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ROCK FALLS IN YOSEMITE VALLEY, CALIFORNIA

BY

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ABSTRACT

This report contains a description and maps of prehistoric and historical rock falls in Yosemite National Park. Additionally, the report includes an inventory of data on the location, date, type, trigger, size, geology, damage, description, and references for about 400 historical rock falls in two appendixes (all information for using appendix 2 is available in the READ.ME file on disk in ASCII format). This information was collected from review of published and unpublished historical accounts, aerial photographic interpretation, and field studies.

INTRODUCTION

Rock falls, rock slides, and other forms of slope movement play a prominent role in the evolution of Yosemite National Park and, in particular, Yosemite Valley. In addition to damaging roads, trails, and other facilities, rock falls endanger some of the more than 3 million visitors that annually are attracted to the scenic wonders of Yosemite National Park. Since 1850, six people have been killed and at least 20 injured by rock falls. The U.S. Geological Survey (USGS) and the National Park Service (NPS) have cooperated to document rock-fall hazard in Yosemite Valley and Yosemite National Park from archival records, aerial photographic interpretation, and field mapping.

This investigation began after the 1980 Mammoth Lakes, California, earthquake sequence, which triggered rock falls in Yosemite Valley (Wieczorek, 1981). Information on rock falls affecting trails was collected primarily by James Snyder while serving as a trail-crew foreman, rebuilding trails damaged by rock falls and later as historian, examining historical reports of rock falls. An initial collection of historical rock-fall information compiled by Snyder (NPS, unpub. data, January 1990) became the basis of the rock-fall inventory included in this report as appendixes 1 and 2. All historical events from 1850 to 1992 are included in this rock-fall inventory. Appendix 1 gives an abbreviated version of the available information in selected data fields; appendix 2 gives complete information from all data fields including narrative accounts. In the appendixes and on the plates, historical events are referred to chronologically by number and by letters, D or R, if the point of deposition (D) or release (R) is known, for example #295 or #34D. Subsequent to January 1990, the observation and description of rock falls have not been as systematically recorded. A few subsequent rock-fall events that received widespread notice or were brought to our attention have been added, such as rock falls triggered by the October 23, 1990, Lee Vining earthquake. Smaller and less consequential rock falls between 1990 and 1992 have probably escaped our notice, and consequently, the record of events during that time may be incomplete. Investigation and mapping of prehistoric, historical and recent rock falls was

conducted with the assistance of Christopher Alger and Kathleen Isaacson, volunteer geologists on this project.

Beginning in the early years following the modern discovery of Yosemite Valley, rock falls were mentioned in the writings of many visitors, including Josiah Whitney, State Geologist of California; John Muir, noted naturalist; and Joseph Le Conte, Professor of Geology at the University of California. Subsequently, rock falls were regularly mentioned in the Park Superintendent's Monthly Reports because of repairs necessary to maintain damaged trails and roads. Although the bedrock and glacial geology of Yosemite National Park have been studied extensively, slope-movement processes, such as rock falls and other forms of slope failure, never have been examined systematically. In this report, the term "rock fall," as used in the title, is used as a generic, collective term for all slope-movement processes in Yosemite including rock fall, rock slide, debris slide, debris flow, debris slump, and earth slump, individual types of slope movement according to the classification system of Varnes (1978).

This investigation included studying the unpublished notes, journals, and letters of John Muir on microfilm loaned from the Holt-Atherton Collections, University of Pacific Libraries, Stockton, Calif. The Superintendent's Monthly Reports of Yosemite National Park were examined at the Yosemite Research Library and at the National Archives in Washington, D.C. The field notes and draft maps of François Matthes from the USGS Photo Library and Field Records in Denver, Colo., and the personal diaries of Matthes at the Bancroft Library, University of California, Berkeley, also were inspected.

In this report, the geologic history of Yosemite Valley is first summarized as background for examining rock falls. Photointerpretation and examination of historical accounts were used to compile a rock-fall inventory (apps. 1 and 2) and to map distribution of rock falls (pls. 1-4). Some interesting prehistoric and historical rock falls that we discuss illustrate typical slope movement processes. Finally, the record of historical rock falls is examined statistically to show what types of slope processes and triggering mechanisms are most important, and to find out how the volume rate of rock-fall accumulation compares during prehistoric and historical time.

GEOLOGIC HISTORY

In Yosemite National Park (fig. 1) the predominantly granitic rocks make up the Sierra Nevada batholith, which is composed of numerous individual plutons. Mineralogically these rocks are chiefly granitic but include quartz monzonite, quartz monzodiorite, quartz diorite, diorite, and gabbro (Huber, 1987). In Yosemite Valley the most prominent geologic units are the Diorite of the Rockslides, El Capitan Granite, Taft Granite, Sentinel Granodiorite, and Half Dome Granodiorite (Calkins and others, 1985). Other granitic rocks, such as the Cathedral Peak Granodiorite, occupy significant areas within Yosemite National

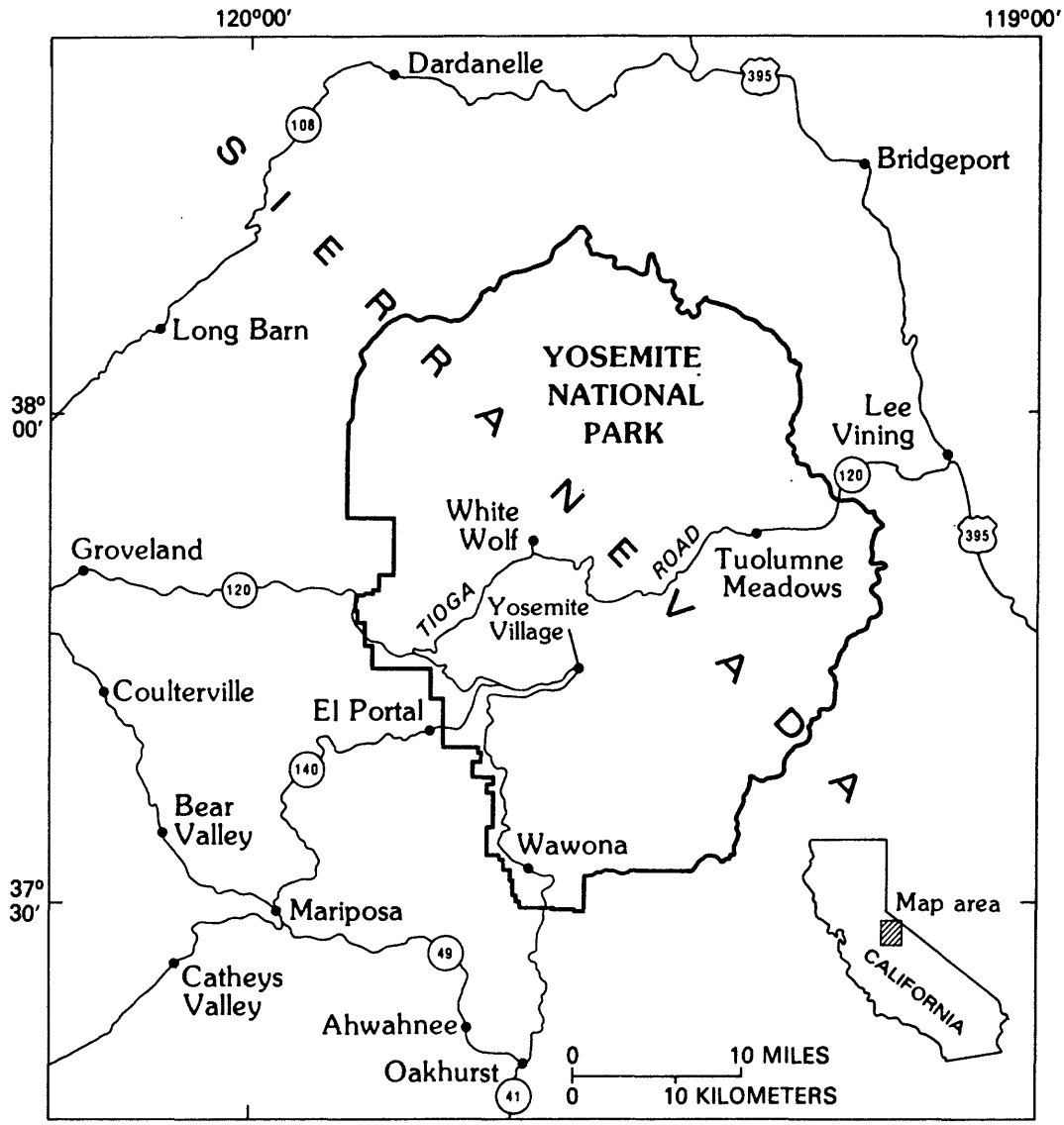

Figure 1- Key localities in Yosemite National Park, California and vicinity

Park. Along the eastern and western margins of the park are Cretaceous and older metamorphic rocks (Huber and others, 1989), but they are of lesser importance to this study because none are in Yosemite Valley.

The geomorphic history of Yosemite Valley is characterized by three stages: (1) initial development of the upland surface, (2) uplift and tilting of the upland accompanied by downcutting of deep river canyons, and (3) modification by glacial erosion to form the present valley (Matthes, 1930; Wahrhaftig, 1962; Huber, 1987). By the end of the Cretaceous, about 65 million years ago, the granitic batholith was well exposed, and the region had been eroded to a low-relief landscape of rounded hills and broad valleys with meandering streams.

Beginning about 25 million years ago, the region was uplifted and tilted to the southwest direction. With increased gradients, the streams draining the west flank of the Sierra Nevada incised deep canyons into the rising range before the onset of glaciation, possibly some 2 million years ago.

The record of glaciation in Yosemite National Park is incomplete. Only for the last two major glaciations, the latest Tioga and the earlier Tahoe, can the extent of the ice be reconstructed with any confidence. Deposits of older glaciations, if preserved at all, are so fragmentary that distinguishing separate ice advances is nearly impossible. Global evidence from deep-sea sediment indicates as many as 10 major glacial episodes during the Pleistocene; the few that are now recognized in Yosemite are probably only a fraction of those that actually occurred.

Glaciations older than the Tahoe are collectively referred to as pre-Tahoe (Huber, 1987; Huber and others, 1989). Ice from at least one pre-Tahoe glaciation filled Yosemite Valley, as evidenced by glacial erratics above the valley rim. The valley has not been filled completely with ice, however, for at least 750,000 years, which is the minimum age of the Sherwin glaciation as recognized on the east side of the Sierra Nevada (Huber, 1987). The major excavation of Yosemite Valley, including the bedrock basin beneath the valley floor, had to have occurred by that time. Since then, the upper reaches of Yosemite Valley's cliffs have been shaped by slope-movement processes, which left pinnacles that could not survive a valley-full glaciation and formed the recessed alcoves into which waterfalls such as Bridalveil Fall now descend (Huber, 1990a,b).

Both the Tahoe and Tioga glaciations in Yosemite Valley were less extensive than pre-Tahoe glaciations and did not fill the valley as deeply with glacial ice; consequently they did not have the erosive power of the pre-Tahoe glaciations. The Tioga glaciation began approximately 60,000 to 30,000 years ago, peaked 20,000 to 15,000 years ago, and ended about 10,000 years ago. A terminal moraine at Bridalveil Meadow marks the farthest advance of the Tioga glaciation. The levels of the Tioga and maximum, pre-Tahoe glaciations are shown on plate 1, and are based on data from Matthes (1930, pl. 29).

After the retreat of Tioga ice from the valley, a prehistoric lake formed behind a recessional moraine at the western edge of El Capitan Meadow and filled the valley (Matthes, 1930). Geophysical evidence of stratified sediment in the valley suggests that there may have been several glacial lakes in Yosemite Valley following separate glaciations (Gutenberg and others, 1956). Slope failures probably contributed both directly and indirectly (aided by glacial or fluvial transport) to the large and rapid accumulation of sediment in the valley and the conversion of prehistoric Lake Yosemite to a meadow.

Upstream from El Capitan, the retreat of Tioga ice and the infilling of prehistoric Lake Yosemite created a relatively flat valley floor upon which subsequent rock falls are recorded. Although rock falls undoubtedly occurred throughout the Pleistocene, most pre-existing rocky debris at the base of cliffs would have been removed by advancing Tioga ice. The majority, if not all, of the rock-fall debris or talus in the valley today upstream of the recessional moraine at Bridalveil Meadow accumulated during the Holocene. Downstream, to at least El Portal, rock-fall debris has possibly accumulated over more than 750,000 years since the retreat of the last major pre-Tahoe glacier.

METHODS OF INVESTIGATION

INVENTORY OF HISTORICAL SLOPE MOVEMENTS

Preparation of the rock-fall inventory involved the collection of historical accounts including field inspection of more recent slope movements. About 400 historical rock falls were mapped, and a computer data base of the location, date, type of slope movement, size, triggering conditions, damage, geologic bedrock, description, and references was prepared. The majority of these documented rock falls are in Yosemite Valley and the Merced Gorge between El Portal and Yosemite Valley. The locations of historical rock falls are shown on a 1:24,000-scale map of Yosemite Valley (pl. 1); those located outside the immediate Yosemite Valley area are shown on a 1:125,000-scale map of Yosemite National Park (pl. 2). The quality of available information on location, date, and size varies considerably, and the information was evaluated with respect to quality based on quantitative standards of accuracy of location, time, and size for rock-fall descriptions; quality assessments are included in the inventory (apps. 1, 2).

Location

Rock falls were located from historical accounts and plotted at scales of 1:24,000 or 1:125,000 (pls. 1, 2), and a few were mapped, accuracy permitting, at a scale of 1:12,000 (pls. 3, 4), from aerial photos and field examination. Many historical accounts describe either the point of release (R) or the point of deposition (D); historical rock falls are identified by chronological number and letter (R or D). Some rock falls were not described in sufficient detail to determine whether the location was a point of release or deposition; these locations are identified by number only on plates 1 and 2.

In some historical accounts, the stated locations were general or referred vaguely to segments of trail. As an illustration, the Superintendent's Monthly Report for November 1924 mentions that a storm on November 9, 1924, caused a rock slide on the "Tenaya Zigzags." This steep section of trail leaving Tenaya Canyon from east of Mirror Lake towards Tenaya Lake is about 1 kilometer long, and the report has no specific information about location. Many informal place names, particularly for climbing routes, are used locally in Yosemite and are not on USGS published topographic maps. These names, such as the "Cookie," are in quotation marks in this text.

Other locations are even less specific; in these cases the names of general locations have been added to the margins of plates 1 and 2. The Superintendent's Monthly Report for April 1928 states, "Six slides were removed from the foot of the grade of the old Big Oak Flat Road at El Capitan Checking Station to Gentry Station," a distance of about 6 kilometers; this event is attributed to a general location on the old Big Oak Flat Road. A few descriptions only mention rock falls occurring within Yosemite Valley and have no reference to specific locations.

Criteria for evaluating the accuracy of a location were developed on the basis of detail of the historical account (table 1). In the inventory, the most accurately known locations are assigned to a category, Q_{loc}=0, indicating a location precisely identified on a 1:24,000-scale map, believed to be accurate within $\leq \pm$ 25 m. The category of lowest accuracy, Q_{loc}=4, reflects a general location where the site could not be accurately located within $\geq \pm$ 1 km; this applies for instance to the few accounts that refer to events somewhere in Yosemite Valley.

Table 1. Criteria for determining the accuracy of location of rock falls

[Q_{loc}, quality of location. Accuracy is the estimated uncertainty of locating historically described events]

Q_{loc}	ACCURACY (±) (m)
0	≤25
1	100
2	250
3	500
4	≥1000

Time of Occurrence

The times of occurrence of historical rock falls are known with varying degrees of accuracy. The larger and more damaging events attracted more attention and were more commonly noted with precision as to the day and hour. In the early accounts, such as the monthly reports, there is a greater accuracy in date and location information for events that affected trails, roads, or structures. For example, a rock fall from the cliff known as Middle Brother, which covered Northside Drive with boulders, was reported in the Superintendent's Monthly Report for January 1923 as occurring at 5:00 p.m. on January 3, 1923. However, even the monthly reports sometimes contain imprecise information, such as a vague mention of repairs of minor rock falls that occurred sometime during the winter or spring. The quality of time of occurrence was evaluated according to the precision given in the historical report. In cases where the events could be dated to the nearest day, climatologic records could be used to evaluate whether rainfall, extreme temperature changes, or earthquakes may have triggered the event.

The criteria for evaluating the accuracy of the time of occurrence are given in table 2. The stated time frames were selected because of their applicability to the majority of documented accounts. If time of day, such as early afternoon, was reported, then $Q_{date}=0$ could be assigned, even if the exact hour of the event was unknown, because the time was probably known within $\leq \pm 2$ hours from the middle of the described period. For events when the specific day was known, $Q_{date}=1$ was assigned. Because many events in the monthly reports were only attributed to a particular month, $Q_{date}=3$ was assigned where the event is known within a 4-week time frame ($\pm$ 2 weeks). In the category of lowest accuracy, events that could only be attributed to a particular season, such as spring or winter, were assigned to $Q_{date}=4$.

Table 2. Criteria for determining the accuracy of time of occurrence of rock falls

[Q_{date}, quality of time of occurrence. Accuracy is the estimated uncertainty of time of occurrence of historical events]

Q_{date}	ACCURACY (±)
0	≤2 hours
1	12 hours
2	2 days
3	2 weeks
4	≥1 months

Size

The volume or weight of a rock fall is sometimes mentioned in the historical reports, but more frequently accounts include only relative size terms, such as small or large. In other cases, descriptions include incomplete estimates of size, such as the length of distance that a rock fall blocked a trail; such descriptions require additional assumptions to estimate volume. Other descriptions lack any information relative to size. The quality of information on size of a particular rock fall was categorized according to the criteria in table 3.

Table 3. Criteria for determining the accuracy of size of historical rock falls

Q_{size}	SIZE INFORMATION
0	Volume or weight reported
1	Some dimensions given
2	Vague indication of size
3	No information given

Several factors complicate the determination of accuracy of rock-fall size. A historical estimate of rock-fall volume blocking a road may represent only a fraction of the total deposit because other portions of the rock fall may have stopped uphill or have been transported downhill beyond the road. In such cases, the reported volume is a minimum estimate. Momentum transfer also can complicate rock-fall volume estimates. The volume of an empty rock-fall scar is at most an accurate measure of the initial minimum volume at the release point; upon impact, a transfer of momentum may mobilize additional talus on a steep slope and increase the volume significantly. Thus, in some events, the initial and final volumes may differ substantially; historical reports generally refer to final volumes of deposition. Where tonnage was reported, volume was calculated assuming an average unit weight for granite of 2,614 kg/m^3 (164 lbs/ft^3) (Hoek and Bray, 1974, table 1). Inaccuracy in estimating volume also can result from differences in average unit weight between intact bedrock and rock-fall deposits. With the above qualifications of estimating volume, the volumes reported should be considered only as order-of-magnitude estimates.

Using the most reliable size information (Q_{size}= 0, 1, or 2) of measured or estimated volumes, eight relative-size categories were devised to qualitatively characterize the range of sizes of historical rock falls. Volume ranges were assigned to these categories, each of which differs by an order of magnitude (table 4).

Table 4. Relative-size categories of rock falls

RELATIVE SIZE	VOLUME RANGE (m^3)	MEDIAN VOLUME (m^3)
Extremely small	0-0.5	0.2
Very small	0.5-5	2
Small	5-50	20
Medium	50-500	200
Large	500-5,000	2,000
Very large	5,000-50,000	20,000
Extremely large	50,000-500,000	200,000
Gigantic	>500,000	N/A

Historical rock-fall volumes (for Q_{size}= 0, 1, or 2) have approximately a log-normal distribution (fig. 2), although extremely small events are certainly underrepresented. A relative volume category was assigned to rock falls with Q_{size}= 3 on the basis of knowledge of typical rock-fall volumes at specific locations. In some cases having no size information, the median volume of 200 m^3 was arbitrarily assigned from the medium category.

Triggering Mechanisms

Events that triggered rock falls were identified from historical accounts together with correlation of the timing of climatic or seismic events. Intense rain, warm rain that rapidly melted a snowpack, freeze-thaw cycles, earthquakes, and blasting and other human-related causes were attributed to triggering slope movements in Yosemite.

In many accounts no mention is made of a trigger. In some cases rock falls occurred on clear warm days without any apparent cause. The relative importance of the various triggers is discussed in the "RESULTS" section. Rock falls that occur without an apparent trigger are not unusual in areas where post-glacial stress unloading or rebound occurs. In cases without an apparent trigger, the trigger is listed as "unknown" in the inventory.

Daily precipitation has been measured in Yosemite since 1903; maximum and minimum daily temperatures have been recorded since 1904; hourly precipitation values are available from 1948 to the present. A catalog of earthquake times, magnitudes, and epicenters from 1910 to 1987 for magnitudes greater than 4 for the central Sierra Nevada was compiled by Fred Lester (USGS, unpub. data, 1987). These tabulations were consulted for comparison

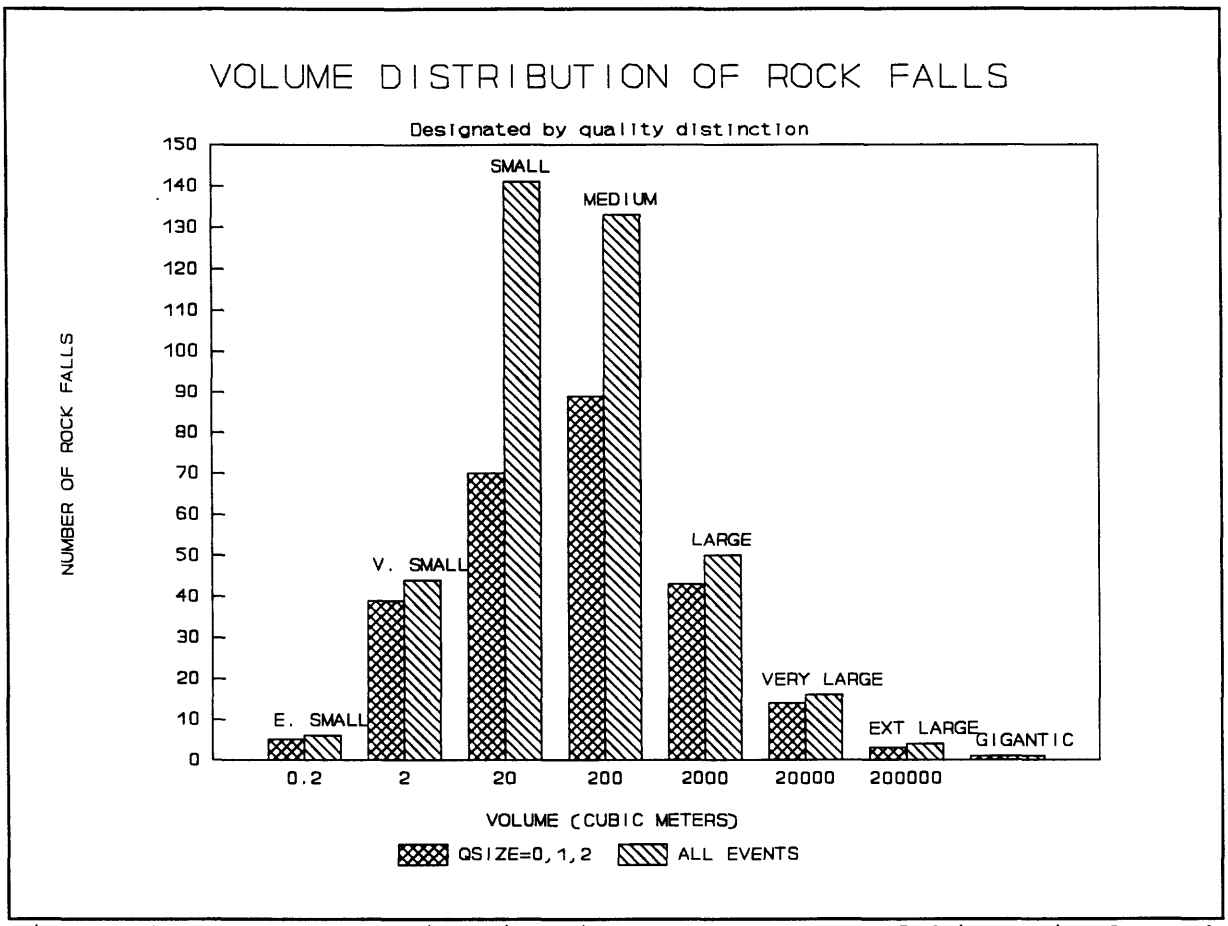

Figure 2- Frequency distribution of volumes of historical rock falls with Q_{size}= 0,1, and 2 and for all events. Values on abscissa represent median volumes of each size category.

with times of rock falls.

Some rock falls occurred in conjunction with trail or road construction when slopes were oversteepened or blasted. If the rock fall was an immediate (or near-immediate) response, then construction or blasting is listed as a trigger. The extent to which blasting weakened adjacent rock and caused rock falls subsequently in conjunction with rain or other events was not assessed. The few accounts of blasting of precarious rock from slopes are included in the inventory because in some cases these events provide additional information on rock-fall processes, as demonstrated in the account of work following the November 16, 1980, Yosemite Falls rock fall (Snyder, 1981):

> "Lowered 1100 feet from the rim to a small ledge just over the slab fragment, climbers established a high line and anchors for workers and a drilling platform. Drilling a line of holes for the explosives across the slab * * *.

"By cutting a clean roof in strong granite across the slab, a ragged, fractured fragment, such as that left by the rock slide [fall], could be avoided. Preparations were also made for explosives to go behind the hanging flake * * *.

"The resulting blast cleared out the fractured rock, leaving a clean roof. The newly exposed wall showed further how the actions of weathering, extension of plant root systems and freezing and thawing had worked on this flake of granite. The blast brought down another 450 tons of granite, most of which caught in the fresh jumble of angular rock below."

Types of Slope Movement

Slope movements in Yosemite are not exclusively rock falls and are classified according to the system of Varnes (1978). Some historical descriptions are sufficiently accurate to identify the type of slope movement; in other cases, identification was difficult. The more common slope movement processes observed in Yosemite National Park are debris flows and slides, rock slides and falls, and snow avalanches.

Debris Flows

Debris flows are a form of rapid mass movement of a body of granular solids, water, and air (Varnes, 1978) intermediate in character between a landslide and a waterflood (Johnson, 1970). Flow properties vary with water content, clay content, sediment size, and sorting. If a flow consists predominantly of fine-grained soil materials, it is referred to as a mud flow; if it consists of poorly sorted rock and soil, it is termed a debris flow (Varnes, 1978). Debris flows and mud flows are most commonly mobilized from hillsides and channels by the addition of moisture, either by intense rainfall or rapid snowmelt. Debris flows leave characteristic, easily identifiable deposits including bouldery levees and snouts. Debris-flow deposits are ubiquitous from the steep channels of ephemeral and permanent streams below the cliffs of Yosemite Valley to the nearly flat alluvial fans adjacent to the Merced River floodplain.

John Muir (1960) noted and described debris flows in Yosemite:

"The transporting power of steeply inclined torrents is far greater than is commonly supposed. Stones weighing several tons are swept down steep cañon gorges and spread in rugged deltas at their mouths, as if they had been floated and stranded like blocks of wood."

Matthes described the effects of a "severe cloud-burst" and "unusually violent torrential floods" of May 28, 1919, near Cathedral Spires as recently deposited walls of blocky debris that formed natural levees along a "torrent" channel on an alluvial fan (Matthes, USGS, unpub. data, 1919; 1930, p. 109). He acknowledged that the process by which these walls formed was not known from direct observation. Matthes described the recent aftermath

of a debris flow capable of carrying large boulders in suspension and depositing these boulders on levees that controlled the flow.

A contemporary of Matthes, Eliot Blackwelder (1928) was among the first to recognize and study debris flows as a slope process distinctly different from flooding on the alluvial fans at the bases of the eastern Sierra Nevada and the White Mountains in California. Debris-flow deposits are pervasive along intermittent stream courses on alluvial fans within Yosemite Valley, and during periods of rapid snowmelt debris flows have been observed carrying boulders (Steve Botti, NPS, oral commun., May 1985).

Historical accounts commonly mention "flooding" or "washout" damage to roads and trails after intense rainfall left substantial volumes of sediment and rock on trails. In these accounts it was impossible to definitively distinguish debris flow from normal flood damage; however, if deposits high in sediment and rock content are mentioned, then we assumed these events were debris flows.

Debris Slides

Coarse soil and loose rock mixtures that have low intergranular water content are referred to collectively as debris and do not mobilize flows; instead, these materials slide. Debris slides are less mobile than debris flows, and, although debris slides are common below the steep valley walls, they are not as widely distributed as debris flows on the lower parts of alluvial fans. Unless debris slides are inspected in the field they are generally indistinguishable from rock slides on aerial photographs. Likewise, historical accounts do not generally distinguish debris slides from debris flows or rock slides.

Rock Slides

Rock slides are composed of either loose rocks or large intact blocks of rock. The term rock slide is used extensively in accounts of events in the monthly reports, and, for those accounts, this term is retained in the inventory classification. In the case of a deposit described as blocking a trail or road without mention of the particular type of failure or exact location, we assumed it to be a rock slide, although in many circumstances it might just as easily have been a rock fall.

Rock Falls

Transport of rock masses mostly by falling, with some bouncing or rolling of individual rocks, is the definition of rock fall according to Varnes (1978). Unless the release point can be located, determining whether an event initiated as a rock fall or a rock slide is difficult. Many of the events described near the valley walls may actually be a complex rock fall/rock slide, in which the initial rock-fall movement becomes transformed into a rock slide as additional talus is mobilized by the transfer of momentum from the falling mass to loose talus deposits. For simplicity, such complex events were classified simply as rock falls.

Snow Avalanches

Snow avalanches are not included as a separate type of slope movement by Varnes (1978), but they can incorporate, transport, and deposit masses of loose soil, rocks, and vegetation. Muir (1960) discussed snow avalanches as significant erosive agents, especially in the higher elevations of Yosemite. He recognized the eroded bedrock channels of snow-avalanche chutes and the poorly sorted, sandy, rocky debris carried along with the snow and deposited in the valley bottom. In unpublished notes Muir described some snow avalanches firsthand[1]:

> "Yesterday (May 13, 1872) I was on Clouds Rest, 6000 feet above the bottom of the valley. A short but severe snow storm came down suddenly in blinding force. I witnessed three magnificent avalanches of ice and snow that started a few yards from me. They descend from here in loud boomings and in glorious array for a distance of a mile or more, carrying boulders and trees with them.
>
> "Thus, the largest of the Clouds' Rest avalanches, in rushing down their magnificent pathway of nearly a mile in vertical depth, on their arrival at the Tenaya Creek dash across its channel and up the opposite bank to a height of more than a hundred feet, pushing all the pebbles and boulders of the stream up with them."

Snow avalanches play an important part in erosive sculpturing in the alpine region above timber line in the Sierra Nevada (Matthes; 1938, 1965). While acknowledging snow avalanches as an active erosive agent at higher elevations of Yosemite, we believe their role in sculpturing of the walls and transport of material to Yosemite Valley is relatively minor compared to the other slope processes. Because of an incomplete historical record of snow avalanches and the presumed minimal significance of snow avalanches, we did not include them in the inventory.

Damage

The damage from rock falls was categorized according to whether roads or trails were affected, whether injuries or casualties resulted, and whether any structures or utilities, such as pipelines, transmission towers, flumes, or telephone lines, were disrupted. In a few cases, costs of damage were listed, and these too are indicated. Consult the narrative memo field in appendix 2 for details of damage.

Geology

To compare location with geologic units, the site of each slope movement was located

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[1]Reprinted from the John Muir Papers, Holt-Atherton Special Collections, University of the Pacific Libraries, Copyright 1984 Muir-Hanna Trust and published with permission.

as accurately as possible on the geologic map of Yosemite Valley (Calkins and others, 1985) or on the smaller scale map of Yosemite National Park (Huber and others, 1989). For most events, assigning the geologic unit was straightforward; however, for less accurate locations (Q_{loc}=3 or 4), where the location spanned several geologic units or where several geologic units were in close proximity to the location, this assignment was problematic. In cases where the degree of uncertainty was too high, no specific geologic unit was assigned, and a question mark is indicated in the field in appendix 2.

Glaciations and their relative age and level in Yosemite Valley influence rock-fall incidence in several ways. The level of the last major glaciation (Tioga), which progressed to Bridalveil Meadow as shown by Matthes (1930, pl. 29), is portrayed on plate 1. Above this level the valley walls have not been trimmed in perhaps more than 750,000 years; whereas below this trim line, fresh rock is more recently exposed from beneath ice cover and may still be unloading from stresses imposed by Tioga or earlier glaciations. Some areas were not covered by glacial ice; these unglaciated areas above the oldest glaciation as identified by Matthes (1930, pl. 29) are shown on plate 1.

After glacial retreat, rocks undergo physical changes, such as opening of joints, exfoliation, and mechanical and chemical weathering, that generally weaken the rock and make it more susceptible to slope failures. Many historical rock falls and rock slides in the Yosemite Valley initiated from below the trim line of the Tioga glaciation (pl. 1) where slopes of jointed rock are extremely steep to nearly vertical. Generally, the longer rocks are exposed, the more pronounced the physical changes become, and thin soils begin to develop from gradual disaggregation of rock. The source areas of many debris flows are above the Tioga trim line and below the unglaciated areas (pl. 1). On these steep slopes up to the rim of the valley, thin soils can develop that provide the fine-grained matrix necessary for supporting boulders in a debris flow.

Geologic factors--geologic unit, jointing, and glaciation--affect the susceptibility to triggering different types of slope movement. The specific geologic unit will generally not have as much influence on debris-flow susceptibility as depth and degree of weathering, which are largely affected by length of time since the last glaciation. Orientation, spacing, roughness, and alteration of joints affect the susceptibility to rock falls and rock slides more than the differences in geologic units, which principally reflect differences in mineralogic composition. In compiling this rock-fall inventory, we did not systematically survey joints and their properties or try to systematically evaluate the factors affecting incidence or susceptibility.

PHOTOINTERPRETATION AND FIELD EXAMINATION

Rock falls in Yosemite were mapped at a scale of 1:12,000 (pls. 3, 4) from several sets of aerial photographs having different ages and scales (table 5).

Table 5- Aerial photography used for photointerpretation

[X-14, Experimental; GS-VDYM, U.S. Geological Survey; GS-VFGIC, U.S. Geological Survey; YOSE, Yosemite National Park. In flight numbers second set of numbers or letters is arbitrarily assigned. B/W, black and white; IR, infrared; Fairchild, photos from Fairchild Aerial Photography Collection, Whittier College, Calif.]

DATE FLOWN	SCALE	FLIGHT NUMBER	TYPE OF PHOTO	SOURCE
5/10/32	1:26,000	X-14	B/W	FAIRCHILD
8/29/75	1:80,000	GS-VDYM	B/W	USGS
6/30/76	1:80,000	GS-VDYM	B/W	USGS
8/6/84	1:28,000	GS-VFGIC	COLOR	USGS
9/28/84	1:28,000	GS-VFGIC	COLOR	USGS
8/8/85	1:28,000	GS-VFGIC	COLOR	USGS
6/21/90	1:2000	YOSE	IR	NPS

Appearance of Rock Falls

For mapping the extent of prehistoric and historical rock falls, field evidence of the degree of modification by revegetation, lichen growth, and other weathering processes were examined. In general, the correlation between rock falls identified in the historical accounts and those identified in the field and on aerial photographs was difficult because of the uncertainty associated with the exact placement of historical locales and correlation with field evidence. The degree of regrowth of vegetation on rock-fall deposits generally can be correlated with the age of the events. The deposits of some large historically dated rock falls are only partially revegetated.

Scars and deposits of recent rock falls in Yosemite generally retain a fresh bright, black, gray, or white appearance (depending on rock composition), indicative of recently exposed rock, for about one or two decades. Initially, moss and water stains may cover fresh surfaces before lichens begin gradually to colonize, depending on exposure to sunlight and moisture conditions. The deposits of the April 1982 rock slide (#311R-pl. 3) northeast of the "Cookie" and across the Merced River from Elephant Rock, still exhibited fresh rock and lichen- and moss-free rock surfaces in 1992. This location receives full sunlight. In contrast, a 2-meter diameter boulder from the 1980 Sierra Point rock fall (#288R-pl. 4), which reached the trail at Happy Isles, was covered within a decade by black stain to the extent that it was indistinguishable from other older boulders scattered throughout the vicinity under a dense

tree canopy.

Dendrochronology

We attempted to use the ages of trees resprouted due to rock-fall damage or trees reestablished on rock-fall deposits to bracket the age of some rock falls. An inherent problem with this technique is determining the time required to establish regrowth after a rock fall; regrowth varies depending on thickness of boulder deposit, presence of soil, exposure to sunlight, elevation and abundance of moisture. Several hundred years or more may be necessary to completely revegetate a large, thick, rock-fall deposit; for instance, the 1872 rock fall from the west side of Liberty Cap (#6R-pl. 4) is still only sparsely revegetated. Consequently, trees of many different ages may be found reestablished on the same large rock fall; the oldest tree will give the best lower bound or minimum estimate of the rock-fall age.

In the summer of 1991 we measured diameters and counted tree rings on recently cut stumps throughout Yosemite Valley. Several different diameters were measured and averaged on each stump to minimize differences due to non-uniform directional growth. To obtain a larger sample for analysis, we combined our data with similar data for ponderosa and incense cedar from Yosemite Valley collected by Gibbens and Heady (1964). The oldest measured trees were generally about 300 years old; only one or two trees were found between 300 and 400 years old. Average growth rates of several species, including ponderosa pine, incense cedar, douglas fir, and oak were determined from a linear regression analysis of annual increment growth. By measuring the diameters of trees on rock-fall deposits, we estimated the ages of trees with this method within about 50 years.

In most areas, because of a lack of clear evidence of trees predating and postdating rock falls, the age of most rock falls could not be bracketed, and only occasionally could a minimum or maximum age be determined. Estimated ages of a few rock falls that were determined by this approximate dendrochronologic method are identified on plate 4.

Lichenometry

Although lichenometry has been successfully applied as an absolute dating technique (Bull and others, 1991), using it to date rock falls in Yosemite Valley presents some problems. The moderately low altitude of the valley (compared to alpine environments where much of the lichen dating has been done), relatively high annual precipitation, and the predominance of shade on the southern side of the valley, which promotes the growth of moss that covers many boulders and obscures lichens, all limit the potential usefulness of lichenometry.

For each species of lichen, a historical datum for calibration of growth rate must be established to provide absolute dates for geologic events; no such calibrations have been made for species in Yosemite Valley. Particularly in dry, sunny locations, we noted the presence and abundance of lichens and their maximum relative size on rock surfaces; however, we did

not attempt any systematic measurement of lichens on individual rock falls for quantitative dating analyses because of the problems noted above.

RELATIVE AGE OF ROCK FALLS

Degree of rock weathering, extent of revegetation of deposits, size of lichen growth and other factors affecting the appearance of rock-fall scars and deposits, were used as diagnostic criteria for classifying the relative ages of rock falls. As characterized by the criteria listed in table 6, three different relative ages of rock falls were identified: prehistoric (pre-1850), historical (1850-1970), and recent (1970-92). We have adopted the year 1850, approximating the arrival of non-Native American visitors to Yosemite, as the datum for the beginning of the historical period. In discussion and on plates 3 and 4 we assigned recent to those rock falls that occurred after 1970 or that were only minimally revegetated (<20%) or that had fresh rock scar and deposits. On plates 1 and 2 and for statistical analyses and discussion of the entire rock-fall inventory, recent and historical rock falls are referred to together as historical.

Table 6. Criteria for determining relative age of rock falls

RELATIVE AGE	WEATHERING	REVEGETATION	LICHENS
Recent (1970-92)	Fresh rock scar and deposits; little to no staining; jagged or sharp rock edges; sharp hammer ring	Grasses, brush, small trees; (<20% area); open rough scars on trees from rock impact	No new growths on fresh surfaces.
Historical (1850-1970)	Dull color scar and deposits; partial to full staining; semi-rounded rock edges; solid hammer ring	Grasses,bushes, trees partially reestablished (20-50%); tree scars partially to fully healed	Small new growth (<25 mm) on fresh surfaces.
Prehistoric (pre-1850)	Gray-black stained scar and deposits; rounded rock edges; solid ring to hollow hammer thud	Mature trees almost fully reestablished (50-100%); thin soil forming	Medium-large (>25 mm) inter-connected growth.

PREHISTORIC ROCK FALLS

Several conspicuous large prehistoric deposits have been noted in Yosemite National Park. McClure (1895) described a large rock slide deposit below Slide Mountain that blocked Piute Creek in the northeastern part of the park (pl. 2), with an estimated volume of 1.9 million m^3 (Bronson and Watters, 1987). Initial dendrochronologic findings indicate that this rock slide occurred between 1739-40 (William Bull, University of Arizona, written commun., 1992). In Yosemite Valley, Matthes (1930, pl. 29) recognized several masses of rocky debris of enormous extent, wholly distinct from the ordinary sloping talus, by their irregular, hummocky, sprawling form.

The floor of Yosemite Valley contains more than 100 recorded archeological sites; some are rock shelters among prehistoric deposits of large rock-fall boulders. Radiometric analyses at one rock-fall shelter site (CA-MRP-158/309) has shown that it was occupied about 1,000 years ago (Mundy and Hull, 1988). Very few rock-fall shelters have been dated; however, archeological evidence suggests occupation of the Yosemite area by Native Americans for more than 3,000 years (Riley, 1987); consequently, some rock-fall shelters may be that old.

El Capitan Meadow

One large prehistoric deposit of rocky debris, which extends from the base of El Capitan about 0.6 km into El Capitan Meadow, was outlined by Matthes (1930, pl. 29). This deposit is almost completely revegetated but is recognizable by its geomorphology. The rocky deposit has an irregular hummocky to slightly undulatory surface, which has been incised by subsequent drainage development. The leading edge of the rock fall left a steep rocky front about 12 m high. This deposit in El Capitan Meadow has an estimated volume of about 3.8 million cubic meters (table 7). Two archaeological sites on this deposit have not been dated (CA-MRP-818, 823) (Mundy and Hull, 1988).

Mirror Lake

Matthes (1930, p. 105) attributed the formation of Mirror Lake at the head of Yosemite Valley to the blockage of Tenaya Creek by prehistoric rock slides from both sides of Tenaya Canyon; he argues that this blockage must have occurred rather recently in prehistoric time because of the rapid rate at which the lake has been filling during historical time. Despite historical episodes of dredging and construction of several small dams (Samco, 1977), sedimentation had significantly reduced the size of Mirror Lake by the summer of 1992. Recent sandy debris-flow deposits across trails above Mirror Lake in Tenaya Canyon attest to the active processes that are providing an abundant source of sediment for Tenaya Creek and Mirror Lake.

