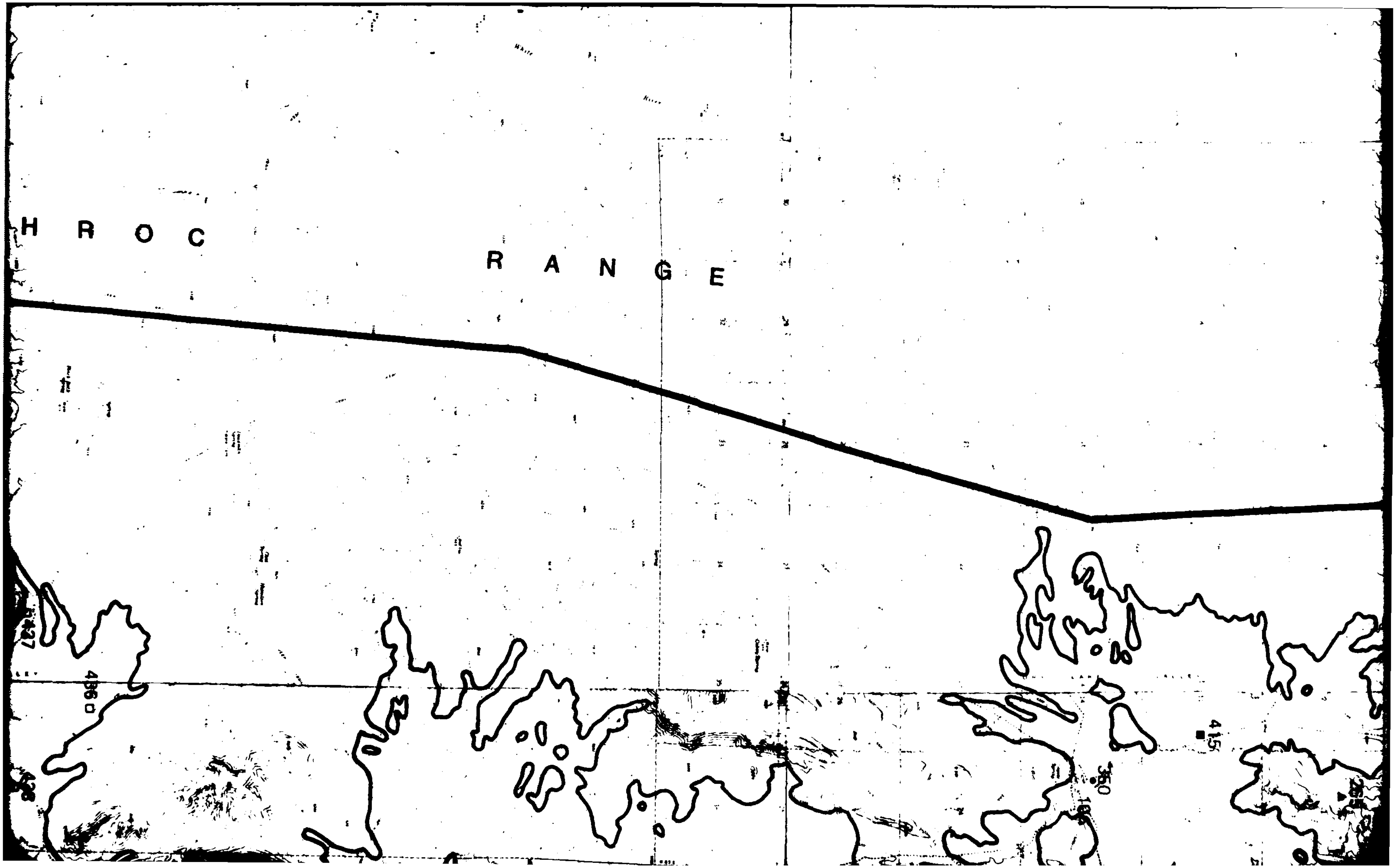
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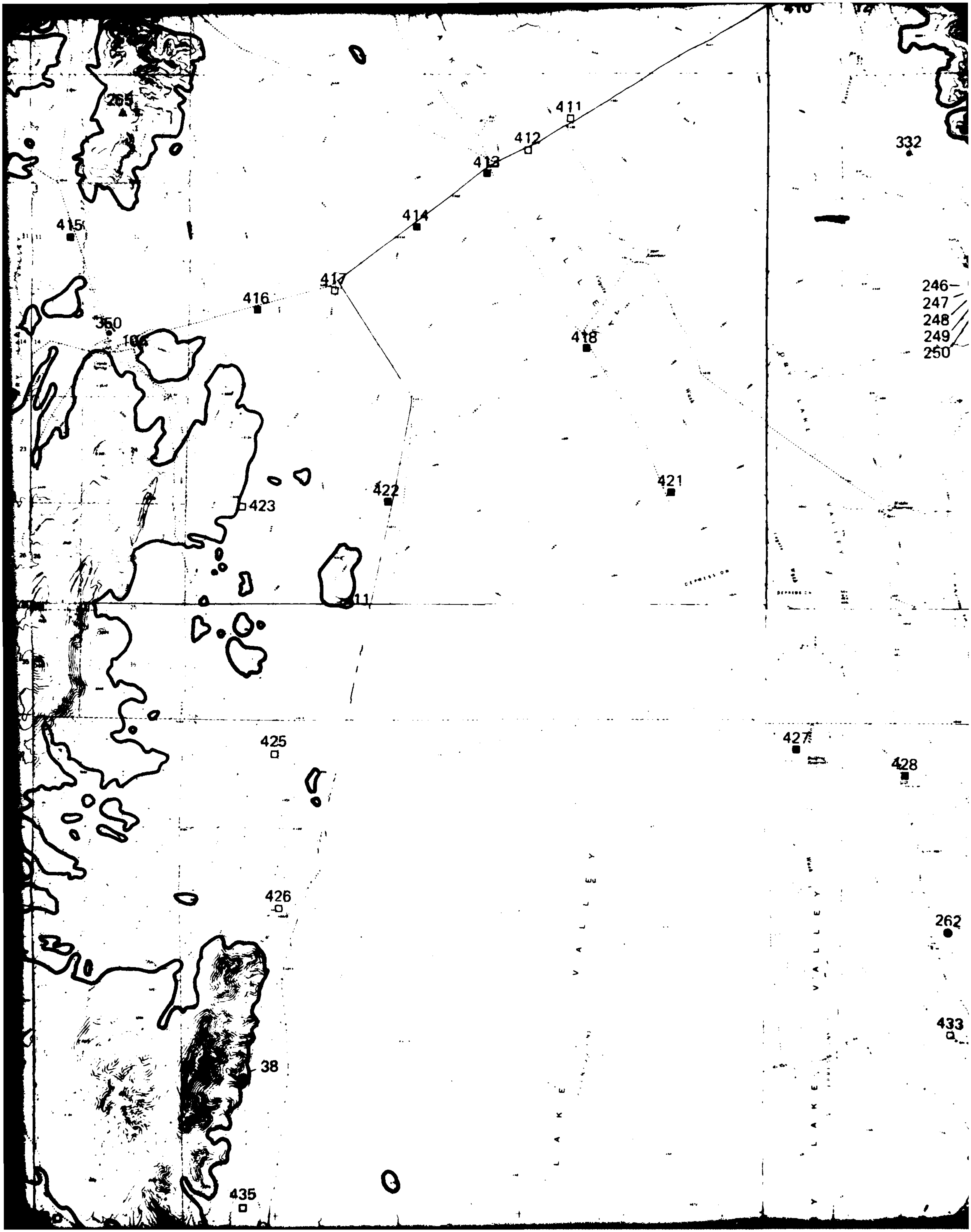

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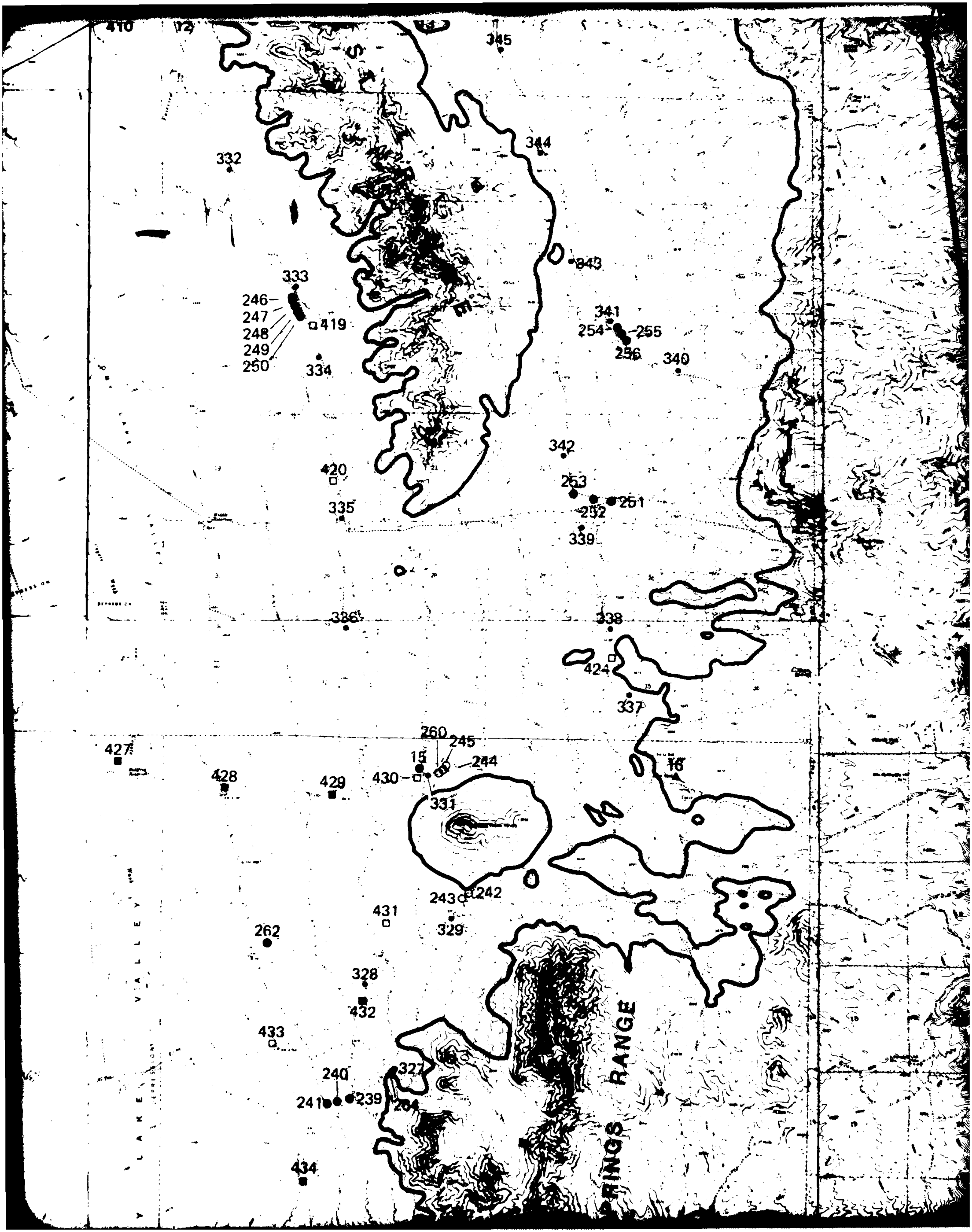
LAKE VALLEY
LAKE VALLEY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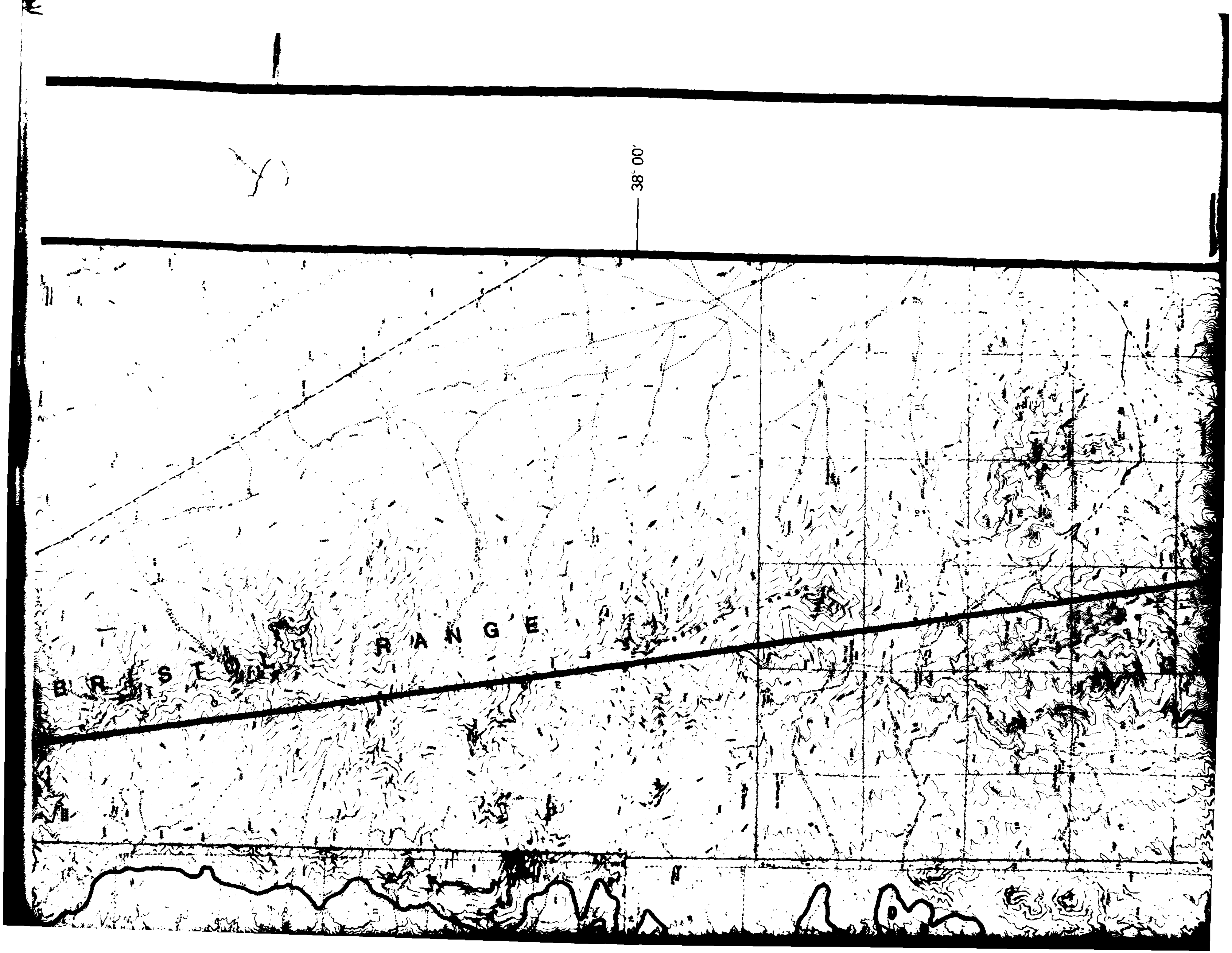
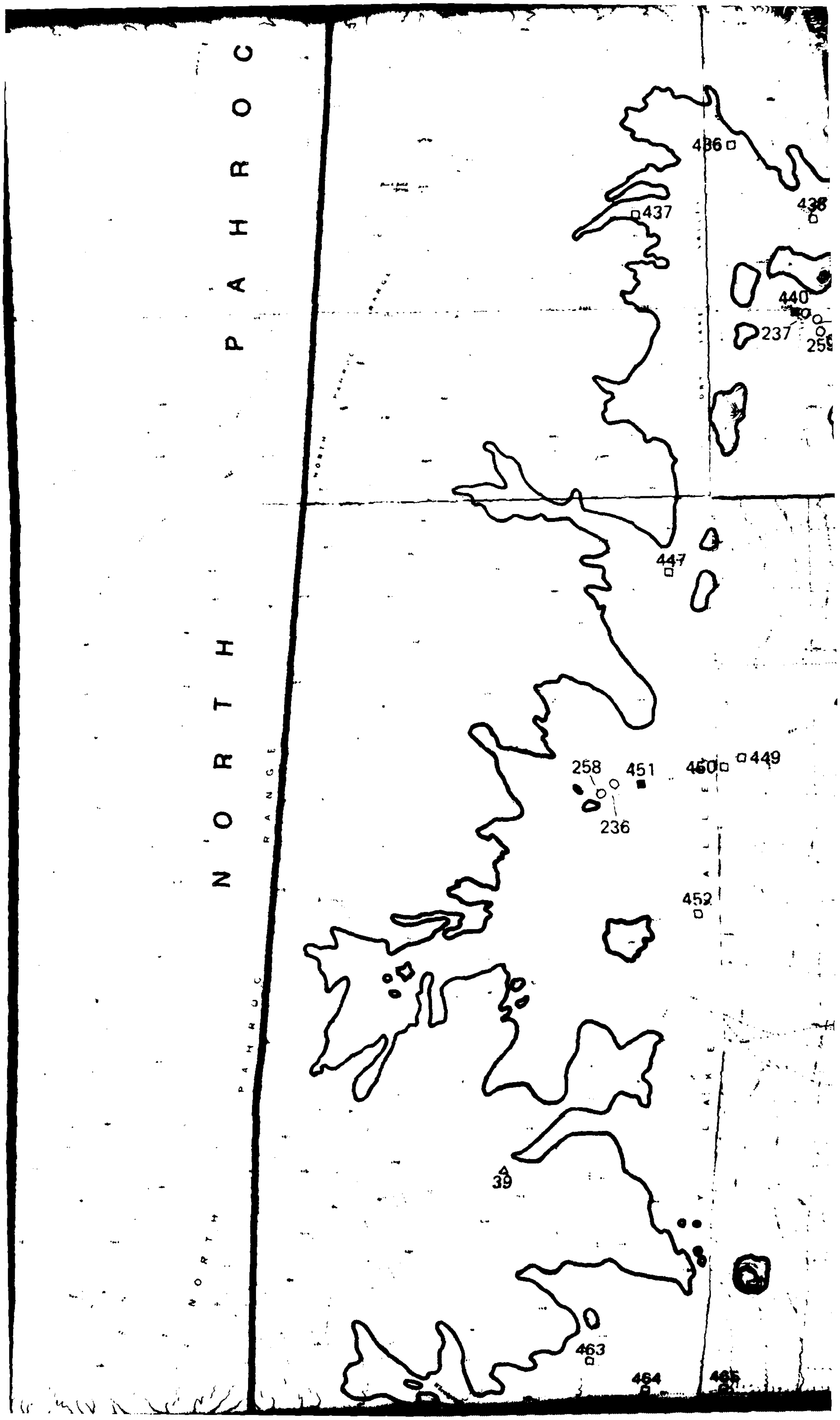
RANGE
RINGS
L A K E   V A L L E Y



BRISTOL
RANGE
38° 00′


NORTH PAHROC
NORTH PAHROC RANGE
NORTH PAHROC RANGE
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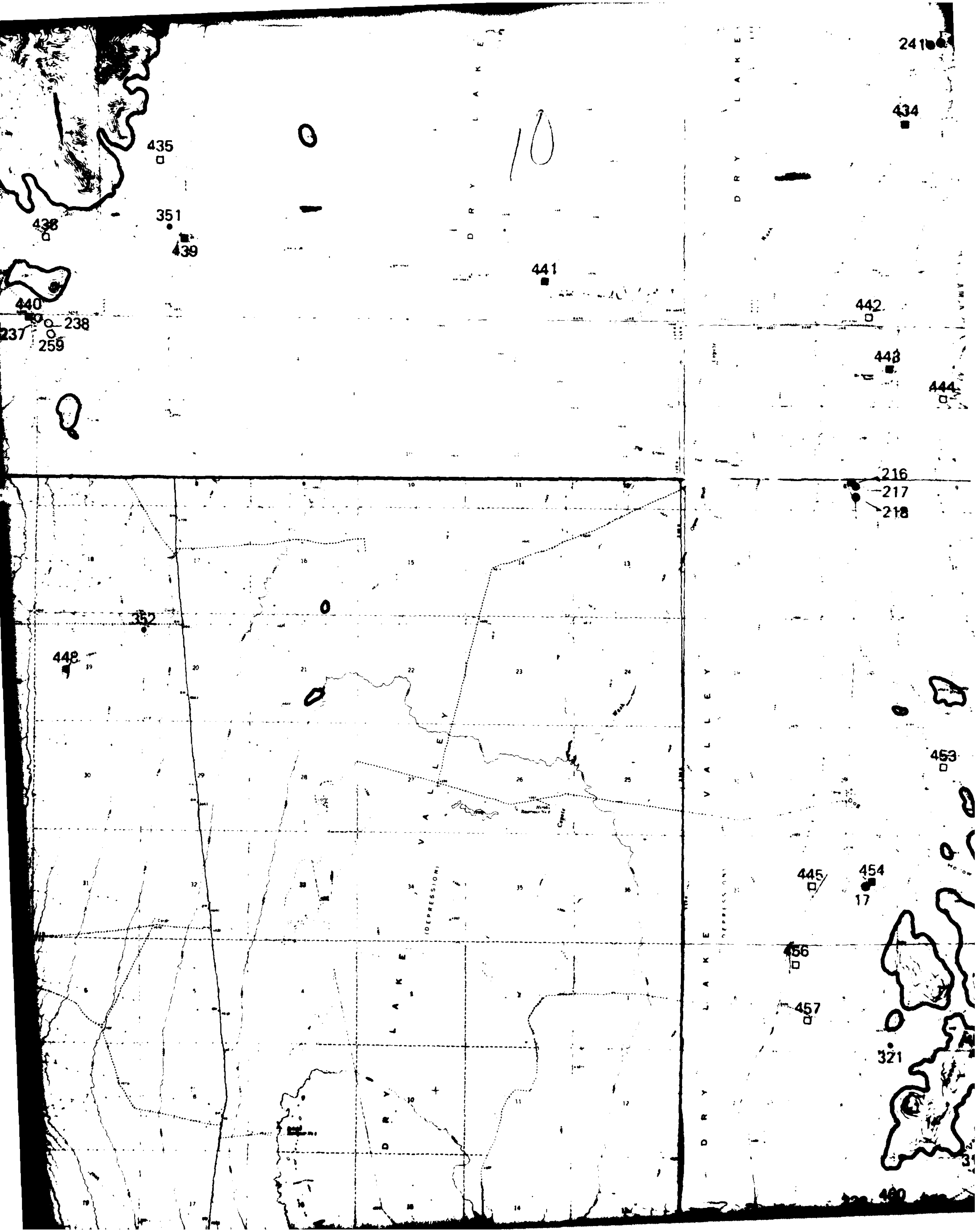
465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241
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DRY LAKE
DRY LAKE
352
448
VALLEY
VALLEY
(DEPRESSION)
453
445
454
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456
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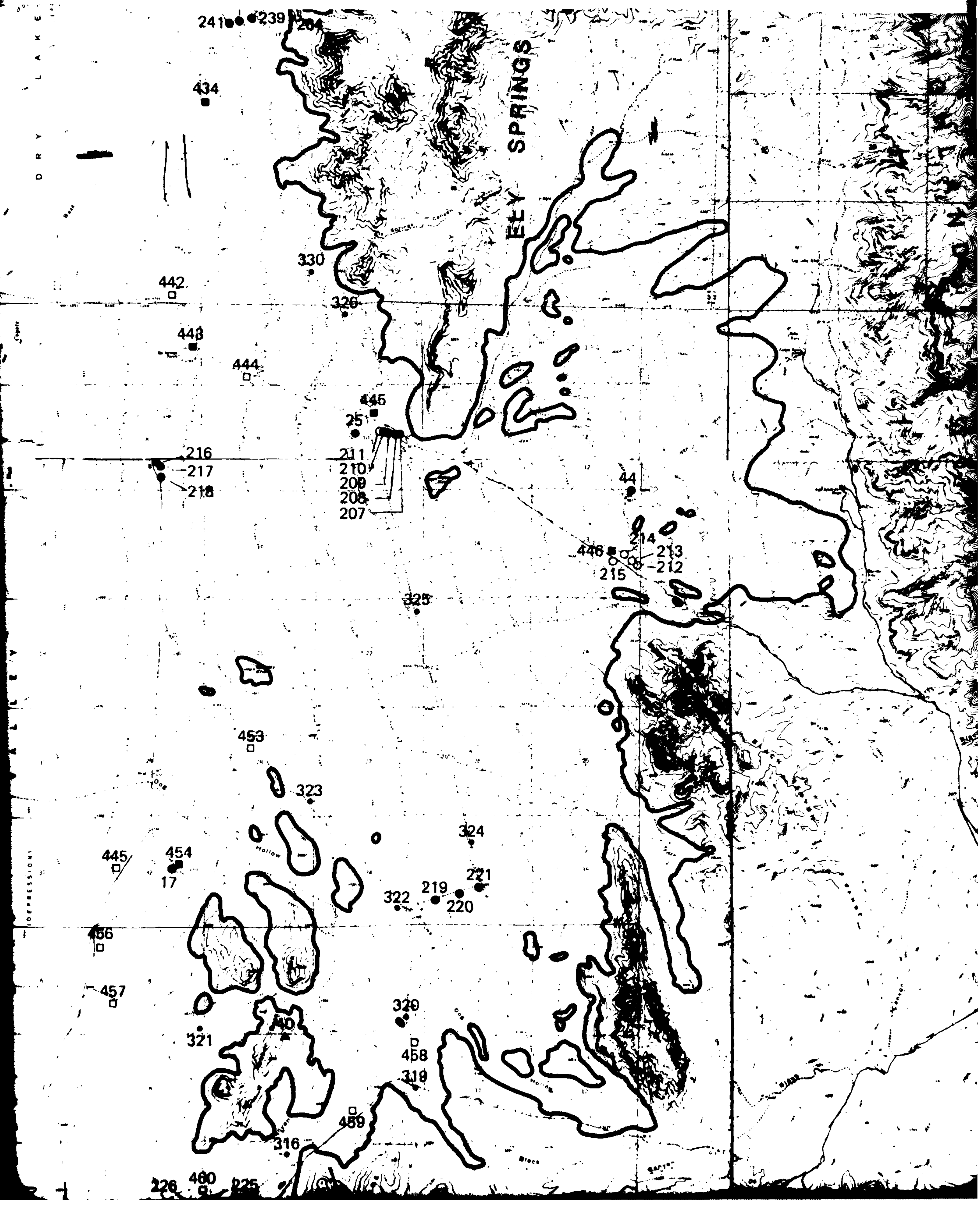
321
LAKE
LAKE
DRY
DRY
460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DRY LAKE
434
ELY SPRINGS
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442
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444
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209
208
207
44
446
214
213
212
215
325
VALLEY
453
323
324
(DEPRESSION)
445
454
17
221
219
220
322
Hollow
456
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320
321
140
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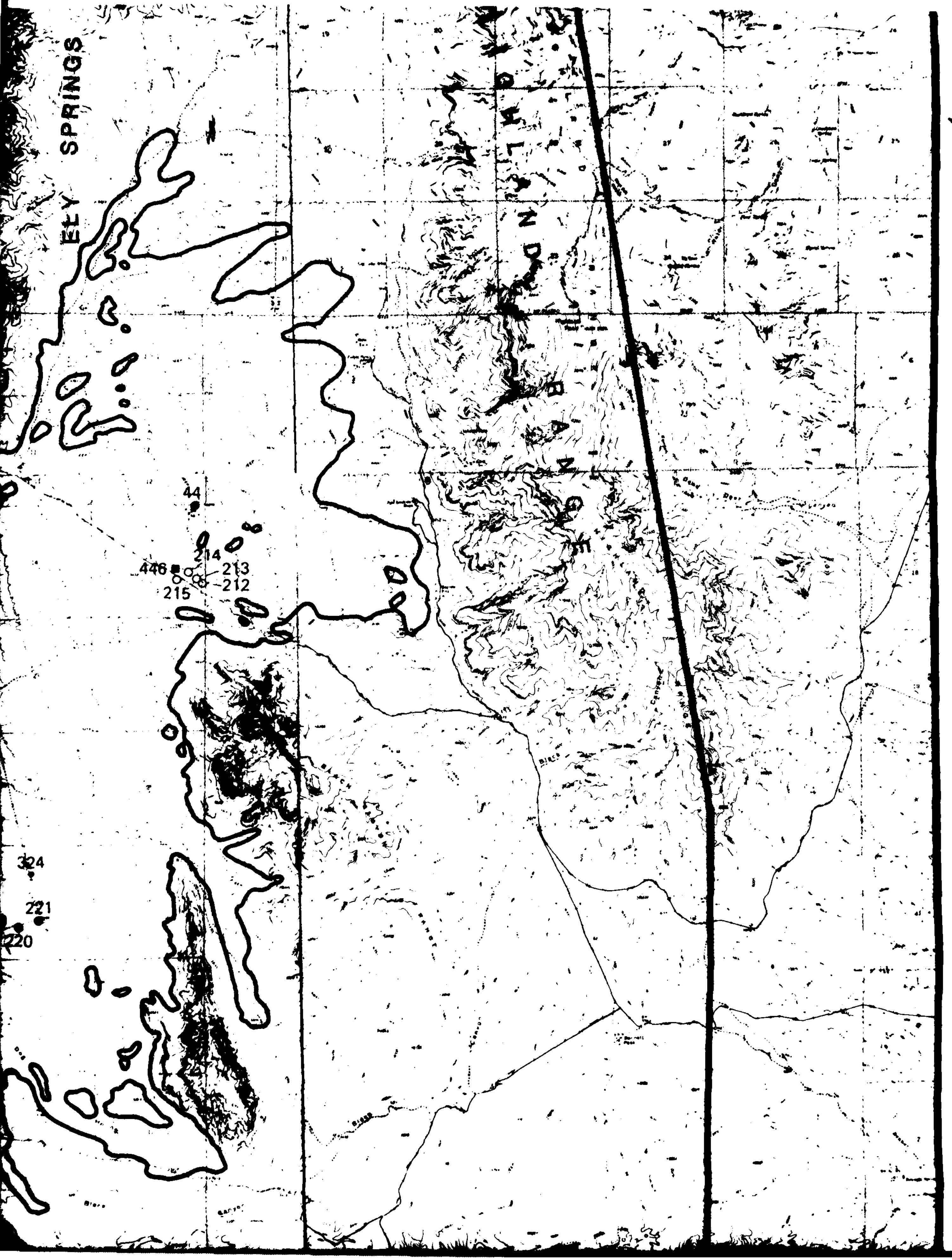
319
459
316
460
226
225
Black
Canyon



