DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

# CATALOG OF CREEPMETER MEASUREMENTS IN CALIFORNIA FROM 1966 THROUGH 1988

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# INTRODUCTION

As part of its earthquake prediction research program, the U.S. Geological Survey (USGS) has been monitoring aseismic fault creep along earthquake faults in California for more than 20 years. Studies of the data have shown correlations between fault creep and earthquakes, displacements measured by tiltmeters, strainmeters, and other geophysical instruments, and drops in water level in wells (*Bufe and Nason*, 1973; *Burford*, 1972; *Burford*, 1976; *Burford*, 1988; *Burford and others*, 1973; *Goulty and Gilman*, 1978; *Johnston*, 1980; *King and others*, 1977; *King and others*, 1987; *Lisowski and Prescott*, 1981; *Mavko*, 1982; *Mavko and others*, 1985; *McHugh and Johnston*, 1976; *Mortensen and others*, 1977; *Nason*, 1973; *Poley and others*, 1987; *Raleigh and others*, 1979; *Roeloffs and others*, 1989; *Scholz and others*, 1969; *Schulz and others*, 1982; *Schulz and others*, in press; *Simpson and others*, 1986; *Simpson and others*, 1987; *Simpson and others*, 1988; *Wesson and others*, 1973).

In recent years studies of an unusual 22–year average recurrence interval between moderate earthquakes since 1857 at Parkfield, California have resulted in the evolution of a Parkfield prediction experiment conducted jointly by the USGS and the State of California and the release in 1985 of a USGS forecast that a magnitude 5.0+ earthquake is expected to occur in the area before 1993 (*Bakun and Lindh*, 1985). Because of observations interpreted as accelerated fault creep on the San Andreas fault near Parkfield before the magnitude 5.5 earthquake in 1966 (*Wallace and Roth*, 1967), fault creep measurements are an integral part of this experiment (*Bakun and others*, 1987).

Fault creep is monitored by a variety of techniques utilizing several different instruments. Trilateration networks consisting of survey lines up to 41 km long across the fault are measured with geodolites for regional studies of deformation (*King and others* 1987; *Prescott and others*, 1981; *Savage and Prescott*, 1973). Two–color laser geodimeters are used to measure lines 1–9 km long for a closer–in look at fault motion and premonitory strain (*Huggett and others*, 1977; *Slater and Burford*, 1979; *Langbein*, 1981), as are short-aperture geodolite measurements (*Lisowski and Prescott*, 1981). Near–fault horizontal deformation is monitored by theodolite measurements of multiple-monument survey lines called alinement arrays that span 100-200 m of the fault zone (*Burford and Harsh*, 1980; *Wilmesher and Baker*, 1987).

Creepmeters are used to obtain precise measurements of movement across 5 to 18 meters of the fault zone. Creepmeters, because of the small aperture, yield a minimum value for creep across the fault zone as comparisons with data from the larger aperture alinement array and geodolite surveys have shown (*Burford and Harsh*, 1980; *Lisowski and Prescott*, 1981; *Wilmesher and Baker*, 1987). These comparisons also show that occasionally a creepmeter has been placed across only one of two or more active traces at a site (*Burford and Harsh*, 1980; *Wilmesher and Baker*, 1987). However, unlike surveying methods, creepmeters provide continuous data that can be monitored via telemetry for instantaneous knowledge of direct fault movement.

## CREEPMETER INSTRUMENTATION, DATA COLLECTION, AND USGS STATION LOCATIONS

The USGS creepmeter is a thermally–stable length standard (rod or wire) 10 to 36 meters long, stretched across an active fault trace at a typical angle $22° \leq \theta \leq 45°$ from the fault strike (Figure 1). The rod or wire is anchored on a pier at one end and tensioned through the instrument on a pier at the other end. When one side of the fault moves horizontally past the other, the creepmeter piers will either move closer together or farther apart, depending on the instrument orientation and the sense of lateral slip. As the piers move, the rod or wire will move an amount $\Delta\ell$ through electronic and mechanical measuring devices at the instrument end. The actual fault slip is calculated by dividing the amount of wire movement by $\cos\theta$. Resolution of the creepmeter electronic signal ranges from 0.02 to 0.50 mm, depending on instrument design, and full range for the majority of creepmeters is 25 mm before a reset is necessary.

In addition to maintaining its own network of instruments during 20 years of fault monitoring, the USGS has become responsible for instruments originally installed by the National Oceanic and Atmospheric Administration Earthquake Mechanism Laboratory and by the California Institute of Technology. Consequently, the creepmeter described above and shown in Figure 1 appears in various modifications in the field, depending on original instrument design, but the basic principle remains the same. Currently, 37 extension creepmeters and one contraction meter are being monitored in central and northern California.

In an attempt to measure the coseismic and postseismic slip after a moderate earthquake, a special strong motion creepmeter was developed and installed in 1986–87 in 7 of the regular creepmeter vaults at Parkfield, site of the current USGS prediction experiment. The USGS length standard for this 35–cm–range instrument is a stainless steel cable originally developed for water level monitoring. The cable is secured to the vault wall at the anchor end, and looped over a pulley and tensioned with a weight at the instrument end. Like its anchor, the instrument is secured to the vault wall, to avoid any interference with the regular 25–mm–range creepmeter instrument and anchor, which are mounted on piers in the vaults and decoupled from vault movement by special rubber fittings. Field measurements for the strong–motion creepmeters are provided by a dial counter graduated in millimeters, and an on–site record is produced by the signal from a potentiometer connected to the pulley.

A more complete description of the various USGS creepmeters appears in *Schulz and others*, 1982.

Real–time data from 29 of the 38 creepmeters are transmitted every 10 minutes via satellite telemetry to a computer at USGS Menlo Park headquarters. At the end of each month, telemetry data are hand–edited, compared with micrometer readings made in the field, and appended to the files of creep data. When telemetry from a station fails, or if a station is not on telemetry, daily data points are plotted by hand from the on–site recorder chart and appended to the files.

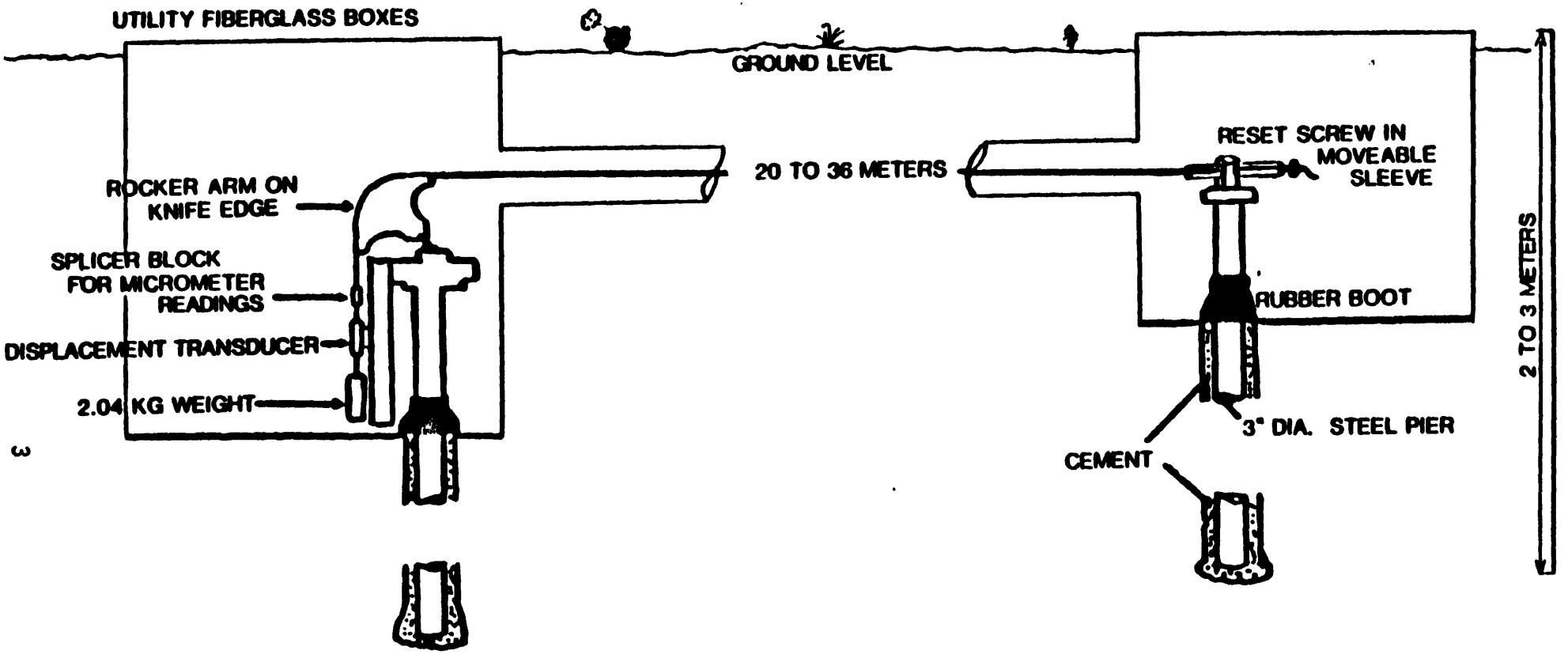


**Figure 1.**

**Typical wire creepmeter installation. The USGS uses several different types of creepmeters (see text), but the basic design–a rod or wire under tension–is the same for all except the Cienega Winery instruments (CWN1, CWC3). There the unique placement of the winery building on two cement slabs with their junction parallel to and directly over the creeping fault trace allows instrumentation to be bolted directly to the floor and walls.**

USGS creepmeters operating as of December 31, 1988 are shown in regular print on Figures 2, 3, and 4 and are listed in Table 1. Stations that ceased operating before December 31, 1988, are shown in italics in Figures 2, 3, and 4 are described in Table 2. Data from these discontinued sites do not appear here, but can be found in catalogs referenced in Table 2.

## DATA PRESENTATION

This catalog presents data from USGS creepmeters for the years 1966 through 1988. Creepmeter location information and data are ordered herein geographically from north to south along each of three faults—the San Andreas, Hayward, and Calaveras. Each creepmeter has a separate section that includes a station description, latitude, longitude, type and length of instrument, the station's distance from a given geographical point, a portion of the appropriate 7½' series topographic map with the station location marked on it, and a brief description of the geology and local creep rate. There is also a spread sheet for each station, showing cumulative slip values calculated from field readings of the micrometer or dial on each instrument, and a page-size long-term plot of the station's cumulative values for the period 1966 through 1988. Instrument installation dates are indicated on the spread sheets and plots by 0.0 values for creep.

Several station descriptions refer to contraction meters installed along with extension meters in configurations to provide a double check on fault slip. Rod contraction instruments proved at an early date to have mechanical disadvantages that rendered their data questionable, and many of the meters soon became disabled. Contraction data do not appear here, but are included in tables in earlier catalogs (*Nason and others*, 1974; *Schulz and others*, 1976; *Schulz and Burford*, 1979). Also not presented here are data from the experimental strong-motion creepmeters installed in 1987–88 in seven Parkfield creepmeter vaults. The primary purpose of these meters is to provide information on fault movement during and after the next Parkfield earthquake. Thus, the data are not routinely digitized, but each station's cumulative movement is calculated from quarterly field readings and stored in the computer.

Weekly micrometer and dial readings made in the field were used to calculate cumulative values in the early years of creepmeter monitoring before electronic recording systems were in place. Since the advent of on-site chart recorders, and more recently telemetry, field readings have been made only during routine quarterly maintenance visits. Nevertheless, the fundamental form of each data trace comes from these field readings, joined together when possible with daily data points from electronic records. Thus, separate dots on the plots represent individual field readings, and a continuous data trace represents a period when electronic records were available and of sufficient quality to be used together with the readings. In 1977, budget cuts forced removal of electronics from several sites; however, quarterly field readings do exist into the 1980's for most of these sites.

Occasionally a wire or rod broke, and months or a year would pass before repairs. In the case of stations like San Juan Bautista (XSJ2), the trend from the pre-break record

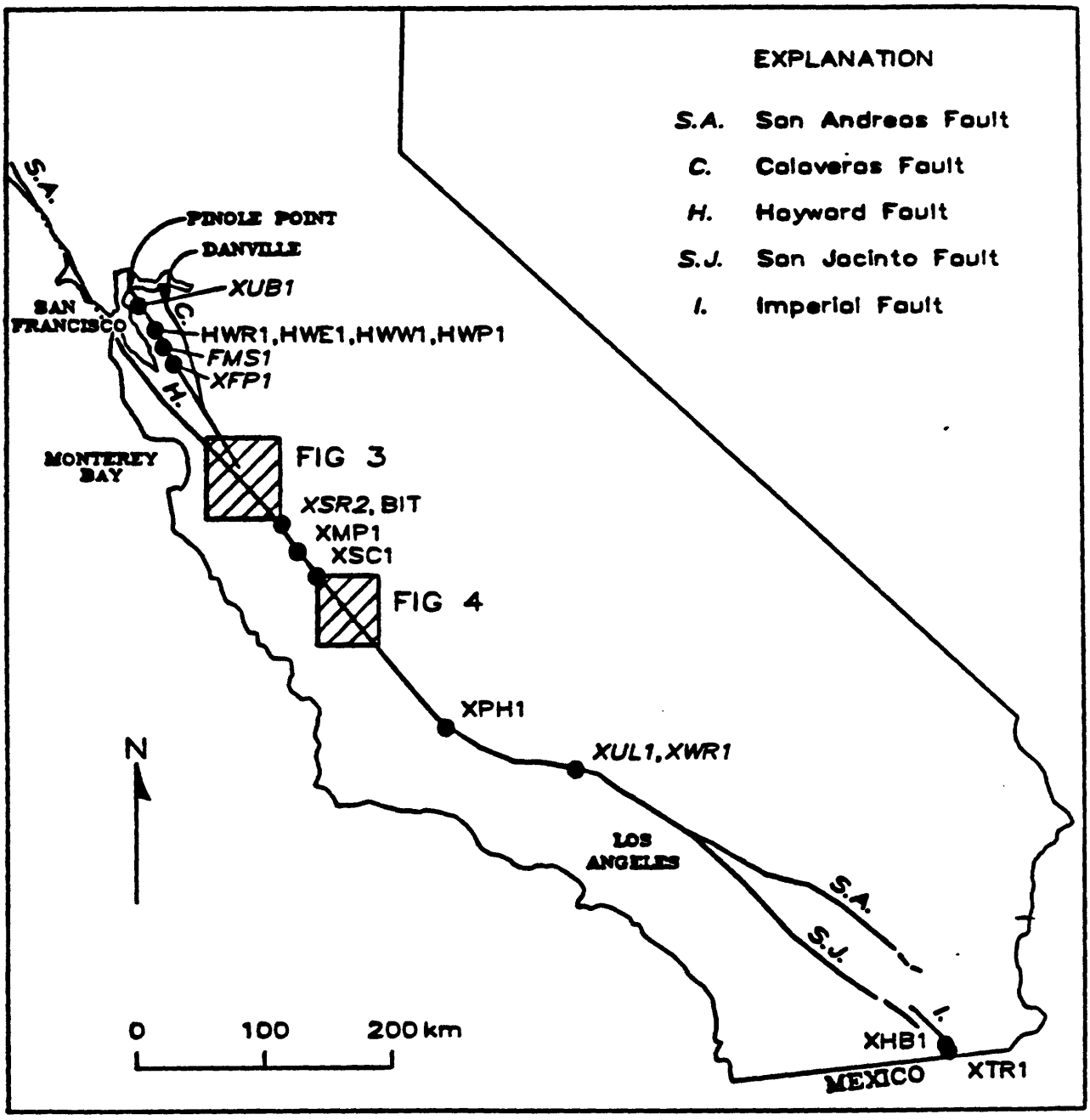


**Figure 2.**

Map showing locations of USGS creepmeters in California. Stations with code names in regular type were operating as of December 31, 1988 (see Table 1). Stations with code names in italics have been discontinued (see Table 2 for date of removal or abandonment, and appropriate catalog reference). See Figure 3 for the Hollister area creepmeters and Figure 4 for the Parkfield creepmeters.

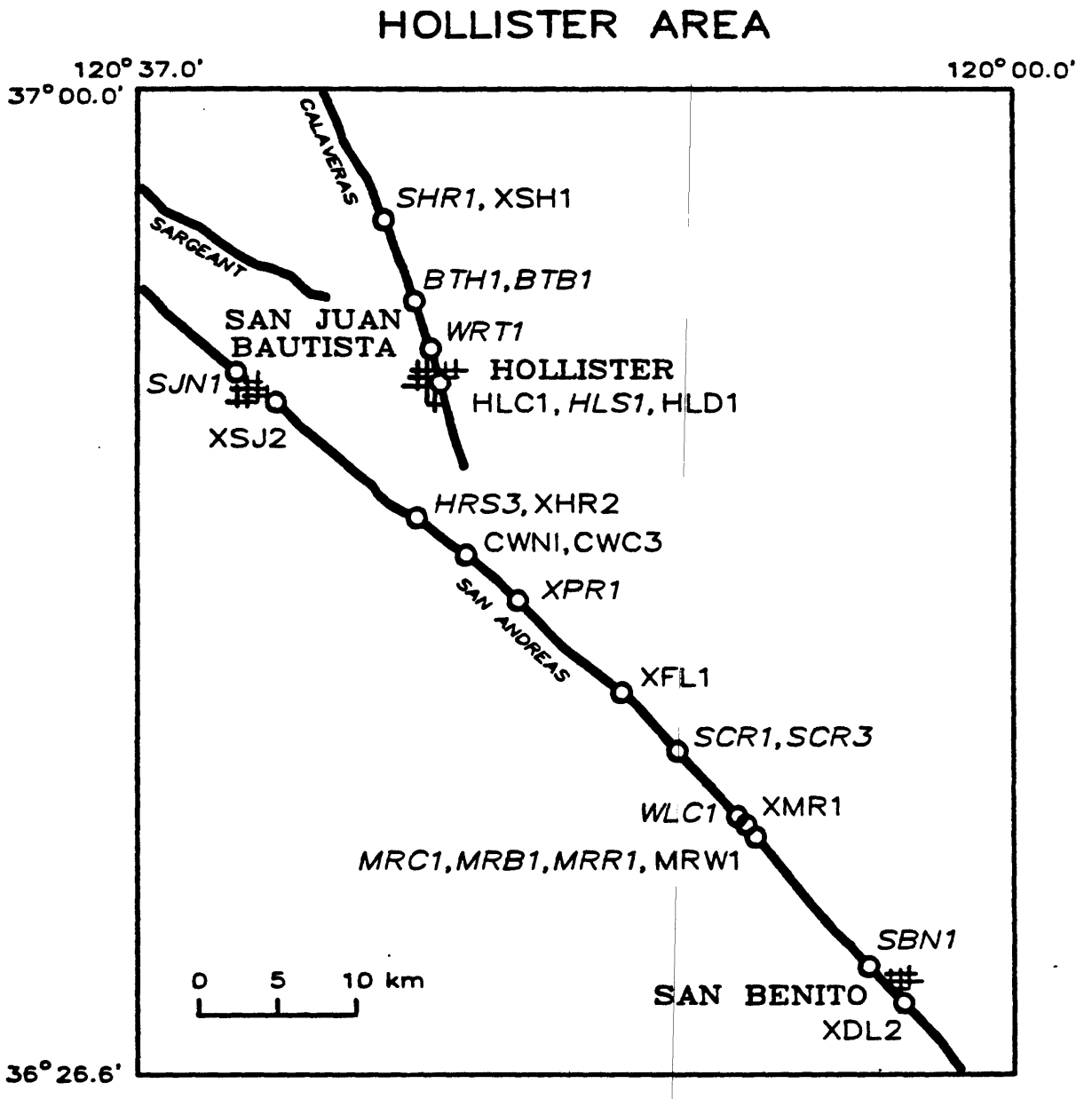


**Figure 3.**

**Map showing locations of USGS creepmeters in Hollister, California, area. Stations with code names in regular type were operating as of December 31, 1988 (see Table 1): Stations with code names in italics have been discontinued (see Table 2 for date of removal or abandonment, and appropriate catalog reference).**

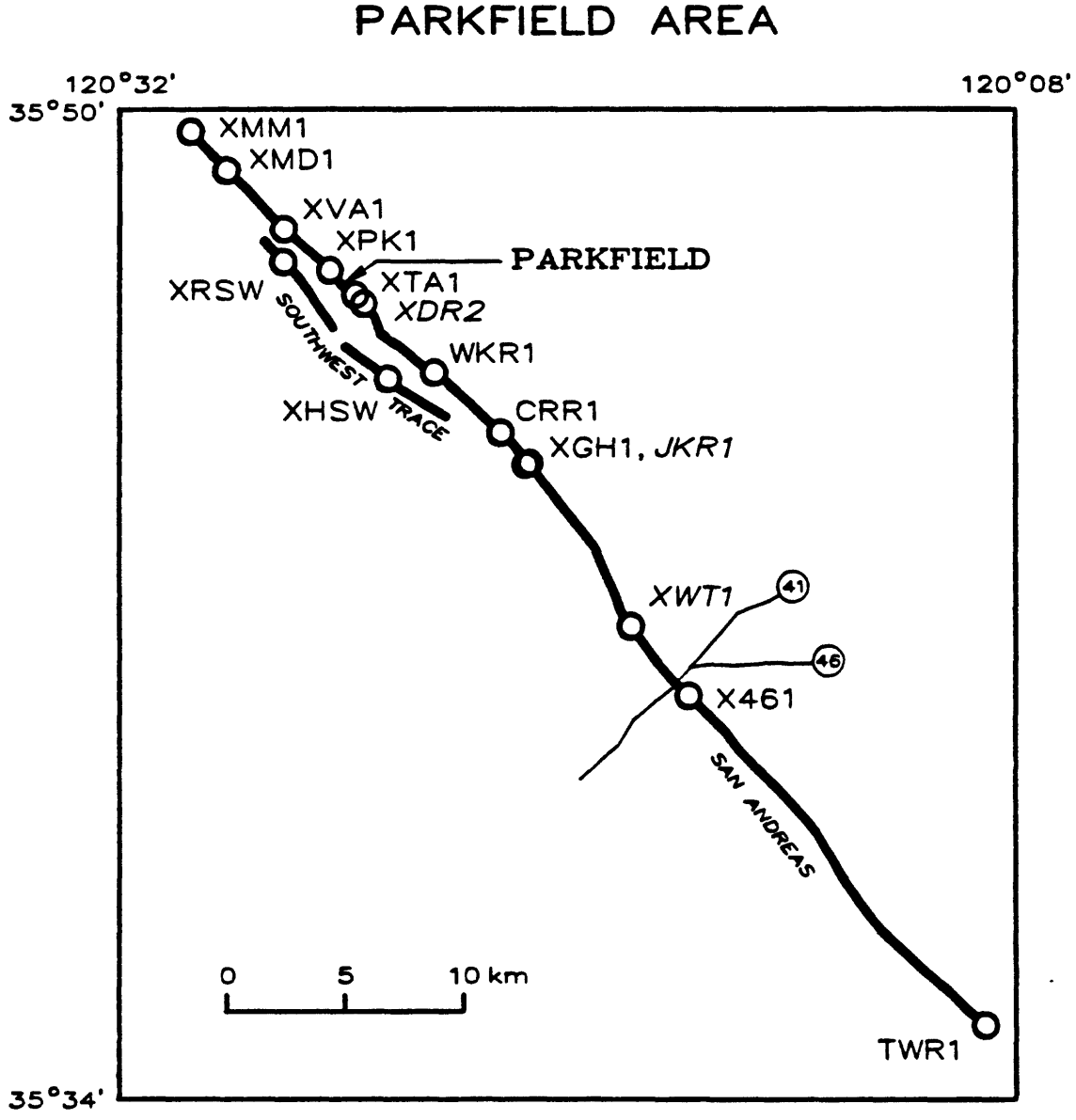


**Figure 4.**

**Map showing locations of USGS creepmeters in Parkfield, California, area. Stations with code names in regular type were operating as of December 31, 1988 (see Table 1). Stations with code names in italics have been discontinued (see Table 2 for date of removal or abandonment, and appropriate catalog reference.**

**Table 1. Creepmeter Sites**

| Site | Name | Distance km[1] | Latitude West | Longitude North | Installation Date | Average Creep Rate mm/yr[2] |
|---|---|---|---|---|---|---|
| | San Andreas Fault | | | | | |
| XSJ2 | San Juan Bautista | 310.8 | 36°50.2' | 121°31.2' | June 1969 | 7.0 |
| XHR2 | Harris Ranch | 321.9 | 36°46.3' | 121°25.3' | April 1985 | 8.9 |
| CWN1 | Cienega Winery, North | 326.0 | 36°45.0' | 121°23.1' | June 1972 | 11.5 |
| CWC3 | Cienega Winery, Central | 326.0 | 36°45.0' | 121°23.1' | Nov. 1968 | 10.0 |
| XFL1 | Frank Lewis Long | 339.4 | 36°39.9' | 121°16.3' | April 1973 | 7.0 |
| XMR1 | Melendy Ranch | 350.8 | 36°35.7' | 121°11.2' | June 1969 | 19.0 |
| MRW1 | Melendy Windmill | 352.1 | 36°35.1' | 121°10.6' | Sept. 1972 | 20.0 |
| XDL2 | Dry Lake Long | 365.7 | 36°29.5' | 121°04.7' | 1973 | 0.25 |
| BIT1 | Bitterwater | 379.1 | 36°23.9' | 120°58.9' | July 1969 | 17.0 |
| XMP1 | Monarch Peak | 405.1 | 36°12.8' | 120°47.9' | June 1969 | 14.0 |
| XSC1 | Slack Canyon | 427.6 | 36°03.9' | 120°37.7' | June 1969 | 22.0 |
| XMM1 | Middle Mountain | 443.5 | 35°57.5' | 120°30.1' | Oct. 1979 | 14.2 |
| XMD1 | Middle Ridge | 445.8 | 35°56.6' | 120°29.1' | July 1986 | 19.0 |
| XVA1 | Varian Ranch | 448.9 | 35°55.3' | 120°27.7' | April 1987 | 7.3 |
| XPK1 | Parkfield | 451.8 | 35°54.1' | 120°26.5' | Oct. 1979 | 13.0 |
| XTA1 | Taylor Ranch | 453.8 | 35°53.4' | 120°25.6' | Sept. 1985 | 7.0 |
| XDR2 | Durham Ranch | 454.8 | 35°53.0' | 120°25.2' | July 1969 | 8.0 |
| WKR1 | Work Ranch | 458.7 | 35°51.5' | 120°23.5' | May 1976 | 5.0 |
| CRR1 | Carr Ranch | 463.0 | 35°50.1' | 120°21.8' | May 1966 | 2.5 |
| XGH1 | Gold Hill | 463.8 | 35°49.2' | 120°20.9' | July 1969 | 5.3 |
| X461 | Highway 46 | 477.4 | 35°43.4' | 120°16.7' | Aug. 1986 | −0.4* |
| TWR1 | Twisselman Ranch | 508.0 | 35°35.8' | 120°08.8' | Nov. 1976 | −0.4* |
| XRSW | Roberson Southwest | 450.6 | 35°54.4' | 120°27.6' | May 1987 | 2.3 |
| XHSW | Hearst Southwest | 457.0 | 35°51.7' | 120°24.9' | June 1987 | −2.7* |
| XPH1 | Panorama Hills | 563.7 | 35°08.9' | 119°41.5' | Aug. 1977 | −0.16* |
| | Hayward Fault | | | | | |
| HWR1 | Hayward, Rose St. | 42.6 | 37°40.8' | 122°05.4' | April 1968 | 4.1 |
| HWE1 | Hayward, D St. East | 44.0 | 37°40.2' | 122°04.8' | April 1968 | 1.0 |
| HWW1 | Hayward, D St. West | 44.0 | 37°40.2' | 122°04.8' | April 1963 | 3.2 |
| HWP1 | Hayward, Palisade St. | 45.0 | 37°39.8' | 122°04.5' | June 1970 | 3.6 |

**Table 1. Creepmeter Sites**
**continued**

| Site | Name | Distance km[1] | Latitude West | Longitude North | Installation Date | Average Creep Rate mm/yr[2] |
|---|---|---|---|---|---|---|
| | Calaveras Fault | | | | | |
| XSH1 | Shore Road | 109.2 | 36°56.6' | 121°26.7' | April 1986 | 7.5 |
| HLC1 | Hollister, Central Ave. | 119.5 | 36°51.4' | 121°24.3' | April 1970 | 8.7 |
| HLD1 | Hollister, D St. | 121.0 | 36°50.5' | 121°24.2' | April 1970 | 2.1 |

[1]The positions on the San Andreas fault are given in kilometers southeastward along the fault trace from Point Arena. The positions on the Hayward fault are given in kilometers southeastward along the fault trace from Pinole Point. The positions on the Calaveras fault are given in kilometers southeastward along the fault trace from Danville,California.

[2]Average creep rate over life of meter.

*A negative sign indicates left-lateral movement

## Table 2. Creepmeter Sites Discontinued Prior to December 31, 1988

| Site | Name | Distance km | Latitude West | Longitude North | Installation Date | Date of Last Available Data | Catalog Reference |
|---|---|---|---|---|---|---|---|
| | San Andreas Fault | | | | | | |
| XWD1 | Woodside, Roberta Dr. | 217.5 | 37°25.0' | 122°15.6' | June 1969 | Feb. 1970 | *Yamashita et al.*, 1973 |
| SJN1 | San Juan Nyland | 307.7 | 36°51.3' | 121°32.7' | Aug. 1968 | Aug. 1985 | *This Report* |
| HRS3 | Harris Ranch | 321.9 | 36°46.3' | 121°25.3' | June 1969 | July 1980 | *This Report* |
| CWB | Cienega Barograph | 326.0 | 36°45.0' | 121°23.1' | July 1958 | Dec. 1972 | *Nason et al.*, 1974 |
| EYR | Eyre Ranch | 328.8 | 36°44.1' | 121°21.8' | Sept. 1970 | Dec. 1972 | *Nason et al.*, 1974 |
| XPR1 | Paicenes Ranch | 330.0 | 36°43.4' | 121°20.9' | May 1973 | Nov. 1979 | *This Report* |
| XFL2 | Frank Lewis NS | 339.4 | 36°39.9' | 121°16.3' | April 1973 | Dec. 1977 | *Schulz et al.*, 1982 |
| SCN1 | Stone Canyon No. | 344.2 | 36°38.2' | 121°14.3' | Sept. 1972 | Nov. 1977 | *Schulz et al.*, 1982 |
| SCH | Stone Canyon Hill | 344.6 | 36°38.2' | 121°14.0' | June 1968 | Dec. 1972 | *Nason et al.*, 1974 |
| SCR1 | Stone Canyon River | 344.9 | 36°37.9' | 121°13.9' | Sept. 1970 | Sept. 1978 | *This Report* |
| WTC | Waters Central | 345.9 | 36°37.4' | 121°13.4' | Oct. 1972 | Aug. 1975 | *Schulz et al.*, 1976 |
| WTW | Waters West | 345.9 | 36°37.4' | 121°13.4' | Oct. 1972 | Aug. 1975 | *Schulz et al.*, 1976 |
| HKN | Hawkins | 347.7 | 36°36.7' | 121°12.7' | Sept. 1972 | Nov. 1972 | *Nason et al.*, 1974 |
| WLC | Willow Creek | 350.0 | 36°35.8' | 121°11.5' | Oct. 1972 | Oct. 1981 | *This Report* |
| MRC1 | Melendy Corral | 351.2 | 36°35.5' | 121°11.1' | Sept. 1970 | Dec. 1982 | *This Report* |
| MRB1 | Melendy Barn | 351.3 | 36°35.4' | 121°11.0' | June 1969 | Nov. 1979 | *This Report* |
| MRR1 | Melendy Ranch | 351.5 | 36°35.3' | 121°10.9' | Oct. 1972 | Nov. 1979 | *This Report* |
| SBN1 | San Benito | 362.2 | 36°30.8' | 121°06.0' | June 1969 | Sept. 1982 | *This Report* |
| XLR1 | Little Rabbit Valley | 374.5 | 36°25.2' | 121°00.3' | June 1969 | Aug. 1972 | *Yamashita et al.*, 1973 |
| XSR1 | Smith Ranch Strain | 381.0 | 36°23.0' | 120°58.0' | June 1969 | Dec. 1972 | *Yamashita et al.*, 1973 |
| XSR2 | Smith Ranch | 381.0 | 36°23.0' | 120°58.0' | June 1969 | May 1982 | *This Report* |
| XDR1 | Durham Ranch | 454.8 | 35°53.0' | 120°25.2' | July 1969 | Oct. 1985 | *This Report* |
| XDR2 | Durham Ranch | 454.8 | 35°53.0' | 120°25.2' | Oct. 1985 | July 1987 | *This Report* |
| JKR1 | Jack Ranch | 464.8 | 35°48.8' | 120°20.7' | Sept. 1976 | none | *This Report* |
| XDR2 | Durham Ranch | 454.8 | 35°53.0' | 120°25.2' | Oct. 1985 | July 1987 | *This Report* |
| XWT1 | Water Tank | 472.8 | 35°45.4' | 120°18.5' | June 1969 | Mar. 1984 | *This Report* |
| XUL1 | Una Lake | 720.5 | 34°32.9' | 118°06.4' | Oct. 1977 | Feb. 1981 | *This Report* |
| XWR1* | Wiebe Ranch | 733.2 | 34°29.6' | 117°58.2' | Oct. 1977 | Sept. 1983 | *This Report* |

**Table 2. Creepmeter Sites Discontinued Prior to December 31, 1988 (continued)**

| Site | Name | Distance km | Latitude West | Longitude North | Installation Date | Date of Last Available Data | Catalog Reference |
|---|---|---|---|---|---|---|---|
| | Hayward Fault | | | | | | |
| XUB1 | Berkeley | 17.0 | 37°52.4' | 122°15.1' | Sept. 1983 | Oct. 1988 | *This Report* |
| CWT | Claremont Water Tunnel | 19.5 | 37°51.3' | 122°14.2' | 1972 | Nov. 1974 | *Schulz et al.*, 1976 |
| FMN | Fremont, Nursery Ave. | 56.6 | 37°34.8' | 121°59.3' | Mar. 1971 | Jan. 1972 | *Nason et al.*, 1974 |
| FMS1 | Fremont, Shinn Sta. | 58.2 | 37°34.1' | 121°58.9' | Aug. 1970 | Feb. 1983 | *This Report* |
| XFP1 | Fremont, Prune Ave. | 66.3 | 37°30.4' | 121°55.8' | June 1969 | Dec. 1977 | *This Report* |
| | Sargeant Fault | | | | | | |
| XCR1 | Chase Ranch | 24.1 | 36°58.6' | 121°38.7' | June 1969 | Nov. 1970 | *Yamashita et al.*, 1973 |
| | Calaveras Fault | | | | | | |
| XCY1 | Coyote | 92.5 | 37°04.2' | 121°31.5' | June 1969 | Jan. 1970 | *Yamashita et al.*, 1973 |
| FTN | Fortado N | 102.4 | 36°59.9' | 121°28.6' | June 1972 | Nov. 1972 | *Nason et al.*, 1974 |
| FTE | Fortado E | 102.8 | 36°59.7' | 121°28.5' | June 1972 | Nov. 1972 | *Nason et al.*, 1974 |
| FTW | Fortado W | 102.8 | 36°59.7' | 121°28.5' | June 1972 | Nov. 1972 | *Nason et al.*, 1974 |
| LKE | Lake Road | 108.1 | 36°57.2' | 121°26.9' | June 1969 | April 1976 | *Schulz and Burford*, 1979 |
| SHR1 | Shore Road | 109.2 | 36°56.6' | 121°26.7' | June 1971 | May 1986 | *This Report* |
| XCD1 | Costa Dairy | 111.1 | 36°55.5' | 121°26.2' | Aug. 1976 | Dec. 1977 | *Schulz and Burford*, 1979 |
| BTH1 | Bertuccio House | 114.0 | 36°54.1' | 121°25.6' | June 1971 | June 1979 | *This Report* |
| BTB1 | Bertuccio Barn | 114.1 | 36°54.1' | 121°25.6' | June 1971 | Aug. 1982 | *This Report* |
| BLS | Bolsa Road | 114.9 | 36°53.6' | 121°25.4' | June 1971 | Aug. 1977 | *Schulz and Burford*, 1979 |
| WRT1 | Wright Road | 117.7 | 36°52.2' | 121°24.8' | June 1971 | July 1983 | *This Report* |
| HLS1 | Hollister, Seventh St. | 120.0 | 36°51.1' | 121°24.2' | April 1970 | July 1987 | *This Report* |

**Table 2. Creepmeter Sites Discontinued Prior to December 31, 1988 (continued)**

| Site | Name | Distance km | Latitude West | Longitude North | Installation Date | Date of Last Available Data | Catalog Reference |
|---|---|---|---|---|---|---|---|
| | Other Faults | | | | | | |
| BSH | Busch (Hollister Valley) | | 36°56.6' | 121°27.1' | June 1970 | Nov. 1975 | *Schulz et al.*, 1976 |
| OVF | Lone Pine Fan (Owens Valley) | | 36°37.2' | 118°05.1' | Dec. 1968 | April 1974 | *Schulz et al.*, 1976 |
| OVA | Lone Pine Aqueduct (Owens Valley) | | 36°37.2' | 118°05.1' | Dec. 1968 | April 1974 | *Schulz et al.*, 1976 |
| KER | Kern Front Fault (Bakersfield) | | 35°27.2' | 119°01.9' | Oct. 1968 | June 1974 | *Schulz et al.*, 1976 |
| TFT | Buena Vista Fault (Taft) | | 35°09.7' | 119°26.4' | Aug. 1967 | Mar. 1975 | *Schulz et al.*, 1976 |
| XHB1** | Imperial Fault (Heber Road) | | 32°43.8' | 115°24.3' | Oct. 1975 | Nov. 1977 | *Schulz et al.*, 1979 |
| XTR1** | Imperial Fault (Tuttle Ranch) | | 32°41.6' | 115°24.3' | Oct. 1975 | Nov. 1977 | *Schulz and Burford*, 1979 |

Distances are measured southeastward from Point Arena on the San Andreas fault, southeastward from Pinole Point on the Hayward fault, northwestward from the junction of the Sargeant and Calaveras faults on the Sargeant fault, and southeastward from Danville on the Calaveras fault.

*This station is now operated by the University of Southern California, which has all data after September, 1983.

**These stations are now operated by California Institute of Technology, which has all data after November, 1977

and data from surveys of a nearby alinement array were used to extrapolate a beginning point for the post–break record. For Harris Ranch (HRS3, XHR1, XHR2), we started XHR2 at zero rather than extrapolate the trend provided by the short and discontinuous record from XHR1 or the trend from the longer record of the earlier instrument HRS3, which differed both in design and length from XHR1 and XHR2. In other cases, if a break in data lasted no longer than one or two months and no supportive alinement array data were available, the last cumulative data point before the break was used to begin the post–break record.

In order to show as much detail as possible on the page–size long–term plots, different vertical scales have been employed, depending on a station's cumulative creep rate, its geographical location, or the extent of its data set. This varying scale can best be explained by its use on the Parkfield data. The southermost stations in Cholame Valley have low cumulative creep rates but long records, and thus were plotted using the moderate–total–offset scale required by the Parkfield stations further north. Stations south of Highway 46 and on the Southwest Trace, however, have shorter data sets and such low creep rates that they were plotted on the lowest–total–offset scale. The rate at Carr Ranch is low to moderate, but the station was installed in 1966 and is the longest data set in our files; it requires the highest–total–offset scale to show all the data points.

The plots were scaled as follows:

## LOW CUMULATIVE CREEP TOTAL OFFSETS

**Total vertical scale 112.5 mm**

**San Andreas fault stations:**

- **Southwest Trace in Parkfield.**
- **south of Highway 46 in Parkfield.**
- **Carrizo Plain.**
- **Palmdale stations.**

**All Hayward fault stations.**

**Calaveras fault stations in Fremont.**

## MODERATE CUMULATIVE CREEP TOTAL OFFSETS AND/OR LONG DATA SETS

**Total vertical scale 225 mm**

**San Andreas fault stations:**

- **from San Juan Bautista to Melendy Ranch.**
- **from Middle Mountain to Carr Ranch in Parkfield.**
- **from Gold Hill to Highway 46 in Parkfield.**

**Calaveras fault stations:**

- **from Shore Road through Hollister.**

## HIGH CUMULATIVE CREEP TOTAL OFFSETS AND/OR LONG DATA SETS

**Total vertical scale 450 mm**

**San Andreas fault stations:**

- **from Melendy Ranch south of Hollister through Slack canyon north of Parkfield.**
- **Carr Ranch in Parkfield.**

The total vertical scale appears in the upper left–hand corner of each plot. The lowest–total–offset scale is half the moderate scale, which in turn is half the highest scale.

Our previous catalogs also presented yearly creep data plots produced by whatever computer was in use at the time of compilation. The resulting plot scales varied from one catalog to the next, making direct comparisons between time periods difficult. As a partial remedy we have omitted here the one–year plots and have produced instead composite long–term plots of data for all stations still active or still archived in our current computer files as of 1989, from the time of each station's installation until its removal, or, if still an active instrument, until December 31, 1988. These composite plots have the same horizontal scale (time = 1966–1988) and vertical scale (1 unit = 20 mm) for easy visual comparisons, and appear as separate plates accompanying this report. Plate 1 presents data for the San Andreas fault from San Juan Bautista to Melendy Ranch, south of Hollister. Plate 2 shows data from San Benito south to Palmdale, omitting the Parkfield areas but including the creepmeter in the Carrizo Plain; and Plate 3 is devoted to the creepmeters in Parkfield. Plate 4 displays data for the Hayward and Calaveras faults. More detailed information for any station or stations is available upon request.

## NEW DEVELOPMENTS

Three noteworthy developments have been observed in the creepmeter data since our last catalog (*Schulz and others*, 1982). The first was the dramatic effect produced by the Coalinga magnitude 6.5 earthquake of May 2, 1983, on creep on the San Andreas fault at Parkfield, 35 km distant from the earthquake source (*Mavko and others*, 1985; *Schulz and others*, in press). Creepmeters from TWR1 (Twisselman Ranch) south of Parkfield to XSJ2 (San Juan Bautista) 200 km north of Parkfield recorded coseismic steps, followed by varying periods of retardation in right–lateral creep along the San Andreas fault recorded at creepmeters from BIT1 (Bitterwater) to XGH1 (Gold Hill) (Figures 2, 3, 4, and 5). A reversal from right–lateral to left–lateral creep at one Parkfield creepmeter (XMM1, Middle Mountain) persisted until a sequence of small earthquakes occurred in summer, 1984, directly under the station (*Poley and others*, 1987). Right–lateral creep then resumed at a rate reduced from the pre–1983 average. The longest retardation, at XGH1, Gold Hill, finally ended in summer, 1986, three years after the Coalinga earthquake. To date (1989), rates at all Parkfield creepmeters but two (XPK1, Parkfield; XGH1, Gold Hill) remain less than the pre–Coalinga average rates (Figure 5, Plate 3). For creepmeters still recording reduced creep rates, slip deficits as of January 1, 1989 ranged from 14 to 50 mm, suggesting a possible delay in the projected occurrence of the next Parkfield earthquake of from 8.5 to 30 months. However, the highest slip deficits appear in data from creepmeters installed after 1976, while lower deficits appear in data from creepmeters installed seven years earlier. If longer data sets can provide more confidence, the next Parkfield earthquake may only be delayed from 8.5 to 14 months. This conclusion assumes the Coalinga earthquake was not, in fact, the anticipated Parkfield earthquake.

The second new observation of interest also comes from the Parkfield area. After the last "characteristic" Parkfield earthquake (June 27, 1966, magnitude 5.5), surface ruptures

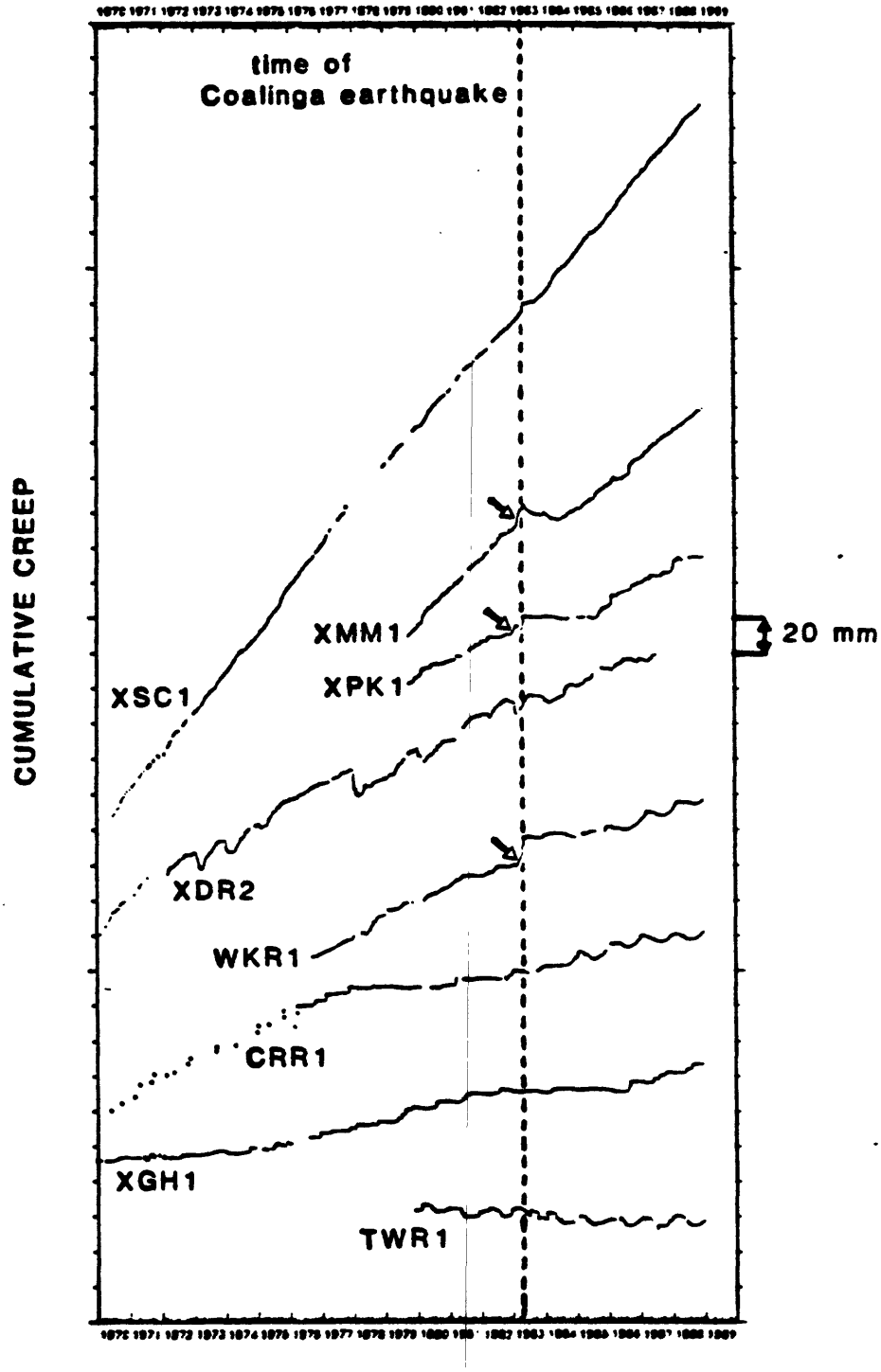


**Figure 5.**

**Plots of cumulative creep from the 8 Parkfield creepmeters operating at the time of the magnitude 6.5 earthquake at Coalinga, California on May 2, 1983. Stations are arranged from north to south along the fault. Large surges in creep were recorded at 3 sites (XMM1, XPK1, and WKR1) during the extremely wet winter preceding the earthquake (arrows). Right-lateral coseismic steps ranging from 0.50 to 8.22 mm were recorded on May 2 by 6 of the more northern creepmeters, while the 2 southern creepmeters (XGH1 and TWR1) recorded left-lateral coseismic steps of −0.19 and −0.75 mm, respectively. Creep rates at the creepmeters were sharply affected for up to 3 years following the earthquake (see Plate 3).**

were mapped along the main trace of the San Andreas fault from Middle Mountain on the north to just south of Highway 46, 29 km south of Parkfield (*Brown and others*, 1967) (Figure 4). Surface ruptures were also discovered on a trace approximately 1 km to the southwest of the main trace, for a distance of 12 km (Figure 4). This branch of the fault was named the Southwest Trace (*Brown and others*, 1967). Near-fault movement was not routinely monitored until 1983, when special survey lines (alinement arrays) were installed at two locations on the trace. Movement at those sites measured during the next 3 years was greater than could be accounted for by observational errors, and in 1986–87 two more arrays and two creepmeters (XRSW, Roberson Southwest, and XHSW, Hearst Southwest) were installed on the trace. After 2 years of operation, the Roberson creepmeter shows an overall right-lateral trend of 2.3 mm/yr, while the Hearst creepmeter shows a left-lateral trend of 3.5 mm/yr (Figure 6). A model for transfer of some motion from the main trace to the Southwest Trace has been postulated by *Wilmesher* (in review), who also suggests the Southwest Trace is actually a series of traces providing step-over of movement from the San Andreas main trace to as-yet unidentified traces farther west.

The third new item of interest comes from intensive instrumentation of the Parkfield area for the prediction experiment that has allowed comparison of creepmeter data with that from other close-by geophysical instruments. At one particularly sensitive site on Middle Mountain in Parkfield, an interesting interaction has appeared between surface fault creep, changes in water level in a nearby well, and seismic activity. The first significant observation was an apparent 90-day periodicity between large drops in water level in a deep well on Middle Mountain coincident with significant (> 0.5 mm) creep events on one or both of two Middle Mountain creepmeters—XMM1, 0.7 km northwest of the well, and XMD1, 1.8 km southeast of the well (*Roeloffs and others*, 1989). This periodicity continued from January to October, 1987, with amplitude of the water level drops and cumulative creep decreasing with time. Between October 1987 and November 1988, periodicity was altered by combination water-level drops/creep events occurring within the 90-day windows. In mid-1989, it was discovered that magnitude 2 or greater earthquakes had occurred in the Middle Mountain area within ±10 days of each of the larger water level drops during 1987, and, perhaps more significantly, the period when the 90-day cycle was disturbed coincided with a 16-month hiatus in earthquakes greater than 2.0 in the area (8/3/87–11/10/88). Shortly after the largest water level drop to date in October 1988 and the return of the magnitude 2 or greater earthquakes in November, 1988, the 90-day cycle began to appear again.

Figure 7 shows amplitudes of the water level drops (solid circles), and amounts of cumulative slip as of those dates at XMM1 creepmeter (open circles). The amplitude of any creep event at the time of a water level drop is included in the amount of cumulative creep shown on that date. At the bottom of the plot appears a tally of the number of earthquakes of all magnitudes that occurred in the fault segment under Middle Mountain that is considered the Preparation Zone for the next Parkfield earthquake. Stars above the tally line represent earthquakes of magnitude 2 or greater. Table 3 lists dates and amplitudes of water level drops and any coincidental creep events at XMM1 and/or XMD1 creepmeters, as well as magnitude 2 or greater earthquakes under Middle Mountain within

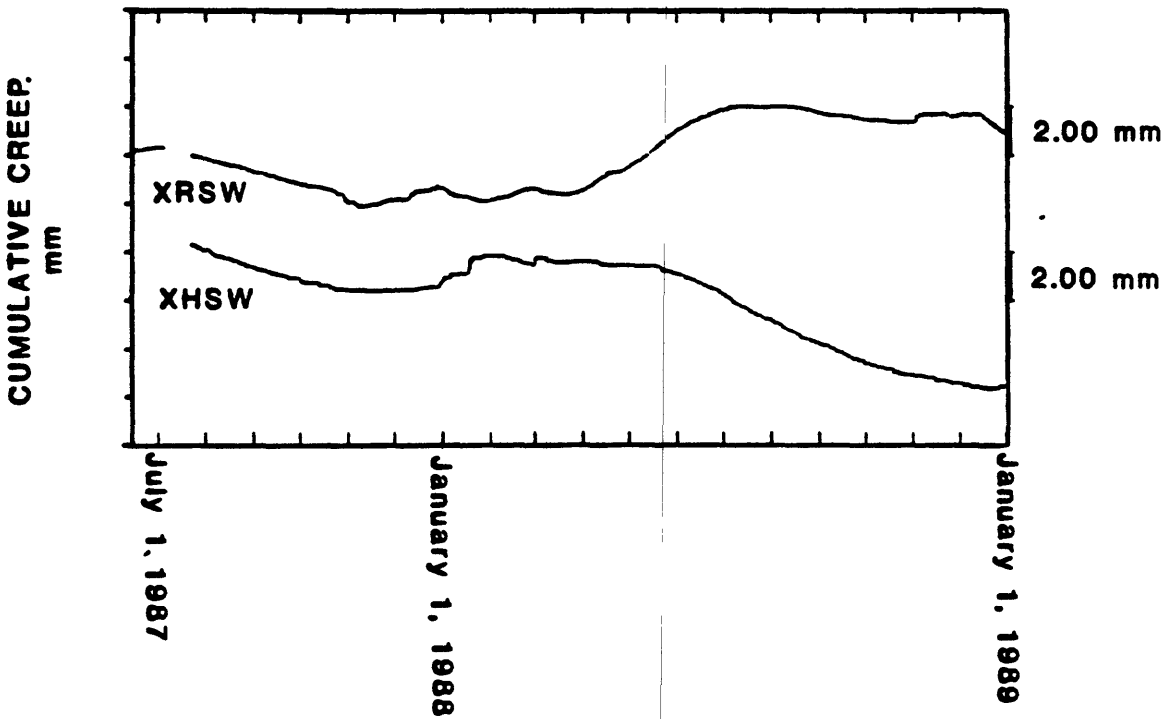


**Figure 6.**

**Cumulative creep recorded at the two new creepmeters on the Southwest Trace of the San Andreas fault in Parkfield between July, 1987 and December, 1988. XRSW (*Roberson* southwest) creepmeter is 7.6 km northeast of XHSW (*Hearst* southwest) and the divergent directions of slip they record supports the possibility that the Southwest Trace may consist of two or more traces (see text).**

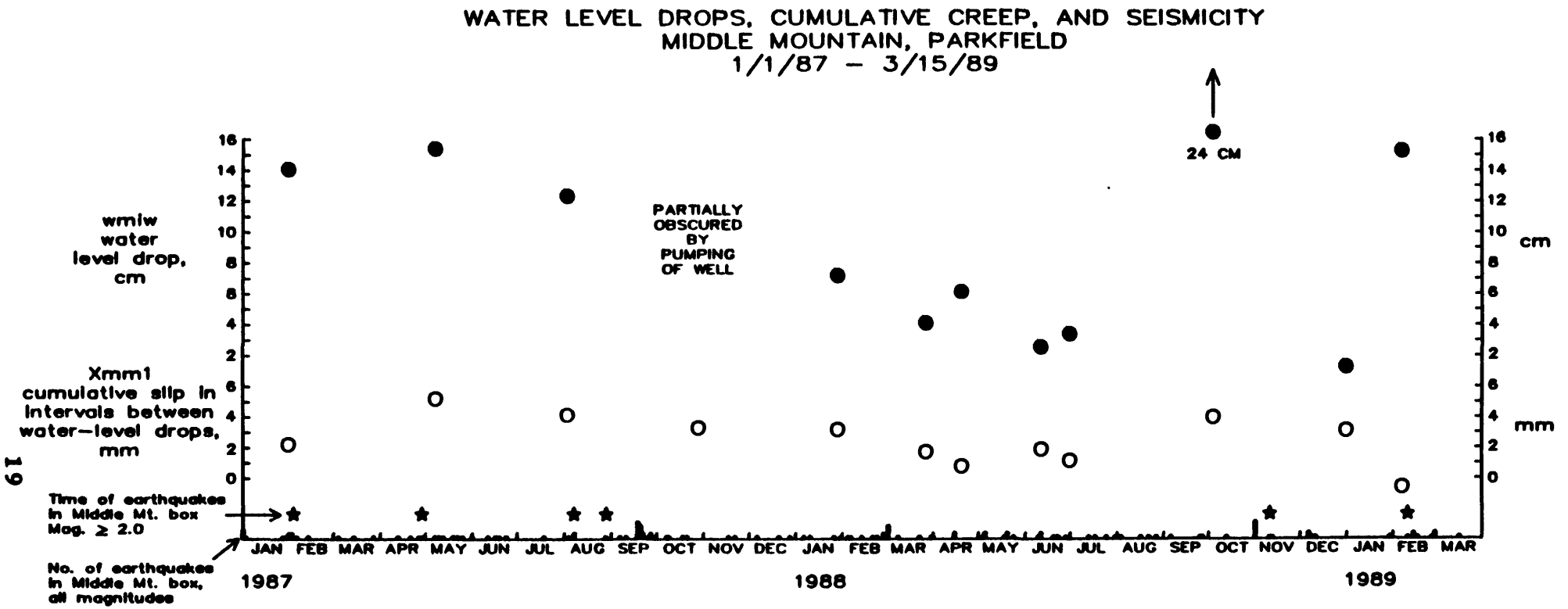


**Figure 7.**

**Comparison of amplitude of water level drops in wmiw (Middle Mountain) deep well with cumulative creep recorded at XMM1 (Middle Mountain) creepmeter and seismicity in the Middle Mountain preparation zone, where foreshocks to the next characteristic Parkfield earthquake are expected to occur. Wmiw well is located 0.32 km southeast of XMM1 and 2.05 km northwest of XMD1, and is thought to be slightly east of the creeping fault zone. Solid circles represent the amplitude of water-level drops in centimeters. Regular circles indicate the amount of cumulative creep between drops, including the amplitude of any creep event coincident with the water-level drop (see Table 3). The dots along the axis represent a tally of earthquakes of all magnitudes in the Middle Mountain preparation zone; the stars represent earthquakes in the preparation zone with a magnitude $\geq$ 2.0. As Spring of 1989 began, periodicity of water-level drops and magnitude $\geq$ 2.0 earthquakes seen during the first half of 1987 appeared to be returning.**

Table 3.

| Water Level drop, wmiw | Amplitude cm | Event XMM1 | Event XMDI | Mag. $\geq$ 2, $\pm$10 Days |
|---|---|---|---|---|
| 2/1/87 | 14.1 | X | | X |
| 5/7/87 | 15.4 | X | X | X |
| 8/3/87 | 12.3 | X | X | X |
| 10/28/87 | * | X | X | |
| 1/28/87 | 7.2 | | X | |
| 3/28/88 | 4.1 | X | | |
| 4/17/88 | 6.1 | | X | |
| 6/11/88 | 2.5 | X | | |
| 6/30/88 | 3.4 | | X | |
| 10/3/88 | 24.0 | X | X | |
| 1/1/89 | 1.2 | | | |
| 2/6/89 | 15.2 | X | | X |

*Partially obscured by pumping of well.

±10 days of the water-level drops. Details of the relationship of surface fault creep to strain changes at depth and to seismicity may be appearing in data from the instrumental networks around Middle Mountain in Parkfield.

Of general interest are the long-term composite plots (Plates 1–4) accompanying this report. On plates 1, 2, and 3, the creepmeters are arranged from north to south along the San Andreas fault, and the reader will see south of the San Francisco peninsula "locked" segment the onset of creep at the San Juan Bautista instruments (7 mm/yr, Plate 1), the increase of creep rates through central California that peaks at XSR2 north of Parkfield (28 mm/yr, Plate 2), the decay in creep rate at the end of Cholame Valley south of Parkfield, where the fault again becomes "locked" (XWT1, X461, TWR1, Plate 3), and the lack of right-lateral creep in the Carrizo Plain and at Palmdale (XPH1, XUL1, XWR1, Plate 2).

On the Hayward–Calaveras fault system, the creep rate gradually increases from 1.3 mm/yr at Berkeley (XUB1) to 5 mm/yr in downtown Hollister (HLS1, Plate 4). South of Hollister, the Calaveras fault splays out into several traces before joining the San Andreas fault.

## ACKNOWLEDGEMENTS

Special thanks are due Richard Liechti, James Wilmesher, F. Brett Baker, Andrew Records, Beth Brown, Ronald Jenkins, Eugene Iwatsubo, Thomas Murray, G. Douglas Myren, Vincent Keller, Alan Jones, and R.O. Burford for retrieving on-site records, making field readings, keeping the creepmeters and telemetry functioning, improving creepmeter electronics, and installing new creepmeters and telemetry through the years. The gathering and interpretation of data would have been impossible without the continued patience, support, and cooperation of the many landowners, ranchers, and civic officials on whose property the instruments are located, and we offer them our appreciation. A special word of gratitude is owed the City of Hayward Public Works Department, whose cooperation and assistance for 20 years has made maintenance and repair of our Hayward instruments possible.

## APPENDIX A – CRR1 DATA SOURCES

1966-1979 data points for CRR1 creepmeter have been taken from the following four sources:

(1) *Wallace, R.E.* and *E.F. Roth* (1967), Rates and patterns of progressive deformation, in the Parkfield–Cholame California Earthquakes of June–August, 1966: U.S. Geological Survey Professional Paper 579, pp 23–40.

The white centerline of Highway 46 near Cholame had been repainted June 6, 1966, and was thought to be undisturbed prior to the earthquakes on June 27. After the earthquakes, Wallace and Roth measured the offset in the centerline where the highway crosses the San Andreas fault just east of Cholame.

| | |
|---|---|
| By 7 a.m. PDT June 28, 1966, dispacement = | 1.8 in. (45.7 mm) |
| June 30 | 3.0 in (76.2 mm) |
| July 6, July 7 | 4.0 in. (101.6 mm) |
| July 13 | 4.3 in. (109.2 mm) |
| August 4 | 4.7 in. (119.4 mm) |

The millimeter values were used to start the cumulative–reading file for CRR1.

(2) *Smith, S.W. and Wyss, M.* (1968), Displacement on the San Andreas fault subsequent to the 1966 Parkfield earthquake: Bulletin of the Seismological Society of America, v. 58, pp. 1955–1973.

This paper describes the small–scale geodetic networks that were established across the fault trace on June 29, June 30, and July 1, 1966 and a strainmeter that was installed at Carr Ranch on July 4, and presents the continuous record obtained from the strainmeter from July 9 to September 18, 1966. We plotted data points from this record and used them as cumulative values, with the initial point (and reset value) set to start July 13 at the value of 109.2 mm, as measured by Wallace and Roth (above).

(3) *Scholz, C.H., Wyss, M. and Smith, S.W.* (1969), Seismic and aseismic slip on the San Andreas fault: Journal of Geophysical Research, v. 74, no. 8, pp 2049–2069.

In order to generate four data points between September 1966, when the strainmeter failed, and February 1967, when a new creepmeter was installed, we compared creepmeter data points during 1966, 1967, and 1968 from a plot in Smith and Wyss with geodetic values in Scholz's paper. For the 34 pairs of data points we compared, creepmeter values appeared to average $0.23 \pm .06$ of geodetic values and this ratio was used to calculate creepmeter data points for October 31, November 20, December 15, 1966, and January 4, 1967.

(4) *Goulty N.R. and Gilman, R.* (1978), Repeated creep events on the San Andreas fault near Parkfield, California recorded by a strainmeter array: Journal of Geophysical Research v. 83, no. B11, pp. 5415–5419.

Creepmeter data points for CRR1 from 1967 through 1976 were taken from a figure in the Goulty paper. Data points from 1976 to December 1979 were taken from field readings in Neil Goulty's field notebook, which he graciously turned over to us in 1979. Points after December, 1979, were taken from USGS field readings and on–site Rustrak records. The cumulative reset was added to all points.

Possible errors include:

1. Reading data points from creep plots: ±2 mm
2. Reading data points from geodetic plots: ±1.5 mm
3. Possible interpolation error, creep data from geodetic data: ±1.9 mm (4 data points only)
4. Possible error by Wallace and Roth in measurements of coseismic and postseismic creep at Highway 46 immediately after earthquakes: ±3.2 mm (early measurements). By August 1966, the white line was wearing away and accurate measuring had become more difficult.

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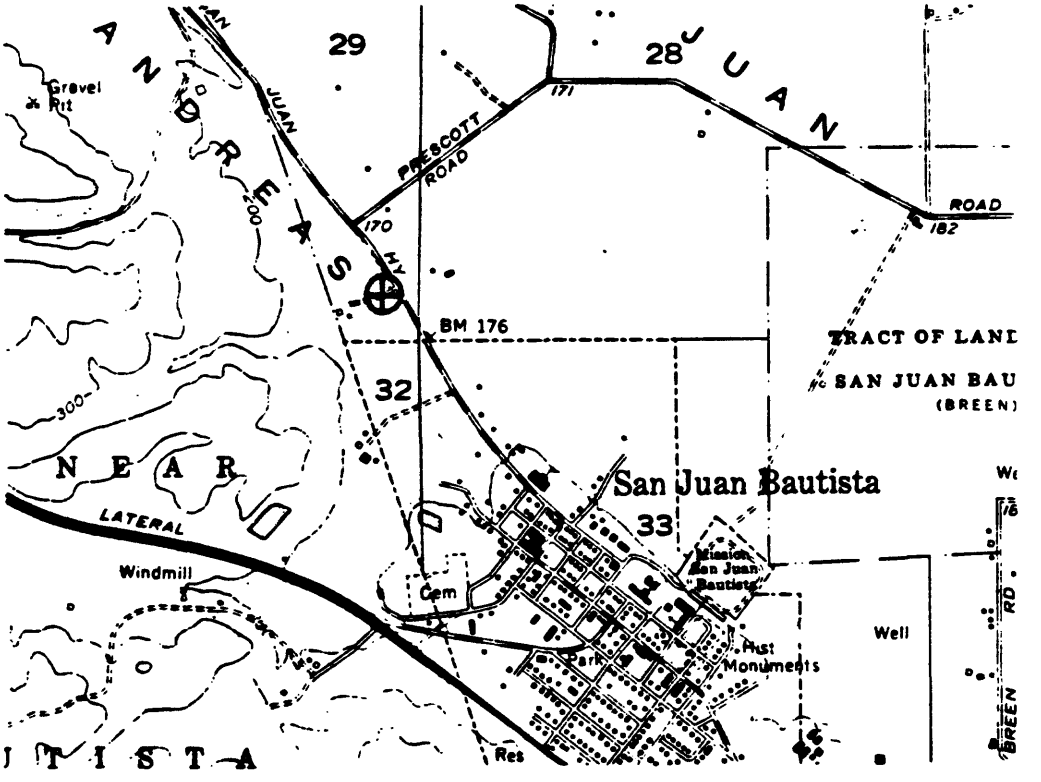
## STATION SJN1

Latitude 36° 51.3'
Longitude 121° 32.7'

Position 307.7 km
12-meter rods, ø=45°

The San Juan Bautista (Nyland Ranch) creepmeters were installed during August, 1968, on the San Andreas fault at a site 1.4 km northwest of Mission San Juan Bautista. The installation consisted of a pair of crossed rods buried in alluvium a few centimeters below a nearly flat surface. Creep activity at this site was composed of occasional minor events of up to 1 mm in amplitude, superimposed on a background of nearly steady-state long-term slip of about 8 mm/yr, with a distinct seasonal variation. SJN1 was destroyed in early 1980 during excavation of a broken water pipe, and a replacement instrument was installed in June, 1980. Measurements from a nearby alinement array were used to establish a starting point for the data from the new instrument. This instrument in turn was destroyed in summer, 1982, during installation of a natural gas line to the landowner's house. A replacement instrument was installed in August, 1982, but high ground water made operation of the instrument extremely difficult. The site was abandoned in August, 1985.

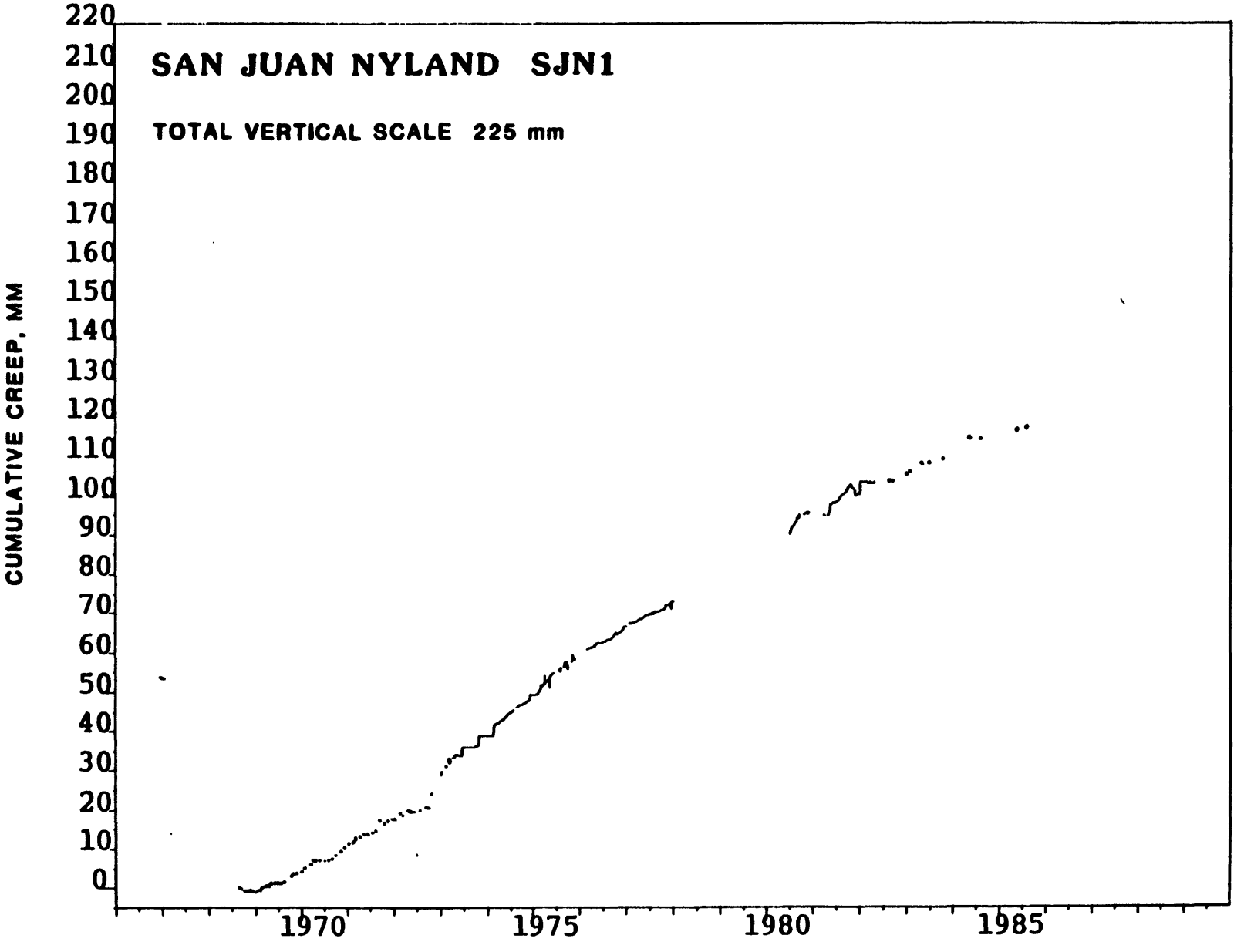



SAN JUAN BAUTISTA QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** SJN1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | 23 | 0.00 | 5 | -0.06* | 4 | 0.54 | 5 | 0.50 | 2 | 0.68 |
| 1969 | 7 | 0.64 | 5 | 0.91 | 7 | 2.04 | 4 | 2.20 | 12 | 2.75 | 6 | 2.78 | 15 | 2.79 | 8 | 2.86 | 17 | 3.69 | 6 | 4.28 | 19 | 5.26 | 30 | 5.57 |
| 1970 | | | 3 | 6.66 | 10 | 7.62 | 15 | 8.47 | 26 | 8.47 | 29 | 8.46 | 29 | 8.47 | 10 | 8.47 | 2 | 8.83 | 1 | 9.69 | 5 | 10.87 | 3 | 11.89 |
| 1971 | 6 | 12.77 | 5 | 13.43 | 4 | 14.17 | 7 | 14.54 | 5 | 15.10 | 9 | 15.36 | 9 | 15.54 | 11 | 15.82 | 14 | 17.27 | 13 | 18.02 | 17 | 18.89 | 16 | 18.99 |
| 1972 | 17 | 18.99 | 15 | 20.31 | 14 | 20.17 | 18 | 21.29 | 16 | 20.98 | 16 | 21.07 | 26 | 21.30 | | | 7 | 21.89 | 4 | 22.06 | 29 | 27.47 | | |
| 1973 | 12 | 29.78 | 8 | 30.97 | 5 | 32.11 | 24 | 33.87 | 24 | 33.80 | | | 12 | 35.90 | | | 13 | 35.98 | | | 20 | 38.92 | | |
| 1974 | | | 1 | 38.78 | 23 | 42.01 | | | | | 7 | 44.08 | | | 19 | 46.05 | | | 29 | 47.55 | | | | |
| 1975 | 16 | 49.49 | 26 | 51.07 | | | | | | | | | 9 | 55.51 | | | | | 24 | 57.69 | 19 | 58.62 | | |
| 1976 | | | 11 | 60.86 | | | 20 | 61.69 | | | | | | | 18 | 63.40 | | | 1 | 64.94 | 4 | 65.13 | 8 | 66.56 |
| 1977 | 17 | 67.18 | 10 | 67.55 | 19 | 68.20 | 14 | 68.51 | | | | | 15 | 70.16 | 10 | 70.54 | | | 4 | 70.93 | | | 30 | 73.02 |
| 1978 | | | 27 | 73.81 | 27 | 74.08 | 24 | 74.46 | 24 | 76.72 | 20 | 76.05 | | | | | 15 | 77.84 | 11 | 78.39 | 16 | 79.06 | | |
| 1979 | | | | | 2 | 67.42 | | | | | 7 | 67.43 | | | | | | | | | | | | |
| 1980 | | | | | | new instrument; trend extrapolated | | | | | 27 | 90.00 | 30 | 92.26 | 28 | 94.50 | | | 7 | 95.03 | | | 4 | 95.42 |
| 1981 | | | 10 | 93.38 | 9 | 94.94 | 17 | 95.29 | | | 1 | 98.47 | | | | | 8 | 100.99 | | | | | 4 | 99.98 |
| 1982 | | | | | | | | | new instrument; trend extrapolated | | | | | | 12 | 103.80 | 1 | 103.75 | | | | | 30 | 105.33 |
| 1983 | 20 | 105.91 | | | | | 26 | 107.72 | | | 30 | 108.46 | | | | | | | 13 | 109.32 | | | | |
| 1984 | | | | | | | | | 4 | 114.58 | | | 30 | 114.54 | | | | | | | | | | |
| 1985 | | | | | | | | | 16 | 116.92 | | | 19 | 117.18 | | removed August 1985 | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

Negative numbers indicate cumulative left-lateral movement.