From inspection of aerial photographs and field evidence, the largest portion of the Mirror Lake blockage appears to have come from a massive rock fall from cliffs behind the

Table 7. Volume estimates for selected large prehistoric rock falls in Yosemite Valley

LOCATION	SURFACE AREA ($x10^5$ m^2)	AVERAGE ESTIMATED THICKNESS (m)	VOLUME ($x10^6$ m^3)
Sugarpine Bridge	0.85	5	0.43
Tenaya Bridge	1.26	5	0.63
Old Yosemite Village	1.09	8	0.87
El Capitan Meadow	2.51	15	3.76
Mirror Lake	4.06	28	11.37

spire of Washington Column, on the northwest side of Tenaya Creek. Grading and sorting of the large bouldery debris, as well as transverse ridges across the middle and lower parts of the deposit, strongly suggest that the blockage was formed by a single large rock-fall event from behind Washington Column. Tenaya Creek drains the blockage through a spillway cut into a bouldery rock-fall fabric; individual boulders, each up to 200 cubic meters, are in contact with adjacent boulders.

Despite the difficulty in accurately estimating the average thickness of the Mirror Lake rock-fall deposit without an exposure of the original canyon bottom surface, the deposit is at least 28-m thick in the vicinity of Tenaya Creek between Mirror Lake and Iron Spring, based on surveyed bench marks. The Mirror Lake rock fall is the largest identified in Yosemite National Park, with a volume of approximately 11.4 million cubic meters (table 7).

Tenaya Bridge, Old Yosemite Village, and Sugarpine Bridge

Three other large prehistoric rock-fall deposits have been recognized (pl. 4); one south of Tenaya Bridge (630,000 m^3; Matthes, 1930, pl. 29), one at the site of Old Yosemite Village (870,000 m^3; between the Chapel and Sentinel Bridge), and another east of Sugarpine Bridge (430,000 m^3). Archeological sites (CA-MRP-79 and CA-MRP-53, respectively) containing mortar pits in large boulders have been identified on both the Old Yosemite Village and Sugarpine Bridge rock-fall deposits. Although the rock-fall deposit at the site of Old Yosemite Village has been slightly modified by clearing of the smaller boulders for locating structures, paths, and Southside Drive, the larger boulders are undisturbed. The deposit extends to the edge of Southside Drive, and outlying boulders extend possibly to the

Merced River. The Sugarpine Bridge rock fall extends to the junction of Tenaya Creek with the Merced River.

Smaller Prehistoric Rock Falls

In many places, smaller prehistoric rock-fall deposits cover the slopes at the base of the valley walls. These smaller rock-fall deposits commonly interfinger and form a near continuous talus slope along the base of the walls. Matthes (1930, pl. 29) mapped "rock waste shed from cliffs" as a postglacial unit indicating the furthest downhill extent of rock talus. We only mapped individual prehistoric rock-fall deposits on plates 3 and 4 that could be clearly distinguished amongst pervasive talus. Downstream from Bridalveil Moraine, in areas such as the Rockslides, many individual rock falls have produced talus that has accumulated since the end of pre-Tahoe glaciation; individual prehistoric rock-fall deposits are difficult to distinguish.

HISTORICAL ROCK FALLS

Either the Walker expedition in 1833 or William Penn Abrams in 1849 were the first non-Native Americans to view the deep chasm of Yosemite Valley. Lafayette Bunnell was with the first party to actually enter the valley in 1851 (Farquhar, 1965). Early visitors witnessed rock falls in Yosemite, some have been described in unpublished form, and a few accounts have been published. Because no systematic effort has previously been made to catalog or examine these events in any detail, we have collected all existing accounts into the present inventory. Our documentation effort included searching diaries, reports, notes, and letters of early visitors to the valley and park administrators for any mention of rock falls.

The following historical descriptions of rock falls are presented to illustrate typical slope-movement processes; not all documented rock falls are repeated here, but the narrative record of all documented rock falls is contained in appendix 2.

Early Accounts

During the initial exploration of the valley, Lafayette Bunnell described a place below Three Brothers referred to by the Native Americans as "We-ack" or "the rocks," where the old (Native American) northside trail had been covered by recently fallen rocks (Bunnell, 1911). Although the date of this rock fall is unknown, the description of its appearance suggests that it had occurred recently, perhaps within a decade of Bunnell's visit in 1851. The Legend of Lost Arrow (Hutchings, 1886), which describes a rock fall from near Lost Arrow, is an example of the Native American's recognition of active rock-fall processes in Yosemite.

James Hutchings (1886) includes a brief mention of an early rock fall observed in Yosemite and provides both general date and location:

"A little northerly of this (Profile or Fissure Mountain) is a light-colored spot, whence, in 1857, a chip fell, the debris from which is said to cover over thirty acres."

Floods in January 1862 (Hutchings, 1886), November 12-14, 1864 (King, 1872), and December 23, 1867 (Hutchings, 1886), may have caused some of the rock-fall effects evident in early photographs of the valley. A rainstorm that began on January 2, 1862, and continued unabated for 4 days led to flooding of the Merced River that interrupted the attempted travel of James Hutchings to Yosemite. The specific effects of this storm in Yosemite were not directly observed but could well have caused rock falls. During the 1867 flood, Hutchings and his family were the only residents of the valley (Hutchings, 1886):

"On December 23, 1867, after a snow fall of about three feet, a heavy down-pour of rain set in, and incessantly continued for ten successive days * * * throughout the entire Valley * * * each rivulet became a foaming torrent * * * The whole meadow land of the Valley was covered by a surging and impetuous flood to an average depth of nine feet. Bridges were swept away * * *.

"Immense quantities of talus were washed down upon the Valley during the storm,--more than at any time for scores, if not hundreds, of years * * *."

In 1863 Josiah Whitney, State Geologist of California, initiated scientific investigations of the Yosemite Valley and of the Sierra Nevada. Accompanying Whitney's scientific findings, photographs of Yosemite Valley by Carleton Watkins were included in a limited edition of 250 copies of "The Yosemite Book" (Whitney, 1868). Watkins photograph of The Three Brothers (Whitney, 1868, pl. VII) clearly shows a very recent unvegetated debris-flow scar and path to the west of the Three Brothers below Split Pinnacle that is not present in his earlier (1861) photograph (Solnit, 1992, p. 55). An 1866 Watkins photo from Union Point shows recent rocky deposits below Cathedral Spires, Taft Point, and the Eagle Creek fan (Gibbens and Heady, 1964).

Whitney (1868, p. 78), on the basis of his examinations of the valley, was well aware of the processes and frequency of rock falls as judged by his statement:

"We see that fragments of rock are loosened by rain, frost, gravity, and other natural causes, along the walls, and probably not a winter elapses that some great mass of detritus does not come thundering down from above, adding, as it is easy to see from actual inspection of these slides which have occurred within the last few years, no inconsiderable amount to the *talus*. Several of these great rock-avalanches have taken place since the Valley was inhabited. One which fell near Cathedral Rock is said to have shaken the Valley like an earthquake."

In October of 1864 Clarence King of the California Geological Survey visited Yosemite to make a survey defining the boundaries of Yosemite Valley. On June 30, an act

of Congress had been signed by President Lincoln granting Yosemite Valley and the Mariposa Grove of Big Trees to the State of California. King abandoned an exploration to Mount Clark, southeast of Yosemite Valley, because of heavy snowfall that began during the evening of November 12, 1864, and the next morning hastened his return to Yosemite Valley. Reaching Inspiration Point near sunset during a temporary lull in the storm, he observed magnificent snow avalanches from El Capitan, Cathedral (Spires?), Three Brothers, and Clouds Rest. Several hours later, after reaching camp near Black's Hotel, in Yosemite Valley, the storm resumed. In a chapter titled "A Sierra Storm," King (1872) vividly described the effects of this storm of November 13, 1864, in Yosemite Valley:

> "Rocks, loosening themselves from the plateau, came thundering down precipice-faces, crashing upon *débris* piles and forest groups below. Sleet and snow and rain fell fast, and the boom of falling trees and crashing avalanches followed one another in an almost uninterrupted roar. In the Sentinel gorge, back of our camp, an avalanche of rock suddenly let loose, and came down with a harsh rattle, the boulders bounding over *débris* piles and crashing through the trees by our camp. * * *
>
> "After hours the fitfulness of the tempest passed away * * * and at last settled down to a continuous gale, laden with torrents of rain * * *. Toward morning a second thunderstorm burst, and by the light of its flashes I saw that the river had risen nearly to our cabin door, covering the broad valley in front of us with a sheet of flood."

Joseph Le Conte, geology professor from the University of California, was visiting Yosemite Valley during the afternoon of August 6, 1870, and "heard a hollow rumbling, then a crashing sound * * * looking up quickly, the white streak down the cliff of Glacier Point, and the dust there, rising from the valley, revealed the fact that it was the falling of huge rock mass from Glacier Point" (Le Conte, 1875, p. 45). As has been observed for some other rock falls in Yosemite, this rock fall was described without mention of wind, rain, or earthquake; that is, it occurred without an apparent triggering mechanism.

John Muir first visited Yosemite in 1868 and lived there almost continuously until 1873. As an astute scientific observer and chronicler throughout Yosemite and the Sierra Nevada, his detailed descriptive accounts of slope processes form a unique set of firsthand observations unparalleled for his period. His geomorphic theories and conclusions regarding the glacial and mass movement processes responsible for the formation of Yosemite Valley are still sound.

Muir recognized the large talus piles throughout Yosemite as the product of prehistoric rock falls. After he observed one rock fall triggered by the 1872 Owens Valley (Inyo) earthquake, he came to the conclusion that most, if not all, such large talus piles were earthquake generated. From the size and age of well-established trees growing on distinctly older talus he postulated that these older rock falls had occurred during a great earthquake at least 300 years earlier (Muir, 1960, p. 83).

Eagle Rock

Muir (1912) eloquently described an "Eagle Rock avalanche" triggered by the March 26, 1872, Owens Valley (Inyo) earthquake:

> "At half past two o'clock of a moonlit morning in March, I was awakened by a tremendous earthquake * * * and I ran out of my cabin, both glad and frightened, shouting, 'A noble earthquake! A noble earthquake!' feeling sure I was going to learn something. The shocks were so violent and varied, and succeeded one another so closely, that I had to balance myself carefully in walking as if on the deck of a ship among waves, and it seemed impossible that the high cliffs of the Valley could escape being shattered. In particular, I feared that the sheer-fronted Sentinel Rock, towering above my cabin, would be shaken down, and I took shelter back of a large yellow pine, hoping that it might protect me from at least the smaller outbounding boulders * * *.
>
> "It was a calm moonlight night, and no sound was heard for the first minute or so, save low, muffled, underground, bubbling rumblings, and the whispering and rustling of the agitated trees, as if Nature were holding her breath. Then suddenly, out of the strange silence and strange motion there came a tremendous roar. The Eagle Rock on the south wall, about half a mile up the Valley, gave way and I saw it falling in thousands of the great boulders I had so long been studying, pouring to the Valley floor in a free curve luminous from friction, making a terribly sublime spectacle--an arc of glowing, passionate fire, fifteen hundred feet span. * * *
>
> "The first severe shocks were soon over, and eager to examine the new-born talus I ran up the Valley in the moonlight and climbed upon it before the huge blocks, after their fiery flight, had come to complete rest. They were slowly settling into their places, chafing, grating against one another, groaning, and whispering; but no motion was visible except in a stream of small fragments pattering down the face of the cliff. A cloud of dust particles, lighted by the moon, floated out across the whole breadth of the Valley, forming a ceiling that lasted until after sunrise, and the air was filled with the odor of crushed Douglas spruces from a grove that had been mowed down and mashed like weeds."

Although this published account of the earthquake and the rock fall are well known, the exact locations of Eagle Rock and this rock-fall deposit remained a matter of speculation. Matthes (1930, p. 106) described the source of the rock fall, Eagle Rock, as having been on the south side of the valley not far from Moran Point, but did not show an exact location on any map. Photographer Eadweard Muybridge's stereograph caption identifies an Eagle Rock as the presently known Taft Point, about 3.2 km (2.0 mi) downvalley (southwest) from Moran Point. If Eagle Rock had been near Taft Point, this would contradict Muir's (and Matthes') location of the rock fall as being about 0.8 km or "half a mile" up the valley from Muir's stated observation point on the night of March 26, 1872.

This dilemma of the location of Eagle Rock was resolved by examining unpublished notes, letters, and journal articles from the archival microfilm collection of Muir's writings. In an unpublished journal description, Muir included additional details that he later edited and omitted parts of for publication. In the following citation, Muir crossed out the words in parentheses and added words shown in brackets for context:[2]

> "Yesterday (March 26) at half past 2, AM I was suddenly awakened out of a sound sleep by the movements of my Cabin, back of Blacks Hotel. * * *
>
> "Turning in the direction of the huge uproar I saw (that) the Eagle Rock [was] falling. (This rock) [It] was 1500 ft-high + (was) capped by a large stone somewhat like an eagle with wings outspread ready to take [for] flight. It did take flight (last) [that] night. * * *
>
> "A second [severe] grand shock occurred about half past 3 o'clock which caused a second rock avalanche in the same (direction) place as the first, that is, back of the Hutchings hotel."

The Hutchings' Hotel (Hutchings' House or Upper Hotel) that Muir refers to was located at the site of Old Yosemite Village, which was between the present Chapel and Sentinel Bridge. In the spring of 1872 Muir was staying in a cabin behind Black's Hotel (located just southwest of BM-3965 and east of "Footbridge" on pl. 1). This location matches the description of a "half mile" or 0.8 km from the Hutchings' Hotel on the south side of the valley. The site of the release point of the rock fall would have been to the north of Union Point or Moran Point, and the talus deposit would be that behind the site of Old Yosemite Village.

Muir included in his unpublished narratives a sketch of the "Hutch avalanche" with several captions indicating measurements or observations. He noted the height of the talus in back of Hutchings' Hotel as being 410 feet (125 m) high with an average slope of 31°, and he noted an extreme slope where the material had been spouted down a narrow chute of 36°. He showed where the larger, heavier blocks had been sorted out from the smaller pieces. This unpublished illustration is almost identical to a later published figure (Muir, 1960, fig. 4, p. 83) that was not identified with a specific location.

Galen Clark (1872), the first appointed Guardian of Yosemite Valley, wrote the following in a letter of the effects of the March 26, 1872, Owens Valley (Inyo) earthquake:

> "One prominent point known as Pelican Peak, just back of Hutchings' Hotel, fell with a terrible crash, scattering immense masses of boulders around, but did no damage to

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[2]Reprinted from the John Muir Papers, Holt-Atherton Special Collections, University of the Pacific Libraries, Copyright 1984 Muir-Hanna Trust and published with permission.

any of the houses in the vicinity."

This description by Clark, although less dramatic than Muir's, describes a rock fall in the same general vicinity behind Hutchings' Hotel. Neither Pelican Peak nor Eagle Rock are currently recognized as named geographic features; however, a rock pinnacle in shape similar to a great bird may well have inspired both names for the same feature. The fact that the pinnacle was destroyed by the earthquake would account for its absence as a place name on subsequent maps. Because of the similarity in location and description of the rock fall, Muir and Clark very likely described the same event.

Liberty Cap

Both Muir and Clark also noted a rock fall from Liberty Cap triggered by the 1872 earthquake at the head of the Little Yosemite Valley. Muir (in Kneeland, 1872) briefly mentioned "other avalanches * * * on the west side of the Cap of Liberty," and Clark (1872) gave the following more interesting account:

> "The most remarkable results of the shake occurred at Snows, between the Vernal [and] Nevada Falls. Mr. Snow, on hearing the terrible rumbling noise preceding the shake, rushed out of his house somewhat alarmed. The night was very light and he being in plain view of the Nevada Falls, distinctly saw that the water ceased to flow over the falls for at least half a minute. A large mass of rocks, which would weigh thousands of tons fell from the west side of the 'Cap of Liberty' about a thousand feet above its base."
>
> "When this great mass of rocks struck the earth Mr. Snow says he was instantaneously thrown prostrate to the ground. The house which stands on the solid bed rock which has an incline of about twenty degrees to the eastward towards the Cap of Liberty and Nevada Falls, has moved two inches to the east. An addition to the house, which was built last Fall, was so badly wrecked and shattered as to have to be taken down and rebuilt. The earth around Snow's place is still completely covered with dust from the pulverized rocks. I think that the prostration of Mr. Snow, and perhaps the moving of the main house and wrenching apart of the timbers of the addition, was probably more the result of the concussion of the atmosphere when the rocks fell than the effects of the shake."

Although rare, the effects of blasts of compressed air such as the snapping of trees and the displacement of heavy objects generated by rapidly moving landslides have been noted elsewhere (Harp and others, 1981, p. 15). The available evidence is insufficient to resolve this question, but the observed effects to the structures might also have been caused either by the strong earthquake shaking or by strong shaking generated by the impact of the Liberty Cap rock fall, only some 250 m away.

The brief cessation of flow over Nevada Fall could have been caused by brief

damming of the Merced River by either a small, quickly breached rock slide, or by a snow avalanche. According to recent studies (Costa and Schuster, 1988), many landslide blockages fail shortly after formation; about a quarter failed within one day. In support of Snow's observation, Muir (1901) in talking about the effects of the earthquake, commented:

> "* * * in many places thousands of boulders were hurled into their (stream) channels, roughening and half damming them * * *. Some of the streams were completely dammed, driftwood, leaves, etc., filling the interstices between the boulders, thus giving rise to lakes."

Muir (1912) also described other earthquake effects, probably caused by either earth falls, topples, or slides, that occurred along the banks of the Merced River:

> "After the ground began to calm I ran across the meadow to the river * * *. Its waters were muddy from portions of its banks having given way * * *. The mud would soon be cleared away and the raw slips on the banks would be the only visible record of the shaking it suffered."

Muir mentioned other rock falls triggered by the earthquake in Indian and Illilouette canyons (Kneeland, 1872); he also mentioned that other rock falls were triggered by the earthquake in the Sierra Nevada, which he neither specifically located nor described. From 1870 to 1877, Muir assisted the photographer J.J. Reilly, who captioned one of his stereographs (No. 555) "Earthquake Rock" (Hickman and Palmquist, 1985). We located this large rock along a trail on the south side of Yosemite Valley and identified its background as Taft Point. By coring several trees in this area we determined that this rock could have possibly moved to its present position during the earthquake, although other large boulders and their impact craters upslope are attributable to the 1860's or earlier.

Muir's geologic interests included studies of the post-glacial denudation of Yosemite. He attributed the greatest importance to the ability of earthquakes to produce the talus observed throughout the Sierra Nevada; this belief can be attributed to his firsthand observations of the Owens Valley (Inyo) earthquake. However, Muir (1960) remarked that "the attentive mountaineer may have the pleasure of witnessing small avalanches in every month of the year," such as his following description of a rock fall from Middle Brother:

> "On the 12th of March, 1873, I witnessed a magnificent avalanche in Yosemite Valley from the base of the second of the Three Brothers. A massive stream of blocks bounded from ledge to ledge and plunged into the talus below with a display of energy inexpressibly wild and exciting. Fine gray foam-dust boiled and swirled along its path, and gradually rose above the top of the cliff, appearing as a dusky cloud on the calm sky. Unmistakable traces of similar avalanches are visible here, probably caused by the decomposition of the feldspathic veins with which the granite is interlaced."

In an earlier unpublished version of this account, Muir mentions that at first he suspected an earthquake, but observing the nearby pool of water in the meadow to be motionless, he recognized the event as a "common fall of rock."

RECENT ROCK FALLS

We examined some recent rock falls in and near Yosemite Valley shortly after they occurred, often at the request of the Park Superintendent or other officials to provide information for evaluation of hazards or reopening of trails and roads. These studies also were conducted to discover more about rock-fall processes and triggering mechanisms; they provided information not generally available from historical accounts or aerial photographic interpretation.

In one case, an extremely large (600,000 m^3) rock fall from Middle Brother was closely observed while it occurred. Continuing rock falls at Middle Brother were subsequently monitored for several months to determine their rate of occurrence versus time as an indicator of how long rock falls might continue, and when Northside Drive could be safely reopened. In another case, close examination of a recent rock-fall site along the Vernal Fall Trail disclosed fresh hairline cracks behind the scarp, which posed an additional hazard at this site. We recommended that the trail remain closed, and during a storm several days later the rocks downslope of the cracks failed and again sent rock across the trail (Wieczorek and others, 1989).

RESULTS

VOLUME

The distribution of historical (1850-1992) rock-fall volumes was examined by grouping ranges of volumes according to the qualitative size categories introduced in table 4. On a logarithmic scale, volumes of rock falls are approximately normally distributed (fig. 2), although small events are probably underreported. The distribution has a mean of about 5,000 m^3 and a median of 83 m^3. The rather low median value reflects the frequent small volume of rock-fall events that regularly affect trails and roads. The larger mean shows the influence of infrequent, but very large rock falls. If only the more accurately measured volumes (Q_{size}= 0, 1, 2) are compared, a similar distribution is attained (fig. 2).

The largest historical events are about one to one and one-half orders of magnitude smaller than the largest prehistoric events (table 7). The prehistoric rock fall that impounded Mirror Lake is estimated to contain about 11.4 million cubic meters, and the prehistoric rock slide at Slide Mountain in northeastern Yosemite is estimated to have a volume of 1.9 million cubic meters (Bronson and Watters, 1987). The largest historical rock fall, the March 1987 rock fall from Middle Brother, had a volume of only about 0.6 million cubic meters.

TYPES OF PROCESSES

The relative importance or significance of different slope-failure processes was examined by comparing both the percentage frequency (fig. 3) of individual processes and the cumulative percentage of volume (fig. 4) attributable to each process. For all historical events, rock slides (62 percent), rock falls (21 percent), debris flows (9 percent), and debris slides (6 percent) were the most frequent types of processes (fig. 3a). Miscellaneous rock, debris, or earth slumps were rare (1 percent). For the better documented events, with Q_{size}=0, 1, 2, the distribution (fig. 3b) was almost identical having rock slides (60 percent), rock falls (25 percent), debris flows (10 percent) and debris slides (5 percent). To some extent, the preferential reporting of small, frequent rock falls or rock slides primarily affecting roads and trails influenced this assessment by increasing their relative frequency.

A different trend in the relative abundance of specific processes was found when the percentages of cumulative volumes for all events were compared (fig. 4a). The percentage cumulative volume of rock falls (82 percent) greatly exceeded that of rock slides (17 percent) and other processes (1 percent). Similarly for the smaller subset of more accurately recorded volumes (fig. 4b, Q_{size}= 0, 1, 2), the cumulative percentage volume of rock falls (78 percent) greatly exceeded that of rock slides (21 percent) and other processes (1 percent). The glacial sculpturing of the massive jointed granitic rocks of Yosemite has produced steep slopes and cliffs particularly susceptible to rock falls and rock slides. To some extent, subsequent stress relief or unloading after glacial retreat has produced loose slabs or sheets by exfoliation that subsequently are susceptible to failure by rock fall or rock slide.

Although the depositional areas of prehistoric debris flows and debris slides are extensive from the valley sides to floor (pls. 3, 4), historical deposits are limited in area and are generally thin (<1 m); consequently, the total cumulative volume of historical debris flows and slides is generally small. Alluvial fans containing prehistoric debris-flow deposits are extensive along the floor of Yosemite Valley and represent accumulations of material deposited throughout the Holocene. The extent of talus in the valley, either historical or prehistoric, was depicted by Matthes (1930, pl. 29). In only a relatively few locations is rock-fall talus absent where bedrock of the valley walls meets the valley floor directly.

TRIGGERING EVENTS

The triggers for individual rock falls were noted in some cases by firsthand observation during earthquakes or rain storms. For a majority (54 percent) of events, however, no direct triggering event was observed. Rain or spring runoff caused 27 percent of events, snowmelt or rain on snow events caused about 8 percent, earthquakes triggered about 5 percent, and other miscellaneous causes, including human-induced blasting and freeze-thaw, cumulatively made up about 6 percent (fig. 5a). When cumulative volumes of rock falls triggered by different causes are examined, a slightly different picture appears (fig. 5b). The volume triggered by earthquakes (about 12 percent), slightly exceeds the combined volumetric effects of rain, snow, and other known causes (11 percent). The high percentage of

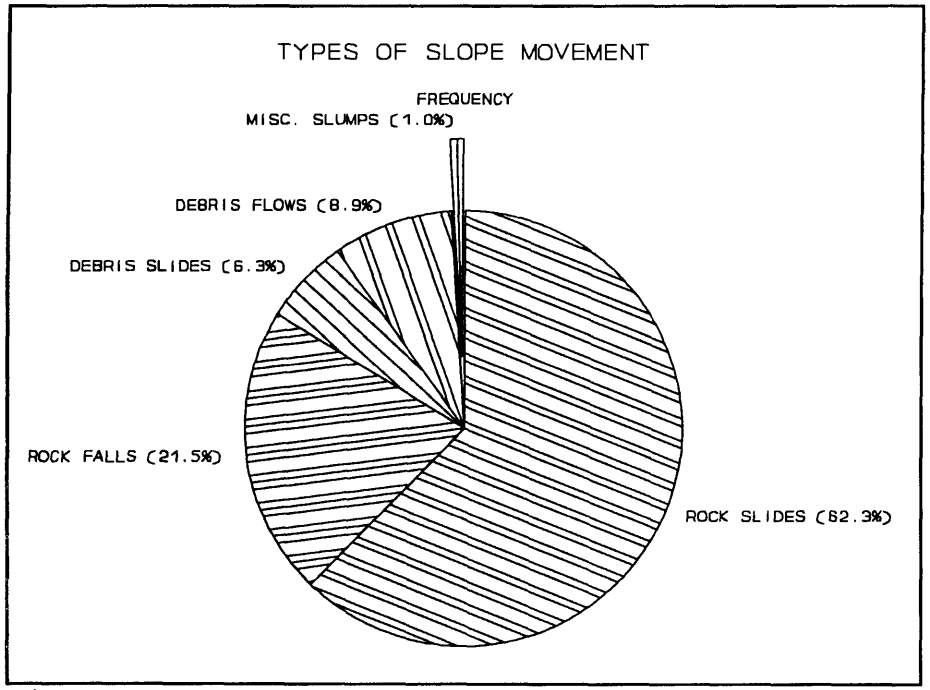

Figure 3a- Types of slope movement according to frequency of occurrence (in percent) for all historical events (N=395).

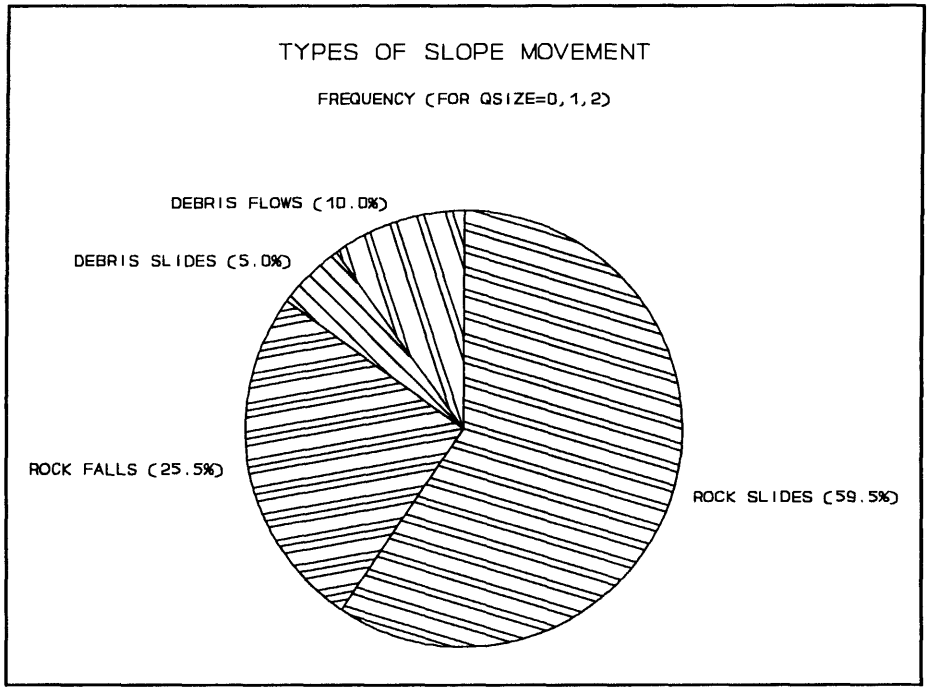

Figure 3b- Types of slope movement according to frequency of occurrence (in percent) for historical events with Q_{size}=0, 1, and 2 (N=259).

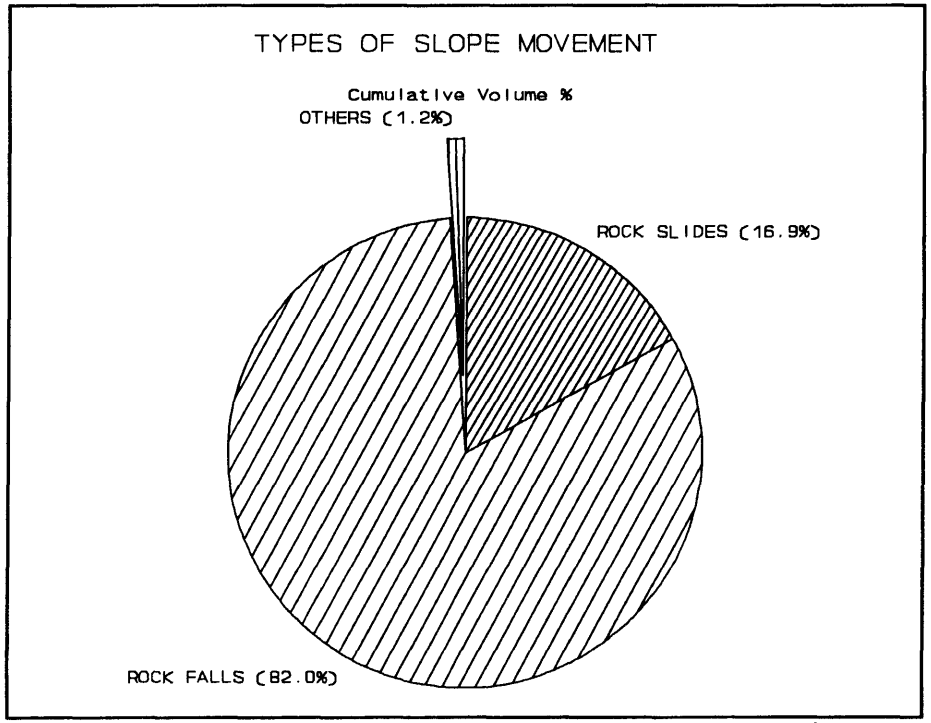

Figure 4a- Types of slope movement according to cumulative volume (in percent) for all historical events (N=395).

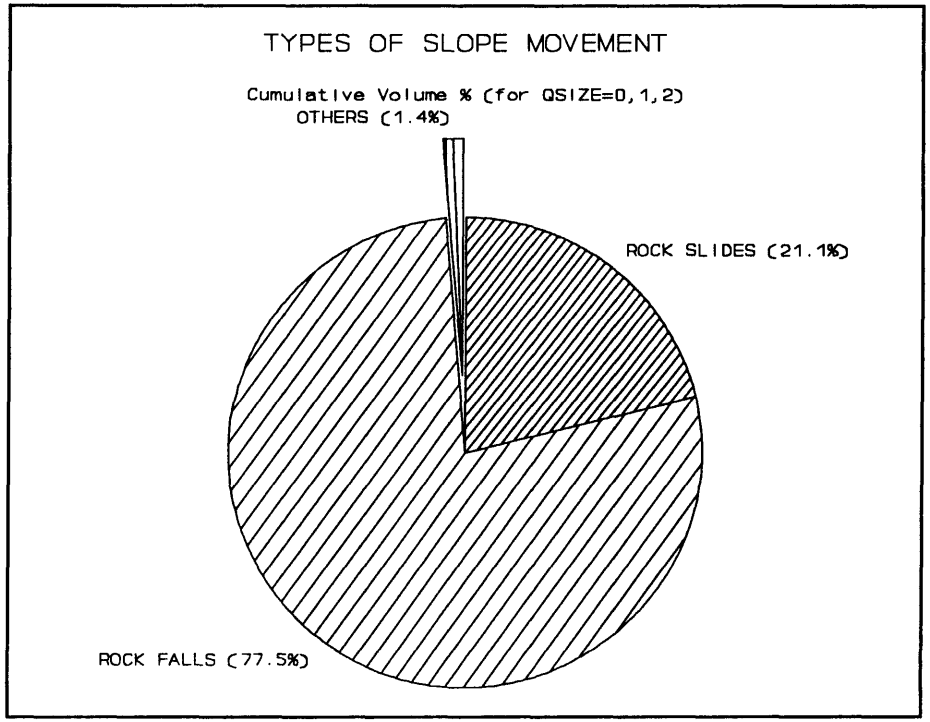

Figure 4b- Types of slope movement according to cumulative volume (in percent) for historical events with Q_{size}=0, 1, and 2 (N=259).

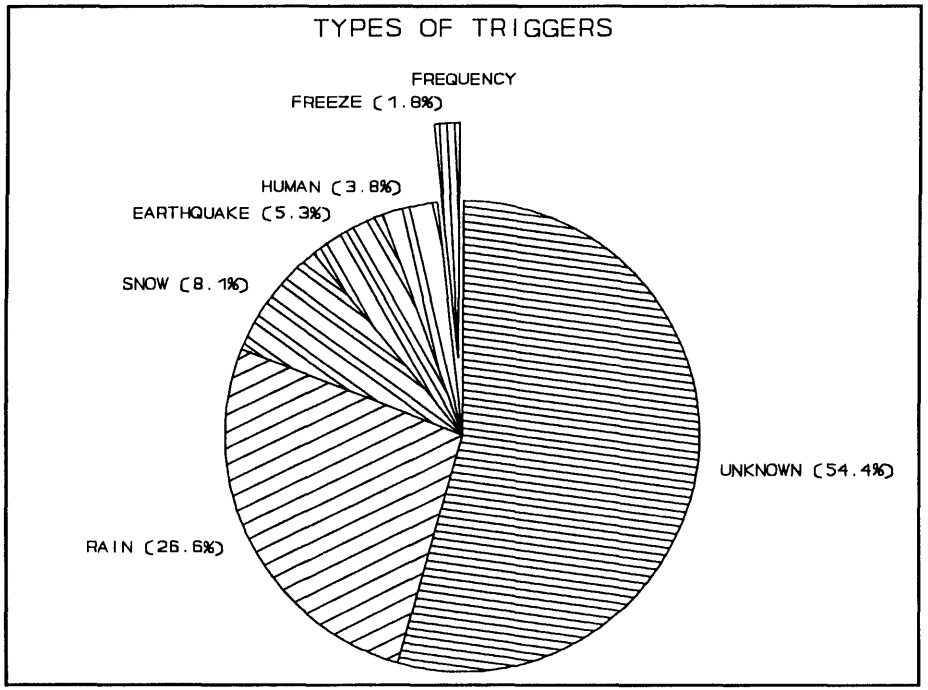

Figure 5a- Types of triggers of slope movements according to frequency of occurrence (in percent) for all historical events (N=395).

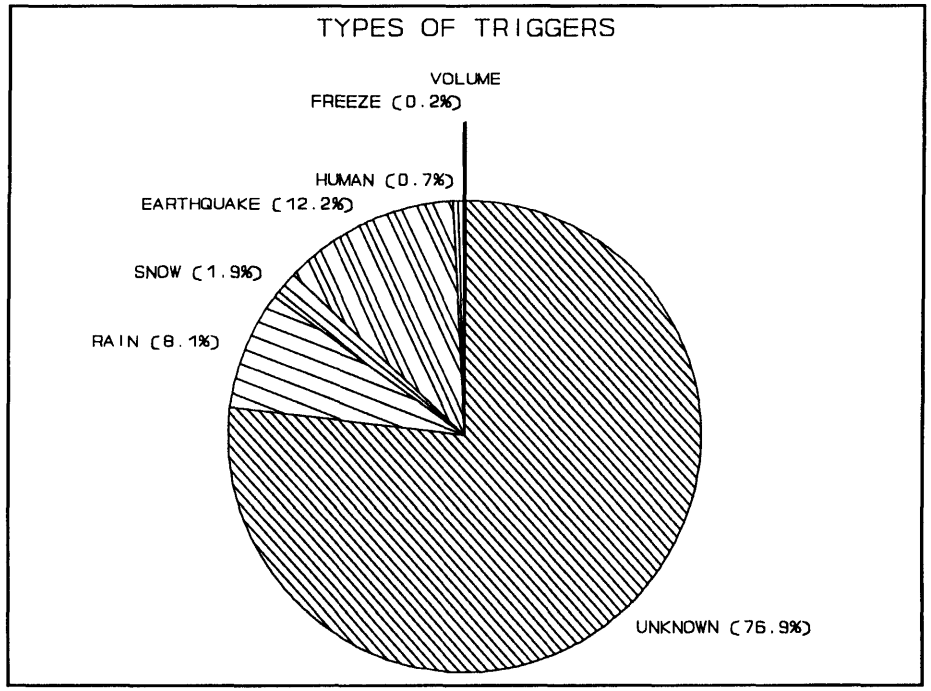

Figure 5b- Types of triggers of slope movement according to cumulative volume (in percent).

events by volume with unknown triggers (77 percent) indicates the importance of other possible causes that are difficult to observe directly or document, such as freeze-thaw cycles, slow buildup of groundwater from spring snowmelt, long-duration rainfall, or gradual processes, such as weathering and exfoliation that lead to slope failure.

Earthquakes have been identified as a significant producer of rock-fall talus in Yosemite Valley. Of rock falls having specific recognized triggering events, rock-fall volume from earthquakes is slightly greater than that from all other known causes combined. This finding fits more closely with observations of Matthes (1930, p. 106) that "to credit earthquakes with five-tenths of the total amount of rock waste in the valley" than with Muir's beliefs that "more than nine-tenths" of all the rock waste in the Sierra had been shaken down by a single strong earthquake.

The record of historical rock-fall triggering events is probably biased with respect to both time and space and does not uniformly represent the long-term distribution of events in Yosemite National Park. The relatively few reports (19) before 1900 reflect the small number of visitors to the valley and park. Most events were reported from Yosemite Valley, which reflects the greater number of visitors to this part of the park. The reports of events outside the valley are almost exclusively restricted to roads and trails. Limited travel outside the valley limits the reported number of rock falls throughout the rest of the park as compared to those observed in the valley.

Within the area of Tioga glaciation in Yosemite Valley, east of Bridalveil Moraine (pl. 1), the annual long-term volume rate of rock-fall accumulation within about the last 10,000 years after the retreat of Tioga-age glaciers is at least 1,700 m^3/yr. This minimum rate was determined by using only the five largest prehistoric rock falls in Yosemite Valley (table 7) and attributing them to having occurred during the last 10,000 years. Within the same part of Yosemite Valley, the historical (1850-1992) rock-fall accumulation rate has been about 8,700 m^3/yr. Although these rates are for vastly different lengths of time, they are comparable within an order of magnitude and might be more comparable if all smaller prehistoric rock falls and talus were included in the analysis.

Within Yosemite Valley (pl. 1), the historical volume rate of rock-fall accumulation and the average volume of rock falls per decade are shown in figure 6. Each of the first 6 decades had fewer than 10 events reported, and consequently the average volume is greater than for succeeding decades because the largest events probably were reported preferentially.

The highest peak values of rock-fall accumulation rate in the decades of 1870-80 and 1980-90 corresponded with decades of major seismic events (1872 and 1980 earthquakes), heavy storms, or unusually wet seasons (1979-80, 1981-82, 1982-83, and 1985-86). Dryer than normal conditions in the western United States, from about 1890 to 1980, generally produced lower than average volumes and accumulation rates of rock falls from climatic causes.

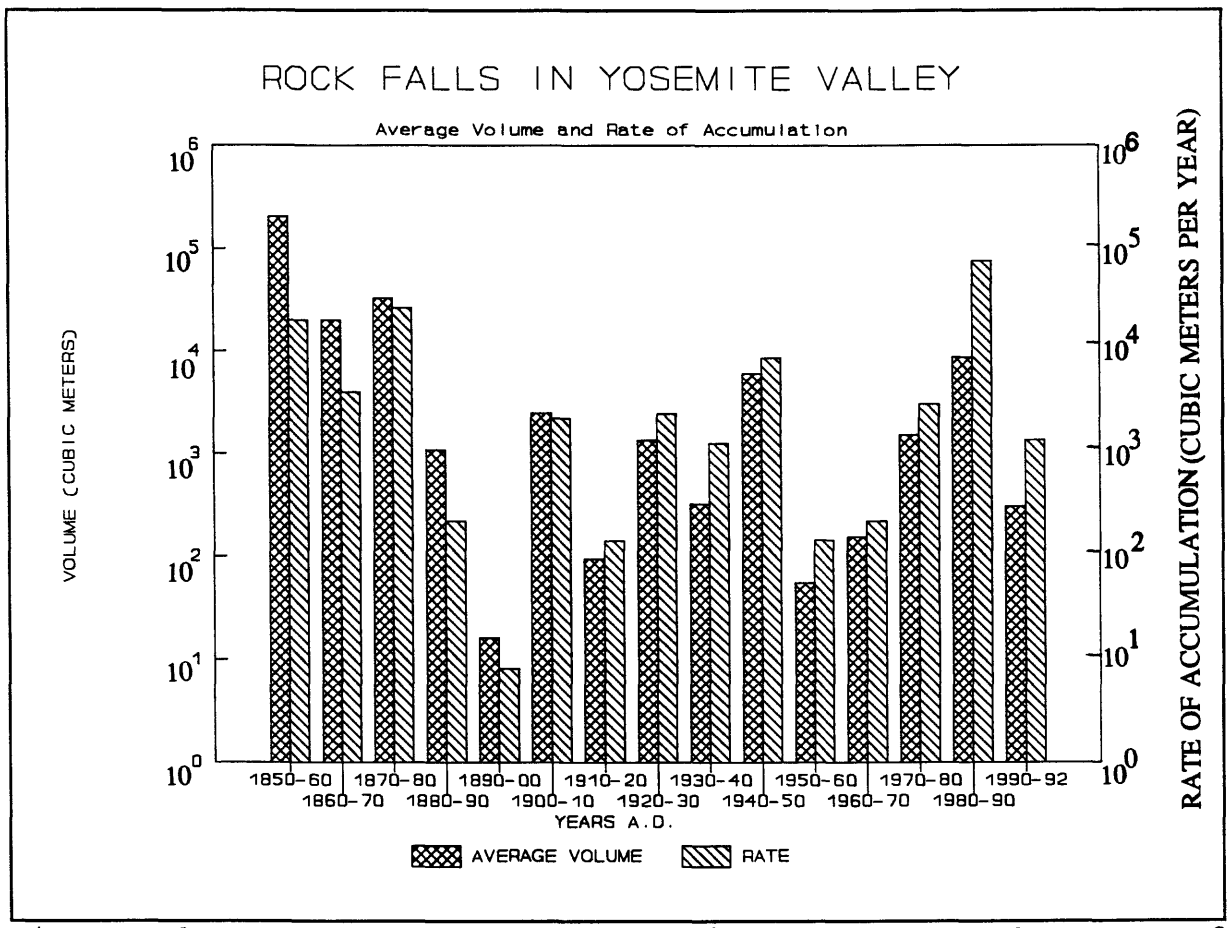

Figure 6- Rock-fall volume (cubic meters) and rate of accumulation (cubic meters per year) in Yosemite by decade within historical period of 1850-1992. Volume is plotted on a logarithmic scale.