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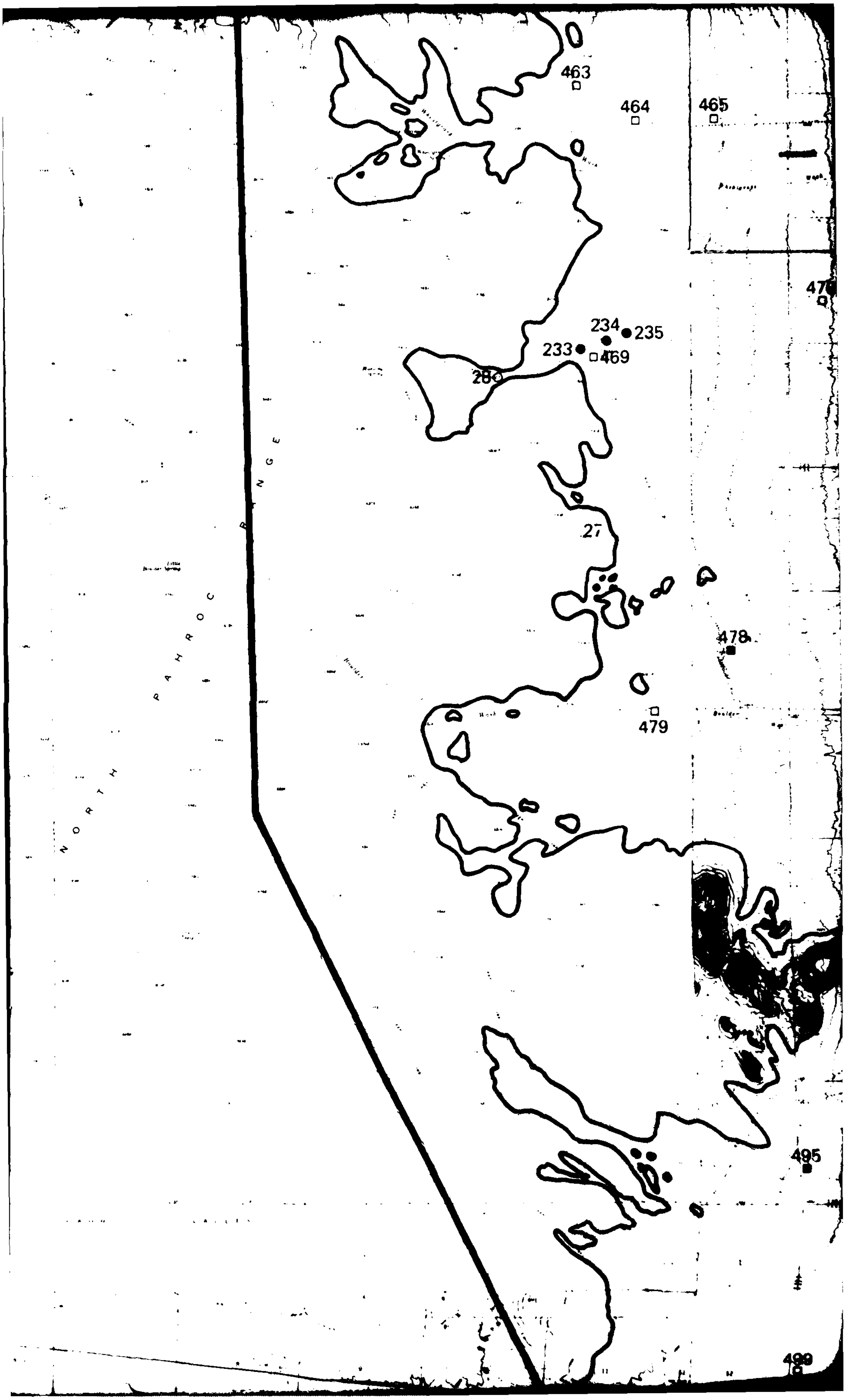
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465
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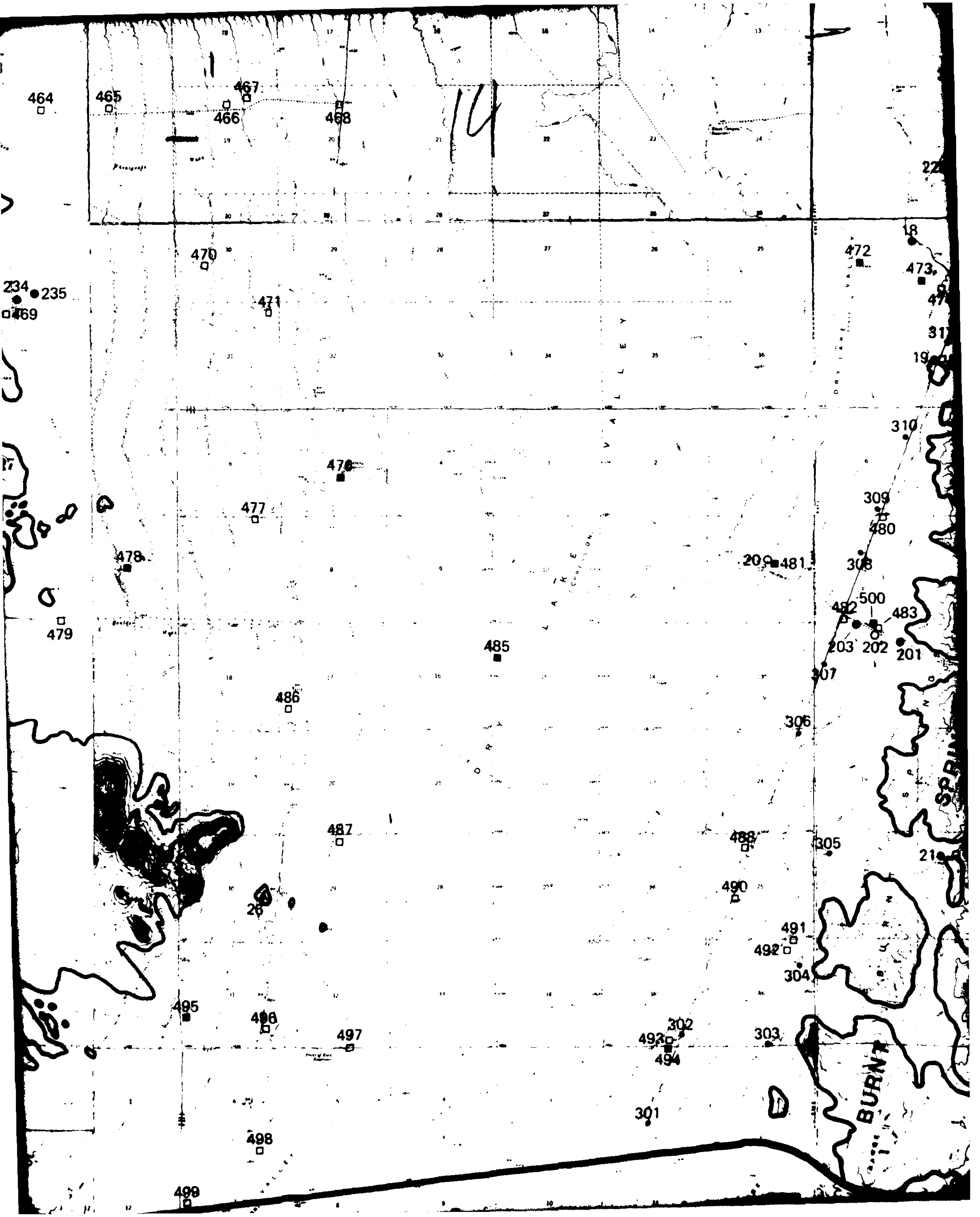
469
28
27
478
479
495
499
NORTH PAHROC RANGE


14
464
465
466
467
468
470
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471
472
18
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476
477
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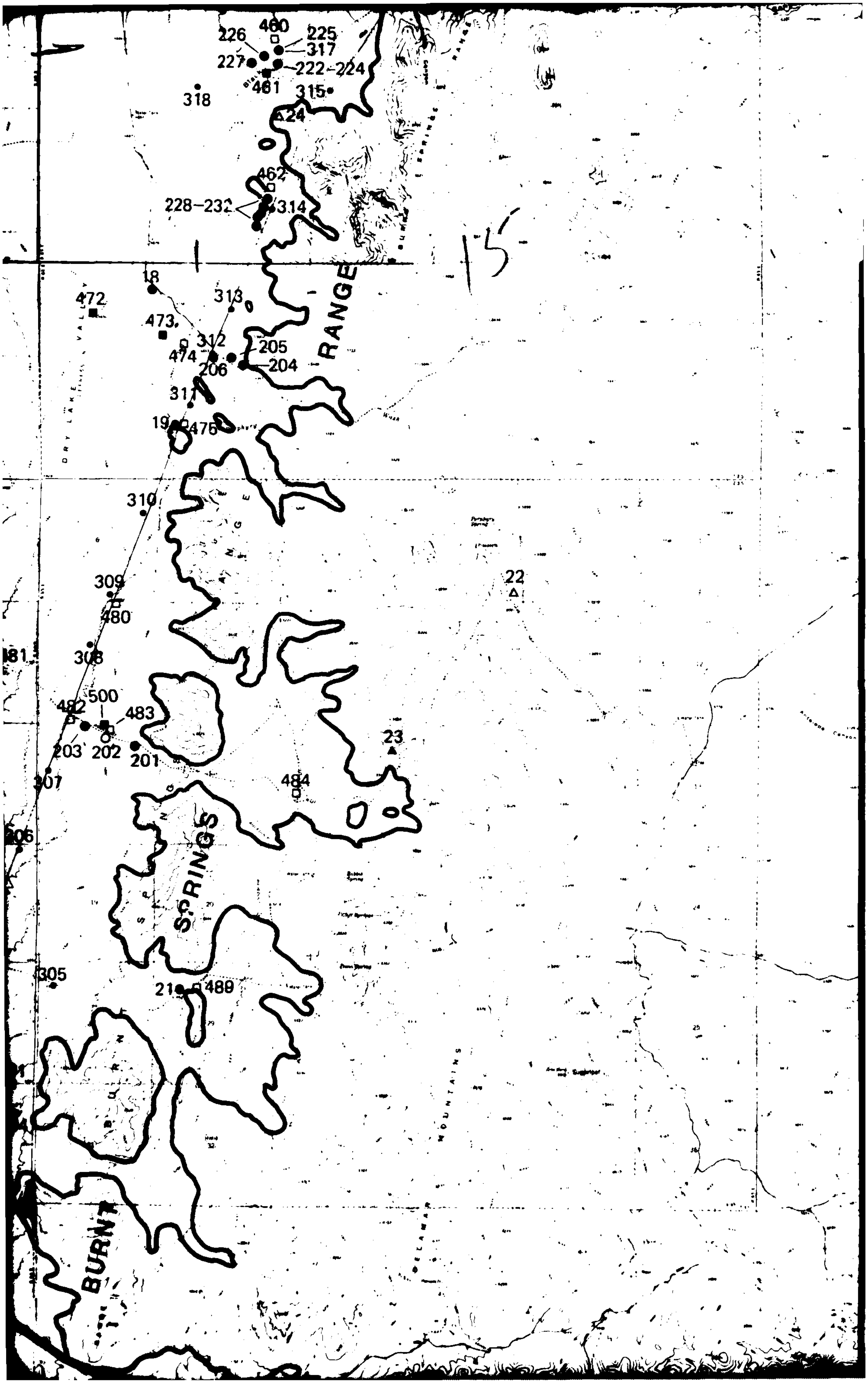
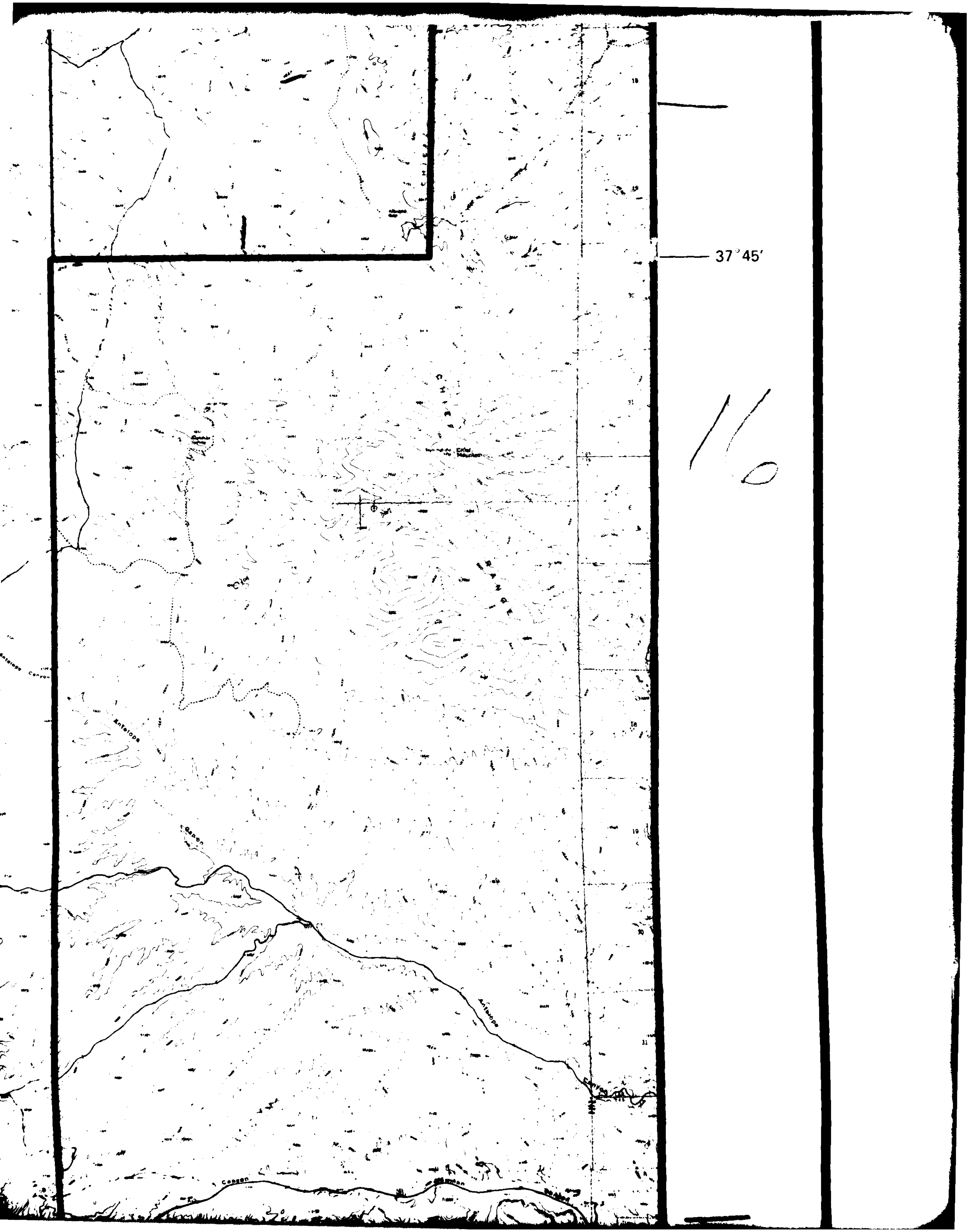
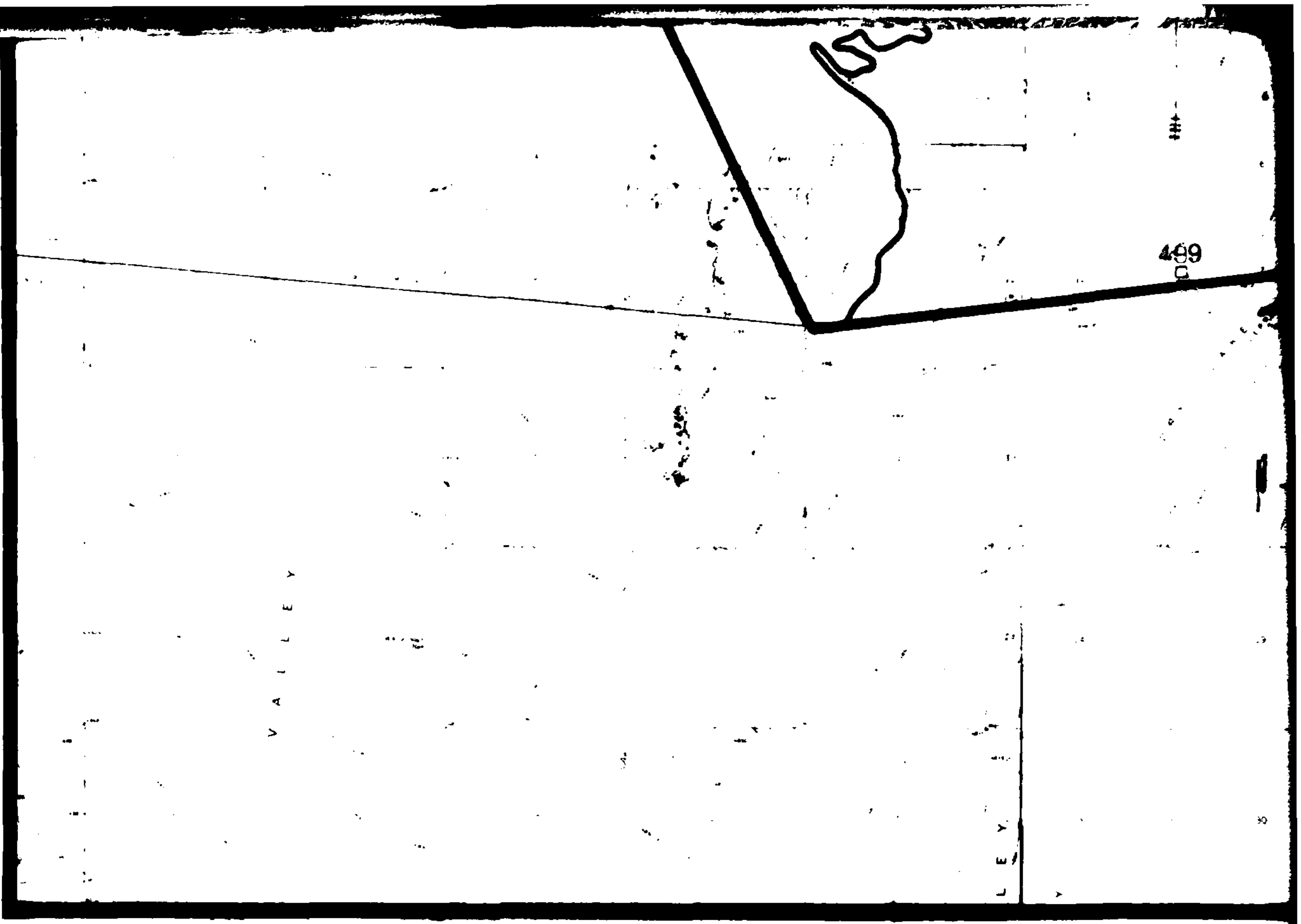
478
209
481
308
500
482
483
479
203
202
201
485
307
486
306
487
488
305
490
26
491
492
304
495
496
497
302
493
494
303
301
498
499
DRY LAKE VALLEY
BURNT
SPRIN



226
460
225
317
227
222-224
461
315
318
24
462
228-232
314
15
18
472
313
473
312
205
474
206
204
RANGE
311
19
475
DRY LAKE VALLEY
310
22
309
480
308
500
482
483
203
202
201
23
307
484
306
SPRINGS
305
21
489
MOUNTAINS
BURNT


37°45'
CHIEF
CHIEF RANGE
Chief Mountain
Antelope Canyon
Antelope
Antelope
Canyon

16



ERTEC WESTERN AGGREGATE RESO

VALLEY–SPECIFIC AGGREGA
(MAP NUMBERS FROM

BASIN–FILL UNITS (CO

● DATA STOP, S

○ DATA STOP

ROCK UNITS (CRUSHED

▲ DATA STOP, S

△ DATA STOP

DETAILED AGGREGATE RESO
(MAP NUMBERS FRO

EXPLANATION

OURCES STUDY FIELD STATIONS

ATE RESOURCES STUDY *
1 TO 199)

OARSE AND/OR FINE AGGREGATES)

SAMPLED AND TESTED

D-ROCK AGGREGATES)

SAMPLED AND TESTED

URCES STUDY * *
200 TO 299 FOR BASIN–FILL
ATIONS; 300 TO 399 FOR FIELD

EXISTING ERTEC WESTERN TEST DATA LOCATIONS
(MAP NUMBERS FROM 400 TO 599)

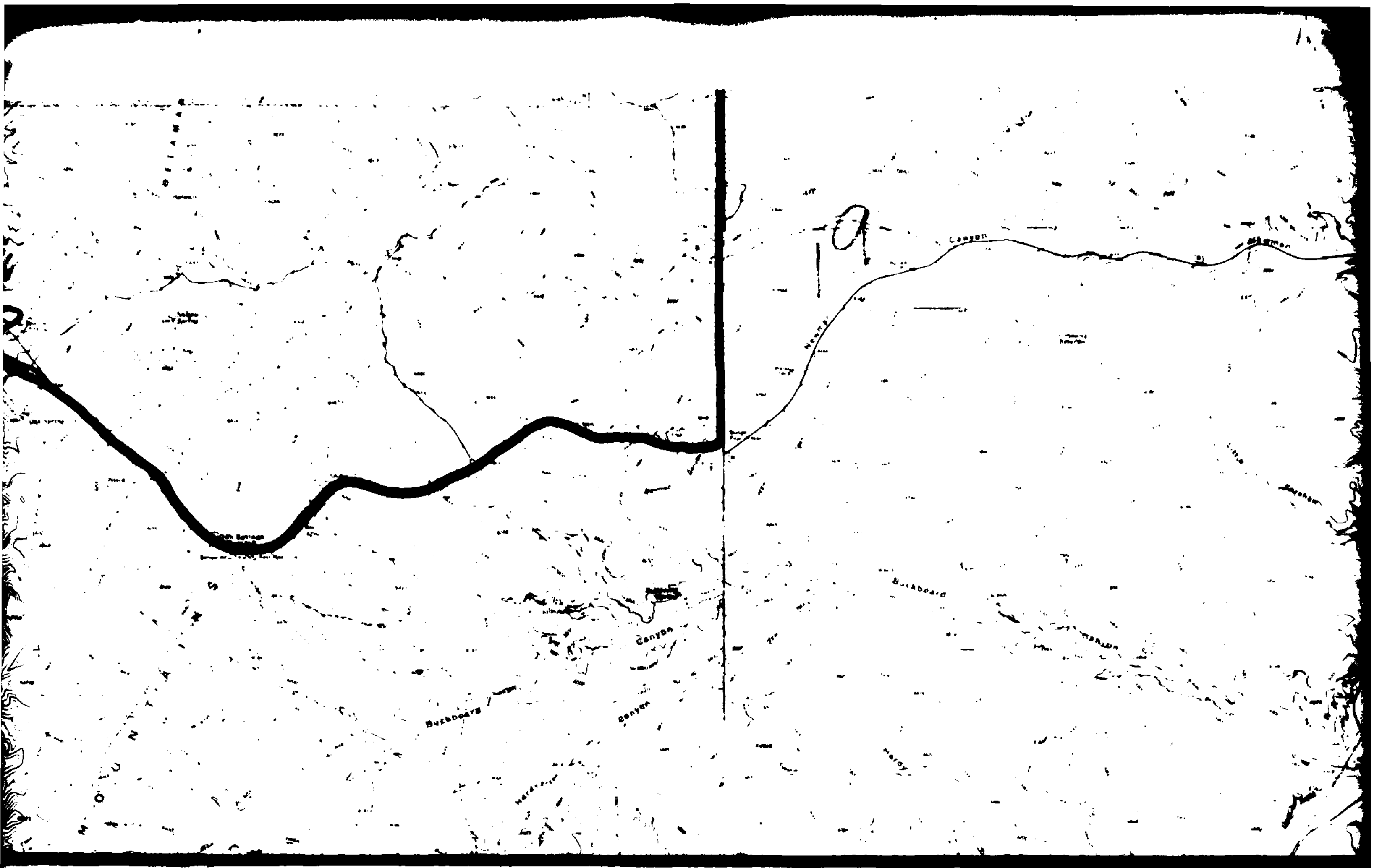
■ DATA STOP, SAMPLED AND TESTE

□ DATA STOP

* SEE DRY LAKE, MULESHOE, DELAMAR, PAHR
REPORT (FN-TR-37-a) FOR DETAILED INFORM

* * SEE CORRESPONDING MAP NUMBER IN APPEN
FOR DETAILED INFORMATION.