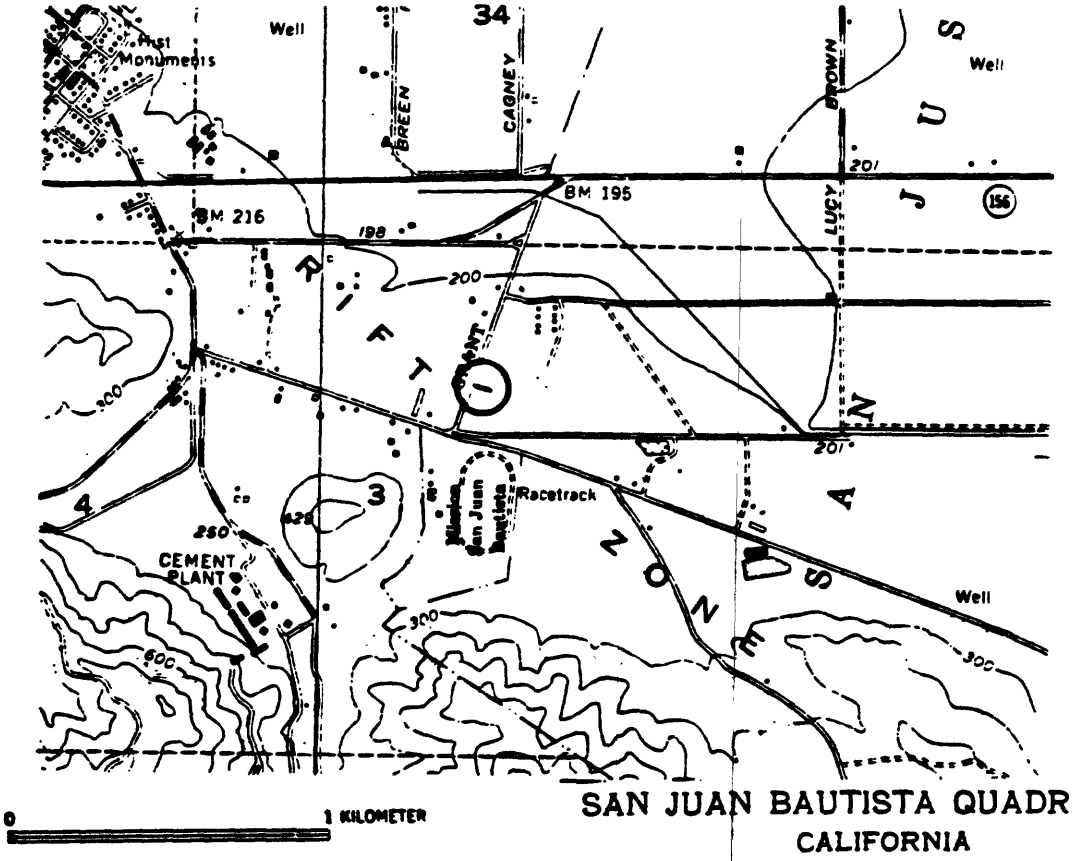

SAN JUAN NYLAND SJN1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION XSJ2

Latitude 36° 50.2'
Longitude 121° 31.2'

Position 310.8 km
20-meter wire, ø=30°

The San Juan Bautista (Mission Vineyard Road) creepmeter was installed during November, 1974, on the San Andreas fault at a site 1.7 km southeast of Mission San Juan Bautista as a replacement for a 10-meter wire instrument (XSJ1) that was destroyed during November, 1973. The installation consists of a single wire entrenched about 1 meter below the surface across a slight scarp on the northeast side of a shallow fault-line trough on a broad, low alluvial fan. Creep activity at this site is composed of distinct events of up to about 5 mm in amplitude, superimposed on a background of zero to slight right- or left-lateral drift. Data from XSJ1 has been merged with that of XSJ2 to provide a semi-continuous record from 1969 to the present. The data gap between destruction of XSJ1 and installation of XSJ2 was bridged by extrapolation of the 1973 XSJ1 trend and data from a nearby alinement array. The average long-term creep rate is about 7 mm/yr.

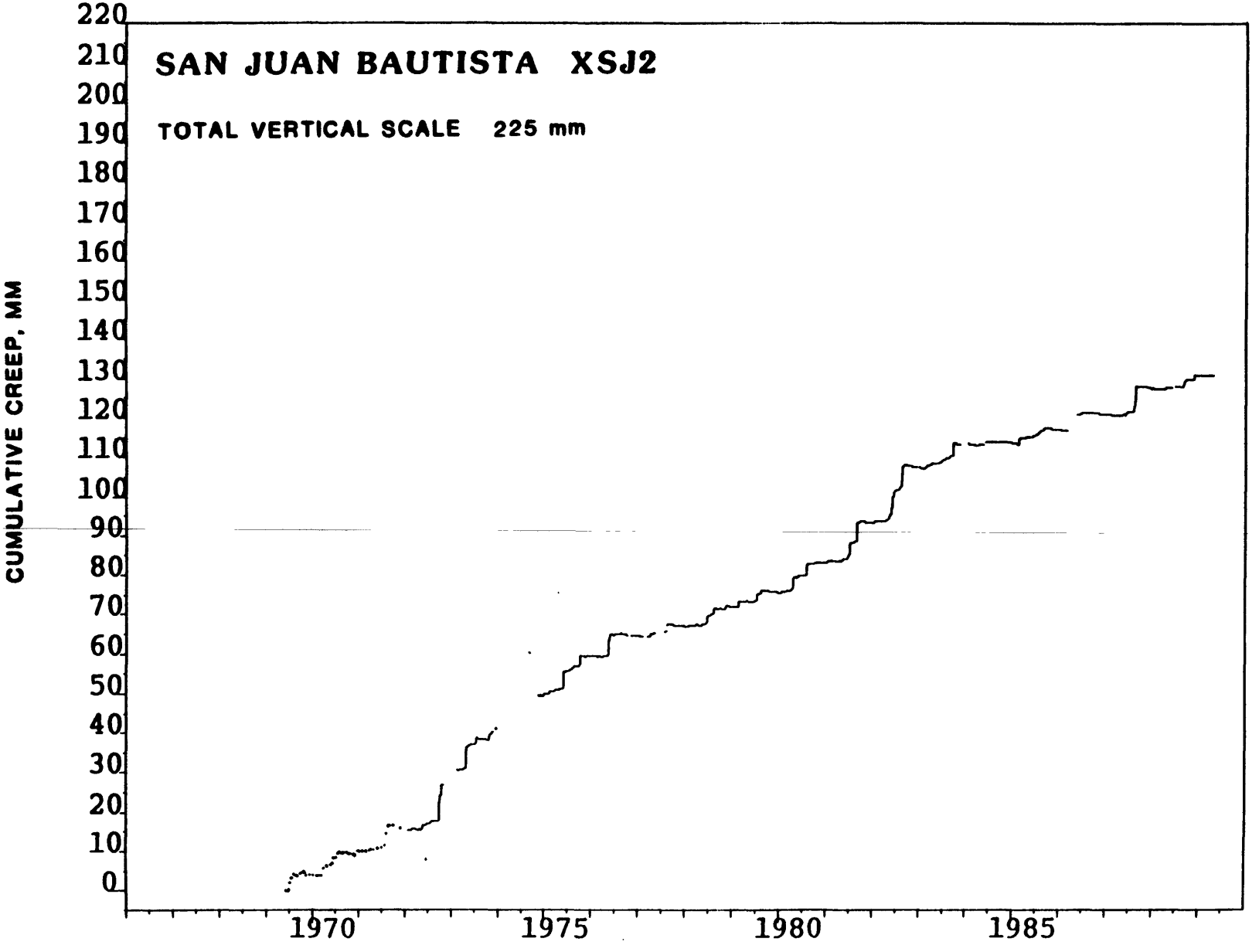



SAN JUAN BAUTISTA QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XSJ2

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 5 | 0.00 | 9 | 1.94 | 6 | 3.52 | 3 | 3.73 | 3 | 4.41 | 6 | 4.49 | 7 | 3.95 |
| 1970 | 4 | 3.80 | 1 | 3.92 | 2 | 3.91 | 5 | 6.06 | 3 | 6.29 | 7 | 6.83 | 3 | 8.30 | 2 | 9.79 | 5 | 9.52 | 4 | 9.57 | 8 | 9.30 | 28 | 9.92 |
| 1971 | 3 | 9.82 | 7 | 9.91 | 7 | 10.14 | 1 | 10.29 | 9 | 10.42 | 4 | 10.57 | 8 | 10.85 | 6 | 11.46 | 9 | 16.42 | 3 | 16.22 | 26 | 15.65 | 2 | 15.64 |
| 1972 | 26 | 15.45* | 2 | 15.41* | 1 | 15.62 | 1 | 15.71 | 5 | 15.60 | 5 | 16.86 | 3 | 17.06 | 3 | 17.65* | 6 | 17.79 | 1 | 17.87 | 5 | 26.90 | | flooded |
| 1973 | | | 22 | 30.74* | 2 | 30.69* | 5 | 30.88 | 1 | 36.35* | 5 | 37.01 | | | 1 | 38.57 | 10 | 38.30 | | | 9 | 39.82 | destroyed | |
| 1974 | | | | | | | | | | | | | | | new instrument; trend extrapolated | | | | | | 13 | 49.50 | 24 | 50.02 |
| 1975 | 14 | 50.00 | | | | | 12 | 50.83 | 22 | 51.32 | | | 8 | 55.87 | 15 | 56.87 | | | | | 19 | 59.50 | | |
| 1976 | | | 3 | 59.48 | | | | | 13 | 59.87 | | | | | 19 | 64.99 | | | 13 | 64.76 | 4 | 64.78 | 8 | 64.59 |
| 1977 | 17 | 64.45 | | | 3 | 64.29 | 14 | 65.02 | | | | | 15 | 65.64 | 10 | 67.35 | 8 | 67.44 | 4 | 67.29 | 4 | 67.40 | 30 | 66.92 |
| 1978 | | | 27 | 67.51 | 27 | 67.48 | 24 | 68.58 | 24 | 67.66 | | | 19 | 70.12 | 23 | 71.89 | 15 | 71.82 | 11 | 71.89 | 16 | 72.92 | | |
| 1979 | 6 | 72.30 | 5 | 72.20 | 2 | 72.44 | | | | | 6 | 72.86 | | | 9 | 75.91 | | | 22 | 76.82 | 16 | 76.02 | | |
| 1980 | 4 | 75.89 | 27 | 76.19 | | | | | | | 4 | 79.93 | | | | | 4 | 82.94 | | | | | 4 | 82.96 |
| 1981 | | | | | 9 | 83.51 | 17 | 83.88 | | | 1 | 84.05 | | | | | 8 | 93.45 | | | | | 4 | 93.58 |
| 1982 | | | 23 | 93.99 | | | | | | | 4 | 97.41 | | | | | 1 | 107.57 | | | | | 30 | 107.56 |
| 1983 | | | | | 28 | 108.03 | | | | | 30 | 109.02 | | | | | 9 | 109.97 | 4 | 113.38 | | | | |
| 1984 | 13 | 113.49 | | | | | 25 | 113.77 | 31 | 113.93 | | | 30 | 113.85 | | | | | 30 | 114.09 | | | | |
| 1985 | 30 | 113.36 | | | | | | | 16 | 115.34 | | | 26 | 116.32 | 8 | 116.56 | | | | | 1 | 117.12 | | |
| 1986 | 29 | 116.76 | | | 12 | 116.92 | 18 | 120.10 | 9 | 120.90 | | | | | 13 | 121.50 | | | | | 20 | 121.18 | | |
| 1987 | | | 19 | 120.82 | | | | | 28 | 121.67 | | | | | 25 | 127.74 | | | | | 23 | 128.05 | | |
| 1988 | | | 11 | 127.26 | | | | | 18 | 127.78 | 22 | 127.98 | | | 19 | 127.66 | | | | | 29 | 130.87 | | |

*1972-73 data point determined from mechanical micrometer readings. Other 1972-73 entries are from on-site analog records. Pre-1972 and post-1973 entries are all based on micrometer readings.

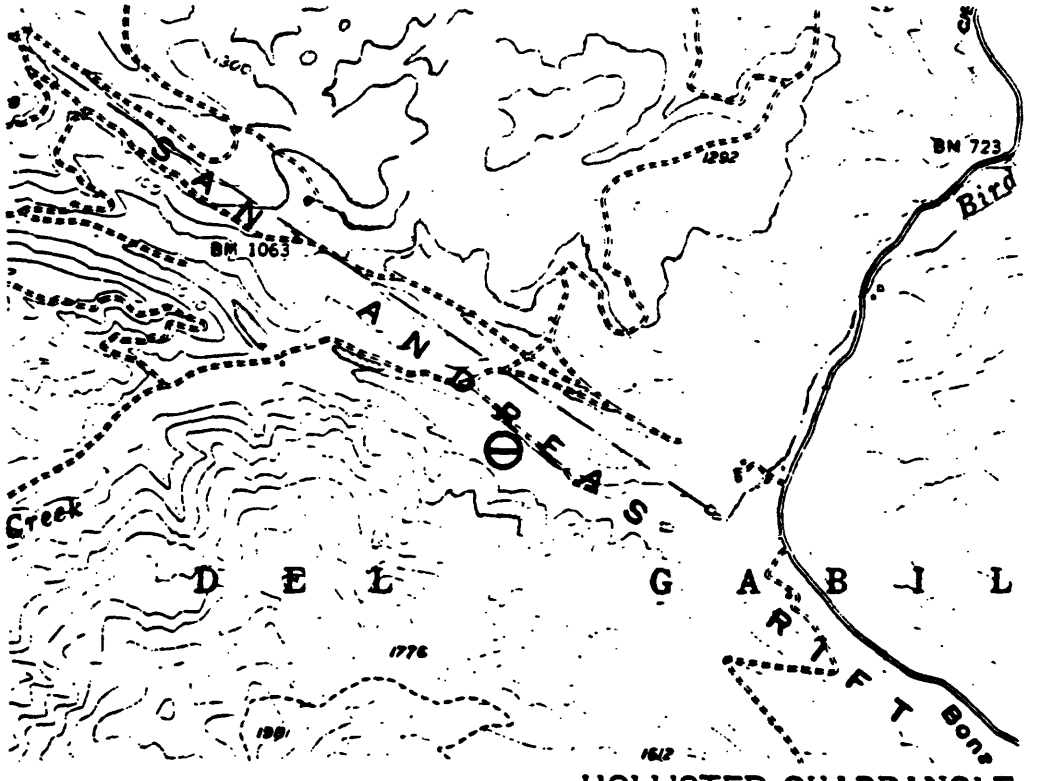

SAN JUAN BAUTISTA XSJ2
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

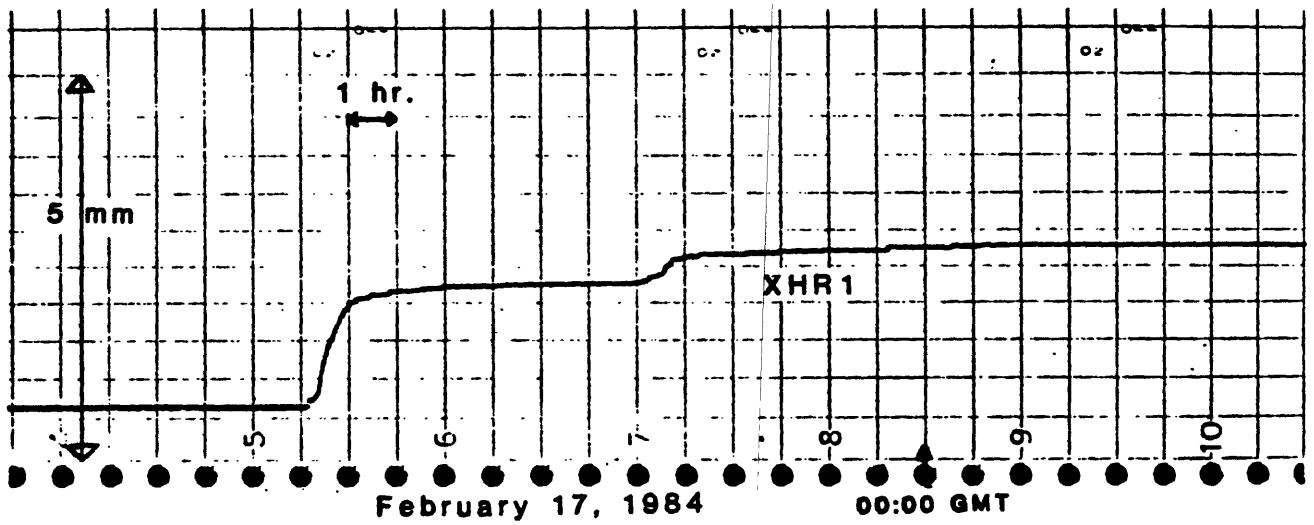
## STATION HRS3, XHR1, XHR2

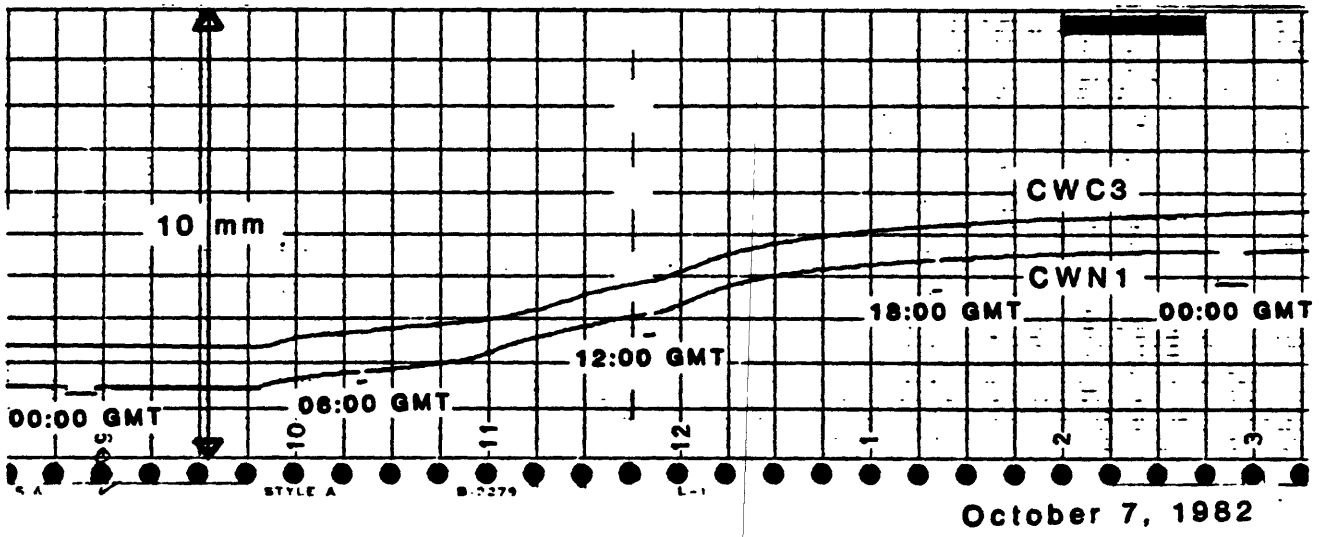
Latitude 36° 46.3'
Longitude 121° 25.3'

Position 321.9 km
30-meter wire, ø=22°

The Harris Ranch rod creepmeter (HRS1) was installed during June, 1969, on the San Andreas fault at a site 12.8 km southeast of San Juan Bautista. The installation consisted of a single rod buried a few centimeters below the surface on the gentle slope of a stream terrace. In September, 1970, a second rod was installed (HRS3), and data presented here are from this second instrument and later replacements of it. HRS3 records show the effects of considerable instrumental friction. The instrument was replaced in July, 1980, by a new wire creepmeter, XHR1, which was plagued by periodic wire breakages. Zero was lost in late 1984, and a new specially-plated wire (XHR2) was installed in April, 1985, and the cumulative total restarted at 0. Creep events recorded by HRS3 rod had appeared as single friction steps. However, the more sensitive wire instruments XHR1 and XHR2 show single events to be two or more close-spaced events, similar to those frequently recorded at Cienega Winery (CWN1 and CWC3) creepmeters 4.1 km southeast down Cienega Valley from XHR2 (see illustration). The long-term creep rate at Harris Ranch has averaged from 6 mm/yr to 9 mm/yr, depending on the time period measured. Average rate during the last 3 years is 8.9 mm/yr. Slippage occurs in distinct events of 1 to 4 mm in size, with little movement between events.





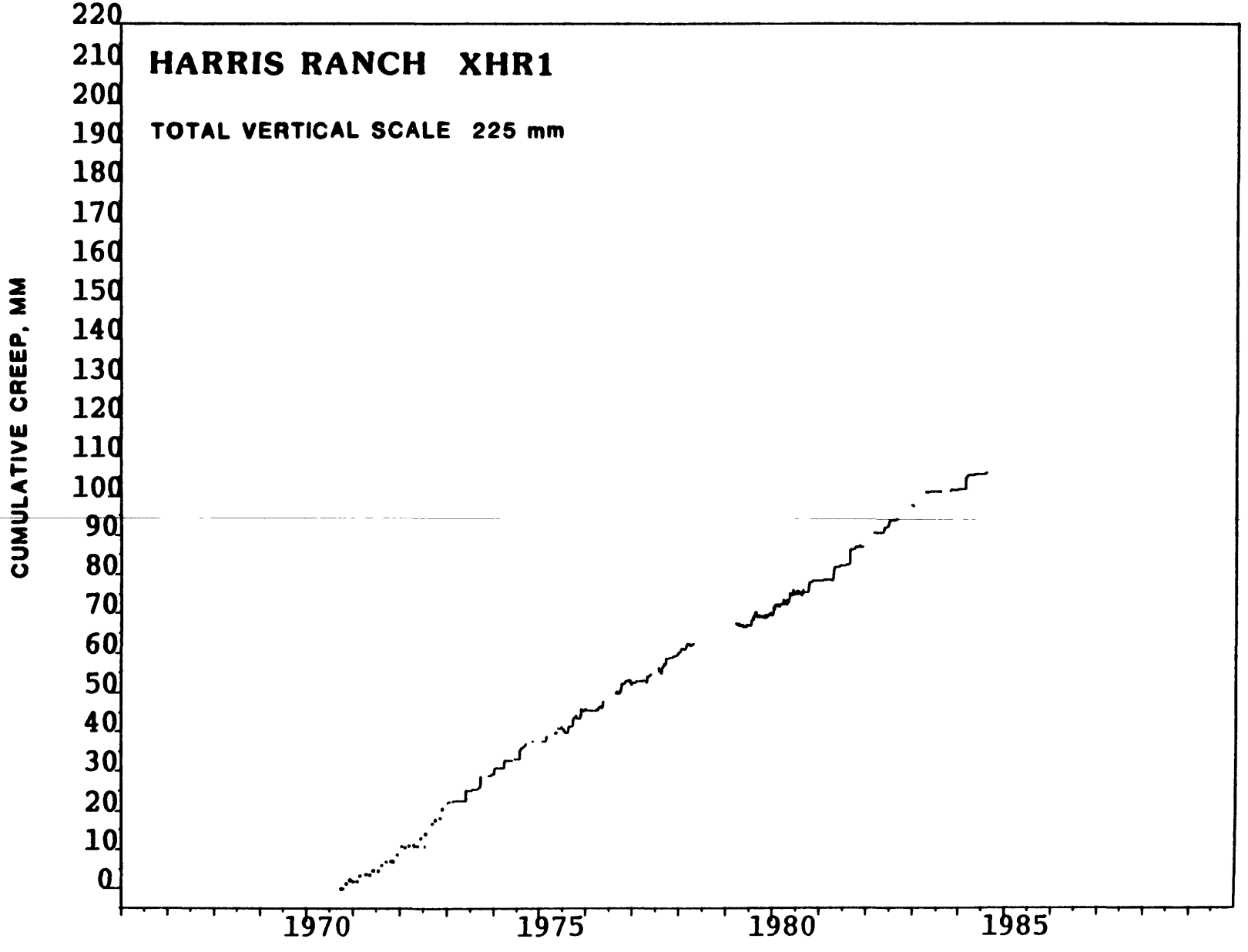



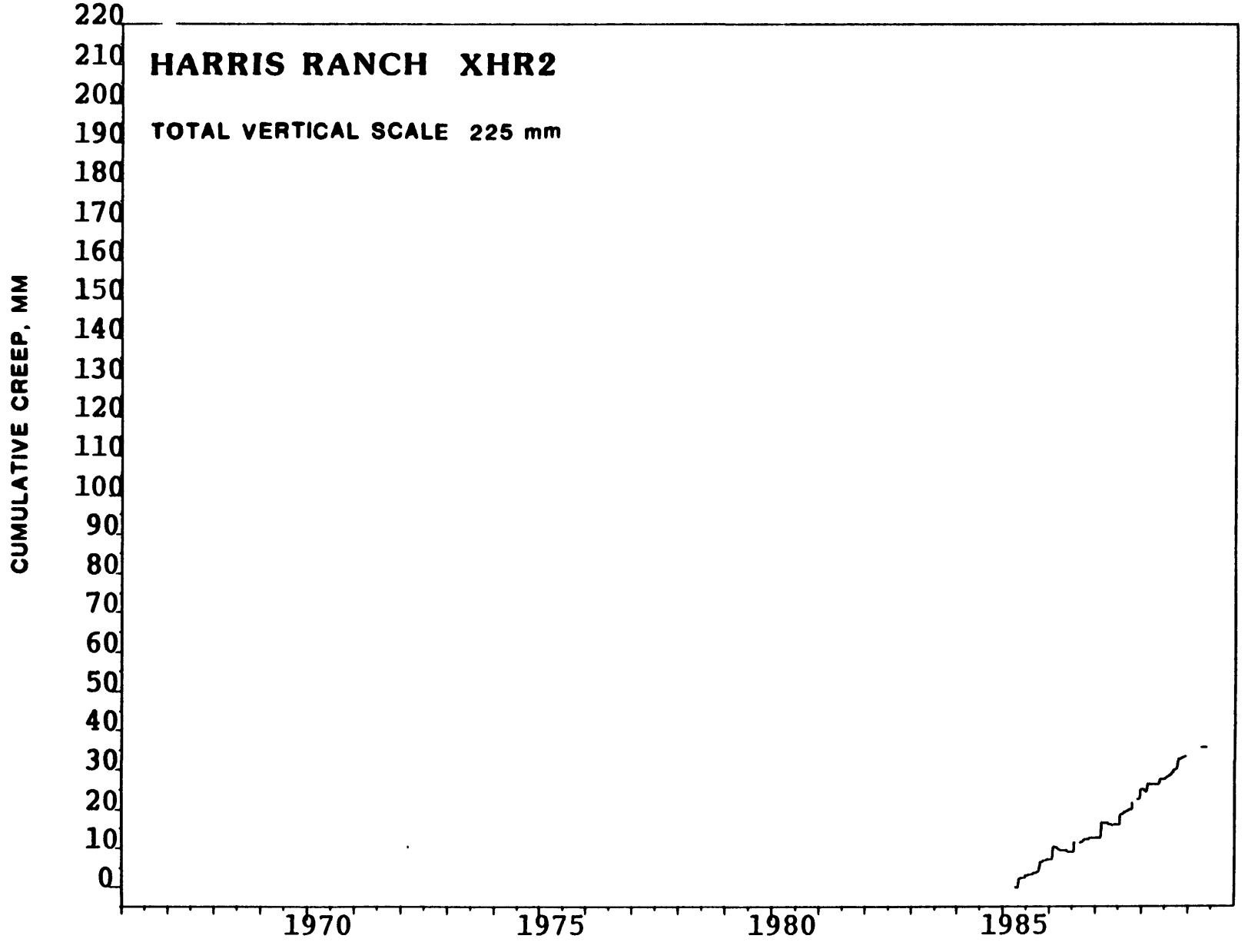

**MULTIPLE CREEP EVENTS CHARACTERISTIC OF CIENEGA VALLEY PORTION OF SAN ANDREAS FAULT**

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** **STATION** HRS3, XHR1, XHR2

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | 24 | 0.00 | 16 | 0.01 | 4 | 1.42 | 4 | 1.85 |
| 1971 | 7 | 1.86 | 6 | 1.93 | 5 | 3.40 | 8 | 3.47 | 6 | 3.65 | 9 | 4.67 | 10 | 4.70 | 12 | 6.28 | 15 | 6.83 | 14 | 7.18 | 18 | 7.20 | 17 | 8.72 |
| 1972 | 18 | 10.62 | 16 | 10.66 | 15 | 11.07 | 20 | 10.95 | 17 | 10.96 | 17 | 12.65 | 27 | 14.22 | | | 8 | 16.83 | 5 | 17.42 | 28 | 20.31 | | |
| 1973 | 10 | 22.27 | 5 | 22.45 | 7 | 22.49 | | | 23 | 22.63 | | | 11 | 25.21 | | | 11 | 26.11 | | | 15 | 28.98 | | |
| 1974 | 31 | 30.93 | | | 19 | 30.94 | | | | | 4 | 33.07 | | | 19 | 36.14 | | | 29 | 37.46 | | | | |
| 1975 | 16 | 37.74 | 26 | 39.11 | | | | | 2 | 39.43 | | | | | 15 | 41.37 | | | | | 19 | 45.25 | | |
| 1976 | | | 11 | 45.55 | | | 26 | 46.32 | | | | | | | 18 | 49.95 | 17 | 50.06 | 6 | 52.43 | 3 | 52.71 | 8 | 52.74 |
| 1977 | 17 | 52.82 | | | 19 | 53.01 | 13 | 53.02 | | | | | 15 | 55.69 | 11 | 55.85 | | | 3 | 58.86 | 16 | 59.19 | | |
| 1978 | 11 | 60.72 | | | | | 19 | 61.97 | 24 | 61.98 | | | | | 9 | 62.22 | 15 | 64.71 | | | 16 | 64.76 | | |
| 1979 | | | | | 2 | 67.29 | | | | | 6 | 67.11 | | | 17 | 70.02 | | | | | 15 | 70.13 | | |
| 1980 | | | 28 | 72.83 | 11 | 72.61 | 24 | 73.69 | 1 | 73.69 | 4 | 76.04 | 31 | 76.04 | 22 | 76.04 | XHR1 installed | | | | | | 8 | 78.53 |
| 1981 | | | | | 9 | 76.61 | | | | | 2 | 82.30 | | | 5 | 82.84 | 8 | 86.34 | 15 | 87.37 | 30 | 87.68 | | |
| 1982 | 14 | 87.99 | 22 | 90.71 | | | | | 21 | 92.12 | 2 | 92.19 | | | | | 1 | 94.13 | | | | | 15 | 97.49 |
| 1983 | | | | | 29 | 101.22 | 4 | 101.01 | | | 29 | 101.19 | | | | | | | 13 | 101.17 | | | | |
| 1984 | 12 | 102.03 | | | | | | | 4 | 105.51 | | | 31 | 105.76 | | | | | | | | | | |
| 1985 | | | | | XHR2 installed | | 4 | 0.00 | 17 | 2.25 | | | 25 | 3.32 | | | | | | | 1 | 6.81 | | |
| 1986 | 29 | 10.25 | | | | | | | 21 | 8.95 | | | | | 28 | 11.42 | | | | | 20 | 12.48 | | |
| 1987 | | | 18 | 16.34 | | | | | 27 | 15.97 | | | | | 24 | 19.35 | | | | | 23 | 22.47 | | |
| 1988 | | | 11 | 24.89 | | | | | 19 | 26.71 | | | | | 18 | 25.48 | | | | | 22 | 34.43 | | |

Values for this station in earlier catalogs reflect use of a 45-degree angle correction. It was discovered during installation of XHR2 that the angle is really 22 degrees. Thus, the values in this table differ from values in earlier catalogs.


HARRIS RANCH XHR1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

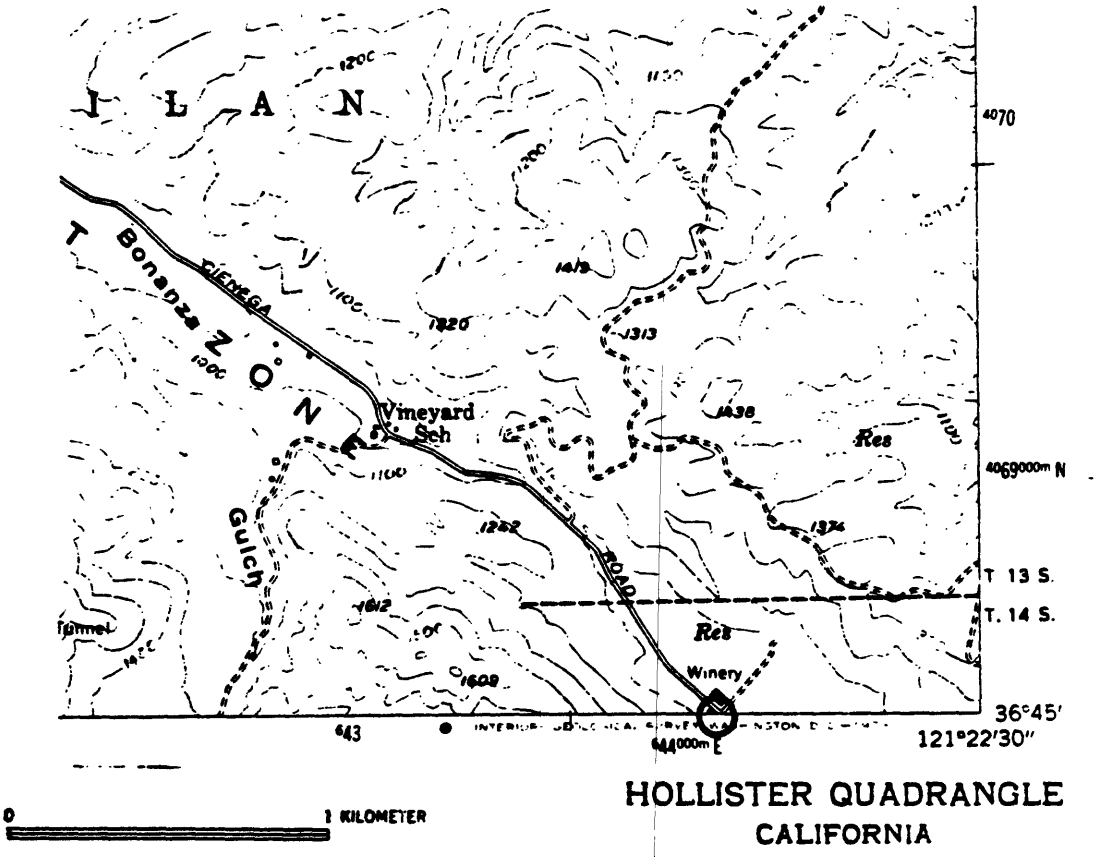

HARRIS RANCH XHR2
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION CWN1

Latitude 36° 45.0'
Longitude 121° 23.1'

Position 326.0 km
15-cm beam, $\phi$=0°

The Cienega Winery (North) creepmeter was installed during June, 1972, on the San Andreas fault at the Winery site 16.9 km southeast of San Juan Bautista. The installation is near the northwest wall of the winery building. Components of the beam instrument are bolted to adjacent concrete slabs of the winery floor. The beam crosses a construction joint that is approximately parallel to, and centered over, the underlying fault trace. Outside of the building the fault trace is characterized by a line of prominent springs along a steep, northeast-facing scarp at the base of a broad high ridge. Creep activity at this site consists of distinct events of up to about 3.5 mm in amplitude. superimposed on a background of zero to slight right-lateral slip. The average long-term creep rate is about 11.5 mm/yr.

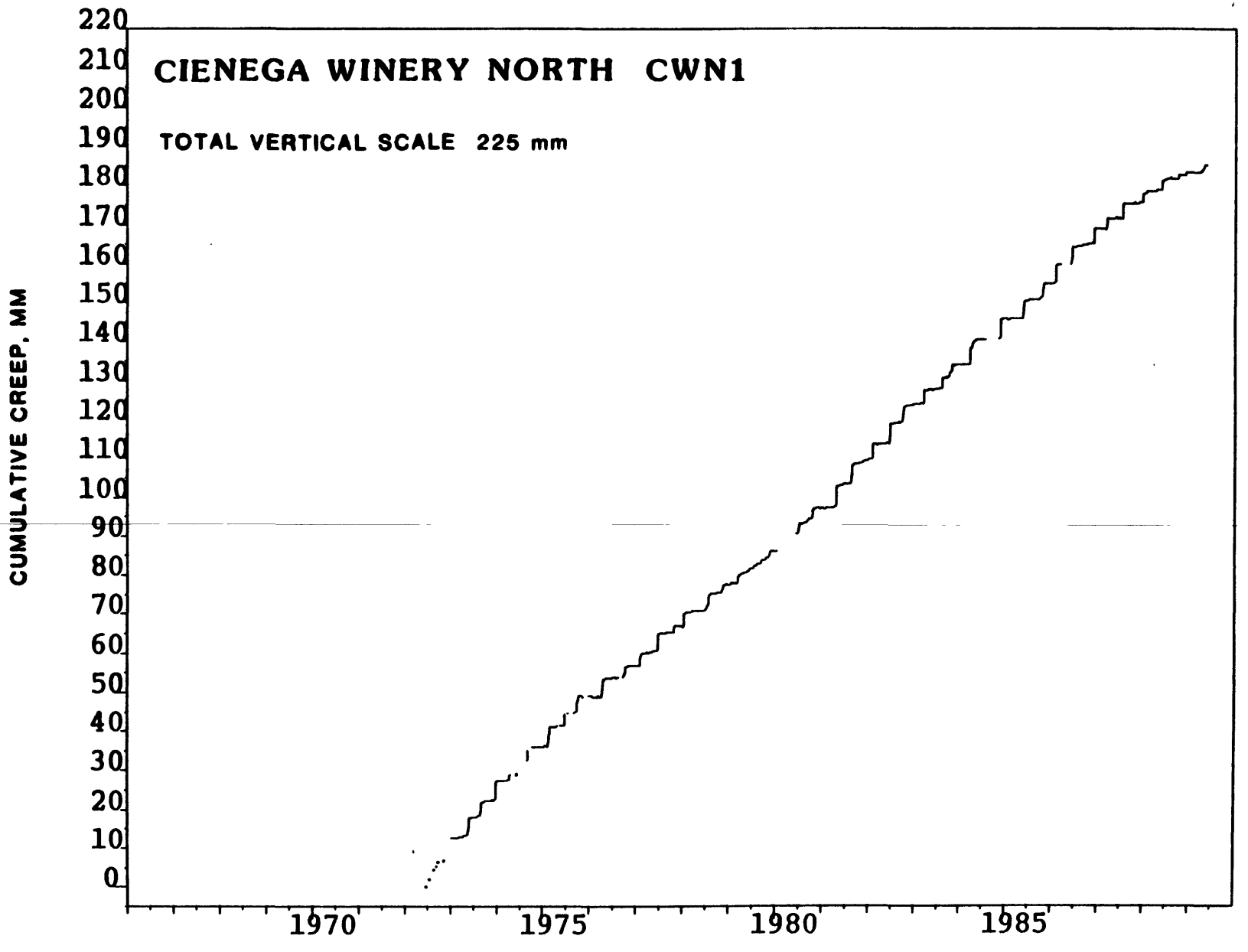



HOLLISTER QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** **STATION** CWN1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | 29 | 0.00 | 26 | 2.09 | 24 | 4.39 | 7 | 6.24 | 4 | 6.54 | 27 | 6.81 | | |
| 1973 | 10 | 12.49 | 6 | 12.67 | 7 | 12.82 | | | 23 | 13.83 | | | 11 | 17.97 | | | 11 | 21.82 | | | 15 | 22.22 | | |
| 1974 | 17 | 22.17 | | | 19 | 27.37 | 25 | 28.88 | | | | | | | 19 | 28.88 | | | 29 | 32.28 | | | | |
| 1975 | 16 | 32.45 | 26 | 37.39 | | | | | 7 | 37.64 | | | | | 22 | 40.93 | | | | | 19 | 45.33 | 17 | 45.38 |
| 1976 | 16 | 45.49 | | | | | | | 12 | 49.84 | | | | | 18 | 50.23 | 17 | 53.77 | 1 | 55.86 | 4 | 56.19 | 8 | 56.38 |
| 1977 | 17 | 56.41 | | | | | 14 | 59.76 | 25 | 59.96 | | | 18 | 64.65 | 11 | 64.71 | | | 3 | 64.93 | 4 | 66.32 | 2 | 66.38 |
| 1978 | 11 | 69.98 | 27 | 70.47 | | | 4 | 70.74 | | | | | | | 9 | 74.86 | 15 | 75.32 | 11 | 75.49 | 16 | 77.10 | | |
| 1979 | | | | | 2 | 77.85 | | | | | 6 | 80.92 | | | 17 | 81.37 | | | | | 15 | 85.55 | | |
| 1980 | 16 | 86.00 | 28 | 86.43 | 11 | 86.48 | 10 | 88.98 | 1 | 90.48 | 2 | 90.54 | 1 | 93.11 | | | 4 | 94.11 | | | | | 4 | 97.33 |
| 1981 | | | | | 9 | 97.56 | | | | | 2 | 103.07 | 20 | 103.48 | | | 4 | 108.32 | | | 30 | 109.34 | | |
| 1982 | | | 22 | 113.37 | | | | | | | 2 | 113.76 | | | | | 1 | 119.06 | | | | | 30 | 123.74 |
| 1983 | | | 29 | 127.09 | | | | | 3 | 127.42 | 29 | 127.64 | | | 23 | 130.51 | 29 | 130.77 | | | | | | |
| 1984 | 12 | 133.95 | | | | | | | 4 | 139.86 | | | | | 1 | 140.24 | | | 30 | 140.67 | 8 | 140.68 | | |
| 1985 | 31 | 145.77 | | | | | | | 17 | 146.09 | 18 | 150.40 | 25 | 150.71 | | | | | | | 1 | 154.83 | | |
| 1986 | 27 | 159.19 | | | 12 | 159.64 | | | 21 | 159.77 | | | | | 14 | 164.91 | | | | | 20 | 168.86 | | |
| 1987 | | | 18 | 169.23 | | | | | 27 | 171.80 | | | | | 24 | 174.70 | | | | | 20 | 174.78 | | |
| 1988 | | | 11 | 178.00 | | | | | 19 | 178.42 | | | | | 18 | 181.51 | | | | | 23 | 182.77 | | |

Note: A non-tectonic left-lateral step of 5.09 mm reflected in the 1/16/75 reading was subtracted and the trend extrapolated to show consistent right-lateral movement.

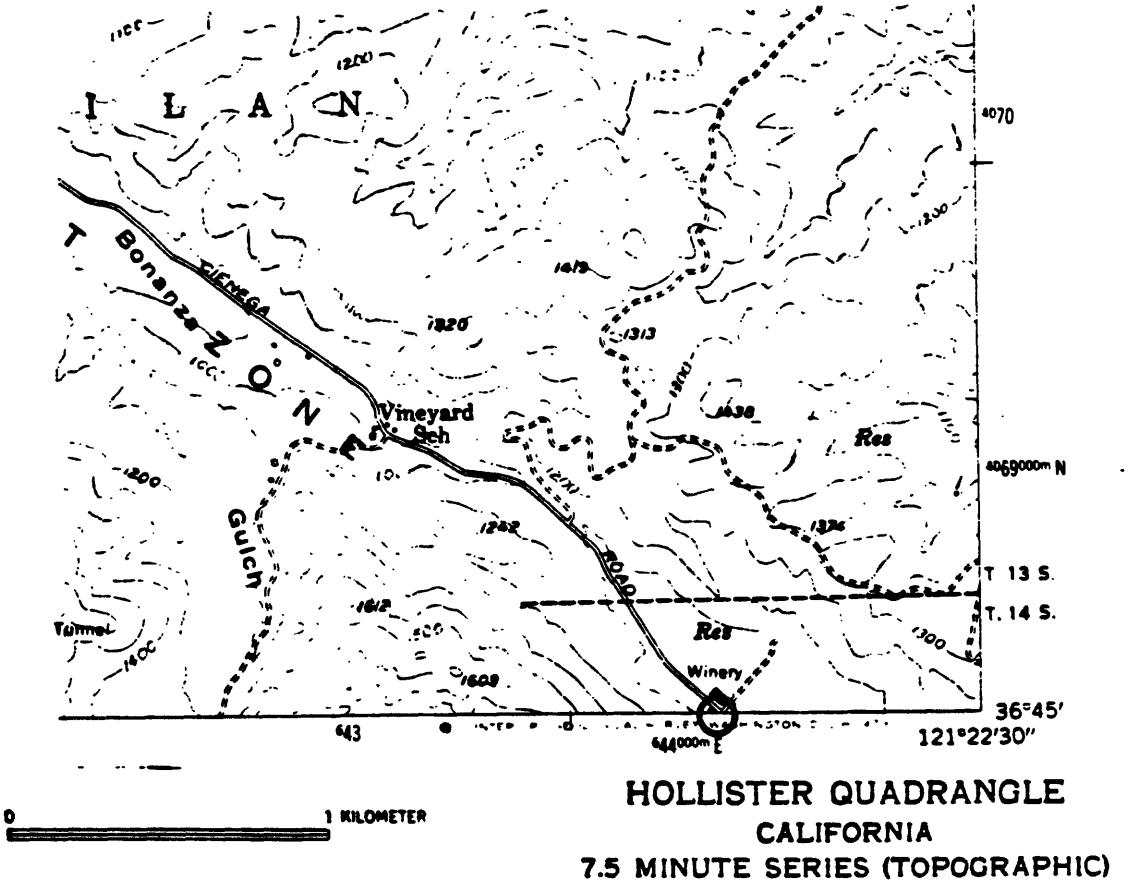

CIENEGA WINERY NORTH CWN1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION CWC3

Latitude 36° 45.0'
Longitude 121° 23.1'

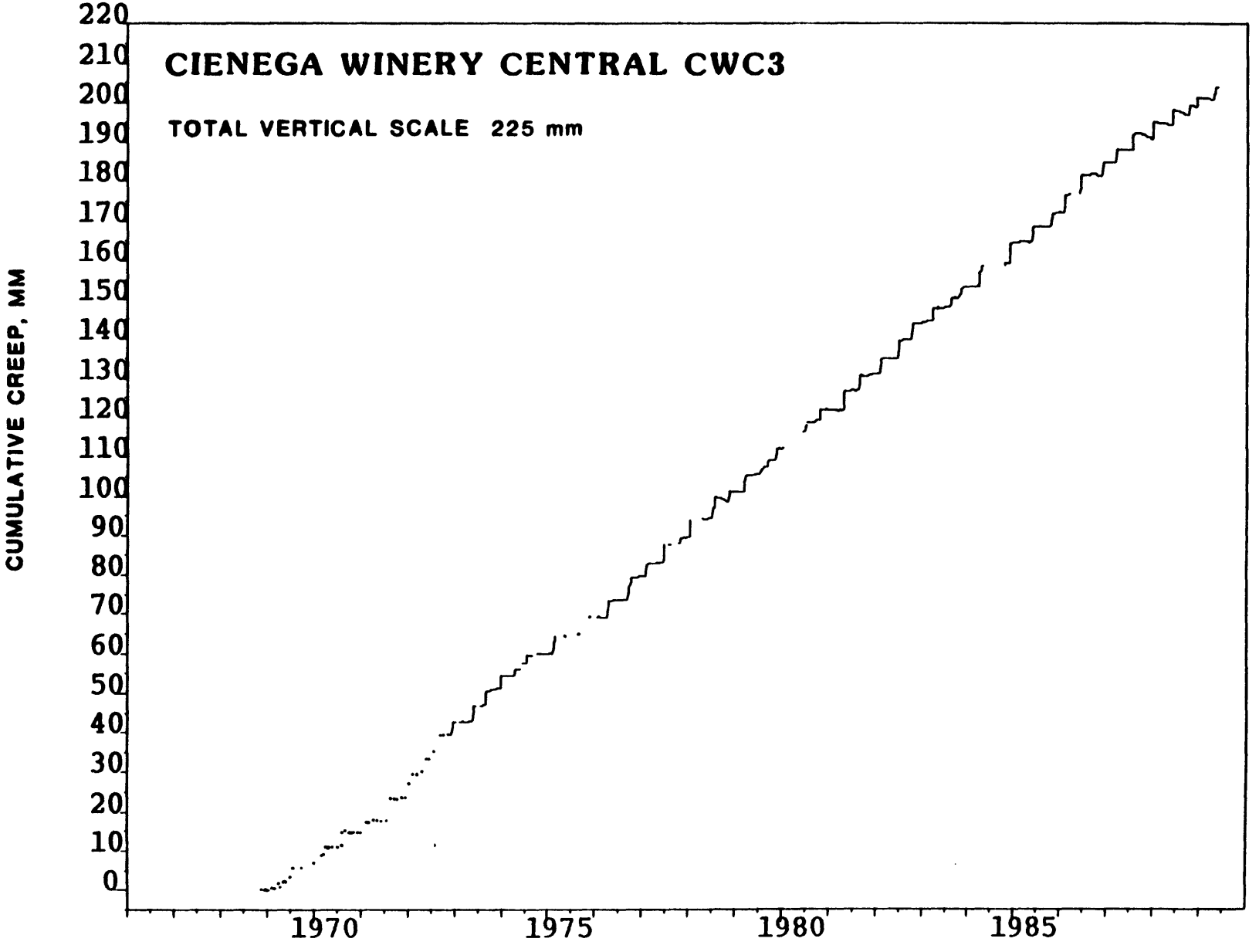
Position 326.0 km
15-cm beam, ø=0°

The Cienega Winery (Central) creepmeter was installed near the center of the winery building during October, 1968, as a replacement for an instrument installed by the University of California (Berkeley) in 1958. The CWC3 creepmeter was constructed in a manner similar to that described for CWN1, at a point 30 meters farther southeast along the same construction joint. Records from CWC3 and CWN1 are practically identical, except that some of the event amplitudes are slightly smaller at CWC3, and the long-term apparent creep rate from CWC3 records is usually somewhat lower, perhaps due to local complexities in the building at a strong crosswall attached to both floor slabs near the instrument.



**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** CWC3

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | 29 | 0.00 | 15 | 1.27 | 7 | 1.41 |
| 1969 | 6 | 1.48 | 17 | 1.61 | 7 | 1.82 | 7 | 2.06 | 6 | 3.13 | 30 | 4.57 | 24 | 6.69 | 15 | 6.87 | 26 | 7.03 | | | | | 30 | 8.35 |
| 1970 | | | 3 | 8.33 | 9 | 8.35 | 28 | 10.72 | 26 | 10.73 | 29 | 10.81 | 29 | 11.02 | 3 | 14.34 | 2 | 14.68 | 1 | 14.46 | 3 | 14.51 | 3 | 14.51 |
| 1971 | 6 | 14.61 | 5 | 16.95 | 4 | 17.19 | 7 | 17.23 | 5 | 17.23 | 8 | 17.24 | 9 | 17.26 | 11 | 23.02 | 14 | 23.08 | 13 | 23.19 | 18 | 23.35 | 16 | 23.46 |
| 1972 | 17 | 26.84 | 15 | 29.05 | 13 | 29.20 | 19 | 29.83 | 16 | 32.94 | 16 | 33.06 | 26 | 35.01 | | | 7 | 38.96 | 4 | 39.26 | 27 | 39.52 | | |
| 1973 | 10 | 42.60 | 6 | 42.49 | 7 | 42.48 | | | 23 | 43.39 | | | 11 | 46.79 | | | 11 | 50.54 | | | 15 | 50.92 | | |
| 1974 | 17 | 54.52 | | | 19 | 54.54 | | | | | 4 | 57.79 | | | 19 | 59.48 | | | 29 | 59.80 | | | | |
| 1975 | 16 | 60.06 | 26 | 64.17 | | | | | 7 | 64.32 | | | | | 22 | 65.12 | | | | | 19 | 69.13 | | |
| 1976 | 16 | 69.13 | | | | | | | 12 | 73.44 | | | | | 18 | 73.56 | 17 | 76.93 | 1 | 78.99 | 4 | 79.36 | 8 | 79.59 |
| 1977 | 17 | 79.73 | | | | | 13 | 83.06 | 25 | 83.10 | | | 18 | 87.72 | 11 | 87.78 | | | 3 | 87.91 | 4 | 89.25 | 2 | 89.28 |
| 1978 | 11 | 93.99 | 27 | 94.19 | | | 19 | 94.26 | | | | | | | 9 | 99.50 | 15 | 99.47 | 11 | 99.04 | 16 | 101.23 | | |
| 1979 | | | | | 2 | 101.23 | | | | | 6 | 105.65 | | | 17 | 108.34 | | | | | 15 | 111.75 | | |
| 1980 | 16 | 111.86 | 28 | 111.93 | 11 | 112.00 | 24 | 116.02 | 28 | 116.24 | 19 | 116.29 | 2 | 118.61 | | | 4 | 118.12 | | | | | 4 | 121.03 |
| 1981 | | | | | 9 | 120.77 | | | | | 2 | 126.83 | 20 | 126.83 | | | 17 | 130.50 | | | | | 1 | 131.10 |
| 1982 | | | 22 | 134.94 | | | | | | | 2 | 135.13 | | | | | 1 | 140.05 | | | | | 30 | 144.42 |
| 1983 | | | | | 29 | 147.79 | | | 3 | 148.03 | 29 | 148.14 | | | | | 29 | 150.45 | | | | | | |
| 1984 | 12 | 153.55 | | | | | | | 4 | 159.08 | | | | | 1 | 159.07 | | | 30 | 159.38 | 16 | 159.50 | | |
| 1985 | 8 | 164.48 | | | | | | | 17 | 166.47 | 18 | 168.51 | 25 | 168.39 | | | | | | | 1 | 172.01 | | |
| 1986 | 29 | 176.30 | | | 12 | 176.89 | | | 21 | 177.13 | | | | | 14 | 181.77 | | | | | 20 | 184.38 | | |
| 1987 | | | 18 | 184.75 | | | | | 27 | 187.94 | | | | | 24 | 192.09 | | | | | 20 | 191.40 | | |
| 1988 | | | 11 | 194.85 | | | | | 19 | 194.38 | | | | | 18 | 197.35 | | | | | 23 | 199.06 | | |

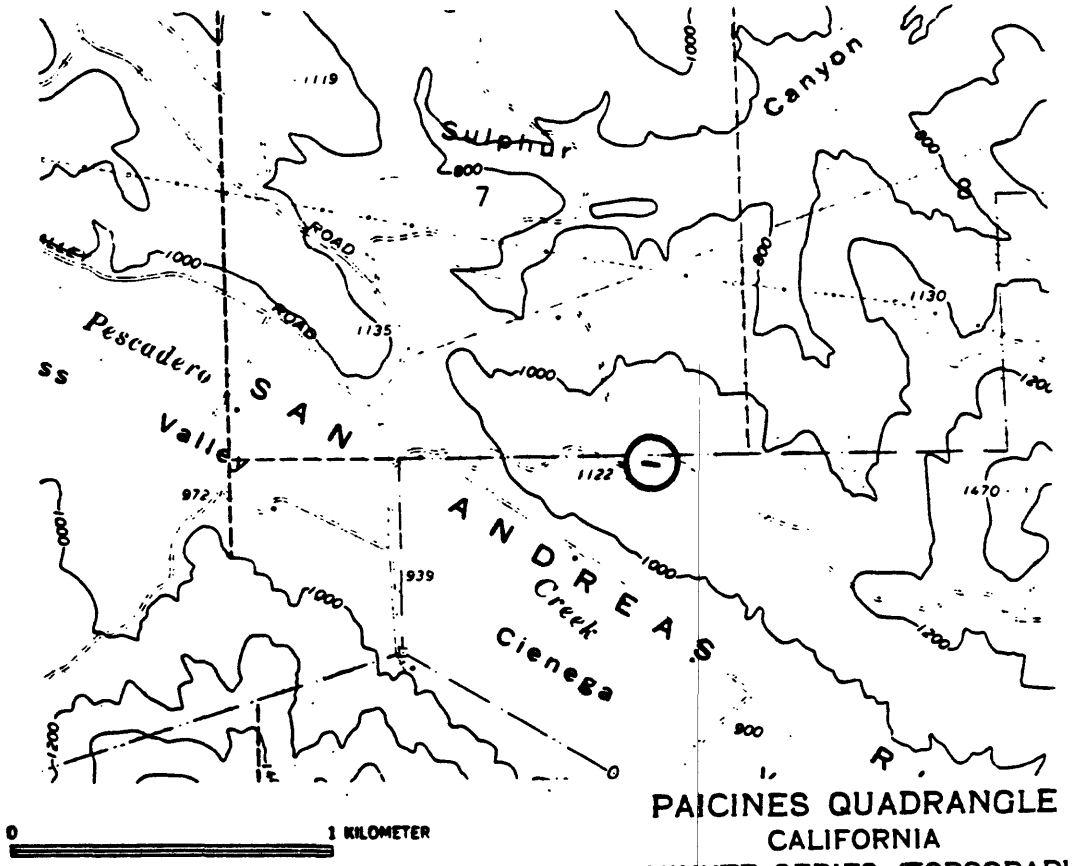

CIENEGA WINERY CENTRAL CWC3
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION XPR1

Latitude 36° 43.4'
Longitude 121° 20.9'

Position 330.0 km
20-meter wire, ø=30°

The Paicines Ranch creepmeter was installed during April and May, 1973, on the San Andreas fault at a site 20.9 km southeast of San Juan Bautista. The installation consisted of a single wire entrenched about 1 meter below the surface within a prominent fault-line trough along the crest of a broad ridge. Creep activity at this site was composed of distinct events of up to about 2.5 mm in amplitude, superimposed on a background of low- to moderate-rate right-lateral slip. The average long-term creep rate was about 13 mm/yr. The station was abandoned in 1979 at the request of the landowner.

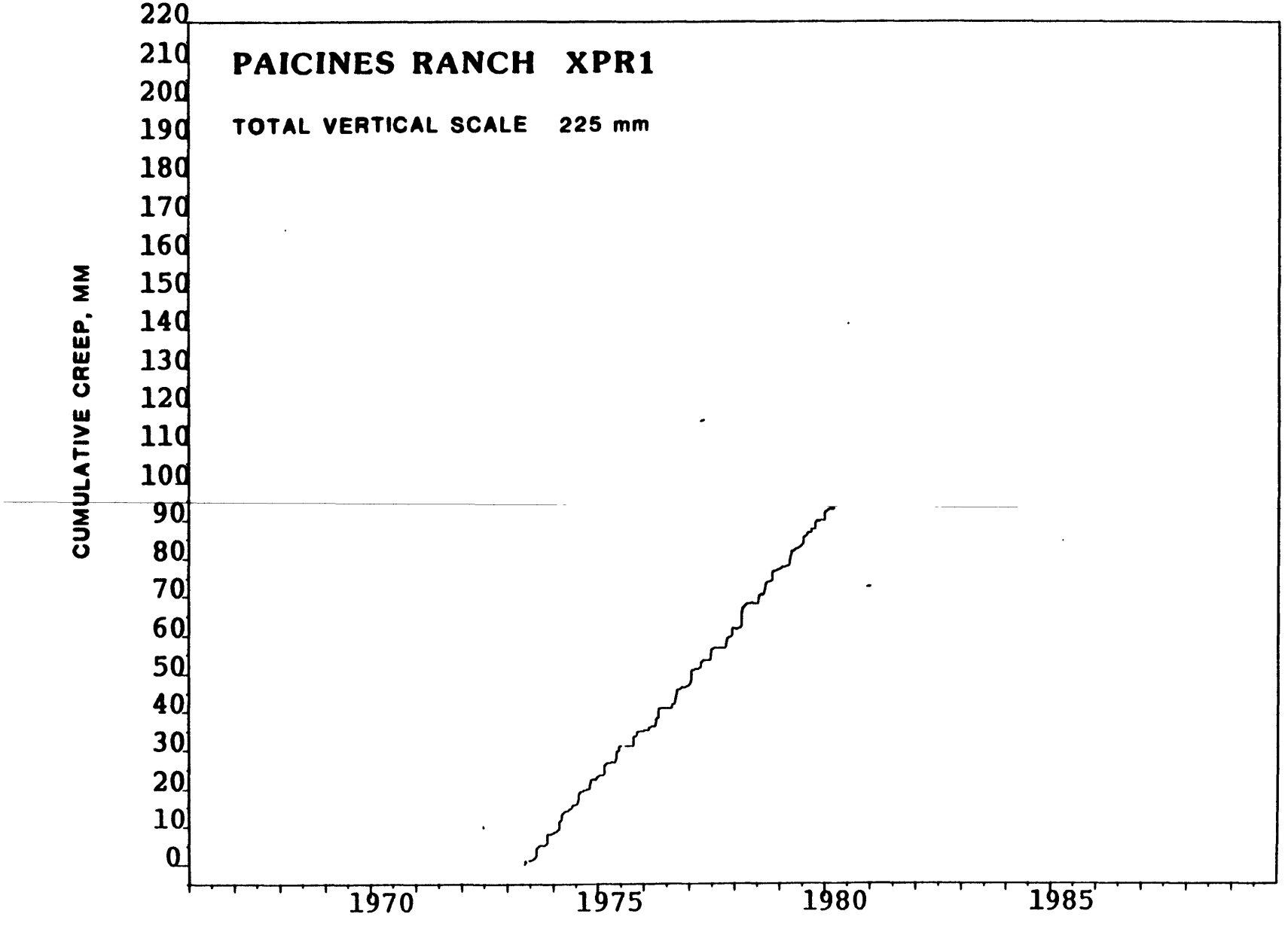



PAICINES QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XPR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | 22 | 0.00 | 27 | 1.19 | | | 1 | 1.47 | 13 | 4.98 | | | 7 | 5.41 | 20 | 8.23 |
| 1974 | 25 | 8.86 | 8 | 9.19 | | | 4 | 13.79 | 20 | 14.71 | | | 11 | 15.96 | 28 | 19.51 | | | 17 | 19.88 | | | 18 | 23.07 |
| 1975 | | | | | | | 4 | 26.77 | 6 | 26.96 | | | 24 | 31.03 | 15 | 31.06 | | | | | 19 | 34.98 | | |
| 1976 | | | 10 | 35.99 | | | | | 12 | 41.03 | | | | | 19 | 42.01 | | | 5 | 45.97 | 4 | 46.50 | 16 | 46.95 |
| 1977 | 18 | 50.80 | | | 19 | 51.46 | 14 | 53.11 | | | | | 18 | 56.73 | 11 | 56.74 | | | 3 | 56.80 | | | | |
| 1978 | 11 | 61.76 | | | | | 19 | 68.40 | | | | | | | 8 | 71.16 | | | | | 15 | 77.29 | | |
| 1979 | | | | | 7 | 79.50 | | | | | 6 | 83.60 | | | | | | | | | 16 | 90.50 | | abandoned |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

Station was abandoned in late 1979 at request of landowner.

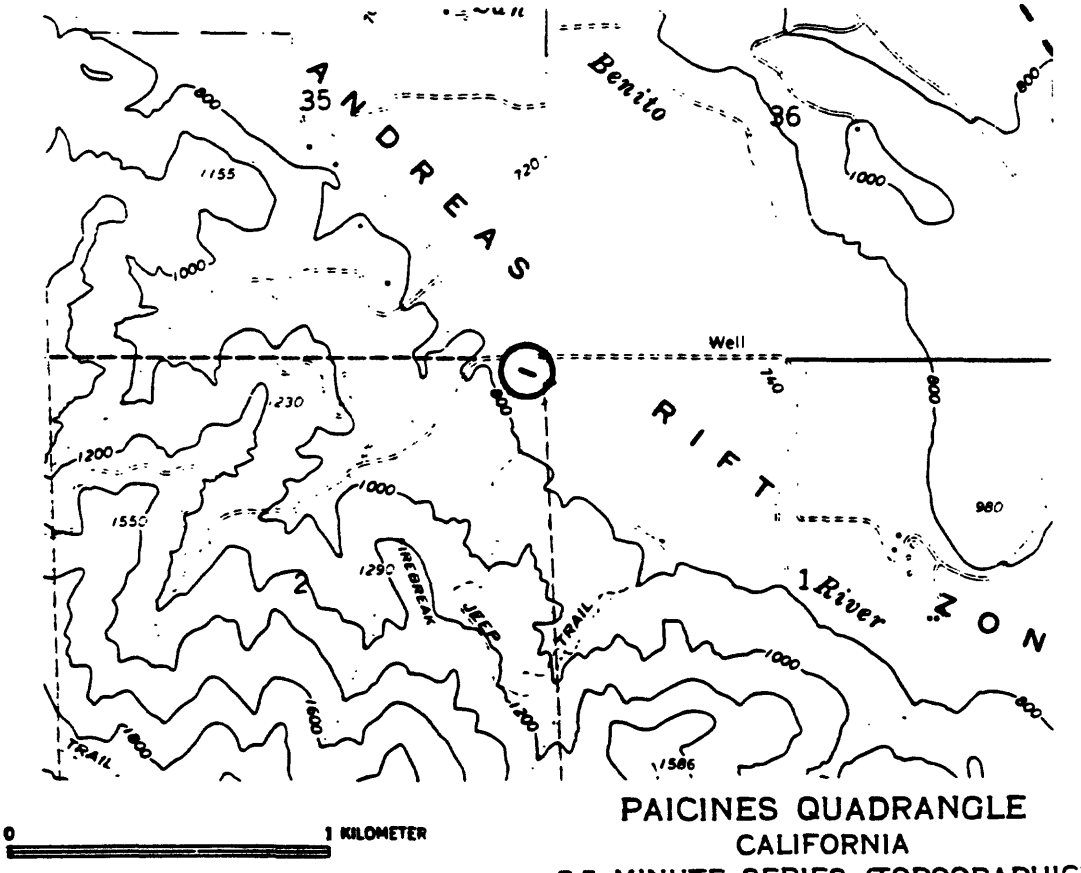

PAICINES RANCH XPR1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION XFL1

Latitude 36° 39.9'
Longitude 121° 16.3'

Position 339.4 km
27-meter wire, ϕ=30°

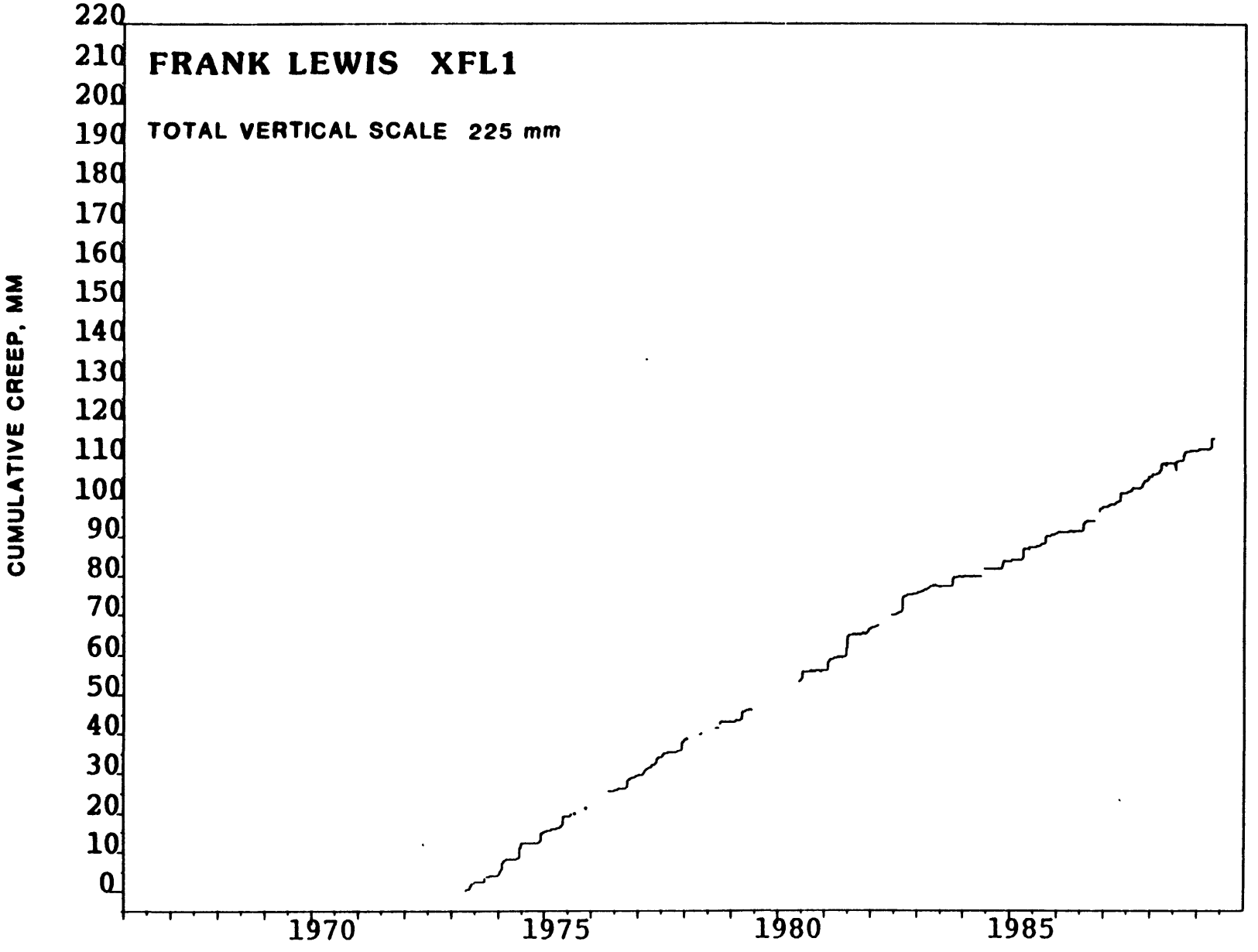
The Lewis Ranch creepmeter was installed during April, 1973, on the San Andreas fault at a site 30.3 km southeast of San Juan Bautista. The installation consists of a single wire entrenched about 1 meter below the surface across a prominent scarp on the northeast side of a bedrock pressure ridge, adjacent to the southwest edge of an abandoned river channel. Creep activity at this site is composed of distinct, gradual events of several days duration and up to about 3 mm in amplitude, superimposed on a background of low- to moderate-rate steady slip. The average long-term creep rate is about 7 mm/yr.




PAICINES QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XFL1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | 15 | 0.00 | | | 22 | 2.14 | 6 | 2.21 | 1 | 2.36 | 4 | 2.44 | | | 7 | 3.78 | 20 | 3.99 |
| 1974 | 28 | 5.52 | 8 | 7.36 | 11 | 7.97 | 4 | 8.01 | 20 | 8.22 | | | 11 | 12.31 | 28 | 12.24 | | | 16 | 12.37 | | | 18 | 16.03 |
| 1975 | | | 12 | 15.56 | | | 12 | 16.04 | 6 | 16.30 | | | 29 | 19.54 | 16 | 19.55 | | | | | 18 | 21.23 | | |
| 1976 | | | 10 | 21.80 | | | | | 5 | 25.22 | | | | | 19 | 26.00 | | | 6 | 27.82 | 4 | 28.63 | 16 | 29.22 |
| 1977 | 18 | 29.55 | | | 19 | 31.30 | 14 | 31.78 | | | | | 18 | 34.77 | 12 | 34.50 | | | 4 | 35.31 | 16 | 35.58 | | |
| 1978 | 11 | 38.72 | | | | | 19 | 39.86 | | | 20 | 40.41 | | | 8 | 41.11 | 21 | 41.11 | | | 15 | 43.18 | | |
| 1979 | | | | | 7 | 43.75 | | | | | 6 | 46.62 | | | 17 | 47.92 | | | | | 16 | 49.79 | | |
| 1980 | | | | | 20 | 51.68 | 24 | 52.29 | | | 5 | 53.30 | | | | | 4 | 55.89 | | | | | 8 | 56.21 |
| 1981 | | | | | 9 | 59.32 | | | | | 2 | 60.34 | | | | | 9 | 64.71 | | | | | 4 | 65.87 |
| 1982 | | | 22 | 67.02 | | | | | | | 4 | 69.96 | | | | | 1 | 73.15 | | | | | 30 | 75.57 |
| 1983 | | | | | 29 | 76.52 | | | | | 30 | 77.40 | | | | | 29 | 77.63 | | | | | | |
| 1984 | 12 | 79.64 | | | | | | | 31 | 81.88 | | | 31 | 82.07 | | | | | 30 | 83.71 | | | | |
| 1985 | 31 | 83.97 | | | | | 11 | 87.00 | 17 | 87.32 | | | 25 | 87.88 | | | | | | | 1 | 90.42 | | |
| 1986 | | | 6 | 91.16 | | | | | 21 | 91.34 | | | | | 13 | 93.79 | | | | | 20 | 96.38 | | |
| 1987 | | | 18 | 98.07 | | | | | 27 | 101.31 | | | | | 25 | 102.31 | | | | | 20 | 104.69 | | |
| 1988 | | | 12 | 106.14 | | | | | 18 | 109.29 | | | | | 30 | 109.68 | | | | | 29 | 112.19 | | |

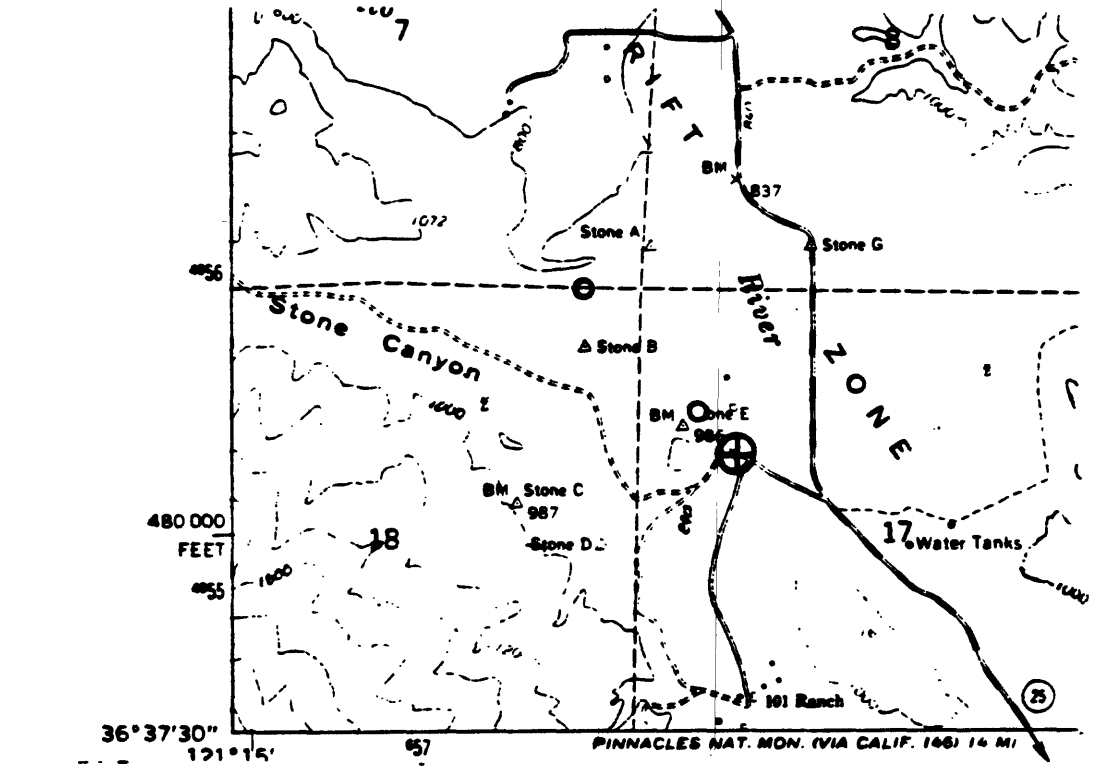

FRANK LEWIS XFL1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION SCR1

Latitude 36° 37.9'
Longitude 121° 13.9'

Position 344.9 km
10-12 meter rods, ø=45°

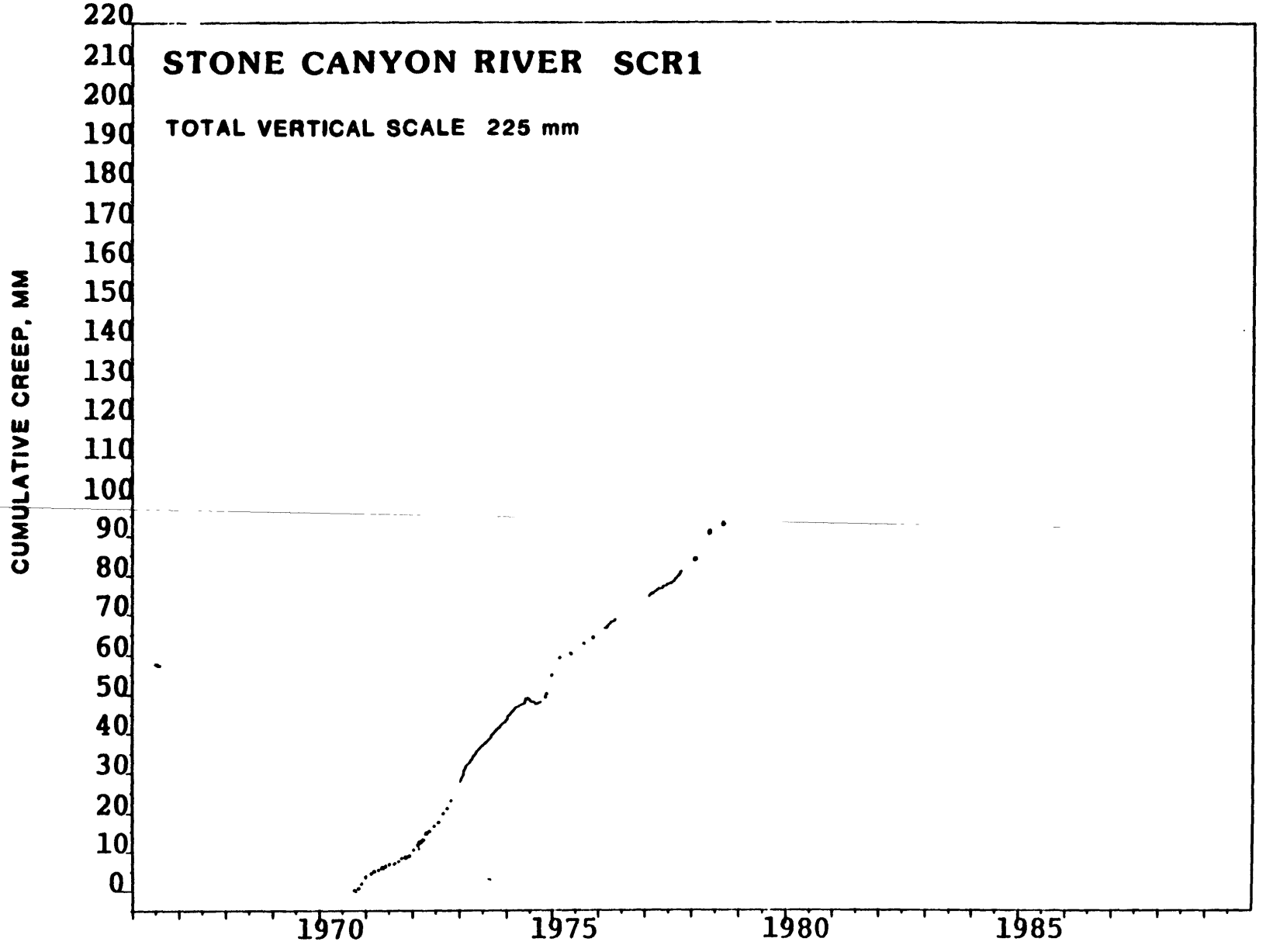
The Stone Canyon River (101 Ranch) creepmeters were installed during September, 1970, on the San Andreas fault at a site 35.8 km southeast of San Juan Bautista. The installation consisted of a pair of crossed rods buried a few centimeters below a nearly flat surface on a river terrace of the San Benito River. Creep activity at this site was composed of almost steady-state slip at an average long-term rate of about 11 mm/yr, with a distinct seasonal variation. The instruments were accidentally destroyed by earthmoving equipment in 1978.




