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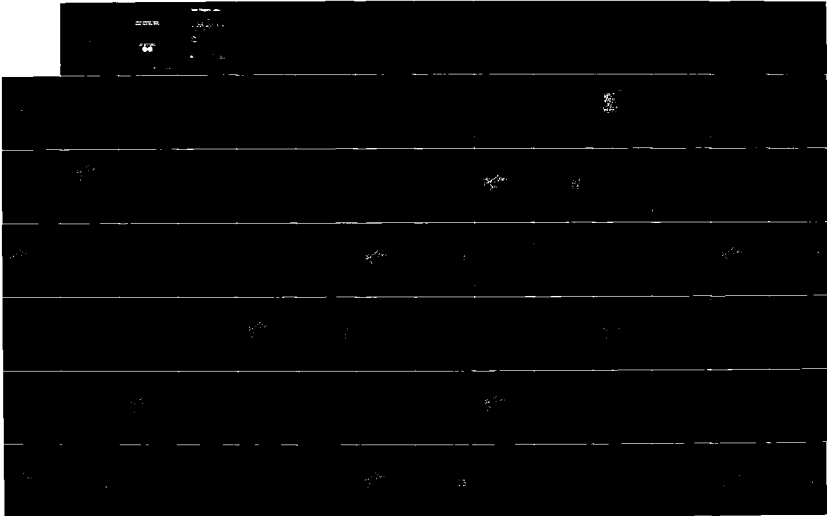
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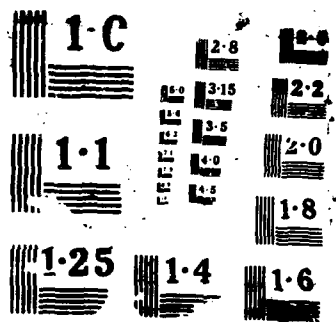
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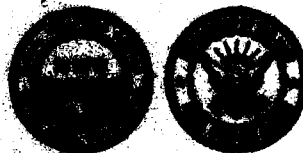


Naval Weapons Center Active Fault Map Series

by
G. R. Roquemore
and
J. T. Zellmer
Research Department

AUGUST 1967

**NAVAL WEAPONS CENTER
CHINA LAKE, CA 93555-6001**



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Naval Weapons Center

FOREWORD

This report describes the results of nearly 10 years of effort to map and better understand the active faults, that is, faults that have moved during about the last 10,000 years, within NWC and the surrounding areas. The maps show, with a high degree of reliability, the locations of fault scarps and other geomorphic expressions of active faults. The mapping and descriptive annotations will be of use to planners, engineers, scientists, and others interested in the locations of faults and the potential for seismic activity.

This report describes work performed over the period 1979 through 1987. Work was funded by Management Support Items.

This report has been reviewed for technical accuracy by Dr. P. St. Amand.

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19 ABSTRACT (Continue on reverse if necessary and identify by block number) The NWC Active Fault Map Series shows the locations of active faults and features indicative of active faulting within much of Indian Wells Valley and portions of the Randsburg Wash/Mojave "B" test range areas of the Naval Weapons Center. Map annotations are used extensively to identify criteria employed in identifying the fault offsets, and to present other valuable data. All of the mapped faults show evidence of having moved during about the last 12,500 years or represent geologically young faults that occur within seismic gaps. Only faults that offset the surface or show other evidence of surface deformation were mapped. A portion of the City of Ridgecrest is recommended as being a Seismic Hazard Special Studies Zone in which detailed earthquake hazard studies should be required.					
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INTRODUCTION

The maps that comprise the NWC Active Fault Map Series include much of Indian Wells Valley (IWV) and a large portion of the Randburg Wash/Mojave "B" test range area of the Naval Weapons Center (Figure 1). Mapping within Indian Wells Valley included seven complete 7-1/2 minute quadrangles and sections of four additional quadrangles for a total of over 1400 km². Mapping within the Randburg Wash/Mojave "B" test ranges included five complete 7-1/2 minute quadrangles, largely along the Garlock fault, and totaled nearly 800 km². These annotated maps show the locations and morphology of the active faults identified within the study area. The annotations and map symbols describe features indicative of fault offsets or give characteristics of the fault's history, such as the scarp angle or number of earthquakes. For several locations the features suggestive of fault activity or of slope instability are indicated.

The following sections describe the mapping process, criteria used in evaluating the faults, descriptions of the major active fault zones and discussions of various seismic hazards. Also included is the recommendation that a seismic hazard special studies zone be established along the trace of the Little Lake fault zone, within the City of Ridgecrest.

ACTIVE FAULT DEFINITION

Although it is a commonly used term, "active fault" lacks a precise and universally accepted definition. Most workers, however, accept the following:

"Active fault - a fault along which there is recurrent movement, which is usually indicated by small, periodic displacements or seismic activity" (Reference 1).

Slemmons and McKinney (Reference 2) expand on this basic definition and include several characteristics of active faults:

"An active fault is a fault that has slipped during the present seismotectonic regime and is therefore likely to have renewed displacement in the future. The fault activity may be indicated by historic, geologic, seismologic, geodetic, or other geophysical evidence of activity. The rates of activity may vary from very low, with long recurrence intervals, to very high, with short recurrence intervals."

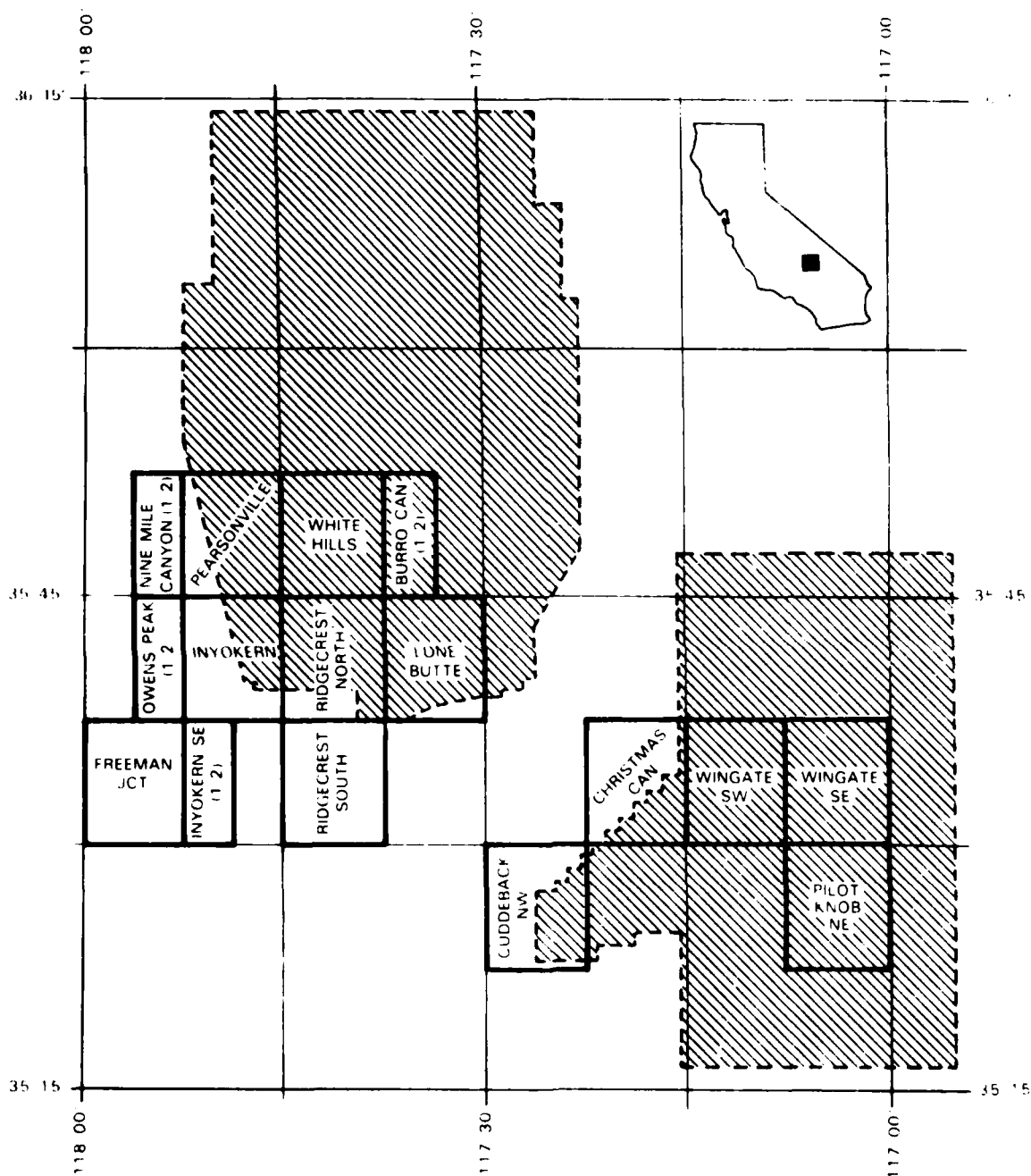


FIGURE 1. Locations of Mapped Quadrangles. Cross-hatched regions are NWC range areas.

In addition to the above, current usage generally requires that a time factor be included. Most agree that any demonstrable movement during the Holocene Epoch, approximately the last 10,000 years, qualifies the fault as "active." For this study we use 12,500 years, which corresponds to the most recent high level of pluvial Lake China. Depositional and erosional features of this and much more recent; lower lake levels occur within Indian Wells Valley and provide useful age constraints.

Some mapped offsets along the Sierra Nevada may predate 12,500 years. However, this segment of the fault zone has been designated as a "seismic gap" (References 3 and 4) which justifies conservatism in earthquake hazard assessment. Seismic gaps are segments of fault zones that have not experienced a significant earthquake during the time that most of the other segments of the zone have. Thus, seismic gaps are thought to have a high potential for future earthquakes and have been found useful in predicting earthquakes.

ACTIVE FAULT MAPPING AND DATA ACQUISITION

Preparation of the NWC Active Fault Map Series spanned nearly 10 years. During this time, we obtained and analyzed about 1,500 new aerial photographs, conducted aerial reconnaissance, acquired special purpose aerial photography along critical fault zones, excavated and logged several trenches across active faults, surveyed and profiled numerous fault scarps, conducted seismic surveys, and carried out field studies to verify the correctness of our data and interpretations and to obtain additional data.

We produced initial fault maps using stereographic pairs of low-sun-angle, color, aerial photographs at a scale of 1:12,000 in the manner of Cluff and Slemmons (Reference 5). These photographs were taken early in the morning or late in the afternoon when the sun was less than about 20 degrees above the horizon. The low sun-angle accentuates fault traces by casting shadows across the fault scarp or by highlighting it. Many of the faults mapped from these photographs are difficult, if not impossible, to recognize on existing black and white, small scale, high-sun-angle photographs because of the subtle topographic and geomorphic expression and the subdued contrast of the desert sand and other surficial deposits. The photographs were useful in identifying topographic and geomorphic features that are commonly associated with active faults. Most of the features are shown in the block diagram at the lower left corner of each map.

In addition to the color aerial photographs, we obtained low-altitude, large-scale, black and white, stereographic photographs

along certain critical zones, such as the segment of the Little Lake fault responsible for the 1 October 1982, M=5.2 (recently downgraded to M=4.8) earthquake. The available photographic coverage was supplemented with color slides, and color and black and white photographs taken from both aircraft and on the ground with hand-held cameras. Existing black and white aerial mapping photographs with scales ranging from 1:34,000 to 1:47,200 were also used extensively.

Trenches were excavated across several faults to determine the displacement history of the fault and to collect datable materials such as carbon for radiometric dating (Reference 6). The trenches which were about 4 m wide and ranged from 3 to 5 m in depth and from 30 to 50 m in length. In one particularly important trench in which the walls tended to collapse, we photographed the walls with a large-format camera to obtain stereographic coverage for later analysis. Trench locations are indicated on some of the maps.

We surveyed and constructed topographic profiles for numerous fault scarps that displayed evidence of multiple offsets. A slope formed by faulting and subsequent erosion is often composed of two or more segments, or bevels that are useful in estimating the age of the earthquakes, the amounts of offset, and their magnitudes. The bevel angle and height can be directly measured in the field or from topographic profiles of the fault scarp obtained by surveying. The locations and data obtained from these surveys are shown on the maps.

The mapping project involved considerable field work and ground verification. This consisted of examining the fault scarps and adjacent areas to determine the characteristics of the mapped or suspected offsets. The field work provided data such as fault-scarp profiles, displacement measurements, analyses of small-scale geologic structures, sample collection, field measurements, and detailed mapping that could not be obtained by other means. During the field work we added several previously unrecognized active faults and eliminated several fault-like features that could be attributed to other causes.

DETERMINATION OF FAULT AGE

Determining the age of prehistoric fault offsets is frequently a difficult task based upon the synthesis of numerous bits of data from several, sometimes independent sources. The age-determination techniques used during this study include structural and stratigraphic relationships, soil development, trenching data, tephrochronology, radiometric dating, fault-scarp profiling, and geomorphology. Using these techniques, we were able to estimate or at least bracket the

ages of movement along many of the faults within the study area and thereby classify them as either active or inactive.

A basic tenet of geology states that any structure, for example a fault, that cuts across a stratigraphic unit is younger than that stratigraphic unit. Thus, by determining the age of the stratigraphic unit we can assign a maximum age for the fault offset. Within the mapped region, many of the faults cut across sediments (stratigraphic units) deposited in ancient Lake China and Lake Searles. These lakes filled completely and overflowed into lower basins between about 12,500 and 10,000 years ago (Reference 7). Climatic changes then caused the disappearance of the lakes until between about 6,000 and 2,500 years ago when they were partially refilled. The sediments deposited in the lakes during these two periods provide datums for estimating the ages of the faults that offset them. Other datable stratigraphic units such as deposits of airborne volcanic materials (tephra) and ancient soils (paleosols) can also be used for this purpose.

Tephra and paleosols are found within the study area. The tephra deposits are often associated with volcanic eruptions that have been dated by radiometric methods. Although found at some distance from their sources in the Coso Range and elsewhere they generally provide reliable age control markers. The age dating of paleosols is not as reliable or straightforward as it is for tephra and involves assessing the degree of soil development. Because numerous factors affect the rate and characteristics of soil development only a minimum, maximum, or broad range can generally be estimated for the age of most paleosols. Despite the difficulties encountered, both paleosols and tephra often prove useful in fault movement age determinations.

Often, datable materials or stratigraphic units with known ages are not found at the surface and it becomes necessary to dig an exploration across the fault. The trench walls often reveal the fault plane, offset stratigraphic units and younger non-offset stratigraphic units. Figure 2 shows an example of how these features might appear in a trench. Of special interest to the geologist is the progressively greater increase in offset with age. This indicates that more than one earthquake has occurred along the fault since the oldest sediments were deposited.

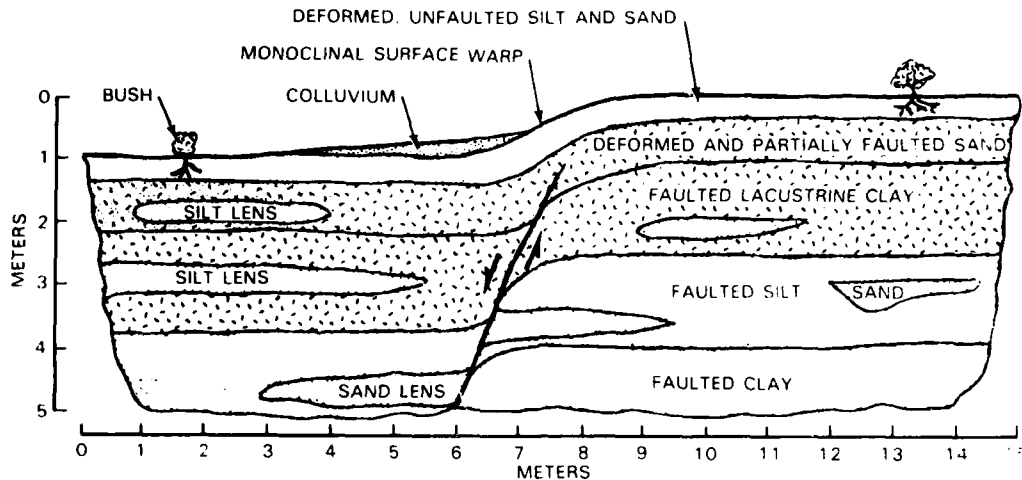


FIGURE 2. Features Typically Observed in Walls of Trenches Excavated Across Active Faults. The ages of the sediments increase with depth.

The number of bevels that comprise a fault scarp and the steepness of the bevels can be used to determine the number and ages of the earthquakes that formed the scarp (Reference 8). Figure 3, an example of a fault scarp profile, shows the youngest bevel, which corresponds to the actual fault plane; an older, shallower-dipping intermediate bevel; the oldest and shallowest dipping bevels; and the original offset ground surface. The bevels indicate that three earthquakes formed the fault scarp and that there was sufficient time between the earthquakes for the original, steep fault scarp bevel to erode to a shallower angle prior to the subsequent earthquake. If we can determine the rate of bevel erosion, it is possible to correlate the bevel angle with the age of the bevel. The age/angle correlation problem is difficult to solve, but can provide reasonable estimates for the ages of earthquakes, and at a minimum, provides valuable information about the recurrence characteristics of earthquakes associated with a particular fault.

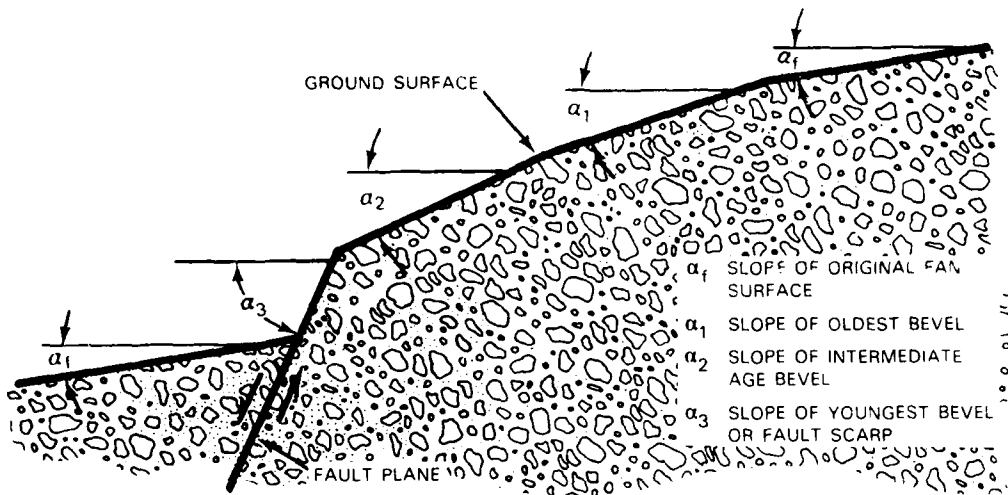


FIGURE 3. Topographic Profile and Hypothetical Cross Section Across an Active Fault Showing the Development of Erosional Bevels.

Geomorphic (landform) criteria such as that described above are useful in estimating the ages or relative ages of fault scarps (Reference 9). Typical fault-related geomorphic features are shown in the block diagram on each map sheet. In practice, subjective judgments of the ages of the features must be made. Young, fault-related geomorphic features tend to be sharp and angular whereas older features become more rounded and subdued. The fault scarp bevels shown in Figure 3 are an example of this phenomenon. Although they do not yield definitive ages, geomorphic features help the geologist determine the number of earthquakes that have occurred, their ages, and amounts of displacement. Data such as these are used in reconstructing the earthquake history of the fault which is used as an indicator of future seismic activity.

MAJOR ACTIVE FAULTS IN THE REGION

Four major active faults present a direct hazard to development within the mapped area: the Little Lake (LLFZ), the Airport Lake (ALFZ), the Sierra Nevada (SNFZ), and the Garlock (GFZ) fault zones. Figure 4 shows these fault zones relative to the other major active faults in the region. The LLFZ strikes southeast across UNV from its

intersection with the SNFZ near Little Lake and based on seismicity data, appears to terminate against the Garlock fault. The maximum credible earthquake for the right-slip to right-oblique-slip LLFZ could conceivably exceed $M=8$ if simultaneous rupture along the SNFZ occurs. However, work by Roquemore (Reference 5) and a preliminary analysis by the U.S. Geological Survey indicate that $M=6.5$ is more appropriate for earthquakes involving only the LLFZ. Data obtained since 1938 suggest that earthquakes of about $M=5$ with a recurrence period of 20 years could be considered as "characteristic earthquakes" (Reference 10) for the fault. Seismological studies of the LLFZ (Reference 11) indicate that the fault dips steeply northeast and, therefore, earthquake epicenters are displaced northeast of the mapped fault trace. As a result, much of Ridgecrest and NWC are located within the expected epicentral zone for future, damaging earthquakes. The southern segment of the LLFZ is also referred to as the Shangri La Ranch fault.

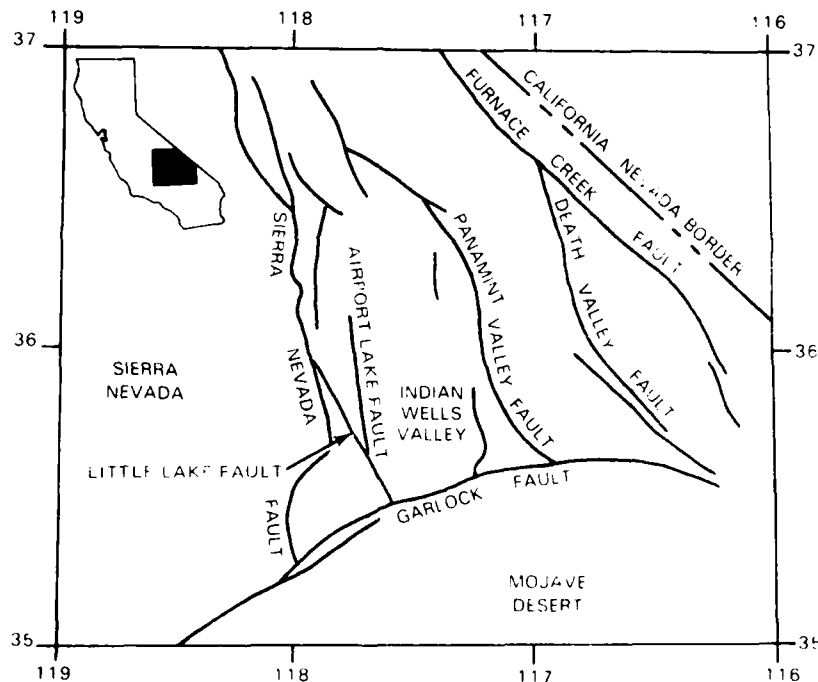


Figure 4. Locations of Important Active Faults in the NWC Region.

The ALFZ strikes north-south through the Coso Range, into IWV and terminates against the LLFZ in the Armitage Field area. The fault zone is a system of nested grabens that range in width from 0.5 to 8 km. The maximum vertical offset is 600 m. Because of its

structural characteristics and close association with volcanic activity, Roquemore (Reference 12) describes the ALFZ as a possible rift valley that could be responsible for future volcanic and seismic activity. Trenching studies by Roquemore (Reference 6) suggest that the zone may be capable of $M=7.4$ earthquakes. Several swarms with earthquakes exceeding $M=4$ have occurred along the fault in the Airport Lake area during the last several years (see for example Reference 13). South of Airport Lake, within the zone of intersection between the ALFZ and LLFZ, five earthquake swarms with over 1000 earthquakes occurred during 1981-1983, including the 1 October 1982, $M=4.8$ shock (References 11, and 13 through 16). Within IWV it appears that the regional east-west extensional stresses and northwest-southeast shear stresses are being accommodated by displacements along the LLFZ and ALFZ.

The SNFZ is a major range-bounding fault that separates IWV and the Sierra Nevada and extends for several hundred kilometers along the east side of the range. The fault has generally been considered as the western edge of the transition zone separating the right-slip tectonics of the San Andreas fault system from the extensional tectonics of the Basin and Range Province. However, work during the last several years (References 17 through 19) suggests that regional extension is migrating westward into the Sierra Nevada. Normal and right-normal-oblique-slip faulting that accommodates northwest-southeast regional shear and east-west regional extension has been documented at several locations along the Sierra Nevada fault (References 20 and 21). Savage et al. (Reference 22) report 4 mm/yr of right-slip parallel to the fault and about 1 mm/yr of extension normal to it, based on geodetic surveys in Owens Valley, thus confirming right-normal-oblique-slip strains.