* * * SEE CORRESPONDING MAP NUMBER AND ACT
APPENDIX G FOR REFERENCE TO DRY LAKE
VERIFICATION REPORT (FN-TR-27-DL-I AND II



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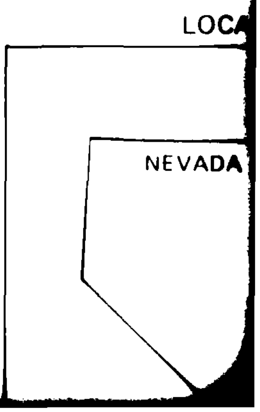
KIL

LOCA



DATA LOCATIONS ***
TO 599)

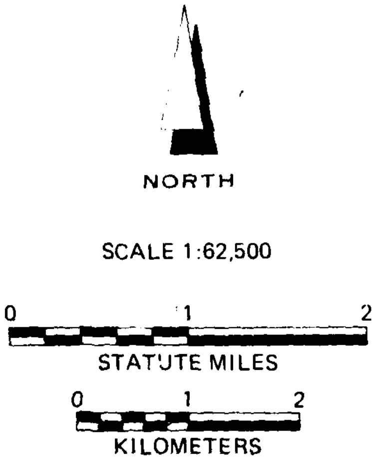
MPLED AND TESTED

E, DELAMAR, PAHROC VSARS
DETAILED INFORMATION.

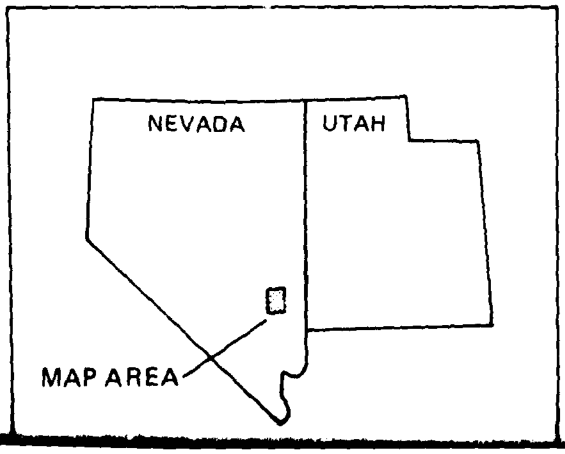
NUMBER IN APPENDICES A AND B
TION.

NUMBER AND ACTIVITY TYPE IN
CE TO DRY LAKE VALLEY

30



LOCATION MAP



● DATA S

○ DATA S

ROCK UNITS (CR

▲ DATA S

△ DATA S

DETAILED AGGREGATE
(MAP NUMBERS
AND ROCK SAMP
PETROGRAPHIC

BASIN -FILL UNI

● DATA S

○ DATA S

ROCK UNITS (CR

▲ DATA S

PETROGRAPHIC

• DATA

ED

ES)

71

ED

N–FILL
FOR FIELD

GGREGATES)

□ DATA STOP

* SEE DRY LAKE, MULESHOE, DELAMAR, PAHROC VSARS REPORT (FN-TR-37-a) FOR DETAILED INFORMATION.

** SEE CORRESPONDING MAP NUMBER IN APPENDICES A AND B FOR DETAILED INFORMATION.

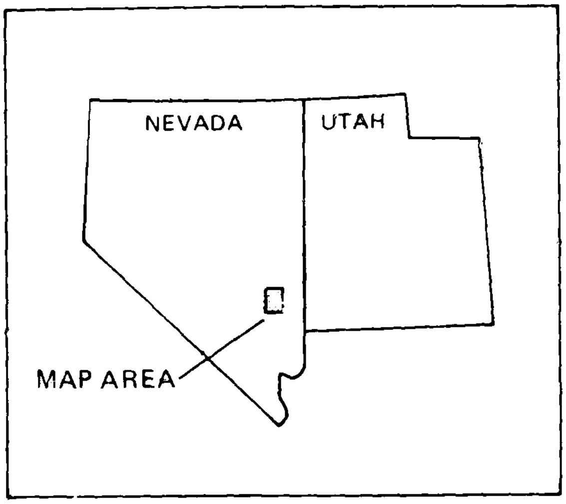
*** SEE CORRESPONDING MAP NUMBER AND ACTIVITY TYPE IN APPENDIX G FOR REFERENCE TO DRY LAKE VALLEY VERIFICATION REPORT (FN-TR-27-DL-I AND II).

SYMBOLS

━━━ STUDY AREA BOUNDARY

─── ROCK/BASIN–FILL CONTACT

LOCATION MAP



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The Earth Technology Corporation

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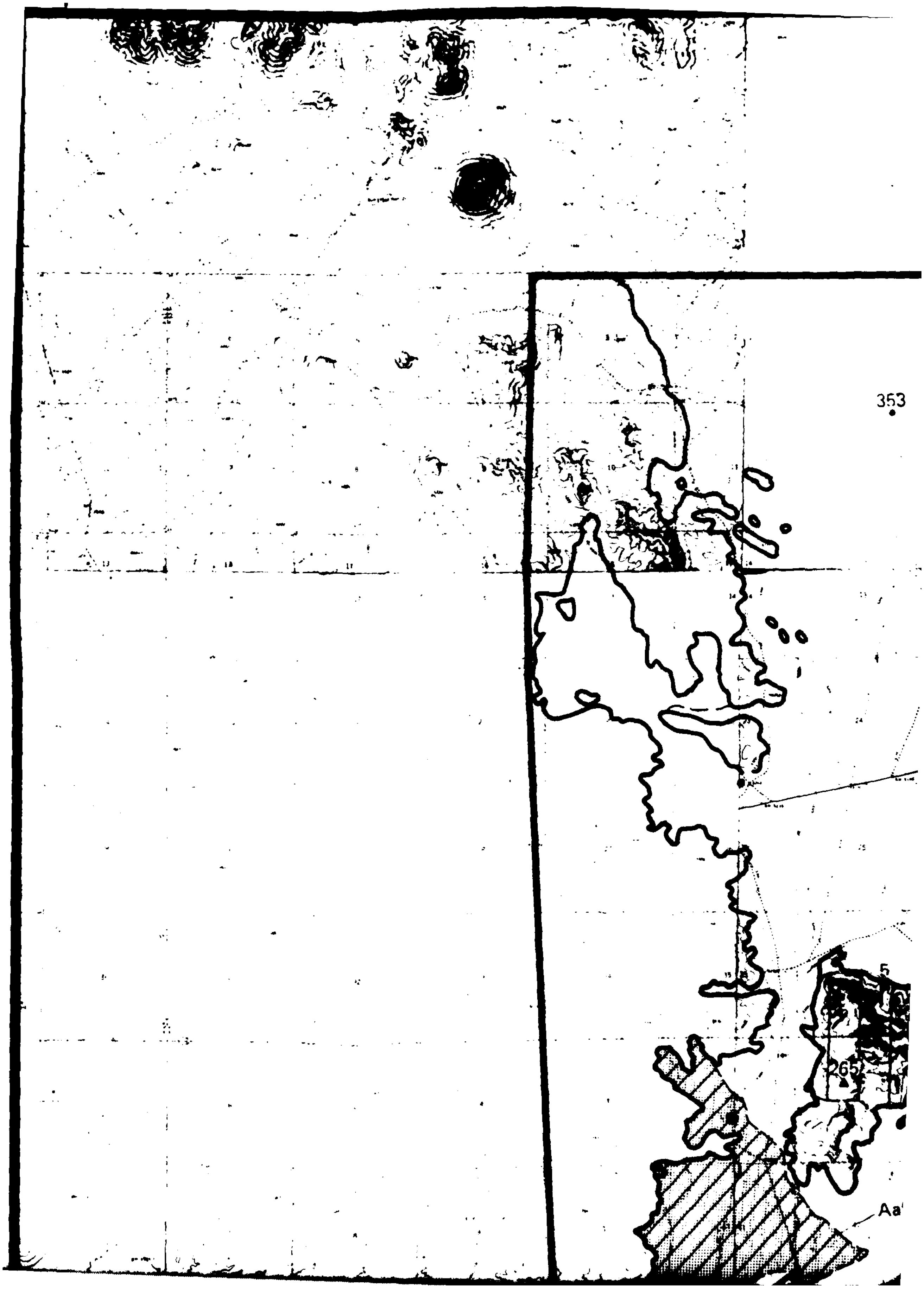
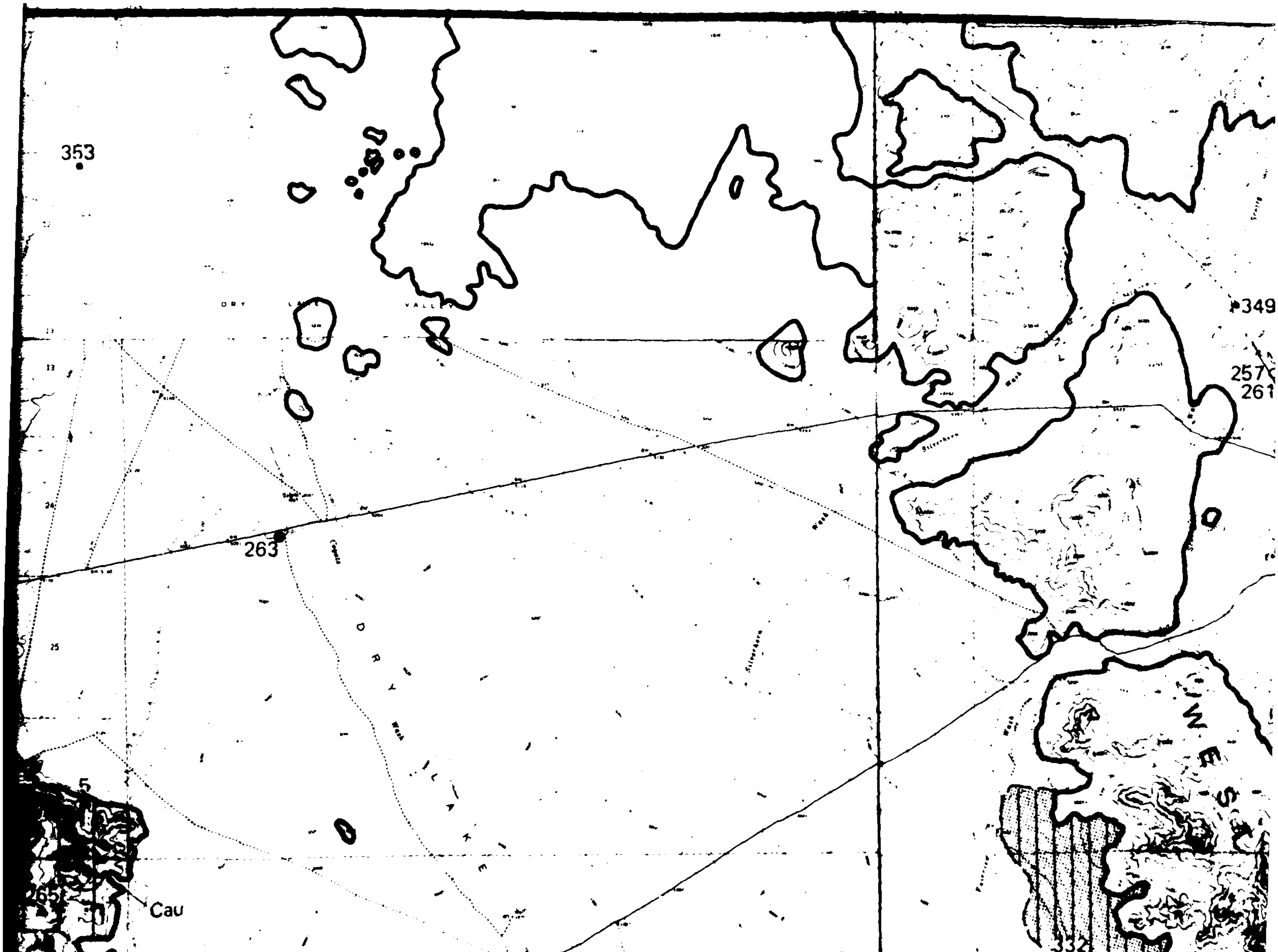
DEPARTMENT OF THE AIR FORCE
BMO/AFRCE-MX

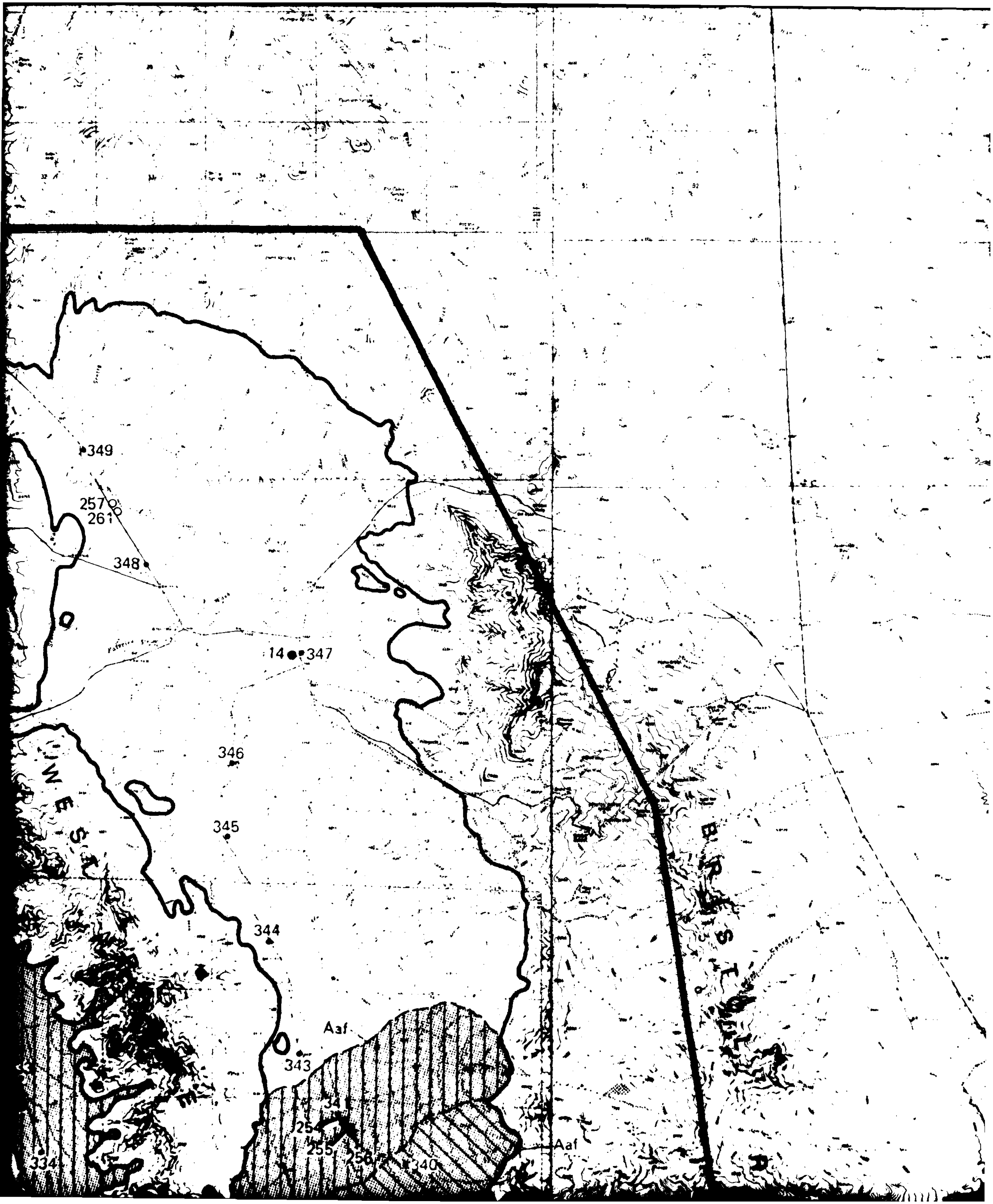
FIELD STATION AND SELECTED EXISTING DATA SITE LOCATIONS DETAILED AGGREGATE RESOURCES STUDY DRY LAKE VALLEY, NEVADA

29 MAY 81

DRAWING 1

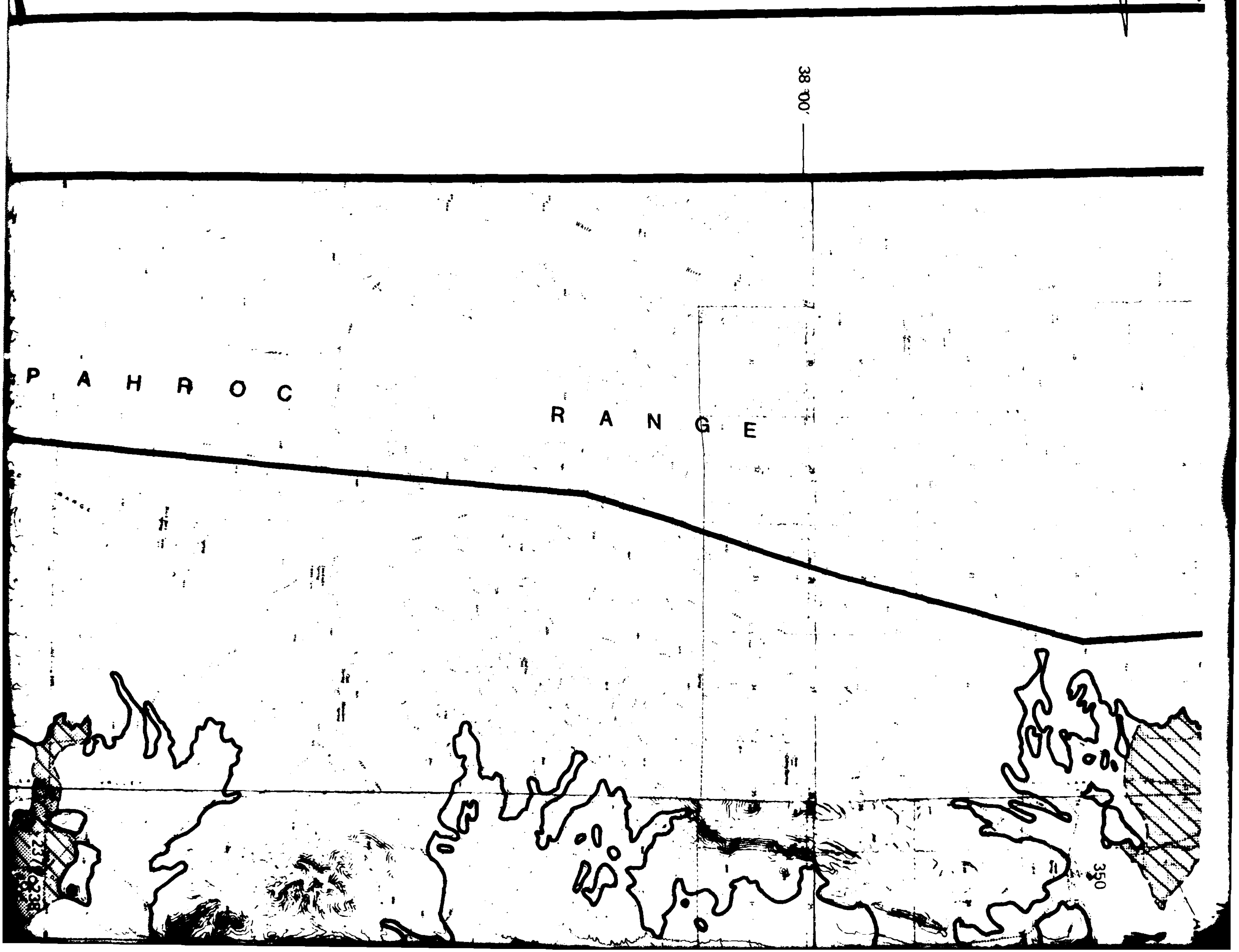

353
5
265
Aa'

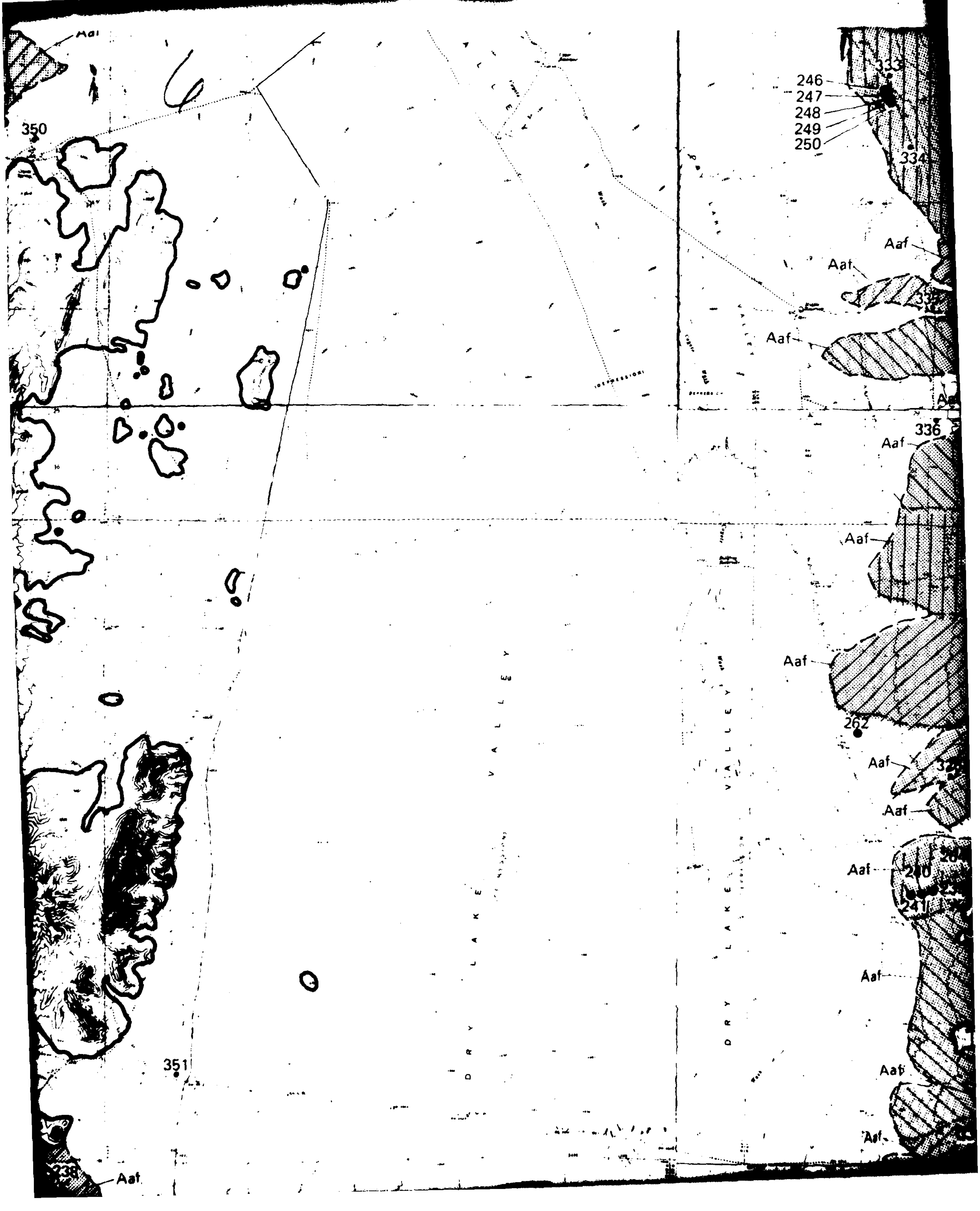

353
DRY LAKE VALLEY
349
257
261
263
DRY LAKE
WES
5
265
Cau
332
Aaf
Aaf
246
247
248
249
250
334
60


349
257
261
348
14
347
346
345
344
343
Aaf
34
254
255
256
340
334
Aaf
W E S
B R S T