CONCLUSIONS

This study has shown that rock falls and rock slides are the primary slope processes altering the walls of Yosemite Valley in historical time, although debris flows and debris slides have also frequently damaged trails, roads, structures, and utilities. Historically, rain-triggered failures have been most frequent, but earthquakes are the single largest producer by volume of all types of triggering events. Within Yosemite Valley, the rates of accumulation of rock-fall debris during the historical (1850-1992) and prehistoric (last 10,000 years) periods appear to be comparable to within an order of magnitude. Variations in rate of accumulation and average volume of rock falls within individual decades of the historical period fluctuate widely but reflect periods of increased seismicity and higher than normal precipitation or major storms.

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Various colleagues at the USGS assisted this project. Tom Yanosky provided equipment, mounted samples and interpreted tree-ring dendrochronology. Fred Lester prepared a catalog of earthquakes for central California. Carol Edwards scrutinized the USGS Photo Library and Field Records for the field notes and photographs of Matthes. Carmen O'Neill conducted searches for and obtained obscure references through interlibrary loan. Jim Estabrook, Linda Jacobsen, Jane Timmins, Charles Devinney, and Michelina Johnson assisted with editing, preparing base map materials and formatting computer data base release. King Huber and Ed Harp reviewed early versions of the manuscript and suggested worthwhile revisions.

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EXPLANATION-APPENDIXES 1 AND 2

Yosemite Historical Rock-Fall Inventory

List of fields including memo field of narrative information used in appendixes 1 and 2:

ID: Rock falls assigned numbers chronologically by date, with letter R representing release point, D representing point of deposition; and no letter indicating that narrative description is not clear as to whether location is a release point or point of deposition. These numbers and letters refer to locations of rock falls shown on plates 1 and 2. Plates 3 and 4 depict some numbered historical rock falls that could be accurately mapped. Modifications in chronological numbers (#11 has been removed from list and map; the date of #13 changed chronological order; and #299 describes two separate dated events at the same location, hence #299R1 and #299R2 have been assigned).

LOCATION: Geographic point of reference on published base map of plate 1 or 2. Additional local names, such as climbing routes, may be added to location in quotation marks.

DATE: Time of occurrence; year; season or month/day; time, if known. For events within a particular season or year, the chronological date was assigned as the last day of that season or year.

TYPE: Type of slope movement according to Varnes (1978).

TRIGGER: Triggering event, such as earthquake, rain, or unknown as described in text.

SIZE: Categories as defined in text: extremely small, very small, small, medium, large, very large, extremely large, and gigantic.

VOL(m3): Estimated volume in cubic meters, for extremely small size rock falls with volumes less than 1 m^3, the volume has been rounded up to 1 m^3.

GEOLOGY: Symbols of geologic units according to Calkins and others (1985) or Huber and others (1989).

DAMAGE: Types of damage categorized as damage to trails, roads, structures, or utilities; injuries or casualties; and itemized costs of damages.

CROSS REF: Original numbers for early version of rock-fall inventory as compiled by James Snyder (NPS, unpub. data, January 1990) with letter R for release point of rock fall and I impact point.

PRIME REFS: Main source(s) of information on historical rock falls. Published references are listed in text. Other sources of unpublished information may be referenced in

narrative account. The majority of the many sources of unpublished data are from the Yosemite Research Library in Yosemite National Park, Calif. However, a few Superintendent's Monthly Reports and other NPS documents from 1910 to 1924 that were missing from the research library are from the National Archives in Washington, D.C. Unpublished information on Matthes is from either the USGS Office of Photo Library and Field Records in Denver, Colo., or the Bancroft Library, University of California, Berkeley. If no published references or unpublished data are available, then written or oral communications are listed as the prime reference. If None is listed, the cross reference to James Snyder (NPS, unpub. data, January 1990) was the source of the information.

QDATE, QSIZE, QLOC: Assessment of quality of date, size and location information with 0 indicating the highest quality and 3 or 4 the lowest quality of information as described in text.

NARRATIVE: Original description(s) of rock falls except for Muir's accounts of Eagle Rock (#5D, #10D), which are given in their entirety in text.

Appendix 1 - Summary Listing of Yosemite Historical Rock Falls

01/13/93

Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
1R	rock fall	3	Middle Brother-Rocky Point	4	pre-1851	3	500000	ext. large	unknown
2R	rock fall	2	Profile Cliff	4	1857;??/??	2	200000	ext. large	unknown
3R	rock fall	2	Sentinel Rock	0	1864;11/13 late pm	3	20000	very large	rain/snow
13	rock fall	4	Cathedral Rock	4	pre-1868	2	20000	very large	unknown
4R	rock slide	3	Glacier Point	0	1870; 8/6 early pm	2	20000	very large	unknown
5D	rock fall	2	'Eagle Rock'-'Pelican Peak'	0	1872;3/26 2:30 am	2	200000	ext. large	earthquake
6R	rock fall	0	Liberty Cap	0	1872;3/26 2:30 am	1	36000	very large	earthquake
7R	rock fall	3	Sentinel Rock	0	1872;3/26 2:30 am	3	2000	large	earthquake
8	rock fall	4	Indian Canyon	0	1872;3/26 2:30 am	3	2000	large	earthquake
9	rock fall	4	Illilouette Canyon	0	1872;3/26 2:30 am	3	2000	large	earthquake
10D	rock slide	2	'Eagle Rock'-'Pelican Peak'	0	1872; 3/26 3:30 am	3	2000	large	earthquake
12R	rock fall	3	Middle Brother	1	1873; 3/12	2	20000	very large	unknown
14R	rock slide	1	Sentinel Rock-'Cooks field'	1	1886; 4/19	2	200	medium	unknown
15R	rock slide	2	Indian Canyon Trail	4	1886; Fall	2	2000	large	unknown
16D	rock slide ?	0	Glacier Point-Fourmile Trail	1	1892;5/1	2	2	very small	unknown
17D	rock slide	1	Liberty Cap-Nevada Fall Trail	1	1892;12/19	3	20	small	rain
18D	rock slide	2	Yosemite Falls Trail	1	1892;12/19	3	20	small	rain
19	rock slide	1	Union Point	1	1897;1/26	3	20	small	unknown
20D	rock slide	3	Nevada Fall Trail	4	1898-99; Winter	3	20	small	unknown
21	rock slide	3	Glacier Point-Fourmile Trail	3	1900; 4/??	3	20	small	unknown
22	rock slide	3	Glacier Point-Fourmile Trail	3	1901; 4/??	3	20	small	unknown
23D	rock fall	1	Vernal Fall Mist Trail	3	1901; 5/??	2	2	very small	unknown
24	rock slide	3	Glacier Point-Fourmile Trail	3	1901; 5/??	3	20	small	unknown
25	rock slide	3	Yosemite Falls Trail	3	1901; 5/??	3	20	small	unknown
26D	rock slide	2	Glacier Point-Fourmile Trail	4	1886-1905; 5/??	2	3	very small	unknown
27D	rock slide	1	Moran Point-Glacier Point	4	1886-1905;5-9/??	2	2000	large	unknown
28R	rock slide	1	Liberty Cap-Nevada Fall Trail	4	1907-8?; Winter	2	20000	very large	unknown
29D	rock slides	2	Yosemite Falls Trail	3	1909; 1/??	3	2000	large	unknown
30D	rock slides	4	Wawona Road- Fort Monroe	3	1909; 1/??	3	200	medium	unknown
31	rock slide	3	old Big Oak Flat Road	3	1909; 1/??	3	20	small	unknown
32	rock slide	3	El Portal Road	3	1911; 1/16-31	2	20	small	rain
33	rock slides	3	Hetch Hetchy Road	4	1912; Spring	3	20	small	unknown
34D	rock fall	2	Middle Brother-Rocky Point	3	1912; 12/??	3	200	medium	unknown
35	rock slide	4	El Portal Road-Arch Rock	1	1913; 6/4	3	200	medium	rain
36	debris slides ?	4	Wawona Road-Fort Monroe	1	1913; 6/4	3	20	small	rain
37	debris slides ?	4	old Big Oak Flat Road	1	1913; 6/4	3	20	small	rain
38	rock slide	4	Vernal and Nevada Falls Trail	3	1913; 7/??	3	20	small	rain
39	rock slide	4	El Portal Road	3	1913; late 12/??	2	200	medium	rain-snow
40D	rock slide	0	El Portal Road-'Windy Point'	3	1914; 1/??	2	2000	large	rain
41	rock slides	4	old Big Oak Flat Road	4	1914; 3-4/??	3	200	medium	unknown

Appendix 1 - Summary Listing of Yosemite Historical Rock Falls

01/13/93

Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
42	rock slide	3	Glacier Point-Fourmile Trail	4	1914; 4-5/??	2	200	medium	rain-snow ?
43	rock slides	4	Tenaya Lake Trail	4	1914; 4-5/??	3	20	small	unknown
44	debris flows	4	Yosemite Point Trail	4	1914; 4-5/??	3	20	small	unknown
45	debris flows	4	Eagle Peak Trail	4	1914; 4-5/??	3	20	small	unknown
46	rock slide	4	Hetch Hetchy Road	1	1915; 1/27	0	15	small	unknown
47	rock slides	4	El Portal Road	3	1917; 2/??	2	200	medium	rain-snow
48	debris slide	1	El Portal Road-'Devil's Elbow'	3	1917; 2-3/??	0	57	medium	snow
49	rock slides	4	El Portal Road	3	1918; 3/??	3	200	medium	rain-snow
50	debris slides ?	4	old Big Oak Flat Road	2	1918; 9/27-10/1	3	200	medium	rain
51	rock slides	4	Tioga Road-Lee Vining Canyon	2	1918; 9/27-10/1	2	200	medium	rain
52D	rock slide	2	El Portal Road-'Windy Point'	1	1918; 11/28	3	20	small	unknown
53	rock slides ?	4	El Portal Road	3	1919; 3/??	2	200	medium	unknown
54D	rock falls	3	Liberty Cap	1	1919; 5/28 pm	2	20	small	rain
55	debris slides ?	4	Glacier Point-Fourmile Trail	1	1919; 5/28 pm	3	20	small	rain
56	debris flows/slides	4	Chinquapin-Glacier Point Road	1	1919; 5/28 pm	3	20	small	rain
57	debris flow	4	Tenaya Lake Trail	1	1919; 5/28 pm	3	200	medium	rain
58R	rock slide	3	Taft Point	0	1919; 8/17 6:30 pm	2	200	medium	unknown
59D	rock slide	1	El Portal Road-'Windy Point'	3	1919; 8/??	0	8450	very large	blasting
60	rock slides	4	old Big Oak Flat Road	3	1920; 3/??	3	20	small	unknown
61D	rock fall	2	El Portal Road-'Windy Point'	3	1920; 4/??	2	2000	large	rain
62R	rock fall	3	El Capitan	0	1920; 9/28 8:30 pm	2	20	small	unknown
63D	debris slides	2	El Portal Road	0	1921; 1/28 late pm	3	20	small	rain snow
64	debris slides	4	El Portal Road	3	1921; 1/16-30	2	2000	large	rain snow
65D	rock fall	1	Middle Brother	0	1921; 9/16 1:15 pm	2	20	small	unknown
66	rock slides	4	El Portal Road	3	1921; 12/??	2	200	medium	rain snow
67D	rock slide	2	El Portal Road	3	1922; 2/??	2	2	very small	rain
68D	debris slide	1	Glacier Point-Curry Village	3	1922; 2/??	2	200	medium	rain
69	rock slides	4	El Portal Road	3	1922; 2/??	2	2000	large	rain
70	rock slides	4	El Portal Road	3	1922; 3/??	3	200	medium	rain snow ?
71D	rock fall	1	Middle Brother	0	1923;1/3,5 5:00pm	2	20000	very large	unknown
72	rock slide	2	El Portal Road-Arch Rock	3	1924; 1/??	2	20	small	unknown
73D	rock slide	2	El Portal Road-below 'Windy Point'	1	1924; 9/17	0	242	medium	construction
74	rock slide	2	old Big Oak Flat Road	3	1924; 9/??	2	200	medium	unknown
75	rock slide	2	Tenaya Lake Trail	1	1924; 11/9	3	20	small	rain
76	rock slides	4	old Big Oak Flat Road	2	1924; 11/9-10	2	20	small	rain
77	rock slide	3	old Big Oak Flat Road	3	1924; 12/??	2	200	medium	rain
78	rock slide	2	El Portal Road	1	1925; 2/5 pm	2	20	small	rain
79	debris flow	2	El Portal Road	1	1925; 2/5 pm	1	1275	large	pipeline break
80	rock slide	3	Glacier Point-Fourmile Trail	3	1925; 2/??	2	2000	large	rain
81	rock slide	3	Tenaya Lake Trail	4	1924-25; Winter	3	20	small	rain snow ?

Appendix 1 - Summary Listing of Yosemite Historical Rock Falls

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Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
82D	debris slide	1	Tuolumne Meadows	4	1924-25; Winter	2	200	medium	unknown
83	rock slides	4	El Portal Road	3	1927; 2/??	2	2000	large	rain
84	rock slides	4	El Portal Road	3	1927; late 10/??	3	200	medium	rain
85	rock slides	4	old Big Oak Flat Road	3	1927; late 10/??	2	200	medium	rain
86	rock slides	3	El Portal Road	2	1928; 3/25-31	3	20	small	rain snow
87	rock slides	4	old Big Oak Flat Road	3	1928; 4/??	3	200	medium	unknown
88	rock slides	4	El Portal Road	3	1930; 1/?? 12night	2	20	small	unknown
89D	rock slide	3	Yosemite Falls Trail-'Columbia Point'	3	1930; 1/??	2	200	medium	unknown
90	rock slide	4	Wawona Road	1	1930; 2/1	2	92	medium	rain
91	rock slides	4	El Portal Road	3	1930; 2/??	2	20	small	unknown
92	rock slide	4	old Big Oak Flat Road	3	1930; 2/??	2	200	medium	unknown
93R	rock slide	1	Yosemite Falls Trail-'Columbia Point'	1	1930; 3/17	2	200	medium	unknown
94	rock/debris slides	4	Wawona Road-Grouse Creek	3	1930; 3/??	3	20	small	unknown
95R	rock slide	0	old Big Oak Flat Road	3	1930; 7/??	3	200	medium	unknown
96D	rock slide	2	Vernal Fall-'Porcupine Spring'	1	1930; 9/8	3	20	small	unknown
97	rock slides	4	El Portal Road	3	1930; 11/??	3	20	small	rain
98	rock slides	4	El Portal Road	3	1931; 1/??	2	20	small	unknown
99	rock slide	4	Yosemite Falls Trail	2	1931; 2/24	2	2	very small	unknown
100	rock slides	4	old Big Oak Flat Road	3	1931; 2/??	2	20	small	unknown
101	rock slides	4	old Big Oak Flat Road	3	1931; 6/??	2	20	small	unknown
102	rock slides	4	El Portal Road	1	1931; 10/25	2	200	medium	rain
103	rock slides	4	El Portal Road	3	1931; 12/21-29	0	180	medium	rain
104D	rock slide	0	El Portal Road	3	1931; 12/21-29	2	20	small	rain
105D	rock slide	0	El Portal Road	3	1931; 12/21-29	2	20	small	rain
106D	rock slide	0	El Portal Road-Arch Rock	3	1931; 12/21-29	0	26	small	rain
107D	rock slides	0	El Portal Road-'Windy Point'	1	1932; 2/11	0	51	medium	unknown
108	debris slides ?	4	Glacier Point-Fourmile Trail	4	1931-32; Winter	2	20	small	spring runoff
109	rock/debris slides	4	Wawona Road-Turtleback Dome	4	1931-32; Winter	0	9182	very large	spring runoff
110	rock slump	4	Wawona Road-Grouse Creek	3	1932; 3/??	2	200	medium	construction
111R	rock slide	2	Yosemite Falls Trail	3	1932; 3/??	2	200	medium	unknown
112R	rock fall	0	Liberty Cap-Nevada Fall trail	3	1932; 4/??	2	200	medium	unknown
113	rock fall	4	Panorama Cliff	3	1932; 4/??	3	20	small	unknown
114	rock slide	4	old Big Oak Flat Road	3	1932; 4/??	2	20	small	unknown
115R	rock slide	1	old Big Oak Flat Road	3	1932; 4/??	0	1	very small	unknown
116R	rock fall	3	Indian Canyon-east wall	1	1932; 5/22 pm	2	2000	large	freeze-thaw
117D	rock fall	2	Moran Point-'Old Village'	0	1932; 5/24 4 am	2	20	small	freeze-thaw
118	rock falls	4	Indian Canyon	1	1932; 5/25 pm	3	20	small	freeze-thaw
119	rock slides	4	Glacier Point-Curry Village	1	1932; 5/25 pm	3	20	small	freeze-thaw
120R	rock slide	0	Vernal Fall-Mist Trail	3	1932; 11/??	3	2	very small	unknown
121	rock slides	4	Yosemite Valley	1	1932; 12/20	2	2	very small	earthquake

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Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
122D	rock slide	0	Wawona Road-west of tunnel	3	1933; early 3/??	0	118	medium	unknown
123D	rock slide	0	El Portal Road-Arch Rock	1	1933; 3/19	1	600	large	spring runoff
124	rock slide	4	El Portal Road-Arch Rock	1	1933; 3/23	2	2000	large	spring runoff
125D	rock slide	0	Nevada Fall Trail	4	1932-33; Winter	3	20	small	unknown
126D	rock slide	1	Vernal Fall-Mist Trail	4	1932-33; Winter	3	20	small	unknown
127D	rock slide	0	Nevada Fall Trail	4	1932-33; Winter	3	20	small	unknown
128	rock slide	4	El Portal Road	2	1933; 10/30-31	2	200	medium	rain
129	rock slides	4	El Portal Road	3	1934; early 1/??	3	20	small	unknown
130R	rock slide	1	old Big Oak Flat Road	1	1934; 11/23	2	200	medium	rain ?
131D	rock slides	1	El Portal Road-'Windy Point'	3	1935; 1/??	3	20	small	unknown
132	rock slides	4	El Portal Road	3	1935; 2/??	2	20	small	rain
133	rock slides	4	El Portal Road	3	1935; 3/??	3	20	small	unknown
134R	rock slide	0	Yosemite Falls Trail	0	1935; 4/10 12:15am	2	200	medium	unknown
135	rock slides	4	El Portal Road	3	1935; 4/??	3	200	medium	rain ?
136	debris slide	4	Wawona Road	3	1935; 4/??	3	20	small	rain ?
137D	rock slide	2	Big Oak Flat Road	1	1935; 5/25	2	200	medium	blasting
138D	rock slide	1	Wapama Falls	3	1935; early 7/??	2	20000	very large	unknown
139R	rock slide	1	Yosemite Falls Trail	3	1936; 2/1-7	2	20	small	rain ?
140	rock/debris slides	4	Wawona Road	3	1936; 2/??	2	200	medium	rain ?
141R	debris slide	1	Wawona Road-Grouse Creek	3	1936; 3/??	3	200	medium	unknown
142	rock slides	3	El Portal Road	3	1936; 4/??	3	20	small	blasting
143R	debris slide	1	Wawona Road-Grouse Creek	3	1936; 4/??	3	2000	large	unknown
144	debris slides	3	El Portal Road	3	1936; 4/??	3	200	medium	pipeline break
145	rock slide	4	Yosemite Falls Trail	3	1936; 5/??	2	200	medium	unknown
146R	debris flow	0	Big Oak Flat Road-Cascades	1	1937; 2/5	2	2000	large	rain
147	debris slides	4	Wawona Road	1	1937; 2/5	2	20	small	rain
148R	debris flow	0	Big Oak Flat Road	1	1937; 2/16?	3	20	small	rain
149D	rock slide	0	Glacier Point-Fourmile Trail	4	1936-37; Winter	2	200	medium	unknown
150D	rock slide	0	Medial Moraine	3	1937; 3/??	0	140	medium	unknown
151R	debris flows	0	Big Oak Flat Road-El Portal Road	1	1937; 12/11	2	2000	large	rain
152D	rock slides	4	Hetch Hetchy Reservoir	1	1937; 12/11	2	200	medium	rain
153D	debris flow	0	Curry Village-'Ash Can Slide'	2	1937; 12/9-12	2	765	large	rain
154D	rock slide	1	Wawona Road-Washburn Slide	2	1937; 12/9-12	2	200	medium	rain
155D	rock slide	0	Wawona Road-Bridalveil Fall	2	1937; 12/9-12	3	20	small	rain
156D	debris flow	1	Illilouette Gorge	2	1937; 12/9-12	3	2000	large	rain
157D	rock slide	1	Wawona Road	2	1937; 12/9-12	2	200	medium	rain
158	debris slides	4	Yosemite Valley	3	1938; 2/??	3	200	medium	rain ?
159D	debris slump	2	Wawona Road-Washburn Slide	0	1938; 5/14 6 pm	3	200	medium	unknown
160D	rock slide	1	Glacier Point-Happy Isles	1	1938; 8/2	3	200	medium	unknown
161D	rock slide	2	Royal Arch Cascade	1	1938; 8/28	3	20	small	unknown

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Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
162D	rock slides	4	Vernal Fall Trail	4	1938-39; Winter	2	20	small	unknown
163	rock slide	4	old Big Oak Flat Road	4	1939-40; Winter	3	200	medium	unknown
164D	rock slide	0	Sentinel Rock	3	1940; 3/??	2	2000	large	unknown
165R	rock slide	1	Red Peak Pass Trail	4	1939-40; Winter	3	200	medium	unknown
166D	rock slide	1	Church Bowl	3	1941; 2/??	3	20	small	unknown
167	earth slump	4	Wawona Road	3	1941; 2/??	3	200	medium	unknown
168D	rock slide	1	old Big Oak Flat Road	3	1941; 3/??	0	42	small	unknown
169D	rock slide	1	Wawona Road	3	1941; 3/??	3	20	small	unknown
170D	rock slide ?	3	Wawona Road	3	1941; 3/??	3	200	medium	unknown
171	rock slides ?	4	Yosemite Valley	1	1941; 10/2	3	200	medium	wind storm
172D	rock slide	1	Big Oak Flat Road	1	1942; 4/21	0	864	large	unknown
173D	rock slide	1	Castle Cliffs	3	1942; 4/??	0	83	medium	unknown
174D	rock slide	2	Big Oak Flat Road-El Portal Road	0	1943; 3/19 12:50am	3	20000	very large	unknown
175	rock slides	4	El Portal Road-Arch Rock	1	1945; 2/2	2	200	medium	unknown
176R	rock slide	1	old Big Oak Flat Road	3	1945; 5/??	2	20000	very large	unknown
177	debris slide	1	Tuolumne Meadows	4	1946; Spring	0	460	medium	unknown
178	rock slides	4	Big Oak Flat Road	1	1946; 11/8	3	20	small	rain
179	rock slides	4	Glacier Point Road-Badger Pass	1	1946; 11/8	3	20	small	rain
180	rock slide	4	Yosemite Falls Trail	1	1946; 11/8	2	200	medium	rain
181	rock slides	4	Tioga Road	1	1946; 11/8	3	200	medium	rain
182	rock slides	4	Glacier Point-Fourmile Trail	3	1946; 11/?	3	20	small	unknown
183D	rock fall	0	Big Oak Flat Road	3	1947; 2/??	1	1	very small	unknown
184R	rock fall	0	Lake Eleanor-Hetch Hetchy Road	3	1947; 10/??	2	200	medium	unknown
185D	rock slide	2	Glacier Point Road-'Mono Grade'	3	1948; 1/??	2	2000	large	unknown
186	rock slides	4	El Portal Road	3	1948; 1/??	3	200	medium	unknown
187	rock slides	4	Yosemite Valley	3	1948; 3/??	2	2000	large	unknown
188	rock slides	4	Yosemite Valley	3	1947-48; Winter	3	200	medium	unknown
189D	rock slide	1	El Portal Road-Coulterville Road	3	1948; 4/??	2	200	medium	unknown
190D	rock slide	0	Big Oak Flat Road	3	1948; 4/??	2	2000	large	unknown
191	rock slide	4	El Portal Road	3	1948; 10/??	3	20	small	unknown
192	rock slide	4	El Portal Road	3	1949; 2/??	2	20	small	unknown
193	rock slide	4	Wawona Road	3	1949; 2/??	3	20	small	unknown
194D	rock slide	2	Glacier Point-'Ledge Trail'	3	1949; 7/??	2	3	very small	unknown
195R	rock slide	1	Sentinel Creek	0	1949; 10/23 1:40pm	2	20000	very large	unknown
196R	rock fall	1	Sentinel Rock	0	1949; 10/23 1:40pm	2	20000	very large	unknown
197R	debris slide	1	Big Oak Flat Road	1	1950; 1/5	0	138	medium	unknown
198D	rock slide	2	Yosemite Falls Trail	3	1950; 7/??	0	23	small	unknown
199	debris flow	4	Yosemite Valley Trails	2	1950; 11/13-18	0	100	medium	rain/snow
200D	rock fall	4	Liberty Cap-Clark Point	2	1950; 11/13-18	0	4	very small	rain/snow
201R	rock slide	1	El Portal Road-'Windy Point'	1	1951; 3/31	1	765	large	blasting

Appendix 1 - Summary Listing of Yosemite Historical Rock Falls

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Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
202D	rock slide	1	Clark Point-Mist Trail junction	1	1951; 4/22	1	12	small	unknown
203R	rock slides	0	El Portal Road-'Windy Point'	3	1951; 4/??	3	200	medium	construction
204D	rock slide	1	Yosemite Falls Trail	3	1951; 6/??	2	2	very small	unknown
205D	rock slide	1	Moraine Dome	1	1951; 8/24	0	15	small	unknown
206D	rock slide	0	Arch Rock	3	1952; 1/??	3	20	small	unknown
207	rock slides	4	El Portal Road	3	1952; 3/??	3	200	medium	unknown
208	rock slides	3	Tenaya Lake Trail- 'Tenaya Zigzags'	4	1951-52; Winter	0	84	medium	unknown
209D	rock slide	4	Vernal Fall Trail	4	1951-52; Winter	2	3	very small	unknown
210D	rock slide	0	Clark Point-'Nevada Fall Horse Trail'	3	1952; 8/??	0	5	very small	unknown
211D	rock slide	1	Nevada Fall Trail	3	1952; 8/??	0	17	small	unknown
212R	rock falls	0	Wawona Tunnel-west entrance	3	1953; 4/??	0	153	medium	construction
213D	rock slide	1	Big Oak Flat Road	3	1954; 3/??	2	20	small	unknown
214	rock slides	4	Yosemite Falls Trail	4	1953-54; Winter	2	20	small	unknown
215R	rock slide	0	Clark Point-Nevada Fall Trail	1	1954; 6/21	1	2	very small	unknown
216	rock slide	4	Mirror Lake	0	1954;10/30 10:44pm	3	20	small	earthquake ?
217	rock slide	2	El Portal Road	0	1955; 2/2 5:30pm	3	20	small	unknown
218D	rock fall	1	Sierra Point Trail	1	1955; 5/15	3	1	ext. small	unknown
219D	debris flow	1	Liberty Cap-Nevada Fall Trail	1	1955; 12/23	3	200	medium	rain/snow
220	rock slides	4	Yosemite Falls Trail	1	1955; 12/23	2	20	small	rain/snow
221	rock slide	4	Tenaya Lake Trail-'Tenaya Zigzags'	1	1955; 12/23	3	20	small	rain/snow
222D	debris flow	3	Mirror Lake Trail	1	1955; 12/23	0	153	medium	rain/snow
223D	debris flow	2	Happy Isles	1	1955; 12/23	0	31	small	rain/snow
224	debris flows/flood?	4	Yosemite Valley	1	1955; 12/23	0	421	medium	rain/snow
225	debris flows/flood?	4	Yosemite Valley	1	1955; 12/23	0	50	medium	rain/snow
226D	rock slide	1	Arch Rock	1	1955; 12/23	2	200	medium	rain/snow
227D	debris slide	1	Jack Main Canyon	3	1955; 12/23	2	2000	large	rain/snow
228	rock slides	4	Tioga Road	3	1955; 12/23	3	200	medium	rain/snow
229D	rock slide	2	El Portal Road-Arch Rock	1	1956; 1/14	3	20	small	unknown
230D	rock slide	0	El Portal Road-'Windy Point'	3	1956; 6/??	0	77	medium	unknown
231D	rock fall	1	Sierra Point Trail	1	1957; 3/24	2	1	ext. small	unknown
232	rock slide	4	Wawona Road	3	1958; 3/??	0	230	medium	snow ?
233	debris slide	4	El Portal Road	3	1958; 3/??	0	383	medium	snow ?
234D	rock slide	0	Nevada Fall Trail	3	1958; 5/??	3	20	small	unknown
235D	rock fall	1	Union Point-Glacier Point	3	1958; 12/??	3	2	very small	unknown
236D	rock fall	1	Glacier Point-Fourmile Trail	1	1960; 3/22	2	2	very small	unknown
237	rock slide	4	El Portal Road	1	1960; 4/23	2	2000	large	unknown
238D	rock slide	1	Wapama Falls	4	1961; early Spring	3	20	small	unknown
239D	rock slide	2	Middle Brother	0	1962; 11/17 4:10pm	2	20	small	unknown
240D	rock slide	2	Middle Brother	2	1963; 1/31-2/3	3	200	medium	rain
241D	debris flow	3	Mirror Lake Trail	3	1963; early 2/??	0	230	medium	rain

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Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
242D	debris flow	2	Happy Isles Trail	2	1963; early 2/??	0	77	medium	rain
243D	rock slide	3	Yosemite Falls Trail	3	1963; 3/??	0	23	small	unknown
244D	rock slides	4	Vernal Fall Trail	3	1963; 3/??	2	20	small	unknown
245	rock slide	4	El Portal Road	1	1963; 4/17 am	0	207	medium	unknown
246	rock slide	3	El Portal Road	1	1963; 4/20 pm	3	200	medium	unknown
247D	rock fall	1	El Portal Road-'Windy Point'	3	1963; 4/??	3	20	small	unknown
248	rock slide	4	Tioga Pass-Lee Vining Grade	1	1963; 6/7	2	200	medium	unknown
249D	rock slide	1	May Lake Trail	4	1963; Spring	2	2	very small	unknown
250D	rock slide	1	Jack Main Canyon	4	1963; Spring	0	1	ext. small	unknown
251D	rock slide	1	Piute Creek	4	1964; Spring ?	0	1	ext. small	unknown
252R	rock slide	1	Glacier Point-Fourmile Trail	3	1965; 5/??	3	20	small	unknown
253D	debris flow	1	Panorama Cliff-Nevada Fall Trail	3	1965; 7/??	2	200	medium	rain
254D	rock slide	1	Glacier Point-Fourmile Trail	4	1966; Spring	3	20	small	unknown
256D	rock slide	1	Nevada Fall Horse Trail	4	1967; Spring	2	9	small	unknown
257D	rock slide	1	Sierra Point Trail	4	1967; Spring	2	20	small	unknown
258R	rock fall	0	Panorama Point	4	1967-68;7-8/?;11am	2	1500	large	unknown
259D	rock slide	3	Yosemite Falls Trail	4	1968; ??/??	2	20	small	unknown
255D	rock slide	1	Sierra Point Trail	4	1970;Winter-spring	2	20	small	unknown
260R	rock slide	0	Elephant Rock-'Steamboat Bay'	4	1971;mid-Winter	2	24000	very large	unknown
261R	rock slide	1	Moran Point-'Le Conte Gully'	4	1970-71; Winter	3	200	medium	unknown
262R	rock slide	1	Rogers Canyon	4	1971; Spring	0	15	small	unknown
263R	rock fall	1	Union Point-'Chapel Wall'	4	1971?; ??/??	1	160	medium	unknown
264D	rock slide	3	Yosemite Falls Trail	4	1972; Spring	2	20	small	unknown
265D	rock slide	1	Sierra Point Trail	4	1973; Spring	2	20	small	unknown
266R	rock slide	1	Yosemite Falls Trail	3	1973; 6/??	2	20	small	unknown
267R	rock fall	0	Liberty Cap-Nevada Fall Trail	3	1973; 6/??	2	200	medium	unknown
268R	rock slide	0	Nevada Fall Trail	4	1974; Spring	2	20	small	unknown
269D	rock slide	0	Glacier Point-Fourmile Trail	4	1974; Spring	3	20	small	unknown
270R	rock slide	1	Tiltill Creek	4	1975;Winter-Spring	2	20	small	unknown
271D	rock slide	1	Wapama Falls	4	1975; Spring	2	20	small	unknown
272D	rock fall	1	El Capitan-'The Footstool'	4	1976?	1	510	large	unknown
273R	rock fall	1	Bunnell Point	4	1977; Spring	0	2	very small	unknown
299R1	rock fall	0	Upper Yosemite Falls	4	1977; Spring?	1	2280	large	rain
274R	rock slide	1	Yosemite Falls Trail	4	1977; Spring	3	20	small	unknown
275R	rock fall	0	Illilouette Fall	4	1977; Spring	2	2	very small	unknown
276R	rock fall	0	Panorama Point	4	1977; Spring	1	3000	large	unknown
277D	rock slide	3	Yosemite Falls Trail	4	1977; Spring	2	20	small	unknown
278R	rock slide	1	Glacier Point-Fourmile Trail	4	1977; Spring	2	20	small	unknown
279R	rock slide	1	El Capitan-'Horsetail Falls'	4	1976-77	3	200	medium	unknown
280D	rock slide	1	Wapama Falls	4	1978; Spring	2	2000	large	unknown

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Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
281R	rock slide	0	Yosemite Falls Trail	4	1978; Spring	2	20	small	unknown
282R	rock slide	1	Half Dome	3	1978; 9/??	3	20	small	unknown
283R	rock fall	1	Castle Cliffs	0	1980; 1/12 6:17 am	2	2000	large	rain
284	debris flows	1	Castle Cliffs	0	1980; 1/12 11:00am	2	200	medium	rain
285D	rock slide	2	Big Oak Flat Road	0	1980; 1/13 9:00 pm	3	20	small	rain
286D	rock slide	0	Sentinel Rock	2	1980; 1/12-13	2	200	medium	rain
287	rock slide	3	Wawona Campground	0	1980; 1/13 11:59pm	3	200	medium	rain
288R	rock fall	1	Sierra Point-Happy Isles Trails	1	1980; 5/25	2	200	medium	earthquake
289	rock fall	4	Cathedral Spires	0	1980; 5/25 9:00am	3	200	medium	earthquake
290D	rock fall	2	Arch Rock	0	1980; 5/27 7:51 am	2	200	medium	earthquake
291D	rock fall	0	Glacier Point-Fourmile Trail	1	1980; 5/27	3	20	small	earthquake
292R	rock fall	0	Clark Point- Nevada Fall Trail	1	1980; 5/27	2	2	very small	earthquake
293R	rock slide	1	Sentinel Creek	1	1980; 5/27	2	2000	large	earthquake
294R	rock fall	1	Castle Cliffs	1	1980; 5/27	1	8	small	earthquake
295	rock slide	3	Pulpit Rock	2	1980; 5/25-27	3	20	small	earthquake
296R	rock slide	1	North Dome	2	1980; 5/25-27	3	200	medium	earthquake
297R	rock slide	1	Half Dome	4	1980; Spring	3	2	very small	unknown
298R	rock fall	0	Clark Point- Mist Trail	1	1980; 10/4	2	200	medium	unknown
299R2	rock fall	0	Upper Yosemite Fall	0	1980;10/6 1-1:30pm	1	1	very small	unknown
300	rock slide	3	Royal Arches	1	1980; 10/7	3	20	small	unknown
301R	rock fall	0	Yosemite Falls Trail	0	1980;11/16 12:06pm	1	1500	large	freeze-thaw
302D	rock slide	1	El Portal Road	1	1981; 3/3 ?	3	2	very small	unknown
303R	debris flow	1	El Portal Road	0	1981; 3/4 4:30 pm	2	200	medium	pipeline break
304R	rock slide	0	Elephant Rock-'Steamboat Bay'	4	1980-81?; Winter	2	24000	very large	rain
305R	rock fall	1	Sierra Point	0	1981; 4/9 5:50 pm	0	104	medium	blasting
306R	rock slide	1	Hetch Hetchy-Lake Eleanor Road	4	1981;Winter-spring	2	20	small	unknown
307R	rock fall	1	Yosemite Falls Trail	0	1981; 5/8 2:32 pm	0	173	medium	blasting
308R	rock slide	1	Glacier Point-Fourmile Trail	3	1981; 5/??	2	2	very small	unknown
309D	debris flow	2	Chilnualna Fall Trail	4	1981; Spring	2	200	medium	rain ?
310R	rock fall	1	Cathedral Rock	3	1981; late 11/??	2	200	medium	unknown
311R	rock slide	0	old Coulterville Road-'Cookie'	0	1982; 4/3 10:20pm	1	100000	ext. large	rain
312R	debris slide	1	Hodgdon Meadow-Hwy 120	1	1982; 4/4	2	200	medium	rain
313R	rock slide	0	old Coulterville Road	0	1982; 4/8 1:10pm	0	1730	large	blasting
314R	rock fall	0	Yosemite Falls Trail	1	1982; 6/10	0	0	ext. small	unknown
315R	rock fall	0	Yosemite Falls Trail	0	1982; 10/25 4 am	0	38	small	rain
316R	rock fall	0	Yosemite Falls Trail	0	1982;10/26 12:01am	3	249	medium	rain
317R	rock slide	1	Grand Canyon of Tuolumne	4	1982; Fall	2	1	very small	rain ?
318R	rock slide	1	Grand Canyon of Tuolumne	4	1982; Fall	0	1	ext. small	rain ?
319R	rock slide	1	West Quarter Dome	4	1982?; Winter	3	200	medium	unknown
320R	rock fall	0	Clark Point-Mist Trail	4	1982-83; Winter	1	1	very small	unknown

Appendix 1 - Summary Listing of Yosemite Historical Rock Falls

01/13/93

Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
321R	debris slide	2	Sentinel Creek	0	1983; 5/20 4:30 pm	2	2000	large	unknown
322R	rock slide	1	Glacier Point Road-Badger Pass	4	1983;Winter-spring	0	25	small	unknown
323R	rock slide	1	Benson Pass-Smedberg Lake	4	1983, Spring	0	1	very small	unknown
324R	rock slide	0	Glacier Point- 'Ledge Trail'	1	1984; 5/1	3	20	small	unknown
325R	rock slide	0	Glacier Point-Fourmile Trail	4	1984; Spring	0	2	very small	unknown
326R	rock slide	1	Glacier Point-Fourmile Trail	4	1984; Spring	0	1	very small	unknown
327	debris flow	2	Tenaya Lake Trail	1	1984; 7/17 pm	2	200	medium	rain
328D	rock fall	0	Sentinel Rock	1	1984; 10/12	2	20	small	unknown
329R	rock fall	0	Yosemite Falls Trail	4	1984; Fall	0	7	small	unknown
330R	rock slide	1	Hetch Hetchy-Lake Eleanor Road	1	1985; 2/23	2	20	small	unknown
331D	rock slide	1	Wapama Falls	3	1985; 2/??	3	200	medium	unknown
332D	debris flow	1	Sentinel Creek	3	1985; 3/??	2	2000	large	rain
333R	rock slide	2	Glacier Point	3	1985; 4/??	3	20	small	unknown
334R	rock fall	0	Yosemite Falls Trail	0	1985; 7/20 5:30 am	2	20	small	rain
335R	rock fall	0	Yosemite Falls Trail	1	1985; 9/25	1	9	small	unknown
336D	debris slide	1	Sentinel Rock	1	1985; 10/7	2	200	medium	rain
337R	rock slide	0	Glacier Point-'Ledge Trail'	0	1985;11/21 8:30 pm	3	20	small	rain
338R	rock slide	0	Middle Brother-'Rixon's Pinnacle'	0	1985;11/29 7:30 am	2	2000	large	unknown
339D	debris flow	2	Taft Point-Southside Drive	3	1985; 11/??	2	200	medium	rain
340R	rock slide	0	Middle Brother-'Rixon's Pinnacle'	1	1985; 12/8	2	200	medium	unknown
341D	rock slide	3	Castle Cliffs	0	1986; 1/30 8:50 am	2	20	small	rain
342R	rock slide	0	Sierra Point-Vernal Fall Trail	0	1986; 2/7 1:20 pm	0	104	medium	rain ?
343R	rock slide	0	Sierra Point-Vernal Fall Trail	0	1986; 2/13 4:30 pm	0	415	medium	rain
344	debris flow	1	Glacier Point-Curry Village	1	1986; 2/18 late pm	2	2000	large	rain
345R	debris flow	1	Clark Point-'Porcupine Spring'	2	1986; 2/17-19	2	2000	large	rain
346D	debris slides	3	Sentinel Creek	2	1986; 2/17-19	2	2000	large	rain
347D	debris flow	3	Half Dome-Mirror Lake Trail	2	1986; 2/17-19	2	200	medium	rain
348D	debris flow	1	Sentinel Creek	2	1986; 2/17-19	2	4500	large	rain
349D	debris flow	1	Sentinel Creek-Cathedral Spires	2	1986; 2/17-19	3	200	medium	rain
350D	debris flow	1	Profile Cliff-Taft Point	2	1986; 2/17-19	3	200	medium	rain
351D	rock slide	0	El Portal Road-'Windy Point'	2	1986; 2/17-19	3	200	medium	rain
352D	debris slide	1	Union Point	2	1986; 2/17-19	3	20	small	rain
353D	debris flow	1	Grand Canyon of Tuolumne	2	1986; 2/17-19	2	200	medium	rain
354R	rock slide	0	Sierra Point-Vernal Fall Trail	1	1986; 3/8	0	691	large	rain
355D	rock fall	0	Glacier Point-Fourmile Trail	3	1986; 3/??	0	4	very small	rain
356R	rock fall	0	Glacier Point-Fourmile Trail	3	1986; 3/??	0	2	very small	rain
357D	debris flows	0	'Lower' Cathedral Rock	4	1986; 2-3/??	2	60	medium	rain
358D	rock slide	2	Yosemite Falls Trail	1	1986; 4/2	2	20	small	rain
359R	rock fall	0	Glacier Point-Fourmile Trail	3	1986; early 4/??	0	2	very small	rain ?
360R	rock fall	0	Castle Cliffs-Yosemite Point	0	1986; 5/6 noon	1	31	small	unknown

Appendix 1 - Summary Listing of Yosemite Historical Rock Falls

01/13/93

Id	Type	Qloc	Location	Qdate	Date	Qsize	Volume	Size	Trigger
361R	rock fall	1	Arrowhead Spire	0	1986; 5/27 5:23 am	2	200	medium	unknown
362R	rock fall	1	Arrowhead Spire	0	1986; 5/28 5:33 am	2	20	small	unknown
363R	rock slide	1	Castle Cliffs	4	1986; Spring	2	200	medium	unknown
364R	rock slide	1	Bunnell Point	4	1986; 5-6/??	0	1	very small	unknown
365R	rock fall	0	Middle Brother	0	1987; 3/10 2:47 pm	1	600000	ext. large	unknown
366R	rock fall	0	Tenaya Lake Trail	1	1987; 4/12 midday	0	118	medium	snowmelt ?
367R	rock slide	0	Union Point-Fourmile Trail	1	1987; 4/16	0	2	very small	snowmelt
368R	rock slide	0	Liberty Cap-Nevada Fall	1	1987; 5/2	0	102	medium	rain ?
369R	rock slide	0	Tenaya Lake Trail	0	1987; 6/3 3:10 pm	0	15	small	blasting
370R	rock fall	1	Middle Brother	1	1987; 8/10-12	2	20	small	unknown
371R	rock fall	0	North Dome-Mirror Lake Trail	1	1987; 9/1	2	2000	large	unknown
372	rock fall	2	Sentinel Rock	1	1987; 9/1	2	20	small	unknown
373D	rock fall	0	Panorama Cliff	3	1987; early 12/??	1	1	very small	freeze-thaw
374R	rock fall	0	Sierra Point-Vernal Fall Trail	0	1988; 8/23 3:30 pm	0	1	very small	unknown
375R	rock slides	0	Half Dome	0	1988; 9/18 1:40 pm	0	3	very small	unknown
376R	rock fall	0	Half Dome	0	1988; 9/18 4:15 pm	0	1	very small	unknown
377R	rock slide	0	Big Oak Flat Road	3	1989; 1/21-28	0	1	very small	rain
378	rock fall	0	Big Oak Flat Road	0	1989;2/14 10:30 pm	0	142	medium	unknown
379D	debris flows	3	Half Dome-Mirror Lake Trail	1	1989; 3/5 late pm	2	200	medium	rain
380R	rock slide	1	Tueeulala Falls	1	1989; 3/15	1	44	small	rain
381	rock slide	3	Sentinel Rock	1	1989;3/29 early pm	3	2	very small	unknown
382R	rock fall	0	Panorama Cliff	3	1989; 4/??	2	69	medium	unknown
383R	rock fall	1	Union Point	4	1989; Spring	0	2	very small	unknown
384R	rock fall	0	Middle Brother	0	1989; 7/25 6:13 pm	2	2	very small	unknown
385R	rock fall	2	'Lower' Cathedral Rock	4	1989; ??/??	3	200	medium	unknown
386R	rock fall	0	North Dome-Mirror Lake	0	1990;4/23 early am	1	2	very small	rain
387D	rock slides	1	Big Oak Flat Road	0	1990;10/23 11:15p	1	518	large	earthquake
388D	rock slide	1	Big Oak Flat Road-El Portal Road	0	1990;10/23 11:15p	2	20	small	earthquake
389	rock falls	4	Indian Canyon	0	1990;10/23 11:15p	3	20	small	earthquake
390	rock slide	4	Lee Vining Canyon-Tioga Road	0	1990;10/23 11:15p	3	20	small	earthquake
391R	rock fall	1	Glacier Point	3	1990; late 10/??	2	20	small	unknown
392R	rock fall	0	Middle Brother	0	1992; 2/18 10:45pm	1	173	medium	rain
393	debris slump	3	The Rostrum-Elephant Rock	4	1991-92; Winter	3	200	medium	unknown
394D	debris flow	0	Royal Arch Cascade-Ahwahnee Hotel	1	1992; 7/14 pm	0	675	large	rain
395R	rock fall	0	Yosemite Point	0	1992; 7/24 6:05am	2	1100	large	unknown

01/13/93

ID: 1R
LOCATION: Middle Brother-Rocky Point DATE: pre-1851

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: ext. large VOL(m3): 500000 GEOLOGY: Ks QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #1R QLOC: 3

PRIME REF: Bunnell (1911, p. 151)

NARRATIVE: Before 1851: A rock slide from Middle Brother at Rocky Point was described by Bunnell (1911) this way: We "found the trail obstructed by a mass of what then appeared to be recently fallen rocks ... The obstructing rocks on the old north side trail were known as 'We-ack,' 'The Rocks,' and understood to mean the 'fallen rocks' because, according to traditions they had fallen upon the old trail."