CHERRY PEAK QUADRANGLE
CALIFORNIA—SAN BENITO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** SCR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | 24 | 0.00 | | | 3 | 0.51 | 2 | 1.97 |
| 1971 | 6 | 3.47 | 5 | 4.27 | 4 | 4.80 | 6 | 5.28 | 4 | 5.75 | 8 | 6.45 | 8 | 6.68 | 11 | 6.90 | 15 | 7.45 | 13 | 7.99 | 18 | 8.61 | 15 | 9.16 |
| 1972 | 17 | 10.68 | 15 | 11.44 | 13 | 12.35 | 19 | 14.31 | 15 | 15.18 | 15 | 16.24 | 26 | 17.41 | | | 4 | 19.66 | 4 | 20.86 | 29 | 25.13 | | |
| 1973 | 11 | 28.35 | 7 | 30.38 | 6 | 32.29 | | | 23 | 35.58 | | | 11 | 37.41 | | | 12 | 39.63 | | | 19 | 41.95 | | |
| 1974 | 14 | 44.62 | | | 21 | 46.84 | | | 31 | 48.82 | 5 | 49.10 | | | 20 | 47.55 | | | 30 | 49.38 | 7 | 49.95 | 18 | 54.90 |
| 1975 | | | 17 | 59.36 | | | | | 20 | 60.14 | | | | | 22 | 62.54 | | | | | 6 | 64.24 | | |
| 1976 | | | 10 | 66.63 | | | | | 11 | 68.75 | | | | | 18 | 70.38 | | | | | 4 | 73.21 | 28 | 74.13 |
| 1977 | 18 | 74.70 | | | 19 | 75.83 | 14 | 76.47 | | | | | 19 | 78.23 | 12 | 79.01 | | | 4 | 80.71 | 17 | 81.69 | | |
| 1978 | 11 | 83.96 | | | | | | | 2 | 90.61 | | | | | 8 | 92.73 | | destroyed | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

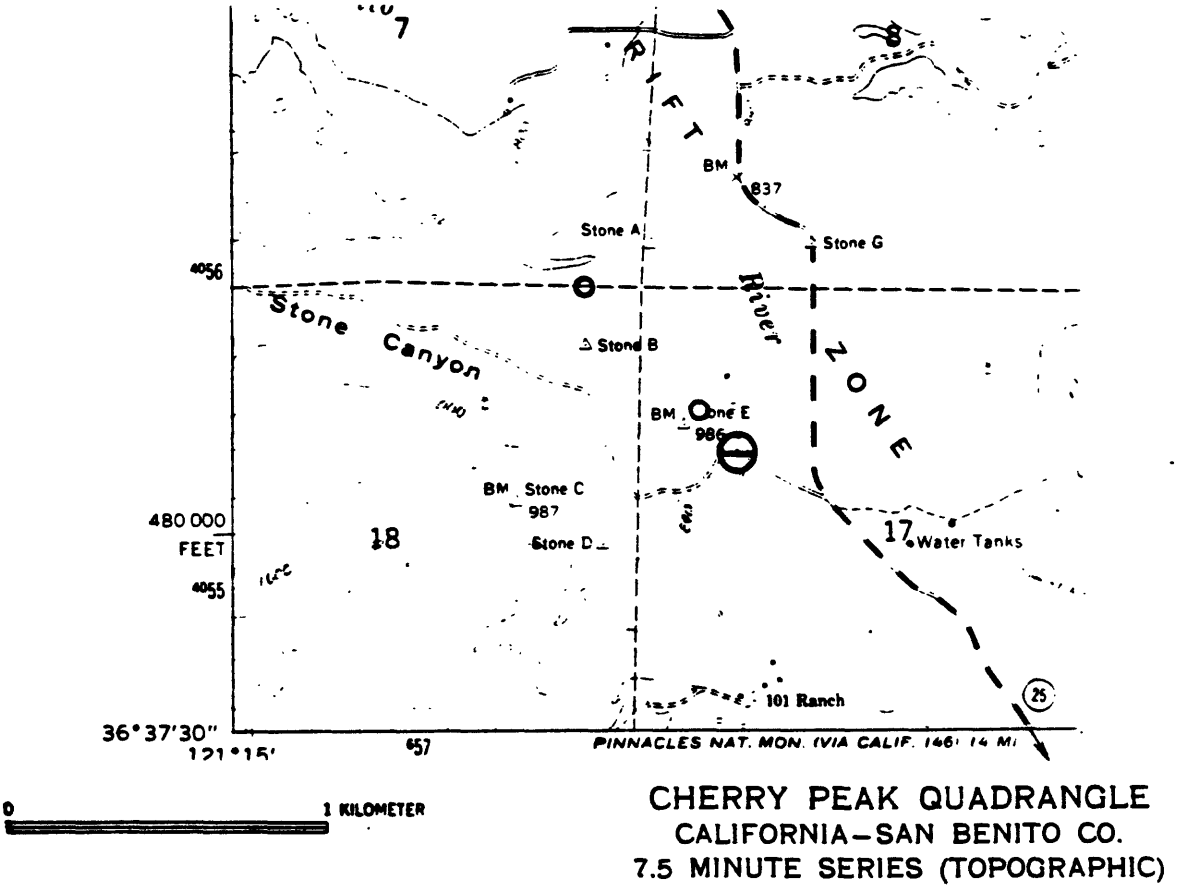

STONE CANYON RIVER SCR1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION SCR3

Latitude 36° 37.9'
Longitude 121° 13.9'

Position 344.9 km
23-meter rod, $\phi$=45°

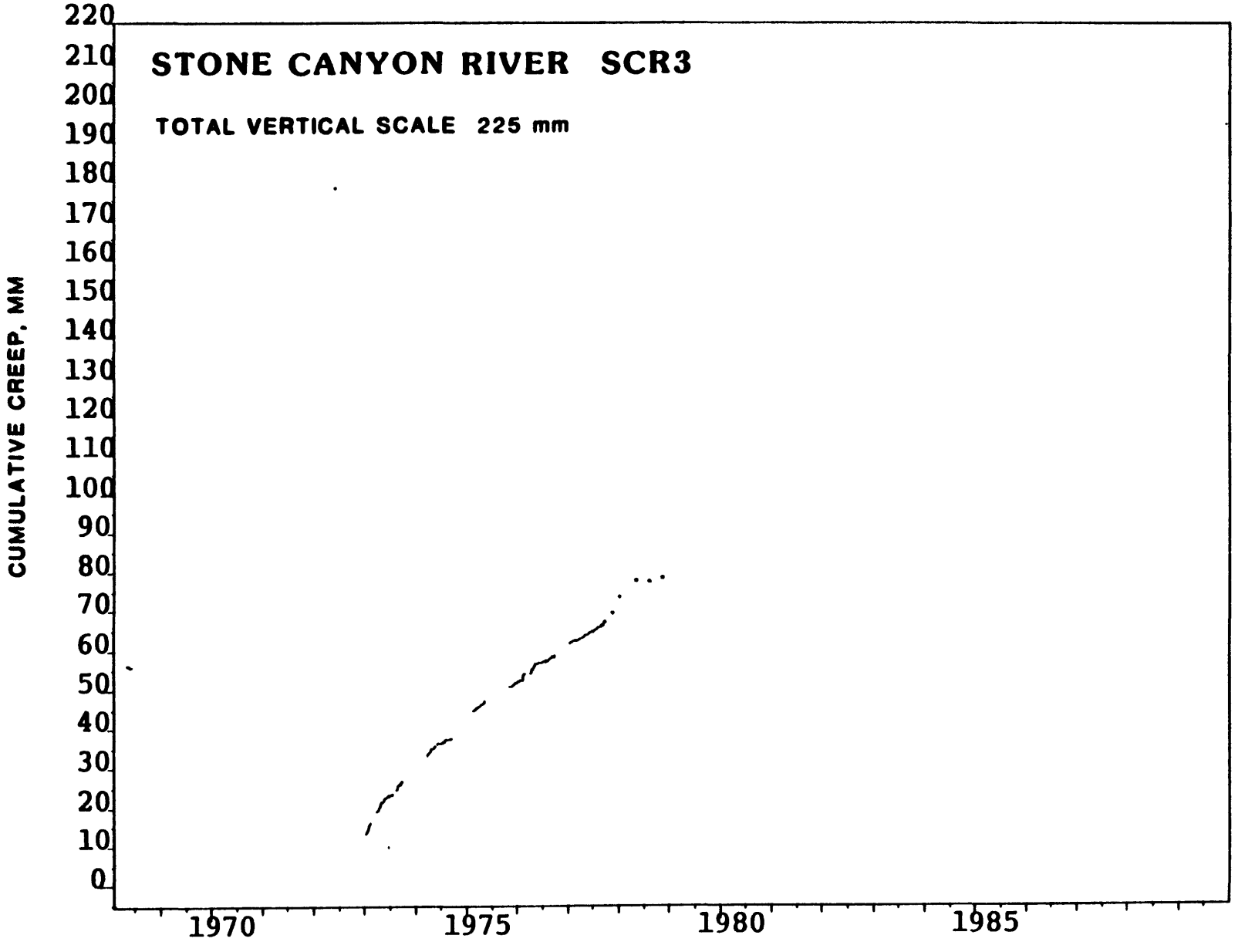
The Stone Canyon (101 Ranch) long-rod creepmeter was installed during October, 1972, on the San Andreas fault at a site 35.8 km southeast of San Juan Bautista. The installation consisted of a single rod adjacent to the extension rod of SCR1, buried a few centimeters below the surface (see description of SCR1 for other details). Creep activity at this site was composed of almost steady-state slip at an average rate of about 11 mm/yr, with a possible seasonal variation. The instrument was accidentally destroyed by earthmoving equipment in 1978.




CHERRY PEAK QUADRANGLE
CALIFORNIA–SAN BENITO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** SCR3

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | 1 | 0.00 | | |
| 1973 | 12 | 4.10 | 7 | 6.22 | 6 | 8.20 | 12 | 10.32 | 23 | 12.59 | | | 11 | 14.00 | 14 | 15.42 | 12 | 16.41 | | | 15 | 19.23 | | |
| 1974 | 14 | 21.78 | | | 21 | 23.90 | | | | | 5 | 26.73 | | | 20 | 37.48 | | | 30 | 39.46 | 7 | 39.46 | 18 | 37.62 |
| 1975 | | | | | | | | | 20 | 47.66 | | | | | 22 | 49.94 | | | | | 6 | 51.05 | | |
| 1976 | | | 10 | 53.88 | | | | | 11 | 56.29 | | | | | 18 | 57.49 | | | | | 4 | 60.74 | 13 | 60.95 |
| 1977 | 18 | 61.80 | | | 19 | 62.79 | 14 | 63.22 | | | | | 19 | 65.34 | 12 | 65.76 | | | 4 | 67.46 | 17 | 69.58 | | |
| 1978 | 11 | 73.54 | | | | | | | 2 | 77.64 | | | | | 8 | 77.91 | destroyed | | | | 15 | 78.49 | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

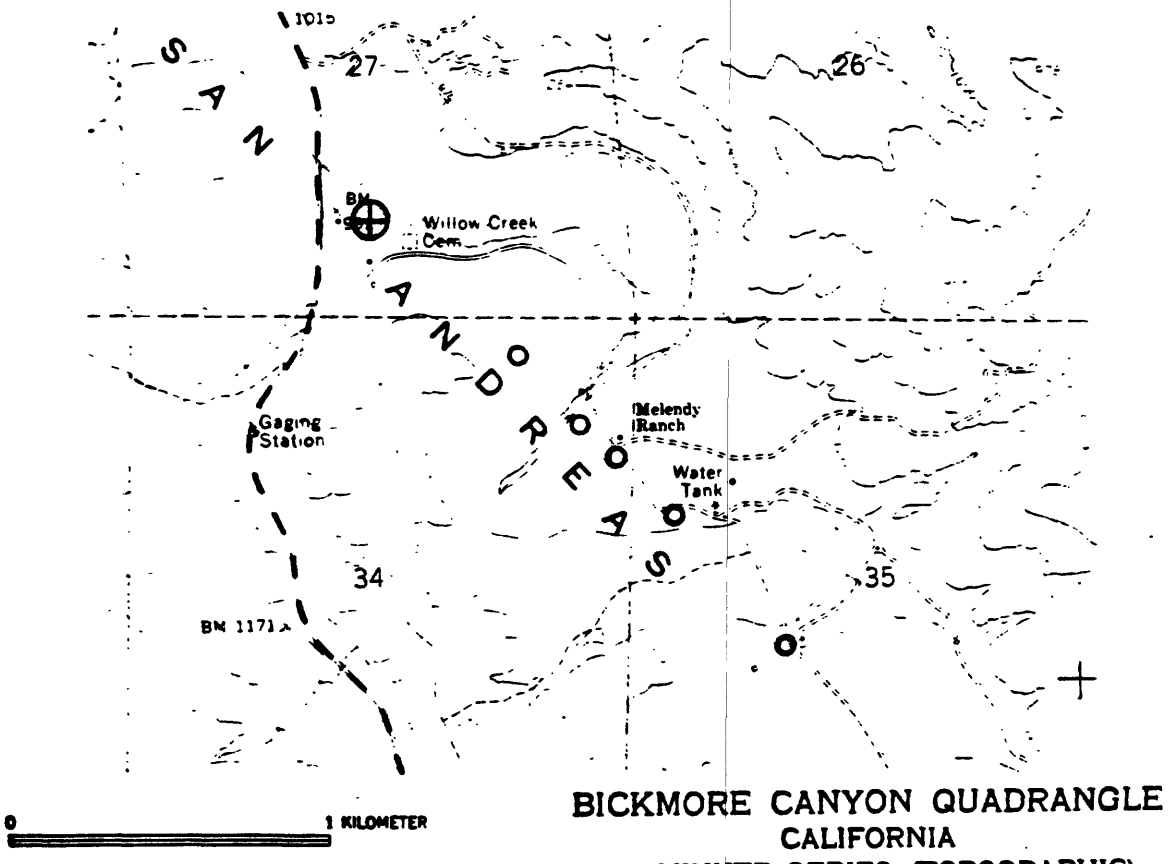

STONE CANYON RIVER SCR3
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION WLC1

Latitude 36° 35.8'
Longitude 121° 11.5'

Position 350.0 km
19-meter rods, $\phi$=45°

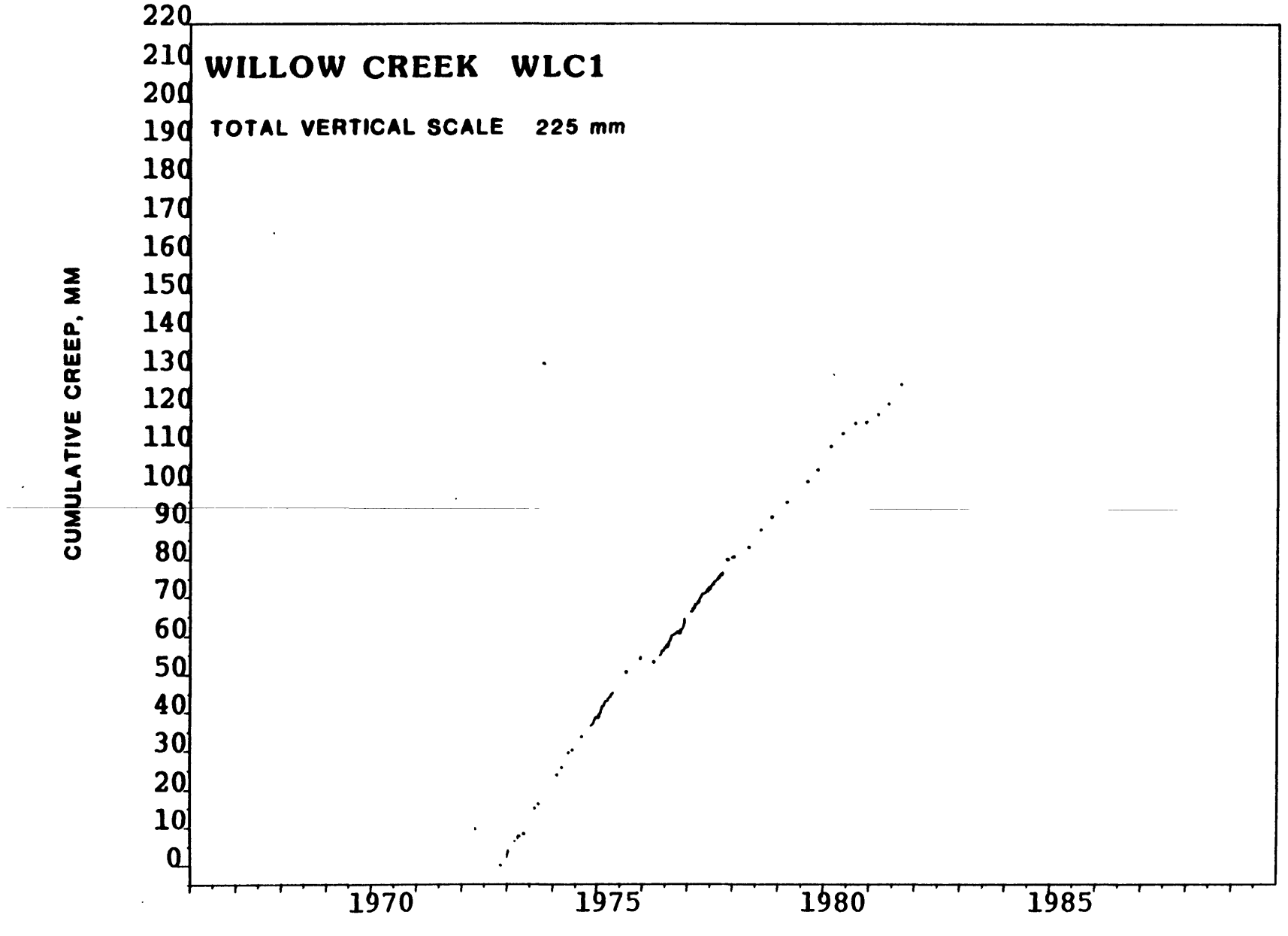
The Willow Creek creepmeters were installed during November, 1972, on the San Andreas fault at a site 40.9 km southeast of San Juan Bautista. The installation consisted of a pair of crossed rods buried a few centimeters below the surface on sloping ground near the bottom of Willow Creek. Creep activity at this site was composed of nearly steady-state slip at an average long-term rate of about 15 mm/yr, with a slight seasonal variation. The instruments were abandoned in 1981, due to rising ground water.



**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** WLC1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | 7 | 0.00 | | |
| 1973 | 11 | 3.25 | 7 | 5.09 | 7 | 6.08 | 24 | 8.49 | 23 | 9.33 | | | | | 14 | 16.41 | 12 | 17.25 | | | | | | |
| 1974 | 30 | 24.75 | | | 20 | 27.01 | | | 9 | 30.83 | 5 | 31.25 | | | 21 | 34.79 | | | 27 | 37.76 | | | | |
| 1975 | 21 | 42.00 | | | | | | | 6 | 46.53 | | | | | 20 | 51.48 | | | | | | | 17 | 55.44 |
| 1976 | | | | | 4 | 56.71 | | | 11 | 55.01 | | | | | 18 | 59.28 | | | | | 4 | 61.24 | | |
| 1977 | 18 | 66.33 | | | 19 | 68.73 | 14 | 70.14 | | | | | 19 | 73.26 | 12 | 74.25 | | | 4 | 76.23 | 17 | 79.65 | | |
| 1978 | 11 | 80.65 | | | | | | | 2 | 83.23 | | | | | 8 | 87.82 | | | | | 15 | 91.36 | | |
| 1979 | | | | | 7 | 95.18 | | | | | | | | | 17 | 100.27 | | | | | 16 | 103.66 | | |
| 1980 | | | 28 | 109.67 | | | | | | | 5 | 112.85 | | | | | 4 | 115.82 | | | | | 8 | 115.97 |
| 1981 | | | | | 11 | 118.23 | | | | | 3 | 120.49 | | | | | 9 | 126.15 | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

Late 1981 - Rising water table destroyed instrument.


WILLOW CREEK WLC1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

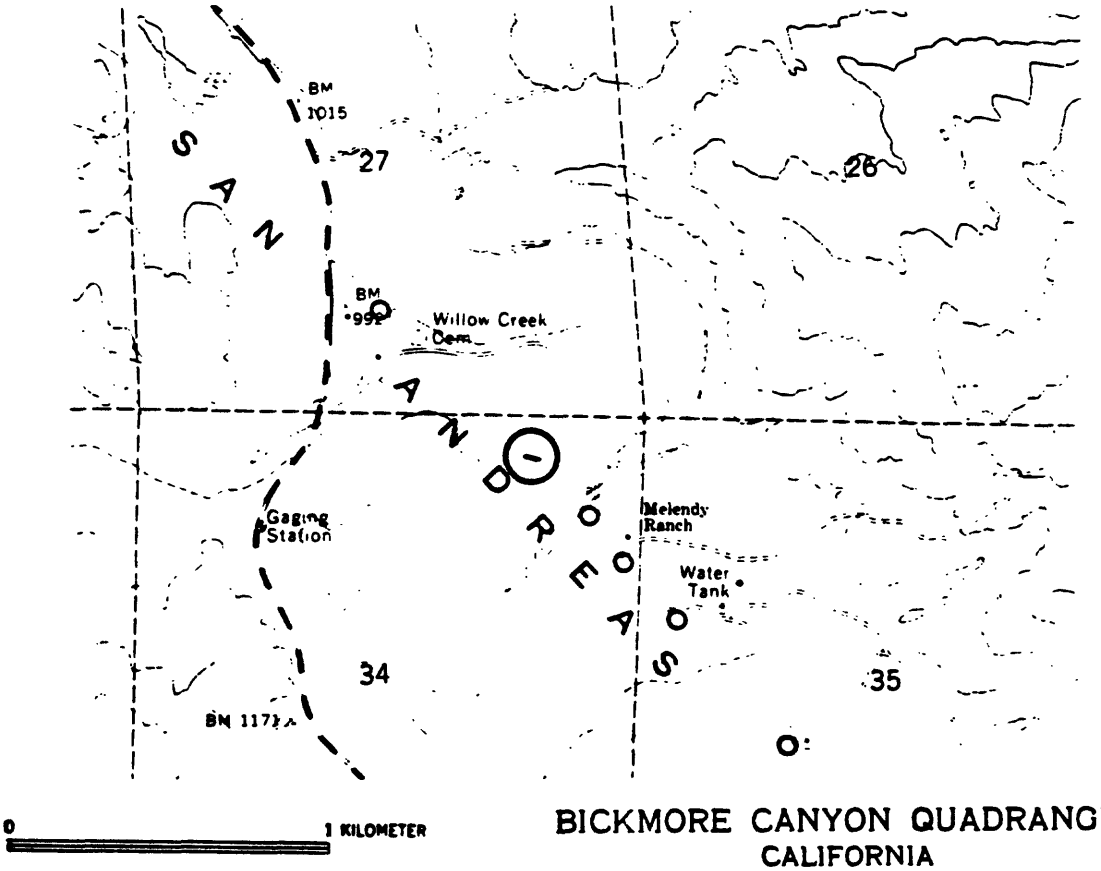
09

## STATION XMR1

Latitude 36° 35.7'
Longitude 121° 11.2'

Position 350.8 km
10-meter wire, ø=30°

The Melendy Ranch (North) creepmeter was installed during June, 1969, on the San Andreas fault at a site 41.7 km southeast of San Juan Bautista. The installation consists of a single wire buried a few centimeters below the surface on the crest of a low pressure ridge between a small sag pond and an old river terrace. Creep activity at this site is composed of regular creep events of up to about 3.5 mm amplitude, superimposed on a variable background of right-lateral slip at near-zero to moderate rates. The average long-term creep rate is about 19 mm/yr, with a significant seasonal variation.

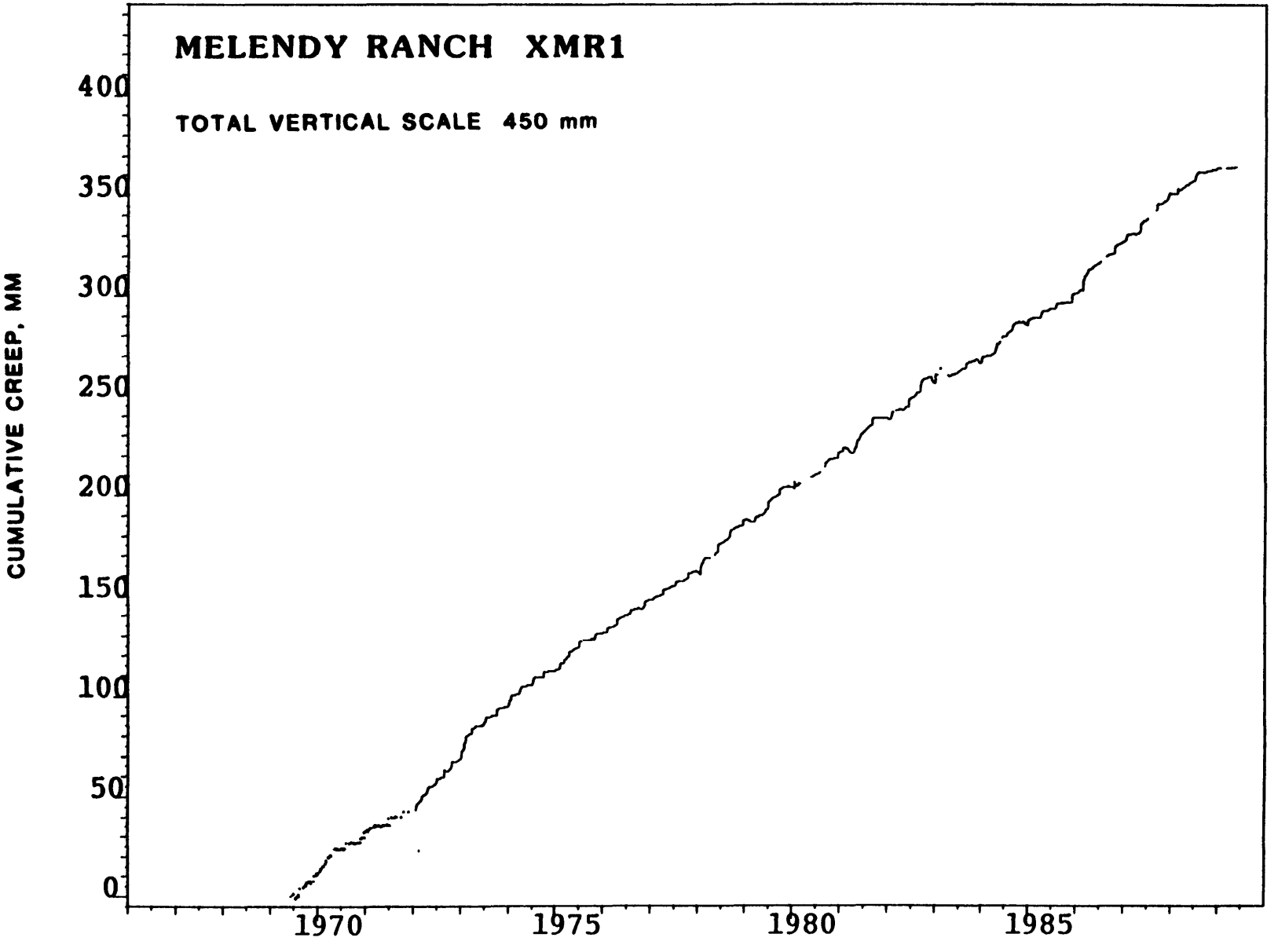



BICKMORE CANYON QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XMR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 5 | 0.00 | 9 | -1.23* | 6 | -0.05 | 3 | 4.46 | 3 | 6.75 | 6 | 7.50 | 28 | 10.55 |
| 1970 | 4 | 10.66 | 1 | 14.19 | 3 | 16.95 | 7 | 20.39 | 10 | 23.54 | 7 | 23.75 | 1 | 24.05 | 2 | 24.23 | 5 | 26.99 | 4 | 26.80 | 8 | 26.73 | 29 | 32.46 |
| 1971 | 3 | 32.51 | 7 | 33.43 | 7 | 34.29 | 4 | 35.34 | 9 | 35.51 | 13 | 35.81 | 1 | 36.11 | 8 | 39.71 | | | 2 | 39.91 | 26 | 42.46 | 2 | 42.61 |
| 1972 | 26 | 42.69 | 2 | 45.76 | 8 | 47.73 | 14 | 51.17 | 12 | 54.97 | | | 3 | 58.70 | 8 | 59.19 | 5 | 63.02 | 10 | 63.58 | | | 4 | 67.65 |
| 1973 | 9 | 68.75 | 7 | 77.30 | 8 | 81.10 | 4 | 81.25 | | | 14 | 85.35 | 18 | 89.07 | 1 | 89.34 | 13 | 89.84 | | | 8 | 93.77 | 20 | 94.43 |
| 1974 | | | 8 | 100.10 | | | 4 | 101.26 | 22 | 105.09 | | | 11 | 105.96 | 28 | 109.25 | | | 10 | 111.91 | | | 18 | 112.54 |
| 1975 | | | | | 24 | 118.73 | | | 6 | 122.30 | | | 31 | 127.70 | 16 | 127.77 | | | | | 4 | 131.01 | | |
| 1976 | | | 12 | 133.98 | | | | | 11 | 138.75 | | | 23 | 140.47 | 19 | 142.84 | | | | | 4 | 143.73 | 16 | 147.53 |
| 1977 | | | 2 | 149.31 | 19 | 150.23 | 14 | 152.91 | | | | | 19 | 156.80 | 12 | 156.74 | | | 4 | 156.45 | 16 | 161.87 | | |
| 1978 | 11 | 160.33 | | | | | | | 2 | 169.99 | | | | | 8 | 177.89 | | | | | 15 | 184.54 | | |
| 1979 | | | | | 7 | 186.63 | | | | | 7 | 192.05 | | | 17 | 200.26 | | | 27 | 204.10 | 16 | 204.26 | | |
| 1980 | | | 28 | 206.95 | 7 | 206.08 | 10 | 205.14 | 14 | 209.29 | 5 | 210.08 | | | 5 | 212.67 | 4 | 213.92 | 28 | 218.01 | | | 8 | 218.51 |
| 1981 | | | | | 6 | 223.67 | 23 | 223.17 | | | 3 | 229.50 | | | 11 | 234.23 | 9 | 237.91 | | | | | 4 | 238.48 |
| 1982 | | | 23 | 242.27 | | | | | | | 4 | 244.36 | | | | | 3 | 252.00 | | | | | 26 | 256.74 |
| 1983 | | | | | 29 | 260.74 | 5 | 260.57 | | | 30 | 262.08 | | | | | | | 27 | 267.04 | | | | |
| 1984 | 13 | 269.44 | | | | | | | 31 | 278.86 | | | 31 | 281.46 | | | | | 31 | 285.70 | | | | |
| 1985 | 31 | 287.85 | | | | | | | 17 | 292.36 | | | 25 | 296.66 | | | | | 31 | 297.57 | | | | |
| 1986 | 29 | 302.04 | | | | | | | 21 | 314.97 | | | | | 12 | 319.93 | | | | | 20 | 325.91 | | |
| 1987 | | | 18 | 331.15 | | | | | 27 | 337.30 | | | | | 24 | 343.14 | | | | | 20 | 347.96 | | |
| 1988 | | | 11 | 351.17 | | | | | 18 | 356.45 | | | | | 19 | 361.87 | | | | | 22 | 363.70 | | |

*Negative numbers indicate cumulative left-lateral movement.

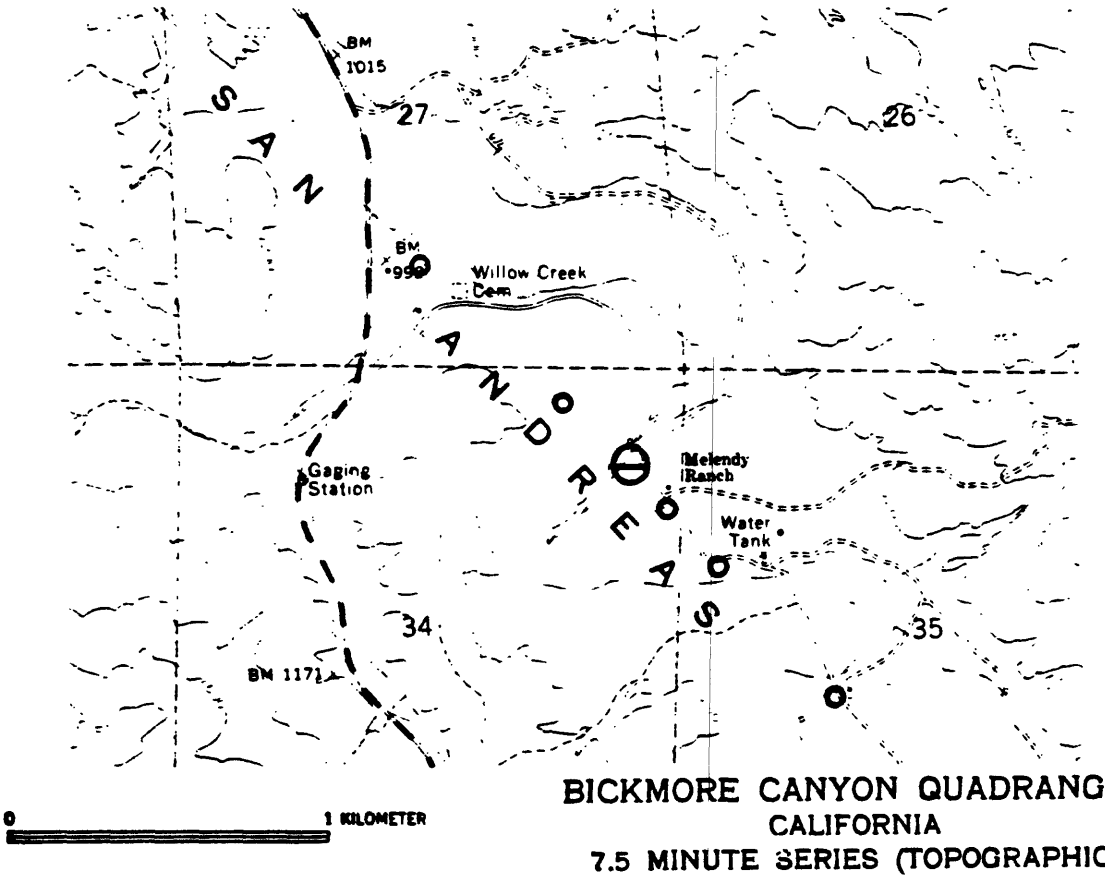

MELENDY RANCH XMR1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION MRC1

Latitude 36° 35.5'
Longitude 121° 11.1'

Position 351.2 km
15-meter rod, $\phi$=45°

The Melendy Ranch Corral creepmeter was installed during September, 1970, on the San Andreas fault at a site 42.1 km southeast of San Juan Bautista. The installation consisted of a single rod buried a few centimeters below the surface of gently sloping, recent river deposits. Creep activity at this site was composed of distinct events of up to 4.1 mm amplitude, superimposed on the background of nearly steady-state slip at moderate rates. The average long-term creep rate was about 20 mm/yr. The instrument was abandoned in December, 1982, after the flooding river buried it under several feet of sand.

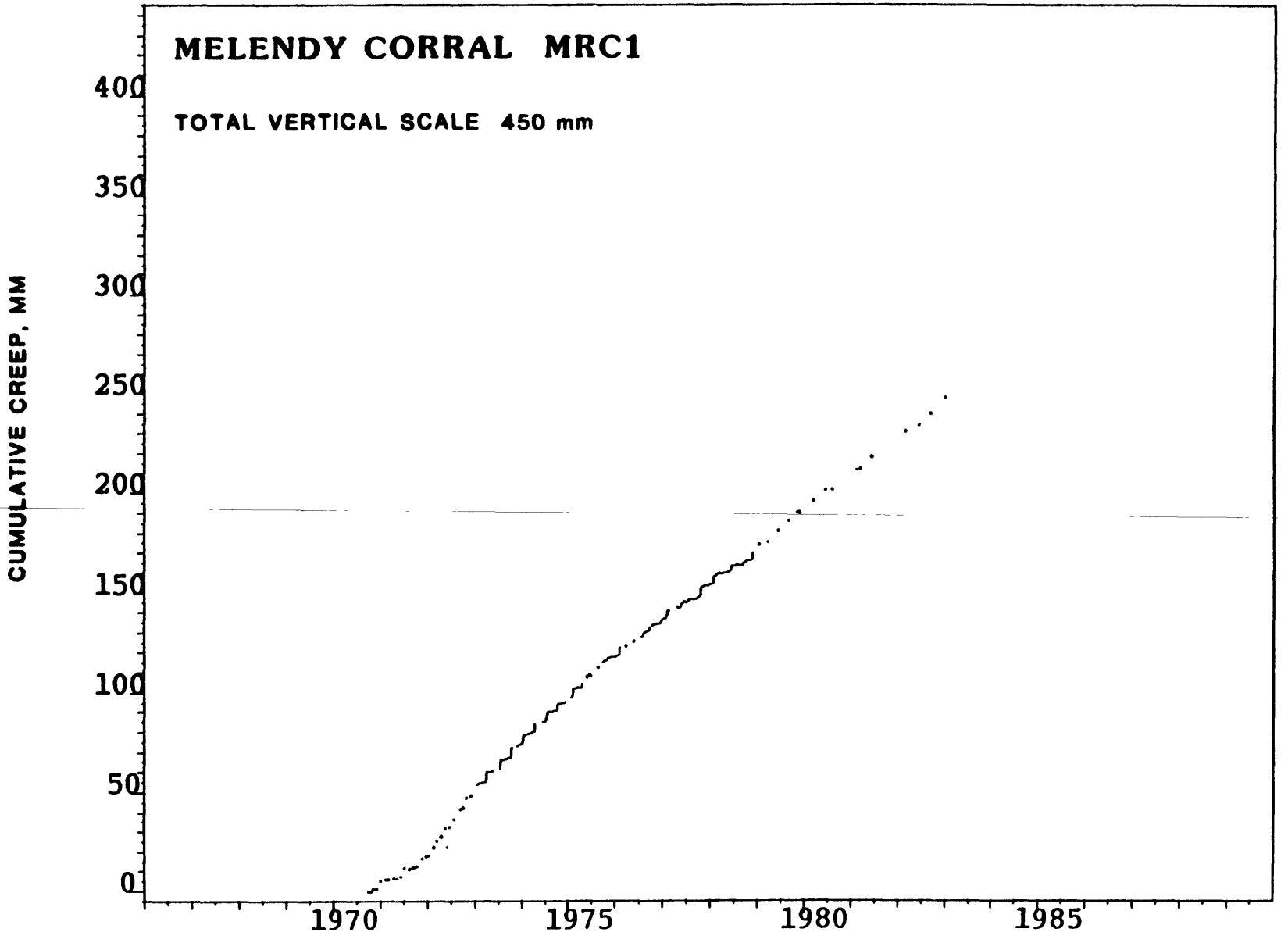



BICKMORE CANYON QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** MRC1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | 24 | 0.00 | 16 | 0.16 | 3 | 0.48 | 2 | 1.19 |
| 1971 | 6 | 5.20 | 5 | 5.62 | 4 | 5.92 | 6 | 6.18 | 4 | 6.56 | 8 | 6.93 | 8 | 11.31 | 11 | 11.85 | 13 | 12.44 | 13 | 13.06 | 18 | 16.82 | 15 | 17.28 |
| 1972 | 17 | 18.08 | 10 | 22.05 | 13 | 25.81 | 19 | 27.39 | 15 | 31.56 | 15 | 32.32 | 26 | 36.38 | | | 8 | 41.61 | 4 | 42.28 | 28 | 48.26 | | |
| 1973 | 11 | 53.68 | 7 | 54.45 | 6 | 54.89 | 24 | 60.08 | 23 | 60.54 | | | 11 | 61.60 | | | 13 | 67.13 | | | 19 | 72.90 | | |
| 1974 | 30 | 78.77 | | | 20 | 79.82 | | | | | 5 | 84.99 | | | 21 | 90.51 | | | 27 | 93.95 | | | | |
| 1975 | 17 | 97.48 | | | 6 | 102.12 | 21 | 104.36 | 20 | 108.18 | 10 | 108.46 | | | 19 | 112.56 | | | | | 4 | 117.09 | 3 | 117.51 |
| 1976 | | | 12 | 122.46 | 17 | 122.74 | | | 11 | 125.29 | | | | | 18 | 130.27 | | | 1 | 132.78 | 4 | 133.49 | 16 | 136.74 |
| 1977 | | | 3 | 140.70 | 19 | 141.27 | 14 | 142.68 | | | | | 19 | 146.12 | 11 | 146.48 | | | 4 | 147.95 | 17 | 153.12 | | |
| 1978 | 11 | 154.67 | | | | | | | 2 | 160.61 | | | | | 8 | 165.21 | | | | | 15 | 169.87 | | |
| 1979 | 5 | 173.69 | | | 7 | 175.38 | | | | | 7 | 181.19 | | | 17 | 186.14 | | | 22 | 190.45 | 16 | 190.81 | | |
| 1980 | | | 28 | 196.25 | | | | | | | 5 | 201.20 | | | | | 4 | 201.48 | | | | | | |
| 1981 | | | 12 | 211.95 | 6 | 212.51 | | | | | 3 | 218.17 | | | | | | | | | | | | |
| 1982 | | | 23 | 231.89 | | | | | | | 4 | 234.01 | | | | | 3 | 239.95 | | | | | 26 | 247.37 |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

By January, 1983, river had overflowed, changed course, and buried instrument in several feet of silt. Instrument was abandoned.

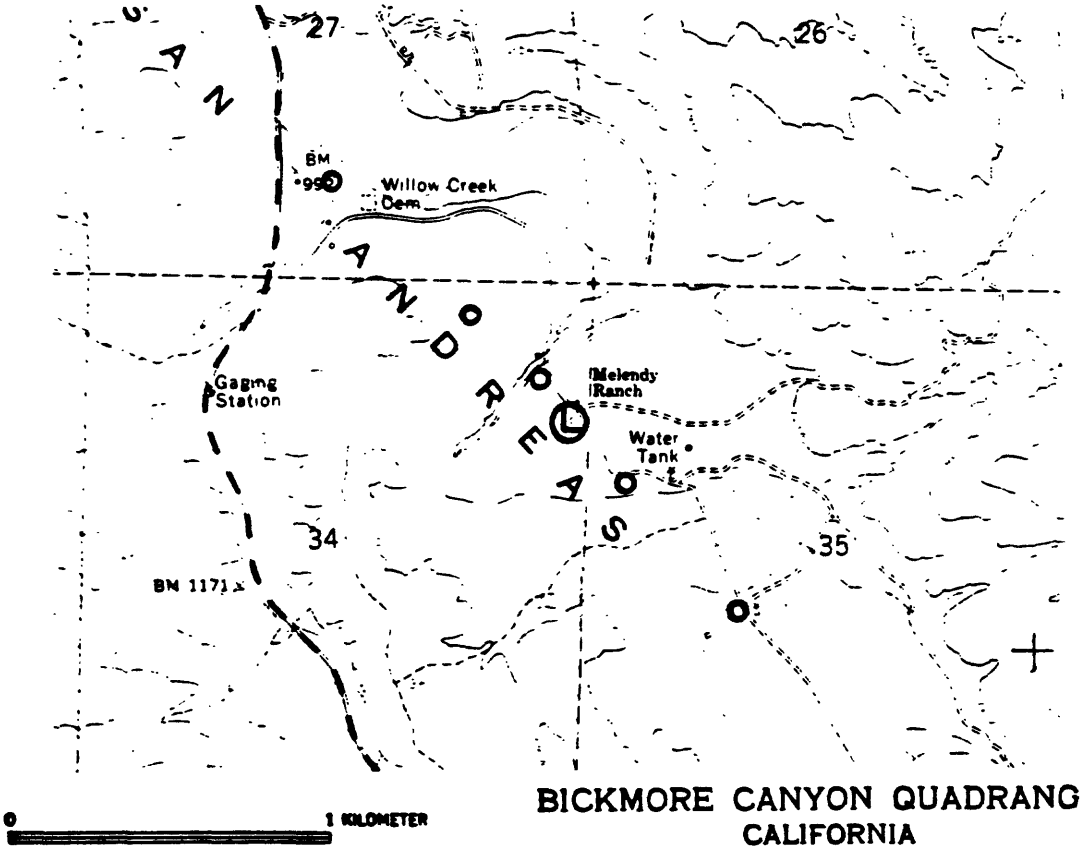

MELENDY CORRAL MRC1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION MRB1

Latitude 36° 35.4'
Longitude 121° 11.0'

Position 351.3 km
12-meter rods, $\phi$=45°

The Melendy Ranch Barn creepmeters were installed during June, 1969, on the San Andreas fault at a site 42.3 km southeast of San Juan Bautista. The installation consisted of a pair of rods in a "V" configuration, buried a few centimeters below the surface in river terrace deposits across a prominent northeast-facing scarp. Creep activity at this site was composed of distinct events of up to 4.2 mm amplitude, superimposed on a background of nearly steady-state slip at moderate rates. The long-term average creep rate was about 16 mm/yr, with a slight seasonal variation. MRB2, the rod measuring contraction across the fault, was abandoned in August, 1975. MRB1, the rod measuring extension, was removed in November, 1979, at the landowner's request.

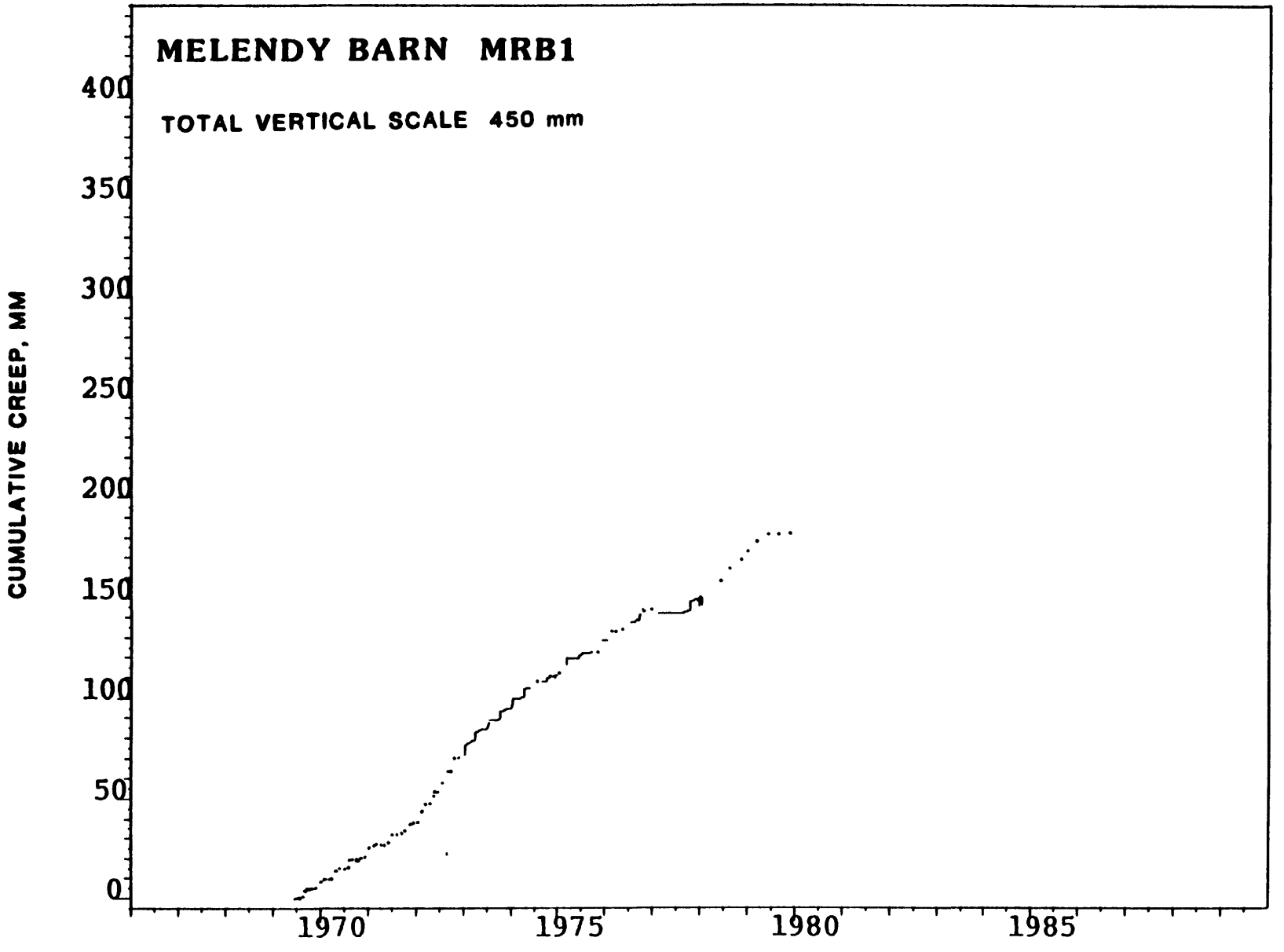



BICKMORE CANYON QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** MRB1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 10 | 0.00 | 9 | 0.11 | 8 | 0.27 | 17 | 4.53 | 6 | 4.82 | 19 | 5.26 | 30 | 8.36 |
| 1970 | | | 3 | 8.93 | 9 | 9.52 | 28 | 14.21 | 27 | 14.53 | 29 | 14.79 | 29 | 15.37 | 31 | 19.07 | | | 2 | 19.30 | 3 | 19.60 | 2 | 20.48 |
| 1971 | 6 | 25.71 | 5 | 26.37 | 4 | 26.77 | 6 | 26.87 | 4 | 27.09 | 8 | 27.38 | 8 | 31.86 | 11 | 32.32 | 13 | 32.68 | 13 | 33.75 | 18 | 37.39 | 15 | 37.91 |
| 1972 | 17 | 38.29 | 10 | 42.70 | 2 | 43.63 | 18 | 47.43 | 15 | 51.51 | 15 | 53.21 | 26 | 57.51 | | | 4 | 63.38 | 4 | 64.28 | 27 | 70.48 | | |
| 1973 | 11 | 76.18 | 6 | 77.54 | 6 | 78.43 | 13 | 83.01 | 23 | 84.29 | | | 11 | 85.21 | | | 13 | 89.18 | | | 16 | 94.29 | | |
| 1974 | 30 | 99.77 | | | 20 | 100.38 | | | | | 5 | 105.06 | 12 | 108.17 | 21 | 108.36 | | | 27 | 111.16 | | | | |
| 1975 | 16 | 112.84 | | | 3 | 116.71 | | | 9 | 119.74 | 10 | 119.74 | | | 19 | 122.29 | | | | | 4 | 127.95 | 3 | 128.51 |
| 1976 | | | 12 | 132.75 | 17 | 133.03 | | | 11 | 134.30 | | | | | 18 | 137.79 | | | 1 | 141.80 | 4 | 143.22 | 17 | 144.21 |
| 1977 | | | 2 | 141.80 | 19 | 141.80 | 14 | 141.90 | | | | | 19 | 141.94 | 12 | 142.37 | | | 4 | 143.15 | 17 | 148.76 | | |
| 1978 | 11 | 150.15 | | | | | | | | | 2 | 158.63 | | | 8 | 164.15 | | | | | 15 | 169.07 | | |
| 1979 | 5 | 173.65 | | | 7 | 177.72 | | | | | 7 | 181.40 | | | 17 | 181.12 | | | | | 16 | 181.83 | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

12/79 - Instrument removed at request of landowner.

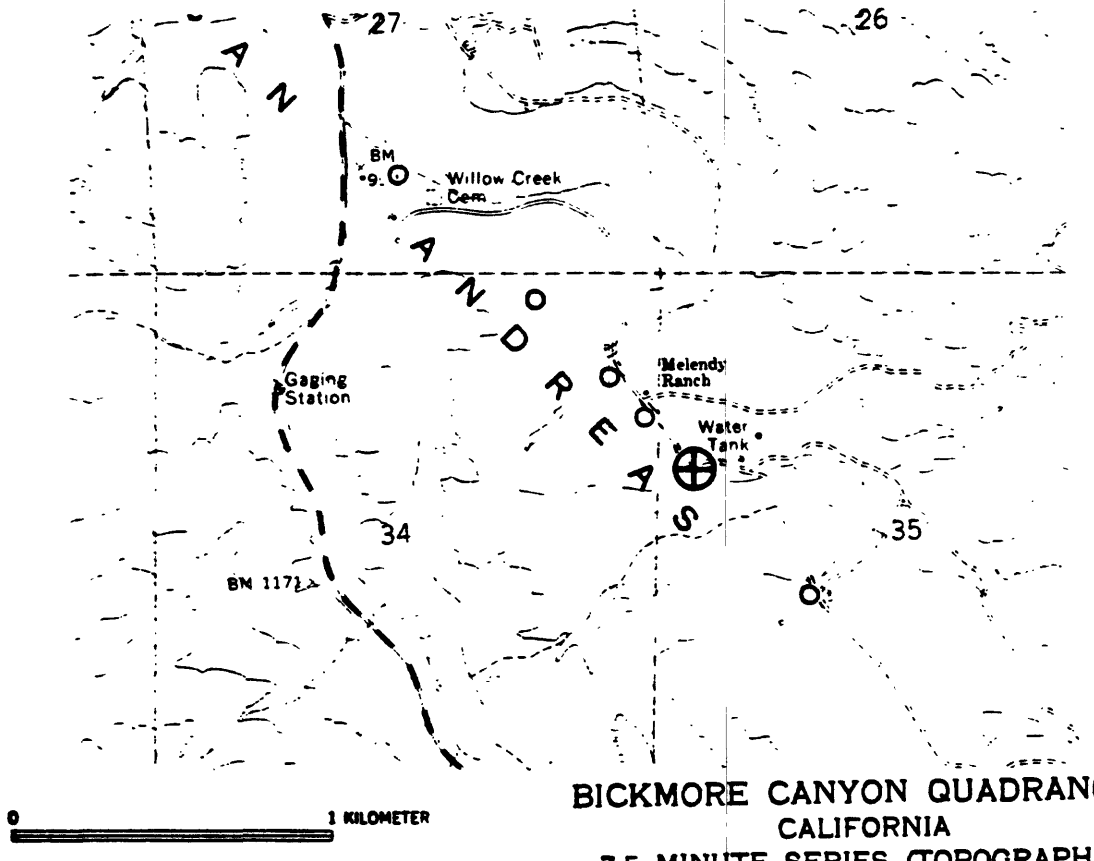

MELENDY BARN MRB1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION MRR1

Latitude 36° 35.3'
Longitude 121° 10.9'

Position 351.5 km
24-meter rods, ø=45°

The Melendy Ranch River creepmeters were installed during October, 1972, on the San Andreas fault at a site 42.4 km southeast of San Juan Bautista. The installation consisted of a pair of crossed rods buried a few centimeters below the surface in gently sloping river terrace deposits. Creep activity at this site was composed of distinct events of up to 4.4 mm amplitude, superimposed on a background of nearly steady-state slip at low to moderate rates. The average long-term creep rate was about 20 mm/yr, with a slight seasonal variation. Continued flooding forced removal of both instruments in November, 1979.

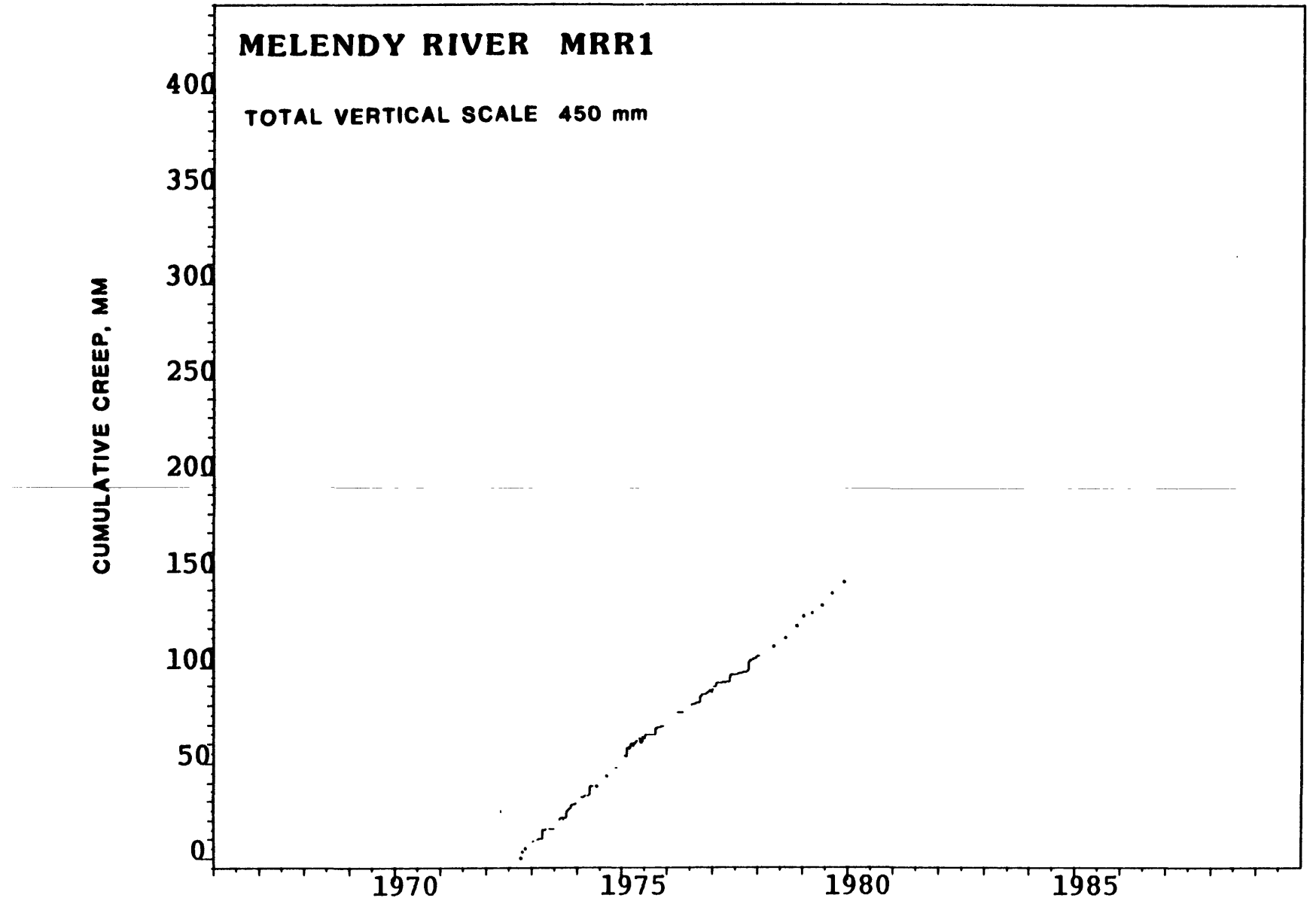



BICKMORE CANYON QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** MRR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | 13 | 0.00 | 28 | 4.38 | | |
| 1973 | 11 | 8.48 | 7 | 9.62 | 6 | 10.18 | 24 | 14.85 | 23 | 15.27 | | | 11 | 15.84 | 14 | 20.08 | 13 | 20.08 | 3 | 21.35 | 1 | 26.02 | | |
| 1974 | 30 | 31.82 | | | 21 | 32.53 | | | | | 5 | 38.04 | | | 21 | 42.57 | | | 27 | 47.52 | | | | |
| 1975 | 14 | 53.46 | 28 | 57.00 | | | | | 20 | 61.24 | | | | | 19 | 64.78 | | | | | 4 | 68.60 | 3 | 69.30 |
| 1976 | | | 12 | 75.38 | 17 | 75.95 | | | 11 | 76.09 | | | | | 19 | 81.32 | | | 1 | 85.42 | 4 | 85.86 | 17 | 86.55 |
| 1977 | | | 2 | 91.50 | 19 | 92.07 | 14 | 92.21 | | | | | 19 | 96.73 | 12 | 96.87 | | | 4 | 98.08 | 17 | 103.59 | | |
| 1978 | 11 | 107.76 | | | | | | | 2 | 110.59 | | | | | 8 | 114.98 | | | | | 15 | 121.62 | | |
| 1979 | 5 | 126.78 | | | 7 | 127.85 | | | | | 7 | 131.95 | | | 17 | 138.03 | | | | | 16 | 143.68 | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

12/79 - Instrument removed.

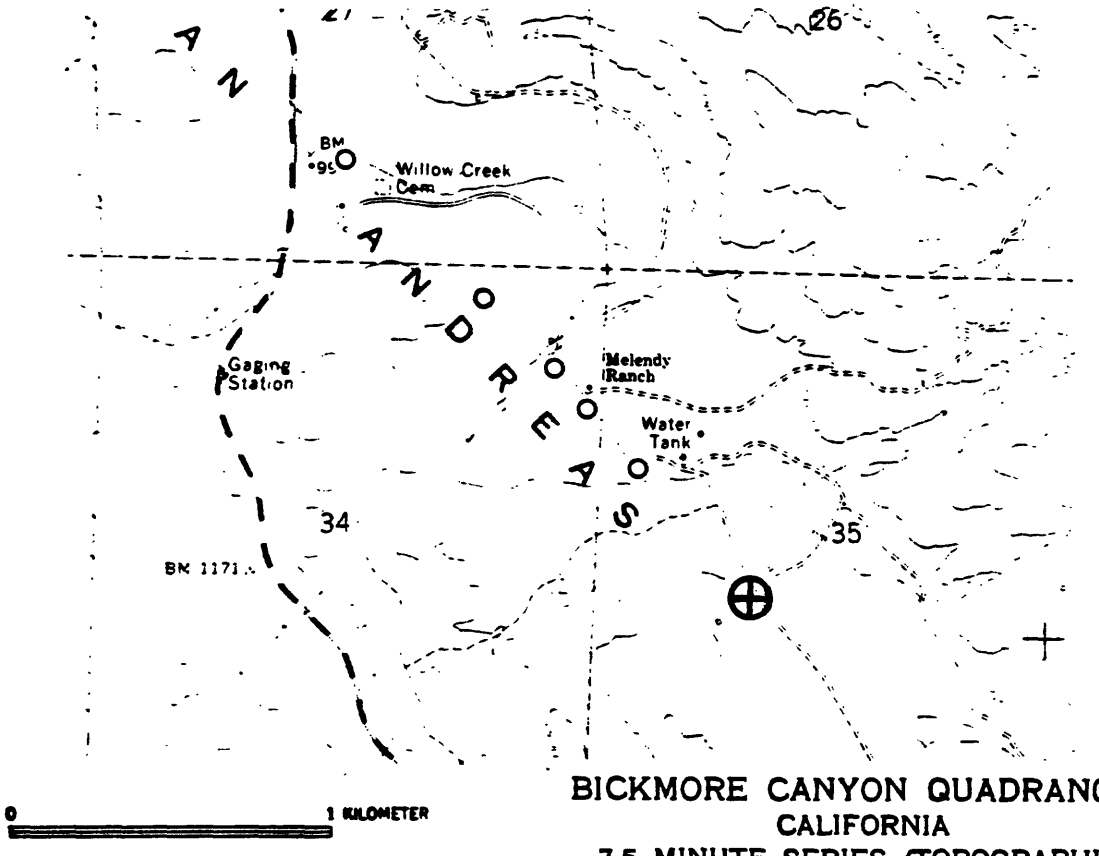

MELENDY RIVER MRR1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION MRW1

Latitude 36° 35.1'
Longitude 121° 10.6'

Position 352.1 km
23-meter rods, ø=45°

The Melendy Ranch Windmill creepmeters were installed during October, 1972, on the San Andreas fault at a site 43.0 km southeast of San Juan Bautista. The installation consisted of a pair of crossed rods buried a few centimeters below the surface in nearly flat river terrace deposits. The extension instrument was rebuilt in 1981 in its original configuration. Creep activity at this site is composed of distinct events of up to 3.8 mm amplitude, superimposed on a background of nearly steady-state slip at low to moderate rates. The average long-term creep rate is about 20 mm/yr, with a slight seasonal variation.



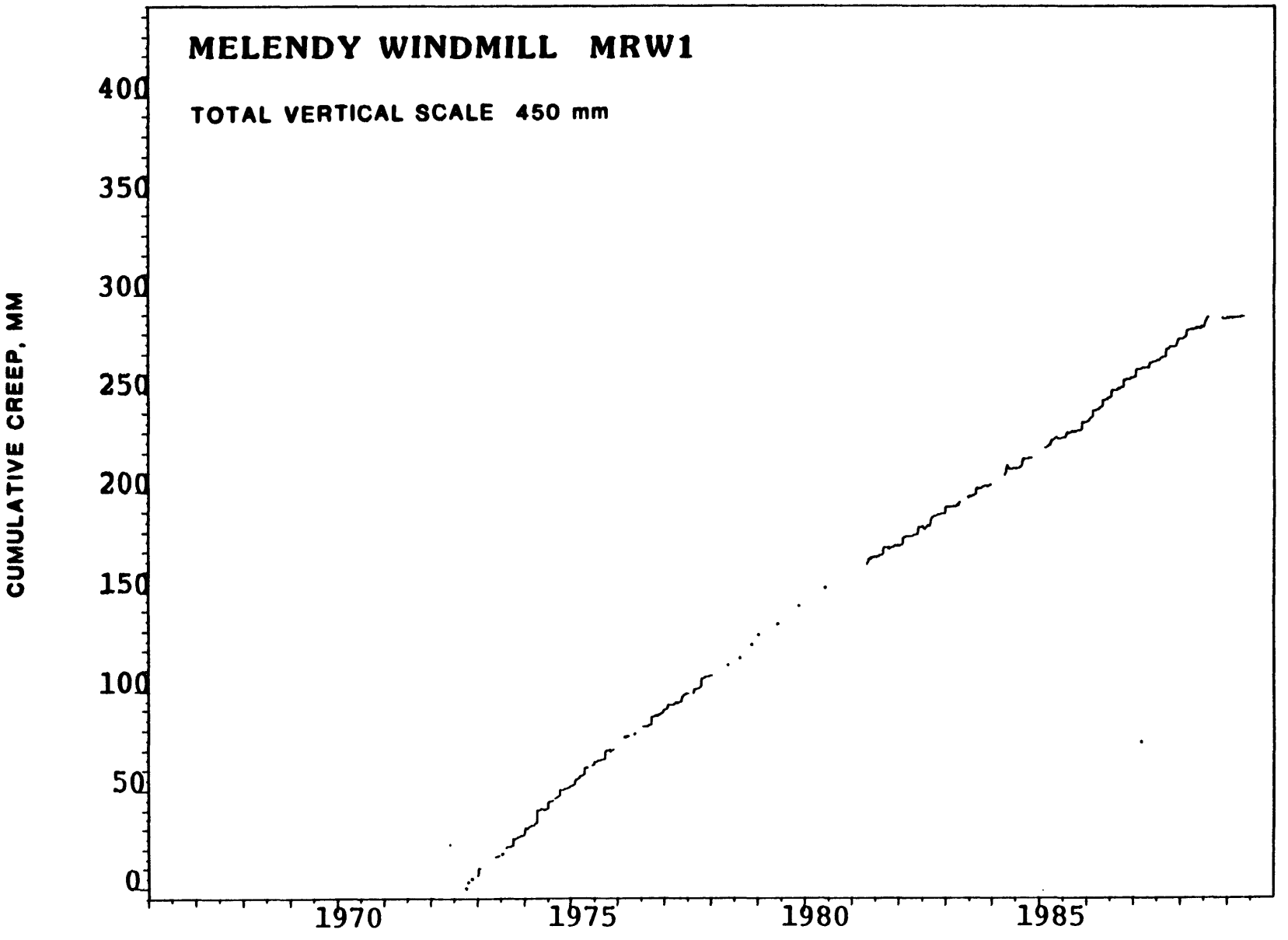

BICKMORE CANYON QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** MRW1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | 4 | 0.00 | 28 | 4.67 | | |
| 1973 | 11 | 9.35 | | | | | | | 23 | 15.84 | | | 11 | 17.25 | 14 | 20.65 | 13 | 21.07 | 3 | 21.50 | 1 | 25.31 | | |
| 1974 | 30 | 30.83 | | | 21 | 31.96 | | | | | 5 | 40.59 | | | 21 | 45.40 | | | 27 | 50.06 | | | | |
| 1975 | 14 | 52.04 | | | 3 | 55.86 | | | 9 | 61.21 | 10 | 61.99 | | | 19 | 64.75 | | | | | 4 | 70.12 | 3 | 70.97 |
| 1976 | | | 12 | 76.06 | 17 | 76.48 | | | 11 | 77.75 | | | | | 18 | 82.21 | | | 7 | 86.67 | 4 | 87.09 | 17 | 89.35 |
| 1977 | | | 2 | 92.74 | 19 | 94.02 | 14 | 94.37 | | | | | 19 | 98.54 | 12 | 98.54 | | | 4 | 101.80 | 17 | 106.29 | | |
| 1978 | 11 | 107.73 | | | | | | | 2 | 112.68 | | | | | 8 | 116.57 | | | | | 15 | 123.05 | | |
| 1979 | 5 | 127.75 | | | | | | | | | 7 | 133.26 | | | | | | | | | 16 | 142.45 | | |
| 1980 | | | | | | | | | | | 5 | 151.93 | | | | | | | | | | | | |
| 1981 | | | | | | | 29 | 163.23 | | | 3 | 168.32 | | | | | 9 | 173.38 | | | | | 4 | 173.06 |
| 1982 | | | 23 | 177.65 | | | | | | | 4 | 179.21 | | | | | 3 | 183.59 | | | | | 26 | 192.15 |
| 1983 | | | | | | | | | | | 20 | 197.45 | | | | | | | 4 | 202.56 | | | | |
| 1984 | 13 | 207.49 | | | 9 | 208.34 | | | 7 | 212.23 | | | 31 | 213.29 | | | | | 31 | 217.53 | | | | |
| 1985 | 31 | 222.34 | | | | | | | 17 | 227.58 | | | 25 | 230.83 | | | | | 31 | 231.25 | | | | |
| 1986 | 29 | 237.90 | | | | | | | 21 | 246.38 | | | | | 12 | 251.33 | | | | | 19 | 257.13 | | |
| 1987 | | | 18 | 261.79 | | | | | 27 | 266.18 | | | | | 24 | 268.72 | | | | | 20 | 273.25 | | |
| 1988 | | | 11 | 277.92 | | | | | 18 | 283.01 | | | | | | | | | | | 22 | 288.81 | | |

5/78 - Electronics removed.