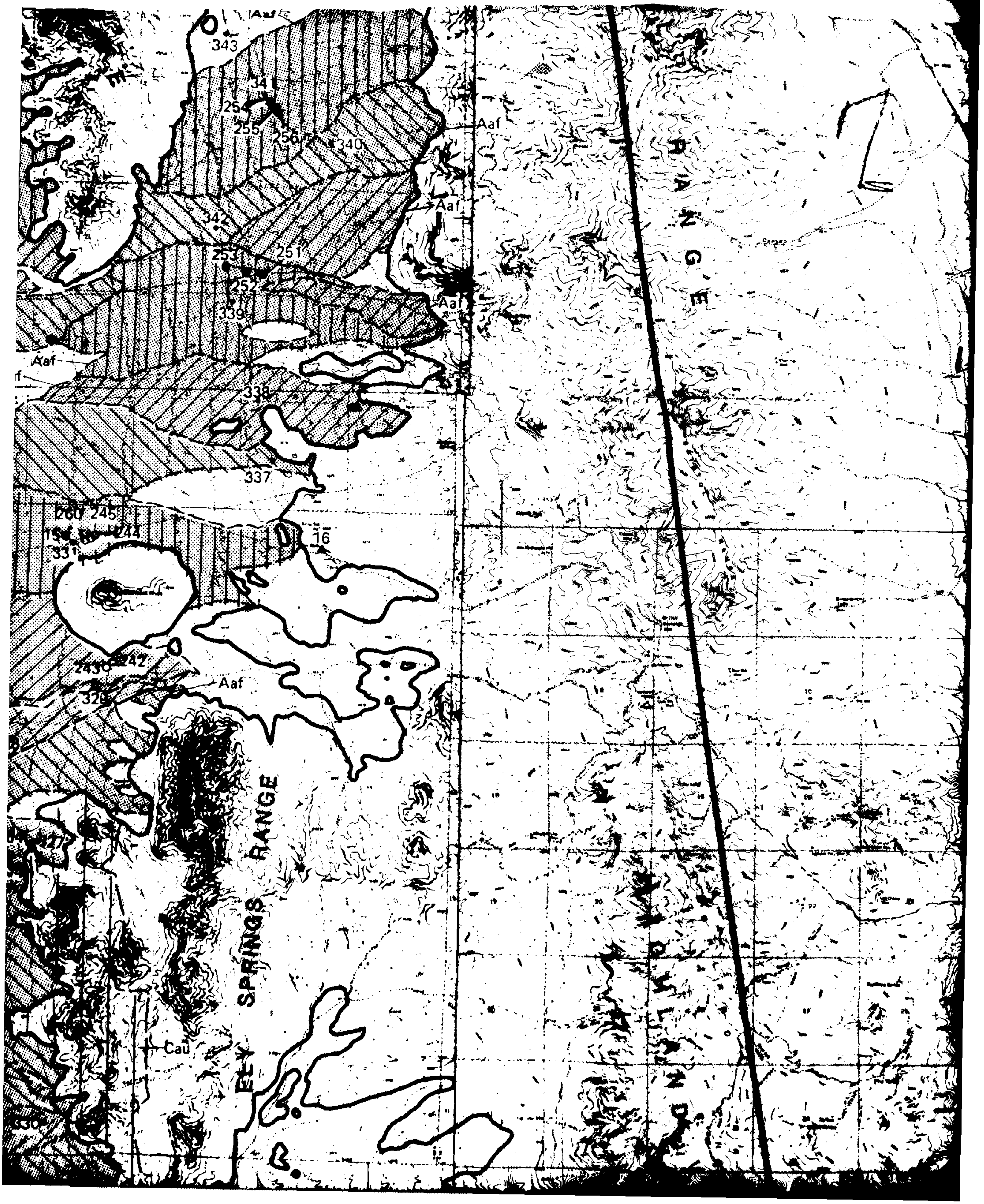
4

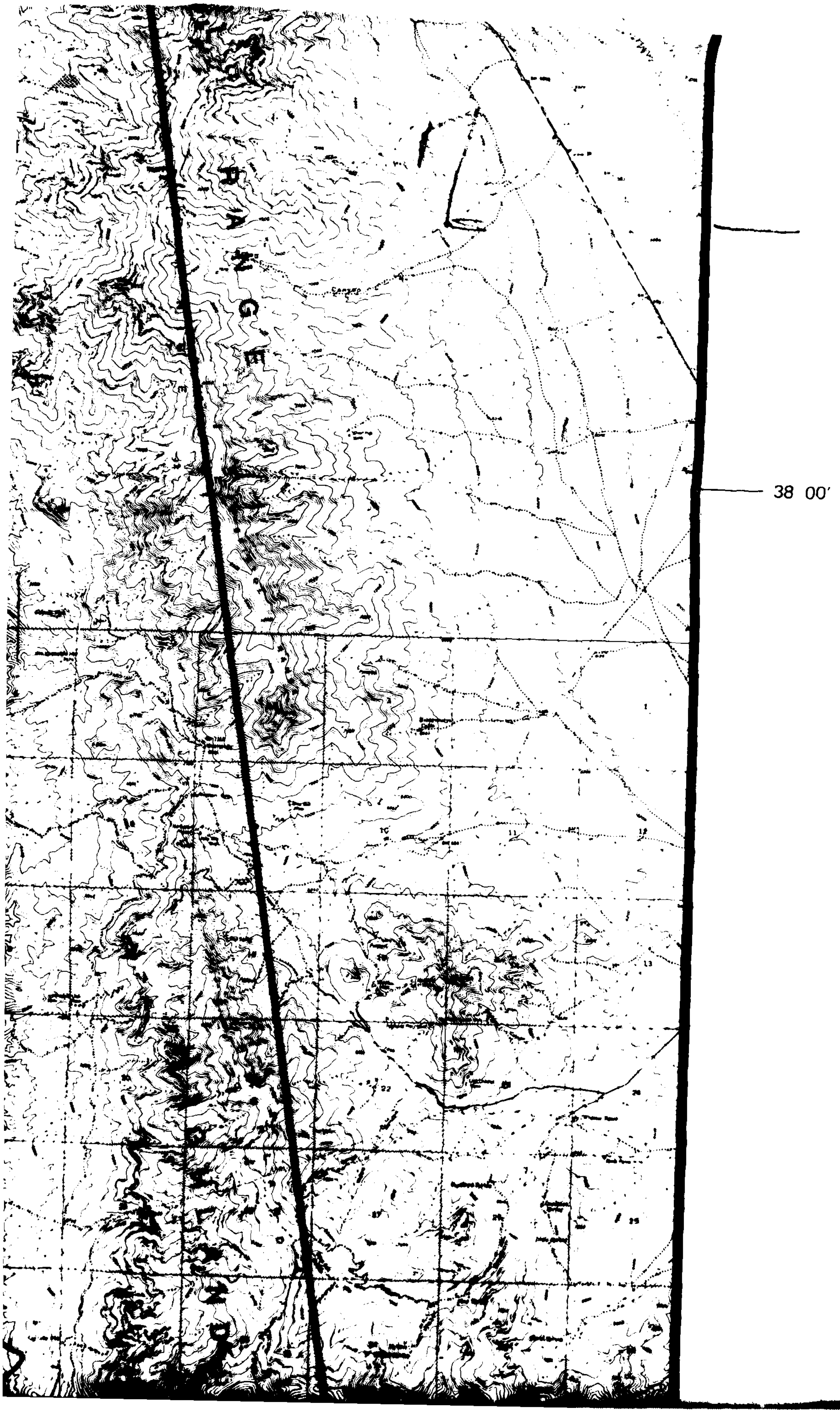
5



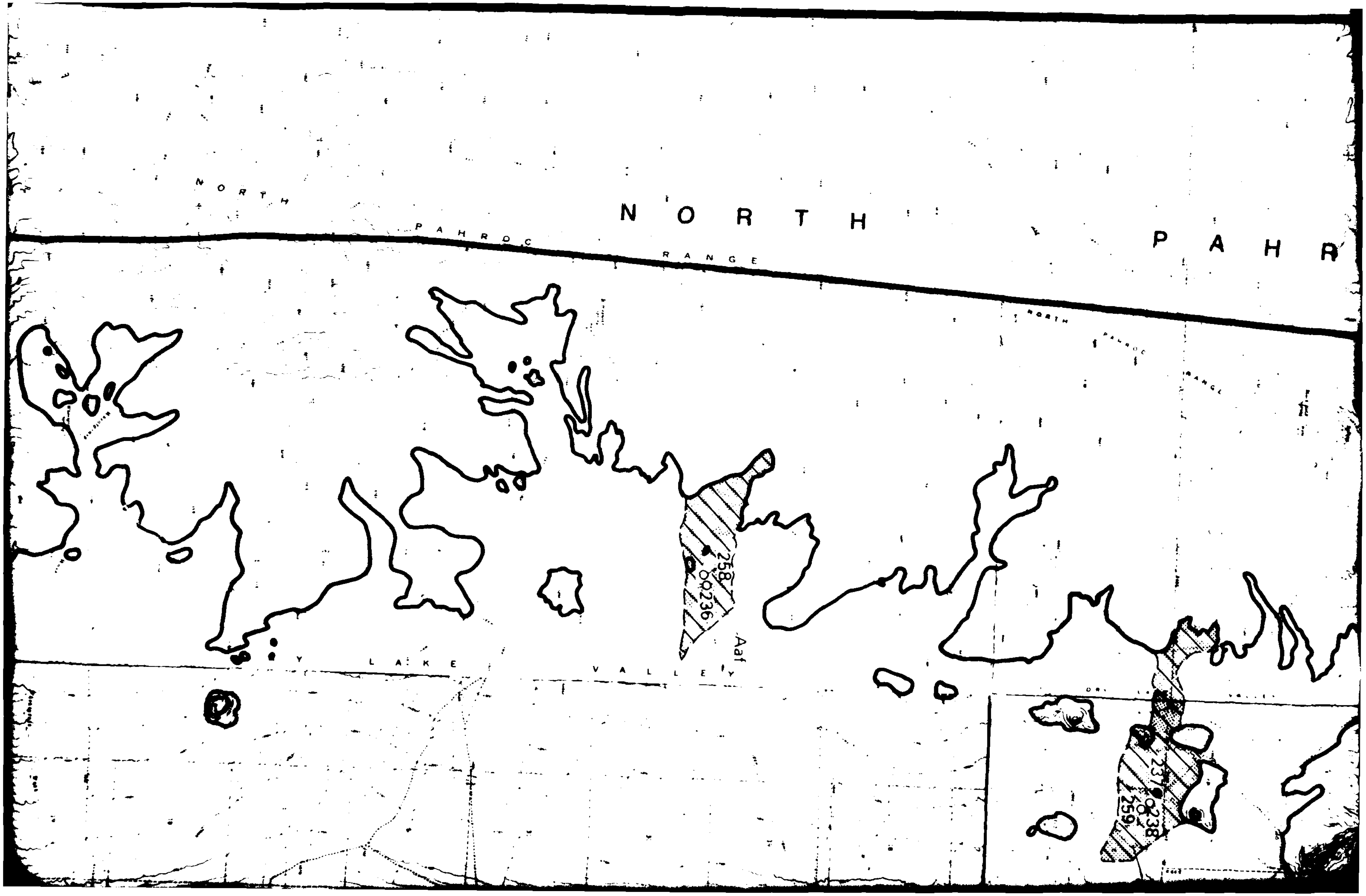


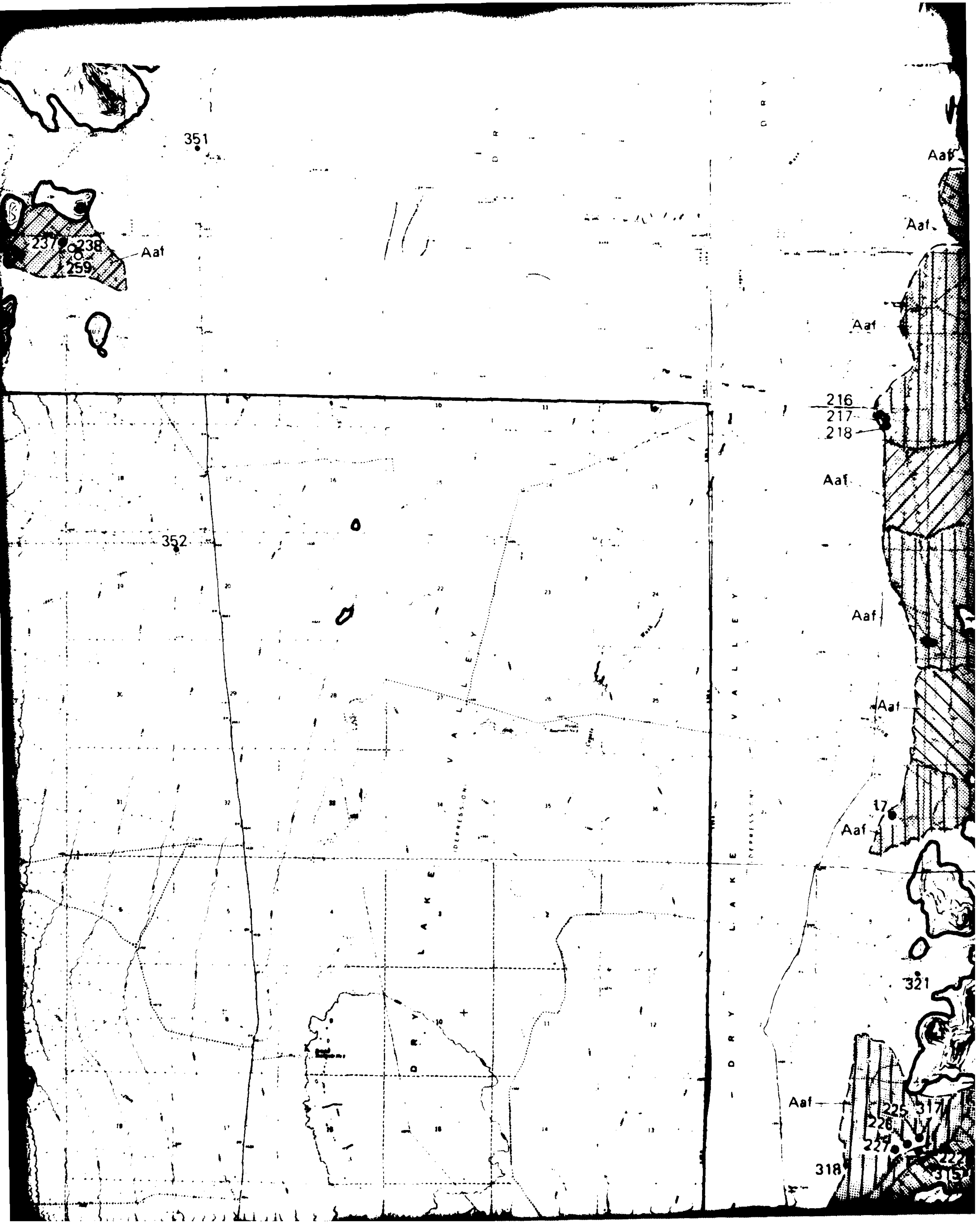
Aaf
350
333
246
247
248
249
250
334
Aaf
Aaf
335
Aaf
336
Aaf
Aaf
Aaf
262
Aaf
Aaf
Aaf
240
241
Aaf
Aaf
Aaf
DRY LAKE VALLEY
DRY LAKE VALLEY
351
238
Aaf

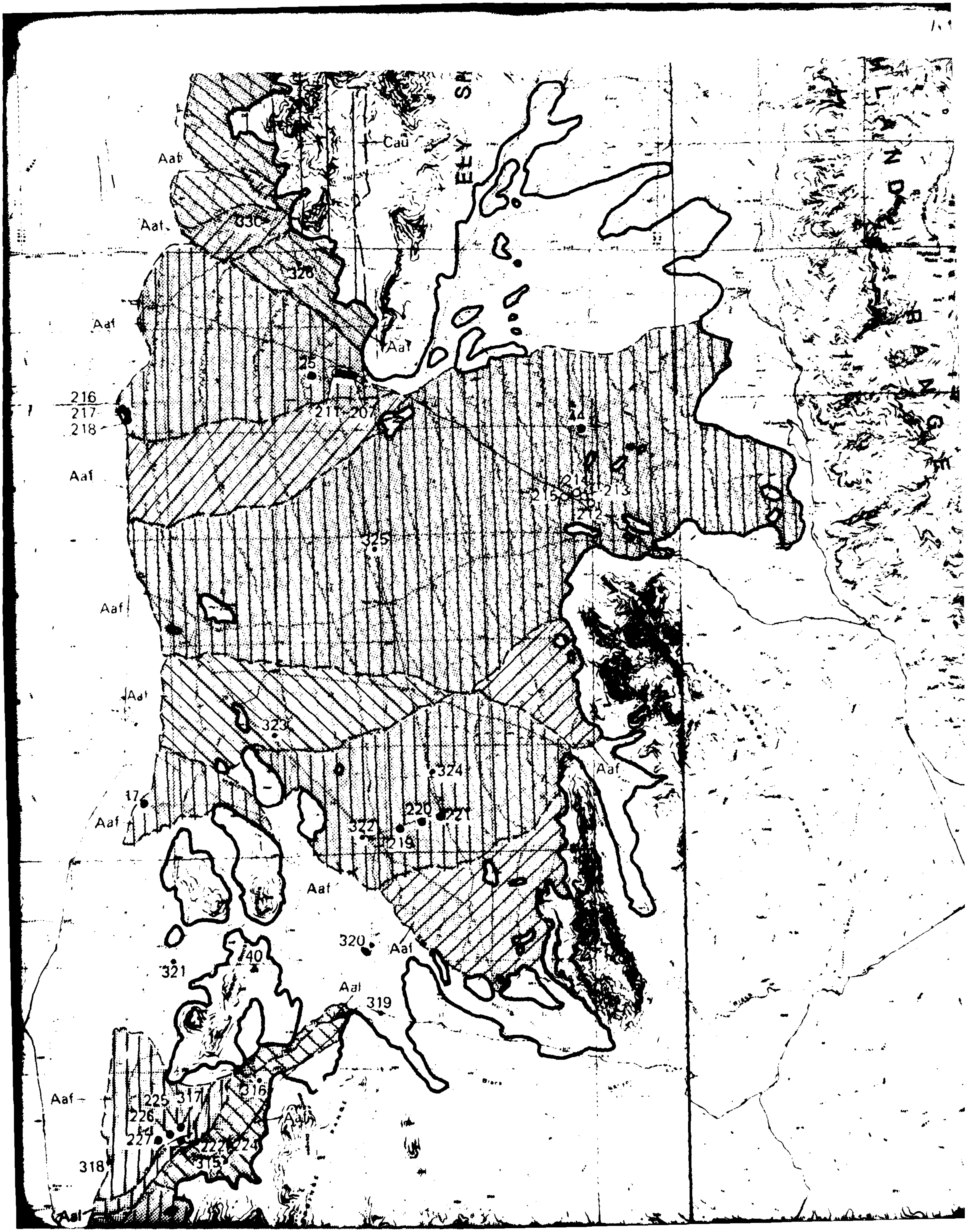

343
341
254
255
256
340
Aaf
342
253
251
252
339
Aaf
Aaf
Aaf
338
337
260
245
244
331
16
243
242
329
Aaf
Cau
330
ELY SPRINGS RANGE
RANGE



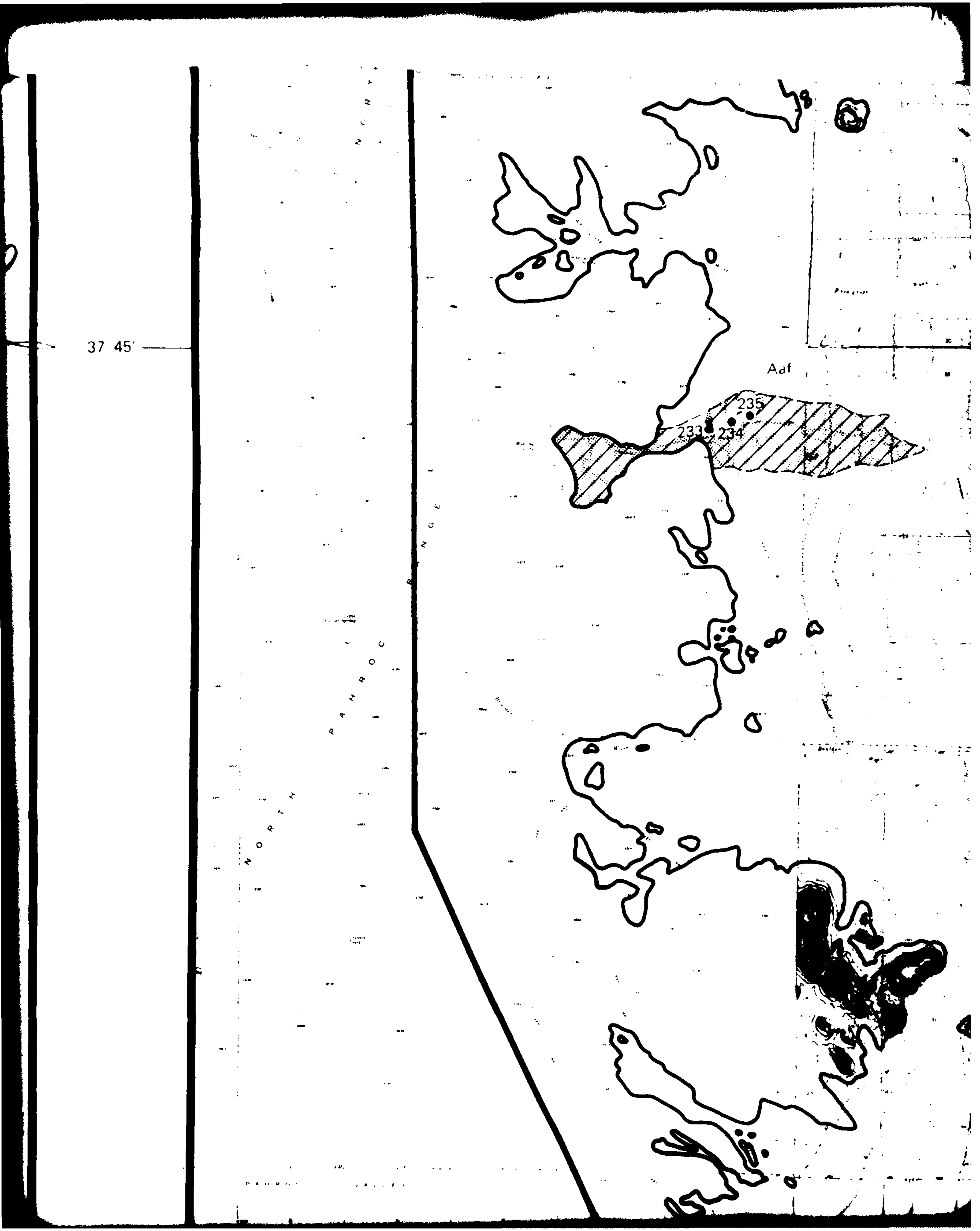
8

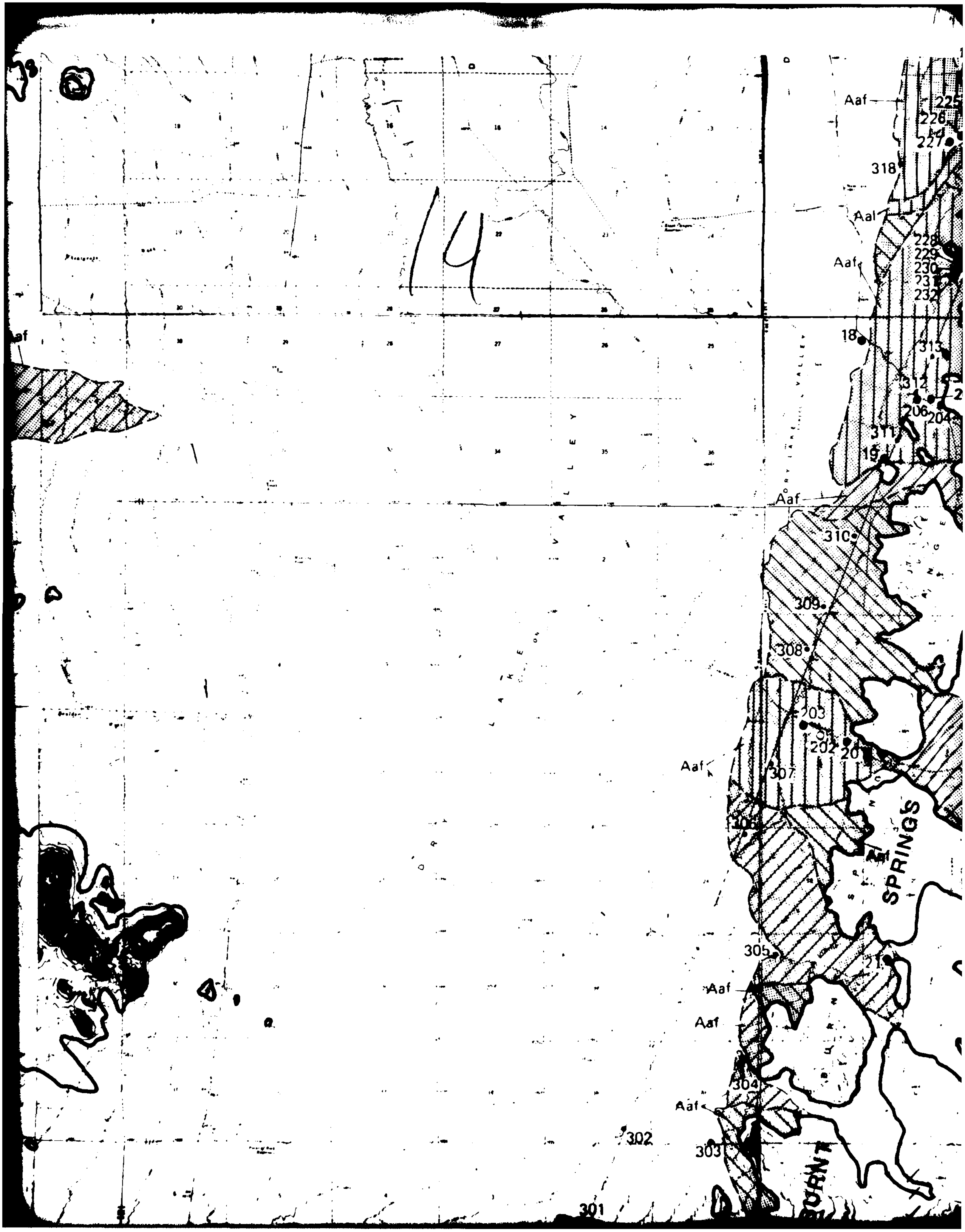

NORTH PAHR
NORTH PAHROC RANGE
NORTH PAHROC RANGE
LAKE VALLEY
Aaf
258
236
237
238
259

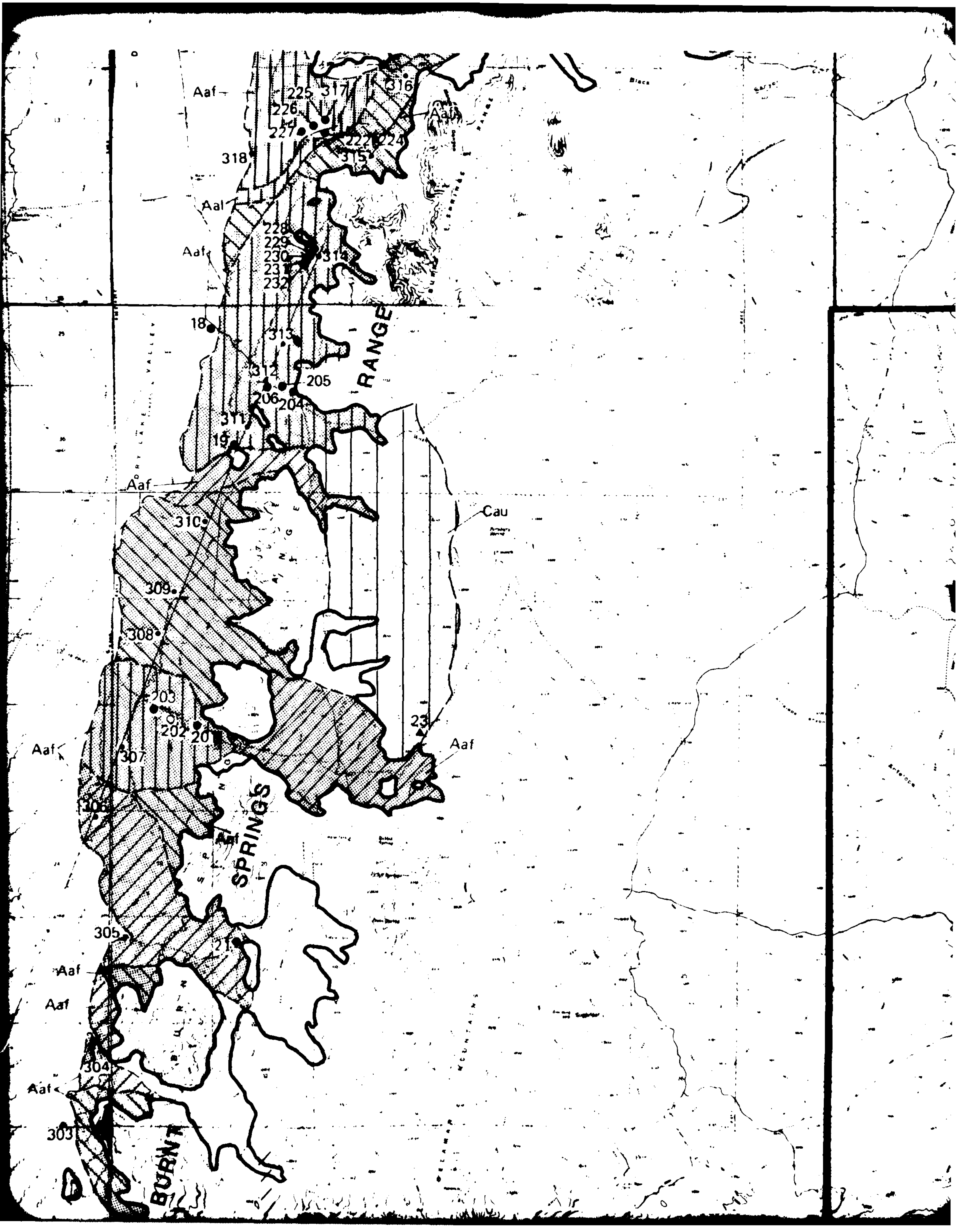

351
237
238
259
Aaf
352
216
217
218
Aaf
Aaf
Aaf
Aaf
Aaf
Aaf
17
Aaf
321
Aaf
225
317
226
227
222
318
315
DRY LAKE VALLEY
DEPRESSION
DRY LAKE VALLEY
DEPRESSION