According to Jim Snyder, the size could easily have been greater than "very large". The trail undoubtedly was out closer to the river around the talus cone. Because rock fall debris had to come as far as it did in 1987, this rock fall would have been no less than very large and could easily have been gigantic.

ID: 2R
LOCATION: Profile Cliff DATE: 1857;??/??

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: ext. large VOL(m3): 200000 GEOLOGY: Kt? QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 2

PRIME REF: Hutchings (1886, p. 412-3)

NARRATIVE: According to Hutchings (1886): "Among these, however, one point stands out somewhat prominently, known as Profile or Fissure Mountain. ... The crown of this bluff is nearly three hundred feet higher than any of its illustrious compeers in this immediate vicinity ... A little northerly of this is a light-colored spot, whence, in 1857, a chip fell, the debris from which was said to cover over thirty acres."

ID: 3R
LOCATION: Sentinel Rock DATE: 1864;11/13 late pm

TYPE: rock fall TRIGGER: rain/snow QDATE: 0

SIZE: very large VOL(m3): 20000 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 2

PRIME REF: King (1872)

NARRATIVE: From Clarence King (1872): "Rocks, loosening themselves from the plateau, came thundering down precipice-faces, crashing upon debris piles and forest groups below. Sleet and snow and rain fell fast, and the boom of falling trees and crashing avalanches followed one another in an almost uninterrupted roar. In the Sentinel gorge, back of our camp, an avalanche of rock was suddenly let loose, and

came down with a harsh rattle, the boulders bounding over debris piles and tearing through the trees by our camp [at 'Black's Hotel']."

ID: 13
LOCATION: Cathedral Rock DATE: pre-1868

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: very large VOL(m3): 20000 GEOLOGY: ? QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 4

PRIME REF: Whitney (1868, p. 78)

NARRATIVE: From Whitney (1868): "We see that fragments of rock are loosened by rain, frost, gravity, and other natural causes, along the walls, and probably not a winter elapses that some great mass of detritus does not come thundering down from above, adding, as it is easy to see from actual inspection of those slides which have occurred within the past few years, no inconsiderable amount to the talus. Several of these great rock-avalanches have taken place since the Valley was inhabited. One which fell near Cathedral Rock is said to have shaken the Valley like an earthquake."

ID: 4R
LOCATION: Glacier Point DATE: 1870; 8/6 early pm

TYPE: rock slide TRIGGER: unknown QDATE: 0

SIZE: very large VOL(m3): 20000 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 3

PRIME REF: Le Conte (1875, p. 45)

NARRATIVE: From Le Conte (1875) August 6 [1870]: "In the afternoon we moved camp ... Soon after leaving camp, Soule and myself, riding together, heard a hollow rumbling, then a crashing sound. "Is it thunder or earthquake?" Looking up quickly, the white streak down the cliff of Glacier Point, and the dust there, rising from the valley, revealed the fact that it was the falling of a huge rock mass from Glacier Point."

ID: 5D
LOCATION: 'Eagle Rock'-'Pelican Peak' DATE: 1872;3/26 2:30 am

TYPE: rock fall TRIGGER: earthquake QDATE: 0

SIZE: ext. large VOL(m3): 200000 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: Snyder #7I QLOC: 2

PRIME REF: Kneeland (1872); Clark (1872)

NARRATIVE: From a May 4, 1872 letter from Galen Clark as a result of the March 26, 1872 earthquake, 'Pelican Peak', just back of Hutchings Hotel, fell with a terrible crash, scattering immense masses of boulders around, but did no damage to any of the houses in the vicinity."

In Kneeland (1872) is an earthquake comment from John Muir "'Eagle Rock' had fallen from a height of 2000 feet, and was pouring an avalanche of boulders over precipices, and through the forests of firs and spruces, filling the Valley with dust and with countless reverberations."

In the April 12, 1872, issue of the Mariposa Gazette, Peter Gordon (1872) reported that ..." A portion of 'Pelican Peak', on the south side of the Valley tumbled down, huge rocks came crashing down the precipitous heights, cutting off fir trees in their path three or four feet in diameter."

The lengthy account of this event by Muir (1912) is given in main text of this report.

ID: 6R
LOCATION: Liberty Cap DATE: 1872;3/26 2:30 am

TYPE: rock fall TRIGGER: earthquake QDATE: 0

SIZE: very large VOL(m3): 36000 GEOLOGY: Khd QSIZE: 1

DAMAGE: structure CROSS REF: Snyder #8R QLOC: 0

PRIME REF: Clark (1872); Kneeland (1872)

NARRATIVE: From a May 4, 1872 letter from Galen Clark "A large mass of rocks, which would weigh thousands of tons fell from the west side of the 'Cap of Liberty' about a thousand feet above its base. When this great mass of rocks struck the earth Mr. Snow says he was instaneously thrown prostrate to the ground. The house, which stands on the solid bed rock which has an incline of about twenty degrees to the eastward towards the Cap of Liberty and Nevada Falls, has moved two inches to the east. An addition to the house, which was built last Fall, was so badly wrecked and shattered as to have to be taken down and rebuilt. The earth around Snow's place is still completely covered with dust from the pulverized rocks. I think that the prostration of Mr. Snow, and perhaps the moving of the main house and the wrenching apart of the timbers of the addition, was probably more the result of the concussion of the atmosphere when the rocks fell than the effects of the shake."

In Kneeland (1872) is an earthquake comment of John Muir "other avalanches occurred ... on the west side of the Cap of Liberty."

ID: 7R
LOCATION: Sentinel Rock DATE: 1872;3/26 2:30 am

TYPE: rock fall TRIGGER: earthquake QDATE: 0

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #11 QLOC: 3

PRIME REF: Wolfe (1938)

NARRATIVE: In Wolfe (1938) Muir notes yet another rock slide from the Owens Valley earthquake: "The shoulder of the west Sentinel has a talus gray and white, the gray blocks dating from some ancient earthquake, the white from the Inyo [Owens Valley] earthquake."

ID: 8
LOCATION: Indian Canyon DATE: 1872;3/26 2:30 am

TYPE: rock fall TRIGGER: earthquake QDATE: 0

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #9 QLOC: 4

PRIME REF: Kneeland (1872, p. 78)

NARRATIVE: Through Muir, Kneeland (1872) notes that "other avalanches occurred in Indian and Illilouette canyons."

ID: 9
LOCATION: Illilouette Canyon DATE: 1872;3/26 2:30 am

TYPE: rock fall TRIGGER: earthquake QDATE: 0

SIZE: large VOL(m3): 2000 GEOLOGY: Khd QSIZE: 3

DAMAGE: none CROSS REF: Snyder #10 QLOC: 4

PRIME REF: Kneeland (1872, p. 78)

NARRATIVE: Through Muir, Kneeland (1872) notes that "other avalanches occurred in Indian and Illilouette canyons..."

ID: 10D
LOCATION: 'Eagle Rock'-'Pelican Peak' DATE: 1872; 3/26 3:30 am

TYPE: rock slide TRIGGER: earthquake QDATE: 0

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #7I QLOC: 2

PRIME REF: Kneeland (1872)

NARRATIVE: From Kneeland (1872) is an account from Muir: "A second well-defined shock, about an hour after the first, was followed by another avalanche of rocks from the region of 'Eagle Rock'."

ID: 12R
LOCATION: Middle Brother DATE: 1873; 3/12

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: very large VOL(m3): 20000 GEOLOGY: Khd QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 3

PRIME REF: Muir (1960, p.63)

NARRATIVE: From Muir (1960): "On the 12th of March, 1873, I witnessed a magnificent avalanche in Yosemite Valley from the base of the second of the Three Brothers. A massive stream of blocks bounded

from ledge to ledge and plunged into the talus below with a display of energy inexpressibly wild and exciting. Fine gray foam-dust boiled and swirled along its path, and gradually rose above the top of the cliff, appearing as a dusky cloud on the calm sky. Unmistakable traces of similar avalanches are visible here, probably caused by the decomposition of the feldspathic veins with which the granite is interlaced."

ID: 14R
LOCATION: Sentinel Rock-'Cooks field' DATE: 1886; 4/19

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Kec QSIZE: 2

DAMAGE: none CROSS REF: Snyder #12R QLOC: 1

PRIME REF: Guardian's Report 2, unpub. data, p. 133

NARRATIVE: April 19, 1886: Guardian W.E. Dennison observed, "an avalanche of rocks, some as large as a stagecoach, came down back of Hill's Studio. A few fragments were hurled through the fence into 'Cooks field'. Whatever damage was done, if any the trail suffered." Dennison saw the rock slide as an omen related to continued problems in getting McCauley to maintain the Fourmile Trail to Glacier Point.

ID: 15R
LOCATION: Indian Canyon Trail DATE: 1886; Fall

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail,cost CROSS REF: Snyder #13R QLOC: 2

PRIME REF: Guardian's Report 11, unpub. data, p. 184, 191, 223

NARRATIVE: Fall, 1886: In a December 5, 1886, letter from W.E. Dennison to I.W. Raymond, the Yosemite Valley Guardian described a rock slide on the Indian Canyon Trail: "Roughly estimating the cost of reopening the Indian Canyon Trail on the old grade and of cutting a new course through the slide [which caused the trail's abandonment] about 1200 feet, I should ask an allowance of from $200 to $250. As the summit is approached the labor is very much increased."

ID: 16D
LOCATION: Glacier Point-Fourmile Trail DATE: 1892;5/1

TYPE: rock slide ? TRIGGER: unknown QDATE: 1

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #14I QLOC: 0

PRIME REF: Guardian's Report 9, unpub. data, May 1892, p. 40

NARRATIVE: "May 1, 1892: A snow slide on the Fourmile Trail at "the tramway and upper zigzags" probably brought rock down on the trail with

it."

According to Snyder (written communs., April 7, 1992 and November 4, 1992) a snow slide in this vicinity would usually go right over the trail. But later in the year in this very fractured area, slides would have hit the trail and contain more rock than snow. The "tramway" was a section of steep switchbacks on the old Fourmile trail, the last stack of switchbacks up and across a fractured chute to the top of the trail. This event like others in this area was probably both rock fall and rock slide.

ID: 17D
LOCATION: Liberty Cap-Nevada Fall Trail DATE: 1892;12/19

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #15I QLOC: 1

PRIME REF: Guardian's Report 9, unpub. data, May-June 1893

NARRATIVE: "December 19, 1892: A flood and Mono wind on this date damaged trails which were being fixed in the spring. Flood damage to the Nevada Fall trail in the vicinity of 'Casa Nevada' ... was notable. In May 1893, state crews were blasting rocks from the flooding off these trails."

ID: 18D
LOCATION: Yosemite Falls Trail DATE: 1892;12/19

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #16I QLOC: 2

PRIME REF: Guardian's Report 9, unpub. data, May-June 1893

NARRATIVE: December 19, 1892: A flood and Mono Wind on this date damaged trails which were being fixed in the spring. Flood damage to the ... and to the Yosemite Falls trail in the upper part of the gully was notable. In May of 1893, state crews were blasting rocks from the flooding off these trails. Galen Clark wrote to John P. Irish on April 23, 1893, that "The trail to the foot of the Upper Yosemite Fall was put in good repair two weeks ago. From that point up through the canyon the trail much of the distance is completely washed out by the big floods of water from heavy rain storms during the past winter which broke over and carried away all barriers across the trail."

ID: 19
LOCATION: Union Point DATE: 1897;1/26

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #17 QLOC: 1

PRIME REF: Guardian's Report 11, unpub. data, p. 49

NARRATIVE: "January 26, 1897: There was a rock slide on the Fourmile Trail near Union Point."

ID: 20D
LOCATION: Nevada Fall Trail DATE: 1898-99; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #18I QLOC: 3

PRIME REF: Guardian's Report 10, unpub. data, April 1899, p. 34

NARRATIVE: "Winter, 1899: A slide was removed from the Nevada Fall Trail. This was probably winter damage removed in April."

ID: 21
LOCATION: Glacier Point-Fourmile Trail DATE: 1900; 4/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Ks? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #19 QLOC: 3

PRIME REF: Guardian's Report 10, unpub. data, April 1900, p. 393

NARRATIVE: "April 1900: A slide was reported on the Fourmile Trail."

ID: 22
LOCATION: Glacier Point-Fourmile Trail DATE: 1901; 4/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Ks? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #20 QLOC: 3

PRIME REF: Guardian's Report 10, unpub. data, April 1901, p. 436

NARRATIVE: "April 1901: There was a rock slide on the Fourmile Trail."

ID: 23D
LOCATION: Vernal Fall Mist Trail DATE: 1901; 5/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #23I QLOC: 1

PRIME REF: Foley (1901)

NARRATIVE: May 1901: In the periodical, The Yosemite Tourist, Foley (1901): "a rock slide across the Mist Trail was bridged by a board."

The old Mist Trail was narrower than the present trail. When the trail runs out of talus to run on, it had to use narrow joints in the cliffs. This cliff at the west end of the trail, is the one place where they would have had to use a board to bridge about 10 feet of trail (Jim Snyder, written commun., November 4, 1992.)

ID: 24
LOCATION: Glacier Point-Fourmile Trail DATE: 1901; 5/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Ks? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #21 QLOC: 3

PRIME REF: Guardian's Report 10, unpub. data, May 1901

NARRATIVE: "May 1901: There was a rock slide on the Fourmile Trail ..."

ID: 25
LOCATION: Yosemite Falls Trail DATE: 1901; 5/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Ks? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #22 QLOC: 3

PRIME REF: Guardian's Report 10, unpub. data, May 1901

NARRATIVE: "May 1901: There was a rock slide on the Fourmile Trail and another slide on the Yosemite Falls Trail."

ID: 26D
LOCATION: Glacier Point-Fourmile Trail DATE: 1886-1905; 5/??

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 3 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 2

PRIME REF: John Degnan, NPS, unpub. data, December 13, 1941

NARRATIVE: "I had many narrow escapes myself. On one occasion I was working about half a mile up the Glacier Point Trail. Two men above me were getting out sand and clay for the trail. All of a sudden, a huge rock came down and smashed the shovel in my hand." from John Degnan (unpub. data, 1941) "Notes of Early Days in Yosemite".

This slide probably occurred in spring, about May, because it was the practice to work on the trails and roads each spring to open up the drainages, preventing erosion. The same work would be done each fall, to prepare the trails for winter.

ID: 27D
LOCATION: Moran Point-Glacier Point DATE: 1886-1905;5-9/??

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: none QLOC: 1

PRIME REF: John Degnan, NPS, unpub. data, December 13, 1941

NARRATIVE: According to John Degnan (unpub. data, 1941) in "Notes of Early Days in Yosemite": "Another time we were up near Glacier Point before you get to the last zigzag about three miles up. A lot of us were on the trail, when a long saddle train of about 50 horses came along, and we all stepped to the side to let them pass, leaving our tools beside the trail. The last horse had just passed when there was a tremendous rock slide that closed the trail for half a mile. Fortunately, no one was killed."

The slide appears to have occurred late spring or during the summer, sometime between May and September, judging from the long saddle train that was on the trail at the same time coming down from Glacier Point. The last switchbacks on the old trail were stacked up in a chute and called 'The Zigzags' or sometimes 'The Tramway'. The "new" trail, built in the 1920's went around this section of the old trail, which clung to narrow ledges and was overhung by cliffs (Jim Snyder, written commun., February 25, 1992).

ID: 28R
LOCATION: Liberty Cap-Nevada Fall Trail DATE: 1907-8?; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very large VOL(m3): 20000 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #24R QLOC: 1

PRIME REF: Harry Benson, NPS, unpub. data, April 14, 1908

NARRATIVE: "Winter: 1907?: 800 feet of the Nevada Fall Trail was wiped out by a slide. On the Nevada Fall Trail below Liberty Cap "practically the whole hillside was destroyed". Superintendent Sovulewski noted that there were two more slides in this area during the next twenty years."

ID: 29D
LOCATION: Yosemite Falls Trail DATE: 1909; 1/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Kec QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #27I QLOC: 2

PRIME REF: Sovulewski, NPS, unpub. data, April 1909

NARRATIVE: January 1909: "Beginning from the foot of the upper fall for about a mile, the [Yosemite Falls] trail was practically destroyed by slides."

ID: 30D
LOCATION: Wawona Road- Fort Monroe DATE: 1909; 1/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kec QSIZE: 3

DAMAGE: road CROSS REF: Snyder #28I QLOC: 4

PRIME REF: Sovulewski, NPS, unpub. data, April 1909

NARRATIVE: January, 1909: "The Wawona Road was damaged heavily to Fort Monroe."

ID: 31
LOCATION: old Big Oak Flat Road DATE: 1909; 1/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kdg QSIZE: 3

DAMAGE: road CROSS REF: Snyder #29 QLOC: 3

PRIME REF: Sovulewski, NPS, unpub. data, April 1909

NARRATIVE: January 1909: "Rocks on the Big Oak Flat Road were blasted."

ID: 32
LOCATION: El Portal Road DATE: 1911; 1/16-31

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1911

NARRATIVE: "Heavy rains and snow storms have prevailed in the valley almost continuously, such that the only work attempted has been the repair and maintenance of electric lines and roads.

One heavy slide and one serious washout with numerous smaller slides and washouts occurred on the El Portal Road. The road was rendered actually impassible only a few hours; but for two days stages would have gotten over the road with some difficulty. The downpour of rain was long and heavy .... "

ID: 33
LOCATION: Hetch Hetchy Road DATE: 1912; Spring

TYPE: rock slides TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #30 QLOC: 3

PRIME REF: Hetch Hetchy Marches, unpub. data, 1912, p. 1

NARRATIVE: Spring, 1912: Two rock slides were fixed by a cavalry patrol about five miles from the Hetch Hetchy outpost. Presumably the slides were on the trail into Hetch Hetchy from 'Hog Ranch.'

ID: 34D
LOCATION: Middle Brother-Rocky Point DATE: 1912; 12/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 3

DAMAGE: vehicle CROSS REF: none QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1912

NARRATIVE: "We had a slide [rock fall] above Rocky Point during the month, and a large rock came down and struck our road grader destroying the outside frame entirely. I doubt whether we can use it any more."

ID: 35
LOCATION: El Portal Road-Arch Rock DATE: 1913; 6/4

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Kga QSIZE: 3

DAMAGE: road, cost CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1913

NARRATIVE: "Owing to the heavy storms at the end of May and first of June, a great deal of damage was done both to the roads and trails in the park; practically all of the repairs have to be done over again. On the 4th of June a cloud burst below Arches Rocks on the El Portal road brought down several slides and damaged the road badly for about 1 1/2 miles, and injured other parts of the road as far as the Cascades, for a distance of about 3 1/2 miles. Ten stages were blocked between El Portal and Arches Rocks on account of the slides, on the afternoon of June 4th. The road was opened for traffic by 9:00 a.m. on the morning of June 5th. The slides were taken out, and repairs that were immediately needed were made by the force of men under the Resident Engineer on the improvement of the El Portal road from its junction with the Coulterville road towards the park boundary. One hundreds days labor was expended for the immediate repairs, costing about $250."

ID: 36
LOCATION: Wawona Road-Fort Monroe DATE: 1913; 6/4

TYPE: debris slides ? TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1913

NARRATIVE: "The Wawona Road was repaired from the floor of the valley to Fort Monroe, a distance of 4 miles. The storm [June 4, 1913] also injured this road, and also the Big Oak Flat Road, but repairs were made to these two roads with only small additional help."

ID: 37
LOCATION: old Big Oak Flat Road DATE: 1913; 6/4

TYPE: debris slides ? TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1913

NARRATIVE: "The storm [June 4, 1913] also injured this road [Wawona Road], and also the Big Oak Flat Road, but repairs were made to these two road with only small additional help."

ID: 38
LOCATION: Vernal and Nevada Falls Trail DATE: 1913; 7/??

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, July 1913

NARRATIVE: "The repairs of ledge trails during July were rather heavy on account of cloud bursts and heavy, unexpected rains. The Vernal and Nevada Falls trail suffered the most"

ID: 39
LOCATION: El Portal Road DATE: 1913; late 12/??

TYPE: rock slide TRIGGER: rain-snow QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road, cost CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1913

NARRATIVE: "The first storms of December brought considerable snow ... During the later part of the month, however, it began raining and rained very hard and steadily for several days. There were several small slides on the El Portal Road in consequence, and one big slide."

"Removing slides from the El Portal Road below the Pohono Bridge. 1st, slide...This slide occured in the month of December and was removed at total labor cost of $83.50." (Road Maintenance Report from Resident Engineer for Month of January 1914, unpub. data, February 5, 1914).

ID: 40D
LOCATION: El Portal Road-'Windy Point' DATE: 1914; 1/??

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Kga QSIZE: 2

DAMAGE: road, cost CROSS REF: none QLOC: 0

PRIME REF: Road Maintenance Report, unpub. data, January 1914

NARRATIVE: "The above [$155.50] was expended in removing a large slide about a mile from the park boundary at a place commonly known as 'Windy Point', the removal of this slide is still in progress, and will be taken up in next report.

The heavy rains of the month of January have done considerable damage to the El Portal Road, washing the road surface away in many places, causing numerous small rock slides and the large one above mentioned."

ID: 41
LOCATION: old Big Oak Flat Road DATE: 1914; 3-4/??

TYPE: rock slides TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Kdg QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March/April 1914

NARRATIVE: "in March and April of 1914, the Big Oak Flat Road required repairs over 4 miles from the valley floor to 'Gentry', slides taking out walls."

ID: 42
LOCATION: Glacier Point-Fourmile Trail DATE: 1914; 4-5/??

TYPE: rock slide TRIGGER: rain-snow ? QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: none QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, April/May 1914

NARRATIVE: "On account of slides and washouts during the winter season, especially on the short trail to Glacier Point, where approximately 200 feet of wall had to be rebuilt ..."

ID: 43
LOCATION: Tenaya Lake Trail DATE: 1914; 4-5/??

TYPE: rock slides TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April/May 1914

NARRATIVE: "On account of slides and washouts during the winter season ... and unusually heavy washouts on Tenaya Lake, Yosemite Point and 'Eagle Point' trails, the labor for repairs thereto amounts to more than ordinary."

ID: 44
LOCATION: Yosemite Point Trail DATE: 1914; 4-5/??

TYPE: debris flows TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: trail CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April/May 1914

NARRATIVE: "On account of slides and washouts during the winter season, ... and unusually heavy washouts on Tenaya Lake, Yosemite Point and 'Eagle Point' Trails, the labor repairs thereto amounts to more than ordinary."

ID: 45
LOCATION: Eagle Peak Trail DATE: 1914; 4-5/??

TYPE: debris flows TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: trail CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April/May 1914

NARRATIVE: "On account of slides and washouts during the winter season, ... and unusually heavy washouts on Tenaya Lake, Yosemite Point and 'Eagle Point' Trails, the labor repairs thereto amounts to more than ordinary."

ID: 46
LOCATION: Hetch Hetchy Road DATE: 1915; 1/27

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 15 GEOLOGY: ? QSIZE: 0

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Charles C. Bull, NPS, unpub. data, 1915

NARRATIVE: According to a letter of January 27, 1915 from Charles C. Bull, Park Ranger to O.R. Prien, Chief Ranger: "I was requested by Mr. Rankin to report to you that the Hetch Hetchy Road was officially finished today... A small slide (about 20 yards) came in and blocked the road for wagons, but this will be cleared up."

ID: 47
LOCATION: El Portal Road DATE: 1917; 2/??

TYPE: rock slides TRIGGER: rain-snow QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1917

NARRATIVE: "The bulk of the road work done on the maintenance of roads during the month consisted of the handling of snow and removing of rock and earth slides resulting from the heavy fall of snow and rain, which continued through the latter half of the month. With the exception of the El Portal Road, where slides of such volume took place as to effectively close the road for two days and necessitate the employment of a considerable force of men for a few days ...(p.4) Between the 16th and 19th of February, some three feet of snow fell on the floor of the valley. This was followed by rain which fell almost continuously up to the 25th, thoroughly saturating the snow and making it particularly heavy ..."

ID: 48
LOCATION: El Portal Road-'Devil's Elbow' DATE: 1917; 2-3/??

TYPE: debris slide TRIGGER: snow QDATE: 3

SIZE: medium VOL(m3): 57 GEOLOGY: Kga QSIZE: 0

DAMAGE: road CROSS REF: none QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1917

NARRATIVE: "On the El Portal Road it was necessary to do considerable work as the heavy snow of late February and early March brought down considerable quantities of earth and rock resulting in considerable damage to the rock walls and in some cases parts of the road bed itself was carried away... In this repair work 34 cubic yards of rock wall was replaced, 75 cubic yards of earth was removed at 'Devil's Elbow'...".

ID: 49
LOCATION: El Portal Road DATE: 1918; 3/??

TYPE: rock slides TRIGGER: rain-snow QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1918

NARRATIVE: "The snow disappearing very rapidly towards the latter part of the month, work on the repair of roads on the floor of the Valley was begun on March 28th... Heavy rains caused a number of slides on the El Portal Road which necessitated a considerable amount of work of repair."

ID: 50
LOCATION: old Big Oak Flat Road DATE: 1918; 9/27-10/1

TYPE: debris slides ? TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, September 1918

NARRATIVE: "... the heavy rains which began on September 27th did considerable damage to the road. These storms culminated in a very extensive cloud burst on the first of October which carried debris of all kinds into the road below 'Gentrys' to such an extent that it has been closed for the season."

ID: 51
LOCATION: Tioga Road-Lee Vining Canyon DATE: 1918; 9/27-10/1

TYPE: rock slides TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, September 1918

NARRATIVE: "... the heavy rains which began on September 27th did considerable damage to the road. These storms culminated in a very extensive cloud burst on the first of October... No work was done on the Tioga Road. The heavy rains heretofore referred to washed the road badly in places and because of heavy rock slides which occurred on the Lee Vining Canyon side, all traffic across it has been stopped."

ID: 52D
LOCATION: El Portal Road-'Windy Point' DATE: 1918; 11/28

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Kga QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1918

NARRATIVE: "a rock slide, occurring on November 28, near 'Windy Point', made necessary the employment of three additional men for a period of a day and a half in removing the boulders and earth brought down by the slide."

ID: 53
LOCATION: El Portal Road DATE: 1919; 3/??

TYPE: rock slides ? TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1919

NARRATIVE: "The usual work, however, was done on the El Portal Road, the force there consisting of two men with horse and dump cart each who were employed throughout the entire month. One or two rather large slides occurred during the month, making it necessary to put on additional men for two or three days at a time in each case."

ID: 54D
LOCATION: Liberty Cap DATE: 1919; 5/28 pm

TYPE: rock falls TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: none QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1919

NARRATIVE: "Very extensive repairs were also necessary on the long trail to Glacier Point particularly on the switch backs going up over Nevada Fall. Here retaining walls were washed out and numbers of large boulders falling from the cliffs above almost eliminated the trail in places."

ID: 55
LOCATION: Glacier Point-Fourmile Trail DATE: 1919; 5/28 pm

TYPE: debris slides ? TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: trail CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1919

NARRATIVE: "During the month the long and short trail to Glacier Point, ... where all repaired and put in excellent condition for the seasons travel. The short trail to Glacier Point suffered particularly, it being entirely impassable for three or four days as a result of washouts and giving way of retaining walls. Some 20 men were immediately put to work on this trail..."

ID: 56
LOCATION: Chinquapin-Glacier Point Road DATE: 1919; 5/28 pm

TYPE: debris flows/slides TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1919

NARRATIVE: "This road [Chinquapin Glacier Point Road] was entirely free from snow and in first class passable condition as early as the morning of May 28th, the day of the storm. On that date the repair crew, having just completed the repairs to the road, returned to the Valley ... In probably less than two hours on the afternoon of the 28th, all evidence of our work was completely washed away and it was necessary to duplicate almost the entire work of repair for opening. A force of 10 to 12 men were immediately put on the worst grades the next day with the result that on the afternoon of June 1st the road was again in passable condition and open to travel..."

ID: 57
LOCATION: Tenaya Lake Trail DATE: 1919; 5/28 pm

TYPE: debris flow TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1919

NARRATIVE: "During the month [May 1919] ... the Tenaya Lake trail, ... suffered excessively from the storm [May 28], damage having been caused in some instances that it will take weeks to repair."

ID: 58R
LOCATION: Taft Point DATE: 1919; 8/17 6:30 pm

TYPE: rock slide TRIGGER: unknown QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 3

PRIME REF: F.E. Matthes, USGS, unpub. data [no date]

NARRATIVE: "August 17, 1919; 6:30 p.m.- Large avalanche fell from cliff at end of promonotory of Taft Point. Left concave scar of great height. Consisted of thin sheet. Blocks did not roll far. Did not reach base of talus."

(in notes of Matthes, F.E., information provided by Herbert Earl Wilson, USGS Denver Field Records Library, NO-7466, folder #1, p. 33)

ID: 59D
LOCATION: El Portal Road-'Windy Point' DATE: 1919; 8/??

TYPE: rock slide TRIGGER: blasting QDATE: 3

SIZE: very large VOL(m3): 8450 GEOLOGY: Kga QSIZE: 0

DAMAGE: road CROSS REF: none QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, August 1919

NARRATIVE: "Work of reconstruction of this road (El Portal Road) has not progressed as favorably during the last month as usual due to heavy rock slides encountered just above 'Windy Point'. At this place the old road was exceedingly narrow and very precipitous on the outer edge making it necessary in order to widen it to the desired width to extend the road into the heavy rock bank from six to eight feet. This of course necessitated heavy blasting which carried on in an unstable rock mass as exists at that point, caused all kinds of difficulties in the way of rock slides."

ID: 60
LOCATION: old Big Oak Flat Road DATE: 1920; 3/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1920

NARRATIVE: "Slides were taken out of the Big Oak Flat Road and repairs made for a distance of about 2 1/2 miles from the floor of the valley."

ID: 61D
LOCATION: El Portal Road-'Windy Point' DATE: 1920; 4/??

TYPE: rock fall TRIGGER: rain QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Kga QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1920

NARRATIVE: "The maintenance of the El Portal Road was confined to ... and such additional labor as was necessary to remove slides resulting from the two heavy storms that we had during the month. One of these slides had its origin on the cliff some 500 feet above the road and a good many tons of rock were avalanched into and over the road, with the result that in one place near 'Windy Point', about 100 feet of the retaining wall was taken out. All of this damage was repaired during the month ".

ID: 62R
LOCATION: El Capitan DATE: 1920; 9/28 8:30 pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Kec QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 3

PRIME REF: F.E. Matthes, USGS, unpub. data [no date]

NARRATIVE: September 28, 1920; 8:30 p.m.- Small avalanche from southern front of El Capitan. Origin about 1500 feet high. Material rests on talus slope.

(in notes of Matthes, F.E., information given by Herbert Earl Wilson; USGS Denver Field Records Library, NO-7466, folder #1, p. 33)

ID: 63D
LOCATION: El Portal Road DATE: 1921; 1/28 late pm

TYPE: debris slides TRIGGER: rain snow QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Kec QSIZE: 3

DAMAGE: utility CROSS REF: none QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1921

NARRATIVE: "Storms that night (January 28) brought down additional slides of earth and rock which took out part of the trestle under the new flume ..."

ID: 64
LOCATION: El Portal Road DATE: 1921; 1/16-30

TYPE: debris slides TRIGGER: rain snow QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1921

NARRATIVE: "The heavy storms during January have brought down great quantities of rock and earth for almost the entire length of the road from El Portal to Pohono Bridge. While these slides were small so that the road was not blocked, two of them were large enough to block the road from a short time on two occassions. Sixty feet of wall on the lower El Portal Road has also been weakened by the heavy storms and is about ready to fall out...During the period January 16th to the 30th inclusive ... it rained or snowed every day and in most cases nearly all day and all night with the exception of Saturday 29th."

ID: 65D
LOCATION: Middle Brother DATE: 1921; 9/16 1:15 pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: F.E. Matthes, USGS, unpub. data [no date]

NARRATIVE: "September 16, 1921: 1:15 p.m. - A smaller rock avalanche fell from a somewhat higher point just to west of large one mentioned [refers to description #71D]. Made small pile of debris resting at toe of slope immediately against cliff. Dust hung in air 3 hours."

(In notes of Matthes, F.E., information given by Herbert Wilson; USGS Denver Field Records Library, NO-7466, folder #1, p. 33)

ID: 66
LOCATION: El Portal Road DATE: 1921; 12/??

TYPE: rock slides TRIGGER: rain snow QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1921

NARRATIVE: "The night of the 17th, however, snow began to fall, representing the start of the longest and heaviest storm of many years in Yosemite. The storm continued almost continuously for sixteen days, out of which there were only two days that it did not either rain or snow continuously during the whole twenty-four hours. Although from the start it snowed and rained intermittently, by noon of the 24th there were 52 inches of snow on the ground. On the afternoon of the 24th heavy rain started to fall and it rained almost continuously for the next four or five days.

The recent storms, however, have made it necessary to supplement this crew on two or three occasions with several more men for a day or two at a time in order to remove slides that have come into the road at various places. In one or two instances in fact these slides are so large that we will probably do nothing towards removing them other than to make the (El Portal) road passable until spring as the volume of material to be moved is quite considerable."

ID: 67D
LOCATION: El Portal Road DATE: 1922; 2/??

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: very small VOL(m3): 2 GEOLOGY: Kec QSIZE: 2

DAMAGE: utility CROSS REF: none QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1922

NARRATIVE: "During one of the heavy storms a large boulder was loosened and rolled against the pipe line breaking three staves causing a large leak. This was repaired by the master mechanic ... during a period of three hours."

ID: 68D
LOCATION: Glacier Point-Curry Village DATE: 1922; 2/??

TYPE: debris slide TRIGGER: rain QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 2

DAMAGE: utility CROSS REF: none QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1922

NARRATIVE: "A large land and snow slide which occurred on the mountain side above 'Camp Curry' completely tore down for an approximate distance of three-quarters of a mile our 2300-volt transmission line to Glacier Point." This would have been in 'Le Conte gully' in the upper part of the 1-mile 'Ledge Trail' to Glacier Point.

ID: 69
LOCATION: El Portal Road DATE: 1922; 2/??

TYPE: rock slides TRIGGER: rain QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1922

NARRATIVE: "On the El Portal Road seven men were employed on maintenance throughout the month. Their principal work was the removal of a number of slides, one slide being more than 100 feet wide."

ID: 70
LOCATION: El Portal Road DATE: 1922; 3/??

TYPE: rock slides TRIGGER: rain snow ? QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1922

NARRATIVE: "The greatest amount of maintenance and repair work, so far as roads are concerned, was done on the El Portal Road where a force of seven men and six head of stock was employed during a good bit of the month removing slides... all of which resulted from the unusually heavy winter storms from which the roads have suffered."

ID: 71D
LOCATION: Middle Brother DATE: 1923;1/3,5 5:00pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: very large VOL(m3): 20000 GEOLOGY: Ks QSIZE: 2

DAMAGE: road CROSS REF: Snyder #31R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1923

NARRATIVE: "On January 3 at 5 p.m. a large rock slide occurred from under Eagle Peak and landed just east of Rocky Point opposite the sewer system pumping station. The road was blocked with rocks and trees for a distance of 300 feet. All of the timber in the path of the slide was destroyed. The trees ranged from 6" to 2 1/2 feet in diameter. Many of the trees were broken and covered by the falling rock and the rest of them were uprooted or had the tops whipped off by the vacuum created by the falling rock. This vacuum caused an inrush of air which was strong enough to knock down 500 feet of the high tension electric line, carrying 11,000 volts, breaking and uprooting several of the poles. The number of trees destroyed cannot by ascertained as hundreds of them are under the rock. It is estimated that between five hundred and six hundred trees were destroyed. It took one truck, two span of horses, and five men, five and one-half days to clear the road. Two hundred pounds of TNT, and three hundred pounds of picric acid were also used in doing this work."

"January 5, 1923 [note discrepancy in date], a few minutes before 5 p.m. Large rock avalanche eastern base of Three Brothers. Dropped about 1000 feet. Scar seems insignificant. Yet entire forest wiped out. Large blocks across wagon road. Trees "blown" across roads. Shook valley like earthquake." (in Field Notes of Matthes, F.E., information given by Herbert Earl Wilson; USGS Denver Field Records Library, NO-7466, folder #1, p. 33)

From Matthes (1930): "A large sheet or spall of rock that had been in process of being loosened for centuries, perhaps, suddenly detached itself from the cliff face without being impelled by any noticeable earth tremor and, as it fell, crushed and obliterated with its debris a forest of pine trees that had grown up on the talus below."

ID: 72
LOCATION: El Portal Road-Arch Rock DATE: 1924; 1/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kga QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1924

NARRATIVE: "A small slide occurred on this road (El Portal Road) below Arch Rock, but was taken out by the regular maintenance gang."

ID: 73D
LOCATION: El Portal Road-below 'Windy Point' DATE: 1924; 9/17

TYPE: rock slide TRIGGER: construction QDATE: 1

SIZE: medium VOL(m3): 242 GEOLOGY: Kga QSIZE: 0

DAMAGE: road CROSS REF: none QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, September 1924

NARRATIVE: "On September 17th the San Joaquin Light and Power Company crew while constructing the pole line bewteen El Portal and the power plant [about 1/4 mile west or below 'Windy Point' near power pole #9], dislodged a huge rock which rolled down the hillside and into the road. The rock was about 25 feet high and 20 feet wide, and is estimated to have weighed from six to eight hundred tons."

ID: 74
LOCATION: old Big Oak Flat Road DATE: 1924; 9/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kdg QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, September 1924

NARRATIVE: "On the Big Oak Flat Road part of a retaining wall went out and it was necessary to rebuild 75 feet of the wall ... at a point below Rainbow View [at switchbacks]."

ID: 75
LOCATION: Tenaya Lake Trail DATE: 1924; 11/9

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #32 QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1924

NARRATIVE: "There was no trail work done, except for the taking out of a rock slide on the 'Tenaya Canyon Trail' caused by the heavy rain storm on November 9 [1924]. This trail was re-ditched, and emergency repairs made so as to make it passable."

ID: 76
LOCATION: old Big Oak Flat Road DATE: 1924; 11/9-10

TYPE: rock slides TRIGGER: rain QDATE: 2

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: trail,road,cost CROSS REF: none QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1924

NARRATIVE: "Several small slides of rock were also taken out along the Big Oak Flat Road between the valley floor and 'Gentrys'...

All of our roads and trails were severely damaged during the heavy rain storm on November 9 and 10, and preliminary estimate indicates that the damage will be approximately six or seven thousand dollars. The rain was so heavy that drainage ditches failed to carry off the water with the result that the roads and trails have been very badly washed out requiring excessive repairs."

ID: 77
LOCATION: old Big Oak Flat Road DATE: 1924; 12/??

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #33 QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1924

NARRATIVE: December 1924: "The last heavy rain storm did considerable damage to the Big Oak Flat Road ... On the first water course about two miles up the grade a large slide of heavy rocks destroyed the retaining wall for a distance of twenty feet in a very critical place and cut a hole in the road directly in the water course, turning the water under the road bed. The damage is being repaired and cars may be sent to Rainbow View by January 4."

ID: 78
LOCATION: El Portal Road DATE: 1925; 2/5 pm

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: utility CROSS REF: Snyder #34 QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1925

NARRATIVE: "On the El Portal Road a great deal of damage was done on the night of February 5, from heavy rain storms ... The storm brought down a huge boulder above our fifty-four inch wood stave pipe which carried out a section twenty feet in length, and the water rushing down the hillside covered the road for a distance of three hundred feet with rocks, earth, trees, etc., to a depth of three feet."