4/81 - Instrument rebuilt; electronics replaced.

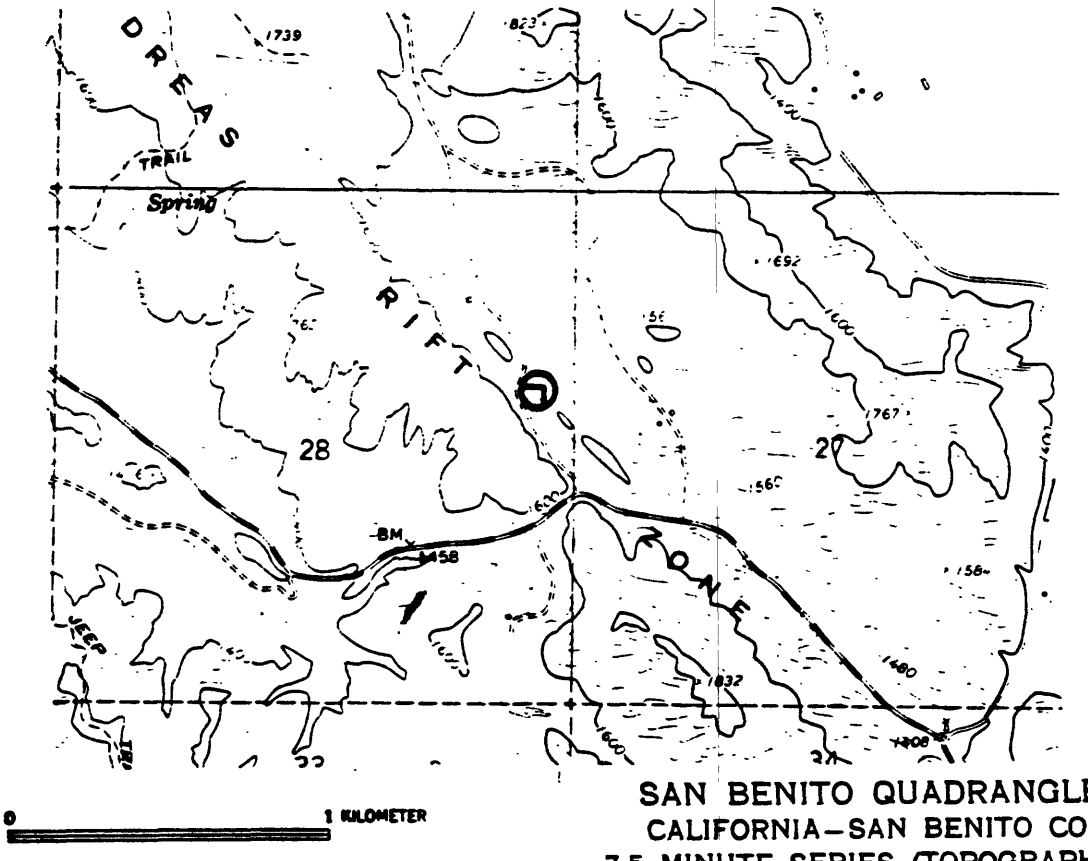

MELENDY WINDMILL MRW1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION SBN1

Latitude 36° 30.8'
Longitude 121° 06.0'

Position 362.2 km
12-meter rods, ø=45°

The San Benito creepmeters were installed during June, 1969, on the San Andreas fault at a site 53.1 km southeast of San Juan Bautista. The installation consisted of a pair of rods in a "V" configuration buried a few centimeters below the surface in clay-rich sag pond sediments. Creep activity at this site was composed of infrequent events of up to 2.7 mm amplitude, superimposed on a background of nearly continuous slip with a strong seasonal variation. The average long-term creep rate was about 21 mm/yr. SBN2, the instrument measuring contraction across the fault, was abandoned in August, 1976. SBN1, the extension instrument, was abandoned in September, 1982, due to a rise in the level of the adjacent sag pond.



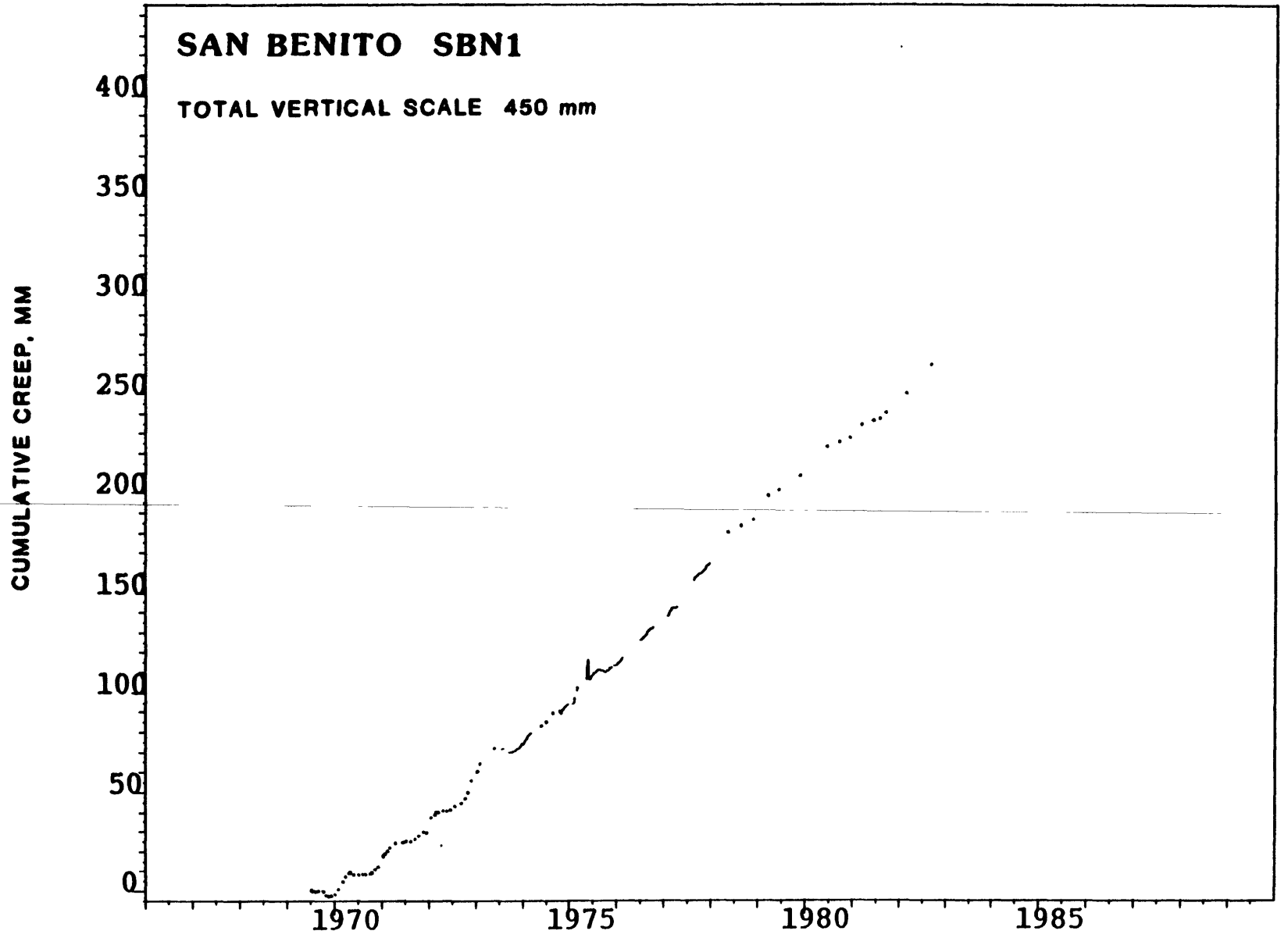

SAN BENITO QUADRANGLE
CALIFORNIA—SAN BENITO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** SBN1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 10 | 0.00 | 9 | -0.01* | 8 | 0.08 | 17 | -0.14* | 6 | -0.90* | 9 | -2.65* | 30 | -1.88* |
| 1970 | | | 3 | 0.65 | 9 | 5.10 | 28 | 8.74 | 27 | 8.22 | 29 | 8.18 | 29 | 8.22 | 31 | 8.36 | | | 2 | 9.21 | 3 | 10.67 | 2 | 12.18 |
| 1971 | 6 | 17.64 | 5 | 19.75 | 4 | 21.49 | 6 | 23.56 | | | 8 | 24.09 | 8 | 24.81 | 11 | 25.24 | 13 | 26.15 | 13 | 27.32 | 18 | 29.54 | | |
| 1972 | 17 | 37.26 | 15 | 38.53 | 13 | 39.79 | 18 | 40.38 | 15 | 40.18 | 15 | 40.85 | 26 | 42.56 | | | 7 | 45.10 | 5 | 46.94 | 27 | 55.98 | | |
| 1973 | 11 | 60.36 | 5 | 63.94 | | | | | 22 | 71.56 | | | 11 | 71.56 | | | 11 | 69.68 | | | 13 | 71.32 | | |
| 1974 | 15 | 75.52 | 6 | 77.30 | 21 | 79.99 | | | 21 | 83.30 | | | 9 | 85.35 | 28 | 89.45 | | | 13 | 88.93 | | | | |
| 1975 | 14 | 94.30 | 22 | 100.92 | | | | | 1 | 107.21 | | | | | 8 | 111.26 | | | | | | | 3 | 113.25 |
| 1976 | | | 11 | 117.54 | | | | | 5 | 123.03 | 24 | 126.28 | | | 19 | 129.70 | | | | | 12 | 134.51 | | |
| 1977 | 18 | 138.39 | | | 19 | 142.65 | 8 | 143.78 | | | | | 19 | 154.91 | 4 | 155.35 | | | 4 | 158.39 | | | | |
| 1978 | | | | | | | | | 2 | 180.34 | | | | | 8 | 183.85 | | | | | 15 | 186.86 | | |
| 1979 | | | | | 8 | 198.40 | | | | | 7 | 201.68 | | | | | | | | | 16 | 208.58 | | |
| 1980 | | | | | | | | | | | 5 | 223.46 | | | | | 4 | 225.50 | | | | | 8 | 227.87 |
| 1981 | | | | | 6 | 234.35 | | | | | 3 | 236.75 | 20 | 237.39 | | | 9 | 240.42 | | | | | | |
| 1982 | | | 23 | 250.36 | | | | | | | | | | | | | 3 | 264.44 | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

*Negative numbers indicate cumulative left-lateral movement.

Late 1982 - A nearby sag pond permanently engulfed instrument.

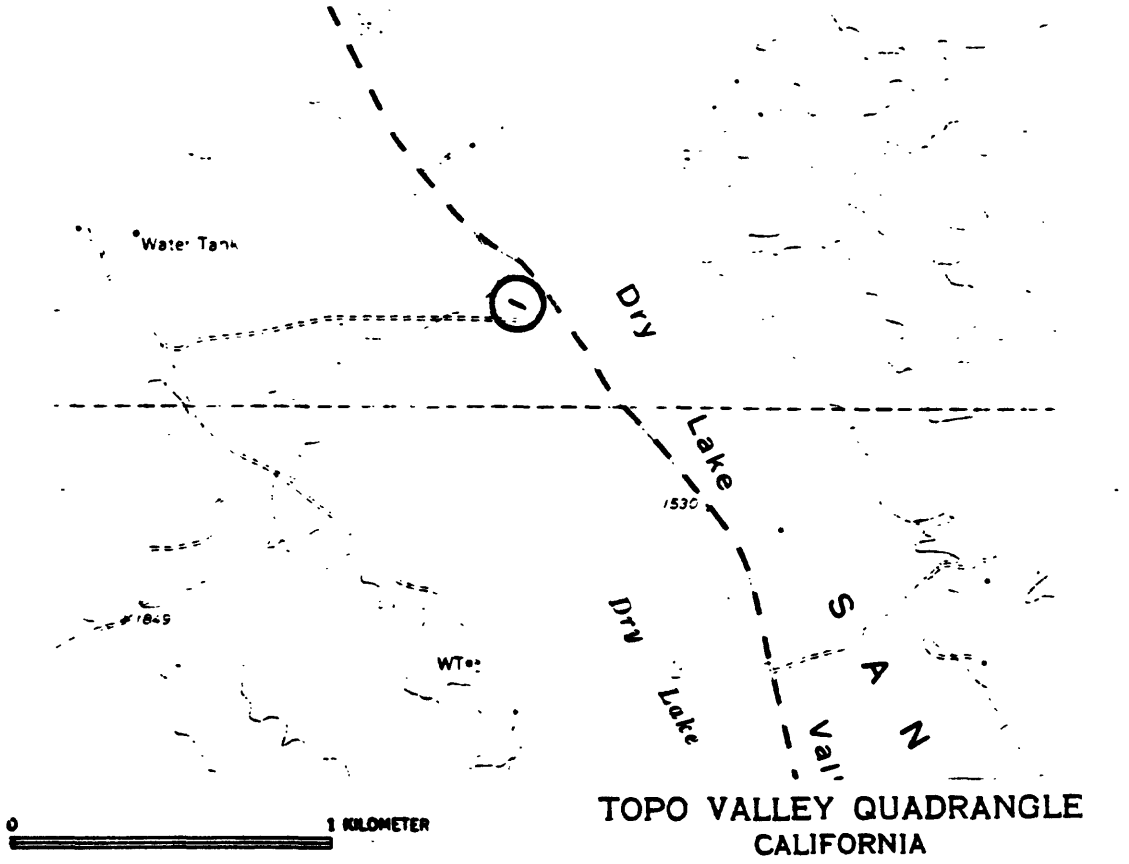

SAN BENITO SBN1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION XDL2

Latitude 36° 29.5'
Longitude 121° 04.7'

Position 365.7 km
12-meter wire, ø=30°

The Dry Lake 2 creepmeter (or near-field strainmeter) was installed during August, 1973, on the San Andreas fault at a site 56.6 km southeast of San Juan Bautista, as a replacement for an earlier station, XDL1. The installation consists of a single wire entrenched a few centimeters below the surface on a northeast-facing scarp near the crest of a low ridge. Activity at this site is composed of frequent negative events (contraction between piers) and occasional creep events of up to 1.5 mm amplitude, superimposed on a background of gradual positive and negative changes showing a strong seasonal pattern. Nearby alinement array results suggest XDL2 may have been placed slightly off the fault.

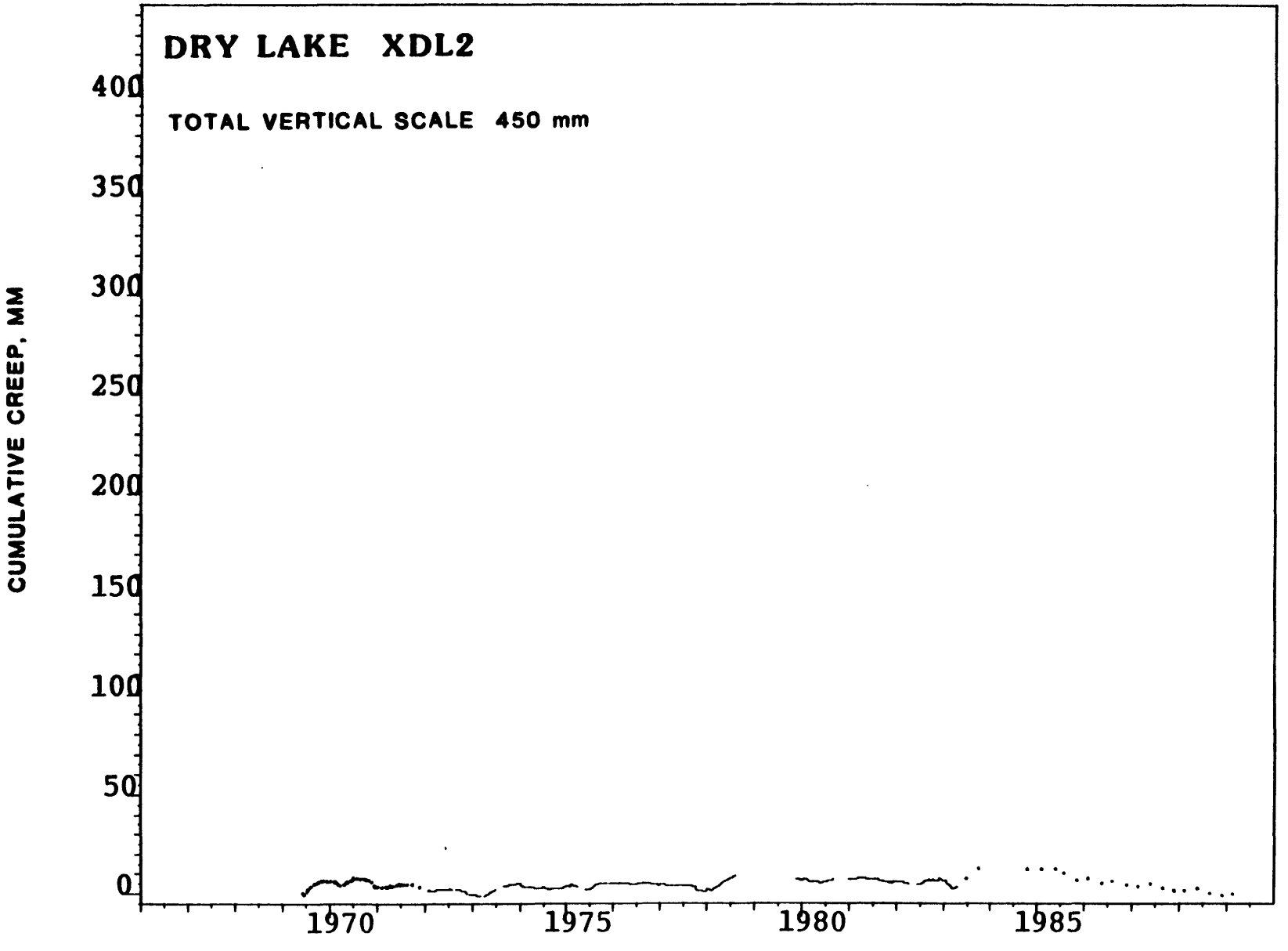



TOPO VALLEY QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XDL2

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | 22 | 0.00 | 13 | 0.16 | | | 10 | 1.11 | 19 | 1.37 |
| 1974 | | | 7 | -0.26* | 3 | -0.63* | | | 21 | -1.22* | 11 | -1.51* | | | 28 | -2.40* | | | 13 | -1.74* | | | 18 | -1.02* |
| 1975 | | | 22 | -0.38* | | | | | 21 | -2.53* | | | 30 | -1.00* | 5 | -0.65* | | | | | | | 8 | 0.69 |
| 1976 | | | 11 | 0.53 | | | | | 5 | 0.17 | | | | | 20 | 0.84 | | | | | 12 | -0.14* | | |
| 1977 | 18 | -0.20* | | | | | 8 | -0.83* | | | | | 19 | -0.59* | | | | | 4 | -2.35* | | | | |
| 1978 | 16 | -1.56* | | | | | | | 2 | 2.63 | | | | | 8 | 6.06 | | | | | 15 | 7.88 | | |
| 1979 | | | | | 8 | 9.24 | | | | | 6 | 6.80 | | | 17 | 7.84 | | | | | 16 | 7.16 | | |
| 1980 | | | 28 | 5.01 | | | | | | | 5 | 4.92 | | | | | 4 | 7.18 | | | | | | |
| 1981 | | | | | 6 | 7.78 | | | | | 3 | 7.45 | | | | | 9 | 6.20 | | | | | 3 | 5.47 |
| 1982 | | | 23 | 5.33 | | | | | | | 4 | 4.34 | | | | | 3 | 6.98 | | | | | 26 | 6.87 |
| 1983 | | | | | | | | | | | 30 | 7.72 | | | | | | | 4 | 12.66 | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | 16 | 12.66 | | | | |
| 1985 | 31 | 12.52 | | | | | | | 17 | 12.24 | | | 25 | 10.25 | | | | | 31 | 7.08 | | | | |
| 1986 | 29 | 7.02 | | | | | | | 21 | 5.06 | | | | | 12 | 6.68 | | | | | 19 | 4.48 | | |
| 1987 | | | 18 | 3.84 | | | | | 26 | 4.40 | | | | | 24 | 2.81 | | | | | 19 | 1.38 | | |
| 1988 | | | 11 | 1.20 | | | | | 18 | 1.86 | | | | | 19 | 0.34 | | | | | 22 | -1.23* | | |

*Negative numbers indicate cumulative left-lateral movement.

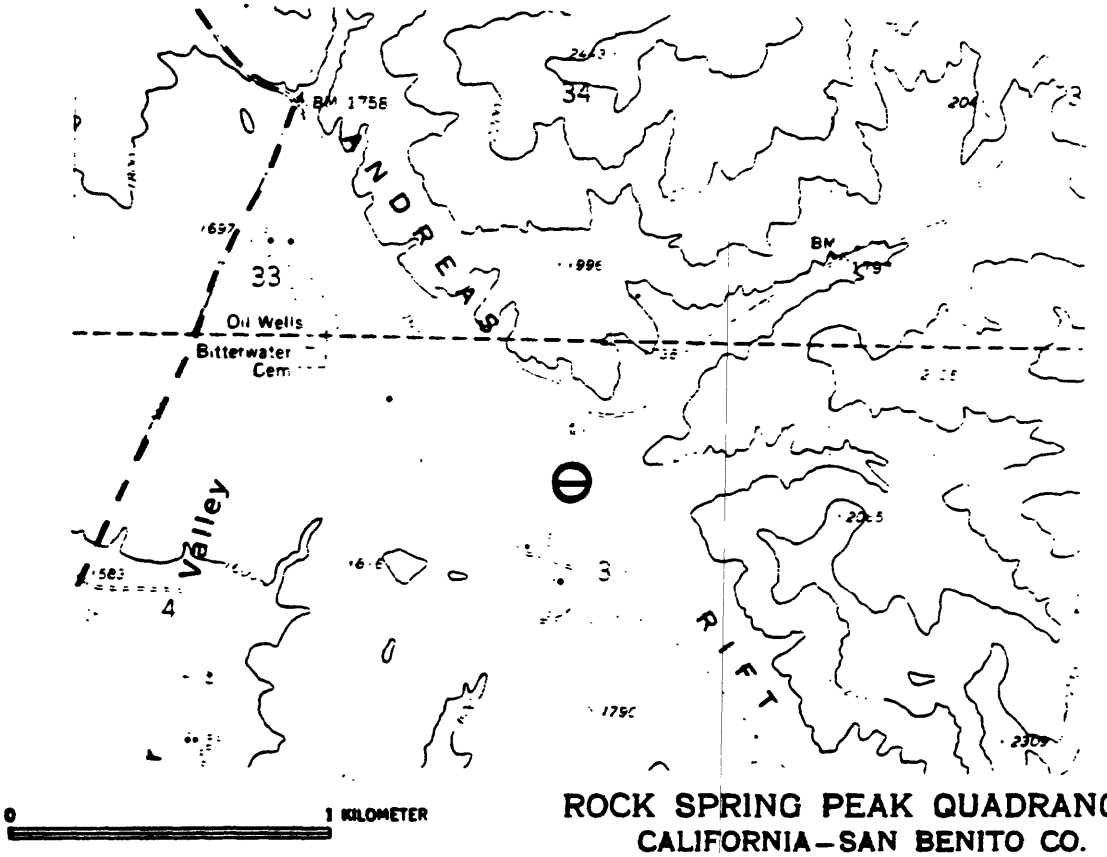

DRY LAKE XDL2
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION BIT1

Latitude 36° 23.9'
Longitude 120° 58.9'

Position 379.1 km
18-meter rod, $\phi$=45°

The Bitterwater Valley creepmeter was installed during June, 1969, on the San Andreas fault at a site 70.0 km southeast of San Juan Bautista. The installation consists of a single rod buried a few centimeters below the surface in alluvium. Creep activity at this site is composed of distinct events of up to 2.9 mm amplitude, superimposed on a background of gradual right-lateral movement at low to moderate rates, and occasional slight left-lateral drift. The average long-term creep rate is about 17 mm/yr, with a distinct seasonal variation.

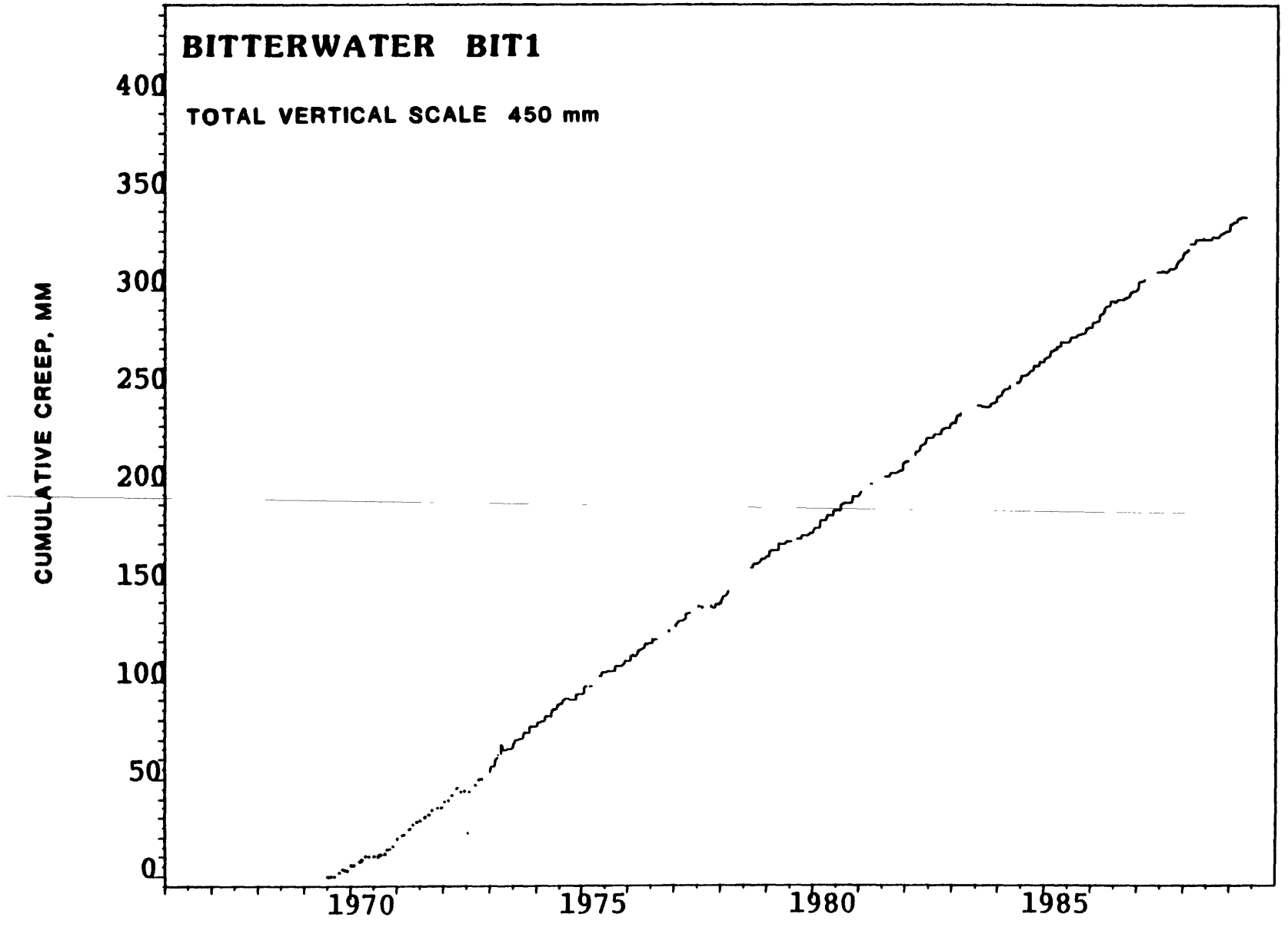



ROCK SPRING PEAK QUADRANGLE
CALIFORNIA–SAN BENITO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** BIT1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | 2 | 0.00 | 8 | -0.06* | 25 | 2.04 | 6 | 2.05 | 14 | 3.07 | 30 | 5.57 |
| 1970 | | | 3 | 5.57 | 9 | 7.83 | 28 | 10.24 | 27 | 10.12 | 29 | 10.21 | 29 | 10.22 | 31 | 11.62 | | | 2 | 11.72 | 3 | 14.10 | 2 | 15.70 |
| 1971 | 6 | 19.27 | 5 | 21.09 | 4 | 21.26 | 6 | 24.09 | 4 | 26.40 | 8 | 27.50 | 8 | 27.92 | 11 | 30.91 | 13 | 31.19 | 13 | 34.67 | 19 | 34.90 | 15 | 35.07 |
| 1972 | 17 | 38.55 | 15 | 38.85 | 13 | 41.68 | 18 | 44.51 | 15 | 48.83 | 15 | 43.46 | 26 | 43.71 | | | 7 | 46.26 | 5 | 49.09 | 27 | 52.74 | | |
| 1973 | 11 | 56.03 | 5 | 56.54 | 6 | 62.31 | | | 22 | 65.10 | | | 11 | 68.69 | | | 11 | 70.51 | | | 13 | 76.49 | | |
| 1974 | 15 | 78.53 | | | 19 | 81.87 | | | 22 | 85.26 | | | 10 | 88.03 | 28 | 90.57 | | | 13 | 90.40 | | | | |
| 1975 | 14 | 93.56 | 22 | 97.10 | | | | | 7 | 102.38 | | | | | 8 | 105.18 | | | | | | | 3 | 110.15 |
| 1976 | | | 10 | 112.94 | | | | | 5 | 116.26 | | | | | 20 | 121.14 | | | | | 12 | 125.18 | 29 | 128.04 |
| 1977 | | | 3 | 130.21 | | | 8 | 134.01 | | | | | 11 | 137.29 | | | | | 6 | 137.52 | | | | |
| 1978 | 25 | 142.93 | | | | | | | 10 | 151.74 | | | | | 16 | 157.33 | | | | | | | 4 | 161.86 |
| 1979 | | | | | 8 | 166.25 | | | | | 7 | 170.10 | | | 23 | 172.05 | | | | | 14 | 175.00 | 7 | 175.97 |
| 1980 | | | 5 | 178.77 | 28 | 182.28 | | | | | 18 | 186.78 | | | | | 18 | 190.47 | 12 | 190.57 | | | 23 | 193.86 |
| 1981 | | | | | 24 | 200.14 | | | | | 15 | 201.29 | 17 | 204.02 | | | 30 | 206.10 | | | | | 3 | 207.33 |
| 1982 | | | | | 10 | 214.88 | | | 27 | 221.60 | | | | | 31 | 226.18 | | | | | | | 26 | 231.78 |
| 1983 | | | | | | | 4 | 240.77 | | | | | 8 | 239.99 | 23 | 239.22 | | | 4 | 239.39 | | | | |
| 1984 | 14 | 245.38 | | | | | | | 7 | 252.43 | | | 31 | 256.44 | | | | | 16 | 260.93 | 8 | 262.62 | | |
| 1985 | 17 | 265.19 | | | | | 17 | 270.98 | | | | | 25 | 275.63 | | | | | 31 | 277.71 | | | | |
| 1986 | 29 | 284.20 | | | | | | | 21 | 293.42 | | | | | 12 | 294.75 | | | | | 19 | 299.19 | | |
| 1987 | | | 18 | 305.05 | | | | | 26 | 309.25 | | | | | 24 | 309.18 | | | | | 19 | 315.74 | | |
| 1988 | | | 11 | 323.39 | | | | | 18 | 325.61 | | | | | 19 | 326.65 | | | | | 22 | 330.33 | | |

*Negative numbers indicate cumulative left-lateral movement.

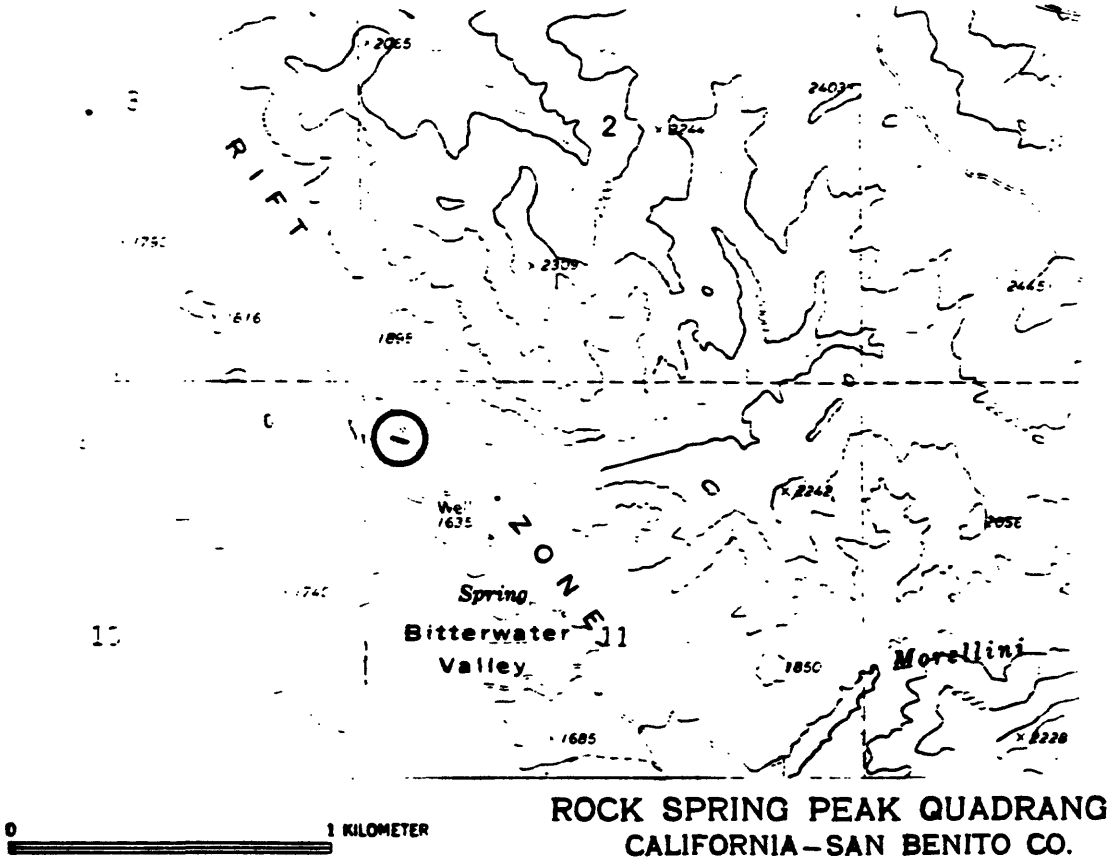

BITTERWATER BIT1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION XSR2

Latitude 36° 23.0'
Longitude 120° 58.0'

Position 381.0 km
10-meter wire, ϕ=30°

The Smith Ranch 2 (SW) creepmeter was installed during June, 1969, on the San Andreas fault at a site 71.9 km southeast of San Juan Bautista. The installation consisted of a single wire buried a few centimeters below the surface at the crest of a steep, southwest-facing fault scarp. Creep activity at this site was composed of long-term surges of accelerated right-lateral slip superimposed on a background of otherwise steady-state movement with infrequent minor events of up to 0.3 mm and rare events as large as 2.5 mm. The average creep rate was about 28 mm/yr, with a distinct seasonal variation. The instrument was dismantled in 1982.

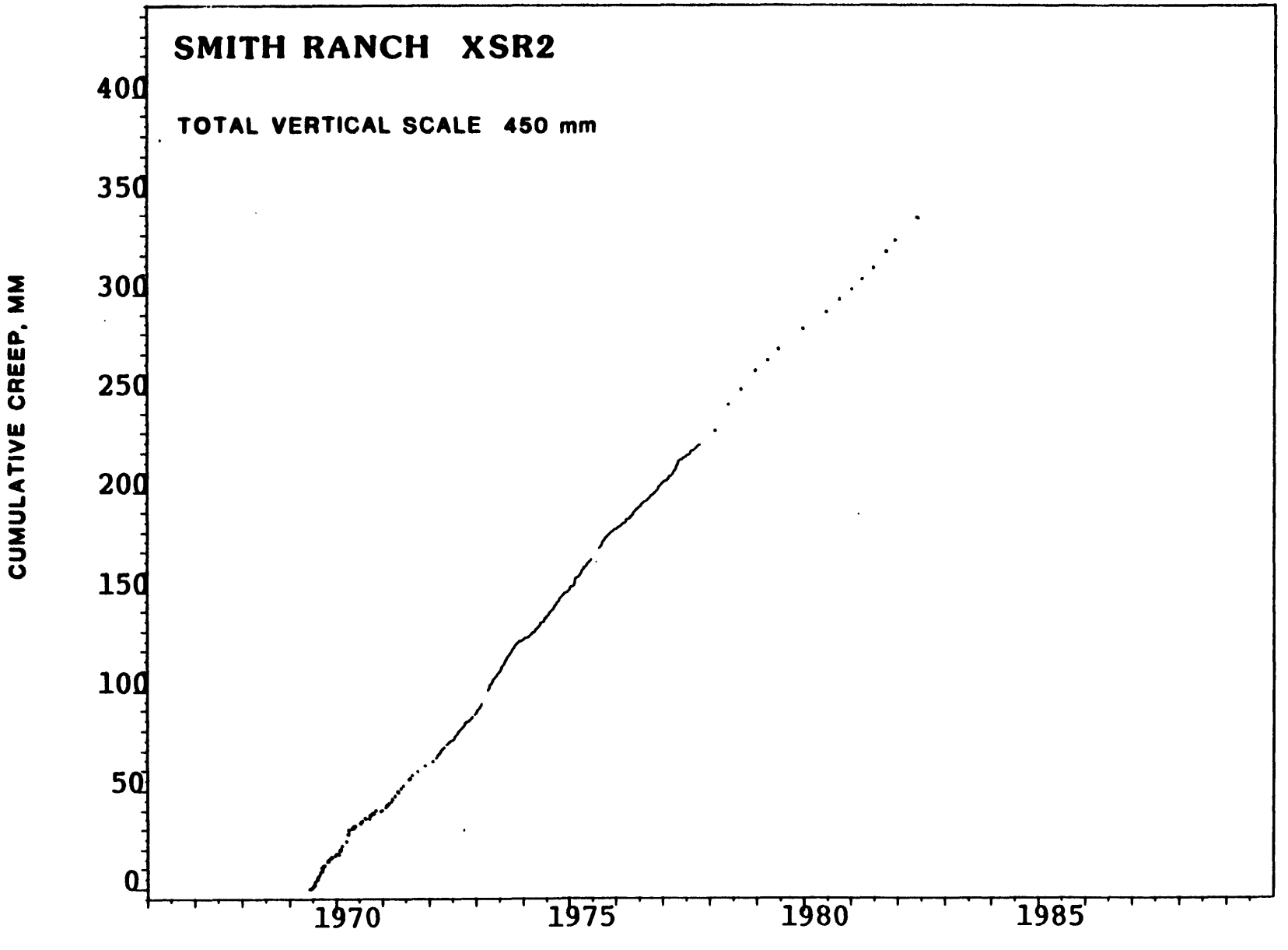



ROCK SPRING PEAK QUADRANGLE
CALIFORNIA–SAN BENITO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XSR2

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 5 | 0.00 | 9 | 2.36 | 6 | 5.53 | 3 | 9.09 | 3 | 12.42 | 6 | 14.60 | 28 | 16.71 |
| 1970 | 4 | 17.00 | 1 | 19.46 | 15 | 24.49 | 5 | 28.43 | 2 | 30.54 | 6 | 32.15 | 12 | 33.89 | 2 | 34.58 | 4 | 36.08 | 4 | 37.59 | 1 | 38.82 | 13 | 38.98 |
| 1971 | 3 | 39.98 | 7 | 42.12 | 7 | 43.94 | 4 | 46.61 | 1 | 49.01 | 13 | 52.53 | 22 | 55.17 | 5 | 56.08 | | | 2 | 59.54 | 27 | 62.10 | | |
| 1972 | | | 3 | 64.36 | 8 | 68.34 | | | 12 | 72.70 | 20 | 75.15 | 7 | 76.05 | 17 | 79.36 | | | 10 | 83.59 | | | 13 | 87.50 |
| 1973 | 12 | 89.70 | | | 28 | 99.74 | 27 | 103.80 | | | 14 | 108.11 | | | 1 | 113.20 | 12 | 118.14 | | | 9 | 123.41 | 19 | 125.46 |
| 1974 | | | 7 | 127.03 | | | 3 | 130.24 | 21 | 134.03 | | | 9 | 137.73 | 27 | 142.27 | | | 13 | 146.32 | 20 | 149.08 | 12 | 150.18 |
| 1975 | | | 22 | 156.58 | | | | | 21 | 164.30 | | | | | 8 | 166.33 | | | | | | | 3 | 175.80 |
| 1976 | | | 11 | 178.87 | | | | | 5 | 184.12 | | | | | 20 | 191.11 | | | | | 25 | 197.95 | | |
| 1977 | | | 3 | 206.90 | | | 8 | 212.91 | | | | | 11 | 219.18 | | | | | 6 | 224.38 | | | | |
| 1978 | 25 | 230.82 | | | | | | | 10 | 244.68 | | | | | 16 | 252.29 | | | | | | | 4 | 261.39 |
| 1979 | | | | | 8 | 267.06 | | | | | 7 | 272.32 | | | | | | | | | | | 7 | 282.86 |
| 1980 | | | | | | | | | | | 18 | 291.30 | | | | | 18 | 297.65 | | | | | 23 | 302.40 |
| 1981 | | | | | 24 | 307.91 | | | | | 15 | 313.76 | | | | | 30 | 321.97 | | | | | 3 | 327.47 |
| 1982 | | | | | | | | | 27 | 338.15 | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

1982 - Instrument removed.

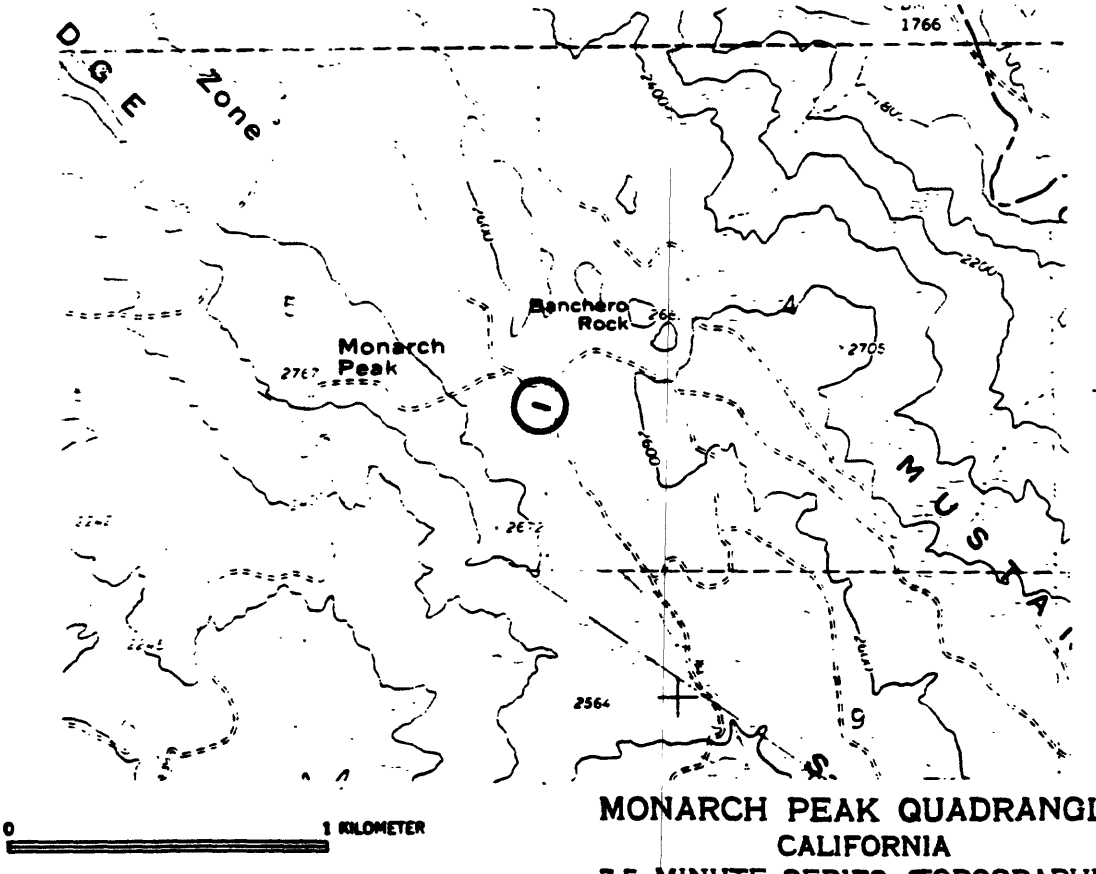

SMITH RANCH XSR2
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION XMP1

Latitude 36° 12.8'
Longitude 120° 47.9'

Position 405.1 km
10-meter wire, ø=30°

The Monarch Peak creepmeter was installed during June, 1969, on the San Andreas fault at a site 96.0 km southeast of San Juan Bautista, and 71.0 km northwest of Cholame. The installation consists of a single wire buried a few centimeters below the surface in alluvium. Creep activity at this site is composed of occasional minor events of up to 1.3 mm amplitude, superimposed on a background of nearly steady-state slip. The average long-term creep rate is about 14 mm/yr, with a slight seasonal variation. Results of repeated surveys from an adjacent alinement array demonstrate that the creepmeter covers only the northeasternmost 5 m of the slip zone often containing most of the slip activity, but during certain periods, much of the slip activity has occurred in a portion of the slip zone southwest of the instrument. In November, 1988, the wire was found to be broken, and will be replaced as soon as possible.

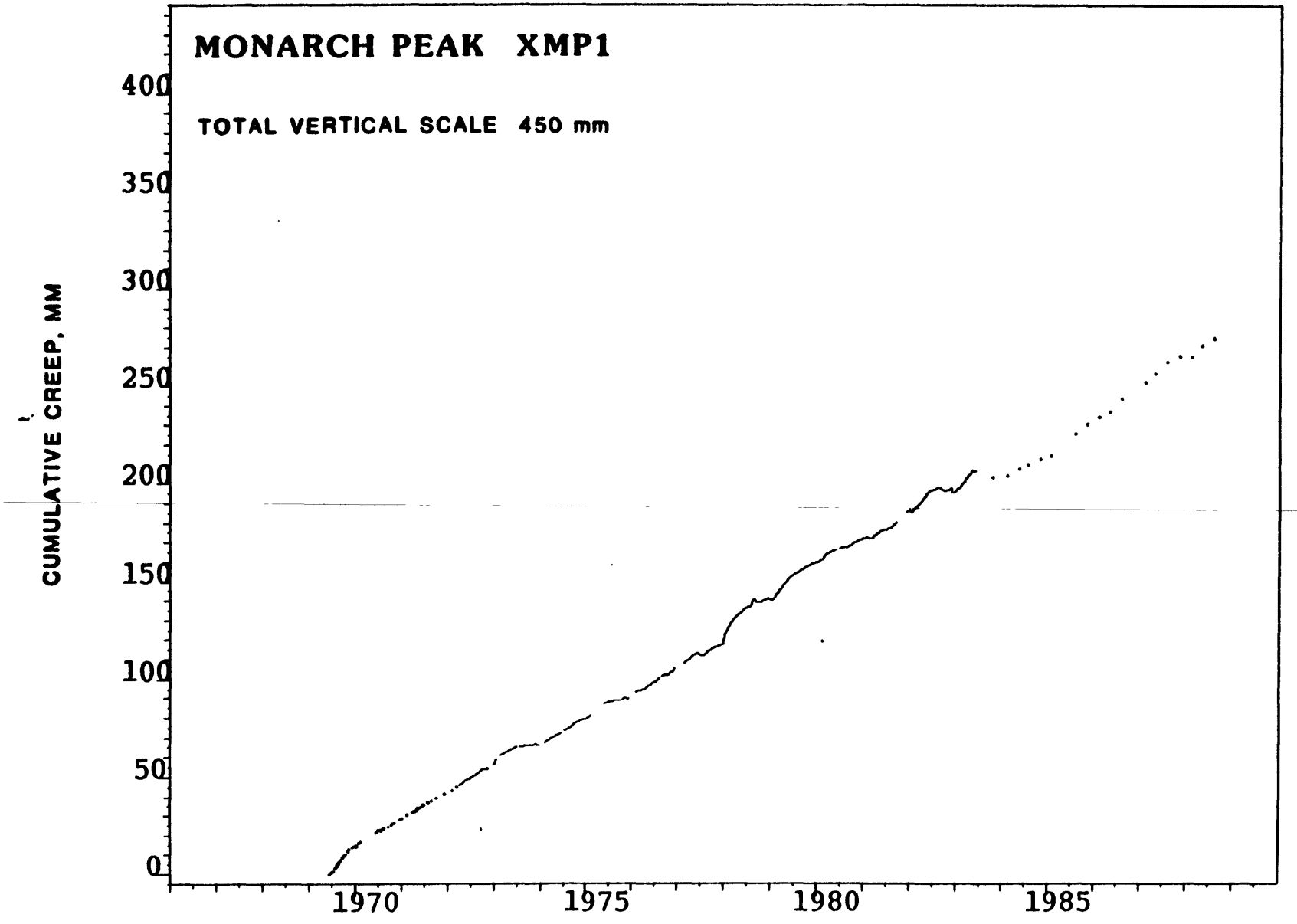



MONARCH PEAK QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XMP1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 5 | 0.00 | 9 | 1.53 | 5 | 3.53 | 2 | 6.43 | 4 | 9.81 | 7 | 12.05 | 28 | 14.11 |
| 1970 | 4 | 14.65 | 8 | 16.34 | | | | | | | 19 | 22.00 | 2 | 22.31 | 2 | 23.27 | 4 | 24.14 | 3 | 24.96 | 8 | 25.94 | 13 | 28.26 |
| 1971 | 3 | 29.11 | 6 | 30.28 | 21 | 31.92 | 6 | 32.64 | 1 | 33.69 | 12 | 35.56 | 22 | 36.89 | 5 | 37.29 | | | 2 | 39.27 | 27 | 41.27 | | |
| 1972 | | | 3 | 43.16 | 10 | 44.81 | | | 12 | 47.57 | | | 6 | 49.85 | 17 | 51.60 | | | 27 | 53.87 | | | 29 | 56.30 |
| 1973 | | | 20 | 60.93 | 28 | 62.32 | | | 1 | 63.40 | 14 | 64.76 | 13 | 65.10 | 17 | 65.51 | 11 | 65.71 | | | 9 | 66.12 | 19 | 66.21 |
| 1974 | | | 6 | 67.21 | 23 | 69.56 | | | 21 | 71.28 | | | 10 | 73.08 | 27 | 74.63 | | | 13 | 77.27 | 19 | 78.71 | 12 | 79.05 |
| 1975 | | | 19 | 81.93 | | | | | 21 | 86.57 | | | | | 7 | 88.79 | | | | | | | 2 | 91.40 |
| 1976 | 30 | 93.29 | | | | | | | 5 | 96.06 | | | | | 24 | 101.42 | | | | | 24 | 104.44 | | |
| 1977 | | | 3 | 107.07 | | | 8 | 110.60 | | | | | 12 | 112.32 | | | | | 7 | 115.93 | | | | |
| 1978 | 26 | 125.10 | | | | | | | 10 | 134.24 | | | | | 16 | 140.91 | | | | | | | 4 | 141.26 |
| 1979 | | | | | 8 | 144.60 | | | | | 13 | 152.18 | | | 23 | 155.20 | | | | | 14 | 158.47 | | |
| 1980 | | | 5 | 161.19 | 28 | 164.38 | | | | | 18 | 166.95 | | | | | 18 | 168.74 | | | | | 23 | 171.88 |
| 1981 | | | | | | | 16 | 174.24 | | | 16 | 176.49 | | | | | | | 19 | 182.17 | | | 3 | 185.32 |
| 1982 | | | | | 9 | 189.23 | | | 27 | 195.73 | | | | | 31 | 198.06 | | | | | | | 28 | 196.50 |
| 1983 | | | | | | | 16 | 204.36 | wire broken - 0 lost | | | | | | new wire; trend extrapolated | | | | 13 | 204.36 | | | | |
| 1984 | | | 2 | 204.74 | | | | | 7 | 207.82 | | | 7 | 209.79 | | | | | 25 | 212.87 | | | | |
| 1985 | 17 | 214.82 | | | | | | | | | | | 25 | 225.92 | | | | | 31 | 231.06 | | | | |
| 1986 | | | 6 | 234.83 | | | | | 1 | 237.61 | | | | | 1 | 243.94 | | | | | | | | |
| 1987 | | | 5 | 252.94 | | | 29 | 256.46 | | | | | 31 | 263.04 | | | | | | | 9 | 265.37 | | |
| 1988 | | | 10 | 265.72 | | | | | 5 | 271.14 | | | | | 2 | 274.59 | wire broken | | | | | | | |

7/83 - Found wire broken.
10/83 - Wire replaced; cumulative total restarted with extrapolated trend.
11/88 - Found wire broken.

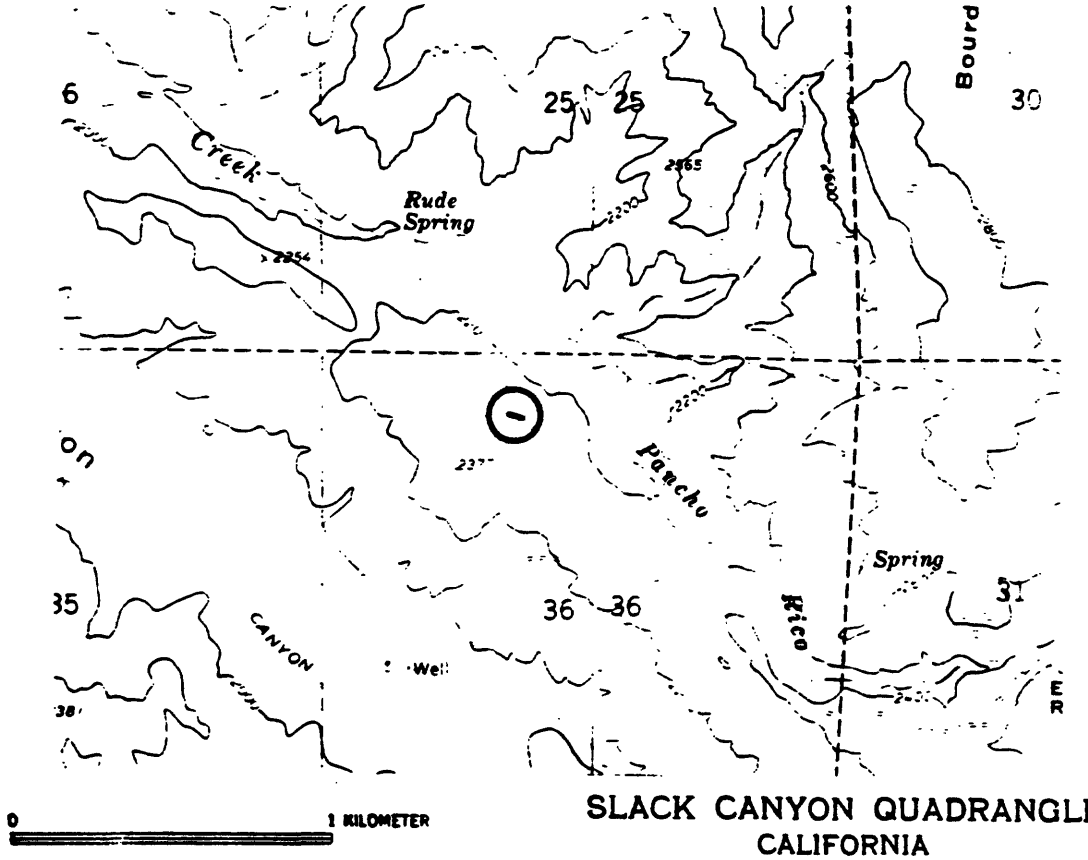

MONARCH PEAK XMP1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION XSC1

Latitude 36° 03.9'
Longitude 120° 37.7'

Position 427.6 km
10-meter wire, ø=30°

The Slack Canyon creepmeter was installed during June, 1969, on the San Andreas fault at a site 48.5 km northwest of Cholame, and 118.5 km southeast of San Juan Bautista. The installation consists of a single wire buried a few centimeters below the surface in weathered bedrock. In July, 1988, the entire instrument was uncovered by excavation and found to have been rotated 3 degrees clockwise by fault action during 19 years of operation. It now lies at an angle of 27 degrees to the fault instead of the original 30 degrees. The cumulative creep amounts listed here for 1974 and later years include a sliding angle correction to provide for rotation through time, and thus the values differ from those listed in earlier catalogs. Creep activity at this site is composed of steady-state right-lateral slip at a long-term rate of about 22 mm/yr, with a slight seasonal variation.

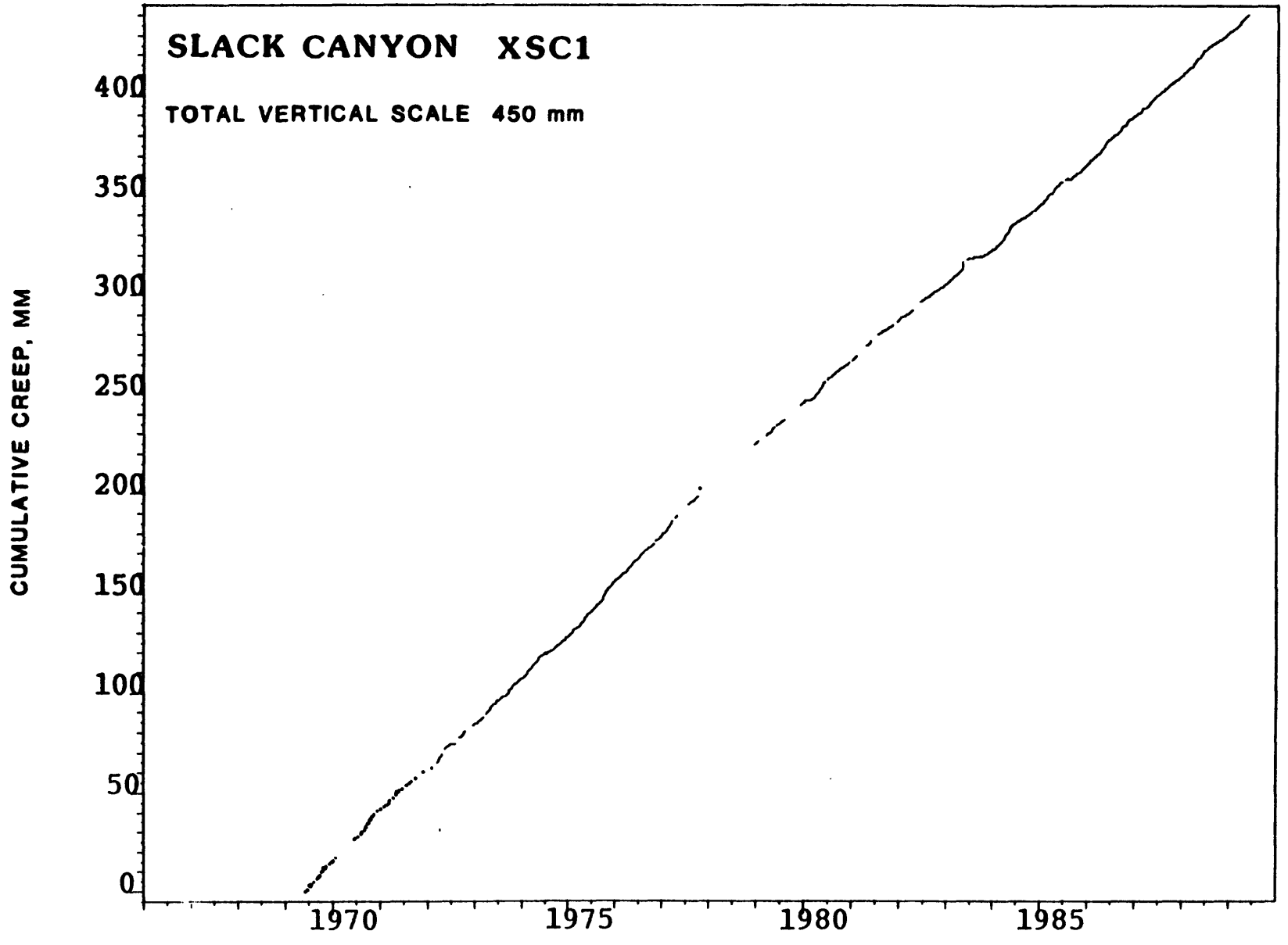



SLACK CANYON QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XSC1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 5 | 0.00 | 8 | 2.53 | 5 | 4.41 | 2 | 6.37 | 4 | 9.55 | 7 | 12.72 | 28 | 15.58 |
| 1970 | 3 | 16.10 | | | | | | | | | 19 | 26.30 | 2 | 27.01 | 1 | 28.93 | 4 | 32.03 | 3 | 35.49 | 7 | 38.16 | 5 | 40.15 |
| 1971 | 3 | 41.29 | 8 | 43.28 | 8 | 44.76 | 4 | 46.73 | 1 | 48.80 | 12 | 51.63 | 22 | 53.36 | 7 | 54.09 | | | 3 | 57.08 | 28 | 60.19 | 2 | 60.34 |
| 1972 | | | 3 | 61.98 | 9 | 64.92 | | | 12 | 71.48 | | | 6 | 74.43 | 30 | 77.18 | | | 10 | 79.60 | | | 12 | 83.23 |
| 1973 | 12 | 84.56 | | | 28 | 88.77 | | | 2 | 91.83 | 13 | 94.67 | | | 1 | 97.47 | 11 | 98.94 | | | 8 | 104.01 | 19 | 106.16 |
| 1974 | | | 7 | 109.22 | 23 | 112.65 | | | 21 | 117.55 | | | 10 | 119.20 | 27 | 121.08 | | | 12 | 123.75 | | | 11 | 127.00 |
| 1975 | | | 19 | 131.28 | | | | | 20 | 138.19 | | | | | 7 | 143.47 | | | | | | | 2 | 153.95 |
| 1976 | 29 | 157.65 | | | | | | | 5 | 163.80 | | | | | 25 | 170.46 | | | | | 11 | 175.44 | | |
| 1977 | | | 3 | 180.65 | | | 8 | 186.80 | | | | | 12 | 193.41 | | | | | 7 | 201.19 | | | | |
| 1978 | | | | | | | | | 10 | 210.53 | | | | | 17 | 217.52 | | | | | | | 5 | 224.38 |
| 1979 | | | | | 8 | 228.87 | | | 24 | 234.54 | 13 | 235.38 | | | 23 | 238.79 | | | | | 23 | 243.73 | | |
| 1980 | | | 5 | 246.83 | | | | | | | 18 | 257.57 | | | | | 18 | 261.86 | | | | | 24 | 266.72 |
| 1981 | | | 5 | 270.03 | 30 | 274.01 | | | | | 16 | 278.53 | 8 | 279.97 | | | 24 | 283.02 | | | | | 3 | 286.71 |
| 1982 | | | | | | | | | 27 | 296.41 | 30 | 297.88 | | | 31 | 300.99 | | | | | | | 28 | 306.29 |
| 1983 | | | | | | | 15 | 313.30 | 6 | 317.49 | | | 8 | 318.61 | | | | | 12 | 320.19 | 2 | 322.19 | 8 | 322.78 |
| 1984 | | | 2 | 325.62 | | | 20 | 332.02 | | | | | 17 | 337.29 | | | | | 25 | 341.60 | | | | |
| 1985 | 17 | 346.78 | | | | | 17 | 354.17 | | | | | 25 | 358.20 | | | | | 31 | 362.70 | | | | |
| 1986 | | | 4 | 369.14 | | | | | 1 | 374.62 | | | | | 1 | 381.06 | | | 31 | 387.56 | | | | |
| 1987 | | | 5 | 392.24 | 4 | 394.61 | 29 | 397.34 | | | | | 31 | 402.30 | | | | | | | 7 | 405.51* | | |
| 1988 | 26 | 409.74* | | | | | 25 | 415.19* | 5 | 415.83* | | | 12 | 423.95 | | | | | 25 | 428.27 | | | | |

*These readings are lower than the on-site recorder values on these dates due to misalignment of the micrometer reading block. The recorder values were used on the long-term plot.
The instrument was rebuilt 7/12/88.

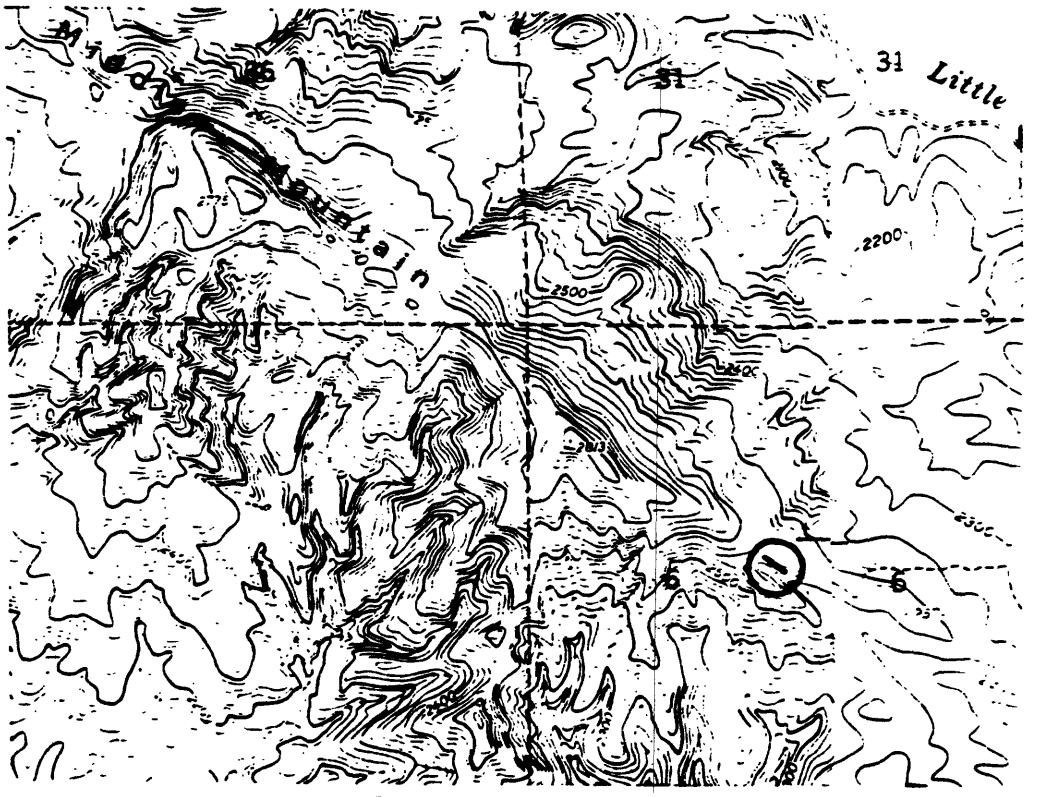

SLACK CANYON XSC1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION XMM1

Latitude 35° 57.5'
Longitude 120° 30.1'

Position 443.5 km
26-meter wire, ø=30°

The Middle Mountain creepmeter was installed in September, 1979, on the San Andreas fault 32.2 km north of Cholame. The installation consists of a single wire entrenched about 1 meter below the surface on a gentle slope where the surface rupture of the 1966 Parkfield-Cholame earthquake sequence broke through deformed non-marine sediments (Paso Robles formation), near the crest of Middle Mountain. Following the Coalinga earthquake (5/2/83, M6.2), creep at XMM1 reversed to left lateral; right-lateral movement resumed following a swarm of magnitude 1+ earthquakes under the station in summer, 1984. In September, 1986, a drain trench was dug beside the instrument, causing a 3-mm creep event, which we have left in the record as nominally tectonic. Creep activity here is composed of occasional right-lateral creep events of less than 1-mm amplitude, superimposed on a background of continuous right-lateral movement. The average long- term creep rate during periods of right-lateral movement was 20 mm/yr before the Coalinga earthquake, and is 14.2 mm/yr since resumption of right-lateral movement in 1984. See text for discussion of creep events at XMM1 that have occurred simultaneous with drops in water level in a deep well on Middle Mountain.



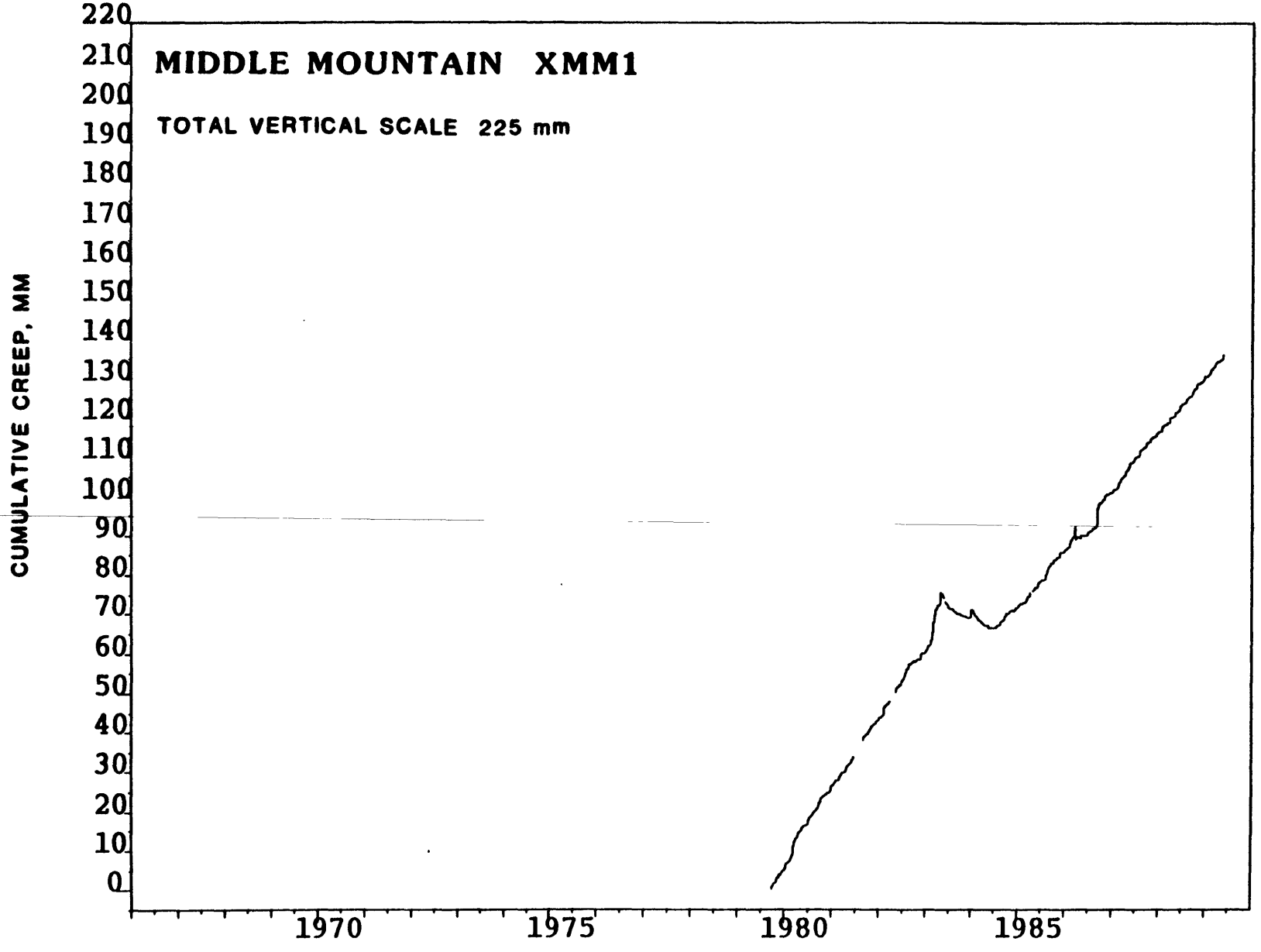

STOCKDALE MOUNTAIN QUADRANGLE
CALIFORNIA-MONTEREY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

0 1 KILOMETER

PARKFIELD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XMM1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | 25 | 0.00 | 12 | 1.35 | 29 | 3.37 | | |
| 1980 | | | 6 | 6.78 | 18 | 11.55 | | | | | 19 | 16.18 | | | | | 22 | 20.50 | | | | | 29 | 25.88 |
| 1981 | 4 | 26.35 | | | | | 6 | 29.97 | | | 18 | 34.21 | 24 | 35.50 | 26 | 38.17 | 15 | 39.50 | | | | | 1 | 42.12 |
| 1982 | | | | | | | | | 11 | 50.38 | 29 | 52.40 | | | 25 | 56.86 | | | | | | | 9 | 60.22 |
| 1983 | | | | | 31 | 71.81 | | | 6 | 75.88 | 6 | 72.88 | 6 | 72.19 | | | | | 6 | 70.16 | | | | |
| 1984 | 24 | 69.67 | | | | | 19 | 67.00 | 10 | 67.28 | | | 19 | 67.15 | 29 | 68.35 | | | 17 | 69.73 | | | | |
| 1985 | 17 | 73.04 | | | | | 16 | 75.68 | | | | | 24 | 78.91 | 21 | 81.53 | | | 30 | 83.93 | | | | |
| 1986 | | | 2 | 86.83 | 26 | 88.70 | 28 | 89.01 | | | | | 30 | 91.55 | | | 3 | 92.23 | 28 | 98.90 | | | | |
| 1987 | 27 | 101.68 | | | 18 | 104.02 | | | 1 | 106.13 | | | 30 | 110.49 | | | | | | | 6 | 115.01 | | |
| 1988 | 25 | 117.86 | | | | | | | 2 | 120.77 | | | 29 | 123.58 | 16 | 125.03 | | | 27 | 128.34 | | | | |

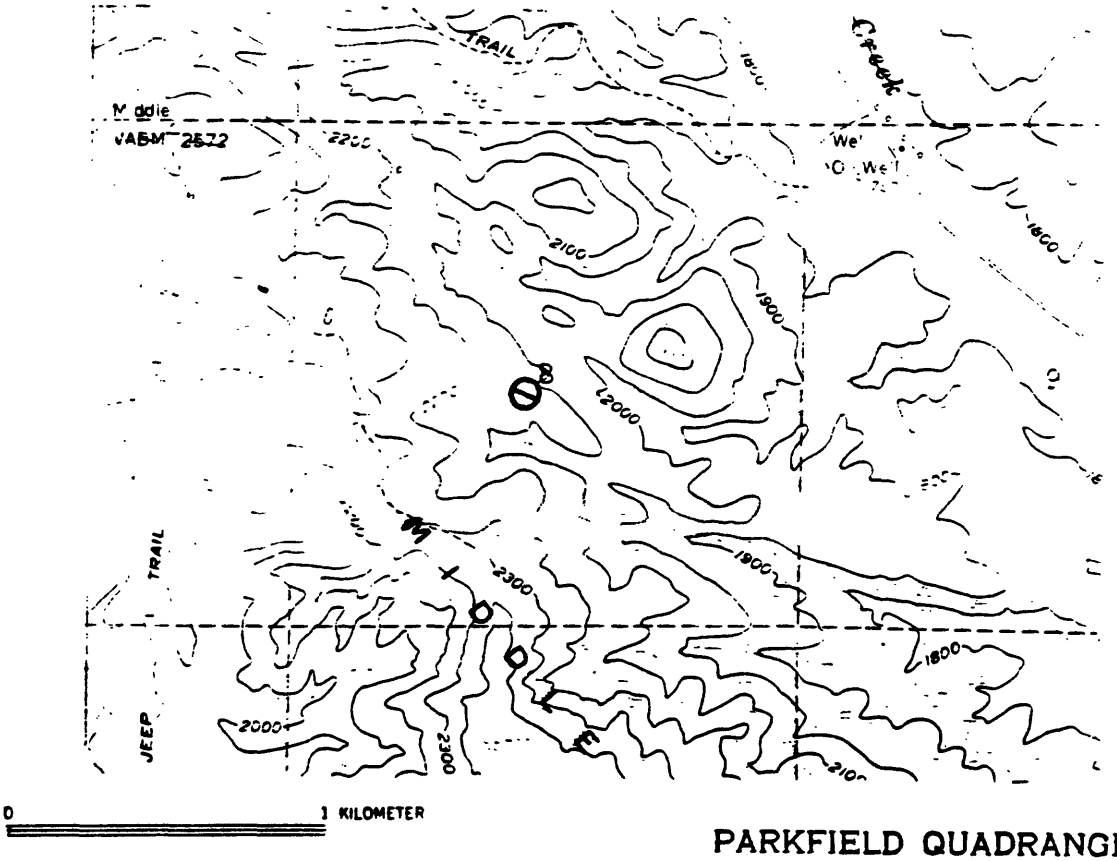

MIDDLE MOUNTAIN XMM1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION XMD1

Latitude 35° 56.6'
Longitude 120° 29.1'

Position 445.8 km
36-meter wire, ø=27°

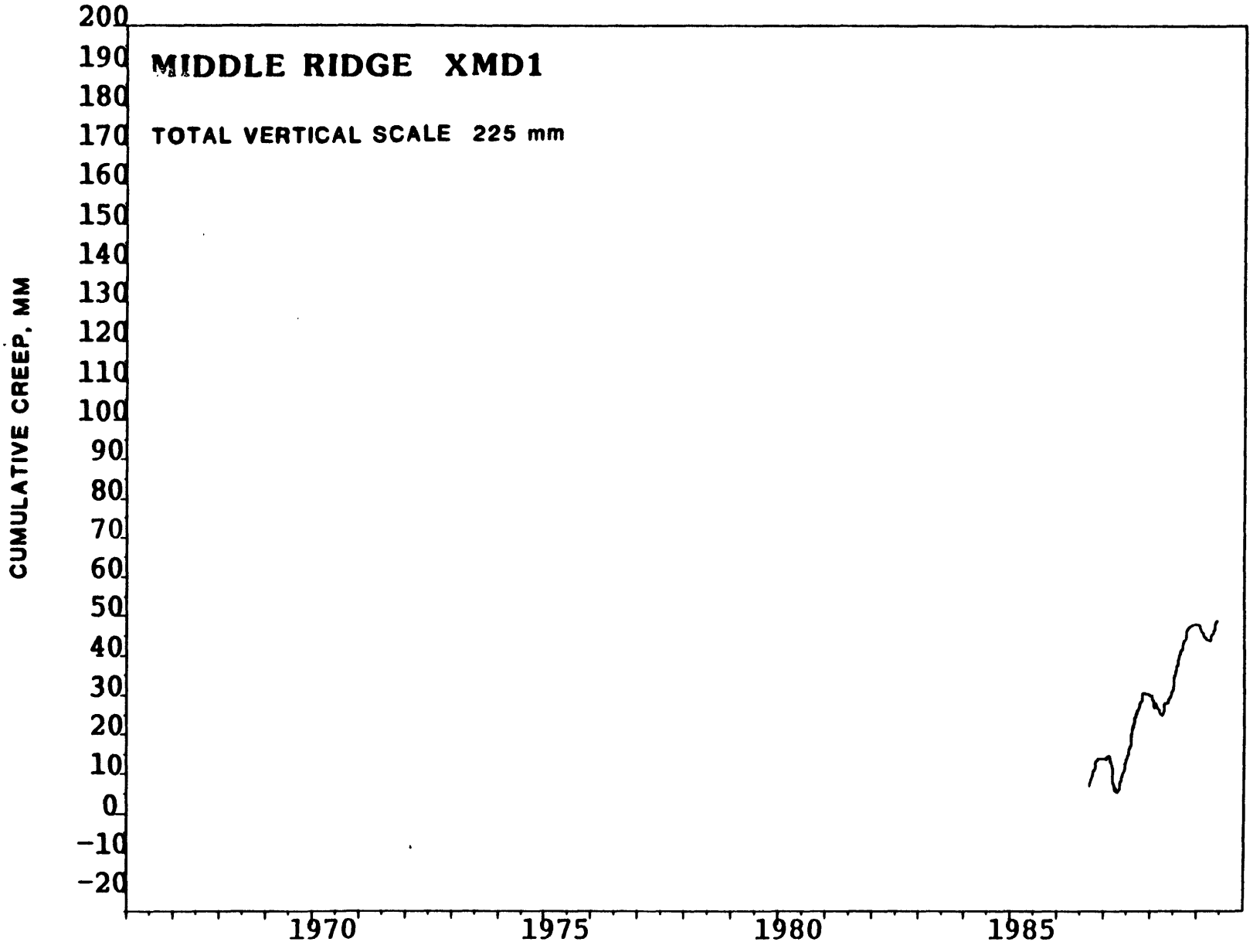
The Middle Ridge creepmeter, the longest wire installation yet attempted, was installed in July, 1986, on the San Andreas fault 29.9 km northwest of Cholame. The installation consists of a single wire entrenched about 1 meter below the surface across one of several parallel traces covered by an alinement array installed in 1979. The creepmeter was placed to cover the area of greatest displacement in the array monuments. However, surveys of the array show seasonal right-lateral movement on adjacent traces, apparently producing left-lateral movement on the trace monitored by the instrument. Data from the creepmeter reflects this seasonal backup, the cumulative effect of which is to produce a long-term creep rate of only 19 mm/yr, when in fact as much as 25 mm of right-lateral movement has occurred at the site in a year (May 1-December 15, 1987). Creep activity at this site is composed of several daily right-lateral creep events of 1 mm or less amplitude between spring and mid-winter, at which time movement ceases, only to resume as fast left-lateral movement when heavy rains begin in January or February. See text for discussion of creep events at XMD1 occurring simultaneous with drops in water level in a deep well on Middle Mountain.