SP
ELY
Cau
Aaf
Aaf
330
326
Aaf
Aaf
25
216
217
218
211
207
44
Aaf
214
215
213
212
325
Aaf
Aaf
323
324
Aaf
17
Aaf
220
221
322
219
Aaf
320
Aaf
40
321
Aal
319
316
Aaf
225
317
226
Aaf
227
228
224
315
318
Aal


HLAND RANGE


37 45′
NORTH PAHROC RANGE
Adf
235
233
234
PAHROC VALLEY


14
Aaf
225
226
227
318
Aal
Aaf
228
229
230
231
232
Aaf
18
313
312
206
204
311
19
VALLEY
Aaf
310
309
308
203
202
201
Aaf
307
306
SPRINGS
Aaf
305
21
Aaf
Aaf
304
Aaf
302
303
BURNT
301


Aaf
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316
226
Aaf
227
222
224
318
315
Aal
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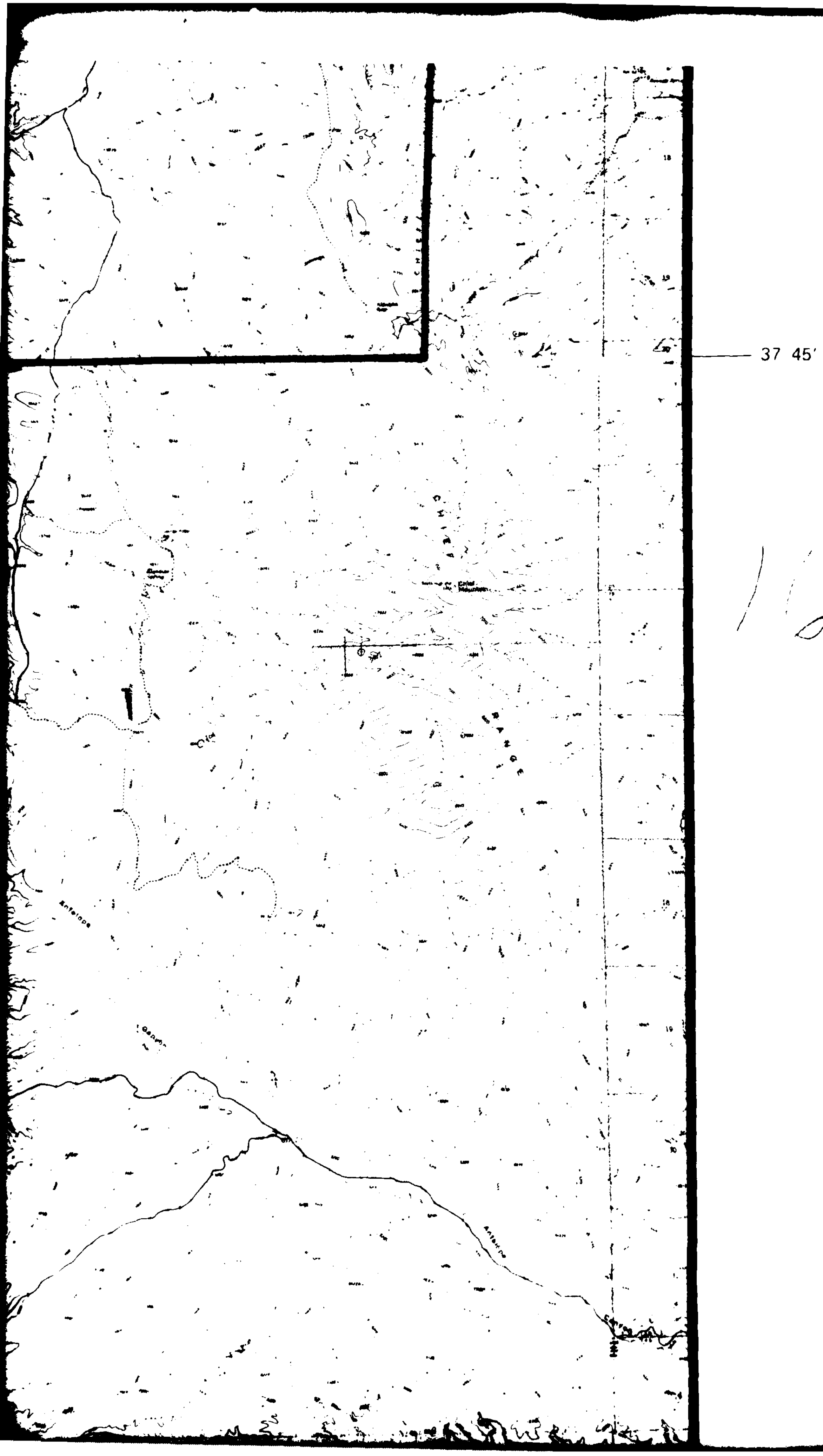
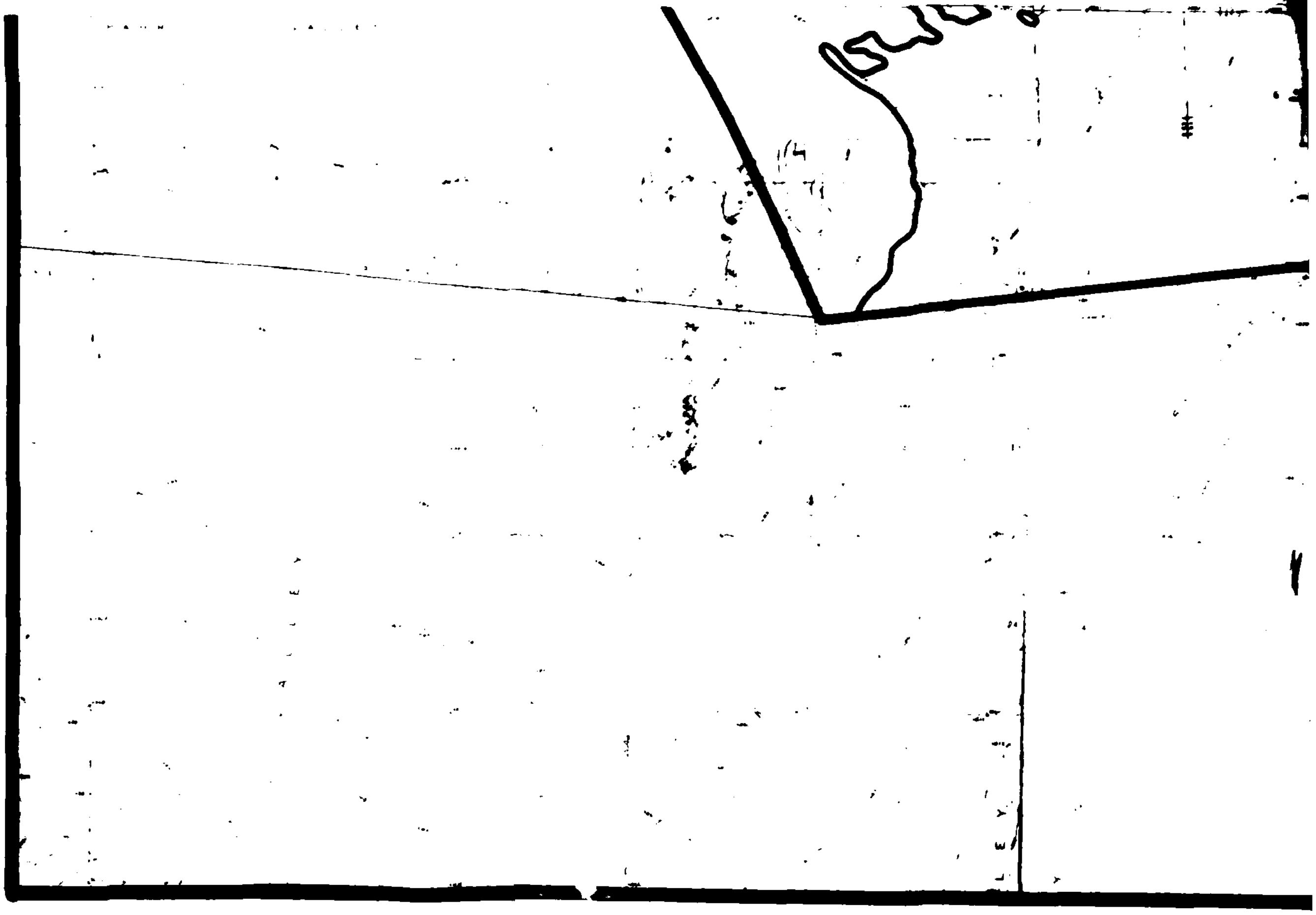
229
230
231
232
314
Aaf
18
313
RANGE
312
205
206
204
311
19
Aaf
Cau
310
309
308
203
202
201
23
Aaf
Aaf
307
306
Aaf
SPRINGS
305
21
Aaf
Aaf
304
Aaf
303
BURNT



16



ERTEC WESTERN AGGREGATE RESOURCES STUDY FIELD STATIONS

VALLEY-SPECIFIC AGGREGATE RESOURCES STUDY *
(MAP NUMBERS FROM 1 TO 199)

BASIN-FILL UNITS (COARSE AND/OR FINE AGGREGATES)

- ● DATA STOP, SAMPLED AND TESTED
- ○ DATA STOP

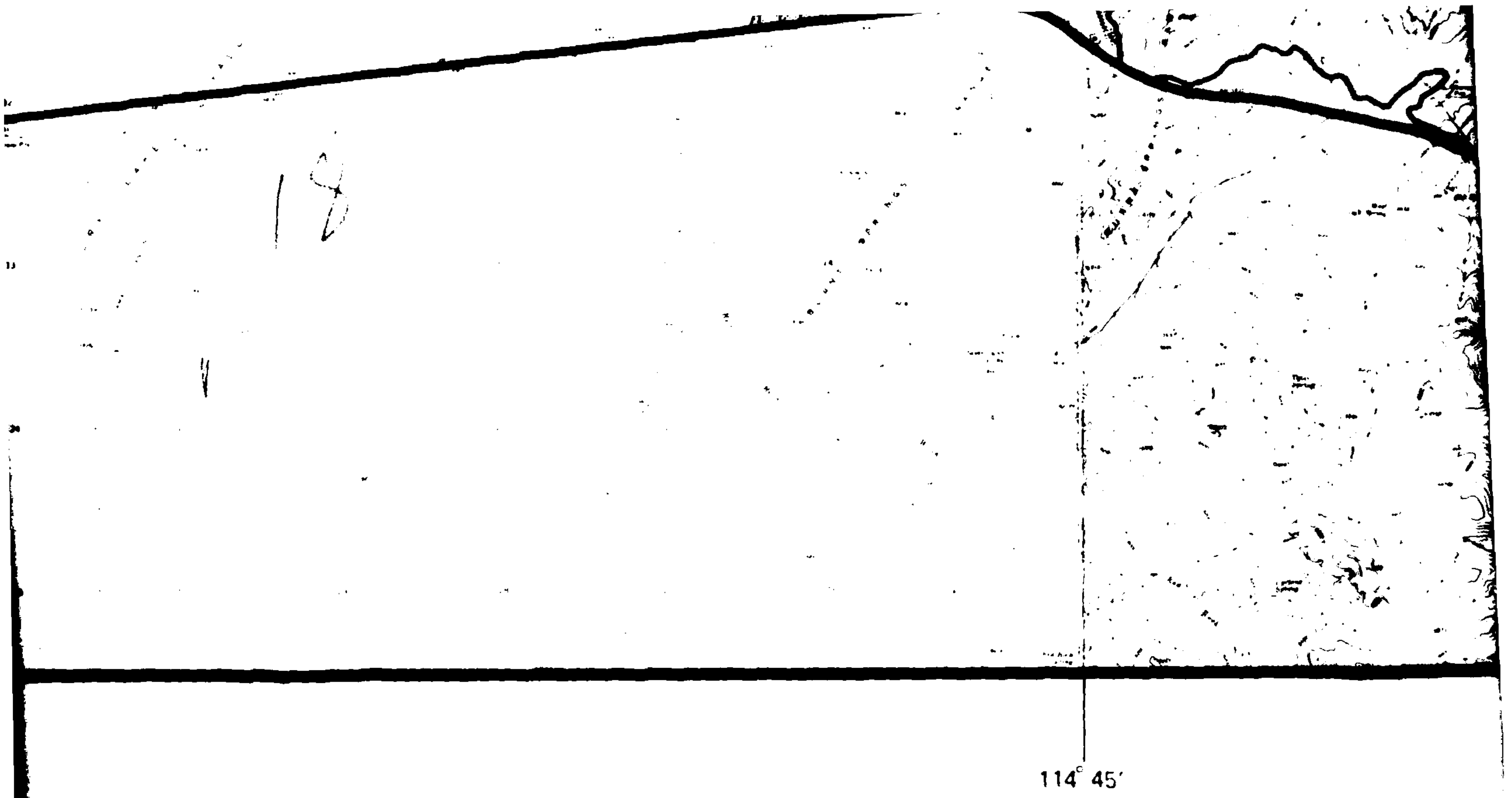
ROCK UNITS (CRUSHED-ROCK AGGREGATES)

- ▲ DATA STOP, SAMPLED AND TESTED
- ▲ DATA STOP

B

R

RI

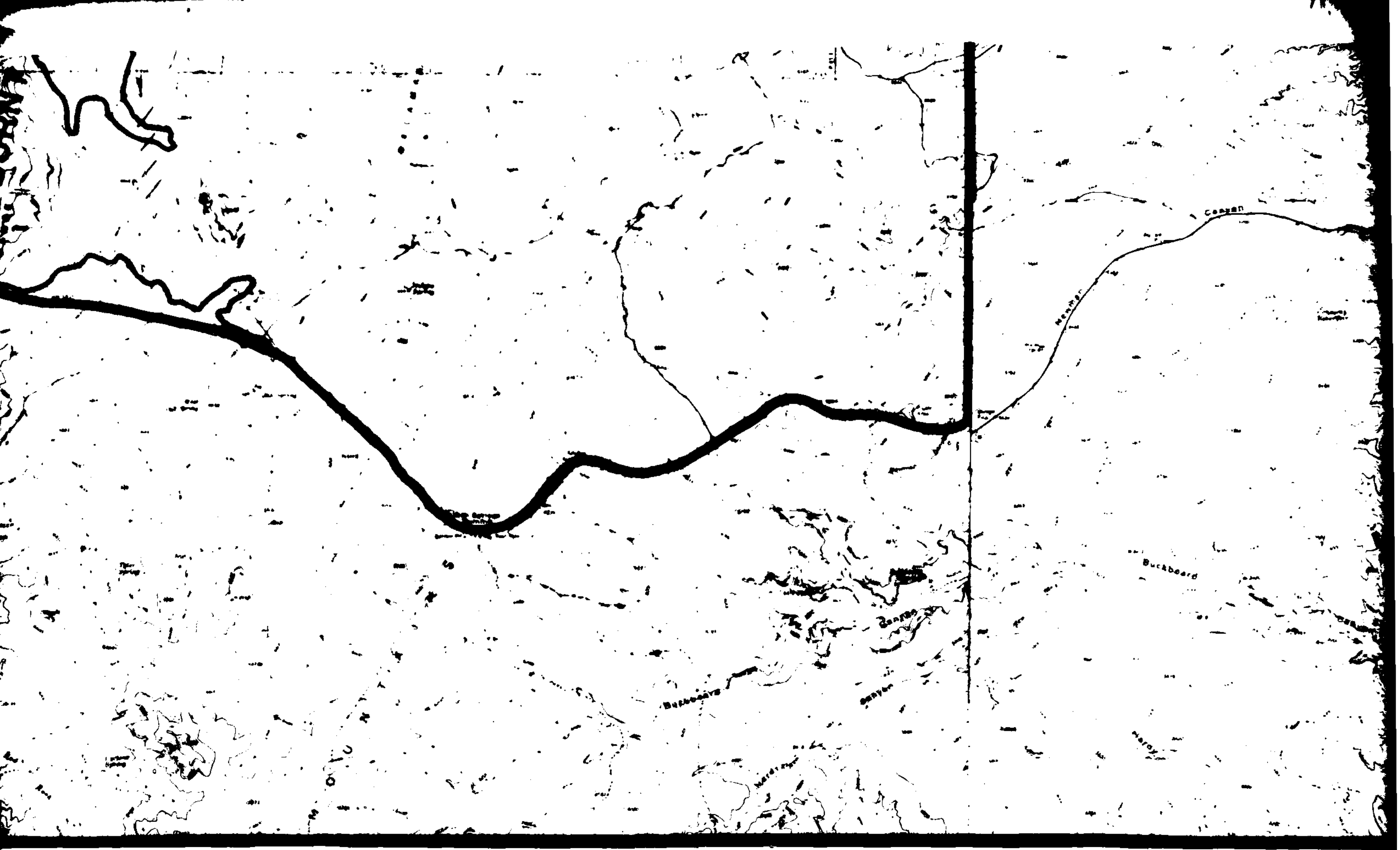


EXPLANATION

AGGREGATE CLASSIFICATION SYSTEM

BASIN–FILL AND ROCK SOURCES* * *

RBIa	▥	BASIN FILL	BASIN–FILL OR ROCK SOURCES CONTAINING MATERIALS SUITABLE FOR USE AS ROAD-BASE AGGREGATES; BASED ON ACCEPTABLE LABORATORY AGGREGATE TEST RESULTS.
	□	ROCK	
RBIb	▧	BASIN FILL	BASIN–FILL SOURCES CONTAINING MATERIALS SUITABLE FOR USE AS ROAD-BASE AGGREGATES, BASED ON CORRELATION WITH CLASS RBIa SOURCE AREAS.
	▨		POTENTIAL BASIN–FILL SOURCES OF MATERIALS SUITABLE FOR USE AS ROAD-BASE



19

ION

E AGGRE-
Y AGGRE-

LS
ES;
URCE

ALS
ES;
S, FIELD
VE SIEVE

GEOLOGIC UNITS[†]

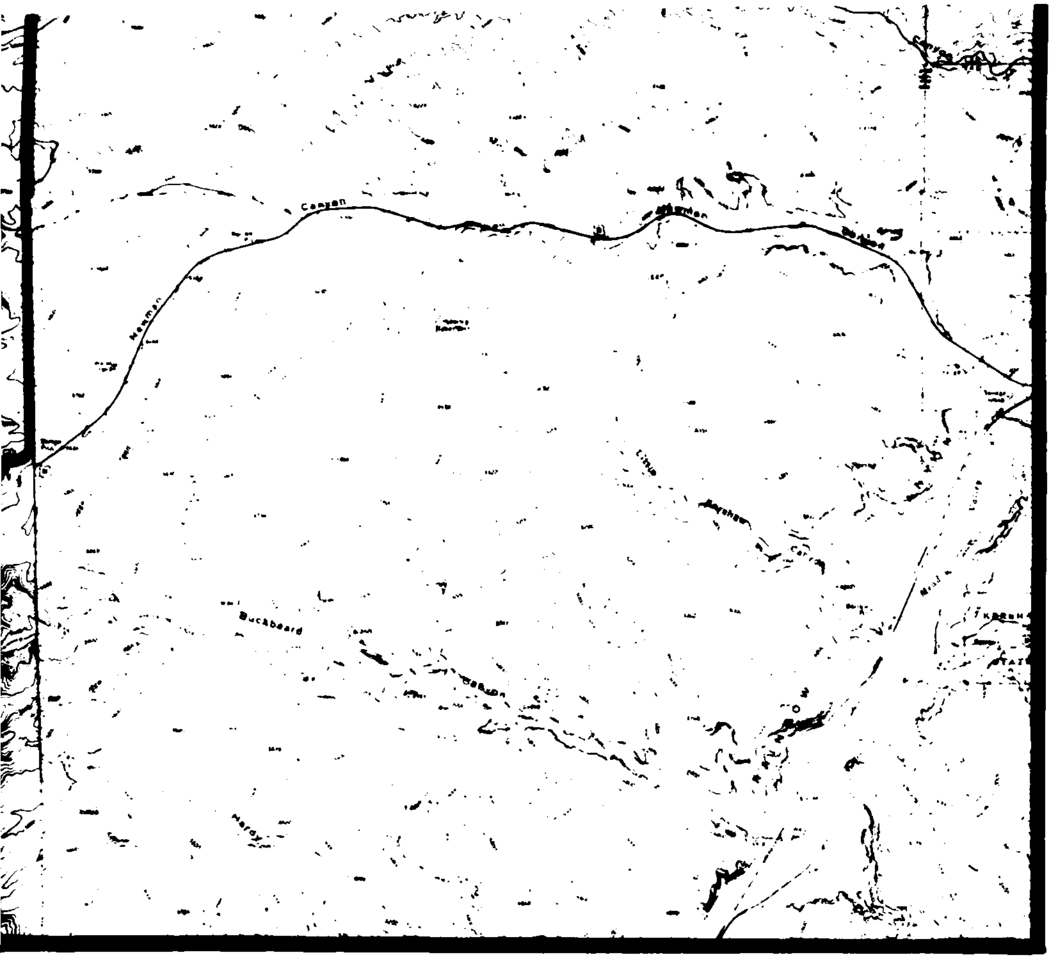
BASIN–FILL UNITS

Aal	STREAM-CHANNEL AND/OR TERRACE DEPOSITS	(A1 A2)
Aaf	ALLUVIAL FAN DEPOSITS	(A5)

ROCK UNITS

Cau	CARBONATE ROCKS UNDIFFERENTIATED	(S2)

[†] SEE APPENDIX TABLE F-3 FOR SYMBOL EXPLANATION AND COMPARISON



20

NORTH

SCALE 1 62,500

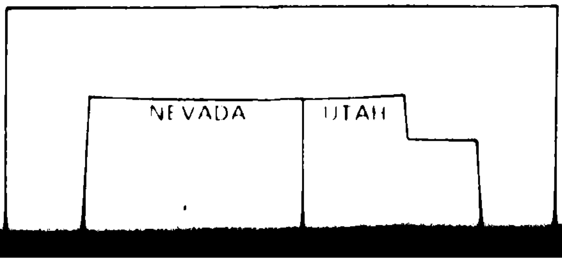
0 1 2
STATUTE MILES

0 1 2
KILOMETERS

RACE DEPOSITS (A1/A2)

(A5)

LOCATION MAP



NTIATED (S2)

AND COMPARISON

● DATA STOP, SAMPLED AND TESTED

○ DATA STOP

ROCK UNITS (CRUSHED ROCK AGGREGATES)

▲ DATA STOP, SAMPLED AND TESTED

△ DATA STOP

DETAILED AGGREGATE RESOURCES STUDY * *
(MAP NUMBERS FROM 200 TO 299 FOR BASIN-FILL
AND ROCK SAMPLE LOCATIONS; 300 TO 399 FOR
FIELD PETROGRAPHIC STATIONS)

BASIN-FILL UNITS (COARSE AND/OR FINE AGGREGATES)

● DATA STOP, SAMPLED AND TESTED

○ DATA STOP

ROCK UNITS (CRUSHED ROCK AGGREGATES)

▲ DATA STOP, SAMPLED AND TESTED

PETROGRAPHIC FIELD STATIONS

• DATA STOP

* SEE DRY LAKE, MULESHOE, DELAMAR, PAHROC VSARS REPORT (FN-TR-37-a) FOR DETAILED INFORMATION.