ID: 79
LOCATION: El Portal Road DATE: 1925; 2/5 pm

TYPE: debris flow TRIGGER: pipeline break QDATE: 1

SIZE: large VOL(m3): 1275 GEOLOGY: Qat QSIZE: 1

DAMAGE: road CROSS REF: Snyder #34 QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1925

NARRATIVE: February 5, 1925: "On the El Portal Road a great deal of damage was done on the night of February 5, from heavy rain storms ... The storm brought down a huge boulder above our fifty-four inch wood stave pipe which carried our a section twenty feet in length, and the water rushing down the hillside covered the road for a distance of three hundred feet with rocks, earth, trees, etc., to a depth of three feet."

ID: 80
LOCATION: Glacier Point-Fourmile Trail DATE: 1925; 2/??

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Ks? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #35 QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1925

NARRATIVE: February, 1925: Damage to the Glacier Point-Fourmile Trail "was caused by a large rock slide due to the heavy storms. Four hundred feet of trail was obliterated entirely and six hundred feet additional was more or less damaged by being covered with rock and debris of all kinds."

ID: 81
LOCATION: Tenaya Lake Trail DATE: 1924-25; Winter

TYPE: rock slide TRIGGER: rain snow ? QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #36 QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1925

NARRATIVE: Winter, 1925: "One slide was taken out on the Lake Tenaya Trail, and the retaining walls repaired, which had been destroyed by a rock slide during the winter." This slide was most likely below the first creek crossing where there are substantial retaining walls, though the release point is unclear.

ID: 82D
LOCATION: Tuolumne Meadows DATE: 1924-25; Winter

TYPE: debris slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Qti QSIZE: 2

DAMAGE: road CROSS REF: Snyder #37I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, June 1925

NARRATIVE: Winter, 1925: "There was also a good sized slide above Tuolumne Meadows [on the Tioga Road]. The snow did not amount to much at any point."

ID: 83
LOCATION: El Portal Road DATE: 1927; 2/??

TYPE: rock slides TRIGGER: rain QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #40 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1927

NARRATIVE: February 1927: "... several large slides were removed from the El Portal Road."

ID: 84
LOCATION: El Portal Road DATE: 1927; late 10/??

TYPE: rock slides TRIGGER: rain QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #41 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1927

NARRATIVE: October 1927: "The heavy rainfall during the latter part of the month brought in three rock slides on the El Portal Road. Two large rocks fell from some height and damaged the pavement in two places."

ID: 85
LOCATION: old Big Oak Flat Road DATE: 1927; late 10/??

TYPE: rock slides TRIGGER: rain QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #42 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1927

NARRATIVE: October 1927: "On the Big Oak Flat Road several slides occurred during the storm [heavy rainfall during the later part of the month], one of which took out twenty feet of retaining wall in a very difficult place. Part of the wall was eight feet high."

ID: 86
LOCATION: El Portal Road DATE: 1928; 3/25-31

TYPE: rock slides TRIGGER: rain snow QDATE: 2

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road,utility,cost CROSS REF: Snyder #43 QLOC: 3

PRIME REF: E.P. Leavitt, NPS, unpub. data, March 27, 1928

NARRATIVE: March 1928: In a telegram from E.P. Leavitt, Acting Superintendent to Director NPS "Heavy steady warm rain last several days melted snow bringing highest water in years doing much damage. Falling rocks broke pipeline four places. One hundred feet [of] pipe out with transmission lines above and below power plant washed out. Estimated cost repair fifteen thousand dollars, principal items follow: $1300-penstock, $1500-El Portal road, $6000-Wawona road, $1500-Big Oak Flat Rd, $500-Bridalveil road, $4000-miscellaneous pumping plant water system."

ID: 87
LOCATION: old Big Oak Flat Road DATE: 1928; 4/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #45 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1928

NARRATIVE: April 1928: "Six slides were removed from the foot of the grade [of the old Big Oak Flat Road] at 'El Capitan Checking Station' to 'Gentry Station'."

ID: 88
LOCATION: El Portal Road DATE: 1930; 1/?? 12night

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #46 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1930

NARRATIVE: January 1930: "A number of rock slides had to be removed from the El Portal Road. One large boulder fell about midnight [no date] and completely blocked the road. This was removed and the road cleared by six o'clock the following morning."

ID: 89D
LOCATION: Yosemite Falls Trail-'Columbia Point' DATE: 1930; 1/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #47I QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1930

NARRATIVE: January 1930: "A large slide on the trail to Columbia Point was also removed."

ID: 90
LOCATION: Wawona Road DATE: 1930; 2/1

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 92 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #50 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1930

NARRATIVE: Photograph showing "Rock slide, Wawona Road, February 1, 1930", that completely closed the road. From the photograph, the amount on the road is roughly estimated to be 120 yards of material. The biggest rock went in the vicinity of 100 tons. The slide was initiated by storms on a new roadcut on the new Wawona Road and brought down chunks of bedrock as well as soil and trees.

ID: 91
LOCATION: El Portal Road DATE: 1930; 2/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #48 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1930

NARRATIVE: February 1930: "It was necessary to remove several small rock slides from the El Portal Road...".

ID: 92
LOCATION: old Big Oak Flat Road DATE: 1930; 2/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #49 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1930

NARRATIVE: February 1930: "One large slide and a small tree were removed from the Big Oak Flat Road, making it passable form the 'El Capitan Checking Station' to 'Gentry Station'."

ID: 93R
LOCATION: Yosemite Falls Trail-'Columbia Point' DATE: 1930; 3/17

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #52R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1930

NARRATIVE: March 17, 1930: "On March 17th a rock slide on the Yosemite Falls Trail wiped out one hundred feet between 'Columbia Point' and 'Valley View'." A photo of the slide is included.

ID: 94
LOCATION: Wawona Road-Grouse Creek DATE: 1930; 3/??

TYPE: rock/debris slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kec QSIZE: 3

DAMAGE: road CROSS REF: Snyder #51 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1930

NARRATIVE: March 1930: "The Contoules Construction Company, operating between Grouse Creek and Turtleback Dome are expected to commence operations in the very near future ... Clearing of slides in this section is being done by the Bureau of Public Roads."

ID: 95R
LOCATION: old Big Oak Flat Road DATE: 1930; 7/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kdg QSIZE: 3

DAMAGE: road, cost CROSS REF: Snyder #53R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, July 1930

NARRATIVE: July 1930: "The rock slide cutting through three switchbacks on the Big Oak Flat Road caused difficult emergency repairs, the costs of which were $850.00."

ID: 96D
LOCATION: Vernal Fall-'Porcupine Spring' DATE: 1930; 9/8

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: fatality CROSS REF: Snyder #54I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, September 1930

NARRATIVE: "On September 8th a slide resulted in the tragic death of Mike Rhodes, a government trail laborer, near Vernal Fall." Rhodes was likely working on the new horse trail in the cut below 'Porcupine Spring', since that is where trail work was concentrated at the time.

ID: 97
LOCATION: El Portal Road DATE: 1930; 11/??

TYPE: rock slides TRIGGER: rain QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #55 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1930

NARRATIVE: November 1930: "Storms made necessary the clearing away of rocks from slides in various places on the El Portal Road, blasting being necessary in one place."

ID: 98
LOCATION: El Portal Road DATE: 1931; 1/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #56 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1931

NARRATIVE: January 1931: "Several small rock slides were removed from the El Portal Road."

ID: 99
LOCATION: Yosemite Falls Trail DATE: 1931; 2/24

TYPE: rock slide TRIGGER: unknown QDATE: 2

SIZE: very small VOL(m3): 2 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #58 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1931

NARRATIVE: February 24, 1931: "A small slide occurred about the 24th on the Yosemite Falls Trail. This was cleared away."

ID: 100
LOCATION: old Big Oak Flat Road DATE: 1931; 2/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #57 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1931

NARRATIVE: February 1931: "Snow removal has been subnormal. The higher temperatures made protection unnecessary. The [old] Big Oak Flat Road has been kept open for winter sports to 'Gentry' and two small slides were removed."

ID: 101
LOCATION: old Big Oak Flat Road DATE: 1931; 6/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #59 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, June 1931

NARRATIVE: June 1931: "Small rock slides on the Big Oak Flat Road between the floor of the valley and 'Gentry Checking Station' required our constant attention."

ID: 102
LOCATION: El Portal Road DATE: 1931; 10/25

TYPE: rock slides TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #60 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1931

NARRATIVE: October 25, 1931: "It was necessary to remove several slides brought down by the rain of October 25, especially on the El Portal

Road where one large slide nearly closed this road to traffic for a few hours."

ID: 103
LOCATION: El Portal Road DATE: 1931; 12/21-29

TYPE: rock slides TRIGGER: rain QDATE: 3

SIZE: medium VOL(m3): 180 GEOLOGY: ? QSIZE: 0

DAMAGE: road, cost CROSS REF: Snyder #61 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1931

NARRATIVE: "The month of December, 1931, can boast ... a total precipitation of 14.9 inches. This figure is about three times the normal for December and represents the wettest December on record ... Eleven slides occurred on the El Portal Road, most of them occurring at night, and the road was always open for traffic every morning at 6 a.m."

The storm continuing from December 21st to 29th caused an immediate damage of $2000 to the El Portal Road... Enormous rocks, some of them weighing 50 tons, gave way as a result of erosion by heavy rains.... The above mentioned slides, together with numerous minor slides, total approximately 269 yards of rock and earth."

ID: 104D
LOCATION: El Portal Road DATE: 1931; 12/21-29

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kga QSIZE: 2

DAMAGE: road, cost CROSS REF: Snyder #62I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1931

NARRATIVE: December 21-29, 1931: "The storm continuing from December 21st to 29th caused an immediate damage of $2000 to the El Portal Road. Three principal slides occurred, one near the park line ... parapet wall demolished by large rock .45 mile above park line.

Due to the loyal cooperation and zeal of the permanent maintenance force, assisted by valley Indians, these slides were removed in record time and the road was not closed during traveling hours."

ID: 105D
LOCATION: El Portal Road DATE: 1931; 12/21-29

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kar QSIZE: 2

DAMAGE: road, cost CROSS REF: Snyder #63I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1931

NARRATIVE: December 21-29, 1931: "The storm continuing from December 21st to 29th caused an immediate damage of $2000 to the El Portal Road. Three principal slides occurred, ..., and one at 'Dead Mans Curve' below the dam... typical small slide 3 miles above park line."

ID: 106D
LOCATION: El Portal Road-Arch Rock DATE: 1931; 12/21-29

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: small VOL(m3): 26 GEOLOGY: Kar QSIZE: 0

DAMAGE: road, cost CROSS REF: Snyder #61I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1931

NARRATIVE: December 21-29, 1931: "The storm continuing from December 21st to 29th caused an immediate damage of $2000 to the El Portal Road. Three principal slides occurred, ... one just east of the S curve above Arch Rock... pavement slightly damaged just east of 'S' curve by two boulders approximating 75 tons."

ID: 107D
LOCATION: El Portal Road-'Windy Point' DATE: 1932; 2/11

TYPE: rock slides TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 51 GEOLOGY: Kga QSIZE: 0

DAMAGE: road, cost CROSS REF: Snyder #64I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1932

NARRATIVE: February 11, 1932: "Below 'Windy Point' on the El Portal Road a slide which was removed on the night of February 11, bringing an amount of 67 cubic yards, mainly of rock, which was removed at a cost of about 80 cents a yard. This in addition to numerous small slides on the El Portal Road."

ID: 108
LOCATION: Glacier Point-Fourmile Trail DATE: 1931-32; Winter

TYPE: debris slides ? TRIGGER: spring runoff QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #65 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, July 1932

NARRATIVE: Winter, 1932: "Small slides were cleared from the Glacier Point or Fourmile Trail. The trail was opened for travel in May after a heavy winter. These slides, common on the Fourmile Trail below Union Point, probably occurred earlier in the winter or during spring runoff."

ID: 109
LOCATION: Wawona Road-Turtleback Dome DATE: 1931-32; Winter

TYPE: rock/debris slides TRIGGER: spring runoff QDATE: 4

SIZE: very large VOL(m3): 9182 GEOLOGY: ? QSIZE: 0

DAMAGE: road CROSS REF: Snyder #66 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1932

NARRATIVE: Winter, 1932: "[On the] Wawona Road, [between] Turtleback Dome [and] Big Trees ... the road has suffered considerable damage during the past winter. The slide yardage on the road totals about 12,000 cubic yards and there has been considerable damage to the fills from washouts and settlement."

ID: 110
LOCATION: Wawona Road-Grouse Creek DATE: 1932; 3/??

TYPE: rock slump TRIGGER: construction QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kga QSIZE: 2

DAMAGE: road CROSS REF: Snyder #67 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1932

NARRATIVE: March 1932: "However on the new road between Grouse Creek and Chinquapin there are several very bad slides which will continue coming down for some time during the high water season." This comment is a reference to poor construction practices and slides created by the new Wawona road cuts.

According to Jim Snyder (written commun., April 7, 1992) this description alludes to one place at which there was a lot of continuing slumping, a springy area that kept moving onto the road once the cut was made.

ID: 111R
LOCATION: Yosemite Falls Trail DATE: 1932; 3/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #68R QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1932

NARRATIVE: March 1932: "The Yosemite Falls Trail was opened and repaired to 'Valley View'. A large rock slide destroyed about 50 feet of retaining wall in a difficult place and carried away one turn." This slide had to have been either on the straight stretches with the two short switchbacks below 'Columbia Point' or on the switchback past 'Dorn's crossing' beyond 'Columbia Point', the more likely location.

ID: 112R
LOCATION: Liberty Cap-Nevada Fall trail DATE: 1932; 4/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #69R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1932

NARRATIVE: April 1932: "A large slab of rock has destroyed approximately 600 feet of trail on the old Nevada Fall route. However this trail will probably not be repaired since the new trail has been constructed."

ID: 113
LOCATION: Panorama Cliff DATE: 1932; 4/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: none CROSS REF: Snyder #70 QLOC: 4

PRIME REF: Jensen (1933, p. 11)

NARRATIVE: "... a mass broke loose from the center of Panorama Cliff."

ID: 114
LOCATION: old Big Oak Flat Road DATE: 1932; 4/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #71 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1932

NARRATIVE: April 1932: Photo caption: "Large rock on Big Oak Flat Road caved in retaining wall for fifty feet. New rock wall installed this month." Photograph looks like the lower end of the road.

ID: 115R
LOCATION: old Big Oak Flat Road DATE: 1932; 4/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 1 GEOLOGY: Kdg QSIZE: 0

DAMAGE: road CROSS REF: Snyder #72R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1932

NARRATIVE: April 1932: Photo caption: "Rock which demolished wall, Big Oak Flat Road, was stopped in first switchback. This is similar to many other boulders that fell during the winter." The rock was about 6 feet in diameter.

ID: 116R
LOCATION: Indian Canyon-east wall DATE: 1932; 5/22 pm

TYPE: rock fall TRIGGER: freeze-thaw QDATE: 1

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: Snyder #73R QLOC: 3

PRIME REF: Jensen (1933, p. 10)

NARRATIVE: "On the afternoon of Sunday, May 22, 1932, the attention of the writer was called by a thunderlike roar coming from Indian Canyon, the first canyon east of Yosemite Falls. A great mass of granite had fallen from the east wall, and rocks could be heard rolling for a few seconds thereafter. A cloud of dust hovered over the tree tops for several minutes." Jensen attributed this slide to freezing and thawing.

ID: 117D
LOCATION: Moran Point-'Old Village' DATE: 1932; 5/24 4 am

TYPE: rock fall TRIGGER: freeze-thaw QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: Snyder #74I QLOC: 2

PRIME REF: Jensen (1933, p. 10)

NARRATIVE: "Two days later at 4 o'clock in the morning [May 24] a mass of rock fell from the south wall of Yosemite Valley 300 yards east of the 'Old Village'...Fresh debris near the 'Old Village' was examined and found to contain angular blocks of granite ranging in size from small grains to some weighing more than a ton. The biggest was estimated at between five and ten tons."

ID: 118
LOCATION: Indian Canyon DATE: 1932; 5/25 pm

TYPE: rock falls TRIGGER: freeze-thaw QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #75 QLOC: 4

PRIME REF: Jensen (1933, p. 10)

NARRATIVE: "The next evening more [slides] were heard in Indian Canyon." Jensen attributed these slides to freezing and thawing.

ID: 119
LOCATION: Glacier Point-Curry Village DATE: 1932; 5/25 pm

TYPE: rock slides TRIGGER: freeze-thaw QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #76 QLOC: 4

PRIME REF: Jensen (1933, p. 10)

NARRATIVE: May 25, 1932, evening: "Slides occurring at about the same time were reported as having fallen in the vicinity of 'Camp Curry'." The 'Camp Curry' slides were likely from the roof above the 'Ledge Trail' and below Glacier Point. Jensen attributed these slides to freezing and thawing.

ID: 120R
LOCATION: Vernal Fall-Mist Trail DATE: 1932; 11/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #77R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1932

NARRATIVE: November 1932: There were some repairs "on the Mist Trail where a slide broke down some of the railing and steps near Vernal Fall" presumably the last railing and steps just beside the fall.

ID: 121
LOCATION: Yosemite Valley DATE: 1932; 12/20

TYPE: rock slides TRIGGER: earthquake QDATE: 1

SIZE: very small VOL(m3): 2 GEOLOGY: ? QSIZE: 2

DAMAGE: none CROSS REF: Snyder #78 QLOC: 4

PRIME REF: Jensen (1933, p. 10)

NARRATIVE: "The earthquake of December 20, 1932, was severe enough to be felt over a large area of several western states. In Yosemite valley local residents were quite disturbed by the rocking effect on their homes. Pictures were shaken from walls, chandeliers swayed for several minutes, dishes were broken, and many left their houses for safety.

A few scattered rocks fell here and there, all of them very small. There were some 20 succeeding smaller tremors during the next few weeks none of which dislodged a rock so far as local observers could tell." No specific locations were provided for these earthquake generated rock slides...no major earthquakes have been recorded in the region before or after 1872 ...

Fred Lester (USGS, unpub. data, 1987) lists a M7.2 earthquake on 12/20/32 10:10 p.m. P.S.T., with an approximate epicenter location near Gabbs, Nevada, about 110 miles from Yosemite Valley.

ID: 122D
LOCATION: Wawona Road-west of tunnel DATE: 1933; early 3/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 118 GEOLOGY: Kec QSIZE: 0

DAMAGE: road CROSS REF: Snyder #82I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1933

NARRATIVE: March 1933: "A large slide a half mile west of the tunnel completely blocked the Wawona road the first part of the month." A photograph caption: "This single granite boulder 16 feet high and weighing about 340 tons fell into the Wawona about one-half mile west of the new tunnel."

ID: 123D
LOCATION: El Portal Road-Arch Rock DATE: 1933; 3/19

TYPE: rock slide TRIGGER: spring runoff QDATE: 1

SIZE: large VOL(m3): 600 GEOLOGY: Kga QSIZE: 1

DAMAGE: road CROSS REF: Snyder #83I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1933

NARRATIVE: March 19, 1933: There had been a heavy winter with rapid runoff during March. "On March 19 a large slide 1.4 miles below Arch Rock blocked traffic for several hours." A photograph caption: "This rock slide over 50 feet across completely blocked the road and was estimated to contain about 800 yards of granite-- weighing approximately 1000 tons."

ID: 124
LOCATION: El Portal Road-Arch Rock DATE: 1933; 3/23

TYPE: rock slide TRIGGER: spring runoff QDATE: 1

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #84 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1933

NARRATIVE: "equipment and men were needed on March 23 to remove a large rock slide on the El Portal Road below Arch Rock- a slide over 80 feet long which took out the parapet wall and was 40 feet in height at certain points. Three shifts of men were used and all necessary equipment placed in operation to open this road to travel, and it was possible to clear it for one-way traffic on the 25th." It had been a heavy winter with rapid runoff during March.

ID: 125D
LOCATION: Nevada Fall Trail DATE: 1932-33; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #79I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1933

NARRATIVE: Winter, 1933: "On April 6 the slide on the Nevada Fall Trail above the Mist Trail intersection had been removed."

ID: 126D
LOCATION: Vernal Fall-Mist Trail DATE: 1932-33; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #80I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1933

NARRATIVE: Winter, 1933: "A number of days were required cleaning out the slide on the Mist Trail near the foot of Vernal Fall and replacing stone steps. The men had to work in a heavy mist which kept them drenched most of the time."

ID: 127D
LOCATION: Nevada Fall Trail DATE: 1932-33; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #81I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1933

NARRATIVE: Winter, 1933: "The trail crew is now engaged in removing a rock slide on the Nevada Fall Trail near the 'Rock Chimney'; it is expected that this trail will be open to Clark Point on the 28th."

ID: 128
LOCATION: El Portal Road DATE: 1933; 10/30-31

TYPE: rock slide TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #85 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1933

NARRATIVE: October 30-31, 1933: "The rain and wind storm October 30 and 31 brought down a number of trees and rocks which had to be cleared from the roads without delay. One large slide was removed from the El Portal Road, as well as numerous rocks cleared off as various places along the road."

ID: 129
LOCATION: El Portal Road DATE: 1934; early 1/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #86 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1934

NARRATIVE: January 1934: "A few rock slides were removed from the El Portal Road early in the month."

ID: 130R
LOCATION: old Big Oak Flat Road DATE: 1934; 11/23

TYPE: rock slide TRIGGER: rain ? QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Kdg QSIZE: 2

DAMAGE: road CROSS REF: Snyder #87R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1934

NARRATIVE: After 5 inches of rain between November 15 and 20, "November 23 a slide blocked the control section of the Big Oak Flat Road; running across two portions of the road near the second switchback above 'El Capitan Station', it destroyed 40 lineal feet of retaining wall averaging 12 feet in height on the upper road and about 30 lineal feet of the same height on the road beneath."

ID: 131D
LOCATION: El Portal Road-'Windy Point' DATE: 1935; 1/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kga QSIZE: 3

DAMAGE: road, cost CROSS REF: Snyder #88I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1935

NARRATIVE: January 1935: "Several slides occurred on the El Portal Road; one, just below 'Windy Point', will necessitate about $200 in the construction of a rubble masonry wall to prevent further giving away of dirt and rock which is progressively undermining an enormous boulder."

ID: 132
LOCATION: El Portal Road DATE: 1935; 2/??

TYPE: rock slides TRIGGER: rain QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #89 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1935

NARRATIVE: February 1935: "There were numerous small rocks and slides along the El Portal Road each morning after rainfalls, requiring periodic removal and patrol."

ID: 133
LOCATION: El Portal Road DATE: 1935; 3/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #90 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1935

NARRATIVE: March 1935: "Occasional rocks and two slides were removed" from the 'All-Year Highway'.

ID: 134R
LOCATION: Yosemite Falls Trail DATE: 1935; 4/10 12:15am

TYPE: rock slide TRIGGER: unknown QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #93R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1935

NARRATIVE: April 10, 1935: "The Yosemite Falls Trail was open to the foot of the upper fall early in the month, but at 12:15 a.m. April 10 a slide took out 300 feet of the trail, preventing passage beyond 'Columbia Point'; the area was dry enough on April 28 to start construction of a new rock retaining wall." The report included a photograph "of the havoc caused by a slide across the Yosemite Falls Trail. The dotted line indicates where the trail was. It is now being rebuilt. The slide continued to the floor of the valley, over a thousand feet below." The slide was located on the switchback corner between 'Dorn's crossing' and the spring. The report for May 1935, has a photograph of completed reconstruction through this slide.

ID: 135
LOCATION: El Portal Road DATE: 1935; 4/??

TYPE: rock slides TRIGGER: rain ? QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road, cost CROSS REF: Snyder #91 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1935

NARRATIVE: April 1935: "The 11.99 inches of rainfall was the heaviest in park records, for April, extending back to 1904.

There were numerous slides on the El Portal Road; storm damages on this road involved about $500 extra expense."

ID: 136
LOCATION: Wawona Road DATE: 1935; 4/??

TYPE: debris slide TRIGGER: rain ? QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #92 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1935

NARRATIVE: April 1935: "The 11.99 inches of rainfall was the highest in park records for April, extending back to 1904. Saturation of cut banks along the Wawona Road caused many slides."

According to Jim Snyder (written commun., April 7, 1992) this was maybe an earth slump, although rock and debris slides are more likely, or debris slides and flows.

ID: 137D
LOCATION: Big Oak Flat Road DATE: 1935; 5/25

TYPE: rock slide TRIGGER: blasting QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Kec QSIZE: 2

DAMAGE: fatality,injuries CROSS REF: Snyder #94I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1935

NARRATIVE: May 25, 1935: "May 25, William Anderson Combs, age 41, a Government employee, working on the new Big Oak Flat Road job as a powderman under supervision of the Bureau of Public Roads, was killed by a large rock slide. . . . Blasting had loosened large rocks on which he was working. Two other men working nearby, Walter Goodnight and J. M. Bowersox, were injured, but not seriously."

The two men were "seriously injured, escaping the full force of the slide by dodging beneath an overhanging rock." (Merced Star)

ID: 138D
LOCATION: Wapama Falls DATE: 1935; early 7/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: very large VOL(m3): 20000 GEOLOGY: Kg QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #95I QLOC: 1

PRIME REF: E.M. Hilton, NPS, unpub. data, 1935

NARRATIVE: Early July 1935: A slide occurred on the trail around Hetch Hetchy about 700 feet east of Wapama Falls. "It is 250 feet across, approximately 650 feet in length and is on an average 62 percent or 32 degree slope. A thin section of the cliff above the trail gave way, and wiped out the growth of live oak throughout this stretch." (July 16, 1935, memorandum to Superintendent from Park Engineer E.M. Hilton)

ID: 139R
LOCATION: Yosemite Falls Trail DATE: 1936; 2/1-7

TYPE: rock slide TRIGGER: rain ? QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #97R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1936

NARRATIVE: February 1936: "The first week of the month a slide again occurred above the Yosemite Falls Trail, and about 50 feet of the trail will have to be replaced."

ID: 140
LOCATION: Wawona Road DATE: 1936; 2/??

TYPE: rock/debris slides TRIGGER: rain ? QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #96 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1936

NARRATIVE: February 1936: "19.53 inches of precipitation in February broke all records...

There were two serious slides, and a number of of smaller ones, on the Wawona Road; one of the large ones blocked traffic for about two hours."

ID: 141R
LOCATION: Wawona Road-Grouse Creek DATE: 1936; 3/??

TYPE: debris slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kec QSIZE: 3

DAMAGE: road CROSS REF: Snyder #98R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March, May 1936

NARRATIVE: March 1936: "Constant maintenance work is required at the slide in the Grouse Creek area in order to keep a one-way road through this section. There are 17 men on the work." A photograph on the previous page shows earth slumping in a road cut with a caption: "This slide is working continually and requiring constant maintenance." This slide is at the rock wall on the east side of the present road, downhill from the Grouse Creek crossing.

ID: 142
LOCATION: El Portal Road DATE: 1936; 4/??

TYPE: rock slides TRIGGER: blasting QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: utility CROSS REF: Snyder #99 QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1936

NARRATIVE: April 1936: "The 'All-Year Highway' was blocked twice during the month by slides; one closed the road for an hour, the other for nearly four hours. Both slides were caused by the rush of water from breaks in the pipe line to the power house, which in turn had been caused by rocks loosened by blasts on the new Big Oak Flat road construction work."

ID: 143R
LOCATION: Wawona Road-Grouse Creek DATE: 1936; 4/??

TYPE: debris slide TRIGGER: unknown QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Kec QSIZE: 3

DAMAGE: road CROSS REF: Snyder #100R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1936

NARRATIVE: April 1936: "Slide removal on the Wawona Road, particularly at one spot, kept BPR crews busy throughout the month."

ID: 144
LOCATION: El Portal Road DATE: 1936; 4/??

TYPE: debris slides TRIGGER: pipeline break QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Qat QSIZE: 3

DAMAGE: road CROSS REF: Snyder #99 QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1936, p.6

NARRATIVE: April 1936: "The 'All Year Highway' was blocked twice during the month by slides; one closed the road for an hour, the other for nearly four hours. Both slides were caused by the rush of water from breaks in the pipe line to the power house, which in turn had been caused by rocks loosened by blasts on the new Big Oak Flat Road construction work."

ID: 145
LOCATION: Yosemite Falls Trail DATE: 1936; 5/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #101 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1936

NARRATIVE: May 1936: "Repair of a slide on the Yosemite Falls Trail required the placing of 170 lineal feet of dry rock wall with an average height of 6 feet."

ID: 146R
LOCATION: Big Oak Flat Road-Cascades DATE: 1937; 2/5

TYPE: debris flow TRIGGER: rain QDATE: 1

SIZE: large VOL(m3): 2000 GEOLOGY: Qaf QSIZE: 2

DAMAGE: road CROSS REF: Snyder #102R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1937

NARRATIVE: February 1937: "Heavy rain washed out a fill on the new Big Oak Flat Road on February 5, and the dislodged dirt and rocks swept down across the 'All Year Highway' and to within 3 inches of the floor level on one of the residences at Cascades." A photograph shows the maximum depth of material on the roadway of approximately 12 feet."

ID: 147
LOCATION: Wawona Road DATE: 1937; 2/5

TYPE: debris slides TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #103 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1937

NARRATIVE: February 1937: "Rain caused several smaller slides of snow and debris on the Wawona Road at about the same time [February 5], closing it for a few hours."

ID: 148R
LOCATION: Big Oak Flat Road DATE: 1937; 2/16?

TYPE: debris flow TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Qaf QSIZE: 3

DAMAGE: structure CROSS REF: Snyder #104R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1937

NARRATIVE: February 1937: "One of the two turbines at the Cascades power house failed on February 16. Investigation disclosed that large amounts of sand and gravel that had been washed down the new Big Oak Flat Road by heavy rainfall had entered the penstock line, filled the sand trap quickly, and continued down the pipe line to the turbine, damaging it considerably and necessitating an immediate shutdown."

According to Jim Snyder (written commun., April 7, 1992) debris flow is probably the best category for this event, since it occurred not so much from cliffs or cuts above the new road, but from incompletely compacted road fills with no cap [the cuts were] vulnerable to heavy wash.

ID: 149D
LOCATION: Glacier Point-Fourmile Trail DATE: 1936-37; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Kec QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #105I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1937

NARRATIVE: Winter, 1937: "A winter slide wiped out 600 feet of the short trail to Glacier Point, necessitating the combined work of regular maintenance crews and ECW men to get it into shape for hikers and saddle horse parties before the heavily travelled Memorial Day week-end." A photograph shows CCC enrollees at work and locates the slide at the 'Italian Wall' switchbacks of the Fourmile Trail.

ID: 150D
LOCATION: Medial Moraine DATE: 1937; 3/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 140 GEOLOGY: Khd QSIZE: 0

DAMAGE: road CROSS REF: Snyder #106I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, March/April 1937

NARRATIVE: March 1937: "... removal of a portion of a 1000-cubic-yard boulder which slid into and obstructed a roadway in the upper end of the valley."

A later description of this same rock notes "A large amount of rock was removed from an enormous boulder that had slide down and obstructed about 8 feet of one of the roads in the upper section of the valley, permitting two-way travel again on this road."

Caption of April 1937 photograph in the Superintendent's Monthly Report "Before. Photograph of the large boulder which slide down and partially obstructed one of the roads in the upper section of Yosemite Valley." According to Jim Snyder (written commun., March 1992) the remainder of the block is about 80 cubic yards. What was shot off appears from the photograph and the remaining portion to have been about 100 cubic yards, so the original rock was probably about 180 cubic yards. The rock slipped three or four feet down the embankment to the edge of the road in the May 25-27, 1980 Mammoth Lakes, California earthquake sequence. Presently, the rock slightly overhangs the road.

ID: 151R
LOCATION: Big Oak Flat Road-El Portal Road DATE: 1937; 12/11

TYPE: debris flows TRIGGER: rain QDATE: 1

SIZE: large VOL(m3): 2000 GEOLOGY: Qaf QSIZE: 2

DAMAGE: road CROSS REF: Snyder #113R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1937

NARRATIVE: December 11, 1937: "During the rain storm two large fills were washed out [on the new Big Oak Flat Road], one of them blocking the 'All Year Highway' within the park for several hours with 4 to 5 feet of rock and mud over a length of 200 to 300 feet."

ID: 152D
LOCATION: Hetch Hetchy Reservoir DATE: 1937; 12/11

TYPE: rock slides TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #112I QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, August 1938

NARRATIVE: December 11, 1937: "The trail along the north side of Hetch Hetchy Reservoir from the dam to and including Rancheria Creek will not

open until late in October [1938] on account of all bridges out and several severe rock slides."

(August 1, 1938, news release appended to Superintendent's Monthly Report, unpub. data, August 1938)

ID: 153D
LOCATION: Curry Village-'Ash Can Slide' DATE: 1937; 12/9-12

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: large VOL(m3): 765 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #107I QLOC: 0

PRIME REF: Report on Flood-Storm Damage, NPS, unpub. data, 1937

NARRATIVE: December 9-12, 1937: Photo 15: Heavy rocky debris flow which completely blocked the road near 'Ash Can Slide'. The photograph shows the road just east of the Housekeeping Camp entrance, looking west across the slide to a car on the other side of it. The 'Ash Can Slide' was a sort of tobaggan run, except you did it on ash can lids. The flow was about 50 feet across and roughly three feet deep. It carried a lot of soil with it and a number of 300-500 pound rocks. The photograph shows maybe 60 feet of the slide, which may have gone to the river.

ID: 154D
LOCATION: Wawona Road-Washburn Slide DATE: 1937; 12/9-12

TYPE: rock slide TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #109I QLOC: 1

PRIME REF: Report on Flood-Storm Damage, NPS, unpub. data, 1937

NARRATIVE: December 9-12, 1937: Caption photo 19: "Heavy rock slide at Washburn Slide which temporarily blocked Wawona Road near Wawona Road tunnel."

ID: 155D
LOCATION: Wawona Road-Bridalveil Fall DATE: 1937; 12/9-12

TYPE: rock slide TRIGGER: rain QDATE: 2

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #110I QLOC: 0

PRIME REF: Report on Flood-Storm Damage, NPS, unpub. data, 1937

NARRATIVE: December 9-12, 1937: Caption photo 20: "Rock slide near Bridalveil Fall on Wawona Road after high way had been reopened as one-way travel road." At the point where the old road comes in to the new road.

ID: 156D
LOCATION: Illilouette Gorge DATE: 1937; 12/9-12

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: large VOL(m3): 2000 GEOLOGY: Khd QSIZE: 3

DAMAGE: structure CROSS REF: Snyder #111I QLOC: 1

PRIME REF: Report on Flood-Storm Damage, NPS, unpub. data, 1937

NARRATIVE: December 9-12, 1937: Caption photo 24: at the location of the water intake. "The dam beyond these men is entirely covered and partially destroyed. Here the former channel of Illilouette Creek is completely filled with boulders and gravel. Two new channels developed on the far side of the old channel, and another new channel on the near side."

According to Jim Snyder (written commun., April 7, 1992) there was not much soil, but lots of rock and water involved in this event.

ID: 157D
LOCATION: Wawona Road DATE: 1937; 12/9-12

TYPE: rock slide TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #108I QLOC: 1

PRIME REF: Report on Flood-Storm Damage, NPS, unpub. data, 1937

NARRATIVE: Storm Damage, December 9-12, 1937: "Slide on road near 'Grape Vine' turn ruining the base course for 120 feet, not far from Wawona."

ID: 158
LOCATION: Yosemite Valley DATE: 1938; 2/??

TYPE: debris slides TRIGGER: rain ? QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road, utility CROSS REF: Snyder #114 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1938

NARRATIVE: February 1938: February was a cold, stormy month with 16.64 inches of precipitation, three times normal. "A wind storm and slides during the month did considerable damage to power and telephone lines. Numerous mud and rock slides had to be removed from roads."

ID: 159D
LOCATION: Wawona Road-Washburn Slide DATE: 1938; 5/14 6 pm

TYPE: debris slump TRIGGER: unknown QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #115I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1938

NARRATIVE: May 14, 1938: "The Wawona Road, which is under post construction by the Bureau of Public Roads, is in rather poor condition. An unusual slide developed on this road about 6 p.m. May 14 [no rain since May 2, and then light], one-half mile south of the tunnel, closing this road until about 8 a.m. the following morning." A photograph shows mud, trees, and rock in the woods toward Artists Creek.

ID: 160D
LOCATION: Glacier Point-Happy Isles DATE: 1938; 8/2

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 3

DAMAGE: none CROSS REF: Snyder #116I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, August 1938

NARRATIVE: August 2, 1938: The rock slide "on August 2 occurred in the Happy Isles area from the Glacier Point side of the valley. This caused the formation of a new talus slope in the area where it occurred. Outside of creating clouds of dust and making such noise, this rock slide did little damage." A photograph shows the new talus slope beneath Glacier Point. There was no rain this month.

ID: 161D
LOCATION: Royal Arch Cascade DATE: 1938; 8/28

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #117I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, August 1938

NARRATIVE: August 28, 1938: "The slide on August 28 occurred in back of the Ahwahnee Hotel and was of less magnitude than the rock slide occurring earlier in the month [Glacier Point]. No damage resulted." A photograph shows talus from the slide but not a release point.

ID: 162D
LOCATION: Vernal Fall Trail DATE: 1938-39; Winter

TYPE: rock slides TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #118I QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1939

NARRATIVE: Winter, 1939: "Opening of trails commenced in March by removal of a number of large rocks on the Vernal Fall trail ..."

ID: 163
LOCATION: old Big Oak Flat Road DATE: 1939-40; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #119 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1940

NARRATIVE: Winter, 1940: "On the old Big Oak Flat Road, work has been under way for two weeks rebuilding retaining walls taken out by a slide last winter."

ID: 164D
LOCATION: Sentinel Rock DATE: 1940; 3/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail, utility CROSS REF: Snyder #121I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1940

NARRATIVE: March 1940: "A large slide destroyed over 100 feet of retaining wall and 200-300 feet of trail below Sentinel Rock, an enormous boulder being deposited on the [Glacier Point-Fourmile] trail at this location from the slide." Photographs showing the boulder and trail and phone line damage.

ID: 165R
LOCATION: Red Peak Pass Trail DATE: 1939-40; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Kjl QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #120R QLOC: 1

PRIME REF: none

NARRATIVE: Winter, 1940: According to Nick Brocchini, who worked on the trail crew, the north side of the Red Peak Pass Trail was wiped out by a slide and had to be rebuilt.

ID: 166D
LOCATION: Church Bowl DATE: 1941; 2/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #123I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1941

NARRATIVE: February 1941: A CCC crew removed "a rock slide from the nearby bridle path"- near the Church Bowl toward Indian Canyon rather than towards the Ahwahnee Hotel.

ID: 167
LOCATION: Wawona Road DATE: 1941; 2/??

TYPE: earth slump TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #122 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1941

NARRATIVE: February 1941: "Considerable difficulty has been experienced for some time with the removal of a slide that is continually encroaching on the Wawona Road beyond Chinquapin."

According to Jim Snyder (written commun., April 7, 1992) although the precise location is not known, there are several places that are likely candidates because they slump occasionally in winter or spring.

ID: 168D
LOCATION: old Big Oak Flat Road DATE: 1941; 3/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 42 GEOLOGY: Kdg QSIZE: 0

DAMAGE: road CROSS REF: Snyder #126I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1941

NARRATIVE: March 1941: "Considerable damage was done on the one-way section of the old Big Oak Flat Road about 1 1/4 miles above the valley floor where a slide deposited a 120-ton boulder on the road, destroying at least 50 lineal feet of the retaining wall of which the average height is 15 feet."

ID: 169D
LOCATION: Wawona Road DATE: 1941; 3/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road, structure CROSS REF: Snyder #124I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1941

NARRATIVE: March 1941: There was above normal rain and snowfall this winter. "A slide on the roadside near Wawona broke the 4 inch water main leading to the campground there, and about 200 feet of the pipe was removed and probably will not be replaced until a retaining wall is completed at the slide."

ID: 170D
LOCATION: Wawona Road DATE: 1941; 3/??

TYPE: rock slide ? TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kec QSIZE: 3

DAMAGE: road CROSS REF: Snyder #125I QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1941

NARRATIVE: March 1941: There was above normal rain and snowfall this winter. "A slide above 'Rail Creek' on the Wawona Road continued to require almost daily removal throughout the month, but it has been stabilized to a considerable extent."

ID: 171
LOCATION: Yosemite Valley DATE: 1941; 10/2

TYPE: rock slides ? TRIGGER: wind storm QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: trails, roads CROSS REF: Snyder #127 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1941

NARRATIVE: October 2, 1941: "Considerable maintenance was necessary, including removal of trees and rocks, drainage repair, etc., on major park roads following the severe wind storm October 2, which also caused extensive blocking of park trails."

ID: 172D
LOCATION: Big Oak Flat Road DATE: 1942; 4/21

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: large VOL(m3): 864 GEOLOGY: Kec QSIZE: 0

DAMAGE: road CROSS REF: Snyder #129I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1942

NARRATIVE: April 21, 1942: "Although opening of the Big Oak Flat Road was scheduled for April 25, a slide containing 2,500 tons of granite crashed into the road April 21 and completely blocked the highway in a cut 3 1/2 miles above the long tunnel."

ID: 173D
LOCATION: Castle Cliffs DATE: 1942; 4/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 83 GEOLOGY: ? QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #128I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1942

NARRATIVE: April 1942: "The principal trail maintenance job was removing a slide which deposited 240 tons of large boulders across the trail back of the utility area. Approximately 40 cubic yards of rock wall had to be rebuilt on this job."

ID: 174D
LOCATION: Big Oak Flat Road-El Portal Road DATE: 1943; 3/19 12:50am

TYPE: rock slide TRIGGER: unknown QDATE: 0

SIZE: very large VOL(m3): 20000 GEOLOGY: Kec QSIZE: 3

DAMAGE: road, utility CROSS REF: Snyder #130I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1943

NARRATIVE: March 19, 1943: "A rock slide occurred at 12:50 a.m., March 19, a short distance below the power house dam, blocking the El Portal and new Big Oak Flat Roads, and damaging the power house penstock... Slide was removed from 'All-Year Highway' within twenty-four hours. By the end of the month, the one on the Big Oak Flat Road was 90 percent cleared."

ID: 175
LOCATION: El Portal Road-Arch Rock DATE: 1945; 2/2

TYPE: rock slides TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #131 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1945

NARRATIVE: February 2, 1945: "The road maintenance crew removed many small slides and one larger one below Arch Rock, which closed the 'All-Year Highway' for several hours on February 2."

ID: 176R
LOCATION: old Big Oak Flat Road DATE: 1945; 5/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: very large VOL(m3): 20000 GEOLOGY: Kdg QSIZE: 2

DAMAGE: road, cost CROSS REF: Snyder #132R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1945

NARRATIVE: May 1945: "Because of a large rock slide, the old Big Oak Flat Road from 'Gin Flat' to the valley will be closed until appropriations are available to make repairs estimated at approximately $15,000....a map was prepared of the slide at switchbacks on the control portion of the old Big Oak Flat Road." A copy of this map has not been found.

According to Jim Snyder (written commun., April 7, 1992) this was the slide that closed the road for good and took out the switchback and its walls. Much of the pavement is intact though buried beneath tons of rock. The slide cut quite a wide swath. The old road is shown on the Yosemite Valley topographic map as having a break in it where the slide hit, and it is often called the "Rock Slides Trail" as a result.