PARKFIELD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XMD1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | 25 | 0.00 | | | 4 | 7.07 | | | 12 | 13.92 | | |
| 1987 | 6 | 13.98 | 4 | 14.72 | 16 | 7.35 | | | 1 | 5.93 | | | | | 3 | 19.96 | | | | | 7 | 30.39 | 15 | 29.71 |
| 1988 | 25 | 26.34 | | | | | | | 4 | 28.27 | | | 28 | 37.57 | | | | | 31 | 47.94 | | | | |

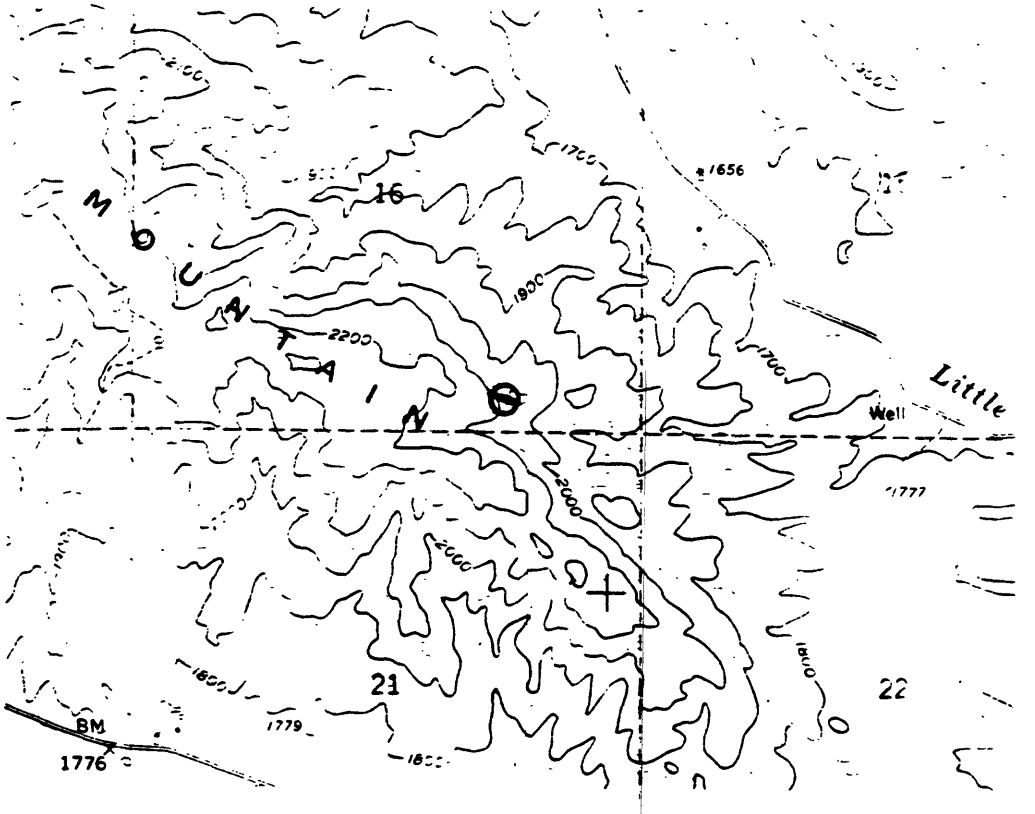

MIDDLE RIDGE XMD1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
1970
1975
1980
1985

## STATION XVA1

Latitude 35° 55.3'
Longitude 120° 27.7'

Position 448.9 km
30-meter wire, ø=30°

The Varian creepmeter was installed in April, 1987, on the San Andreas fault 26.8 km northwest of Cholame. The installation consists of a single wire entrenched about 1 meter deep below the surface across a sharp gully between two slopes. An alinement array had been placed across the gully and up both slopes in 1986, and surveys for a year had indicated displacement was occurring in the gully. However, displacement now also appears to be occurring at the top of the slope to the west, and, like XMD1, XVA1 records both right- and left-lateral movement, depending on the season. Creep at this site is characterized by steady-state movement, with occasional surge-like creep events, usually during rain. The long-term rate of 7.3 mm/yr masks a seasonal right-lateral movement of 11.8 mm (1988). During periods of right-lateral movement, the creep rate at XVA1 matches that measured by the Parkfield two-color distance-monitoring laser at its station MIDE, located upslope from XVA1 and across the fault from the laser.



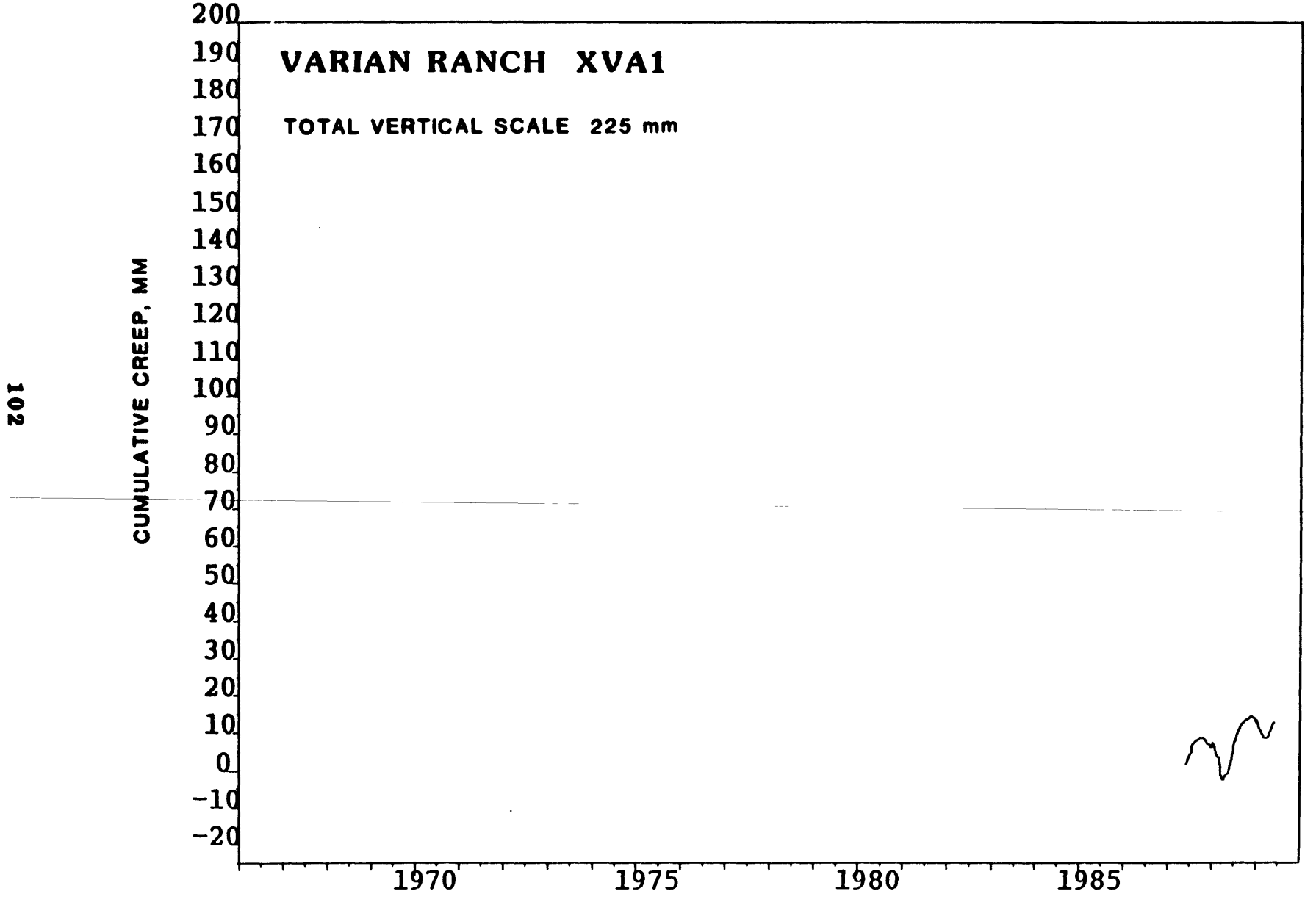

PARKFIELD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

CUMULATIVE CREEP CALCULATED FROM FIELD READINGS

STATION XVA1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | 23 | 0.00 | 1 | 0.10 | | | 30 | 7.23 | 26 | 8.02 | | | | | 6 | 7.73 | | |
| 1988 | 25 | 5.19 | | | 21 | -2.29* | | | 4 | -0.77* | | | 29 | 9.52 | | | | | 27 | 13.28 | | | | |

*Negative numbers indicate cumulative left-lateral movement.

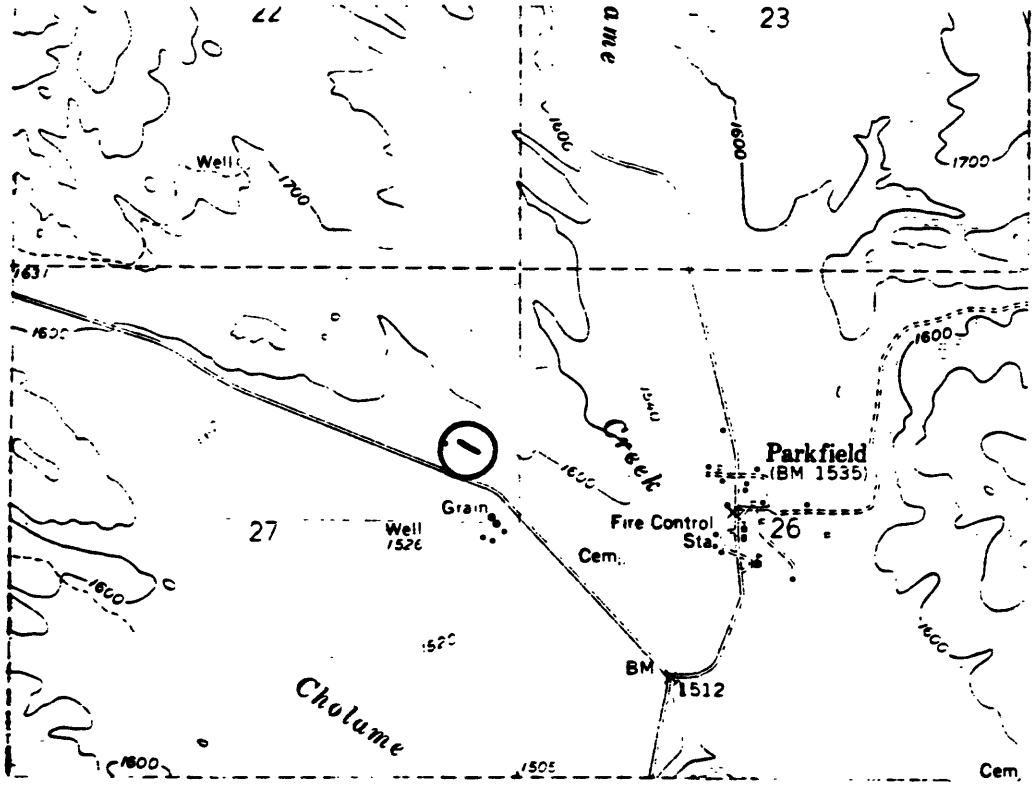

VARIAN RANCH XVA1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
1970
1975
1980
1985

## STATION XPK1

Latitude 35° 54.1'
Longitude 120° 26.5'

Position 451.8 km
23-meter wire, ø=30°

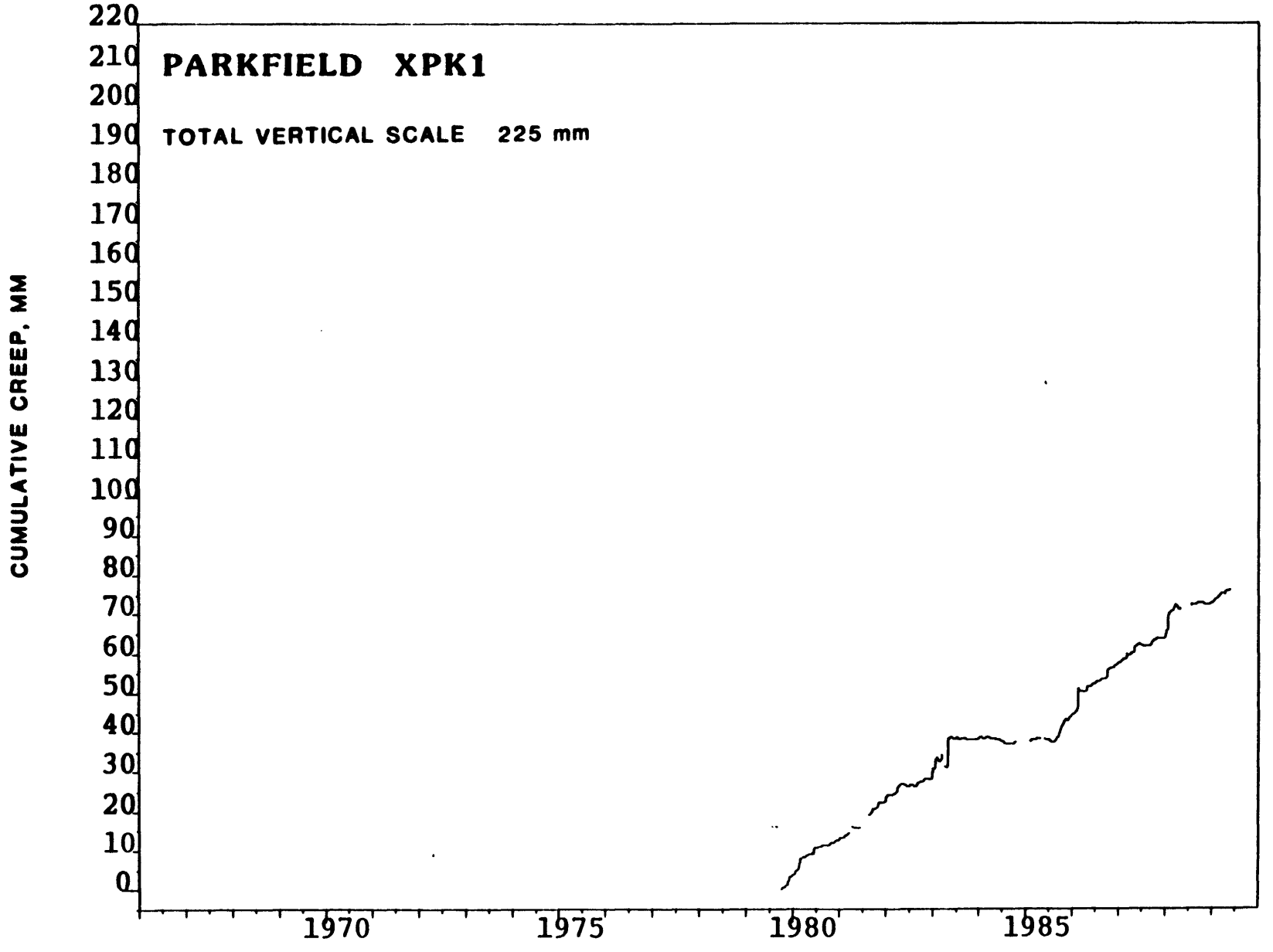
The Parkfield creepmeter was installed in September, 1979, on the San Andreas fault approximately 24 km northwest of Cholame. The installation consists of a single wire entrenched about 1 meter below the surface across the surface rupture of the 1966 Parkfield-Cholame earthquake sequence, and adjacent to a sagpond. This station recorded a right-lateral coseismic step of 6.6 mm during the Coalinga earthquake (5/2/83, M6.2), the second largest coseismic step in the Parkfield creepmeter network. Activity slowed until August 9, 1985, when, coincident with an aftershock of the Kettleman Hills earthquake (8/4/85, M3.5), right-lateral creep resumed at the site. XPK1 is the only Parkfield creepmeter to record a return to its pre-Coalinga creep trend. Creep activity at this site before the Coalinga earthquake and after the return to right-lateral movement consists of occasional right-lateral creep events of less than 1 mm in amplitude superimposed on a background of nearly continuous right-lateral movement. The average creep rate to date is about 13 mm/yr.




PARKFIELD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XPK1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | 26 | 0.00 | 12 | 0.32 | 6 | 1.23 | 15 | 3.45 |
| 1980 | | | 6 | 5.25 | 19 | 8.45 | | | | | 19 | 10.50 | | | | | 22 | 11.42 | | | | | 24 | 12.44 |
| 1981 | 8 | 12.89 | | | | | 6 | 15.95 | | | 18 | 16.38 | 22 | 18.82 | 21 | 18.85 | 15 | 19.95 | | | | | 2 | 22.36 |
| 1982 | | | | | 9 | 24.26 | | | 25 | 26.72 | 30 | 26.14 | | | 25 | 26.11 | | | | | | | 10 | 28.24 |
| 1983 | | | | | | | 21 | 31.36 | 6 | 38.57 | 7 | 38.59 | 6 | 38.59 | | | | | 6 | 38.29 | | | | |
| 1984 | 17 | 38.93 | | | | | 20 | 38.64 | | | | | 19 | 37.25 | 31 | 36.67 | 14 | 36.62 | 17 | 37.07 | | | | |
| 1985 | 17 | 37.87 | | | | | 18 | 38.28 | | | | | 24 | 37.26 | | | 27 | 40.82 | 18 | 41.95 | | | | |
| 1986 | 8 | 44.61 | | | | | 3 | 50.28 | | | | | 31 | 53.06 | | | | | 28 | 56.23 | | | | |
| 1987 | | | 4 | 58.44 | | | 14 | 60.40 | 1 | 60.49 | | | 24 | 61.66 | 19 | 61.68 | | | | | 10 | 63.62 | | |
| 1988 | 19 | 68.46 | | | | | | | 4 | 71.39 | | | 19 | 72.26 | | | | | 27 | 72.66 | | | | |

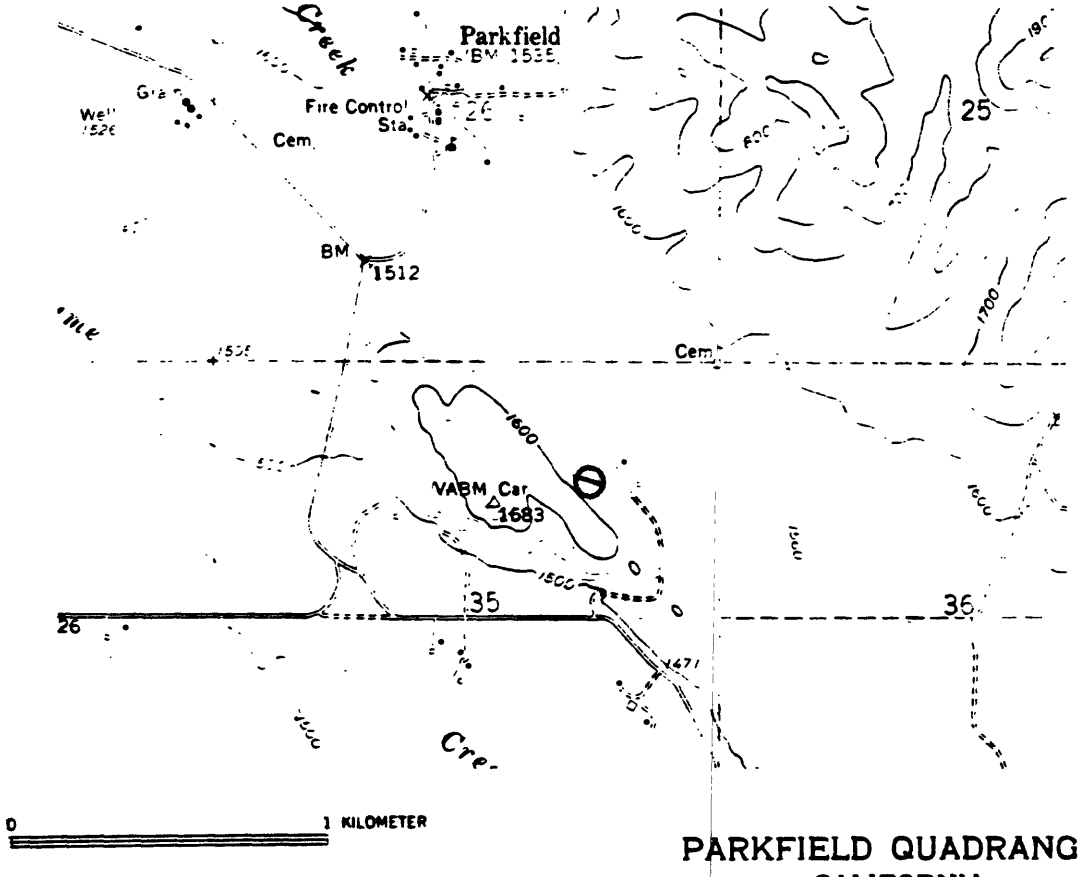

PARKFIELD XPK1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION XTA1

Latitude 35° 53.4'
Longitude 120° 25.6'

Position 453.8 km
30-meter wire, ø=30°

The Taylor Ranch creepmeter was installed in September, 1985, on the San Andreas fault approximately 22 km northwest of Cholame. The installation consists of a single wire entrenched about 1 meter below the surface across a distinctive swale to the east of the hilltop on which the Parkfield two-color distance-monitoring laser is located. Frequent surveys of an alinement array installed at the Taylor site in 1984 showed displacement occurring near the bottom of the swale, and the creepmeter was placed to cover the area of greatest displacement. Creep activity at this site consists of occasional small right-lateral events and left-lateral surges (seasonal) superimposed on a background of gradual right- and left-lateral drift, perhaps reflecting seasonal activity on an adjacent trace or traces. The average creep rate to date is 7 mm/yr.

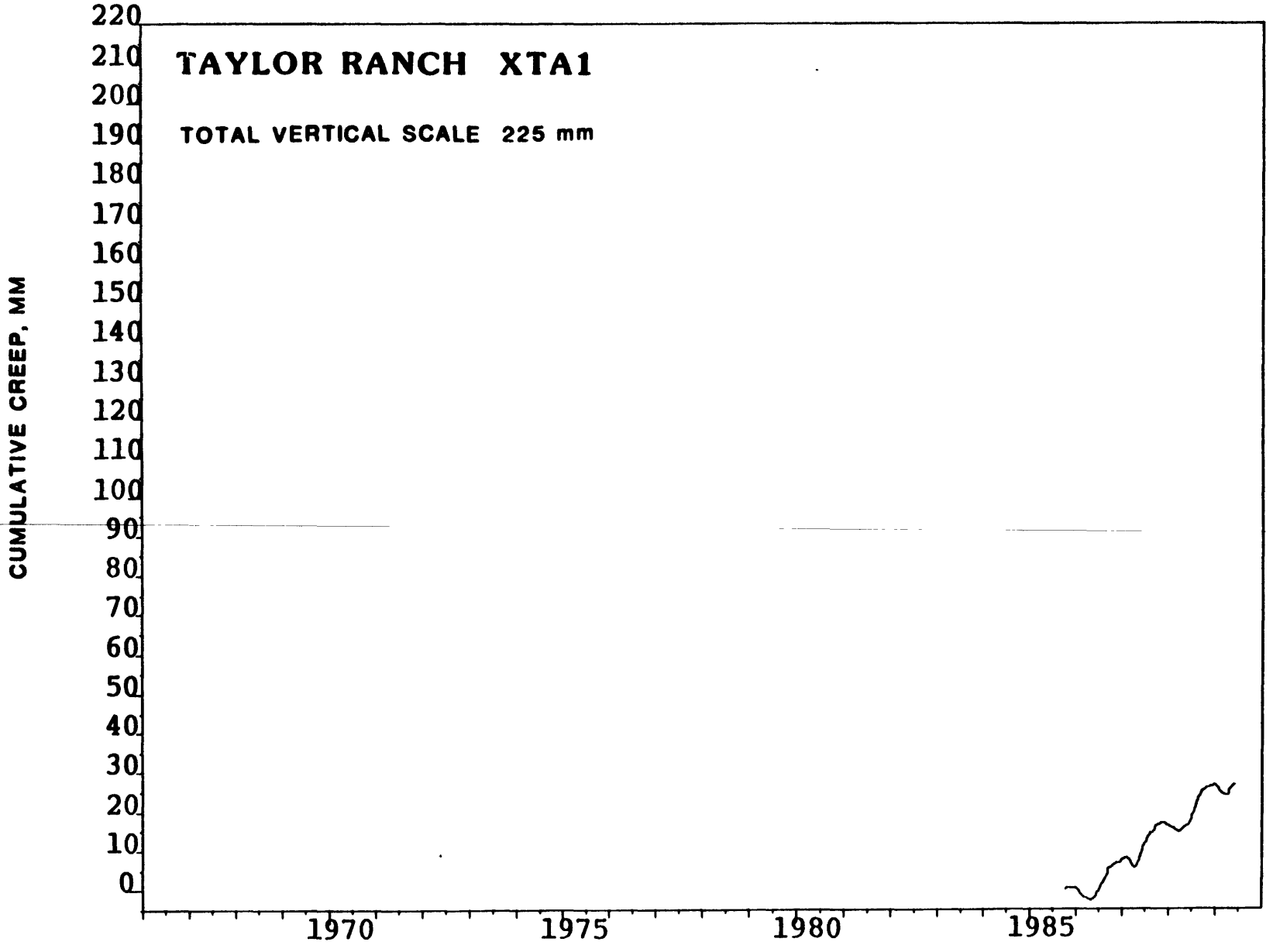



PARKFIELD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XTA1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | 27 | 0.00 | 29 | 0.70 | | | | |
| 1986 | 8 | 0.33 | 1 | -1.13* | | | 3 | -2.35* | | | 12 | -0.94* | 31 | 1.85 | | | 5 | 3.96 | 28 | 6.35 | | | | |
| 1987 | 27 | 7.91 | | | | | 30 | 6.59 | | | | | 29 | 13.66 | | | | | | | 6 | 17.11 | | |
| 1988 | 29 | 16.11 | | | | | | | 6 | 15.90 | | | 27 | 21.17 | | | | | 27 | 25.50 | | | | |

*Negative numbers indicate cumulative left-lateral movement.

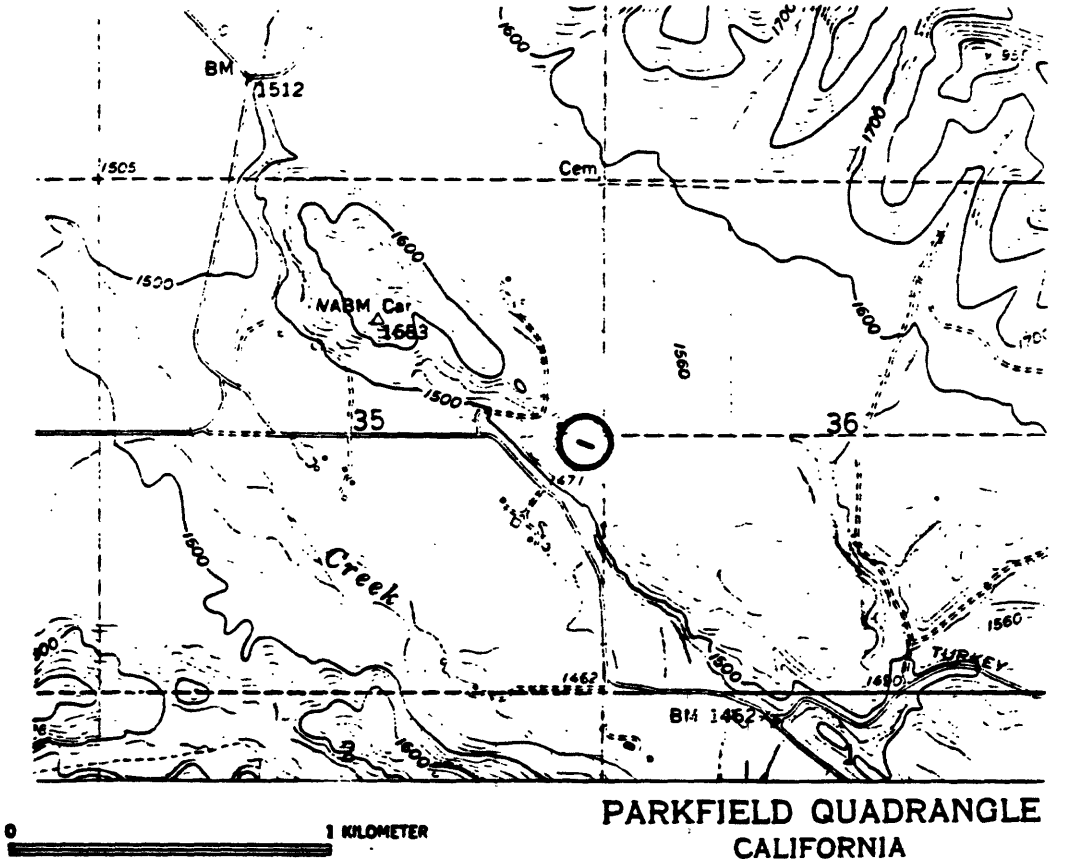

TAYLOR RANCH XTA1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION XDR1, XDR2

Latitude 35° 53.0'
Longitude 120° 25.2'

Position 454.8 km
10,30-meter wire, ø=30°

The Durham Ranch creepmeter was installed during June, 1969, on the San Andreas fault at a site 21.3 km northwest of Cholame. The installation consisted of a single wire buried a few centimeters below the surface on the northeast side of a ridge. Creep activity at this site was composed of occasional minor right-lateral events and left-lateral surges of up to 12 mm amplitude superimposed on a background of gradual right- and left-lateral drift. The average long-term creep rate was about 8 mm/yr, with a distinct seasonal variation consisting of onsets of left-lateral events and negative drift during periods of heavy rainfall. Results of repeated surveys from an adjacent alinement array demonstrate that the creepmeter covered only the southwesternmost 5 m of a 23-m-wide slip zone. The northeast portion of the slip zone not covered by the creepmeter was intermittently active, perhaps on a seasonal basis. In October, 1985, XDR1 was removed and replaced with the 30-m instrument XDR2. Creep activity continued to consist of right- and left-lateral surges, but surge amplitudes were considerably decreased from those recorded by XDR1. In July, 1987, the instrument was removed at the request of the landowner. The creep rate between 1985 and 1987 was 3.8 mm/yr.



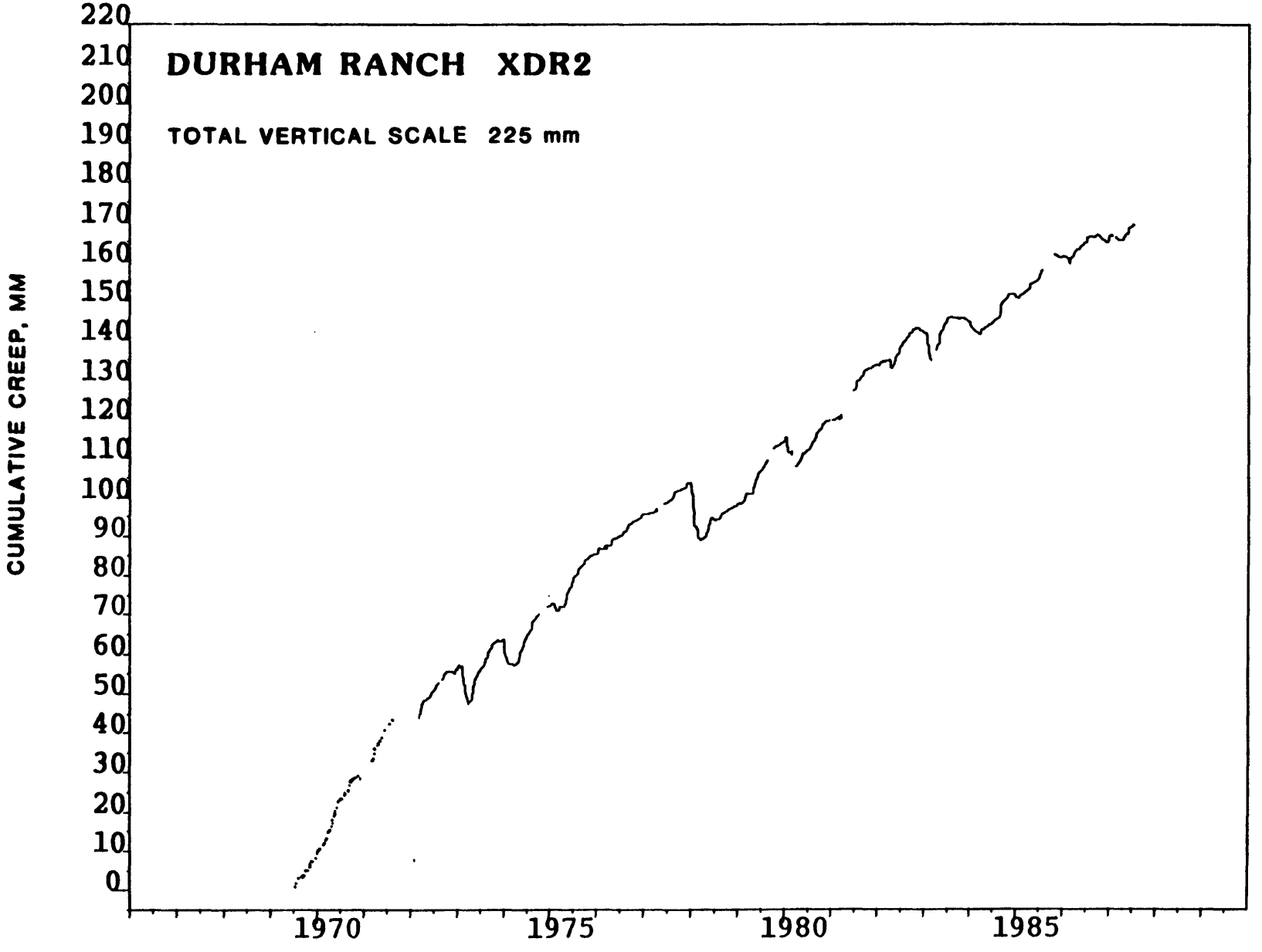

PARKFIELD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XDR1, XDR2

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | 15 | 0.00 | 5 | 2.09 | 2 | 2.20 | 4 | 4.20 | 7 | 4.62 | 28 | 6.67 |
| 1970 | 3 | 7.06 | 7 | 8.14 | 1 | 9.42 | 4 | 12.72 | 2 | 14.57 | 6 | 18.70 | 2 | 20.91 | 1 | 21.78 | 4 | 23.33 | 3 | 25.84 | 7 | 26.51 | 5 | 25.88 |
| 1971 | | | 25 | 28.00 | 6 | 27.93 | 3 | 30.87 | 1 | 32.67 | 12 | 35.83 | | | 7 | 38.94 | | | 3 | 41.49 | 28 | 43.71 | | |
| 1972 | | | 2 | 43.20 | 9 | 44.03 | | | 12 | 48.68 | | | 11 | 50.99 | 30 | 53.50 | | | 11 | 55.33 | 7 | 55.76 | 12 | 55.37 |
| 1973 | 5 | 56.52 | | | 13 | 49.50 | 27 | 48.75 | | | 13 | 54.98 | | | 3 | 57.31 | 11 | 60.82 | | | 8 | 63.48 | 19 | 63.49 |
| 1974 | | | 7 | 57.90 | 24 | 57.37 | | | 21 | 61.17 | | | 11 | 65.02 | 27 | 68.46 | | | 12 | 70.32 | | | 11 | 72.12 |
| 1975 | 7 | 72.74 | 19 | 71.16 | | | | | 20 | 75.76 | | | | | 7 | 81.44 | 14 | 82.67 | | | | | 1 | 85.30 |
| 1976 | 29 | 86.80 | | | | | | | 4 | 89.32 | | | | | 17 | 89.45 | | | | | 10 | 91.87 | | |
| 1977 | | | 4 | 95.94 | | | 8 | 96.70 | 23 | 98.12 | | | 12 | 99.22 | | | | | 7 | 101.60 | | | | |
| 1978 | 26 | 92.97 | | | | | | | 11 | 92.10 | | | | | 17 | 94.90 | | | | | | | 5 | 97.80 |
| 1979 | | | | | 8 | 101.28 | | | 22 | 105.64 | 13 | 106.88 | | | | | 19 | 111.95 | | | 6 | 113.65 | | |
| 1980 | | | | | 19 | 107.85 | | | 23 | 107.40 | 19 | 111.54 | | | | | 22 | 117.23 | 11 | 117.42 | | | 29 | 119.61 |
| 1981 | | | | | | | 6 | 120.48 | | | 17 | 126.98 | 10 | 127.70 | 26 | 131.01 | 29 | 132.75 | | | | | 2 | 133.54 |
| 1982 | | | | | 9 | 134.89 | | | 25 | 136.05 | | | 22 | 140.08 | 26 | 141.38 | | | | | | | 10 | 143.11 |
| 1983 | | | | | | | 22 | 139.10 | 5 | 141.48 | 7 | 144.18 | 7 | 145.47 | | | | | 6 | 145.58 | | | | |
| 1984 | 17 | 143.10 | | | | | 19 | 143.01 | | | | | 19 | 145.29 | | | | | 17 | 151.06 | | | | |
| 1985 | 17 | 150.77 | | | | | 19 | 154.18 | | | | | 23 | 158.31 | | | 27 | 162.08 | 4 | 162.22* | 12 | 161.23 | | |
| 1986 | 7 | 161.15 | | | | | 3 | 162.95 | | | 24 | 165.07 | 31 | 166.31 | | | 5 | 166.11 | 28 | 165.69 | | | | |
| 1987 | 27 | 166.23 | 3 | 166.19 | | | 30 | 166.89 | | | | | 16 | 169.21 | Inst. removed | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

*XDR1 removed; XDR2 installed.

XDR2 was removed in July 1987 at the request of the landowner.

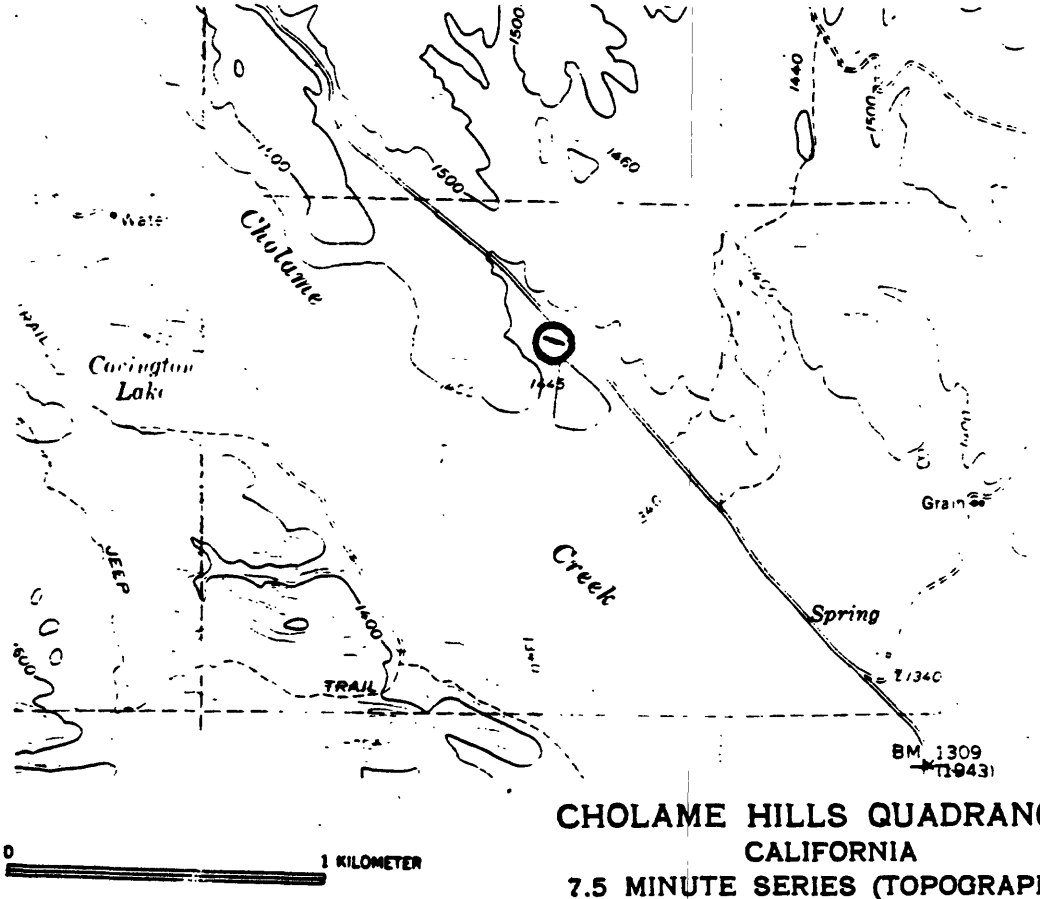

DURHAM RANCH XDR2
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION WKR1

Latitude 35° 51.5'
Longitude 120° 23.5'

Position 458.7 km
14-meter rod, ø=45°

The Work Ranch creepmeter was installed by California Institute of Technology personnel in 1976, and was incorporated into the USGS network in 1979. The instrument is located at the base of a low hill at the north end of Cholame Valley, approximately 17 km northwest of Cholame. The installation consists of a single rod buried about a meter below the surface, between the hill and the Parkfield-Cholame Road. A large right-lateral acceleration was underway at WKR1 when the Coalinga earthquake (5/2/83, M6.2) occurred. WKR1 recorded the largest coseismic step of all the Parkfield creepmeters (8.2 mm), followed by a slowdown to approximately 2 mm/yr of creep. Right-lateral creep resumed in 1984 at a rate less than half the pre-Coalinga earthquake rate of 11 mm/yr.

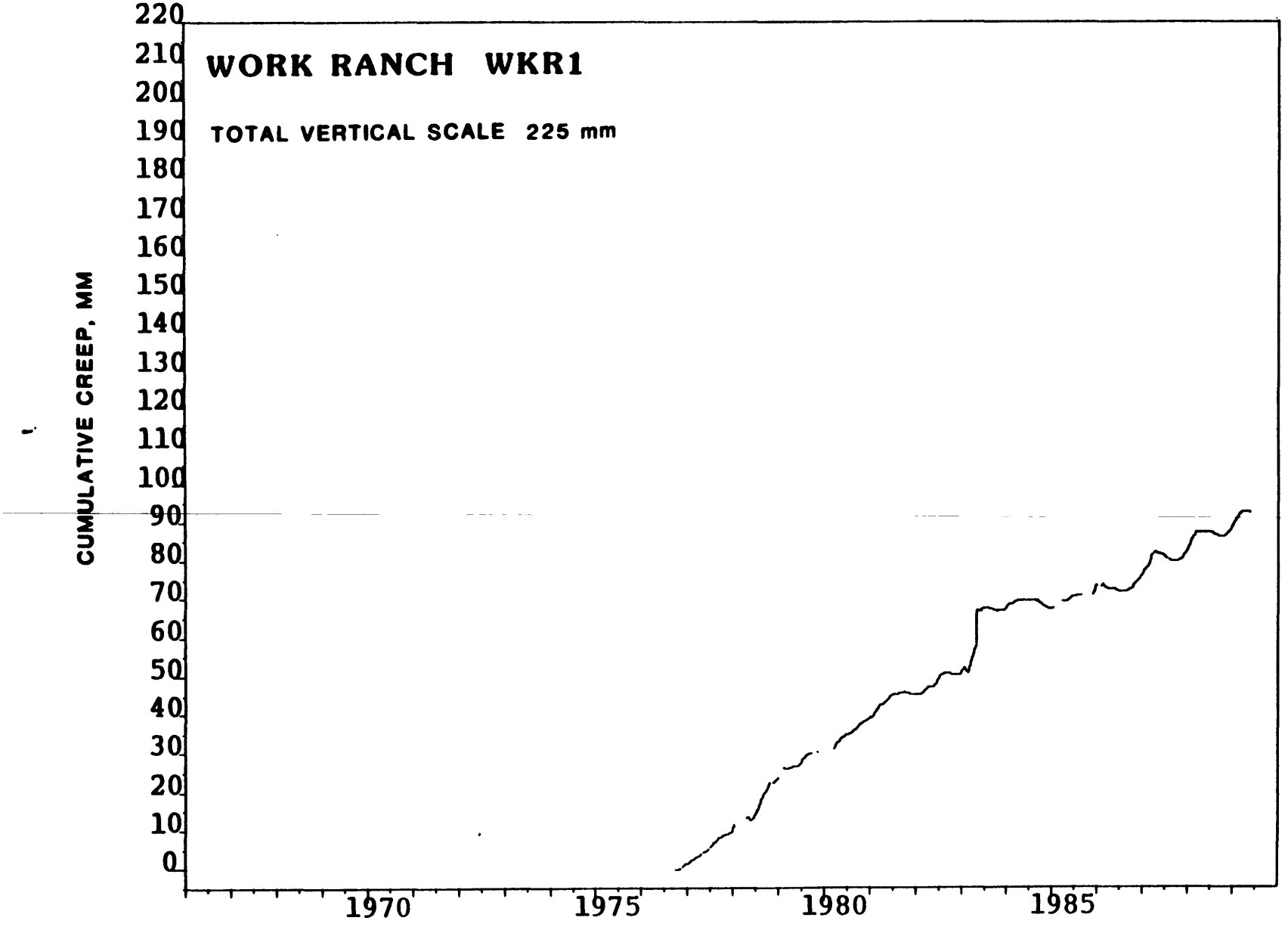



CHOLAME HILLS QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** WKR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | 24 | 0.00 | 6 | -0.14* | 22 | 0.52 | | |
| 1977 | 18 | 1.78 | | | 8 | 2.82 | 1 | 3.48 | | | 28 | 5.52 | | | 2 | 6.56 | 13 | 7.96 | 25 | 8.79 | | | 12 | 9.45 |
| 1978 | | | 21 | 12.05 | | | 18 | 13.17 | 15 | 13.13 | | | | | 7 | 17.05 | | | | | 13 | 22.51 | | |
| 1979 | | | 12 | 26.39 | | | | | 8 | 26.64 | | | | | 13 | 29.80 | | | | | 6 | 30.52 | 4 | 30.66 |
| 1980 | 28 | 31.99 | | | 19 | 30.99 | | | 23 | 34.11 | 2 | 34.33 | 8 | 35.07 | 4 | 35.63 | 22 | 37.06 | 10 | 37.67 | | | 29 | 38.97 |
| 1981 | 15 | 39.43 | | | | | 2 | 42.99 | | | 17 | 45.00 | | | | | 24 | 45.97 | | | | | 2 | 45.50 |
| 1982 | | | | | 9 | 46.33 | | | 26 | 47.98 | 30 | 49.67 | | | 26 | 50.78 | | | | | | | 10 | 50.64 |
| 1983 | | | | | | | 1 | 50.89 | 5 | 66.98 | | | 7 | 67.92 | | | | | 6 | 67.07 | | | | |
| 1984 | 17 | 68.67 | | | | | 20 | 69.28 | | | | | 18 | 69.43 | | | | | 17 | 68.41 | | | | |
| 1985 | 18 | 68.37 | 6 | 68.77 | 13 | 69.57 | 18 | 69.73 | | | | | 23 | 71.23 | wire broken | | | | | | 18 | 71.23 | | |
| 1986 | 8 | 73.60 | | | | | 29 | 72.76 | | | | | 31 | 71.79 | | | | | 29 | 73.84 | | | | |
| 1987 | 27 | 77.95 | | | 19 | 81.40 | 28 | 81.92 | | | | | 29 | 80.38 | | | 18 | 79.83 | | | 10 | 80.51 | | |
| 1988 | 29 | 84.03 | | | | | | | 6 | 87.48 | 17 | 87.79 | 18 | 87.65 | | | | | 31 | 86.95 | | | | |

*Negative numbers indicate cumulative left-lateral movement.

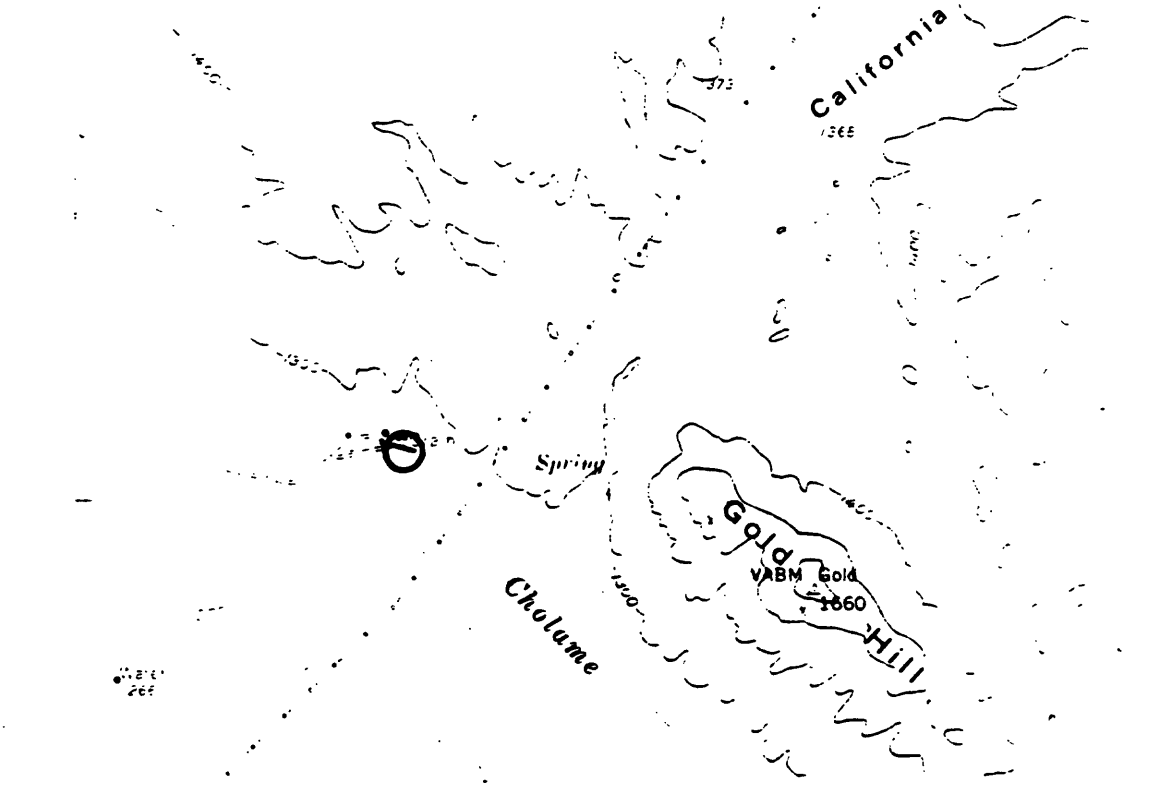

WORK RANCH WKR1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION CRR1

Latitude 35° 50.1'
Longitude 120° 21.8'

Position 463.0 km
9.4-meter rod, ø=45°

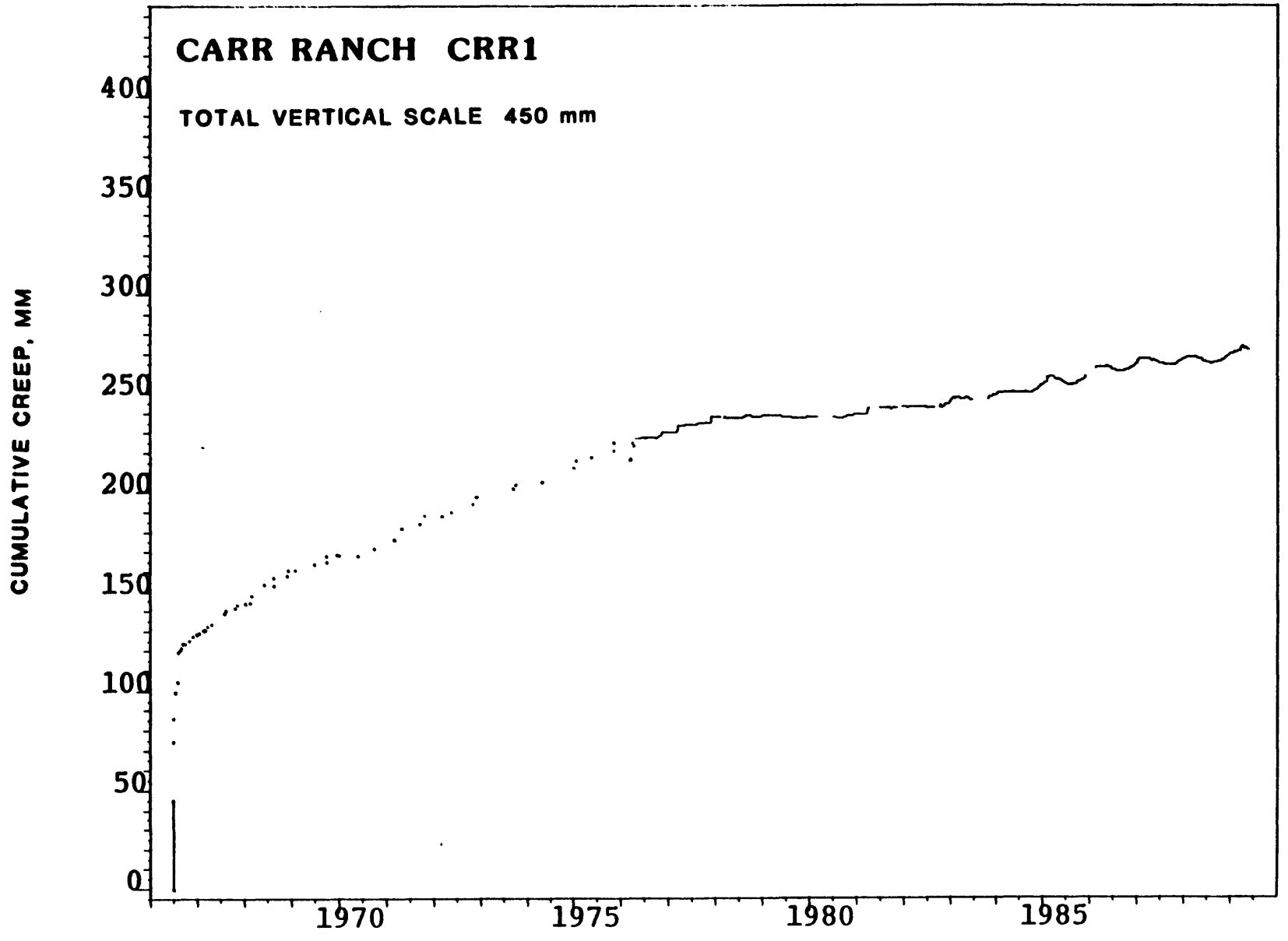
The Carr Ranch creepmeter was installed by California Institute of Technology personnel shortly after the 1966 Parkfield-Cholame earthquake sequence. The instrument was sited directly over the earthquake ground rupture approximately 13 km northwest of Cholame. The instrument was incorporated into the USGS network in 1979. The installation consists of a single rod buried about 1 meter below the surface near the edge of a field on the southwest side of Cholame Creek. Creep activity at this site was remarkably consistent (approximately 9 mm/yr) from installation until late 1977, at which time the creep rate declined to nearly 0 and the instrument began recording apparent left-lateral slip at a very low rate (slight contraction). Right-lateral creep resumed in late 1982. The Coalinga earthquake (5/2/83, M6.2) had no apparent effect on the creep rate at CRR1. However, in 1985, cultivation of the area immediately around the creepmeter was begun, and a large seasonal signal now appears in the data, superimposed on a background creep rate of 2.5 mm/yr. See Appendix A for a description of the sources of the 1966-1979 data plotted herein.




CHOLAME VALLEY QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** CRR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | 27 | 0.00 | 7 | 101.60 | 4 | 119.38 | 7 | 123.40 | 31 | 125.40 | 20 | 127.50 | 15 | 128.88 |
| 1967 | 4 | 129.10 | 13 | 130.50 | 15 | 132.30 | 24 | 133.40 | | | | | | | 2 | 139.10 | | | 21 | 141.60 | | | | |
| 1968 | 9 | 143.70 | 18 | 144.30 | 1 | 148.30 | | | | | 3 | 153.30 | | | 15 | 153.30 | | | | | 30 | 160.30 | | |
| 1969 | | | 1 | 161.30 | | | | | | | | | 3 | 164.30 | | | 28 | 165.30 | | | | | 15 | 168.30 |
| 1970 | 1 | 168.30 | | | | | | | 27 | 168.30 | | | | | | | | | 1 | 172.30 | | | | |
| 1971 | | | 27 | 176.30 | | | 22 | 182.30 | 1 | 182.30 | | | | | | | 15 | 184.30 | 15 | 188.30 | | | | |
| 1972 | | | | | 1 | 188.30 | | | 20 | 190.30 | | | | | | | | | 29 | 194.30 | | | 1 | 198.30 |
| 1973 | | | | | | | | | | | | | | | | | 15 | 202.30 | | | | | | |
| 1974 | | | | | | | 29 | 205.30 | | | | | | | | | | | | | | | 29 | 212.30 |
| 1975 | 15 | 216.30 | | | | | | | 15 | 217.30 | | | | | | | | | 29 | 221.30 | 1 | 224.30 | | |
| 1976 | | | | | 3 | 216.00 | 2 | 223.47 | 7 | 227.30 | 22 | 227.60 | 8 | 227.20 | 9 | 227.24 | 7 | 227.24 | 5 | 227.94 | 22 | 230.20 | | |
| 1977 | 18 | 230.50 | | | 8 | 233.70 | 1 | 233.75 | | | 28 | 234.10 | | | 2 | 234.33 | 13 | 234.50 | | | | | 12 | 238.00 |
| 1978 | | | 21 | 237.60 | | | | | 15 | 237.50 | | | | | | | | | | | 13 | 238.10 | | |
| 1979 | | | 12 | 238.40 | | | | | 8 | 238.40 | | | | | | | | | | | 6 | 237.70 | 4 | 237.80 |
| 1980 | | | | | 19 | 237.78 | | | | | 19 | 237.70 | | | | | 22 | 237.70 | 9 | 238.30 | | | 29 | 238.94 |
| 1981 | | | | | | | 3 | 243.20 | 19 | 243.10 | 3 | 243.10 | 14 | 242.70 | | | | | | | | | 20 | 243.10 |
| 1982 | | | | | 9 | 243.40 | | | 26 | 243.26 | 30 | 242.64 | | | 26 | 242.56 | | | 4 | 242.56 | | | 9 | 243.42 |
| 1983 | | | | | | | 1 | 246.83 | 6 | 247.30 | | | 7 | 245.86 | | | | | 7 | 247.19 | | | | |
| 1984 | 17 | 250.71 | | | | | 20 | 249.65 | | | | | 18 | 250.75 | | | | | 17 | 248.23 | | | | |
| 1985 | 18 | 255.66 | | | | | 19 | 256.56 | | | | | 23 | 254.34 | | | | | 29 | 256.29 | | | | |
| 1986 | | | 4 | 262.53 | | | 29 | 262.67 | | | | | 31 | 260.44 | | | | | 29 | 261.83 | | | | |
| 1987 | 27 | 267.61 | | | 20 | 267.52 | | | 1 | 266.68 | | | 29 | 264.51 | | | | | | | 6 | 265.23 | | |
| 1988 | 27 | 268.37 | | | | | | | 6 | 267.62 | | | 28 | 265.60 | | | | | | | 1 | 267.14 | | |

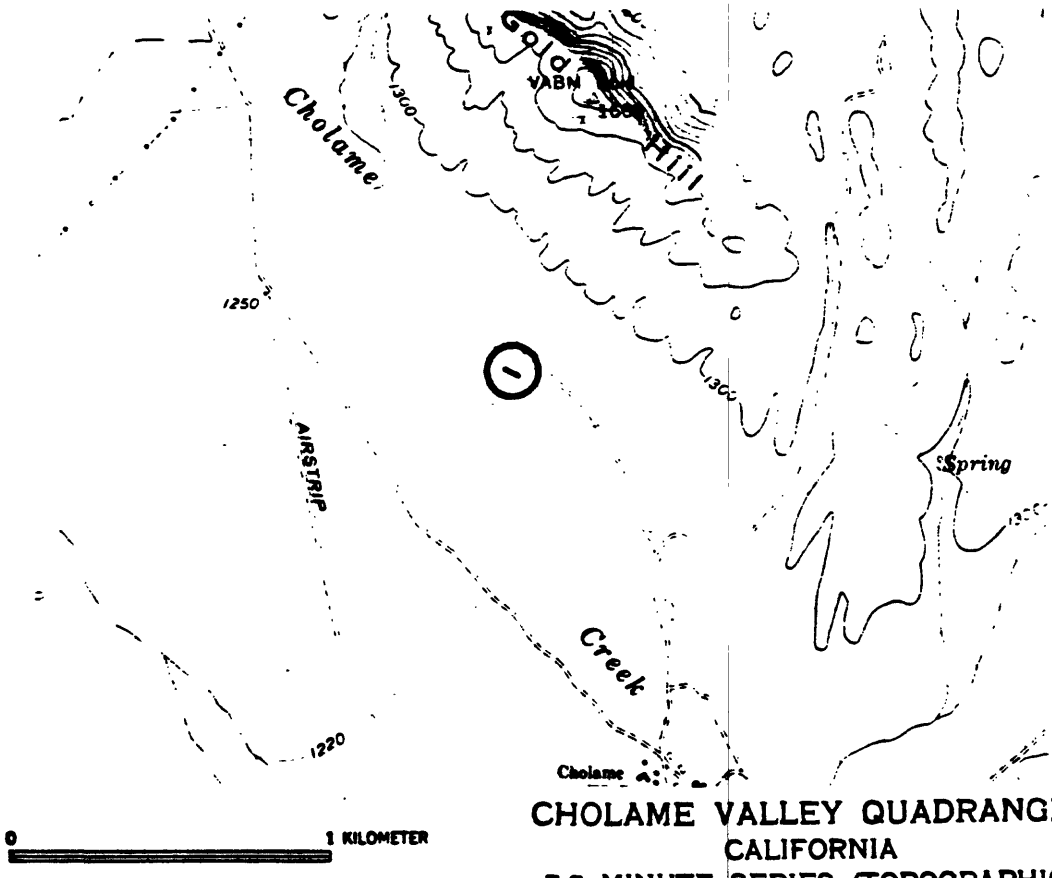

CARR RANCH CRR1
TOTAL VERTICAL SCALE 450 mm
CUMULATIVE CREEP, MM
400
350
300
250
200
150
100
50
0
1970
1975
1980
1985

## STATION XGH1

Latitude 35° 49.2'
Longitude 120° 20.9'

Position 463.8 km
10-meter wire, ø=30°

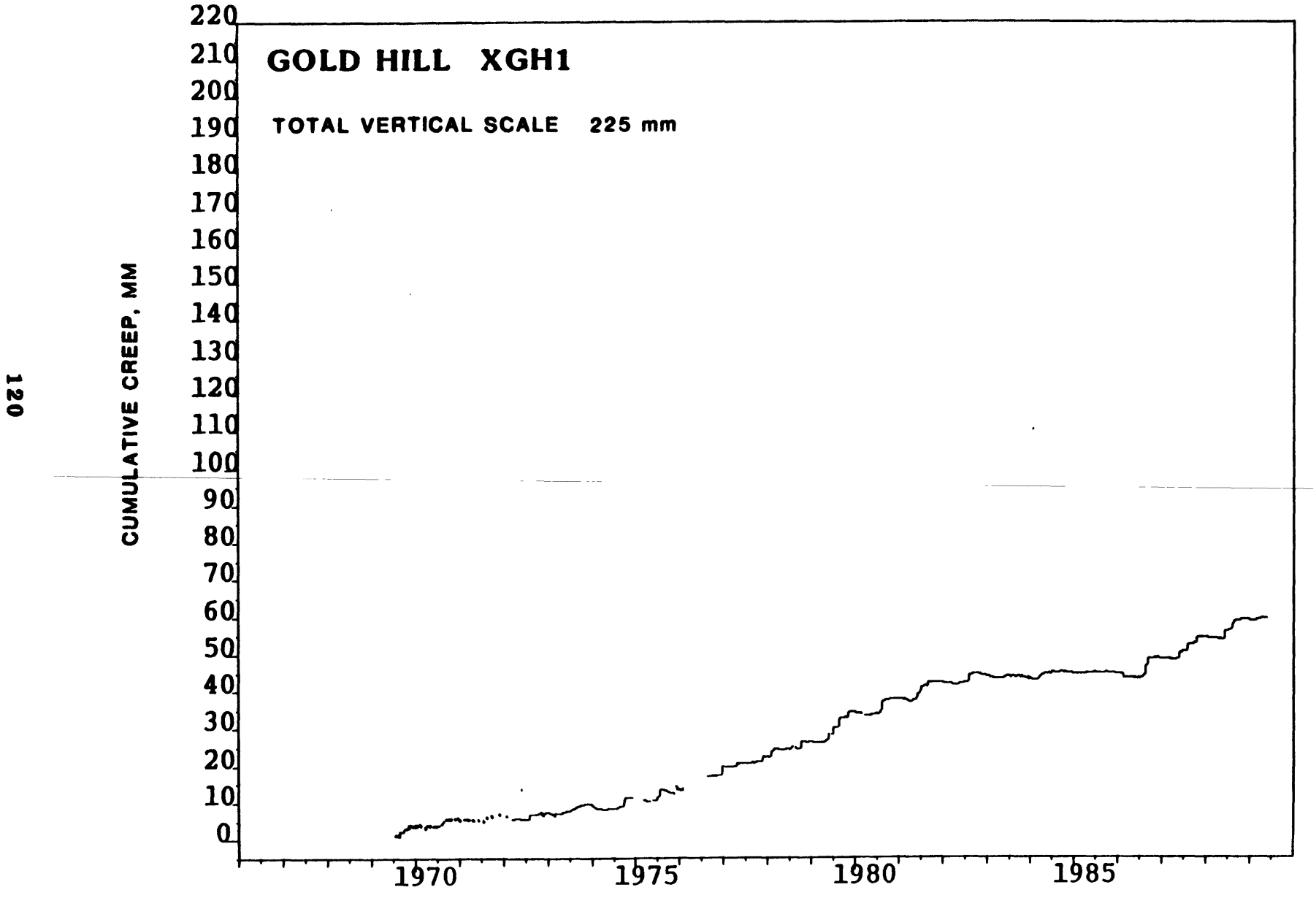
The Gold Hill creepmeter was installed during June, 1969, on the San Andreas fault at a site 12.3 km northwest of Cholame. The installation consists of a single wire buried a few centimeters below the surface on a low bench on the northeast side of Cholame Creek. The instrument was rebuilt in August, 1981, in the original configuration. After the Coalinga earthquake (5/2/83, M6.2), creep activity at XGH1 slowed to a rate of 0.5 mm/yr. Right-lateral movement resumed in late summer, 1986, concurrent with two earthquakes, one near Parkfield and one near station XGH1. Creep activity at this site is composed of infrequent events of up to 1.8 mm amplitude, superimposed on a background of slight right- and left-lateral drift. The average long-term creep rate before the Coalinga earthquake was 3 mm/yr. The rate since resumption of creep is 5.3 mm/yr, with the usual slight seasonal variations.