One of the largest earthquakes that has occurred in the Western United States is often, and incorrectly, attributed to the SNFZ. This was the 1872, $M>8.25$, Lone Pine, California, earthquake (Reference 23) that occurred along the Owens Valley fault, slightly east of and subparallel to the SNFZ. These two faults merge into a single zone near Big Pine on the north and Owens Lake on the south and therefore should probably be considered as segments of the same regional fault. These, and other data, prompted Wallace (References 3 and 4) to classify the segment of the SNFZ south of the 1872 rupture zone as a seismic gap capable of a $M=7.0$ earthquake. This segment of the SNFZ includes the west border of IWV. Although the faults mapped along this segment have not been shown to have moved during the last 10,000 yr, their youthful appearance and designation as a seismic gap should qualify them as "active" for planning purposes.

The GFZ is one of the longest active faults in California and forms the boundary between the extensional tectonics of the Basin and Range province to the north and the relatively more stable Mojave

Desert province to the south. Numerous studies have shown that the GFZ is a major active left-slip fault, the western segment of which is slipping at a rate of about 7 mm/yr, and the eastern segment of which appears to be temporarily locked. Astiz and Allen (Reference 24) summarize much of what is known about the seismology and tectonics of the fault. As a result of their study, they conclude that the eastern segment of the GFZ, that is, the segment approximately between the Garlock townsite and Death Valley, is a seismic gap capable of producing earthquakes in the $M=7.6$ to 8.0 range.

The four active fault zones discussed above are capable of producing moderate to great earthquakes. Each fault passes beneath or near population centers, important facilities, utility corridors and transportation routes. Active faults of lesser importance also occur throughout the mapped area. The potential hazards associated with active faults in this region should be adequately incorporated into any future development or planning.

RECOMMENDED SEISMIC HAZARD SPECIAL STUDIES ZONE

Several factors, most notably ground-surface disruption by cultural activities, prevented detailed mapping of the Little Lake (Shangri La) fault zone in the Ridgecrest area. Because of the potentially serious earthquake hazard, we have designated a portion of this area as a Recommended Seismic Hazard Special Studies Zone. At least three earthquakes with magnitudes of about $M=5$ have occurred on the Little Lake fault during the last 49 years: 1938, 1961, and 1982. Of these, only the 1982 $M=4.8$ event received detailed study (References 14 and 15). The epicenter of this earthquake was 14 km northwest of the Ridgecrest City Hall and occurred within a sparsely developed area of the NWC test ranges. The earthquake ruptured the ground surface over a distance of 10 km and was associated with numerous lesser magnitude aftershocks. Reported damage was minor due to the distance between the epicenter and population centers. Had the epicenter been further south, for example, within Ridgecrest, serious damage and injuries could have occurred.

Standard construction and siting practices designed for use in seismically active areas can greatly reduce the hazard to life and property. These practices depend on the proximity of the structure to the fault; and, therefore, the locations of any faults should be determined prior to construction so that the proper design and setback criteria can be incorporated. In addition, one should be aware of other factors such as potentially liquefiable materials, high ground-water tables or marginally stable slopes that may affect the structure during an earthquake. Because the locations of the faults

within the special studies zone cannot be readily determined from surface expression alone, we recommend that appropriate investigations, for example trenching, drilling or geophysical exploration techniques, be conducted on a site-specific basis prior to final construction approval.

EARTHQUAKE DAMAGE POTENTIAL

The following is a brief discussion of several factors that influence the level of damage that occurs during earthquakes. The list is not all inclusive, only exemplary. Considering factors such as these during the planning, siting, exploration, design and construction phases of any project can result in a holistic solution to the general problems of damage, personal injury and death that will occur as the result of future, damaging earthquakes, both locally and in the region.

The level of damage resulting from an earthquake is influenced by several geologic and geotechnical factors, such as the magnitude of the earthquake, the distance from the epicenter, the depth of the earthquake, the type of fault movement, the type of geologic materials, the depth to ground water at the site, and local topography. The NWC Active Fault Map Series is intended to show the locations of known active faults so that inappropriate development of these areas can be avoided. Active fault zones are ideally suited for greenbelts and various recreational uses, and should be avoided for residential and commercial development; they must absolutely be avoided when constructing lifeline facilities such as hospitals, fire and police stations, utilities, and other facilities that must function during emergencies. One must also recognize that other, unmapped active faults may exist and that faults now considered inactive, and thus not shown on the maps, could rupture during future earthquakes.

Ground Shaking and Building Response

The severity of ground shaking experienced at a site is strongly influenced by the magnitude of the earthquake, the distance from the epicenter and site geology. In general terms, the severity of shaking tends to decrease with decreasing earthquake magnitude and increasing epicentral distance. However, the site geology and type of construction can markedly intensify the arriving seismic energy. It has long been recognized that structures built on bedrock often suffer less damage than those sited on alluvium (Reference 25). The difference results from the manner in which the seismic energy passes through the medium. For bedrock, the energy passes without

modification, but for the softer alluvium the seismic wave behaves similarly to a shoaling sea wave, that is, the wave amplitude and wavelength increase. As a result, structures sited on thick alluvium tend to experience larger ground surface displacements and higher accelerations and velocities that can result in more severe structural damage than would occur to similar structures on bedrock. This is especially true of tall buildings built on alluvium.

Another factor that should be considered is the natural frequency of the structure relative to that of the subsurface mass. If the two natural frequencies are similar, for example a ductile five story building with a natural frequency of about 0.5 second, and the alluvium of Indian Wells Valley with an estimated natural frequency of 0.5 second, then there would be a tendency for the structure to resonate during an earthquake and suffer greater damage than if the natural frequencies were dissimilar. Similarly, stiff, brittle structures should be avoided on bedrock, where the natural frequency would usually be higher.

Although structures cannot always be built in perfect harmony with their seismic and geologic environment, the level of damage experienced during an earthquake can be minimized by incorporating the results of a preconstruction geotechnical and geological site investigation and strict adherence to at least the minimum design and construction practices required by the Uniform Building Code for Seismic Zone Four. These are, however, minimum requirements; and higher standards should be used wherever possible, especially when critical facilities, such as lifelines, are involved. Additional protection can be obtained by incorporating modern earthquake engineering concepts such as base isolation and various damping systems.

Liquefaction

Liquefaction refers to the temporary transformation of a soil mass from the solid to liquid state during an earthquake. Because the soil mass may lose the ability to support even itself, liquefaction is responsible for a high percentage of the damage that has occurred during many earthquakes. In general, liquefaction is most likely to occur under the following conditions: (1) the local earthquake has a magnitude of $M > 5$, (2) the water table is within 10 m of the surface, and (3) the soil consists of fine grained, poorly-graded, cohesionless material such as silt or fine sand. Typical liquefaction damage includes foundation failures of buildings and bridges, collapsed roads, slope failures and waterfront and shoreline failures. The generalized liquefaction potential for a portion of IWV has been determined by Banks (Reference 26). Detailed studies should be conducted for sites that are located in areas of high to moderate susceptibility as indicated by Banks.

Slope Stability

Seismically induced slope instability is not a major consideration throughout much of the mapped area. The greatest hazard will occur in the adjacent mountainous areas of the Sierra Nevada, Argus and other ranges. Rockfalls, landslides and related road closures should be the most serious problems. These will range from localized to regional in extent depending on earthquake magnitude and location. Slope failure or fault rupture could, however, seriously affect the aqueduct system along the Sierra Nevada.

SUMMARY

The NWC Active Fault Map Series shows the locations of active faults within much of Indian Wells Valley and portions of the Randsburg Wash/Mojave "B" test range areas of NWC. The mapped faults either show evidence of having moved during the last 12,500 years or occur within identified seismic gaps. Only fault traces that extend to the ground surface or show other evidence of surface deformation have been mapped; and, therefore, additional studies, such as trenching, should be conducted prior to developing areas near or along the trend of the mapped faults. This is especially true within the recommended Seismic Hazard Special Studies Zone of Ridgecrest where the fault traces are poorly developed or preserved.

ACKNOWLEDGMENTS

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Active fault data for the Indian Wells Valley area were also obtained from St. Amand (1958) (Reference 27), von Huene (1960) (Reference 28), Moyle (1963) (Reference 29), and Dutcher and Moyle (1973) (Reference 30).

Mapping of the most recent breaks on the Garlock fault located on the Christmas Canyon Quadrangle was aided by Malcomb Clark's Miscellaneous Geologic Investigation, Map I-741 (Clark, 1973) (Reference 31).

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ERRATA SHEET FOR MAPS

Pearsonville Quadrangle Map

- Allignment should be Alignment
- Nothern should be Northern
- 1 Oct 1985 should be 1 Oct 82

Inyokern Southeast Quadrangle Map

- Vegetation should be Vegetation
- Vegatation should be Vegetation
- Allignment should be Alignment
- groundwater should be ground-water

Ridgecrest North Quadrangle Map

- STUDES ZONE should be STUDIES ZONE
- actively-occurring should be actively occurring
- 1 Oct 85 should be 1 Oct 82

Ridgecrest South Quadrangle Map

- Fault trace in the northwest corner is mislocated approximately 800 feet northeast of its true location.

Christmas Canyon Quadrangle Map

- allignment should be alignment
- Liner trench should be Linear trench

Windgate Quadrangle - SW Map

- alluviu should be alluvium

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 - Division of Civil and Environmental Engineering, Dr. Sub-ch: Liu (1)
- 2 Physical and Geophysical Sciences Directorate, Bolling Air Force Base, Washington, DC (Dr. H. R. Radford)

118° 00'
35° 37' 30"

57' 30"

Vegetation/Texture change

Texture change
probable erosion

Offset alluvium

Texture change
Color/Topographic
lineation

Uplifted t_1
& texture c

Slope break

Topographic/Color lineation

Drainage change &
probable t_1 & texture c

FREEMAN JUNCTION QUADRANGLE
CALIFORNIA - KERN CO.

55'

117° 52' 30"

35° 37' 30"

Erosional scarps ?

Aqueduct appears to be on scarp

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35'

glomerates
grgs

32' 30"

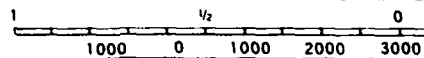
35° 30'

118° 00'

57' 30"

change

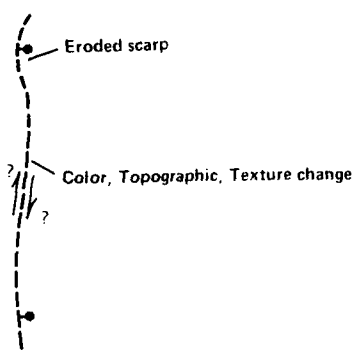
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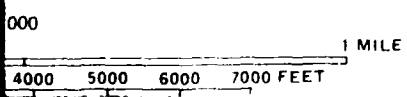
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32° 30"

35° 30'
117° 52' 30"

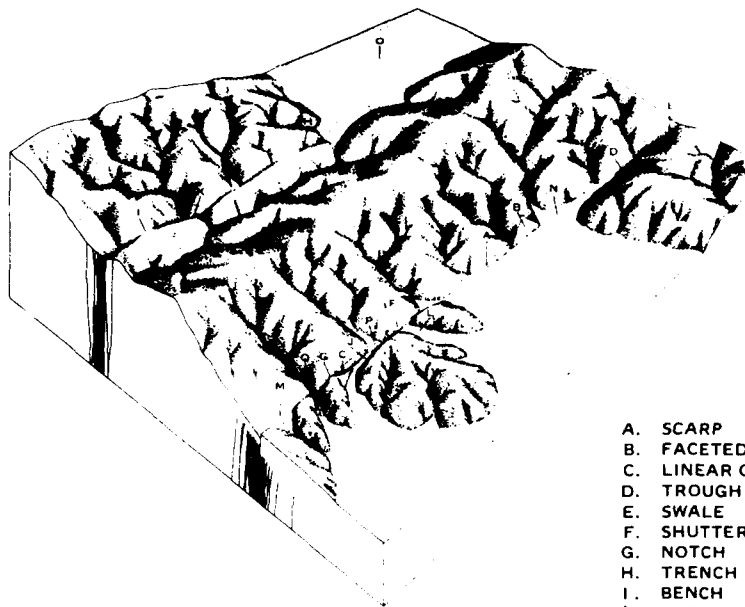
55'



BY G. R. ROQUEMORE,
J. T. ZELLMER 1986

35° 30'
118° 00'

57° 30'



GENERALIZED DIAGRAM OF FAULT FEATURES

- A. SCARP
- B. FACETED RIDGE
- C. LINEAR GULLY
- D. TROUGH OR LINEAR CANYON
- E. SWALE
- F. SHUTTER-RIDGE SCARP
- G. NOTCH
- H. TRENCH
- I. BENCH
- J. OFFSET DRAINAGE CHANNEL
- K. DEFLECTED DRAINAGE CHANNEL
- L. BEHEADED DRAINAGE CHANNEL
- M. BEHEADED DRAINAGE CHANNEL WITH ALLUVIAL RAMP
- N. SAG POND
- O. DEPRESSION (PLAYA BASIN)
- P. PONDED ALLUVIUM
- Q. SPRING

Solid line, field or
scarps, trenches, etc.
interpretations not
distinctive surficial
active fault trace
regarded as approx
of relative motion

Other recently ac
features may be p

¹ The brief notes along tr
clear. Fault trace features
the mapped fault lines

55'

35° 30'

117° 52' 30"

24 000

1 MILE

0 4000 5000 6000 7000 FEET

1 KILOMETER

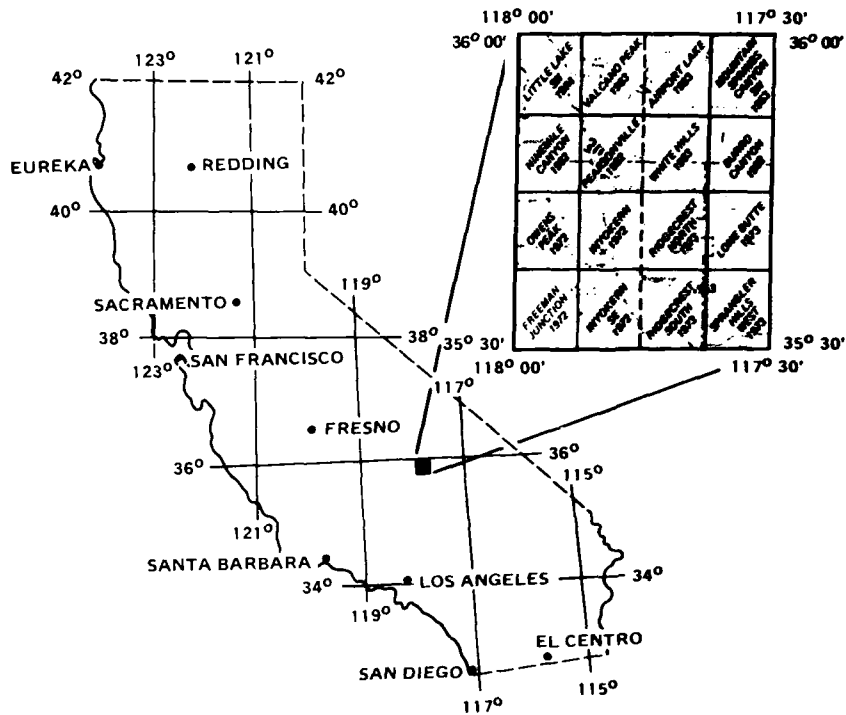
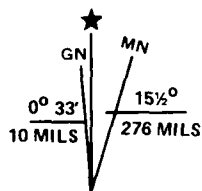
BY G. R. ROQUEMORE,
J. T. ZELLMER 1986

INTO
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not present; dotted line, potentially
cent alluvium (position should be
thrown side; arrows show direction

UTM GRID & 1972 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



117° 52' 30"
35° 45'

50'

42' 30"

INYOKERN QUADRA
CALIFORNIA KER

47' 38"

Northern segment of
zone of ground cracking
associated with 1 Oct 1982,
M=4.8 earthquake

Trench location
Unconsolidated
eolian and lacustrine
sediments.
To 0.4m depth, the
sediments are warped
Below 4m sediments
are offset by fault
fault dip ~ 60° E

INYOKERN QUADRANGLE
CALIFORNIA - KERN CO

117° 45'

35° 45'

Northern segment of
zone of ground cracking
associated with 1 Oct 1962,
M=4.8 earthquake

Trench location

Unconsolidated
eolian and lacustrine
sediments.

To 0.4m depth, the
sediments are warped.
Below 4m sediments
are offset by fault.
fault dip ~ 60° E

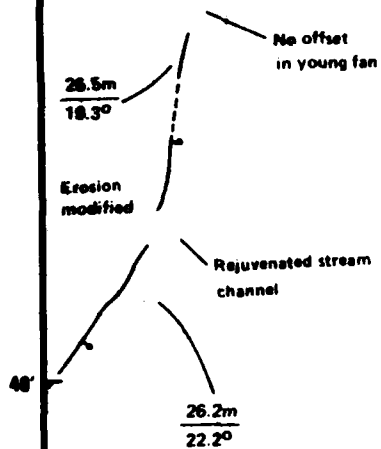
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42' 30"

Fault Scarp Profile Data

$\frac{12.0m}{15^\circ}$	=	$\frac{\text{Scarp height}}{\text{max scarp angle}}$
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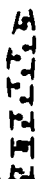
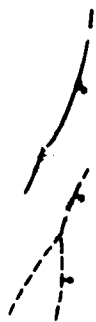


Erosion modified

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Depression

36° 37' 30"
117° 52' 30"

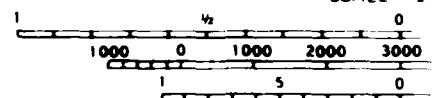
50'



GENERALIZED DIAGRAM OF FAULT FEATURES

- A. SCARP
- B. FACETED RIDGE
- C. LINEAR GULLY
- D. TROUGH OR LINEAR CANYON
- E. SWALE
- F. SHUTTER-RIDGE SCARP
- G. NOTCH
- H. TRENCH
- I. BENCH
- J. OFFSET DRAINAGE CHANNEL
- K. DEFLECTED DRAINAGE CHANNEL
- L. BEHEADED DRAINAGE CHANNEL
- M. BEHEADED DRAINAGE CHANNEL
WITH ALLUVIAL RAMP
- N. SAG POND
- O. DEPRESSION (PLAYA BASIN)
- P. PONDED ALLUVIUM
- Q. SPRING

SCALE 1:24



CONTOUR INTERVAL
DATUM IS MEAN

TOPOGRAPHIC BASE FROM
SURVEY IN YOKER, CALI
7.5' QUADRANGLE 1972

CARTOGRAPHY BY

EXPLANATION



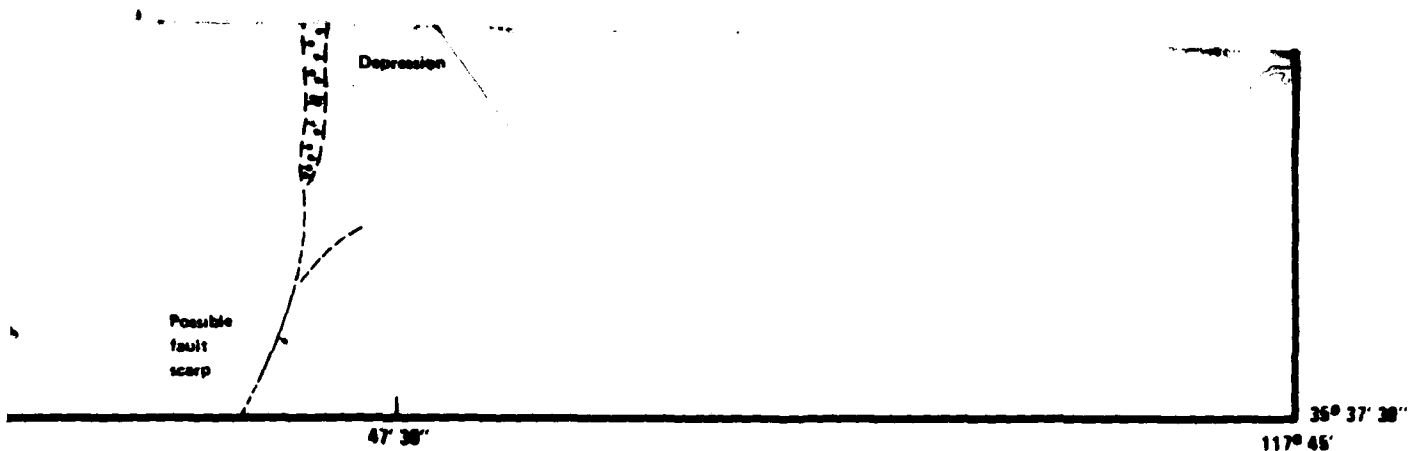
Fault trace

Solid line field or photogeologic evidence
scarps, trenches, sag ponds, or other surficial
features where noted dashed line possible
interpretations not excluded dashed line
distinctive surficial features of faulting not
active fault trace concealed by very recent
regarded as approximate ball on down the
of relative motion

Other recently active breaks that have
features may be present

The brief notes along the fault traces indicate locations
clear. Fault trace features are not limited to those indicated
the mapped fault lines

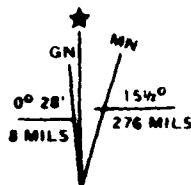
Pleistocene Lake



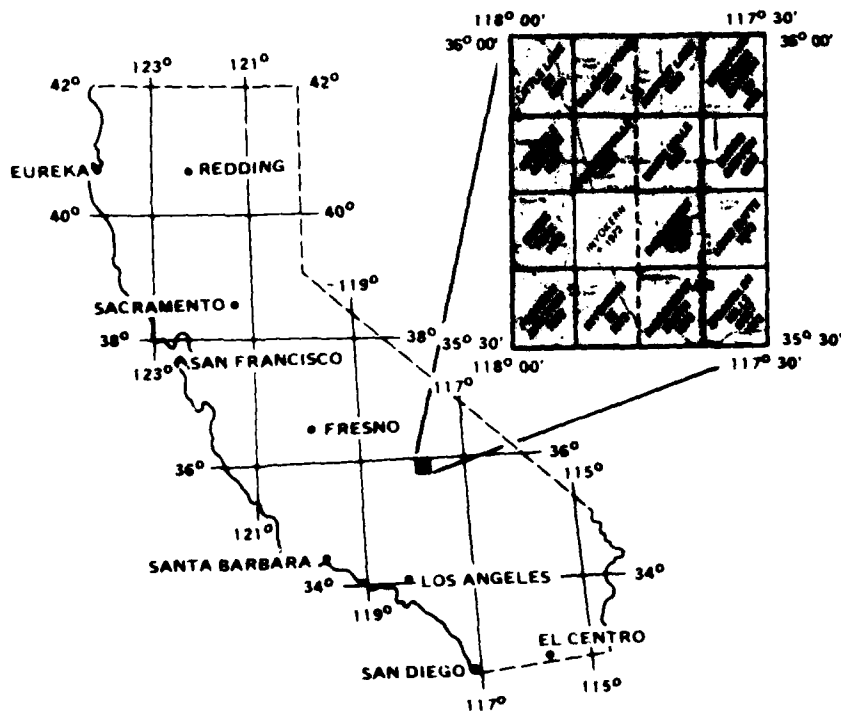
BY G. R. ROQUEMORE,
J. T. ZELLNER 1986



ICAL



UTM GRID & 1972 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



ment shown by
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scarp but other
movement but
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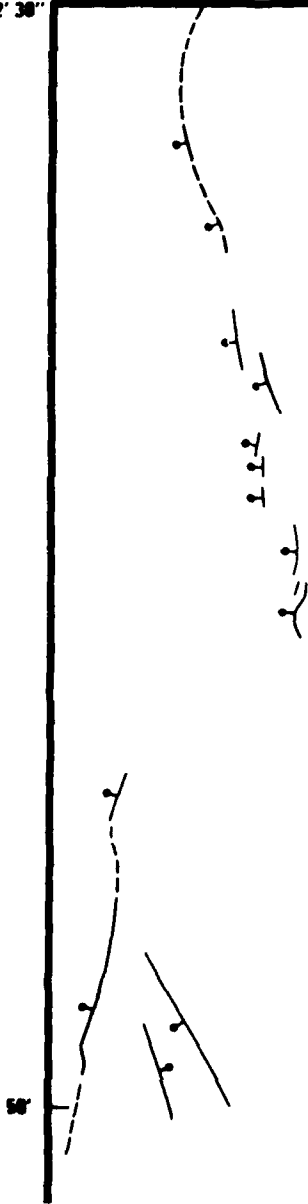
stinctive surficial

oriented are obliquely
some degree of along

BURRO CANYON QUADRANGLE
CALIFORNIA - INYO CO., SAN BERNARDINO CO

117° 37' 30"
35° 52' 30"

35'



INYOKERN SOUTHEAST QUADRANGLE
CALIFORNIA - KERN CO.