* * SEE CORRESPONDING MAP NUMBER IN APPENDICES A AND B FOR DETAILED INFORMATION.

Ib	▧	BASIN FILL	BASIN–FILL SOURCES CONTAINING MATERIALS SUITABLE FOR USE AS ROAD-BASE AGGREGATES; BASED ON CORRELATION WITH CLASS RBIa SOURCE AREAS.
II	▨	BASIN FILL	POTENTIAL BASIN–FILL SOURCES OF MATERIALS SUITABLE FOR USE AS ROAD-BASE AGGREGATES; BASED ON PHOTOGEOLOGIC INTERPRETATIONS, FIELD OBSERVATIONS, AND LIMITED OR INCONCLUSIVE SIEVE ANALYSIS AND/OR ABRASION DATA.
	☐		UNSUITABLE SOURCES OF BASIN–FILL MATERIALS THAT MAY LOCALLY CONTAIN POTENTIALLY SUITABLE SOURCES OF AGGREGATES OF LIMITED EXTENT. UNTESTED SOURCES OF ROCK MATERIALS THAT MAY CONTAIN POTENTIALLY SUITABLE CRUSHED-ROCK AGGREGATES (SEE TEXT FOR ADDITIONAL INFORMATION).

* A COMPLETE CLASSIFICATION SYSTEM IS SHOWN, ALTHOUGH ALL BASIN–FILL OR ROCK SOURCES MAY NOT BE PRESENT WITHIN THE STUDY AREA.

Cau

† SEE APPENDI

SYMBOLS[††]

━━━

———

— —

- - - -

[††] GEOLOGIC
APPROX'MA

KILOMETERS

ROCK UNITS

Cau	CARBONATE ROCKS UNDIFFERENTIATED	(S2)

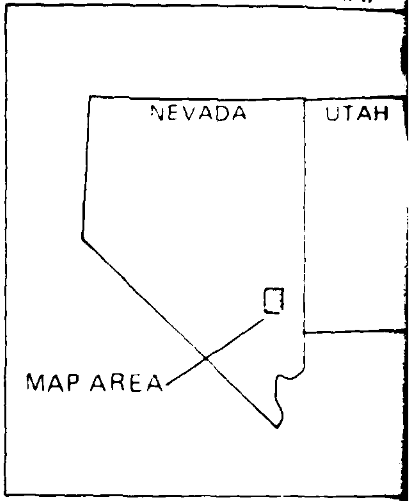
EE APPENDIX TABLE F-3 FOR SYMBOL EXPLANATION AND COMPARISON

MBOLS††

━━━━	STUDY AREA BOUNDARY
────	ROCK/BASIN–FILL CONTACT
—— ——	GEOLOGIC ROCK CONTACT
— — — —	BASIN–FILL CONTACT

†GEOLOGIC ROCK AND BASIN–FILL CONTACTS ARE
APPROXIMATELY LOCATED AND MAY VARY LOCALLY

LOCATION MAP



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The Earth Technology Corporation

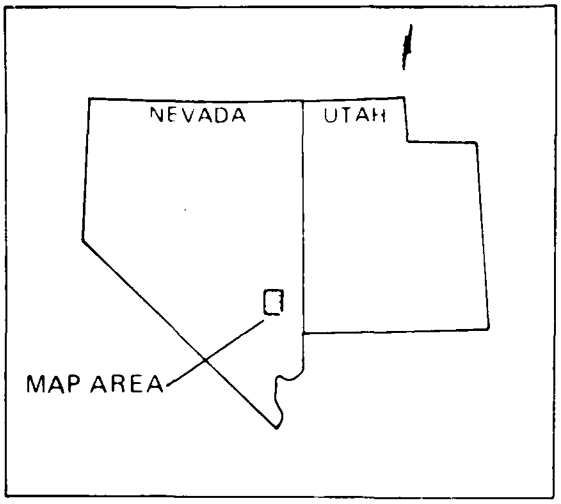
MX SIT
DEPARTME
B

ROAD-BASE AGGREGATE
DETAILED AGGREGATE RE
DRY LAKE VALLEY

29 MAY 81

KILOMETERS

LOCATION MAP



Ertec

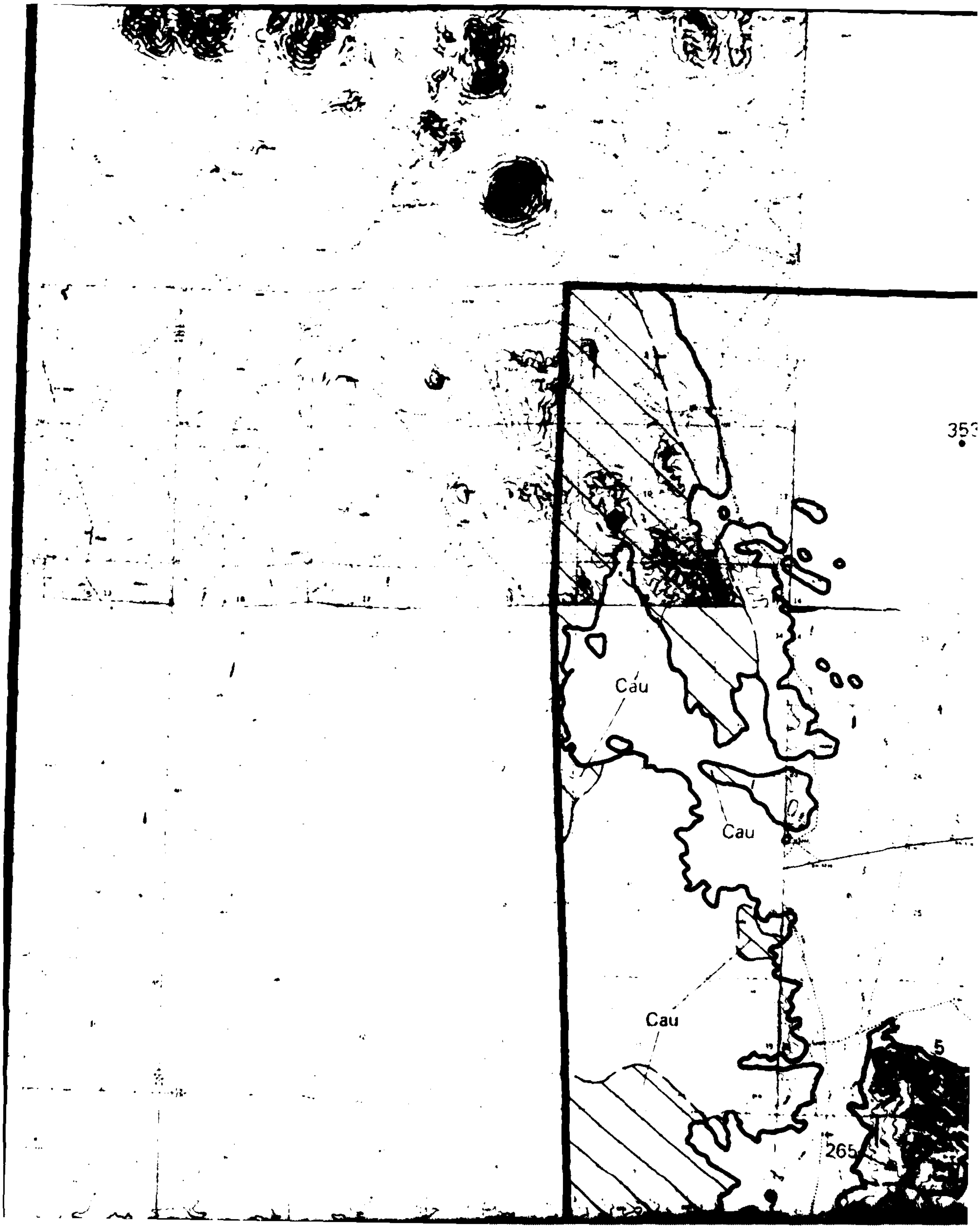
The Earth Technology Corporation

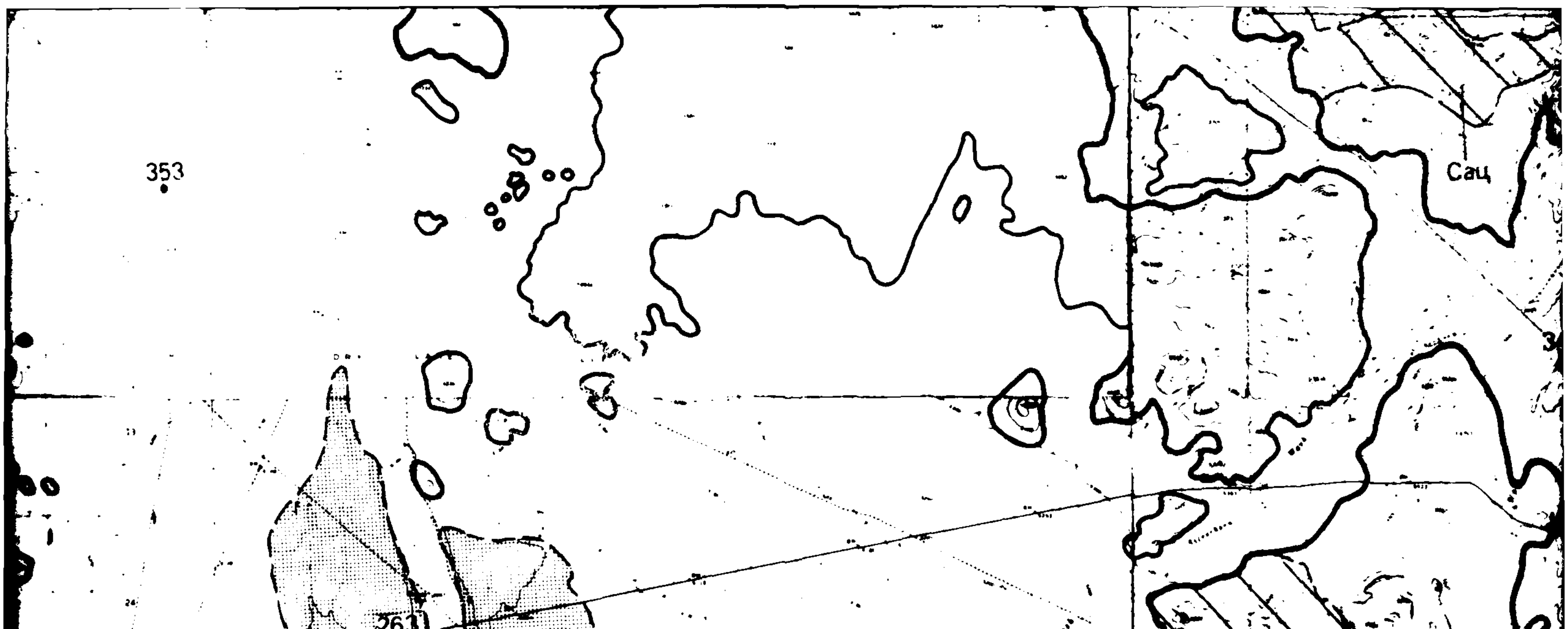
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRCE-MX

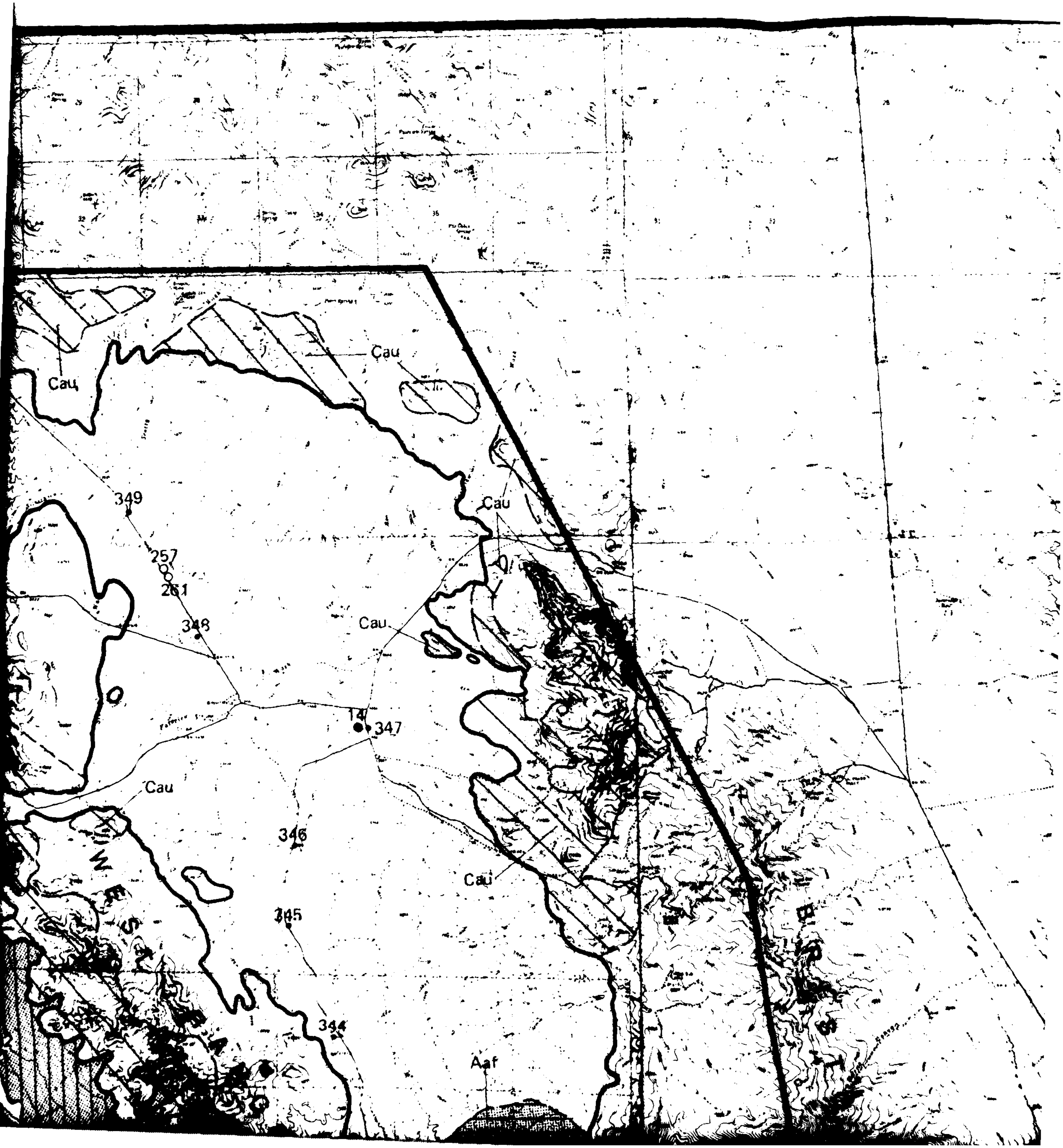
ROAD-BASE AGGREGATE RESOURCES MAP
DETAILED AGGREGATE RESOURCES STUDY
DRY LAKE VALLEY, NEVADA