CHOLAME VALLEY QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XGH1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | 15 | 0.00 | 5 | 0.30 | 2 | 1.29 | 4 | 2.21 | 7 | 2.83 | 28 | 2.65 |
| 1970 | 3 | 2.67 | 7 | 2.96 | 14 | 2.18 | 4 | 2.58 | 2 | 2.62 | 6 | 2.46 | 2 | 2.72 | 1 | 4.09 | 10 | 5.32 | 3 | 5.45 | 7 | 5.38 | 12 | 5.25 |
| 1971 | 2 | 5.07 | 6 | 4.90 | 6 | 4.93 | 3 | 5.06 | 1 | 5.07 | 12 | 5.15 | | | 24 | 6.03 | | | 3 | 6.25 | 28 | 6.42 | | |
| 1972 | | | 4 | 5.77 | 9 | 5.62 | | | 11 | 5.75 | | | 6 | 5.55 | | | 1 | 6.87 | 11 | 7.05 | | | 13 | 7.40 |
| 1973 | 5 | 7.52 | | | 13 | 7.11 | 27 | 7.12 | | | 13 | 7.68 | | | 3 | 8.12 | 11 | 8.82 | | | 8 | 9.49 | 19 | 9.55 |
| 1974 | | | 7 | 8.62 | 24 | 8.22 | | | 21 | 8.27 | | | 10 | 8.44 | 27 | 8.94 | | | 12 | 11.20 | | | 10 | 11.22 |
| 1975 | 7 | 11.27 | 18 | 10.90 | 1 | 10.76 | | | 20 | 10.56 | | | | | 8 | 13.46 | 14 | 14.00 | | | | | 1 | 14.32 |
| 1976 | 29 | 14.41 | | | | | | | 4 | 17.02 | | | | | 17 | 17.08 | | | | | 10 | 17.38 | | |
| 1977 | | | 4 | 19.51 | 9 | 19.68 | 8 | 19.73 | | | | | 12 | 20.68 | | | | | 7 | 21.18 | | | | |
| 1978 | 26 | 23.12 | | | | | | | 11 | 23.89 | | | | | 17 | 24.55 | | | | | | | 5 | 26.37 |
| 1979 | | | | | 8 | 26.04 | | | 23 | 26.96 | 13 | 28.27 | | | | | 19 | 32.53 | 12 | 33.24 | 6 | 33.87 | 15 | 34.10 |
| 1980 | 25 | 33.96 | | | 19 | 33.45 | | | | | 20 | 33.61 | | | | | 21 | 36.94 | | | | | | |
| 1981 | 5 | 37.99 | | | | | 2 | 37.80 | | | 17 | 39.39 | | | 12 | 41.27 | 28 | 42.47 | | | | | 2 | 41.95 |
| 1982 | | | | | 8 | 41.66 | | | 11 | 41.04 | 29 | 42.06 | | | 26 | 44.36 | | | | | | | 10 | 44.14 |
| 1983 | | | | | | | 1 | 43.27 | 6 | 43.25 | | | 7 | 43.92 | | | | | 7 | 44.07 | | | | |
| 1984 | 18 | 42.65 | | | | | 20 | 44.44 | | | | | 18 | 44.80 | | | | | 17 | 44.87 | | | | |
| 1985 | 18 | 44.50 | | | | | 18 | 44.84 | | | | | 23 | 45.13 | | | | | 29 | 45.16 | | | | |
| 1986 | | | 1 | 44.50 | | | 30 | 43.56 | | | 24 | 43.49 | 31 | 43.89 | | | | | 29 | 48.72 | | | | |
| 1987 | 27 | 49.18 | | | | | 14 | 48.32 | | | | | 28 | 50.77 | | | | | | | 5 | 54.47 | | |
| 1988 | 27 | 54.13 | | | | | | | 6 | 53.99 | | | 27 | 56.53 | | | | | | | 1 | 59.27 | | |

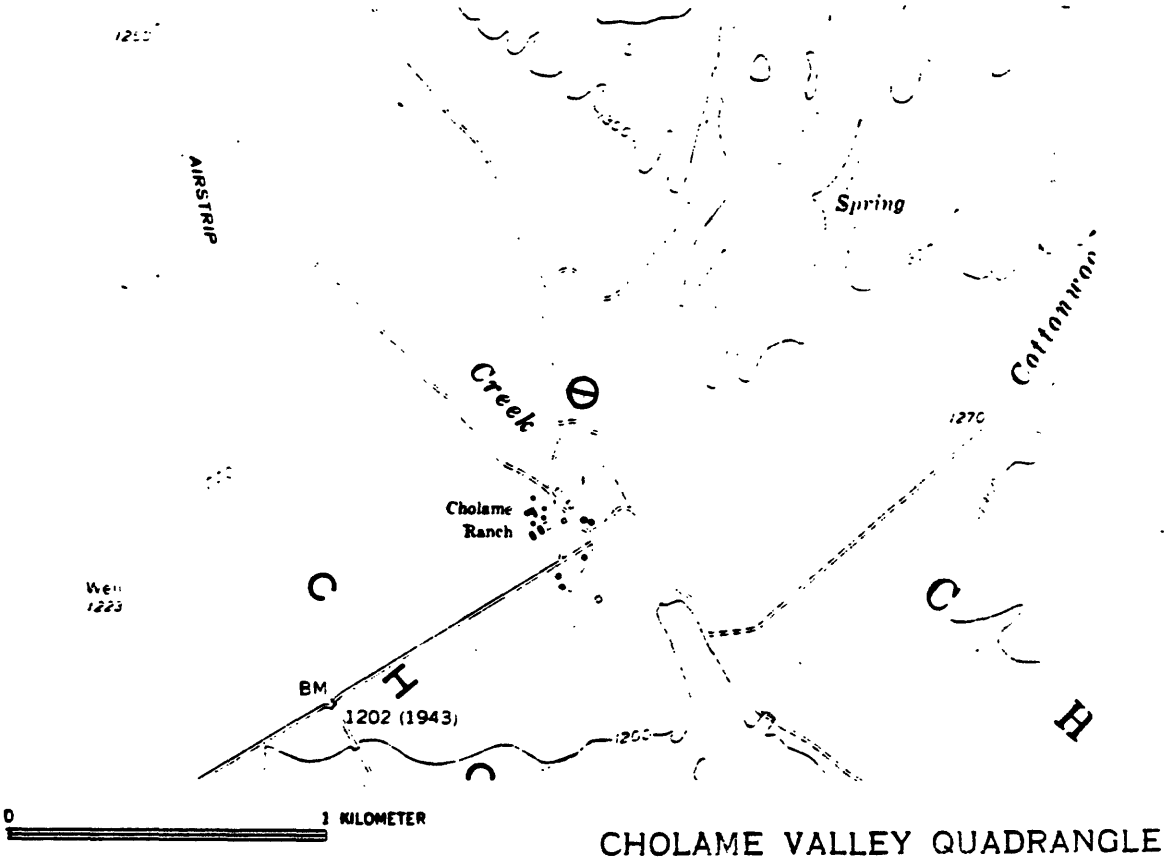

GOLD HILL XGH1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION JKR1

Latitude 35° 48.8'
Longitude 120° 20.7'

Position 464.8 km
20-meter rod, ø=45°

The Jack Ranch creepmeter was installed by California Institute of Technology personnel in 1976, approximately 0.8 km southeast of XGH1 creepmeter and about 11.3 km northwest of Cholame. The instrument was incorporated into the USGS network in 1979. The installation consisted of a single rod buried 1 meter below the surface on flat terrain northeast of Cholame Creek near the base of a small ridge. Owing to frequent site flooding, JKR1 data have been difficult to analyze to date and thus they have not been plotted here.




CHOLAME VALLEY QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** JKR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | 25 | 0.00 | 5 | 0.54 | 22 | 0.83 | | |
| 1977 | 18 | 1.44 | | | 8 | -0.14* | 1 | 0.03 | | | 28 | 0.10 | | | 2 | 0.47 | 13 | 1.05 | 25 | 1.15 | | | 12 | 0.42 |
| 1978 | | | 21 | 6.96 | | | 18 | 10.38 | 15 | 10.05 | | | | | 7 | 4.41 | | | | | 13 | 5.53 | | |
| 1979 | | | 12 | 9.62 | | | | | 7 | 10.76 | | | | | 13 | 8.40 | | | | | 6 | 8.40 | 14 | 9.33 |
| 1980 | 25 | 13.51 | | | | | | | | | 19 | 12.36 | | flooded | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

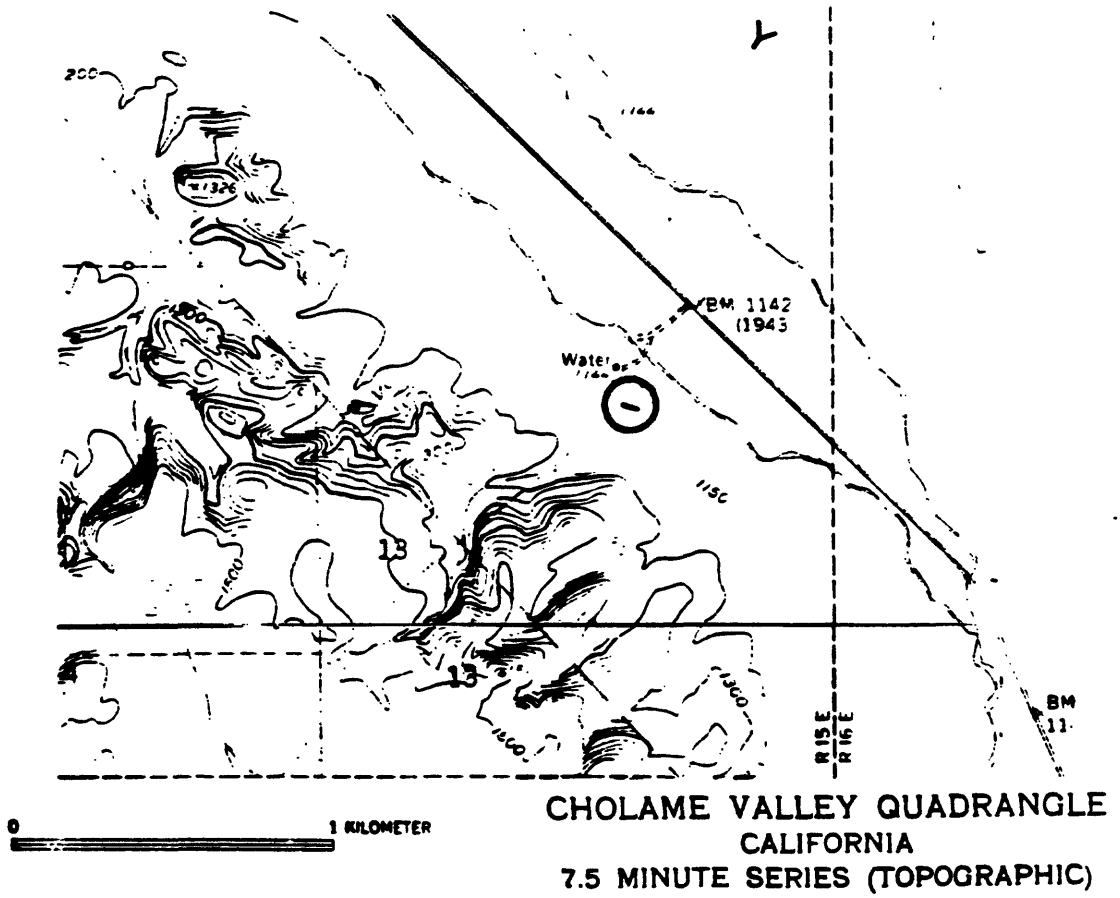
*Negative numbers indicate cumulative left-lateral movement.

## STATION XWT1

Latitude 35° 45.4'
Longitude 120° 18.5'

Position 472.8 km
10-meter wire, ø=30°

The Water Tank creepmeter was installed during June, 1969, on the San Andreas fault at a site 3.5 km northwest of Cholame. The installation consisted of a single wire buried a few centimeters below the surface on a broad, low alluvial fan. Creep activity at this site was composed of infrequent events of up to 9 mm amplitude, superimposed on a background of zero to slight right- and left-lateral drift. The average long-term creep rate was about 3 mm/yr. The instrument was destroyed by flooding in 1983 and was removed in March, 1984, at the request of the landowner.

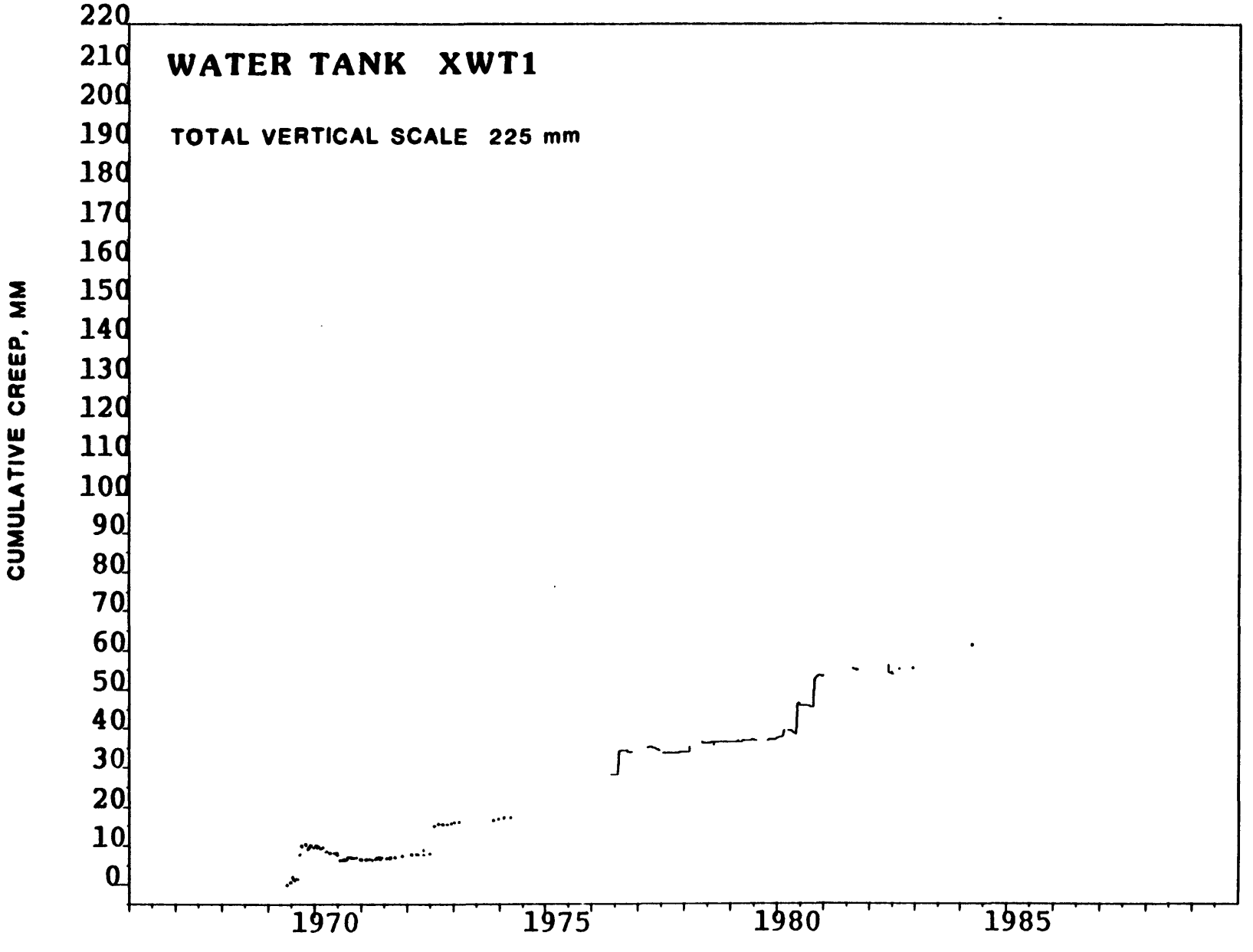



CHOLAME VALLEY QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XWT1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 5 | 0.00 | 8 | 2.46 | 5 | 1.57 | 2 | 1.69 | 3 | 9.75 | 7 | 8.65 | 28 | 9.59 |
| 1970 | 10 | 9.67 | 7 | 8.90 | 1 | 8.83 | 4 | 8.18 | 2 | 8.09 | 6 | 8.14 | 2 | 8.35 | 1 | 8.46 | 4 | 8.60 | 3 | 8.84 | 7 | 8.82 | 29 | 8.25 |
| 1971 | 2 | 8.23 | 7 | 8.13 | 6 | 8.30 | 3 | 8.47 | 1 | 8.59 | 12 | 8.64 | 22 | 9.03 | 7 | 8.98 | | | 3 | 9.23 | 28 | 9.58 | 2 | 9.62 |
| 1972 | | | 4 | 9.67 | 9 | 9.64 | | | 11 | 9.73 | | | 6 | 9.87 | 3 | 17.14 | 1 | 17.23 | 11 | 17.31 | 7 | 17.49 | 13 | 17.68 |
| 1973 | 6 | 17.85 | 2 | 17.61 | | | | | | | | | | | | | | | | | 8 | 18.40 | 19 | 18.51 |
| 1974 | | | 7 | 18.93 | 24 | 19.10 | | | 21 | 18.01 | | | | | 27 | 18.03 | | | 12 | 27.23 | | | 10 | 27.64 |
| 1975 | 7 | 27.90 | 18 | 28.34 | | | | | | | | | 18 | 27.76 | | | 14 | 27.85 | | | | | 1 | 27.93 |
| 1976 | | | | | | | | | 20 | 28.32 | | | | | 17 | 34.34 | 1 | 33.72 | | | 10 | 34.11 | | |
| 1977 | | | 4 | 34.85 | 9 | 34.87 | | | | | | | 12 | 33.46 | | | | | 7 | 33.44 | | | | |
| 1978 | 26 | 33.57 | | | | | | | 11 | 36.44 | | | | | 17 | 36.56 | | | | | | | 5 | 36.66 |
| 1979 | | | | | 8 | 36.74 | | | | | 13 | 37.00 | | | | | 19 | 37.12 | 11 | 37.11 | 6 | 36.71 | 14 | 36.82 |
| 1980 | | | | | 19 | 39.34 | | | | | 4 | 45.84 | | | | | 20 | 45.88 | 10 | 49.54 | 13 | 55.86 | 2 | 56.75 |
| 1981 | | | | | | | | | | | 17 | 56.55 | 23 | 55.78 | 12 | 55.45 | 28 | 55.09 | 20 | 54.92 | | | 2 | 56.06 |
| 1982 | | | | | 9 | 56.40 | | | 26 | 55.92 | 30 | 54.37 | | | 28 | 55.07 | | | | | | | 10 | 55.33 |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | 23 | 61.07 | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

3/84 - Instrument removed.

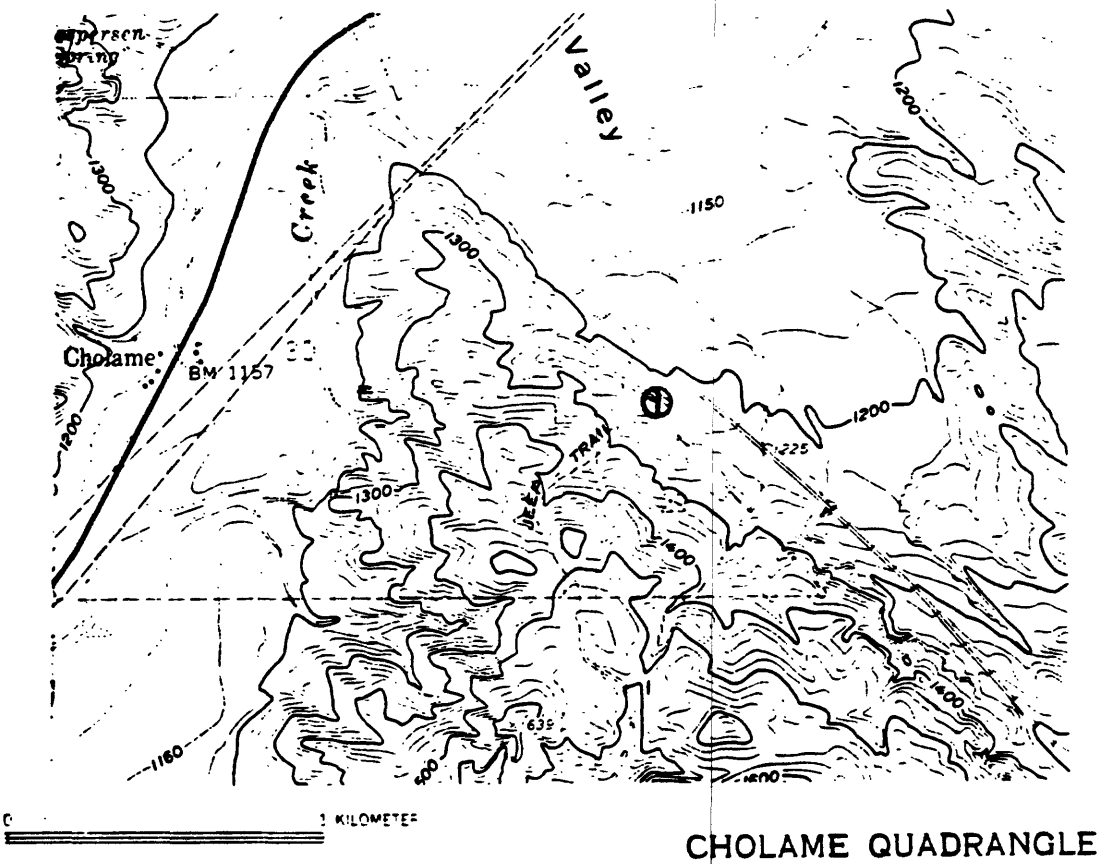

WATER TANK XWT1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION X461

Latitude 35° 43.4'
Longitude 120° 16.7'

Position 477.4 km
27 meter wire, ø=44°

The Highway 46 (South) creepmeter was installed in August, 1986, on the San Andreas fault at a site 1.5 km southeast of Cholame. The installation consists of a single wire buried about 1 meter below the surface across a well-defined depression a few hundred meters north of the location of the southernmost surface fractures of the 1966 Parkfield-Cholame earthquake sequence. Due to topography, the instrument was installed in the contraction rather than the extension mode. Since its installation in 1986, the station has recorded occasional right-lateral creep events of less than 1-mm amplitude, but shows a predominant left-lateral creep rate of -0.4 mm/yr.

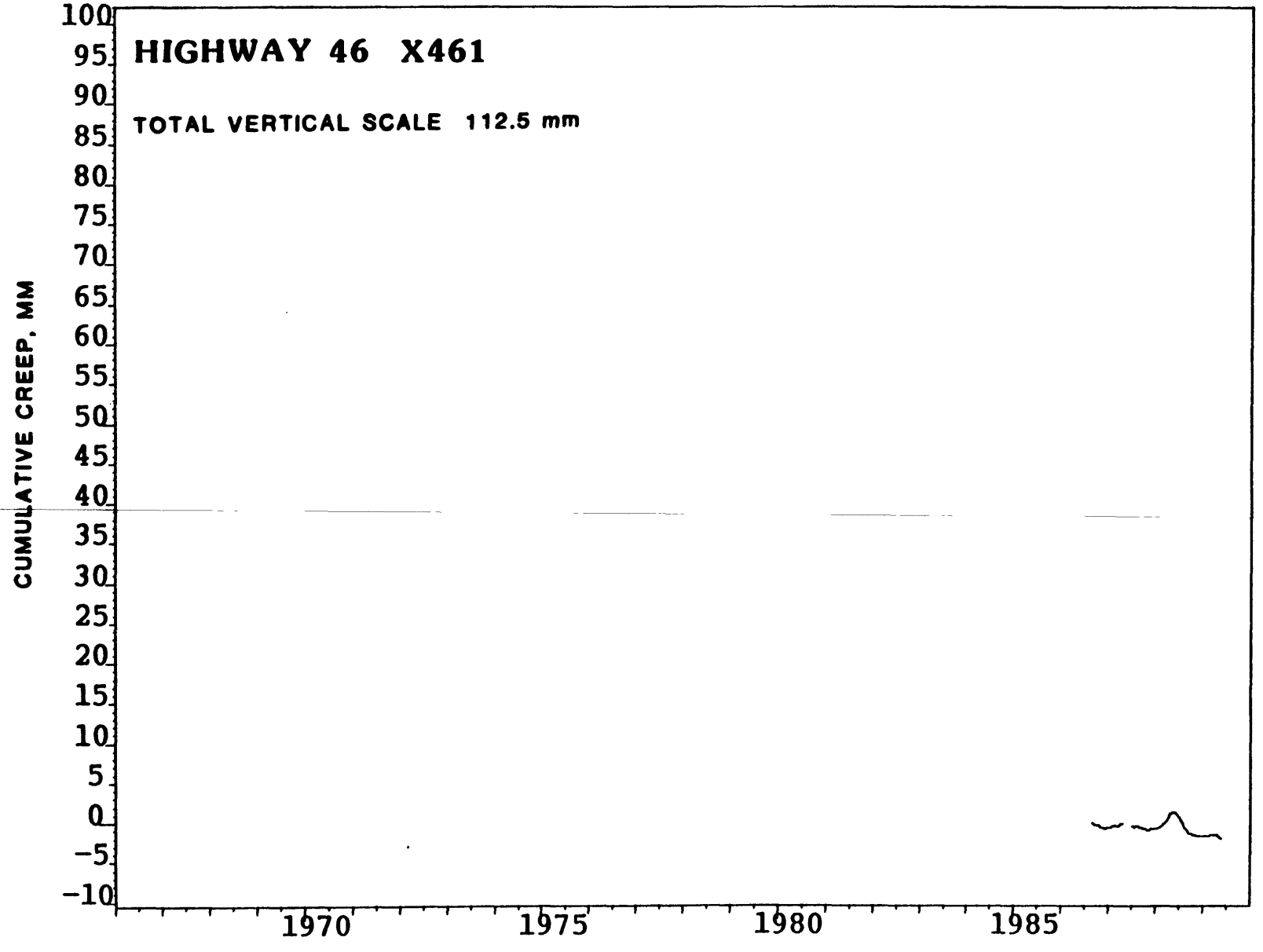



CHOLAME QUADRANGLE
CALIFORNIA–SAN LUIS OBISPO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** X461

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | 22 | 0.00 | | | 29 | -0.78* | | | | |
| 1987 | 27 | -0.65* | | | | | 28 | -0.24* | | | | | 28 | -0.38* | | | | | | | 5 | -0.93* | | |
| 1988 | 28 | -0.66* | | | | | | | 9 | 1.05 | | | 26 | -0.83* | | | | | | | 1 | -1.66* | | |

*Negative numbers indicate cumulative left-lateral movement.

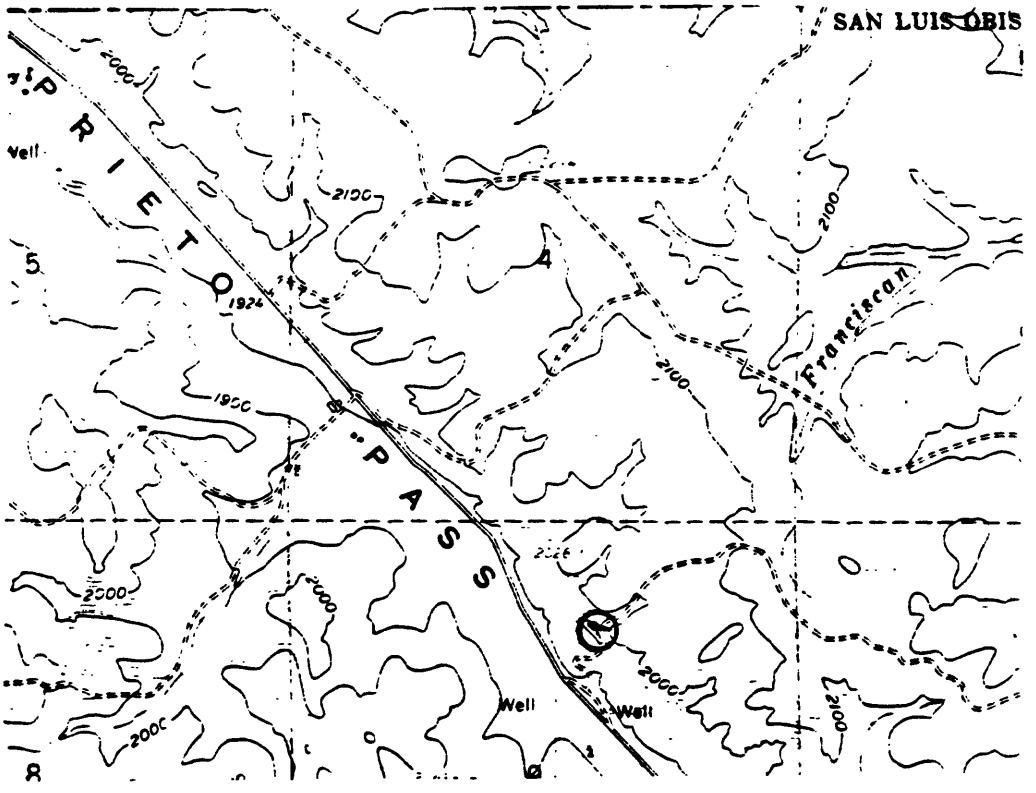

HIGHWAY 46 X461
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION TWR1

Latitude 35° 35.8'
Longitude 120° 08.8'

Position 508.0 km
10(?)meter-rod, ø=45°

The Twisselman Ranch creepmeter was installed in 1976 by California Institute of Technology personnel. The instrument was placed approximately 24 km southeast of Cholame, near a large offset in a stream that crosses the San Andreas fault. The installation consists of a single stainless steel rod buried about 2 m below the surface on the sloping edge of what appears to be a fault trough. The instrument was incorporated into the USGS network in 1979, at which time an on-site electronic recording system was installed. At the time of the Coalinga earthquake (5/2/83, M6.2), TWR1 recorded a small left-lateral step. The creep rate at this site is slightly less than 0.5 mm/yr in a left-lateral sense.



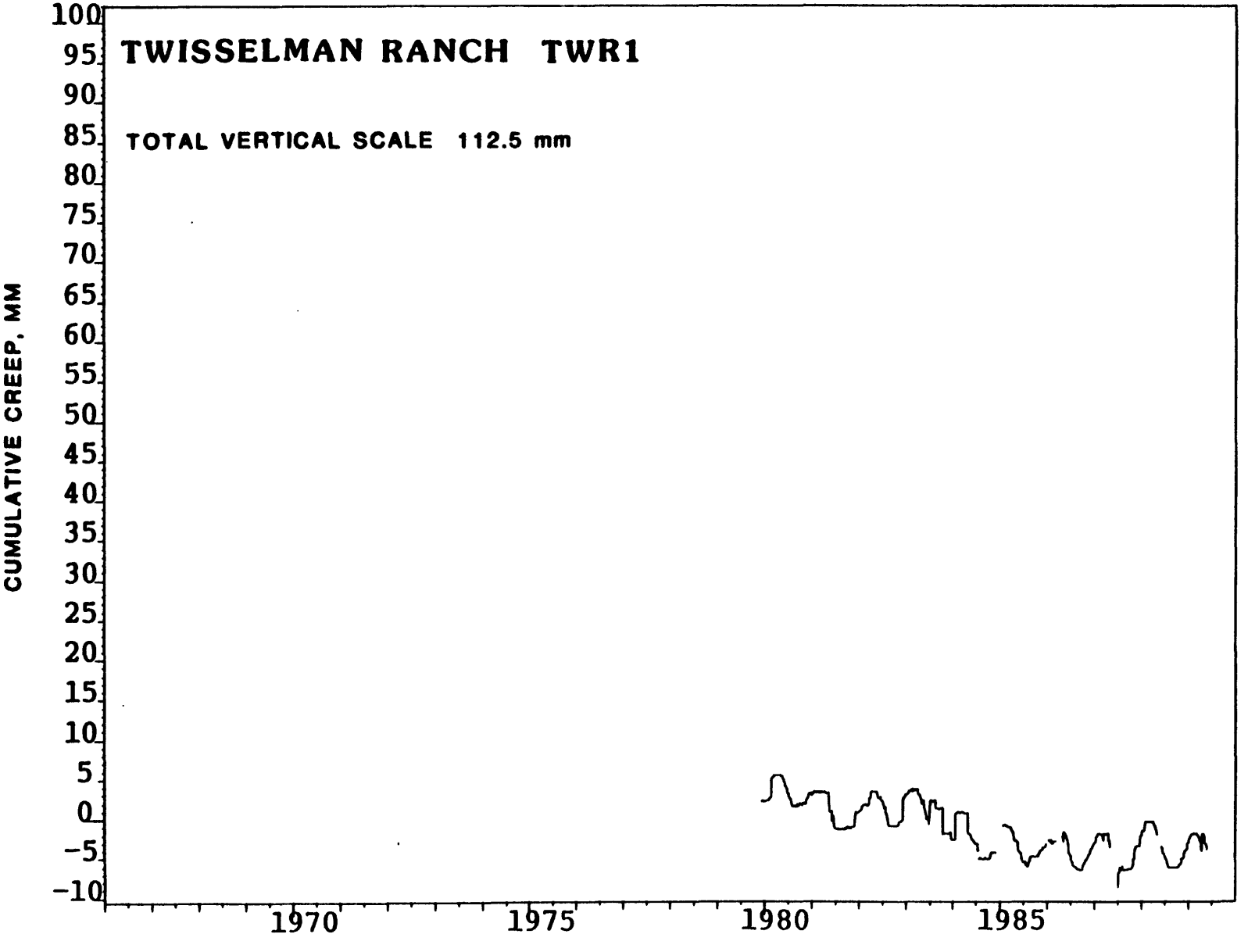

0 1 KILOMETER

HOLLAND CANYON QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** TWR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | 23 | 0.00 | | |
| 1977 | | | | | | | 1 | -0.65* | | | | | 1 | -0.33* | 3 | -1.44* | | | | | | | | |
| 1978 | | | | | | | 18 | -1.44* | | | | | | | 7 | -8.12* | | | | | 13 | 2.69 | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | 13 | 1.61 | 15 | 2.29 |
| 1980 | | | | | 20 | 4.72 | | | | | 19 | 2.90 | | | | | 20 | 1.46 | | | | | | |
| 1981 | 5 | 2.86 | 3 | 3.30 | | | 9 | 3.25 | | | 17 | 0.31 | | | | | 30 | -1.13* | | | | | 2 | 0.74 |
| 1982 | | | | | 9 | 1.71 | | | 26 | 2.65 | | | | | 25 | -0.99* | | | | | | | 10 | 2.60 |
| 1983 | | | | | | | 1 | 3.00 | 6 | 2.22 | 8 | 0.42 | 8 | 2.32 | | | | | 7 | -2.09* | | | | |
| 1984 | 19 | 0.71 | | | | | 24 | -1.85* | | | | | 19 | -5.01* | | | | | 18 | -4.33* | | | | |
| 1985 | 19 | -0.86* | | | | | 18 | -2.67* | | | | | 22 | -5.90* | | | | | 28 | -4.09* | | | | |
| 1986 | 6 | -2.74* | 1 | -2.77* | | | 29 | -1.80* | | | | | 28 | -5.89* | | | | | 29 | -5.17* | | | | |
| 1987 | 27 | -1.82* | | | | | 28 | -3.74* | | | | | 28 | -5.98* | | | | | | | 5 | -3.95* | | |
| 1988 | 28 | -0.50* | | | | | 4 | -1.14* | 9 | -1.96* | | | 26 | -6.16* | 12 | -6.19* | | | | | 1 | -5.16* | | |

*Negative numbers indicate cumulative left-lateral movement.

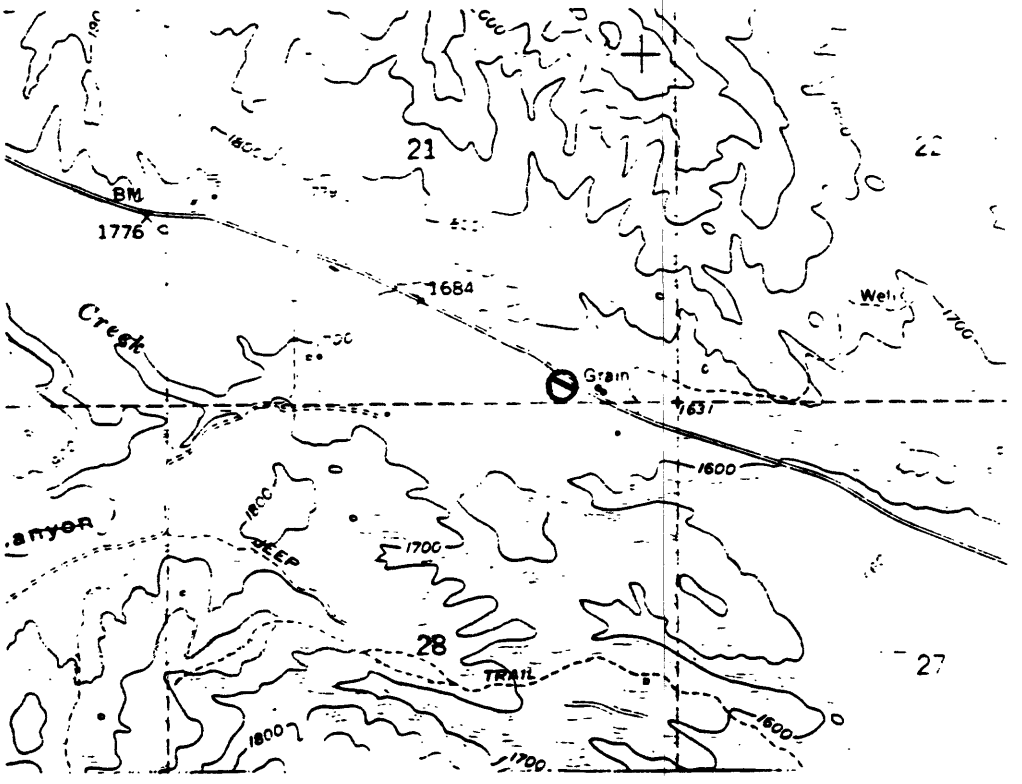

TWISSELMAN RANCH TWR1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION XRSW

Latitude 35° 54.4'
Longitude 120° 27.6'

Position 450.6 km
30-meter wire, ø=30°

The Roberson Southwest trace creepmeter was installed in May, 1987, across the projection of a line from recently-formed en echelon cracks in the southwest trace fault zone across the Parkfield-San Miguel (Bear Valley) Road on the northwest to a spot where several surveys of an alinement array in a pasture immediately to the southeast indicated aseismic slip might be occurring. The creep record after 1-1/2 years of operation shows oscillatory movement with occasional right-lateral creep events of approximately 1-mm amplitude, and an overall right-lateral trend of 2.3 mm/yr.

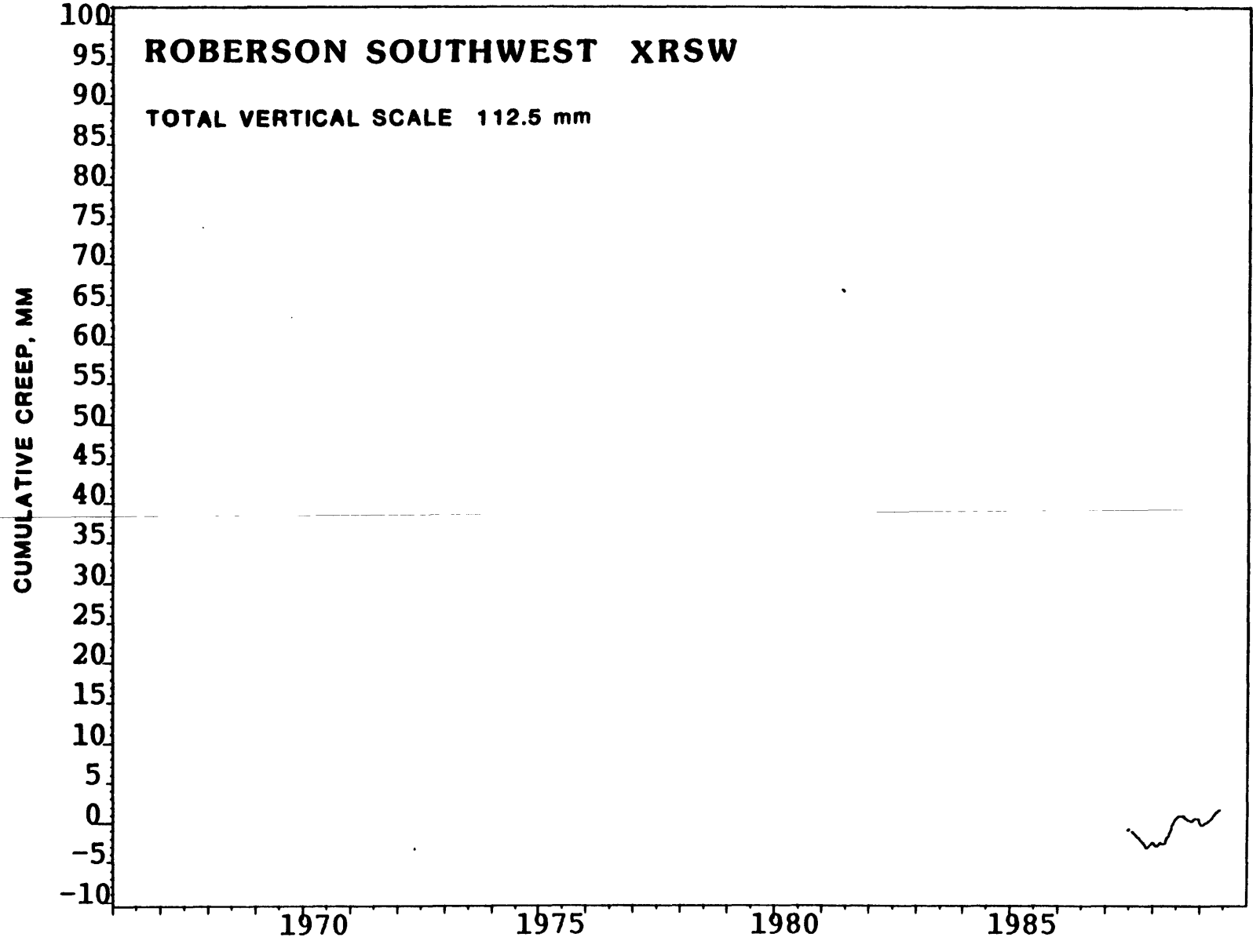



PARKFIELD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XRSW

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | 29 | 0.00 | 2 | -0.14* | 30 | -1.21* | | | | | | | 10 | -3.20* | 15 | -2.61* |
| 1988 | 29 | -2.99* | | | | | | | 4 | -1.43* | 24 | 0.52 | 27 | 0.81 | | | | | 27 | 0.23 | | | | |

*Negative numbers indicate cumulative left-lateral movement.

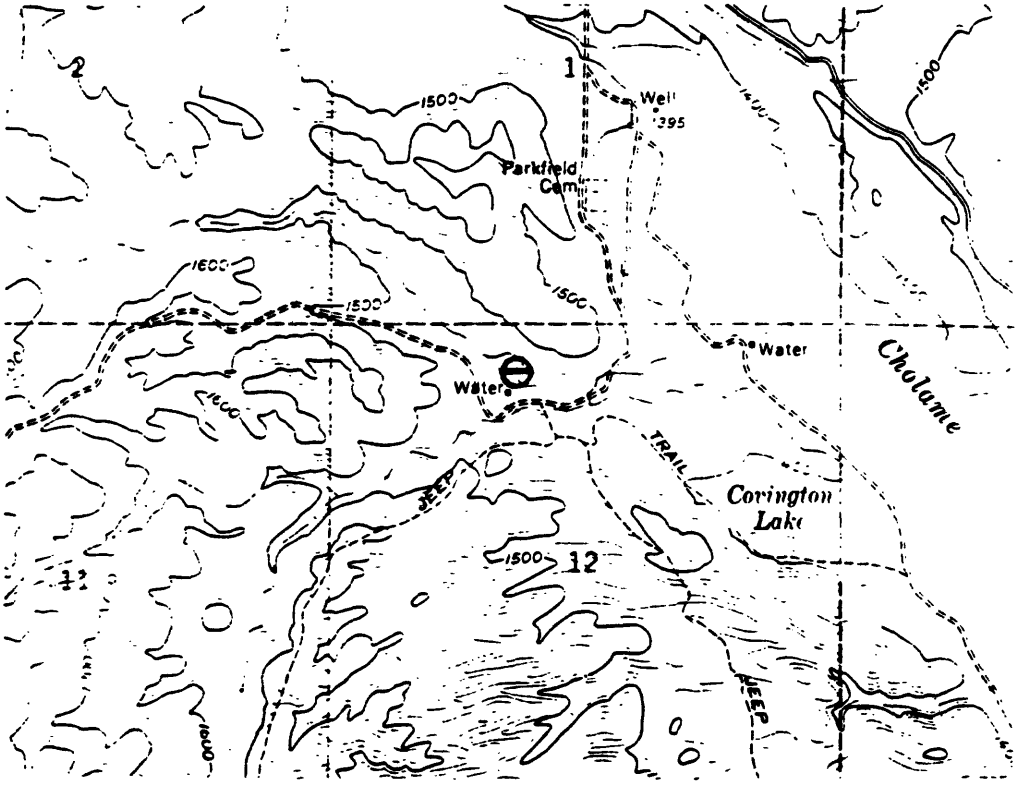

ROBERSON SOUTHWEST XRSW
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION XHSW

Latitude 35° 51.7'
Longitude 120° 24.9'

Position 457.0 km
30-meter wire, ø=45°

The Hearst Southwest creepmeter was installed in June, 1987, along the ridge of a slight slope where surface fractures were observed on the Southwest trace after the 1966 Parkfield-Cholame earthquake sequence. The eastern side of the slope paralleling the fault falls off to a deep ravine, where some fault movement may be occurring. In 1-1/2 years of operation, the creepmeter has recorded both right- and left-lateral creep events of 1-mm amplitude or less, with an overall left-lateral trend of -2.7 mm/yr.



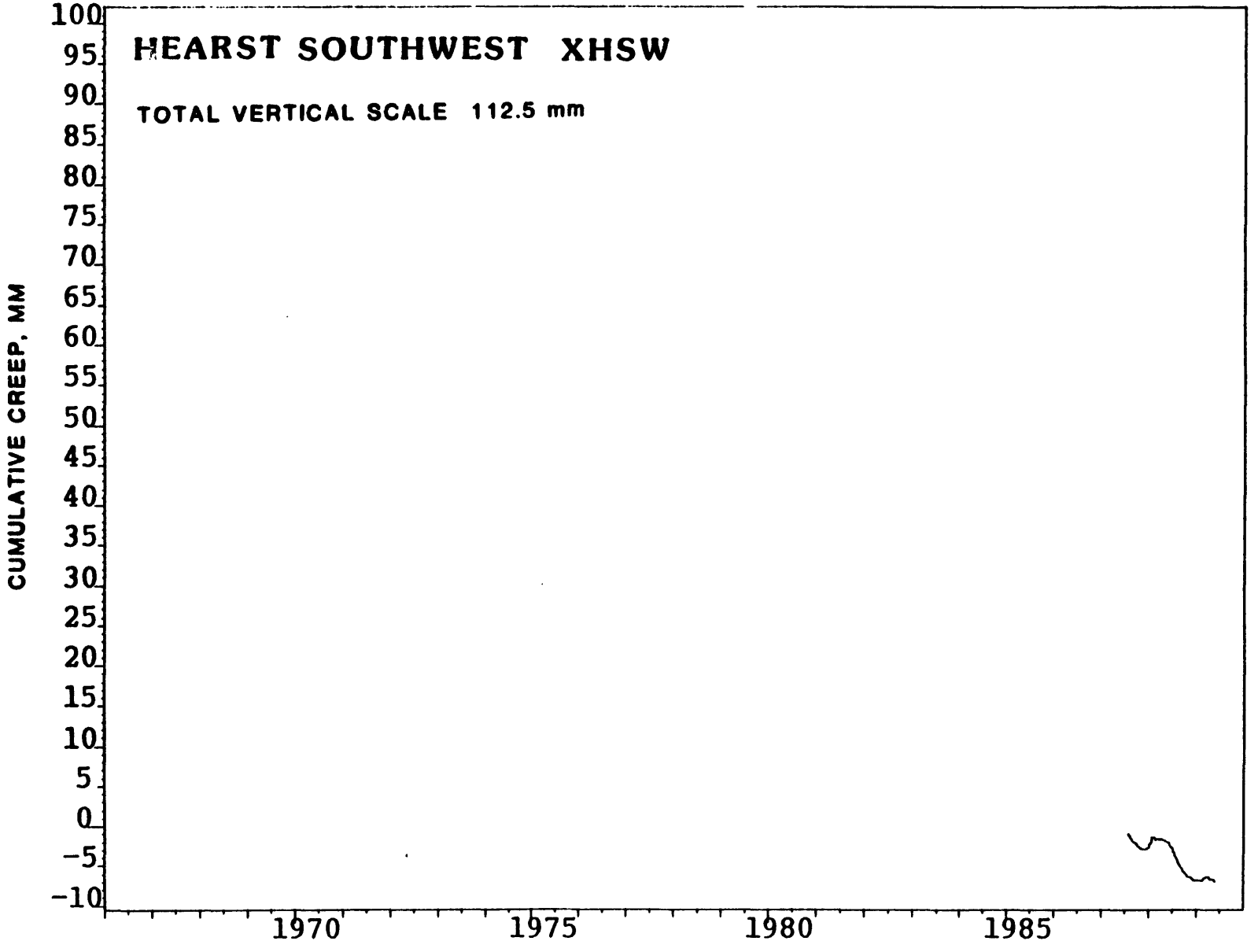

0 1 KILOMETER

CHOLAME HILLS QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XHSW

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | 25 | 0.00 | 29 | -1.06* | 10 | -1.40* | | | | | 10 | -2.77* | | |
| 1988 | 27 | -1.40* | | | | | | | 6 | -1.81* | | | 28 | -3.98* | | | | | 31 | -6.35* | | | | |

*Negative numbers indicate cumulative left-lateral movement.

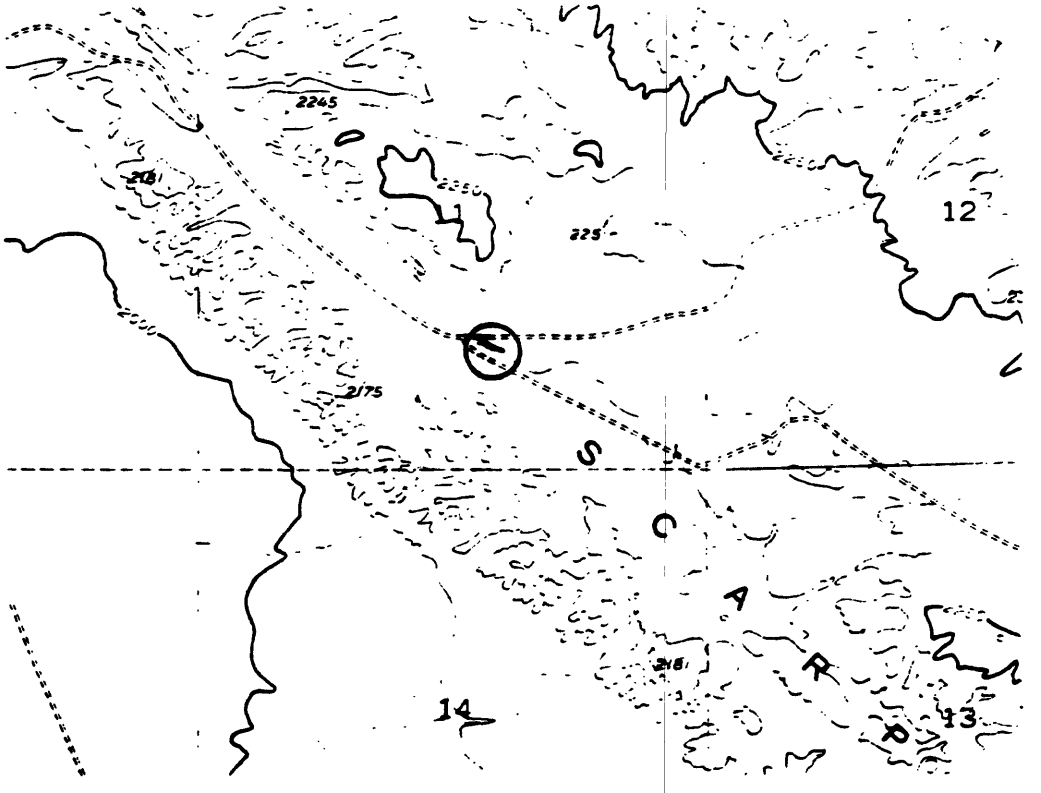

HEARST SOUTHWEST XHSW
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION XPH1

Latitude 35° 08.9'
Longitude 119° 41.5'

Position 563.7 km
20-meter wire, ø=30°

The Panorama Hills creepmeter was installed during August, 1977, on the San Andreas fault at a site 80.7 km southeast of Cholame. The installation consists of a single wire entrenched about 1 meter below the surface across a low scarp in alluvium on the 1857 surface rupture. Subsequent air photos show the instrument is at the outer edge of the active trace. The long-term creep rate at XPH1 is approximately 0.16 mm/yr, in a left-lateral sense.

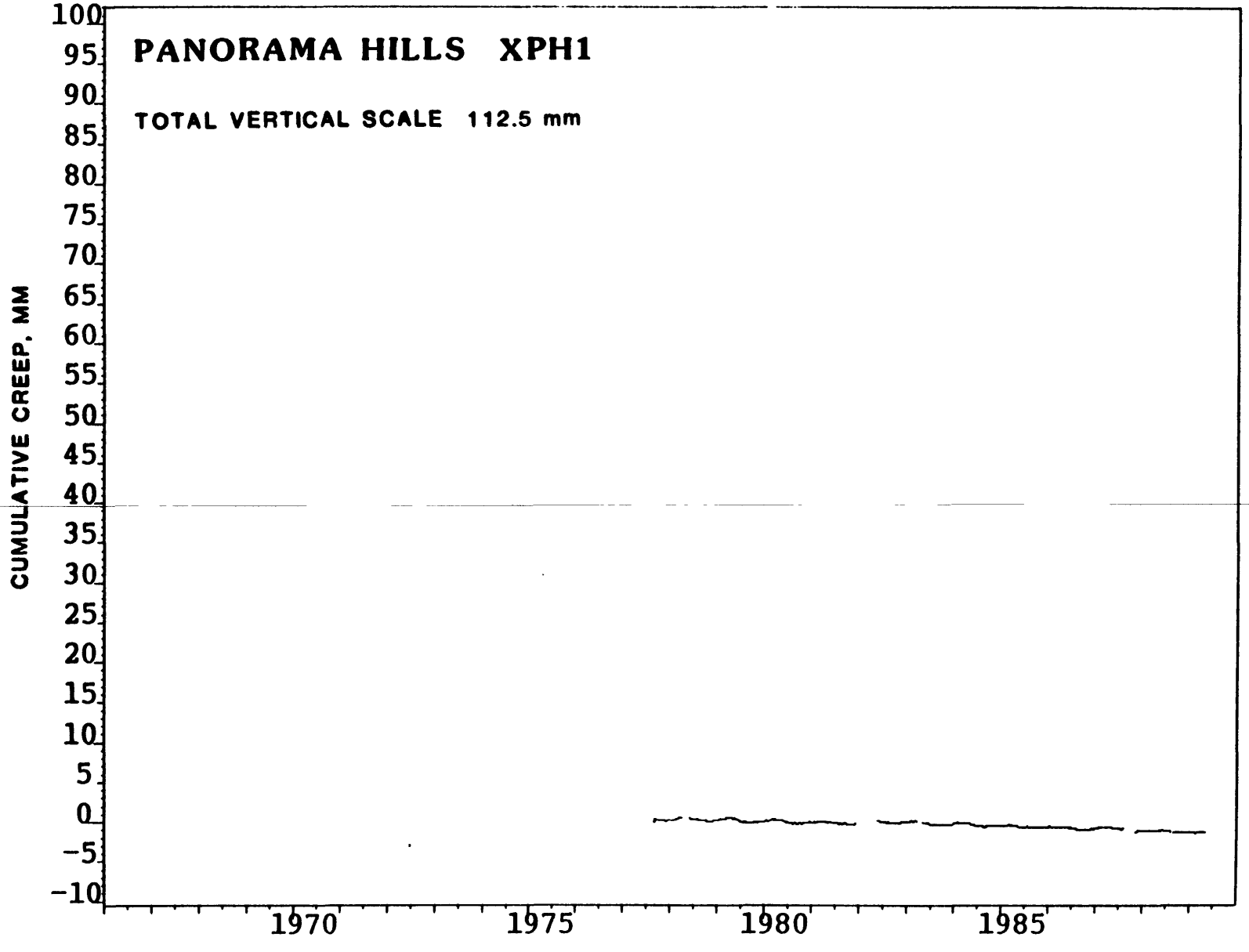



PANORAMA HILLS QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XPH1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | 27 | 0.00 | 7 | 0.26 | | | | | 7 | 0.32 |
| 1978 | | | | | | | | | 30 | 0.48 | | | | | 28 | 0.13 | | | | | 29 | 0.09 | | |
| 1979 | | | | | 9 | 0.48 | | | | | 18 | 0.29 | | | | | 26 | 0.01 | 15 | 0.01 | | | 7 | 0.07 |
| 1980 | 15 | 0.18 | | | 7 | 0.29 | 16 | 0.26 | | | | | 31 | -0.06* | | | | | 22 | -0.14* | | | 31 | -0.12* |
| 1981 | | | 13 | -0.03* | | | | | | | 3 | -0.13* | | | | | 14 | -0.39* | | | | | | |
| 1982 | | | 3 | -0.10* | | | | | 13 | 0.16 | | | | | 13 | -0.10* | | | | | 26 | -0.09* | | |
| 1983 | | | | | | | | | 4 | -0.02* | | | | | 4 | -0.27* | | | | | 18 | -0.37* | | |
| 1984 | 27 | -0.17* | | | | | | | 9 | -0.27* | | | | | | | 1 | -0.57* | | | | | | |
| 1985 | 2 | -0.54* | | | | | 10 | -0.46* | | | | | 22 | -0.65* | | | | | 28 | -0.69* | | | | |
| 1986 | | | 1 | -0.57* | | | 29 | -0.59* | | | | | 28 | -0.78* | | | | | 30 | -0.94* | | | | |
| 1987 | 26 | -0.76* | | | | | 27 | -0.75* | | | | | 27 | -0.94* | | | | | | | 3 | -1.20* | | |
| 1988 | 28 | -1.25* | | | | | | | 3 | -1.22* | | | 26 | -1.44* | | | | | 28 | -1.15* | | | | |

*Negative numbers indicate cumulative left-lateral movement.

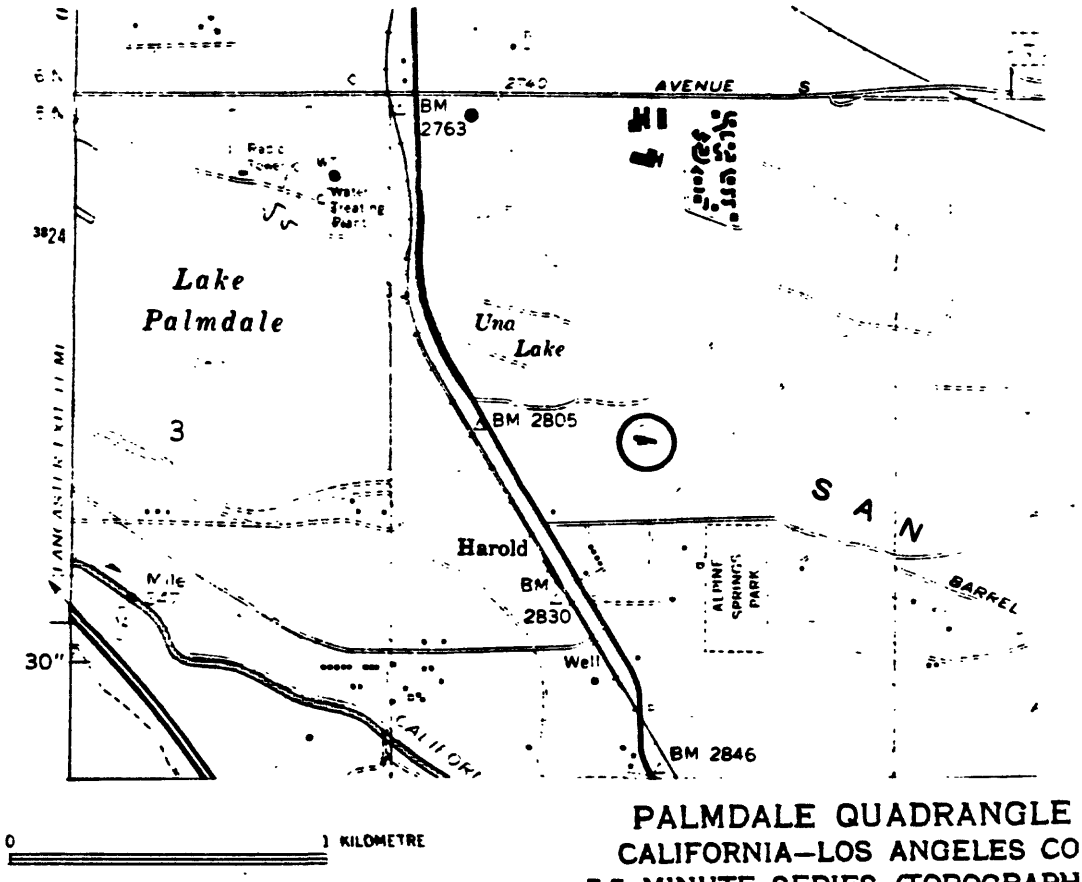

PANORAMA HILLS XPH1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION XUL1

Latitude 34° 32.9'
Longitude 118° 06.4'

Position 720.5 km
22-meter wire, ø=30°

The Una Lake creepmeter was installed during October, 1977, on the San Andreas fault at a site about 3.5 km south of the center of Palmdale, California. The installation consisted of a single wire entrenched about 1 meter below the surface in ponded alluvium near the southeast end of a prominent southwest-facing scarp. Creep activity at this site was composed of occasional minor right- and left-lateral events of 0.05 to 0.20 mm amplitude, superimposed on a background of very slight right- and left-lateral (thermal) drift apparently accumulating in a right-lateral sense at about 0.3 mm/yr. Inadvertently, XUL1 had been installed in a sag pond area, and when the 1976-77 drought ended, the instrument was submerged in several feet of water (February, 1981).

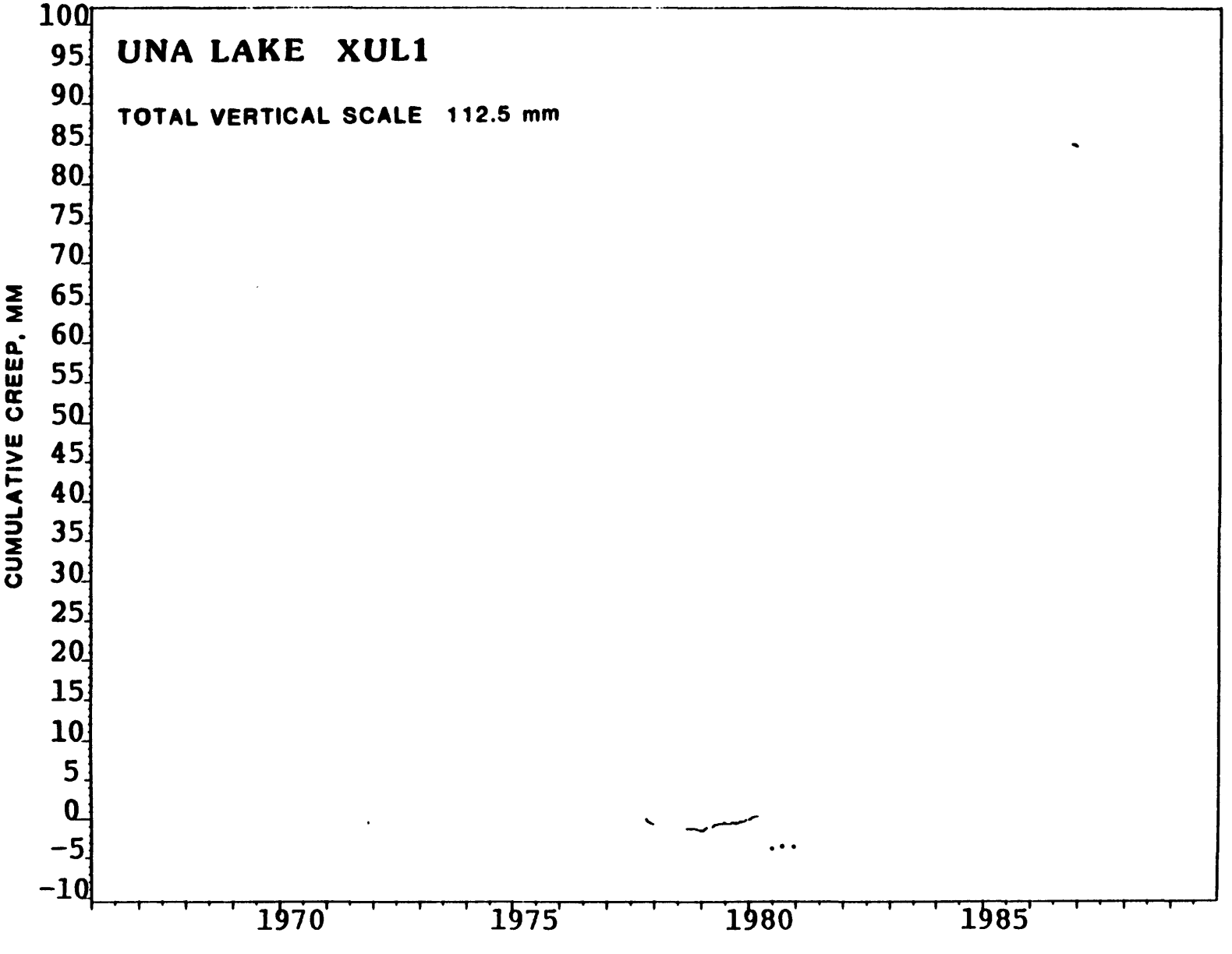



PALMDALE QUADRANGLE
CALIFORNIA—LOS ANGELES CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XUL1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | 24 | 0.00 | | | | |
| 1978 | 28 | -0.81* | | | | | | | 31 | -1.13* | | | | | 29 | -1.20* | | | | | 29 | -1.21* | | |
| 1979 | | | | | 22 | -0.65* | | | | | 18 | -0.04* | | | | | | | 16 | 0.10 | | | 31 | 0.06 |
| 1980 | 17 | 0.82 | 5 | 0.97 | | | | | | | 23 | -3.84* | | | | | 11 | -3.45* | | | | | 15 | -3.45* |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

*Negative numbers indicate cumulative left-lateral movement.
By 2/6/81, instrument had been destroyed by flooding.

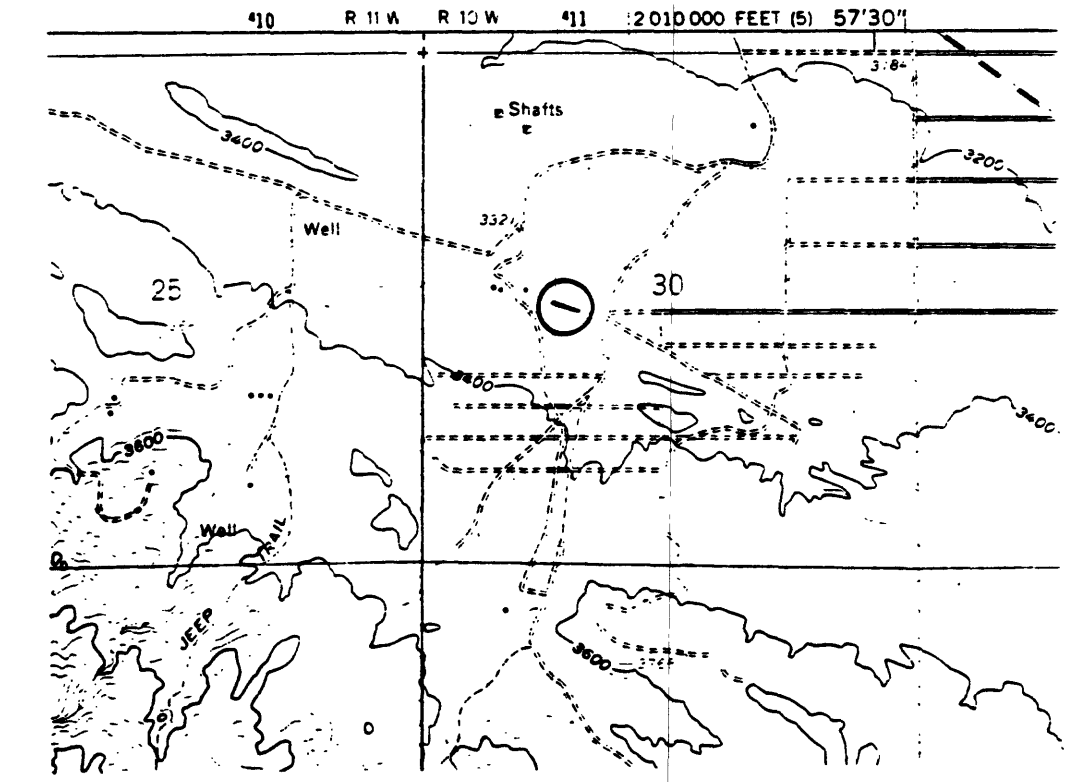

UNA LAKE XUL1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION XWR1

Latitude 34° 29.6'
Longitude 117° 58.2'

Position 733.2 km
22-meter wire, $\phi$=30°

The Wiebe Ranch creepmeter was installed during October, 1977, on the San Andreas fault at a site 17.2 km southeast of Palmdale, California. The installation consists of a single wire entrenched about 1 meter below the surface across a low southwest-facing scarp in coarse fan deposits and weathered bedrock. Creep activity at this site is composed of infrequent minor events of up to about 0.30 mm amplitude, superimposed on a background of very slight right-lateral slip accumulation at 0.3 mm/yr. In September, 1983, instrument maintenance and data were taken over by University of Southern California personnel at their request.




JUNIPER HILLS QUADRANGLE
CALIFORNIA–LOS ANGELES CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

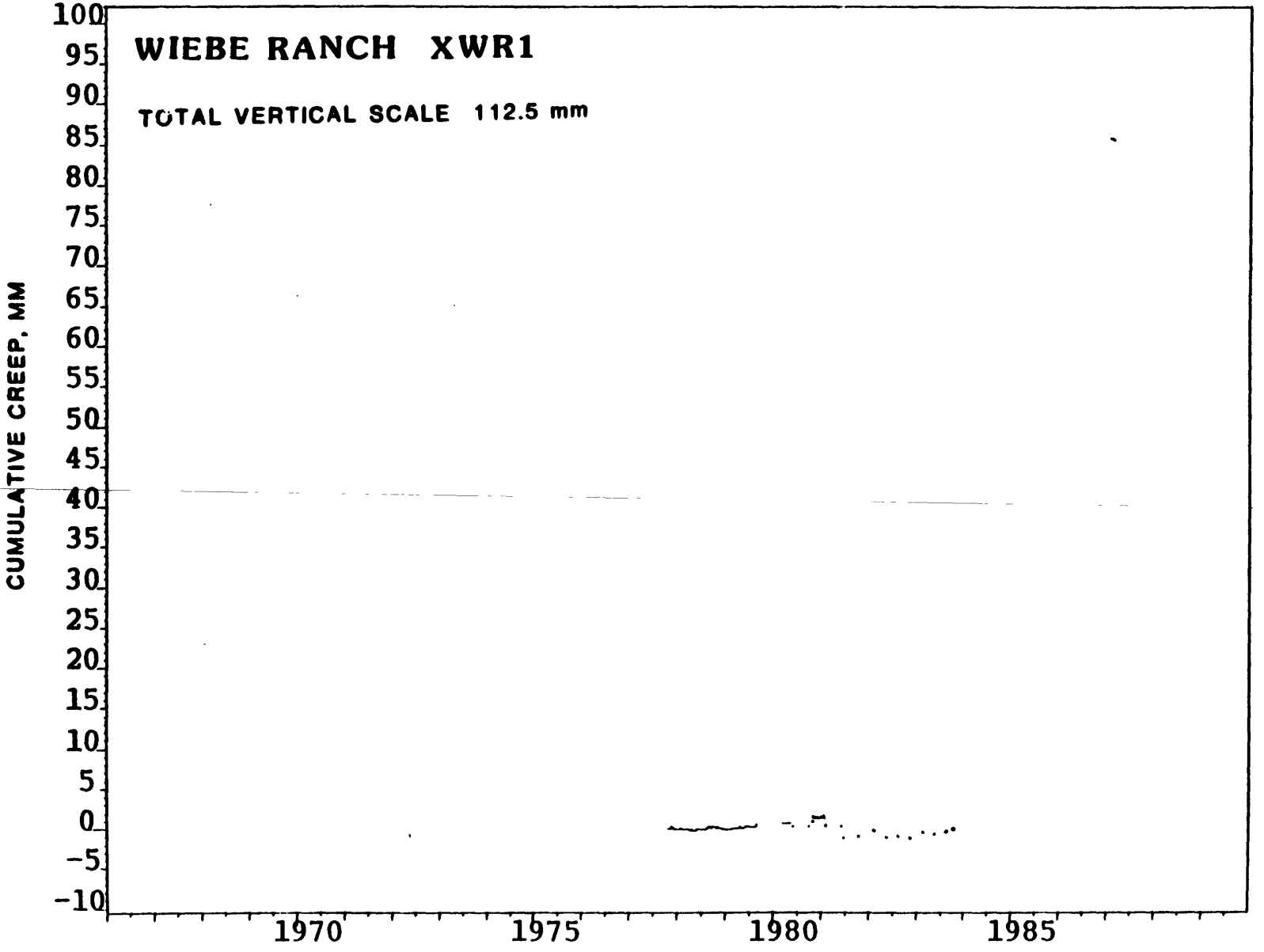
CUMULATIVE CREEP CALCULATED FROM FIELD READINGS

STATION XWR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | 24 | 0.00 | | | | |
| 1978 | 28 | 0.31 | | | | | | | 31 | -0.15* | 1 | -0.24* | | | 29 | 0.80 | | | | | 30 | 0.08 | | |
| 1979 | | | | | 22 | 0.19 | | | | | 18 | 0.47 | | | 30 | 0.81 | | | 16 | 0.99 | | | | |
| 1980 | | | | | 7 | 0.99 | | | 22 | 0.18 | | | | | | | 17 | 0.19 | 23 | 0.86 | | | | |
| 1981 | | | 11 | 0.37 | | | | | | | 5 | 0.20 | | | | | | | 13 | -1.03* | | | | |
| 1982 | | | 3 | -0.28* | | | | | 12 | -1.16* | | | | | 17 | -1.12* | | | | | 12 | -1.26* | | |
| 1983 | | | 16 | -0.56* | | | | | 15 | -0.81* | | | | | 2 | -0.52* | 30 | -0.24* | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

*Negative numbers indicate cumulative left-lateral movement.

On 9/30/83, instrument was modified and maintenance was assumed by University of Southern California personnel.