117° 52' 30"

50'

35° 37' 30"

Vegetation and
texture lineament

Slope break
transverse to
drainage

Graben

Slope break
Vegetation alignment

Possible graben

Erosion

Color/Texture change

Erosion

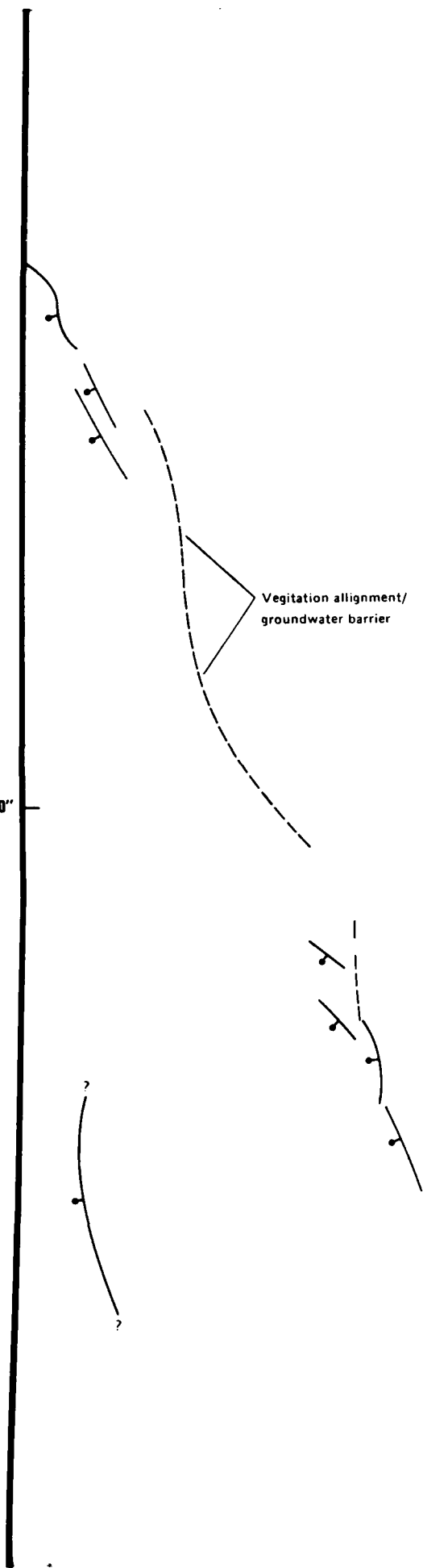
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35'

47' 30"

Vegetation alignment/
groundwater barrier



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32' 30"

Trough truncates drainage

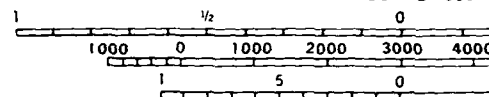
rough

35° 45'

117° 37' 30"

35'

SCALE 1:24,000



CONTOUR INTERVALS, 2
DATUM IS MEAN SEA LEVEL

TOPOGRAPHIC BASE FROM U.S. GEOLOGICAL SURVEY BURRO CANYON, CALIFORNIA, AND INYOKERN SOUTHEAST, CALIFORNIA

CARTOGRAPHY BY P. O'D

EXPLANATION



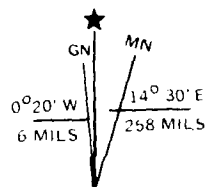
Fault trace

Solid line, field or photogeologic evidence of recent scarps, trenches, sag ponds, or other surface features where noted; queried line, possible recent interpretations not excluded; dashed line, probably distinctive surficial features of faulting not present; active fault trace concealed by very recent alluvium, regarded as approximate; ball on downthrown side of relative motion.

Other recently active breaks that have not produced features may be present.

¹The brief notes along the fault traces indicate locations where they are clear. Fault trace features are not limited to these localities but are the mapped fault lines.

Pleistocene Lake Shore



UTM GRID & 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

GENERALIZED DIAGRAM OF FAULT FEATURES

- A. SCARP
- B. FACETED RIDGE
- C. LINEAR GULLY
- D. TROUGH OR LINEAR CANYON
- E. SWALE
- F. SHUTTER-RIDGE SCARP
- G. NOTCH
- H. TRENCH
- I. BENCH
- J. OFFSET DRAINAGE CHANNEL
- K. DEFLECTED DRAINAGE CHANNEL
- L. BEHEADED DRAINAGE CHANNEL
- M. BEHEADED DRAINAGE CHANNEL WITH ALLUVIAL RAMP
- N. SAG POND
- O. DEPRESSION (PLAYA BASIN)
- P. PONDED ALLUVIUM
- Q. SPRING

350

distinct ed distinctive surficial

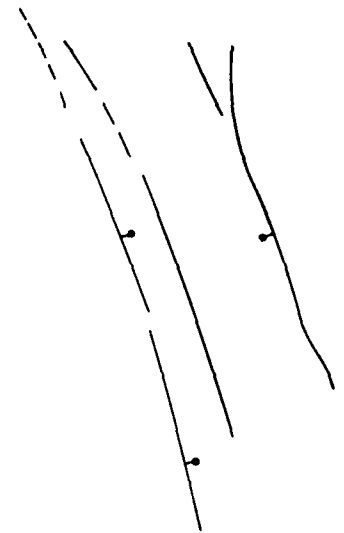
ures mentioned are especially
s mentioned ent to some degree, all along
to some

Erosion

117° 37' 30"
35° 45'

35'

42' 30"



LONE BUTTE QUADRANGLE
CALIFORNIA - SAN BERNARDINO CO.

32' 30"

117° 30"

35° 45'

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Right-slip offsets
in drainages

42' 30"

Shore line

40'

Warped lacustrine
sediments exposed

Possible

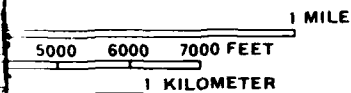
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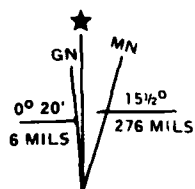
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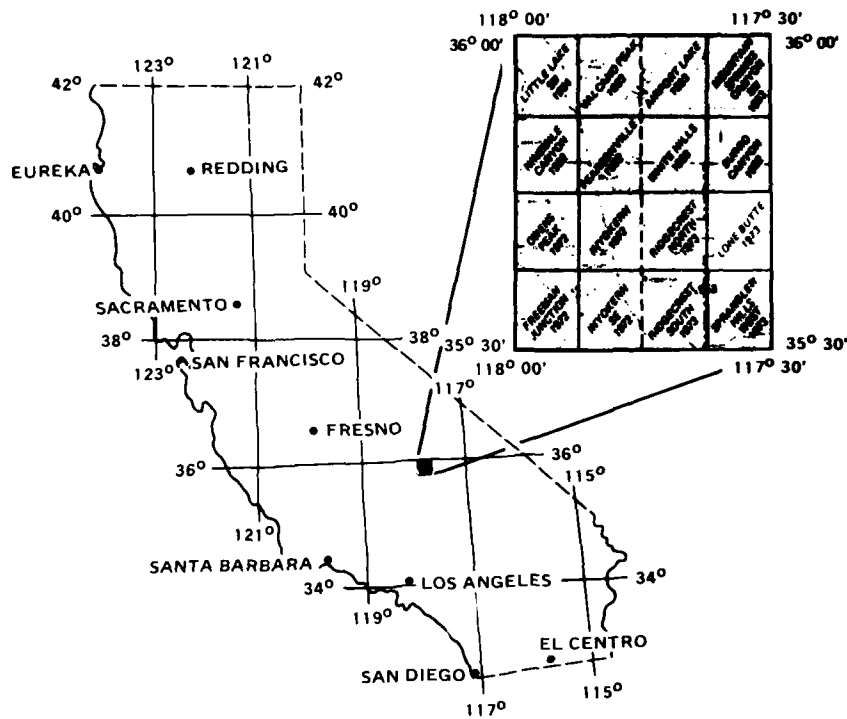
BY G. R. ROQUEMORE,
J. T. ZELLMER 1986



FEET
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UTM GRID & 1973 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



ent movement shown by
lines including landslide
fault scarp, but other
recent movement, but
dotted line, potentially
um position should be
arrows show direction

ed distinctive surficial

ures mentioned are especially
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ne

NINE MILE CANYON QUADRANGLE
CALIFORNIA INYO CO. KERN CO.

117° 5'

35° 52' 30"

55'

$\frac{12.0m}{15^\circ}$

Faceted spur

Graben

Erosional (?) scarps

Fault Scarp Profile Data

$\frac{12.0m}{15^\circ} = \frac{\text{Scarp height}}{\text{Max scarp angle}}$

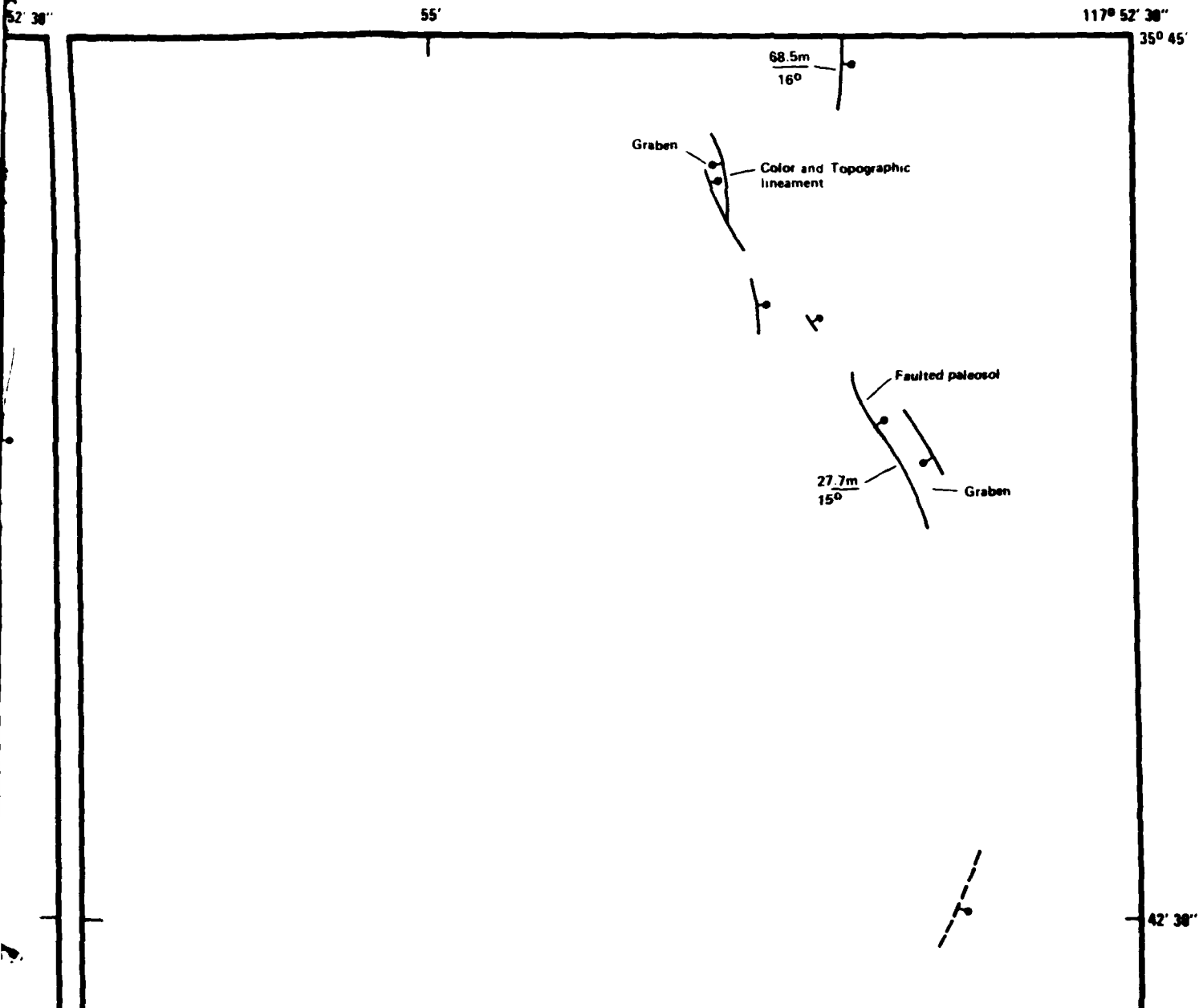
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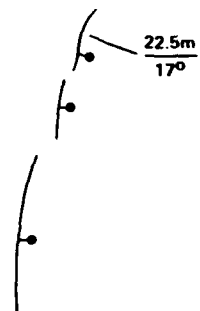
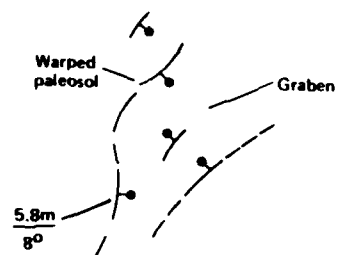
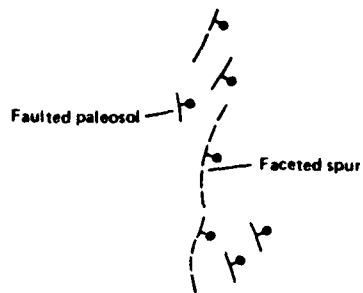
58'

OWENS PEAK QUADRANGLE
CALIFORNIA KERN CO

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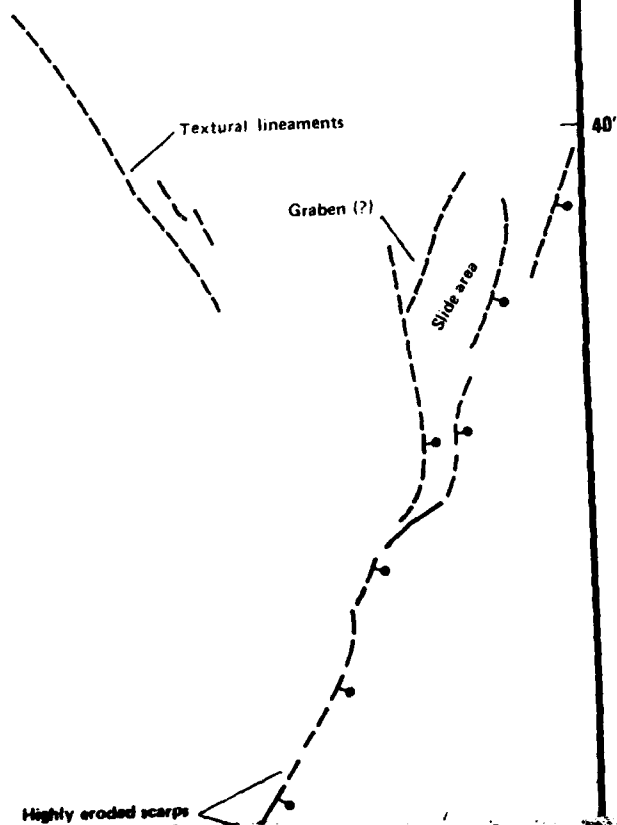


47' 30"

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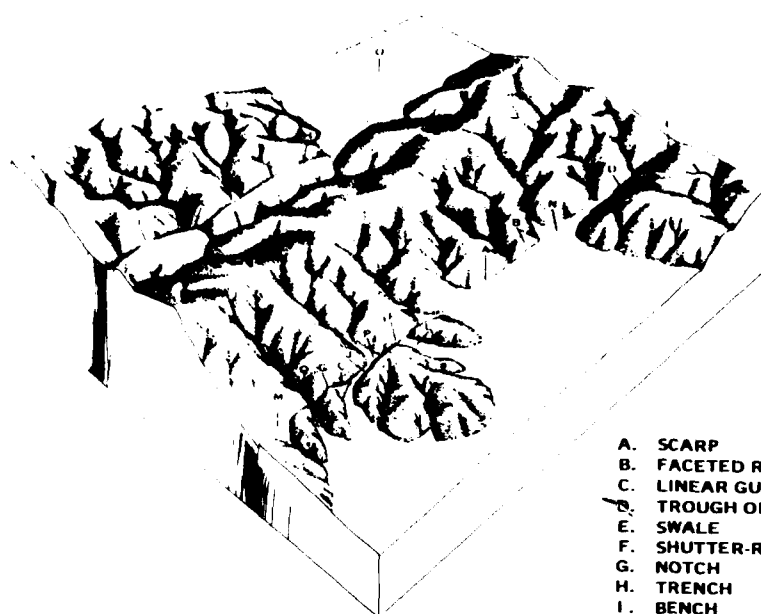
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35° 45'

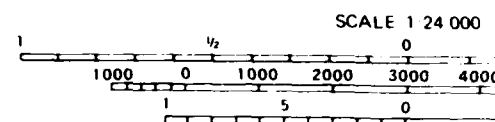
55'

117° 52' 31"



GENERALIZED DIAGRAM OF FAULT FEATURES

- A. SCARP
- B. FACETED RIDGE
- C. LINEAR GULLY
- D. TROUGH OR LINEAR CANYON
- E. SWALE
- F. SHUTTER-RIDGE SCARP
- G. NOTCH
- H. TRENCH
- I. BENCH
- J. OFFSET DRAINAGE CHANNEL
- K. DEFLECTED DRAINAGE CHANNEL
- L. BEHEADED DRAINAGE CHANNEL
- M. BEHEADED DRAINAGE CHANNEL WITH ALLUVIAL RAMP
- N. SAG POND
- O. DEPRESSION (PLAYA BASIN)
- P. PONDED ALLUVIUM
- Q. SPRING



CONTOUR INTERVALS, 4
 DATUM IS MEAN SEA LEVEL
 TOPOGRAPHIC BASE FROM U.S.
 SURVEY NINEMILE CANYON, CALIF.
 QUADRANGLE 7.5' 1982 AND 0
 CALIFORNIA 7.5' QUADRANGLE
 CARTOGRAPHY BY P. O'D.

EXPLANATION



Solid line, field or photogeologic evidence of recent scarps, trenches, sag ponds, or other surface features where noted, queried line, possible recent interpretations not excluded, dashed line, probably distinctive surficial features of faulting not present, active fault trace concealed by very recent alluvium, regarded as approximate, ball on down thrown side of relative motion

Other recently active breaks that have not produced features may be present

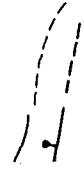
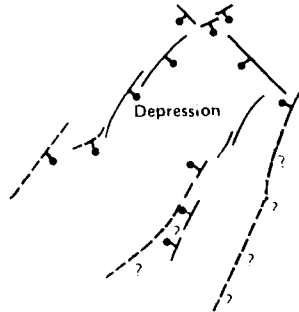
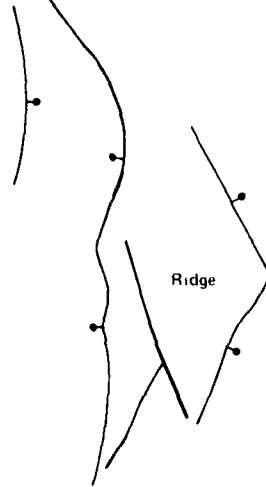
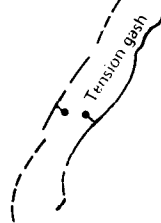
¹ The brief notes along the fault traces indicate locations where the clear fault trace features are not limited to these localities but are the mapped fault lines

Pleistocene Lake Shore

117° 52' 30"
35° 52' 30"

50'

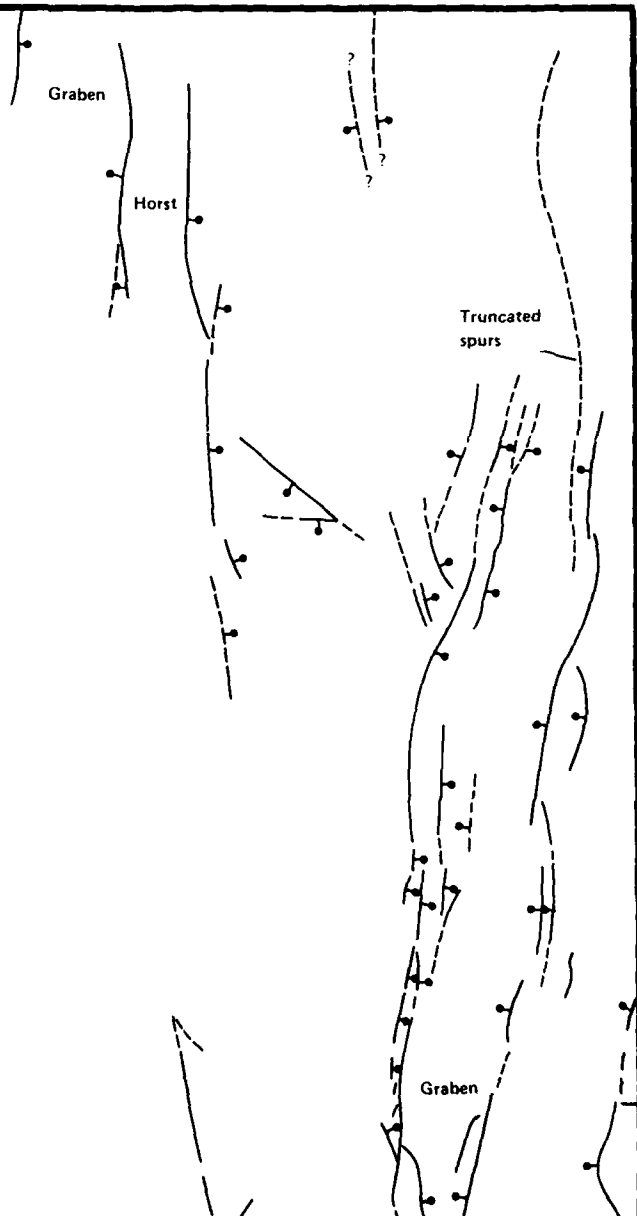
50'



PEARSONVILLE QUADRANGLE
CALIFORNIA - KERN CO

47° 30''

117° 45'
35° 52' 30''