29 MAY 81

DRAWING 2

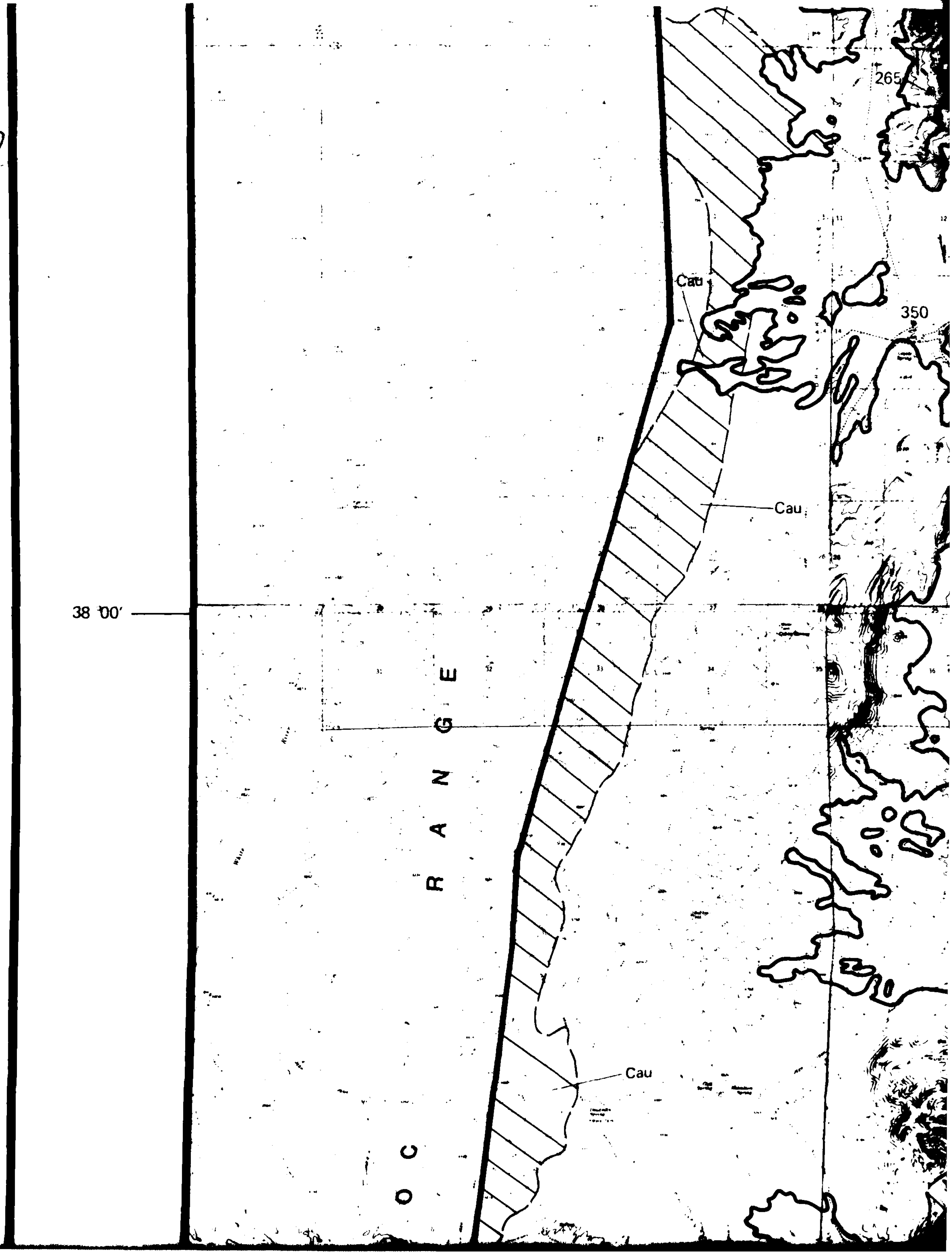

353
Cau
Cau
Cau
5
265

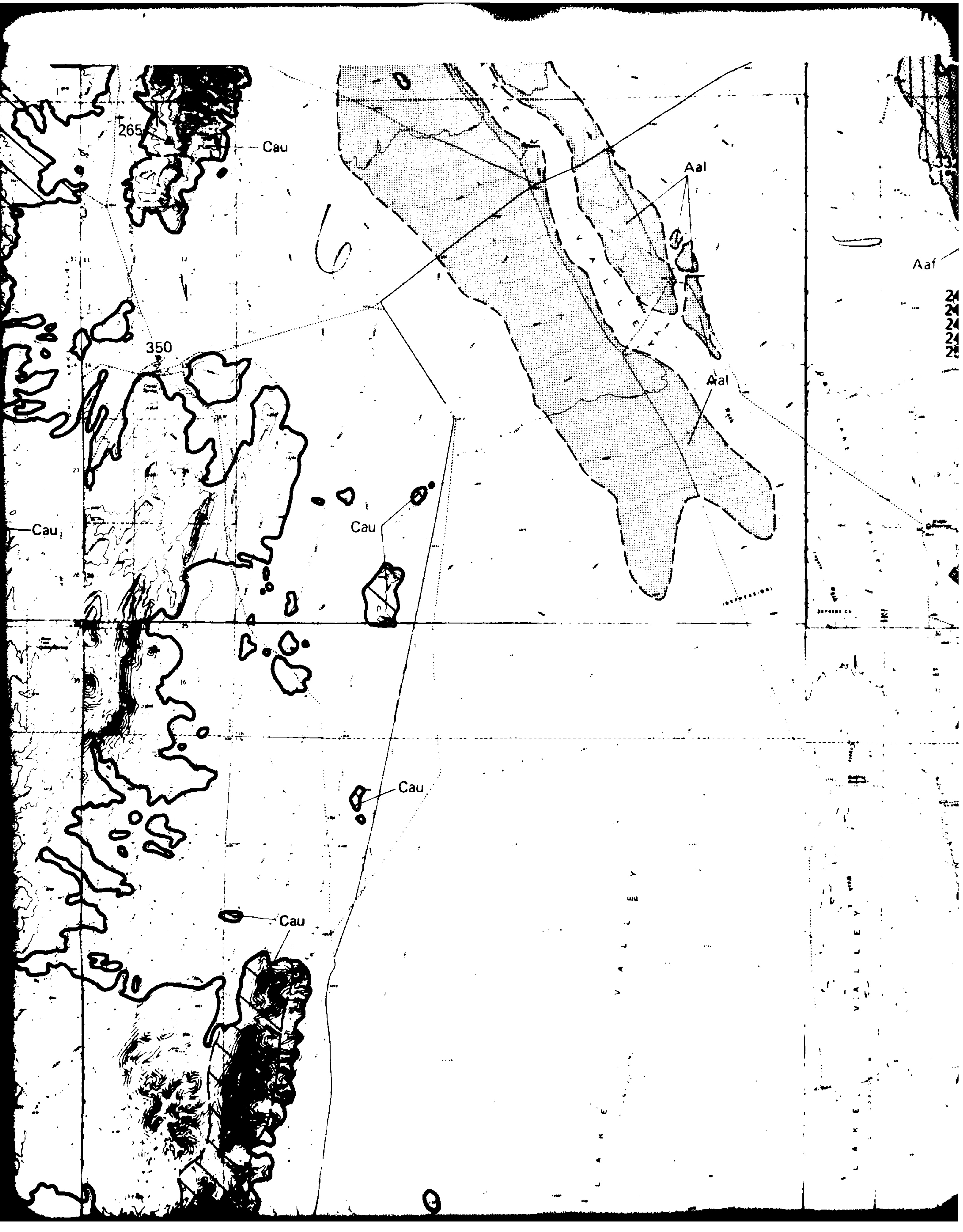

Cau
353
263
Aal
Aal
D R Y L A K E
Cau
Cau
5
265
Cau
Aal
332

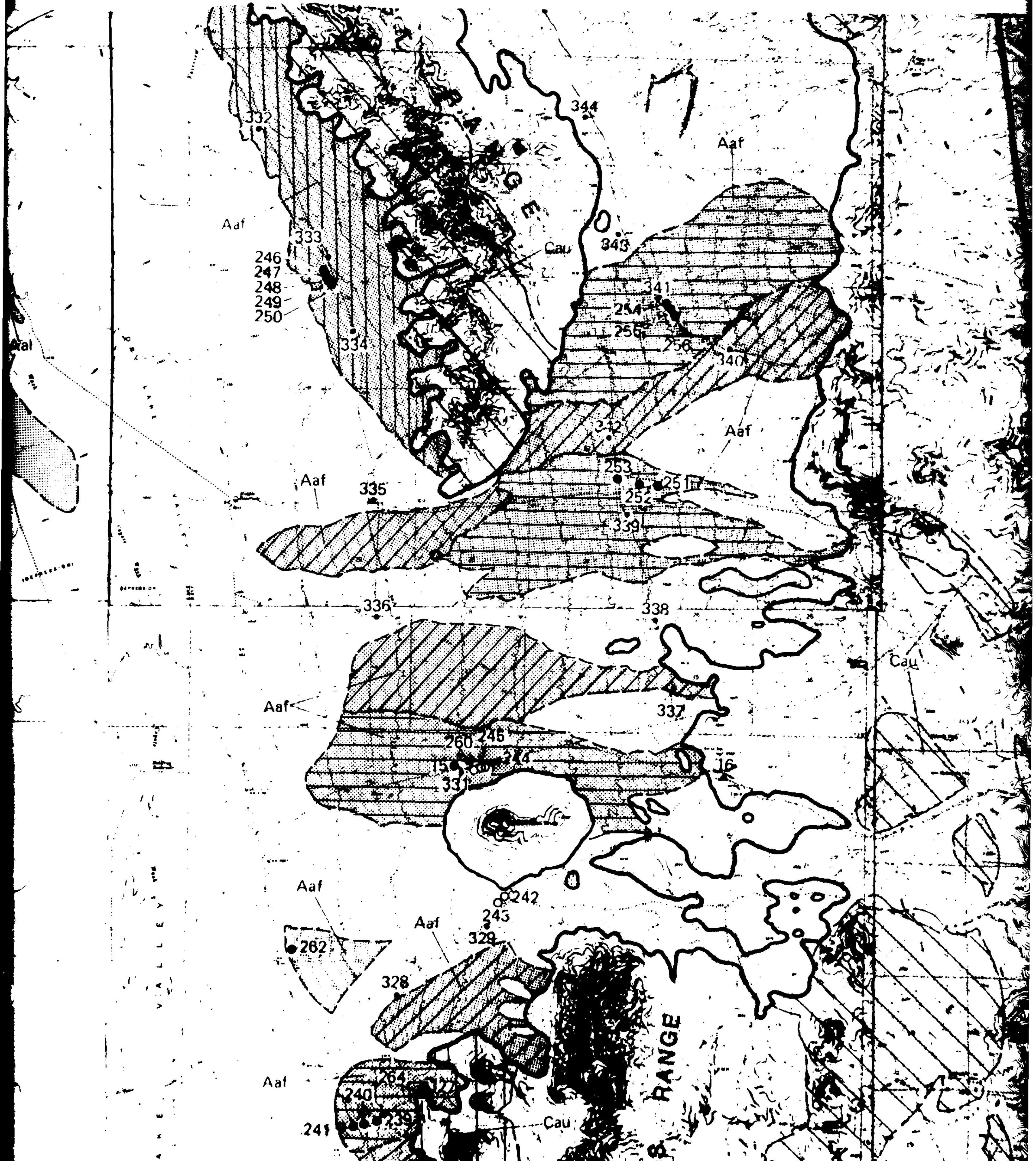

Cau
Cau
349
Cau
257
261
348
Cau
14
347
Cau
346
Cau
345
344
Aaf

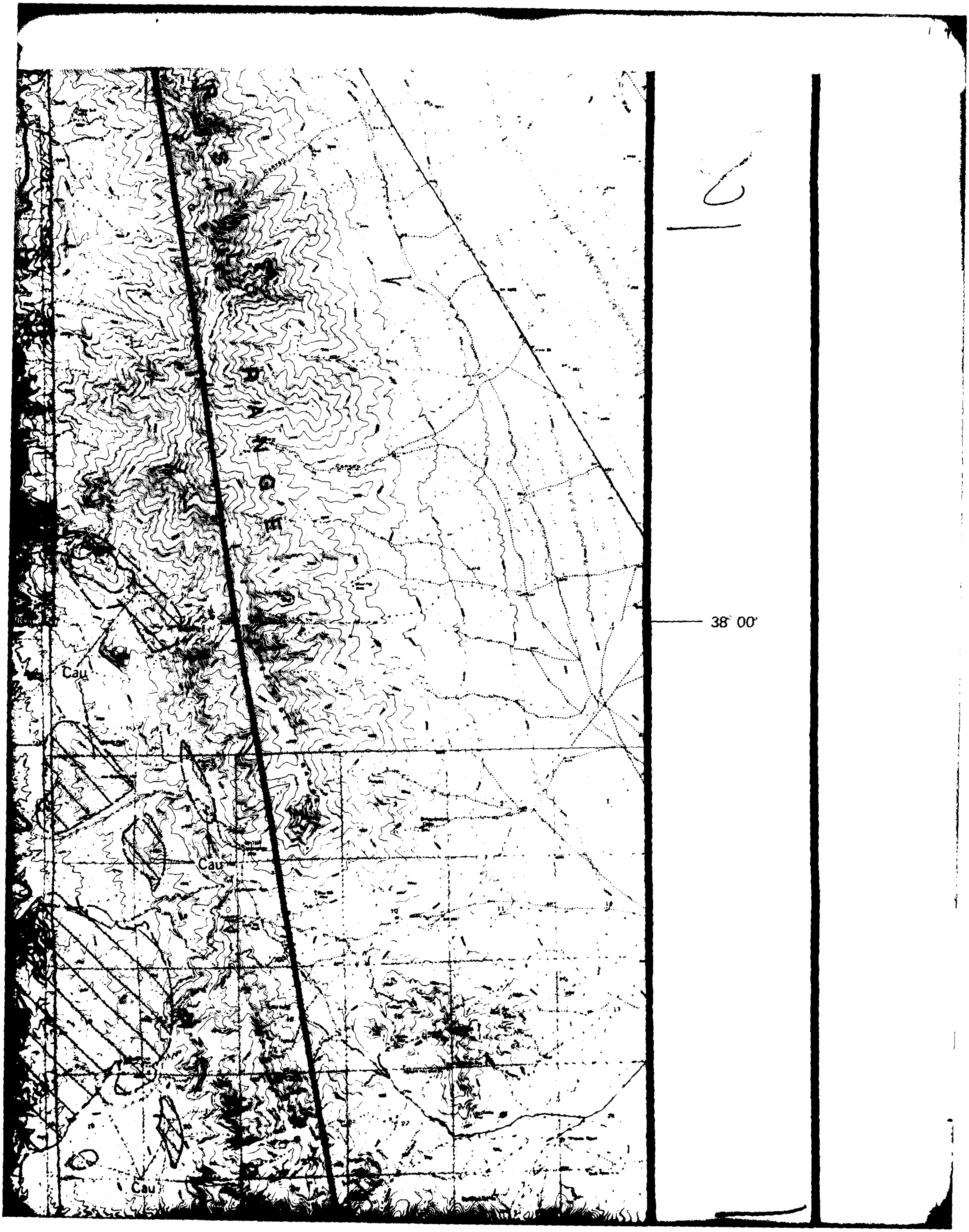
29
28
27
26
25
32
33
34
35
36

5




265
Cau
Aal
Aaf
350
Cau
Cau
Aal
Cau
Cau
VALLEY
LAKE
VALLEY
LAKE
VALLEY


344
Aaf
332
GE
343
Cau
Aaf
333
246
247
248
249
250
341
254
255
256
340
334
Aal
342
Aaf
Aaf
253
251
252
339
335
336
338
Cau
Aaf
337
260
245
244
15
331
16
Aaf
242
243
329
Aaf
262
328
RANGE
Aaf
264
240
239
241
Cau
NGS
VALLEY
LAKE



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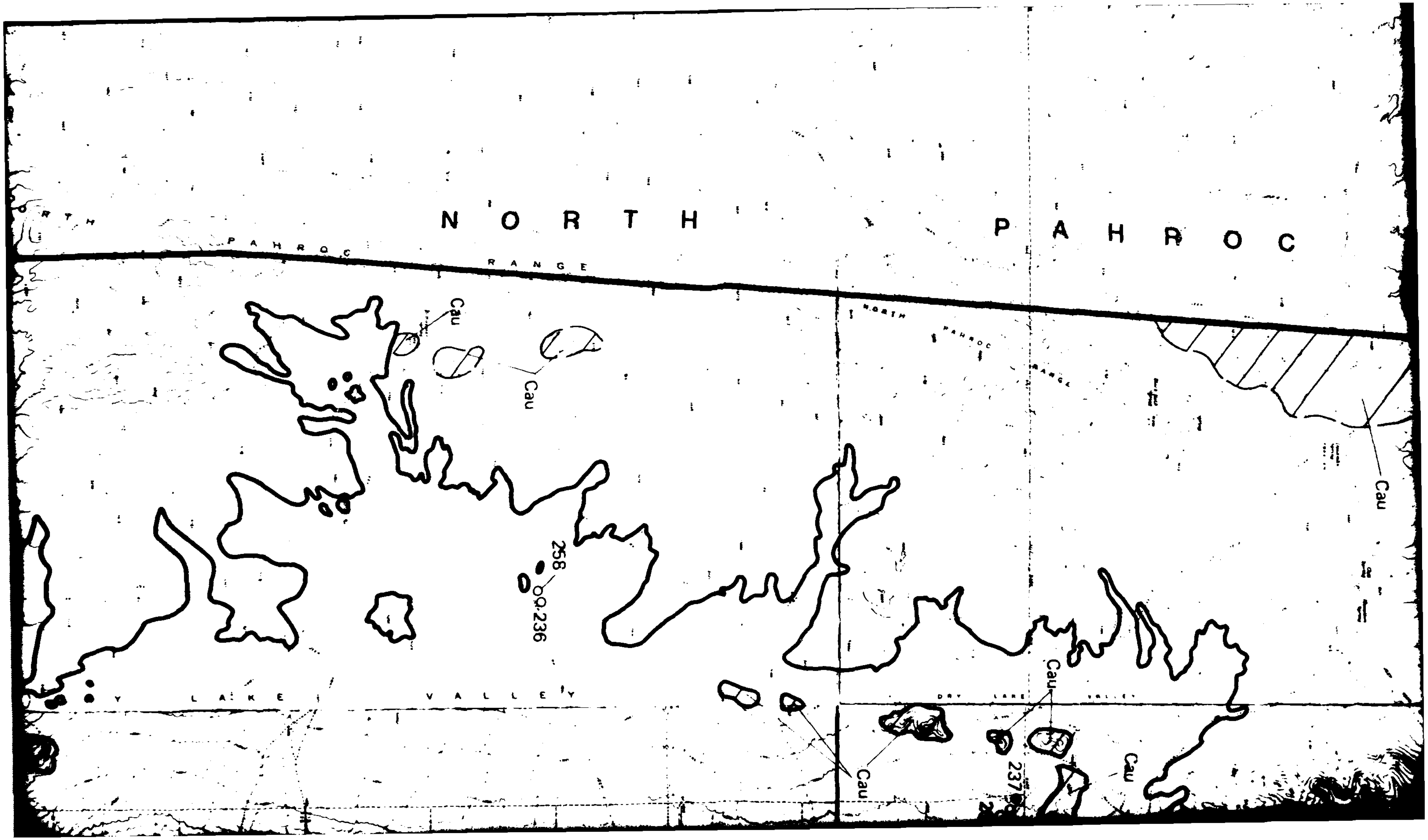
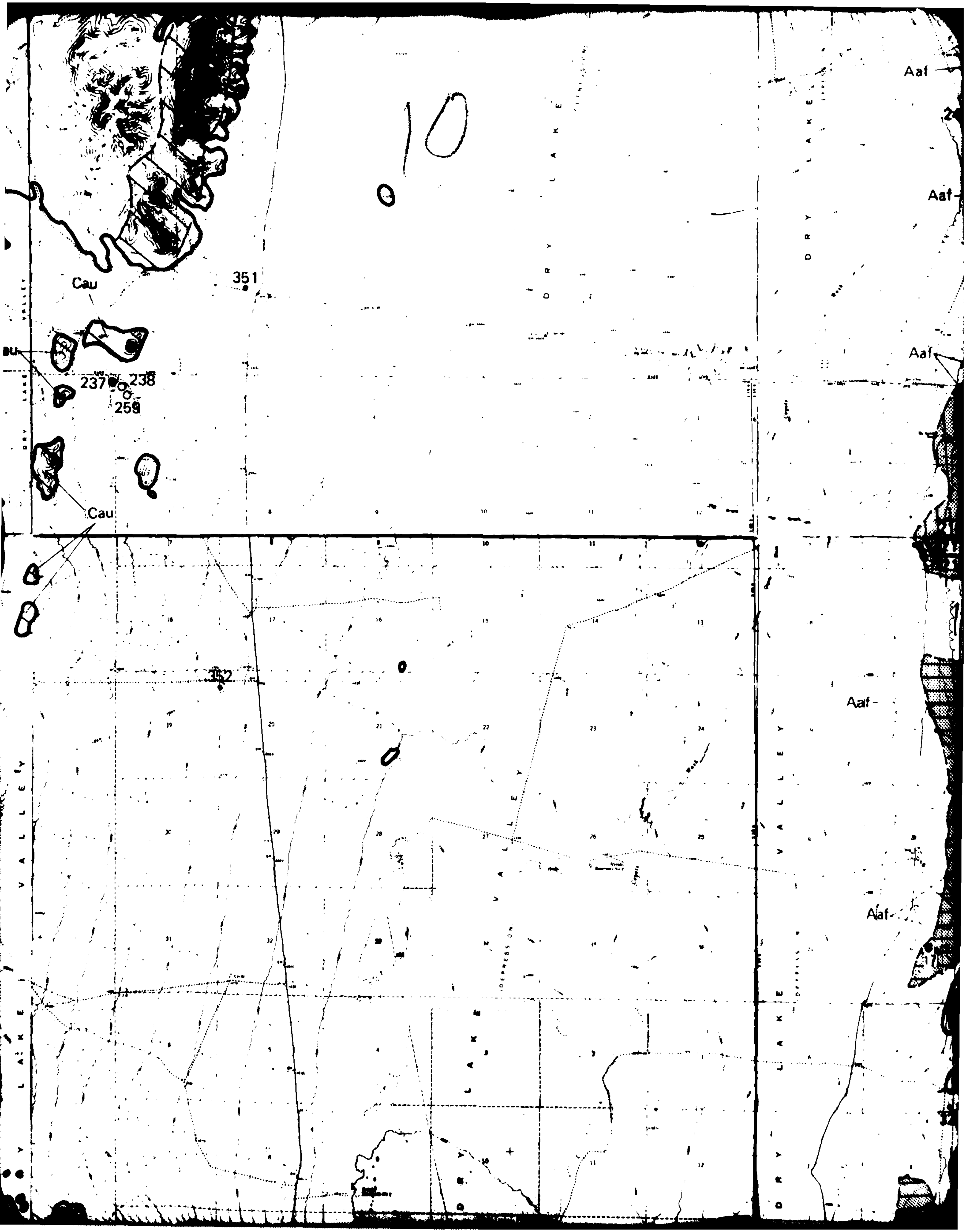
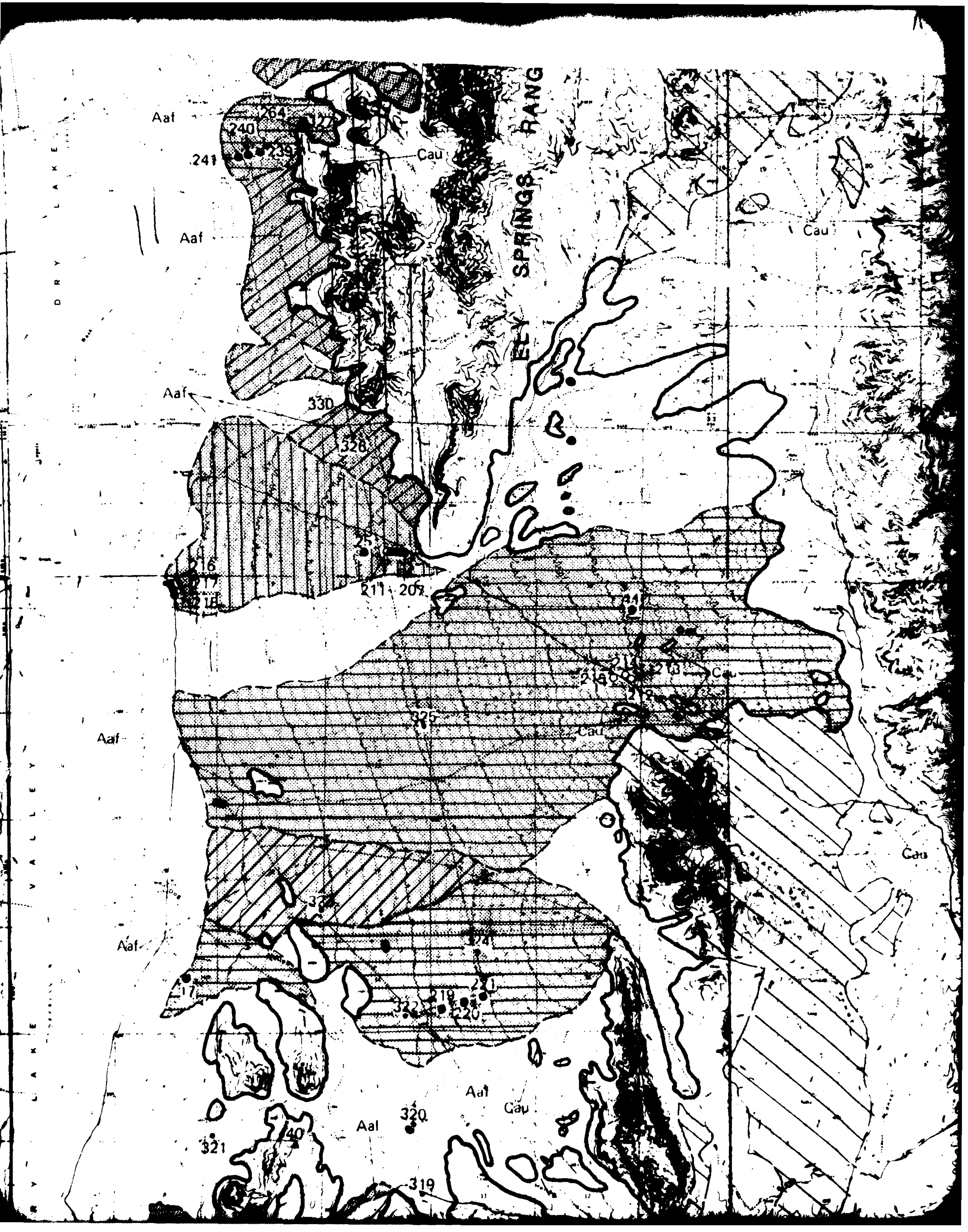
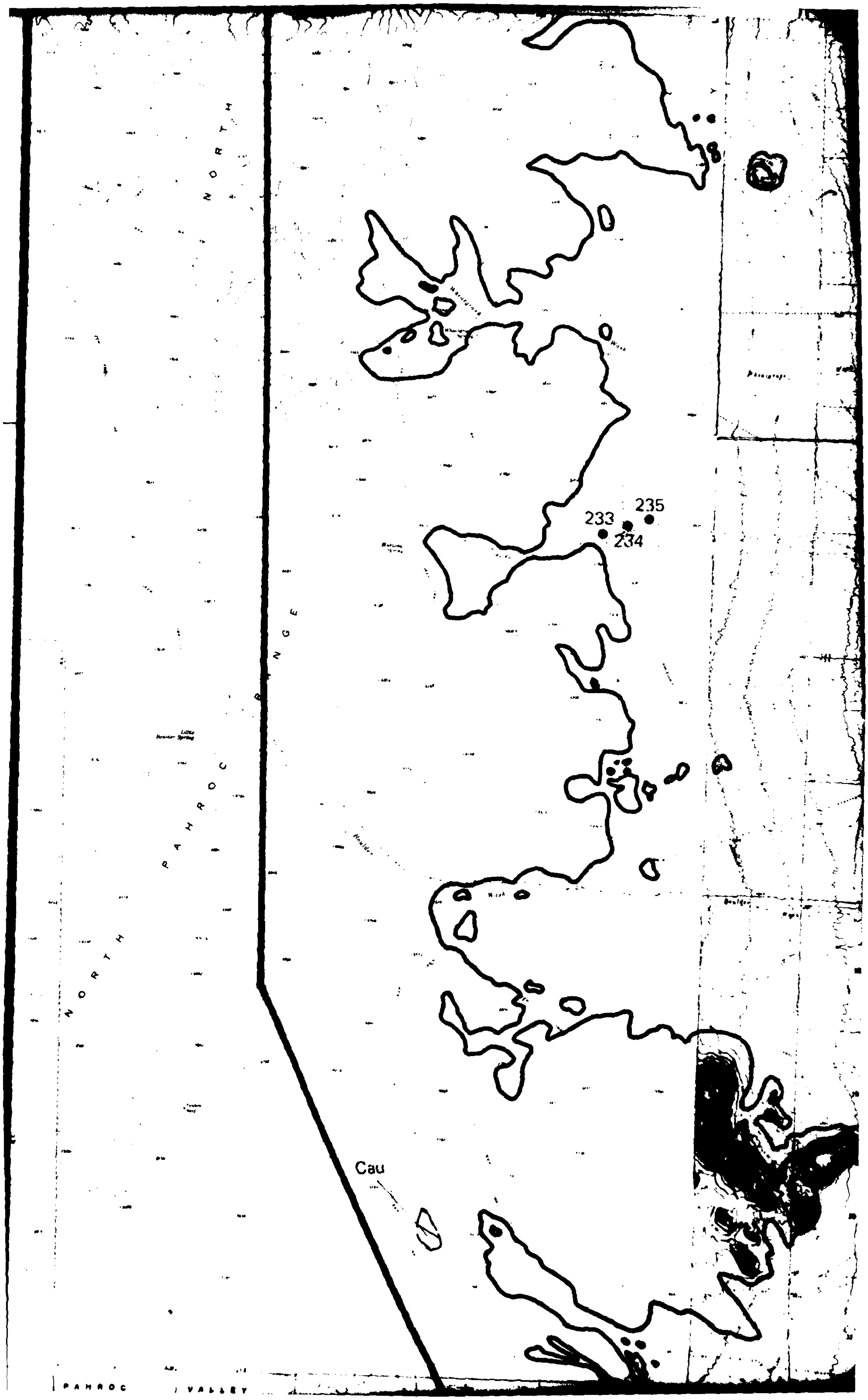
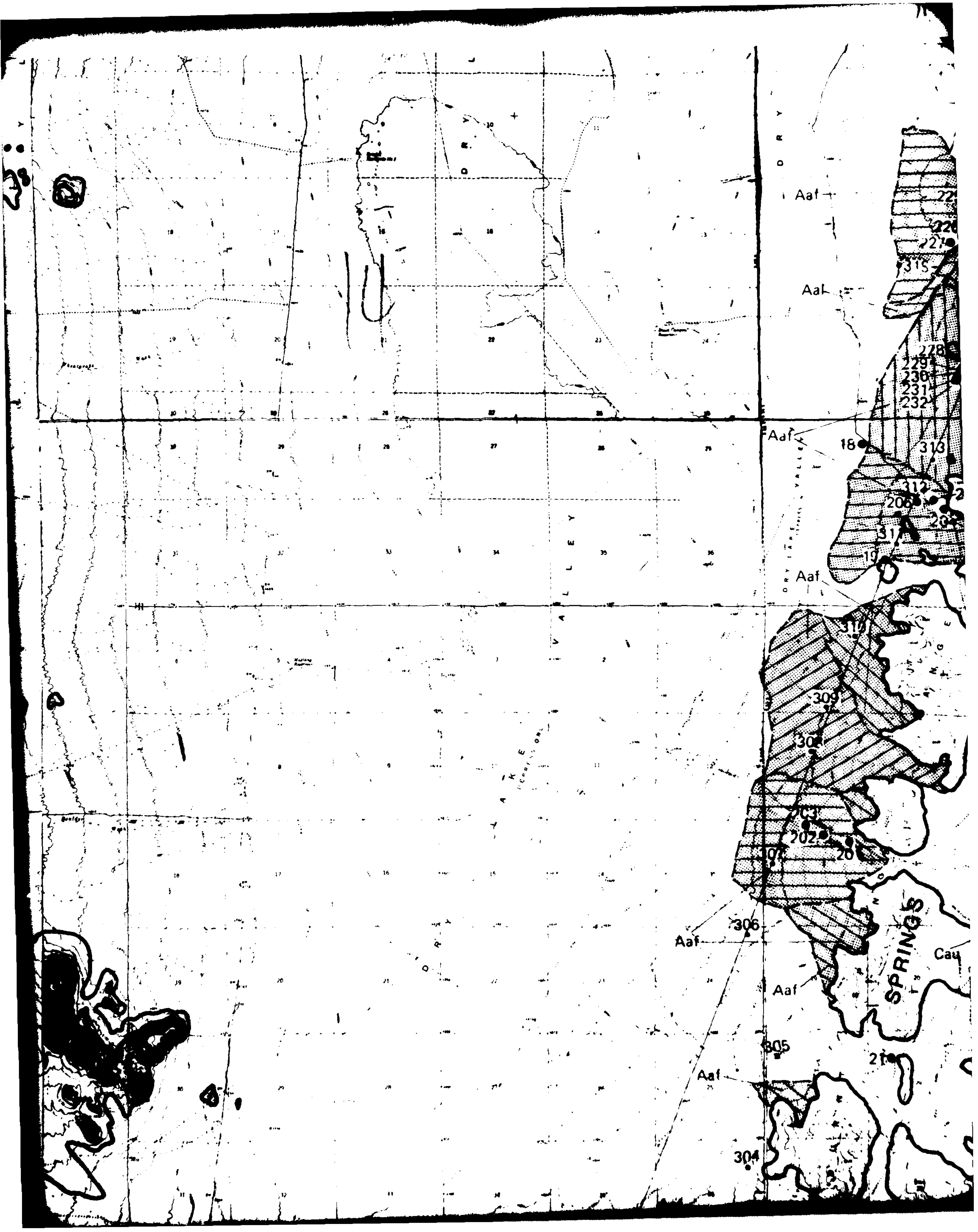

NORTH PAHROC
NORTH PAHROC RANGE
NORTH PAHROC RANGE
DRY LAKE VALLEY
DRY LAKE VALLEY
Cau
Cau
Cau
Cau
Cau
Cau
258
236
237


10
Aaf
Aaf
DRY LAKE
DRY LAKE
351
Cau
Aaf
237
238
259
Cau
352
Aaf
VALLEY
Aaf
DRY LAKE VALLEY
DRY LAKE VALLEY
DRY LAKE VALLEY
DEPRESSION


Aaf
264
240
127
241
239
Cau
SPRINGS
RANG
Aaf
Cau
DRY LAKE
Aaf
330
328
25
216
217
218
211
207
44
214
214a
213
Cau
325
Cau
Aaf
Cau
VALLEY
323
324
Aaf
17
221
219
322
220
Aal
Cau
320
Aal
321
140
319
LAKE