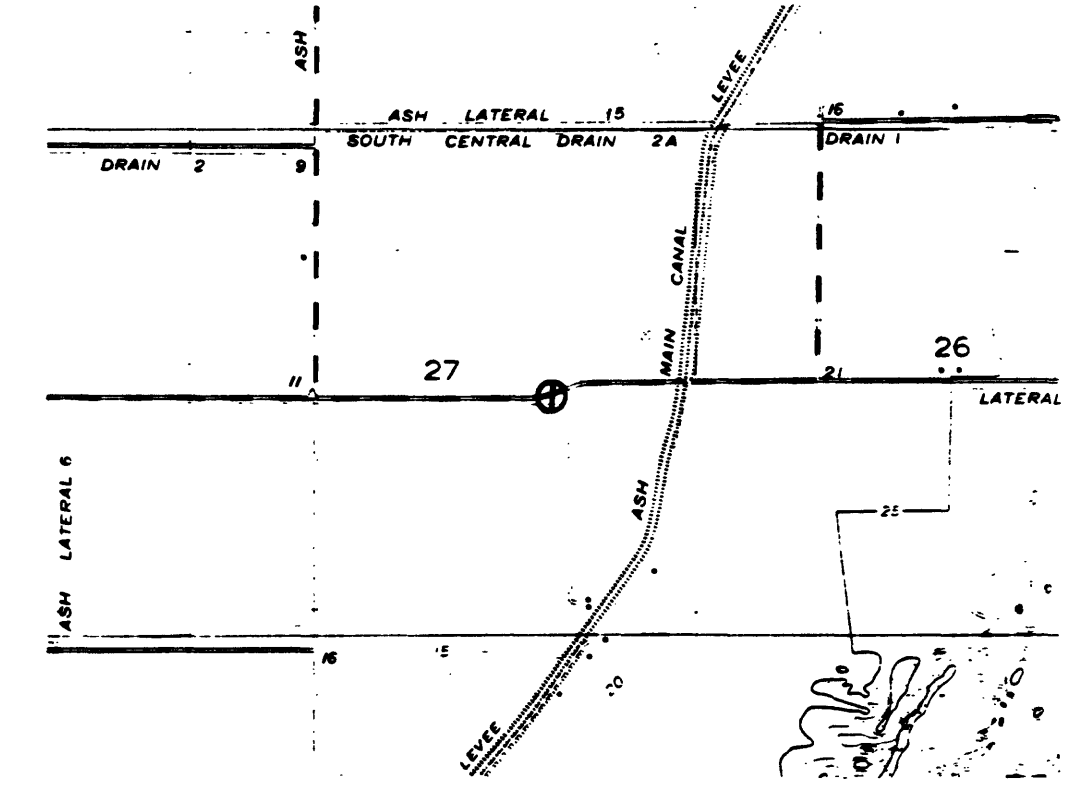

WIEBE RANCH XWR1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION XHB1

Latitude 32° 43.8'
Longitude 115° 24.3'

Position 7.6 km
20-meter wire, ø=46°

The Heber Road creepmeter was installed during October, 1975, on the Imperial fault (1940 surface break) at a site 7.6 km northwest of the U.S.-Mexico border. The installation consists of a single wire entrenched about 1 meter below the surface in alluvium. The instrument was established and is maintained in cooperation with the California Institute of Technology. Creep activity at this site is composed of clusters of large events of up to 15 mm amplitude, superimposed on a background of zero to slight right-lateral drift. The data after September, 1977, have not been received from California Institute of Technology, and thus do not appear here.




0 1 KILOMETRE

CALEXICO QUADRANGLE
CALIFORNIA—IMPERIAL CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XHB1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | 1 | 0.00 | | | 2 | 0.48 |
| 1976 | 22 | 0.44 | | | | | 30 | 0.32 | | | | | 27 | 0.59 | | | 29 | 0.89 | | | | | | |
| 1977 | | | 1 | 1.16 | | | 7 | 1.22 | 26 | 25.85 | | | | | | | 7 | 26.93 | ** | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

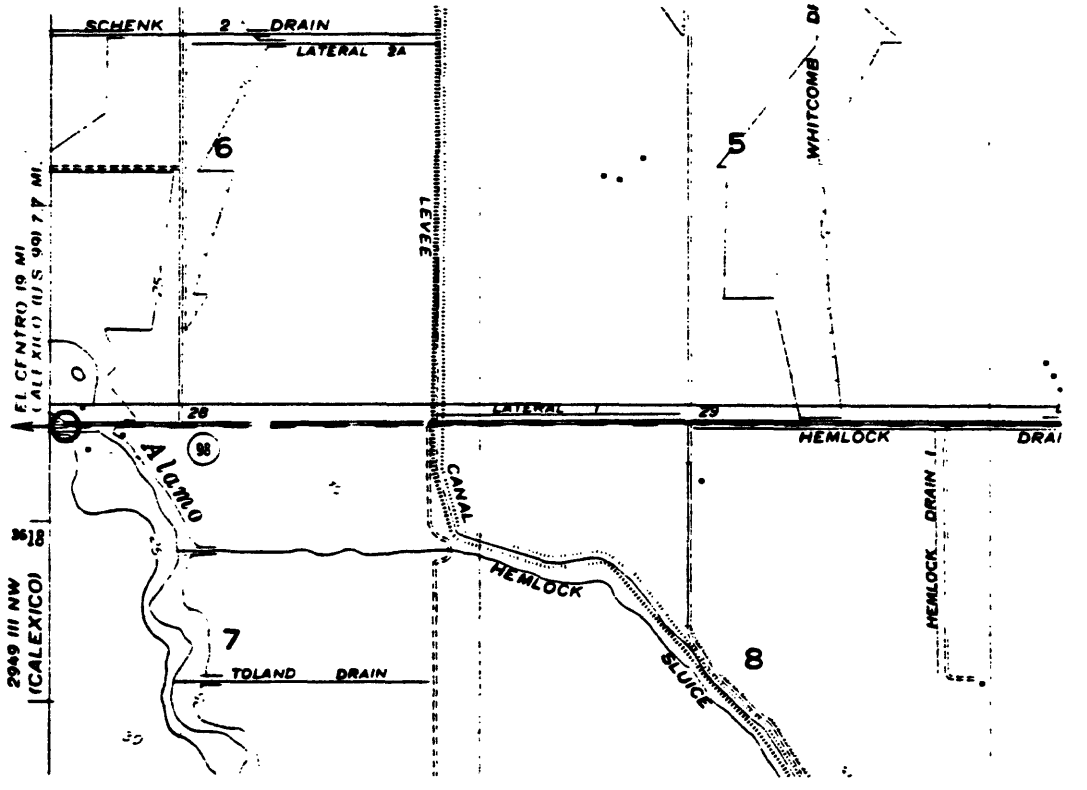
**Instrument maintenance and data taken over by California Institute of Technology personnel.

## STATION XTR1

Latitude 32° 41.6'
Longitude 115° 24.3'

Position 2.7 km
20-meter wire, ø=46°

The Tuttle Ranch creepmeter was installed during October, 1975, on the Imperial fault (1940 surface break) at a site 2.7 km northwest of the U.S.-Mexico border. The installation consists of a single wire entrenched about 1 meter below the surface in thin-layered sediments. A vertical offset in the strata was encountered within about 1 meter of the trench mid-point (northeast side down). The instrument was established and is maintained in cooperation with the California Institute of Technology. The records show slight right- and left-lateral (thermal) drift, with no significant creep activity up to September, 1977. Data after that time have not been received from California Institute of Technology, and thus do not appear here.




0 1 KILOMETER

BONDS CORNER QUADRANGLE
CALIFORNIA—IMPERIAL CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XTR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | 30 | 0.00 | 26 | 0.73 | | | 1 | 1.21 |
| 1976 | 22 | 1.61 | | | | | 30 | 2.10 | | | | | 27 | 1.39 | | | 30 | 1.45 | | | | | | |
| 1977 | | | 1 | 2.86 | | | 7 | 2.99 | 26 | 2.39 | | | | | | | 8 | 2.39 | | | 29 | 3.98 | ** | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

**Instrument maintenance and data taken over by California Institute of Technology personnel.

## STATION XUB1

Latitude 37° 52.4'
Longitude 122° 15.1'

Position 17 km
20-meter wire, ø=30°

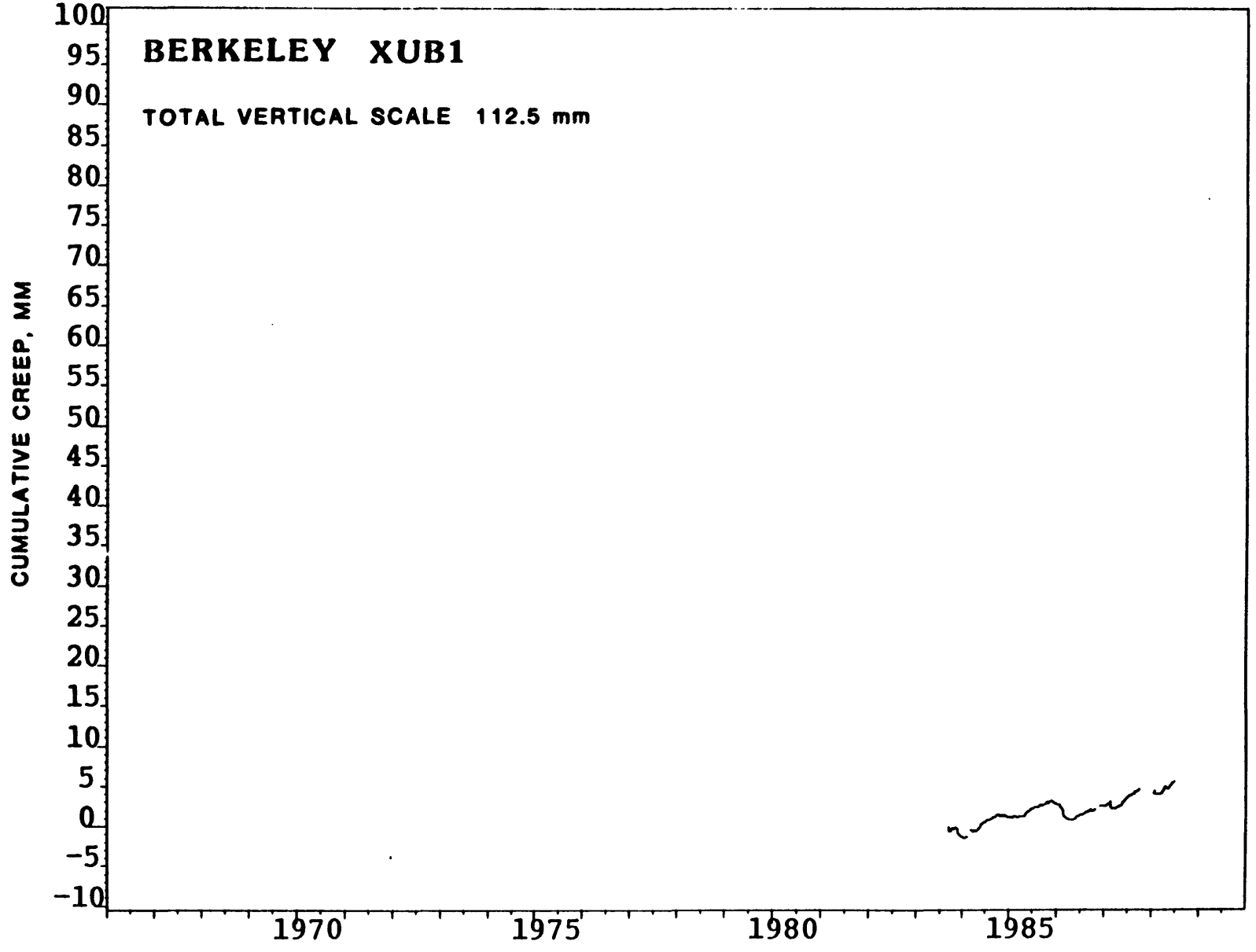
The Berkeley (University of California) creepmeter was installed in September, 1983, across a suspected trace of the Hayward fault discovered by seismic refraction tests by Ben Lennert Associates. The site was located on a small flat plateau between a steep bank on the northeast and Bowles Residence Hall on the southwest. The ground was unstable due to old landslides, and vibrations from traffic on Cyclotron Road at the top of the steep bank introduced constant low-level noise into the instrument signal. A yearly periodicity in the data coincident with rainfall (left-lateral movement) was superimposed on a background right-lateral creep rate of 1.3 mm/yr. The instrument was removed at the request of the University in October, 1988, to allow construction of a parking garage and new dormitory in the area.

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XUB1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1972 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1973 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1974 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1975 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1976 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | 7 | 0.00 | 7 | -0.19* | | | | |
| 1984 | | | 22 | -0.50* | 14 | -0.58* | 5 | -0.37* | | | | | 24 | 0.97 | | | | | | | 16 | 1.02 | | |
| 1985 | | | | | 18 | 1.31 | | | | | 26 | 2.36 | | | 16 | 2.64 | | | | | 19 | 3.40 | | |
| 1986 | | | 25 | 1.34 | | | | | 28 | 1.26 | | | | | 26 | 2.05 | | | | | 24 | 2.56 | | |
| 1987 | | | | | 2 | 2.34 | | | | | 10 | 3.40 | | | 12 | 4.29 | 16 | 4.71 | | | | | | |
| 1988 | 6 | 4.26 | | | | | | | | | 23 | 5.36 | | | | | | | 4 | 6.62 | ** | | | |

*Negative numbers indicate cumulative left-lateral movement.

**Instrument removed 10/4/88 at request of University of California to allow construction of a parking garage and dormitory.

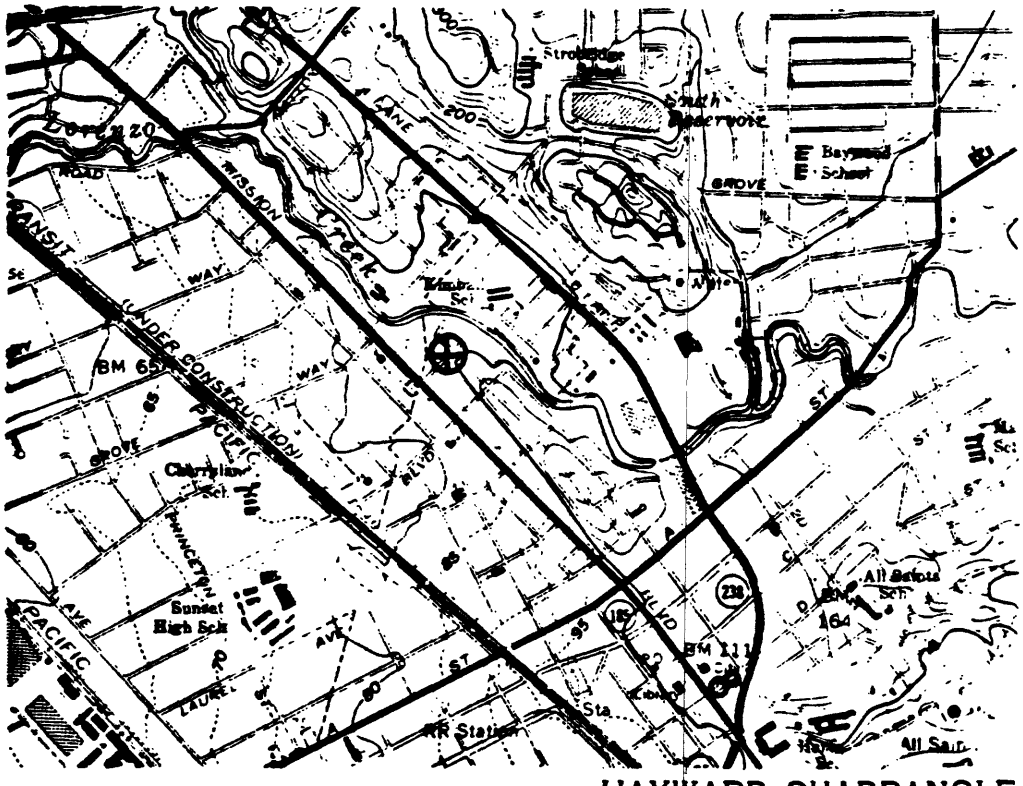

BERKELEY XUB1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION HWR1

Latitude 37° 40.8'
Longitude 122° 05.4'

Position 42.6 km
12-meter rods, ø=45°

The Hayward Rose Street creepmeters were installed during April, 1968 (contraction) and June, 1969 (extension) on the Hayward fault at a site 42.6 km southeast of Pinole Point on San Pablo Bay. The installation consists of a pair of crossed rods buried a few centimeters beneath the surface of the Rose Street pavement. Creep activity at this site is composed of gradual right-lateral movement at about 4.1 mm/yr with a distinct seasonal variation. No distinct events have been observed.



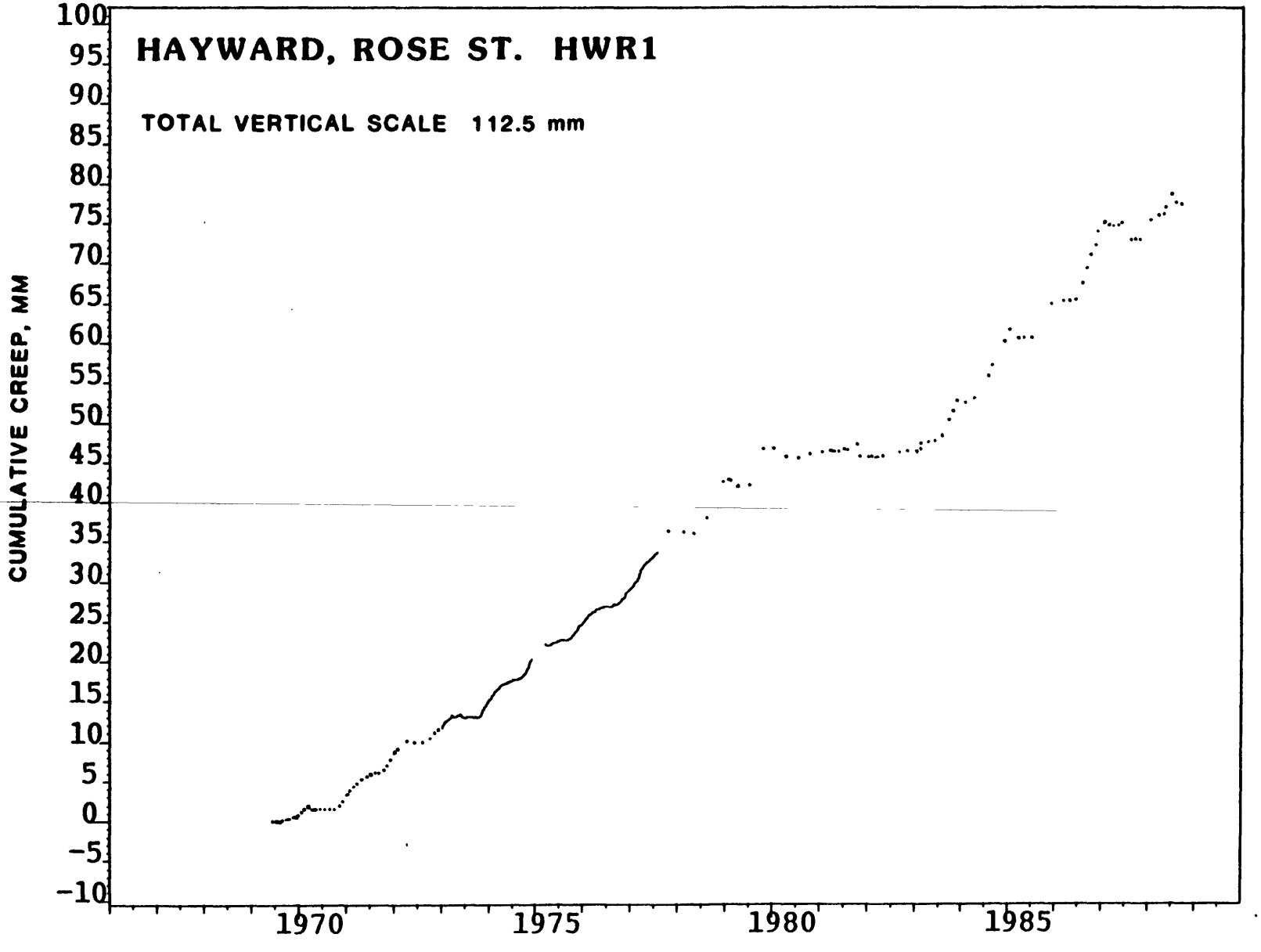

HAYWARD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** HWR1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 11 | 0.00 | 10 | 0.06 | 3 | 0.06 | 1 | 0.11 | 2 | 0.30 | 18 | 0.65 | 29 | 0.86 |
| 1970 | 22 | 1.17 | 9 | 1.55 | 4 | 1.72 | 9 | 1.61 | 12 | 1.64 | 10 | 1.62 | 22 | 1.61 | | | 1 | 1.67 | 7 | 1.68 | 12 | 1.89 | 1 | 2.47 |
| 1971 | 21 | 3.56 | 4 | 3.88 | 4 | 4.33 | 1 | 4.69 | 10 | 5.23 | 10 | 5.60 | 7 | 5.91 | 12 | 6.11 | 8 | 6.69 | 14 | 6.47 | 2 | 6.87 | 2 | 7.69 |
| 1972 | 6 | 8.45 | 3 | 9.04 | | | 13 | 10.18 | | | 7 | 9.95 | | | 9 | 9.88 | | | 6 | 10.39 | 3 | 11.10 | 6 | 11.47 |
| 1973 | | | 1 | 12.53 | 29 | 13.25 | | | 8 | 13.36 | | | 18 | 13.07 | | | | | 4 | 12.94 | 28 | 14.16 | | |
| 1974 | 29 | 15.78 | | | | | 10 | 17.14 | | | 13 | 17.54 | | | 29 | 17.90 | | | | | | | 20 | 20.42 |
| 1975 | 7 | 21.01 | | | 19 | 22.30 | | | 14 | 22.50 | | | | | 6 | 22.81 | | | | | 24 | 24.13 | | |
| 1976 | | | 18 | 25.83 | | | | | 7 | 26.75 | | | | | 23 | 27.15 | | | | | 30 | 28.63 | 10 | 28.74 |
| 1977 | | | 14 | 29.97 | | | 21 | 32.39 | | | | | 28 | 33.86 | | | | | 11 | 36.36 | | | | |
| 1978 | | | 15 | 36.26 | | | | | 3 | 35.98 | | | | | 10 | 38.13 | | | | | | | 1 | 42.50 |
| 1979 | 24 | 42.72 | 7 | 42.70 | 28 | 41.96 | | | | | | | 2 | 42.19 | | | | | 17 | 46.71 | | | | |
| 1980 | 15 | 46.66 | | | | | 22 | 45.55 | | | | | 23 | 45.65 | | | | | 20 | 45.86 | | | | |
| 1981 | 20 | 46.32 | | | 19 | 46.43 | 13 | 46.39 | 2 | 46.36 | | | 2 | 46.51 | 2 | 46.63 | | | 20 | 47.15 | 1 | 45.64 | | |
| 1982 | 7 | 45.64 | | | 5 | 45.65 | 28 | 45.64 | | | | | | | 28 | 46.30 | | | 27 | 46.39 | | | | |
| 1983 | 8 | 46.39 | 14 | 46.56 | | | 9 | 47.49 | 31 | 47.59 | 11 | 47.63 | 28 | 48.21 | 14 | 48.30 | 18 | 50.22 | 23 | 51.45 | 22 | 52.65 | | |
| 1984 | 24 | 52.48 | | | | | 1 | 52.94 | | | | | 25 | 55.78 | 25 | 57.11 | | | | | 16 | 60.16 | | |
| 1985 | 8 | 61.78 | | | 18 | 60.57 | 21 | 60.66 | | | 26 | 60.77 | | | | | | | | | 19 | 64.96 | | |
| 1986 | | | 25 | 65.27 | | | 19 | 65.28 | 28 | 65.48 | | | 26 | 67.46 | 26 | 69.45 | 21 | 70.97 | | | 24 | 74.09 | | |
| 1987 | 10 | 74.98 | | | 2 | 74.86 | | | 2 | 74.64 | 6 | 75.07 | | | 9 | 72.88 | 16 | 72.89 | 18 | 73.02 | | | | |
| 1988 | 6 | 75.56 | | | 19 | 75.92 | 30 | 76.17 | 15 | 77.08 | 23 | 78.49 | 24 | 77.51 | | | 3 | 77.50 | * | | | | | |

*Found rod broken on 9/26/88.

Many of the readings from 1983-88 were made and provided to us by Jon Galehouse's survey teams when they surveyed the adjacent San Francisco State University alinement array.


HAYWARD, ROSE ST. HWR1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION HWE1

Latitude 37° 40.2'
Longitude 122° 04.8'

Position 44.0 km
14-meter rods, ø=45°

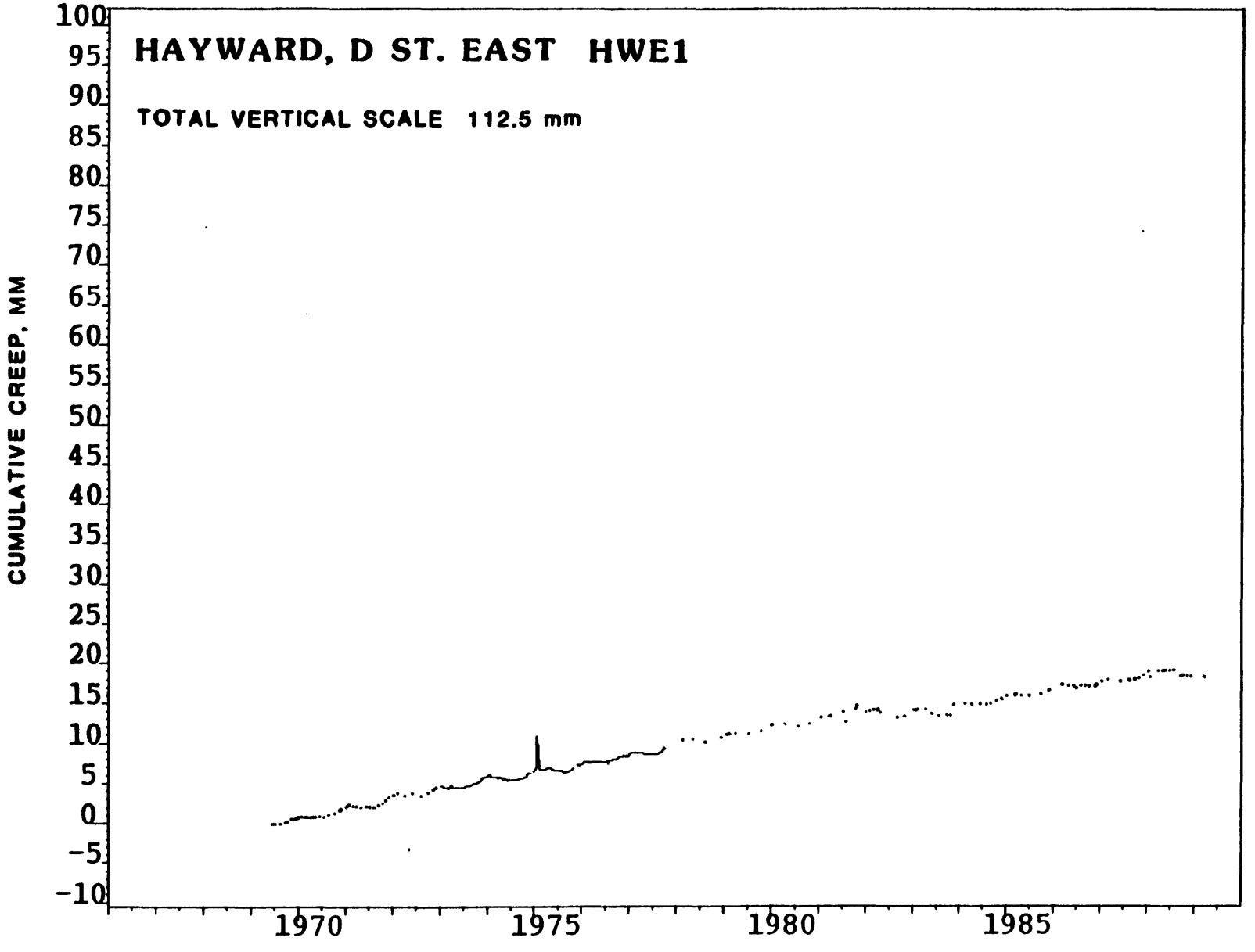
The Hayward D Street East creepmeters were installed during April, 1968 (contraction), and June, 1969 (extension), on the Hayward fault at a site 44.0 km southeast of Pinole Point on San Pablo Bay. The installation consists of a pair of rods in a "V" configuration buried a few centimeters beneath the surface of the D Street pavement. The Hayward fault zone is split into two distinct traces about 50 meters apart along D Street, and the HWE rods are installed across the northeastern trace. Creep activity at this site is composed of gradual right-lateral movement of about 1.0 mm/yr, with a distinct seasonal variation. No distinct events have been observed.


HAYWARD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** HWE1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 13 | 0.00 | 11 | 0.03 | 8 | 0.05 | 10 | 0.11 | 2 | 0.32 | 7 | 0.48 | 4 | 0.55 |
| 1970 | 2 | 0.88 | | | 12 | 0.89 | 9 | 0.81 | 12 | 0.87 | 10 | 0.85 | 22 | 0.84 | | | 1 | 1.11 | 7 | 1.40 | 12 | 1.71 | 1 | 1.94 |
| 1971 | 6 | 2.20 | 4 | 2.21 | 4 | 2.20 | 1 | 2.16 | 10 | 2.16 | 10 | 2.16 | 7 | 2.16 | 12 | 2.12 | 8 | 2.30 | 14 | 2.60 | 2 | 2.89 | 2 | 3.18 |
| 1972 | 6 | 3.57 | 15 | 3.68 | | | 13 | 3.61 | | | 7 | 3.65 | | | 9 | 3.60 | | | 6 | 3.94 | 3 | 4.18 | 6 | 4.59 |
| 1973 | | | 1 | 4.52 | 29 | 4.68 | | | 8 | 4.54 | | | 18 | 4.61 | | | | | 4 | 4.96 | 28 | 5.61 | | |
| 1974 | 29 | 5.76 | | | | | 10 | 5.76 | | | 13 | 5.52 | | | 29 | 5.57 | | | | | | | 20 | 6.43 |
| 1975 | 7 | 6.74 | | | 19 | 6.73 | | | 14 | 6.65 | | | | | 6 | 6.62 | | | | | 24 | 7.35 | | |
| 1976 | | | 18 | 7.73 | | | | | 7 | 7.63 | | | | | 23 | 7.86 | | | | | 29 | 8.55 | | |
| 1977 | | | 14 | 8.87 | | | 21 | 8.70 | | | | | 28 | 8.71 | | | | | 11 | 9.35 | | | | |
| 1978 | | | 15 | 10.47 | | | | | 3 | 10.37 | | | | | 10 | 10.23 | | | | | | | 1 | 10.79 |
| 1979 | 24 | 11.24 | 7 | 11.27 | 28 | 11.30 | | | | | | | 2 | 11.20 | | | | | 17 | 11.60 | | | | |
| 1980 | 15 | 12.40 | | | | | 22 | 12.39 | | | | | 23 | 12.18 | | | | | 20 | 12.50 | | | | |
| 1981 | 20 | 13.28 | | | 19 | 13.46 | 13 | 13.42 | | | | | 2 | 14.13 | 2 | 12.73 | | | 20 | 14.26 | 1 | 14.54 | | |
| 1982 | 7 | 13.94 | | | 5 | 14.04 | 28 | 13.92 | | | | | | | 28 | 13.24 | | | 27 | 13.39 | | | | |
| 1983 | 8 | 14.21 | 14 | 14.27 | | | 9 | 14.23 | | | 1 | 13.83 | 28 | 13.46 | 4 | 13.48 | 18 | 13.48 | 23 | 13.53 | 22 | 14.67 | | |
| 1984 | | | 4 | 14.93 | | | 1 | 14.95 | | | 12 | 14.92 | 25 | 14.95 | 25 | 15.05 | | | 21 | 15.37 | 16 | 15.61 | | |
| 1985 | 9 | 16.05 | 24 | 16.09 | 18 | 16.12 | 21 | 16.04 | | | 26 | 16.07 | | | | | 14 | 16.19 | | | 19 | 16.70 | | |
| 1986 | | | 25 | 17.25 | | | 27 | 17.13 | 28 | 17.07 | 18 | 17.04 | 26 | 17.07 | 26 | 17.08 | 21 | 17.11 | | | 24 | 17.24 | | |
| 1987 | 10 | 17.84 | | | 2 | 17.93 | | | | | 6 | 17.83 | | | 9 | 17.87 | 16 | 17.94 | 18 | 18.03 | | | 5 | 18.62 |
| 1988 | 6 | 19.00 | | | 19 | 19.03 | 30 | 19.05 | 15 | 19.05 | 23 | 19.03 | 24 | 19.03 | | | 26 | 18.40 | | | | | | |

Many of the readings from 1983-88 were made and provided to us by Jon Galehouse's survey teams when they surveyed the adjacent San Francisco State University alinement array.

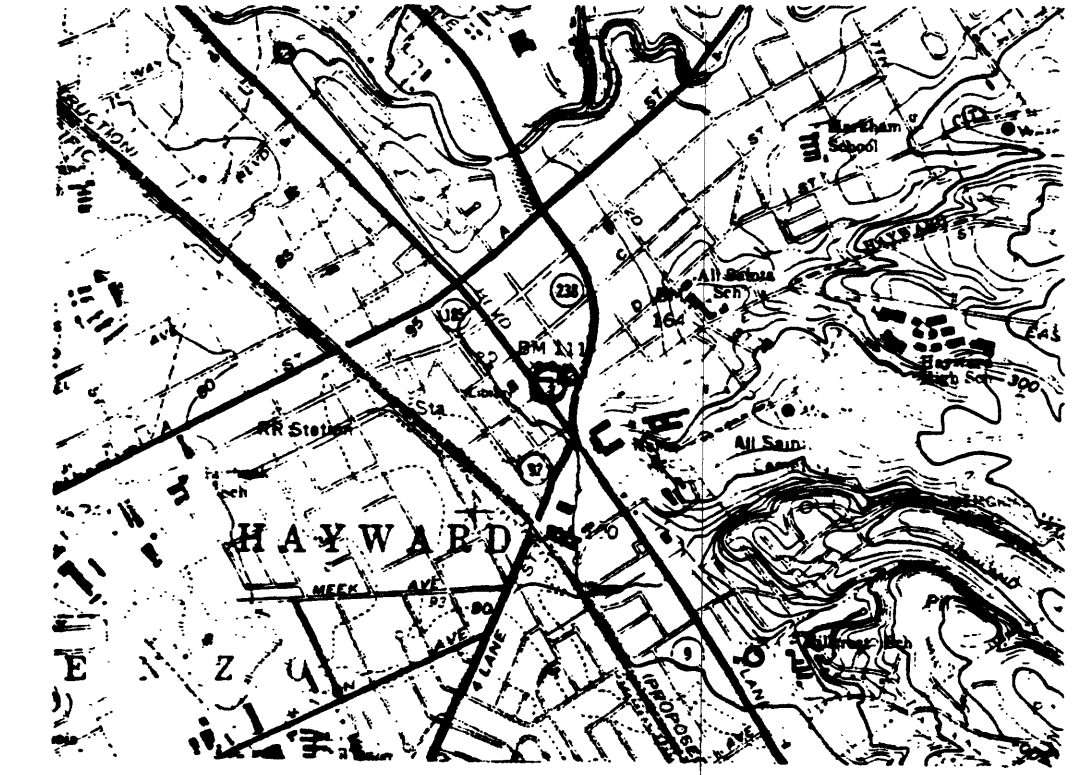

HAYWARD, D ST. EAST HWE1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION HWW1

Latitude 37° 40.2'
Longitude 122° 04.8'

Position 44.0 km
12-meter rods, ø=45°

The Hayward D Street West creepmeters were installed during April, 1968 (contraction) and June, 1969 (extension), on the Hayward fault at a site 44.0 km southeast of Pinole Point on San Pablo Bay. The installation consists of a pair of rods in a "V" configuration buried a few centimeters beneath the surface of the D Street and adjacent parking lot pavements. The Hayward fault zone is split into two distinct traces about 50 meters apart along D Street, and HWW rods are installed across the southwestern trace. Creep activity at this site is composed of occasional minor events of up to about 1 mm in amplitude, superimposed on a background of gradual right-lateral slip. The average long-term creep rate is about 3.2 mm/yr, with a distinct seasonal variation.



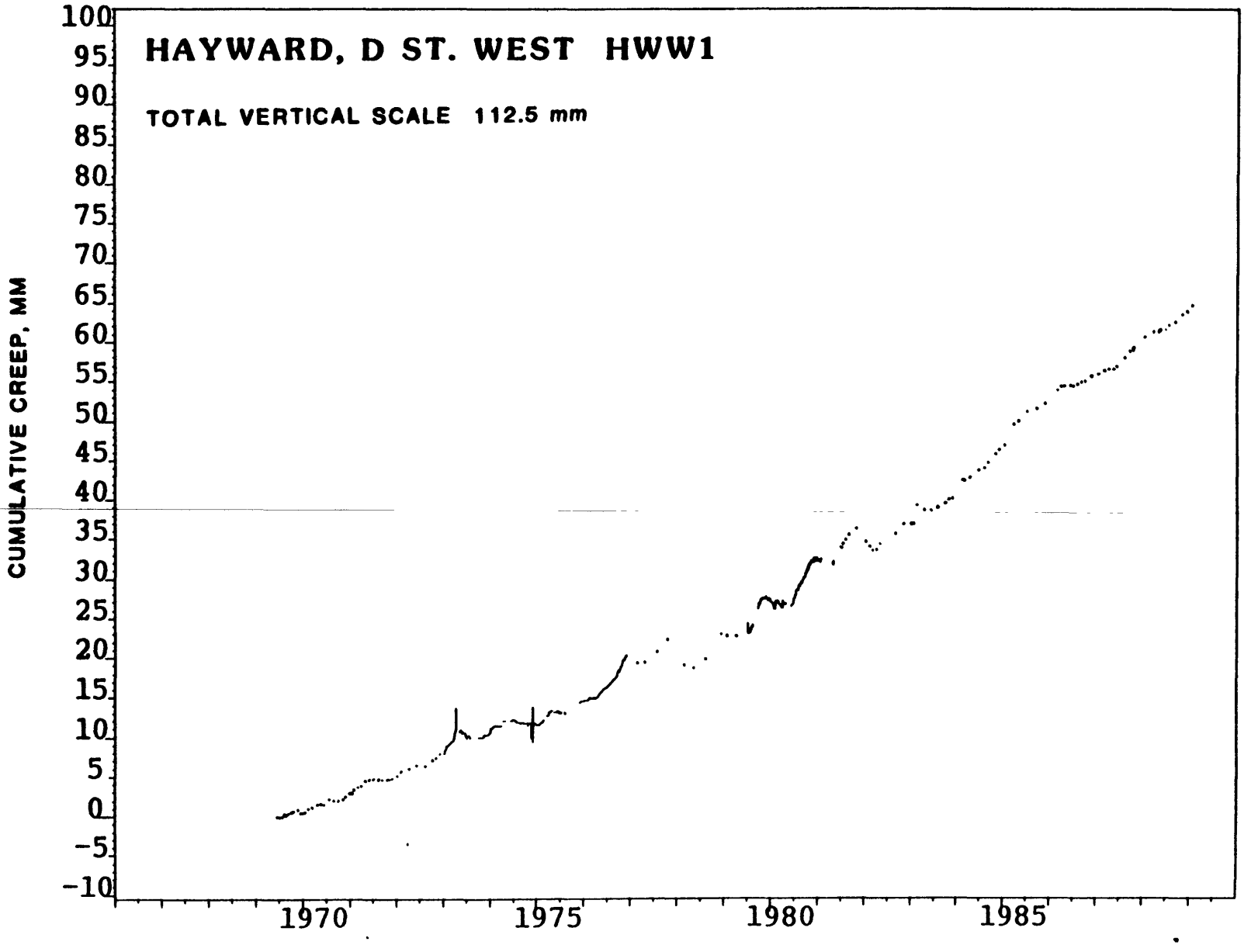

HAYWARD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** HWW1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 13 | 0.00 | 11 | -0.01* | 8 | 0.23 | 2 | 0.41 | 3 | 0.48 | 24 | 0.79 | 29 | 0.57 |
| 1970 | 20 | 0.61 | 9 | 1.02 | 4 | 1.22 | 15 | 1.42 | 12 | 1.59 | 10 | 1.53 | 22 | 2.06 | | | 1 | 2.16 | 7 | 2.16 | 12 | 2.24 | 1 | 2.61 |
| 1971 | 21 | 3.15 | 4 | 3.44 | 4 | 3.75 | 1 | 3.89 | 10 | 4.53 | 10 | 4.76 | 7 | 4.67 | 12 | 4.73 | 8 | 4.67 | 14 | 4.66 | 2 | 4.73 | 2 | 4.91 |
| 1972 | 6 | 5.10 | 3 | 5.62 | | | 13 | 6.09 | | | 7 | 6.41 | | | 9 | 6.40 | | | 6 | 6.93 | 3 | 7.25 | 6 | 7.73 |
| 1973 | | | 1 | 8.76 | 29 | 10.13 | | | 8 | 10.52 | | | 18 | 10.30 | | | | | 4 | 9.89 | 28 | 10.28 | | |
| 1974 | 29 | 11.33 | | | | | 10 | 12.01 | | | 13 | 12.06 | | | 29 | 11.68 | | | | | | | 20 | 11.81 |
| 1975 | 7 | 11.85 | | | 19 | 12.60 | | | 14 | 13.14 | | | | | 6 | 13.00 | | | | | 24 | 14.40 | | |
| 1976 | | | 18 | 14.92 | | | | | 7 | 15.51 | | | | | 23 | 17.35 | | | | | 30 | 20.36 | | |
| 1977 | | | 14 | 19.45 | | | 21 | 19.46 | | | | | 28 | 20.85 | | | | | 11 | 22.33 | | | | |
| 1978 | | | 15 | 19.23 | | | | | 3 | 18.75 | | | | | 10 | 19.79 | | | | | | | 1 | 23.09 |
| 1979 | 24 | 22.81 | 7 | 22.74 | 28 | 22.66 | | | | | | | 2 | 24.31 | | | | | 17 | 27.42 | | | | |
| 1980 | 15 | 27.10 | | | | | 22 | 26.88 | | | | | 23 | 28.38 | | | | | 20 | 31.65 | | | | |
| 1981 | 20 | 32.40 | | | 19 | 32.19 | 13 | 31.93 | 2 | 32.03 | | | 2 | 33.88 | 2 | 34.92 | | | 20 | 36.36 | 1 | 36.32 | | |
| 1982 | 7 | 34.52 | | | 5 | 33.58 | 28 | 34.47 | | | | | | | 28 | 35.72 | | | 27 | 36.78 | | | | |
| 1983 | 8 | 36.78 | 14 | 39.23 | | | 9 | 38.76 | | | 1 | 38.65 | 28 | 38.88 | 4 | 38.91 | 18 | 39.42 | 23 | 39.92 | 22 | 40.24 | | |
| 1984 | | | 4 | 42.38 | | | 1 | 42.72 | | | 12 | 43.63 | 25 | 44.04 | 25 | 44.68 | | | 21 | 45.75 | 16 | 46.17 | | |
| 1985 | 9 | 46.91 | 24 | 49.05 | 18 | 49.47 | 21 | 49.89 | | | 26 | 51.17 | | | | | 14 | 51.51 | | | 19 | 52.10 | | |
| 1986 | | | 25 | 53.87 | 22 | 54.31 | 19 | 54.45 | 28 | 54.35 | 18 | 54.39 | 26 | 54.52 | 26 | 54.87 | 21 | 55.12 | | | 24 | 55.73 | | |
| 1987 | 10 | 55.84 | | | 2 | 56.34 | | | 2 | 56.48 | 6 | 56.90 | | | 9 | 58.04 | 16 | 58.64 | 4 | 58.88 | | | | |
| 1988 | 6 | 60.64 | | | 19 | 61.29 | 30 | 61.33 | 15 | 61.37 | 23 | 61.66 | 24 | 62.05 | | | 3 | 62.61 | | | | | 12 | 63.91 |

*Negative numbers indicate cumulative left-lateral movement.

Many of the readings from 1983-88 were made and provided to us by Jon Galehouse's survey teams when they surveyed the adjacent San Francisco State University alinement array.

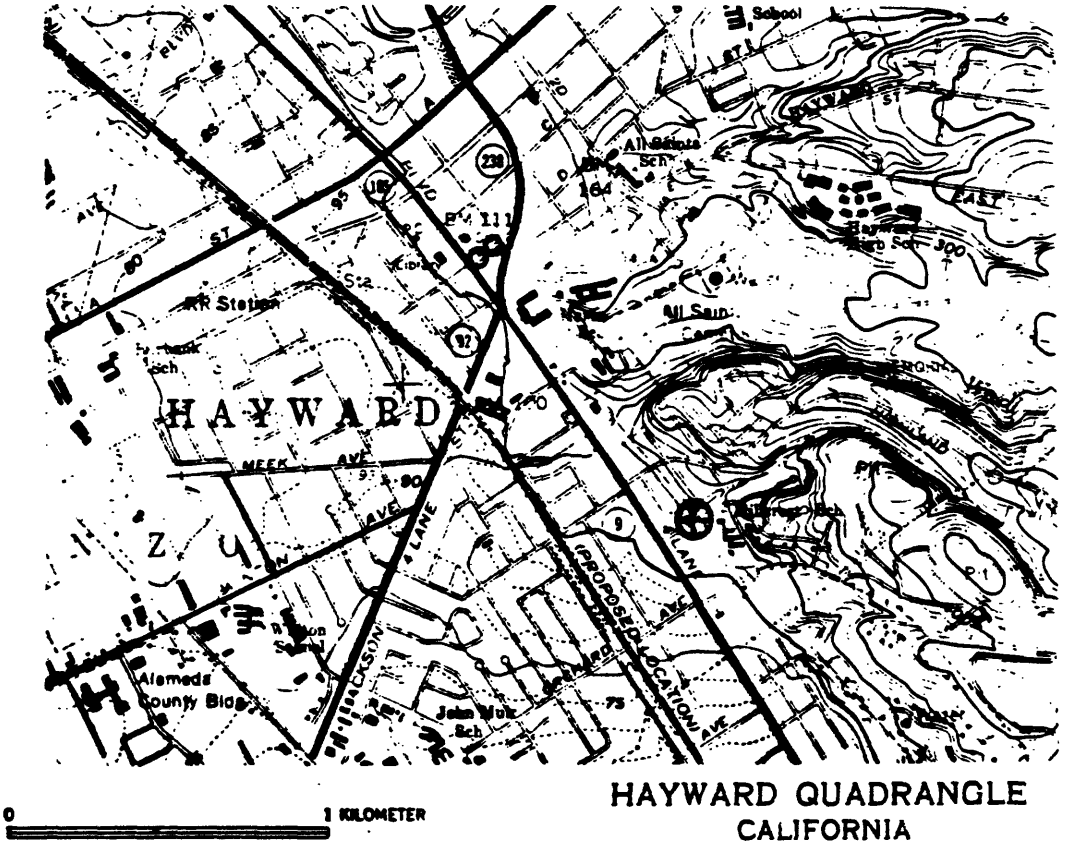

HAYWARD, D ST. WEST HWW1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION HWP1

Latitude 37° 39.8'
Longitude 122° 04.5'

Position 45.0 km
12-meter rods, ø=45°

The Hayward Palisade Street creepmeters were installed during May, 1970, on the Hayward fault at a site 45.0 km southeast of Pinole Point on San Pablo Bay. The installation consists of a pair of crossed rods buried a few centimeters beneath the surface of the Palisade Street pavement. Creep activity at this site is composed of gradual long-term right-lateral movement of about 3.6 mm/yr, with a distinct seasonal variation. No distinct events have been observed.

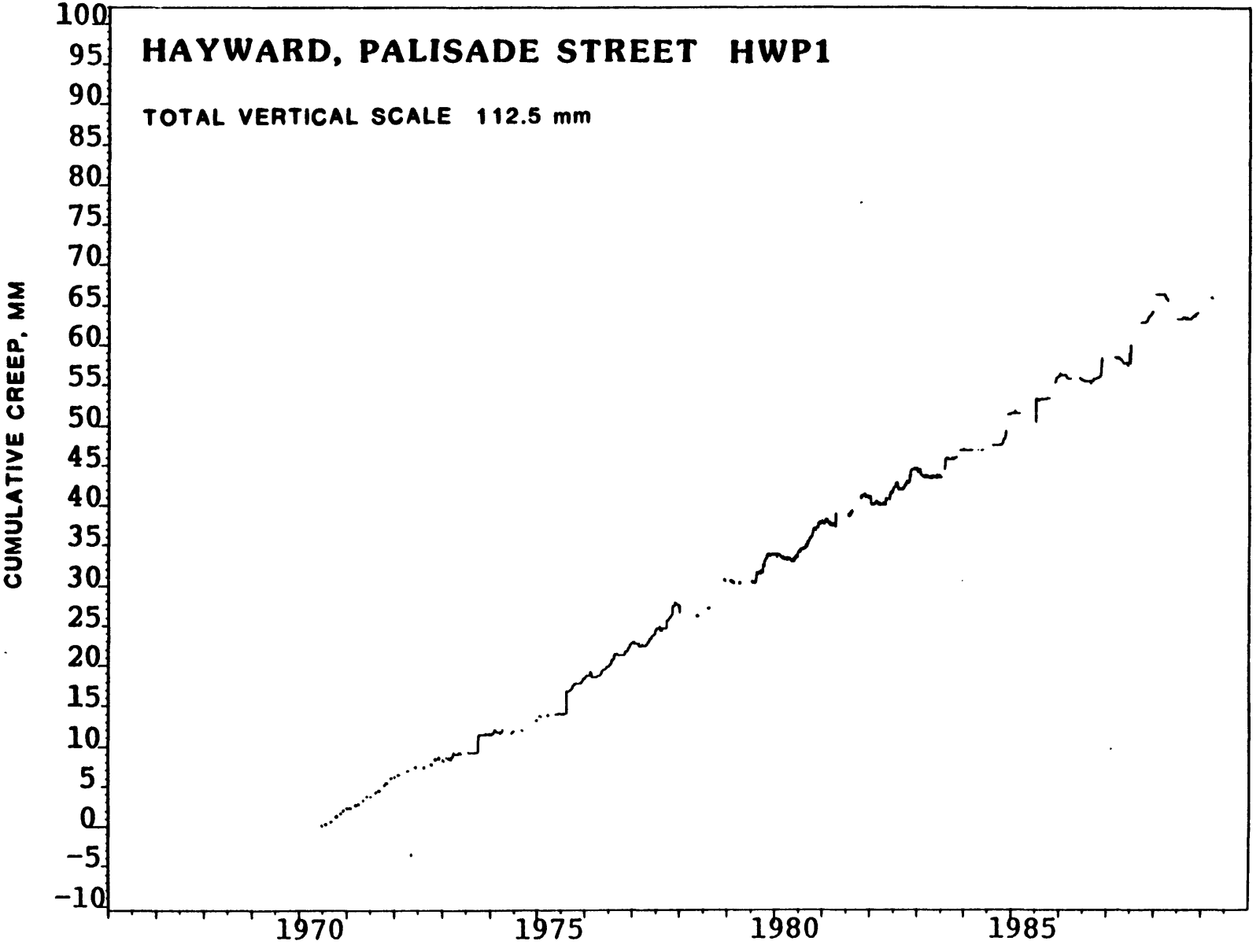



HAYWARD QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** HWP1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | 10 | 0.00 | 22 | 0.28 | | | 1 | 0.71 | 7 | 1.23 | 12 | 1.63 | 1 | 1.88 |
| 1971 | 6 | 2.21 | 4 | 2.36 | 4 | 2.55 | 1 | 2.71 | 10 | 3.29 | 3 | 3.66 | 7 | 3.70 | 12 | 4.14 | 8 | 4.57 | 14 | 5.20 | 2 | 5.54 | 2 | 5.90 |
| 1972 | 6 | 6.05 | 3 | 6.38 | | | 13 | 7.00 | | | 7 | 7.41 | | | 9 | 7.45 | | | 6 | 7.65 | 3 | 8.25 | 6 | 8.34 |
| 1973 | | | 1 | 8.62 | 29 | 9.05 | | | 8 | 9.09 | | | 18 | 9.23 | | | | | 4 | 11.26 | 28 | 11.34 | | |
| 1974 | 29 | 11.84 | | | | | 10 | 12.25 | | | 13 | 12.25 | | | 29 | 12.63 | | | | | | | 20 | 13.82 |
| 1975 | 7 | 14.20 | | | 19 | 14.44 | | | 14 | 14.64 | | | | | 6 | 14.86 | | | | | 24 | 18.29 | | |
| 1976 | | | 18 | 19.09 | | | | | 7 | 19.95 | | | | | 23 | 22.00 | | | | | 29 | 22.54 | | |
| 1977 | | | 14 | 23.38 | | | 21 | 23.48 | | | | | 28 | 25.44 | | | | | 11 | 26.62 | | | | |
| 1978 | | | | | | | | | 3 | 26.23 | | | | | 10 | 27.24 | | | | | | | 1 | 30.50 |
| 1979 | 24 | 30.58 | 7 | 30.43 | 28 | 30.42 | | | | | | | 2 | 30.59 | | | | | 17 | 32.80 | | | | |
| 1980 | 15 | 33.39 | | | | | 22 | 33.11 | | | | | 23 | 34.39 | | | | | 20 | 36.98 | | | | |
| 1981 | 20 | 38.14 | | | 19 | 37.73 | 13 | 38.92 | | | | | 14 | 38.71 | 2 | 39.02 | | | 20 | 41.08 | 1 | 41.21 | | |
| 1982 | 7 | 40.36 | | | 5 | 40.02 | 28 | 39.95 | | | | | | | 28 | 42.10 | | | 27 | 43.28 | | | | |
| 1983 | 8 | 43.94 | 14 | 43.59 | | | 11 | 43.67 | | | 1 | 43.77 | 28 | 44.41 | | | | | 27 | 46.16 | 22 | 46.92 | | |
| 1984 | | | 4 | 46.87 | | | 1 | 46.93 | | | 12 | 46.94 | 25 | 47.56 | | | | | | | 16 | 51.39 | | |
| 1985 | 15 | 51.83 | | | 18 | 51.45 | | | | | 26 | 53.27 | | | | | | | | | 19 | 55.37 | | |
| 1986 | | | 25 | 56.00 | | | 27 | 54.97 | 28 | 55.97 | 3 | 55.84 | | | 26 | 55.28 | | | | | 24 | 58.43 | | |
| 1987 | | | | | 2 | 58.49 | | | | | 10 | 57.44 | 1 | 60.00 | | | 16 | 62.95 | | | | | | |
| 1988 | 6 | 66.39 | | | | | | | | | 23 | 63.41 | 28 | 63.43 | | | 26 | 63.99 | | | | | 12 | 65.68 |

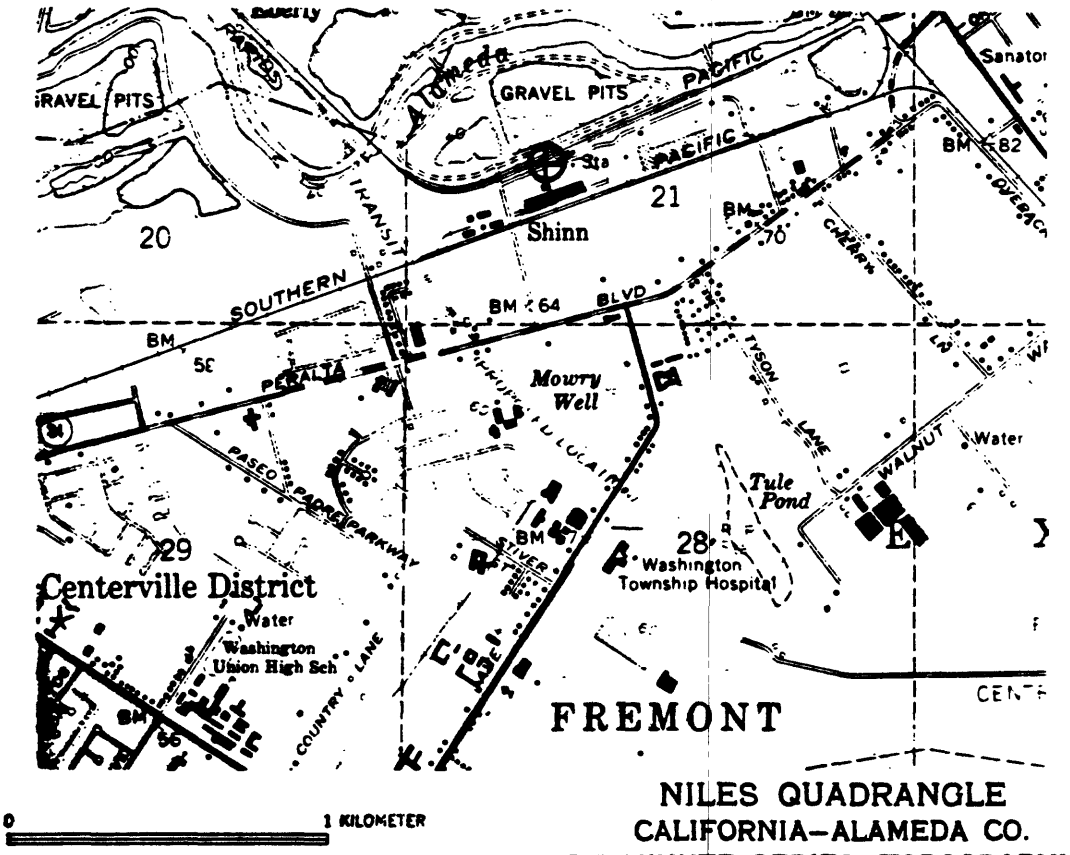
Values after 4/10/74 differ from those in earlier catalogs, due to recent discovery of an error in field reading procedure on 4/10/74.
Some field readings from 1983-88 were made and provided to us by Jon Galehouse's survey teams when they surveyed the San Francisco State University Hayward arrays.


HAYWARD, PALISADE STREET HWP1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION FMS1

Latitude 37° 34.1' Position 58.2 km
Longitude 121° 58.9' 12-meter rods, ø=45°

The Fremont Shinn Station creepmeters were installed during August, 1970, on the Hayward fault at a site 58.2 km southeast of Pinole Point on San Pablo Bay. The installation consisted of a pair of crossed rods buried a few centimeters below a nearly flat surface in alluvium. Creep activity at this site was composed of occasional events of up to 8 mm in amplitude, superimposed on a background of zero to right-lateral slip. The average long-term creep rate was about 3.6 mm/yr. The instruments were removed in February, 1983, due to flooding.

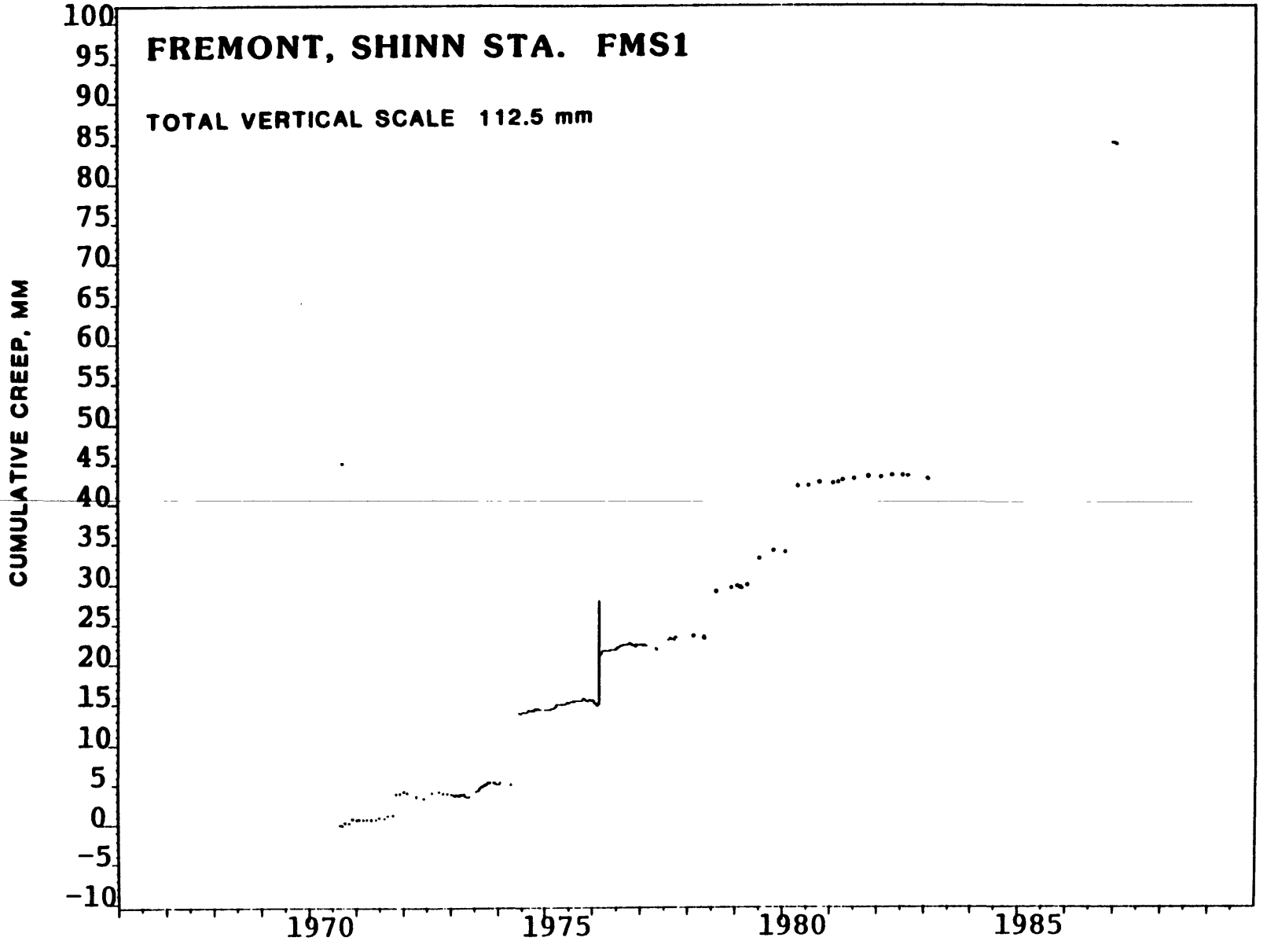


CUMULATIVE CREEP CALCULATED FROM FIELD READINGS

STATION FMS1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | 3 | 0.00 | 1 | 0.08 | 7 | 0.11 | 12 | 0.11 | 7 | 0.66 |
| 1971 | 21 | 0.72 | 4 | 0.74 | 4 | 0.72 | 1 | 0.72 | 10 | 0.69 | 9 | 0.68 | 7 | 0.85 | 12 | 0.89 | 8 | 1.12 | 14 | 1.14 | 2 | 3.86 | 2 | 3.93 |
| 1972 | 6 | 4.07 | 3 | 3.86 | | | 13 | 3.33 | | | 7 | 3.15 | | | 9 | 3.77 | | | 6 | 4.07 | 3 | 3.86 | 6 | 3.79 |
| 1973 | | | 1 | 3.72 | 29 | 3.68 | | | 8 | 3.46 | | | 18 | 3.99 | | | | | 4 | 4.65 | 28 | 5.20 | | |
| 1974 | 29 | 5.29 | | | | | 10 | 5.19 | | | 13 | 13.94 | | | 29 | 14.17 | | | | | | | 20 | 14.20 |
| 1975 | 7 | 14.21 | | | 19 | 14.62 | | | 14 | 14.90 | | | | | 6 | 15.27 | | | | | 24 | 15.40 | | |
| 1976 | | | 18 | 21.11 | | | | | 7 | 21.68 | | | | | 23 | 22.41 | | | | | 29 | 22.35 | | |
| 1977 | | | 14 | 22.34 | | | 21 | 21.91 | | | | | 29 | 22.84 | | | | | 11 | 23.07 | | | | |
| 1978 | | | 15 | 23.59 | | | | | 3 | 23.42 | | | | | 10 | 29.05 | | | | | | | 1 | 29.39 |
| 1979 | 24 | 29.58 | 7 | 29.53 | 28 | 29.60 | | | | | | | 2 | 33.19 | | | | | 17 | 33.98 | | | | |
| 1980 | 15 | 33.73 | | | | | 22 | 42.03 | | | | | 23 | 42.27 | | | | | 20 | 42.33 | | | | |
| 1981 | 21 | 42.41 | | | 3 | 42.58 | 13 | 42.67 | | | | | 14 | 42.82 | | | | | 20 | 43.08 | | | | |
| 1982 | 28 | 43.01 | | | | | 28 | 43.20 | | | | | 26 | 43.13 | 23 | 43.13 | | | | | | | | |
| 1983 | 25 | 42.85 | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

By 2/1/83, rod had broken.

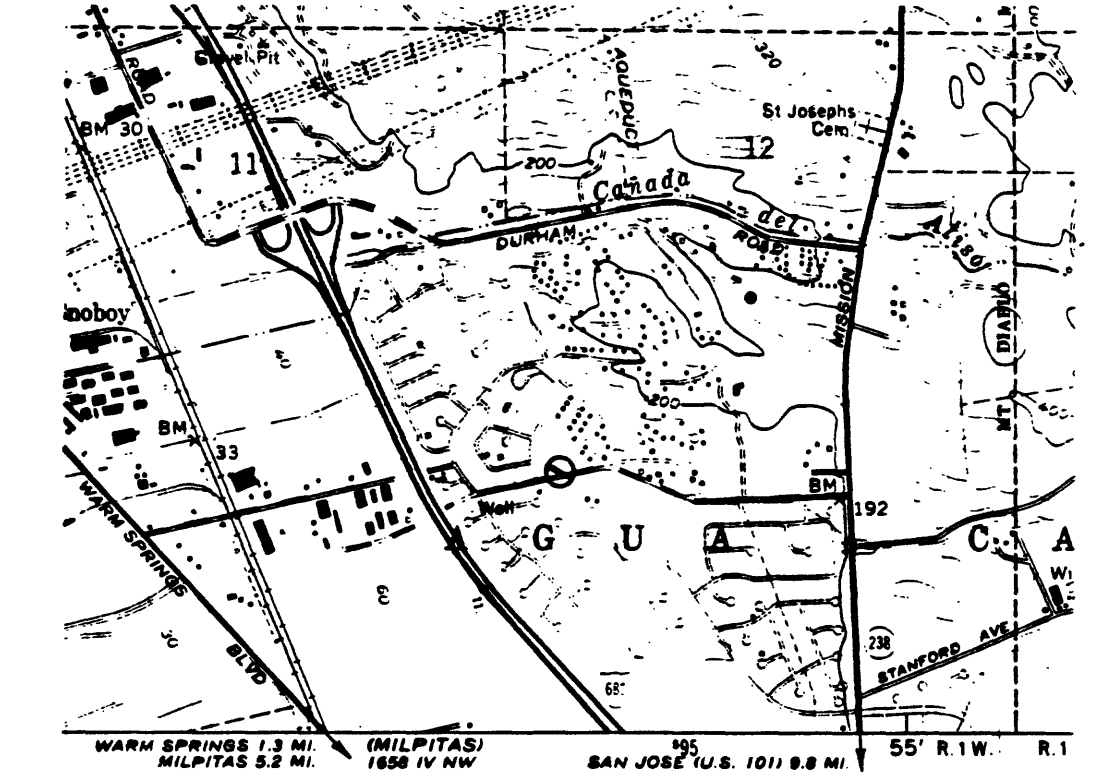

FREMONT, SHINN STA. FMS1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION XFP1

Latitude 37° 30.4'
Longitude 121° 55.8'

Position 66.3 km
10-meter wire, ø=30°

The Fremont Prune Avenue creepmeter was installed during June, 1969, on the Hayward fault at a site 66.3 km southeast of Pinole Point on San Pablo Bay. The installation consisted of a single wire buried a few centimeters below the surface on a broad, southwest-facing scarp. Creep activity at this site was composed of wild seasonal fluctuations of up to 20 mm in amplitude, superimposed on a background of gradual right-lateral slip. The average creep rate was about 3 mm/yr. The instrument crossed a subsidiary fracture with a broad slip zone that was dominated by activity on a separate fault trace about 20 meters to the southeast. Occasional events of both right- and left-lateral offset were occasionally observed. The instrument was destroyed by flooding in January 1980, and shortly thereafter, the former site was incorporated into a new city park.

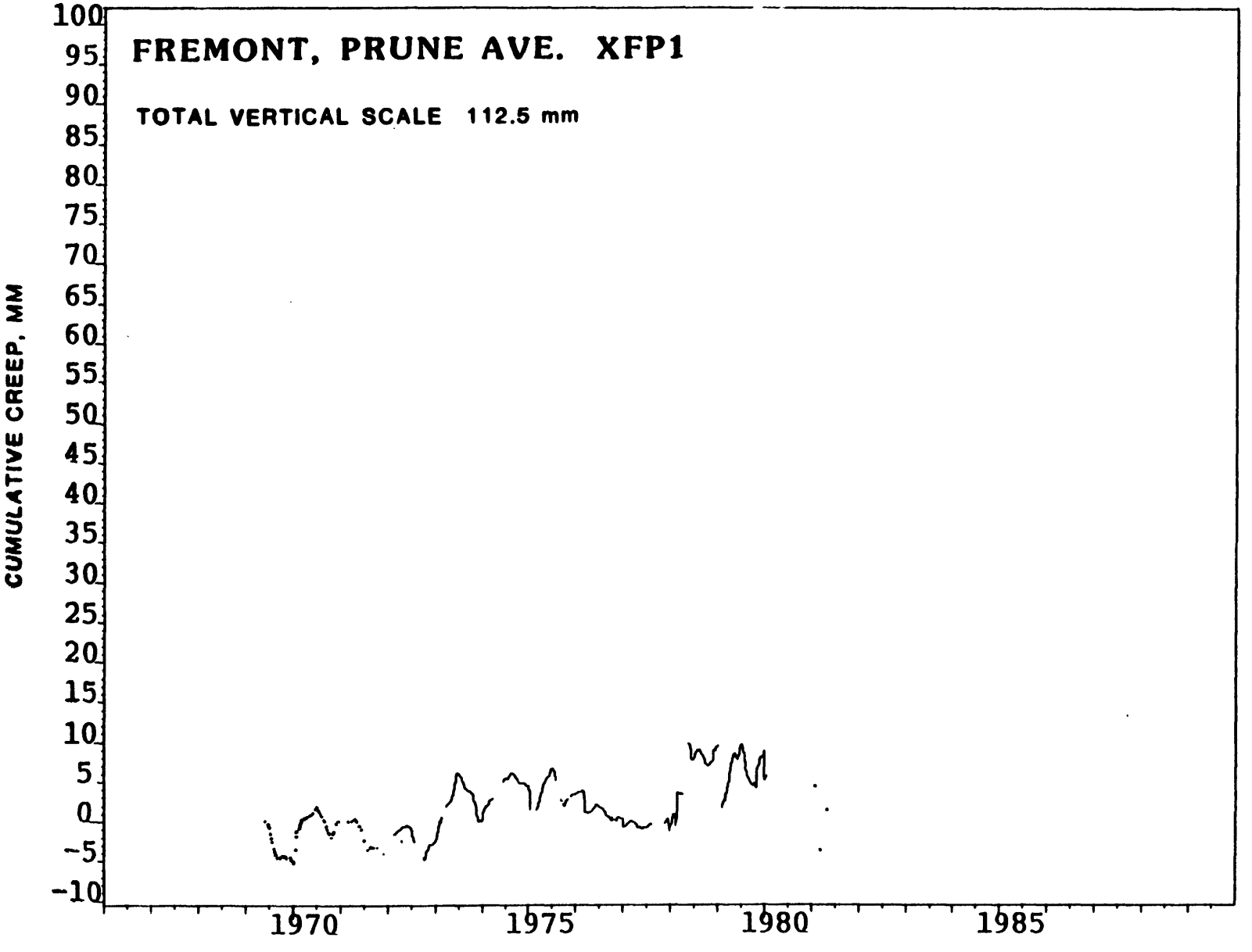



NILES QUADRANGLE
CALIFORNIA—ALAMEDA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** XFP1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | 5 | 0.00 | 9 | -2.97* | 6 | -6.60* | 3 | -8.77* | 2 | -8.56* | 3 | -9.31* | 28 | -10.46* |
| 1970 | 4 | 10.46 | 1 | -3.07* | 2 | -0.87* | 5 | 0.54 | 3 | 1.08 | 7 | 1.94 | 3 | 3.19 | 2 | 1.37 | 11 | -1.61* | 4 | -3.36* | 8 | -3.70* | 13 | -0.48* |
| 1971 | | | | | 5 | 2.62 | 4 | 2.82 | 2 | 2.87 | 8 | 0.80 | 5 | -2.82* | 12 | -4.85* | 9 | -4.81* | 5 | -5.07* | 29 | -6.28* | 3 | -6.47* |
| 1972 | | | 15 | -3.27* | 14 | -2.43* | | | 3 | -1.21* | | | 7 | -3.26* | | | 27 | -8.93* | | | | | 14 | -5.48* |
| 1973 | 26 | -1.11* | 22 | 0.89 | 22 | 3.53 | | | 16 | 6.70 | 5 | 10.45 | | | 10 | 9.20 | 14 | 7.83 | | | 9 | 4.21 | 21 | 0.33 |
| 1974 | 8 | 2.32 | 12 | 4.32 | | | 10 | 6.42 | 23 | 8.41 | 13 | 10.22 | 25 | 11.45 | 13 | 12.45 | 4 | 12.45 | 15 | 10.18 | | | 5 | 9.26 |
| 1975 | 7 | 7.22 | | | 19 | 4.91 | | | | | | | 11 | 13.07 | 4 | 9.20 | | | | | 24 | 6.90 | | |
| 1976 | | | 18 | 7.93 | | | | | 7 | 3.30 | | | | | 23 | 2.06 | | | | | 29 | 0.95 | | |
| 1977 | | | 14 | 0.01 | | | 21 | -1.35* | | | | | 29 | -0.60* | | | | | | | 15 | -1.11* | | |
| 1978 | | | 15 | 3.55 | | | | | 3 | 9.85 | 14 | 6.98 | 20 | 7.70 | 10 | 8.25 | | | | | | | 1 | 9.25 |
| 1979 | 24 | 1.58 | 7 | 2.06 | 28 | 7.12 | | | | | | | 2 | 11.97 | | | | | 17 | 7.08 | | | | |
| 1980 | 15 | 10.53 | | | | | 22 | 12.72 | | | | | 23 | 6.49 | | | | | 20 | 5.37 | | | | |
| 1981 | 21 | 4.57 | | | 3 | -3.62* | 13 | 1.53 | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

*Negative numbers indicate cumulative left-lateral movement.
8/13/74 - Wire broke; new wire installed 9/4/74.
Instrument was dismantled in 1981 due to inclusion of site into city park.