N
W
C

A
C
T
I
V
E

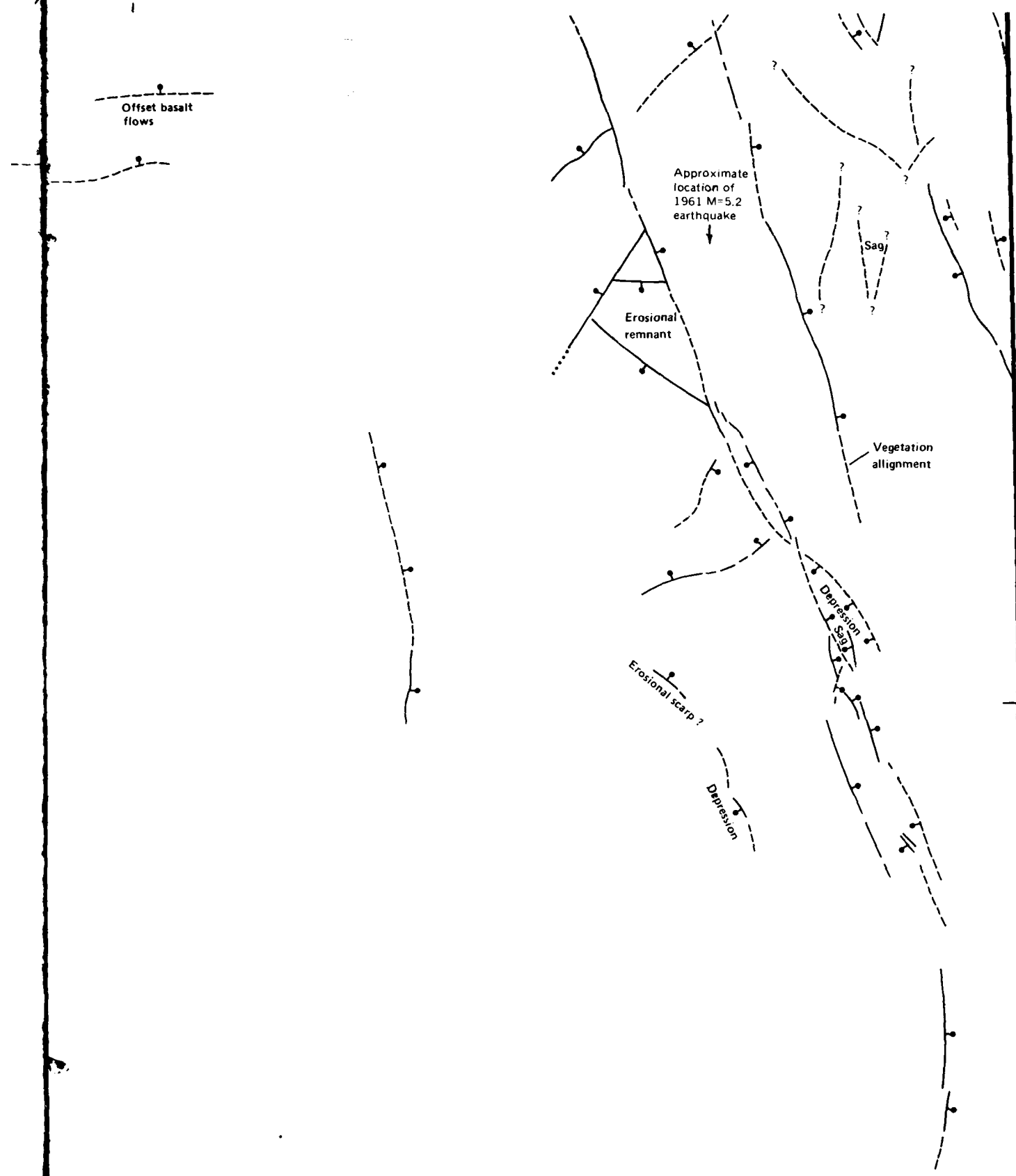
47' 30"

Graben

F
A
U
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P

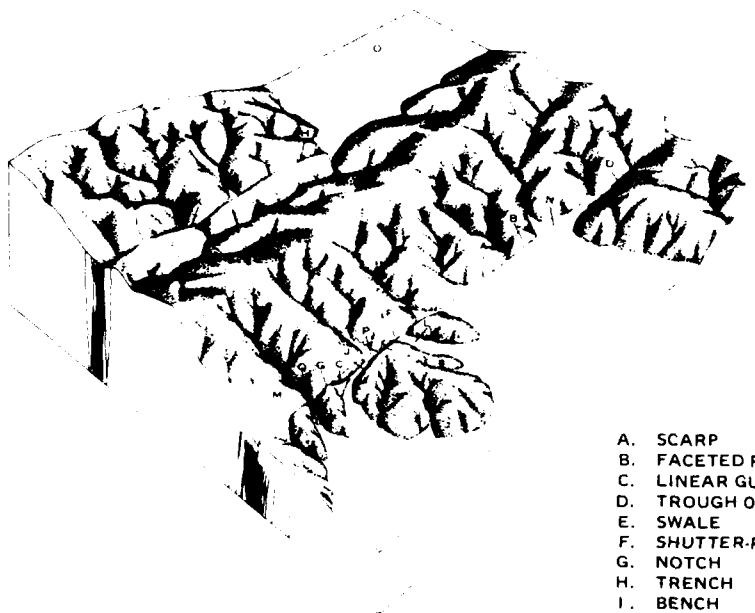
S
E
R
I
E
S



47° 30"

35° 45'
117° 52' 30"

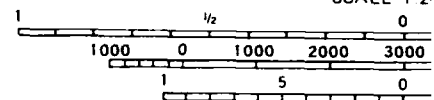
50'



GENERALIZED DIAGRAM OF FAULT FEATURES

- A. SCARP
- B. FACETED RIDGE
- C. LINEAR GULLY
- D. TROUGH OR LINEAR CANYON
- E. SWALE
- F. SHUTTER-RIDGE SCARP
- G. NOTCH
- H. TRENCH
- I. BENCH
- J. OFFSET DRAINAGE CHANNEL
- K. DEFLECTED DRAINAGE CHANNEL
- L. BEHEADED DRAINAGE CHANNEL
- M. BEHEADED DRAINAGE CHANNEL WITH ALLUVIAL RAMP
- N. SAG POND
- O. DEPRESSION (PLAYA BASIN)
- P. PONDED ALLUVIUM
- Q. SPRING

SCALE 1:2



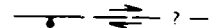
CONTOUR INTERVAL

DATUM IS MEAN

TOPOGRAPHIC BASE FROM
SURVEY PEARSONVILLE,
QUADRANGLE 1982

CARTOGRAPHY BY

EXPLANATION



Fault trace

Solid line, field or photogeologic evidence; scarp, trench, sag pond, or other surface features where noted; queried line, possible interpretations not excluded; dashed line, distinctive surficial features of faulting not active; fault trace concealed by very recent deposits regarded as approximate; ball on down throw side of relative motion.

Other recently active breaks that have no features may be present.

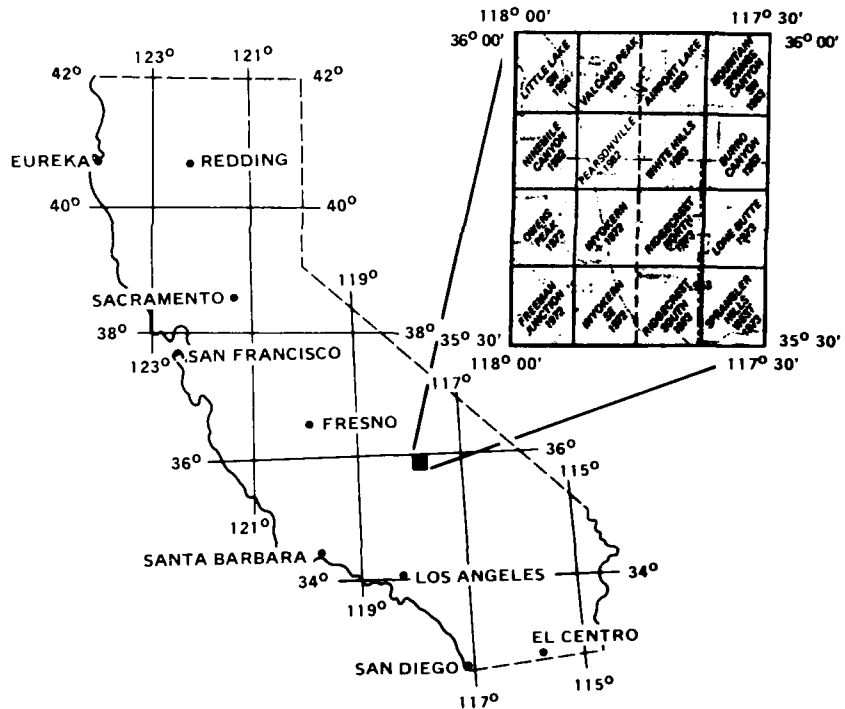
The brief notes along the fault traces indicate locations of recent activity. Fault trace features are not limited to these localities but are mapped fault lines.

Pleistocene Lake

35° 45'

117° 45'

Shoreline



117° 45'
35° 45'

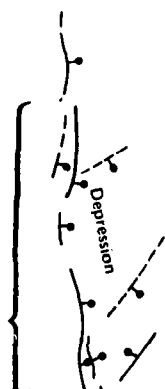
42' 30"

Approximate location of
the 1982 M=4.8 earthquake.



42' 30"

Southern segment of zone of
ground cracking associated
with 1 Oct.-1985 earthquake



RIDGE CREST NORTH QUADRANGLE
CALIFORNIA - KERN CO.

40'

117° 37' 30"

35° 45'

N
W
C

A
C
T
I
V
E

42' 30"

Mole tracks

Right-slip
offset in
sand dunes

Trench
location

open crack ?

40'

The recommended special studies zone contains the southern extension of the Little Lake fault. This fault was responsible for earthquakes with magnitudes of $M > 5$ in 1938, 1961 and 1982. Evidence of actively-occurring, tectonic deformation exists within the special studies zone. The extent and characteristics of this deformation could not be determined because of widespread alterations to the natural landscape by cultural activities. Consequently, detailed, site-specific, geologic studies designed to identify areas potentially subject to fault offset, severe ground shaking and earthquake-

RECOMMENDED

F
A
U
L
T

M
A
P

S
E
R
I
E
S

40'

Probable liquefaction
damage to building
during 1 Oct 1985,
M = 4.8 earthquake.

Mole tracks

Topographic and
textural lineaments

RECOMMENDED

Identify areas potentially subject to fault offset, severe ground shaking and earthquake-induced soil instability should be conducted prior to future development within this zone.

RECOMMENDED SPECIAL STUDIES

35° 37' 30"

117° 45'

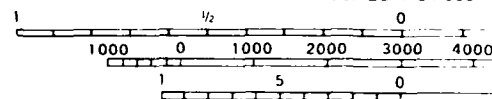
42° 30"



GENERALIZED DIAGRAM OF FAULT FEATURES

- A. SCARP
- B. FACETED RIDGE
- C. LINEAR GULLY
- D. TROUGH OR LINEAR CANYON
- E. SWALE
- F. SHUTTER-RIDGE SCARP
- G. NOTCH
- H. TRENCH
- I. BENCH
- J. OFFSET DRAINAGE CHANNEL
- K. DEFLECTED DRAINAGE CHANNEL
- L. BEHEADED DRAINAGE CHANNEL
- M. BEHEADED DRAINAGE CHANNEL WITH ALLUVIAL RAMP
- N. SAG POND
- O. DEPRESSION (PLAYA BASIN)
- P. PONDED ALLUVIUM
- Q. SPRING

SCALE 1:24,000



CONTOUR INTERVALS, 5 FEET
DATUM IS MEAN SEA LEVEL

TOPOGRAPHIC BASE FROM U.S. GEODETIC SURVEY RIDGECREST NORTH, CALIFORNIA 7.5' QUADRANGLE 1973

CARTOGRAPHY BY P. O'DONNELL

EXPLANATION



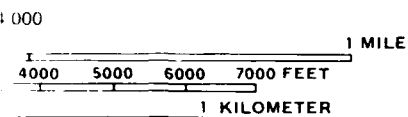
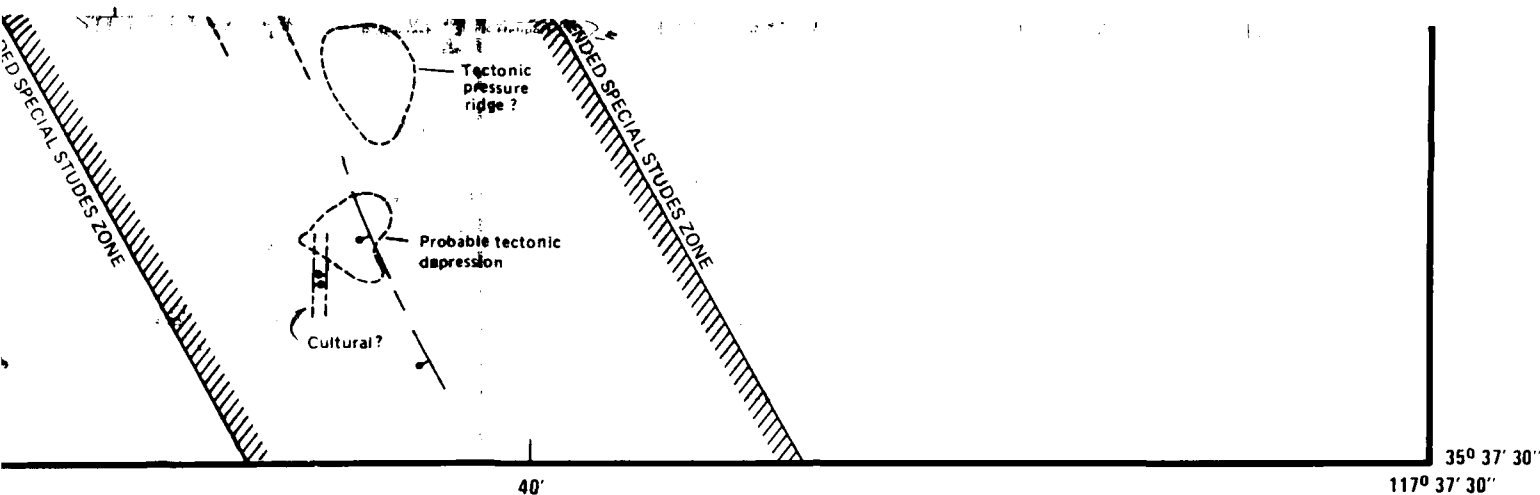
Fault trace

Solid line: field or photogeologic evidence of recent scarps, trenches, sag ponds, or other surface features where noted; queried line: possible recent interpretations not excluded; dashed line: probable distinctive surficial features of faulting not present; active fault trace concealed by very recent alluvium regarded as approximately half on downthrown side of relative motion.

Other recently active breaks that have not produced features may be present.

The brief notes along the fault traces indicate locations where the fault is clear. Fault trace features are not limited to these locations but are present along the mapped fault lines.

Pleistocene Lake Shoreline



ALS, 5 FEET
SEA LEVEL
U.S. GEOLOGICAL
SURVEY, NORTH, CALIFORNIA

BY P. O'DELL

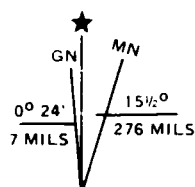
ATION

Recent movement shown by
features including landslide
recent fault scarp, but other
probable recent movement, but
present dotted line, potentially
alluvium position should be
down side, arrows show direction

produced distinctive surficial

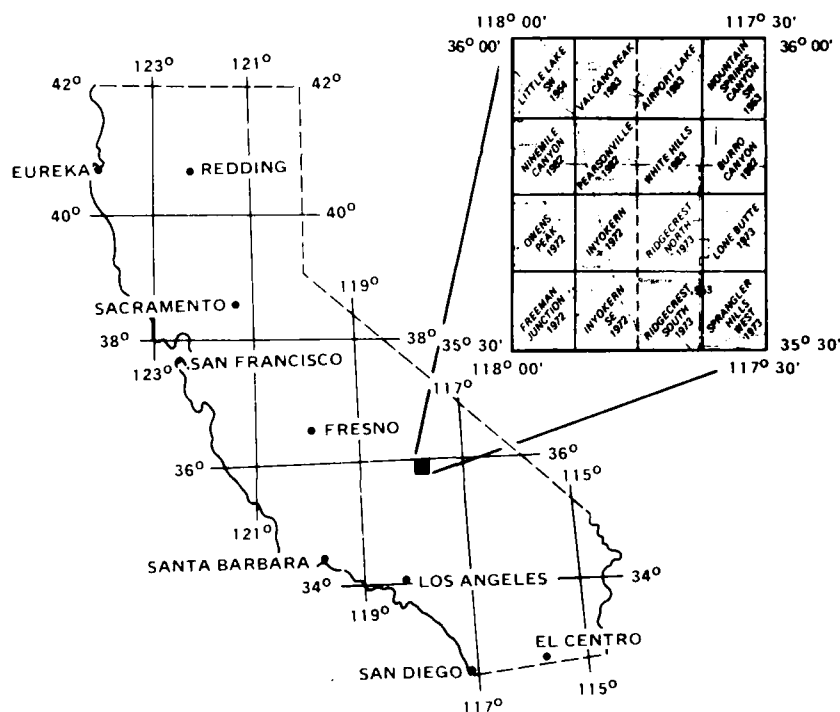
the features mentioned are especially
present to some degree all along

Shoreline



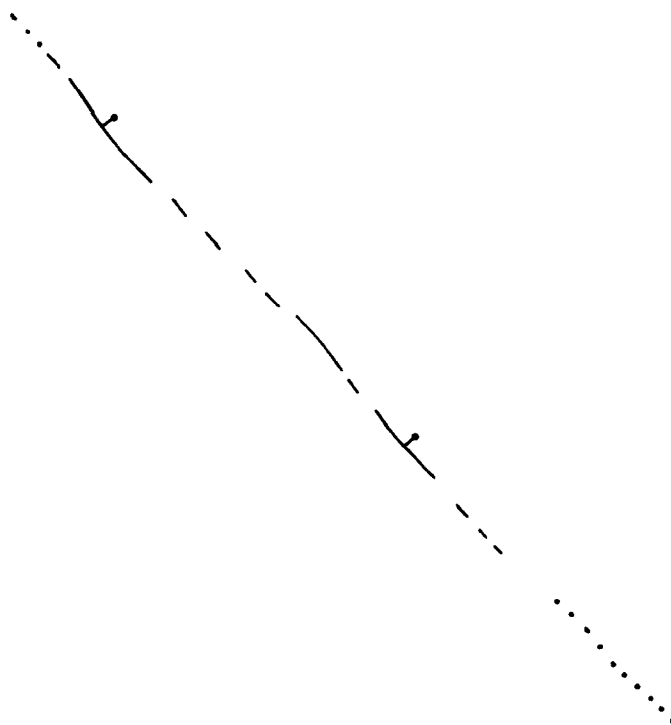
UTM GRID & 1973 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

BY G. R. ROQUEMORE,
J. T. ZELLMER 1986



117° 45' 35° 37' 30' 42' 30'

35'



RIDGECREST SOUTH QUADRANGLE
CALIFORNIA - KERN CO.

40'

117° 37' 30"
35° 37' 30"

Approximate location of
the 1938 M=5.0 earthquake.

N
W
C
A
C
T
I
V
E

35'

32' 30"

F
A
L
L
T

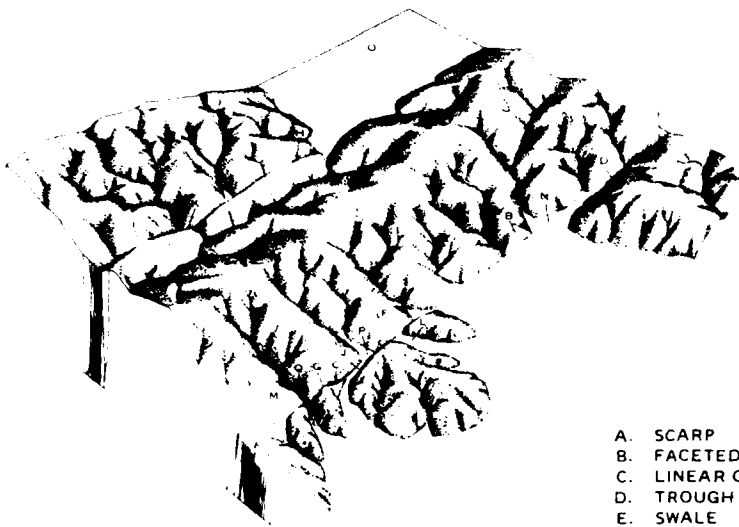
M
A
F

S
E
E

E
S

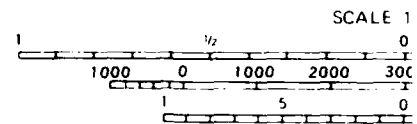
32' 30"

35° 30'
117° 45'



GENERALIZED DIAGRAM OF FAULT FEATURES

- A. SCARP
- B. FACETED RIDGE
- C. LINEAR GULLY
- D. TROUGH OR LINEAR CANYON
- E. SWALE
- F. SHUTTER-RIDGE SCARP
- G. NOTCH
- H. TRENCH
- I. BENCH
- J. OFFSET DRAINAGE CHANNEL
- K. DEFLECTED DRAINAGE CHANNEL
- L. BEHEADED DRAINAGE CHANNEL
- M. BEHEADED DRAINAGE CHANNEL WITH ALLUVIAL RAMP
- N. SAG POND
- O. DEPRESSION (PLAYA BASIN)
- P. PONDED ALLUVIUM
- Q. SPRING

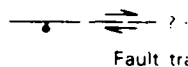


CONTOUR INTERVAL
DATUM IS MEAN

TOPOGRAPHIC BASE FROM
SURVEY RIDGECREST S
7.5' QUADRANGLE 1973

CARTOGRAPHY

EXPLANATION



Fault trace

Solid line, field or photogeologic evidence; scarp, trench, sag pond, or other surface features where noted, queried line, possible interpretations not excluded, dashed line, distinctive surficial features of faulting not active fault trace concealed by very recent deposits (regarded as approximate), ball on down trace of relative motion

Other recently active breaks that have features may be present

The brief notes along the fault traces indicate location of features. Fault trace features are not limited to those shown on the mapped fault lines

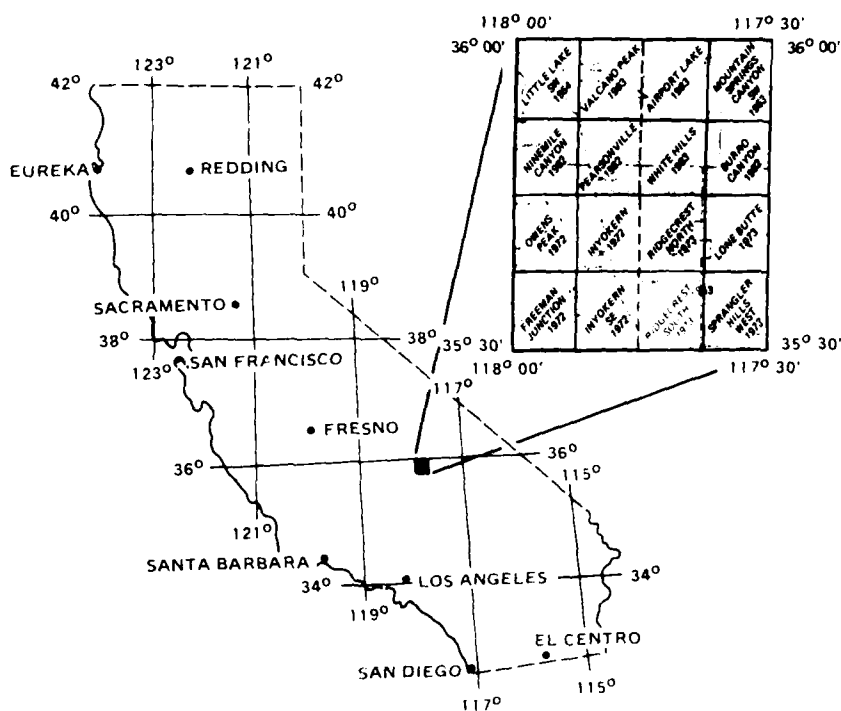
Pleistocene Lake

BY G. R. ROQUEMORE,
J. T. ZELLMER 1986

1 KILOMETER

FEET
VEL
EOLOGICAL
ALIFORNIA

UTM GRID & 1973 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



117° 45'
35° 52' 30"

42' 30"

50'

WHITE HILLS QUADRANGLE
SAN BERNARDINO CO., KERN CO.,
INYO CO.