ID: 177
LOCATION: Tuolumne Meadows DATE: 1946; Spring

TYPE: debris slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 460 GEOLOGY: Qti QSIZE: 0

DAMAGE: road CROSS REF: Snyder #133 QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, June 1946

NARRATIVE: Spring, 1946: "The Tioga Road was officially opened June 8 with but 18 hours of snow removal being required to open it. That portion of the Tioga Road approximately one mile above Tuolumne Meadows which every year is blocked by an unstable cut section proved no exception this year, and over 600 cubic yards of muck had to be removed to make this road safe for travel."

ID: 178
LOCATION: Big Oak Flat Road DATE: 1946; 11/8

TYPE: rock slides TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #135 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1946

NARRATIVE: November 8, 1946: "The first heavy fall storm occurred on November 8 and resulted in the closing of the Tioga and Big Oak Flat Roads... The unusually heavy rainfall caused rock slides, plugged culverts, and filled drainage ditches, all of which required considerable time and effort to restore to usable condition."

ID: 179
LOCATION: Glacier Point Road-Badger Pass DATE: 1946; 11/8

TYPE: rock slides TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #136 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1946

NARRATIVE: November 8, 1946: "The Glacier Point Road above Badger Pass was closed to travel by snow on November 20. The unusually heavy rainfall caused rock slides, plugged culverts, and filled drainage ditches, all of which required considerable time and effort to restore to usable condition."

ID: 180
LOCATION: Yosemite Falls Trail DATE: 1946; 11/8

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #137 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1946

NARRATIVE: November 8, 1946: "The first heavy fall storm occurred on November 8 .... A rather severe rock slide on the Yosemite Falls Trail obliterated approximately 300 feet of the trail and wall. It has now been repaired."

ID: 181
LOCATION: Tioga Road DATE: 1946; 11/8

TYPE: rock slides TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #134 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1946

NARRATIVE: November 8, 1946: "The first heavy fall storm occurred on November 8 and resulted in the closing of the Tioga ... Road. ... The unusually heavy rainfall caused rock slides, plugged culverts, and filled drainage ditches, all of which required considerable time and effort to restore usable condition."

ID: 182
LOCATION: Glacier Point-Fourmile Trail DATE: 1946; 11/?

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #138 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1946

NARRATIVE: November 1946: "Work was done on the Fourmile Trail consisting of clearing the trail of slides and undergrowth and replacing or repairing water breaks."

ID: 183D
LOCATION: Big Oak Flat Road DATE: 1947; 2/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 1 GEOLOGY: Kec QSIZE: 1

DAMAGE: road, structure CROSS REF: Snyder #139I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1947

NARRATIVE: February 1947: "A large rock weighing considerably over a ton cascaded from considerable height above the Big Oak Flat Road near the dam and caused severe damage to the telephone lines and the pavement."

ID: 184R
LOCATION: Lake Eleanor-Hetch Hetchy Road DATE: 1947; 10/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #140R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1947

NARRATIVE: October 1947: "A fairly large slide on the Hetch Hetchy Road approximately three miles above the dam, has been removed."

ID: 185D
LOCATION: Glacier Point Road-'Mono Grade' DATE: 1948; 1/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #141I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1948

NARRATIVE: January 1948: "A large rock slide came down on the Glacier Point Road in the vicinity of the 'Mono Grade'. One rock approximated 50 ton and many would average 10 to 15 ton, the impact cracking the pavement severely. The road has been cleared sufficiently to permit one-way passage in the event Glacier Point needed to be made accessible."

ID: 186
LOCATION: El Portal Road DATE: 1948; 1/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #142 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1948

NARRATIVE: January 1948: "Several rock slides were also removed from the El Portal Road."

ID: 187
LOCATION: Yosemite Valley DATE: 1948; 3/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: roads CROSS REF: Snyder #143 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1948

NARRATIVE: March 1948: "Several large rock slides occurred on various roads during the month and required drilling and blasting to be removed. The snowfall in the valley of 42 inches was one of the heaviest

March snowfall in years."

ID: 188
LOCATION: Yosemite Valley DATE: 1947-48; Winter

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: trails, roads CROSS REF: Snyder #144 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1948

NARRATIVE: Winter, 1948: "All roads as well as the fire roads have been subjected to heavy washouts and rock slides during the winter, requiring more than usual repair and cleanup. This applies also to trails and bridal paths."

ID: 189D
LOCATION: El Portal Road-Coulterville Road DATE: 1948; 4/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kg QSIZE: 2

DAMAGE: road CROSS REF: Snyder #145I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1948

NARRATIVE: April 1948: "Several large rocks above the old Coulterville Road broke loose and rolled onto the El Portal Road causing considerable damage to the concrete road and rock wall, blocking both roads."

ID: 190D
LOCATION: Big Oak Flat Road DATE: 1948; 4/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Kec QSIZE: 2

DAMAGE: road CROSS REF: Snyder #146I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1948

NARRATIVE: April 1948: "A large rock slide occurred at the entrance to the Big Oak Flat Road damaging the road bed and culvert and blocking the entrance. Drilling and blasting were necessary to clear the road. A section of the rock wall had to be removed for about 200 feet in order to dispose of the slide by bulldozer."

ID: 191
LOCATION: El Portal Road DATE: 1948; 10/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: utility CROSS REF: Snyder #147 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1948

NARRATIVE: October 1948: "Several outages occurred on telephone lines during the month caused by a rock slide and fallen trees on the line to El Portal."

ID: 192
LOCATION: El Portal Road DATE: 1949; 2/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #148 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1949

NARRATIVE: February 1949: "Two large rocks required blasting to get them off the roads, one on the El Portal Highway ..."

ID: 193
LOCATION: Wawona Road DATE: 1949; 2/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #149 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1949

NARRATIVE: February 1949: "Two large rocks required blasting to get them off the roads, one on the El Portal Highway and one on the Wawona Road."

ID: 194D
LOCATION: Glacier Point-'Ledge Trail' DATE: 1949; 7/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 3 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail, injury CROSS REF: Snyder #150I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, July 1949

NARRATIVE: July 1949: "A slide occurred on the 'Ledge Trail' to Glacier Point which necessitated removal of four cubic yards of rock and dirt spread over 100 feet of trail.

"A hiker suffered a broken leg while climbing the 'Ledge Trail' [when] a rock slide occurred. He was carried down the trail in a stretcher by rangers and volunteer Company employees."

ID: 195R
LOCATION: Sentinel Creek DATE: 1949; 10/23 1:40pm

TYPE: rock slide TRIGGER: unknown QDATE: 0

SIZE: very large VOL(m3): 20000 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: Snyder #151R QLOC: 1

PRIME REF: McHenry (1949, p. 146-147)

NARRATIVE: "With a thunderous roar and amid a mushrooming cloud of dust tons of rock and rock debris cascaded from the south wall of Yosemite Valley in the vicinity of Sentinel Rock at 1:40 p.m., Sunday afternoon, October 23, 1949. So thick, indeed, was this cloud that it blotted out the sun in the general area of the slide and made it impossible to determine for the time just what had happened... Dust was deposited in the upper valley.

High on the south wall of the valley, within a hundred or so feet of the top and across the ravine of Sentinel Fall from Sentinel Rock, a huge section of the shoulder of a cliff had broken off leaving a scar of perhaps several acres of loose and weathered rock. The tremendous concussion caused by this slide started a second slide from the west shoulder of Sentinel Rock itself about 1000 feet from the top...

It is difficult to determine just what started these rock slides. It is worth noting, however, that at the time of the slides the sun had just crept around to a position which allowed it to shine on these cliffs for the first time that day...

Whatever the cause, according to old residents, this is undoubtedly the largest and most spectacular rock slide which has occurred in Yosemite Valley during about the last twenty-five years. So spectacular was this phenomena that a considerable crowd of people immediately assembled in the general region within minutes after it was first seen and heard- people who were accustomed to numerous rock slides during any year."

ID: 196R
LOCATION: Sentinel Rock DATE: 1949; 10/23 1:40pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: very large VOL(m3): 20000 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #152R QLOC: 1

PRIME REF: McHenry (1949, p. 146-147)

NARRATIVE: "The tremendous concussion caused by this slide started a second slide from the west shoulder of Sentinel Rock itself about 1000 feet from the top.

This later slide descended to within a few hundred yards of the parking area at the valley terminus of the Fourmile Trail to Glacier Point. About 600 feet of the lower end of this trail was wiped out, as it was covered to a depth of from two to six feet of loose rock debris. Mature trees were splintered or sheared off while still others stood stark beneath the cliff shorn of all their branches... Dust lay an eighth of an inch thick over the rocks and ground for a quarter of a mile....

Miss Lois Nordlinger has given a vivid eyewitness account. She and Betty Barnard were on horseback in the immediate region at the time of the slides.

"We looked up just as the first rocks were breaking loose from the top of Sentinel Rock. We didn't think too much about it at first, believing it to be just another small slide. We kept watching as we rode along. Suddenly the slide gained momentum and larger boulders were swept down. We stared, hypnotized, our horses tense and trembling. We could see great boulders shearing the branches from trees along the cliff wall; the noise increased, the low rumble was terrifying. Suddenly the foremost part of the slide hit bottom and dense clouds of dust and debris arose. It seemed as if a huge tidal wave were advancing toward us. Within seconds we were completely enveloped, unable to see the trees next to us and obscured from each other. The dust became fiery red, filled with flying sparks caused by intense friction. There and then we decided we'd better get out of here before we were goners. Simultaneously, we wheeled our horses and raced back to the 'Old Village', the billowing dust in hot pursuit." ...

Although the major rock slides occurred on October, 23, 1949, numerous slides of considerable proportions continued over a period of several weeks. The area is not yet stabilized and probably won't be for some time to come. It is for that reason that repair of the trail is not to be undertaken until well past next spring."

ID: 197R
LOCATION: Big Oak Flat Road DATE: 1950; 1/5

TYPE: debris slide TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 138 GEOLOGY: Kec QSIZE: 0

DAMAGE: road, cost CROSS REF: Snyder #153R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1950

NARRATIVE: January 5, 1950: "A slide which occurred on the Big Oak Flat Road on January 5 covered the road for a hundred feet or more with an estimated 400 tons of rock and dirt. An estimate of $2500 has been forwarded to the Region Four Office..." Photos show the slide to be just below the second tunnel.

ID: 198D
LOCATION: Yosemite Falls Trail DATE: 1950; 7/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 23 GEOLOGY: Ks QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #154I QLOC: 2

PRIME REF: Trail Report, NPS, unpub. data, July 1950

NARRATIVE: July 1950: "Took out slide on Yosemite Falls trail above 'Columbia Point'. Slide consisted of about 30 cubic yards of rock. Drilled 12 holes 10 inches to 16 inches and used 30 sticks of powder."

ID: 199
LOCATION: Yosemite Valley Trails DATE: 1950; 11/13-18

TYPE: debris flow TRIGGER: rain/snow QDATE: 2

SIZE: medium VOL(m3): 100 GEOLOGY: ? QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #155 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1950

NARRATIVE: "Warm rains occurred on the 18th after several days of snow and colder temperatures."

"The November flood put 128 cubic yards of silt and 5 cubic yards of rock on bridle paths and the Nevada Fall foot trail."

ID: 200D
LOCATION: Liberty Cap-Clark Point DATE: 1950; 11/13-18

TYPE: rock fall TRIGGER: rain/snow QDATE: 2

SIZE: very small VOL(m3): 4 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #155I QLOC: 4

PRIME REF: Trail Report, NPS, unpub. data, April 1951, p. 1

NARRATIVE: November 13-18: "Warm rains occurred on the 18th after several days of snow and colder temperatures. "The November flood put 128 cubic yards of silt and 5 cubic yards of rock on bridle paths and the Nevada Fall foot trail.

According to Jim Snyder (written commun., April 7, 1992) the damage to the Nevada Falls foot trail, which is that section between Clark Point and Nevada Fall at Liberty Cap, usually occurs right below Liberty Cap.

ID: 201R
LOCATION: El Portal Road-'Windy Point' DATE: 1951; 3/31

TYPE: rock slide TRIGGER: blasting QDATE: 1

SIZE: large VOL(m3): 765 GEOLOGY: Kga QSIZE: 1

DAMAGE: road CROSS REF: Snyder #156R QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1951

NARRATIVE: March 31, 1951: "Work at 'Windy Point' continued throughout the month as weather permitted ... On March 31 the exploding of a relatively minor shot apparently dislodged a key rock in a large portion of disintegrated granite which resulted in a slide of approximately 1000 yards covering the road. In many respects the slide was to the advantage of the project as it dislodged a great quantity of hazardous material. It is estimated at the end of the month that approximately 2000 yards of material had been removed from the face of the bluff by slides and blasting."

ID: 202D
LOCATION: Clark Point-Mist Trail junction DATE: 1951; 4/22

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 12 GEOLOGY: Khd QSIZE: 1

DAMAGE: trail CROSS REF: Snyder #158I QLOC: 1

PRIME REF: Trail Report, NPS, unpub. data, April 1951

NARRATIVE: "On April 22 an approximate 35-ton rock slid down between Clark Point and the Nevada Fall-Mist trail junction; this was removed on April 24."

ID: 203R
LOCATION: El Portal Road-'Windy Point' DATE: 1951; 4/??

TYPE: rock slides TRIGGER: construction QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kga QSIZE: 3

DAMAGE: road CROSS REF: Snyder #157R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1951

NARRATIVE: April 1951: "The detrital material at 'Windy Point' continued througout the entire bluff. Continued careful scaling after each shot was imperative to reduce the possibility of accidents to a minimum. It was found that by playing a stream of water under high pressure on the face of the cliff, scaling was facilitated and the work expedited. After the bluff had been blasted back the necessary distance, it was completely scaled and flushed and a temporary roadway constructed at its base which permitted the resumption of travel."

ID: 204D
LOCATION: Yosemite Falls Trail DATE: 1951; 6/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #159I QLOC: 1

PRIME REF: none

NARRATIVE: June 1951: According to Jim Murphy, there was a small slide on the Yosemite Falls Trail above 'Columbia Point'.

ID: 205D
LOCATION: Moraine Dome DATE: 1951; 8/24

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 15 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #160I QLOC: 1

PRIME REF: Trail Report, NPS, unpub. data, August 1951

NARRATIVE: "On Friday, August 24, company packers reported a rock slide near Lost Valley. This was removed August 25. Rock removed was approximately 20 cubic yards."

ID: 206D
LOCATION: Arch Rock DATE: 1952; 1/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kar QSIZE: 3

DAMAGE: utility CROSS REF: Snyder #161 QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1952

NARRATIVE: January 1952: "Several power failures occurred during the month. The 70,000 volt line was damaged by a rock slide one mile east of Arch Rock and a steel tower was torn from its footings and also crushed during the fall."

ID: 207
LOCATION: El Portal Road DATE: 1952; 3/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road, cost CROSS REF: Snyder #162 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1952

NARRATIVE: March 1952: "There have been several slides on the El Portal Road which have damaged the road, the parapet wall and the dry rock walls which stabilize the road. The cost of repairs will be

approximately $1000."

ID: 208
LOCATION: Tenaya Lake Trail- 'Tenaya Zigzags' DATE: 1951-52; Winter

TYPE: rock slides TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 84 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #163 QLOC: 3

PRIME REF: Trail Report, NPS, unpub. data, April 1952

NARRATIVE: Winter, 1952: "Several small slides came down during the winter on the 'Tenaya Switchbacks'. The slides themselves were not much, but they diverted water down the trail gutting several sections totaling about one-half mile." 75 cubic yards of rock were removed; 35 yards blasted.

ID: 209D
LOCATION: Vernal Fall Trail DATE: 1951-52; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 3 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #164I QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1952

NARRATIVE: Winter, 1952: "On Vernal Fall trail up to bridge about 4 cubic yards of rock were rolled from the trail."

ID: 210D
LOCATION: Clark Point-'Nevada Fall Horse Trail' DATE: 1952; 8/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 5 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #165I QLOC: 0

PRIME REF: Trail Report, NPS, unpub. data, August 1952

NARRATIVE: August 1952: "Two 3 cubic yard rocks were blasted off the Nevada Fall Horse Trail below Clark Point."

ID: 211D
LOCATION: Nevada Fall Trail DATE: 1952; 8/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 17 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #166I QLOC: 1

PRIME REF: Trail Report, NPS, unpub. data, August 1952

NARRATIVE: August 1952: "There are two 20 to 30 ton rocks on the foot trail below Nevada Fall which will be removed as soon as compressor is available."

ID: 212R
LOCATION: Wawona Tunnel-west entrance DATE: 1953; 4/??

TYPE: rock falls TRIGGER: construction QDATE: 3

SIZE: medium VOL(m3): 153 GEOLOGY: Kec QSIZE: 0

DAMAGE: road CROSS REF: Snyder #167R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1953

NARRATIVE: April 1953: "The west entrance of the Wawona Tunnel was scaled of approximately 200 cubic yards of rock which presented a hazardous condition because the rocks were continuously falling on the road at the tunnel entrance."

ID: 213D
LOCATION: Big Oak Flat Road DATE: 1954; 3/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kdg QSIZE: 2

DAMAGE: road CROSS REF: Snyder #168I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1954

NARRATIVE: March 1954: "Several slides occurred during the month the most serious of which was on the new Big Oak Flat Road which blocked the entrance to the first tunnel going toward Crane Flat in such a manner that there was no possible way of breaking through with motorized equipment until the rocks were blasted."

ID: 214
LOCATION: Yosemite Falls Trail DATE: 1953-54; Winter

TYPE: rock slides TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #169 QLOC: 4

PRIME REF: Trail Report, NPS, unpub. data, April 1954

NARRATIVE: Winter, 1954: "Yosemite Falls Trail itself has several rock slides of small size across it. It will require approximately a week for crew to put this trail in shape."

ID: 215R
LOCATION: Clark Point-Nevada Fall Trail DATE: 1954; 6/21

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 1

DAMAGE: trail, fatality CROSS REF: Snyder #170R QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, June 1954

NARRATIVE: "On June 21, Assistant Chief Ranger Charles R. Scarborough was instantly killed when he was swept off the Nevada Fall trail near Clark Point by a rock slide. The slide which occurred on Nevada Fall Trail June 21 was cleaned off by [Murphy] crew. Approximately 2 or 3 cubic yards of rock was removed and about 1/2 cubic yard of wall was repaired. This slide area was checked on June 22 by Doug Thomas. On June 24 the trail was closed as a company packer reported more rock sliding. On June 25 Thurman Murphy and the Park Engineer checked the slide area but found no new rock on the trail. On June 27 Doug Thomas and Rangers Gallison and Henneberger checked the area with ropes. The area of where the slide started was located and appeared to be completely dissipated. The slab of rock that had broken loose had all gone over the top of the spring." A special report on the slide has photographs showing the release point above 'Porcupine Spring' and on the east side of the small gully running across the switchbacks below Clark Point.

ID: 216
LOCATION: Mirror Lake DATE: 1954;10/30 10:44pm

TYPE: rock slide TRIGGER: earthquake ? QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: none CROSS REF: Snyder #171 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, October 1954

NARRATIVE: "An earth tremor was felt in the valley October 30 at 10:44 p.m. coming from east to west and was followed by at least one rock slide somewhere above Mirror Lake."

No earthquakes were recorded October 30, 1954 in the vicinity of Yosemite Valley, although a M 4.0 event occurred October 31, 1954

at 10:42 p.m. in the vicinity of Millerton Lake, about 40 km northeast of Fresno (Fred Lester, unpub. data, August 1987). This October 31, 1954 event would have been approximately 85 km south of Yosemite Valley and extremely unlikely to trigger a rock slide in Yosemite Valley according to relationships between earthquake magnitude, epicenter and furthest observed historic rock slides (Keefer, 1984).

ID: 217
LOCATION: El Portal Road DATE: 1955; 2/2 5:30pm

TYPE: rock slide TRIGGER: unknown QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Kec QSIZE: 3

DAMAGE: utility CROSS REF: Snyder #172 QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, February 1955

NARRATIVE: February, 1955: "A rock slide damaged the penstock pipe line in three places on February 2 at 5:30 p.m. and the pipe was drained of water."

ID: 218D
LOCATION: Sierra Point Trail DATE: 1955; 5/15

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: ext. small VOL(m3): 1 GEOLOGY: Khd QSIZE: 3

DAMAGE: injury CROSS REF: Snyder #173I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1955

NARRATIVE: May 1955: "May 15: Gwen Coates, age 18, Lodi, California, suffered abrasions and a fracture of her right foot when she was hit by a rock falling from the trail side on Sierra Point Trail."

ID: 219D
LOCATION: Liberty Cap-Nevada Fall Trail DATE: 1955; 12/23

TYPE: debris flow TRIGGER: rain/snow QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #174I QLOC: 1

PRIME REF: none

NARRATIVE: December 1955: "December was the wettest month in park records with 21 days of precipitation totaling 29.78 inches. Yosemite Valley experienced a serious flood December 23 due to an unusually heavy warm rain which extended to elevations as high as 10,000 feet.

According to Bob Barr, the flood left heavy damage on the section of the old Nevada Fall trail below Liberty Cap..."

According to Jim Snyder (written commun., April 7, 1992) this flood

took out the dam at the head of Liberty Cap gully (built by Albert Snow in about 1873) and the trail bridge there. The trail lost roughly a dozen switchbacks. Whether the rocky talus from the Liberty Cap joint was moved by flood waters or mobilized into a rocky debris flow is not discernable.

ID: 220
LOCATION: Yosemite Falls Trail DATE: 1955; 12/23

TYPE: rock slides TRIGGER: rain/snow QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #175 QLOC: 4

PRIME REF: Trail Report, NPS, unpub. data, March 1956

NARRATIVE: December 23, 1955: On trails the flood left: "... small slides on Yosemite Falls Trail."

ID: 221
LOCATION: Tenaya Lake Trail-'Tenaya Zigzags' DATE: 1955; 12/23

TYPE: rock slide TRIGGER: rain/snow QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #176 QLOC: 4

PRIME REF: Trail Report, NPS, unpub. data, March 1956

NARRATIVE: December 23, 1955: On trails the flood left: "... a slide on the 'Tenaya Zigzags".

ID: 222D
LOCATION: Mirror Lake Trail DATE: 1955; 12/23

TYPE: debris flow TRIGGER: rain/snow QDATE: 1

SIZE: medium VOL(m3): 153 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #177I QLOC: 3

PRIME REF: Trail Report, NPS, unpub. data, March 1956

NARRATIVE: December 23, 1955: On trails the flood left: "... 200 cubic yards of sand on the Mirror Lake Trail"

ID: 223D
LOCATION: Happy Isles DATE: 1955; 12/23

TYPE: debris flow TRIGGER: rain/snow QDATE: 1

SIZE: small VOL(m3): 31 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #178I QLOC: 2

PRIME REF: Trail Report, NPS, unpub. data, March 1956

NARRATIVE: December 23, 1955: On trails the flood left: "... 40 cubic yards of muck and sand on the horse trail near Happy Isles"

ID: 224
LOCATION: Yosemite Valley DATE: 1955; 12/23

TYPE: debris flows/flood? TRIGGER: rain/snow QDATE: 1

SIZE: medium VOL(m3): 421 GEOLOGY: ? QSIZE: 0

DAMAGE: trails CROSS REF: Snyder #180 QLOC: 4

PRIME REF: Trail Report, NPS, unpub. data, January/April 1956

NARRATIVE: December 23, 1955: On trails the flood left: "... 550 cubic yards of sand on other bridle paths"

According to Jim Snyder (written commun., April 7, 1992) some of the damage was probably from debris flows and some from river deposition at high water during flooding. Both debris flows and flooding processes are common during a typical Yosemite flood situation brought on by low altitude snows followed by high altitude rains resulting in flooding.

ID: 225
LOCATION: Yosemite Valley DATE: 1955; 12/23

TYPE: debris flows/flood? TRIGGER: rain/snow QDATE: 1

SIZE: medium VOL(m3): 50 GEOLOGY: ? QSIZE: 0

DAMAGE: trails CROSS REF: Snyder #181 QLOC: 4

PRIME REF: Trail Report, NPS, unpub. data, January/April 1956

NARRATIVE: December 23, 1955: On trails the flood left: "... 65 cubic yards of sand on paved walks"

According to Jim Snyder (written commun., April 7, 1992) damage was probably caused by both debris flows and river deposition at high water during flooding. Both debris flow and flooding processes are common during a typical Yosemite flood situation when low altitude snow is followed by high altitude rain.

ID: 226D
LOCATION: Arch Rock DATE: 1955; 12/23

TYPE: rock slide TRIGGER: rain/snow QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Kar QSIZE: 2

DAMAGE: utility CROSS REF: Snyder #185I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1957

NARRATIVE: December 1955: "A slide of large boulders took out a portion of the pipe across the river from the ranger station [at Arch Rock] and these rocks have been blasted out and a new pipe will be installed."

According to Jim Snyder (written commun., April 7, 1992) this slide occurred in December 1955, but it took a long time to get the report of the repair.

ID: 227D
LOCATION: Jack Main Canyon DATE: 1955; 12/23

TYPE: debris slide TRIGGER: rain/snow QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Kec QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #183I QLOC: 1

PRIME REF: none

NARRATIVE: December 23, 1955: December was the wettest month in park records with 21 days of precipitation totaling 29.78 inches. Yosemite Valley experienced a serious flood December 23 due to an unusually heavy warm rain which extended to elevations as high as 10,000 feet. According to Jim Murphy a mud and rock slide buryied a hundred yards of trail between Paradise and Wilmer Lake.

ID: 228
LOCATION: Tioga Road DATE: 1955; 12/23

TYPE: rock slides TRIGGER: rain/snow QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #184 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, June 1956

NARRATIVE: December was the wettest month in park records with 21 days of precipitation totaling 29.78 inches. Yosemite Valley experienced a serious flood December 23 due to an unusually heavy warm rain which extended to elevations as high as 10,000 feet.

"The Tioga Road and Tuolumne Meadows area were opened for traffic on June 16. Fallen trees, slides, minor washouts and heavy snowdrifts made snow removal work slow and expensive."

According to Jim Snyder (written commun., April 7, 1992) there are several cuts that slump regularly or which dump rock because of spring activity inside the banks. There are a number of others that

regularly dump rock in heavy weather and in the spring. These slides occurred during the December 1955 flood, when the rains melted snow well above Tuolumne Meadows. The repairs were not done until the road opening in June 1956.

ID: 229D
LOCATION: El Portal Road-Arch Rock DATE: 1956; 1/14

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Kga QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 2

PRIME REF: Yosemite Research Library Photo Archives, NPS, unpub. data, 1956

NARRATIVE: "Rock slide of January 14, 1956 on the 'All-Year Highway' about 1 mile below Arch Rock Entrance Station" -caption for about 10 photograph negatives.

ID: 230D
LOCATION: El Portal Road-'Windy Point' DATE: 1956; 6/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 77 GEOLOGY: Kga QSIZE: 0

DAMAGE: road CROSS REF: Snyder #186I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, June 1956

NARRATIVE: June 1956: "A slide of about 100 cubic yards of large boulders just above 'Windy Point' on the El Portal Road. It destroyed pavement in two places and 25 feet of rock coping wall. Traffic was blocked for approximately three hours." There was an unusually heavy snowpack this winter and unusually heavy rain this spring.

ID: 231D
LOCATION: Sierra Point Trail DATE: 1957; 3/24

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: ext. small VOL(m3): 1 GEOLOGY: Khd QSIZE: 2

DAMAGE: injury CROSS REF: Snyder #187I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1957

NARRATIVE: March 24, 1957: "... rangers assisted Robert Wilson, age 25, of the Presidio, San Francisco, California, to the hospital. Mr. Wilson was slightly injured when he was hit on the head by a rock which fell from above him on the Sierra Point Trail on March 24."

ID: 232
LOCATION: Wawona Road DATE: 1958; 3/??

TYPE: rock slide TRIGGER: snow ? QDATE: 3

SIZE: medium VOL(m3): 230 GEOLOGY: ? QSIZE: 0

DAMAGE: road CROSS REF: Snyder #188 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1958

NARRATIVE: March 1958: "Due to severe storms, snow removal costs mounted to a near alltime high for March. Several rock slides, including a 300 cubic yard rock slide on the Wawona Road ... occurred and were removed during the month."

ID: 233
LOCATION: El Portal Road DATE: 1958; 3/??

TYPE: debris slide TRIGGER: snow ? QDATE: 3

SIZE: medium VOL(m3): 383 GEOLOGY: ? QSIZE: 0

DAMAGE: road CROSS REF: Snyder #189 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1958

NARRATIVE: March 1958: "Due to severe storms, snow removal costs mounted to a near all time high for March. Several rock slides, including a ... 500 cubic yard rock and dirt slide on the El Portal Road, occurred and were removed during the month."

ID: 234D
LOCATION: Nevada Fall Trail DATE: 1958; 5/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #190I QLOC: 0

PRIME REF: Superintendent's Monthly Report, unpub. data, May 1958

NARRATIVE: May 1958: "Three rocks which block part of the foot trail above the Silver Apron Bridge still are to be blasted."

ID: 235D
LOCATION: Union Point-Glacier Point DATE: 1958; 12/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 3

DAMAGE: utility CROSS REF: Snyder #191I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, December 1958

NARRATIVE: December 1958: "Six breaks in the four-inch pressure line from Union Point to Glacier Point were repaired. The breaks were caused by falling rocks."

ID: 236D
LOCATION: Glacier Point-Fourmile Trail DATE: 1960; 3/22

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 2

DAMAGE: utility CROSS REF: Snyder #192I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, March 1960

NARRATIVE: March 22, 1960: "The season's first fire occurred March 22 when a falling rock hit the power line which runs from the valley up the side of the mountain to Glacier Point. The wire stretched to the ground causing sparks which set fire to old leaves and brush."

ID: 237
LOCATION: El Portal Road DATE: 1960; 4/23

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #193 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1960

NARRATIVE: April 23, 1960: "Approximately 300 feet of major repairs on the El Portal Road were necessary due to a rock slide on April 23. The slide pulverized part of the concrete travelway, crushed a culvert and headwalls, and obliterated approximately 600 feet of rock wall."

ID: 238D
LOCATION: Wapama Falls DATE: 1961; early Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Kg QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #194I QLOC: 1

PRIME REF: none

NARRATIVE: Early spring, 1961: According to Jim Murphy, a slide was cleared from the trail on the west side of the crossing of Wapama Falls at Hetch Hetchy.

ID: 239D
LOCATION: Middle Brother DATE: 1962; 11/17 4:10pm

TYPE: rock slide TRIGGER: unknown QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #195I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, November 1962

NARRATIVE: "On November 17, at 4:10 p.m., a rock slide from the north wall of the valley occurred approximately one mile below the 'Camp 4' entrance. Several large rocks came down, and impacts were noted on the road below Middle Brother and the rock fall probably emanated from that point. The road was open to one-way traffic only until the road crew could repair the damage and clean up the debris."

ID: 240D
LOCATION: Middle Brother DATE: 1963; 1/31-2/3

TYPE: rock slide TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #196I QLOC: 2

PRIME REF: Superintendent's Monthly Report, unpub. data, January 1963

NARRATIVE: January 31, 1963: "The biggest flood in Yosemite since 1955 began on the last day of the month and continued into the first few days of February. ... The rain also caused several rock slides off the valley walls, one of which closed Route 140 below 'Indian Village' for a 12-hour period."

ID: 241D
LOCATION: Mirror Lake Trail DATE: 1963; early 2/??

TYPE: debris flow TRIGGER: rain QDATE: 3

SIZE: medium VOL(m3): 230 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #197I QLOC: 3

PRIME REF: Trail Report, NPS, unpub. data, February 1963

NARRATIVE: Early February 1963: "300 cubic yards of muck and debris was removed from the trail near Mirror Lake."

ID: 242D
LOCATION: Happy Isles Trail DATE: 1963; early 2/??

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 77 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #198I QLOC: 2

PRIME REF: Trail Report, NPS, unpub. data, February 1963

NARRATIVE: Early February 1963: "100 cubic yards of material was removed from trail near Happy Isles."

According to Jim Snyder (written commun., April 7, 1992) this was probably a debris flow. There are regular debris flows onto the trail on the east side of the Merced River northeast of Happy Isles, from the west-facing wall below the Diving Board. The trail on the west side of the river around the campground northwest of Happy Isles also gets hit regularly by flooding and has never been completely repaired since the 1964 flood.

ID: 243D
LOCATION: Yosemite Falls Trail DATE: 1963; 3/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 23 GEOLOGY: ? QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #199I QLOC: 3

PRIME REF: Trail Report, NPS, unpub. data, March 1963

NARRATIVE: March 1963: "On the Yosemite Falls trail, one slide of 30 cubic yards was removed near the base of upper falls."

ID: 244D
LOCATION: Vernal Fall Trail DATE: 1963; 3/??

TYPE: rock slides TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #200I QLOC: 4

PRIME REF: Trail Report, NPS, unpub. data, March 1963

NARRATIVE: March 1963: "Several small slides were removed from the Vernal Fall Trail."

ID: 245
LOCATION: El Portal Road DATE: 1963; 4/17 am

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 207 GEOLOGY: ? QSIZE: 0

DAMAGE: road CROSS REF: Snyder #204 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1963

NARRATIVE: April 1963: "One 600-ton boulder closed the El Portal Road early on the 17th for about 10 hours..."

ID: 246
LOCATION: El Portal Road DATE: 1963; 4/20 pm

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #204 QLOC: 3

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1963

NARRATIVE: April 1963: "a slide in the same area destroyed a short piece of this [El Portal] road on the evening of the 20th, necessitating closure for approximately 20 hours."

ID: 247D
LOCATION: El Portal Road-'Windy Point' DATE: 1963; 4/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Kga QSIZE: 3

DAMAGE: utility CROSS REF: Snyder #203I QLOC: 1

PRIME REF: Superintendent's Monthly Report, unpub. data, April 1963

NARRATIVE: April 1963: "A rock fall damaged the 70 KV line at Tower #6. Two strings of insulators were broken, strands on two lines were broken and several spots damaged by arcs when the line touched. Braces on the tower were broken by rock but the legs were undamaged."

ID: 248
LOCATION: Tioga Pass-Lee Vining Grade DATE: 1963; 6/7

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: Snyder #205 QLOC: 4

PRIME REF: Superintendent's Monthly Report, unpub. data, June 1963

NARRATIVE: June 7, 1963: "Tioga Pass was closed on June 7 for 1.5 days by a rock [slide] on the Lee Vining grade which destroyed 100 feet of road."

ID: 249D
LOCATION: May Lake Trail DATE: 1963; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 2

DAMAGE: none CROSS REF: Snyder #201I QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1963: A big rock rolled out of the woods onto the May Lake Trail not far above the Tenaya-Glen Aulin junction toward May Lake.

ID: 250D
LOCATION: Jack Main Canyon DATE: 1963; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: ext. small VOL(m3): 1 GEOLOGY: Kdg QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #202I QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1963: A rounded diorite boulder about 4 feet in diameter rolled onto the Jack Main Canyon trail below Paradise. It was probably an erratic that slipped during winter runoff. Murphy and Snyder removed it with dynamite in July.

ID: 251D
LOCATION: Piute Creek DATE: 1964; Spring ?

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: ext. small VOL(m3): 1 GEOLOGY: Kg QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #206I QLOC: 1

PRIME REF: none

NARRATIVE: Spring?, 1964: On the trail from Pate Valley to Pleasant Valley near the top of the straightaway along Piute Creek, a weathered

rounded boulder 4 feet in diameter came to rest on the trail. The trail crew lifted it off with dynamite in August.

ID: 252R
LOCATION: Glacier Point-Fourmile Trail DATE: 1965; 5/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #207R QLOC: 1

PRIME REF: none

NARRATIVE: May 1965: On the Fourmile Trail, in the chute below Union Point, three switchbacks were damaged by rock slide. These were the three switchbacks crossing the chute."

ID: 253D
LOCATION: Panorama Cliff-Nevada Fall Trail DATE: 1965; 7/??

TYPE: debris flow TRIGGER: rain QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #208I QLOC: 1

PRIME REF: none

NARRATIVE: July 1965: With heavy summer rains turning talus to debris flow, the talus below Panorama Cliff on the Nevada Fall Horse Trail buried parts of three switchbacks just above the last Illilouette culvert.

I was given one day to fix the trail through there in 1965. There also have been more recent debris flows at this location. When we rebuilt the trail in 1975 we dug through 3 to 4 feet of rock and sand to reach the 1965 riprap to clear out the channel for the ford (Jim Snyder, written commun., November 4, 1992).

ID: 254D
LOCATION: Glacier Point-Fourmile Trail DATE: 1966; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #210I QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1966: According to Jim Murphy, trail crews cleared a slide from the Fourmile Trail at the creek crossing east of Sentinel Rock at its base.

ID: 256D
LOCATION: Nevada Fall Horse Trail DATE: 1967; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 9 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #212I QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1967: According to Jack Knierieman with photgraphs by Lee Patterson, several slab fragments slid into the 'Ice Cut' on the Nevada Fall Horse Trail and were blasted off June 1 by Bob Barr.

ID: 257D
LOCATION: Sierra Point Trail DATE: 1967; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #213I QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1967: The Sierra Point Trail lost about 50 steps in the chute with the cable, and the trail was officially closed, though the steps were replaced and the slide cleared.

ID: 258R
LOCATION: Panorama Point DATE: 1967-68;7-8/?;11am

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: large VOL(m3): 1500 GEOLOGY: Khd QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 0

PRIME REF: Jim Snyder, NPS, written commun., April 29, 1992

NARRATIVE: According to Jim Snyder (written commun., April 29, 1992) the first and smaller of two rock falls at Panorama Point occurred in the summer of 1967 or 1968. Kerry Maxwell, a guide for the Curry Company thought it was more likely 1968. He was out with an all-day ride and they stopped at Panorama Point for the view, then mounted their horses to continue to Glacier Point for lunch. The rock fall occurred not long after they left the point, though they did not hear about it until they returned to the valley. Kerry said it had to have happened between 10:30 and 11 a.m. that day, probably in August. The rock fall was large enough it was heard and the dust seen from the valley at the Curry stables apparently, or else riders to Nevada Fall heard it. The second rock fall occurred in 1977 and is described separately. This first rock fall was the smaller of the two and did leave the railing intact.

ID: 259D
LOCATION: Yosemite Falls Trail DATE: 1968; ??/??

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #214I QLOC: 3

PRIME REF: none

NARRATIVE: 1968: According to Jack Knierieman, there was a small slide on the trail in the upper fall gully on the Yosemite Falls Trail.

ID: 255D
LOCATION: Sierra Point Trail DATE: 1970;Winter-spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #211I QLOC: 1

PRIME REF: none

NARRATIVE: Winter-spring, 1967: The Sierra Point Trail lost about 120 steps in the chute with the cables.

ID: 260R
LOCATION: Elephant Rock-'Steamboat Bay' DATE: 1971;mid-Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very large VOL(m3): 24000 GEOLOGY: Kec QSIZE: 2

DAMAGE: none CROSS REF: Snyder #224R QLOC: 0

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: Mid-winter, 1971: According to Norman Hinson, a large rock slide came from the cliffs over 'Steamboat Bay' below the 'Cookie' on the Merced River. The massive jointed rock produced large blocks-- the reason for the place name there-- which stopped in the river but splashed several cars on the El Portal Road with water.

According to Don Reid (Jim Snyder, written commun., February 25, 1992) the rock slide at Elephant Rock occurred in two stages, the first around 1971. Dennis Miller witnessed the slide from the 'Cookie', which he was climbing. This slide created a scar and a new climbing route which Ray Jardan and Bill Critchlow did on the perimeter of the scar for a couple years while the route existed.

Aerial photographs bracket the rock slide at Elephant Rock between November 1, 1969 (YOSE 10-8) and September 24, 1971 (YOSE 28-244).

According to Jeffrey P. Schaffer (oral commun., January 1992) the rock slide at Elephant Rock occurred in mid-winter of 1971 (1970-71). According to Robert Reece (NPS, oral commun., July 1991) Bill Domingues saw a three-foot wall of water on a dark January/February night at sunset coming down the road shortly after

the rock slide. Domingues (NPS, oral commun., July 1991) remembers the event but cannot recall the date.

ID: 261R
LOCATION: Moran Point-'Le Conte Gully' DATE: 1970-71; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: According to Don Reid, "above and west of 'Le Conte Gully', from the area of spires below Moran Point and above the ledges forming Staircase Falls to the east, a rock slide in winter, 1971.

ID: 262R
LOCATION: Rogers Canyon DATE: 1971; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 15 GEOLOGY: Kec QSIZE: 0

DAMAGE: none CROSS REF: Snyder #215R QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1971: At the trail camp site below Rodgers Creek near Muir Gorge a large boulder, roughly an 8-foot cube, came down a small intermittent creek channel and stopped in the trail. No damage was done; the trail is in a sandy flat and simply detours around the boulder now. The boulder broke loose from a cliff just far enough above the creek channel to provide momentum for its path. It seems to have been an isolated break rather than a larger slide.

ID: 263R
LOCATION: Union Point-'Chapel Wall' DATE: 1971?; ??/??

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 160 GEOLOGY: Kec QSIZE: 1

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Jim Snyder, NPS, written communs., February 25, March 4, 1992

NARRATIVE: According to Don Reid (Jim Snyder, written commun., February 25, 1992), the scar on the 'Chapel Wall' was formed about 1971. The area had been a climbing route called 'The Symphony' in the old Roper guidebook, and now some of the climb is gone.

Jim Snyder (written commun., March 4, 1992) believes there have been additional rock falls at this location in the May 25-27, Mammoth Lakes, California earthquake sequence and more recently as well enlarging its original scar.

ID: 264D
LOCATION: Yosemite Falls Trail DATE: 1972; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #216I QLOC: 3

PRIME REF: none

NARRATIVE: Spring, 1972: On the Yosemite Falls Trail, a slide at the bottom of the upper falls gully damaged two switchbacks.

ID: 265D
LOCATION: Sierra Point Trail DATE: 1973; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #217I QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1973: The Sierra Point Trail lost 45 steps in the chute with the cables.

ID: 266R
LOCATION: Yosemite Falls Trail DATE: 1973; 6/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #218R QLOC: 1

PRIME REF: none

NARRATIVE: June 1973: A rock slide on the Yosemite Falls Trail at the spring past 'Columbia Point', damaged three switchbacks. The release point was the decomposed section of rock not far above the spring. The switchbacks were rebuilt by Larry Roberts' crew after blasting the release point by climbing rangers Walt Dabney and others.

ID: 267R
LOCATION: Liberty Cap-Nevada Fall Trail DATE: 1973; 6/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #219R QLOC: 0

PRIME REF: none

NARRATIVE: June 1973: According to Jim Snyder, the Nevada Fall foot trail below Liberty Cap lost 12 switchbacks as rocks fell from the master

joint on Liberty Cap. No rain preceded this rock fall.

ID: 268R
LOCATION: Nevada Fall Trail DATE: 1974; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #220R QLOC: 0

PRIME REF: none

NARRATIVE: Spring, 1974: On the Nevada Fall trail, failure of a large block in the chimney below 'Porcupine Spring' damaged five switchbacks.

ID: 269D
LOCATION: Glacier Point-Fourmile Trail DATE: 1974; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #221I QLOC: 0

PRIME REF: none

NARRATIVE: Spring, 1974: According to Jack Knierieman, on the Fourmile Trail a slide below the creek crossing was apparently caused by spring moisture working on erosion from a rock climbers trail to a route on Sentinel Rock. The slide crossed two switchbacks.