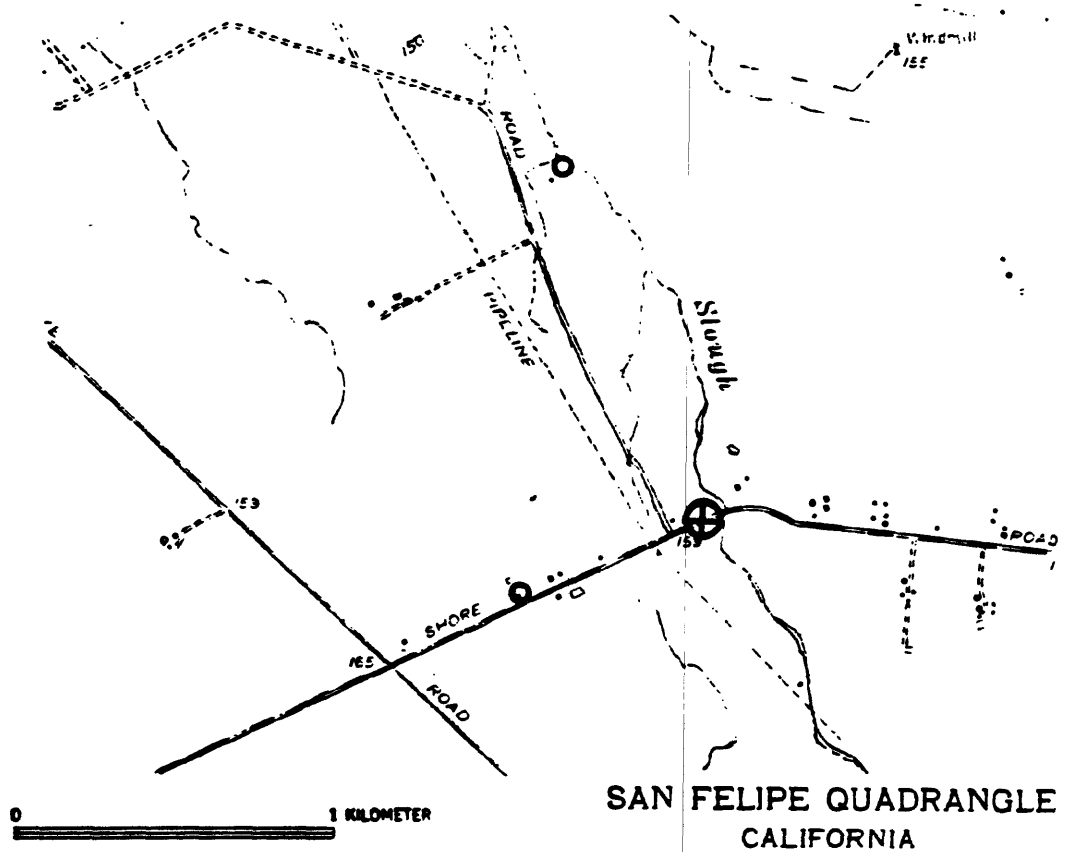

FREMONT, PRUNE AVE. XFP1
TOTAL VERTICAL SCALE 112.5 mm
CUMULATIVE CREEP, MM
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1970
1975
1980
1985

## STATION SHR1, XSH1

Latitude 36° 56.6'
Longitude 121° 26.7'

Position 109.2 km
14-meter wire, ø=41.5°

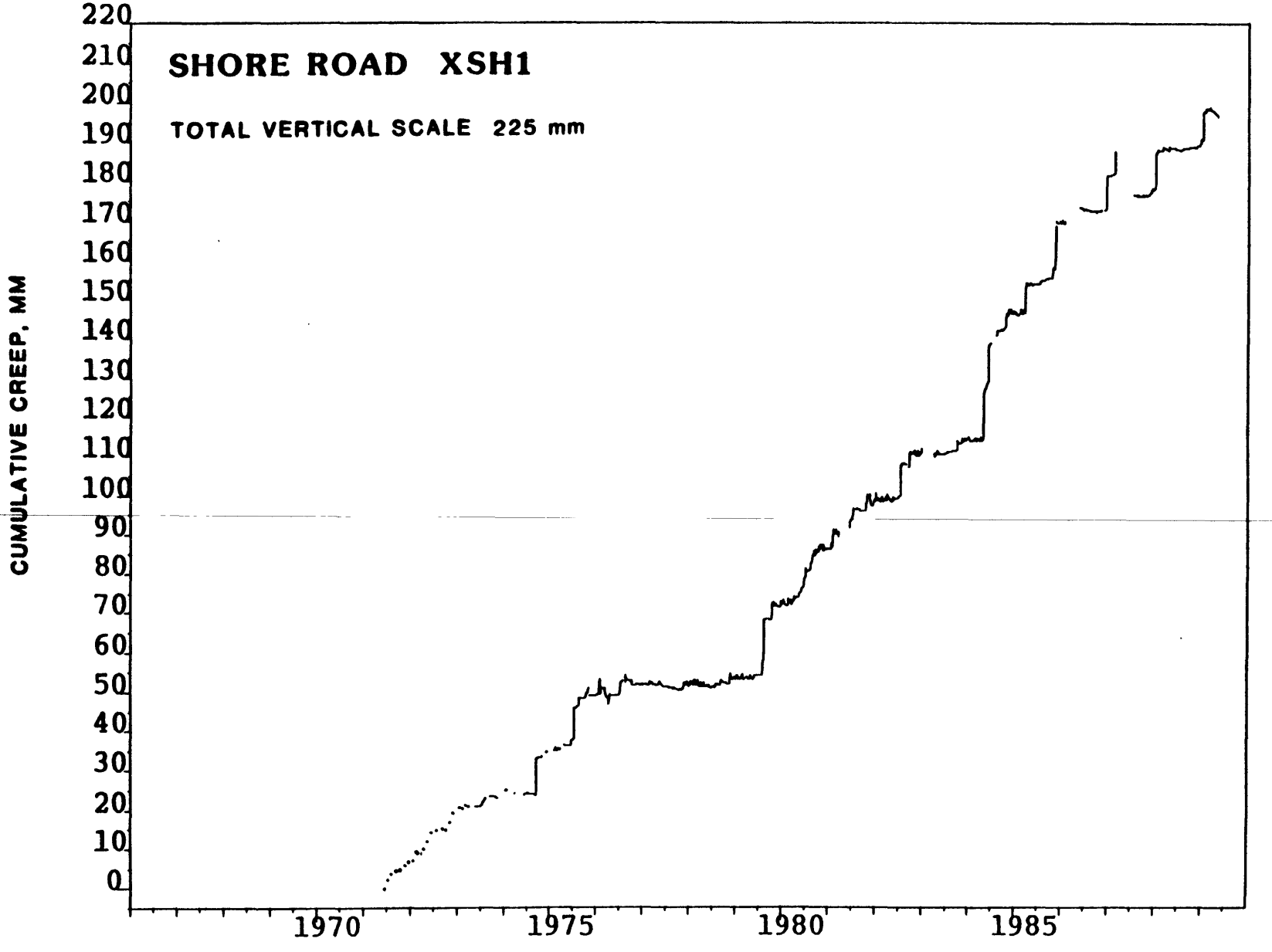
The Shore Road creepmeters SHR1 and SHR2, 6-meter rods at an angle of 45 degrees to the fault, were installed during June, 1971, on the Calaveras fault at a site 10.9 km northwest of Hollister, California. The installation consisted of a pair of crossed rods buried a few centimeters beneath the surface of the pavement and shoulder of Shore Road in Hollister Valley. Creep activity at this site was composed of distinct events of up to 9 mm in amplitude, superimposed on a background of zero to slight right-lateral slip. The average long-term creep rate recorded by SHR1 was about 7 mm/yr. In May, 1986, SHR1 was replaced by a 14-meter wire, XSH1, placed in contraction across the fault just south of SHR1. The new instrument covers approximately 5 meters more of the fault zone than did SHR1, and has recorded at least one creep event of 12 mm amplitude. The creep rate recorded on XSH1 since 1986 is 7.5 mm/yr.




SAN FELIPE QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** SHR1 XSH1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | 15 | 0.00 | 9 | 2.22 | 10 | 3.73 | 14 | 4.33 | 14 | 4.88 | 16 | 5.98 | 16 | 6.56 |
| 1972 | 17 | 6.64 | 16 | 9.24 | 21 | 9.11 | 17 | 9.97 | 16 | 12.04 | 16 | 14.06 | 27 | 14.94 | | | 6 | 15.10 | 5 | 14.87 | 28 | 19.23 | | |
| 1973 | 10 | 20.48 | 7 | 20.48 | 8 | 21.13 | | | 22 | 20.85 | | | 10 | 21.26 | | | 12 | 23.31 | | | 15 | 23.25 | | |
| 1974 | 16 | 25.13 | | | 19 | 24.10 | | | | | 4 | 24.03 | | | 20 | 23.84 | | | 28 | 34.05 | | | 2 | 34.56 |
| 1975 | | | 5 | 35.09 | | | 15 | 35.12 | | | | | 9 | 45.77 | | | | | 24 | 49.49 | 4 | 48.99 | | |
| 1976 | 20 | 49.21 | | | | | 15 | 49.03 | | | 25 | 49.38 | | | 17 | 52.17 | | | 6 | 51.92 | 3 | 51.57 | 16 | 51.64 |
| 1977 | 20 | 51.79 | | | 19 | 52.03 | 13 | 51.72 | | | 15 | 51.18 | 9 | 51.04 | 11 | 50.91 | | | 3 | 50.52 | 16 | 50.85 | | |
| 1978 | 10 | 52.00 | | | | | 4 | 51.52 | | | | | | | 9 | 51.56 | 15 | 52.23 | | | 16 | 52.40 | | |
| 1979 | | | | | 7 | 52.76 | | | | | 6 | 53.43 | | | 8 | 63.19 | | | 22 | 72.34 | 15 | 72.11 | | |
| 1980 | | | 27 | 72.45 | 27 | 73.17 | | | | | 4 | 75.02 | | | | | 3 | 84.50 | | | | | 4 | 86.48 |
| 1981 | | | | | 5 | 90.69 | 2 | 88.54 | | | 2 | 90.48 | 10 | 94.60 | | | 9 | 96.11 | | | 30 | 97.98 | | |
| 1982 | | | 22 | 98.63 | | | | | | | 2 | 98.99 | | | | | 8 | 102.97 | 5 | 110.55 | | | 15 | 109.90 |
| 1983 | | | | | 14 | 111.28 | | | | | 29 | 110.74 | | | | | 29 | 111.43 | | | | | | |
| 1984 | 12 | 113.44 | | | | | 25 | 125.85 | | | | | 30 | 140.74 | | | | | 31 | 145.60 | 8 | 147.22 | | |
| 1985 | 30 | 146.12 | | | | | | | 16 | 153.58 | 18 | 153.77 | 26 | 154.46 | 8 | 154.62 | | | | | 1 | 157.39 | | |
| 1986 | 28 | 170.98 | | | | | XSH1 begins | | 1 | 173.28 | | | | | 13 | 172.65 | | | | | 20 | 172.89 | | |
| 1987 | | | 19 | 185.91 | | | | | 27 | 180.15 | | | 10 | 176.71 | 25 | 176.51 | | | 6 | 175.58 | 23 | 176.54 | | |
| 1988 | 15 | 189.76 | 12 | 188.42 | | | | | 19 | 188.33 | | | | | 18 | 188.87 | | | | | 29 | 189.00 | | |

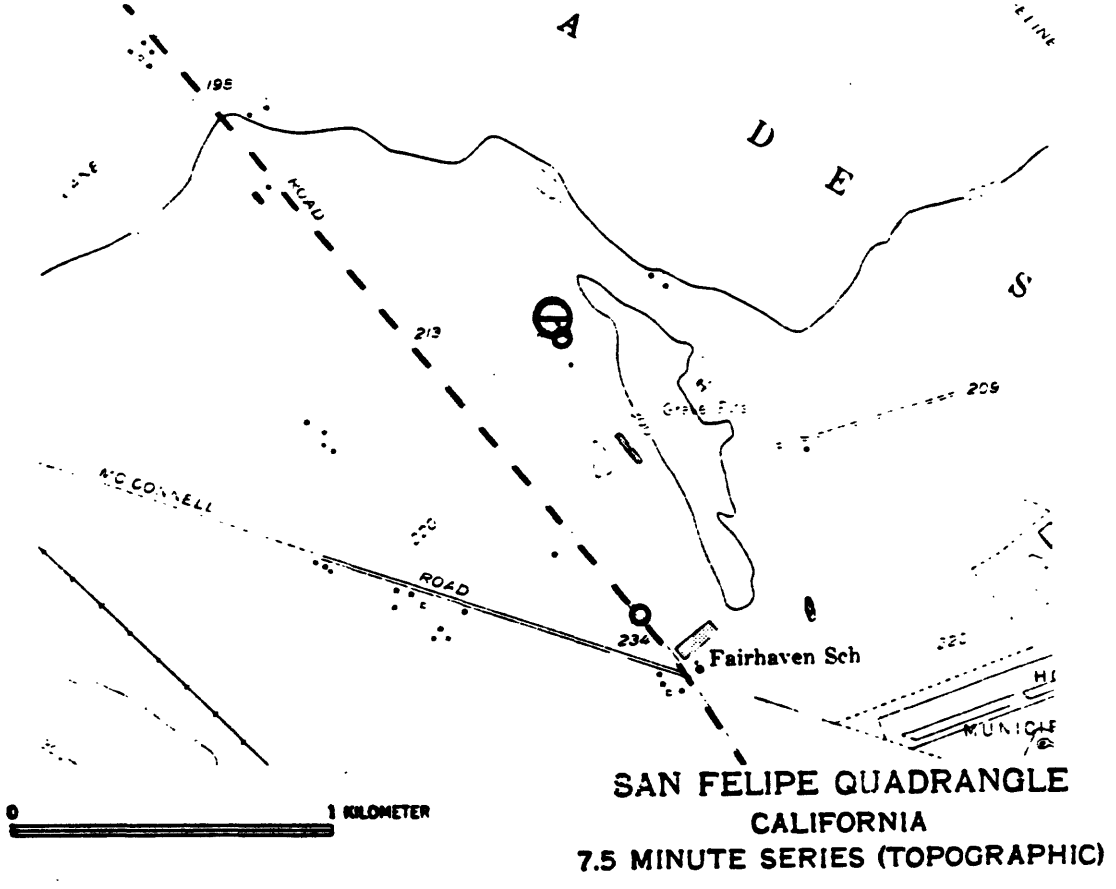

SHORE ROAD XSH1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION BTH1

Latitude 36° 54.1'
Longitude 121° 25.6'

Position 114.0 km
10-meter rod, ø=45°

The Bertuccio Farm (House) creepmeter was installed during June, 1971, on the Calaveras fault at a site 6.0 km northwest of Hollister. The installation consisted of a single (extension) rod buried a few centimeters below a sloping surface in alluvium near the base of a prominent southwest-facing scarp. Creep activity at this site was composed of distinct events of up to 7 mm in amplitude, superimposed on a background of right- and left-lateral drift at moderate rates. The average long-term creep rate was about 3 mm/yr, with a strong seasonal variation. Some minor left-lateral events occurred during periods of heavy rainfall. The instrument was abandoned in June, 1979, due to access problems.

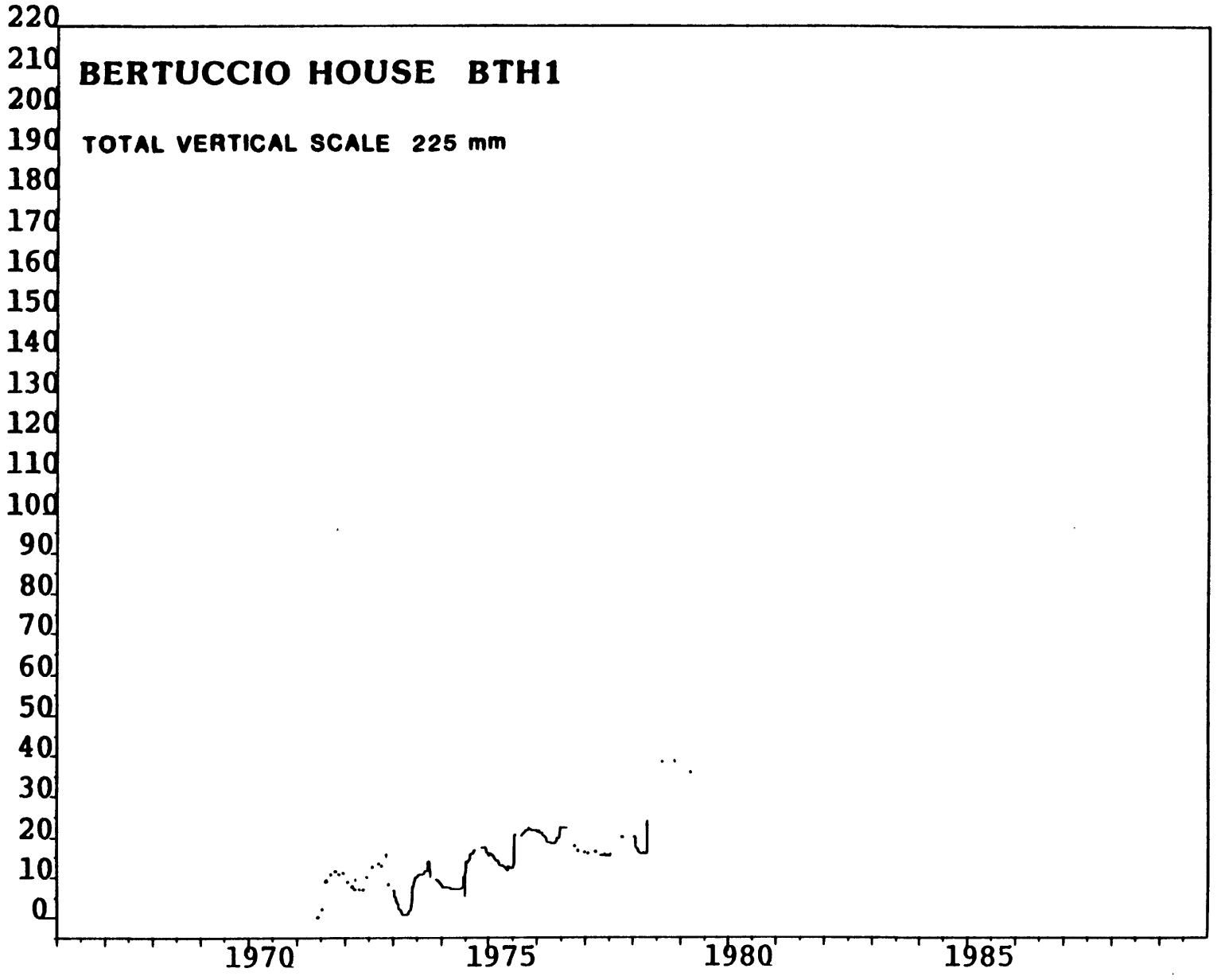


CUMULATIVE CREEP CALCULATED FROM FIELD READINGS

STATION BTH1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | 15 | 0.00 | 9 | 2.11 | 10 | 9.45 | 14 | 10.73 | 14 | 11.14 | 16 | 11.06 | 16 | 11.06 |
| 1972 | 17 | 8.75 | 16 | 7.48 | 15 | 7.08 | 18 | 7.01 | 17 | 6.78 | 16 | 10.11 | 27 | 12.45 | | | 6 | 13.07 | 5 | 12.80 | 28 | 8.40 | | |
| 1973 | 10 | 5.79 | 7 | 3.11 | 8 | 0.74 | | | 22 | 2.74 | | | 10 | 10.54 | | | 11 | 11.54 | | | 15 | 9.45 | | |
| 1974 | 17 | 7.38 | | | 19 | 7.14 | | | | | 5 | 7.52 | | | 20 | 15.61 | | | 28 | 17.41 | 27 | 17.18 | | |
| 1975 | | | 27 | 14.00 | | | | | 20 | 11.94 | 10 | 12.21 | | | 11 | 20.37 | | | 24 | 21.85 | 18 | 21.79 | | |
| 1976 | 20 | 21.21 | | | | | 15 | 18.45 | | | 25 | 22.93 | | | 17 | 22.14 | | | 5 | 17.59 | 3 | 16.66 | 16 | 16.18 |
| 1977 | 20 | 16.18 | | | 19 | 16.00 | 13 | 15.56 | | | 15 | 15.81 | 13 | 16.19 | 11 | 20.35 | | | 3 | 19.79 | 16 | 17.96 | | |
| 1978 | 10 | 21.58 | | | | | 19 | 23.70 | | | | | | | 9 | 38.41 | | | | | 16 | 38.47 | | |
| 1979 | | | | | 7 | 35.58 | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1981 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1982 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

By 6/9/79, landowner had covered over instrument and constructed a duck pen on site.

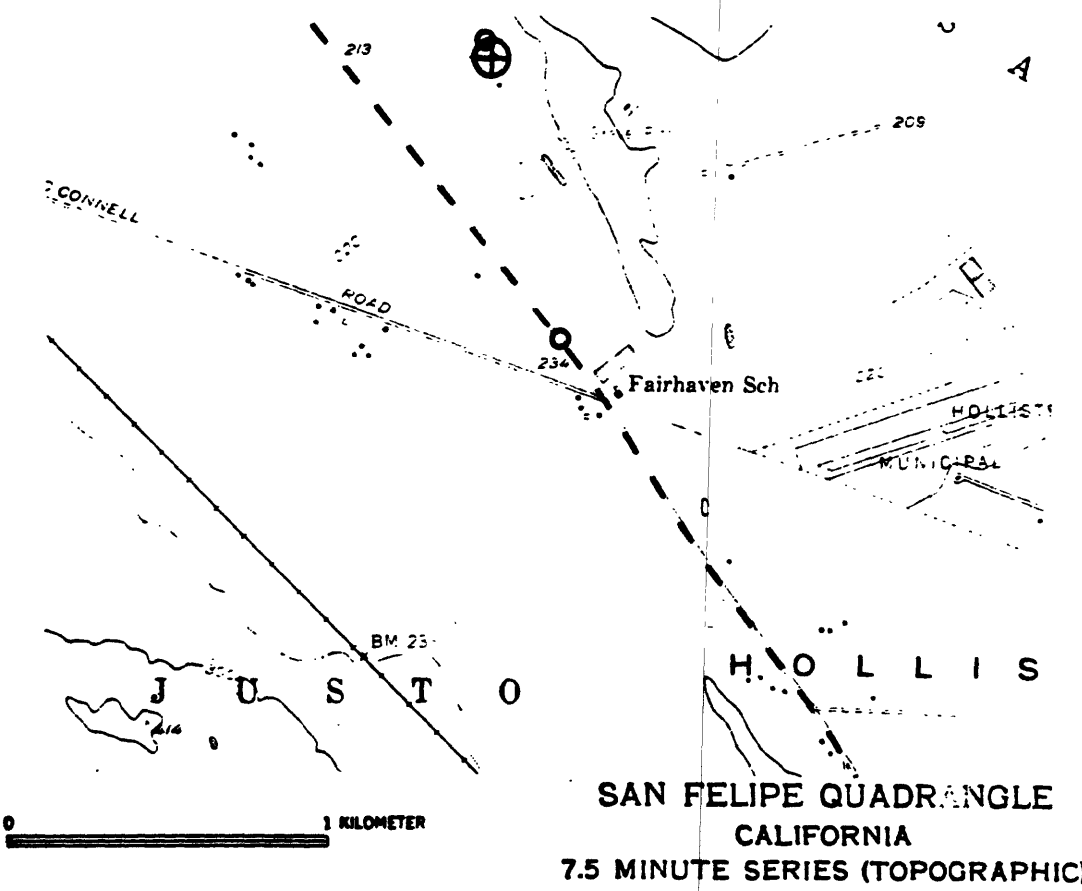

BERTUCCIO HOUSE BTH1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION BTB1

Latitude 36° 54.1'
Longitude 121° 25.6'

Position 114.1 km
12-meter rods, ø=45°

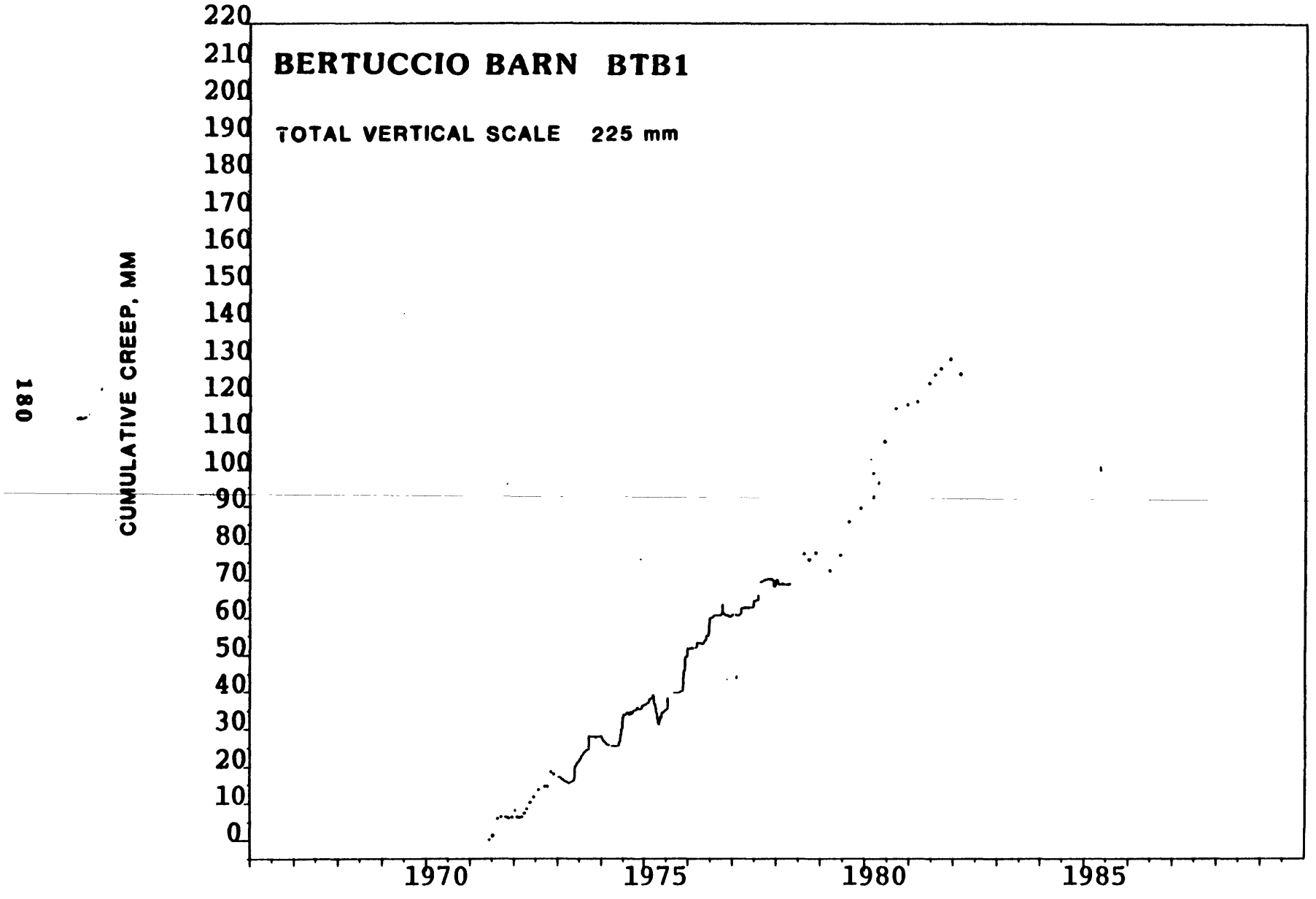
The Bertuccio Farm (Barn) creepmeters were installed during June, 1971, on the Calaveras fault at a site 5.9 km northwest of Hollister. The installation consisted of a pair of crossed rods buried a few centimeters below a sloping surface in alluvium near the base of a prominent southwest-facing scarp. Creep activity at this site was composed of distinct events of up to 4 mm in amplitude, superimposed on a background of right- and left-lateral drift at moderate rates. The average long-term creep rate was about 11 mm/yr, with a strong seasonal variation. Some minor left-lateral events occurred during periods of heavy rainfall. The instruments were destroyed in summer, 1982, by earthmoving equipment.



**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** BTB1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | 14 | 0.00 | 9 | 0.99 | 10 | 5.71 | 14 | 6.02 | 14 | 6.14 | 16 | 6.14 | 16 | 6.14 |
| 1972 | 17 | 6.14 | 18 | 6.17 | 15 | 6.15 | 18 | 8.42 | 17 | 9.94 | 16 | 11.46 | 27 | 13.59 | | | 6 | 14.33 | 5 | 14.44 | 28 | 17.71 | | |
| 1973 | 10 | 16.99 | 7 | 16.49 | 8 | 15.88 | | | 22 | 16.33 | | | 10 | 21.91 | | | 11 | 24.54 | | | 15 | 27.70 | | |
| 1974 | 17 | 26.74 | | | 19 | 25.41 | | | | | 5 | 26.60 | | | 20 | 34.17 | | | 28 | 35.67 | 27 | 35.00 | | |
| 1975 | | | 27 | 38.22 | | | | | 20 | 33.58 | 10 | 34.07 | | | 11 | 39.74 | | | 24 | 40.14 | 18 | 45.25 | | |
| 1976 | 20 | 51.75 | | | | | 13 | 52.98 | | | 25 | 59.32 | | | 17 | 60.59 | | | 5 | 61.20 | 3 | 60.42 | 16 | 60.45 |
| 1977 | 20 | 60.70 | | | 19 | 62.34 | 13 | 62.62 | | | 15 | 63.00 | 13 | 64.47 | 11 | 69.59 | | | 3 | 70.00 | 16 | 70.29 | | |
| 1978 | 10 | 69.25 | | | | | 19 | 66.14 | | | | | | | 9 | 77.30 | 15 | 75.46 | | | 16 | 76.99 | | |
| 1979 | | | | | 7 | 72.75 | | | | | 6 | 76.79 | | | 9 | 85.79 | | | | | 15 | 89.63 | | |
| 1980 | | | 27 | 98.90 | | | | | | | 4 | 107.55 | | | | | 3 | 116.38 | | | | | 4 | 117.41 |
| 1981 | | | | | 6 | 118.27 | | | | | 2 | 123.21 | 20 | 125.79 | | | 9 | 127.10 | | | | | 1 | 129.49 |
| 1982 | | | 22 | 125.50 | | | | | | | | | | | | | | | | | | | | |
| 1983 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |

6/2/82 - Found instrument had been destroyed by earthmoving equipment.

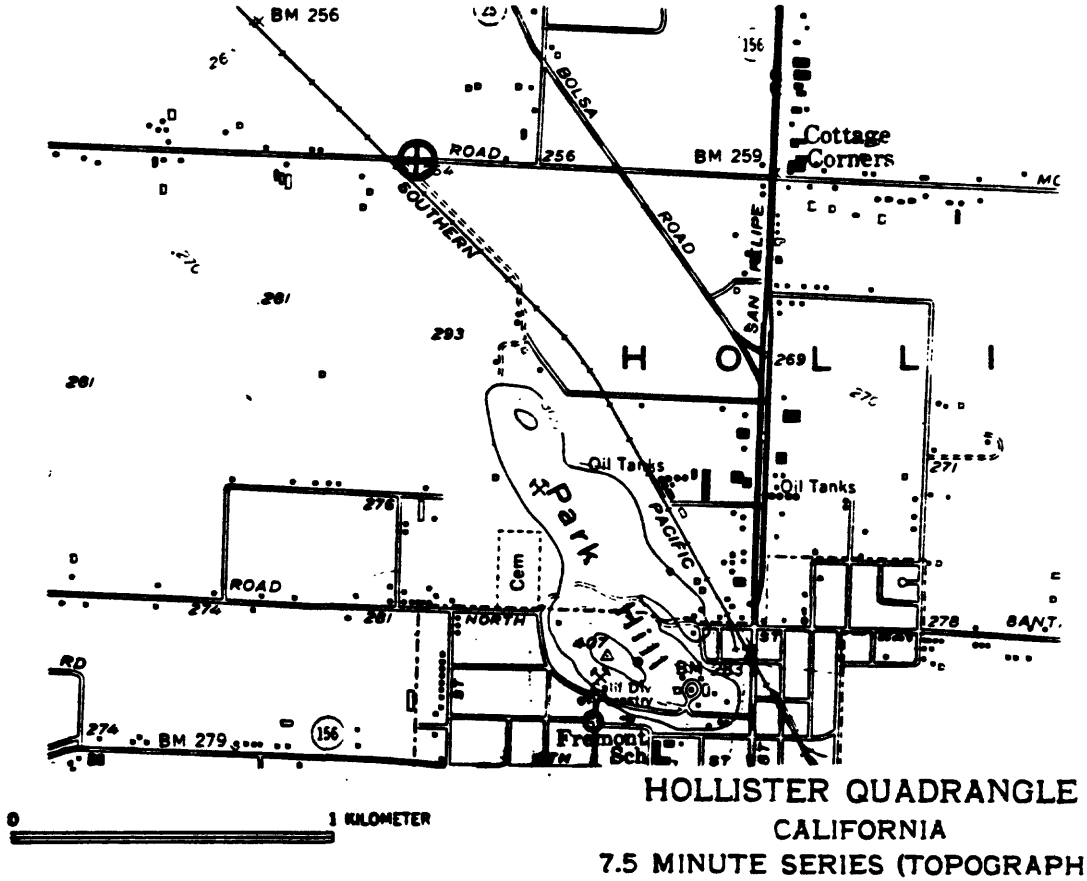

BERTUCCIO BARN BTB1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION WRT1

Latitude 36° 52.2'
Longitude 121° 24.8'

Position 117.7 km
12-meter rods, ø=45°

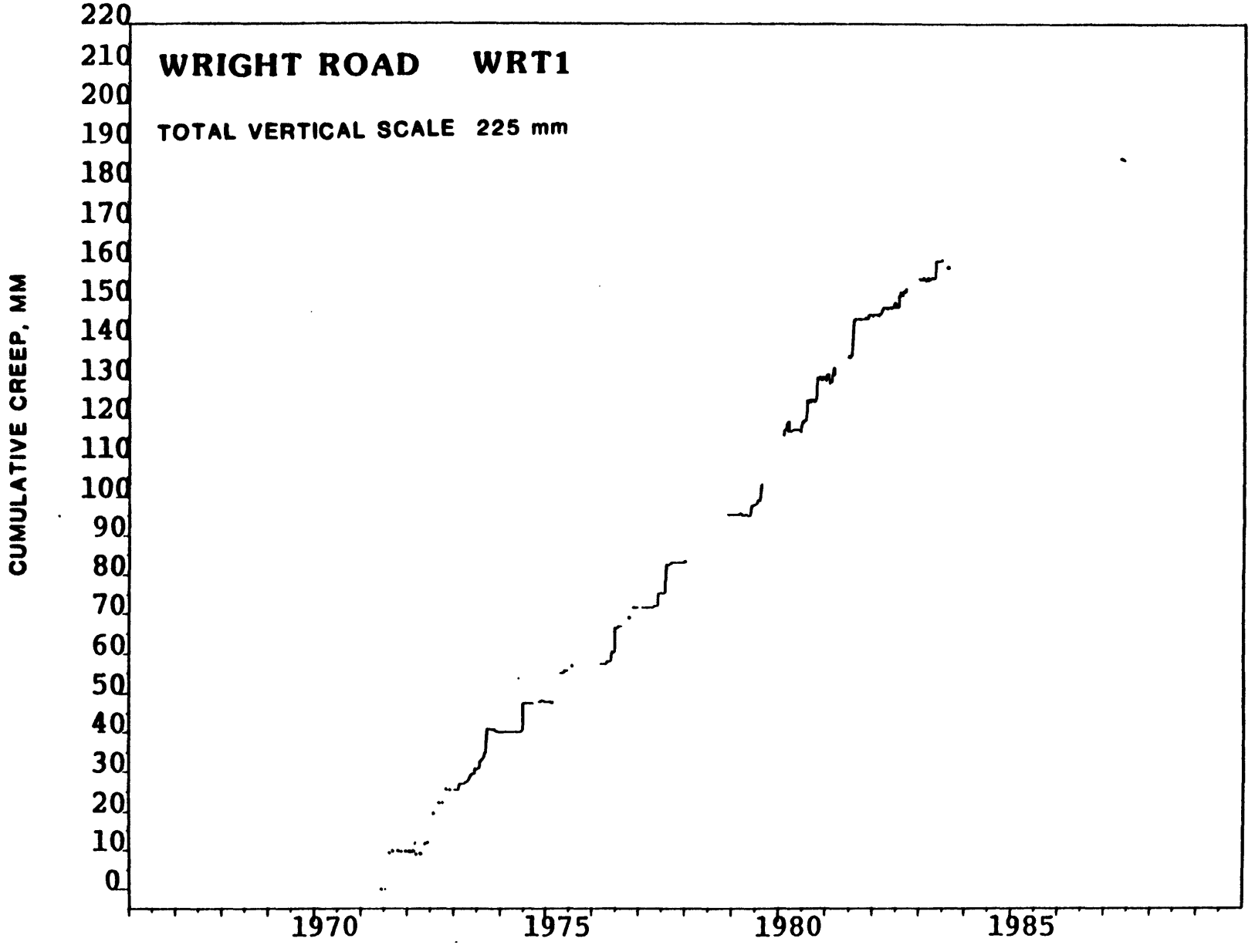
The Wright Road creepmeters were installed during June, 1971, on the Calaveras fault at a site 2.3 km northwest of Hollister. The installation consisted of a pair of crossed rods buried a few centimeters below a nearly flat surface in alluvium beneath the pavement and adjacent north shoulder of Wright Road. Creep activity at this site was composed of distinct events of up to 8.8 mm in amplitude, superimposed on a background of zero to slight right-lateral slip. The long-term average creep rate was about 9.3 mm/yr. The instruments were destroyed in July, 1983, during construction of an agricultural pipeline.



**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** WRT1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1971 | | | | | | | | | | | 14 | 0.00 | 9 | 0.04 | 10 | 9.45 | 14 | 9.64 | 14 | 9.63 | 17 | 9.69 | 16 | 9.67 |
| 1972 | 18 | 9.81 | 16 | 9.58 | 15 | 9.06 | 17 | 9.09 | 18 | 11.65 | 16 | 11.89 | 27 | 19.41 | | | 6 | 22.17 | 5 | 22.22 | 28 | 25.28 | | |
| 1973 | 10 | 25.20 | 7 | 25.43 | 8 | 26.84 | | | 22 | 29.36 | | | 10 | 30.84 | | | 12 | 35.09 | | | 15 | 40.66 | | |
| 1974 | 17 | 40.01 | | | 19 | 39.97 | | | | | 5 | 40.11 | 1 | 46.17 | 20 | 47.39 | | | 28 | 47.66 | | | 2 | 47.90 |
| 1975 | | | 5 | 47.55 | | | | | 20 | 55.79 | | | 15 | 55.86* | | | | | | | | | | |
| 1976 | | | 26 | 55.86 | | | 21 | 55.86 | | | | | | | 17 | 65.83 | | | 6 | 67.48 | 3 | 70.29 | 16 | 70.57 |
| 1977 | 20 | 70.43 | | | 19 | 70.43 | 13 | 70.50 | | | 15 | 76.51 | 18 | 77.07 | 11 | 81.17 | | | 3 | 81.88 | 16 | 82.02 | | |
| 1978 | 10 | 81.88 | | | | | 19 | 82.09 | | | | | | | 9 | 93.12 | 15 | 93.43 | | | 16 | 93.97 | | |
| 1979 | | | | | 7 | 93.69 | | | | | 6 | 98.78 | | | 9 | 108.39 | 5 | 112.21 | 22 | 112.49 | 15 | 112.63 | | |
| 1980 | 16 | 112.35 | 27 | 115.32 | 27 | 115.60 | | | | | 4 | 115.74 | | | | | 3 | 123.52 | | | | | 8 | 130.31 |
| 1981 | | | | | 6 | 132.57 | | | 8 | 134.27 | 2 | 134.27 | | | 6 | 144.31 | 9 | 144.45 | | | 30 | 145.44 | | |
| 1982 | | | 22 | 145.44 | | | | | | | 2 | 145.30 | 31 | 147.42 | | | 8 | 152.75 | | | | | 15 | 154.15 |
| 1983 | 20 | 154.20 | 26 | 153.92 | 28 | 153.63 | | | | | 29 | 158.16 | 29 | 158.44 | instrument removed | | | | | | | | | |
| 1984 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

+Instrument was removed 7/15/75 and replaced 2/26/76. Cumulative total as of 7/15/75 was used as beginning cumulative total for new instrument.
Due to a correction in the 7/15/75 reading, values after that date differ slightly from those of earlier catalogs.
On 7/30/83, instrument was removed to make way for agricultural pipeline.

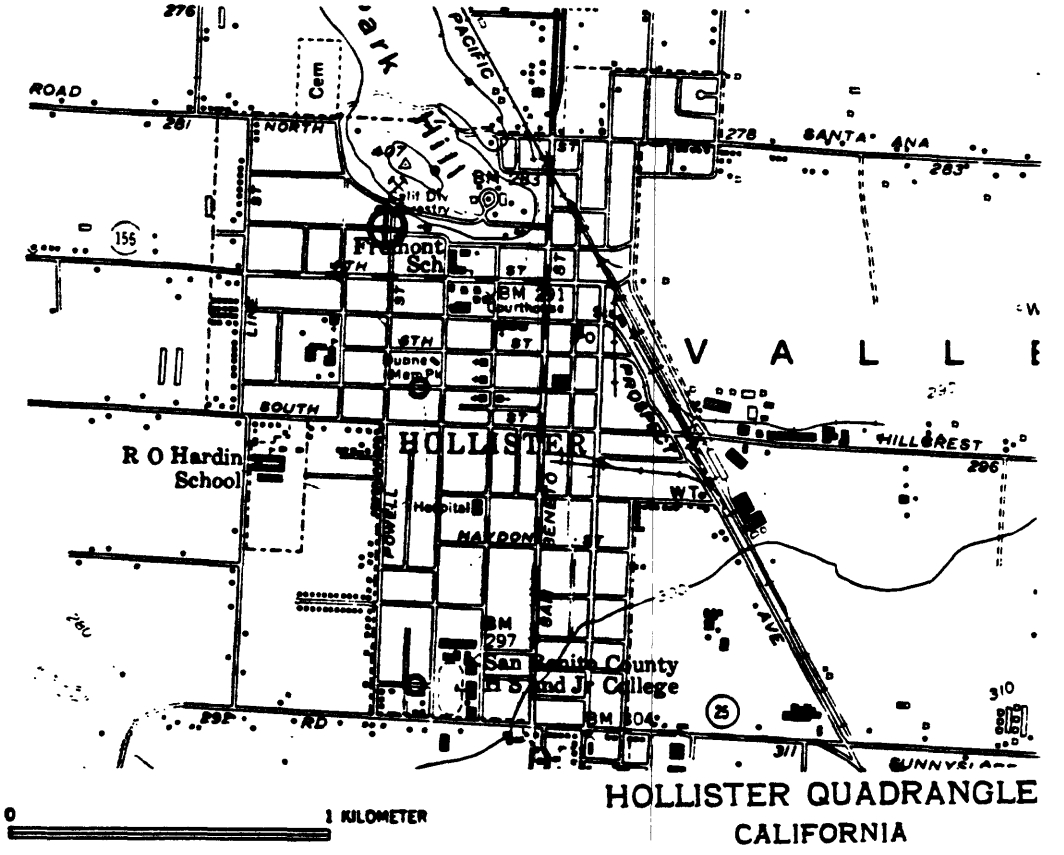

WRIGHT ROAD WRT1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION HLC1

Latitude 36° 51.4'
Longitude 121° 24.3'

Position 119.5 km
12-meter rods, $\phi$=45°

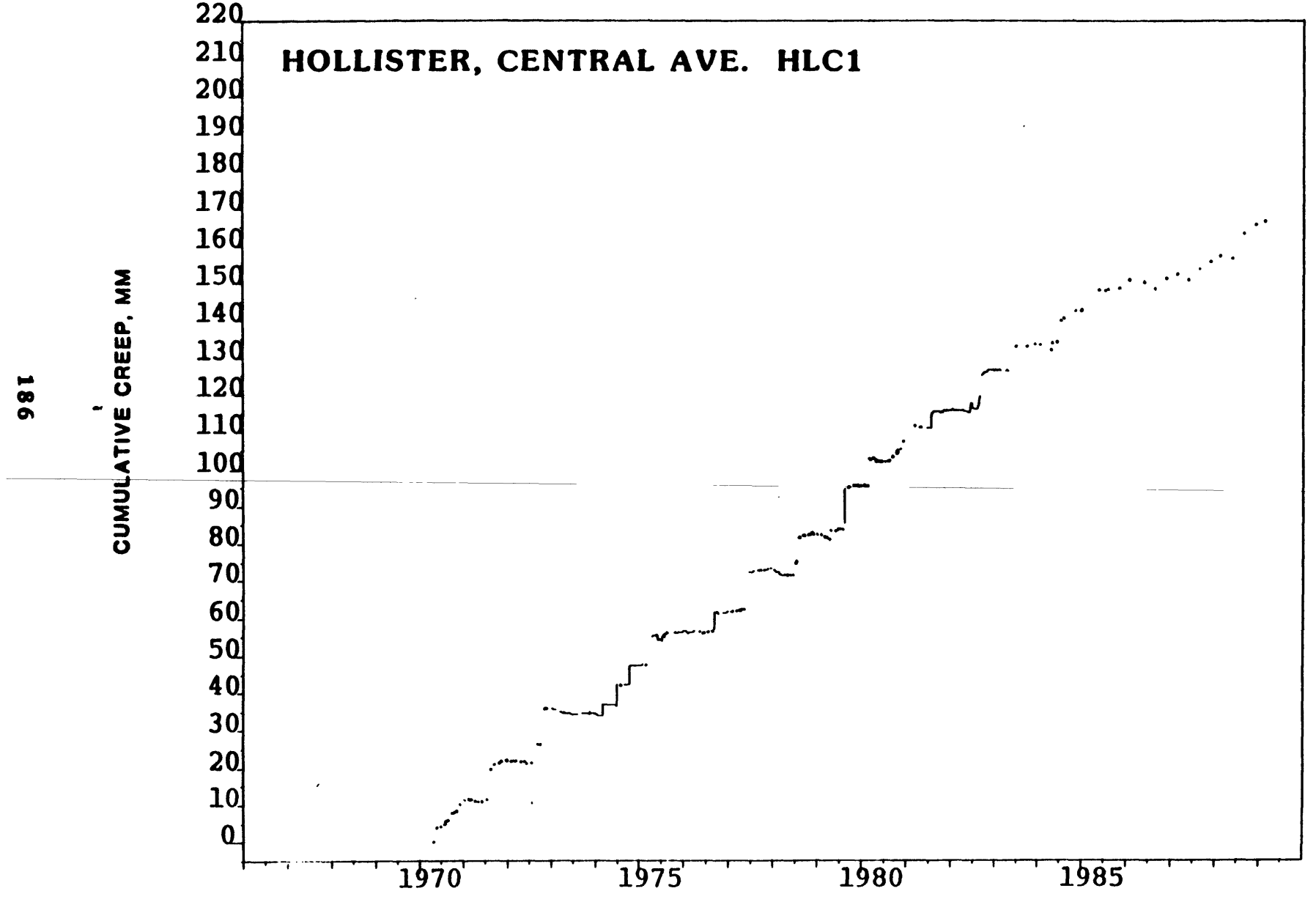
The Hollister Central Avenue creepmeters were installed during April, 1970, on the Calaveras fault at a site 0.5 km northwest of the center of Hollister. The installation consists of a pair of crossed rods buried a few centimeters below the surface beneath the pavement and adjacent north curb of Central Avenue. Creep activity at this site is composed of distinct events of up to 11.0 mm in amplitude, superimposed on a background of slight right- and left-lateral drift. The average long-term creep rate is about 8.7 mm/yr.



CUMULATIVE CREEP CALCULATED FROM FIELD READINGS

STATION HLC1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | 28 | 0.00 | 26 | 4.04 | 30 | 4.09 | 30 | 4.95 | | | 2 | 5.85 | 1 | 7.63 | 5 | 8.28 | 3 | 9.83 |
| 1971 | 6 | 11.28 | 10 | 11.28 | 4 | 11.18 | 7 | 10.81 | 6 | 10.87 | 9 | 10.81 | 12 | 11.21 | 10 | 19.68 | 14 | 20.76 | 14 | 21.32 | 17 | 21.72 | 16 | 21.80 |
| 1972 | 18 | 21.77 | 16 | 21.72 | 15 | 21.64 | 17 | 21.51 | 18 | 21.32 | 16 | 21.25 | 27 | 21.26 | | | 6 | 26.18 | 5 | 26.35 | 27 | 35.89 | | |
| 1973 | 10 | 35.74 | 6 | 35.48 | 8 | 34.98 | | | 22 | 34.58 | | | 10 | 34.28 | | | 12 | 34.76 | | | 16 | 34.63 | | |
| 1974 | 17 | 34.21 | | | 19 | 36.94 | | | | | 5 | 36.70 | 22 | 42.36 | 20 | 42.36 | | | 28 | 47.42 | | | 2 | 45.37 |
| 1975 | 21 | 47.82 | 27 | 47.69 | | | 12 | 55.17 | 19 | 55.31 | | | | | 19 | 56.03 | | | 24 | 56.19 | | | | |
| 1976 | 21 | 56.60 | | | | | 22 | 56.55 | 12 | 56.41 | | | | | 18 | 56.82 | | | 2 | 61.53 | 3 | 61.46 | 16 | 61.42 |
| 1977 | 20 | 61.76 | | | 19 | 62.04 | 13 | 62.11 | | | 15 | 72.38 | 18 | 72.55 | 11 | 72.80 | | | 3 | 72.90 | 16 | 73.07 | | |
| 1978 | 10 | 73.14 | | | | | 19 | 72.01 | | | | | | | 9 | 81.97 | 15 | 82.35 | | | 16 | 82.80 | | |
| 1979 | | | | | 7 | 81.69 | | | | | 6 | 83.67 | | | 9 | 94.34 | | | | | 15 | 95.60 | | |
| 1980 | | | 27 | 102.71 | | | | | | | 4 | 101.94 | 12 | 102.01 | 2 | 102.15 | 3 | 102.43 | 19 | 104.04 | 2 | 105.29 | 4 | 107.58 |
| 1981 | | | | | 10 | 111.62 | 25 | 111.35 | | | 2 | 111.13 | | | | | 10 | 115.37 | | | 30 | 115.94 | | |
| 1982 | | | 22 | 115.79 | | | 24 | 115.20 | | | 2 | 114.89 | | | | | 8 | 125.24 | | | | | 15 | 126.68 |
| 1983 | | | | | 28 | 126.68 | | | | | 29 | 133.10 | | | | | 29 | 133.08 | | | 29 | 133.55 | | |
| 1984 | 12 | 133.55 | | | | | 25 | 132.05 | 4 | 134.07 | 6 | 134.27 | 6 | 140.28 | | | | | 31 | 142.84 | | | | |
| 1985 | 30 | 143.15 | | | | | | | 16 | 148.25 | | | 11 | 148.18 | | | | | | | 1 | 148.86 | | |
| 1986 | 27 | 151.10 | | | | | | | 22 | 150.29 | | | | | 13 | 148.82 | | | | | 20 | 151.44 | | |
| 1987 | | | 19 | 152.35 | | | | | 28 | 150.91 | | | | | 24 | 153.77 | | | | | 23 | 155.93 | | |
| 1988 | | | 11 | 157.42 | | | | | 18 | 156.84 | | | | | 18 | 163.07 | | | | | 29 | 165.89 | | |

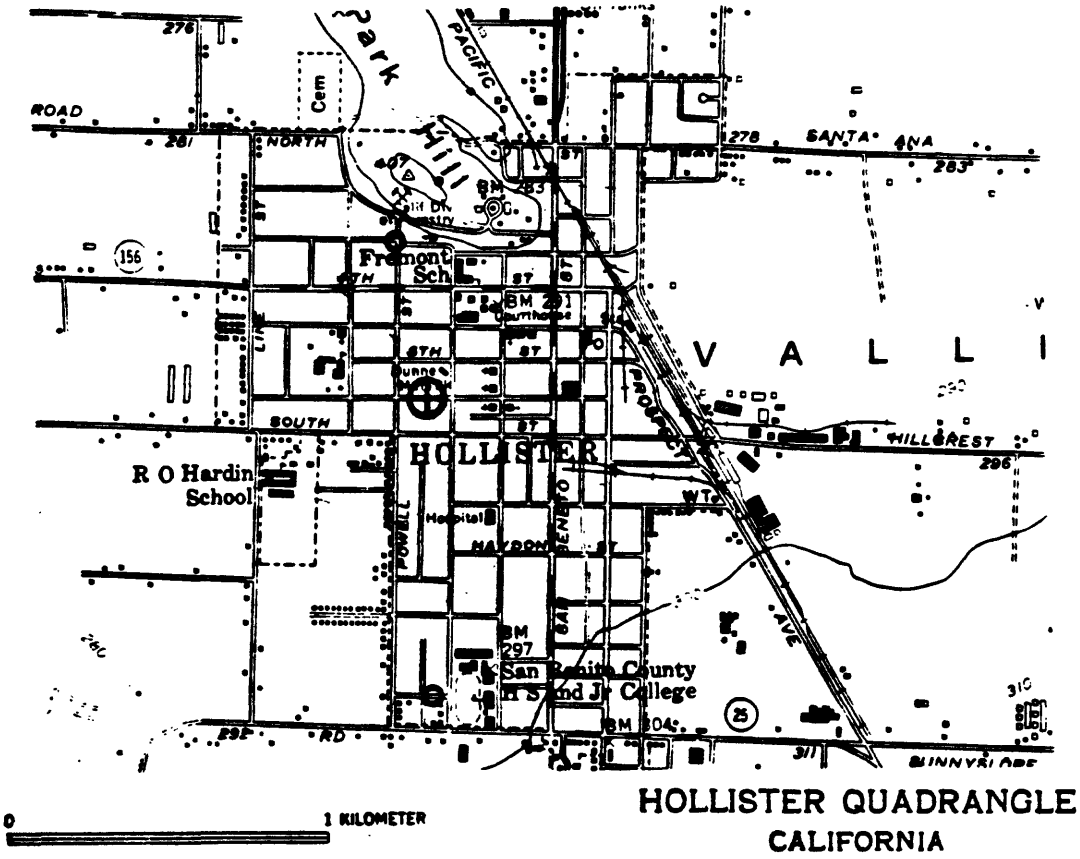

HOLLISTER, CENTRAL AVE. HLC1
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION HLS1

Latitude 36° 51.1'
Longitude 121° 24.2'

Position 120.0 km
12-meter rods, ø=45°

The Hollister Seventh Street creepmeters were installed during April, 1970, on the Calaveras fault near the center of the City of Hollister. The installation consisted of a pair of crossed rods buried a few centimeters below the surface beneath the pavement and adjacent north curb of Seventh Street. Creep activity at this site was composed of distinct events of up to 5.6 mm in amplitude, superimposed on a background of gradual right- and left-lateral drift. The average long-term creep rate was about 7 mm/yr, with a slight seasonal variation. The instruments were destroyed in July, 1987, during construction of a storm drain along Seventh Street.

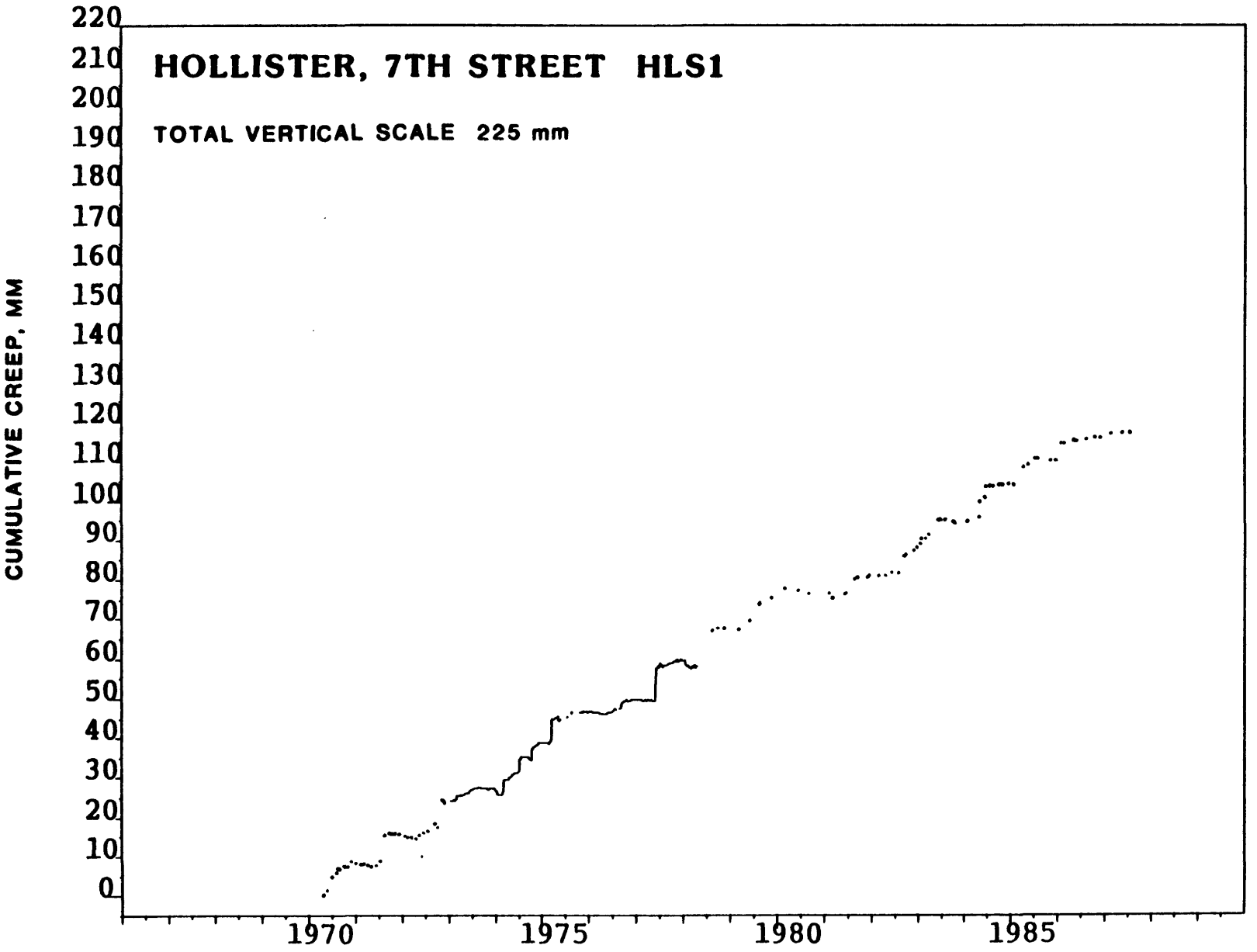



HOLLISTER QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

**CUMULATIVE CREEP CALCULATED FROM FIELD READINGS** | **STATION** HLS1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | 16 | 0.00 | 26 | 1.46 | 30 | 4.94 | 30 | 5.90 | | | 2 | 6.93 | 1 | 7.31 | 5 | 7.48 | 3 | 8.58 |
| 1971 | 6 | 8.48 | 5 | 8.19 | 4 | 8.09 | 7 | 7.62 | 5 | 7.48 | 9 | 7.83 | 12 | 8.63 | 10 | 15.46 | 14 | 15.84 | 14 | 15.81 | 17 | 15.71 | 16 | 15.68 |
| 1972 | 18 | 14.93 | 15 | 14.66 | 15 | 14.68 | 17 | 14.50 | 19 | 15.32 | 16 | 16.03 | 26 | 16.33 | | | 6 | 18.41 | 15 | 17.21 | 28 | 23.59 | | |
| 1973 | 10 | 23.91 | 6 | 24.15 | 8 | 25.20 | | | 22 | 26.01 | | | 10 | 27.05 | | | 11 | 27.39 | | | 16 | 27.28 | | |
| 1974 | 15 | 25.72 | | | 19 | 29.51 | | | | | 5 | 30.99 | | | 20 | 35.34 | | | 28 | 37.94 | | | | |
| 1975 | 21 | 38.90 | 27 | 38.96 | | | | | 19 | 44.42 | | | 9 | 45.24 | 19 | 46.57 | | | 17 | 46.44 | | | | |
| 1976 | 21 | 46.51 | | | | | 21 | 46.23 | 12 | 46.41 | | | | | 18 | 47.40 | | | 2 | 49.37 | 3 | 49.34 | 16 | 49.60 |
| 1977 | 20 | 49.50 | | | 25 | 49.50 | 13 | 49.51 | | | 15 | 57.09 | 18 | 58.02 | 11 | 58.28 | | | 3 | 58.76 | 16 | 59.24 | | |
| 1978 | 10 | 59.01 | | | | | 19 | 58.05 | | | | | | | 9 | 67.09 | 15 | 67.46 | | | 16 | 67.56 | | |
| 1979 | | | | | 7 | 67.71 | | | | | 6 | 69.41 | | | 9 | 73.67 | | | | | 15 | 75.26 | | |
| 1980 | | | 27 | 77.94 | | | | | | | 4 | 77.19 | | | | | 3 | 76.49 | | | | | | |
| 1981 | | | 10 | 76.49 | 6 | 75.28 | | | | | 2 | 76.03 | | | 22 | 80.02 | 10 | 80.30 | | | 30 | 80.81 | 12 | 80.84 |
| 1982 | | | 22 | 80.96 | | | 24 | 81.09 | | | 2 | 81.54 | 31 | 81.76 | | | 1 | 85.69 | | | 27 | 87.51 | 15 | 87.96 |
| 1983 | 13 | 89.01 | 26 | 90.38 | 28 | 91.38 | | | | | 12 | 95.14 | | | 2 | 95.04 | 29 | 94.31 | 22 | 94.21 | | | | |
| 1984 | 12 | 94.39 | | | | | 25 | 95.72 | 4 | 99.50 | 6 | 100.54 | 6 | 103.68 | 10 | 103.77 | | | 7 | 103.90 | | | 8 | 103.95 |
| 1985 | 26 | 104.00 | | | | | 6 | 108.52 | 16 | 109.26 | | | 10 | 110.69 | | | | | | | 1 | 110.17 | 7 | 110.12 |
| 1986 | 27 | 114.41 | 15 | 114.55 | | | | | 3 | 115.13 | | | | | 13 | 115.62 | | | 11 | 115.72 | 20 | 115.77 | | |
| 1987 | | | 17 | 116.86 | | | | | 2 | 117.03 | | | 12 | 116.91 | | | | | | | | | | |
| 1988 | | | | | | | | | | | | | | | | | | | | | | | | |

7/87 - Instrument destroyed during construction of storm drain in street.

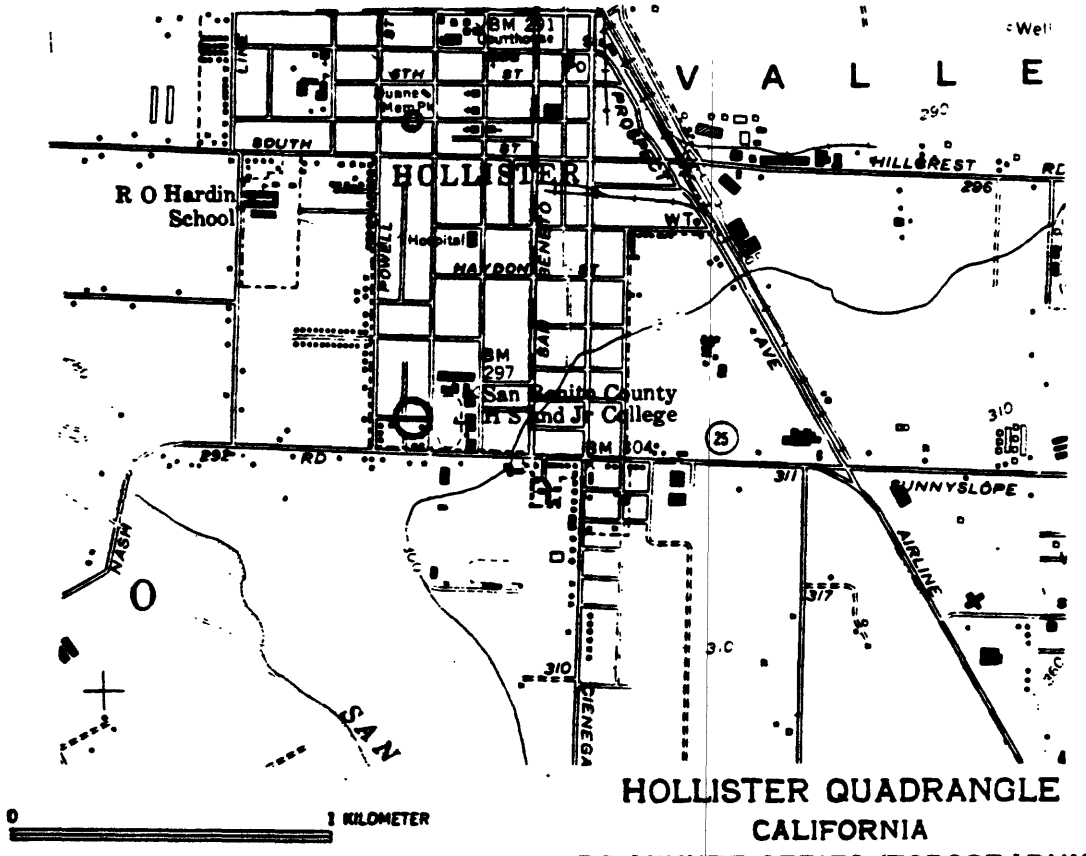

HOLLISTER, 7TH STREET HLS1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## STATION HLD1

Latitude 36° 50.5'
Longitude 121° 24.2'

Position 121.0 km
12-meter rod, ø=45°

The Hollister D Street creepmeter was installed during April, 1970, on the Calaveras fault at a site 1.0 km southeast of the center of Hollister. The installation consists of a single rod buried a few centimeters below the surface of the pavement of D Street. Creep activity at this site is composed of minor events of up to 1.9 mm in amplitude, superimposed on a background of gradual right-lateral slip. The average long-term creep rate is about 2.1 mm/yr, with a slight seasonal variation. Judging from results of surveys of an adjacent alinement array, the creepmeter may span only about 30% of the slip-zone width.



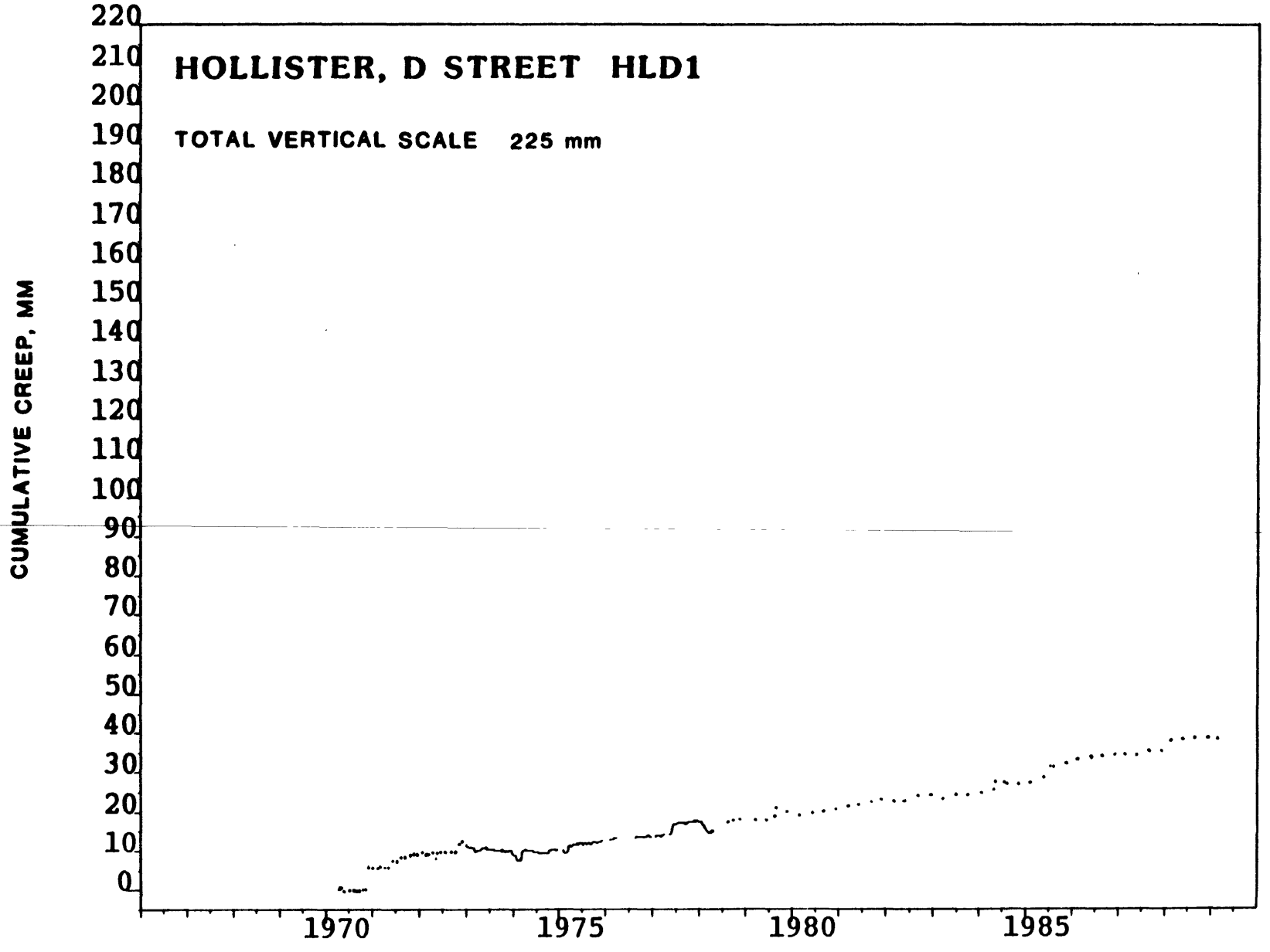

HOLLISTER QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

CUMULATIVE CREEP CALCULATED FROM FIELD READINGS

STATION HLD1

| | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM | DAY | MM |
| 1966 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1967 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1968 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1969 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1970 | | | | | | | 9 | 0.00 | 26 | -0.21* | 30 | -0.28* | 30 | -0.28* | | | 2 | -0.23* | 1 | -0.17* | 5 | 0.04 | 3 | 5.40 |
| 1971 | 6 | 5.64 | 10 | 5.64 | 4 | 5.71 | 7 | 5.68 | 5 | 5.87 | 9 | 7.27 | 12 | 7.52 | 10 | 8.38 | 14 | 8.52 | 14 | 8.67 | 17 | 8.86 | 16 | 8.96 |
| 1972 | 18 | 9.36 | 16 | 9.12 | 15 | 9.05 | 17 | 9.36 | 18 | 9.43 | 16 | 9.52 | 26 | 9.80 | | | 6 | 9.74 | 5 | 9.57 | 28 | 12.17 | | |
| 1973 | 10 | 11.10 | 6 | 10.63 | 8 | 9.96 | | | 22 | 10.51 | | | 10 | 10.18 | | | 12 | 9.81 | | | 16 | 9.76 | | |
| 1974 | 17 | 8.56 | | | 20 | 10.27 | | | | | 5 | 9.83 | | | 20 | 9.42 | | | 29 | 10.18 | | | | |
| 1975 | 22 | 9.94 | 27 | 9.40 | 27 | 10.96 | | | 19 | 11.88 | | | | | 19 | 11.94 | | | 24 | 12.19 | | | | |
| 1976 | 21 | 12.43 | 4 | 12.43 | | | 22 | 13.14 | 12 | 13.25 | 24 | 13.21 | | | 18 | 13.23 | | | 2 | 13.58 | 3 | 13.45 | 16 | 13.53 |
| 1977 | 20 | 13.63 | | | 19 | 13.84 | 13 | 14.10 | | | 15 | 18.16 | 18 | 17.01 | 11 | 16.96 | | | 3 | 17.07 | 16 | 17.25 | | |
| 1978 | 10 | 16.90 | | | | | 19 | 15.37 | | | | | | | 9 | 17.39 | 16 | 18.12 | | | | | | |
| 1979 | | | | | 7 | 17.56 | | | | | 6 | 17.82 | | | 9 | 18.26 | | | | | 15 | 19.80 | | |
| 1980 | | | 27 | 19.09 | | | | | | | 4 | 19.61 | | | | | 3 | 20.04 | | | | | 4 | 20.51 |
| 1981 | | | | | 11 | 21.27 | | | | | 2 | 21.64 | | | | | 10 | 22.43 | | | 30 | 23.04 | | |
| 1982 | | | 22 | 22.42 | | | | | | | 2 | 22.51 | | | | | 1 | 24.00 | | | | | 15 | 24.15 |
| 1983 | | | | | 28 | 23.06 | | | | | 29 | 24.12 | | | | | 29 | 24.08 | | | | | | |
| 1984 | 12 | 24.61 | | | | | 25 | 25.58 | 4 | 27.10 | | | 6 | 27.15 | | | | | 31 | 27.08 | | | | |
| 1985 | 30 | 27.36 | | | | | | | 16 | 28.51 | | | 10 | 31.47 | | | | | | | 1 | 31.94 | | |
| 1986 | 27 | 33.13 | | | | | | | 22 | 33.75 | | | | | 13 | 34.10 | | | | | 20 | 34.33 | | |
| 1987 | | | 19 | 34.33 | | | | | 28 | 34.43 | | | | | 24 | 35.13 | | | | | 23 | 35.14 | | |
| 1988 | | | 11 | 37.95 | | | | | 18 | 38.25 | | | | | 18 | 38.43 | | | | | 29 | 38.43 | | |

*Negative numbers indicate cumulative left-lateral movement.


HOLLISTER, D STREET HLD1
TOTAL VERTICAL SCALE 225 mm
CUMULATIVE CREEP, MM
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1970
1975
1980
1985

## Addendum: Coseismic Steps Recorded on Creepmenters during the October 17, 1989, Loma Prieta Magnitude 7.1 Earthquake

Within the 10-minute interval during which the magnitude 7.1 Loma Prieta earthquake occurred northeast of Santa Cruz on October 17, 1989 (00:04 GMT, October 18, 1989), coseismic steps were recorded on USGS creepmeters on the Calaveras fault near Hollister and for more than 200 km southeast along the San Andreas fault from San Juan Bautista to Parkfield. Listed below are amplitudes of the coseismic steps recorded by those creepmeters that transmit data samples every 10 minutes via satellite telemetry. Data from stations not on telemetry or that showed no response are not listed. See Figures 2, 3, and 4 (pp. 5, 6, 7) for creepmeter locations.

| | Amplitude of Coseismic Step, mm (right-lateral unless otherwise noted) |
|---|---|
| **Calaveras Fault** | |
| XSH1 Shore Road | 5.04 |
| **San Andreas Fault** | |
| XSJ2 San Juan Bautista | 5.18 |
| XHR2 Harris Ranch | 4.25 |
| CWN1 Cienega Winery | 1.05 |
| CWC3 Cienega Central | 6.80 |
| XFL1 Frank Lewis | −0.35 (left lateral) |
| XMR1 Melendy Ranch | 2.60 |
| XSC1 Slack Canyon | 0.20 |
| XMM1 Middle Mountain | 0.63 |
| XMD1 Middle Ridge | 0.98 |
| XVA1 Varian Ranch | 2.86 |
| XPK1 Parkfield | 1.50 |
| XTA1 Taylor | 0.14 |
| WKR1 Work Ranch | 0.78 |
| CRR1 Carr Ranch | 0.03 |
| XGH1 Gold Hill | 0.06 |
| TWR1 Twisselman Ranch | 0.78 |
| XHSW Hearst Southwest | 0.09 |

No unusual preseismic creep was observed before October 17, 1989, at any of the USGS creepmeters in the Hollister–San Juan Bautista area closest to the epicenter. A slight acceleration in creep in the days after the Loma Prieta earthquake was observed at XHR2 (Harris Ranch) in the Cienega Valley, but did not exceed a few millimeters of movement.

No substantial impact of the Loma Prieta earthquake on the creeping section of the San Andreas fault south of the epicenter had become apparent by November 15, 1989.