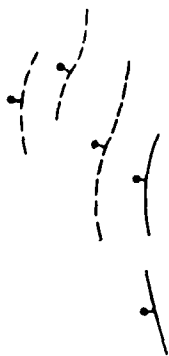
40'

117° 37' 30"
35° 52' 30"

N
W
C

A
C
T
I
V
E

50'



47' 30"

Depression

Mole track

Mole track

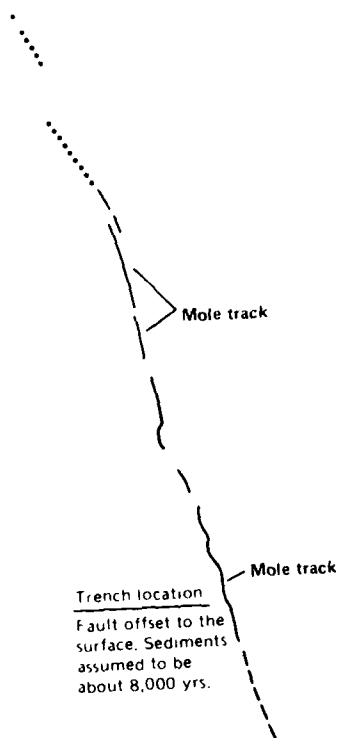
Possible right
slip in wash

Mole track

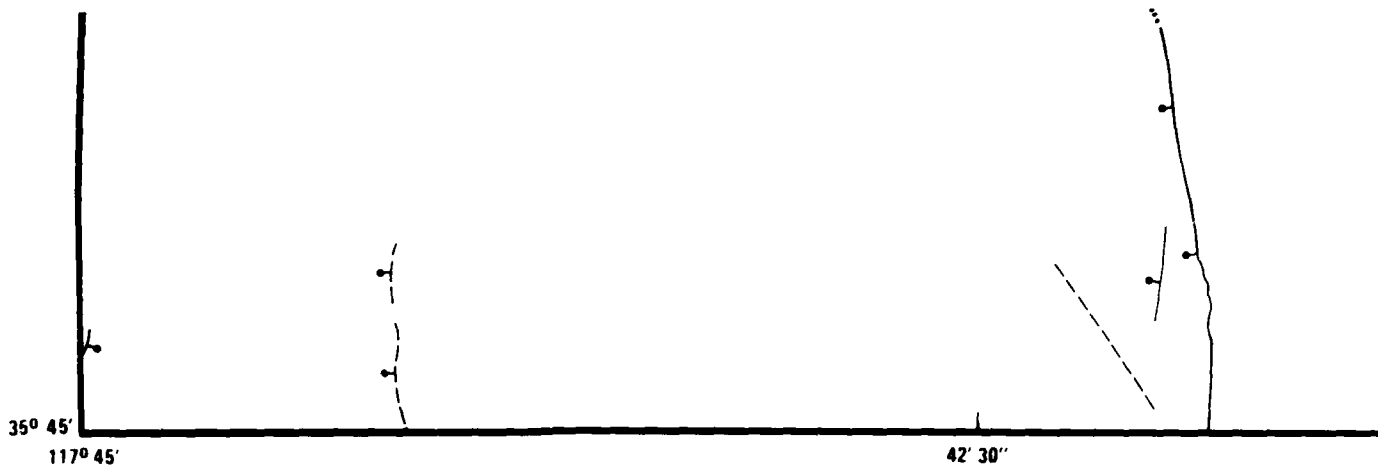
F
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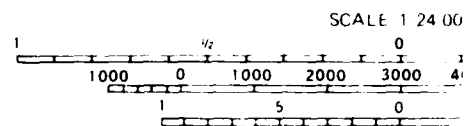


47' 30"



GENERALIZED DIAGRAM OF FAULT FEATURES

- A. SCARP
- B. FACETED RIDGE
- C. LINEAR GULLY
- D. TROUGH OR LINEAR CANYON
- E. SWALE
- F. SHUTTER-RIDGE SCARP
- G. NOTCH
- H. TRENCH
- I. BENCH
- J. OFFSET DRAINAGE CHANNEL
- K. DEFLECTED DRAINAGE CHANNEL
- L. BEHEADED DRAINAGE CHANNEL
- M. BEHEADED DRAINAGE CHANNEL WITH ALLUVIAL RAMP
- N. SAG POND
- O. DEPRESSION (PLAYA BASIN)
- P. PONDED ALLUVIUM
- Q. SPRING



CONTOUR INTERVALS
DATUM IS MEAN SEA

TOPOGRAPHIC BASE FROM U.S. C
SURVEY WHITE HILLS, CALIFOR
QUADRANGLE 1983

CARTOGRAPHY BY P. C.

EXPLANATION



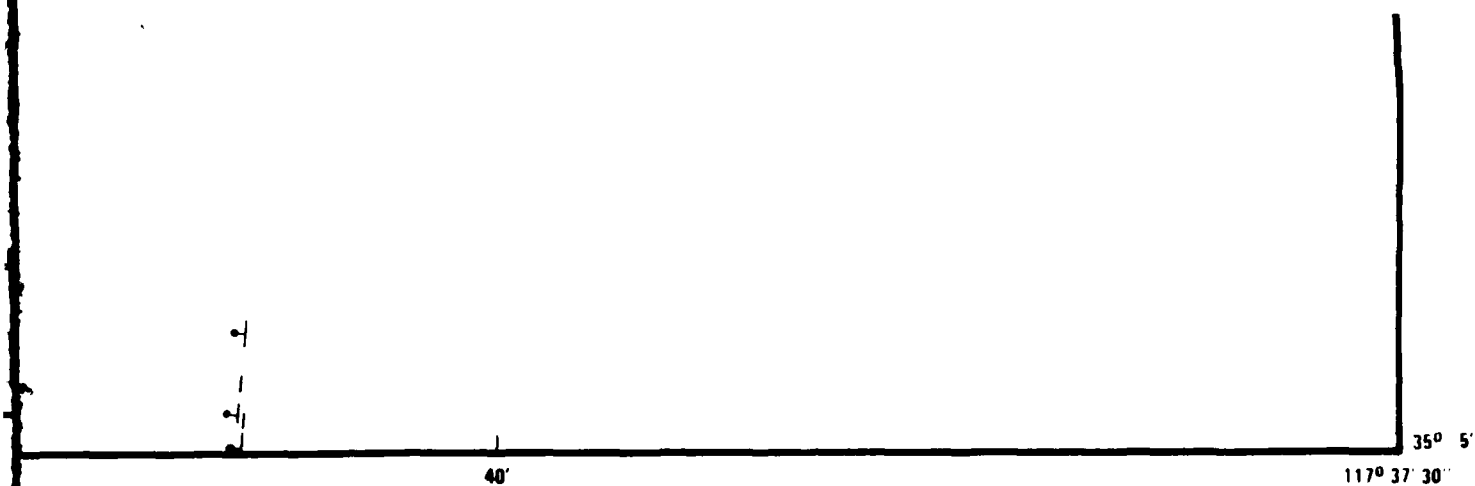
Fault trace

Solid line: field or photogeologic evidence of scarp, trenches, sag ponds, or other surface features where noted; queried line: possible features where interpretations not excluded; dashed line: probable but distinctive surficial features of faulting not present; active fault trace concealed by very recent alluvium regarded as approximate; balloon down: throw of relative motion.

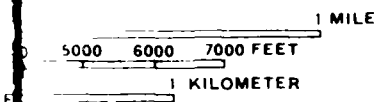
Other recently active breaks that have not produced features may be present.

The brief notes along the fault traces indicate points where the fault trace features are not continuous. These are also shown on the mapped fault lines.

Pleistocene Lake Shore

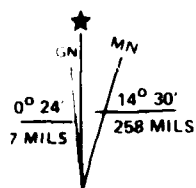


BY G R ROQUEMORE,
J. T. ZELLMER 1986



0 FEET
LEVEL
GEOLOGICAL
MA 75

FEEL



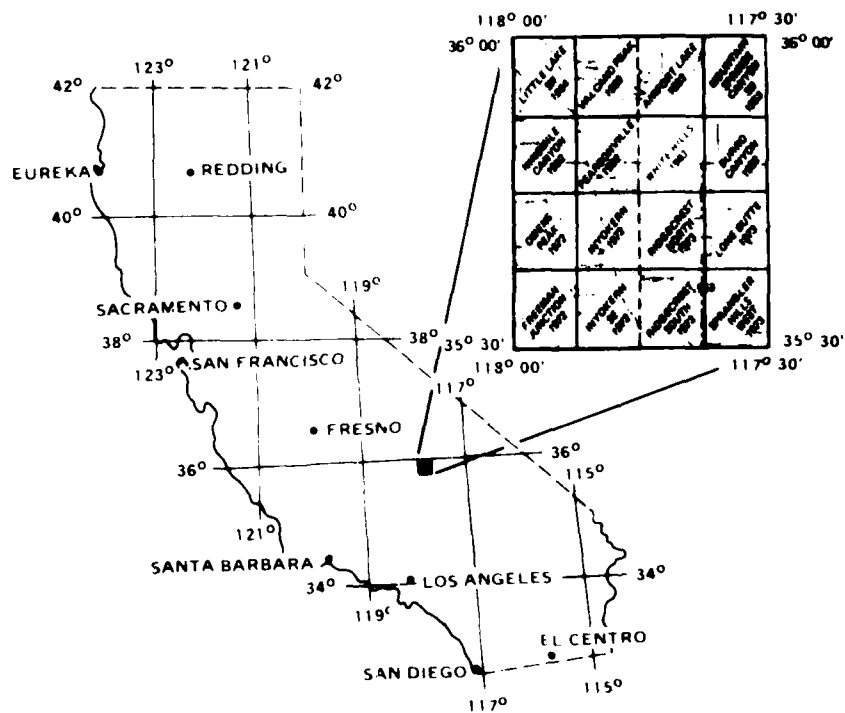
UTM GRID & 1980 MAGNETIC NORTH

earth movement shown by
arrows including landslide
or fault scarp but other
movement but
position should be
arrows show direction

distinctive surficial

mentioned are especially
some degree of

the

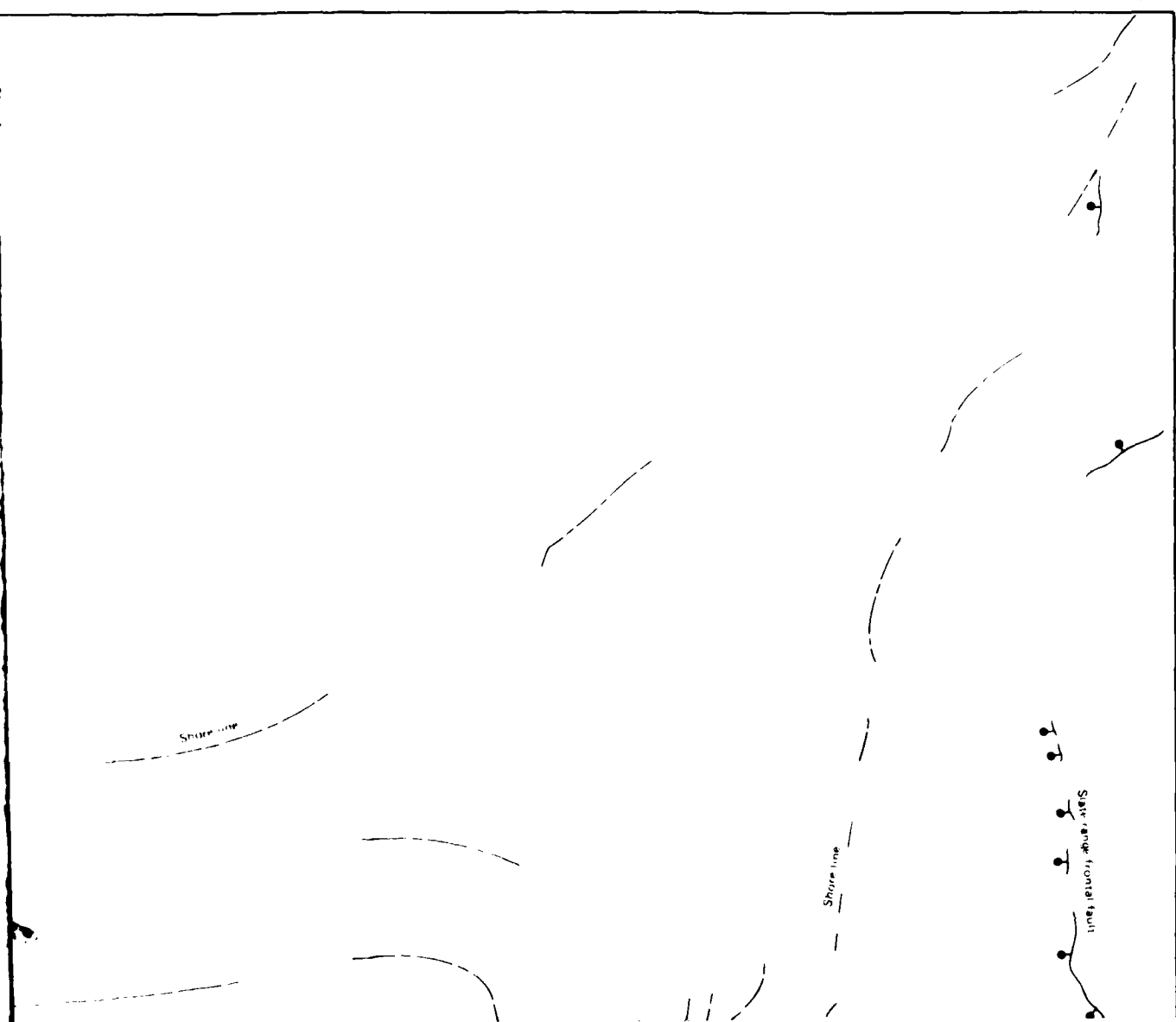


117° 22' 30"
35° 37' 30"

20'

CHRISTMAS CANYON QUADRANGLE
CALIFORNIA SAN BERNARDINO CO

117 15'
35 37' 30"



N
W
C

32° 30'

Shore line

Shore line

Characteristic topography

Graben

Abrupt slope change

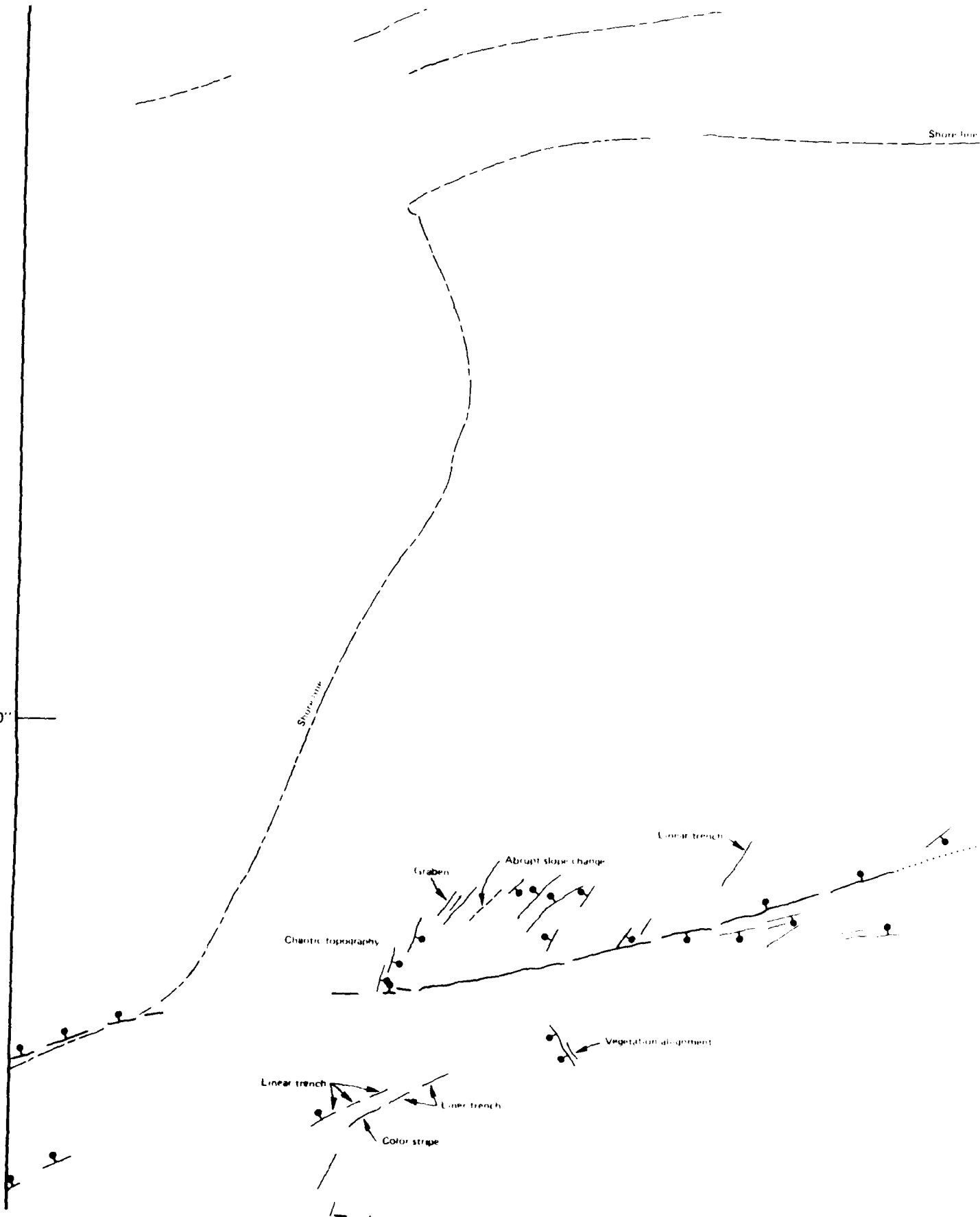
Linear trench

Vegetation alignment

Linear trench

Linear trench

Color stripe



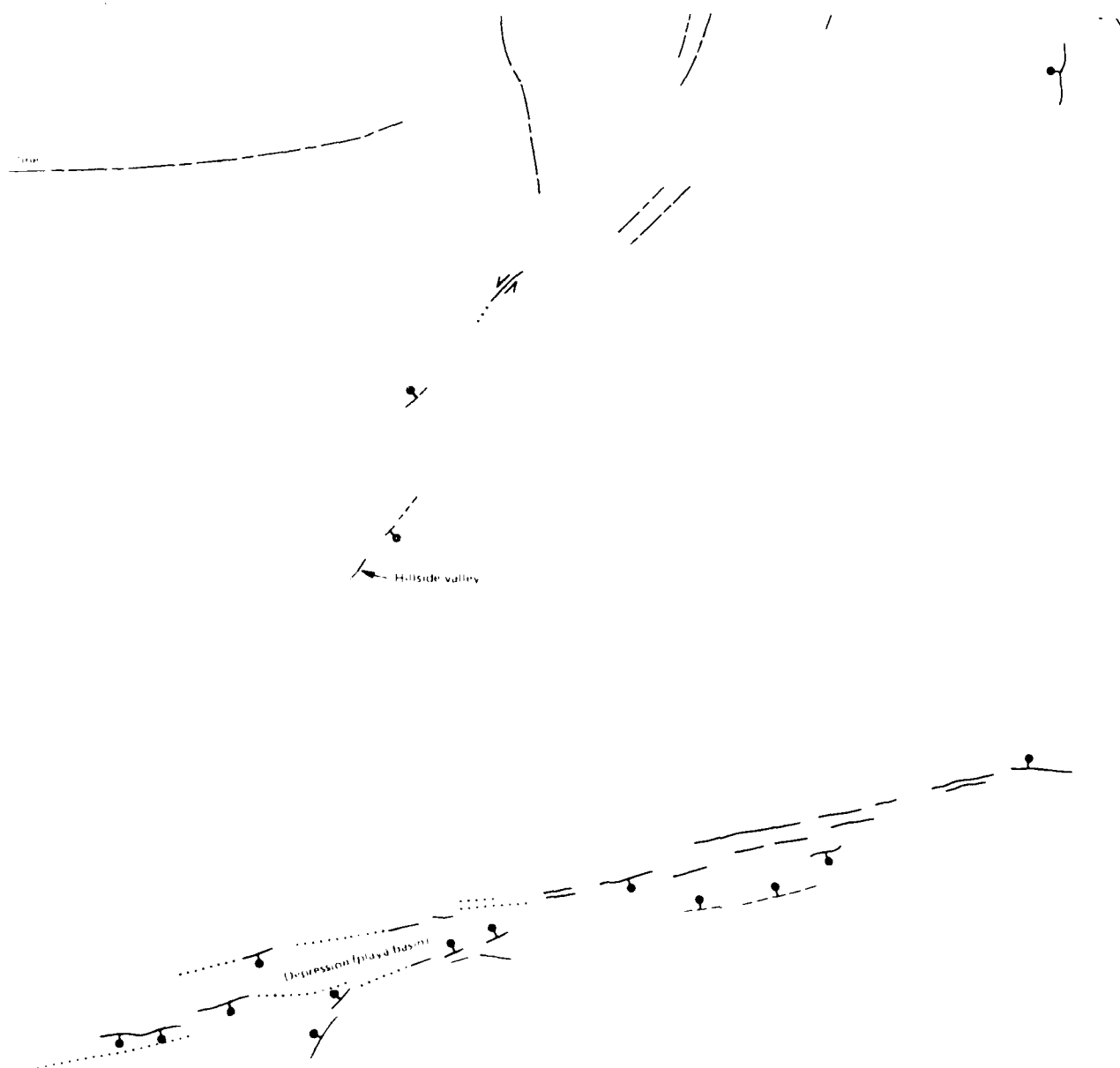
A
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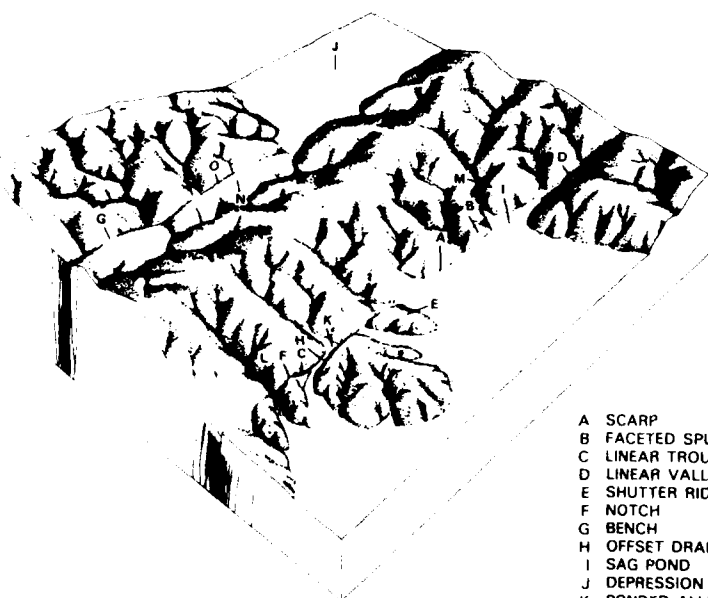
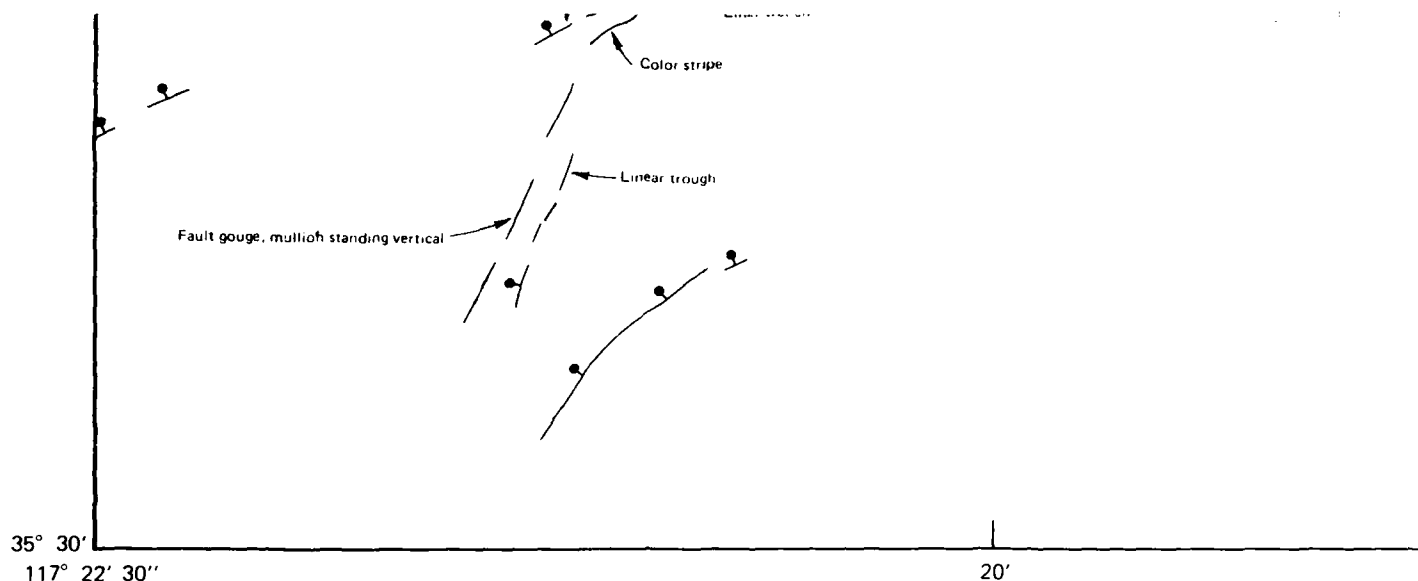
F
A
U
L
T

M
A
P

S
E
R

32' 30"



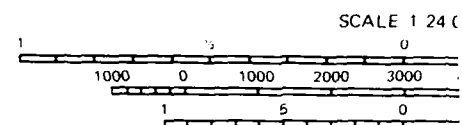


- A SCARP
- B FACETED SPUR
- C LINEAR TROUGH
- D LINEAR VALLEY
- E SHUTTER RIDGE
- F NOTCH
- G BENCH
- H OFFSET DRAINAGE CHANNEL
- I SAG POND
- J DEPRESSION (PLAYA BASIN)
- K PONDED ALLUVIUM
- L SPRING
- M OFFSET RIDGE
- N LINEAR RIDGE
- O HILLSIDE VALLEY

GENERALIZED DIAGRAM OF FAULT FEATURES

REFERENCES:

Clark, M. M., Map Showing Recently Active Breaks along the Garlock and Associated Faults, California. Miscellaneous Geologic Investigation Map I-741, scale 1:24 000, 1973, U.S. Geological Survey, Washington, D.C.