ID: 270R
LOCATION: Tiltill Creek DATE: 1975;Winter-Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Kg QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #222R QLOC: 1

PRIME REF: none

NARRATIVE: Winter-spring, 1975: According to Jack Knierieman, a couple large slabs came down on the Tiltill Valley trail as it enters the meadow on the 'City Camp' side of Tiltill Valley.

ID: 271D
LOCATION: Wapama Falls DATE: 1975; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Kg QSIZE: 2

DAMAGE: none CROSS REF: Snyder #223I QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1975: According to Jack Knierieman, a small slide occurred in the loose talus on the upper side of the trail past Wapama Falls.

ID: 272D
LOCATION: El Capitan-'The Footstool' DATE: 1976?

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: large VOL(m3): 510 GEOLOGY: Kt QSIZE: 1

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: According to Don Reid a rock fall occurred in about 1976 at 'The Footstool', middle of the southwest face on the right hand flank of El Capitan. Werner Braun and Chris Falkenstein were helping another climber when they saw a large flake (60x60 feet and larger) begin to buckle and go. They ran around one side of 'The Footstool' and made it out of the way.

ID: 273R
LOCATION: Bunnell Point DATE: 1977; Spring

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #227R QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1977: At Bunnell Point in the Merced River Canyon, 6 tons of rock broke loose and came down on the trail. This rock was probably affected by blasting during the original trail construction about 1930. The slide was halfway between 'Twin Bridges' and the first switchback corner upriver.

ID: 299R1
LOCATION: Upper Yosemite Falls DATE: 1977; Spring?

TYPE: rock fall TRIGGER: rain QDATE: 4

SIZE: large VOL(m3): 2280 GEOLOGY: ? QSIZE: 1

DAMAGE: none CROSS REF: none QLOC: 0

PRIME REF: Wiley (1977)

NARRATIVE: A 250-foot flake of rock has been peeled off the west edge of Upper Yosemite Fall. Few had heard the thunderous crash... that a huge flake of granite had been dislodged by a bolt of lightning. One observer was riding a valley shuttle bus at a time when most visitors had taken shelter from the weather. 2 photos.

ID: 274R
LOCATION: Yosemite Falls Trail DATE: 1977; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #225R QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1977: According to Bill Burgen, there was a slide on the Yosemite Falls Trail at the spring east of 'Columbia Point'.

ID: 275R
LOCATION: Illilouette Fall DATE: 1977; Spring

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #226R QLOC: 0

PRIME REF: none

NARRATIVE: Spring, 1977: According to Jack Knierieman, two small slabs came down on the east approach of the Illilouette Bridge. Jack Knierieman and Bill Gorgas removed them with bars.

ID: 276R
LOCATION: Panorama Point DATE: 1977; Spring

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: large VOL(m3): 3000 GEOLOGY: Khd QSIZE: 1

DAMAGE: none CROSS REF: Snyder #228R QLOC: 0

PRIME REF: Jim Snyder, NPS, written commun., April 29, 1992

NARRATIVE: Spring, 1977: According to Jim Snyder (written commun., April 29, 1992), the second and larger rock fall at Panorama Point occurred in the spring of 1977-- Jack Knierieman thought it was February or

early March. Enough of the point fell off that the railing was hanging way out in mid-air. They cut the railing off, then rerouted the trail around the point, eliminating it from the route. This work occurred in late spring.

ID: 277D
LOCATION: Yosemite Falls Trail DATE: 1977; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #229I QLOC: 3

PRIME REF: none

NARRATIVE: Spring, 1977: According to Jack Knierieman, there was a small slide on the trail in the upper falls gully of the Yosemite Falls trail.

ID: 278R
LOCATION: Glacier Point-Fourmile Trail DATE: 1977; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #230R QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1977: On the Fourmile Trail a small slide damaged two switchbacks in the chute below Union Point.

ID: 279R
LOCATION: El Capitan-'Horsetail Falls' DATE: 1976-77

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Kt QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: According to Don Reid a rock slide of fair volume occurred in 1976-77 up high on the east side of El Capitan. The slide was in the vicinity of 'Horsetail Falls' at 2/3 or 3/4 height from the valley floor. A climbing route was put up called 'Waterfall Route', going through that scar.

ID: 280D
LOCATION: Wapama Falls DATE: 1978; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: large VOL(m3): 2000 GEOLOGY: Kg QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #232I QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1978: According to Jack Knierieman, a big slide at Wapama Falls heavily damaged the switchbacks leading down to the bridge. Jack Knierieman remembers two slides at this location before this big one, both after 1965.

ID: 281R
LOCATION: Yosemite Falls Trail DATE: 1978; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #231R QLOC: 0

PRIME REF: none

NARRATIVE: Spring, 1978: A minor slide occurred on the Yosemite Falls Trail on the switchbacks below 'Columbia Point', where a small seep and gully crosses the trail just above the old walls remaining from John Conway's work.

ID: 282R
LOCATION: Half Dome DATE: 1978; 9/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #233R QLOC: 1

PRIME REF: none

NARRATIVE: September 1978: According to Bill Wendt, 24 uprights were lost in a rock slide midway up the cables on Half Dome.

ID: 283R
LOCATION: Castle Cliffs DATE: 1980; 1/12 6:17 am

TYPE: rock fall TRIGGER: rain QDATE: 0

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: trail, structure CROSS REF: Snyder #234R QLOC: 1

PRIME REF: Yosemite Flood Report, NPS, unpub. data, 1980

NARRATIVE: January 12, 1980: "The possibility of a flood was announced with authority at 0617 hours by a rock avalanche, which fell from the north wall of Yosemite Valley immediately behind (north) the main

valley maintenance building. The sound of this avalanche, which continued for about one or two minutes, was loud enough to wake almost everybody in the government residence area. This rock slide originated in the pinnacles east of 'Hot Rock Creek' and swept down across the talus slope below, across the horse trail and down between the main maintenance building and the government stables. Where it crossed the horse trail it created a wall of rocks and sand approximately four feet high. Following, and in the same course as the avalanche, a new, temporary, stream ran through the maintenance yard, depositing sand and small rocks two feet high against the rear wall of the Park warehouse."

January 1980: According to Jim Snyder, flooding in the Castle Crags area damaged 50 yards of the valley horse trail behind the Government maintenance yard.

ID: 284
LOCATION: Castle Cliffs DATE: 1980; 1/12 11:00am

TYPE: debris flows TRIGGER: rain QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Yosemite Flood Report, NPS, unpub. data, 1980

NARRATIVE: January 12, 1980: "...Two small [debris flows] occurred at approximately 1100 in the same course" [east of 'Hot Rock Creek' below Castle Cliffs].

ID: 285D
LOCATION: Big Oak Flat Road DATE: 1980; 1/13 9:00 pm

TYPE: rock slide TRIGGER: rain QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Kec QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 2

PRIME REF: Yosemite Flood Report, NPS, unpub. data, 1980

NARRATIVE: January 13, 1980: "A slide near the second of the three tunnels on the Big Oak Flat Road closed that road around 2100 hours. It remained closed until the slide was removed several hours later."

ID: 286D
LOCATION: Sentinel Rock DATE: 1980; 1/12-13

TYPE: rock slide TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #235I QLOC: 0

PRIME REF: none

NARRATIVE: January, 1980: The Fourmile Trail lost sections of two switchbacks below the creek crossing from a slide off the western shoulder of Sentinel Rock.

ID: 287
LOCATION: Wawona Campground DATE: 1980; 1/13 11:59pm

TYPE: rock slide TRIGGER: rain QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: Kga QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 3

PRIME REF: Yosemite Flood Report, NPS, unpub. data, 1980

NARRATIVE: January 13, 1980: "Prior to midnight, a slide north of Wawona Campground closed Highway 41 to all traffic."

ID: 288R
LOCATION: Sierra Point-Happy Isles Trails DATE: 1980; 5/25

TYPE: rock fall TRIGGER: earthquake QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail, injuries CROSS REF: Snyder #237R QLOC: 1

PRIME REF: Wieczorek and others (1989)

NARRATIVE: May 1980: "The May 25 shock sent a rock fall from well up the sharp ridge between Sierra Point and Grizzly Peak, which after hitting the base of the slope proceeded southwesterly as a rock avalanche toward Happy Isles and seriously injured two hikers on the Sierra Point Trail. The 15-30 m wide rock avalanche severed the Sierra Point Trail several times, snapping off trees at their bases and obliterating the trail in a mass of boulders. Most of the rock avalanche stopped shortly before reaching the Nevada Fall Trail. Beyond this point a few large boulders ... bounced or rolled across the trail."

"Below Sierra Point, on the main Vernal Fall trail near Happy Isles, is the 60-ton boulder that cut a swath through the trees as it bounded down from the point in the May earthquake." (Gilliam, 1982)

According to Jim Snyder, an earthquake-generated slide destroyed 70% of the Sierra Point Trail, seriously injuring two people. The rock fall came from the crest of the ridge between Sierra Point and

Grizzly Peak.

ID: 289
LOCATION: Cathedral Spires DATE: 1980; 5/25 9:00am

TYPE: rock fall TRIGGER: earthquake QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 4

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: May 25-27, 1980: According to John Dill (oral commun., May 28, 1980) a rock avalanche at Cathedral Spires included trees and ripped out pitons along climbing routes.

According to Don Reid the slide occurred on the earthquake day, Memorial Day, 1980, at 9 a.m. behind and east of Cathedral Spires. Reid viewed it from 'Delectable Pinnacle'. He heard the earthquake but did not feel it, but then noticed the rock fall down the spires. (Jim Snyder, written commun., February 25, 1992)

ID: 290D
LOCATION: Arch Rock DATE: 1980; 5/27 7:51 am

TYPE: rock fall TRIGGER: earthquake QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: Kar QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 2

PRIME REF: Wieczorek (1981)

NARRATIVE: "NPS employees at Arch Rock Entrance Station reported rock falls occurring at about 8:00 a.m. on May 27, 1980. Presumably these rock falls occurred as a result of the M 6.1 earthquake at 7:51 a.m. (PDT). ... the source is near the rim of the Merced Gorge about two kilometers southeast of Foresta and about 500 meters above Arch Rock Entrance Station. The falling rock impacted on the talus slope at the foot of a 160-m cliff. Pieces of rock fell then slid, rolled and bounced downslope towards the Arch Rock Entrance Station and California State Highway 140. Not more than 5 percent of the rock fall reached the highway. Most of the rock was stopped by the vegetation and by large boulders on the slope above the highway. Many boulders in the path were partly dislodged by the moving rocks. (written commun., letter to Robert Binneweis, Superintendent Yosemite National Park from John Tinsley and Gerald Wieczorek, June 17, 1980)

"Bouncing boulders, several meters in dimension, from a rock fall near Arch Rock Entrance Station narrowly missed a park employee." (Wieczorek, 1981)

ID: 291D
LOCATION: Glacier Point-Fourmile Trail DATE: 1980; 5/27

TYPE: rock fall TRIGGER: earthquake QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #238I QLOC: 0

PRIME REF: none

NARRATIVE: May 27, 1980: During the earthquake on this date, the Fourmile Trail received rock fall from Sentinel Rock just below the creek crossing.

ID: 292R
LOCATION: Clark Point- Nevada Fall Trail DATE: 1980; 5/27

TYPE: rock fall TRIGGER: earthquake QDATE: 1

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #239R QLOC: 0

PRIME REF: Jim Snyder, NPS, written commun., April 7, 1992

NARRATIVE: May 27, 1980: The Nevada Fall Trail had one large rock on it just below Clark Point.

According to Jim Snyder (written commun., April 7, 1992) the rock was a very small chunk of a much larger boulder, probably cracked by blasting for the trail about 1930, which fell out onto the trail, a fall of roughly 3 feet.

ID: 293R
LOCATION: Sentinel Creek DATE: 1980; 5/27

TYPE: rock slide TRIGGER: earthquake QDATE: 1

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: Snyder #240R QLOC: 1

PRIME REF: none

NARRATIVE: May 27, 1980: There was a large slide off the cliff on the west side of Sentinel Creek, a slide of soil and rock.

ID: 294R
LOCATION: Castle Cliffs DATE: 1980; 5/27

TYPE: rock fall TRIGGER: earthquake QDATE: 1

SIZE: small VOL(m3): 8 GEOLOGY: ? QSIZE: 1

DAMAGE: none CROSS REF: Snyder #241R QLOC: 1

PRIME REF: Jim Snyder, NPS, written commun., April 7, 1992

NARRATIVE: May 27, 1980: There was a block that fell from Castle Cliffs toward the maintenance yard during the earthquake as well.

According to Jim Snyder (written communs., April 7, 1992 and November 4, 1992) the block was close to the size of a Volkswagen, 10 cubic yards or so. It was a single block that fell quite a ways but didn't even get close to the bottom [of the chute], hanging up somewhere in between.

ID: 295
LOCATION: Pulpit Rock DATE: 1980; 5/25-27

TYPE: rock slide TRIGGER: earthquake QDATE: 2

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 3

PRIME REF: Dick Riegelhuth, NPS, oral commun., May 28, 1980

NARRATIVE: May 25-27, 1980: A rock slide occurred at Pulpit Rock during this earthquake according to Dick Riegelhuth (oral commun., May 28, 1980).

ID: 296R
LOCATION: North Dome DATE: 1980; 5/25-27

TYPE: rock slide TRIGGER: earthquake QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: none QLOC: 1

PRIME REF: Jim Snyder, NPS, written commun., March 8, 1981

NARRATIVE: May 25-27, 1980: "There was another slide during the earthquake around Memorial Day. I don't know whether it occurred that Sunday or Tuesday [May 25 or May 27]. It occurred southeast of North Dome over the Mirror Lake trail loop and was the reason that trail was closed during the period after the earthquakes.

It occurred between the 5600 and 6000 foot contours I would guess. ...Below North Dome is the 6400 foot contour marked. A little below that is a knob. The slide emanated north east of that knob maybe 800 feet or so between the 5600 and 6000 foot contours. None of it reached the trail, but small pieces from it came down into the talus above the trail several times during the week following the slide."

ID: 297R
LOCATION: Half Dome DATE: 1980; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #236R QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1980: According to Bill Wendt, a slab broke loose near the cables on Half Dome and broke the cable near the bottom.

The slabs came from the south side of the cables because the fall line is roughly across and down the cables. There are several small ledges or roofs in the rock crossed by the cables, and small pieces of these sometimes break away and skid down taking stanchions if the cable is down, or breaking the cable if it is up and big enough pieces hit it. This rock slide probably occurred during freeze-thaw action in Spring when snow melted.

ID: 298R
LOCATION: Clark Point- Mist Trail DATE: 1980; 10/4

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #242R QLOC: 0

PRIME REF: Jim Snyder, NPS, written commun., April 7, 1992

NARRATIVE: October 4, 1980: When water and tree roots combined to loosen a huge block of rock below Clark Point, the Mist Trail lost 476 feet in the resulting [rock fall] which swept the trail from the slickrock buttress at the lowest set of steps.

According to Jim Snyder (written commun., April 7, 1992) the rock fall happened in the morning before 9-10 o'clock, because they were amazed nobody had seen it happen and figured it was because the vacationers got up later. The first hikers who went through it commented on the dust raised by the rock fall but didn't see that much wrong with the trail. I made no notes about an earthquake that day and do not remember one being mentioned. The block that fell was tipped nearly to its balance point by liveoak roots and soil behind it. The bulk of the rock was at top and its lower part sat on a small ledge. It was a rock fall rather than a slide.

There was a M 4.1 earthquake at 8:38 a.m. P.S.T. on October 4, 1980 near Mammoth Lakes, California more than 40 km from Clark Point (Fred Lester, unpub. data, August 1987).

ID: 299R2
LOCATION: Upper Yosemite Fall DATE: 1980;10/6 1-1:30pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: very small VOL(m3): 1 GEOLOGY: Kec QSIZE: 1

DAMAGE: injuries CROSS REF: none QLOC: 0

PRIME REF: John Dill, NPS, oral commun., October 1980

NARRATIVE: October 6, 1980: A rock fall from just west of the base of the Upper Yosemite Fall at between 1-1:30 p.m. on October 6, 1980 injured three girls hiking at the base of Upper Yosemite Fall as part of a Yosemite Institute group. The size of the rock scar from the area that failed was about 5 by 7 feet.

This rock fall-scar was adjacent to that of an earlier rock fall described as ID:299R1.

ID: 300
LOCATION: Royal Arches DATE: 1980; 10/7

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 3

PRIME REF: Scott Thornileg, NPS, oral commun., October 8, 1980

NARRATIVE: According to Scott Thornileg "I heard a rock slide from the Royal Arches behind the Ahwahnee Hotel at 10:50 p.m. on October 7, 1980."

ID: 301R
LOCATION: Yosemite Falls Trail DATE: 1980;11/16 12:06pm

TYPE: rock fall TRIGGER: freeze-thaw QDATE: 0

SIZE: large VOL(m3): 1500 GEOLOGY: Kec QSIZE: 1

DAMAGE: trail,cost,fatality CROSS REF: Snyder #243R QLOC: 0

PRIME REF: San Francisco Chronicle (1980)

NARRATIVE: According to Jim Snyder: At just after 12 noon on November 16, 1980, failure of a large slab on the western side of the upper fall gully caused a slide that destroyed or damaged 48 switchbacks, killing 3 people and injuring 7. The 4000-ton pendent had been heard cracking the day before but was mistaken for gunfire. November 16 was the fifth day of freezing night temperatures this fall. The cost of repair of the trail was $400,000.

"One morning six months after the big 1980 quakes, 29 people were climbing the steep switchbacks to the top of Upper Yosemite Fall when some of them heard what sounded like pistol shots on the slope above them...Half an hour after the first "shots" there was a roar that quickly grew deafening. A slab of rock the size of a football field had broken off from the high granite wall above the trail and shattered as it came hurtling down the steep slope... It traveled a

mile to the valley floor in 30 seconds...After the big 1980 slide, the trail was left closed for the winter... The 300-foot fallen slab had been attached to the wall only by a "hinge" of granite along the left edge. The 'gunshots' heard by the hikers were the cracking of the granite hinge where it was about to break...It took all of last summer to rebuild the trail up to the point of the [release] ... to tackle the release area itself. That job began in April of this year, and by early June the trail was sufficiently restored for it to be opened to hikers. Behind the big slab on the Yosemite Falls Trail we found elaborate patterns of roots where the ice had literally pried the rocks loose." (Gilliam, 1982)

"At 12:06 p.m., rock and debris suddenly rumbled onto a 600-yard stretch of the precipitous, zig-zag trail half a mile below Upper Yosemite Fall at an elevation of about 6000 feet...Powell and his rescue teammate, Hospital Corpsman Second Class Larry Gann, believed there may be more victims buried under the jagged rubble that covers the trail to depths well over 10 feet...(San Francisco Chronicle, 1980)

"A chunk of rock 200 yards long and 65 yards wide tore loose 1600 feet above the valley floor on Sunday and thundered downhill for 100 yards. A cannonade of melon-sized boulders bounded down hundreds of feet farther." Photos show rock fall and trail. (Magagnini, 1980)

"A 10-to-20 foot layer of rock and dirt covers the trail." Photo shows rock fall and trail. (Raess, 1980)

"Reports of sounds variously described as gunshots and low flying jets before the main impact of the slide suggest that people did not know what was happening soon enough to respond effectively...Malcolm Clark [USGS] noted that only one of the larger rocks, greater than 3-5 m, in the talus of Yosemite Fall Gully moved in the November 16 slide ... Clark watched part of the Yosemite Falls slide from Sierra Point, and he thought rocks from the slide reached the base of Upper Yosemite Fall about thirty seconds after the slab failure." (Jim Snyder, written commun., February, 24, 1981)

"At 12:06 we heard distinct, muted rumbling and booming. I assumed the noise was either from a distant and out-of-view rock fall, distant blasting, or sonic booms. ... About 30 seconds after we heard the noise we looked toward Yosemite Falls and saw clouds of dust rising from the Yosemite Falls trail, and with binoculars saw dust just starting to rise both from a debris track that reached down to the top of Lower Yosemite Fall and from another track that extended to a newly arrived, white boulder near the base of Upper Yosemite Fall. Movement of all large boulders had stopped before I inspected the rock fall with binoculars. Before rising dust obscured the scene we could see the brown patch on the wall which looked like the source of the rock fall. About 1/2 hour later, after most of the dust cleared, I took [a] ... photo... [that] shows two new paths cut through the trees near the base of Upper Yosemite Fall and new boulders near the base of the source cliff." (Malcolm Clark, written commun., March 16, 1992)

About thirty minutes before the rock [fall], sounds like gunfire were heard, as the slab of some 270 feet long, weighing about 4400 tons began to give way. Then as the mass shifted, pressure on the most narrow and fractured part at the top produced a ragged horizontal break and the slab came crashing down. For about thirty seconds, rock hurtled down over a half mile of talus. Breaking up

as it came, the slab dropped fragments ranging in size from dust to 125 tons on to the talus slope below. Pieces bounced off the vegetation and slid downward, knocking other rock loose in the gully's old drainage and slide channels (Snyder, 1981).

ID: 302D
LOCATION: El Portal Road DATE: 1981; 3/3 ?

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: very small VOL(m3): 2 GEOLOGY: Qat QSIZE: 3

DAMAGE: road, utility CROSS REF: none QLOC: 1

PRIME REF: Doug Erskine, NPS, written commun., March 9, 1981

NARRATIVE: "At approximately 4:30 p.m. on March 4, 1981, a rock and mud slide closed Highway 140 just above the powerhouse. The slide was a result of a break in the penstock leading to the powerhouse... The water from the penstock had washed out a gully approximately 30 feet deep by 50 feet wide. The penstock was approximately 300 feet upslope of the road.

...the penstock had been built on dry riprap on a steep hillside. Approximately 80 feet upslope from the penstock there was evidence a fractured piece of granite had recently fallen away from an outcropping. Fine white rock dust was visible in a track down the falline below the freshly exposed face. At one point the rock had passed between a rock outcrop and a 3 inch diameter oak tree. Fresh rock dust was apparent on the outcrop and a fresh scar was visible on the inside of the oak tree. The distance between the tree and the outcrop was 5 feet....

There were no obstructions between the freshly exposed face and the midpoint of the penstock break. The freshly exposed granite face has a network of oak tree roots across its surface. Some of these roots are as much as 8 inches in diameter. There was no evidence of recently falling or rolling rock above this point."

ID: 303R
LOCATION: El Portal Road DATE: 1981; 3/4 4:30 pm

TYPE: debris flow TRIGGER: pipeline break QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: Qat QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 1

PRIME REF: Doug Erskine, NPS, written commun., March 9, 1981

NARRATIVE: Refer to narrative for ID 302D.

ID: 304R
LOCATION: Elephant Rock-'Steamboat Bay' DATE: 1980-81?; Winter

TYPE: rock slide TRIGGER: rain QDATE: 4

SIZE: very large VOL(m3): 24000 GEOLOGY: Kec QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 0

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: According to Don Reid (Jim Snyder, written commun., February 25, 1992), the second stage of the rock slide at Elephant Rock probably occurred in winter of 1981 after prolonged rain. When it happened, Curry Garage Manager Roy Seal was scooping up trout off the road about twilight, according to the story Reid had heard. Jim Snyder had heard a story that the splash from the rock fall into the river came up on the road and nearly got a passing visitor's car.

ID: 305R
LOCATION: Sierra Point DATE: 1981; 4/9 5:50 pm

TYPE: rock fall TRIGGER: blasting QDATE: 0

SIZE: medium VOL(m3): 104 GEOLOGY: Khd QSIZE: 0

DAMAGE: none CROSS REF: Snyder #246R QLOC: 1

PRIME REF: none

NARRATIVE: April 9, 1981: The Grizzly Peak blast removed a large block of about 300 tons from the fin of the ridge between Sierra Point and Grizzly Peak. The block had been identified as hazardous over the Vernal Fall Trail and was in the vicinity of the release point for the May 25, 1980, earthquake generated rock fall that destroyed the Sierra Point Trail.

ID: 306R
LOCATION: Hetch Hetchy-Lake Eleanor Road DATE: 1981;Winter-spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 20 GEOLOGY: Kec QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #244R QLOC: 1

PRIME REF: none

NARRATIVE: Winter-early spring, 1981: A rock slide from above the Hetch Hetchy Road to Lake Eleanor--same source as February 23, 1985--dumped a big slab on the corner of switchback 4-5 and cluttered other switchback corners as well. Jointed bedrock and loose boulders slipped from the same area and went to the reservoir.

ID: 307R
LOCATION: Yosemite Falls Trail DATE: 1981; 5/8 2:32 pm

TYPE: rock fall TRIGGER: blasting QDATE: 0

SIZE: medium VOL(m3): 173 GEOLOGY: Kec QSIZE: 0

DAMAGE: none CROSS REF: Snyder #247R QLOC: 1

PRIME REF: Snyder (1981)

NARRATIVE: May 8, 1981: A blast on the Yosemite Falls Trail removed a 500-ton pendent remaining at the top of the release point from the November 16, 1980, rock fall.

The first step in rebuilding the 1200 yards of damaged Yosemite Falls Trail was to remove the remaining fragment of the slab which didn't drop November 16. Lowered 1100 feet from the rim to a small ledge just over the slab fragment, climbers established a high line and anchors for workers and a drilling platform. The resulting blast cleared out the fractured rock, leaving a clean roof. The newly exposed wall showed further how the actions of weathering, extension of plant root systems and freezing and thawing had worked on this flake of granite. The blast brought down another 450 tons of granite, most of which caught in the fresh jumble of angular rock below. (Snyder, 1981)

ID: 308R
LOCATION: Glacier Point-Fourmile Trail DATE: 1981; 5/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: Snyder #248R QLOC: 1

PRIME REF: none

NARRATIVE: May 1981: A slide of loose rock occurred in the chute below Union Point on the Fourmile Trail, crossing 9 switchbacks in a traditional slide area. A single free rock had been held by a dead tree; slow rot and spring moisture worked until the stump could not longer hold the weight. The rock [slide] brought much loose material with it as it went down the chute.

ID: 309D
LOCATION: Chilnualna Fall Trail DATE: 1981; Spring

TYPE: debris flow TRIGGER: rain ? QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Kec QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #245I QLOC: 2

PRIME REF: none

NARRATIVE: Spring, 1981: The Chilnualna Fall trail [was] covered [for] about 150 feet of trail with debris. This was a debris flow type of slide from heavy rains.

ID: 310R
LOCATION: Cathedral Rock DATE: 1981; late 11/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #249R QLOC: 1

PRIME REF: none

NARRATIVE: Late November 1981: One quarter mile east of 'Bridalveil Straightaway' on the trail in the talus, a big chunk came off Cathedral Rock and brought down many big Douglas firs when it hit the talus and trail.

ID: 311R
LOCATION: old Coulterville Road-'Cookie' DATE: 1982; 4/3 10:20pm

TYPE: rock slide TRIGGER: rain QDATE: 0

SIZE: ext. large VOL(m3): 100000 GEOLOGY: Kec QSIZE: 1

DAMAGE: road, utility CROSS REF: Snyder #250R QLOC: 0

PRIME REF: Malcolm Clark, USGS, unpub. data, April 1982

NARRATIVE: April 3, 1982, 10:20 pm: According to Jim Snyder, between the 'Cookie' and the junction of the old Coulterville Road with Highway 140, a large slide occurred, destroying the old road and wiping out the new for about 150 yards. Boulders up to 20,000 tons came down. Heavy rains, high water, and soil saturation along planes sloping steeply downhill overcame friction ...

The trunk sewer line to El Portal was severed and effluent flowed into the Merced until April 7; the telephone line was also destroyed through the stretch of the slide; and as a consequence of the slide, the old Coulterville Road was not repaired. The power was not cut off because the slide went under the lines and between the transmission line towers.

According to Malcolm Clark the southwest wall of slide is on a main joint plane that looks dirty. Some fresh fractures in bedrock are in the center of slide source. Overhanging rock at head of slide (approximately 10 m long, 5-8 m high) appears to rest on rubble. Overhanging block shifted about 1 meter downslope when slide removed support (dirt line showed it was buried about 2/3 on side that now is headwall). Rubble beneath looks real [so that this] is probably a slide block from above. Block on ridge above head of slide is undercut at downstream end- could be old slide block also- though looks like bedrock from top. Old rubble on north side of headwall may be up to 10m deep- but bedrock is exposed below.

ID: 312R
LOCATION: Hodgdon Meadow-Hwy 120 DATE: 1982; 4/4

TYPE: debris slide TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Kol QSIZE: 2

DAMAGE: road CROSS REF: Snyder #251R QLOC: 1

PRIME REF: Jim Snyder, NPS, written commun., April 7, 1992

NARRATIVE: April 4, 1982: A slide occurred in a roadcut 1.5 miles up from the park gate at Hodgdon Meadow entrance on Highway 120 near the turnout for a view of the park's north end. A lot of mud and a few large rocks, weathered out from bedrock in the upper part of a high, steep roadcut, slipped down into the road bed.

According to Jim Snyder (written commun., April 7, 1992) rains combined with a steep road-cut face caused a debris slide out of a saturated bank.

ID: 313R
LOCATION: old Coulterville Road DATE: 1982; 4/8 1:10pm

TYPE: rock slide TRIGGER: blasting QDATE: 0

SIZE: large VOL(m3): 1730 GEOLOGY: Kec QSIZE: 0

DAMAGE: none CROSS REF: Snyder #252R QLOC: 0

PRIME REF: none

NARRATIVE: April 8, 1982: A 5000-ton rock remaining at the top of the Coulterville Road rock slide was blasted because it had moved in that rock slide and posed a danger to workers and Highway 140 below. The rock had slipped about 6 feet in the rock slide. It was another great weathered block, weathered free from massive jointed bedrock and perched on those joints which had become filled with loose soil, roots and rock.

ID: 314R
LOCATION: Yosemite Falls Trail DATE: 1982; 6/10

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: ext. small VOL(m3): 0 GEOLOGY: Kec QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #253R QLOC: 0

PRIME REF: none

NARRATIVE: June 10, 1982: According to Michelle Orfetel, a rock about 400 lbs. in size fell from ledges above switchback 50 and crossed 3 switchbacks on the Upper Yosemite Fall Trail before stopping in the fresh talus of the November 16, 1980, rock fall.

ID: 315R
LOCATION: Yosemite Falls Trail DATE: 1982; 10/25 4 am

TYPE: rock fall TRIGGER: rain QDATE: 0

SIZE: small VOL(m3): 38 GEOLOGY: Ks QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #256R QLOC: 0

PRIME REF: none

NARRATIVE: October 25, 1982: According to Jim Snyder and John Schelhas, on the Yosemite Falls Trail, from just a few feet below the rim, just east of Eagle Tower, an old flake 18 inches x 30 feet x 30 feet fell hitting the trail on 10 switchbacks around the spring in the upper gully. There had been heavy rain Oct 24 (1.31 inches) and October 25 (1.05 inches) and at 4 a.m. a lightning strike hitting a pine 100 yards west of the release point. Lightening ran down the tree into the ground where it dug a 2 foot deep hole and threw small rocks, dirt, and branches into the upper falls gully. It appeared the lightening hit a water-filled joint or fracture. A resultant steam explosion possibly caused the failure of this flake, not far away from the struck tree and just over the edge of the cliff. The flake was well weathered behind and hanging tenuously. The rock fall occurred with the lightening strike according to Bill Burgen, living in Lost Arrow housing, who heard it with the thunder.

As a thin flake that broke up considerably as it fell, the rock did not go much past the trail (Jim Snyder, written commun., November 4, 1992).

ID: 316R
LOCATION: Yosemite Falls Trail DATE: 1982;10/26 12:01am

TYPE: rock fall TRIGGER: rain QDATE: 0

SIZE: medium VOL(m3): 249 GEOLOGY: Kec QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #257R QLOC: 0

PRIME REF: none

NARRATIVE: October 26, 1982: On the Yosemite Falls Trail, after another day of hard rain (2.75 inches), a rock fall occurred just after midnight October 25. Bill Burgen and Terry Gess (Chief of Maintenance living in Lost Arrow housing) both heard the rock fall. An old roof unloaded another chunk burying and destroying 100 yards of trail on the flat past the lower gate on the Yosemite Falls Trail. The roof had been unloading periodically for many years and had a talus cone under it. But the age of trees shows it had not unloaded since Conway built the trail 1873-77. A crude estimate of what fell would be roughly 325 cubic yards.

ID: 317R
LOCATION: Grand Canyon of Tuolumne DATE: 1982; Fall

TYPE: rock slide TRIGGER: rain ? QDATE: 4

SIZE: very small VOL(m3): 1 GEOLOGY: Kyc QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #254R QLOC: 1

PRIME REF: none

NARRATIVE: Fall, 1982: Two miles upstream from Pate Valley a small number of weathered boulders slipped down onto the short switchbacks leading away from the river up over the hill to the 'Gardiner Camp' site. Heavy rains may have caused the slide which amounted to about 1 cubic meter.

ID: 318R
LOCATION: Grand Canyon of Tuolumne DATE: 1982; Fall

TYPE: rock slide TRIGGER: rain ? QDATE: 4

SIZE: ext. small VOL(m3): 1 GEOLOGY: Kec QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #255R QLOC: 1

PRIME REF: none

NARRATIVE: Fall, 1982: Another small rock slide came down on the Tuolumne River Trail about 1 3/4 mile upstream from Pate Valley. A group of rocks--six at 300 lbs. average--slid down a rocky slope on oak duff into the trail on the switchbacks leading up over the slickrock hump below the 'Gardiner Camp'. No fresh breaks were visible. The slide probably resulted from fall rains rearranging the top of the small talus cone by dumping precarious rocks standing at the base of the cliff.

ID: 319R
LOCATION: West Quarter Dome DATE: 1982?; Winter

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Meyers and Reid (1987)

NARRATIVE: According to Don Reid (Jim Snyder, written commun., February 25, 1992) In the winter of 1982(?), Don Reid noticed peeling and a noticeable scar compared with earlier photos on West Quarter Dome. He was doing work on climbing routes then, comparing photographs with what he saw to notice the new scar.

In Meyers and Reid (1987), p. 257, an annotated photograph of Quarter Domes shows a rock slide area on the North Face of West Quarter Dome.

ID: 320R
LOCATION: Clark Point-Mist Trail DATE: 1982-83; Winter

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 1 GEOLOGY: Khd QSIZE: 1

DAMAGE: none CROSS REF: Snyder #258R QLOC: 0

PRIME REF: none

NARRATIVE: Winter, 1983: Several rocks fell from bluffs below Clark Point hitting the new section of the Mist Trail, knocking a few rocks off the top tier. The [event] was set up by the earlier Mist Trail slide of October, 1980. Detritus piled up on ledges became overloaded with water in heavy storms and finally gave way. A small oak tree came down with the slide as well as a lot of debris from the earlier slide, littering the trail with fist-size fresh rock. Nothing bigger than 3 tons fell, judging from the new rock in the river below the trail, which we checked March 20, 1983.

ID: 321R
LOCATION: Sentinel Creek DATE: 1983; 5/20 4:30 pm

TYPE: debris slide TRIGGER: unknown QDATE: 0

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #261R QLOC: 2

PRIME REF: none

NARRATIVE: May 20, 1983, 4:30 pm: A big slide off Sentinel Rock changed the Sentinel Creek channel--this includes more material from the location west of Sentinel Creek that slipped in May, 1980, with high water, flooding, and soil saturation, all contributing to the sliding of the talus material, which jammed the creek at a sharp turn, so the creek changed to a straighter flow toward Southside Drive. One to three feet of debris was deposited across the valley loop trail at the point the trail crosses the old channel and mostly at the point of crossing the new channel.

ID: 322R
LOCATION: Glacier Point Road-Badger Pass DATE: 1983;Winter-spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 25 GEOLOGY: Kic QSIZE: 0

DAMAGE: road CROSS REF: Snyder #259R QLOC: 1

PRIME REF: none

NARRATIVE: Winter-spring, 1983: A large rock roughly 12 feet x 12 feet x 6 feet slipped down a roadcut on the Glacier Point Road one mile west of the Bridalveil Campground. The rock was blasted June 27. The winter of 1983 was heavy and late which was no doubt responsible for the rock movement.

ID: 323R
LOCATION: Benson Pass-Smedberg Lake DATE: 1983, Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 1 GEOLOGY: Kcp QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #260R QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1983: At Benson Pass, on the first switchback down the Smedberg Lake side, a large weathered rock 3 feet x 3 feet x 5 feet, previously held in place at the switchback corner by whitebark pine roots, sloughed into the switchback corner. Consistent with the very weathered rock of the master joint forming Benson Pass, this slippage probably occurred during snowmelt in late spring.

ID: 324R
LOCATION: Glacier Point- 'Ledge Trail' DATE: 1984; 5/1

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 3

DAMAGE: none CROSS REF: Snyder #264R QLOC: 0

PRIME REF: none

NARRATIVE: May 1, 1984: There was a rock slide from the roof above the old 'Ledge Trail' behind 'Camp Curry'. The roof is at the top of a talus cone and an intermittent water source. There was no freezing or contributing vegetation in evidence. There has been long term failure here in massive granite underlying a thinly fractured strata. There was a light earthquake on April 28, but the slide cannot be attributed to this either.

There is a large roof in this location, which periodically dumps material onto the ledge trail above Staircase Falls behind 'Camp Curry'. The material comes down a traditional drainage and chute that comes in to the back showerhouse of 'Camp Curry'.

There were no earthquakes greater than M4 recorded in central California from April 28 to May 1, 1984 (Fred Lester, unpub. data, August 1987).

ID: 325R
LOCATION: Glacier Point-Fourmile Trail DATE: 1984; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #262R QLOC: 0

PRIME REF: none

NARRATIVE: Spring, 1984: On the Fourmile Trail at the junction of the original Fourmile Trail with the new Fourmile Trail below Union Point, 2 cubic yards of fractured, decomposed rock broke off inside of a

trail cut, tore out a small outside wall, and plummeted over the side. The roots of liveoak shrubs had broken up the rock outcrop that failed.

ID: 326R
LOCATION: Glacier Point-Fourmile Trail DATE: 1984; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 1 GEOLOGY: Ks QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #263R QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1984: On the Fourmile Trail a block already free by decomposition along fractures slid into the trail in the blasted cut at the tightest point in the switchbacks under Union Point. The rock slide was about 1.5 cubic yards.

ID: 327
LOCATION: Tenaya Lake Trail DATE: 1984; 7/17 pm

TYPE: debris flow TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #265 QLOC: 2

PRIME REF: none

NARRATIVE: July 17, 1984: A hard rain this afternoon filled drainages on the 'Tenaya Zigzags', causing one drainage to overflow and carry debris over two switchbacks not far from the bottom of the trail. Two small outside walls and two low inside walls had top courses knocked off. The debris flow left between 1 and 3 feet of sand and rock on the trail.

ID: 328D
LOCATION: Sentinel Rock DATE: 1984; 10/12

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #267I QLOC: 0

PRIME REF: none

NARRATIVE: October 12, 1984: According to Jim Snyder and John Schelhas, a small slab fell off Sentinel Rock to the Fourmile Trail at the point closest to Sentinel Rock. The slab fell a long way (1000 feet or more), breaking up considerably as it hit the dirt and then the trail. John Schelhas threw the rocks off the trail in half an hour.

ID: 329R
LOCATION: Yosemite Falls Trail DATE: 1984; Fall

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: small VOL(m3): 7 GEOLOGY: Kec QSIZE: 0

DAMAGE: none CROSS REF: Snyder #266R QLOC: 0

PRIME REF: none

NARRATIVE: Fall, 1984: On the second switchback corner above the 1980 rock [fall] damage on the Yosemite Falls Trail, a slab about 3 feet x 6 feet x 6 feet broke off from 200 feet up and came down on the corner, bringing some liveoak with it. Exact time or cause of sliding is unknown. The source shows considerable weathering around the broken piece. Fall weather may have provided the final touch. There had been frequent small slides from this area, such as June 1982.

ID: 330R
LOCATION: Hetch Hetchy-Lake Eleanor Road DATE: 1985; 2/23

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Kec QSIZE: 2

DAMAGE: road CROSS REF: Snyder #269R QLOC: 1

PRIME REF: none

NARRATIVE: February 23, 1985: According to Scott Emmerick, Hetch Hetchy Ranger, he saw a rock slide from above the corners of switchbacks 4-5 on the old Hetch Hetchy Road to Lake Eleanor. One large rock with a lot of small stuff did little damage to the trail but wiped out half the width of the road near the spring on the bottom switchback.

ID: 331D
LOCATION: Wapama Falls DATE: 1985; 2/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: Kg QSIZE: 3

DAMAGE: none CROSS REF: Snyder #268I QLOC: 1

PRIME REF: none

NARRATIVE: February 1985: According to Scott Emmerick, Hetch Hetchy Ranger, a rock slide at Wapama Falls blocked the east channel of Falls Creek--the channel opened by blasting in April 1983--so that all water was turned under the first two bridges.

ID: 332D
LOCATION: Sentinel Creek DATE: 1985; 3/??

TYPE: debris flow TRIGGER: rain QDATE: 3

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail, road CROSS REF: none QLOC: 1

PRIME REF: Steve Botti, NPS, oral commun., May 21, 1985

NARRATIVE: March 1985: From the upper drainage of Sentinel Creek a debris flow initiated in colluvium, talus and channel fill that travelled to the valley floor crossing Southside Drive. The rocky flow plugged several culverts and deposited sand, gravel and cobbles several feet thick over a 30-m distance of road. One hundred meters southeast of the road, 0.5-m high debris-flow levees were observed.

ID: 333R
LOCATION: Glacier Point DATE: 1985; 4/??

TYPE: rock slide TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 2

PRIME REF: Steve Botti, NPS, oral commun., May 21, 1985

NARRATIVE: In late April 1985 a rock slide came off the northeast cliff of Glacier Point.

ID: 334R
LOCATION: Yosemite Falls Trail DATE: 1985; 7/20 5:30 am

TYPE: rock fall TRIGGER: rain QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: Snyder #270R QLOC: 0

PRIME REF: none

NARRATIVE: July 20, 1985, 5:30 am: According to Mike Durr, a large slab or several slabby rocks broke off from the cliff above the drainage crossing at the top of the first 48 switchbacks of the Yosemite Falls Trail. The roofs in this area, which receive drainage from the rim above, have broken fairly often, contributing to the talus cone below carrying the trail. There had been a good summer rain the day before.

ID: 335R
LOCATION: Yosemite Falls Trail DATE: 1985; 9/25

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 9 GEOLOGY: ? QSIZE: 1

DAMAGE: none CROSS REF: Snyder #271R QLOC: 0

PRIME REF: none

NARRATIVE: September 25, 1985: On the Yosemite Falls Trail, a thin flake, 12 feet across and 25 feet long, fell from the foot of the amphitheater on the south side of Eagle Tower. The weathered flake had been undermined by roots and soil, shrubs and moss. The release point lies on the lower edge of a band of more thinly jointed rock.