Cau
Cau
Cau
Cau


235
233
234
Cau
NORTH PAHROC RANGE
NORTH PAHROC RANGE
PAHROC VALLEY


Aaf
Aaf
227
315
Aaf
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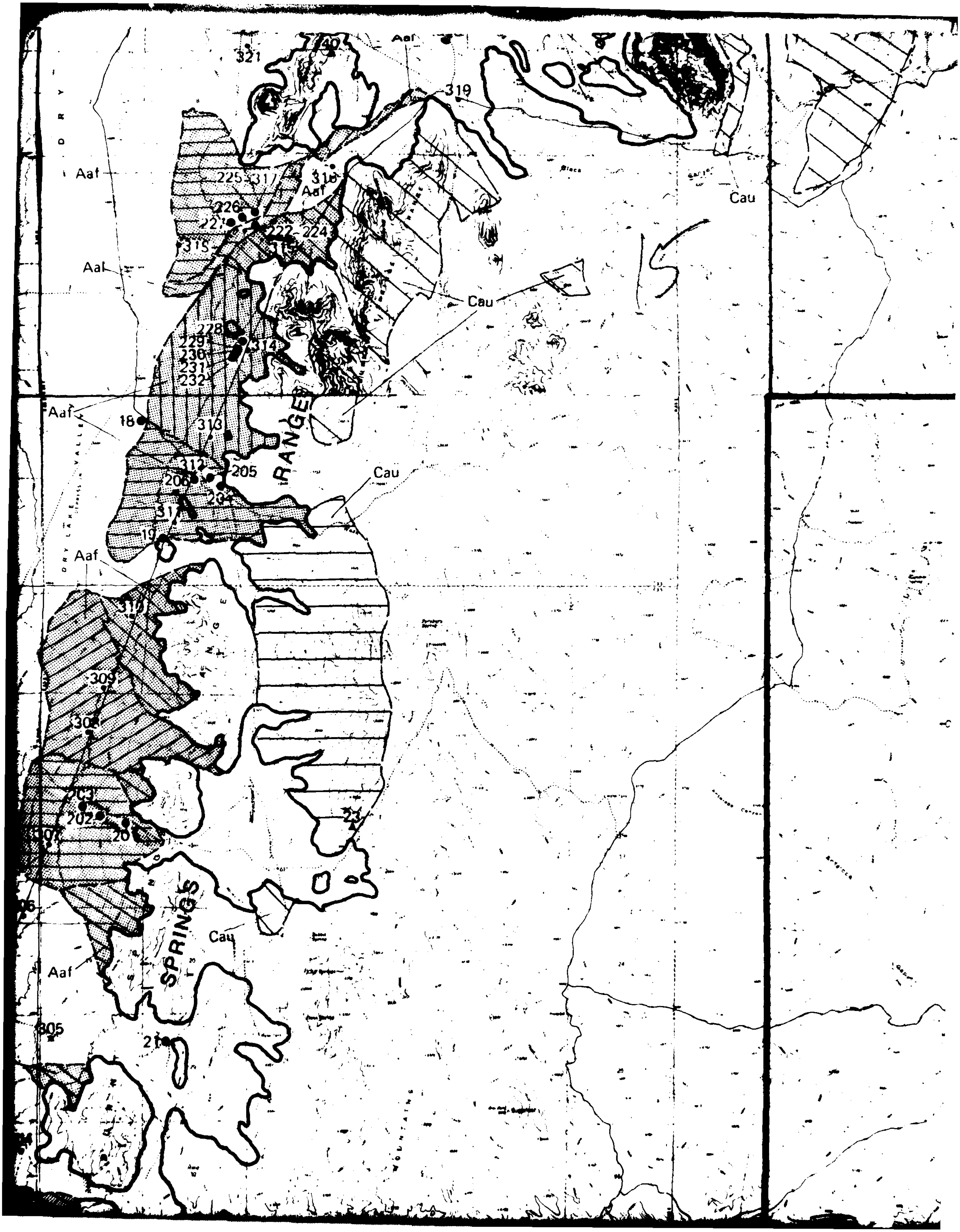
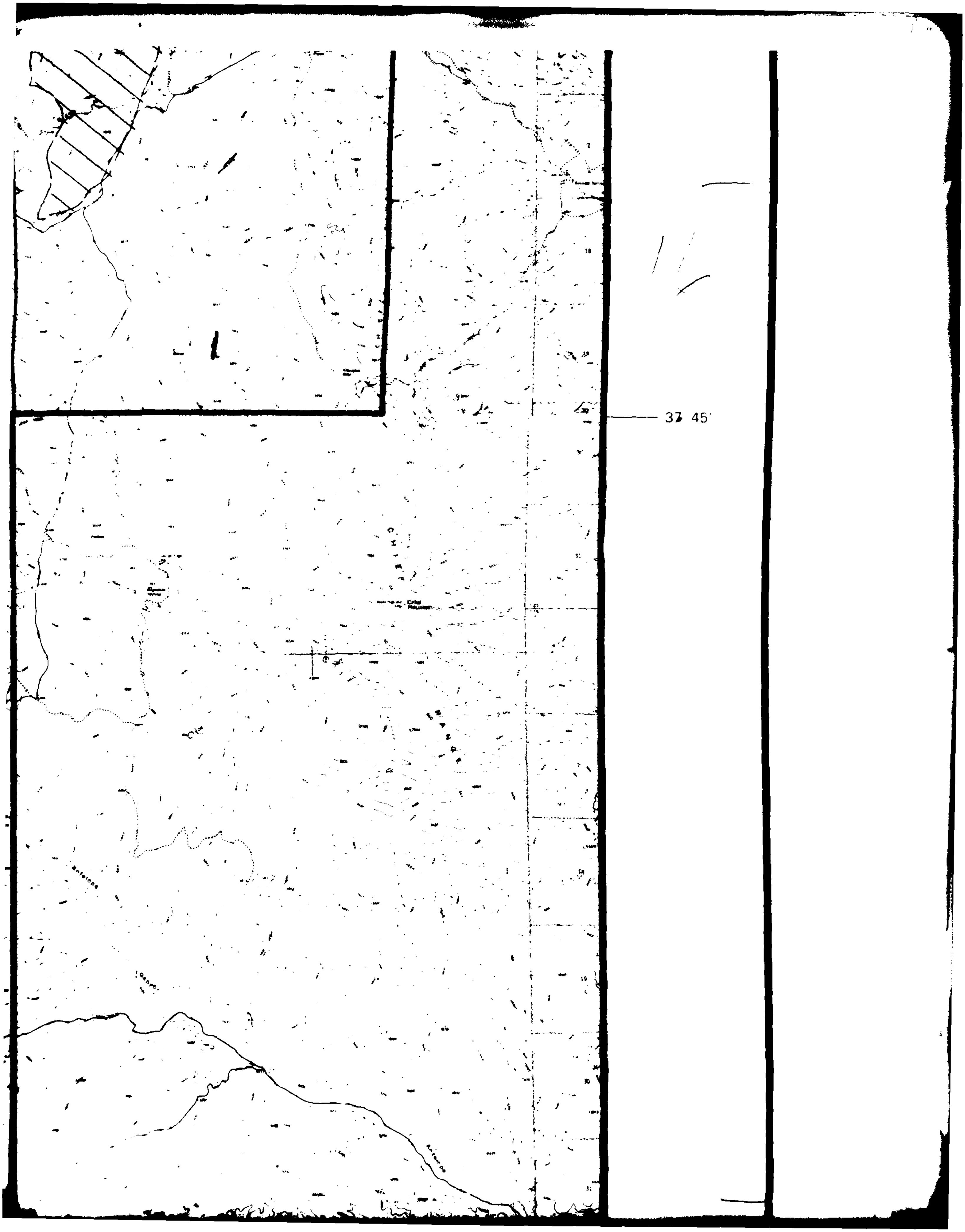
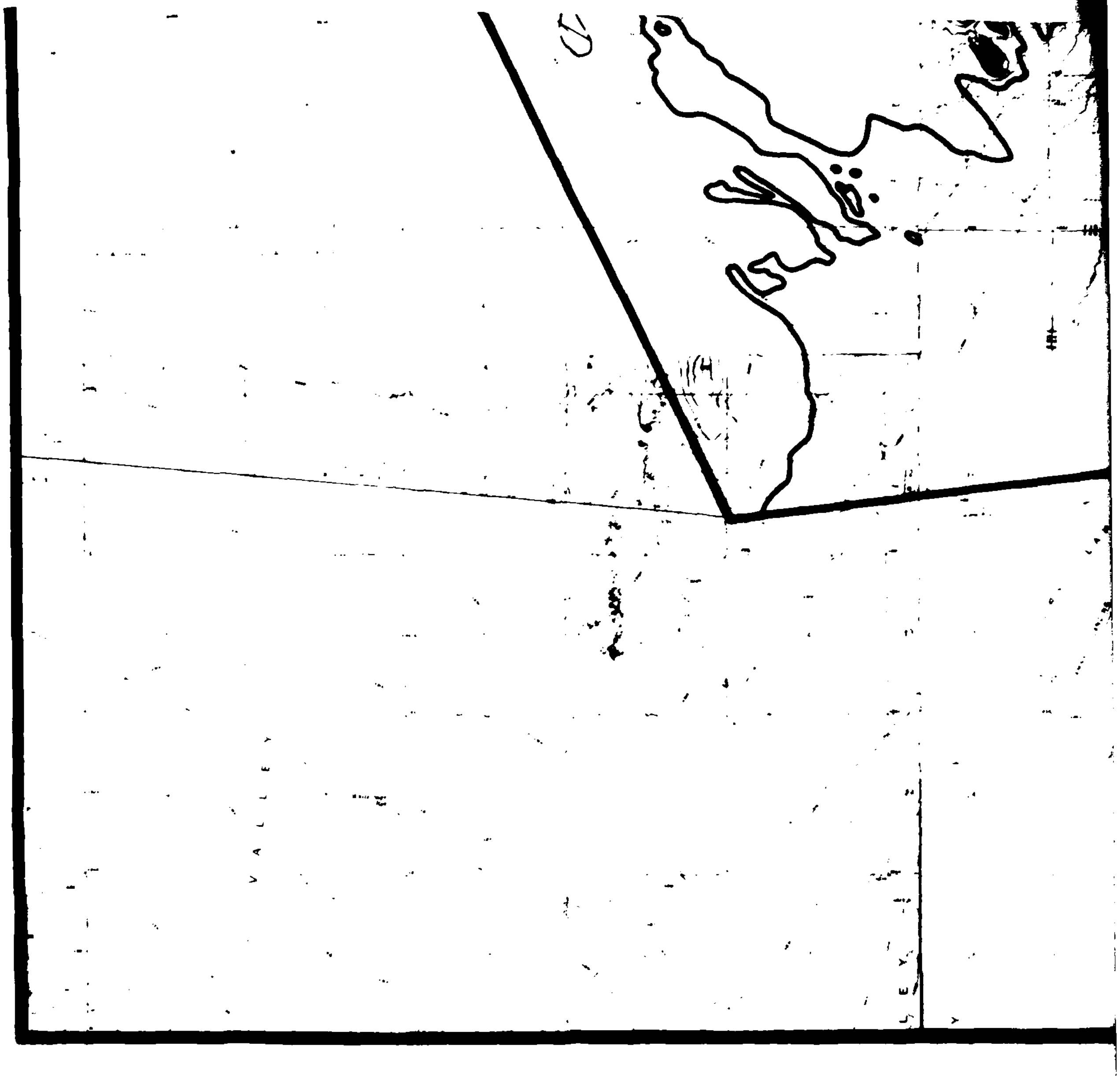
229
230
231
232
Aaf
18
313
312
206
317
19
Aaf
DRY LAKE VALLEY
310
309
308
203
202
201
307
306
Aaf
SPRINGS
Cau
Aaf
305
Aaf
304


DRY
Aaf
321
340
Aaf
319
225
317
318
Aaf
226
227
222
224
315
316
Aaf
Cau
15
Cau
228
229
230
231
232
314
Aaf
18
313
RANGE
312
205
206
234
311
19
Cau
DRY LAKE VALLEY
Aaf
310
309
308
203
202
201
307
306
SPRINGS
Cau
Aaf
305
21
23


CHIEF
Chief
Mountain
RANGE
Antelope
Antelope
37 45'



ERTEC WESTERN AGGREGATE RESOURCES STUDY FIELD STATIONS

AG

VALLEY-SPECIFIC AGGREGATE RESOURCES STUDY *
(MAP NUMBERS FROM 1 TO 199)

BA

BASIN-FILL UNITS (COARSE AND/OR FINE AGGREGATES)

CA

● DATA STOP, SAMPLED AND TESTED

○ DATA STOP

EXPLANATION

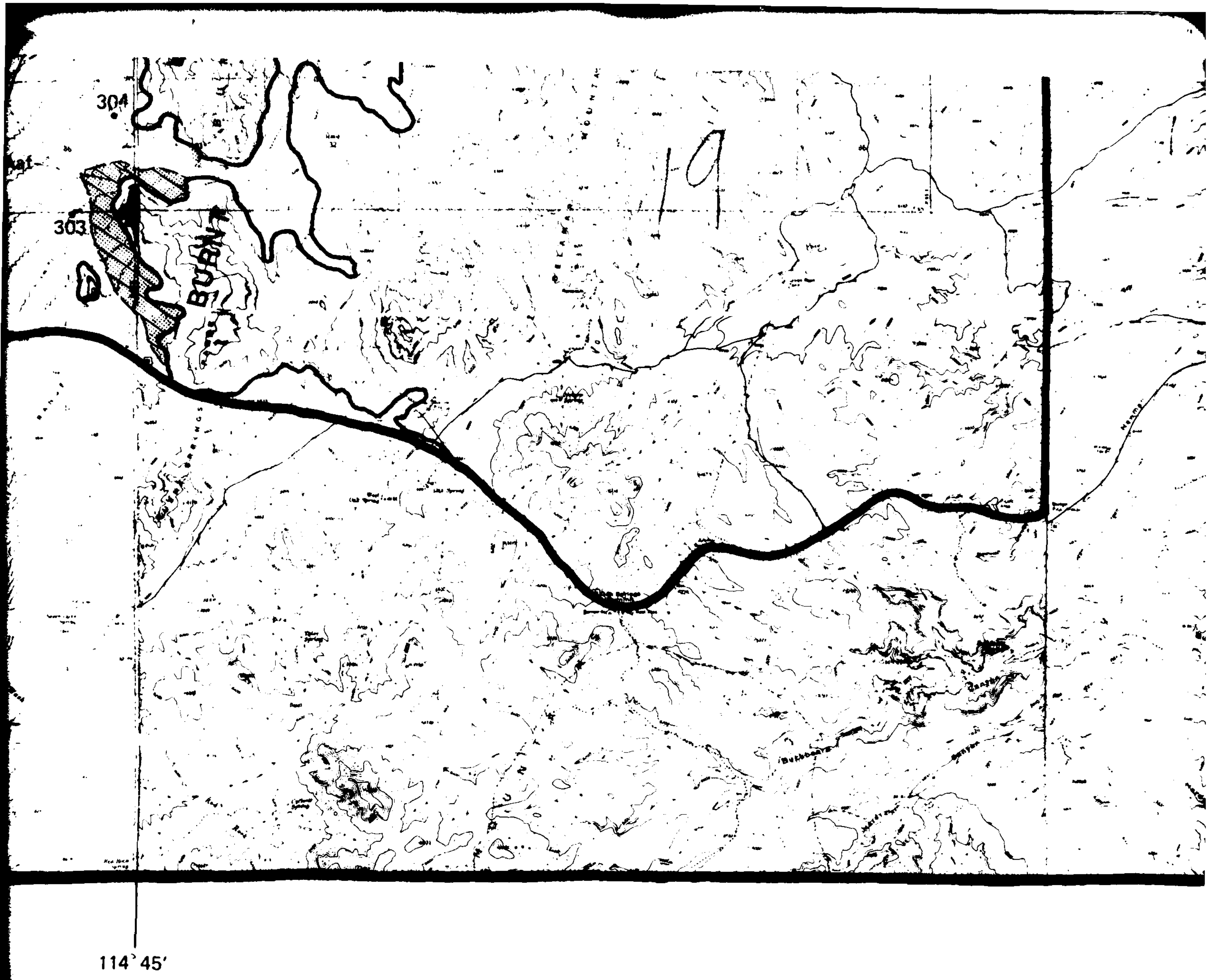
IONS

EGATES)

AGGREGATE CLASSIFICATION SYSTEM

BASIN–FILL AND ROCK SOURCES* * *

CA1	▨	BASIN FILL	BASIN-FILL OR ROCK SOURCES CONTAINING AGGREGATES THAT PRODUCED TRIAL MIX CONCRETE WITH 28-DAY COMPRESSIVE STRENGTHS EQUAL TO OR GREATER THAN 6500 PSI.
	□	ROCK	
CA2	▨	BASIN FILL	BASIN–FILL OR ROCK SOURCES CONTAINING AGGREGATES THAT PRODUCED TRIAL MIX CONCRETE WITH 28-DAY COMPRESSIVE STRENGTHS LESS THAN 6500 PSI.
	□	ROCK	



EXPLANATION

GEOLOGIC UNITS†

BASIN -FILL UNITS

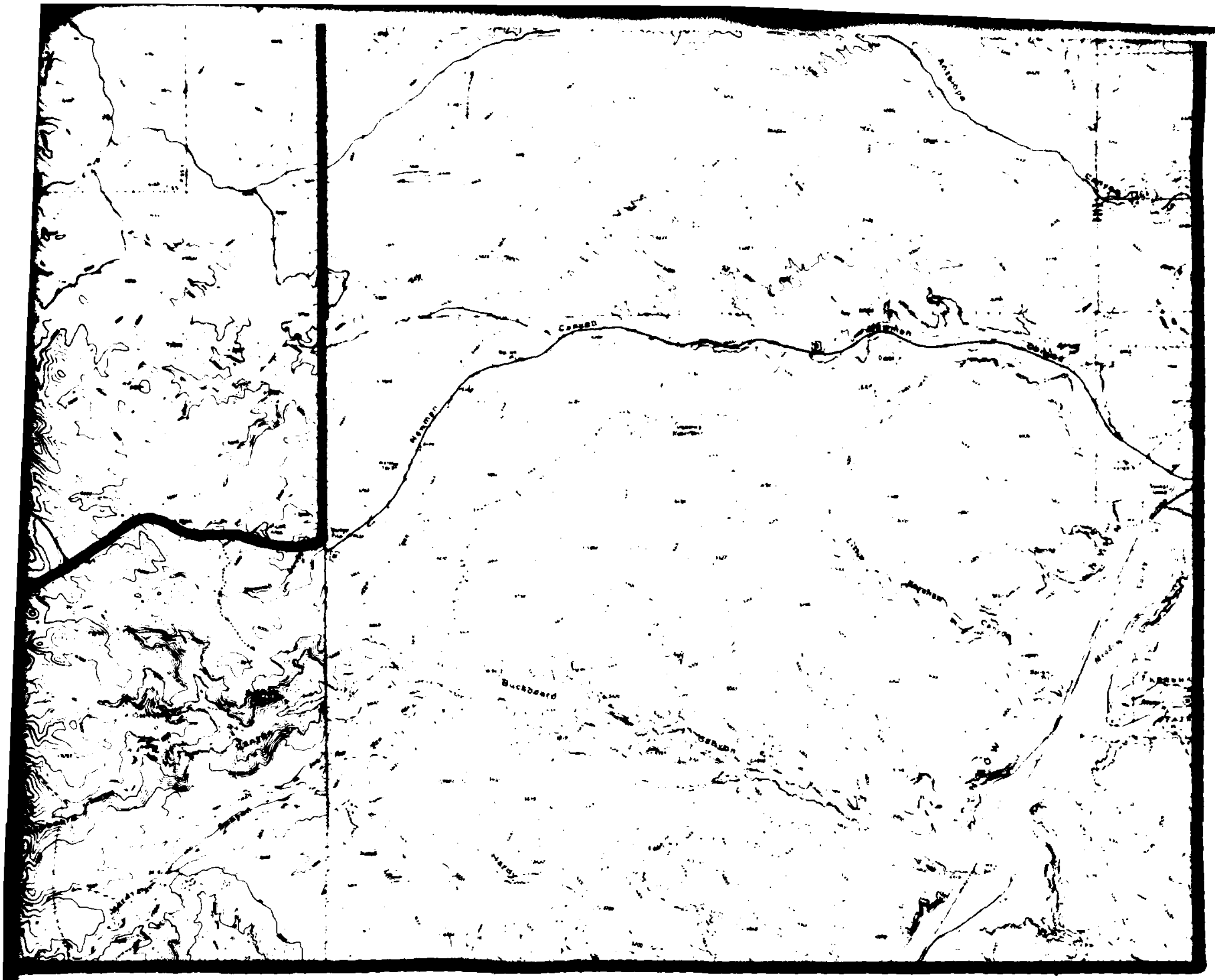
CONTAINING
TRIAL MIX
ESSIVE
TER THAN

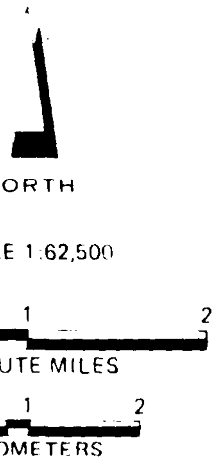
Aal STREAM-CHANNEL AND/OR TERRACE DEPOSITS (A

Aaf ALLUVIAL FAN DEPOSITS (A

CONTAINING
TRIAL MIX
ESSIVE

ROCK UNITS





UNITS

ANNEL AND/OR TERRACE DEPOSITS (A1 A2)

FAN DEPOSITS (A5)

TS

ROCKS UNDIFFERENTIATED (S2)

LOCATION MAP

● DATA STOP, SAMPLED AND TESTED

○ DATA STOP

ROCK UNITS (CRUSHED ROCK AGGREGATES)

▲ DATA STOP, SAMPLED AND TESTED

△ DATA STOP

DETAILED AGGREGATE RESOURCES STUDY * *

(MAP NUMBERS FROM 200 TO 299 FOR BASIN–FILL AND ROCK SAMPLE LOCATIONS; 300 TO 399 FOR FIELD PETROGRAPHIC STATIONS)

BASIN–FILL UNITS (COARSE AND/OR FINE AGGREGATES)

● DATA STOP, SAMPLED AND TESTED

○ DATA STOP

ROCK UNITS (CRUSHED-ROCK AGGREGATES)

▲ DATA STOP, SAMPLED AND TESTED

PETROGRAPHIC FIELD STATIONS

• DATA STOP

* SEE DRY LAKE, MULESHOE, DELAMAR, PAHROC VSARS REPORT (FN-TR-37-a) FOR DETAILED INFORMATION.

* * SEE CORRESPONDING MAP NUMBER IN APPENDICES A AND B FOR DETAILED INFORMATION.

	—		6500 PSI.
CA2	▦ □	BASIN FILL ROCK	BASIN–FILL OR ROCK SOURCES CONTAINING AGGREGATES THAT PRODUCED TRIAL MIX CONCRETE WITH 28-DAY COMPRESSIVE STRENGTHS LESS THAN 6500 PSI.
CB	▤ ▭	BASIN FILL ROCK	BASIN–FILL OR ROCK SOURCES CONTAINING AGGREGATES POTENTIALLY SUITABLE FOR USE IN CONCRETE; BASED ON ACCEPTABLE LABORATORY AGGREGATE TEST RESULTS.
CC1	▧ ◹	BASIN FILL ROCK	BASIN–FILL OR ROCK SOURCES CONTAINING AGGREGATES POTENTIALLY SUITABLE FOR USE IN CONCRETE; BASED ON CORRELATION WITH CLASS CA1 OR CA2 SOURCE AREAS.
CC2	▨	BASIN FILL	BASIN–FILL SOURCES CONTAINING AGGREGATES POTENTIALLY SUITABLE FOR USE IN CONCRETE; BASED ON CORRELATION WITH CLASS CB SOURCE AREAS.
	□		BASIN–FILL SOURCES CONTAINING FINE AGGREGATES USED WITH CRUSHED-ROCK SAMPLES FOR CERTAIN CONCRETE TRIAL MIXES.
	□		UNSUITABLE SOURCES OF BASIN–FILL MATERIALS THAT MAY LOCALLY CONTAIN POTENTIALLY SUITABLE SOURCES OF AGGREGATES OF LIMITED EXTENT. UNTESTED SOURCES OF ROCK MATERIALS THAT MAY CONTAIN POTENTIALLY SUITABLE CRUSHED-ROCK AGGREGATES (SEE TEXT FOR ADDITIONAL INFORMATION).

* * * A COMPLETE CLASSIFICATION SYSTEM IS SHOWN, ALTHOUGH ALL BASIN–FILL OR ROCK SOURCES MAY NOT BE PRESENT WITHIN THE STUDY AREA.

Aaf	ALLUVIAL FAN DEPOSITS	(A5)

ROCK UNITS

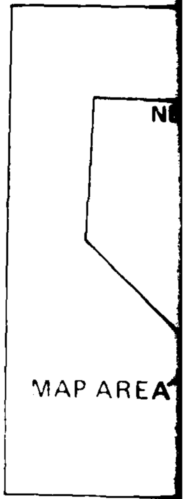
Cau	CARBONATE ROCKS UNDIFFERENTIATED	(S2)

† SEE APPENDIX TABLE F-3 FOR SYMBOL EXPLANATION AND COMPARISON

SYMBOLS ††

━━━	STUDY AREA BOUNDARY
———	ROCK/BASIN–FILL CONTACT
— —	GEOLOGIC ROCK CONTACT
- - -	BASIN–FILL CONTACT

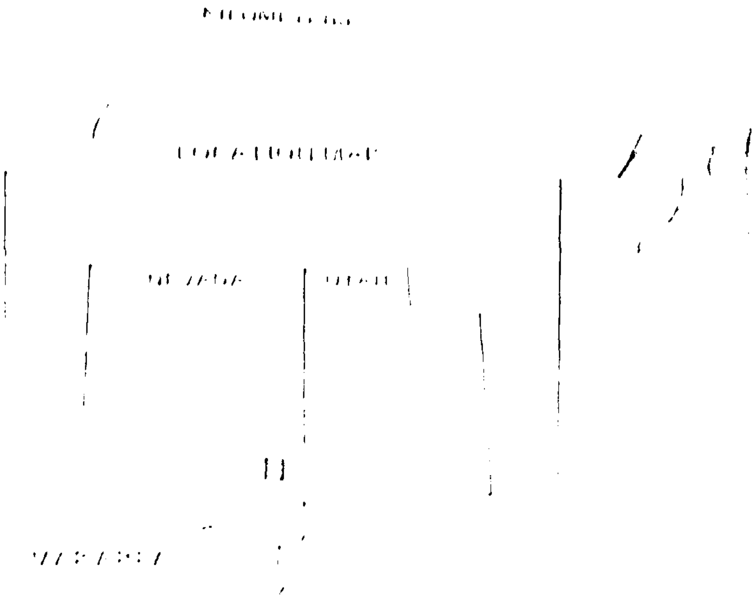
†† GEOLOGIC ROCK AND BASIN-FILL CONTACTS ARE APPROXIMATELY LOCATED AND MAY VARY LOCALLY.



Erte
The Earth Technology Corp

CONCRETE
DETAILED AG
DRY

29 MAY 81



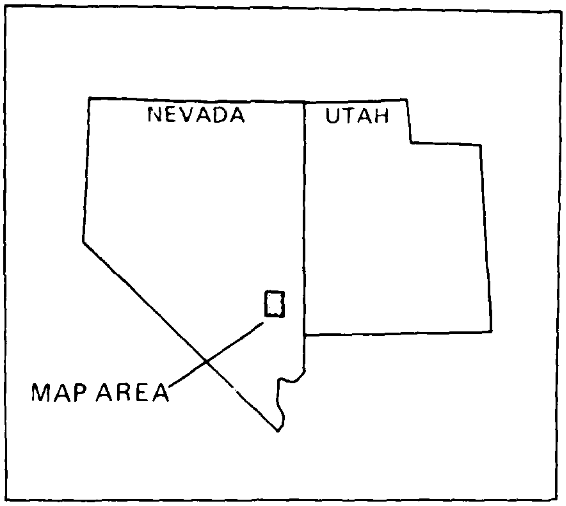
Ertec

The Earth Technology Corporation

KILOMETERS

24

LOCATION MAP



Ertec
The Earth Technology Corporation

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRCE MX

CONCRETE AGGREGATE RESOURCES MAP
DETAILED AGGREGATE RESOURCES STUDY
DRY LAKE VALLEY, NEVADA

29 MAY 81

DRAWING 3

DATE

ILME