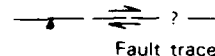


SCALE 1:24 000
CONTOUR INTERVALS,
DATUM IS MEAN SEA

TOPOGRAPHIC BASE FROM U.S.
SURVEY CHRISTMAS CANYON
7 1/2 QUADRANGLE 1973

CARTOGRAPHY BY P.

EXPLANATION



Fault trace

Solid line, field or photogeologic evidence of scarps, trenches, sag ponds, or other surface features where noted; queried line, possible interpretations not excluded; dashed line, or distinctive surficial features of faulting not present; active fault trace concealed by very recent deposits regarded as approximate; ball on down throw of relative motion.

Other recently active breaks that have not been mapped may be present.

¹ The brief notes along the fault traces indicate locations where clear fault trace features are not limited to these localities but are mapped fault lines.

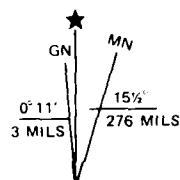
Pleistocene Lake Shore

E R I E S

35° 30'
117° 15'

BY G.R. ROQUEMORE,
P.E. SMITH, E.W. BANKS
& J.T. ZELLMER 1981

5000
1 MILE
000 6000 7000 FEET
1 KILOMETRE



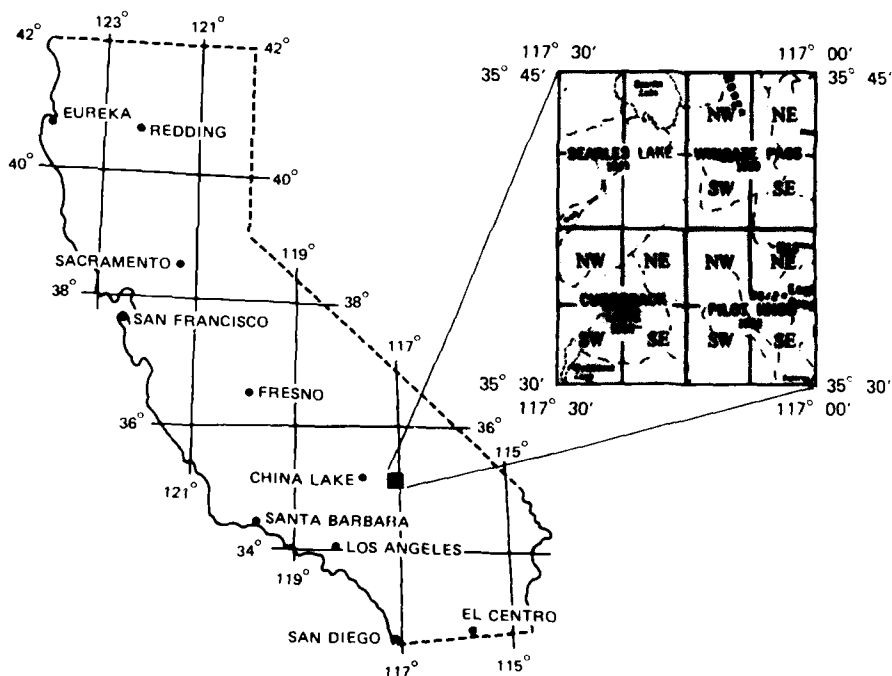
UTM GRID & 1973 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ET
EL
EOLOGIC
-IFORNIA
LOGICAL
ORNIA
ELL

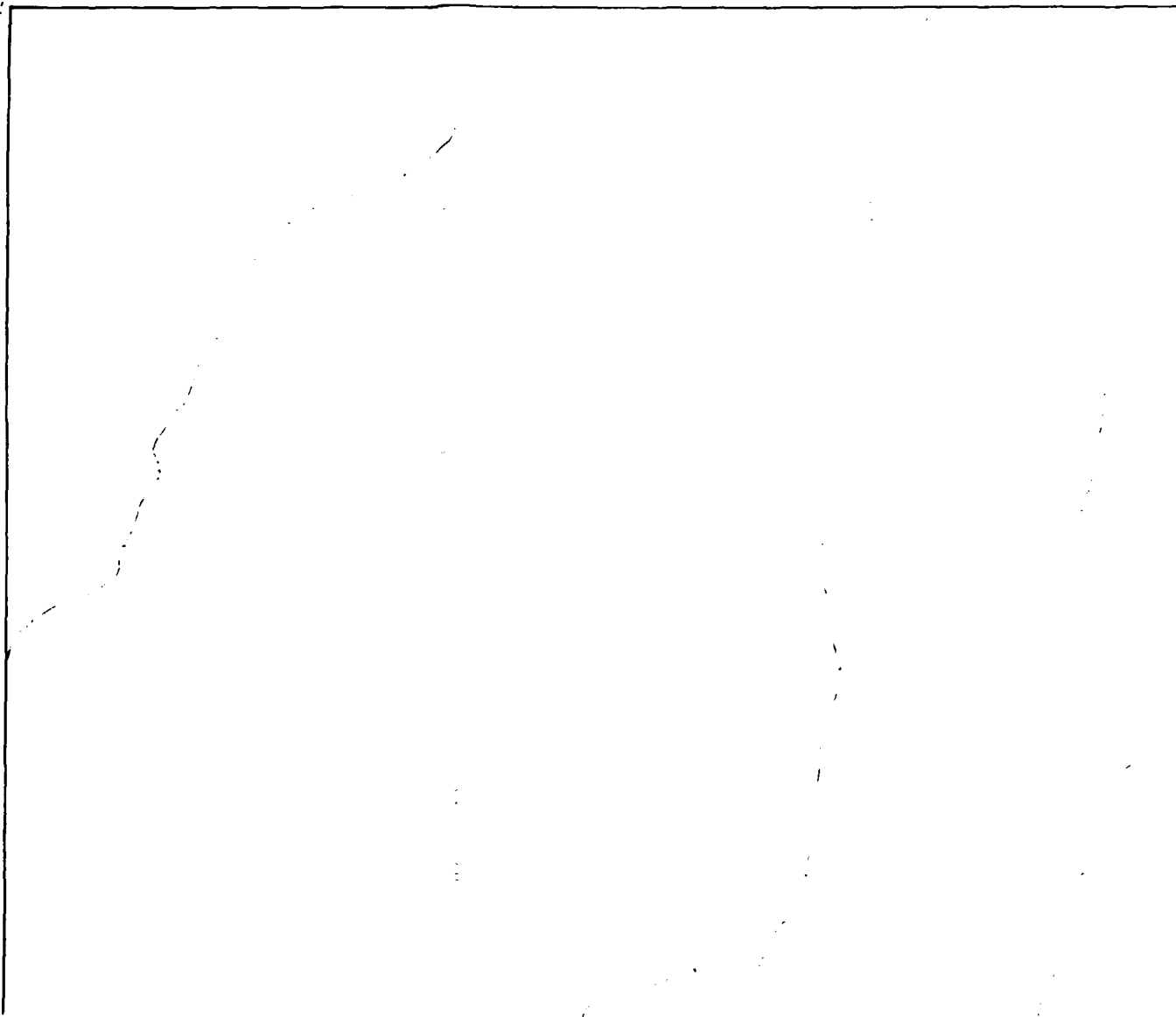
movement
ts, includ
'ault scarp
recent movement shown by
dotted line, including landslide
n (position) ult scarp, but other
arrows show recent movement, but
dotted line, potentially
(position should be
d distinct arrows show direction

ures mentioned distinctive surficial
nt to some

ures mentioned are especially
nt to some degree all along



17' 30"
35° 30'



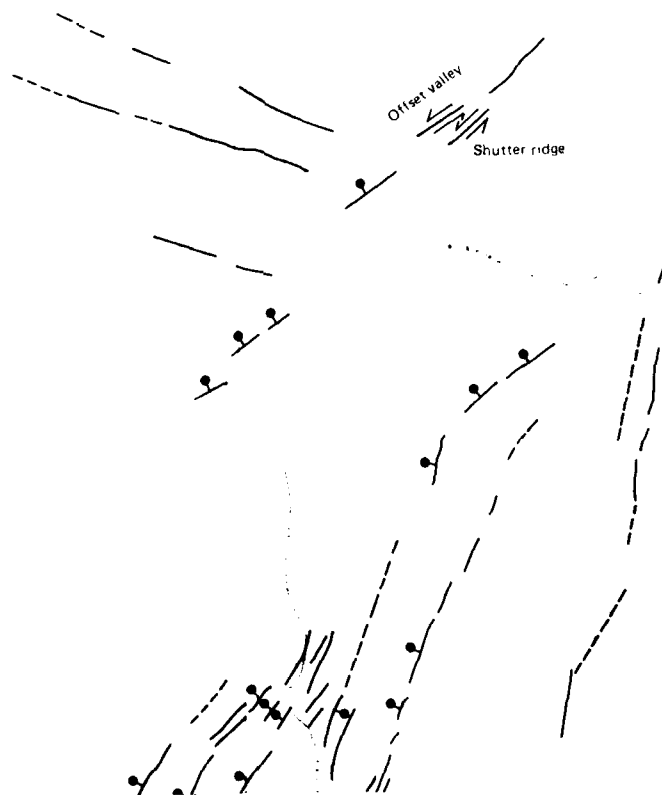
CUDDEBACK LAKE QUADRANGLE--NW
CALIFORNIA--SAN BERNARDINO CO.

25'

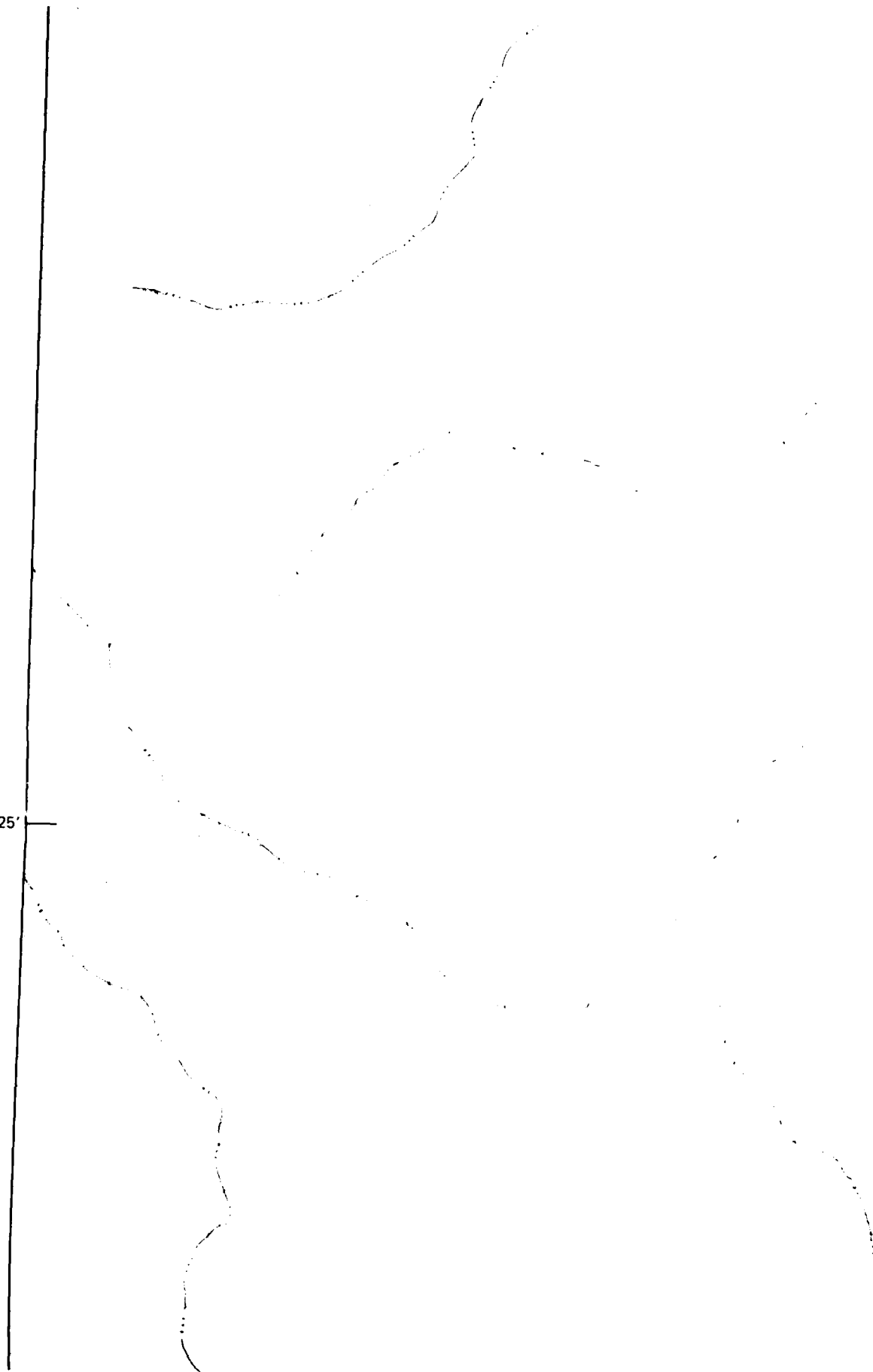
117° 22' 30"
35° 30'

N
W
C
A
C
T
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E

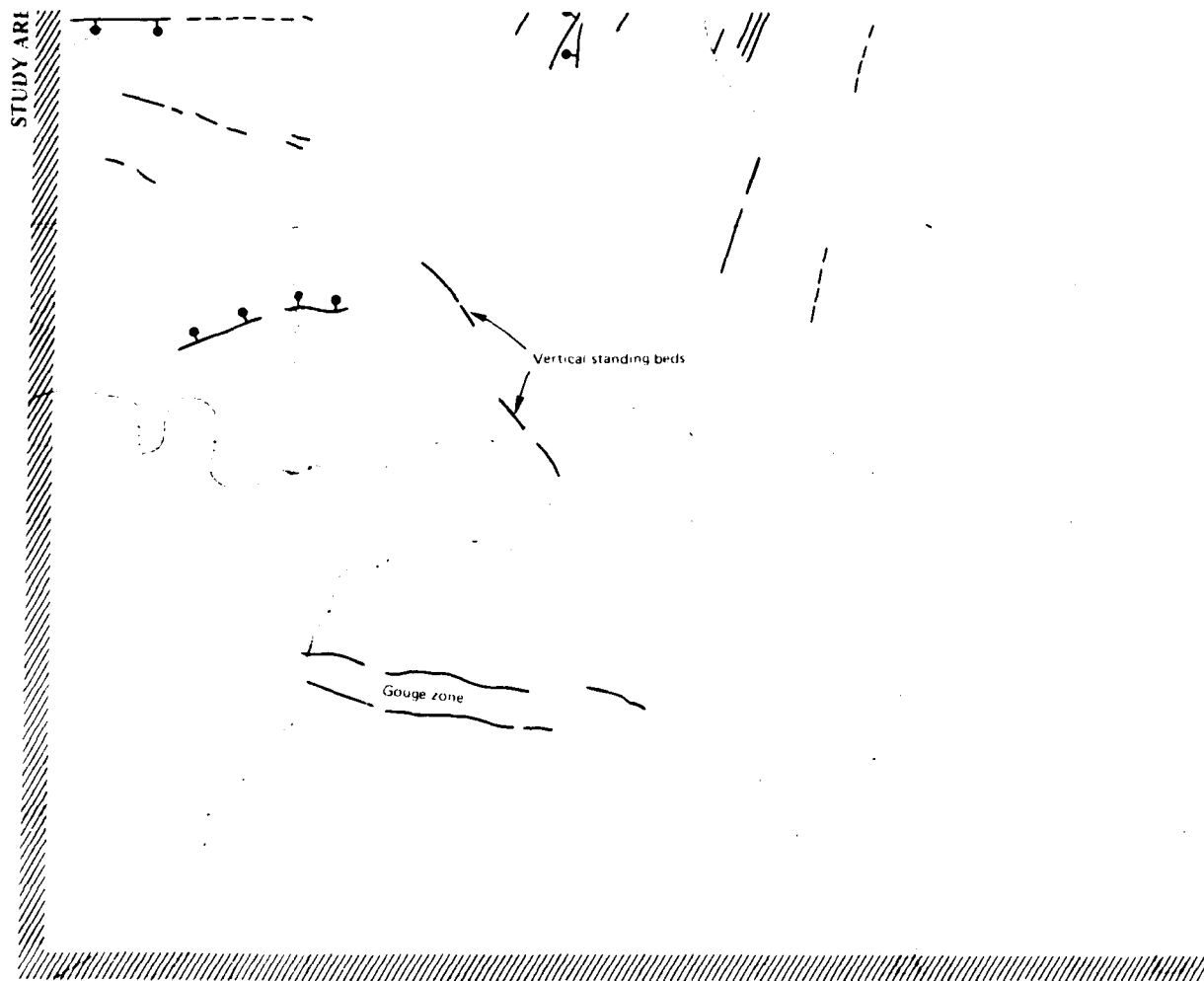
LA BOUNDARY



25'

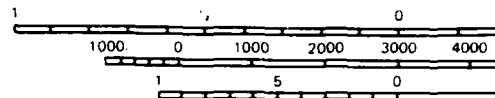


25'



35° 22' 30"
17° 30"

SCALE 1:24 000



CONTOUR INTERVALS, 40 FT
DATUM IS MEAN SEA LEV

TOPOGRAPHIC BASE FROM U.S. G
SURVEY CUDEBACK LAKE, CALI
15' QUADRANGLE 1954

CARTOGRAPHY BY P. O'DE

EXPLANATION



Fault trace

Solid line, field or photogeologic evidence of recent scarp, trenches, sag ponds, or other surface features where noted; queried line, possible recent interpretations not excluded; dashed line, probable distinctive surficial features of faulting not present; active fault trace concealed by very recent alluvium regarded as approximate; ball on down thrown side of relative motion

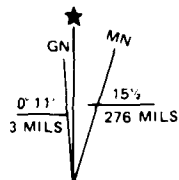
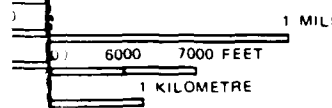
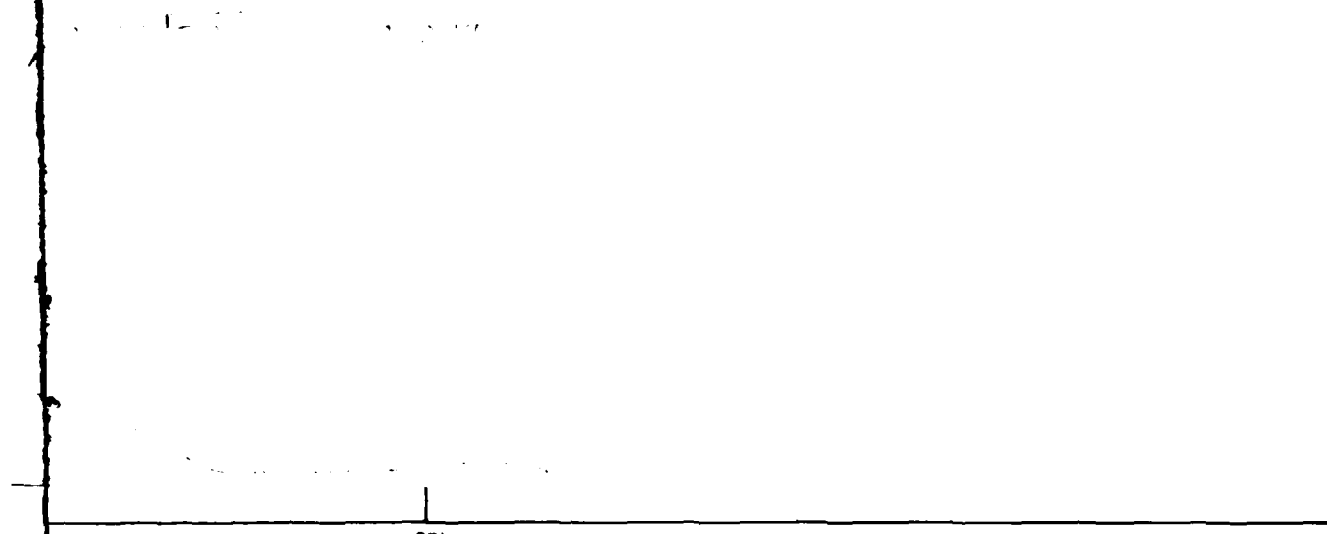
Other recently active breaks that have not produced features may be present.

¹ The brief notes along the fault traces indicate locations where the features are clear. Fault trace features are not limited to these localities but are present along the mapped fault lines.

Pleistocene Lake Shoreline

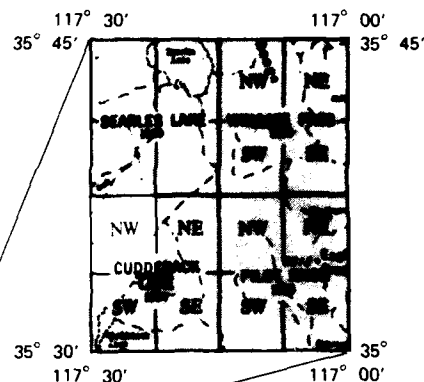
- A SCARP
- B FACETED SPUR
- C LINEAR TROUGH
- D LINEAR VALLEY
- E SHUTTER RIDGE
- F NOTCH
- G BENCH
- H OFFSET DRAINAGE CHANNEL
- I SAG POND
- J DEPRESSION (PLAYA BASIN)
- K PONDED ALLUVIUM
- L SPRING
- M OFFSET RIDGE
- N LINEAR RIDGE
- O HILLSIDE VALLEY

GENERALIZED DIAGRAM OF FAULT FEATURES



UTM GRID & 1973 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

BY G.R. ROQUEMORE,
P.E. SMITH, E.W. BANKS
& J.T. ZELLMER 1981



117° 07' 30"
36° 00'

5'

Linear valley

Linear valley

Linear valley

Faceted spur

Linear valley

Linear Valley

Linear ridge

Linear valley

Faceted spur

Linear valley

Linear valley

TOPOGRAPHIC MAP OF THE AREA

PILOT KNOB QUADRANGLE-NE
CALIFORNIA-SAN BERNARDINO CO.