ID: 336D
LOCATION: Sentinel Rock DATE: 1985; 10/7

TYPE: debris slide TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #272 QLOC: 1

PRIME REF: none

NARRATIVE: October 7, 1985: According to Jim Snyder, Mike Durr, and John Schelhas, a cascade off the shoulder of Sentinel Rock following some rain brought rock with it into a chute which triggered the slide. The debris crossed the westernmost switchback corner, burying the Glacier Point- Fourmile Trail several feet deep.

ID: 337R
LOCATION: Glacier Point-'Ledge Trail' DATE: 1985;11/21 8:30 pm

TYPE: rock slide TRIGGER: rain QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #273R QLOC: 0

PRIME REF: none

NARRATIVE: November 21, 1985, 8:30 pm: After a light rain the day before, a rock slide occurred on the 'Ledge Trail' and went to 'Camp Curry', though nothing was damaged. It went down roughly the common chute at the edge of the talus and a slickrock cliff in back of the showerhouse at 'Camp Curry'.

ID: 338R
LOCATION: Middle Brother-'Rixon's Pinnacle' DATE: 1985;11/29 7:30 am

TYPE: rock slide TRIGGER: unknown QDATE: 0

SIZE: large VOL(m3): 2000 GEOLOGY: Khd QSIZE: 2

DAMAGE: road CROSS REF: Snyder #274R QLOC: 0

PRIME REF: none

NARRATIVE: November 29, 1985, 7:30 am: From above 'Rixon's Pinnacle' on the 'Folly' climbing route, a slide came from the big blocks over a ledge that becomes part of 'Michael's Ledge' system below Middle Brother in Yosemite Valley. The slide was preceded by dribble but crossed Northside Drive when it came down, filling the area between the east side of Rocky Point talus to the woods east of that.

The blocks were freed from the wall by vegetation penetration, especially at bottom of release area. Distribution of weight, judged by fractures in adjoining blocks, the scar, and scrape marks, suggests the bottom gave way first; the top blocks then slid, hit and broke, and some cartwheeled down a diagonal ledge toward the existing Rocky Point talus cone.

ID: 339D
LOCATION: Taft Point-Southside Drive DATE: 1985; 11/??

TYPE: debris flow TRIGGER: rain QDATE: 3

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 2

PRIME REF: Steve Botti, NPS, oral commun., November 1985

NARRATIVE: November, 1985: At least twice during the fall of 1985 the channel below Taft Point experienced debris flows. The first event occurred in either late August or early September during a lightning storm. Details of this event are unknown. In late November a hard rainstorm caused a debris flow that stopped about 40 m short of Southside Drive.

ID: 340R
LOCATION: Middle Brother-'Rixon's Pinnacle' DATE: 1985; 12/8

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: road CROSS REF: Snyder #275R QLOC: 0

PRIME REF: none

NARRATIVE: December 8, 1985: According to Jim Snyder, Mike Durr, and Gary Colliver, a rock slide came from the ledges above 'Rixon's Pinnacle', initiated by freezing, thawing, and vegetation penetration. The release point was the same as the November 29 slide. Two small earthquakes [which] occurred at 5 pm and midnight [were felt in the valley].

There were three small earthquakes recorded on December 8, 1985 although the precise timing of the rock slide is not known. At 0:17 am PST December 8, 1985, a M 2.1 occurred near Bridgeport, Calif.; at 3:13 pm PST, a M 2.9 occurred near Harden Flat, about 32 km from the valley; and at 11:56 pm PST, a M 3.5 occurred near Willow's Spring, along Calif State Hwy 395, about 50 km northeast of the valley (Fred Lester, unpub. data, August 1987). According to historical data (Keefer, 1984) none of these earthquakes were probably strong enough to trigger rock slides in Yosemite Valley.

ID: 341D
LOCATION: Castle Cliffs DATE: 1986; 1/30 8:50 am

TYPE: rock slide TRIGGER: rain QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 3

PRIME REF: Steve Botti, NPS, oral commun., January 30, 1986

NARRATIVE: A rock slide occurred on January 30, at 8:50 a.m. from Castle Cliffs-'Sunnyside Bench' area that reached the trail above the new courthouse site, but nothing reached the site. Several boulders up to 1 m in maximum dimension followed the easternmost gully slightly to the west of the courthouse site. The rock slide occurred during a warm heavy rain which started the previous evening.

ID: 342R
LOCATION: Sierra Point-Vernal Fall Trail DATE: 1986; 2/7 1:20 pm

TYPE: rock slide TRIGGER: rain ? QDATE: 0

SIZE: medium VOL(m3): 104 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #276R QLOC: 0

PRIME REF: Snyder (1986a); Wieczorek and others (1989)

NARRATIVE: February 7, 1986, 1:20 pm: After several days of light rainfall, a rock slide occurred on the Vernal Fall trail. There had not been that much rain or freezing before the first slide, but the liveoaks growing over a poorly supported block loosened it enough that, with the rain, it broke loose. The trail caught most of the debris, consisting of liveoaks rather than quantities of rock which had caught in the talus cone above the trail. The slide created a small roof several hundred feet above the trail at the point Anderson's old trail departs from the present route (Snyder, 1986a).

"The first rock slide on February 7 (1:30 pm PST) was relatively small (270 metric tons) and although it had not rained that day, moderate amounts of rain had fallen in the valley during the preceding week" (Wieczorek and others, 1989).

ID: 343R
LOCATION: Sierra Point-Vernal Fall Trail DATE: 1986; 2/13 4:30 pm

TYPE: rock slide TRIGGER: rain QDATE: 0

SIZE: medium VOL(m3): 415 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #277R QLOC: 0

PRIME REF: Snyder (1986a); Wieczorek and others (1989)

NARRATIVE: February 13, 1986, 4:00 pm: After heavy rain, a second block fell from the February 7 release point above the Vernal Fall trail, a block of about 1200 tons, which buried the trail and tore out many trees to make this once again a new and active, rather than old and stable, talus slope. The first rock slide had removed a key block underneath the rest. Most [of] the block that had weathered joints with little to hold it in place. After, there was an even larger roof, now with visible stress cracks, hanging over the trail. (Snyder, 1986a)

"The second rock [slide] (1100 metric tons) on February 13 coincided with intense rain (6.1 cm on February 13) and flooding in Yosemite Valley ..." (Wieczorek and others, 1989).

ID: 344
LOCATION: Glacier Point-Curry Village DATE: 1986; 2/18 late pm

TYPE: debris flow TRIGGER: rain QDATE: 1

SIZE: large VOL(m3): 2000 GEOLOGY: ? QSIZE: 2

DAMAGE: structures CROSS REF: Snyder #285 QLOC: 1

PRIME REF: Snyder (1989b)

NARRATIVE: February 17-19, 1986: Behind 'Camp Curry' in the talus channel extending from the 'Ledge Trail' and roofs below Glacier Point, there was a debris flow of rock and mud one evening, burying one residence and showerhouse with up to 4 feet of debris and moving several tent platforms off their foundations. The debris flow which surrounded the showerhouse gently, buried its back wall up to its eaves and then flowed on toward the 'Camp Curry' pavilion. At first there was no water in the creek channel behind the showerhouse at Camp Curry; soon, a little trickle appeared. Then flow increased to a small creek, and finally debris started to move slowly toward the structure. (Snyder, 1986b)

According to Jim Snyder (written comm., April 7, 1992) there was a considerable amount of debris in this flow including some large rock. The debris piled deep behind the showerhouse and one residence, and extended all the way up the lower part of the channel and all the way down the channel through 'Camp Curry'.

Debris flows from Glacier Point partially buried several buildings in Curry Village during the evening of February 18. On the talus slope, the debris flow had levees, and contained sand carrying small boulders. The most debris was produced and worst problems occurred on the evening of February 18. Photos of rocky debris around shower house and cabins (Steve Botti, NPS, oral commun., February 19, 1986).

ID: 345R
LOCATION: Clark Point-'Porcupine Spring' DATE: 1986; 2/17-19

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: large VOL(m3): 2000 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #278R QLOC: 1

PRIME REF: Snyder (1986b)

NARRATIVE: February 17-19, 1986: Heavy rains brought channel unloading in the chute below 'Porcupine Spring' on the Nevada Fall Trail. Large amounts of mud and rock swept across the 7 switchbacks below Clark Point, leaving the trail buried in three to six feet of rock and mud.

ID: 346D
LOCATION: Sentinel Creek DATE: 1986; 2/17-19

TYPE: debris slides TRIGGER: rain QDATE: 2

SIZE: large VOL(m3): 2000 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #279I QLOC: 3

PRIME REF: Snyder (1986b)

NARRATIVE: February 17-19, 1986: "On the Fourmile Trail, 34 of the first 41 switchbacks were damaged by water and slides with deposits of rock and mud 1-6 feet deep. One large rock 6 feet x 8 feet x 6 feet was on the trail in the main channel east of Sentinel Creek."

ID: 347D
LOCATION: Half Dome-Mirror Lake Trail DATE: 1986; 2/17-19

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #280I QLOC: 3

PRIME REF: Snyder (1986b)

NARRATIVE: February 17-19, 1986: "On the south side of the Mirror Lake Loop [trail] were several two-foot deep mud and rock deposits from talus below Half Dome."

ID: 348D
LOCATION: Sentinel Creek DATE: 1986; 2/17-19

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: large VOL(m3): 4500 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail, road, cost CROSS REF: Snyder #281I QLOC: 1

PRIME REF: Snyder (1986b)

NARRATIVE: February 17-19, 1986: Sentinel Creek left 350 yards of the valley loop trail buried 1-3 feet deep in rock and mud, clearing out the new channel. There were also debris flows across the trail at two other locations ...repair of the storm damage to roads was estimated at about $700,000... Damage to park trails will cost about $600,000 (Snyder, 1986b).

The older channel below Sentinel Rock has carried a debris flow that plugged the culverts at Southside Drive and muddy water is flowing over the top of the road (Steve Botti, NPS, oral commun., February 19, 1986).

ID: 349D
LOCATION: Sentinel Creek-Cathedral Spires DATE: 1986; 2/17-19

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: trail CROSS REF: Snyder #282I QLOC: 1

PRIME REF: Snyder (1986b)

NARRATIVE: "February 17-19, 1986: ... There was also debris flow across the trail at two other locations with traditional washes between Sentinel and the 'El Capitan Road' junction."

ID: 350D
LOCATION: Profile Cliff-Taft Point DATE: 1986; 2/17-19

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: Snyder #283I QLOC: 1

PRIME REF: Snyder (1986b)

NARRATIVE: February 17-19, 1986: ... There was also debris flow across the trail at two other locations with traditional washes between Sentinel and the 'El Capitan Road' junction (Snyder, 1986b).

The channel below Taft Point has been very active, debris flows have covered Southside Drive (Steve Botti, NPS, oral commun., February 19, 1986).

ID: 351D
LOCATION: El Portal Road-'Windy Point' DATE: 1986; 2/17-19

TYPE: rock slide TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: Kga QSIZE: 3

DAMAGE: road CROSS REF: Snyder #284I QLOC: 0

PRIME REF: Snyder (1986b)

NARRATIVE: "February 17-19, 1986: The El Portal Road suffered a rock slide about a quarter mile below Arch Rock, in the turn above 'Windy Point', a slide that took three days to clear."

ID: 352D
LOCATION: Union Point DATE: 1986; 2/17-19

TYPE: debris slide TRIGGER: rain QDATE: 2

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Wieczorek, USGS, unpub. data, 1986

NARRATIVE: February 17-19, 1986: Debris slide from gully below Union Point; however, a distinct source area was not evident. Most likely runoff had mobilized talus and channel fill. Fresh rock surfaces on the upper part and rock powder and impact marks were evident on the lower part of the slide track.

ID: 353D
LOCATION: Grand Canyon of Tuolumne DATE: 1986; 2/17-19

TYPE: debris flow TRIGGER: rain QDATE: 2

SIZE: medium VOL(m3): 200 GEOLOGY: Kg QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #286I QLOC: 1

PRIME REF: Snyder (1986b)

NARRATIVE: February 17-19, 1986: In Pate Valley heavy rains caused a debris flow across the trail to Muir Gorge, burying the trail over a foot deep in sand from the cliffs above. A fire in the area, just upstream from the Pate Valley-Pleasant Valley junction, had stripped the area of vegetation accelerating erosion during the heavy rains.

According to Jim Snyder (written commun., April 7, 1992) there was a considerable volume of material, nearly all fines, in this flow.

ID: 354R
LOCATION: Sierra Point-Vernal Fall Trail DATE: 1986; 3/8

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: large VOL(m3): 691 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #287R QLOC: 0

PRIME REF: Snyder (1986a); Wieczorek and others (1989)

NARRATIVE: March 8, 1986: During another heavy rainstorm, the remaining roof over the Vernal Fall rock slide collapsed, dropping 1600 tons of rock onto the talus slope and trail below. Impact in the talus moved an additional 2000 tons of rock, burying the trail up to 12 feet deep. This last block had been held solely by its connection at one end, not far from stress cracks developed after earlier slides. The blocks from the February 7,13, and March 8 slides had all been undermined by joint erosion dipping down toward the river, joints which had been penetrated deeply by tree roots and soil formation, leaving gravity the upper hand under the right conditions. (Snyder, 1986a)

The rock slides of February 7 and 13 left an overhang of roughly 1000 cubic meters, geometrically defined by a combination of intersecting joints and fresh semi-arcuate fractures. Beneath this overhang some slabs of rock had partly separated from the rockface as shown by recent minor movements. Other slabs may have been previously separated as evidenced by caliche deposits, water staining and small diameter tree roots (5 cm) visible between slabs. The slabs beneath the overhang were delicately interlocked and some appeared not to be connected to the steeply inclined rockface beneath. On March 6, a 3 to 5 m-long, fine fresh crack was detected about 20 m upslope of the overhang. This crack, with about 0.5 cm of extensional opening roughly paralleled a deep, weathered joint but did not connect to any other cracks near the overhang. The 0.5-1.0 m wide weathered joint was filled with gruss and pine needles from a nearby pine tree growing in the joint.

On March 8, during a storm which dumped 10 cm of rain in Yosemite Valley, a rock slide of some additional 1500-1600 tons occurred at the site. The slide encompassed the area from the overhang back to the deep weathered joint upslope of the crack ... Approximately 150 m of the Nevada Fall Trail was covered by this latest rock slide." (Wieczorek and others, 1989)

ID: 355D
LOCATION: Glacier Point-Fourmile Trail DATE: 1986; 3/??

TYPE: rock fall TRIGGER: rain QDATE: 3

SIZE: very small VOL(m3): 4 GEOLOGY: Kec QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #288I QLOC: 0

PRIME REF: none

NARRATIVE: March 1986: There was a rock fall in the vicinity of the 'Italian Wall' on the Fourmile Trail. Two rocks, 3 feet x 4 teet x 4 feet and 2 feet x 2 feet x 1 foot on the trail wall fell from the cliff directly above. One rock, 5 feet x 4 feet x 4 feet, on the second switchback above the 'Italian Wall' came from a gully above the set

of switchbacks in this chute several hundred feet above points of impact on the trail. The rock fall damaged walls on switchbacks two and three above the 'Italian Wall'. These rock falls occurred during March storms.

ID: 356R
LOCATION: Glacier Point-Fourmile Trail DATE: 1986; 3/??

TYPE: rock fall TRIGGER: rain QDATE: 3

SIZE: very small VOL(m3): 2 GEOLOGY: Kec QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #289aR QLOC: 0

PRIME REF: none

NARRATIVE: One rock, 5 feet x 4feet x 4 feet, on the second switchback above the 'Italian Wall' came from a gully above the set of switchbacks in this chute several hundred feet above points of impact on the trail. The rock fall damaged walls on switchbacks two and three above the 'Italian Wall'. These rock falls occurred during March storms.

ID: 357D
LOCATION: 'Lower' Cathedral Rock DATE: 1986; 2-3/??

TYPE: debris flows TRIGGER: rain QDATE: 4

SIZE: medium VOL(m3): 60 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: none QLOC: 0

PRIME REF: Snyder, NPS, written commun., March 16, 1992

NARRATIVE: According to Jim Snyder (written commun., March 16, 1992) debris flows blocked the trail below 'Lower' Cathedral Rock at two or three points with the storms of February-March, 1986. The amounts of debris that he cleared off the trail was relatively small, six feet wide and two feet deep on the trail at one point and 10 feet wide and three feet deep on another.

ID: 358D
LOCATION: Yosemite Falls Trail DATE: 1986; 4/2

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #290I QLOC: 2

PRIME REF: none

NARRATIVE: April 2, 1986: According to Jose Lopez, trail crew foreman, several large rocks came down in some rain and freezing temperatures on the Yosemite Falls Trail at the crossing at the top of the first 48 switchbacks from the same location as the July 20, 1985, slide. Rocks up to 2 tons each crossed the trail.

ID: 359R
LOCATION: Glacier Point-Fourmile Trail DATE: 1986; early 4/??

TYPE: rock fall TRIGGER: rain ? QDATE: 3

SIZE: very small VOL(m3): 2 GEOLOGY: Kec QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #291R QLOC: 0

PRIME REF: none

NARRATIVE: "Early April 1986: On the Fourmile Trail, two rocks, 3 feet x 3 feet x 2 feet and 5 feet x 4 feet x 3 feet, landed on the third switchback above the 'Italian Wall'. They came out of the bank 20 feet above the fourth switchback above the wall. A dead oak may have given way to release these rocks which hit one switchback, lightly damaging one switchback wall and landing on the switchback below. This rock fall happened during the rains in early April, judging from dirt remaining on the rock."

ID: 360R
LOCATION: Castle Cliffs-Yosemite Point DATE: 1986; 5/6 noon

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: small VOL(m3): 31 GEOLOGY: ? QSIZE: 1

DAMAGE: none CROSS REF: Snyder #292R QLOC: 0

PRIME REF: none

NARRATIVE: May 6, 1986: According to Mike Brocchini, a NPS welder, just before noon, he saw a pickup-sized rock come out of the main chute between Castle Cliffs and Yosemite Point. This rock fall never made it to the trail, breaking up on the talus above it.

ID: 361R
LOCATION: Arrowhead Spire DATE: 1986; 5/27 5:23 am

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Steve Botti, NPS, oral commun., May 27, 1986

NARRATIVE: May 27, 1986, 5:23 am: a rock fall came from near Arrowhead Spire onto talus toward Indian Canyon Creek. It was calm, no wind, no snow or rain, with a temperature of about 55 degrees F. The slide stayed east of the topographic divide from the courthouse, but did not reach the valley floor at Yosemite Village.

Source of the rock fall was a shear vertical cliff with a round circular shaped failure surface estimated [to be] 75 feet by 75 feet, with thickness uncertain. When rock hit slope below, the rock split into two directions...".

ID: 362R
LOCATION: Arrowhead Spire DATE: 1986; 5/28 5:33 am

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Steve Botti, NPS, oral commun., May 28, 1986

NARRATIVE: On May 28, at 5:33 a.m. a second rock fall from same area as the day before near Arrowhead Spire, although indications are that it was smaller than that of May 27.

ID: 363R
LOCATION: Castle Cliffs DATE: 1986; Spring

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #289bR QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1986: There was a slide in the chute from Castle Cliffs at the east end of 'Sunnyside Bench', same location as the January 1980, slide that put so much silt and rock in the government maintenance yard. This slide was smaller, requiring only some trail work to fix it.

ID: 364R
LOCATION: Bunnell Point DATE: 1986; 5-6/??

TYPE: rock slide TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 1 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #293R QLOC: 1

PRIME REF: none

NARRATIVE: May/June 1986: At the Bunnell Point switchbacks, on the seventh switchback, on the Merced River, a block 6 feet x 1.5 feet x 3.5 feet broke off a larger slab of rock a few feet above the trail. A pack train wreck at this point on June 23 resulted in the death of one Curry Company mule. The rock slide may have been a long term result of 1930 blasting for this trail.

ID: 365R
LOCATION: Middle Brother DATE: 1987; 3/10 2:47 pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: ext. large VOL(m3): 600000 GEOLOGY: Ks QSIZE: 1

DAMAGE: road CROSS REF: Snyder #294R QLOC: 0

PRIME REF: Wieczorek and others (1989); Yosemite Association (1987)

NARRATIVE: "At 2:47 p.m. PST on March 10, 1987, a large rock fall dropped 800 m from the face of Middle Brother and spread rapidly across a talus cone, covered Northside Drive, and sent boulders across the Merced River. Much smaller rock falls from Middle Brother had begun on March 8, and by about 2:20 p.m. on March 10, because of an increasing number of rock falls and audible rock popping noises from the face of Middle Brother, Northside Drive, the main exit road from the valley, had been closed and the portion of Leidig Meadow below Middle Brother had been cordoned off.

On the afternoon of March 10, Jim Snyder observed the rock fall initiate as an intact planar slab of rock that separated from the cliff face. As the slab fell it appeared to shorten in a folding-like manner similar to the steps of an escalator. The slab disagregated into a rock avalanche upon hitting and sliding along a prominent ledge before falling onto the talus cone below.

Another large rock fall from the face of Middle Brother occurred later that day at 5:10 p.m. The volume of these rock falls totaled an estimated 600,000 cubic meters of material weighing about 1.3 million metric tons. Dozens of smaller rock falls continued during the next several days ...

During and preceding March 8-10, the weather was dry without extreme temperature variations that might be associated with freeze-thaw or snowmelt cycles. Likewise no earthquakes occurred during this period that could account for this sudden onset of rock falls. During the following two weeks a high number of small rock falls occurred, some of which could be attributed to storms and the abundant loose rock on the ledge beneath the face of Middle Brother. In April after these storms, the rock fall activity noticeably diminished, but remained at a relatively constant rate. By June the rock fall frequency had dropped even more and Northside Drive was reopened for the first time in early July. A brief flareup of rock fall activity in early August again required the closing of Northside Drive, but rock fall activity quickly diminished and the road was reopened."

ID: 366R
LOCATION: Tenaya Lake Trail DATE: 1987; 4/12 midday

TYPE: rock fall TRIGGER: snowmelt ? QDATE: 1

SIZE: medium VOL(m3): 118 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail, injuries CROSS REF: Snyder #295R QLOC: 0

PRIME REF: Yosemite Association (1987)

NARRATIVE: April 12, 1987: A weathered section of low roof gave way above the 'Tenaya Zigzags' trail, breaking up as it fell to run down the main

drainage channel and smaller channels on both sides. Three people were injured, since the slide occurred in mid-day. Many walls on the trail were weakened or damaged, and the trail was heavily littered with rock and down trees from the first switchback above the Mirror Lake loop junction to the several switchbacks above the first creek crossing, where the injuries occurred. The release point was west of the point at which the trail comes back to the creek, where there is a large roof overhanging the creek across the trail. The release point was west of this roof. The slab that failed had been completely weathered behind and was held by the step-like structure of the rock underneath it. No rain preceded the failure... Between April 6 and 14 there was considerable snowmelt ...

"Three hikers were injured, one seriously, when a huge slab of granite estimated to weigh 340 tons came free near the rim and fell some 1800 feet into the Valley. It broke into large boulders, some the size of Volkswagens. The path measured about 300 feet at its widest point, and levelled trees and other vegetation" (Yosemite Association, 1987).

ID: 367R
LOCATION: Union Point-Fourmile Trail DATE: 1987; 4/16

TYPE: rock slide TRIGGER: snowmelt QDATE: 1

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 0

DAMAGE: none CROSS REF: Snyder #296R QLOC: 0

PRIME REF: none

NARRATIVE: April 16, 1987: A rock 5 feet x 3 feet x 3.5 feet came out of the bank into the Fourmile Trail seven switchbacks up from Union Point. Between April 6 and 14 there was considerable snowmelt but little water running on the trail. Leaching out dirt support underneath appears to have been the reason for failure. The rock slipped about five feet into the trail.

ID: 368R
LOCATION: Liberty Cap-Nevada Fall DATE: 1987; 5/2

TYPE: rock slide TRIGGER: rain ? QDATE: 1

SIZE: medium VOL(m3): 102 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #297R QLOC: 0

PRIME REF: none

NARRATIVE: May 2, 1987: According to Jim Snyder and Mike Shenton, on the Nevada Fall Trail, a slide occurred with a release point off the third corner of the Liberty Cap switchbacks, off the south wall between the trail and Nevada Fall. About 120 feet up the cliff, slabs had been undermined by long fir and cedar roots with only a few remaining connections to break. Perhaps influenced by rains of April 30 [0.47 inches], a slab 40 feet x 15 feet x 6 feet fell, hitting another block just above the Liberty Cap gully, causing that block to fail as well. Most of the rock stayed in the gully, but some skidded across to the trail, affecting two switchback corners.

ID: 369R
LOCATION: Tenaya Lake Trail DATE: 1987; 6/3 3:10 pm

TYPE: rock slide TRIGGER: blasting QDATE: 0

SIZE: small VOL(m3): 15 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #298R QLOC: 0

PRIME REF: none

NARRATIVE: June 3, 1987: A slab 15 feet x 12 feet x 3 feet was blasted from above the 'Tenaya Zigzag' trail because the slab had been hit in the April 12 rock slide and would have likely fallen on the trail had it given way naturally.

ID: 370R
LOCATION: Middle Brother DATE: 1987; 8/10-12

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: road CROSS REF: Snyder #299R QLOC: 1

PRIME REF: none

NARRATIVE: August 10, 1987: On this day and for several days afterward the rock fall activity picked up significantly on Middle Brother, closing Northside Drive until Labor Day weekend.

ID: 371R
LOCATION: North Dome-Mirror Lake Trail DATE: 1987; 9/1

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: large VOL(m3): 2000 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #300R QLOC: 0

PRIME REF: none

NARRATIVE: September 1, 1987: According to Jim Snyder and Kim Aufhauser, a section of a large roof fell from the cliff just north of the old Mirror Lake parking lot, damaging roughly 200 yards of trail. Most rock stopped in the talus behind the trail, but some crossed the trail toward the lake.

ID: 372
LOCATION: Sentinel Rock DATE: 1987; 9/1

TYPE: rock fall TRIGGER: unknown QDATE: 1

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 2

DAMAGE: none CROSS REF: Snyder #301 QLOC: 2

PRIME REF: Rock-fall activity log, NPS, unpub. data, September 1, 1987

NARRATIVE: September 1, 1987: According to the Rock-fall Activity Log, "several large rocks fell from high on Sentinel Rock," observed by Middle Brother rock-fall monitor.

ID: 373D
LOCATION: Panorama Cliff DATE: 1987; early 12/??

TYPE: rock fall TRIGGER: freeze-thaw QDATE: 3

SIZE: very small VOL(m3): 1 GEOLOGY: Khd QSIZE: 1

DAMAGE: none CROSS REF: Snyder #302I QLOC: 0

PRIME REF: none

NARRATIVE: Early December 1987: A rock 3 feet x 2 feet x 2 feet and more we did not see came down at 'Valley View' from Panorama Cliff. Some rock scarred trees 5 feet up and broke limbs in the fall, probably caused by freezing and thawing.

ID: 374R
LOCATION: Sierra Point-Vernal Fall Trail DATE: 1988; 8/23 3:30 pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: very small VOL(m3): 1 GEOLOGY: Khd QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #303R QLOC: 0

PRIME REF: none

NARRATIVE: August 23, 1988, 3:30 p.m.: According to Jim Snyder and Ron Mackie, a slab of rock about 2 feet thick and 10 feet square broke loose to fall about 250 feet to the Vernal Fall foot trail, hitting the trail about 100 yards above the spring by the old Sierra Point trail. Friction and an overhanging tree had held the slab in place until weathering and weight broke the last remaining connection.

ID: 375R
LOCATION: Half Dome DATE: 1988; 9/18 1:40 pm

TYPE: rock slides TRIGGER: unknown QDATE: 0

SIZE: very small VOL(m3): 3 GEOLOGY: Khd QSIZE: 0

DAMAGE: none CROSS REF: Snyder #304R QLOC: 0

PRIME REF: none

NARRATIVE: September 18, 1988, 1:40 pm: According to Jim Snyder and Mike Mayer, two slides occurred off Half Dome. At 1:40 p.m. below the Diving Board, at the lower left of the 'Porcelain Wall', a slab 5 feet thick and 15-20 feet square fell, with more falling from the same release point (above and a little left) at 2:40 p.m..

Snyder and Mayer were unable at the time to see how far it went (Jim Snyder, written commun., November 4, 1992).

ID: 376R
LOCATION: Half Dome DATE: 1988; 9/18 4:15 pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: very small VOL(m3): 1 GEOLOGY: Khd QSIZE: 0

DAMAGE: none CROSS REF: Snyder #305R QLOC: 0

PRIME REF: none

NARRATIVE: September 18, 1988: According to Jim Snyder and Mike Mayer, at 4:15 p.m. a slab 2 feet thick and 10 feet square fell from below the 'Visor', falling 2000 feet.

Snyder and Mayer could not tell how far down the slab went. Because it was a small and thin flake, it probably did not drift down very far (Jim Snyder, written commun., November 4, 1992).

ID: 377R
LOCATION: Big Oak Flat Road DATE: 1989; 1/21-28

TYPE: rock slide TRIGGER: rain QDATE: 3

SIZE: very small VOL(m3): 1 GEOLOGY: Kec QSIZE: 0

DAMAGE: none CROSS REF: Snyder #306R QLOC: 0

PRIME REF: none

NARRATIVE: January 1989: A rock of about 3 tons [slid] from this same location [over the new Big Oak Flat Road just below the lower tunnel entrance and south of the drainage just below the tunnel entrance] 3 weeks earlier during a rainstorm.

ID: 378
LOCATION: Big Oak Flat Road DATE: 1989;2/14 10:30 pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: medium VOL(m3): 142 GEOLOGY: Kec QSIZE: 0

DAMAGE: road CROSS REF: Snyder #306 QLOC: 0

PRIME REF: none

NARRATIVE: February 14, 1989, 10:30 p.m.: A rock fall occurred from the cliffs over the new Big Oak Flat Road just below the lower tunnel entrance and south of the drainage just below the tunnel entrance. A stack of interlocked rocks developed mostly from slow processes of bedrock erosion, roughly 400 tons and 10 feet x 20 feet x 25 feet in size, fell about 600 feet down two channels with a 200 foot free fall not far below the release point to generate considerable velocity for impact on the road below. A rock of about 3 tons fell from this same location 3 weeks earlier during a rainstorm and may have been a key block weakening the larger mass. There was substantial soil formation in the rock joints and considerable penetration and widening by roots of liveoak, bay laurel, yellow pines, and shrubs. The mass that failed lay on top of thin, layered seams of fine-grained rock tending to weather more easily and to carry seepage more easily.

ID: 379D
LOCATION: Half Dome-Mirror Lake Trail DATE: 1989; 3/5 late pm

TYPE: debris flows TRIGGER: rain QDATE: 1

SIZE: medium VOL(m3): 200 GEOLOGY: Khd QSIZE: 2

DAMAGE: trail CROSS REF: Snyder #307I QLOC: 3

PRIME REF: none

NARRATIVE: March 5, 1989: During a heavy, high elevation rainstorm late this night, Curry Stables folks heard a [debris flow] in the Mirror Lake area. The source of the debris flow was apparently the unloading of several talus choked drainage channels below Half Dome, for the trail was covered with debris at six points.

ID: 380R
LOCATION: Tueeulala Falls DATE: 1989; 3/15

TYPE: rock slide TRIGGER: rain QDATE: 1

SIZE: small VOL(m3): 44 GEOLOGY: Kg QSIZE: 1

DAMAGE: none CROSS REF: Snyder #308R QLOC: 1

PRIME REF: none

NARRATIVE: March 15, 1989: As a result of heavy rains a rock slide [occurred] from the bedrock side of the Tueeulala Falls creek channel just above the first bridge for that channel. The failed slabs, up to 8 feet x 8 feet x 12 feet, had weathered completely through and had been penetrated by roots of liveoak, bay laurel, manzanita, and cedar.

ID: 381
LOCATION: Sentinel Rock DATE: 1989;3/29 early pm

TYPE: rock slide TRIGGER: unknown QDATE: 1

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: Snyder #309 QLOC: 3

PRIME REF: none

NARRATIVE: March 29, 1989, early afternoon: A rock slide was observed by visitors beneath Sentinel Rock, though no evidence on the Fourmile Trail could be located according to Jim Snyder and Ron Mackie.

ID: 382R
LOCATION: Panorama Cliff DATE: 1989; 4/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: medium VOL(m3): 69 GEOLOGY: Khd QSIZE: 2

DAMAGE: none CROSS REF: Snyder #311R QLOC: 0

PRIME REF: none

NARRATIVE: April 1989: According to Jim Snyder and Jose Lopez, on the Nevada Fall horse trail, a rock fall of roughly 90 cubic yards fell from the small cliff just below the short switchback in the trail between 'Valley View' and the chute below 'Porcupine Spring'. Rock up to 10 feet thick and 12 feet high fell into the talus and only a few landed on the trail a hundred feet below. The weathered joints showed roots and some moss on a slip plane which forced the rock to turn as it fell, before it was stopped by talus, firs, and the trail.

ID: 383R
LOCATION: Union Point DATE: 1989; Spring

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 0

DAMAGE: trail CROSS REF: Snyder #310R QLOC: 1

PRIME REF: none

NARRATIVE: Spring, 1989: A block roughly 10 feet x 4 feet x 2 feet broke loose from weathered fins of rock just below Union Point near 'Agassiz Column' and fell about 250 feet down a narrow chute to land on a switchback corner of the trail. The block broke in two there, after smashing an inside wall. Debris was knocked down onto five switchbacks weakening other retaining walls.

ID: 384R
LOCATION: Middle Brother DATE: 1989; 7/25 6:13 pm

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: very small VOL(m3): 2 GEOLOGY: Ks QSIZE: 2

DAMAGE: road CROSS REF: Snyder #312R QLOC: 0

PRIME REF: none

NARRATIVE: July 25, 1989, 6:13 pm: A small flake fell from the massive face below 'Michael's Ledge' below Middle Brother. The roof created by the failed rock was visible in earlier photographs of Middle Brother. The rock fall was observed by park visitors and reported. Failure of the rock may have been accelerated by impacts from Middle Brother rock falls of March 10, 1987, and later.

ID: 385R
LOCATION: 'Lower' Cathedral Rock DATE: 1989; ??/??

TYPE: rock fall TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: ? QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 2

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: According to Don Reid (Jim Snyder, written commun., February 25, 1992) a rock fall from about 3/5 height of the north face of 'Lower' Cathedral Rock in 1989 hit the top of the talus cone. There had been a [rock fall] from this point in 1986, and this one produced a fresh right-facing corner to that earlier scar.

ID: 386R
LOCATION: North Dome-Mirror Lake DATE: 1990;4/23 early am

TYPE: rock fall TRIGGER: rain QDATE: 0

SIZE: very small VOL(m3): 2 GEOLOGY: Khd QSIZE: 1

DAMAGE: trail CROSS REF: none QLOC: 0

PRIME REF: Jim Snyder, NPS, written commun., April 24, 1990

NARRATIVE: "In the early morning hours on Monday, April 23, 1990, during heavy rains, rock fell from the wall northwest of Mirror Lake. The rock fall was minor, perhaps one or two cubic yards, but it fell far enough down a steep cliff face to gather considerable velocity, enough to cut a 12-inch oak tree off 10 feet above the ground and leave several craters in the trail. Rock fragments from the trail made it to the lake edge.

The release point was not the same as the September 1, 1987, rock fall which did more damage to the trail and which released much more material... The April 23 fall came from a weathered jumble of rock along an intermittent cliff face drainage channel down and east of the 1987 release point. A couple of blocks from that weathering formation came loose in the heavy rains, fell down the channel over one ledge, taking out at least one large pine and

beginning to break up. From the next ledge there is a considerable drop, which greatly increased the velocity and impact of rock fragments sailing on to the trail.

Some further rock was heard falling after the first reports of the slide by Curry Camp wranglers...

To give time for the rock fall to settle, the trail through that area in back of Mirror Lake on its north side has been closed through Wednesday... Trail crews will clear the trail Wednesday, April 25, for reopening April 26..."

ID: 387D
LOCATION: Big Oak Flat Road DATE: 1990;10/23 11:15p

TYPE: rock slides TRIGGER: earthquake QDATE: 0

SIZE: large VOL(m3): 518 GEOLOGY: ? QSIZE: 1

DAMAGE: road, cost CROSS REF: none QLOC: 1

PRIME REF: Wilson (1990)

NARRATIVE: "It's not a big pile of small rocks, it's a small pile of big rock", U.S. Park Service Ranger Kelly McCloskey said of the 6-foot-high boulders that blocked Highway 120 in Mariposa County. (Wilson, 1990)

The largest rock slide in the October 1990 earthquake on Highway 120 [was] north of Pulpit Rock before the first tunnel [and measured] about 1500 tons. (Tim Ludington, NPS, oral commun., July 22, 1991).

Total cost of removing rocks on Highway 120 from the October 1990 earthquake was $11,849 (390 hrs). Trail crews assisted road crews in removing rock from road. This does not include cost of rebuilding damaged rock guardian walls along edge of roadway. (NPS Maintenance Management, Location Maintenance Report, Earthquake Damage--Hwy 120, unpub. data, July 22, 1991)

ID: 388D
LOCATION: Big Oak Flat Road-El Portal Road DATE: 1990;10/23 11:15p

TYPE: rock slide TRIGGER: earthquake QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 2

DAMAGE: road CROSS REF: none QLOC: 1

PRIME REF: Wilson (1990)

NARRATIVE: "A rock slide just half a mile away closed Highway 140 into the Park, but that was expected to be cleaned up today ..." (Wilson, 1990)

Rock stopped on Highway 140 where there is a pullout on river side of road. (Tim Ludington, NPS, oral commun., July 22, 1991)

ID: 389
LOCATION: Indian Canyon DATE: 1990;10/23 11:15p

TYPE: rock falls TRIGGER: earthquake QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: Ks QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 4

PRIME REF: Jim Snyder, NPS, oral commun., May 21, 1991

NARRATIVE: Jim Snyder, who was sleeping nearby at the time, heard rocks falling in Indian Canyon during the earthquake. The following morning he was not able to locate the release points.

ID: 390
LOCATION: Lee Vining Canyon-Tioga Road DATE: 1990;10/23 11:15p

TYPE: rock slide TRIGGER: earthquake QDATE: 0

SIZE: small VOL(m3): 20 GEOLOGY: ? QSIZE: 3

DAMAGE: road CROSS REF: none QLOC: 4

PRIME REF: Wilson (1990)

NARRATIVE: According to the Escondido Times Advocate (October 24, 1990) "State highway crews were also cleaning up a slide on Highway 120 on the east side of the park (due to the earthquake).

ID: 391R
LOCATION: Glacier Point DATE: 1990; late 10/??

TYPE: rock fall TRIGGER: unknown QDATE: 3

SIZE: small VOL(m3): 20 GEOLOGY: Khd QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 1

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: According to Don Reid (Jim Snyder, written commun., 2/25/92), a rock fall occurred in late October 1990, above the 'Glacier Point Apron' and 'Monday Morning Slab' area. The origin of the rock fall is clear in a small scar above that area.

ID: 392R
LOCATION: Middle Brother DATE: 1992; 2/18 10:45pm

TYPE: rock fall TRIGGER: rain QDATE: 0

SIZE: medium VOL(m3): 173 GEOLOGY: Ks QSIZE: 1

DAMAGE: road CROSS REF: none QLOC: 0

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: On February 18, 1992, at 10:45 pm a rock fall of approximately 500 tons from the top of Middle Brother about 2600 feet above the Valley floor sent rock onto the talus cone with small pieces (60-80

lbs) reaching Northside Drive. The rock fall awakened all but the soundest sleepers in the valley. The scar left by the rock fall was in a small drainage immediately east (right) of the scar left by the March 10, 1987 rock fall and to the west (left) of an older scar. The rocky debris reached Northside Drive slightly to the east of where it did during March, 1987. Northside Drive was closed to traffic awaiting the consequences of the next Pacific storm and reopened on February 24.

Along the top ridge of Middle Brother, a column of massive granite roughly 20-foot square and perhaps 3 to 5 feet thick had released. Dirt left on ledges near the scar indicate decomposition and soil development accompanied by roots seen in the exposure had weakened the massive appearing granite. In this section the dark appearing granite is cut by white (quartz) veins. On February 19 water was observed draining from fractures on the steep face and was believed instrumental in triggering the failure. Although little rain had fallen on February 17, the rock fall occurred after eleven days of intermittent, sometimes heavy rain and snow. The previous week had been unusually wet with a series of warm tropical storms bringing heavy rain and melting higher snowpacks. No recent rock falls or unusual popping sounds had been reported in this area prior to this rock-fall event.

ID: 393
LOCATION: The Rostrum-Elephant Rock DATE: 1991-92; Winter

TYPE: debris slump TRIGGER: unknown QDATE: 4

SIZE: medium VOL(m3): 200 GEOLOGY: Kec QSIZE: 3

DAMAGE: none CROSS REF: none QLOC: 3

PRIME REF: Jim Snyder, NPS, written commun., February 25, 1992

NARRATIVE: According to Don Reid (Jim Snyder, written commun., February 25, 1992), between the Rostrum and Elephant Rock, during the winter of 1991, there was a slump from a wooded bench in between these two features. The slump, apparently more of debris than rock is visible from Highway 120.

ID: 394D
LOCATION: Royal Arch Cascade-Ahwahnee Hotel DATE: 1992; 7/14 pm

TYPE: debris flow TRIGGER: rain QDATE: 1

SIZE: large VOL(m3): 675 GEOLOGY: ? QSIZE: 0

DAMAGE: road CROSS REF: none QLOC: 0

PRIME REF: Louise Johnson, NPS, written commun., August 19, 1992

NARRATIVE: A debris flow from Royal Arch Cascade deposited sandy debris in the parking lot of the Ahwahnee Hotel on the late afternoon/early evening of July 14. A debris flow partially buried two cars in the valet parking lot. The flow deposited most of its volume of about 675 cubic meters in the parking lot and in the stream channel of Royal Arch Cascade near the Ahwahnee Hotel; however, a small amount of sediment was deposited by hyperconcentrated flow along the stream for about 300 m to the junction with the Merced River. About 650 cubic meters of debris was trucked away from the Ahwahnee

Hotel parking lot.

The debris flow initiated in the 195-acre area burned by the June 21, 1992 Dome Fire, west of North Dome. There were reports of some debris starting to come down on the afternoon and evening of July 12. At the Yosemite Valley Fire House, about 1.4 km west, rainfall on July 12 amounted to 1.33 inches during 22 hours and was 0.35 inches within a 1-hr period on July 14. Hydrophobic materials were found in the medium-coarse sandy deposits in the parking lot (Louise Johnson, NPS, written commun., August 19, 1992).

ID: 395R
LOCATION: Yosemite Point DATE: 1992; 7/24 6:05am

TYPE: rock fall TRIGGER: unknown QDATE: 0

SIZE: large VOL(m3): 1100 GEOLOGY: Kec QSIZE: 2

DAMAGE: none CROSS REF: none QLOC: 0

PRIME REF: Robert Reece, NPS, oral commun., August 24, 1992

NARRATIVE: According to Robert Reece (NPS, oral commun., August 24, 1992) a large rock fall, about the size of a house, broke loose from Yosemite Point on July 24, 1992 at 6:05 am. He was outside his house in 'Lost Arrow Village Housing' and watched as the rock bounced and split until the final pieces came to rest near the trail behind his house.