117° 00'
36° 00'



N
W
C

25

STUDY AREA A BOUNDARY

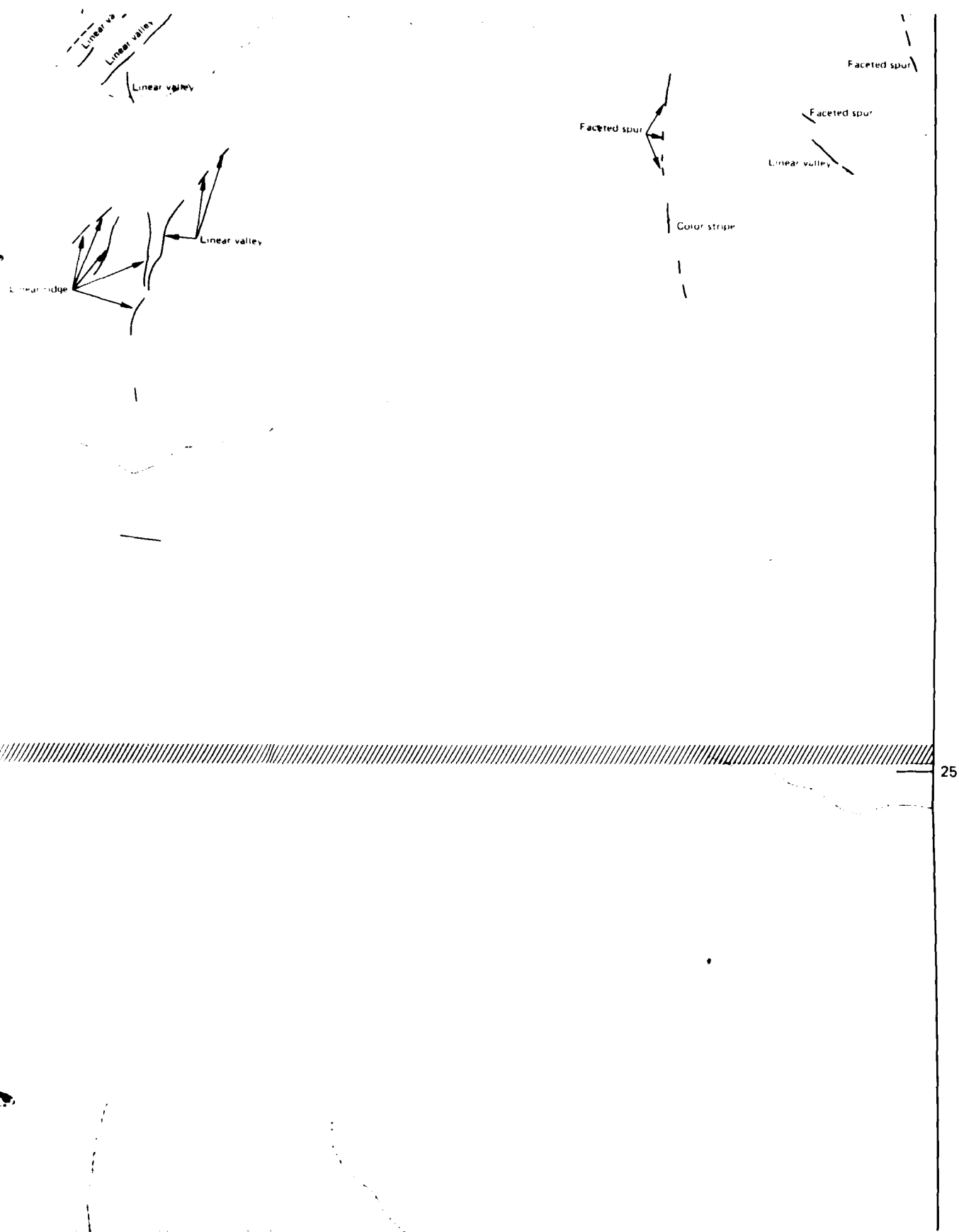


A
C
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35° 22' 30"
117° 07' 30"

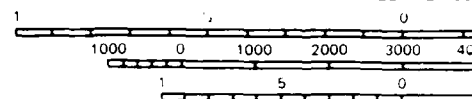
5'



GENERALIZED DIAGRAM OF FAULT FEATURES

- A SCARP
- B FACETED SPUR
- C LINEAR TROUGH
- D LINEAR VALLEY
- E SHUTTER RIDGE
- F NOTCH
- G BENCH
- H OFFSET DRAINAGE CHANNEL
- I SAG POND
- J DEPRESSION (PLAYA BASIN)
- K PONDED ALLUVIUM
- L SPRING
- M OFFSET RIDGE
- N LINEAR RIDGE
- O HILLSIDE VALLEY

SCALE 1:24,000



CONTOUR INTERVALS, 40'
DATUM IS MEAN SEA LEVEL

TOPOGRAPHIC BASE FROM U.S.
SURVEY PILOT KNOB, CALIFORNIA
15' QUADRANGLE 1954

CARTOGRAPHY BY P. O. L.

EXPLANATION



Fault trace

Solid line, field or photogeologic evidence of fault scarps, trenches, sag ponds, or other surface features where noted; queried line, possible interpretations not excluded; dashed line, probable distinctive surficial features of faulting not present; active fault trace concealed by very recent alluvium regarded as approximate; ball on down throw side of relative motion.

Other recently active breaks that have not produced features may be present.

The fault traces along the fault trace are not necessarily the same as the fault trace features, which are not necessarily the same as the fault trace features.

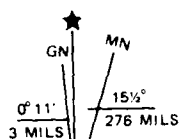
Pleistocene Lake Shore

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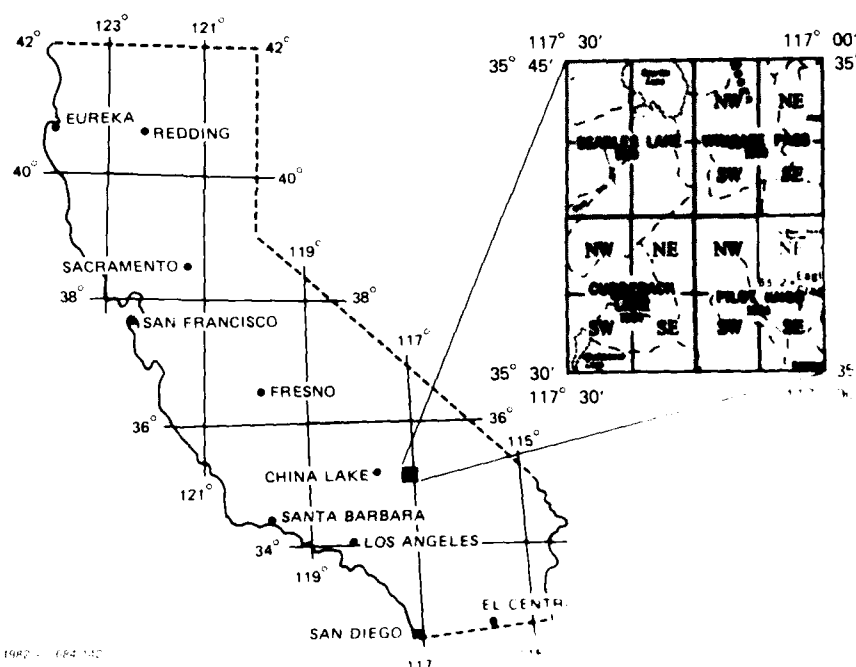
35° 22' 30"
117° 00'

BY G.R. ROQUEMORE,
P.E. SMITH, E.W. BANKS
& J.T. ZELLMER 1981

1 MILE
0 3000 6000 7000 FEET
1 KILOMETRE



UTM GRID & 1973 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



U.S. GOVERNMENT PRINTING OFFICE: 1982 - 684 100

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NAVAL WEAPONS CENTER ACTIVE FAULT MAP SERIES(U) NAVAL
WEAPONS CENTER CHINA LAKE CA G R ROQUEMORE ET AL.
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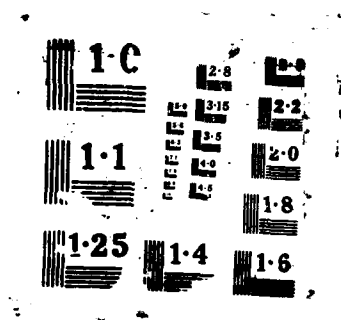
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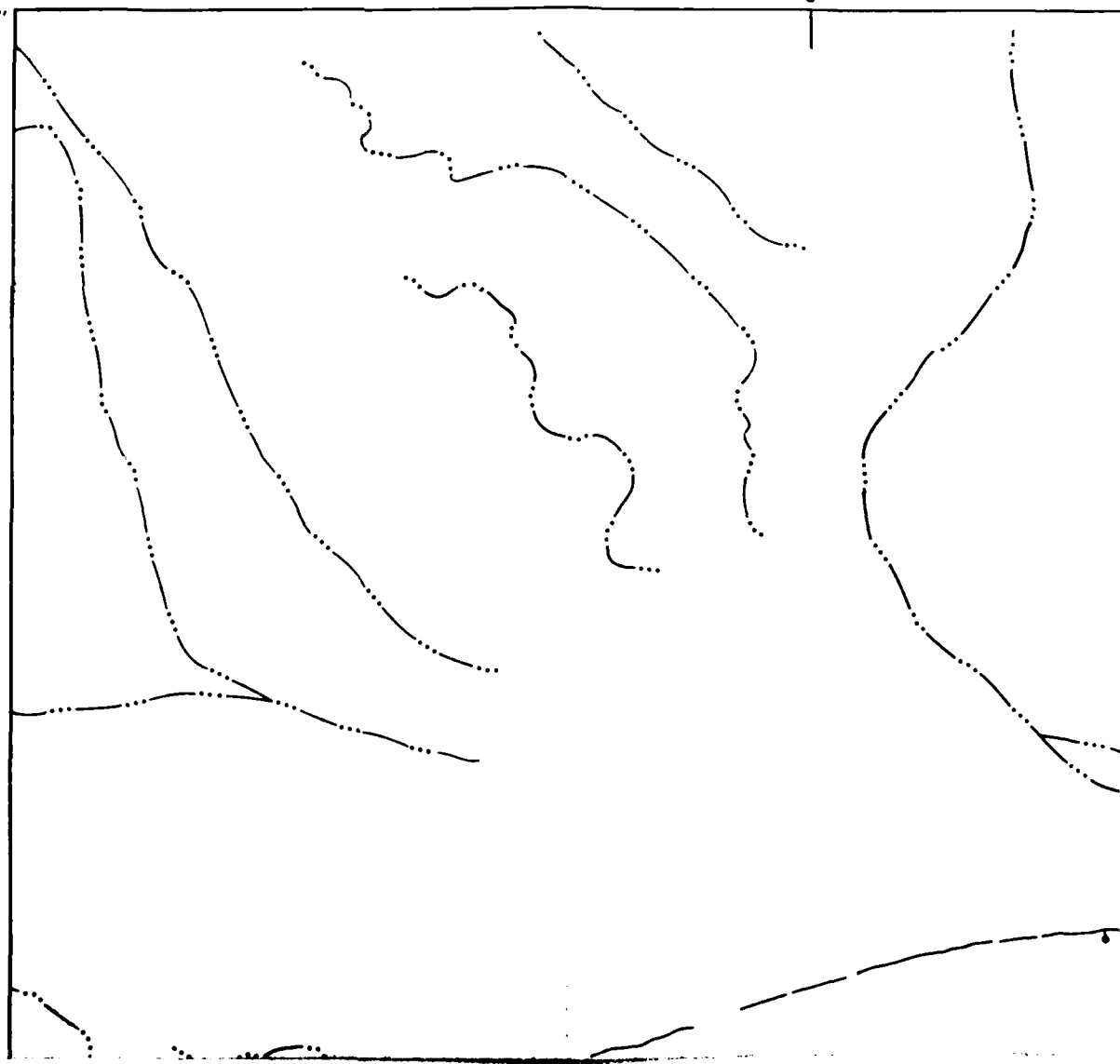


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117° 07' 30"
35° 37' 30"

5'



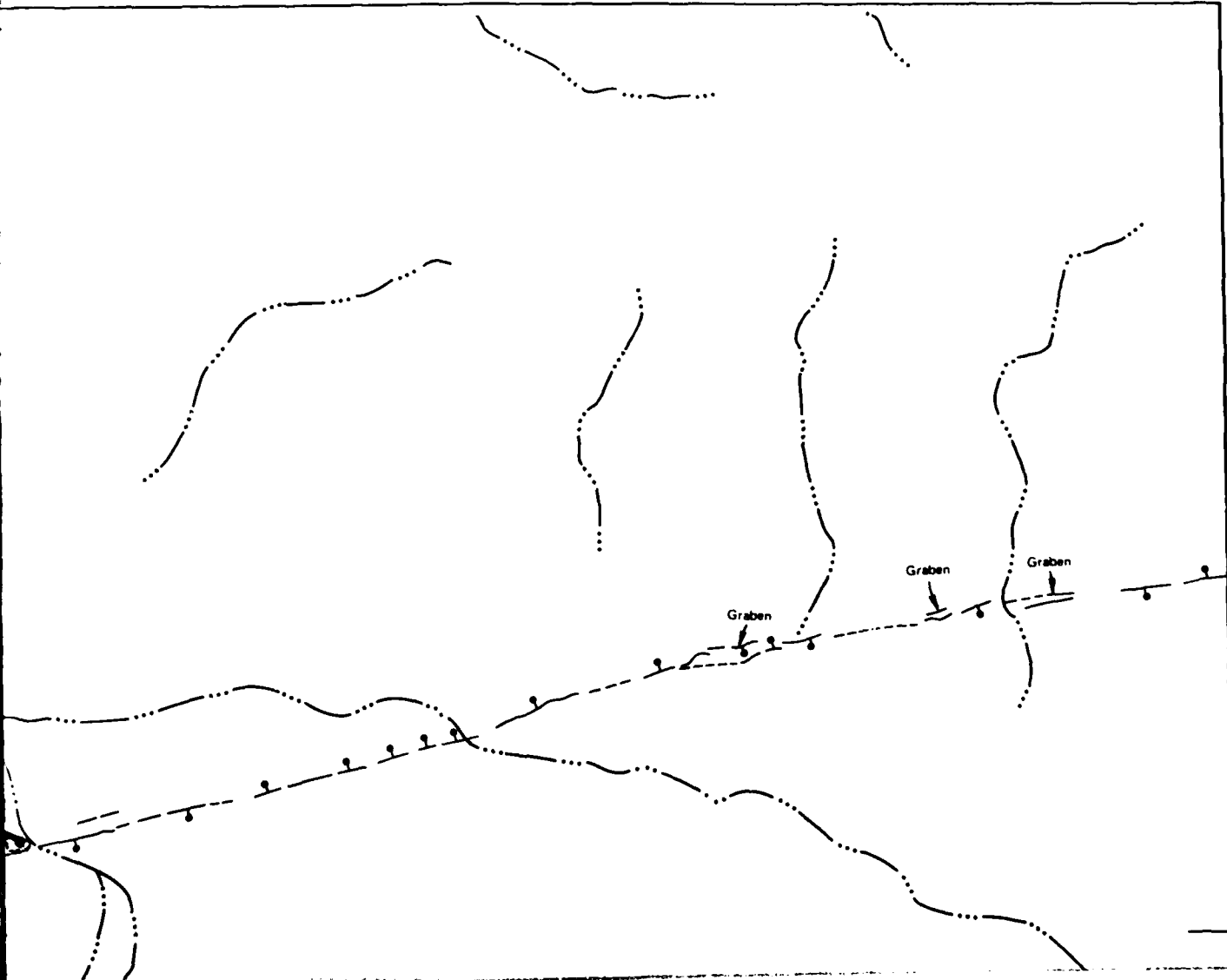
WINDGATE QUADRANGLE-SE
CALIFORNIA-SAN BERNARDINO CO.

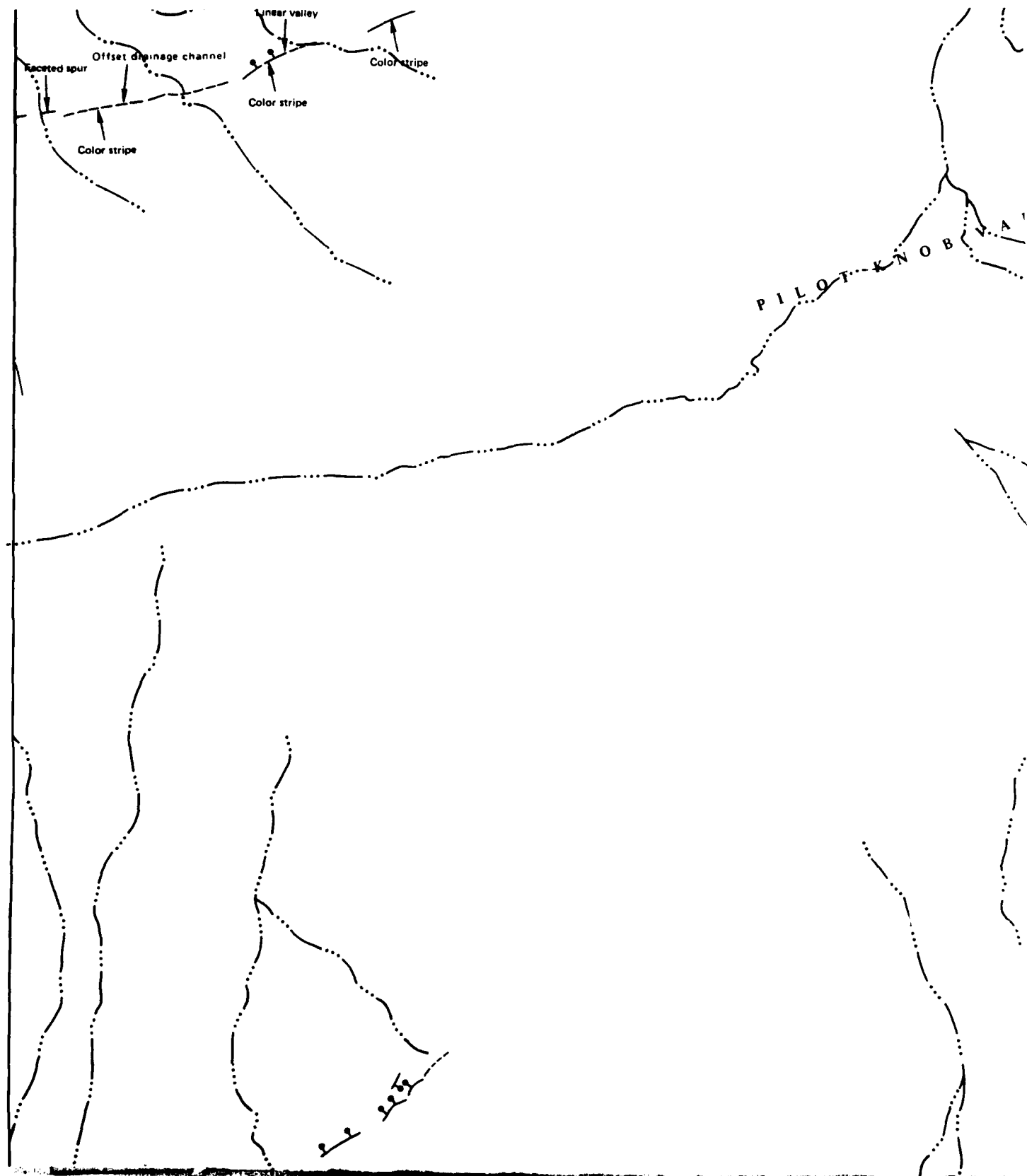
117° 00'
35° 37' 30"

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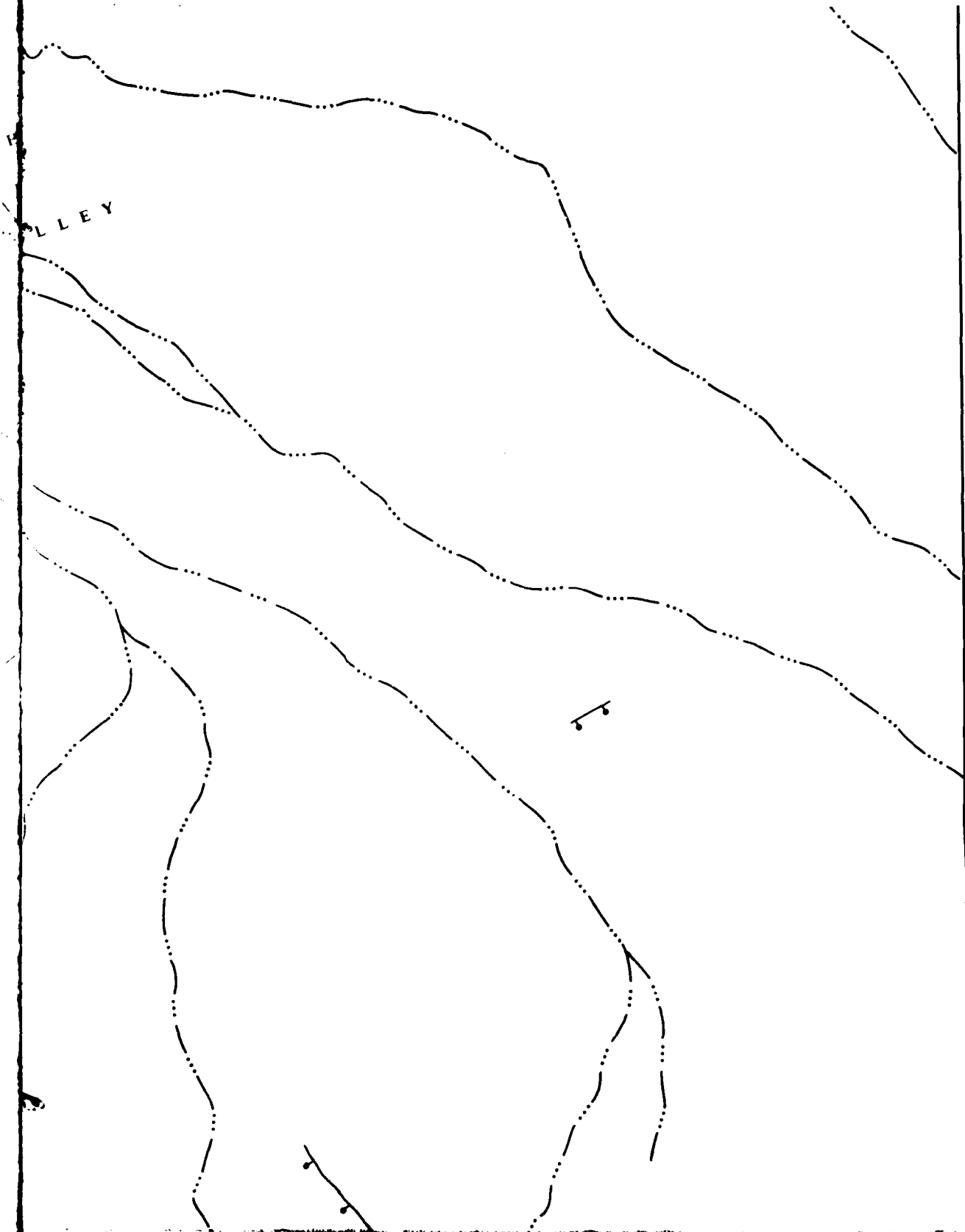


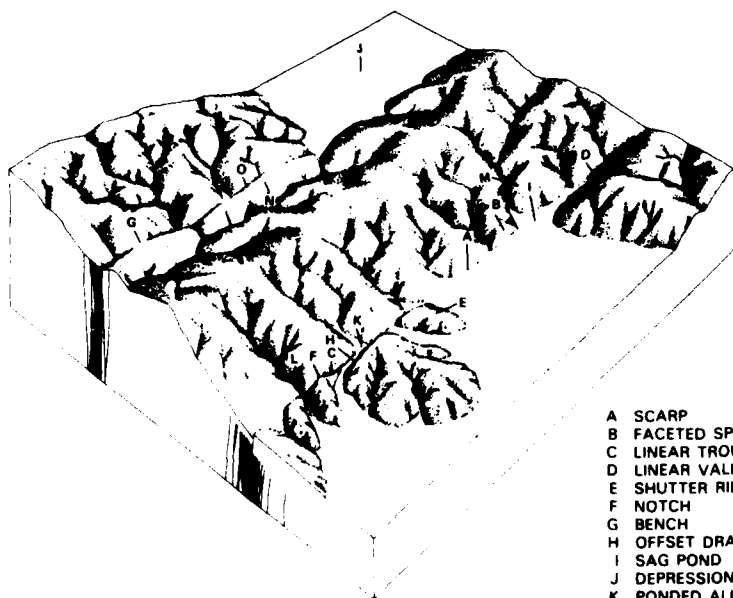
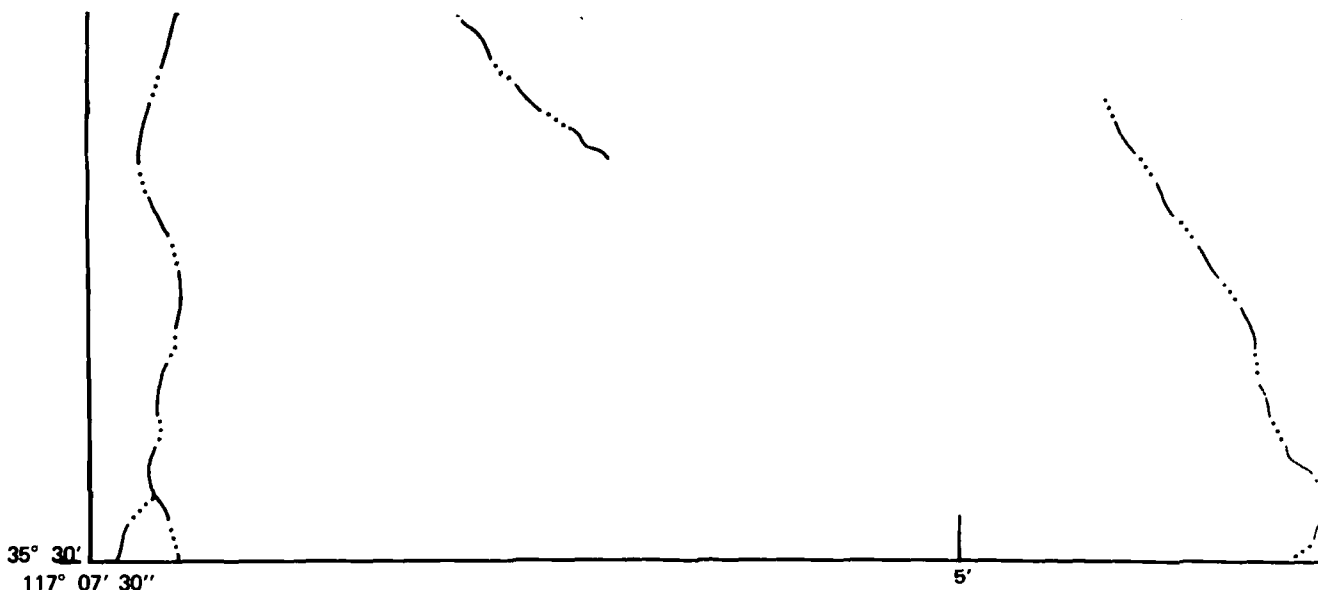
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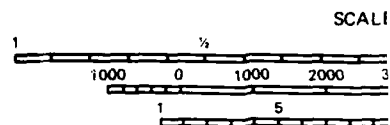


GENERALIZED DIAGRAM OF FAULT FEATURES

- A SCARP
- B FACETED SPUR
- C LINEAR TROUGH
- D LINEAR VALLEY
- E SHUTTER RIDGE
- F NOTCH
- G BENCH
- H OFFSET DRAINAGE CHANNEL
- I SAG POND
- J DEPRESSION (PLAYA BASIN)
- K PONDED ALLUVIUM
- L SPRING
- M OFFSET RIDGE
- N LINEAR RIDGE
- O HILLSIDE VALLEY

REFERENCES:

Clark, M. M., Map Showing Recently Active Breaks along the Garlock and Associated Faults, California. Miscellaneous Geologic Investigation Map I-741, scale 1:24 000, 1973, U.S. Geological Survey, Washington, D. C.

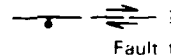


CONTOUR IN'
DATUM IS N

TOPOGRAPHIC BASE
SURVEY WINDGATE
15' QUADRANGLE 195

CARTOGRAPHY

EXPLAN.



Solid line, field or photogeologic evidence of scarp, trench, sag ponds, or other features where noted; queried line position where not noted; dashed line where distinctive surficial features of faulting are not noted; active fault trace concealed by very recent alluvium, regarded as approximate; ball on down of relative motion.

Other recently active breaks that have features may be present.

¹ The brief notes along the fault traces indicate local features. Fault trace features are not limited to those on the mapped fault lines.

Pleistocene Lak

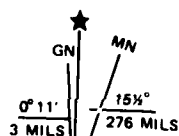
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35° 30'

117° 00'

BY G.R. ROQUEMORE,
P.E. SMITH, E.W. BANKS
& J.T. ZELLMER 1981

1 MILE
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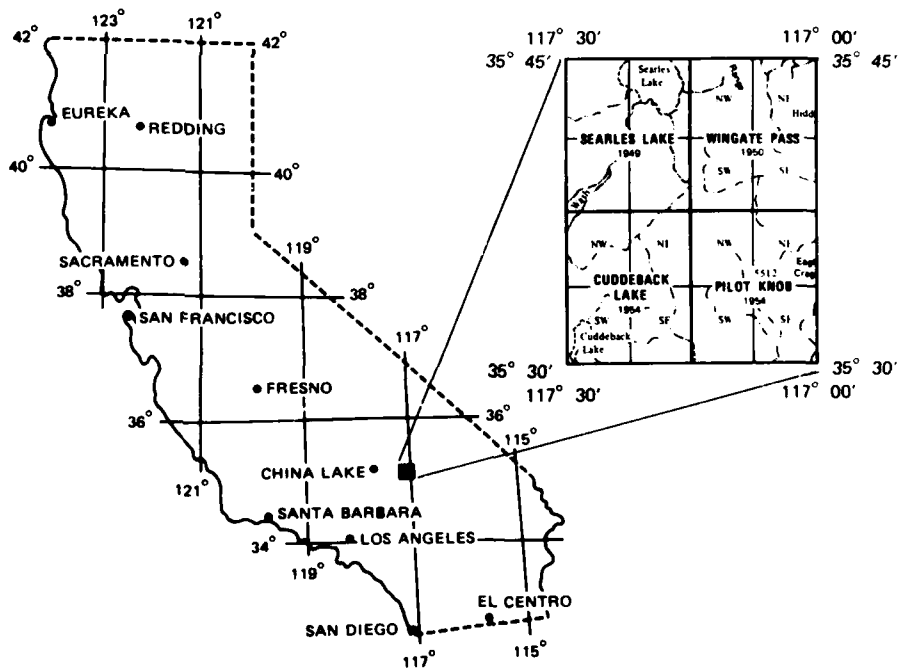
UTM GRID & 1973 MAGNETIC NORTH
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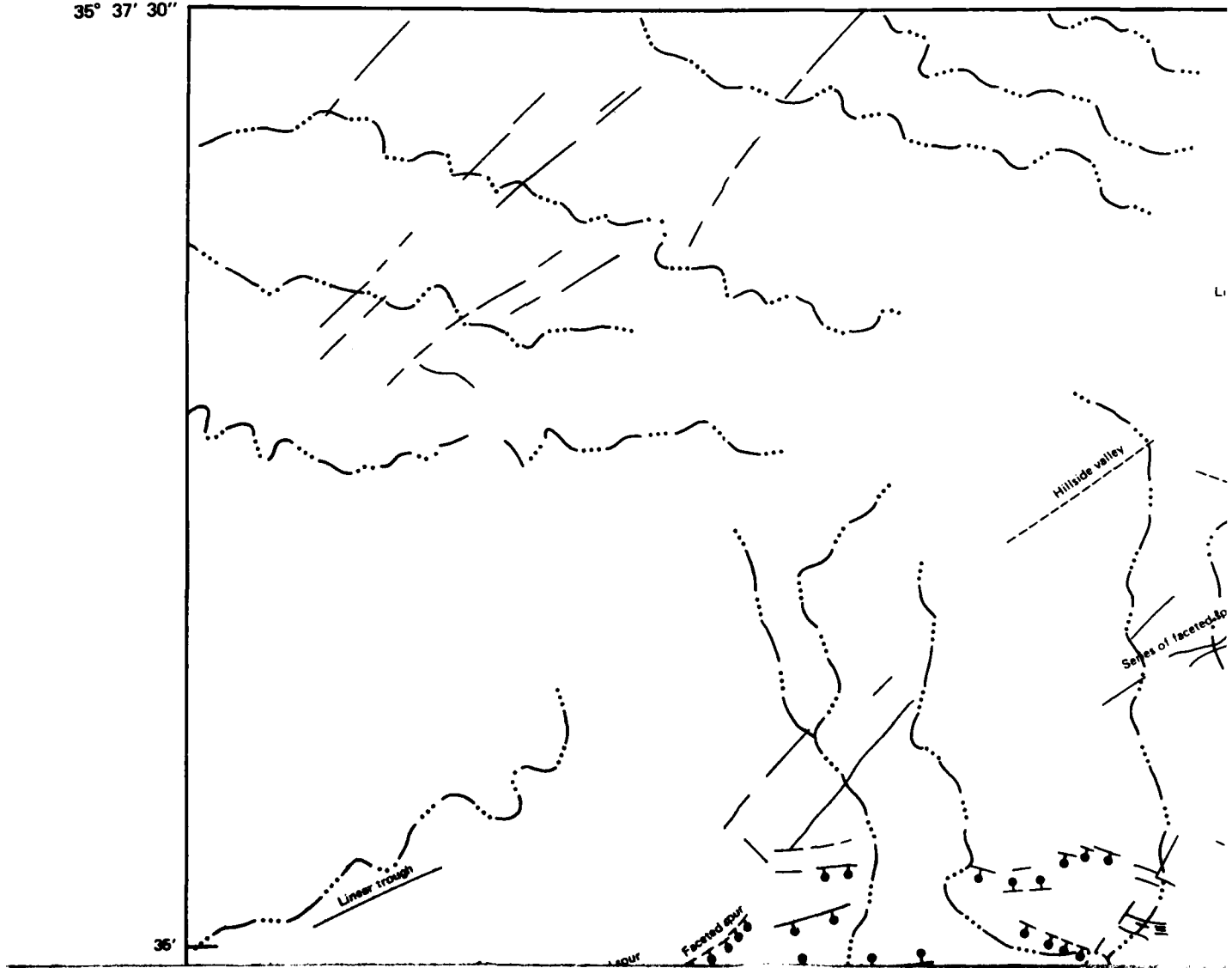
ovement shown by
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position should be
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distinctive surficial

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117° 15'
35° 37' 30"



WINDGATE QUADRANGLE-SW
CALIFORNIA-SAN BERNARDINO CO.

117° 07' 30"
35° 37' 30"

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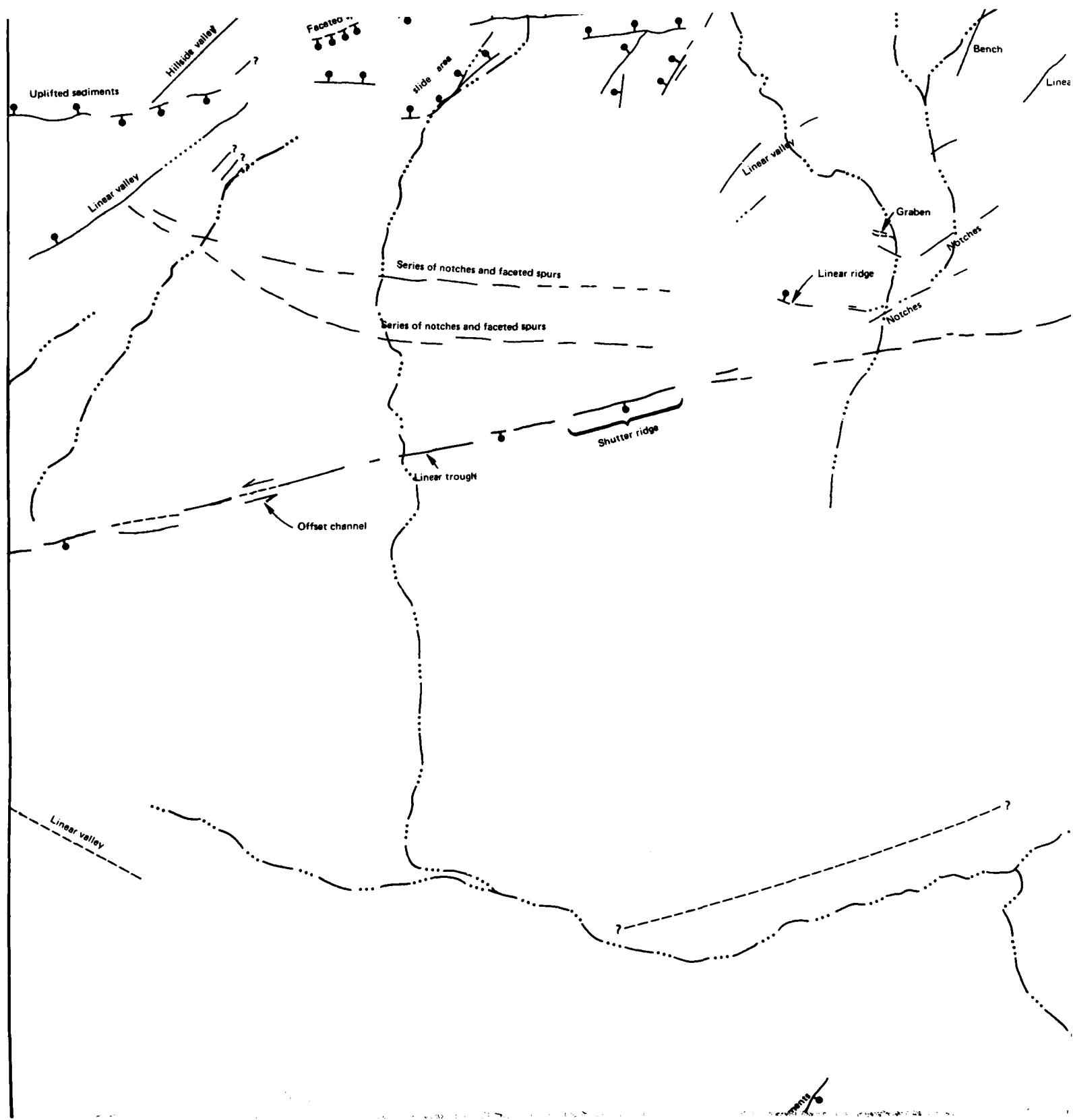
Linear trough

Graben

Linear valley

Graben

35'



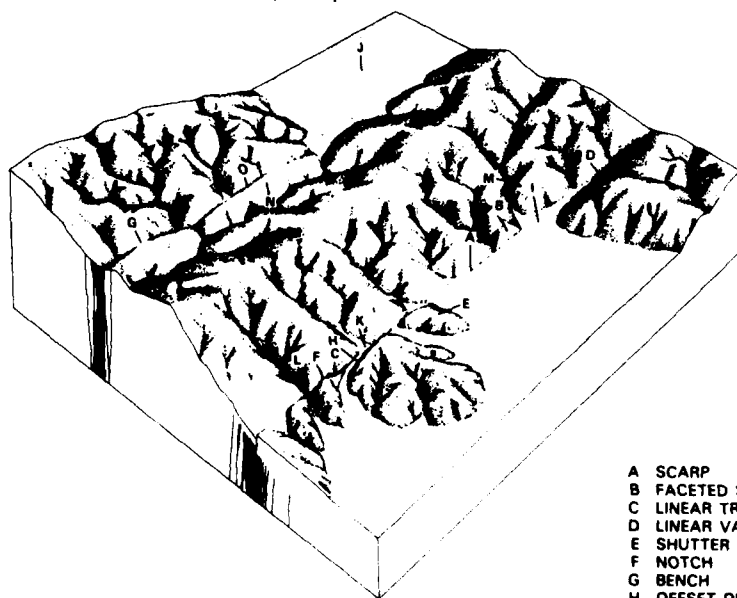
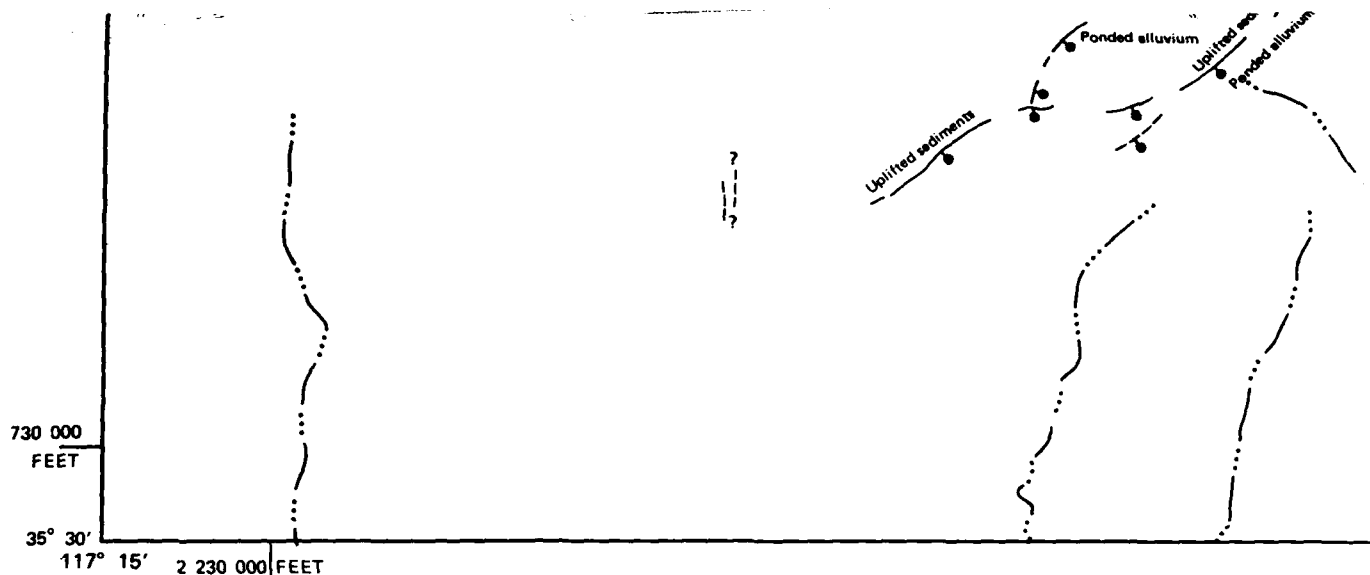
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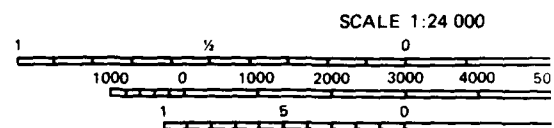


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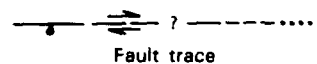


CONTOUR INTERVALS, 40 FEET
DATUM IS MEAN SEA LEVEL

TOPOGRAPHIC BASE FROM U.S. GEOL.
SURVEY WINDGATE PASS, CALIFORNIA
15' QUADRANGLE 1950

CARTOGRAPHY BY P. O'DELL

EXPLANATION

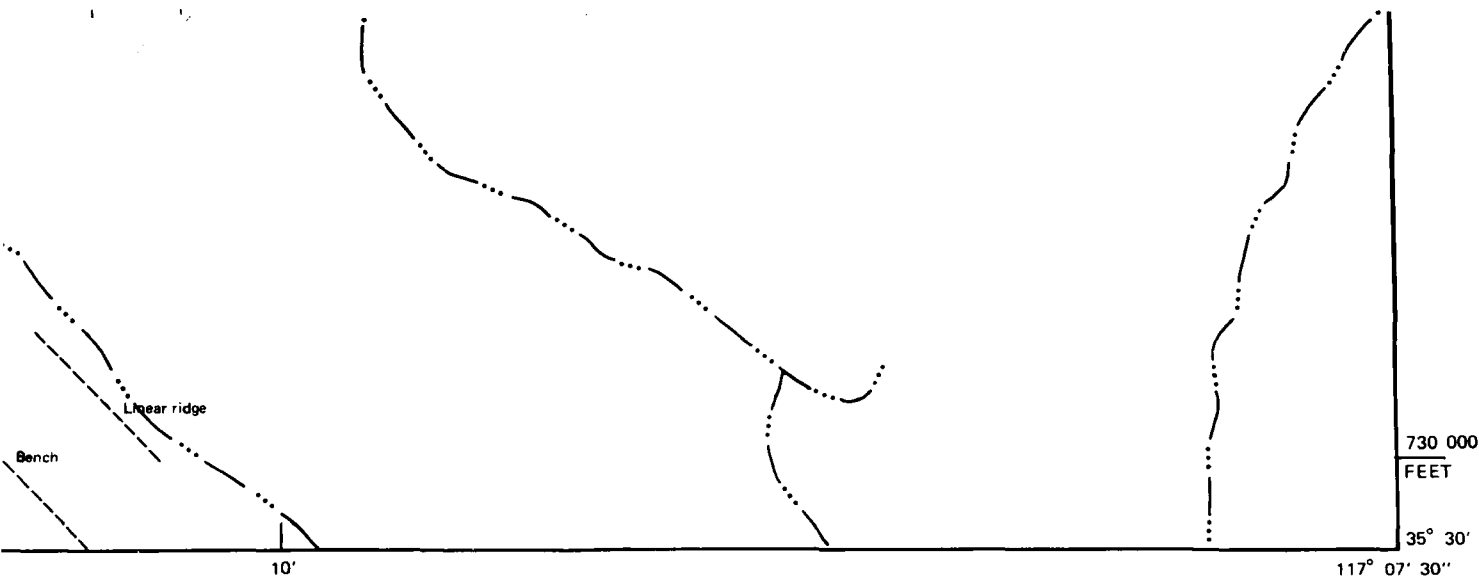


Solid line, field or photogeologic evidence of recent movement; dashed line, possible recent fault interpretations not excluded; dotted line, probable recent fault interpretations not present; dashed line with ball, active fault trace concealed by very recent alluvium (regarded as approximate); ball on down thrown side; arrow of relative motion.

Other recently active breaks that have not produced clear features may be present.

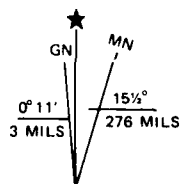
¹The brief notes along the fault traces indicate locations where the features are clear. Fault trace features are not limited to these localities but are present on the mapped fault lines.

Pleistocene Lake Shoreline

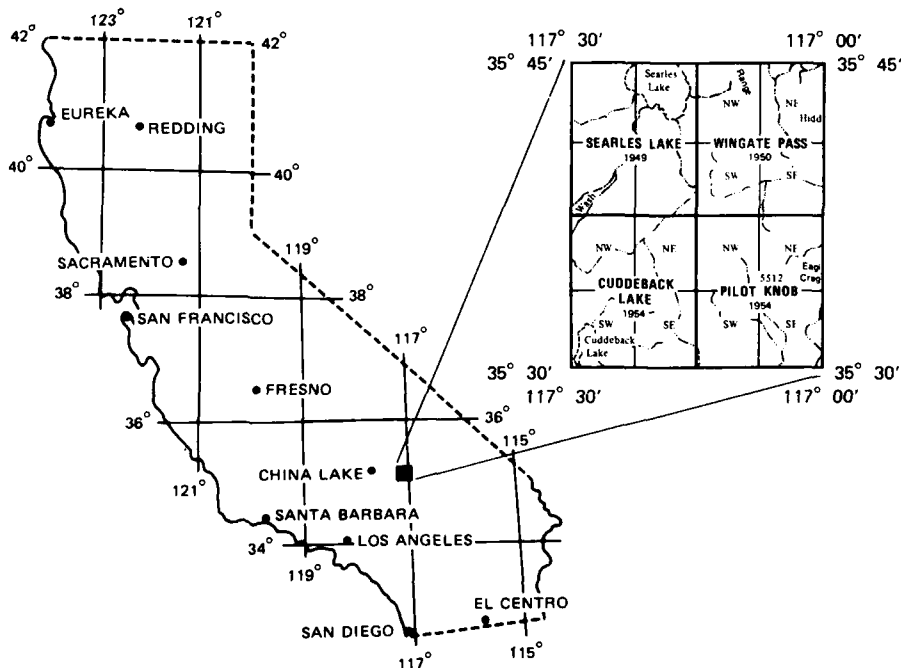


BY G.R. ROQUEMORE,
P.E. SMITH, E.W. BANKS
& J.T. ZELLMER 1981

1 MILE
8000 7000 FEET
1 KILOMETRE



UTM GRID & 1973 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



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